



Macrium Reflect v6

Macrium Reflect v6 User Guide

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These pages introduce you to Macrium Reflect, its capabilities and methods.

The first thing you should do is create rescue media. See [The Macrium Rescue Environment](#) (see page 67).

With your rescue media in-hand, we recommend that you follow through some basic tutorials to learn the system and to gain some immediate security by backing up your Systems. We have a range of tutorials and videos covering many aspects of using Macrium Reflect.

To get you started the following are some useful tutorials and articles:

- [Introduction to Macrium Reflect](#) (see page 7)
- [The Macrium Rescue Environment](#) (see page 67)
- [Backup, imaging and cloning](#) (see page 118)
- [Scheduling and Retention rules](#) (see page 182)
- [Restoring and browsing](#) (see page 207)
- [Re-deploying to new hardware](#) (see page 262)
- [Macrium Reflect Server Plus for Exchange and SQL](#) (see page 271)
- [Command line operations with Macrium Reflect](#) (see page 272)
- [Generating scripts and batch files](#) (see page 281)
- [Backup Folder Synchronization](#) (see page 308)
- [Macrium Reflect default settings](#) (see page 310)
- [PXE Deployment](#) (see page 359)
- [Standalone backup set consolidation](#) (see page 363)
- [Converting a Physical machine to Virtual Machine](#) (see page 366)
- [Automatic System Restore](#) (see page 367)
- [Logging file changes for Incremental and Differential Images](#) (see page 372)

Introduction to Macrium Reflect

Using Macrium Reflect you can backup whole partitions or individual files and folders into a single compressed, mountable archive file. You can use this archive to restore exact images of the partitions on a hard disk so that you can easily upgrade your hard disk or recover your system if it breaks. You can also mount images as a virtual drive in Windows Explorer to easily recover Files and Folders using Copy and Paste.

Summary

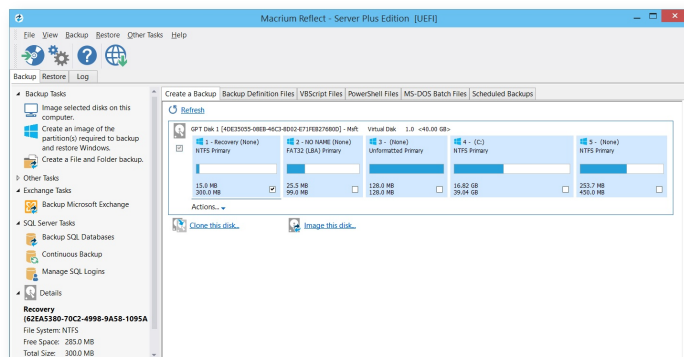
If you consider yourself non-technical this article should help you to start understanding the terminology, workings and concepts of imaging, backup and Macrium Reflect.

Inside a PC, the operating system, applications and all your files need to be kept somewhere when the power is off. This permanent storage is usually a hard disk drive containing a spinning magnetic platter. The information on the platter is recorded and read by read-heads. So that the read-heads can store and find recorded data, the disk is split into blocks, usually of 512 bytes, which are numbered from the start to the end of the platter.

So that the operating system can use different file systems or provide multiple volumes (like the C: drive, D: drive and recovery area), it partitions these blocks into volumes (sometimes also called partitions). These volumes and their file systems are the first thing you'll see when you start Macrium Reflect.

Figure: Macrium Reflect showing the volumes and file systems on a system disk

Macrium Reflect showing the backup task pane



More recently, magnetic disk drives have been replaced or augmented by other technologies like Solid-State Drives (SSD). These devices have slightly different restore requirements which Macrium Reflect handles seamlessly using features like SSD Trim support.

Rescue media and Windows PE

If you lose your Windows operating system, you can start your PC using Macrium Reflect rescue media on CD, DVD, or USB stick. This makes creating rescue media the first thing you need to do with Macrium Reflect. It contains a bootable, lightweight version of Windows and a full version of Macrium Reflect.

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This lightweight version of Windows is called Windows Pre-installation Environment (also known as Windows PE or WinPE) and is provided by Microsoft. When you create rescue media, Macrium Reflect downloads Windows PE automatically for you and writes it to your media. It downloads just those components you need to rescue your system.

Disk imaging

Macrium Reflect creates an accurate and reliable Image of a hard disk or the partitions on the disk. In the event of a partial or complete system loss, you can use this image to restore the entire disk, one or more partitions, or even individual files and folders.

During the imaging process, Macrium Reflect copies the contents of entire volumes including a reference to their physical location on the storage device to an image file (.mrimg). You would normally store the image file on local or network drives, or removable drives connected using USB or eSATA.

We strongly recommend that you create an image of your system at regular intervals.

You can read more about how to use Macrium Reflect to image your PC in our KnowledgeBase article [Creating a backup image of your computer, drive or partitions](#) (see page 119).

Macrium Reflect can help you create regular images by scheduling them for you. It can even tidy up after itself - see [Scheduling retention and disk space](#) (see page 182).

Differential and incremental images

Macrium Reflect can create **Full**, **Differential**, and **Incremental** images to optimize backup speed and disk space requirements.

When you image a volume for the first time, it is referred to as a image. A **Full** image file Full contains the data stored in the volume. Macrium Reflect provides two alternative methods of all backing up your data after the initial full image has been completed:

1. A **Differential** image that backs up all the data that has changed on the volumes since the last Full image was taken.
2. An **Incremental** image that backs up all the data that has changed on the volumes since the *last* image was taken whether that is a **Full**, an **Incremental** or a **Differential** image.

These methods significantly reduce the amount of disk space and time required to create image files and make it possible to restore your system from intermediate points within the backup chain.



Note: In order to restore a differential image, you must have the original full and the differential image you wish to restore. To restore an incremental image, you must have the original full and all subsequent incremental images in the backup set.

If you want to learn how to create differential or incremental backups using Macrium Reflect, please see [Differential and incremental disk images](#) (see page 160).

To learn more about backup sets, please see [Backup, imaging and cloning](#). (see page 118)

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File and folder backups

To create a **File and Folder** backup, select the files and folders you want to backup, apply File and Folder filtering criteria to include and exclude files and/or folders, and Macrium Reflect creates a compressed backup file (.mrbak) that can be restored directly or browsed using Windows Explorer. Storing backups in a single file is beneficial because it can be compressed, encrypted and stored elsewhere with ease.

As you can for images, you can also create **Differential**, and **Incremental** file and folder backups to optimize backup speed and disk space requirements.

File and folder backups are ideal if you only wish to backup specific documents, photos or music, rather than your whole system.

More information on how to backup files and folders is in our KnowledgeBase article [Creating a backup image of your computer, drive or partitions](#) (see page 119).

Disk cloning

With Macrium Reflect, you can clone your system disks to enable you to swap failed disks out of your system and get things back up and running again in minutes.

Cloning is often confused with imaging. The process is identical but instead of storing data to a file, it replicates volume contents and disk structures to an alternative device. When the cloning process is complete, the target disk is identical to the original and contains a duplicate of all volumes, files, operating systems and applications.



Note: Any data on the target disk prior to the cloning process will be erased.

Cloning a disk is particularly useful to upgrade an existing hard disk and in the event of a hard drive failure, you can simply replace the failed disk with a clone and have your system up and running again in minutes. However, cloning a disk is not an efficient way of backing up your data if it changes frequently because the clone will only contain one point in time as there is no 'Backup Chain' history that is available with Disk Images. Also, Disk Images can be compressed and saved to any location.

More information on how to clone your disk is in our KnowledgeBase article [Cloning a disk](#) (see page 141).

Backup Plans and Retention Rules

Macrium Reflect provides multiple **Backup Plan** options to create backup cycles in days, weeks or months that allow you to pick when you want your backup definitions to run and whether they should be Full, Differential or Incremental backups. Scheduled backups can run independently of whether anyone is logged into the computer.

Macrium Reflect provides an easy 3 step approach to editing backup plans for a backup definition:

1. First, optionally select a **Template** from a set that includes implementations of industry best practice like Grandfather, Father, Son (GFS) or Incremental Forever
2. Add, remove or change the schedules as needed for full, differential and incremental backups
3. Finally, define **Retention Rules** for each type of backup. Using the **Retention Rules**, you can retain a specific number of each type of backup or keep them for a number of days or weeks before cleaning up.

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Options define whether to apply the retention rules to all the backups in the folder, whether to run the purge before backing up, and let you define a minimum amount of disk space to retain in gigabytes (GB) before automatically deleting the oldest *backup sets* in the destination folder to make space available for new backups.



Note: A backup set consists of a full backup and any Incrementals or Differentials with the same image ID. The image ID is the part underlined in the following example backup file name: 69B5FC3F39E0F9F5-00-00.mrimg

Restoring files and folders

Macrium Reflect restores selected files and their folder structures from File and Folder backup .mrbak files. There are a number of ways to restore backups:

1. You can restore individual files, for example, accidentally deleted spreadsheets or lost photos by browsing an Image or File and Folder Backup. This process mounts the image file in Windows Explorer as if it were an extra disk drive. After it is mounted, you can browse and open files and copy the files back onto your active file system whenever you like.
2. You can directly restore the contents of a file and folder backup using the Macrium Reflect file and folder restore feature.

You can find more information in [Restoring a file and folder backup \(see page 224\)](#) and [Browsing Macrium Reflect images and backups in Windows Explorer \(see page 218\)](#).

Restoring images

Macrium Reflect restores disks or their partitions exactly as they were when the backup was taken. The restore process also enables you to expand or shrink partitions if the restore target is a new disk and a different size to the original.

If your whole system becomes corrupt, you can load Macrium Reflect and restore your image despite being unable to boot Windows. You can boot from the Macrium Reflect Windows PE rescue media and use Macrium Reflect to find and restore your images

The restore process is documented in the article [Restoring a backup system image from Windows \(see page 211\)](#).

ReDeploy

From the rescue environment you can launch Macrium **ReDeploy** to adapt the recovered Windows system to its new environment whether that is a virtual machine or a different computer. With Macrium Reflect **ReDeploy**, you can restore an image to a replacement computer or even create virtual hard drives to virtualize the machine, a technique sometimes called Physical to Virtual or P2V.

Macrium **ReDeploy** is now included all editions of Macrium Reflect except for the Free Edition.

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VBScript, PowerShell and MS-DOS batch file support

Macrium Reflect stores backup definitions as XML files that are loaded using the Reflect command line. This enables powerful batch and scheduling processing using VBScript, PowerShell or MS DOS batch files.

Macrium Reflect includes a VBScript and PowerShell generator that creates template script files for programmable control over your backup cycles and Pre/Post backup events.

Further Reading

- [Macrium Reflect Minimum System Requirements \(see page 12\)](#)
- [Macrium Reflect Feature Comparison Chart \(see page 13\)](#)
- [Licensing Policy \(see page 15\)](#)
- [New in Version 6 \(see page 23\)](#)
- [New in Version 6.1 \(see page 28\)](#)
- [Upgrade FAQ \(see page 35\)](#)
- [Installing Macrium Reflect \(see page 37\)](#)
- [Installing and updating Macrium Reflect offline \(see page 41\)](#)
- [Installing a Macrium reflect v5 to v6 Upgrade \(see page 46\)](#)
- [Macrium Reflect Quick Start \(see page 49\)](#)
- [Windows Explorer shell integration \(see page 56\)](#)
- [Reviewing your backup history \(see page 60\)](#)
- [Removing your License key when Upgrading your PC \(see page 62\)](#)
- [What is VSS, how does it work and why do we use it? \(see page 64\)](#)

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Macrium Reflect Minimum System Requirements

PC and Windows

In order to run Macrium Reflect, you must have a system that has the following minimum system requirements:

- At least 512MB RAM (1GB min recommended)
- Windows XP Service Pack 3 or Windows Server 2003 Service Pack 2 or later
- A keyboard and mouse

To use the rescue media, you will need either a CD/DVD writing drive or USB pen drive.

Supported File Systems

Imaging clusters in use and changed clusters (intelligent copy) is supported by FAT16, FAT32, NTFS and Ext 2,3,4 file systems. All other file systems and unformatted partitions will be imaged on a sector by sector basis, i.e, every sector in the partition will be copied.



Incremental and Differential images have no file system dependencies. You can even create Incremental and Differential images of unformatted partitions.

Rapid Delta restore (RDR) and Rapid Delta Clone (RDC) is supported by NTFS file systems only. All other file systems will cause a Full restore or clone.

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Macrium Reflect Feature Comparison Chart

Feature \ Edition	Home	Workstation	Server	Server Plus
Disk Imaging	✓	✓	✓	✓
Disk Cloning	✓	✓	✓	✓
Access Images and File and Folder backups in Windows Explorer	✓	✓	✓	✓
Schedule backups	✓	✓	✓	✓
Windows PE 3.0, 4.0 or 5.0 Rescue Media (RAID support)	✓	✓	✓	✓
XP SP3/ Vista / 7 / 8 / 8.1 /10 / WHS compatibility	✓	✓	✓	✓
File and Folder backup	✓	✓	✓	✓
Email notification of backup status	✓	✓	✓	✓
Differential and Incremental backups	✓	✓	✓	✓
Retention rules	✓	✓	✓	✓
Backup scripting	✓	✓	✓	✓
Recovery from Windows boot menu	✓	✓	✓	✓
	✓	✓	✓	✓

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Feature \ Edition	Home	Workstation	Server	Server Plus
Password protection and encryption				
Support for GPT disks	✓	✓	✓	✓
Support for dynamic disks	✓	✓	✓	✓
Restore to dissimilar hardware with ReDeploy	✓	✓	✓	✓
Server 2003 SP2/2008 /2011/2012/2012R2 compatibility			✓	✓
Windows Server cross-hardware restore			✓	✓
Integrated Windows event logging			✓	✓
Microsoft SQL & Exchange database backup & recovery				✓
Microsoft SQL database continuous backup				✓
Microsoft Exchange Mailbox restore (Granular Recovery)				✓
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Licensing Policy

Macrium Reflect Licensing Policy Overview

Macrium Reflect licenses are perpetual: they do not have an expiry date or require an annual renewal.

Macrium Reflect v6 Home Edition, Workstation, Server and Server Plus for Exchange and SQL are licensed per machine - each PC must have its own licensed copy of Macrium Reflect installed.

You may only transfer a Macrium license to another PC if it is a replacement for the original machine (due to hardware failure, for example). See [Removing your License key when Upgrading your PC \(see page 62\)](#)

Support & Maintenance

Macrium Reflect v6 Home Edition includes 12 months free developer level Technical Support. This will ensure that not only do you get a great backup tool for your home PCs, but you know that there is help if you need it. You also have full and permanent access to our active and helpful [support forum](#).

Macrium Reflect v6 Workstation, Server and Server Plus for Exchange and SQL, all include 12 months free Support & Maintenance in the purchase of each license which is renewable for subsequent years. Support is provided via email and, if needed, remote access. This annual subscription includes Upgrade Protection - so Minor updates (i.e. v6.0 to v6.1) and Major updates (i.e. v6 to v7) are free. We also offer a Premium support option which includes priority response and telephone support.

If the Support & Maintenance subscription is not renewed the software will continue to function, Minor updates (i.e. v6.0 to v6.1) will remain free, and access to the [Macrium Support Forum](#) and KnowledgeBase will still be available for all v6 customers.

You can read more about [Macrium Support & Maintenance here](#):

The Macrium Reflect [End User License Agreement](#) can be found here: (see page 17)

Service Providers please see here: [Macrium Services Provider License Agreement explained \(see page 16\)](#)

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Macrium Services Provider License Agreement explained

The Macrium Services Provider License Agreement (SPLA) license provides an alternative usage based charging model, available to high volume service providers where the normal perpetual license model does not make sense. It is currently being piloted with a selected customers. If it is of interest to you, please [contact us](#) for more information.

How it works

You are provided with a single key per edition. This can be installed on an unlimited number of machines hosted by you. You will pay a monthly charge based on the number of unique machines with the software installed that are active within the billing period.

The billing is automatically generated using data from a daily callback to our license server. You will need to ensure that the software has a network route to our server and provide us with an IP range (or ranges) that your machines will use to connect to our server.

Your monthly bill will include a report of usage broken down by machine. This will include the associated IP and MAC address of the interface used to contact the license server and also a user machine reference, if specified.

How to specify the user machine reference

This is configured during the install process and is purely for your convenience in interpreting your bill.

You can install in the usual way, just specifying your SPLA key. However, currently, you can only specify the user machine reference using the command line install method. Use the following, replacing the angle brackets with parameters relevant to you.

```
<installer>.exe /passive /l <log filename> LICKEY=<your spla key> LICOWNREF=<your machine reference>
```

Please read more about command line installs: [Installing Macrium Reflect from the command line \(see page 273\)](#)

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The following terms are used repeatedly in this License, and in each case have the meaning set out below:

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"Documents" means the documents supplied as standard with Macrium Reflect® (whether in printed or electronic form) together with any modified or revised versions of them and/or any supplementary documents that we supply to you from time to time.

"Image" is defined as an exact copy of the data stored on a Computer's built-in media.

"media" means optical disks of any kind, hard or flash drives, and any other media in or on which software and/or data can be loaded or stored on a temporary, volatile or permanent basis.

"Macrium Reflect" means the software supplied to you together with this License and PrimoBurner software together with any related updates, upgrades, patches or fixes we make available to you over time.

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All provisions set out in this License are substantive terms and not merely introductory.

All obligations and restrictions upon you under this License are subject to the provisions of this "General" sub-section.

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Macrium Reflect® must be installed onto a Computer owned, leased or hired by you. Once you have installed Macrium Reflect® and entered your license key, you may not transfer your license key to any other Computer.

Macrium Reflect® enables you to make exact copies of the data stored on a Computer's built-in media ("**Images**"). All Images must be restored to the Computer from which they were taken.

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1. If you permanently replace your Computer you may load Macrium Reflect® and your license key onto your new Computer provided you have removed Macrium Reflect® from your old Computer. Once you have done so, you can use Macrium Reflect® on your new Computer as normal and restore existing Images to it. However, you must not restore Images back to your old Computer.
2. If your Computer develops a hardware fault which makes it inoperable you may load Macrium Reflect® and your license key onto a substitute Computer on a temporary basis whilst the fault is being repaired. You may then use Macrium Reflect® on that substitute Computer as normal and restore existing Images to it.

Once the hardware fault has been repaired, you can re-load Macrium Reflect® and your license key back onto your repaired Computer (if required), and must promptly delete it from your substitute Computer.

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General Requirements

A software-emulated computer (otherwise known as a "virtualized" computer) is a separate Computer for the purpose of this License.

You must at all times take reasonable precautions to protect the Computers on which Macrium Reflect® is loaded from unauthorized use.

You must only use Macrium Reflect® for your own benefit and not to provide services for or on behalf of any other person including on a "service bureau" basis.

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Save as expressly permitted by applicable law, you must not do or try to do anything which would result in you understanding, at a technical level, how Macrium Reflect® works. This restriction prevents you from doing anything which may constitute decompiling, disassembling or reverse engineering. It also means you cannot do anything which would result in you obtaining the source code for Macrium Reflect®, or the algorithms or ideas in, or structure or organization of, Macrium Reflect®. In each case there is an exception for acts permitted by applicable law.

You must not, and must not try to, avoid, defeat, bypass, remove or deactivate any security measures included in Macrium Reflect®, including those that restrict its functions.

You must not modify Macrium Reflect® or the Documents or create anything that is derived from Macrium Reflect® or the Documents.

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Macrium Reflect v6 User Guide

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Macrium Reflect v6 User Guide

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Macrium Reflect v6 User Guide

New in Version 6

Upgrade Macrium Reflect v5 to v6

UPGRADE FROM V5

Introduction

Macrium Reflect v6 includes powerful industry leading technologies to reduce recovery time and time to first backup. The user interface changes from v5 have been kept minimal and upgrading from v5 will be an easy process.

The main new features are listed below:

Rapid Delta Restore (RDR)

Using advanced delta detection technology **RDR** can rapidly recover data from Disk Images. This cuts restore times by 90% or more.



Note: RDR is not available when shrinking partitions during a restore.

[See here for more information on how RDR works \(see page 26\)](#)

Rapid Delta Clone (RDC)

Improving further on the cloning capabilities using technology based on RDR to speed up disk cloning activities by 90% or more.



Note: RDC is not available when shrinking partitions during a clone.

[See here for more information on how RDC works \(see page 27\)](#)

Scheduled Cloning

Clones can now be scheduled to run unattended using the task scheduler. In conjunction with RDC this makes keeping an up-to-date clone of your system an easier process.

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Backup Plans and Retention Rules

Backup plan support allows administrators the flexibility of creating custom backup plans to provide the level of protection they require. Backup Plans can be saved to re-usable templates making backup plan creation a cinch.

The Disk Space Management (DSM) in Macrium Reflect version 5 has been substantially improved in version 6 to provide retention and consolidation of Full, Differential and Incremental backups. The new deletion logic maintains backup-set integrity by ensuring that the backup chain is never broken.

1. **Full Backup Deletion** - As with v5, entire backup sets will be deleted when the specified number or age is reached.
2. **Differential Deletion** - When the specified number or age of backups is reached, Differential backups are removed to together with subsequent linked Incrementals.
3. **Incremental Deletion** - When the specified number or age of backups is reached, Incremental backups are removed. If by removing Incremental backups the backup chain is broken then the oldest retained Incremental is automatically consolidated with the deleted Incremental backups to ensure backup set integrity.

Temp files during backup creation

A common problem with Macrium Reflect v5 customers was that incomplete backups could be left in the backup folder taking up valuable disk space. This could happen if your network dropped, your external drive was unplugged or PC turned off before the backup completed. In v6, all backups are created with an '.mimg.tmp' or '.mrbak.tmp' file extension and only renamed to '.mring' or '.mrbak' after successful creation. To recover space, Macrium Reflect will now automatically delete .tmp files when starting or when creating a new backup to the same folder.



Note: To prevent multiple PC's backing up to the same folder and causing problems with retention rules, consolidation and .tmp file deletion, a mutex file "backup_running" is created and locked in the backup folder. If an existing locked mutex file is found in the folder then a backup cannot proceed.

File and Folder backup matching logic

When creating an incremental or Differential File and Folder backup the backup target folder is scanned for backup set candidates that the new Incremental or Differential backup can be appended to. If none can be found then a new backup set is created by creating a Full backup. In v5 the **matching logic** checked for existing backup sets that had exactly the same root folders to backup and exactly the same selection/filter criteria. This caused a problem if a folder was added to a backup definition or if the include/exclude filters were changed. A new Full backup would always be created. In v6 there are now 3 types of matching logic that can be applied to backup definitions:

1. **Similar** - Match on backups with at least one matching folder. Select this option to match if a backup set is found with at least one folder that is selected in the current backup. This option allows you to add and remove folders to your backup definition and still maintain a single backup set.

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2. **Strict** - Match on backups with the same folders and filters (As Macrium reflect v5). Select this option to match only existing backups that have exactly the same Folder and Include/Exclude Filters. This is similar to the way Macrium Reflect v5 worked. Retention rules will only be applied to exact matched backup sets.
3. **All** - Match on any backup. Select this option to match on any existing File and Folder backup set in the target folder. When selected, the most recent backup set will be appended to regardless of the folders in the set. Retention rules will be applied to all File and Folder backups.

Improved start up time

Macrium Reflect now scans local disks much faster at startup. This significantly reduces the startup time if large (Multi Terra Byte) disks are attached to your system.

SSD TRIM support

This features provides automated SSD optimization resulting enhanced SSD performance and longevity. Writing to an unused block is much quicker than an in-use block as it avoids both the slow erase operation and the read-modify-write cycle. This results an increase of both the lifetime and the performance of the device. It is effective for all windows operating systems, even those that support SSD trim natively as the file system driver can only TRIM blocks on de-allocation; it cannot TRIM blocks written by another process. It is also effective for USB attached SSDs.

Increased maximum partition size when imaging

The maximum partition size that can be imaged is increased from **53.3TB** to **3413.3TB**.



Note: While we can never guarantee 'Future Proofing' of Macrium Reflect, the new limit means that Macrium Reflect should be able to handle the steady increase in available disk sizes for quite some time.

Automatic VSS Fall-back

The Microsoft Volume Shadow Copy Service framework (VSS) can sometimes become unreliable and cause backups to fail with VSS Writer errors. While VSS Writers provide additional support for VSS aware applications, in many cases, a perfectly valid Image can be created without using them. In v6, if a shadow copy fails then another shadow copy is automatically tried without using writers. This is configurable in the program defaults.

iSCSI and BitLocker support in Windows PE

Support has been added to automatically download and include support for **iSCSI** and **BitLocker** encryption in Windows PE.

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Rapid Delta Restore - RDR

Macrium Rapid Delta Restore (RDR)

The concept of RDR has been something that has been thought about for quite some time here at Macrium Software. We were aware of competing technologies that offer fast restore capabilities but wanted to build something better...

Known state restore

This method performs a restore of an incremental image to a file system at a **known state**. The problem with this method is that the 'known state' must be prepared before hand and the target disk cannot be accessed before the final 'rapid' restore. This means that the target disk for the restore cannot be the original 'live' disk and a previous restore of the same backup set must have been performed beforehand and the disk taken offline. Not very flexible.

Snapshot restore

Another method is to rely on an open Microsoft Volume Shadow copy Service (VSS) snapshot and use this to restore back to the state when the snapshot was created. Very quick, but only allows restoration **back to the same disk** and the **image must have been created with VSS**. Again, not flexible enough for real world DR.

Macrium RDR

Where Macrium RDR differs is that it isn't dependent on VSS and a delta restore can be performed to **any disk** that has a previous copy of the imaged file system, **no matter what it's current state**. This means that you can restore quickly back to the original disk (similar to the Open Snapshot) method, **and** have the flexibility to restore to a different disk that contains the same file system on it in any state.

How does RDR work?

Unlike 'Known State' and 'Snapshot' restore, the only dependency for RDR is that the target file system contains a formatted NTFS file system that is the same file system as was originally imaged. When the restore starts the disk image is loaded, again this can be an image taken at any time, and the target NTFS file system structures are analyzed for differences. All the NTFS file system structures are restored to the target disk and any that do not exist or have been modified on the target disk cause the data records for each NTFS file or object to be restored as well. The result is an 'Incremental' restore applying only file system changes detected between the image and the target.



Note: RDR works with NTFS file systems only. All other file systems will perform a full restore



Note: RDR is not available when shrinking partitions during a restore.

See also [New in Version 6](#) (see page 23)

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Macrium Rapid Delta Clone (RDC)

As with Rapid Delta Restore (RDR) the concept of RDC has been something that has been thought about for quite some time here at Macrium Software. We wanted to build a clone solution that would effectively and rapidly copy only the differences between the source and target file systems. The advantage of this is obvious, RDC offers similar a performance increase as an Incremental disk image offers over a Full image and enables regular clones to be a viable and fast DR solution.

How does it work?

The NTFS file system resident on the clone source is compared with file system on the target disk. The two file systems are first verified that they originated from the same format command and then the target NTFS file system structures are analyzed for differences. All the NTFS file system structures are copied to the target disk and any that do not exist or have been modified on the target disk cause the data records for each NTFS file or object to be copied as well. The result is an 'Incremental' clone applying only file system changes detected between the source and the target.



Note: RDC works with NTFS file systems only. All other file systems will perform a full clone



Note: RDC is not available when shrinking partitions during a clone.

See also [New in Version 6 \(see page 23\)](#)

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New in Version 6.1

Windows PE 10

Macrium Reflect v6.1 now includes Windows PE 10 support when building rescue media. Windows PE 10 is now the default Windows PE option for new Macrium Reflect installs on Windows 8, 8.1, 10, Server 2012 or Server 2012R2. Windows PE 10 is a requirement if your system uses Windows 8.1 [WIMBoot technology](#) or if your system is a [Windows 10 'Compact Install'](#). Both of these installation types are rare but may be used on Windows Tablet PCs with limited disk space.

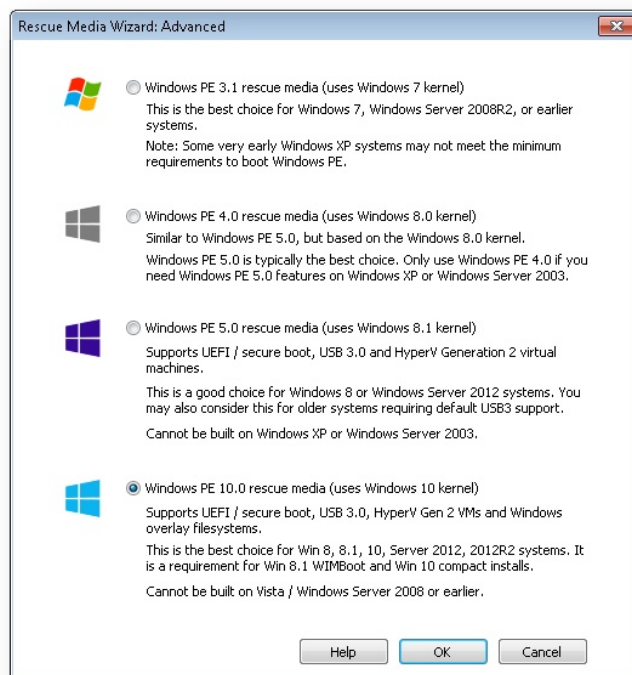


Note: If you are currently using Windows PE 5.0 then you do not need to change to PE 10 unless your system is using WIMBoot or a Windows 10 Compact install. Macrium Reflect will prompt you to create PE 10 when starting the rescue media wizard if this is the case.

Click [here](#) to show how to enable PE 10 support..

Take 'Other Tasks' > 'Create Rescue Media..' and click the 'Change PE Version' button in the Rescue Media wizard...



You can change the version of Windows PE by choosing from the options in this dialog



What version of Windows PE should I choose?

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You should choose a version of Windows PE that can access your System drive and also your backup location. The default option selects the Windows PE version that is the best match for your Windows operating system. This enables the rescue media wizard to automatically copy any required drivers for Network, USB or SATA controllers. However, versions of Windows PE that are more recent than your Windows OS may already contain compatible drivers and also offer additional support for USB 3.0.

PE version	Description
Windows PE 3.1	<p>Based on Windows 7. This is the best option for Windows XP, Vista, Windows 7, Server 2003, Server 2008, 2008R2 operating systems. USB 3.0 support is not included.</p> <p>Note: Some very early Windows XP systems may not meet the minimum requirements to boot Windows PE.</p>
Windows PE 4.0	<p>Based on Windows 8. Similar to Windows PE 5.0, but based on the Windows 8.0 kernel.</p> <p>This is a legacy option that is provided if you have used previous versions of Macrium Reflect before PE 5.0 was included. Includes support for USB 3.0. We recommend that you use PE 5.0/10 unless your require PE 5.0 features on Windows XP or Server 2003.</p>
Windows PE 5.0	<p>Based on Windows 8.1. Supports UEFI / secure boot, USB 3.0 and HyperV Generation 2 virtual machines.</p> <p>This is a good choice for Windows 8/8.1 or Windows Server 2012 systems. You may also consider this for older systems requiring default USB3 support.</p> <div>  Note: The Windows PE 5.0 download option is not available if you are running Windows XP or Server 2003. </div>
Windows PE 10.0	<p>Based on Windows 10. Supports UEFI / secure boot, USB 3.0, HyperV Gen 2 VMs and Windows overlay file systems.</p> <p>This is the best choice for Win 8, 8.1, 10, Server 2012, 2012R2 systems. Windows PE 10 is a requirement if your system uses Windows 8.1 WIMBoot technology or if your system is a Windows 10 'Compact Install'. Both of these installation types are rare but may be used on Windows Tablet PCs with limited disk space.</p> <div>  Note: The Windows PE 10.0 download option is not available if you are running Windows XP, Vista or Server 2003/2008 </div>

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Delta Incremental Indexes

Delta Incremental indexes provides a more efficient way of saving incremental backup files by optimizing the size of the index saved with each incremental.

Without 'Delta Indexes', each Incremental backup contains a full index at the end of the file that describes where all the data for the entire backup is at the time of the Incremental. This includes a reference to the physical backup file and the offset in the file to retrieve the data. The Full index can be as large as 100MB for each partition in the backup. This overhead is present regardless of the amount of data backed up by the Incremental. Delta indexes only contain a list of changed blocks in the incremental itself.

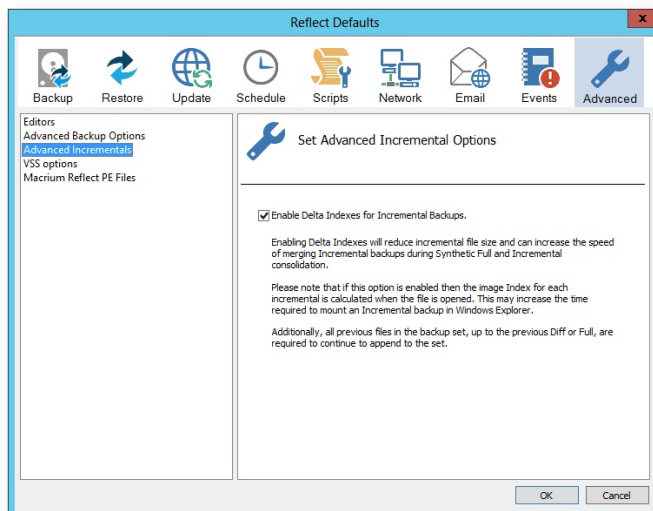


Please ensure that you are using Rescue Media created with Macrium Reflect **v6.1** if Delta Indexing is enabled.

Click the 'Rebuild' button on the final Rescue Media Wizard page. See: [Creating rescue media](#) (see page 69) for more information.

[Click here to show how to enable Delta Incremental Indexes...](#)

Take 'Other Tasks' > 'Edit Defaults' > 'Advanced' > 'Advanced Incrementals'...



Advantages of Full indexes:

Incrementals are self describing	No additional backup files are required to be loaded other than the most recent Incremental when appending to an existing backup set. This enables backup sets to be 'split' over multiple locations; useful if you want to archive part of a backup set.
	Because the entire index is available when the Incremental file is opened the backup set can be mounted and browsed in Windows Explorer very quickly. See: Browsing Macrium Reflect images and backups in Windows Explorer (see page 218)

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Mounting incremental backups is fast	
--------------------------------------	--

Disadvantages of Full indexes:

Increases the size of Incremental backups	When running Incremental backups on a data set where very little has changed the overhead of the Full index may be greater than the size of the data that's backed up.
Consolidation causes subsequent Incrementals to be updated	If your backup 'Retention Rules' invoke a 'Synthetic Full' or 'Incremental Merge' then indexes contained in more recent Incrementals are updated to reflect the consolidation. Without updating the Index would become 'stale'. This file change can cause excessive file copying when synchronizing consolidated backup sets to an archive location. See: Backup Folder Synchronization (see page 308) for more information on this.

Advantages of Delta indexes

Decreases the size of Incremental backups	The Incremental file index contains only a list of the changed data blocks in the incremental. This means that Incremental backups with only a few changes are optimized for backup file size. This is most apparent when performing frequent Incremental backups.
Later Incrementals are unaffected by Consolidation	Because the Incremental index only contains references to itself there is no need to update the Incremental backup file when earlier backups in the same set are consolidated. This overcomes the issue with Backup Folder Synchronization (see page 308) caused by Full indexes.

Disadvantages of Delta Incremental

Incrementals depend on all previous backups	A backup set cannot be appended to unless all previous files in the set are available in the same folder as the most recent Incremental. Partial archiving of a backup set is not possible.
Mounting incremental backups may be slower	Because the Full Index has to be constructed when the Incremental file is opened, this can lead to a delay of a few seconds when browsing images and backups in Windows Explorer (see page 218).



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Note: A backup set can contain a mixture of Incremental backups with Full and Delta Indexes. If Delta Indexing is enabled mid backup set, then only Incrementals created after enabling will contain delta indexes.



Please ensure that you are using Rescue Media created with Macrium Reflect **v6.1** if Delta Indexing is enabled.

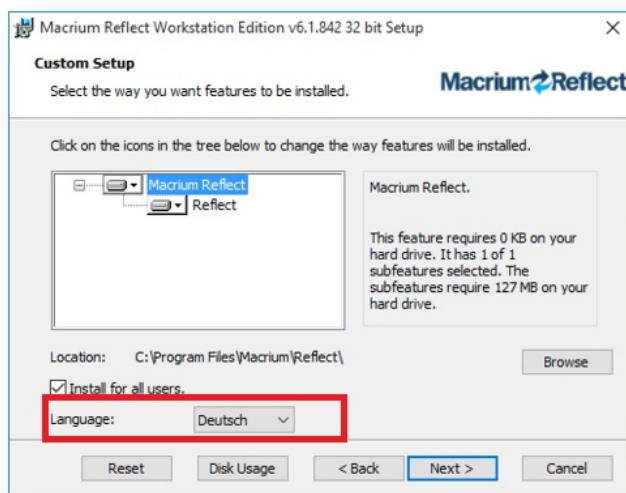
Click the 'Rebuild' button on the final Rescue Media Wizard page. See: [Creating rescue media \(see page 69\)](#) for more information.

German Language Support

Macrium Reflect Home, Workstation, Server and Server Plus now includes German language support. Macrium Reflect Free edition German language support will be coming soon.

[Click here to show how to change the user interface language...](#)

If your Windows language is set to a German locale then new installs will be prompted to choose a language in the installer.



To change the language for an existing installation, press the key Ctrl + Shift + L at the same time:

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Reflect will then automatically re-start with the changed language.

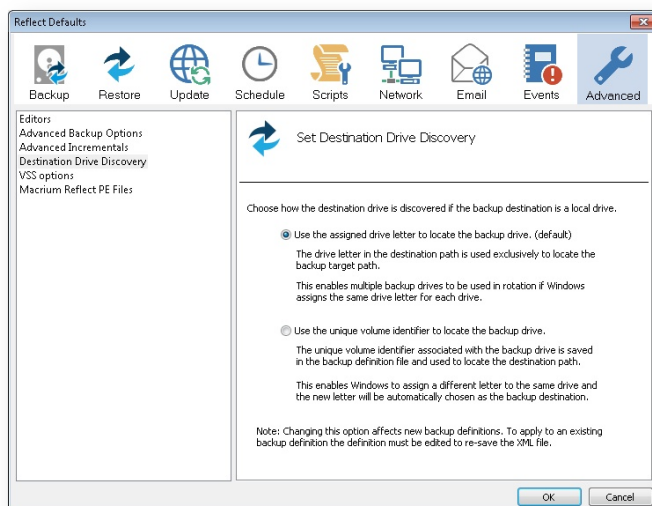
Destination drive letter discovery using Volume GUID path

When saving a backup definition XML file you can now optionally save the Volume GUID path instead of the drive letter for the backup destination drive. This enables Macrium Reflect to handle drive letter changes caused by inconsistent Windows drive letter assignments. Typically this can happen if you are using multiple external USB drives.

 The volume GUID path uses the format `\\?\Volume{GUID}\Folder\` where **GUID** is a globally unique identifier for the volume such as: 'e862fd21-bb78-4f82-8e79-30325125c9c2'

[Click here to show how to enable Volume GUID paths...](#)

Take 'Other Tasks' > 'Edit Defaults' > 'Advanced' > 'Destination Drive Discovery'...



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Option	Description
Use assigned drive letter (default)	<p>The drive letter in the destination path is used exclusively to locate the backup target path. The destination path is saved in the format '<DRIVE LETTER>:\Folder\'</p> <p>This enables multiple backup drives to be used in rotation if Windows assigns the same drive letter for each drive.</p>
Use volume GUID path	<p>The unique volume identifier associated with the backup drive is saved in the backup definition file and used to locate the destination path. The destination path is saved in the format '\\?\Volume{GUID}\Folder\'</p> <p>This enables Windows to assign a different letter to the same drive and the new letter will be automatically chosen as the backup destination.</p>



Note: If 'Use volume GUID path' is selected you must edit/re-save existing backup definitions to reflect the change in the XML file.

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Upgrade FAQ

Introduction

This FAQ covers some of the commonly encountered queries regarding transitioning from Macrium Reflect v5 to v6.

How do I download the v6 Installer if I've purchased an upgrade?

*Enter your **v6** key in the Macrium Reflect download manager. Your v6 key will begin with 36-, 37-, 38- or 39.*

Please see [Installing a Macrium reflect v5 to v6 Upgrade](#) (see page 46)

Where is the v6 Professional Edition?

The v6 Home Edition has all of the features of v5 Professional Edition plus the new features of v6. There is no equivalent of the v5 Standard Edition in v6.

What's the difference between the Home Edition and the Workstation Edition of Macrium Reflect v6?

These two editions are functionally identical. The Workstation Edition includes an annual support and maintenance product. This adds continual support and free major version updates for the duration of the subscription. Year 1 is included in the the Workstation Edition product price.

Can v6 read and restore images created with Macrium Reflect v5?

Yes, v6 is backwards compatible with all Images and File and Folder backups created with earlier versions of Macrium Reflect.

Will I need to recreate my v5 backup XML definition files?

No, your v5 backup definition files will be loaded into v6 without any conversion.

Can Version 6 be installed over 5? Will both 5 and 6 be on the hard drive? Should 5 be uninstalled first?

Versions 5 and 6 will not exist on your system at the same time. The version 6 installer will uninstall version 5, as part of the install process.

Does Windows PE need to be reinstalled and new rescue CDs made? Will the old Rescue CDs still work?

Version 5 rescue media cannot restore images created with v6 so it is essential to create v6 rescue media when you upgrade. Please note that v6 rescue media can restore images from any version of Macrium Reflect.

Can you restore an image taken with v6 to different hardware?

Yes, all editions of Macrium Reflect (except Free) include Macrium ReDeploy and support restoring images to different hardware.

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Why can't I change the install location?

For update installs, the facility to change install location is disabled as your scheduled tasks will fail as they reference the reflect program folder.

If you do wish to change the install location

1. *Remove any scheduled tasks.*
2. *Uninstall Reflect.*
3. *Install, note now you can change the install location.*
4. *Setup your scheduled tasks.*

After purchasing an upgrade, can I continue to use my 5 license on another computer?

The v6 upgrade is discounted on the basis that you are upgrading your license. Therefore you still are only licensed to use reflect on a single computer. Your v5 license key will be revoked as part of the upgrade process.

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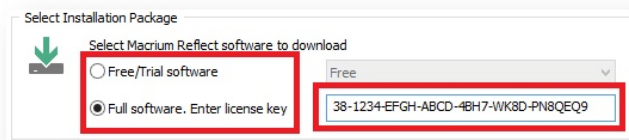
Installing Macrium Reflect

This article explains how to install Macrium Reflect on an Internet connected PC using the Macrium Reflect download agent.

For a description on installing to an offline (non Internet connected) PC please see [here](#) (see page 41)

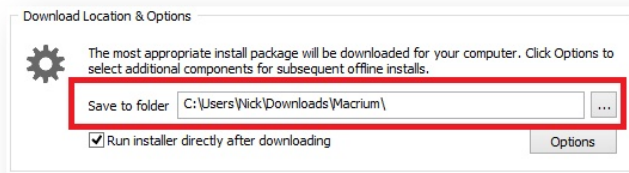
Downloading Macrium Reflect Installer and PE Components

1. Macrium Reflect Download Agent and run it
2. If you have purchased Macrium Reflect then **Click 'Full Software'** and **enter a valid license key** to automatically download your purchased product.



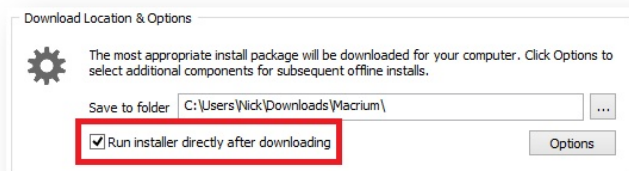
To download a 30 day trial **Click 'Trial Software'** and **select the Macrium Reflect Edition** from the drop down list to the right.

3. **Enter the folder** where the downloads will be saved to or **Click '...'** to select a folder.



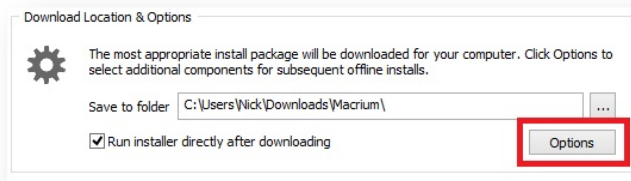
4. **Click 'Run installer directly after downloading'** to run the installation package as soon as the download completes successfully.

Note: If you intend to install on another computer then leave this item unchecked.



5. **Click Options** to select different download options (see Modifying the default selections):

Macrium Reflect v6 User Guide

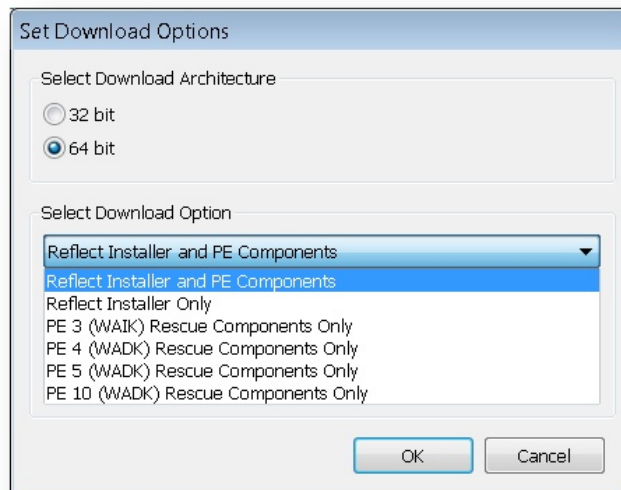


6. **Click Download** to start downloading your installation files.

Modifying the default selections

By default, the most appropriate installation for your PC will be selected for download. This is based on operating system, architecture and existing rescue media components. For more options **Click 'Options'** on the main download agent window as seen at step 5 above:

Select download options and architecture.



Option	Description						
Reflect Installer and PE Components	Downloads both the Macrium Reflect installer and the default Windows PE component files for currently running Windows OS: <table><tr><th>PE</th><th>Windows Version</th></tr><tr><td>PE 3.1</td><td>Windows XP, Windows 7, Windows Vista, Server 2003, Server 2008, Server 2008R2</td></tr><tr><td>PE 10</td><td>All other Windows versions.</td></tr></table>	PE	Windows Version	PE 3.1	Windows XP, Windows 7, Windows Vista, Server 2003, Server 2008, Server 2008R2	PE 10	All other Windows versions.
PE	Windows Version						
PE 3.1	Windows XP, Windows 7, Windows Vista, Server 2003, Server 2008, Server 2008R2						
PE 10	All other Windows versions.						

Macrium Reflect v6 User Guide

Reflect Installer Only	Downloads the Macrium Reflect installer for the chosen trial or entered license key. This option will be defaulted if you have already downloaded the default Windows PE component .zip file and it is located in the download folder.
PE 3 (WAIK)	Downloads the Windows PE 3.1 components to file PE3x86.zip or PE3x64.zip
PE 4 (WADK)	Downloads the Windows PE 4 components to file PE4x86.zip or PE4x64.zip
PE 5 (WADK)	Downloads the Windows PE 5 components to file PE5x86.zip or PE5x64.zip
PE 10 (WADK)	Downloads the Windows PE 10 components to file PE10x86.zip or PE10x64.zip

For more information on the different versions of Windows PE see [this help page](#).



The default and most usual option is '**Reflect Installer and PE Components**'. This downloads all the files to run Macrium Reflect and create your rescue media.



The 'PE 3, PE 4, PE 5 or PE 10 Components only' options can be used to download just the PE component files. The downloaded .zip file can be supplied when building the Windows PE rescue media or copied to a different PC.

Click '**OK**' to return to main Agent Window.

Resolving Download Issues

Download Failures (Error Code: 1)

Download failures can generally be attributed to either an unstable internet connection or anti virus/malware software interfering with the download. Please try the following steps to resolve the issue

- Reboot the computer to clear any internet cache files
- Disable anti virus/malware software for the duration of the download and installation of Macrium Reflect.
- Download the Macrium Reflect installer on it's own. If the internet connection is unstable, the prolonged download of WinPE components can be postponed and attempted from within the Macrium Reflect software
- Perform a CleanBoot of Microsoft Windows (see: [this link for more help](#)) to remove any third party components possibly affecting the download
- Download the installer on another computer

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MD5 Checksum Failures (Error Code: 2)

MD5 checksum failures can generally be attributed to either an unstable internet connection or anti virus/malware software. Please try the following steps to resolve the download issue:

- Reboot the computer to clear any internet cache files
- Anti virus/malware or another third party process has either locked or quarantined the downloaded file preventing the MD5 check. Temporarily disable these forms of software for the duration of the download and install process
- Perform a CleanBoot of Microsoft Windows (see: [this link for more help](#)) to remove any third party components possibly affecting the download

WinPE Download Locations

WinPE installations can be downloaded and installed manually from the following Microsoft links, negating the need to use the Macrium Reflect download manager for WinPE Components.



WARNING: These downloads from Microsoft will be very large and are generally in excess of 1GB

- WinPE 3 (WAIK) - Recommended for Windows 7 and earlier
- WinPE 3.1 Update (WAIK) - Recommended for Windows 7 and earlier
- WinPE 4 (WADK) - Recommended for Windows 8 and later
- WinPE 5 (WADK) - Recommended for Windows 8.1 and later

Macrium Reflect v6 User Guide

Installing and updating Macrium Reflect offline

This article explains how to install Macrium Reflect on a PC that isn't connected to the Internet. For information on installing on an Internet connected PC please see [here](#).

Macrium Reflect uses an Internet connection to:

- Download the installer and Microsoft components to enable building of the PE based rescue environment
- Validation of your license during installation.
- Notification and download of updates



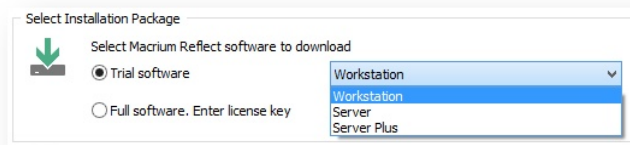
This article refers to the machine you wish to install Reflect on as the "target PC" and the machine connected to the Internet as the "online PC".

You will need access to a computer that is connected to the Internet and a device to copy files to the target PC.

Download the installer and PE components.

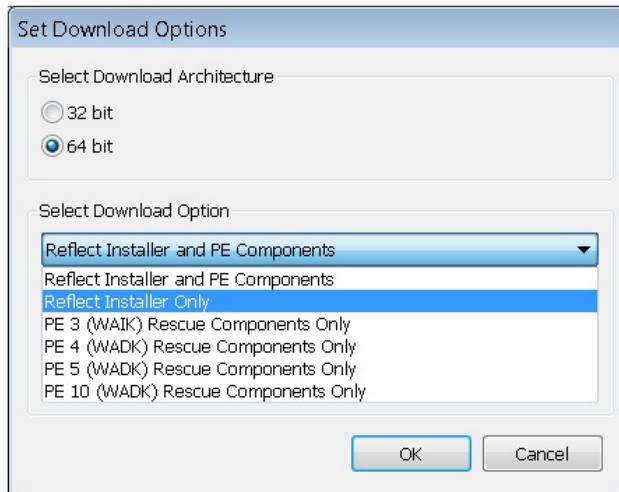
Download the [Macrium Reflect Download Agent](#) to your PC and run it.

Select Trial and choose the edition or select Full and enter your key.



The download agent is automatically configured for the computer it is running on. You will need to reconfigure it to reflect your target PC instead. Do this by **clicking the Options button**.

Macrium Reflect v6 User Guide



Choose the download architecture - 32 or 64 bit - for your offline PC. See the "How to identify the architecture of your target machine" at the end of this article.

Option	Description						
Reflect Installer and PE Components	<p>Downloads both the Macrium Reflect installer and the default Windows PE component files for currently running Windows OS:</p> <table> <tr> <th>PE</th><th>Windows Version</th></tr> <tr> <td>PE 3.1</td><td>Windows XP, Windows 7, Windows Vista, Server 2003, Server 2008, Server 2008R2</td></tr> <tr> <td>PE 10</td><td>All other Windows versions.</td></tr> </table>	PE	Windows Version	PE 3.1	Windows XP, Windows 7, Windows Vista, Server 2003, Server 2008, Server 2008R2	PE 10	All other Windows versions.
PE	Windows Version						
PE 3.1	Windows XP, Windows 7, Windows Vista, Server 2003, Server 2008, Server 2008R2						
PE 10	All other Windows versions.						
Reflect Installer Only	<p>Downloads the Macrium Reflect installer for the chosen trial or entered license key.</p> <p>This option will be defaulted if you have already downloaded the default Windows PE component .zip file and it is located in the download folder.</p>						
PE 3 (WAIK)	Downloads the Windows PE 3.1 components to file PE3x86.zip or PE3x64.zip						
PE 4 (WADK)	Downloads the Windows PE 4 components to file PE4x86.zip or PE4x64.zip						
PE 5 (WADK)	Downloads the Windows PE 5 components to file PE5x86.zip or PE5x64.zip						
PE 10 (WADK)	Downloads the Windows PE 10 components to file PE10x86.zip or PE10x64.zip						

Macrium Reflect v6 User Guide

For more information on the different versions of Windows PE see [this help page](#).



If you require the same PE version as the default Windows PE component files for this PC (see table above)

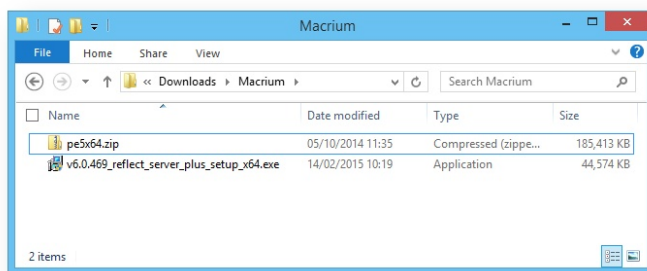
Select 'Reflect installer and PE components'. This will download the required files in **one** download step. **Click OK**, then **un-check "Run installer directly after downloading"**, and **Click download**.



If you require a specific PE version

This will require **two** downloads. First, **select 'Reflect Installer Only'**, **click OK**, then **un-check 'Run installer directly after downloading'**, and **Click download**. After the first download is complete, **click 'Options'** again, choose the desired **'PE X rescue components only'**, **click 'OK'** and then **Click 'Download'**.

Once the download(s) complete, you will find two new files in the folder saved to...



The file names will vary dependent on your particular selections. There will be an installer .exe file and a PE components zip file.

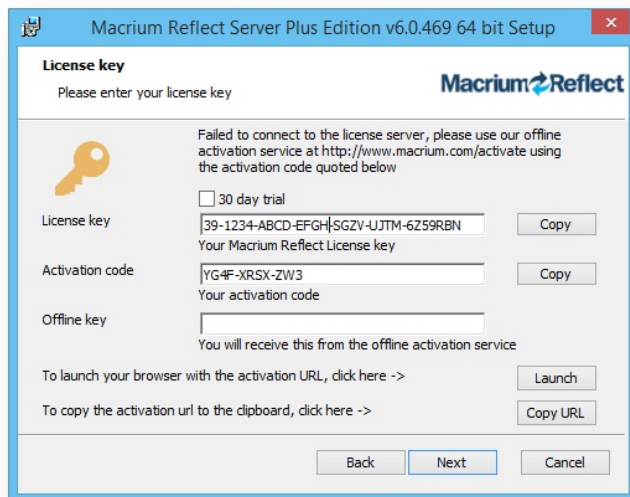
Copy these two files to your target PC and run the installer ensuring that the zip file is in the same folder. You will then be able to install your software and generate PE rescue CDs.

Offline installation of your purchased license.

Note: This step is not necessary for the Free or Trial Editions of Macrium Reflect.

When you run the installer on your target PC, instead of the automatic activation, you will be given an activation code. **F95B-K9XV-8SZ** in the example below.

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Navigate to the [registration server](http://www.macrium.com/activate) on your online PC and enter your license key and activation code.

Please enter your licence key and activation code below.

Licence Key	39-1234-ABCD-EFGH-SGZV-UJTM-6Z59RBN
Activation Key	YG4F-XRSX-ZW3

Submit

Click 'Submit' and you will receive an offline key as shown below.

Registration Successful

Licensee	Macrium
Order Number	24002542
Offline key	QRZT-HKDY-662D-A284-DUAQ-HK2T-7H

Macrium Reflect v6 User Guide

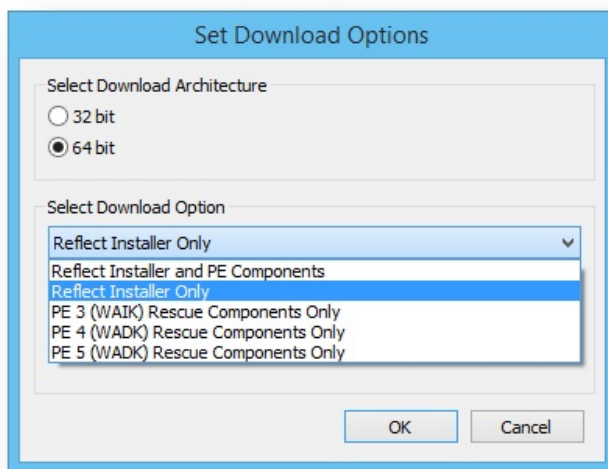
Enter the **Offline key** in the install dialog to complete installation.

Ensuring your software is up to date.



Note: For online installations, update notifications and patching is automatic.

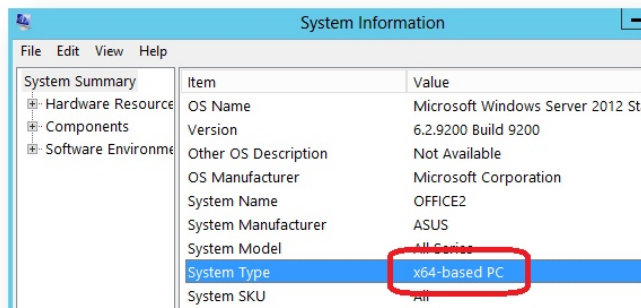
Check the [change log](#) web page periodically for updates. If you see an update that is relevant to your system, follow the steps in 1. above, but **choose the 'Reflect Installer' option** in the download agent.



How to identify the architecture of your target machine.

Run msinfo32 (**type Windows Key + R** and then **type msinfo32**) and note the system type.

x86-based PC indicates that the target machine is 32 bit and x64-based PC indicates a 64bit system.



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Installing a Macrium reflect v5 to v6 Upgrade

This article explains how to download and install Macrium Reflect v6 using your v5 to v6 upgrade license key.

License key format



Note: If you are unable to locate your v5 or v6 keys then please see this page <http://www.macrium.com/account/myorders.aspx> to request your order history

Macrium reflect v5 keys

Product	Key format
v5 Standard	16-XXXX-XXXX-XXXX-XXXX-XXXX-XXXXXXXX
v5 Professional	17-XXXX-XXXX-XXXX-XXXX-XXXX-XXXXXXXX
v5 Server	18-XXXX-XXXX-XXXX-XXXX-XXXX-XXXXXXXX
v5 Server Plus	19-XXXX-XXXX-XXXX-XXXX-XXXX-XXXXXXXX

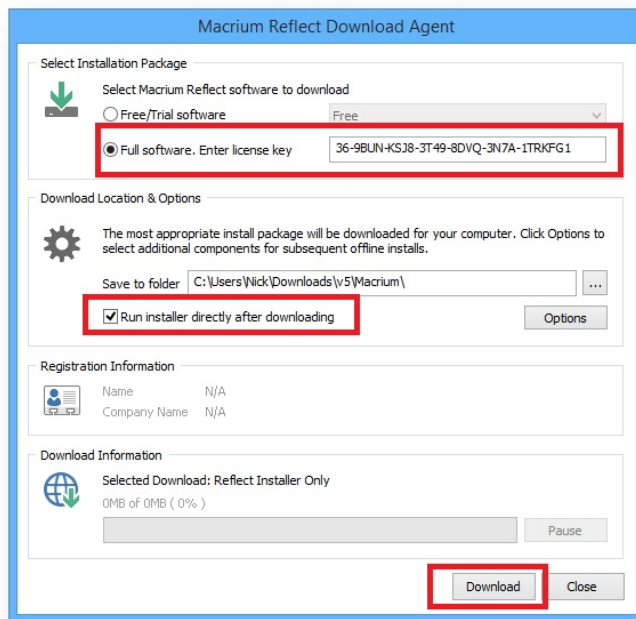
Macrium reflect v6 and v5 to v6 upgrade keys

Product	Key format
v6 Home	36-XXXX-XXXX-XXXX-XXXX-XXXX-XXXXXXXX
v6 Workstation	37-XXXX-XXXX-XXXX-XXXX-XXXX-XXXXXXXX
v6 Server	38-XXXX-XXXX-XXXX-XXXX-XXXX-XXXXXXXX
v6 Server Plus	39-XXXX-XXXX-XXXX-XXXX-XXXX-XXXXXXXX

How to download the Macrium Reflect installer

1. Download and run the Macrium Reflect download manager: Click '[ReflectDLUpgrade.exe](#)' to download.
Enter your **v6 Key** in the download manager to download and run the v6 installer:

Macrium Reflect v6 User Guide

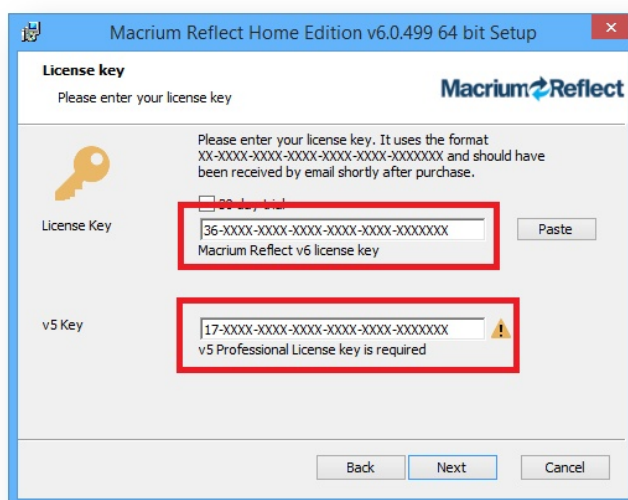


Note: You **must** enter your v6 key. If you enter your v5 key you will download the Macrium Reflect v5 installer

The Macrium Reflect installer and Windows PE rescue media files will be downloaded and the installer will start automatically .

Entering your license keys in the installer

In the installer License Key page **enter your v6 Key** you will then be prompted to **enter your v5 key**:



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Note: You are only required to enter your v5 license key **once**. After this first installation your v6 key becomes a Full key and your **v5 key is deactivated**.

Related articles

[v5 to v6 Upgrade FAQ \(see page 35\)](#)

[Installing Macrium Reflect \(see page 37\)](#)

[Installing and updating Macrium Reflect offline \(see page 41\)](#)

[Troubleshooting installer issues](#)

Macrium Reflect v6 User Guide

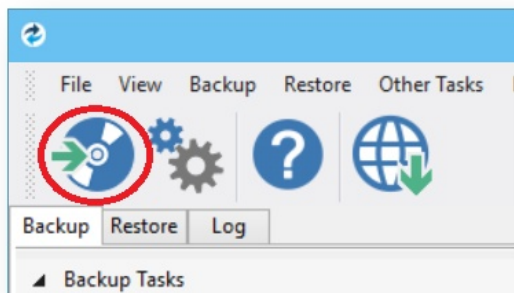
Macrium Reflect Quick Start

Macrium Reflect is intuitively designed and organised with simple to follow wizards guiding you through tasks. If you have never used backup software before, however, you might feel some trepidation, needing a little extra guidance to get you started.

First create rescue media

We recommended that the first time you use Macrium Reflect, you create bootable rescue media before performing any other tasks.

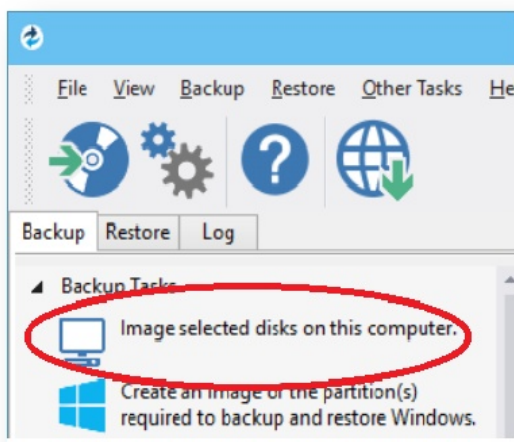
Click the **Create bootable Rescue media** icon to access the wizard.



For further guidance see [Creating rescue media](#) (see page 69).

Imaging disks

Disk imaging is a **Backup** task and can be accessed from the **Backup** task bar.



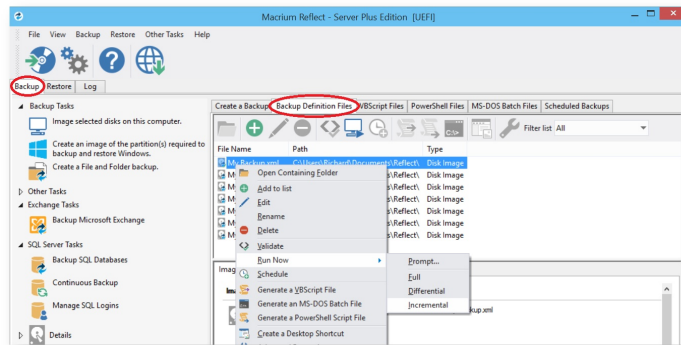
For further guidance see [Creating a backup of your computer](#) (see page 119).

Macrium Reflect v6 User Guide

Differential and incremental disk images

When your first full backup you can run differential and incremental backups to capture just the changes because it is quicker. Macrium then manages these backup sets for you.

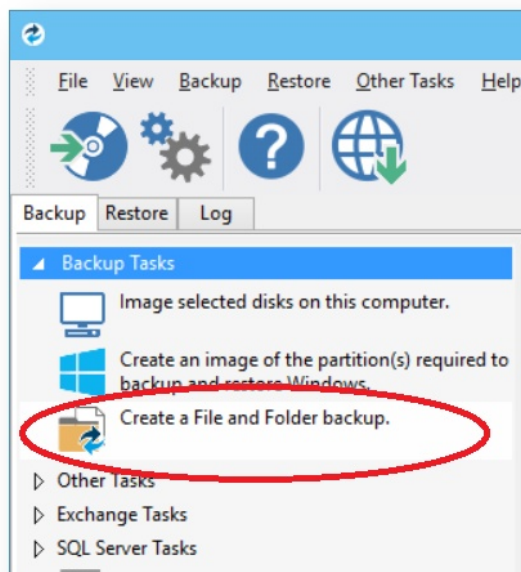
Right click the file you want to backup up and select the type of image to create.



For more information see [Differential and incremental disk images](#) (see page 160).

Backing up files and folders

Creating full, differential, and incremental backups of specific files or folders can optimize backup speed and disk space requirements. The wizard can be accessed from the **Backup** task bar.



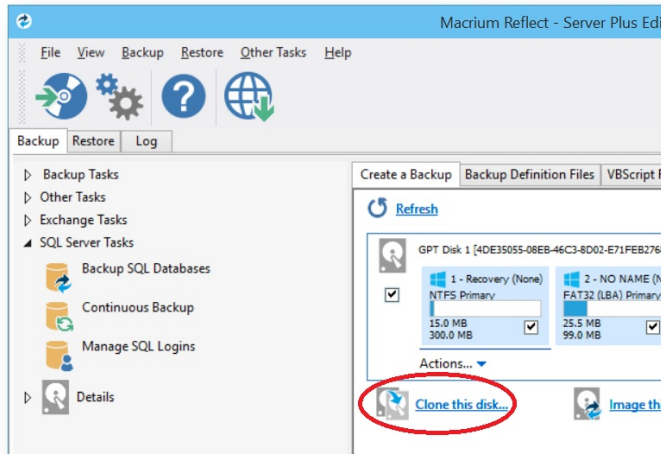
For more information see [Backing up files and folders](#) (see page 134).

Cloning disks

Cloning is particularly useful if you are upgrading to a new, larger hard drive or if you need to quickly swap failed disks out of your system.

Macrium Reflect v6 User Guide

Select the the disk or partition you require from the **Create a Backup** screen and click **Clone this disk**.

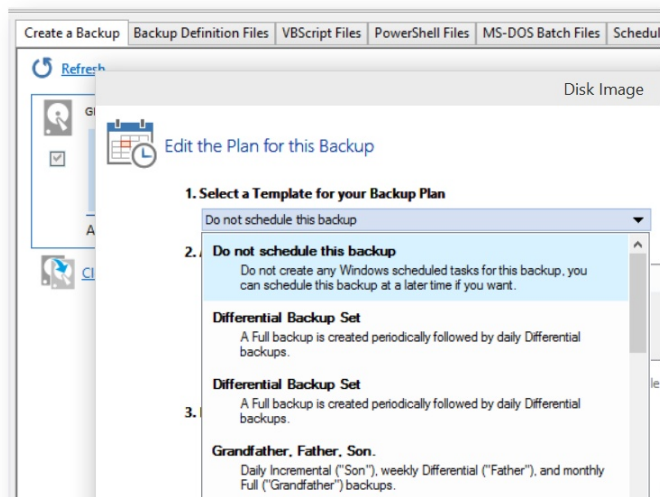


For more information see Cloning a disk (see page 141).

Scheduling, retention and disk space

Whenever you create a backup, regardless of type you have the option to create a backup plan using the scheduling and retention wizard.

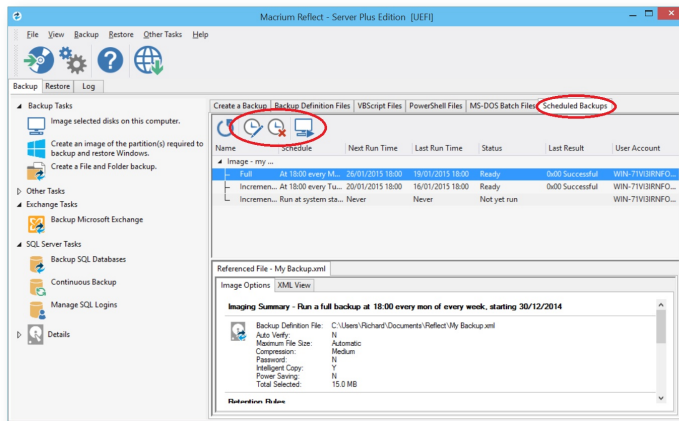
Click below **Select a Template for you Backup Plan** to select from industry best practice backup plans templates, quick-start backup plan templates or even templates that you have created. You can even skip over scheduling to simply take advantage of the retention rules for managing your disk space.



You can then customize the plan to suit your needs.

You can view, edit, cancel or run scheduled backups from the **Scheduled Backups** screen.

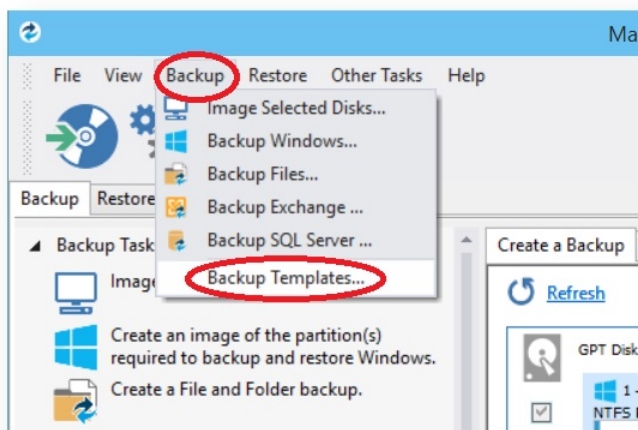
Macrium Reflect v6 User Guide



Backup plan templates

Macrium Reflect includes templates for automating industry best practice backup plans that help you maximize retention for your available storage space. These can be accessed and modified, or you can create your own backup templates.

To manage backup plan templates click **Backup** and select **Backup Templates...**



If you are new to scheduling backups read [Planning a backup strategy](#) (see page 49).

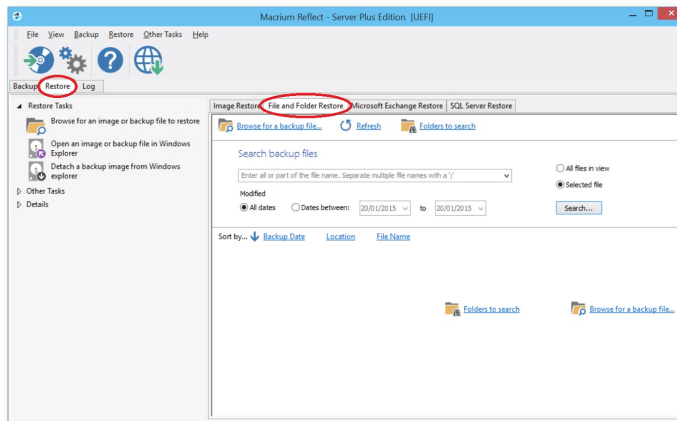
For more information about using backup templates see [Scheduling backups](#) (see page 183).

For more information about retaining backups and backup plans see [Retention and consolidation](#) (see page 203).

Restoring files and folders

To directly restore the contents of a file and folder backup use the Macrium Reflect file and folder restore feature.

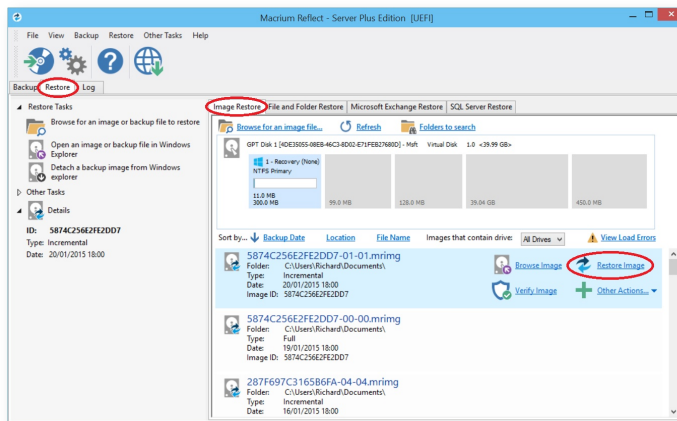
Macrium Reflect v6 User Guide



For more information see [Restoring a file and folder backup](#) (see page 224).

Restoring images

Select the **Restore** task bar, choose the image you want to restore and click **Restore Image**.



For more information see [Restoring an image from within Windows](#) (see page 208).

Note: If you are unable to boot Windows you can still restore an image by booting from the Macrium Reflect rescue media and using the temporary Macrium Reflect to find and restore images.

ReDeploying computers

Macrium ReDeploy is included in the Server editions of Macrium Reflect. With ReDeploy you can restore an image to a replacement computer or even create various types of virtual hard drives to virtualize the machine, a technique sometimes called Physical to Virtual or P2V. ReDeploy modifies an existing offline operating system to work with new hardware.

1. Restore your system image to the PC being deployed before running ReDeploy.

Note: There is no need to reboot your PC after restoring an Image and before you run ReDeploy.

2. Boot the target PC with the Windows PE rescue CD or USB equivalent. There is a link to a video on creating a Windows PE rescue CD at the bottom of this page.

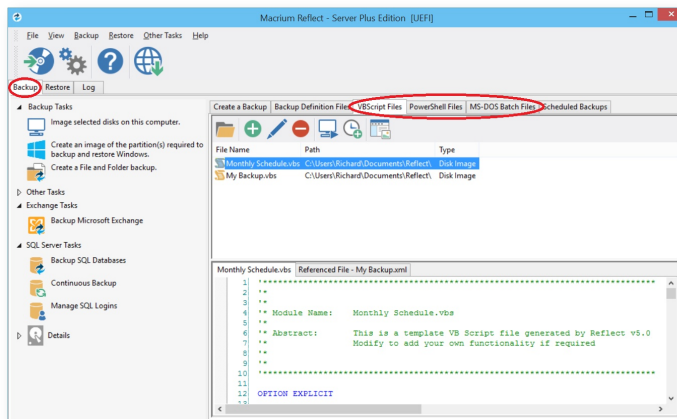
Macrium Reflect v6 User Guide

3. On the **Restore** task pane, click **ReDeploy Restored Image to new hardware**.

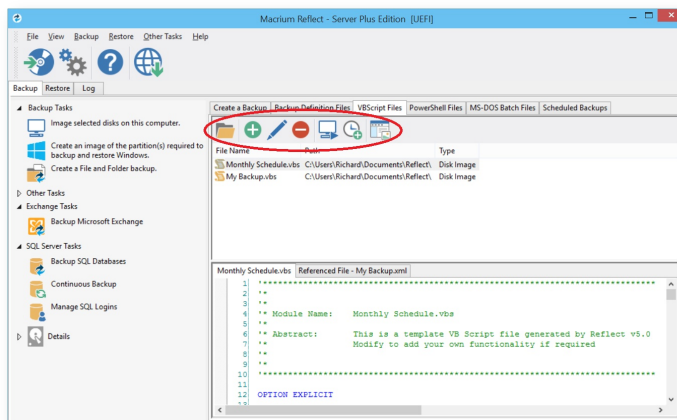
For more information see Re-deploying Windows to new hardware using Macrium ReDeploy (see page 263).

Scripting backup processes

VBScripts, Powershell and MS-DOS batch file tabs are available when you select the **Backup** task bar.



In each tab you can manage files, run or schedule them to run later. You can even create a desktop shortcut for convenience.



Managing Macrium files in Windows

Wherever you browse for files in Windows programs or Windows Explorer, you can find Macrium Reflect functions by right-clicking on drives or Macrium files. If you have file extensions showing, Macrium files have the extensions .mrmimg for images or .mrbak for file and folder backups. Otherwise, you can look for the icons.

With Macrium Reflect installed, directly from Windows you can:

- Image drives
- Run Macrium XML definition files
- Mount and unmount images for browsing

Macrium Reflect v6 User Guide

- View file Macrium properties in the file properties dialog
- See comments in Windows Explorer columns
- See a popup summary of the file contents by hovering the mouse pointer

Note though, the best way to view backup sets is in the Macrium Reflect interface itself where it can automatically collate the multiple files involved in incremental and differential backups and you can manage them as a set.

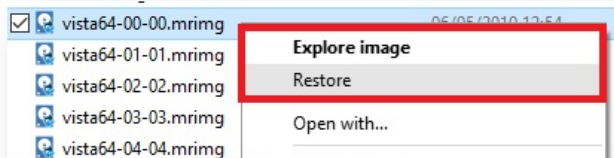
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Windows Explorer shell integration

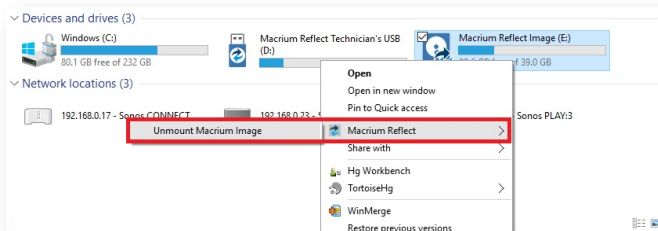
Macrium Reflect is integrated with Windows Explorer giving you the following features:

Context sensitive menus

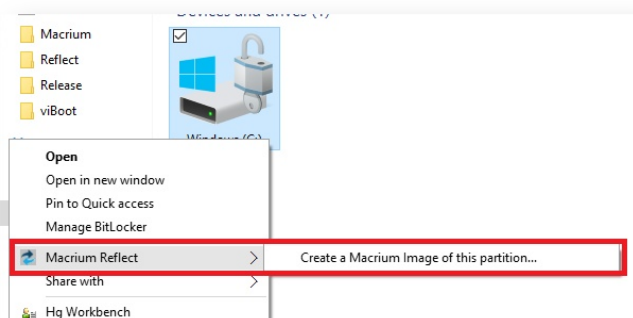
Right-click on Reflect .mrimg and .mrbak files to **Explore** or **Restore** an image.



You can then right click on the disk to unmount the image



You can also image individual drives by **selecting the drive**, **right-clicking** and selecting the **Macrium Reflect** option then **Create a Macrium Image of this partition**

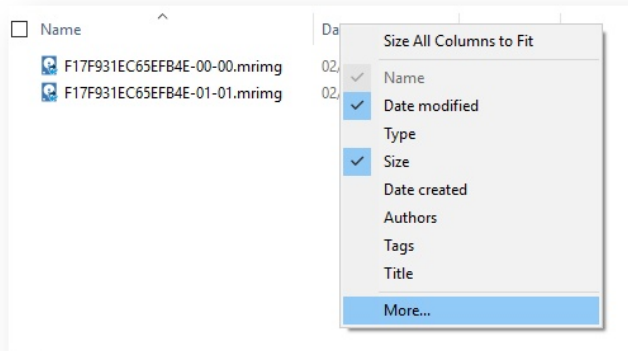


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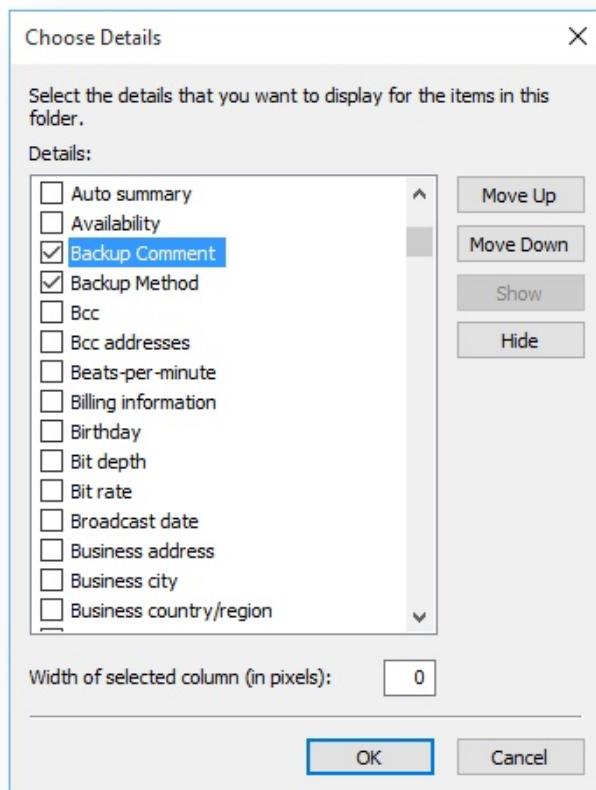
Windows Explorer columns

You can add columns in Windows Explorer to show the Backup Method and the comments stored with the backups.

Open a folder containing Macrium Reflect backup files, **right click** on any Explorer column heading and **select 'More'**:

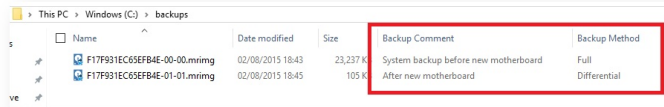


Scroll and **select 'Backup Comment' and 'Backup Method'**:



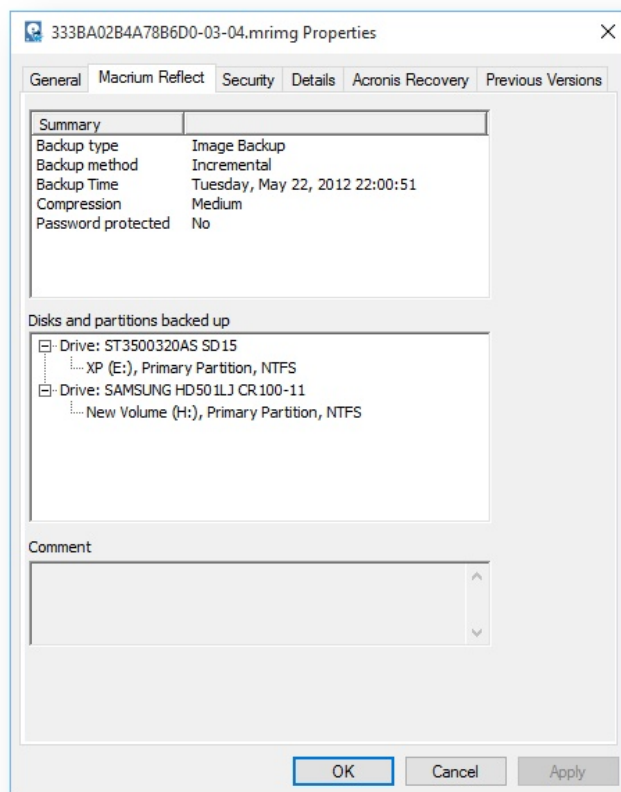
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The columns are then added to the Explorer view:



.mrimg and .mrbak file properties

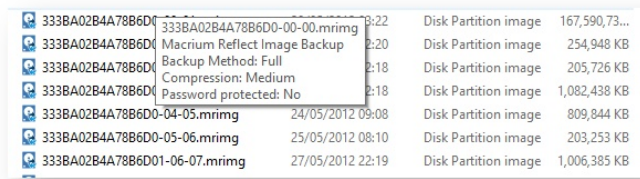
Right-click and select **Properties** to view the Macrium Reflect properties pane on image and backup files. This gives information about the file such as the backup method and time of backup as well as volumes or folders that have been backed up.



File Infotips

Hover the mouse over a Macrium image or backup file, you can get a brief summary of the file including the file type (Image or Backup), backup method, compression level and if the file is password protected.

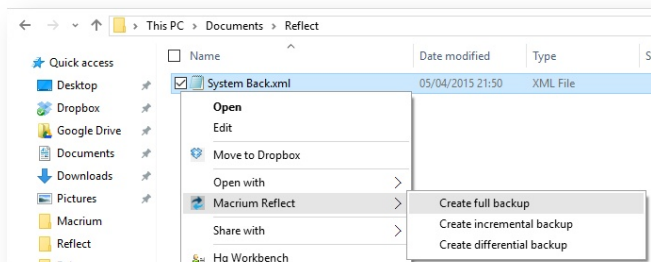
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A screenshot of the Macrium Reflect software interface showing a list of backup files. The list includes columns for file name, date, time, type, and size. A context menu is open over the first file, showing options like 'Open', 'Edit', 'Move to Dropbox', 'Open with', 'Macrium Reflect', 'Share with', and 'Hg Workbench'.

333BA02B4A78B6D0-00-00.mrimg	0:22	Disk Partition image	167,590,73...
333BA02B4A78B6D0-00-00.mrimg	2:20	Disk Partition image	254,948 KB
333BA02B4A78B6D0-00-00.mrimg	2:18	Disk Partition image	205,726 KB
333BA02B4A78B6D0-00-00.mrimg	2:18	Disk Partition image	1,082,438 KB
333BA02B4A78B6D0-04-05.mrimg	24/05/2012 09:08	Disk Partition image	809,844 KB
333BA02B4A78B6D0-05-06.mrimg	25/05/2012 08:10	Disk Partition image	203,253 KB
333BA02B4A78B6D0-06-07.mrimg	27/05/2012 22:19	Disk Partition image	1,006,385 KB

Extended support for Reflect XML definition files

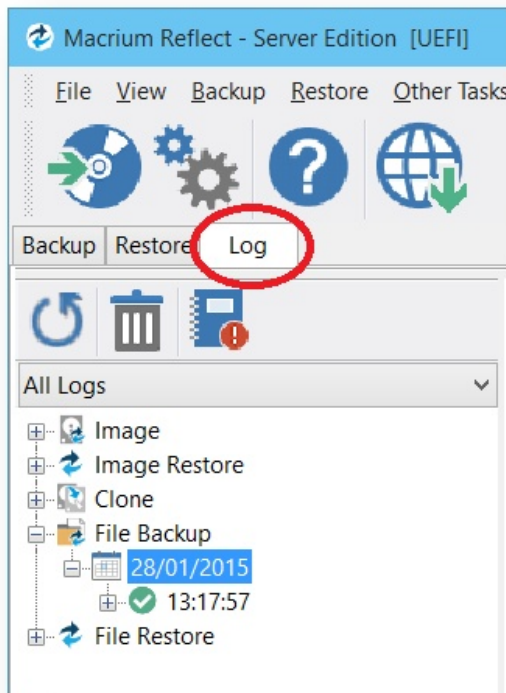
You can run full, differential and incremental backups by **right-clicking on XML definition files**. Select the Macrium Reflect option and then the backup type you wish to perform.



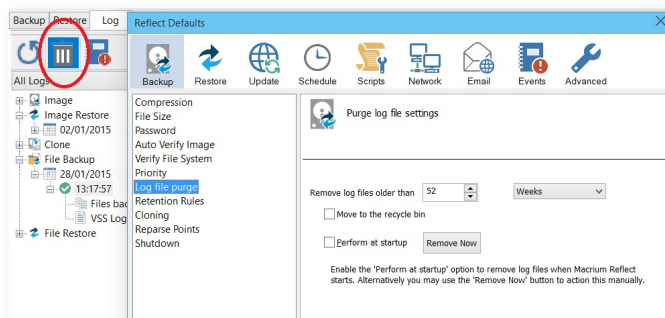
Reviewing your backup history

Macrium Reflect maintains an easy to access log of all types of backups and restores where you can review activities, purge the log files and view Windows VSS events.

1. In the main task bar click **Log**.

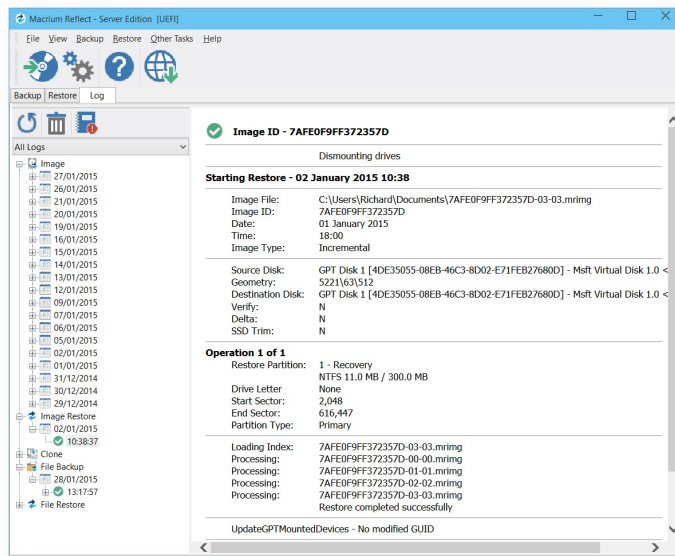


2. Clicking the **Delete old logs** icon will take you to the Log file purge settings, where you can select to remove old logs.

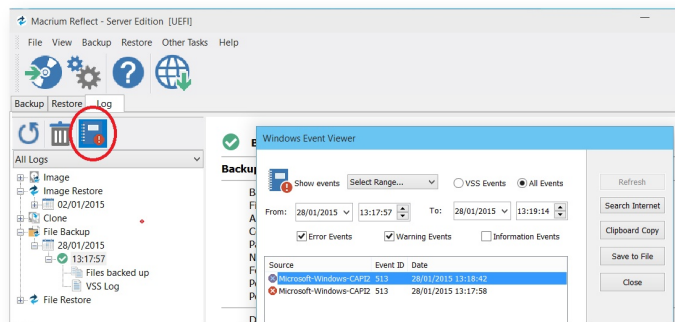


3. Make selection and click **OK**.
4. Select the activity you want to review.

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5. If the activity has a VSS log, select to view VSS events, if required by clicking the **View window VSS events** icon.



Removing your License key when Upgrading your PC

This article covers the procedure for removing a purchased license key from one computer so it can be transferred to another computer, such as when a computer is replaced due to upgrading your computer or so it can be restored to the same computer after a major upgrade.

Please note that a separate license key is required on each computer on which Macrium Reflect is installed. The transfer of a license key from one computer to another is only allowed for legitimate upgrade /replacement purposes.

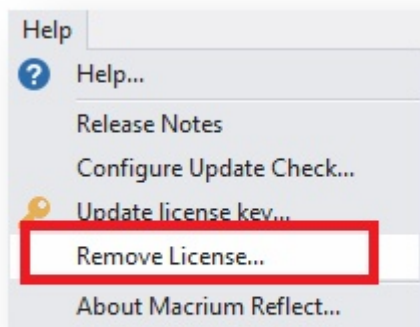
1. Make sure you have a record of your license key:

Your license key was sent by e-mail when you originally purchased. Your license key can also be found in the 'Help' menu of Macrium Reflect by selecting 'About Macrium Reflect...'.

Lost keys can also be retrieved here: <http://www.macrium.com/account/myorders.aspx>

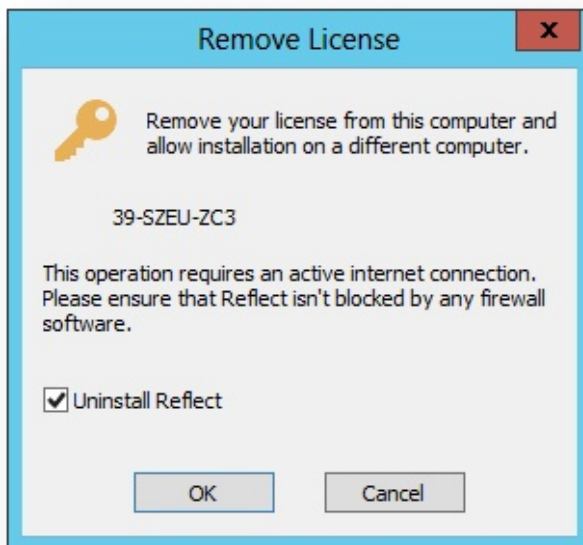
2. Remove your license key and uninstall Macrium Reflect:

Open Macrium Reflect in your old computer and making sure it is connected to the Internet, then in the 'Help' menu select 'Remove License...'.



The following dialog is displayed:

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*Ensure there is a tick against '**Uninstall Reflect**' and click '**OK**'.*

Macrium Reflect will uninstall and your license key will be removed making it available to be used on your replacement computer or original computer after a major upgrade.

More information:

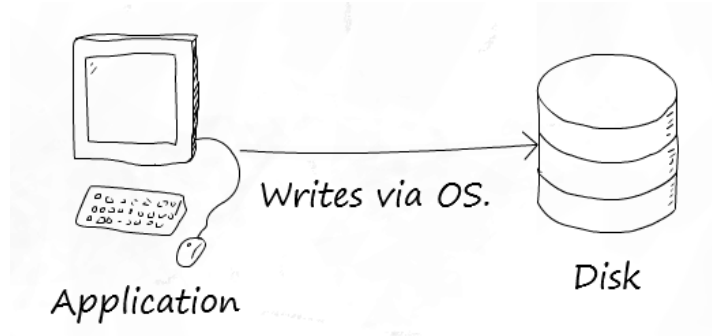
You can download installers and license keys by entering your email address here: <http://www.macrium.com/account/myorders.aspx>

You should create a new Windows PE rescue CD on your new hardware.

Backup Internals: What is VSS, how does it work and why do we use it?

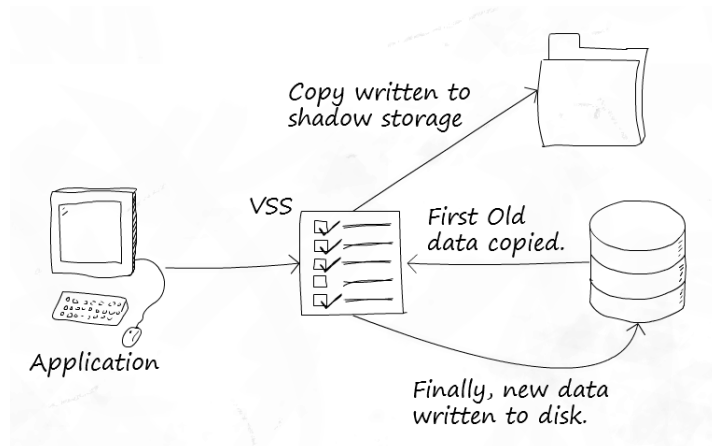
As happens sometimes, our more technically minded customers question a system that “just works”. We like these sort of customers, as they keep us on our toes. In this specific case, the question was [is it safe to continue using my computer during imaging](#) and the answer is yes, although the longer explanation is much more involved. After the ensuing discussion, one of our community members suggested we write this information up as a FAQ entry somewhere and internally we felt it was worth preserving the information from that thread, so this blog post is an extended, polished version of our notes there.

Reflect can take an image of a live system. How does this work?



A simple disk write

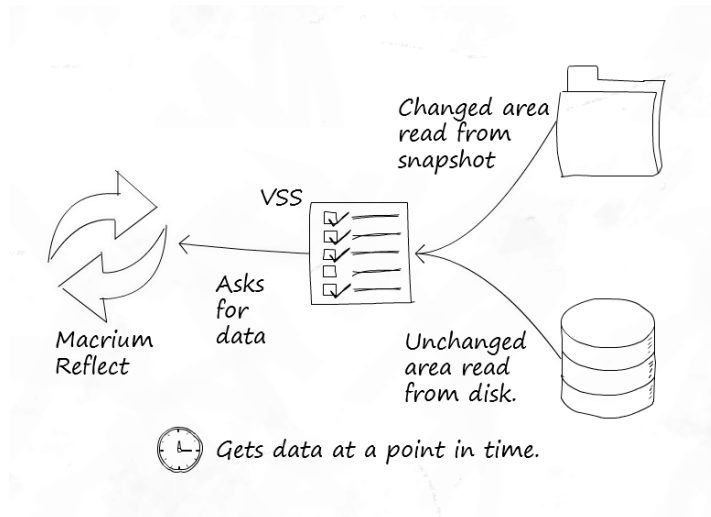
Internally Macrium Reflect relies on a Microsoft Windows component called VSS, which stands for Volume Shadow Storage. Microsoft's VSS operates by taking what is called a copy on write snapshot of your system. This allocates a small temporary storage space. Then, every time you write to a part of your disk, the information on the disk is first copied to the snapshot before allowing the write to take place.



VSS in use

This technique makes VSS quite efficient. A snapshot only contains as much data as has changed since the snapshot started – you do not need an entire copy of your disk. Also, writes are only affected for used space – free space does not need to copy anything, as there is no original to preserve.

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Reading data

However there is another side to this advantage. The more writes made after the snapshot springs into existence, the more VSS must store. So if you perform an excessive amount of disk activity during imaging, the snapshot storage space may become large. VSS imposes a cap on this space, and should a snapshot attempt to exceed it, VSS will stop its copy on write behaviour and delete the temporary storage.

Once the snapshot is finished with, the space can be freed up again – so the temporary storage space is only needed during use.

What determines where this storage space is?

There is no magic to this – VSS chooses sensible defaults based on your available drives. This configuration can of course be altered and Microsoft provide a tool for this called [VSSAdmin](#).

Is the data taken at a point in time really consistent?

This is a difficult question to which there is no straightforward answer. As you may have realized already, if a copy is in progress when the snapshot starts, only the completed part of the copy will be included in the snapshot. The rest of it will count as new writes and the old, inconsistent blocks will be copied to the snapshot!

To understand how VSS gets around this we need to understand a little more about VSS architecture so I'll introduce three terms:

- **Provider:** in VSS land, a provider provides the VSS service and is responsible for all the co-ordination elements. Essentially this is the “core” of VSS. Microsoft include a VSS Provider with Windows, and Reflect uses this. (Technically speaking, there are two components, the co-ordinator and the provider, however, for simplicity we have combined these for the purposes of explaining VSS.)
- **Requester:** a requester is, as you might expect from the name, an application that requests a snapshot to be made. This request goes to the provider.
- **Writers:** these components provide a mechanism for applications to be alerted to the creation of a snapshot, so they can prepare their data for snapshotting. VSS providers can notify VSS writers that a snapshot has been created, and the VSS writer can then perform the appropriate action. Once the snapshot has been taken, the provider again notifies the writers, so they may let the applications resume.

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VSS Writers are an important part of VSS for certain environments. Imagine you are running a heavily loaded database server in production, or a virtual machine cluster. The database server will have open and be manipulating its database files, processing transactions etc. while the VMs are continually performing disk operations for the virtualised OS. Taking a point-in-time snapshot might be fine but, due to the amount of IO, it is likely to catch one or more of these services off guard in an inconsistent state.

The role of writers is to inform these applications a snapshot is about to be created. The application can then perform any tidy up operations necessary to ensure what is on disk is consistent. The snapshot starts and the applications are then notified they can continue. Now the on disk state should be fine.

When do I need to check my applications are VSS aware? I.e. when do I need VSS writers?

You need VSS writers for applications that perform large amounts of IO and depend heavily on the state of the files they are writing if you wish to back them up. Virtual machine disk images are a perfect candidate for this – the running image could easily become inconsistent.

Most applications do not write to disk in quantities of data large enough to be a problem. Many applications from Microsoft are also VSS aware, which helps greatly.

What about current and previous snapshots?

VSS is smart enough to keep track of its temporary storage location, and will exclude anything in it, including the current temporary storage area and any persistent snapshots that have been previously created. So when the data is read by your backup software, you only get what you need.

When is VSS in use and when is it not with regards to taking a backup?

Now a question you may not have thought of – when is VSS in use? Well, VSS solves the problem of imaging a live system neatly, so whenever you image your system with Reflect you are probably using VSS.

There is one exception to this – we have a fall-back mechanism for live versions of 32-bit Windows client operating systems up to Windows 7 (so XP, Vista and 7) called pssnap.sys. Reflect can use this on these systems if VSS is unavailable. pssnap provides the same copy-on-write technique as VSS, but with fewer extra features (pssnap.sys is not a VSS provider and is independent from VSS). Why have both systems? Well, VSS is a core component of Windows and available on every edition of Windows greater than XP SP2. We know it will be there as Microsoft are committed to this feature and it makes sense to use it as it is highly reliable. Before VSS we had no such mechanism so we built our own. It is equally as reliable but we felt the feature additions of VSS and the support for writers for enterprise scenarios really meant VSS made sense.

However in the rescue environment we do not use, or need to use, either pssnap.sys or VSS. Why? Because the system is not in use so the data should be perfectly consistent at all times. Of course we may well end up including persistent snapshots if they exist because without VSS they are not excluded.

You keep saying VSS is a Windows feature, yet only Reflect uses it...

Actually, that's not true. Windows itself uses VSS for system restore points! These system restore points are the persistent snapshots that might exist in your shadow storage.

That's it. If you'd like to read about VSS directly from Microsoft, you can read their article on [TechNet](#).

The Macrium Rescue Environment



Caution

Absolutely the first thing you need to do after purchasing and installing Macrium Reflect is create rescue media

If you lose your Windows operating system, you can start your PC using Macrium Reflect rescue media on CD, DVD, or USB stick. This makes creating rescue media the first thing you need to do with Macrium Reflect. It contains a bootable, lightweight version of Windows and a full version of Macrium Reflect.

This lightweight version of Windows is called Windows Pre-installation Environment (also known as Windows PE or WinPE) and is provided by Microsoft. When you create rescue media, Macrium Reflect downloads Windows PE automatically for you and writes it to your media. It downloads just those components you need to rescue your system.

You have the option of restoring to a new system or virtual machine using Macrium ReDeploy to reconfigure your windows installation for the new hardware.

Windows PE and the rescue environment

Windows PE is a reduced version of Microsoft Windows that is designed to boot from CD, DVD or USB on a wide range of hardware. When you run the rescue media wizard, Macrium Reflect automatically downloads the Windows PE components from Microsoft and builds the rescue environment locally. The Macrium Windows PE rescue media has the following features:

- Fixes for boot problems
- Macrium ReDeploy to prepare Windows to load on new hardware
- RAID support
- USB 3.0 support
- CD boot
- USB boot
- Boot menu
- Full version of Macrium Reflect
- Reduced download size compared with full Windows Automated Installation Kit (WAIK) - 150 MB to 450 MB (depending on PE version and 32- or 64-bit support)

Windows PE hardware support

The Macrium Rescue Environment needs to include support for your hardware such as USB ports, network interfaces, and in particular for your storage device if for example you use RAID disks. The default Windows PE environment supports a good selection of hardware and you can add support for further devices. When Macrium Reflect creates a rescue CD or USB, it analyses your system hardware and tries to locate drivers for unsupported

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devices by looking on your system. If it can't find appropriate drivers, Macrium Reflect prompts you to provide drivers. You can provide drivers by finding driver packages on the local hard drive, looking for driver CDs supplied with the system, or downloading drivers from the web. After you provide these additional drivers, Macrium Reflect adds them to the Windows PE environment.



Note: You cannot add support for booting media because booting takes place before drivers are loaded. For example, if your CD drive is connected via an unsupported SCSI interface card or your boot menu lies on an unsupported RAID array, then the Windows PE cannot boot. Booting using a USB stick is a good workaround in this case as all USB 2 interfaces are supported by default.

Note: You can also overcome this issue using [this solution](#).

CD, DVD and USB rescue media

You can boot your computer into Windows PE from a CD, DVD, USB stick or USB attached external hard disk. For convenience or for automated restores to your system disk, you can add Windows PE to a boot menu that's displayed when your system first starts. Although, do not rely upon this local copy as a rescue mechanism because it could be lost if you suffered hard disk failure or corruption leaving you without a method for rescuing your system.

Macrium Reflect creates custom Windows PE systems for each installation type by downloading the required components from Microsoft.

Further reading:

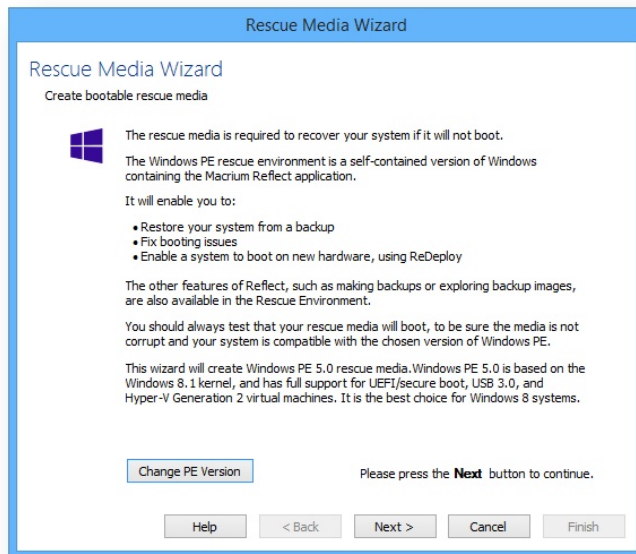
- [Creating rescue media \(see page 69\)](#)
- [Adding a boot menu option for system Image recovery \(see page 82\)](#)
- [Preparing a USB stick for Windows PE \(see page 85\)](#)
- [Creating a bootable Windows PE USB stick \(see page 88\)](#)
- [Accessing network shares in Windows PE \(see page 89\)](#)
- [Technicians portable application support \(see page 94\)](#)
- [Adding device drivers to Windows PE \(see page 97\)](#)
- [About Adding Drivers to WinPE Rescue Media \(see page 100\)](#)
- [Fixing Windows boot problems \(see page 101\)](#)
- [Updating rescue media to include additional hardware drivers \(see page 106\)](#)
- [Adding iSCSI support to Windows PE \(see page 107\)](#)
- [Adding BitLocker support to Windows PE \(see page 111\)](#)
- [Restoring an image from within the Rescue Media \(see page 115\)](#)

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Creating rescue media

The Rescue Media Wizard

1. Insert your blank CD, DVD or USB stick.
2. From the Backup tab of the task pane, below **Other Tasks**, click **Create bootable Rescue media**.

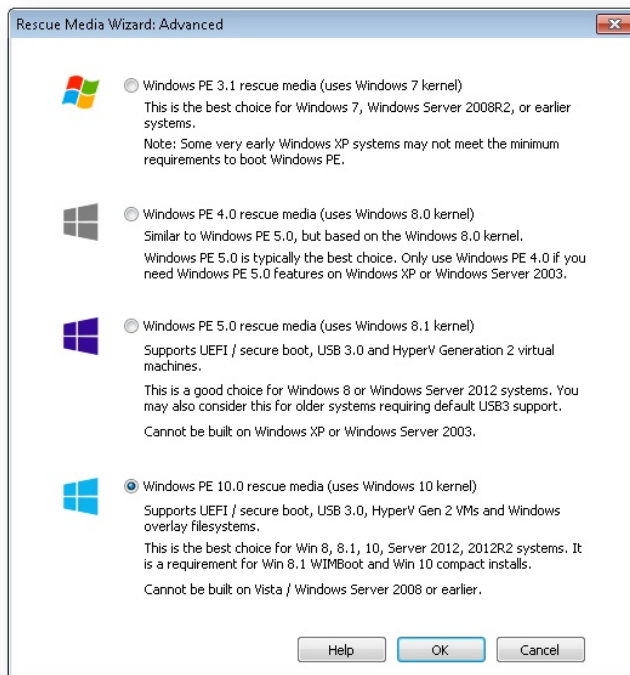


Accept the default Windows PE environment selected by Macrium Reflect or **Click 'Change PE Version'** to use a different version of Windows PE for your rescue media:

Explanation of the 'Change PE version' dialog...

You can change the version of Windows PE by choosing from the options in this dialog

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What version of Windows PE should I choose?

You should choose a version of Windows PE that can access your System drive and also your backup location. The default option selects the Windows PE version that is the best match for your Windows operating system. This enables the rescue media wizard to automatically copy any required drivers for Network, USB or SATA controllers. However, versions of Windows PE that are more recent than your Windows OS may already contain compatible drivers and also offer additional support for USB 3.0.

PE version	Description
Windows PE 3.1	Based on Windows 7. This is the best option for Windows XP, Vista, Windows 7, Server 2003, Server 2008, 2008R2 operating systems. USB 3.0 support is not included. Note: Some very early Windows XP systems may not meet the minimum requirements to boot Windows PE.
Windows PE 4.0	Based on Windows 8. Similar to Windows PE 5.0, but based on the Windows 8.0 kernel. This is a legacy option that is provided if you have used previous versions of Macrium Reflect before PE 5.0 was included. Includes support for USB 3.0. We recommend that you use PE 5.0 /10 unless you require PE 5.0 features on Windows XP or Server 2003.
Windows PE 5.0	Based on Windows 8.1. Supports UEFI / secure boot, USB 3.0 and HyperV Generation 2 virtual machines. This is a good choice for Windows 8/8.1 or Windows Server 2012 systems. You may also consider this for older systems requiring default USB3 support.

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PE version	Description
	<p>Note: The Windows PE 5.0 download option is not available if you are running Windows XP or Server 2003.</p>
Windows PE 10.0	<p>Based on Windows 10. Supports UEFI / secure boot, USB 3.0, HyperV Gen 2 VMs and Windows overlay file systems.</p> <p>This is the best choice for Win 8, 8.1, 10, Server 2012, 2012R2 systems. Windows PE 10 is a requirement if your system uses Windows 8.1 WIMBoot technology or if your system is a Windows 10 'Compact Install'. Both of these installation types are rare but may be used on Windows Tablet PCs with limited disk space.</p> <p> Note: The Windows PE 10.0 download option is not available if you are running Windows XP, Vista or Server 2003/2008</p>

3. Click **Next** and add device drivers if required.

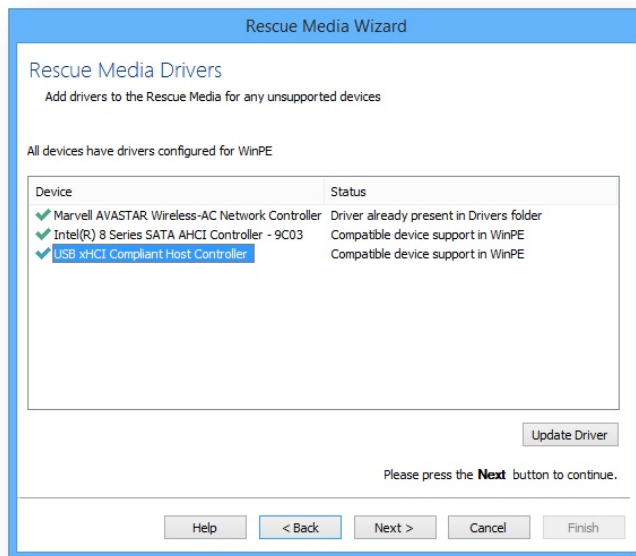
This dialog enables you to add drivers for any Network and Disk controllers that are unsupported in Windows PE.



A device driver is a collection of files (also referred to as a driver package) and generally comprises of:

- The driver software, these files have a .SYS extension.
- The driver information, or INF, file which contains the installation instructions for the drivers, these files have a .INF extension.
- An optional security catalog that signs those drivers for operating systems that require signed drivers, commonly used on x64 operating systems, these files have a .CAT extension.
- One or more optional supporting software library files (Dynamic Link Library) that contain further code to support the driver software, these files have a .DLL extension.

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Windows PE (WinPE) is packaged with a large collection of drivers but there are many devices that are not part of the WinPE driver package. If your device is not compatible then you must add its driver so WinPE recognizes it and communicates with your device.

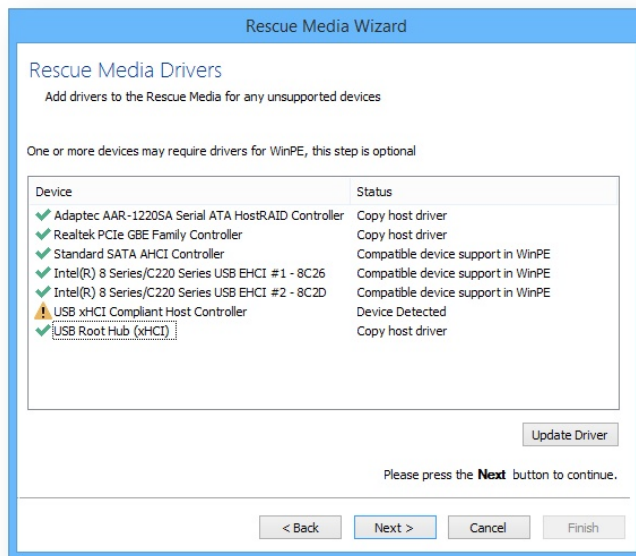
The wizard checks whether your device requires drivers adding to WinPE. It builds a list of devices in your computer that are either Hard Drive/RAID controllers, Network Interface Cards, USB controllers or USB hubs. For each of these devices it checks if:


- The device is supported by default in WinPE
- There is a compatible driver in the host operating system
- There is a compatible driver already present in the collection of drivers on previously created rescue media

Example of adding a device driver...

The sequence below shows an example of adding a device driver to the Windows PE build:

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In the above example a driver is missing for a USB Controller. This is indicated by the  icon next to the device description.



Note: You do not need to install missing drivers for devices that you do not intend using from WinPE.

Supported devices have a status of either:

- Device Support in WinPE
- Compatible Device Support in WinPE
- Copy Host Driver
- Driver already present in Drivers folder

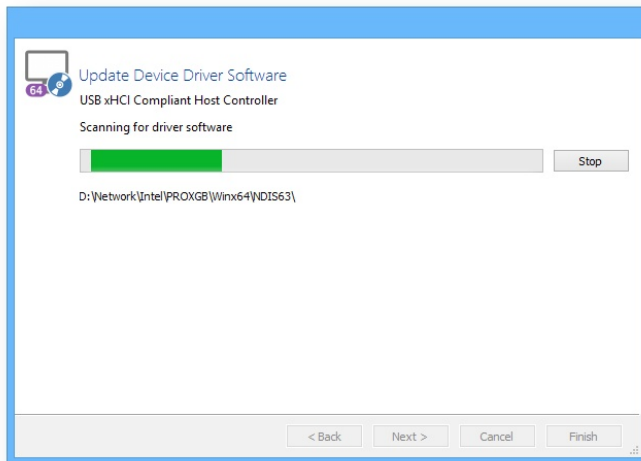
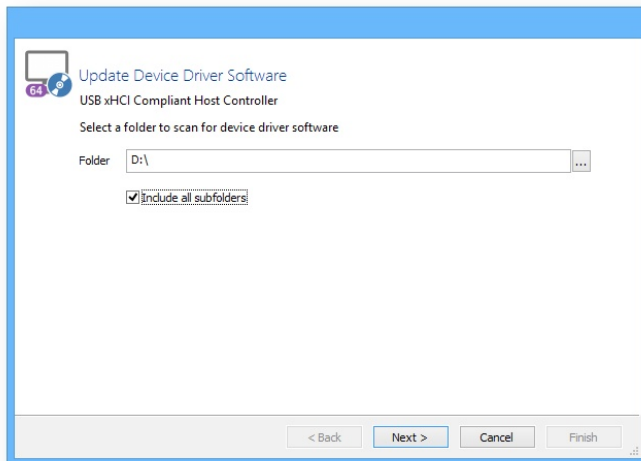
Even if a device is supported you can choose to update it and use a different driver, you do not need to use the driver provided by WinPE. Being able to update drivers in this way is useful if you experiencing issues with performing backups or restores in WinPE, for example, if restoring runs slowly from a USB device.

You can find driver install packages in several places. Most manufacturers create a driver folder on the hard drive of a new PC, often named after the manufacturer. If this is not present, you can download drivers from the device or PC vendor's website. For older PCs, manufacturers of devices and motherboards included driver CDs in the packaging, however, these may not be the latest.

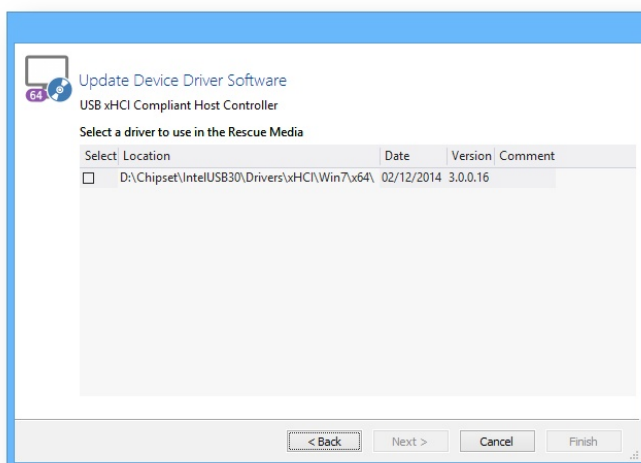
Click the '**Update Driver**' button to search for a compatible driver.

This presents a wizard. This wizard is straightforward to use, the first page prompts you for a folder to scan for drivers and whether you want to include all sub-folders.

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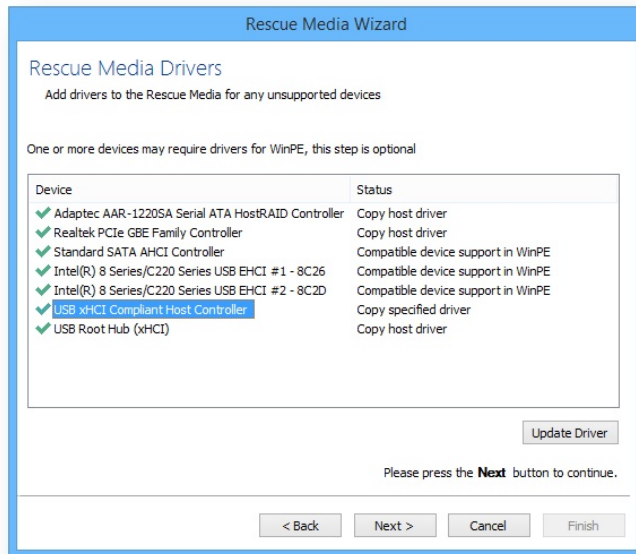


A compatible driver is found. Select it and **click Next**



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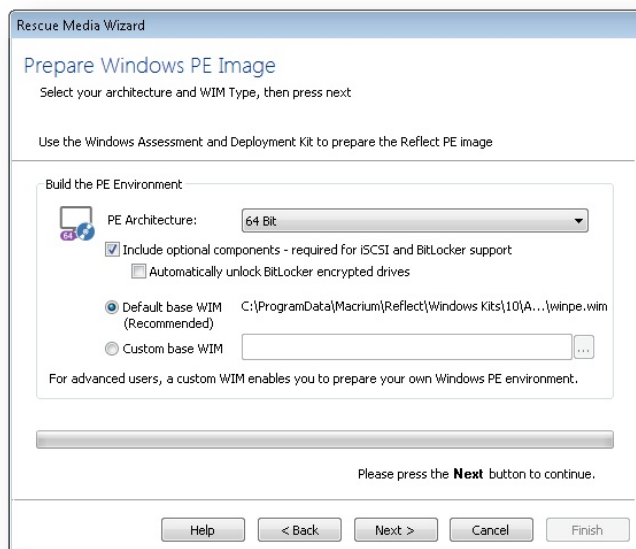
The device now has a green tick next to it to indicate compatibility with Windows PE



4. Click **Next** to prepare and build the Windows PE image



Note: If you have already built the Windows PE image for this rescue media then the wizard will skip this step and advance to the [Burn page](#) (see page 77)

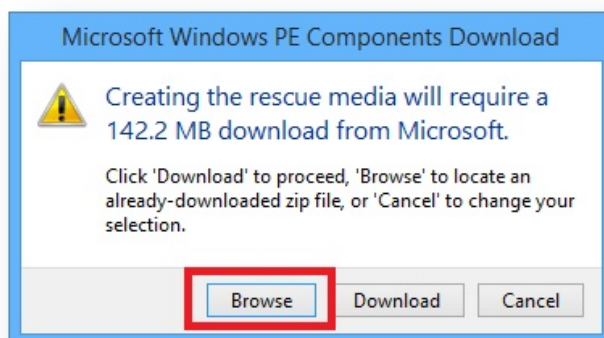


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Option	Description
PE Architecture	Either 32 bit or 64 Bit. The default option is selected to match the architecture of the host Windows OS.
Include optional components	Select this option to add BitLocker Encryption and iSCSI support to the rescue media. Please note that adding these components may several minutes to the creation process. See Adding iSCSI support to Windows PE (see page 107) for more information on using iSCSI in Windows PE
Automatically unlock BitLocker encrypted drives	Select this option to automatically unlock all BitLocker encrypted drives when Windows PE starts. See Adding BitLocker support to Windows PE (see page 111) for more information on using Windows PE to access BitLocker encrypted drives.
Default base WIM	Use the standard Microsoft Windows PE base installation. Macrium Reflect executables will be added to this to crate the rescue media,
Custom Base WIM	Use your own customized WIM for the rescue media. This is an advanced topic not covered in this help.

Click **Next** to begin the WIM build process. If necessary, files will **automatically be downloaded from Microsoft** to complete the build process.

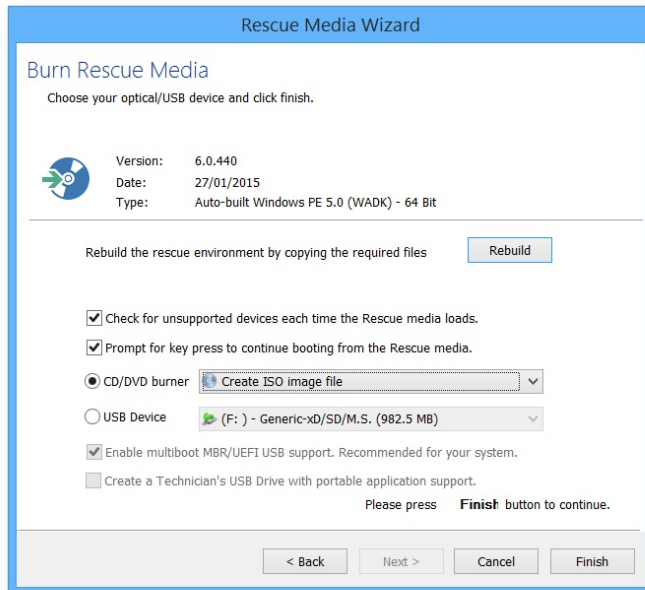
You can also select the PE Components .zip file by clicking the '**Browse**' button in the download dialog. The PE .zip file can be downloaded by using the Reflect download agent 'ReflectDL.exe'.
See [Installing and updating Macrium Reflect offline \(see page 41\)](#) for more information on downloading the PE components separately.



A detailed log of the build process is saved to: 'C:\ProgramData\Macrium\waik\waiklog.txt'

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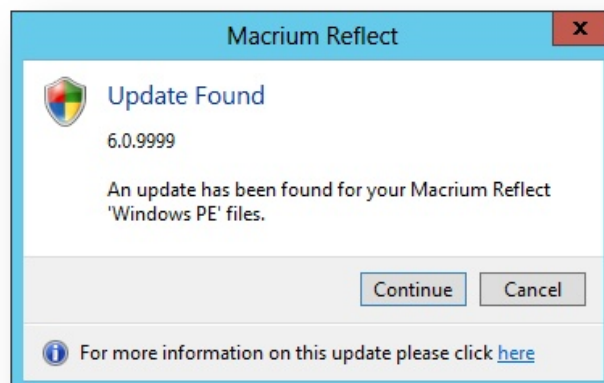
5. Once complete you can choose where to burn the media



Option	Description
Rebuild	Click this button to advance to the 'Prepare Windows PE image' (see page 75) wizard page to rebuild the Windows Image (WIM).




Note: If updates are available for your rescue media then you will receive a message box prompting you to rebuild.





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Check for unsupported devices	Select this option and Windows PE will prompt to add drivers for unsupported Network Interface and Disk controllers when started.
Prompt for key press	Select this option to enable the ' Press any key to boot from CD or DVD... ' prompt when your PC starts. This is useful if you want to bypass Windows PE and boot into your host Windows OS.
CD/DVD burner	Select this option to choose a CD/DVD device that you are using to create your rescue media.

 To save the rescue media to an .ISO image file for burning with any burning software. Click the drop-down list of burners and select 'Create an ISO image file':

☐ Check for unsupported devices each time the Rescue media loads.

☒ Prompt for key press to continue booting from the Rescue media.

☒ CD/DVD burner  

USB Device	Select this option to save your rescue media to a bootable USB stick or external hard drive.
Enable multiboot MBR/UEFI	<p>Only applies if you are saving your rescue media to a USB device. This option enables the USB device to boot both legacy MBR and GPT/UEFI for modern motherboards. Please consult your motherboard user manual for information on choosing these boot options at PC startup.</p> <div>  Note: CD/DVD media is always created multi-boot MBR/UEFI </div>
Technicians USB	Applies to Macrium Reflect Technicians license keys only. See Technicians portable application support (see page 94) for more information

6. Click **Finish**.to create your rescue media

To complete the process, boot from your Rescue media to ensure it works correctly.

After Windows PE loads, Macrium Reflect runs. The Windows PE user interface for Macrium Reflect is identical to that of the main application and offers the same core functions.



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If you are using USB media, you can make the Macrium Rescue Environment compatible with multiple computers:

1. Use the Rescue media wizard to create a bootable USB rescue device on one computer.
2. Repeat the process with each other computer in turn using the same USB device.

Once I have created rescue media, will it work on all my computers?

If the hardware for all your computers is supported by the default Windows PE driver set, then the answer is a simple yes. You can confirm this on the Rescue Media Wizard drivers page. If all the drivers listed have the status **Device support in WinPE** or **Compatible device support in WinPE** for each of your machines then you only need one rescue media.

If any of your machines require extra drivers, then you have three options:

- Create one piece of rescue media for each machine.
- Invoke the **Create Rescue Media Wizard** on each of your machines.
 1. Locate all the necessary drivers and progress to the **Rescue Media Burn** page before canceling.
 2. Copy the contents of folder 'C:\boot\macrium\drivers' from each machine to one machine.
 3. Burn a Rescue CD on that machine.
- Using the Rescue media wizard, create a bootable USB stick, inserting the same device on each machine in turn.

Note: Options 2 and 3 only work if all your machines are configured to use the same version of PE with the same architecture (i.e. they are all 32-bit or all 64-bit).

If my rescue media refuses to boot, what should I do?

The causes of non-booting rescue CD fall into one of two broad categories, either it is an issue with your CD or with your PC.

Verify your CD

Try as many of the following steps as possible:

1. **Try booting the CD on a 2nd PC.**

If it boots, this indicates a configuration or hardware issue with your PC. Please see Verifying your PC later in this article.

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2. Try a different brand of CD media.

We have found that CD recordable media is of variable quality. Often, using different media will resolve your issue.

3. Try creating the rescue media on a 2nd PC.

If Reflect is installed on the 2nd PC, please try creating rescue media there.

Alternatively, following the same CD creation steps as before, select *Create ISO image file* on the last page of the wizard. Transfer this to the 2nd PC and use a third party utility such as [ImgBurn](#) to burn the CD.

In each case, try booting the 1st PC with the new CD.



Note: Booting from DVD and CD can take a while due to the time to load the large boot image, CD in particular can take up to 5 minutes. Unfortunately, on some hardware PE 4 does not show a progress bar during the loading period. Therefore, with a PE4 CD, please give the media chance to finish loading before concluding that it is not bootable.

Verify your PC.

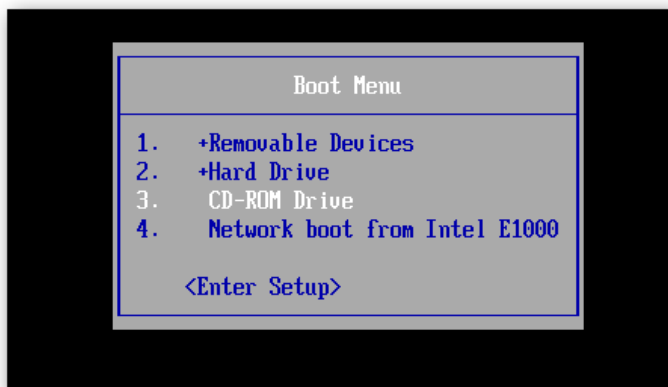
To boot rescue media from CD, your BIOS or UEFI firmware must be correctly configured and have hardware suitable for booting. Please try as many of the following steps as possible to diagnose this.

Note that there is no standard for motherboard firmware configuration, so our instructions are necessarily non-specific. Please consult your motherboard manual for details relevant to your PC.

1. Try booting a Microsoft Windows install CD.

If the boot fails, this is indicative that your hardware is incorrectly configured. Please continue through this list for further diagnosis.

2. Invoke your BIOS/UEFI boot menu.



Boot menus vary in appearance and are invoked in different ways. You may need to refer to your motherboard manual to find the key combination to access this. Sometimes, this is displayed on the screen and is usually a key such as DEL, F8, F11, F12, F2 etc.

Please note that on UEFI/BIOS dual systems, you may be given the option to boot UEFI or not for each device. Please boot the type matching your installed OS. There are a few possible outcomes:

- a. You are able to boot your rescue media in this manner, but not without performing this step. In this case, please see the next step in this section.

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- b. You are unable to boot your rescue media having seen the hardware in the menu. In this case, you may wish to try the *Verify CD* steps above. If these do not rectify the issue, your hardware may not support booting Windows PE (you can also try this with the Windows Install CD to verify). In this case, please try an alternative rescue media format such as USB, or attach a different CD/DVD drive to the system.
 - c. You are unable to see the hardware in your list. In this case your firmware has not recognised the device and it is not supported for booting.
3. **Change the motherboard boot order.**

Please enter your BIOS or UEFI firmware setup utility and navigate to the "boot order" or "boot menu" equivalent screen. Please ensure CD/DVD booting has a higher priority than your hard disk, which may be labelled ATAPI, SATA, SCSI or various other labels depending on your system. Please press F10, or your equivalent for "save and exit" to reboot the system with the new priority.

Please note that some UEFI firmware may not have boot priorities for removable media, or booting from removable media may be a configurable option that you must enable.
4. **Create a USB rescue stick.**

Follows the same steps as used when creating a CD, selecting instead "USB media" on the last page. If this works and you have verified your CD, it is indicative that your hardware cannot boot a CD. However, a usb stick, is just as functional as a CD, so we recommend you use this as your rescue device.
5. **Confirm that the CPU architecture of the PE media is compatible with your system**

For BIOS/MBR systems, in general, a PC with boot either a 32 and 64bit PE.

For EFI systems, the PE architecture must match the system type. A 32bit EFI CD will only boot on 32bit EFI systems and visa versa. Apart from a few tablet devices, all EFI systems are 64bit only.

What to expect when booting rescue media.

1. The **PE 3.1** environment is based on (a cutdown version of) Windows 7 and so boots in a similar fashion.
2. The **PE 4.0** environment is based on Windows 8 and so boots in a similar fashion.
3. The **PE 5.1** environment is based on Windows 8 and so boots in a similar fashion.



You may notice a lag during boot on CD/DVD rescue media whilst the WIM is copied into memory. This can take some time, so please be patient. PE 4.0/5.1 media on UEFI systems may additionally display no progress bar during initial load, so please be patient if you have a blank screen.

Adding a boot menu option for system Image recovery

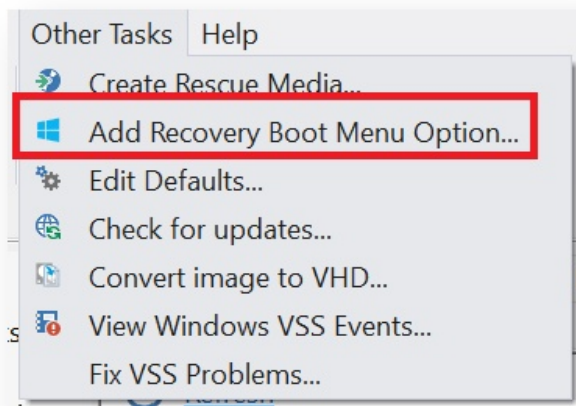
Adding a Macrium Reflect Windows boot menu enables direct access to the Macrium Windows PE recovery environment without the need to burn a DVD or USB Flash drive.



Note: You are advised to create physical boot media, USB or DVD, that can be used if your OS system disk fails.

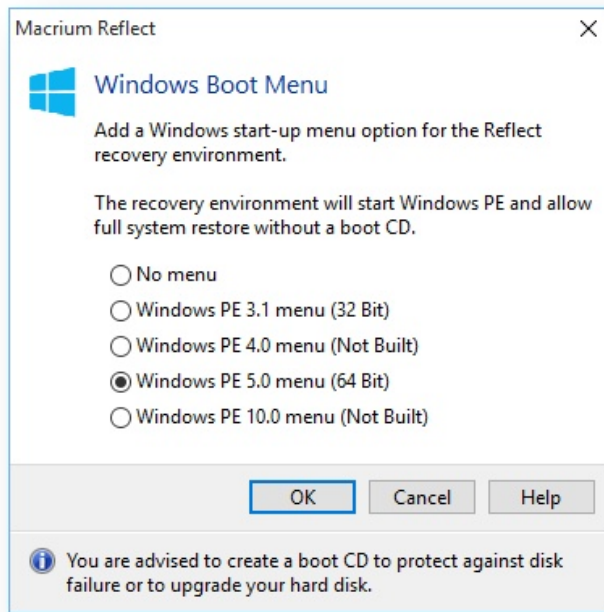
When you have created your rescue media you can add Macrium Recovery to your PC boot menu. By doing this you can restore a system image (the C drive) without a recovery CD.

1. Take 'Other Tasks' > 'Add Recovery Boot Menu Option...'



2. Select the relevant version of Windows PE.

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What version of Windows PE should I choose?

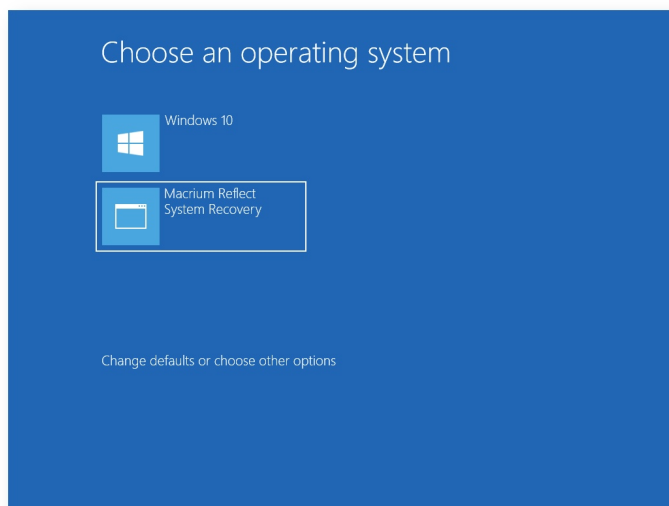
You should choose a version of Windows PE that can access your System drive and also your backup location. The default option selects the Windows PE version that is the best match for your Windows operating system. This enables the rescue media wizard to automatically copy any required drivers for Network, USB or SATA controllers. However, versions of Windows PE that are more recent than your Windows OS may already contain compatible drivers and also offer additional support for USB 3.0.

PE version	Description
Windows PE 3.1	Based on Windows 7. This is the best option for Windows XP, Vista, Windows 7, Server 2003, Server 2008, 2008R2 operating systems. USB 3.0 support is not included. Note: Some very early Windows XP systems may not meet the minimum requirements to boot Windows PE.
Windows PE 4.0	Based on Windows 8. Similar to Windows PE 5.0, but based on the Windows 8.0 kernel. This is a legacy option that is provided if you have used previous versions of Macrium Reflect before PE 5.0 was included. Includes support for USB 3.0. We recommend that you use PE 5.0 /10 unless you require PE 5.0 features on Windows XP or Server 2003.
Windows PE 5.0	Based on Windows 8.1. Supports UEFI / secure boot, USB 3.0 and HyperV Generation 2 virtual machines. This is a good choice for Windows 8/8.1 or Windows Server 2012 systems. You may also consider this for older systems requiring default USB3 support.

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PE version	Description
	<p>Note: The Windows PE 5.0 download option is not available if you are running Windows XP or Server 2003.</p>
Windows PE 10.0	<p>Based on Windows 10. Supports UEFI / secure boot, USB 3.0, HyperV Gen 2 VMs and Windows overlay file systems.</p> <p>This is the best choice for Win 8, 8.1, 10, Server 2012, 2012R2 systems. Windows PE 10 is a requirement if your system uses Windows 8.1 WIMBoot technology or if your system is a Windows 10 'Compact Install'. Both of these installation types are rare but may be used on Windows Tablet PCs with limited disk space.</p> <p> Note: The Windows PE 10.0 download option is not available if you are running Windows XP, Vista or Server 2003/2008</p>

The Macrium recovery boot menu option - Windows 10



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Preparing a USB stick for Windows PE

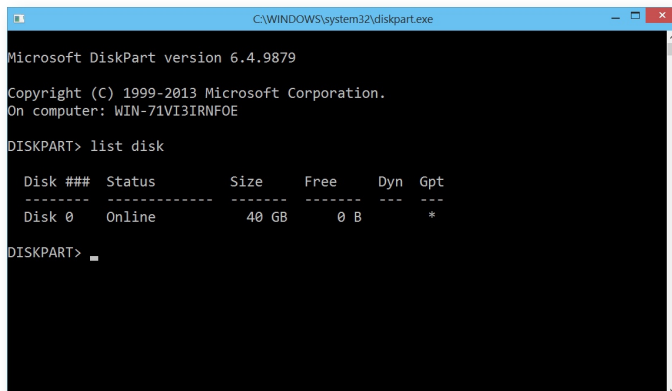
To use a USB stick as a boot device, Windows requires a Master Boot Record (MBR) however some USB sticks are shipped without one and with just a single partition. The USB stick, therefore, needs formatting but the standard Windows format option does not prepare the disk correctly as it does not create a master boot record. You therefore need to prepare the USB stick using other tools, for example, Windows diskpart.

1. Start an elevated command prompt. See [Running an elevated command prompt](#) for more information.
2. Type:

```
diskpart
```

3. Type:

```
list disk
```



The screenshot shows a Windows command prompt window titled "C:\WINDOWS\system32\diskpart.exe". The text inside the window is as follows:

```
Microsoft DiskPart version 6.4.9879
Copyright (C) 1999-2013 Microsoft Corporation.
On computer: WIN-71VI3IRNFOE

DISKPART> list disk

Disk ###  Status       Size      Free      Dyn  Gpt
-----  -
Disk 0    Online       40 GB     0 B      *

DISKPART> _
```

4. Identify the disk number of your USB stick.



Please ensure that you correctly identify your USB stick.

5. Type:

```
select disk <n>
```

Where <n> is the number of the disk previously identified as being the USB stick. Confirm that the current disk selection is correct by typing in detail disk, this will show information relating to the currently selected disk.



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Note: Please be certain you have the disk selection correct before proceeding to the next step.

6. Type:

```
clean
```

This erases all data on the USB stick.

7. Type:

```
create par primary
```

This creates a primary partition on the USB stick using the maximum size available.

8. Type:

```
active
```

To make the primary partition active.

9. Type:

```
format FS=ntfs LABEL="Macrium WinPE" QUICK
```

This formats the newly created partition on the USB stick for **legacy MBR booting**.

If your system has **GPT disks** and uses the newer **UEFI booting** standard then please type the line below instead:.

```
format FS=FAT32 LABEL="Macrium" QUICK
```



Note: UEFI booting requires a FAT32 formatted partition and will not recognize NTFS.

10. Type:

```
exit
```

once the format command has completed to exit diskpart.

11. Type:

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```
exit
```

Again to close the command prompt.

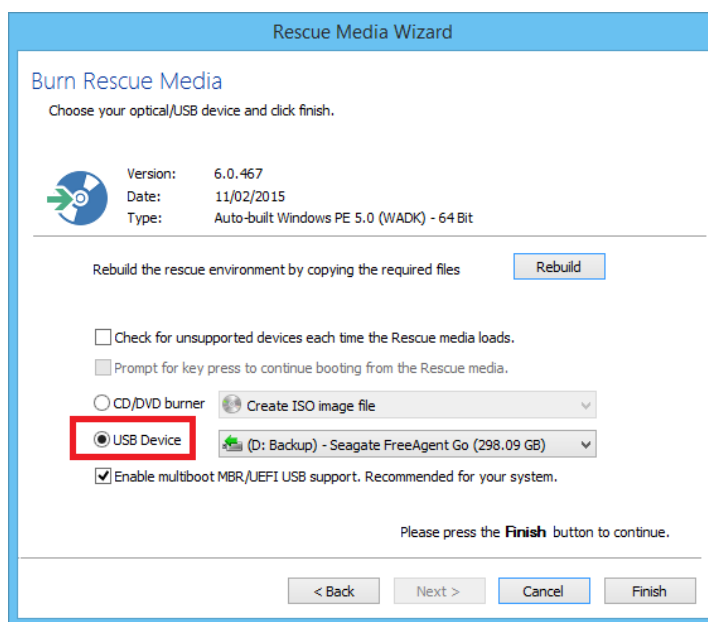
See also: [Troubleshooting USB rescue media](#)

Creating a bootable Windows PE USB stick

Introduction

In this article we will explain how it is possible to create a USB flash drive to boot Windows PE.

1. Follow the steps on [Creating Rescue Media](#) (see page 69)
2. When you get to the final screen as show below:



Select 'USB Device' as indicated in Red and click Finish

See also:	Preparing a USB stick for Windows PE (see page 85)
	Troubleshooting USB rescue media

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Accessing network shares in Windows PE

The Macrium Reflect Windows PE rescue media includes the Windows networking stack and allows connection to authenticated network shares when booted into Windows PE. Network shares can be entered by UNC path using the \\Server\Share or by IP address and shared folder.

If you have problems accessing shared servers then please see [Resolving network issues in Windows PE](#)

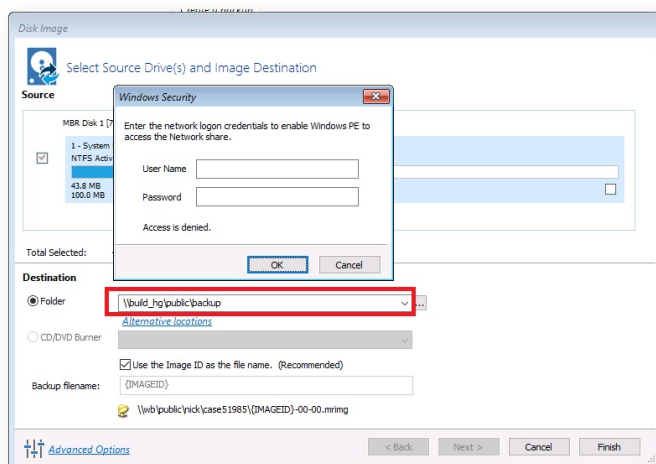
Please note: Wireless Networking is not supported in Windows PE. Please connect to your network using an Ethernet cable.

Please Note: When accessing network shares in **Windows PE 10** it's necessary to prepend the user name with '.' if the network resource is on the local network/domain.
For example enter '.\Administrator'

This is not required for earlier versions of Windows PE.

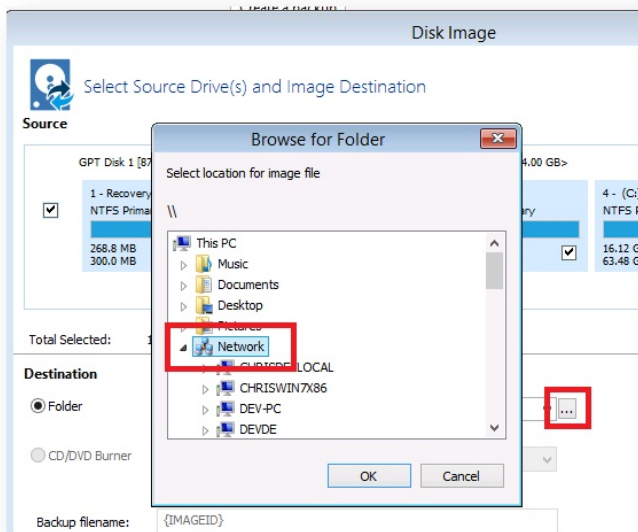
Accessing the network when creating an image in PE

1. In the image wizard **enter the \\server\share\folder path** in the backup destination page. You will be prompted for login credentials if the share is password protected:



2. Alternatively, **click the '...' browse button** to browse the network for the shared folder:

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Expanding a network node that requires authentication will display the Network Credentials dialog:

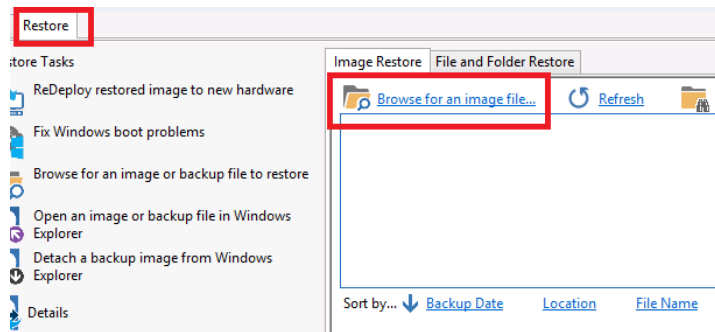


Leave the 'Share Name' field empty for root level authentication of the server.

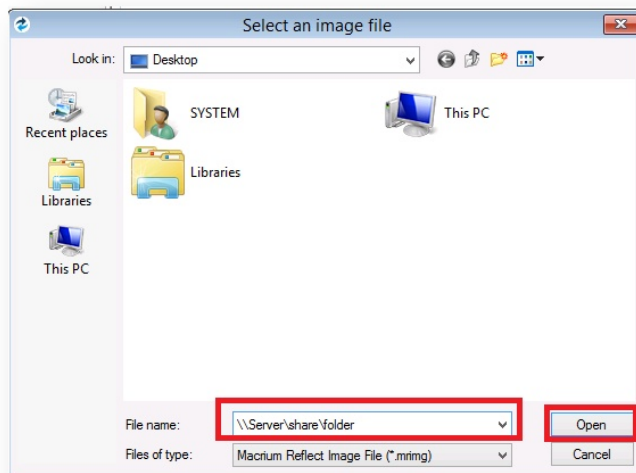
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Accessing the network when restoring an image in PE

1. If the image that you are restoring isn't visible in the Macrium Reflect Restore pane then **click the 'Browse for an image file..' link**

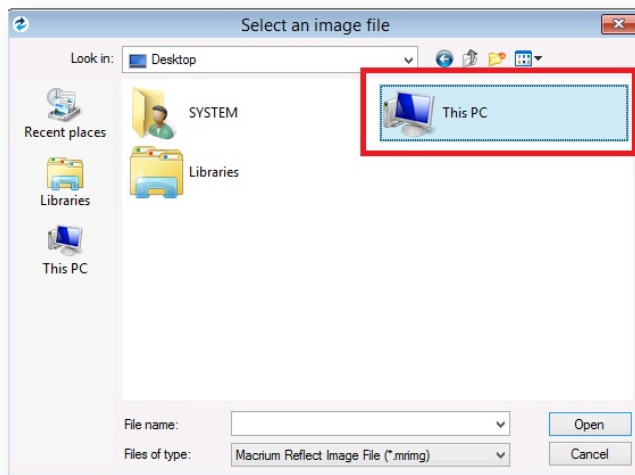


2. In the browse dialog that opens **type the UNC path of the network share** that you want to access:

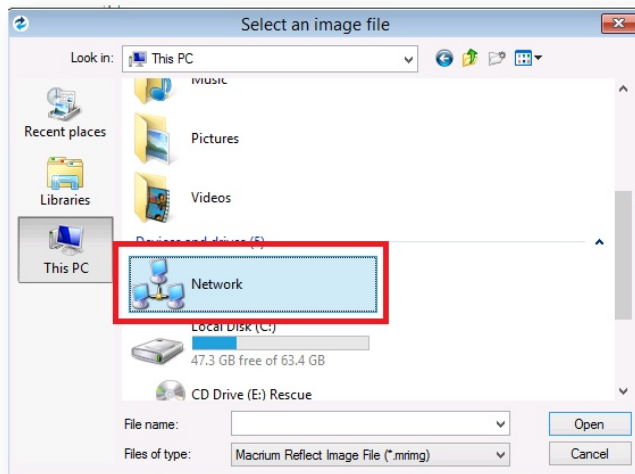


3. Alternatively, **click 'This PC'**:

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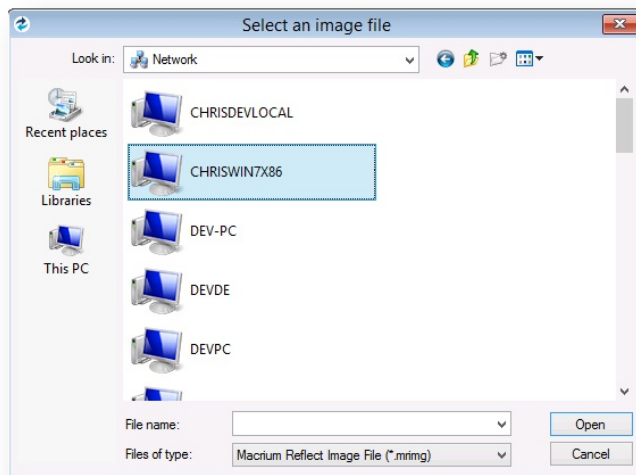


4. Scroll down and **double click 'Network':**

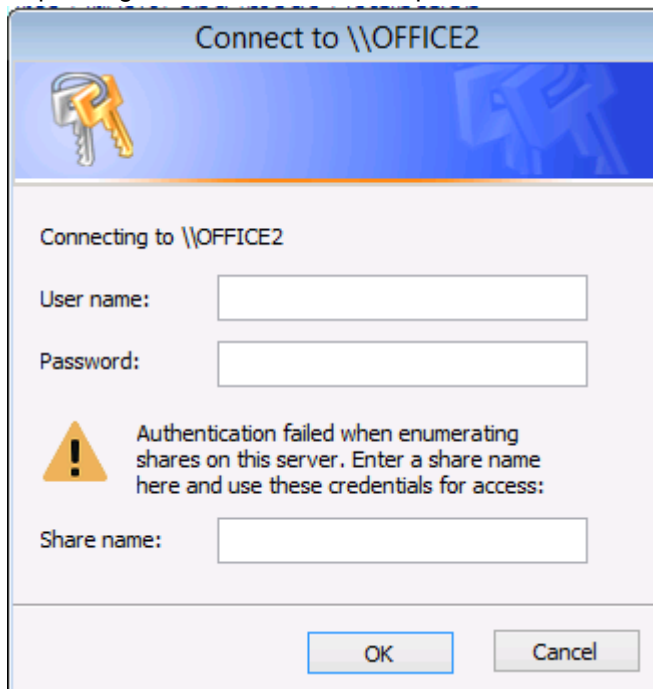


5. **Expand the network server** that contains the share you want to access:

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Expanding a network node that requires authentication will display the Network Credentials dialog:



Leave the 'Share Name' field empty for root level authentication of the server.

See also: Resolving network issues in Windows PE

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Technicians portable application support



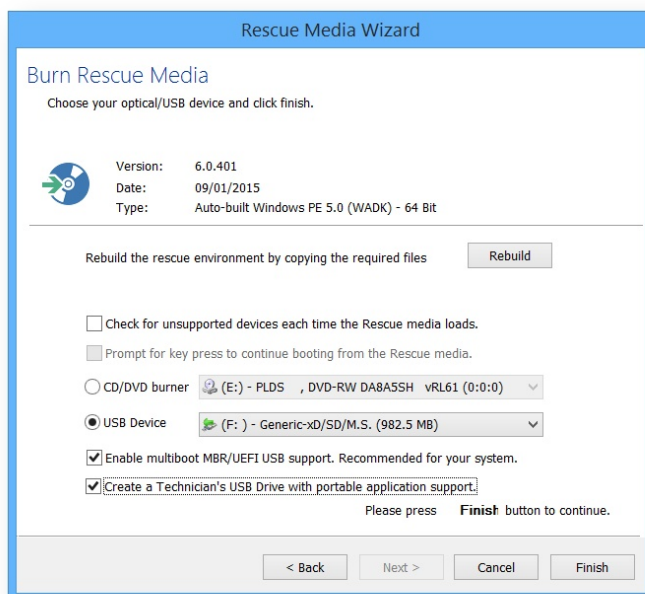
Applies to Server Edition Technician's License only.

Note: Technician's Portable Application USB sticks expire when your license for Technician's expires. You need to recreate your USB stick after this time.

The Macrium Reflect Technician's License allows a single user to image multiple PCs (as specified in the license). Macrium Reflect runs as a portable application from USB Rescue Media. The USB stick also acts as a bootable rescue environment, which you can use to back up and restore licensed PCs. Portable Mode Reflect is very similar to the Macrium Reflect environment you are familiar with.

Creating a technician's USB stick

1. Create a rescue PE environment as explained in [Creating rescue media](#) (see page 69)..
2. Select **USB Device** as your target media and select a USB destination.
3. Check **Create a Technician's USB Drive with portable application support**.



4. Click **Finish**.

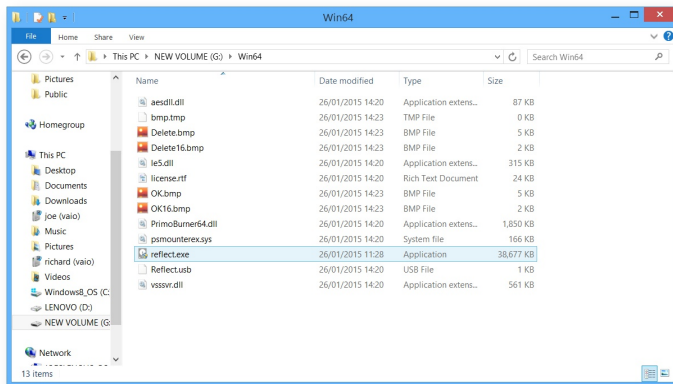
Launching Macrium Reflect from the USB

1. Insert the USB, you will be asked to choose what happens with it.
2. Select **Open folders to view files**.
3. In the root of the USB stick, select folder Win32 or Win64.

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The USB stick contains both 32-bit and 64-bit versions of Macrium Reflect. To launch the right one, a launcher is provided called portable.exe.

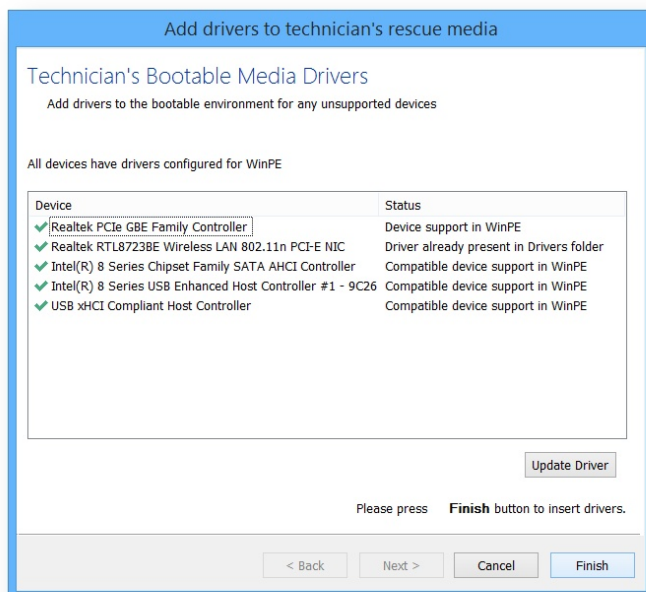
4. Double click **reflect.exe** to launch Macrium Reflect.



Adding drivers to the portable PE environment

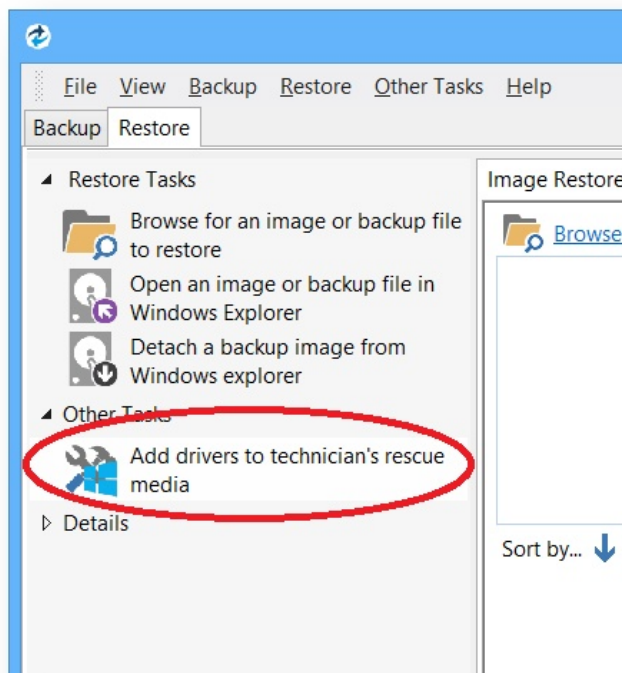
The portable edition of Macrium Reflect has the option to add drivers to the rescue media, so that you can copy any missing drivers from your current system.

1. Launch the portable edition of Macrium Reflect from the USB stick.
2. Select **Add Drivers to technician's rescue media**, this is found in both the backup and restore task bars.



3. Click **Next**.
4. Add any missing drivers, and update drivers as required. For more information see [Adding device driver software](#) (see page 97)

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5. If required, repeat the process for the other rescue environment (32-bit or 64-bit).

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Adding device drivers to Windows PE

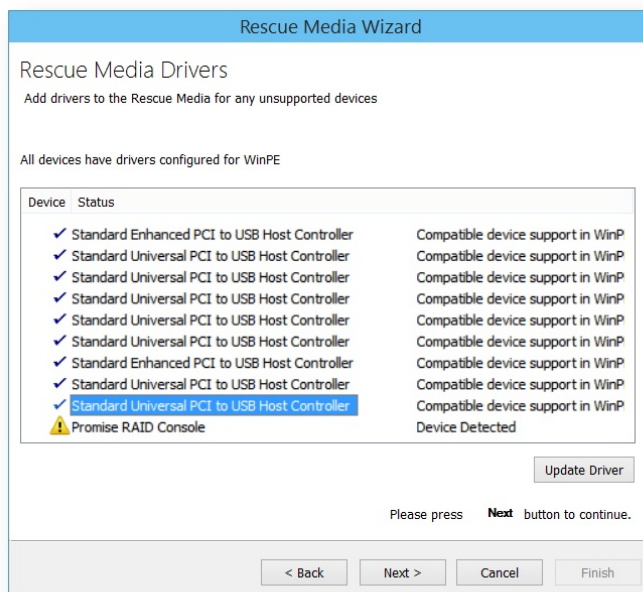
Windows PE (WinPE) is packaged with a large collection of drivers but there are many devices that are not part of the WinPE list of drivers. If your device is not listed you must add its driver so WinPE recognizes it and communicates with your device.



You can run the Create bootable rescue media wizard at any time to check, add or change drivers, if for instance, you have added hardware since creating rescue media.

When you run the Macrium Reflect task, **Create bootable Rescue Media** the wizard checks whether your device requires drivers adding to WinPE. It builds a list of devices in your computer that are either hard drive/RAID controllers, network interface cards, USB controllers or USB hubs. For each of these devices it checks if:

- The device is supported by default in WinPE
- There is a compatible driver in the host operating system
- There is a compatible driver already present in the collection of drivers on previously created rescue media



Unsupported devices show in the list of devices with a warning icon and a status text of Device Detected.

Note: You do not need to install missing drivers for devices that you do not intend using from WinPE.

Supported devices have a status of either:

- Device Support in WinPE
- Compatible Device Support in WinPE
- Copy Host Driver
- Driver already present in Drivers folder

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Even if a device is supported you can choose to update it and use a different driver, you do not need to use the driver provided by WinPE. Being able to update drivers in this way is useful if you experiencing issues with performing backups or restores in WinPE, for example, if restoring runs slowly from a USB device.

A device driver is a collection of files (also referred to as a driver package) and generally comprises of:

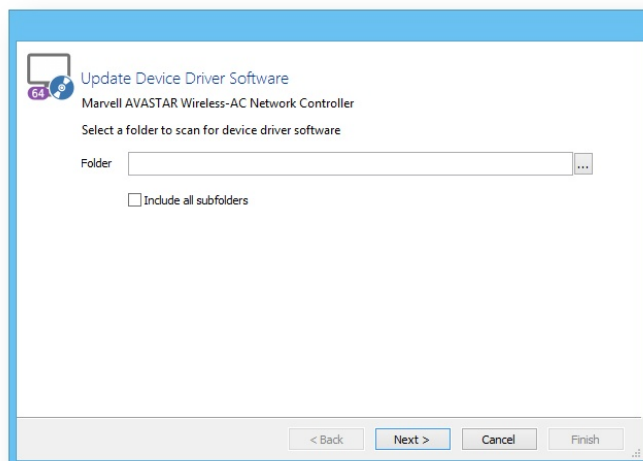
- The driver software, these files have a .SYS extension.
- The driver information, or INF, file which contains the installation instructions for the drivers, these files have a .INF extension.
- An optional security catalog that signs those drivers for operating systems that require signed drivers, commonly used on x64 operating systems, these files have a .CAT extension.
- One or more optional supporting software library files (Dynamic Link Library) that contain further code to support the driver software, these files have a .DLL extension.

You can find driver install packages in several places. Most manufacturers create a driver folder on the hard drive of a new PC, often named after the manufacturer. If this is not present, you can download drivers from the device or PC vendor's website. For older PCs, manufacturers of devices and motherboards included driver CDs in the packaging, however, these may not be the latest.

Updating drivers

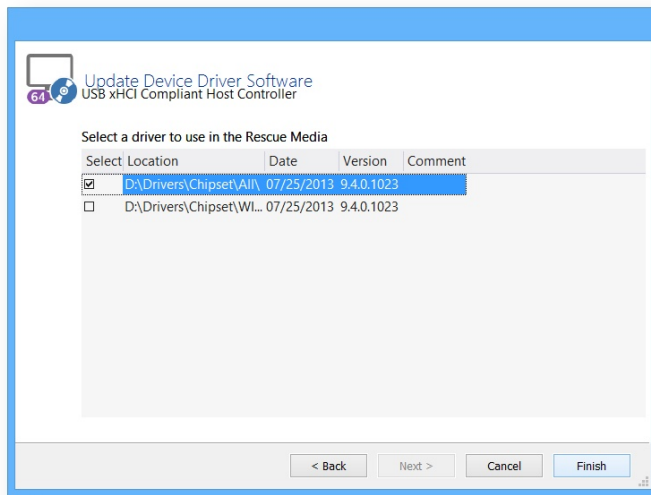
1. Select the driver you want to update, left click it in the list of devices.
2. Click **Update Driver**.

This presents a wizard. This wizard is straightforward to use, the first page prompts you for a folder to scan for drivers and whether you want to include all sub-folders.



3. Select a folder.
4. Click **Next**.
The wizard scans for drivers, automatically including the host operating system drivers if you do not choose to scan that folder.
5. When complete a list of results is displayed, select the driver from the list you want to use.
6. Click **Finish**.

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The rescue environment driver is copied.

About Adding Drivers to WinPE Rescue Media

WinPE is packaged with a large collection of drivers, however, there are many devices that are not part of the WinPE list of drivers. For WinPE to recognize your device, you need to add a driver. Your device then communicates with WinPE and loads at boot time of WinPE.

The main devices to be concerned with are hard drive/RAID controllers, network interface cards (NIC) or USB controllers and USB hubs.

If you intend to use a network device then you need to ensure that your NIC is supported in WinPE. If your hard drives are attached to a RAID controller then you need to ensure that your RAID Controller is supported in WinPE, either by a WinPE driver or by adding a driver.

A device driver is a collection of files (also referred to as a driver package) and generally comprises of:

1. The driver software. These files have a .SYS extension.
2. The driver information, or INF, file which contains the installation instructions for the drivers. These files have a .INF extension.
3. An optional security catalog which signs the drivers for operating systems which require signed drivers, commonly used on x64 operating systems. These files have a .CAT extension.
4. One or more optional supporting software library files (Dynamic Link Library) which contain further code to support the driver software. These files have a .DLL extension.

Your best sources for driver packages are the CD that comes with your device (or motherboard) or downloads from the vendor website as a ZIP file. When downloading a package from the vendor website, it is best to source a ZIP package for easy extraction.

Fixing Windows boot problems

This article explains how to use the 'Fix Boot Problems' option to resolve common boot problems when restoring an image.

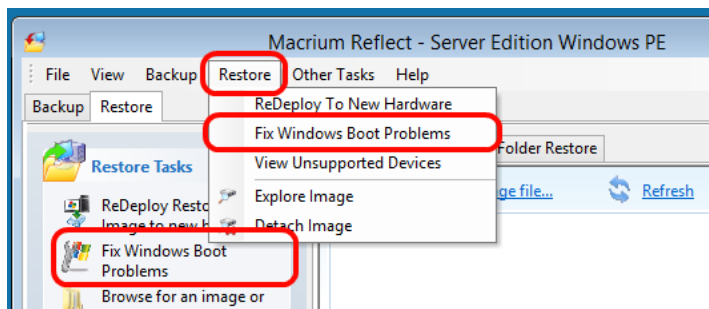
When restoring an image or cloning a HD there can be situations where Windows is unable to boot due to incorrect boot configuration. This article explains how Reflect enables you to resolve these situations.

Depending on whether the disk you have restored uses GPT or MBR partitioning schemes, the action you need to take may vary. This article covers both cases.

Fix boot problems on MBR/BIOS systems

Fix Windows boot problems is available in the Windows PE Rescue media environment. To fix Windows boot problems, start your computer with your rescue media inserted. Then, after a restore or clone, to use fix boot problems:

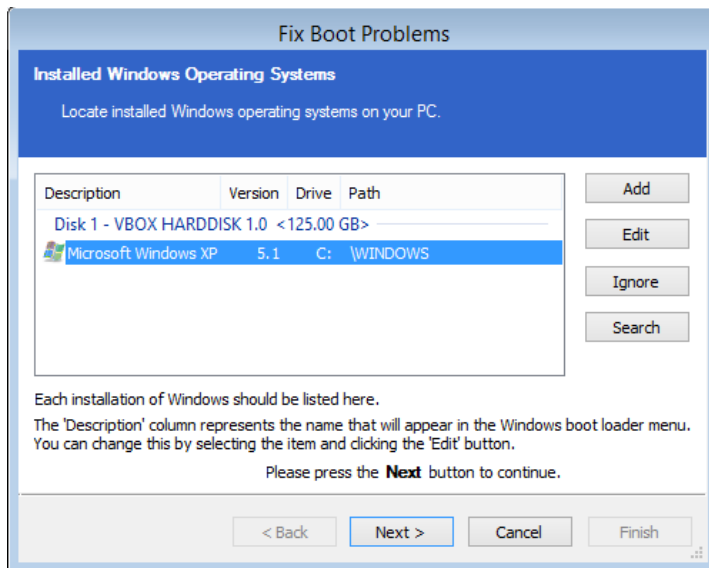
1. **Select** the restore menu, then **select** fix boot problems. Alternatively, **choose** the restore tab then under restore tasks **select** Fix Windows Boot Problems.



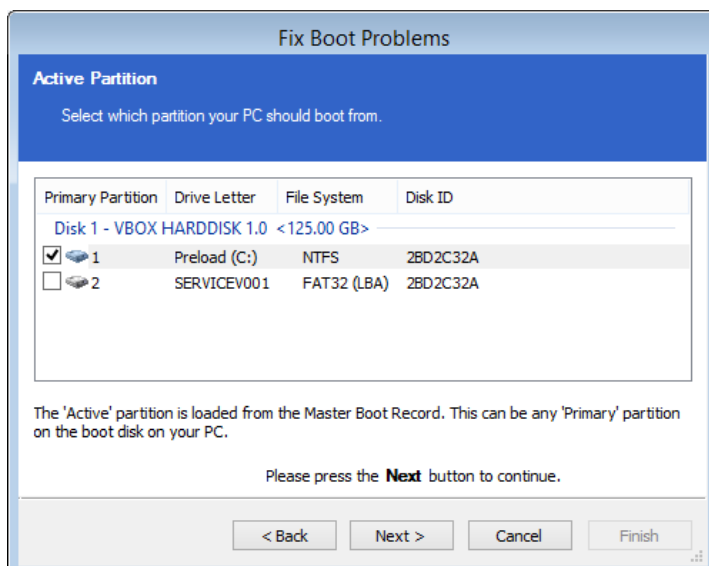
2. The Fix boot problems wizard will then open.

3. You will be presented with a list of Windows Installs, which the wizard detects. **Verify** these are correct. If the wizard has not automatically detected your Windows install, **add it** using the buttons on the right. You can also **correct any details** using the edit functionality.

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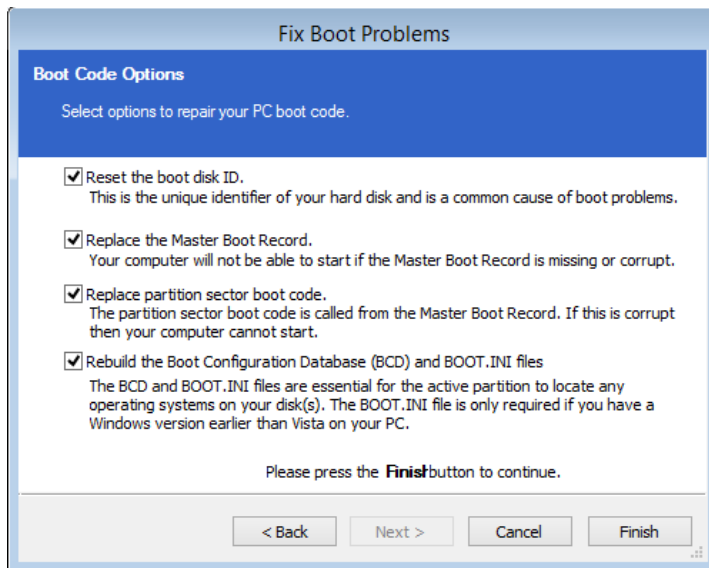


4. **Select the active partition.** The wizard automatically selects the boot disk for the relevant Windows install, but you can change this if you are using an alternative setup:



5. **Choose** the boot options to be fixed. We recommend leaving all options checked, however, power users may wish to alter the behaviour of the wizard.

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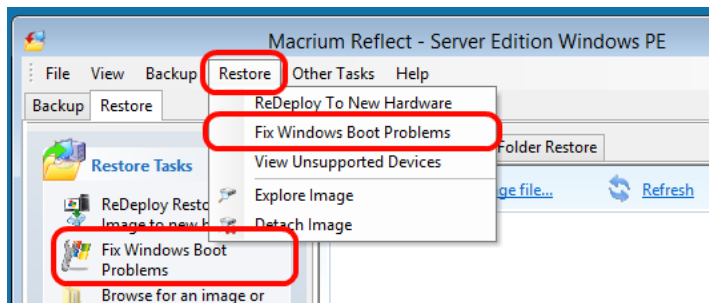
6. **Click finish.** The wizard will then offer you the choice to reboot. If you need to perform additional tasks in the PE environment such as ReDeploy, **select no.** Otherwise, **select yes.**

7. Your system will now boot.

Fix Boot problems for GPT/UEFI Boot Systems

Fix boot problems is available in the same location as for MBR systems. Boot your UEFI capable rescue media. Then:

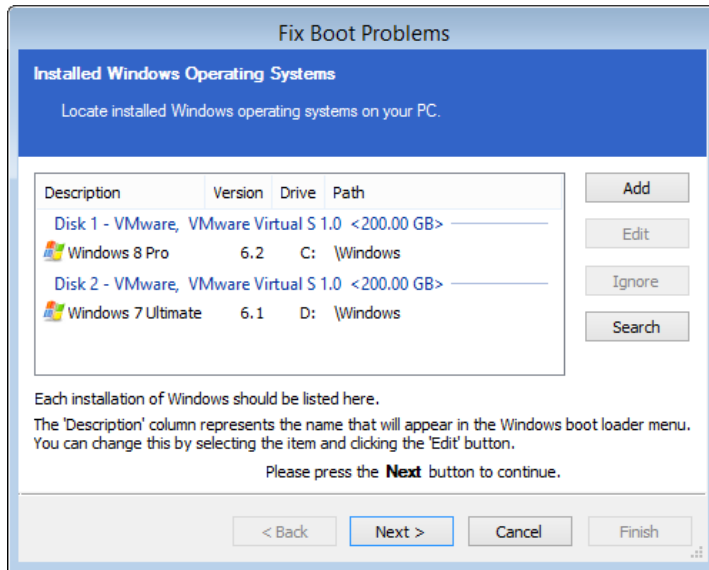
1. **Select** the restore menu, then **select** fix boot problems. Alternatively, **choose** the restore tab then under restore tasks **select** Fix Windows Boot Problems.



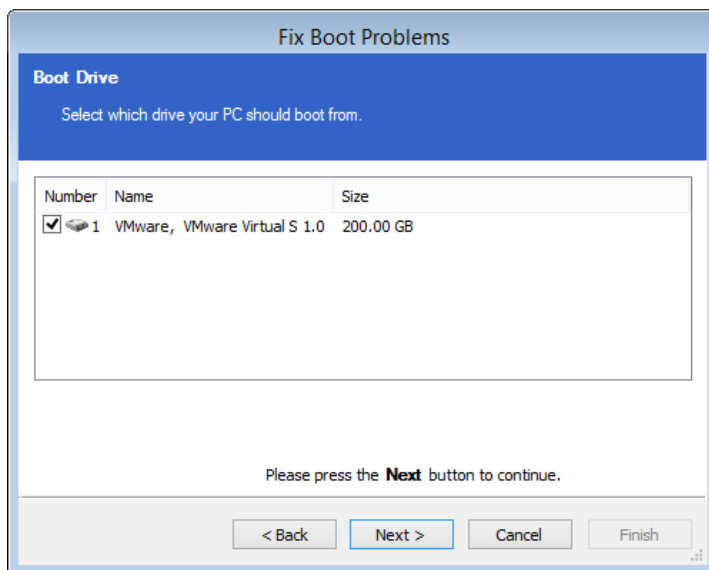
2. The Fix boot problems wizard will then open.

3. You will be presented with a list of Windows Installs, which the wizard detects. **Verify** these are correct. If the wizard has not automatically detected your Windows install, **add it** using the buttons on the left. You can also **correct any details** using the edit functionality.

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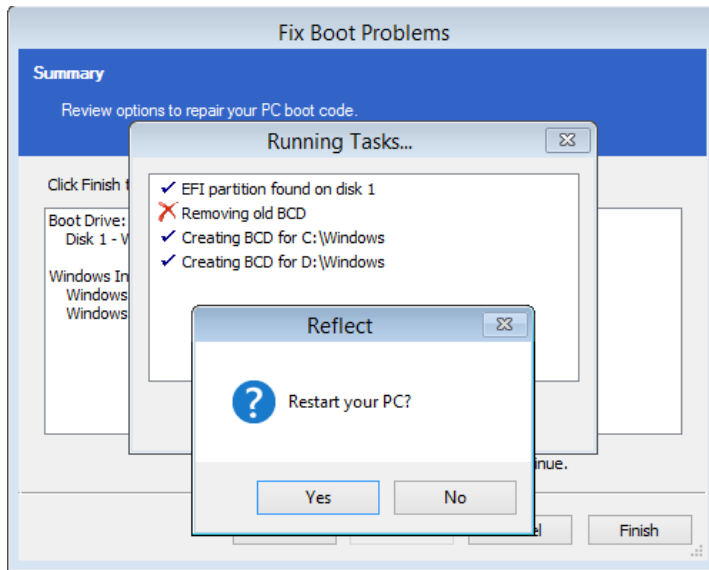
4. **(Optional Step)** if you have multiple disks, you may be asked to select which you should boot from. **Choose** the disk you wish to boot from, then **press next**.



5. The wizard will then display a summary screen. **Press Next**.

6. You will then see a report showing you a choice of actions and allowing you to restart your PC. **Select Yes** if you wish to restart now and **select No** if you wish to perform additional tasks in the PE environment.

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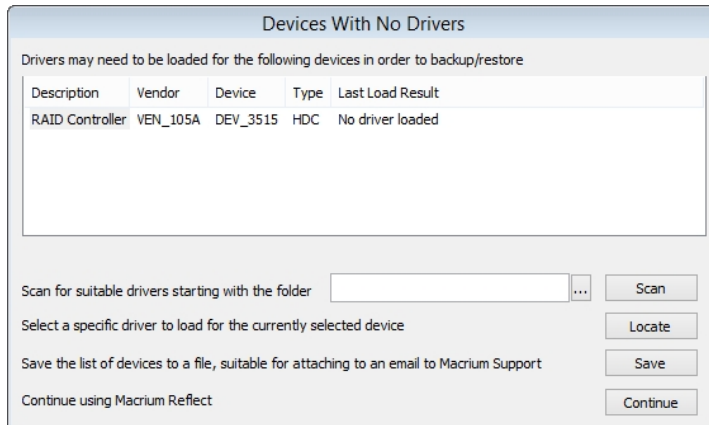


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Updating rescue media to include additional hardware drivers

While you have valid rescue media, it is possible that further down the line you add hardware to your computer without updating the rescue media. Macrium Reflect provides a way of loading drivers for these pieces of hardware when in Windows PE.

Select the Restore > View Unsupported Devices menu option, the following dialog will be shown:



a list of devices which are currently unsupported will be shown. Drivers can be loaded using two methods:

- Select a device from the list and click the Locate Driver. Browse and select a driver INF file in the dialog that is displayed. Macrium Reflect will try and load the driver and report the result back.
- Select a base folder using the ellipsis button and then click Scan. Macrium Reflect will traverse the folder structure looking for driver INF files for all devices in the list. After the scan, a dialog will be displayed showing which devices had drivers loaded.

Notes on Driver Packages

After downloading a driver package, unzip to a folder that Macrium Reflect has access to. All files within the driver package should be extracted including .CAT and .DLL files.

When loading drivers Macrium Reflect will check for device support in INF files and if found will attempt to load the driver. It is important that all the files that the driver package consist of should be present in the same folder as the INF file. There will definitely need to be the .SYS file for the driver. The driver package may also consist of .CAT and .DLL files, these need to be present in the same folder as well in order to load successfully.

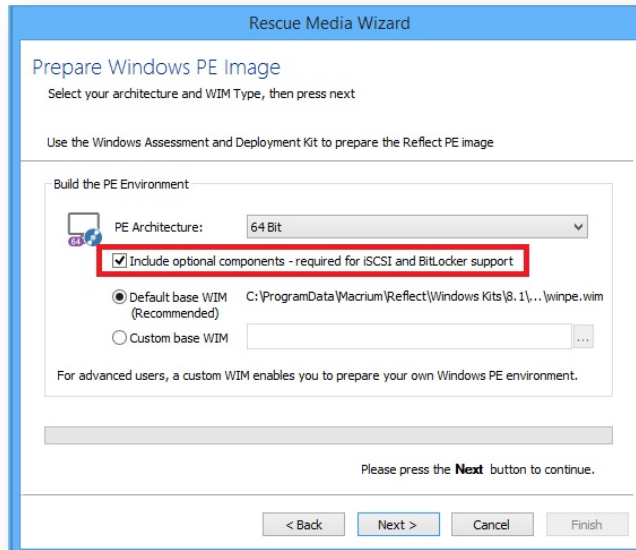
Drivers must ideally match the architecture of your Windows PE installation. It should be noted that Windows 7 drivers may appear to have been added to Windows PE 4.0/5.0 successfully but will only sometimes work.

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Adding iSCSI support to Windows PE

Macrium Reflect can include the components necessary to connect Windows PE to iSCSI. This enables restoration and clones to iSCSI connected disks.

1. Ensure that your Windows PE rescue media has been created with the '**Include optional components**' option selected.

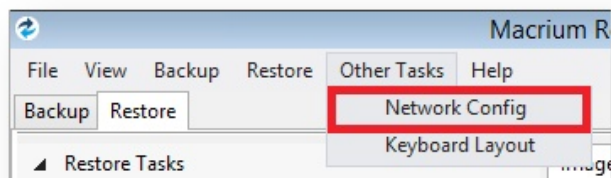


2. Boot into Windows PE and start a command prompt.



The command line can be accessed by clicking the black icon on the bottom left corner of your screen.

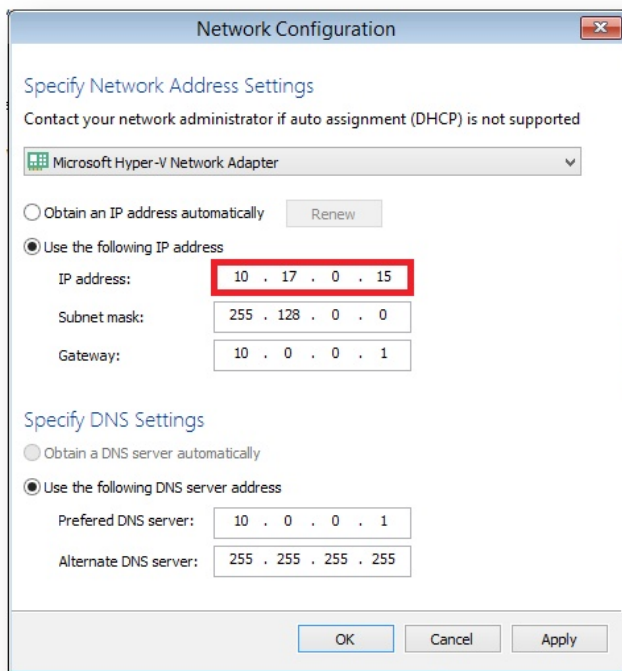
3. You will need to change the IP address of your Windows Pre-installation Environment to the same IP address that is configured on your Windows Host in order to be authenticated by the iSCSI target since unknown IP addresses will result in a timeout when trying to login to the target.



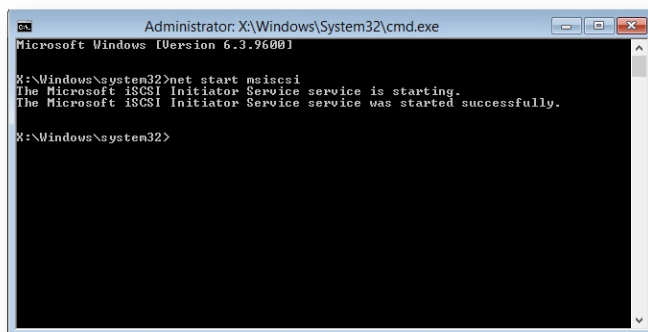
Take '**Other Tasks**' > '**Network Config**'

4. In Network Configuration input the same IP address that is configured to connect to the iSCSI target.
Note: In this case the Windows host IP address is '10.17.0.15'. Please replace with the correct IP address for your Windows host.

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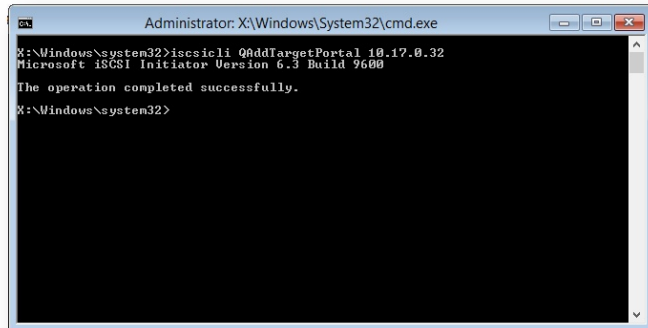
5. In the command window type **"net start msiscsi"** to enable the Microsoft iSCSI server:



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6. After the service has started connect the iSCSI target to Windows PE by typing “**iscsicli QAddTargetPortal 10.17.0.32**” .

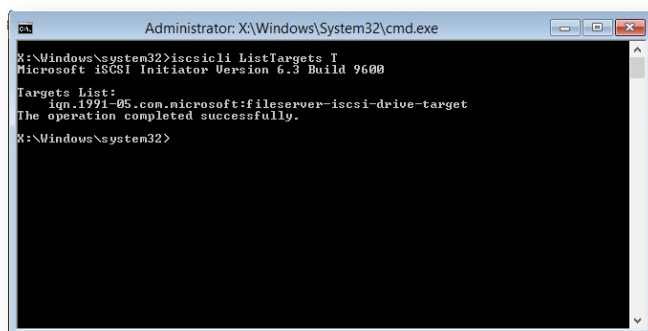
Note: In this case the target is '10.17.0.32' please replace with the correct IP address for your own iSCSI target.



```
Administrator: X:\Windows\System32\cmd.exe
X:\Windows\system32>iscsicli QAddTargetPortal 10.17.0.32
Microsoft iSCSI Initiator Version 6.3 Build 9600
The operation completed successfully.
X:\Windows\system32>
```

Note: Replace 10.17.0.32 with your IP address

7. Connect to the target in order to find out its Internet Qualified Name that is used to logon to the iSCSI target.
Type: “**iscsicli ListTargets T**”



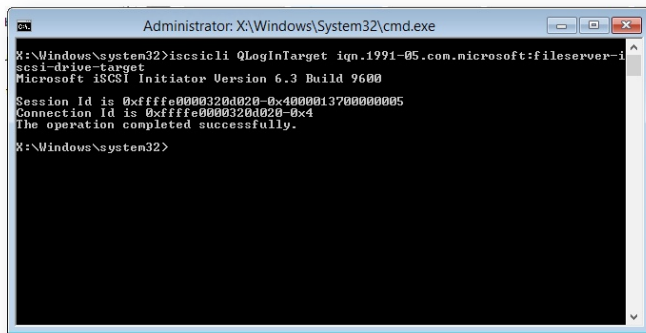
```
Administrator: X:\Windows\System32\cmd.exe
X:\Windows\system32>iscsicli ListTargets T
Microsoft iSCSI Initiator Version 6.3 Build 9600
Targets List:
    iqn.1991-05.com.microsoft:fileserver-iscsi-drive-target
The operation completed successfully.
X:\Windows\system32>
```

The above command gave output to a target name: **iqn.1991-05.com.microsoft:fileserver-iscsi-drive-target**

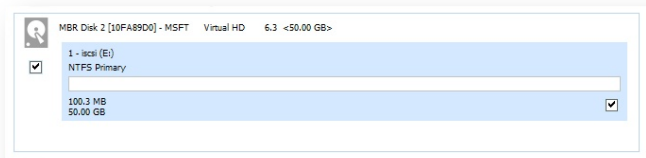
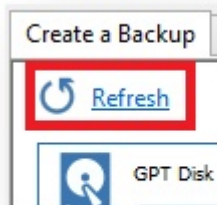
This target name is used to logon and access the iSCSI Virtual Disk.

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8. Using the “**iscsicli QLogInTarget iqn.1991-05.com.microsoft:fileserver-iscsi-drive-target**” you will add the iSCSI Virtual Disk to Reflects interface and it will appear as a local disk available for restore and clone .



9. If the iSCSI disk is not visible at first in the restore tab, **select the 'Backup' tab** in Reflect and **click Refresh** .



Your iSCSI disk is now connected and can be used as a target for your image restores and clones.

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Adding BitLocker support to Windows PE

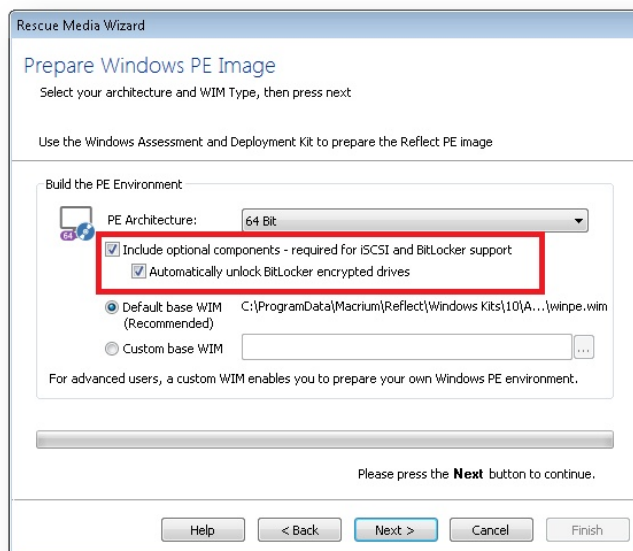


Note: It isn't absolutely necessary to unlock a BitLocker encrypted drive when restoring an image of the encrypted partition. The partition will restore without a problem and will be automatically re-encrypted on reboot, however, unlocking the drive in Windows PE enables intelligent sector copy imaging and cloning, [RapidDelta Restore \(RDR\)](#) (see page 26) and also free access to the drives contents using PE Explorer.

Automatically unlocking BitLocker encrypted drives

Macrium Reflect can include the components and decryption keys necessary automatically to unlock Microsoft BitLocker encrypted drives in Windows PE.

In the [Rescue Media Wizard](#) (see page 69) select '**Include optional components**' and '**Automatically unlock BitLocker encrypted drives**'

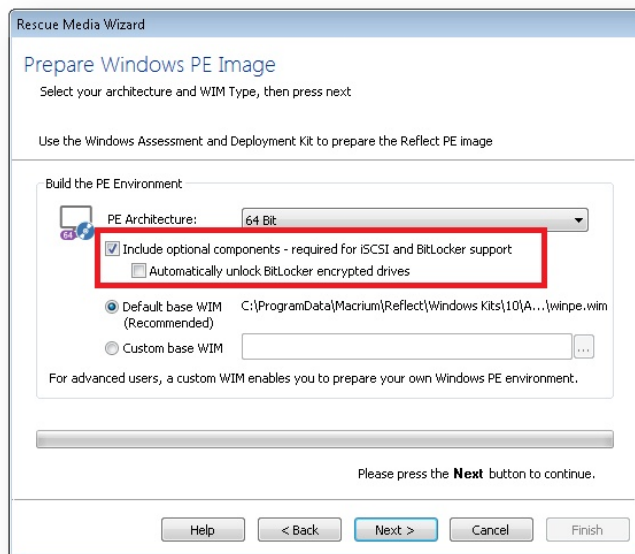


When Windows PE starts any BitLocker unlocked drives that were attached when the recovery media was created will be automatically unlocked in PE.

Unlocking BitLocker encrypted drives using a USB stick

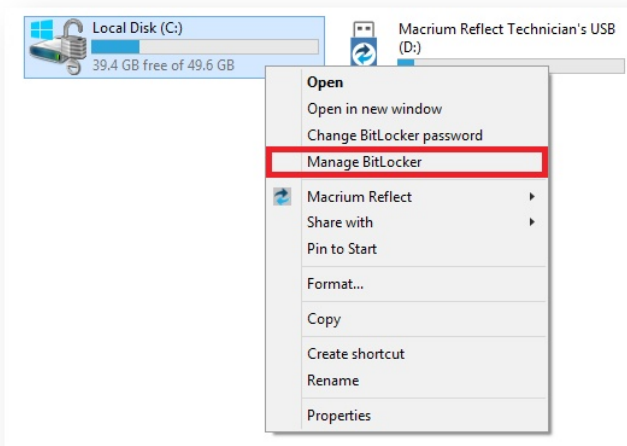
Automatically unlocking encrypted drives when PE starts may present an unacceptable security risk for some users. Automatic unlocking requires no user intervention and the Macrium Reflect boot menu is able to access encrypted drives without password entry. An alternative method is to **de-select** the '**Automatically unlock BitLocker encrypted drives**' option in the rescue media Wizard:

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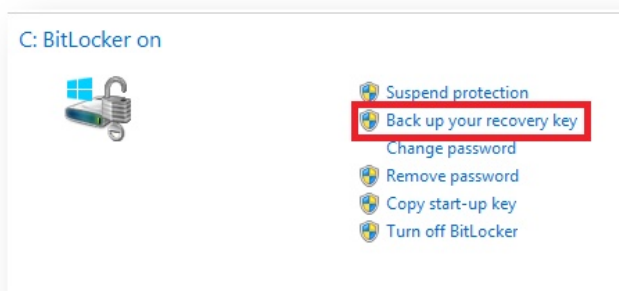


You can then save BitLocker Encryption Key files (.BEK) and/or BitLocker password TXT files to the root of any USB stick. This could also be a Windows PE rescue media USB stick.

1. In Windows Explorer, right click on any BitLocker encrypted drive and click on **'Manage BitLocker'**.

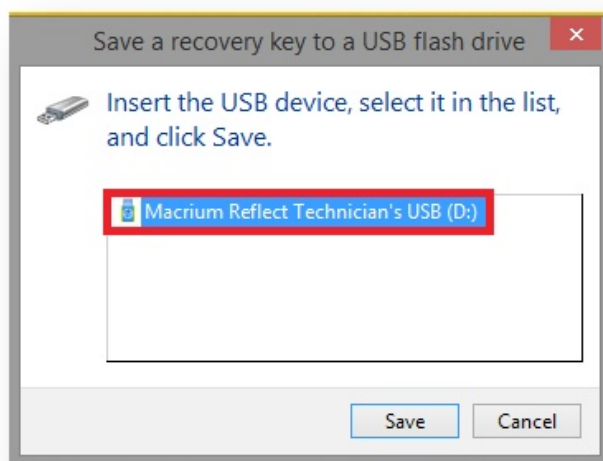
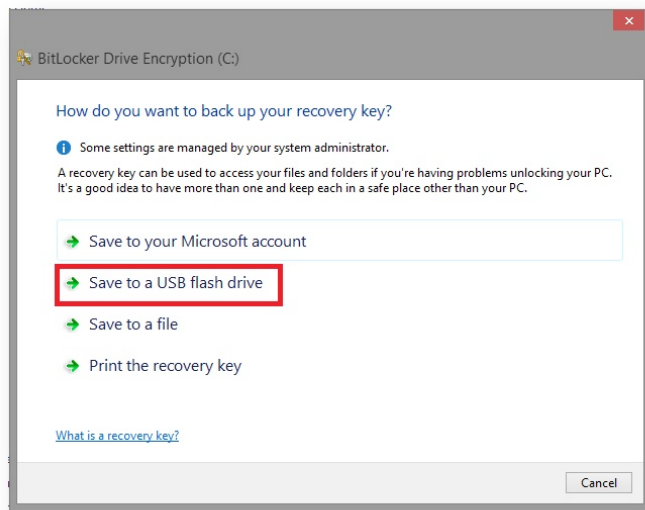


2. In the newly opened window click **'Back up your recovery key'**



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3. In the BitLocker Drive Encryption wizard select '**Save to a USB flash drive**' and chose the USB device you want to save to.



After choosing the USB device you want to save the Recovery Key file to, **click 'Save'** and then '**Finish**' in the BitLocker Drive encryption wizard. This action will save a .BEK file and/or a recovery password text file to the chosen USB device.



Note: The .BEK file is a protected operating system file, it is hidden by default and won't be visible within Windows Explorer. It can be made visible by changing Folder Options and de-selecting the option to '**Hide Protected operating system files**'.

You can add as many keys as you have encrypted drives.

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When Windows PE starts ensure that your USB flash drive is attached to your PC. Your encrypted drives will then be automatically unlocked when Macrium Reflect initializes.

Restoring an image from within the Rescue Media

This article is for Restoring an image from within Windows PE Rescue Media. For restoring an image in Windows see [Restoring an image within Windows \(see page 208\)](#).

If the image contains only data, restoring it is very simple using Macrium Reflect. You can restore it back to its original location without interrupting the operating system.

Before you begin: You must have a backup image of the disk ready to restore.

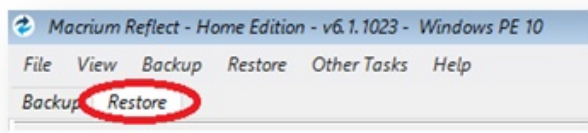
1. During start up of your PC on the first image you see press a button that will start a **Boot selection** menu.

i **Boot selection** button differs from one PC manufacturer to another, best way to find out the **Boot selection** menu on your PC is to consult the motherboard manual provided by the manufacturer.



Chose CD-ROM drive or a **Removable USB device** based on the choice of Rescue Media you've built and press **Enter** to load the Rescue Media.

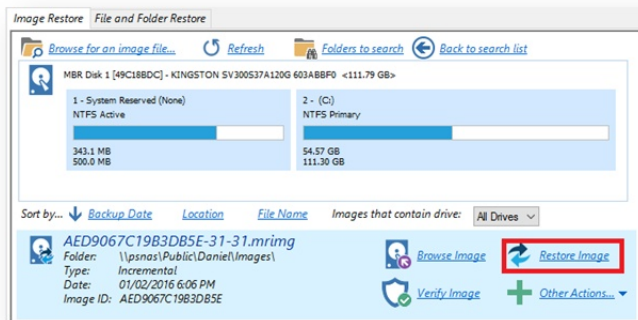
2. When You have loaded into windows PE, **select Restore**



Backup images will be available to choose from and be restored in the main pane.

3. Select the image you wish to restore and **click Restore Image**.

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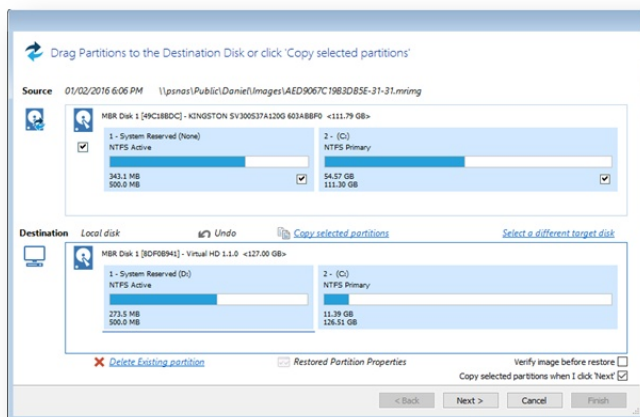


If you cannot find the backup image you would like to use in the provided list, select “**Browse for an image file...**” on the menu at the top and look through the windows explorer to find it.

4. This next windows give you the ability to edit partitions prior to the restore.

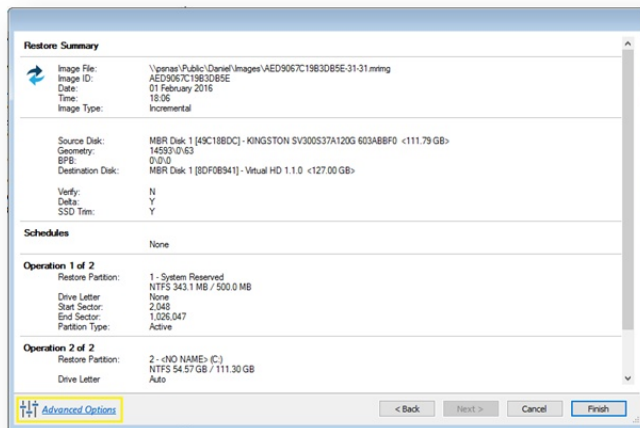
Moving and Resizing the restored partition

By default, partitions restore to their original locations. However, it's also possible to select a different target disk and to drag partitions to different locations and resize them to use the available space. Simply drag the source partition to any available partition or free space on the target disk. You can also delete partitions on the target disk to make space. For more destination options and further information, see [Modifying restored partition properties](#) (see page 214).



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5. This is the restore summary page, here you can finalise your Restore and if required access the "**Advanced Options.**"



The **Advanced Options** include:

Option	Description
Rapid Delta Restore:	Copy only changed data blocks to complete the restore process more quickly See: Rapid Delta Restore - RDR (see page 26)
SSD Trim:	Enable TRIM on restore to increase of both the lifetime and the performance of the SSD. See: SSD Trim Support
Verify Image:	To verify the image integrity before restoring.
Master Boot Record:	To replace the Master Boot Record (MBR) with the MBR from the backup. The MBR is a small program that executes when the computer starts up. If this program becomes corrupt then you can have problems starting the computer operating system. Note: On modern GPT/UEFI systems this option has no effect.

6. Once you have looked over the summary and you are happy with your restore settings you can click "**Finish**" and begin the operation.

Backup, imaging and cloning

Macrium Reflect creates File and Folder backups as well as disk images including cloning complete disks. The [Macrium Reflect Server Plus for Exchange and SQL \(see page 271\)](#) version adds MS Exchange and MS SQL Server backup capabilities to this.

A File and Folder backup is a useful way to backup your working files, personal files and precious data. Unlike other backup solutions Macrium Reflect can backup open and locked files by using Microsoft Volume Shadow copy Service (VSS). You can backup your *Documents* folder and save the backup configuration as an XML file for easy re-running and scheduling.

A Disk Image stores the information required to completely restore disks (or their individual partitions) exactly as they were when the image was taken.

Cloning with Macrium Reflect creates an exact copy of partitions to a different drive. For example, Upgrading to a larger hard drive or moving from a large magnetic hard disk to a smaller and faster SSD. When you Clone a hard drive, you can boot from the target disk on the same system after cloning.

Important

Windows cannot boot from a USB connected drive. This is a restriction imposed by Windows. If you clone your system disk to a USB connected external drive then, to boot your clone, the physical disk must be removed from the USB caddy and attached to your Motherboard SATA port.

- [Creating a backup image of your computer, drive or partitions \(see page 119\)](#)
- [Retrieving a saved XML backup configuration \(see page 129\)](#)
- [How backup sets are created and maintained \(see page 130\)](#)
- [Backing up files and folders \(see page 134\)](#)
- [Cloning a disk \(see page 141\)](#)
- [Backing up Microsoft Exchange databases \(see page 149\)](#)
- [Backing up MS SQL Databases \(see page 156\)](#)
- [Differential and incremental disk images \(see page 160\)](#)
- [Creating desktop shortcuts for full, incremental and differential backups \(see page 163\)](#)
- [Checking VSS events when backups fail \(see page 165\)](#)
- [Alternative Locations For Backups \(see page 167\)](#)
- [Advanced Options \(see page 169\)](#)
- [Verifying image and backup files \(see page 172\)](#)
- [How to backup Hyper-V Cluster Shared Volumes \(see page 174\)](#)

Creating a backup image of your computer, drive or partitions

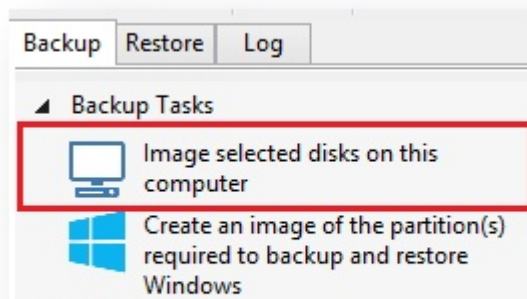
Using Microsoft Volume Shadow Copy Service (**VSS**) Macrium Reflect creates 'point-in-time' persistent images of your system. In Addition to creating backups of all partitions required to backup and restore Windows, you can backup all or selected drives and partitions on the PC.

Starting the Image Wizard

The Image Wizard can be started in multiple ways...

1. By selecting **'Image selected disks on this computer'**.

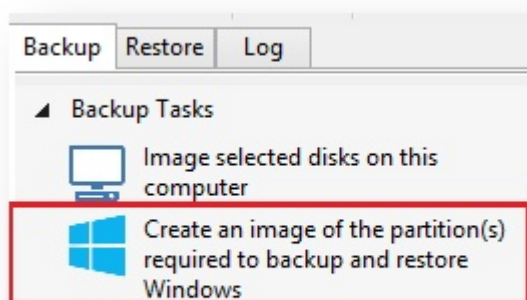
Using this option will populate the Image Wizard with all selected disks and partitions in the application main Window.



2. By selecting **'Create an image of the partition(s) required to backup and restore Windows'**.

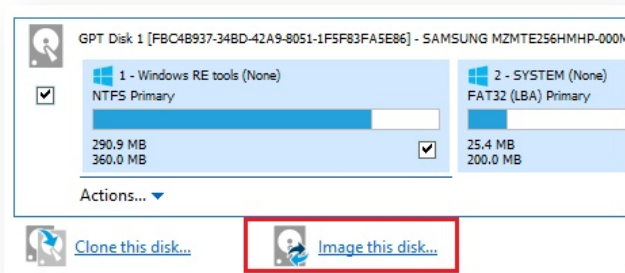
Using this option will choose all the partitions required to boot Windows. This may include hidden system partitions that are essential for Windows to start and run.

See: [Windows Partitions](#) (see page 126)

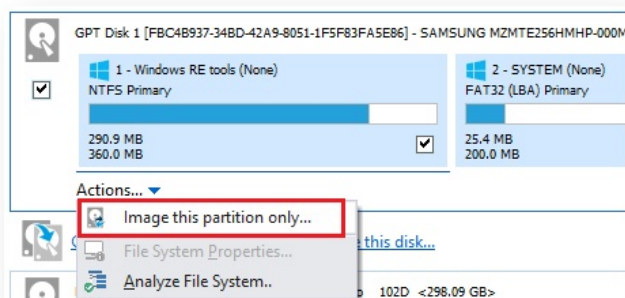


3. By Selecting a disk in the application main Window and click **'Image this disk...'**.

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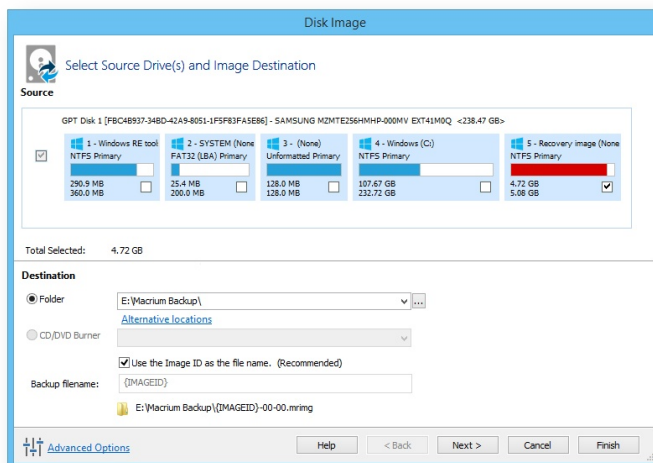


4. By Selecting a disk in the application main Window, click on a partition, then click '**Actions**' and select '**Image this partition only...**'



Setting the Image destination

The first page of the Image Wizard shows the selected disks and partitions to be included in your Image and allows you to choose a destination.



1. In the **Destination** section, enter the target backup folder.
You can type the destination path or click the browse button to choose a folder. The destination path can be on a local drive or network share.

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Alternative Locations (see page 167) can be used to provide backup rotations or as a fail safe for temporary unavailability of the primary backup destination.



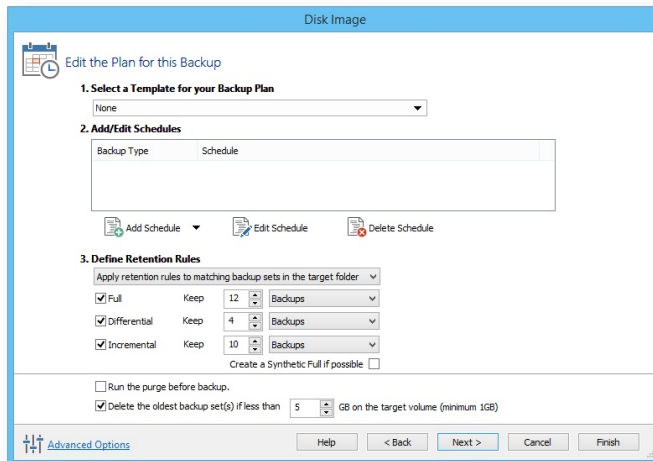
Note: You cannot enter a path that is located in any of the partitions included in the Image.

The recommended name for your Image file is the unique backup set identifier {{ImageID}}. We recommend that you always use this recommended setting as choosing your own name can cause file name collisions. Please see [How backup sets are created and maintained \(see page 130\)](#) for more information on backup file naming.

Click **'Next'** to edit the **Backup Plan** for this image or click **'Finish'** to save and/or run the Image now.

Adding and Editing the Backup Plan

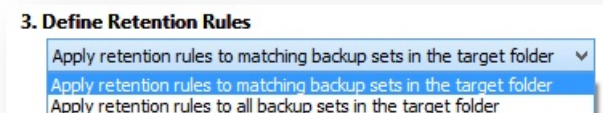
The second page of the Image Wizard is where you create or edit your **'Backup Plan'**. This defines the backup schedules and retention rules for your backup.



The new Macrium Reflect retention rules provide a powerful and flexible way to manage the lifetime and storage space used by your backups.

Choose how backups are matched and retention rules are applied to the target folder

Retention rules are applied to the target folder of the backup by selecting one of two options:



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1. Apply retention rules to matching backup sets in the target folder.

Disk Images are purged if they contain **exactly the same Partitions** as the current Image. Partitions are identified using the unique **Disk ID** stored in sector 0 of the disk and the **Partition sector offset**.



Note: For GPT disks the unique GPT disk GUID is used instead of the Disk ID

For **File and Folder** backups retention rules are applied according to the '**Backup Set Matching**' option select in the '**Advanced Properties**' for this backup.

2. Apply retention rules to all backup sets in the target folder. All backup sets in the target folder of the same type (Disk Image or File and Folder) are purged according the retention rules.



Note: This option uses the same logic as Macrium Reflect v5

Select the age or number of backup types that you wish to keep

<input checked="" type="checkbox"/> Full	Keep	12	Backups
<input checked="" type="checkbox"/> Differential	Keep	4	Backups
<input checked="" type="checkbox"/> Incremental	Keep	10	Backups
Create a Synthetic Full if possible <input type="checkbox"/>			
<input type="checkbox"/> Run the purge before backup.			
<input checked="" type="checkbox"/> Delete the oldest backup set(s) if less than		5	GB on the target volume (minimum 1GB)

Option	Description
Full	When deleting Full backups all linked incremental and Differential backups in the same backup chain (set) are also deleted This operation will delete the entire backup set.
Differential	When deleting Differential backups all linked incremental backups in the same backup chain (set) are also deleted.
Incremental	<p>When deleting Incremental backups the integrity of the backup set is maintained by ensuring that the chain is never broken. This is achieved by merging older Incremental backups when required.</p> <p>In the example below, before retention, there is 1 Full backup, 1 Differential backup and 6 Incremental backups. The retention rules are set to retain 4 incremental backups. After retention, the most recent 4 incremental backups are retained. Deleting the oldest 2 incrementals would cause the backup chain to be invalid as the oldest retained incremental requires the previous 2 incremental backups to complete the chain. To ensure backup integrity the 2 older incremental backups are consolidated with it to create a new incremental backup.</p>

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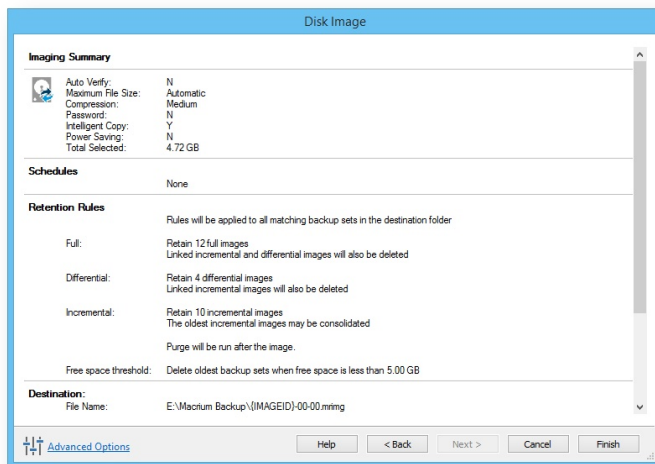
Option	Description																																																						
	<div><div>F = Full</div><div>D = Differential</div><div>I = Incremental</div></div> <table><tr><td>M</td><td>T</td><td>W</td><td>T</td><td>F</td><td></td><td></td><td>M</td><td>T</td><td>W</td><td></td><td>T</td><td>F</td><td></td><td></td><td>M</td><td>T</td><td>W</td></tr><tr><td>F</td><td></td><td></td><td></td><td></td><td></td><td></td><td>D</td><td>I</td><td>I</td><td></td><td>I</td><td>I</td><td></td><td></td><td>F</td><td>I</td><td>I</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>--</td><td>-></td><td></td><td>I</td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>	M	T	W	T	F			M	T	W		T	F			M	T	W	F							D	I	I		I	I			F	I	I									--	->		I						
M	T	W	T	F			M	T	W		T	F			M	T	W																																						
F							D	I	I		I	I			F	I	I																																						
								--	->		I																																												
Create a Synthetic Full if possible	When purging Incremental backups, if the backup folder only contains a Full backup followed by Incremental backups , then this option causes the Full backup to be 'rolled forward' to create a Synthetic Full backup . This is also known as Incremental Forever .																																																						
Run the purge before the backup	<div>Select this option to run the retention rules before the current backup.</div> <div><div></div><div>Note: in Macrium Reflect v5 the current backup set wasn't included in the purge calculation when purging before the current backup. In v6 the current backup set IS included. This means that if you set the retention count to 1 Full backup then all of your backups will be deleted and a new Full backup created.</div></div>																																																						
Delete oldest backup set (s) if less than n GB	<div>Automatically remove the oldest backup set(s) in the target folder if the free space on the drive drops below the GB threshold.</div> <div><div></div><div>Note: The free space threshold is actioned dynamically. If the free space available drops below the threshold then the running backup is temporarily paused while older backup sets are purged.</div></div>																																																						

Click **'Next'** to view a summary of all settings for this image or click **'Finish'** to save and/or run the Image now.

Displaying the Image settings

The final page of the Image Wizard displays all settings used for creating this image.

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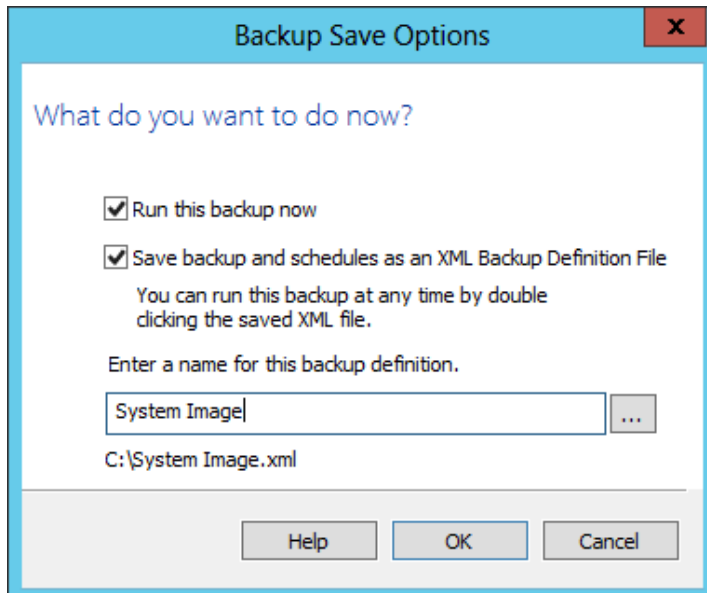
Click **Finish** to Run and/or save your Image definition.

Saving the backup definition


You are now given the opportunity to save the backup options.

The backup Save Options Dialog enables you to save your backup options as a re-usable XML definition file.

i This is essential for many operations in Reflect including Scheduling and creating Incremental and Differential backups

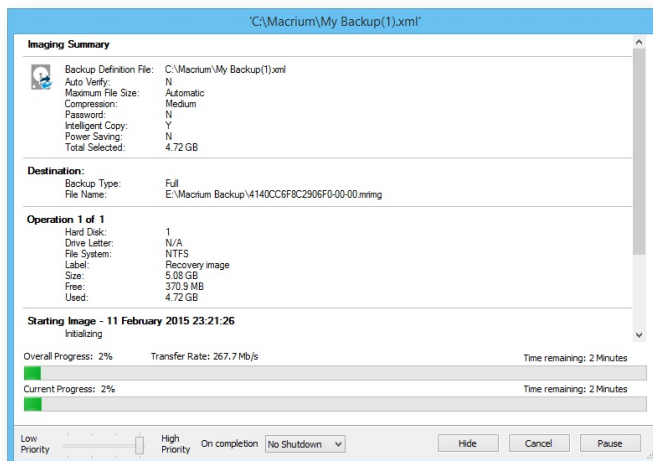


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Option	Description
Run this backup now	Create a 'Full' backup now using the backup definition
Save to an XML file	Saving your definition enables you to: <ul style="list-style-type: none"> • Re-run the same backup without stepping through the wizard • Run Incremental and Differential backups • Schedule your backups • Create a Desktop shortcut for running with one click
Name for this backup definition	Enter a meaningful name for this definition
	Choose a folder to save the XML definition to. Always save to a local folder. It isn't necessary to save the definition to the same folder as your backup target

See also: [Retrieving a saved XML backup configuration \(see page 129\)](#)

If you want to run the backup at this point, select **'Run this backup now'** and click **OK**.

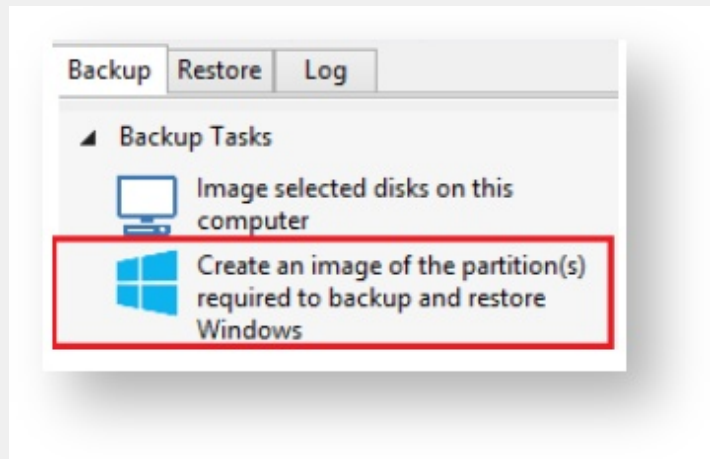


Create a Disk Image video

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Windows Partitions

The Windows operating system requires various partitions for normal operation. This article explains which partitions are automatically selected when selecting '**Create an image of the partition(s) required to backup and restore Windows**'.



UEFI booting systems with GPT style disks

Introduced with Windows 8.0 and a few Windows 7 systems, GPT disks are the replacement for the legacy MBR disk format. GPT disks can have up to 128 partitions and have a maximum size of 9.4 ZB (9.4×10^{21} bytes)

https://en.wikipedia.org/wiki/GUID_Partition_Table

Partition	Unique Identifier	Description
Windows Recovery	de94bba4-06d1-4d40-a16a-bfd50179d6ac	There may be more than one Recovery Partitions: Windows RE Tools - Provides the 'Startup Repair' options for Windows recovery. Recovery Image - There may also be an additional manufacturer system recovery partition.
EFI System partition (ESP)	c12a7328-f81f-11d2-ba4b-00a0c93ec93b	Always formatted FAT32 and between 200 and 300 MB in size, this partition contains the boot loader that runs when the system starts. The critical files in here are the Boot Configuration Data (BCD) and the EFI micro-code.
Microsoft Reserved Partition (MSR)	e3c9e316-0b5c-4db8-817d-f92df00215ae	Usually 128 MB in size, this unformatted partition is reserved for MS data structures including the Logical Disk Manager (LDM) for dynamic disks. Every GPT disk initialized by Windows includes this partition.

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Operating System (Windows C:)	ebd0a0a2-b9e5-4433-87c0-68b6b72699c7	Always formatted using NTFS, this partition contains the full Windows Operating System and is loaded using the BCD in the ESP,
-------------------------------	--------------------------------------	--



Note: The Microsoft Reserved Partition (MSR) is not shown in the Windows Disk Management Console

Surface Pro 3 running Windows 10

Legacy MBR booting systems

MBR systems support a maximum disk size of 2TB and up to four primary partitions. In modern PC's this format has been superseded by the more flexible GPT disk format.

https://en.wikipedia.org/wiki/Master_boot_record

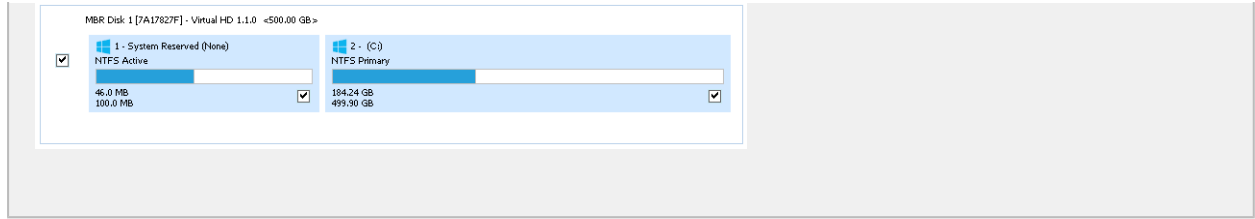
Partition	Description
Microsoft Reserved Partition (MSR)	For MBR disks, Windows 7 onwards, this is the 'Active' partition and contains the Boot Configuration Data (BCD). This partition provides the second stage for the MBR boot process after the MBR boot code. Windows XP and Vista do not use this partition.
Operating System (Windows C:)	This partition contains the full Windows Operating System. For Windows XP & Vista this is the 'Active' partition and is the only partition required to boot and start Windows.



Note: MBR systems may also contains proprietary system recovery partitions, however, there are no unique identifiers for these partitions and they are not automatically included.

Windows 7 MBR System

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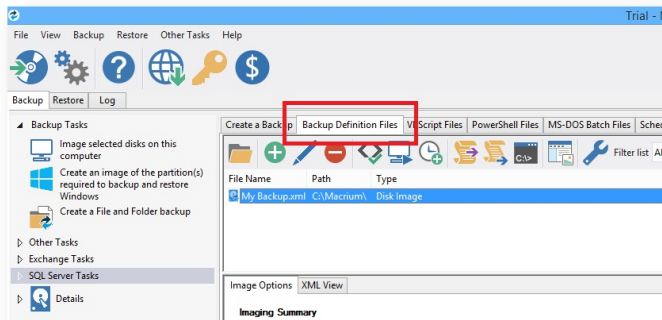


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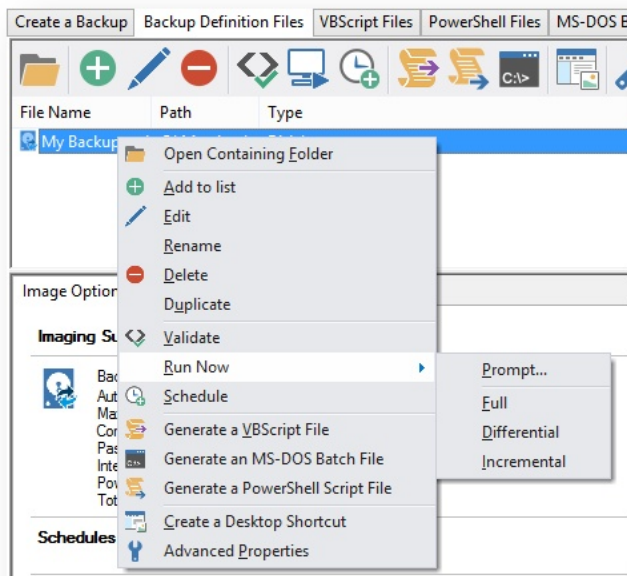
Retrieving a saved XML backup configuration

Macrium Reflect saves backup configurations using XML. Using an XML definition you can schedule a backup, generate a VBScript file for complex scenarios or simply create a desktop shortcut so you can instantly run your backup by clicking the shortcut icon.

1. Select **Backup Definition Files**, to view your saved XML backup configurations.



2. Right click on the XML file to view options including; run the backup, scheduling or creating a desktop shortcut.



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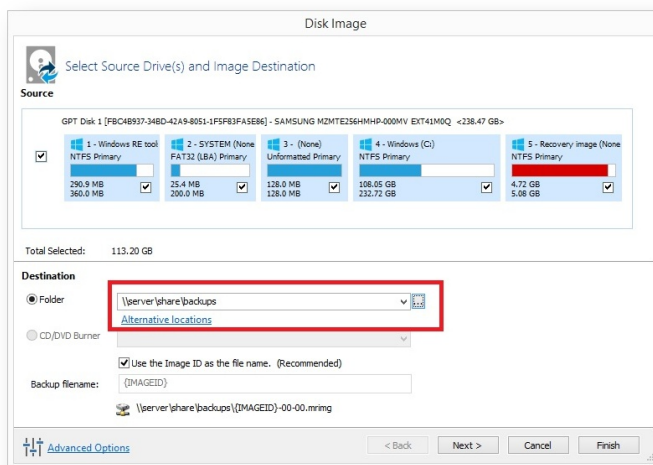
How backup sets are created and maintained

This article explains how Full, Incremental and Differential images and backups are saved to the target folder specified in your backup definition file. Also, which backup set is chosen when you run a Differential or Incremental.

For information on how to create Incremental or Differential backups please see here: [Differential and incremental disk images](#) (see page 160)

How do I specify the backup target folder?

For disk images this is specified in the first page of the backup wizard:



Similarly, for File and Folder backups, this is also on the first page of the backup wizard.

What is a backup set?

Backups are grouped into '**Sets**'. A backup set contains first a **Full backup** and subsequent **linked incremental and differential backups**. This is sometimes referred to as a **Backup Chain**. You can see the links by looking at the default file name which is a unique backup set identifier, followed by a number pair:

Name	Date modified	Backup Method	Type
A7D5FDD036A7B908-00-00.mring	24/01/2013 23:26	Full	Disk Partition image
8AFF20FD7F2BFD9C-00-00.mring	24/01/2013 23:26	Full	Disk Partition image
4F6F6ACA58B077D-04-04.mring	24/01/2013 23:27	Incremental	Disk Partition image
4F6F6ACA58B077D-03-03.mring	24/01/2013 23:27	Incremental	Disk Partition image
4F6F6ACA58B077D-02-02.mring	24/01/2013 23:27	Incremental	Disk Partition image
4F6F6ACA58B077D-01-01.mring	24/01/2013 23:26	Incremental	Disk Partition image
4F6F6ACA58B077D-00-00.mring	24/01/2013 23:26	Full	Disk Partition image

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The above folder contents shows (marked in red) a single backup set {4F6F6CACA58B077D} which contains a full image and 4 increments. The end of the image file contains a number pair? 'xx-yy.mrimg'

'xx' is the increment number.

00 - Full image

01 - first incremental/differential

02 - Second incremental/differential

'yy' is the file number and is always sequential. **00, 01, 02, 03...** . This will be different to the increment number only if files have been split. This can happen if files larger than 4GB are saved to a FAT32 file system or you are saving an image to multiple DVDs.

So the first file for a full image always ends with '**00-00.mrimg**'.

Note: The Image ID, file and increment numbers are also stored as data inside the files. **Renaming a file does not affect the integrity of the set, Macrium Reflects ability to append to the set, or restoration of the files.**

How is a set chosen when an Incremental or Differential backup is run?

Each backup set is grouped by similar backup types. This means that a single set will only consist of images of ***exactly the same partitions** or a File and Folder backups of **exactly the same selection criteria**.

***Note:** A change in partition layout will cause a new backup set to be created even if the drive letters are consistent. The partitions must have the same disk offset and length and must be from the same disk, i.e, the disk must have the same Disk ID.

e.g, If you run an Incremental image of **only drive 'C'** and the target folder contains 4 image files:

6698CD700DF88DF4-00-00.mrimg Drives: **C, D, E** Created **1st Jan 2015**

430D57E2CEE8552-00-00.mrimg Drive: **F** Created **2st Dec 2014**

1EB112ABA7C3898-00-00.mrimg Drive: **C:** Created **1st Nov 2014**

D407A9E1BF98D822-00-00.mrimg Drive: **C:** Created **1st Oct 2014**

Then the newly created image file will be **1EB112ABA7C3898-01-01.mrimg**. This is because file

1EB112ABA7C3898-00-00.mrimg is **the most recent full image in the target folder that contains exactly the same partitions as the current Incremental image**. The next Incremental (or Differential) image would be **1EB112ABA7C3898-02-02.mrimg** and so on...

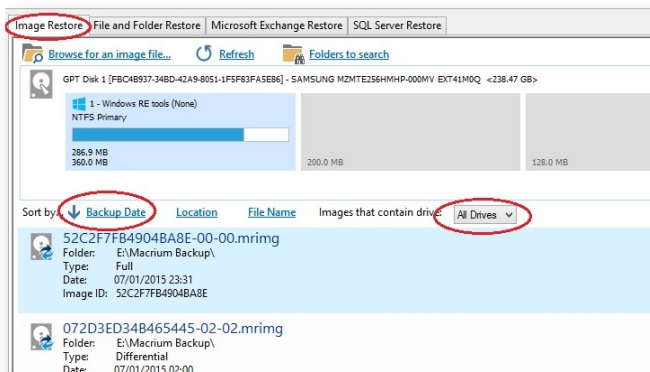
Note: If there was no existing backup set that contained only drive 'C:' then a new backup set (full) would be created.

Doesn't this get confusing if multiple backup types are saved to the same folder?

Not if you use the '**Restore**' tab in Macrium Reflect to view your images to mount and/or restore. The Restore Tab can be restricted to show only images that contain a particular drive and also be sorted by date. So, if you want to restore drive 'C' as it was last week then you can easily find it. In fact Backup Sets are an abstraction that you don't

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need to worry about when restoring data, **they are only relevant to optimizing backup speed and storage space.**



Note: If you want to organize your backup sets so they are easier to find in Windows Explorer then we recommend that you save different backup types to different folders. e.g.

D:\Backups\Images of C

D:\Backups\Images of D

D:\Backups\Images of Disk 1

Additional Information

A differential backup saves **only the changes** made since the **last full** backup of the **same type** found in the target folder for the backup.

An incremental backup saves **only the changes** made since the **last** backup of the **same type** found in the target folder for the backup. See also:

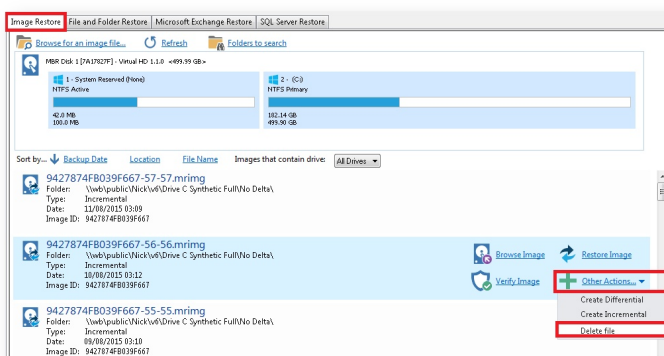
- [How to delete backup files \(see page 133\)](#)

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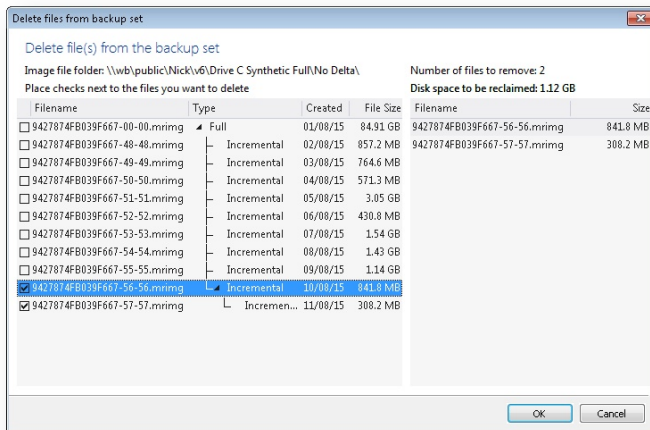
How to delete backup files

If you create only Full images or Full File and Folder backups then you can safely delete your .mrimg or .mrbak files using Windows Explorer. However, if you create Differential and/or Incremental backup files then we suggest that you use the functionality built into Reflect to avoid breaking backup chains. For more information please see [How backup sets are created and maintained](#) (see page 130).

Select the **'Restore'** tab, select either **'Image Restore'** or **'File and Folder Restore'**, select the file you want to delete, click **'Other Actions'** and select **'Delete'**.



This opens the **'Delete files from backup set'** dialog to safely delete backup files:



Along with the select file, any dependant files will automatically be included for deletion. In the above example Incremental image '9427874FB039F667-57-57.mrimg' was also selected because it is dependant on the previous incremental 9427874FB039F667-56-56.mrimg.

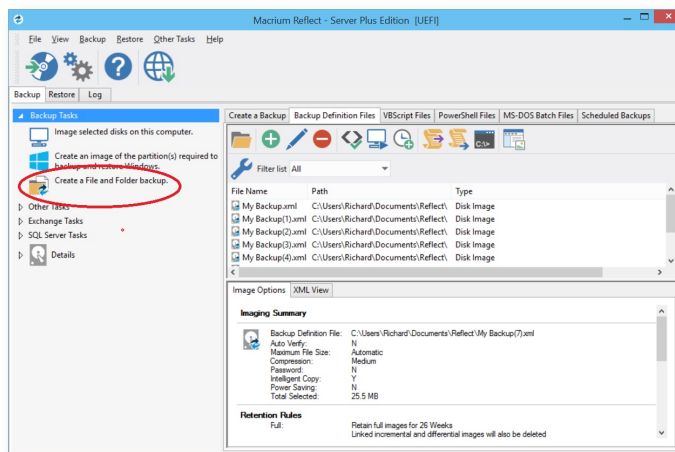
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Backing up files and folders

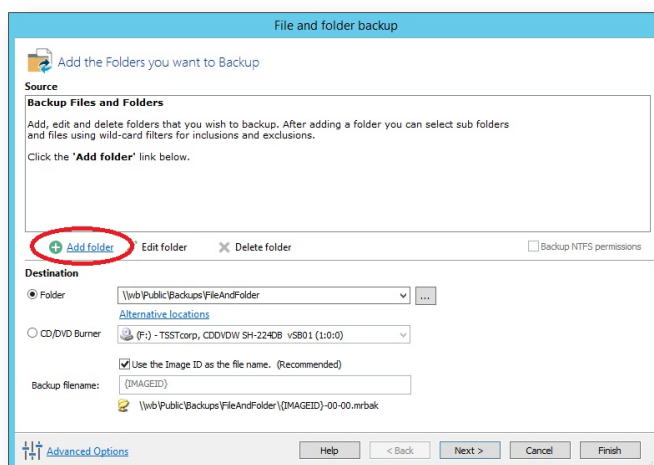
A file and folder backup is a useful way to backup your working files, personal files and precious data. Unlike other backup solutions Macrium Reflect can backup open and locked files by using Microsoft Volume Shadow copy Service (VSS). You can backup your Documents folder and save the backup as an XML file for easy re-running and scheduling.

i To backup your Windows operating system, do not use a file and folder backup, use an image backup, see [Creating a backup of your computer](#) (see page 119). A file and folder backup is not suitable for restoring your Windows operating system.

1. From the **Backup** task bar, select **Create a File and Folder backup** to start the backup wizard.



2. Select **Add folder**.



The **Select Folder to backup** dialog appears.

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Select folder to backup

File and folder inclusion and exclusion masks

1. Folder to backup

C:\Documents and Settings

☒ Include subfolders
☐ Exclude hidden files and folders
☐ Exclude System files and folders

Select files and folders to be included/excluded.
 Wildcards are supported. Separate multiple masks with semi-colon (*.xls; *.doc; *.mp3)

2. Add files to include

.

3. Add any files to exclude

*.temp; *.tmp; *.bak; *.~*

4. Add any folders to exclude

Enter full or partial folder path, wildcards are supported.
 *e.g. c:\temp; temp; *\temp; temp*

OK Cancel

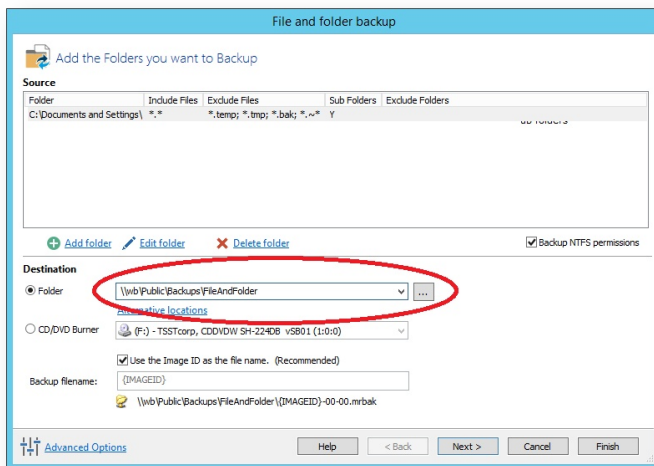
Select the folder you want to backup, or the folder containing the files you want to backup. Several different masks and wildcards can be specified to include specific files within the given directory or exclude other files.

Option	Description
Include subfolders	Recurse all folders below the backup folder using the specified filters
Exclude hidden files and folders	Do not backup files or folders that have the Hidden attribute
Exclude system files and folders	Do not backup files or folders that have the System attribute
Add files to include	Add a semi-colon separated list of file name filters to include in the backup. Use the asterisk * character as a wild card. For example; *.doc; *data*; *.xls
Add files to exclude	Add a semi-colon separated list of file name filters to exclude from the backup. Use the asterisk * character as a wild card. Note: Exclude filters take precedence over include filters
Add any folders to exclude	Add a semi-colon separated list of folder name filters to exclude from the backup. Use the asterisk * character as a wild card. Filter names can be full path and/or folder names.

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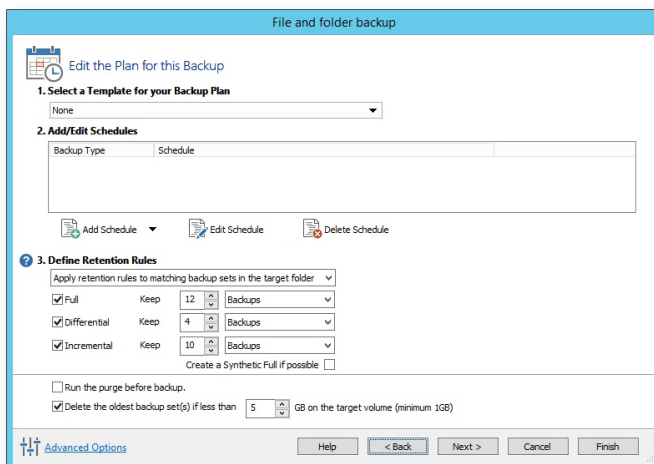
Option	Description
	<p>For example:</p> <p>*temp* will exclude all folders with the letters 'temp' anywhere in the folder name</p> <p>*\data\temp* will exclude all paths where the folder name begins with 'temp' that has a parent folder named 'data'</p>

3. Click **OK**
4. Repeat to add further individual directories if necessary.
5. In the **Destination** section, specify where you want the backup to be made.



[Alternative Locations](#) (see page 167) can be used to provide backup rotations or as a fail safe for temporary unavailability of the primary backup destination.

6. When you have finished adding folders and making all necessary changes, click **Next**.
7. The Backup Plan Page is shown:

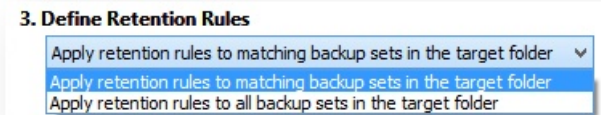


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The new Macrium Reflect retention rules provide a powerful and flexible way to manage the lifetime and storage space used by your backups.

Choose how backups are matched and retention rules are applied to the target folder

Retention rules are applied to the target folder of the backup by selecting one of two options:



a. Apply retention rules to matching backup sets in the target folder.

Disk Images are purged if they contain **exactly the same Partitions** as the current Image. Partitions are identified using the unique **Disk ID** stored in sector 0 of the disk and the **Partition sector offset**.



Note: For GPT disks the unique GPT disk GUID is used instead of the Disk ID

For **File and Folder** backups retention rules are applied according to the '**Backup Set Matching**' option select in the '**Advanced Properties**' for this backup.

b. Apply retention rules to all backup sets in the target folder. All backup sets in the target folder of the same type (Disk Image or File and Folder) are purged according the retention rules.





Note: This option uses the same logic as Macrium Reflect v5

Select the age or number of backup types that you wish to keep

<input checked="" type="checkbox"/> Full	Keep	12	Backups
<input checked="" type="checkbox"/> Differential	Keep	4	Backups
<input checked="" type="checkbox"/> Incremental	Keep	10	Backups
<input type="checkbox"/> Create a Synthetic Full if possible			
<input type="checkbox"/> Run the purge before backup.			
<input checked="" type="checkbox"/> Delete the oldest backup set(s) if less than		5	GB on the target volume (minimum 1GB)

Option	Description
Full	When deleting Full backups all linked incremental and Differential backups in the same backup chain (set) are also deleted This operation will delete the entire backup set.
Differential	When deleting Differential backups all linked incremental backups in the same backup chain (set) are also deleted.

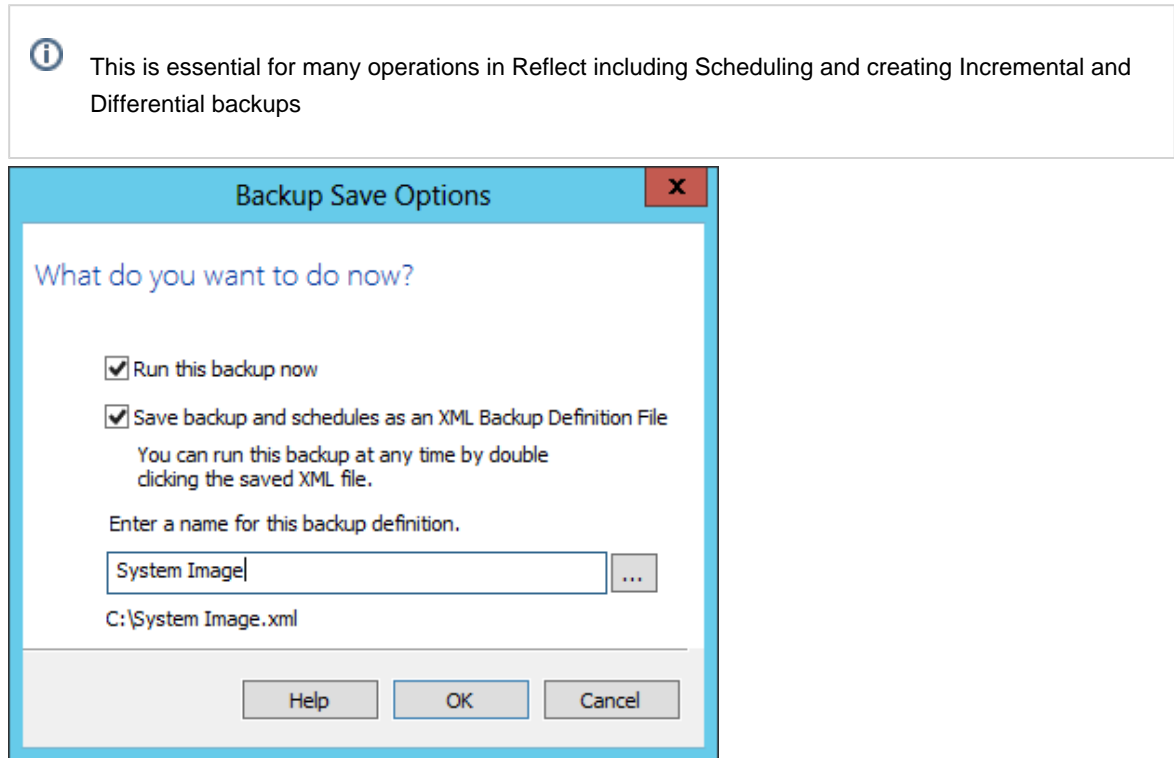
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Option	Description																																																						
Incremental	<p>When deleting Incremental backups the integrity of the backup set is maintained by ensuring that the chain is never broken. This is achieved by merging older Incremental backups when required.</p> <p>In the example below, before retention, there is 1 Full backup, 1 Differential backup and 6 Incremental backups. The retention rules are set to retain 4 incremental backups. After retention, the most recent 4 incremental backups are retained. Deleting the oldest 2 incrementals would cause the backup chain to be invalid as the oldest retained incremental requires the previous 2 incremental backups to complete the chain. To ensure backup integrity the 2 older incremental backups are consolidated with it to create a new incremental backup.</p> <p>F = Full D = Differential I = Incremental</p> <table><tr><td>M</td><td>T</td><td>W</td><td>T</td><td>F</td><td></td><td></td><td>M</td><td>T</td><td>W</td><td></td><td>T</td><td>F</td><td></td><td></td><td>M</td><td>T</td><td>W</td></tr><tr><td>F</td><td></td><td></td><td></td><td></td><td></td><td></td><td>D</td><td>I</td><td>I</td><td></td><td>I</td><td>I</td><td></td><td></td><td>F</td><td>I</td><td>I</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>--</td><td>--></td><td></td><td>I</td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>	M	T	W	T	F			M	T	W		T	F			M	T	W	F							D	I	I		I	I			F	I	I									--	-->		I						
M	T	W	T	F			M	T	W		T	F			M	T	W																																						
F							D	I	I		I	I			F	I	I																																						
								--	-->		I																																												
Create a Synthetic Full if possible	<p>When purging Incremental backups, if the backup folder only contains a Full backup followed by Incremental backups, then this option causes the Full backup to be 'rolled forward' to create a Synthetic Full backup. This is also known as Incremental Forever.</p>																																																						
Run the purge before the backup	<p>Select this option to run the retention rules before the current backup.</p> <div><p> Note: in Macrium Reflect v5 the current backup set wasn't included in the purge calculation when purging before the current backup. In v6 the current backup set IS included. This means that if you set the retention count to 1 Full backup then all of your backups will be deleted and a new Full backup created.</p></div>																																																						
Delete oldest backup set(s) if less than n GB	<p>Automatically remove the oldest backup set(s) in the target folder if the free space on the drive drops below the GB threshold.</p> <div><p> Note: The free space threshold is actioned dynamically. If the free space available drops below the threshold then the running backup is temporarily paused while older backup sets are purged.</p></div>																																																						

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8. The summary screen gives the details of what is being backed up. Click **Finish**.
9. You are now given the opportunity to save the backup options.

The backup Save Options Dialog enables you to save your backup options as a re-usable XML definition file.



Option	Description
Run this backup now	Create a ' Full ' backup now using the backup definition
Save to an XML file	Saving your definition enables you to: <ul style="list-style-type: none"> • Re-run the same backup without stepping through the wizard • Run Incremental and Differential backups • Schedule your backups • Create a Desktop shortcut for running with one click
Name for this backup definition	Enter a meaningful name for this definition
	

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Option	Description
	Choose a folder to save the XML definition to. Always save to a local folder. It isn't necessary to save the definition to the same folder as your backup target

See also: [Retrieving a saved XML backup configuration \(see page 129\)](#)

If you want to run the backup at this point, select '**Run this backup now**' and click **OK**.

Cloning a disk


It is possible to clone an entire hard drive or specific partitions on a hard drive. This is useful if you are upgrading to a larger hard drive. With Macrium Reflect you can boot the target disk on the same system after cloning. Cloning your hard drive creates a bootable new hard drive with the state of your computer at the time you undertook the clone. You can clone to a hard drive installed in your computer or to a hard drive installed in a USB hard-drive Caddy.

Important

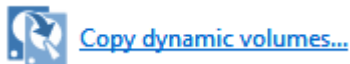
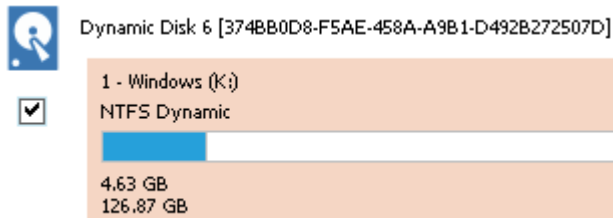
Windows cannot boot from a USB connected drive. This is a restriction imposed by Windows. If you clone your system disk to a USB connected external drive then, to boot your clone, the physical disk must be removed from the USB caddy and attached to your Motherboard SATA port.

Deleting and re-configuring existing partitions or configuring new partitions is possible with Macrium Reflect, so you don't need to do this prior to cloning.

Show important information about MS Dynamic Volumes...

 A [Dynamic volume](#) is a logical abstraction of the underlying physical disk and may be striped or extended over multiple physical disks. Because of this, **Dynamic volume file systems are copied** not disk partitions.

If your source disk contains Dynamic Volume(s) then the background will be orange and the link will show 'Copy Dynamic Volumes...':



In the Clone Wizard:

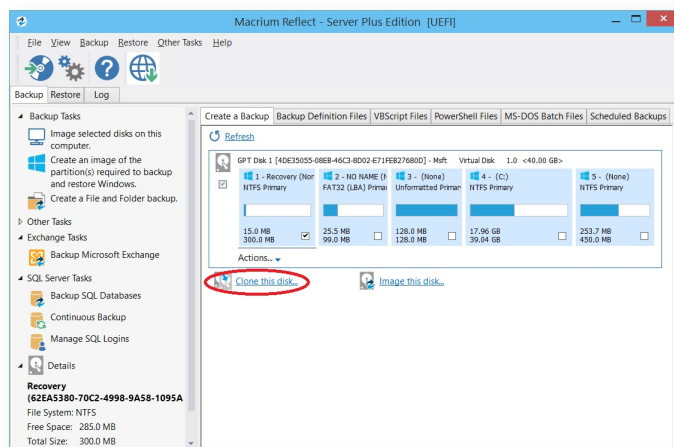
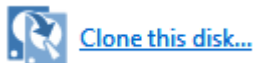
- The **partition selection check boxes** and '**Copy selected partitions**' link will not be available. Therefore, **Dynamic Volumes must be dragged and dropped** to the destination.
- To copy source Dynamic Volume(s) to destination Dynamic Volume(s) you must prepare the target as Dynamic and format the destination volume(s) in advance of the clone operation. This can be achieved using the Windows Disk Management Console to convert one or more physical disks to Dynamic.

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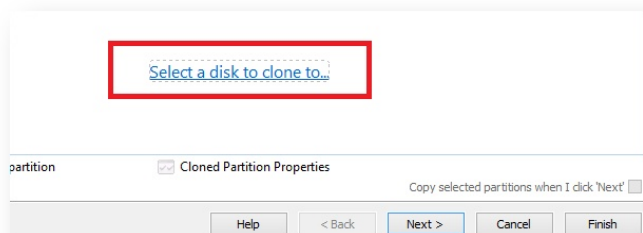
- A destination Dynamic Volume cannot be resized so the **'Cloned partition properties' link will not be available** if the destination is Dynamic.
- To convert Dynamic Volume(s) to standard partitions, select an unformatted or an MBR/GPT basic disk as the destination and use 'Drag and Drop' to copy the source volumes. After the clone operation you can leave the disk as a 'Basic' disk or convert to Dynamic using the Windows Disk Management Console.

See also: [Bare metal restore of a dynamic disk system](#) (see page 248)

1. Select the disk you wish to clone in the main application window and Click **'Clone this disk'..**

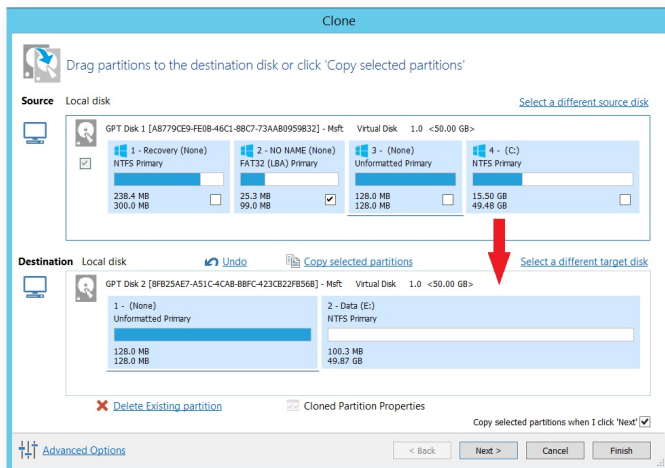


2. In the wizard that opens Click **Select a disk to clone to...**

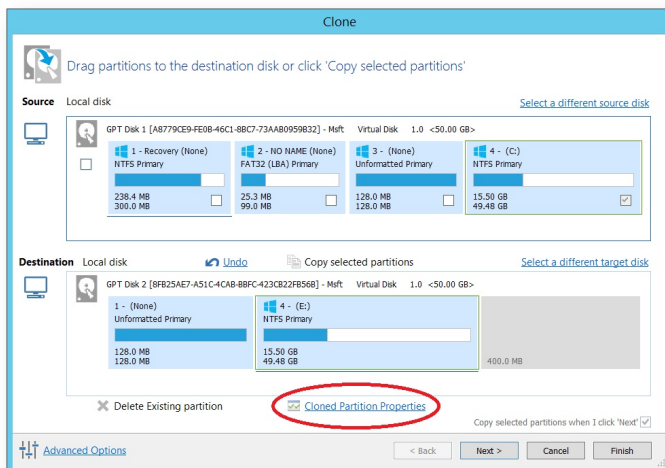


3. Select the hard disk you wish to clone to. In this case, there is only one disk available.
4. If you do not want to modify the order or size of partitions of the clone, **click Next**. This is the default behavior.
Alternatively, drag the partitions you want to clone, the red arrow below shows this.

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Becomes



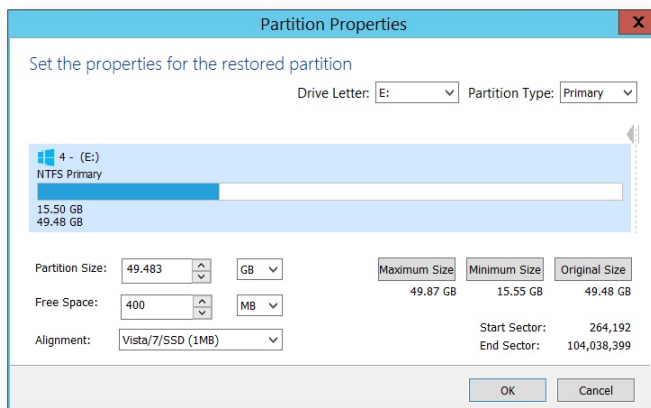
In this example, there is 400MB of free space after the copied partition. You can modify the size of each partition to fit the new disk if required.



You can delete partitions on the target disk by selecting and clicking '**Delete existing partitions**'..

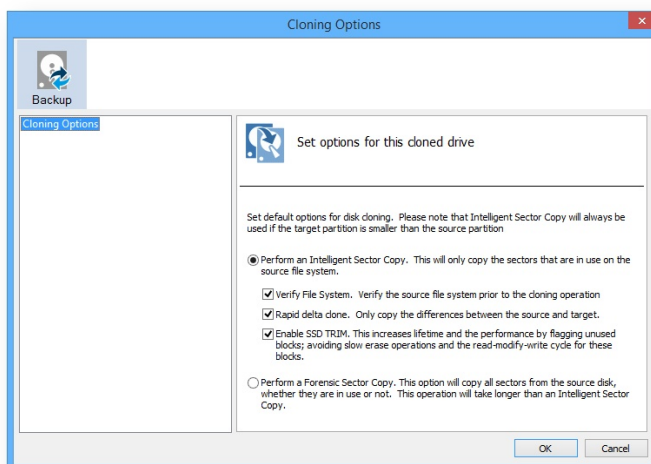
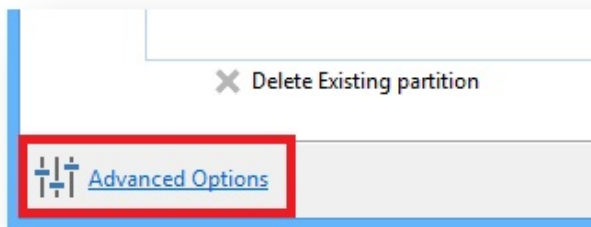
5. To modify the partition sizes, click **Cloned Partition Properties** and adjust the size of the partition by:
 - a. Setting the partition size precisely using the **Partition Size** entry box.
 - b. Resize the partition automatically by clicking **Maximum size**, **Minimum size** or **Original size**.

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6. Click **OK**.

7. If required, click **Advanced Options** to change settings for this clone:




Option	Description
Intelligent sector copy	Copy only file system sectors/clusters that are in use. This reduces the time to create the clone as unused file system clusters are not copied.

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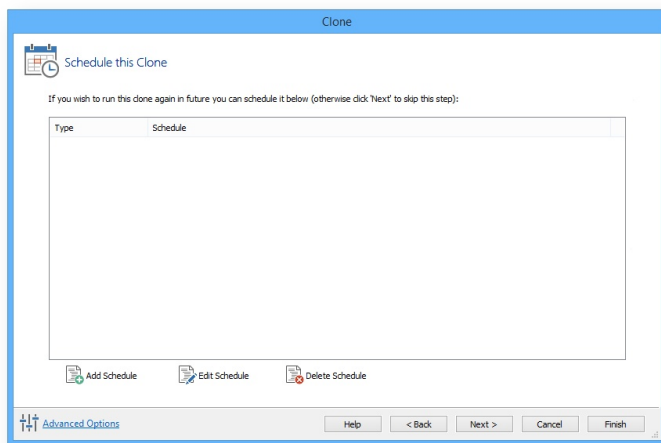
Option	Description
Verify File System	<p>Verifying the file system prior to cloning ensures that there are no file system errors transferred to the clone.</p> <div>  Please note that this may take several minutes to complete </div>
Rapid Delta Clone	<p>Copy only file system differences between the clone source and target. This increases cloning speed dramatically.</p> <p>Show more information on RDC...</p> <p>As with Rapid Delta Restore (RDR) the concept of RDR has been something that has been thought about for quite some time here at Macrium Software. We wanted to build a clone solution that would effectively and rapidly copy only the differences between the source and target file systems. The advantage of this is obvious, RDC offers similar a performance increase as an Incremental disk image offers over a Full image and enables regular clones to be a viable and fast DR solution.</p> <p>How does it work?</p> <p>The NTFS file system resident on the clone source is compared with file system on the target disk. The two file systems are first verified that they originated from the same format command and then the target NTFS file system structures are analyzed for differences. All the NTFS file system structures are copied to the target disk and any that do not exist or have been modified on the target disk cause the data records for each NTFS file or object to be copied as well. The result is an 'Incremental' clone applying only file system changes detected between the source and the target.</p> <div>  Note: RDC works with NTFS file systems only. All other file systems will perform a full clone </div> <div>  Note: RDC is not available when shrinking partitions during a clone. </div>
Enable SSD TRIM	<p>Enable SSD TRIM on the clone target to optimize the disk.</p> <p>Show more information on SSD TRIM...</p> <p>This features provides automated SSD optimization resulting enhanced SSD performance and longevity. Writing to an unused block is much quicker than an in-use block as it avoids both the slow erase operation and the read-modify-write cycle. This results an increase of both the lifetime and the performance of the device. It is effective</p>

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Option	Description
	for all windows operating systems, even those that support SSD trim natively as the file system driver can only TRIM blocks on de-allocation; it cannot TRIM blocks written by another process. It is also effective for USB attached SSDs.
Forensic Sector Copy	<p>Copy every sector from the source to the target disk partition.</p> <div> Please note tat this option is only necessary if you want to copy unused file system space and will significantly increase the time to complete the clone.</div>

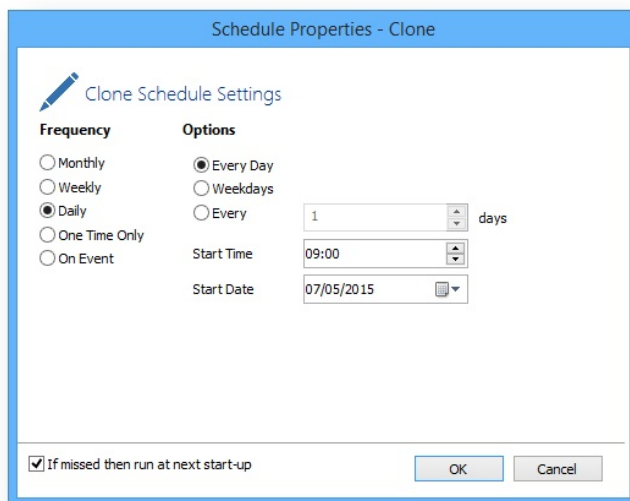
8. Click **Next**.

The options to **Add Schedule**, **Edit Schedule** or **Delete Schedule** is displayed.



Click '**Add Schedule**' to optionally schedule your clone

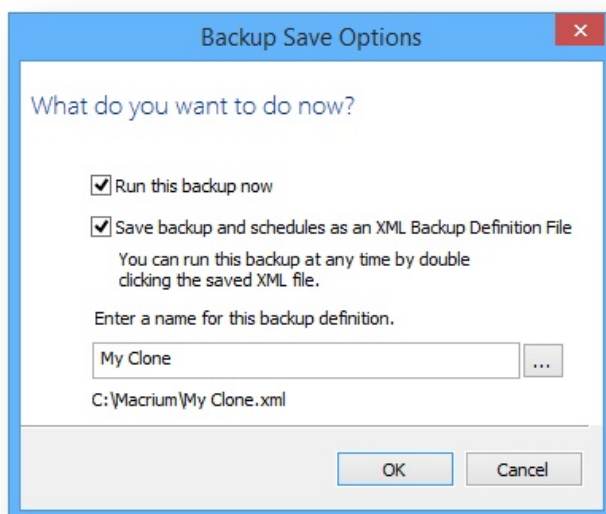
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Make any required changes and click **Next**.

For more information see [Scheduling backups](#) (see page 183).

9. Review the settings and click **Finish**.
10. Verify the settings in **Backup Save Options** and if appropriate, click **OK**.



Note: Saving a backup definition enables you to run your Clone at any time with a single click

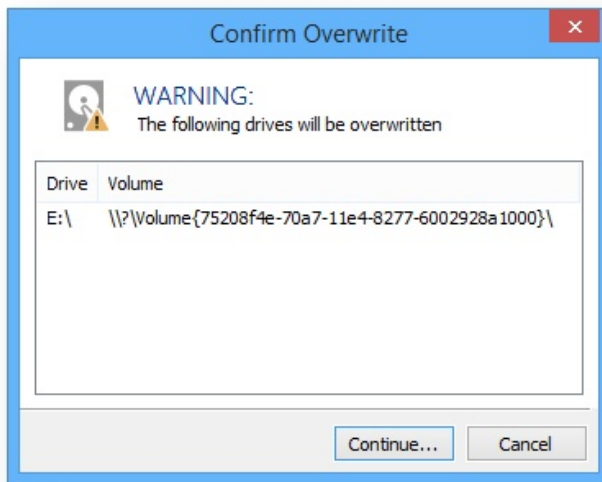


Note: You must save your backup definition if you have created Clone schedules. Your schedules cannot run if this step is missed.

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If you want to run the Clone at this point, select '**Run this backup now**' and click **OK**.

11. A Warning box appears, if appropriate click **Continue**.



Important

The target disk for the clone operation will be overwritten. This is unrecoverable, so please ensure that the target disk contains no valid data.

The clone operation now starts.

Incompatible Disk Selected

If you receive the error message 'Incompatible Disk Selected' when cloning then please see this article for more information: [Incompatible Disk Selected](#)

Creating a clone video

Macrium Reflect v6 User Guide

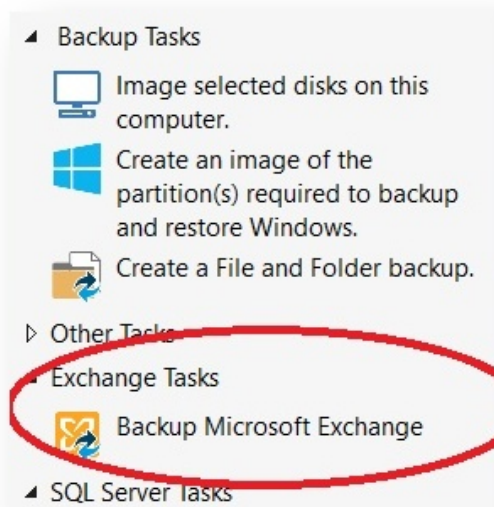
Backing up Microsoft Exchange databases

With Macrium Reflect Server Plus you can choose which databases to backup on the local Microsoft Exchange Server.

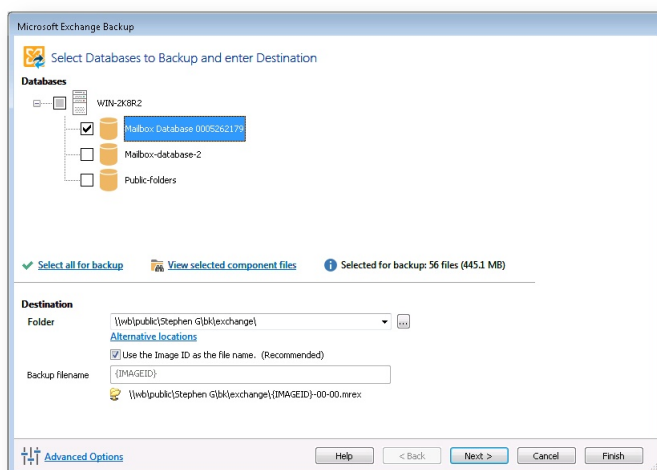
Note: Remote backups are not possible.

Before you begin: Macrium Reflect requires the Microsoft Exchange Information Store service to be installed and running in order for successful database backup to function.

1. On the main Backup interface, click **Backup Microsoft Exchange**.



The Microsoft Exchange Backup wizard appears. A Microsoft Exchange 2010 example is shown below:



2. Select the items you want to backup:
 - For Microsoft Exchange 2010 and later, select individual databases to backup.

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- For Microsoft Exchange 2007 and earlier, select storage groups to backup, this includes all the databases in the selected storage group.

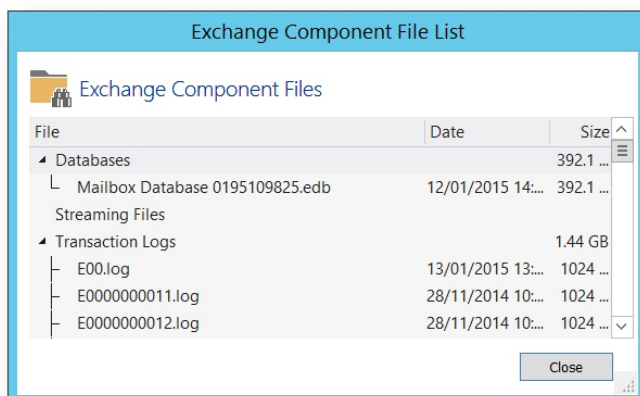
Caution

Unmounted Exchange databases are shown in the Microsoft Exchange Backup Wizard and can be selected for backup. However, VSS will not include unmounted databases in the snapshot and *the Exchange backup will fail*. To include these databases in the backup, either ensure the databases are mounted at point of backup, or use established recovery mechanisms to bring the affected databases into a clean, shutdown state.

[Alternative Locations](#) can be used to provide backup rotations or as a fail safe for temporary unavailability of the primary backup destination.

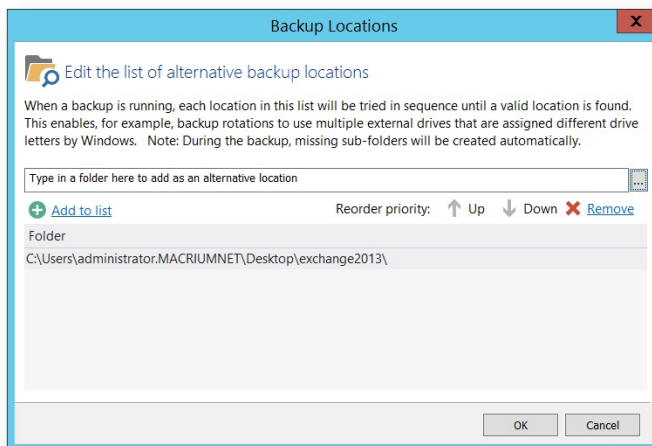
3. Optionally, click **View selected component files** to see the list of files that make up the currently selected items.

The **Exchange Component File List** appears. Files are grouped according to type and show last date modified along with file size. Each category of file shows total size. Groups of files can be expanded /collapsed by clicking the plus/minus button to the left of the file type name.

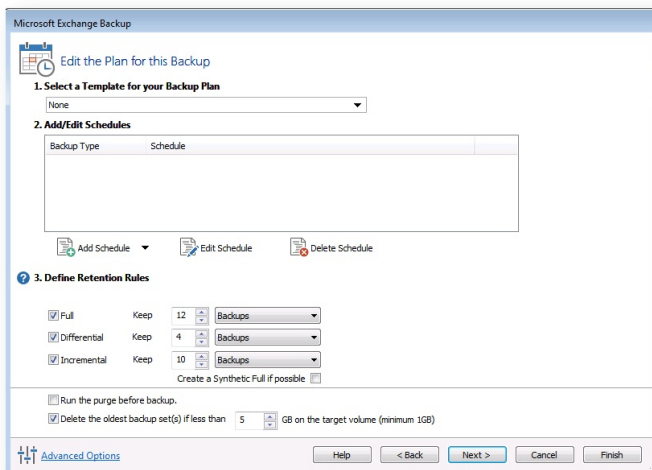


4. Enter the **Destination Folder** for the backup.
Note: MS Exchange backups cannot be stored on optical media.
5. If the primary target location is not available, click **Alternative Locations** to add the relevant folder.

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6. Click **Next** to proceed.
7. If desired, edit the plan for the backup. For more information see [Scheduling backups](#) (see page 183).




Select the age or number of backup types that you wish to keep

<input checked="" type="checkbox"/> Full	Keep	12	Backups
<input checked="" type="checkbox"/> Differential	Keep	4	Backups
<input checked="" type="checkbox"/> Incremental	Keep	10	Backups
Create a Synthetic Full if possible <input type="checkbox"/>			
<input type="checkbox"/> Run the purge before backup.			
<input checked="" type="checkbox"/> Delete the oldest backup set(s) if less than 5 GB on the target volume (minimum 1GB)			

Option	Description
Full	When deleting Full backups all linked incremental and Differential backups in the same backup chain (set) are also deleted This operation will delete the entire backup set.

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Option	Description																																																			
Differential	When deleting Differential backups all linked incremental backups in the same backup chain (set) are also deleted.																																																			
Incremental	<p>When deleting Incremental backups the integrity of the backup set is maintained by ensuring that the chain is never broken. This is achieved by merging older Incremental backups when required.</p> <p>In the example below, before retention, there is 1 Full backup, 1 Differential backup and 6 Incremental backups. The retention rules are set to retain 4 incremental backups. After retention, the most recent 4 incremental backups are retained. Deleting the oldest 2 incrementals would cause the backup chain to be invalid as the oldest retained incremental requires the previous 2 incremental backups to complete the chain. To ensure backup integrity the 2 older incremental backups are consolidated with it to create a new incremental backup.</p> <p>F = Full D = Differential I = Incremental</p> <table><tr><td>M</td><td>T</td><td>W</td><td>T</td><td>F</td><td></td><td></td><td>M</td><td>T</td><td>W</td><td>T</td><td>F</td><td></td><td></td><td>M</td><td>T</td><td>W</td></tr><tr><td>F</td><td></td><td></td><td></td><td></td><td></td><td></td><td>D</td><td>I</td><td>I</td><td>I</td><td>I</td><td></td><td></td><td>F</td><td>I</td><td>I</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>--</td><td>--></td><td>I</td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>	M	T	W	T	F			M	T	W	T	F			M	T	W	F							D	I	I	I	I			F	I	I									--	-->	I						
M	T	W	T	F			M	T	W	T	F			M	T	W																																				
F							D	I	I	I	I			F	I	I																																				
								--	-->	I																																										
Create a Synthetic Full if possible	When purging Incremental backups, if the backup set only contains a Full backup followed by Incremental backups , then this option causes the Full backup to be 'rolled forward' to create a Synthetic Full backup . This is also known as Incremental Forever .																																																			
Run the purge before the backup	<p>Select this option to run the retention rules before the current backup.</p> <div><div></div><div><p>Note: in Macrium Reflect v5 the current backup set wasn't included in the purge calculation when purging before the current backup. In v6 the current backup set IS included. This means that if you set the retention count to 1 Full backup then all of your backups will be deleted and a new Full backup created.</p></div></div>																																																			
	Automatically remove the oldest backup set(s) in the target folder if the free space on the drive drops below the GB threshold.																																																			

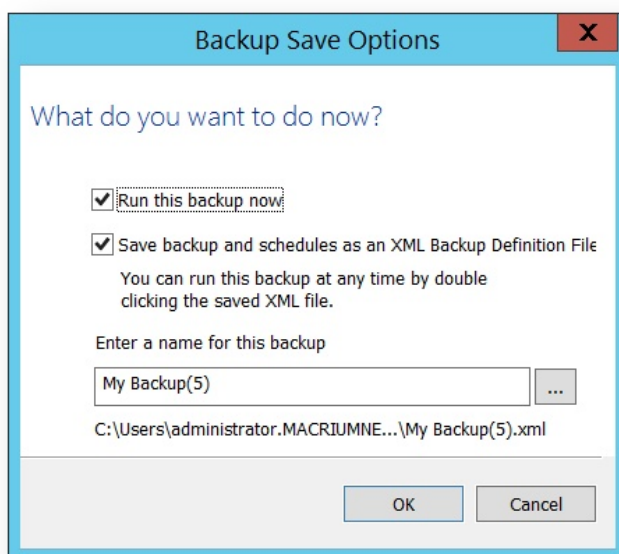
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Option	Description
Delete oldest backup set (s) if less than n GB	

8. Review the summary of the backup.

9. Click **Finish**.

Backup Save Options is shown.



Note: Saving a backup definition enables you to run your backup Image at any time with a single click

Note: You must save your backup definition if you have created backup schedules. Your schedules cannot run if this step is missed.

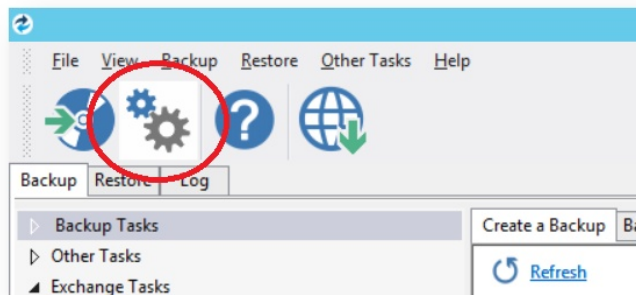
If you want to run the backup at this point, select '**Run this backup now**' and click **OK**.

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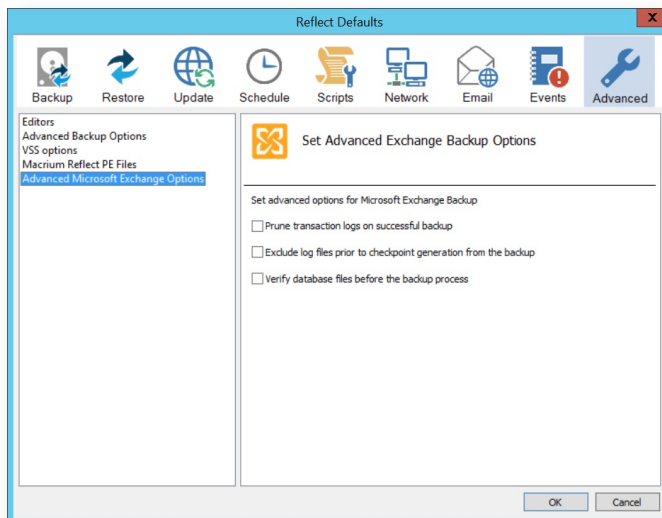
Microsoft Exchange backup options

Macrium Reflect is set up to be intuitive and easy to use with default settings that meet the needs of most people, see [Macrium Reflect default settings](#) (see page 310). These default settings can be modified to meet your needs, and you can access advanced settings specifically for Microsoft Exchange backups.

1. Click **Edit Defaults** from Macrium Reflect toolbar.



2. Select **Advanced** in the top toolbar of the Macrium Reflect defaults dialog.
3. Select **Advanced Microsoft Exchange Options** in the left hand list.



- The option **Prune transaction logs on successful backup** removes all transaction logs for storage groups /databases that are included in the backup process. Checking this option frees up space on the volumes where the transaction logs reside.

Not using this option allows transaction logs to be removed by other, established, in-house mechanisms.

- The option **Exclude log files prior to checkpoint generation from the backup**, only includes transaction log files falling after the current checkpoint generation. Reducing the number of transaction logs included in a backup.

Not using this option backups *a//*transaction logs for the storage groups/databases.

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- The option **Verify database files before the backup process** forces Macrium Reflect Server Plus to verify the database, checkpoint and transaction log files for page integrity.

Use of this option impacts backup time, especially if you have large database files.

6. Click **OK** to save any changes made to the backup options for Microsoft Exchange.

Related articles

- [Page: Microsoft Exchange backup options \(see page 154\)](#)
- [Page: Macrium Reflect default settings \(see page 310\)](#)
- [Page: Restoring MS Exchange databases \(see page 231\)](#)
- [Page: Backing up Microsoft Exchange databases \(see page 149\)](#)
- [Page: Restoring emails with Mailbox Restore \(see page 235\)](#)

6 related results

Backing up MS SQL Databases

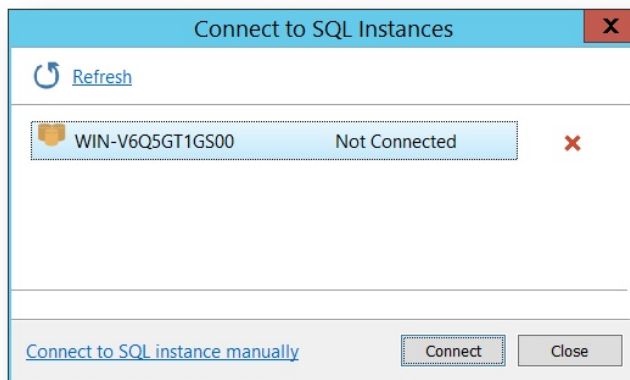
With Macrium Reflect Server Plus you can backup SQL databases. From SQL Server 2005 onwards, all versions of Microsoft SQL Server and Microsoft Server Express are supported. SQL Server 2000 and earlier are not supported.

Connecting to SQL and creating a full backup

1. Select **Manage SQL Logins**.

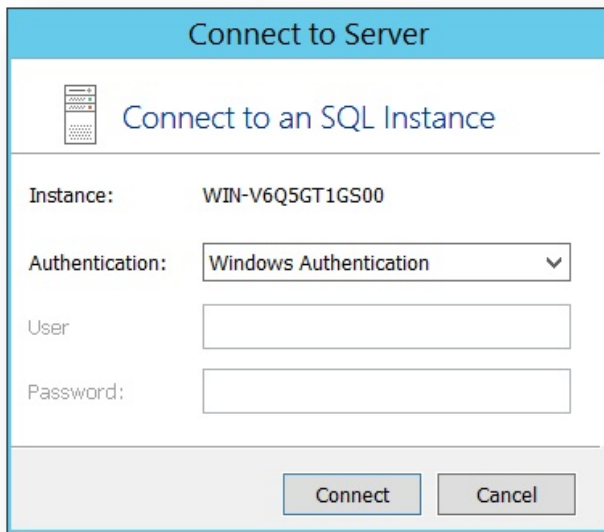


2. Macrium Reflect scans your local PC for installed instances of SQL Server and displays them:



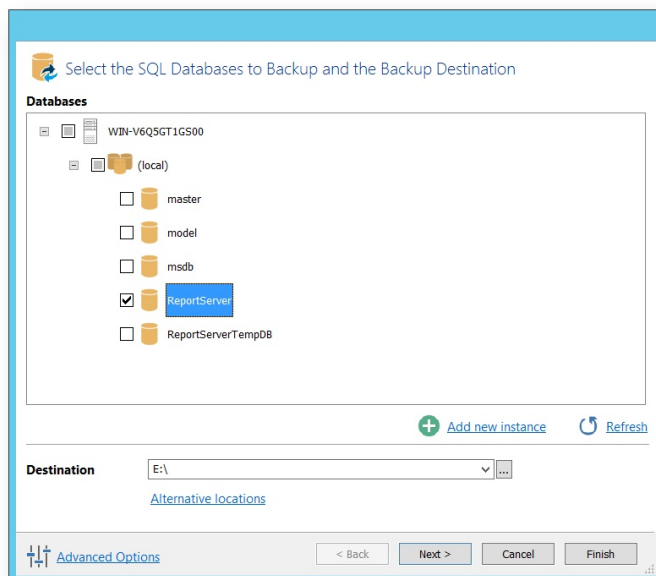
3. If necessary, enter details manually, select **Connect to SQL instance manually**.
4. Select the instance you wish to connect to and click **Connect**.
5. Enter the required login criteria and click **Connect**.

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If successful, the instance shows as **Connected**.

6. Select **Backup SQL Databases**:



This displays all the databases associated with the instances of SQL that you have logged into.

7. Select the databases you wish to backup.

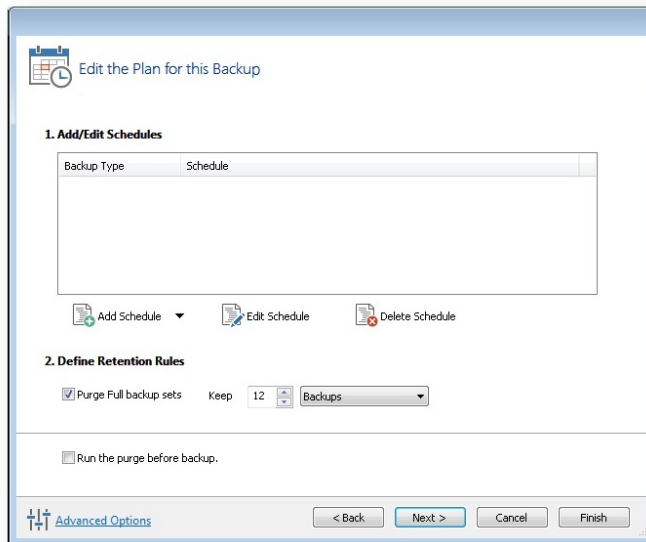
8. Set the destination directory for the image files (in this case E:\ drive) and if necessary any alternative locations.

[Alternative Locations](#) (see page 167) can be used to provide backup rotations or as a fail safe for temporary unavailability of the primary backup destination.

9. If required, add new instances and refresh the list as required.

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10. Click **Next**.
11. Make required edits to the backup plan, for more information see [Scheduling backups](#) (see page 183).



12. If required, click **Advanced Options** to modify aspects of the backup; Compression, File Size, Password, Auto Verify Image, Comments, Reparse Points and Shutdown. When you are happy to proceed, click **Ok**.
13. Click **Finish**.
14. Just as in normal imaging, you are offered the ability to save your configuration as an XML definition file for later reuse. Name the backup and click **OK** to run the backup.

Creating differential and log backups

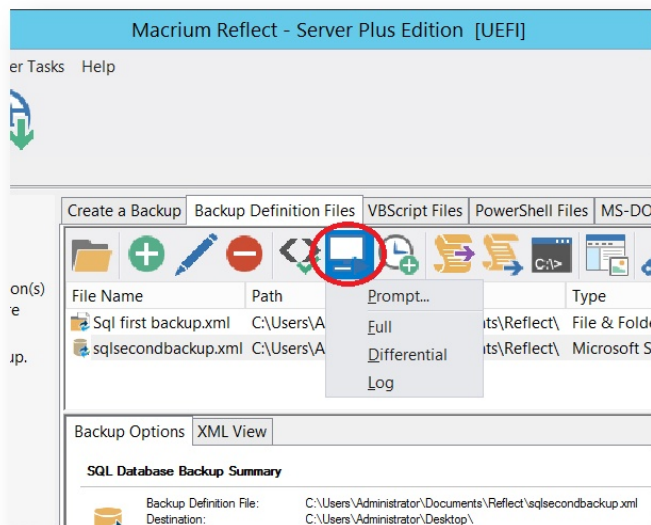
To create a differential or log backup, it is important to ensure that you have already created an SQL XML definition file and run a full backup.



Note: It is not possible to create log backups of database using the Simple recovery model.

1. Go to **Backup Definition Files** and select the XML file you wish to perform an log or differential backup of.
2. Select **Run** or right-click on the XML file you wish to run.

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3. Select the type of backup you wish to run.

The backup should run immediately.

Related articles

- [Page: Backing up MS SQL Databases \(see page 156\)](#)
- [Page: Stopping the SQL Server service automatically when backing up](#)
- [Page: Can't see SQL Instances in Login Window](#)
- [Page: Restoring MS SQL \(see page 227\)](#)
- [Page: Running continuous backup of SQL databases \(see page 197\)](#)

Differential and incremental disk images

The entire contents of the imaged file system are stored in a full image file. This is a reliable way of backing up your PC, however, repeating the process is slow and subsequent images can fill your backup media very quickly.

After you have created an initial full image, you can create differential and incremental images. These are both quicker to execute than full images and create much smaller image files.

Note: With the Free Edition of Macrium Reflect you can only make full and differential images of your disks and partitions.

Differential Images

A differential image stores the changes that have been made to the imaged file system since the last full image. Subsequent differentials can be taken, but only one differential and the full are required in order to fully restore the system.

This is quicker than creating a full image, however the longer the time between the full and the differential, the larger the differential image file is and the longer it takes to create.

Advantages of differential images:

- Differential images created after the initial full Image are very quick because only file system changes since the full backup are saved.
- The amount of disk space used by differential images is significantly less than that of full images.
- Only two image files are required to restore the system.

Disadvantages of differential images:

- As the time since the last full image was taken increases, the size of the differential grows as does the time it takes to create the differential image.
- In order to reduce this time, it is necessary to perform a full image occasionally to reduce the size of the subsequent differential images.

Incremental Images

The main difference with incremental images is that they only store file system changes since the last image, either full, differential or incremental. The resultant backup set therefore consists of a full image and a number of incremental images which must all be present in order to restore the system correctly.

Advantage of incremental images:

- Incremental images have the same advantages as differential images, but since they only store the changes that were made since the last full or incremental. They are always small and very quick to make, especially if done frequently.

Disadvantage of incremental images:

- All files must be present in the image set. If any intermediate incremental images are missing, it is not possible to restore the system to the latest backup.

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Maintaining backup sets

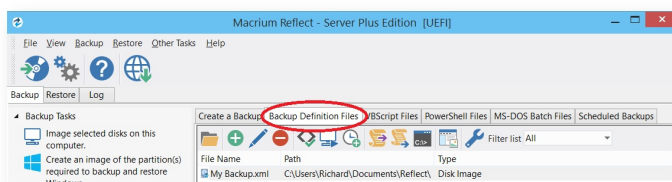
Maintaining backup sets can seem an onerous task, however, Macrium Reflect takes care of all the hard work for you. With Macrium Reflect you can schedule incremental or differential backups automatically. It is as simple as selecting the image you wish to restore and Macrium Reflect automatically selects the required files in the image set as part of the restore process. The same is true for exploring an image. If you choose to explore an incremental image in an explorer window, Macrium Reflect reconstructs all the files that have been backed up to that time.

Macrium Reflect also includes functionality to automatically delete expired image sets. For example, if you take a full image every month and then incremental images every day, you can configure Reflect to keep two full image sets (the equivalent of two months of backups) and delete any older files. As a result, your backup media does not become full of obsolete image files.

Selecting an incremental or differential backup

The process for creating a differential or incremental backup is the same. Both save changes since the full backup if this is the only backup made so far.

1. Initiate an incremental or differential backup, select **Backup Definitions Files**.

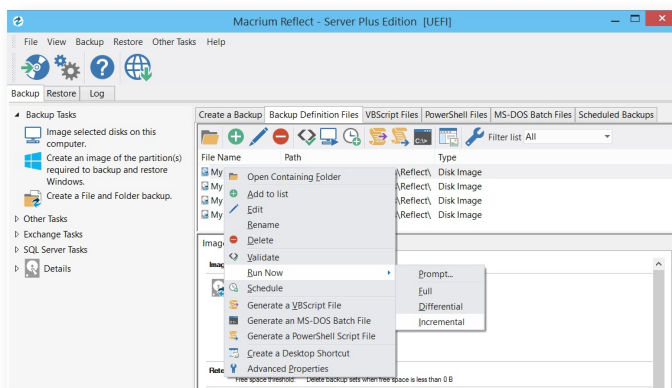


In this instance, there is one saved XML definitions file *MyBackup.xml* which contains the configuration required to back up the C drive.

2. Right click **MyBackup.xml** and select **Run Now**.

You are presented with a number of options.

3. Select **Full**, **Incremental** or **Differential** to automatically execute that particular backup. If unsure which you want to run, click **Prompt**.

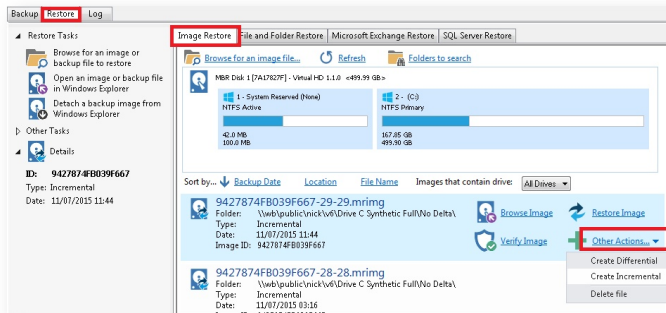


4. Click **Finish**.
5. When the Image is complete close the dialog.

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Alternative method using an existing backup

1. Click the **'Restore'** tab
2. Select either **Image Restore** or **File and Folder Restore**.
This presents a list of image or file and folder backup files
3. Select the file that you want to create an incremental or differential from.
4. Select **Other Actions...** link, and choose 'Differential' or 'Incremental'



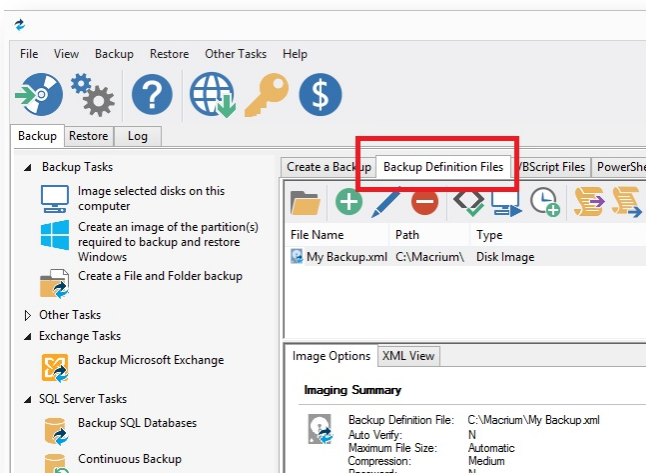
Creating desktop shortcuts for full, incremental and differential backups



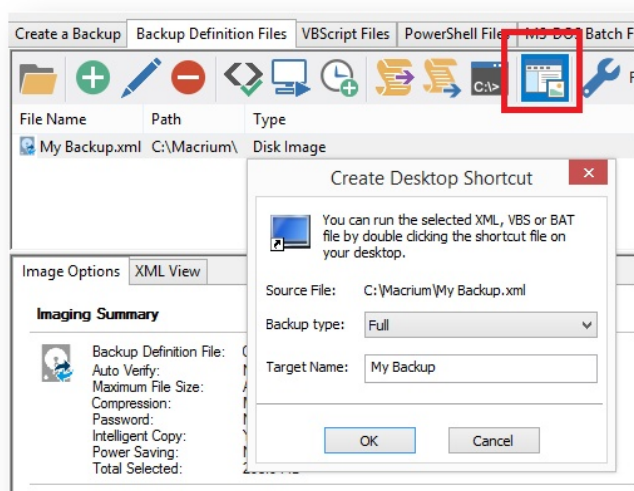
Creating Desktop Shortcuts for your backups enables quick and easy execution without the need to start Macrium Reflect or choose the backup type (Full, Diff or Inc).

Pre-requisite: To create a desktop shortcut for your definitions files you must already have a backup definitions file. If required, follow the instructions in [Creating a backup image of your computer, drive or partitions](#) (see page 119).

1. Select Backup Definitions Files tab.



2. Select the backup definition file and Click the Create Desktop Shortcut button on the Backup Definition File View toolbar.



3. Select the Backup Type and enter the shortcut name that appears on the Desktop.

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For easy reference to the backup type you could add a **Full, Diff or Inc** suffix to the shortcut name.

4. Click **OK**.

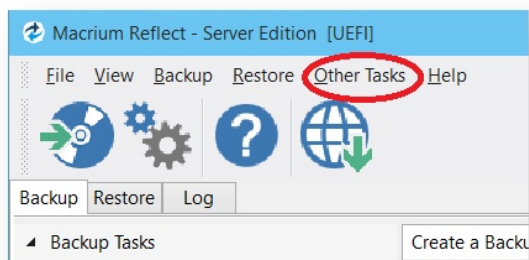
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Checking VSS events when backups fail

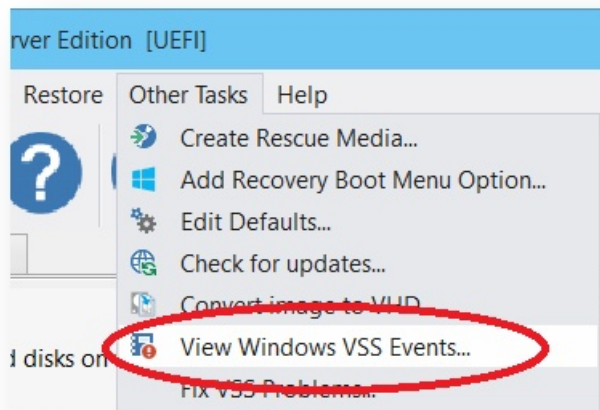
Macrium uses Volume Shadow Copy Service (VSS) to create its images and backups and windows keeps a log of VSS events. These events can give you information, useful if you are experiencing problems, such as backup failures.

View events to check what has occurred as follows.

1. From the toolbar click **Other Tasks**.

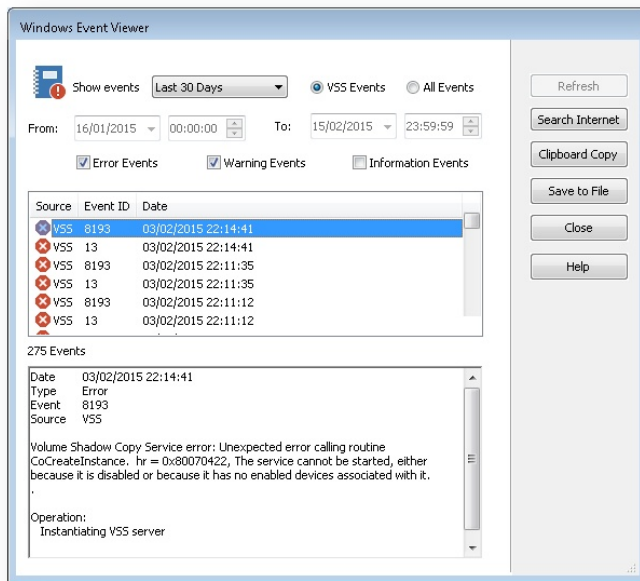


2. Click **View Windows VSS Events**.



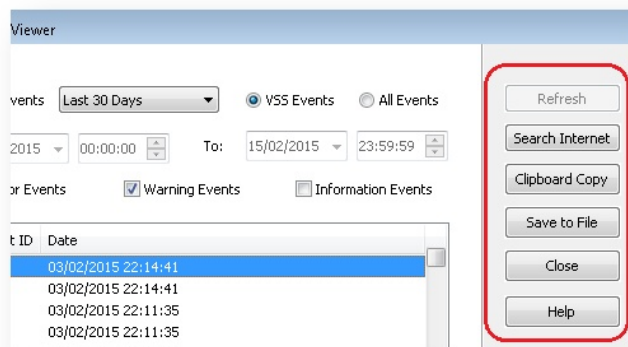
3. Select the parameters for your event search.
4. The viewer updates automatically displaying relevant information.

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5. If required, select an event and choose to:

- Search Internet. This will open your default browser with search terms setup for the selected Windows error event.
- Clipboard Copy. Useful for pasting into an email if you are contacting support.
- Save to File.



6. When you have finished reviewing events, click **Close**.

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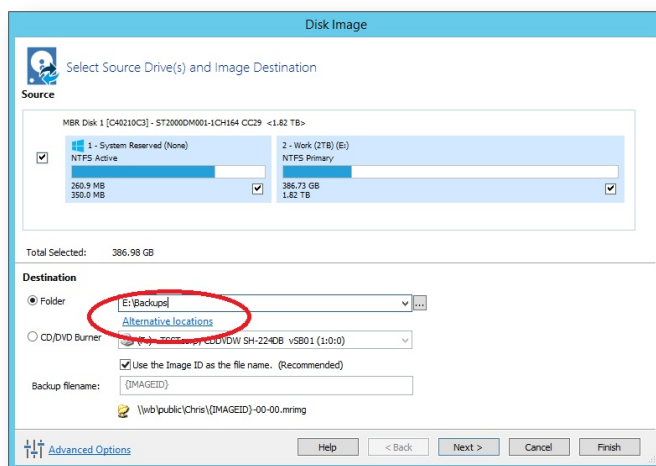
Alternative Locations For Backups

All backup wizards in Macrium Reflect allow you to select **Alternative Locations** to use for the backup destination. Should the primary backup location not be available, each location will be checked in sequence until an available one is found.

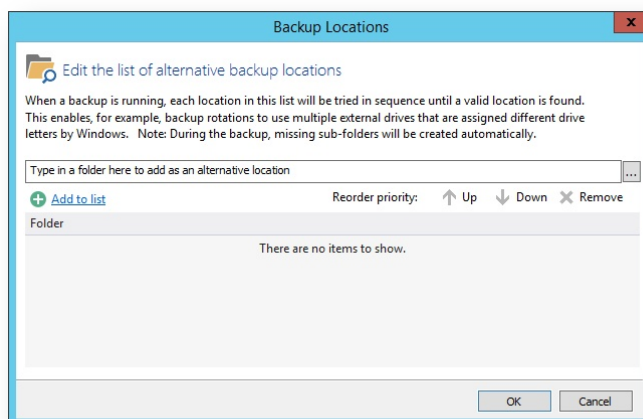


Alternative locations can also be used to provide backup rotations, for example, keeping an offsite backup, or as a fail safe for temporary unavailability of the primary backup destination.

1. Click **Alternative Locations**



2. The **Backup Locations** dialog is shown.

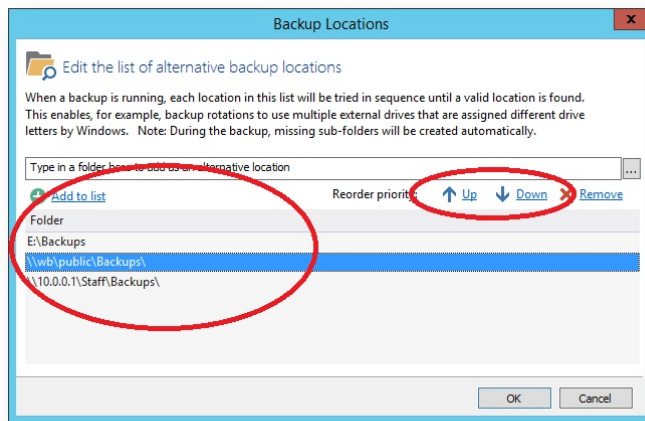


3. Select a folder and click **Add to list**

4. Repeat for each folder to be used as an alternative location

5. Change the order of locations by selecting a folder in the list and click **Up** or **Down**

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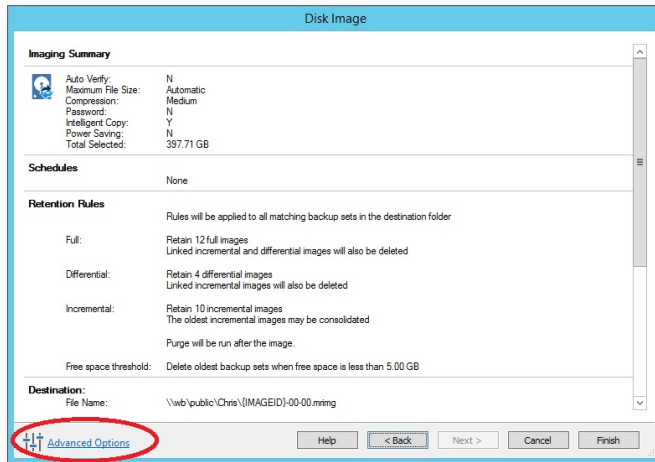


6. Remove a folder by selecting it and clicking **Remove**
7. Click **OK** when done

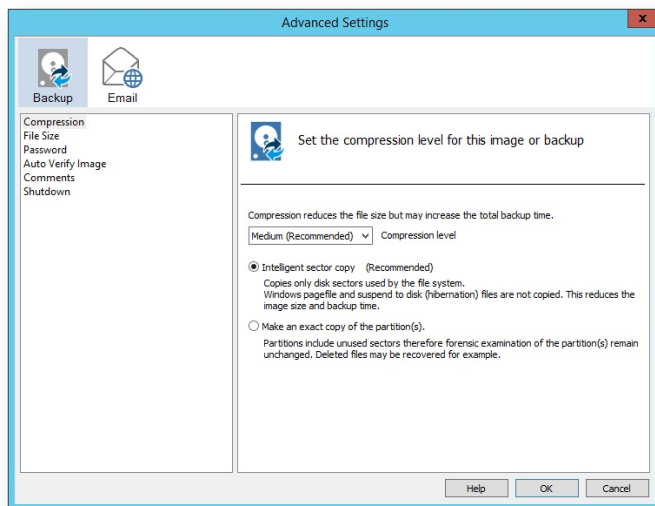
Advanced Options

Advanced Options

All forms of backup in Macrium Reflect have advanced options, accessed by clicking the Advanced Options link, All backup wizards have this link which can always be located in the lower left hand corner of each wizard. Cloning, too, is a form of backup and this also has advanced options, accessed in the same way.



Below is the Image backup advanced options as an example:



Common Advanced Options - Available to all backup types except Cloning

Option	Description
Compression	

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Option	Description
	Set the desired compression on the resulting backup file. Choose between None, Medium or High.
Intelligent sector copy	Copy only file system sectors/clusters that are in use. This reduces the size of the disk image file as unused file system clusters are not copied.
Make an exact copy	Copy every sector/cluster used by the partition. This will also copy unused space and will make the image file significantly larger than 'Intelligent sector copy' .
File Size	Set maximum file size that will be created for the backup file, these are also known as file splits. Choose between Automatic or fixed size in either Megabytes or Gigabytes.
Password	Add password protection to the resulting backup files. Choose between standard, medium and high encryption. Each increasing level of encryption will require a stronger password.
Auto Verify	Automatically verify the resulting backup file. This will add more time to the backup process but confirms if the resulting backup can be restored from.
Comments	Add a free form text comment to the backup.
Shutdown	Once the backup has complete you can choose to shutdown the computer, choose between Shutdown, Hibernate or Suspend.
Email Success	Set recipient, subject, body and attachments should this backup succeed.
Email Failure	Set recipient, subject, body and attachments should this backup fail.

Cloning Advanced Options

Option	Description
Intelligent Copy	<p>Clone only sectors in use from the source disk. Further to this option:</p> <ul style="list-style-type: none"> • Verify File System. Ensure the source file system is valid before cloning. • Rapid Delta Clone. Only clone differences in the source and target disks since the previous clone was made. • Enable SSD Trim. Ensure target SSD partitions are trimmed prior to a clone.

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Option	Description
Forensic Copy	Clone all sectors from the source disk.

File & Folder Backup Advanced Options

Option	Description
Reparse Points	For both system and user reparse points, select to either follow or do not follow. An example reparse point is the folder "Documents and Settings" which when followed points (or expands) to a number of other folders. If followed then all folders the reparse point "contains" will be included in the backup.
Backup Set Matching	Choose between Similar, Strict or All.

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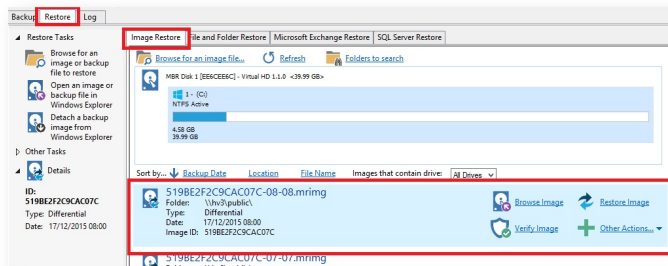
Verifying image and backup files

Backup verification checks the entire contents of backup files against MD5 message digests (Hashes) created from the source data when the backup was created. For more information on the verification process see: [Understanding Image Verification Failures](#)

To verify Image and File and Folder backup files using the command line see: [Verifying image and backup files from the command line](#) (see page 278)

To verify using the Macrium Reflect user interface follow the steps below:

1. Click the 'Restore' tab, choose **Image or File and Folder** and **select the backup** that you want to verify:

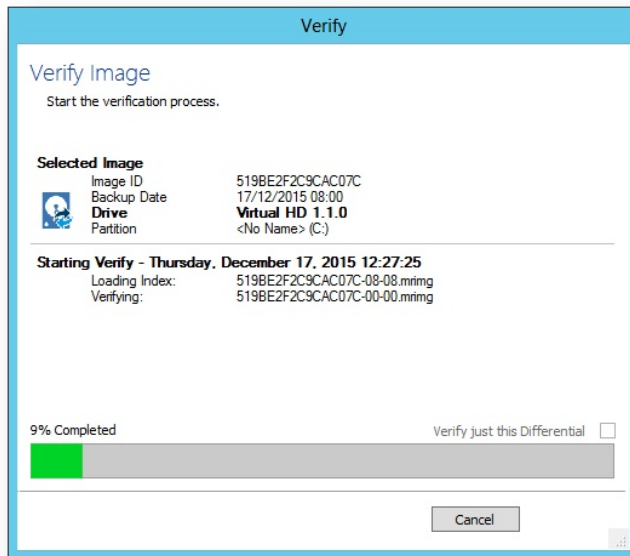


2. Click 'Verify':



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3. Click the 'Verify' button in the dialog that opens:



The entire backup set required to restore the selected backup file will be verified. To just verify the integrity of the selected Differential or Incremental **select the option 'Verify just this Differential/Incremental'**.

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How to backup Hyper-V Cluster Shared Volumes



Please ensure that you are running **Macrium Reflect v6.1.1309 or later**.

Disk images cannot be used to backup Hyper-V Cluster Shared Volumes.

Server 2012R2 Hyper-V Cluster Shared Volumes (CSV) can be backed up using the **File and Folder backup** functionality in Macrium Reflect.

You must use the [File and Folder restore functionality](#) (see page 224) to restore VHD and VHDX files. You cannot mount/browse backup files and use Copy and Paste to restore files larger than 4GB

To ensure that you have correctly backed up the CSV folders please check the backup log.

Successful CSV snapshot Example.

Note the lines 'CSV - Volume n' and the snapshot line:

Folder:	C:\ClusterStorage\Volume1\VHD\
Include File Filter:	*.vhdx
Exclude File Filter:	*.temp; *.tmp; *.bak; *.*
Include Sub Folders:	Y
Exclude Folder Filter:	
Exclude Hidden Files:	N
Exclude System Files:	N
Folder:	C:\ClusterStorage\Volume2\
Include File Filter:	*.*
Exclude File Filter:	*.temp; *.tmp; *.bak; *.*
Include Sub Folders:	Y
Exclude Folder Filter:	
Exclude Hidden Files:	N
Exclude System Files:	N
Email On Success:	N
Email On Failure:	N
Creating Cluster Shared Volume Snapshot - Please Wait	
Volume Snapshot Created	
CSV - Volume1	\\?\GLOBALROOT\Device\CSV{46542b53-ba80-4231-b971-5a0e6bd517cd}
CSV - Volume2	\\?\GLOBALROOT\Device\CSV{1b3332c3-b1ba-4198-8142-53c48e59e8e7}
Starting backup - Thursday, May 11, 2018 11:11:25	
Destination Drive:	Backup Location (D:) - Free Space 87.50 GB
Free space threshold:	Delete oldest backup sets when free space is less than 5.00 GB
Determining files to copy	
Total Number of Files:	4
Total Size:	8.49 GB
Copying files	
Gathering Windows Events - Please Wait	

The successful VSS log will also indicate 'C:\ClusterStorage\Volume*' added to the snapshot:

```
Discover explicitly included components ...
Verifying explicitly specified writers/components ...
Select explicitly included components ...
* Writer 'Microsoft Hyper-V VSS Writer':
  - Add component \6FA1E0B1-72D8-4687-BAD8-C7BBC29E8338
Creating shadow set {e72a35c8-eeec-4fe9-bd50-35e95a123fe5} ...
- Adding volume \\?\Volume{12f7f3d3-b552-4a05-b948-da5ba054f7fd}\ [C:
\ClusterStorage\Volume1\] to the shadow set...
- Adding volume \\?\Volume{2cd57d04-80b0-4d12-ac10-406e9f121b09}\ [C:
\ClusterStorage\Volume2\] to the shadow set...
```

Failed Snapshot Example.

Note the Error message: **VSS failed for Cluster Shared Storage. Ensure that no folders outside of CSV mount points are included in this backup**

Folder:	C:\ClusterStorage\Volume1\VHD\
Include File Filter:	*.vhdx
Exclude File Filter:	*.tmp; *.bak; *~*
Include Sub Folders:	Y
Exclude Folder Filter:	
Exclude Hidden Files:	N
Exclude System Files:	N

Folder:	C:\boot\
Include File Filter:	*
Exclude File Filter:	*.tmp; *.bak; *~*
Include Sub Folders:	Y
Exclude Folder Filter:	
Exclude Hidden Files:	N
Exclude System Files:	N

Folder:	C:\ClusterStorage\Volume2\
Include File Filter:	*.*
Exclude File Filter:	*.tmp; *.bak; *~*
Include Sub Folders:	Y
Exclude Folder Filter:	
Exclude Hidden Files:	N
Exclude System Files:	N

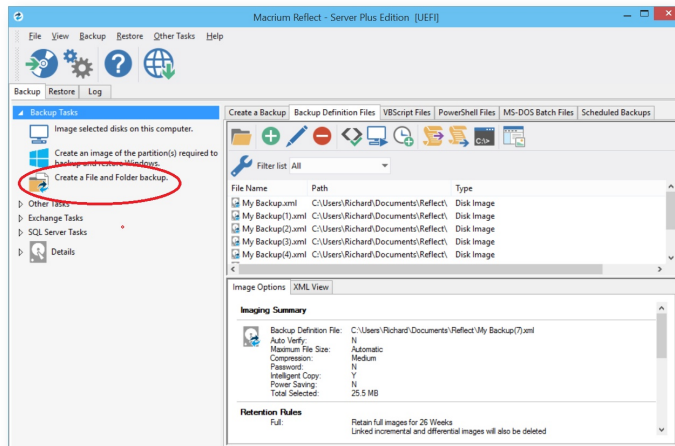
Email On Success:	N
Email On Failure:	N

Creating Cluster Shared Volume Snapshot - Please Wait
Failed To Create Volume Snapshot. Result Code: 0x80042313

VSS failed for Cluster Shared Storage. Ensure that no folders outside of CSV mount points are included in this backup

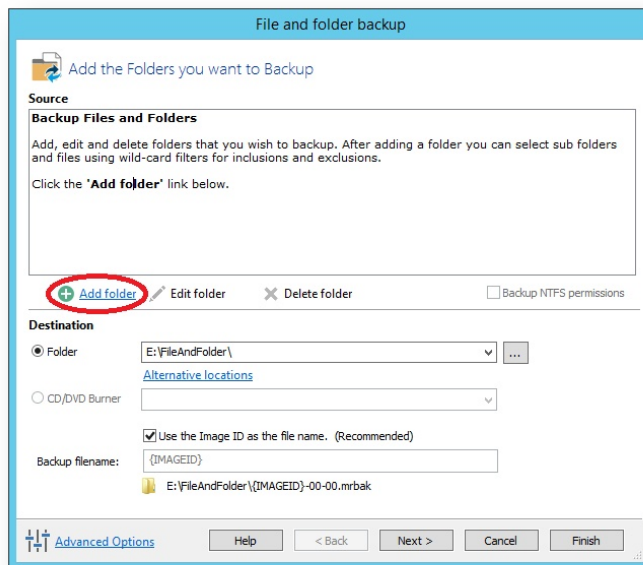
How to backup Cluster Shared Volumes

1. From the **Backup** task bar, select '**Create a File and Folder backup**' to start the backup wizard.

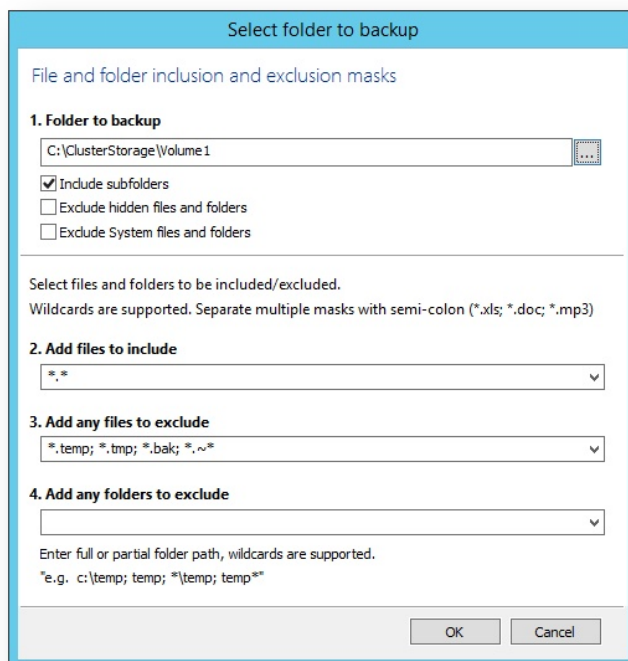


2. Select 'Add folder'.

Macrium Reflect v6 User Guide



The '**Select Folder to backup**' dialog appears.



i Select/Add only folder(s) **beneath the C:\ClusterStorage** in order for the Clustered Shared Volume contents to be included in your backup.
Do not include folders outside of the '**C:\ClusterStorage**' mount point otherwise VSS will fail.

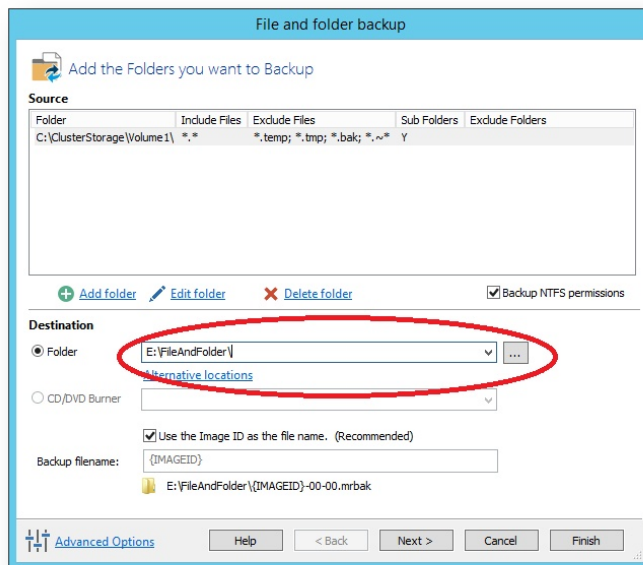
Macrium Reflect v6 User Guide

Several different masks and wildcards can be specified to include specific files within the given directory or exclude other files.

Option	Description
Include sub-folders	Recurse all folders below the backup folder using the specified filters
Exclude hidden files and folders	Do not backup files or folders that have the Hidden attribute
Exclude system files and folders	Do not backup files or folders that have the System attribute
Add files to include	Add a semi-colon separated list of file name filters to include in the backup. Use the asterisk * character as a wild card. For example; *.doc; *data*; *.xls
Add files to exclude	Add a semi-colon separated list of file name filters to exclude from the backup. Use the asterisk * character as a wild card. Note: Exclude filters take precedence over include filters
Add any folders to exclude	Add a semi-colon separated list of folder name filters to exclude from the backup. Use the asterisk * character as a wild card. Filter names can be full path and/or folder names. For example: *temp* will exclude all folders with the letters 'temp' anywhere in the folder name *data\temp* will exclude all paths where the folder name begins with 'temp' that has a parent folder named 'data'

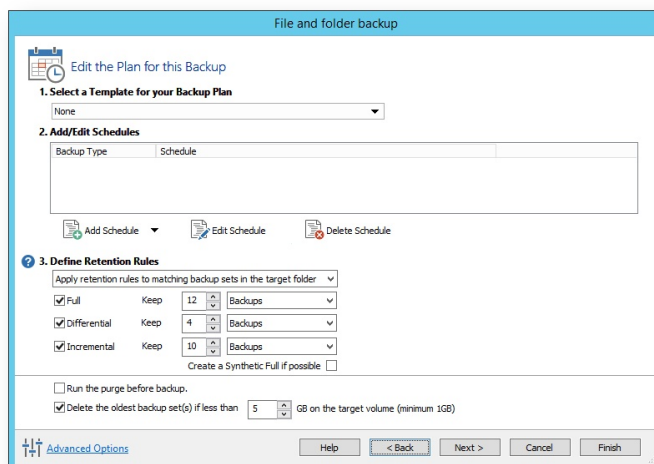
3. Click **OK**
4. Repeat to add further **CSV** directories if necessary.
5. In the **Destination** section, specify where you want the backup to be created.

Macrium Reflect v6 User Guide



[Alternative Locations](#) (see page 167) can be used to provide backup rotations or as a fail safe for temporary unavailability of the primary backup destination.

6. When you have finished adding folders and making all necessary changes, click **Next**.
7. The **Backup Plan** is shown:



The new Macrium Reflect retention rules provide a powerful and flexible way to manage the lifetime and storage space used by your backups.

Choose how backups are matched and retention rules are applied to the target folder

Retention rules are applied to the target folder of the backup by selecting one of two options:

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3. Define Retention Rules

- Apply retention rules to matching backup sets in the target folder
- Apply retention rules to matching backup sets in the target folder
- Apply retention rules to all backup sets in the target folder

a. Apply retention rules to matching backup sets in the target folder.

Disk Images are purged if they contain **exactly the same Partitions** as the current Image. Partitions are identified using the unique **Disk ID** stored in sector 0 of the disk and the **Partition sector offset**.



Note: For GPT disks the unique GPT disk GUID is used instead of the Disk ID

For **File and Folder** backups retention rules are applied according to the '**Backup Set Matching**' option select in the '**Advanced Properties**' for this backup.

b. Apply retention rules to all backup sets in the target folder. All backup sets in the target folder of the same type (Disk Image or File and Folder) are purged according the retention rules.





Note: This option uses the same logic as Macrium Reflect v5

Select the age or number of backup types that you wish to keep

<input checked="" type="checkbox"/> Full	Keep	12	Backups
<input checked="" type="checkbox"/> Differential	Keep	4	Backups
<input checked="" type="checkbox"/> Incremental	Keep	10	Backups
<input type="checkbox"/> Create a Synthetic Full if possible			
<input type="checkbox"/> Run the purge before backup.			
<input checked="" type="checkbox"/> Delete the oldest backup set(s) if less than		5	GB on the target volume (minimum 1GB)

Option	Description
Full	When deleting Full backups all linked incremental and Differential backups in the same backup chain (set) are also deleted This operation will delete the entire backup set.
Differential	When deleting Differential backups all linked incremental backups in the same backup chain (set) are also deleted.
Incremental	When deleting Incremental backups the integrity of the backup set is maintained by ensuring that the chain is never broken. This is achieved by merging older Incremental backups when required.

Macrium Reflect v6 User Guide

Option	Description																																																						
	<p>In the example below, before retention, there is 1 Full backup, 1 Differential backup and 6 Incremental backups. The retention rules are set to retain 4 incremental backups. After retention, the most recent 4 incremental backups are retained. Deleting the oldest 2 incrementals would cause the backup chain to be invalid as the oldest retained incremental requires the previous 2 incremental backups to complete the chain. To ensure backup integrity the 2 older incremental backups are consolidated with it to create a new incremental backup.</p> <p>F = Full D = Differential I = Incremental</p> <table><tr><td>M</td><td>T</td><td>W</td><td>T</td><td>F</td><td></td><td></td><td>M</td><td>T</td><td>W</td><td></td><td>T</td><td>F</td><td></td><td></td><td>M</td><td>T</td><td>W</td></tr><tr><td>F</td><td></td><td></td><td></td><td></td><td></td><td></td><td>D</td><td>I</td><td>I</td><td></td><td>I</td><td>I</td><td></td><td></td><td>F</td><td>I</td><td>I</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>--</td><td>--></td><td></td><td>I</td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>	M	T	W	T	F			M	T	W		T	F			M	T	W	F							D	I	I		I	I			F	I	I									--	-->		I						
M	T	W	T	F			M	T	W		T	F			M	T	W																																						
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Create a Synthetic Full if possible	When purging Incremental backups, if the backup folder only contains a Full backup followed by Incremental backups , then this option causes the Full backup to be 'rolled forward' to create a Synthetic Full backup . This is also known as Incremental Forever .																																																						
Run the purge before the backup	Select this option to run the retention rules before the current backup. <div><div>Note: in Macrium Reflect v5 the current backup set wasn't included in the purge calculation when purging before the current backup. In v6 the current backup set IS included. This means that if you set the retention count to 1 Full backup then all of your backups will be deleted and a new Full backup created.</div></div>																																																						
Delete oldest backup set(s) if less than n GB	Automatically remove the oldest backup set(s) in the target folder if the free space on the drive drops below the GB threshold. <div><div>Note: The free space threshold is actioned dynamically. If the free space available drops below the threshold then the running backup is temporarily paused while older backup sets are purged.</div></div>																																																						

Macrium Reflect v6 User Guide

8. The next screen, **Summary**, gives the details of what is being backed up. Click **Finish**.

Scheduling and Retention rules

Macrium Reflect provides multiple **Backup Plan** options to create backup cycles in days, weeks or months that allow you to pick when you want your backup definitions to run and whether they should be Full, Differential or Incremental backups. Scheduled backups can run independently of whether anyone is logged into the computer.

Macrium Reflect provides an easy 3 step approach to editing backup plans for a backup definition:

1. First, optionally select a **Template** from a set that includes implementations of industry best practice like Grandfather, Father, Son (GFS) or Incremental Forever
2. Add, remove or change the schedules as needed for full, differential and incremental backups
3. Finally, define **Retention Rules** for each type of backup. Using the **Retention Rules**, you can retain a specific number of each type of backup or keep them for a number of days or weeks before cleaning up.

Options define whether to apply the retention rules to all the backups in the folder, whether to run the purge before backing up, and let you define a minimum amount of disk space to retain in gigabytes (GB) before automatically deleting the oldest *backup sets* in the destination folder to make space available for new backups.



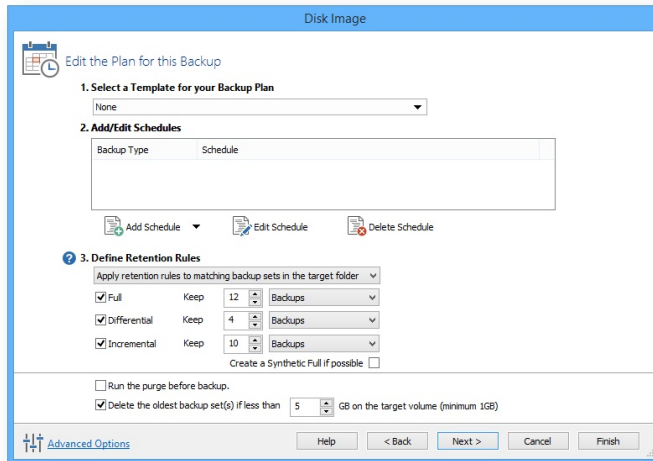
Note: A backup set consists of a full backup and any Incrementals or Differentials with the same image ID. The image ID is the part underlined in the following example backup file name: 69B5FC3F39E0F9F5-00-00.mring

Further reading:

- [Scheduling backups \(see page 183\)](#)
- [Configuring e-mail notifications \(see page 189\)](#)
- [Running continuous backup of SQL databases \(see page 197\)](#)
- [Which user name and password is used when scheduling a backup? \(see page 200\)](#)
- [Retention and consolidation \(see page 203\)](#)

Scheduling backups

Creating and Editing a Backup Plan



The wizard splits the task of scheduling backups and setting retention rules into 3 steps as follows:

Select a Template for your Backup Plan

1. Click the drop down box and chose an applicable template.

A summary is given for each template to help you select the template you require.

Grandfather, Father, Son.
Daily Incremental ("Son"), weekly Differential ("Father"), and monthly Full ("Grandfather") backups.

Differential Backup Set
A Full backup is created periodically followed by daily Differential backups.

Incremental Backup Set
A Full backup is created periodically followed by daily Incremental backups.

Incrementals Forever
Incrementals forever optimizes backup space and time by only ever creating a single Full backup.

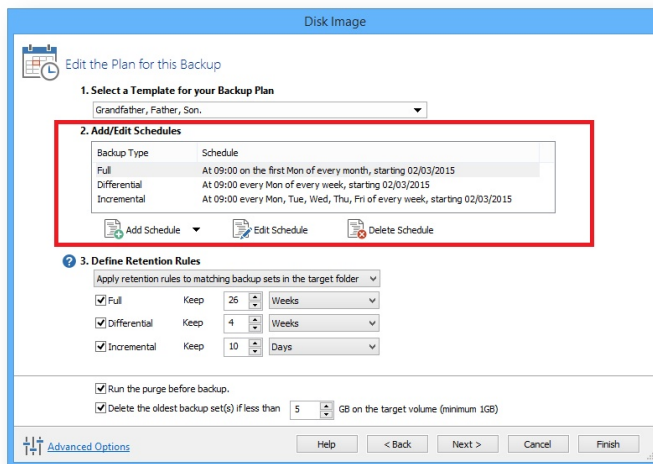
After this Incremental backups are created ad infinitum. The Full backup is consolidated with subsequent Incremental backups once the specified number of Incremental backups is reached.

This is also known as a Synthetic Full backup.

Add/Edit Schedules

When you have selected the template you want to use you can view the planned schedule.

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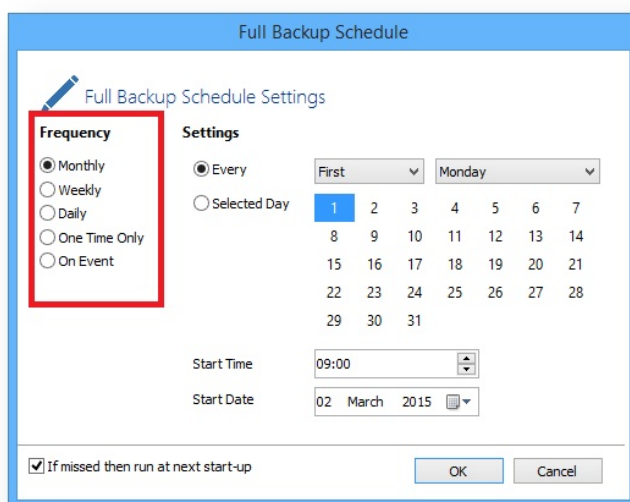
Resolving Scheduling Conflicts

If multiple backup types are scheduled run at the same time on the same day then only one backup will run.. For example, when scheduling a **Full backup on the first Monday** of each month and scheduling a **Differential for every Monday**, on the first Monday a Full and Differential are both scheduled to run at the same time. In this scenario **only the Full backup will run**.

- Full backups take precedence over Differentials and Incrementals
- Differential Backups take precedence over Incrementals.

To add to this schedule:

1. Click **Add Schedule** and select either Full, Differential or Incremental.
2. Set the frequency for the backup schedule.

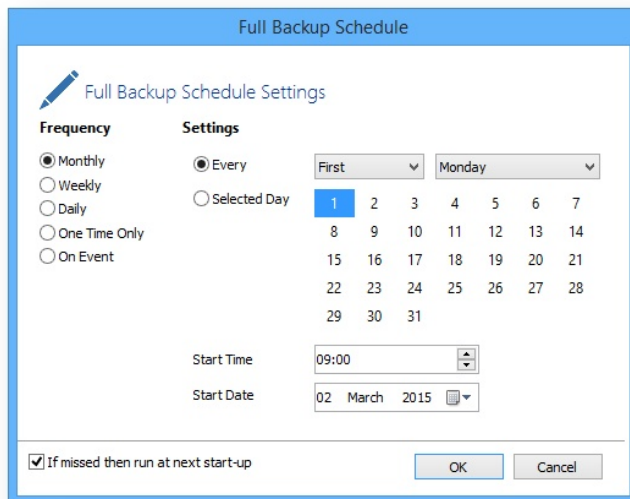


3. Click **OK**.

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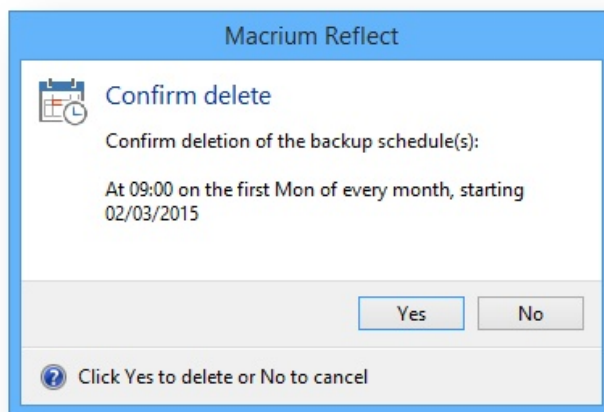
To Edit the schedule:

1. Select the schedule you want to edit and click **Edit Schedule**.
2. Change the schedule to meet your needs and click **OK**.



To delete a schedule:

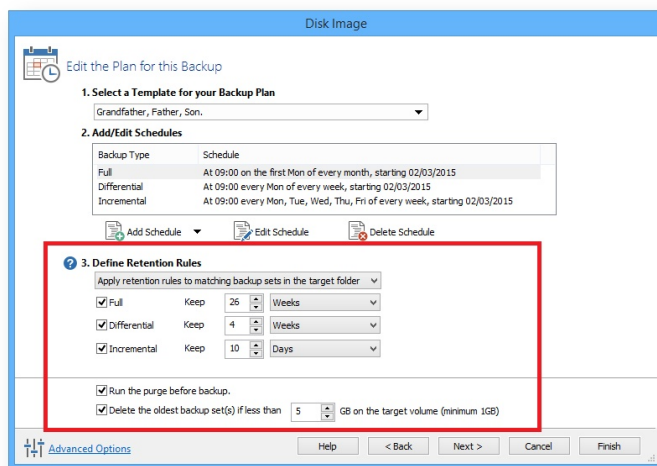
1. Select the schedule you want to delete and click **Delete Schedule**.
2. A confirmation box appears, click **Yes**.



Define Retention Rules

1. Establish how long each type of backup in the schedule should be kept. It is advisable to keep backups for the recommended period, however you can de-select the backup type if you do not want to retain it.

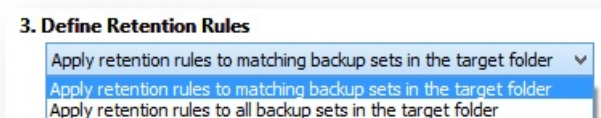
Macrium Reflect v6 User Guide



The new Macrium Reflect retention rules provide a powerful and flexible way to manage the lifetime and storage space used by your backups.

Choose how backups are matched and retention rules are applied to the target folder

Retention rules are applied to the target folder of the backup by selecting one of two options:



a. Apply retention rules to matching backup sets in the target folder.

Disk Images are purged if they contain **exactly the same Partitions** as the current Image. Partitions are identified using the unique **Disk ID** stored in sector 0 of the disk and the **Partition sector offset**.



Note: For GPT disks the unique GPT disk GUID is used instead of the Disk ID

For **File and Folder** backups retention rules are applied according to the '**Backup Set Matching**' option select in the '**Advanced Properties**' for this backup.

b. Apply retention rules to all backup sets in the target folder. All backup sets in the target folder of the same type (Disk Image or File and Folder) are purged according the retention rules.



Note: This option uses the same logic as Macrium Reflect v5


Select the age or number of backup types that you wish to keep

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<input checked="" type="checkbox"/> Full	Keep	12	Backups
<input checked="" type="checkbox"/> Differential	Keep	4	Backups
<input checked="" type="checkbox"/> Incremental	Keep	10	Backups
Create a Synthetic Full if possible <input type="checkbox"/>			
<input type="checkbox"/> Run the purge before backup.			
<input checked="" type="checkbox"/> Delete the oldest backup set(s) if less than 5 GB on the target volume (minimum 1GB)			

Option	Description																																																						
Full	When deleting Full backups all linked incremental and Differential backups in the same backup chain (set) are also deleted This operation will delete the entire backup set.																																																						
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Incremental	<p>When deleting Incremental backups the integrity of the backup set is maintained by ensuring that the chain is never broken. This is achieved by merging older Incremental backups when required.</p> <p>In the example below, before retention, there is 1 Full backup, 1 Differential backup and 6 Incremental backups. The retention rules are set to retain 4 incremental backups. After retention, the most recent 4 incremental backups are retained. Deleting the oldest 2 incrementals would cause the backup chain to be invalid as the oldest retained incremental requires the previous 2 incremental backups to complete the chain. To ensure backup integrity the 2 older incremental backups are consolidated with it to create a new incremental backup.</p> <p>F = Full D = Differential I = Incremental</p> <table><tr><td>M</td><td>T</td><td>W</td><td>T</td><td>F</td><td></td><td></td><td>M</td><td>T</td><td>W</td><td></td><td>T</td><td>F</td><td></td><td></td><td>M</td><td>T</td><td>W</td></tr><tr><td>F</td><td></td><td></td><td></td><td></td><td></td><td></td><td>D</td><td>I</td><td>I</td><td></td><td>I</td><td>I</td><td></td><td></td><td>F</td><td>I</td><td>I</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>--</td><td>--></td><td></td><td>I</td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>	M	T	W	T	F			M	T	W		T	F			M	T	W	F							D	I	I		I	I			F	I	I									--	-->		I						
M	T	W	T	F			M	T	W		T	F			M	T	W																																						
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Create a Synthetic Full if possible	When purging Incremental backups, if the backup folder only contains a Full backup followed by Incremental backups , then this option causes the Full backup to be 'rolled forward' to create a Synthetic Full backup . This is also known as Incremental Forever .																																																						
	Select this option to run the retention rules before the current backup.																																																						

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Option	Description
Run the purge before the backup	Note: in Macrium Reflect v5 the current backup set wasn't included in the purge calculation when purging before the current backup. In v6 the current backup set IS included. This means that if you set the retention count to 1 Full backup then all of your backups will be deleted and a new Full backup created.
Delete oldest backup set(s) if less than n GB	<p>Automatically remove the oldest backup set(s) in the target folder if the free space on the drive drops below the GB threshold.</p> <p> Note: The free space threshold is actioned dynamically. If the free space available drops below the threshold then the running backup is temporarily paused while older backup sets are purged.</p>

Advanced options

If required, set Advanced Options as follows:

- **Compression** to reduce the file size. Select level of compression and whether to make an intelligent sector copy, that copies only disk sectors used by the file system or make an exact copy of the partitions, that includes unused sectors.
Note: reducing the file size may increase the total backup time.
- **File Size** to enter a fixed file size for the image, this is useful for manually copying the image file to CD/DVD.
- **Password** to select whether to password protect the image.
- **Auto Verify Image** to select to verify image or backup file directly after creation.
Note: This can add a significant amount of time to the backup process.
- **Comments** to set comments for the image or backup.
- **Shutdown** to set whether the computer should be shutdown after a backup task has completed.

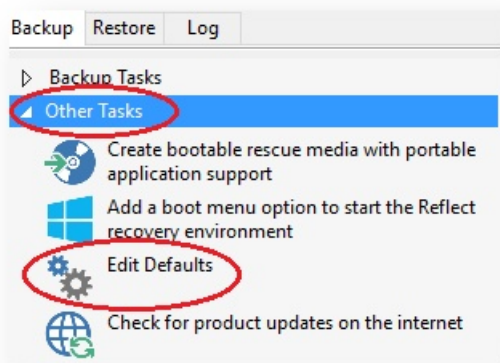
Configuring e-mail notifications

For many users, email notification of success or failure of a backup helps them keep on top of the status of their backups, particularly with scheduled backups which take place in the background.

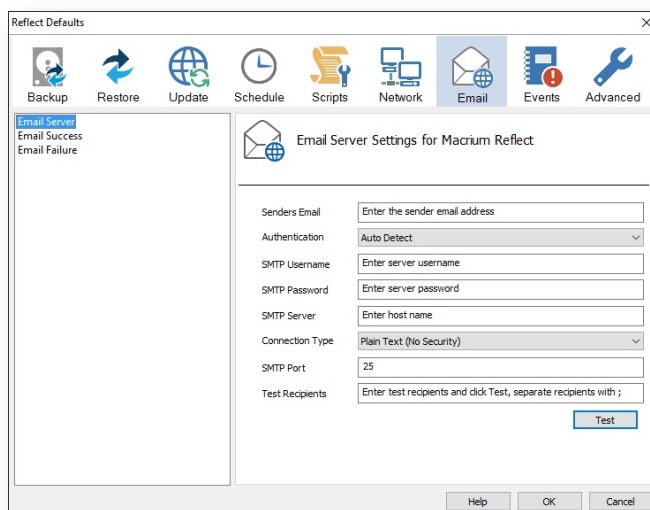
Program Defaults and SMTP Server settings

The default settings are used when creating new backup definitions

- From **Other Tasks** select **Edit Defaults**.


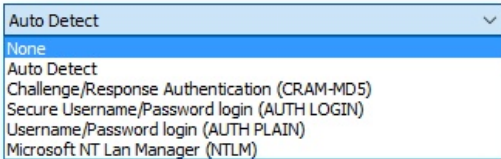

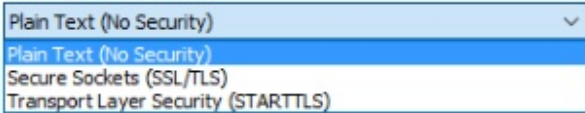



- Select '**Email**' > '**Email Server**'.



Email Server options description:

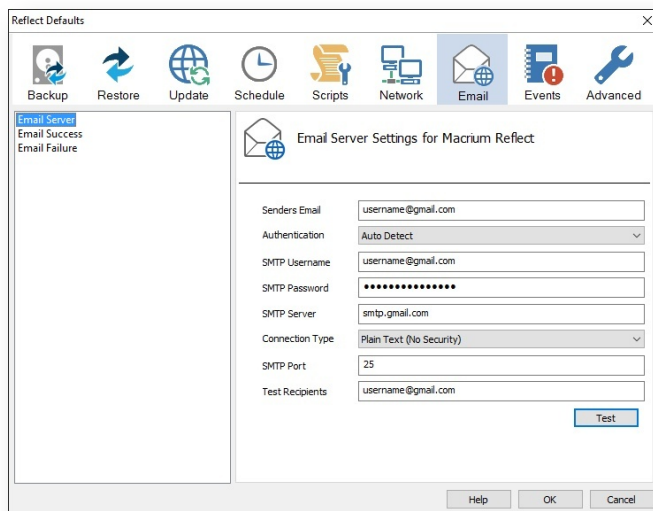
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Option	Description
Senders Email	<p>Your e-mail address associated with your ISP or Gmail account etc.</p> <div>  <p>Note: If you use e-mail software such as MS Outlook, you can find the settings under Account Settings for e-mail address, user-name and Server.</p> </div>
Authentication	<p>Authentication options are set by your email provider/server.</p> <div>  </div> <div>  <p>Note: If you do not know your authentication settings, try Auto Detect.</p> </div>
SMTP Username	The user name associated with your e-mail account. This is essentially your email address.
SMTP Password	This is the password for your e-mail Server.
SMTP Server	This is the outgoing / SMTP Server setting or IP address.
Connection Type	<p>This is the setting for the way Macrium Reflect will contact the Server.</p> <div>  </div> <div>  <p>Note: These settings can be found from your email provider.</p> </div>
SMTP Port	This is associated with Connection Type and is the port number that the SMTP server is listening on.

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Option	Description
	Note: These settings can be found from your email provider.
Test Recipients	This option is used to test the configured settings; enter your e-mail address in that field and click Test to send a test message to your email.

The following examples show completed Server settings for a typical ISP.



- Click **OK** to finish.

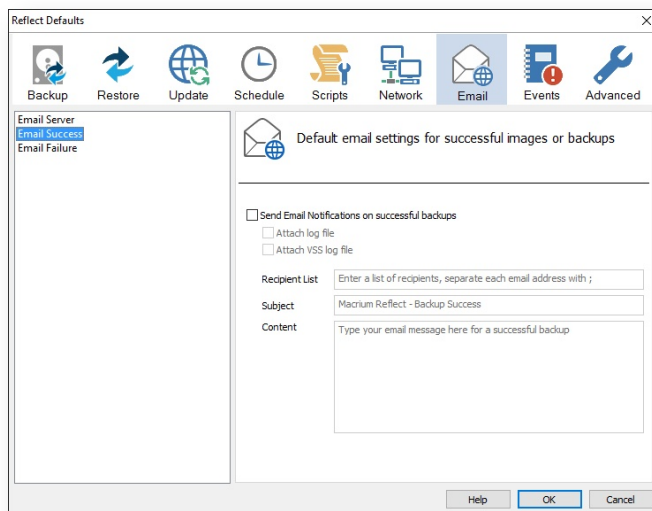


Note: If you are using your Gmail account then please see here: [Using Gmail SMTP Server for sending backup notification emails](#)

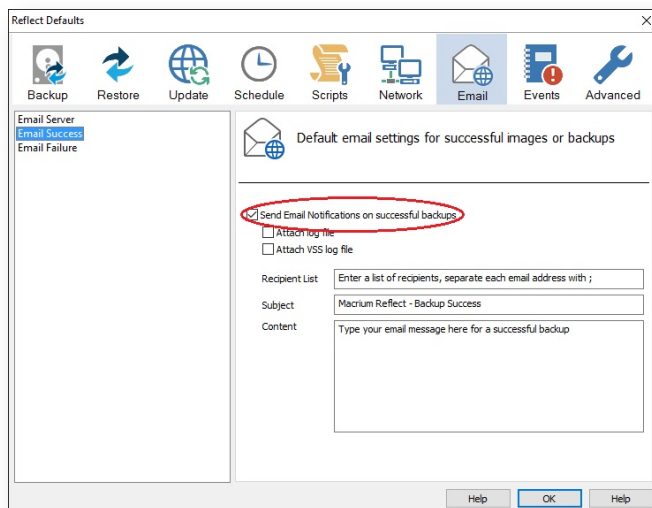
Email success settings define who receives emails regarding the success of a backup and what message they receive.

- Select **Email Success**

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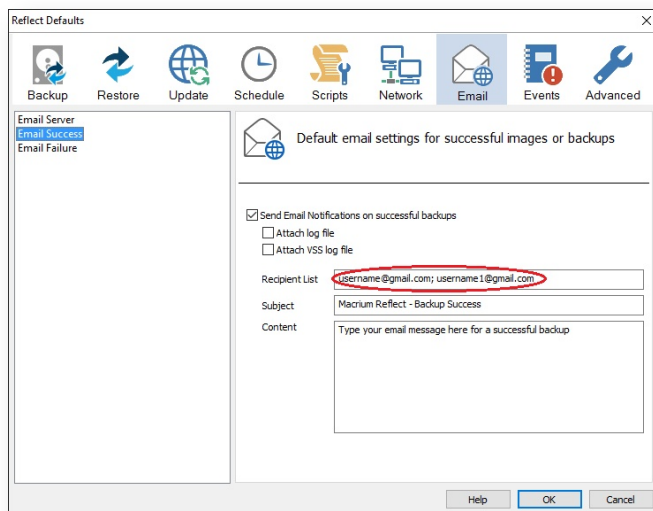
- Select **Send Email Notifications on successful backups**.



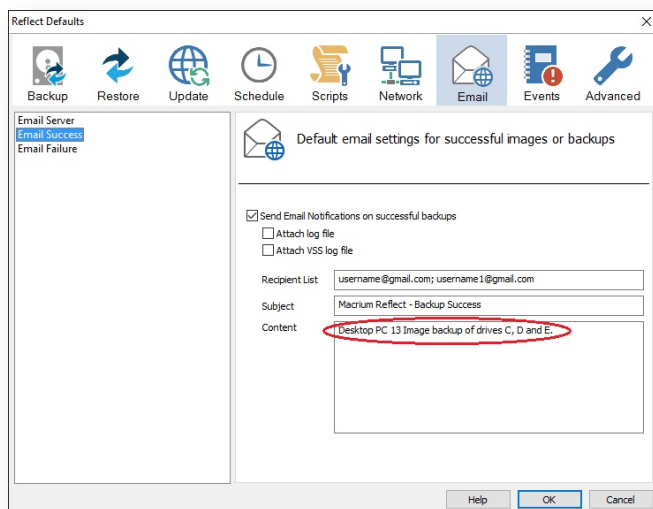
Option	Description
Attach log file	Will attach the log file from the creation of the backup.
Attach VSS log file	Will attach the VSS log with the events made during the backup.

- Enter the email addresses of all recipients in **Recipient List**, separating each email address with a semi-colon.

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- Enter the subject for the email in **Subject**.
- Enter a message to be sent regarding the email in **Content**, include the PC that generated the success is identified.

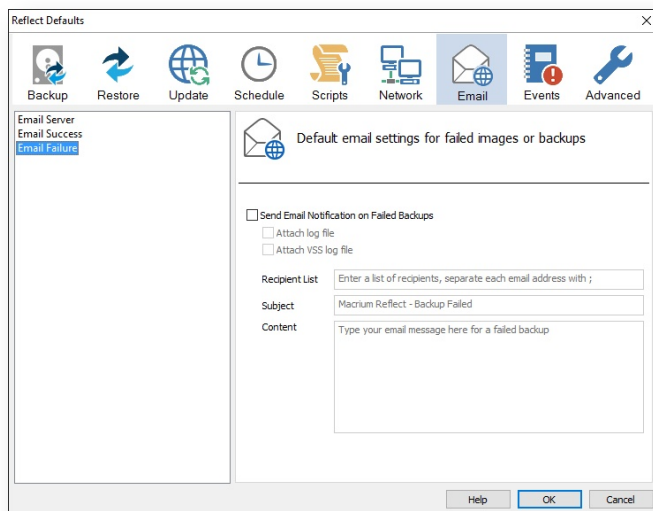


- Click **OK**.

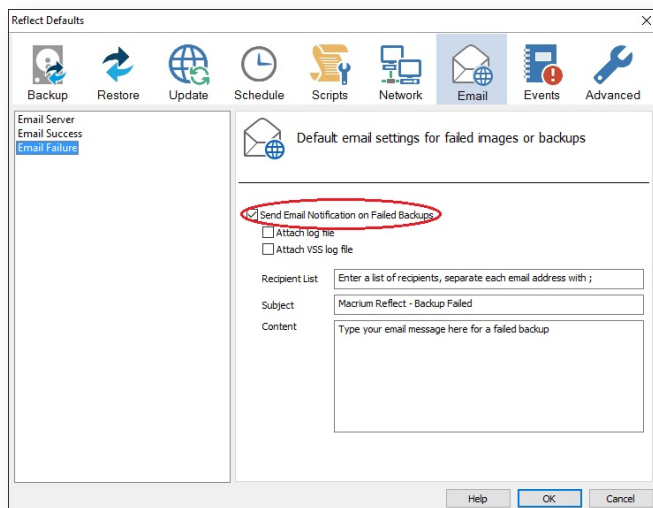
Email failure settings define who receives emails regarding the failure of a backup and what message they receive.

- Select **Email Failure**.

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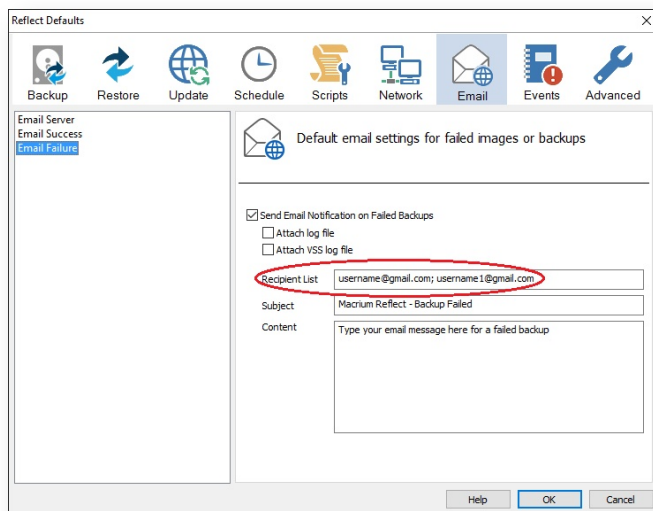
- Select **Send Email Notification on Failed Backups**.



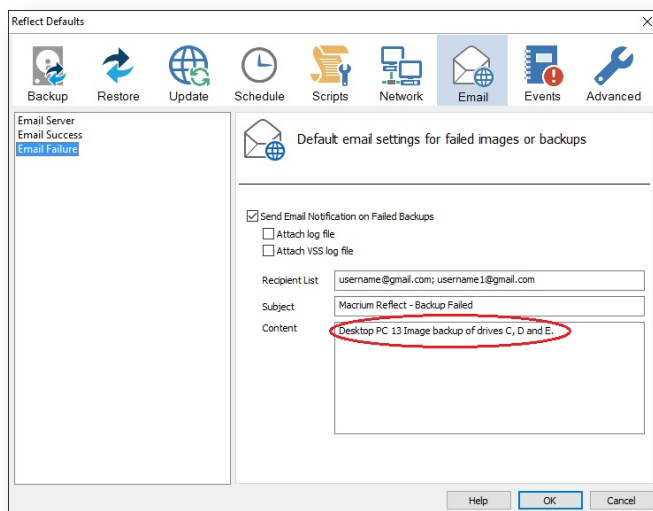
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Attach VSS log file	Will attach the VSS log with the events made during the backup.

- Enter the email addresses of all recipients in **Recipient List** , separating each email address with a semi-colon.

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- Enter the subject for the email in **Subject**.
- Enter a message to be sent regarding the email in **Content**, include the PC that generated the success is identified.

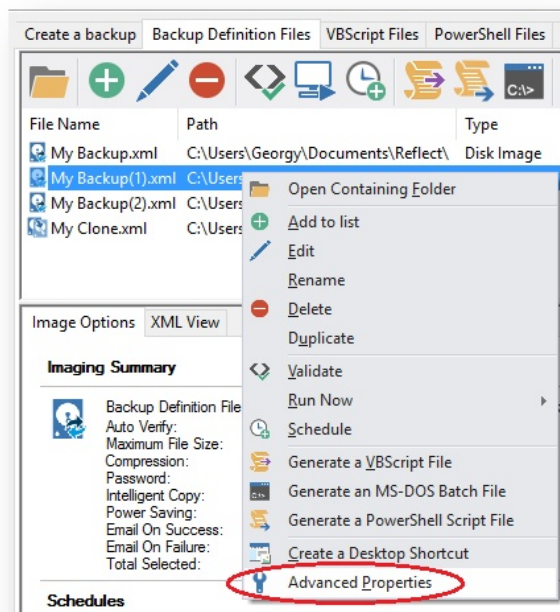


- Click **OK**.

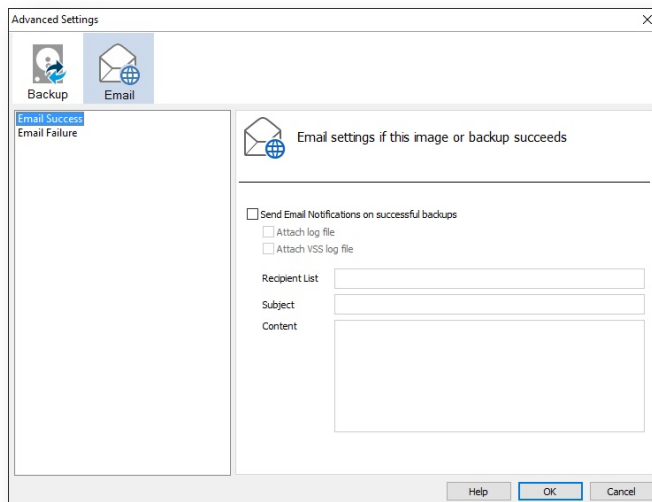
Email notification for existing individual backups

- Click '**Backup Definition Files**', right click on the backup definition and select '**Advanced Properties**'.

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- Click the **Email** icon.



- Set your e-mails for **success** and **failure** of a backup as described above.
- Click **OK**.

Running continuous backup of SQL databases

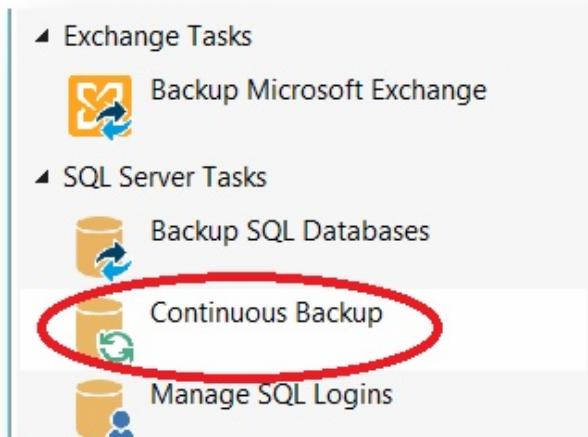
Running continuous backups of SQL databases ensures that frequent backups of your databases are taken at required time intervals. It is always possible, therefore, to restore your data to a point as close as possible to the failure point.

Continuous backups run separately to normal backups and imaging functions. A new Macrium Reflect SQL backup file is made each day and has its own email notification, disk space management, compression and password settings.

If an additional backup of a database under continuous backup is made, Macrium Reflect automatically creates a new full backup to ensure consistency of backed up logs.

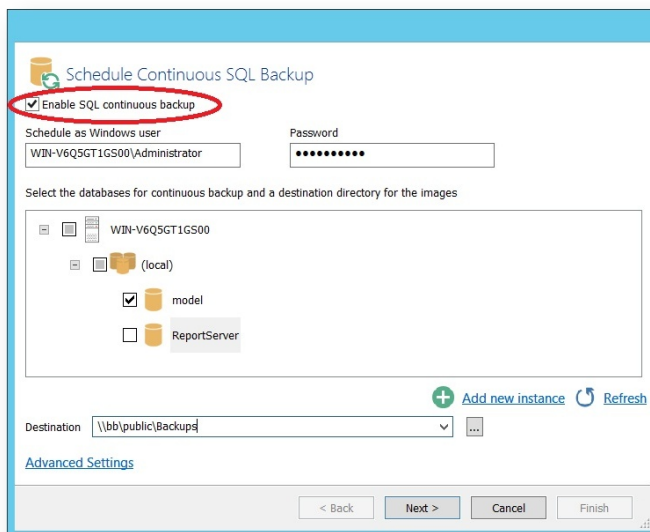
You can not run continuous backup on databases that are not running the Full Recovery Model.

1. Select **Continuous Backup** from **SQL Server Tasks**.



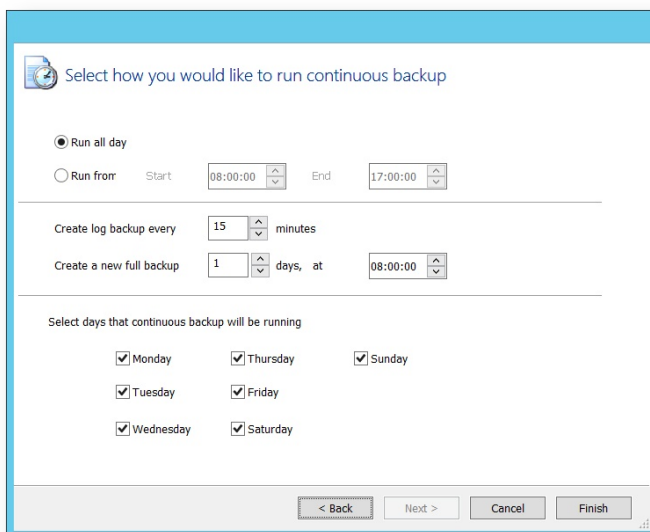
2. The first time a reminder box displays, check **Don't ask me again**, if appropriate and click **OK**.
3. A dialog showing databases running the *Full* recovery model appears, select **Enable SQL continuous backup**.

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4. Select the databases you wish to add to continuous backup.
You can select databases from multiple SQL instances.
5. If required, click **Advanced** Settings to change the compression, password and email option.
6. Click **Next**.

The dialog **Select how you would like to run continuous backup** appears.



By default, **Run all day** is selected.

7. Select **run from** and specify a time range when you want to have the continuous backup running.
8. If required, select frequency for log backups.
9. Specify; how many days between full backups and what time of day you want them start.
10. When you are happy with your selection, click **Finish**.

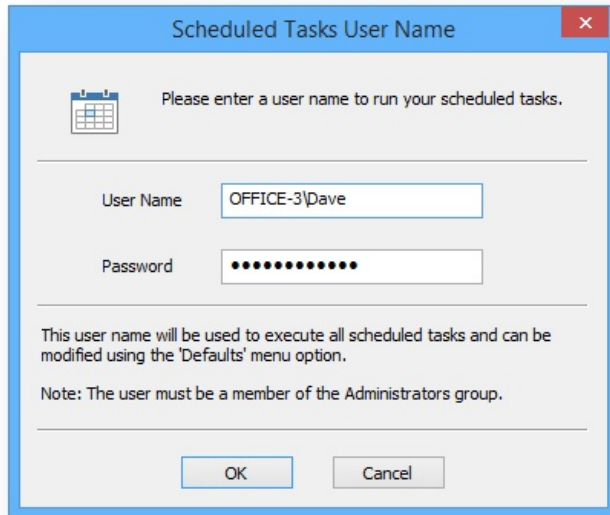
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Continuous backup runs in the background. You can run and create backups of the system or of SQL databases without interfering with continuous backup. Only logs files for failed continuous backups are stored.

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Which user name and password is used when scheduling a backup?

Macrium Reflect uses the standard Windows task scheduler to schedule backup jobs. To ensure that tasks can run when no users are logged on to the computer it is necessary to supply a Windows user account and login password. These are the same details that are used when you login to Windows:



How do I see what my actual user account name is?

The actual account name can be different to the name used at the Windows login screen. If you are having difficulty finding your user account name then:

1. Click the Windows start button and type:

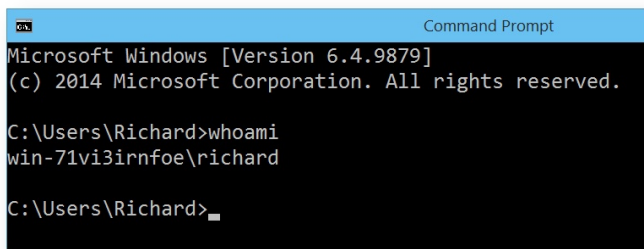
cmd

For more information on starting a command prompt please see [Running an elevated command prompt](#)

2. In the command prompt window, type:

whoami

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```
Microsoft Windows [Version 6.4.9879]
(c) 2014 Microsoft Corporation. All rights reserved.

C:\Users\Richard>whoami
win-71vi3irnfoe\richard

C:\Users\Richard>
```

The screen-shot shows that the user account currently logged on is Richard.

Note: for Windows XP, the command is:

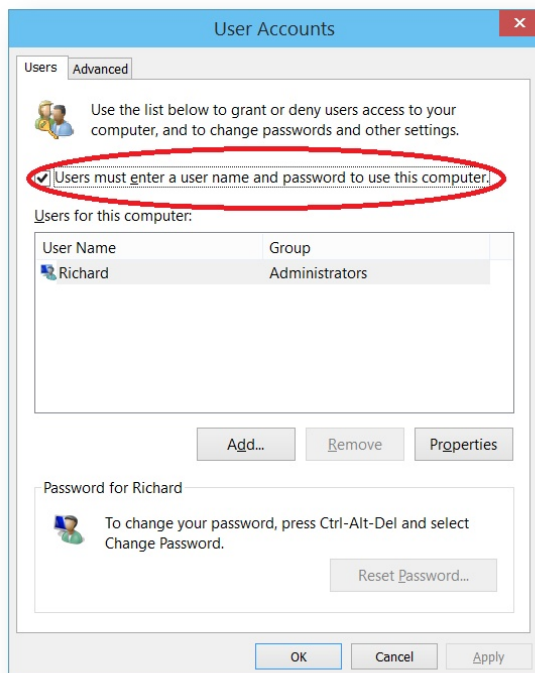
Windows XP

```
echo %username%.
```

I don't use a password but the scheduler is prompting for one

If you don't use a password when logging into Windows your system might have been set to automatically log you in with a saved password. To reset your password:

1. Click **Windows key**
2. Type `netplwiz` and press **Enter**.
3. Check **Users must enter a user name and password to use this computer** and click **Apply**.



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3. To manage/change your user account password press **Ctrl+Alt+Del**.

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Retention and consolidation

Scheduling full, incremental and differential images as part of a regular backup cycle is essential for optimising the use of available storage space, protecting your computer from sudden failure and giving you the ability to recover historical data.

Retention types

Retention and consolidation of full, differential and incremental backups combined with deletion logic maintains backup set integrity by ensuring the backup chain is never broken.

The following are examples to show how retention rules operate on your backup sets....

Full backup retention

In Full backup retention, a specified number, or age, of full backups are retained. When full backups are purged, the entire backup set is also deleted.

F = Full

D = Differential

I = Incremental

M T W T F M T W T F M T W T F M T W T F M T W
F I I I I D I I I I D I I I I D I I I I D I I I I F I I

e.g., Retain 1 Full backup.

After retention, the entire previous backup set is deleted

M T W T F M T W T F M T W T F M T W T F M T W F I I I I D I I I I D I I I I
D I I I I D I I I I F I I

Differential retention

Specify a number of differential backups to retain by age or number,

M T W T F M T W T F M T W T F M T W T F M T W T F M T W
F I I I I D I I I I D I I I I D I I I I D I I I I F I I

For example, Retain 2 differential backups.

After retention, the most recent 2 differential backups are retained. Incremental backups that are linked to previous differential backups are deleted along with the deleted differentials.

M T W T F M T W T F M T W T F M T W T F M T W F I I I I D I I I I D I I I I
D I I I I D I I I I F I I

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Incremental retention

Specify the number of incremental backups to retain. If by deleting an incremental the backup chain is broken this causes consolidation of the oldest retained Incremental.

M T W T F M T W T F M T W T F M T W T F M T W
F I I I I D I I I I D I I I I D I I I I F I I

For example, Retain 4 incremental backups.

After retention, the most recent 4 incremental backups are retained. The oldest retained incremental is not be valid on its own as it requires the previous 2 incremental backups to complete the chain. To ensure backup integrity the 2 older incremental backups are consolidated with it to create a new incremental backup.

M T W T F M T W T F M T W T F M T W T F M T W
F I I I I D I I I I D I I I I D I I I I F I I --->I I F I I

Synthetic Full / Incrementals forever

Incrementals forever optimises backup space and time by only ever creating a single full backup. After this, incremental backups are created forever and, once the specified number of incremental backups is reached, Macrium Reflect consolidates the incremental backup into a new 'synthetic' full backup. This is also known as a Synthetic Full backup.

For example, Incrementals forever with retain 4 incrementals. For the first week,

M T W T F F I I I I

The next Monday, to retain 4 Incrementals, the Full is consolidated with the first incremental to create a new Synthetic Full.

M T W T F M F I I I I I ->F I I I I

On Tuesday the consolidation step is repeated again on the next incremental image.

M T W T F M T F I I I I I -->F I I I I

This process is repeated forever. After the first Full only Incremental backups are required.

Consolidation is performed non destructively and 'In Place'. Therefore, very little additional disk space is required during consolidation and failed consolidations will automatically revert to the pre-consolidation state. For example, a consolidation could fail mid process due to a hardware malfunction such as a dropped network connection. In this circumstance the consolidation would automatically begin again the next time the backup is run without any loss of backup integrity.

Backup Plans

Backups schedules and retention rules are saved in a **Backup Plan** with each backup definition. You can even define your own **Backup Pan Templates** for easy reuse. The following are default templates:

Grandfather, Father, Son.

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Daily Incremental ("**Son**"), weekly Differential ("**Father**"), and monthly Full ("**Grandfather**") backups. Retention for each backup type can be set based on data history and space requirements. e.g,

Backup Type	Schedule	Retention
Monthly Full Backup	Run on the 1st Monday of every month	26 Weeks
Weekly Diff Backup	Run on every Monday (except 1st Monday)	4 Weeks
Daily Inc	Run Tues, Wed, Thu, Fri	14 Days

Differential Backup Set

A Full backup is created periodically followed by daily Differential backups.

Backup Type	Schedule	Retention
Monthly Full Backup	Run on the 1st Monday of every month	26 Weeks
Daily Diff Backup	Run on Mon, Tues, Wed, Thu, Fri (except 1st Monday)	30 Days

Incremental Backup Set

A Full backup is created periodically followed by daily Incremental backups.

Backup Type	Schedule	Retention
Monthly Full Backup	Run on the 1st Monday of every month	26 Weeks
Daily Inc Backup	Run on Mon, Tues, Wed, Thu, Fri (except 1st Monday)	30 Days

Incrementals Forever

An initial Full backup is created followed by daily Incremental backups.

Backup Type	Schedule	Retention
Initial Full Backup	Initially created when the first Incremental is scheduled to be created	A Synthetic Full is created after the first 30 Incrementals
Daily Inc Backup	Run Every Mon, Tues, Wed, Thu Fri	30

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Related articles

- [Page: Retention and consolidation \(see page 203\)](#)
- [Page: Scheduling backups \(see page 183\)](#)
- [Page: How backup sets are created and maintained \(see page 130\)](#)
- [Page: Differential and incremental disk images \(see page 160\)](#)

Restoring and browsing

Macrium Reflect can restore disk partitions exactly as they were when the backup was taken. With File and Folder backups you can restore all or selected files and folders to their original or new location.

You can also explore any backup or image file in Windows Explorer. This powerful feature enables you to restore individual files or folders by simply using copy and paste.

To restore whole computers, including boot partitions, Macrium Reflect uses Windows PE, a cut down version of Windows. On a working system, when you restore to an earlier time, Macrium Reflect reboots into the Windows PE operating system, carries out the requested restore, then boots back into the restored operating system. On a system that is not working, to restore to an earlier time, you need to boot from your Windows PE rescue media, whether that is a CD, DVD or USB-stick. The rescue media contains Macrium Reflect so that you can carry out the restore, then boot back into the restored operating system.

Although this all sounds complex, it really is very simple to perform with Macrium Reflect leading you through each step.

Finally, if you have *Macrium Reflect Server Plus*, it has a rich feature set for restoring backups of SQL databases and Microsoft Exchange Servers while giving you the power to restore to any time and granularity right down to an individual email.

Further reading:

- [Restoring an image from within Windows \(see page 208\)](#)
- [Understanding partition alignment \(see page 217\)](#)
- [Browsing Macrium Reflect images and backups in Windows Explorer \(see page 218\)](#)
- [Restoring a file and folder backup \(see page 224\)](#)
- [Restoring MS SQL \(see page 227\)](#)
- [Restoring MS Exchange databases \(see page 231\)](#)
- [Restoring an MBR System image to UEFI/GPT \(see page 242\)](#)
- [Restoring a UEFI/GPT System image to MBR \(see page 245\)](#)
- [Bare metal restore of a dynamic disk system \(see page 248\)](#)
- [Drive letters assigned to restored or cloned partitions \(see page 253\)](#)
- [Restore to VHD \(see page 257\)](#)

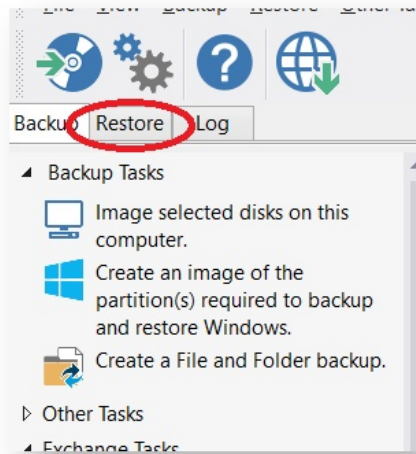
Restoring an image from within Windows

This topic is for restoring a data image. For restoring a system image see [Restoring a system image](#) (see page 211).

If the image contains only data, restoring it is very simple using Macrium Reflect. You can restore it back to its original location without interrupting the operating system.

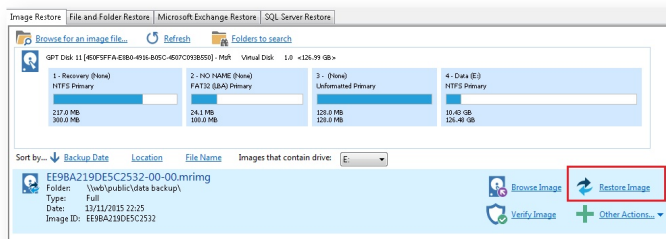
Before you begin: You must have a backup image of the disk ready to restore.

1. On the main screen, select **Restore**.



Backup images available to be restored are shown in the main pane.

2. Select the image you wish to restore and click **Restore Image**.

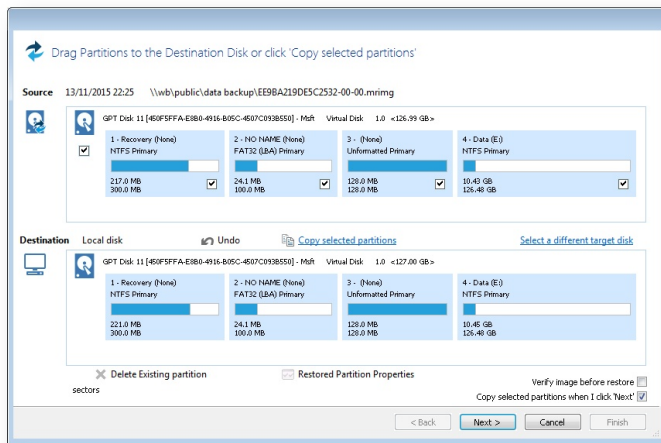


3. The next dialog gives you the opportunity to modify the destination properties.

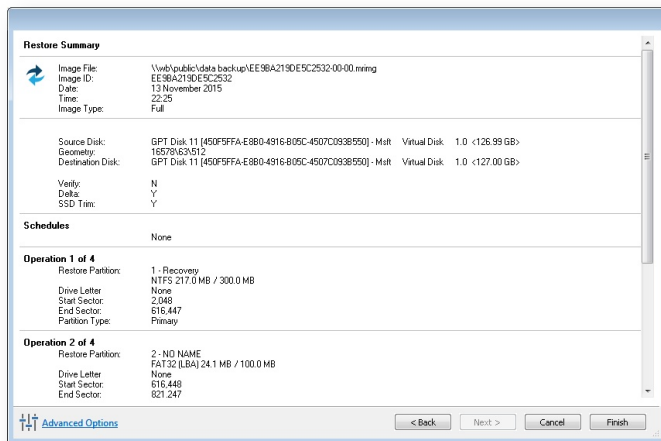
Moving and Resizing the restored partition

By default, partitions restore to their original locations. However, it's also possible to select a different target disk and to drag partitions to different locations and resize them to use the available space. Simply drag the source partition to any available partition or free space on the target disk. You can also delete partitions on the target disk to make space. For more destination options and further information, see [Modifying restored partition properties](#) (see page 214).

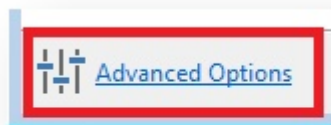
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4. Click **Next** to restore back to the original location.



5. If required, set Advanced Options as follows:



Option	Description
Rapid Delta Restore:	Copy only changed data blocks to complete the restore process more quickly See: Rapid Delta Restore - RDR (see page 26)

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Option	Description
SSD Trim:	Enable TRIM on restore to increase of both the lifetime and the performance of the SSD. See: SSD Trim Support
Verify Image:	To verify the image integrity before restoring.
Master Boot Record:	<p>To replace the Master Boot Record (MBR) with the MBR from the backup. The MBR is a small program that executes when the computer starts up. If this program becomes corrupt then you can have problems starting the computer operating system.</p> <p>Note: On modern GPT/UEFI systems this option has no effect.</p>

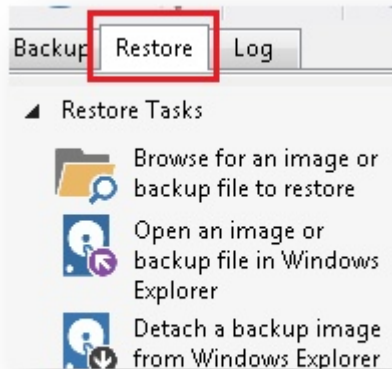
6. A summary screen is displayed confirming the choices that have been made, click **finish**.

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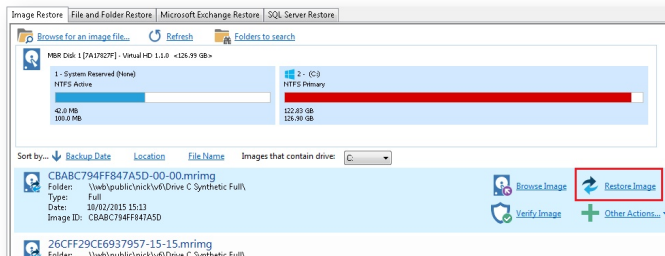
Restoring a System image from Windows

System images of, for example, the C drive, contain operating system files so it is not possible to restore files in real time because they will be in use by the operating system. To resolve this Macrium Reflect boots Windows PE, a cut down version of Windows. It then restores the file system before rebooting again and loading the restored Windows OS. Although this sounds complex, it really is very simple to perform.

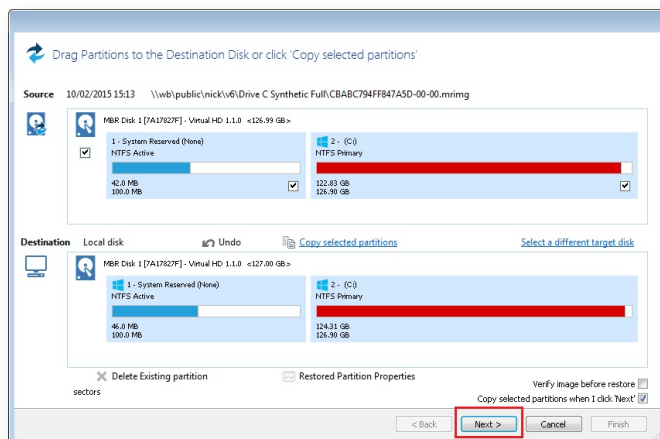
1. In the main application window, select **Restore**.



2. Select the required image and click **Restore Image**.



3. The next dialog gives you the opportunity to restore the image, click **Next** and select all defaults.

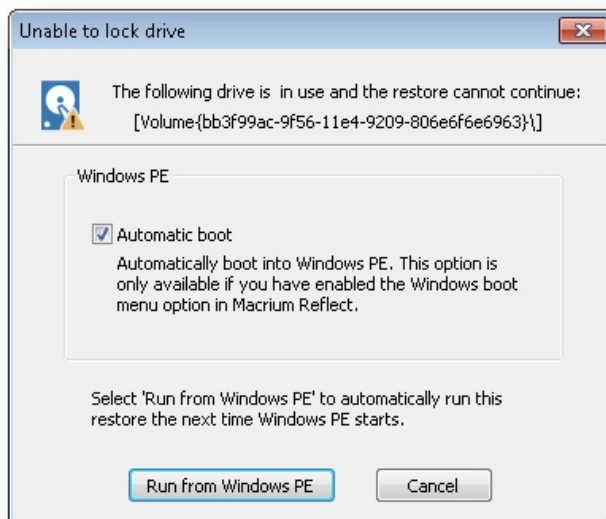


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Note: By default, partition(s) restore to their original locations. However, it is possible to restore to a different partition by using Drag and Drop. Simply drag the source partition to any available partition on the target disk. See [Modifying restored partition properties](#) (see page 214)

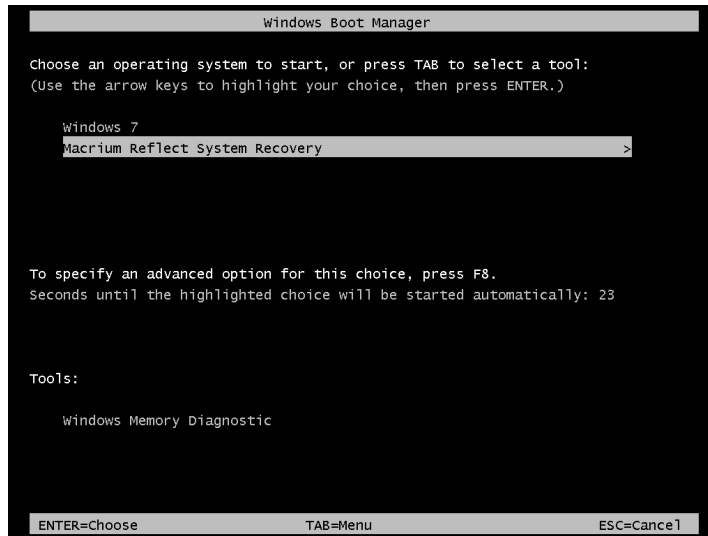
4. Review the summary and click **Finish**.
5. Macrium Reflect, recognizing that it is not possible to restore the image to the C drive, displays a dialog informing you that Windows PE must be used. Click **Run from Windows PE**.



Note: If the option for 'Automatic boot' is unavailable the please follow the steps [Adding a boot menu option for system Image recovery](#) (see page 82) and retry the restore.

6. You are prompted to restart your PC. Close any saved work and click **Restart Now**.

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7. The system reboots, Macrium adds a boot menu option and automatically selects the recovery environment.
8. Windows PE boots and automatically runs Macrium Reflect. Macrium Reflect detects which image is to be restored and starts restoring automatically. When restore is complete, Macrium automatically reboots the PC again and the restored Windows OS boots as normal.

Restoring a system image video

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Modifying restore destination partition properties

Hard disks are organized into partitions, similar to a filing cabinet, to optimize the use of space on the device. Each partition contains a small amount of error correction data, in case of a fault. Partitions are aligned to further optimize the amount of error correction data they require, maximizing the available space on the device.

There are two alignment possibilities used by Windows:

1. 1MB alignment. Beginning with Windows Vista/Server 2008 partitions are aligned on 1MB boundaries. For a disk with 512 bytes per sector this equates to 2048 sector alignment.
2. Cylinder, Head, Sector (CHS) alignment. This is the alignment used by all Windows versions, up to and including Windows XP/Server 2003. Disks are described as having sectors, heads and cylinders, typically 512 bytes per sector, 63 sectors per head and 255 heads per cylinder. A head is often referred to as a track. Partitions start on a head (or track) boundary and end on a cylinder boundary <http://en.wikipedia.org/wiki/Cylinder-head-sector>.

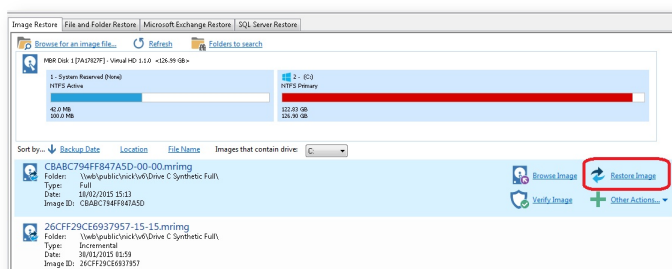
Solid State Disks (SSD) require partition alignment to 4KB boundaries for optimum performance and life. 1MB aligned partitions are aligned on 4KB boundaries so present no problem, however, CHS aligned partition are often aligned on 63 sectors (31.5KB) degrading SSD performance and life time considerably. This can be improved by modifying restore destination partition properties when you restore an image.

When you ask to restore images Macrium Reflect initially sets out to restore the partitions back to their original position on the disk. From here you can modify their destinations.

The example below restores a 122GB partition to a 16TB disk.

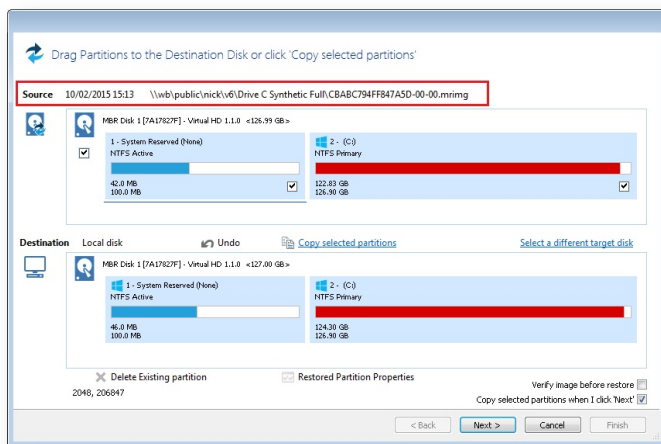
To modify the restore destination:

1. Click **Restore image**.



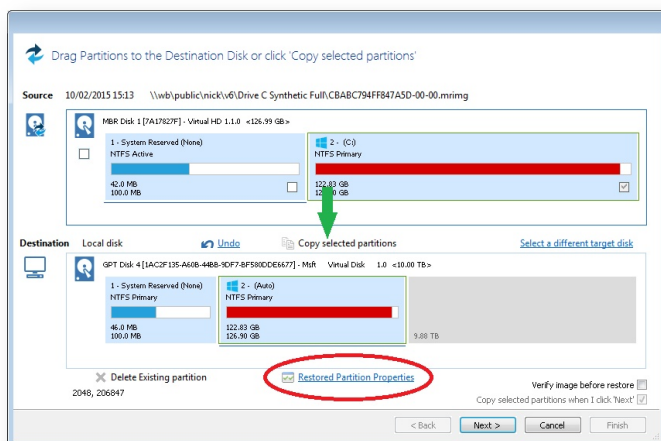
2. The following dialog shows. **Source** shows the location of the image file we are restoring from. The **Target** is the original location.

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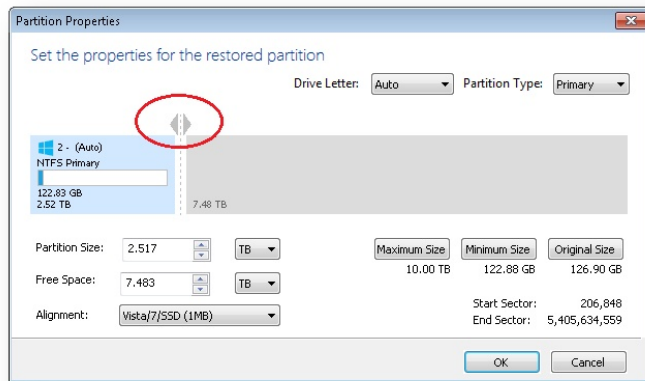
3. Click **Select a different target disk** and select the required target disk.
4. If you have partitions on the target disk which you are sure can be deleted, select each one in turn and click **Delete Existing partition** to create empty space.
5. Drag the source partition onto the destination partition.

The partition locates to the first available free area of the new disk. In this case, partition 2.



6. Click **Restored Partition Properties**.
The Partition Properties dialog appears for you to modify the size of the target partition.

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7. There are a number of things you can do here:

- Modify the drive letter by selecting another from the list.
- Click between the arrows < > above the disk view and drag the partition to a new size.
- Fine-tune the **Partition Size**, **Free Space** and **Alignment**.
- Click **Maximum Size** to configure the partition to the maximum available unallocated space on the disk, in this case about 10 TB (the size of the disk)
- Click **Minimum Size** to configure the partition to the minimum size, The minimum size is equivalent to the used space on the restored partition plus 50MB.
- Click **Original Size** sets the partition to the same size as it was when backed up.



Note: If the source disk is an MBR disk and the target is greater than 2TB in size then the restore process will automatically convert the disk to GPT style format.

8. Click **OK**.

See also: [Drive letters assigned to restored or cloned partitions \(see page 253\)](#)

Understanding partition alignment

Partition alignment refers to the physical sector offset of partitions. There are two alignment possibilities used by Windows:

1. **1MB alignment.** Beginning with Windows Vista/Server 2008 partitions are aligned on 1MB boundaries. For a disk with 512 bytes per sector this equates to 2048 sector alignment.
2. **Cylinder, Head, Sector (CHS) alignment.** This is the alignment used by all Windows versions, up to and including Windows XP/Server 2003. Disks are described as having sectors, heads and cylinders, typically 512 bytes per sector, 63 sectors per head and 255 heads per cylinder. A head is often referred to as a track. Partitions start on a head (or track) boundary and end on a cylinder boundary. <http://en.wikipedia.org/wiki/Cylinder-head-sector>

Partition alignment and Solid State Disks (SSD)

Solid State Disks require partition alignment to 4KB boundaries for optimum performance and life. 1MB aligned partitions are aligned on 4KB boundaries so present no problem, however, CHS aligned partition are often aligned on 63 sectors (31.5KB) degrading SSD performance and life time considerably.

Partition alignment and the Macrium Reflect cloning and restore function

To preserve the source partition alignment either...

1. Select the source partition check box(es) and click the 'Copy selected partitions' link.
2. Drag and drop the source partition(s) to free space on the target disk

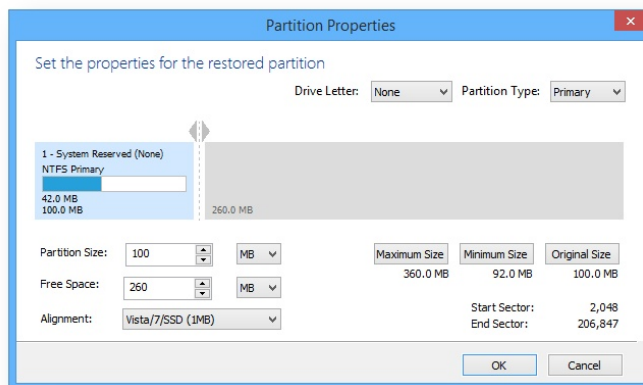
To use the target partition alignment.



Note: This could be used to 'convert' and XP aligned partition for SSD alignment

1. Drag and drop the source partition to an existing partition on the target disk

These defaulted alignment possibilities can be overridden in the Partition Properties dialog by selecting the 'Alignment' drop down control.



Browsing Macrium Reflect images and backups in Windows Explorer

Introduction

By mounting image files in Windows Explorer you can browse or explore an image and access all the files in a backup. The backed up data appears as a temporary drive in Windows Explorer that you can access, just like any other drive, mounted with its own drive letter. Individual Files and Folders can easily be recovered by using Copy and Paste.

If you mount an incremental or differential backup, the chosen folder must contain *a//*the files required to load the image. Meaning an incremental backup requires all the previous files in the backup set to be present, and a differential backup requires the full backup to be present. For example, If your backup is split across multiple DVD's then it isn't possible to mount the backup.

If you restart Windows, all temporary mounted Images are detached.

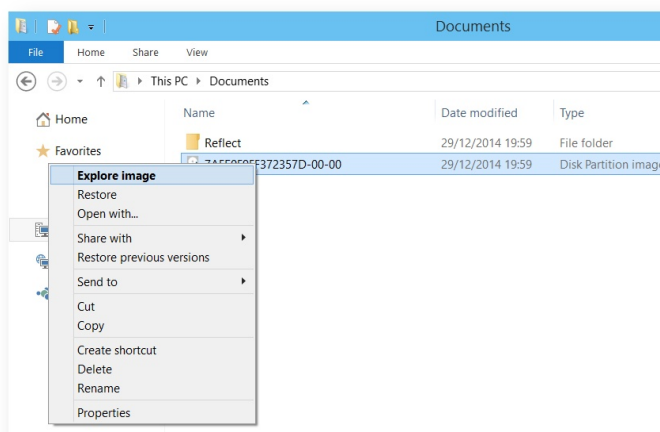


Note: If you have a **File and Folder** backup (not image backup) Macrium Reflect also has a [wizard](#) (see [page 224](#)) to restore selected files and/or folders. You must use the File and Folder restore wizard to restore files greater than 4 GB in size. These files cannot be restored by mounting your backup as described in this article. Please see [Restoring a file and folder backup](#) (see [page 224](#))

There are several ways to mount / unmount an image:

Mounting an image in Windows Explorer

1. Navigate to the location of the image you wish to mount.
2. Right click the image file and select **Explore image**.

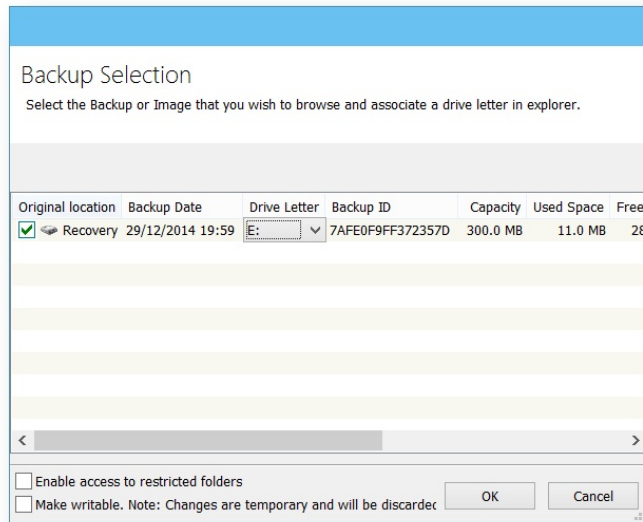


3. Select the partition you wish to mount and Click **OK**.

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In this example, the image only contains one partition.

You can also select which **Drive Letter** you would like to be assigned.



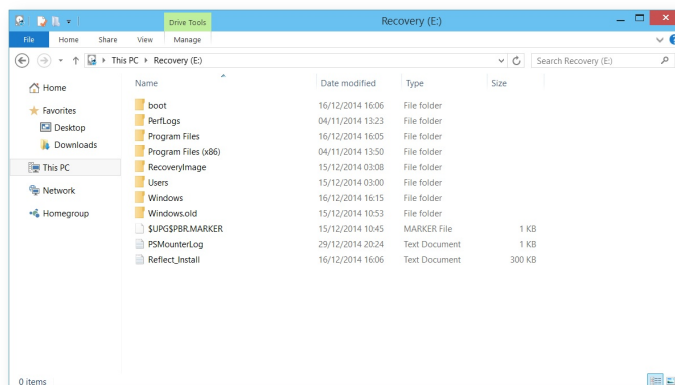
The option **Enable access to restricted folders** mounts the image with full NTFS access rights to all folders in the image. This means you can browse images created on another PC without having to grant NTFS permissions.

The option **Make writable** makes the mounted file system temporarily writable. This is useful when accessing files in the image where the opening application is required to write to the file. For example, Microsoft Virtual Hard Disk (.vhdx) files can be mounted and files in the mounted backup can be recovered without having to restore the .vhdx file first.



Note: Changes made to the mounted file system are temporary and are discarded when the image is unmounted.

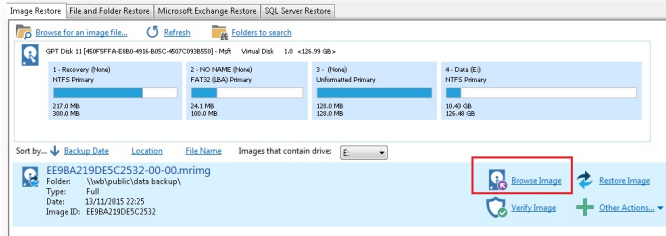
4. You can now navigate through the image in Windows Explorer.



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Using Macrium to mount an image

1. In the main window of Macrium Reflect, select **Restore**.



2. Select the image you wish to mount then click the **Browse Image** link.

Using Macrium Reflect Command Line Interface (CLI) to mount an image


1. Open a **command prompt** and change the directories as necessary so the path to `reflect.exe` is shown. See [Running an elevated command prompt](#).

Complete the command line as follows:

```
reflect.exe ["Path to Image file"] [Add one or more switches]
```

Note: Instead of inserting Path to Image file you can also replace it with `LAST_FILE_CREATED` if you want the last Image created in the current Windows session to be mounted.

Available CLI switches:

-b	Browse Image, always needed to mount Image.
-auto	Do not show the Backup Selection dialog and automatically mount all partitions in the image file.
-drives	A comma separated list of drive letters to use for the mounted image eg; -drives m,n If no drive letters are specified then the next available letters are used. <div> Note: To 'skip' mounting a partition use the Asterisk character instead of a drive letter</div>
-pass	Use for password protected Image files, add password in inverted commas. e.g. -pass "password"

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Note: If you do not use -auto you will be prompted with the **Backup Selection** dialog to assign the drive letters.

Some examples of using the CLI to mount images:

To mount an image and prompt for a drive letter:

```
C:\Program Files\Macrium\Reflect>reflect.exe "J:\76FF71EBB032A35-00-00.mrimg" -b
```

To mount all partitions of an image using the next available drive letter(s):

```
C:\Program Files\Macrium\Reflect>reflect.exe "J:\76FF71EBB032A35-00-00.mrimg" -b -auto
```

To mount all partitions for the last image created in the current Windows session:

```
C:\Program Files\Macrium\Reflect>reflect.exe "LAST_FILE_CREATED" -b -auto
```

To mount all partitions in an image using drive letters p,q,r

```
C:\Program Files\Macrium\Reflect>reflect.exe "J:\76FF71EBB032A35-00-00.mrimg" -b -auto -drives p,q,r
```

To mount the third partition only using drive letter 'R'

```
C:\Program Files\Macrium\Reflect>reflect.exe "J:\76FF71EBB032A35-00-00.mrimg" -b -auto -drives *,*,r
```

To mount all partitions in a password protected image using drive letters p,q,r where *pwd* is the password, (the password is case sensitive):

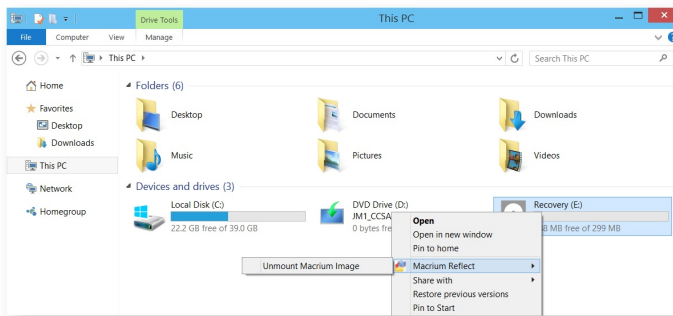
```
C:\Program Files\Macrium\Reflect>reflect.exe "J:\76FF71EBB032A35-00-00.mrimg" -b -auto -drives p,q,r -pass "pwd"
```

Unmounting a temporary mounted drive

Using Windows Explorer:

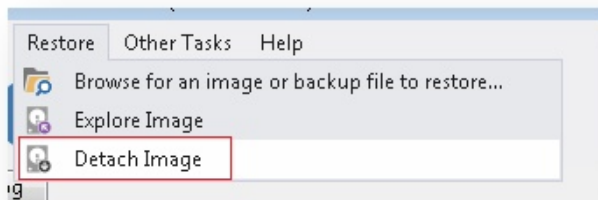
1. To detach a temporary mounted drive using Windows Explorer, right click the drive you wish to unmount.
2. Scroll to **Macrium Reflect**, click **Unmount Macrium Image**.

Macrium Reflect v6 User Guide

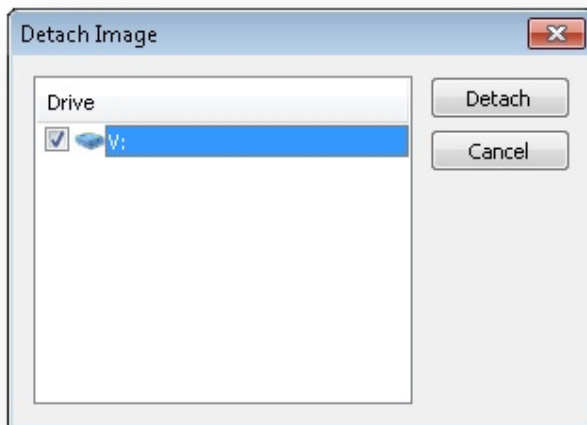


Using Macrium Reflect:

1. In the Macrium Reflect application, select **Restore** in the top menu.
2. Take the '**Restore**' > '**Detach Image**' menu option.



3. Select the drive letter you wish to unmount.



Using the CLI:

1. Open a **command prompt** and change the directory as necessary so the path to `reflect.exe` is shown.
See [Running an elevated command prompt](#) .
2. Complete the command line as follows:

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```
reflect.exe [drive letter to detach] [-u]
```

(if no drive letter is included the switch -u will detach all temporary mounted drives).

3. Press **Enter**.

Examples of using CLI to unmount an image:

To Detach all temporary drives:

```
C:\Program Files\Macrium\Reflect>reflect.exe -u
```

To Detach Drive J only:

```
C:\Program Files\Macrium\Reflect>reflect.exe J -u
```

Problems mounting images

If you have a problem mounting your images, it is possible that the image mounting system driver has failed to load correctly. To resolve this issue it is recommended you reinstall Macrium Reflect. This problem can be caused by anti-virus software disabling features as a security precaution.

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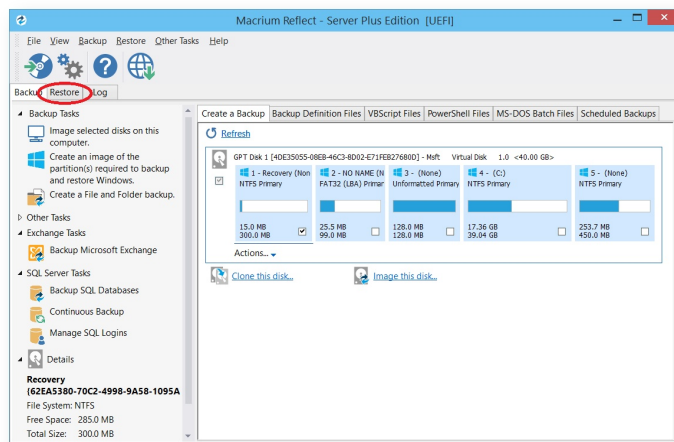
Restoring a file and folder backup

When you restore a file and folder backup, you can restore files to their original folder or restore the folder structure and selected files to a place of your choosing. If you want to restore individual files without their folder structure, browse them (see page 218) instead and use Windows Explorer to copy and paste them.

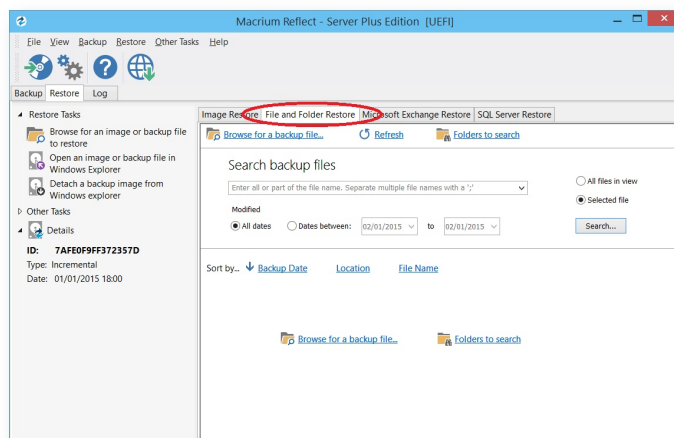


This tutorial is only for **File and Folder backups** and not image backups. For information on restoring image backups see [Restoring a system image](#) (see page 211).

1. Open Macrium Reflect and select the **Restore**.

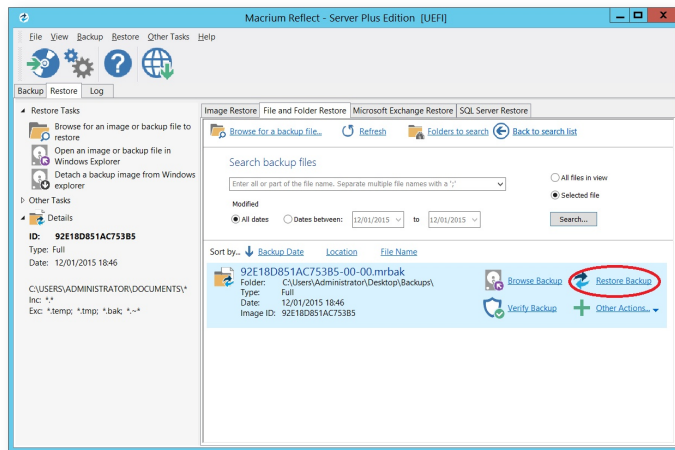


2. Select **File and Folder Restore**.

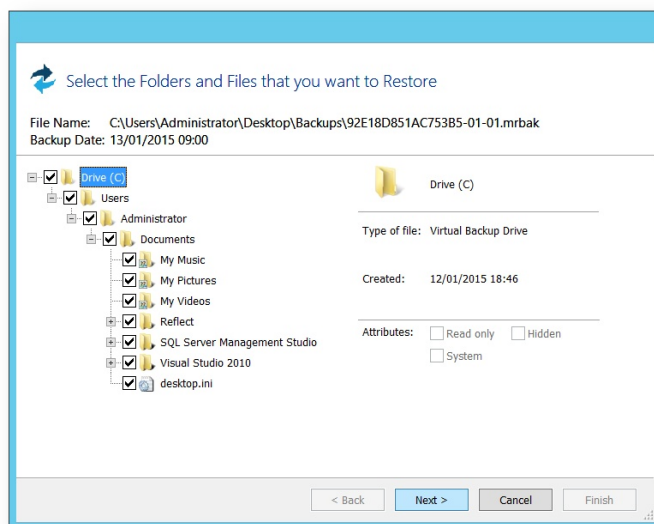


3. Select your backup, if none show select **Browse for a backup file...** and locate the file you want, it is added to the list of backups in the bottom half of the window.

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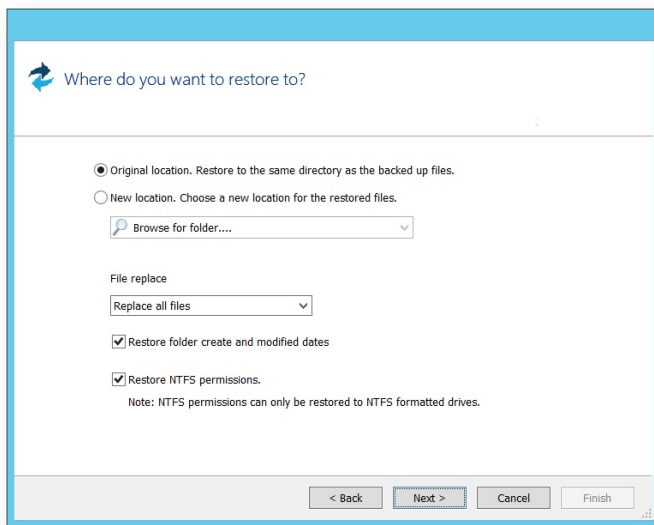


4. Click **Restore Backup**.

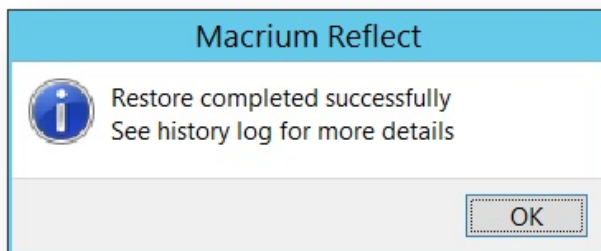


5. Select the files that to be restore. You may restore all the files as shown in this tutorial, or select individual directories and files you wish to restore.

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6. Click **Next**.
7. Select where you would like the files restored to. By default they are placed in the original location, but it is possible to restore them to a new location.
8. Click **Next**.
9. A summary window displays showing the details of the restore.
10. Click **Finish**.



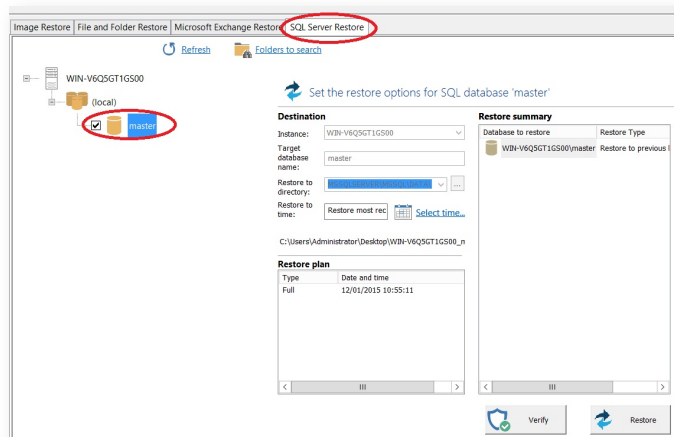
Restoring MS SQL

Macrium Reflect Server Plus offers a rich feature set for restoring backups taken of SQL databases.

Restoring MS SQL to time of backup

1. Select **SQL Server Restore**.

You should see your backups. If no backups show click **Folders to search**, to direct Macrium Reflect to the location of the SQL backup files.



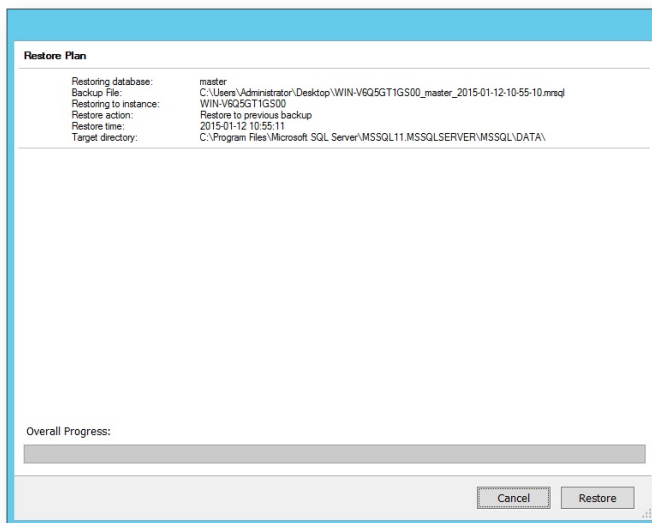
The left hand tree shows databases that can be restored.

2. Select the databases you wish to restore.

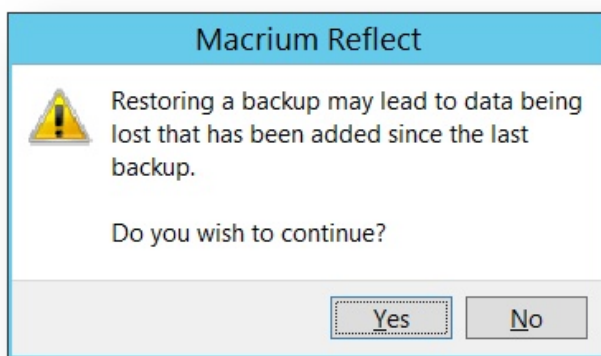
The middle of the screen shows controls for choosing the destination instance, database name and directory that contains the MDF and LDF files. The controls automatically default to the instance, database name and directory of the original backup. The latest backup is selected.

3. If you wish to restore to a different backup click **Select time...** and select the backup you wish to restore to.
4. When you are happy with the selection, click **Restore**.
5. Review the summary and click **Restore**.

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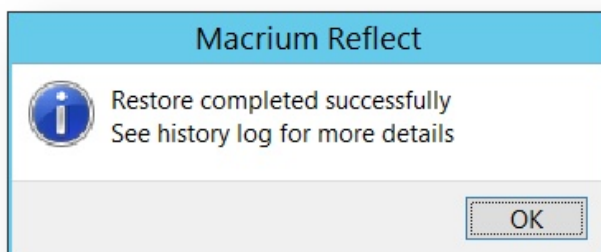


6. A warning box appears, if appropriate click **Yes** to continue with the restore.



The restore completes and a dialog box advising completion appears.

7. Click **OK**.



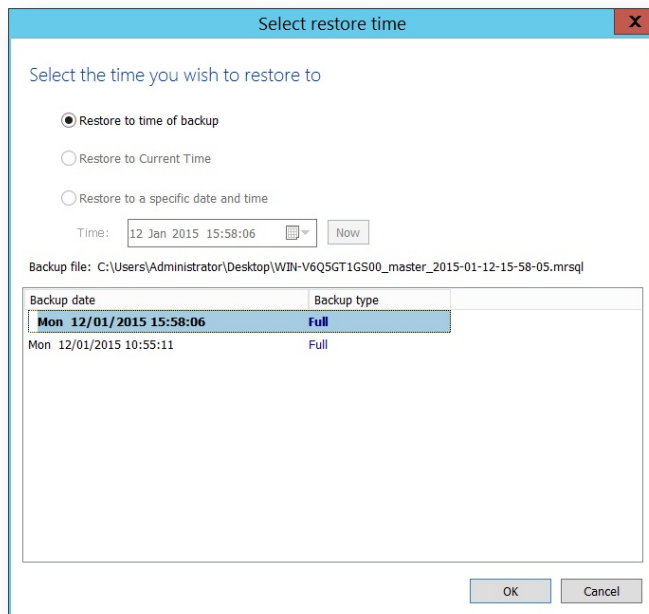
Restoring MS SQL to a point-in-time

In some circumstances, it is possible to restore a database to a specific point-in-time. This is especially useful if you have accidentally deleted a table or other specific piece of data and need to roll back to the point just before the delete was done. The following situations must be considered when trying to restore to a point-in-time:

- The database must be running the FULL recovery model.
- It is not possible to restore to a point-in-time prior to the last full or differential backup.
- It is not possible to restore to a point-in-time between full or differential images. You can restore to a point-in-time from the last full or differential to the present.

In order to restore to a point-in-time:

1. On the Restore task pane, select **SQL Server Restore** and select a database.
2. Click **Select Time...** you see the following dialog showing the history of backups made for the selected database.



3. Select **Restore to a specific date and time**.
4. Select the time you wish to restore to, either setting the time and date manually, or selecting the backup you wish to restore and then tweaking the date/time as required. It is not possible to set the controls to a date /time that can not be restored. Click **OK**.
5. Continue as above.

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Restoring MS SQL to a different instance, folder or database name

It is possible to restore a backup to a different instance by selecting the target instance in the **Instance** drop down combo box. Be aware that there can be compatibility issues when restoring databases to Microsoft SQL instances of differing versions.

By default, the folder selected in **Restore to directory** is the default folder where the instance places MDF and LDF files associated with the databases. If you change the folder, upon restoration, the MDF and LDF files move to the target directory, wherever they were to start with.

By default, Macrium Reflect restores the database back to the original database name. However, if you change the name of the database in **Target database name**, a new database of that name is created. The MDF and LDF files that restore also rename. This ensures the original database does not change but can be deleted manually when it is no longer required.

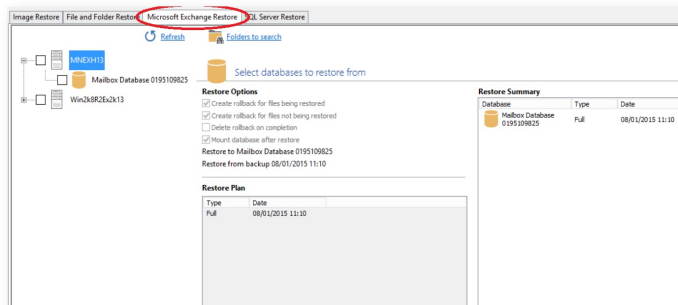
Restoring MS Exchange databases

Macrium Reflect Server Plus can restore select databases back to your Microsoft Exchange Server providing the following restore scenarios:

Restoring MS Exchange databases to time of backup

1. Select **Microsoft Exchange Restore**.

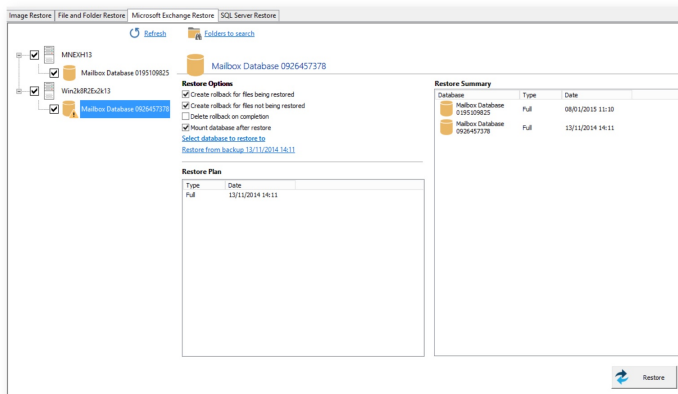
Available databases display. If no databases are showing, click **Folders to search** to search for Microsoft Exchange backup files.



2. Select each database to restore. By default the most recent backup is selected.

Restore Plan shows the backup files selected.

Restore Summary lists all databases restoring and the date/time of the backup file to restore from.



3. Click **Restore** to restore selected databases back to their original volume locations and database names.

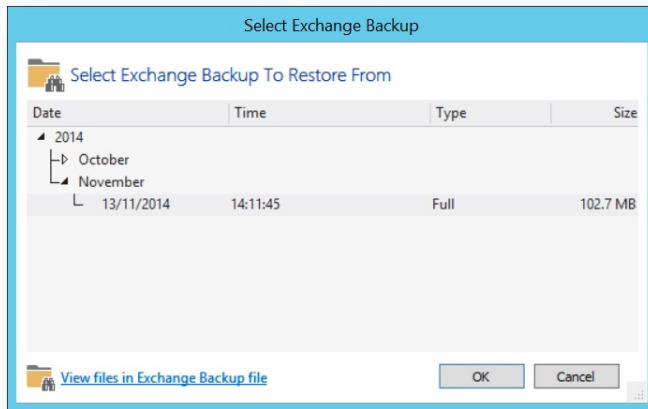
4. Review the information and click **Restore**.

Restoring MS Exchange databases to point in time

When you restore to a different point in time, only the log files up to that point in time are restored which are then replayed into the restored database. you restore to a different point in time Macrium Reflect replays the log files up until the selected point.

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1. Select the databases to restore.
2. For each database restoring, select **Restore from backup**.



3. Select a file in the list.
4. Click **OK**.
5. Optionally, click **View files in Exchange Backup file** to show files contained in the backup.
6. Click **OK** to keep the current selection.



Note: When restoring databases to point in time for the same storage group (under Microsoft Exchange 2003/2007) Macrium Reflect forces you to use the same backup file in a single restore operation to maintain log file consistency during the mount process. If you need to restore databases in the same storage group to different points in time, do so in separate restore operations.

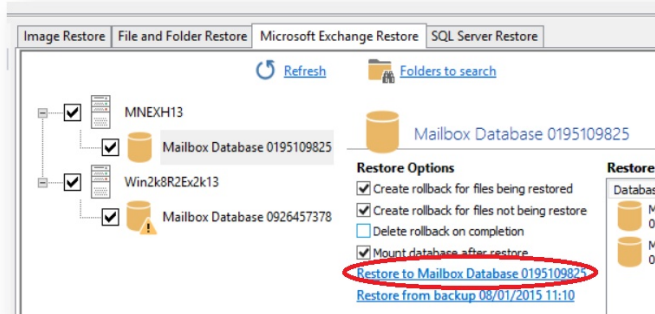
7. Review the information and click **Restore**.

Restoring MS Exchange databases to a different name or location

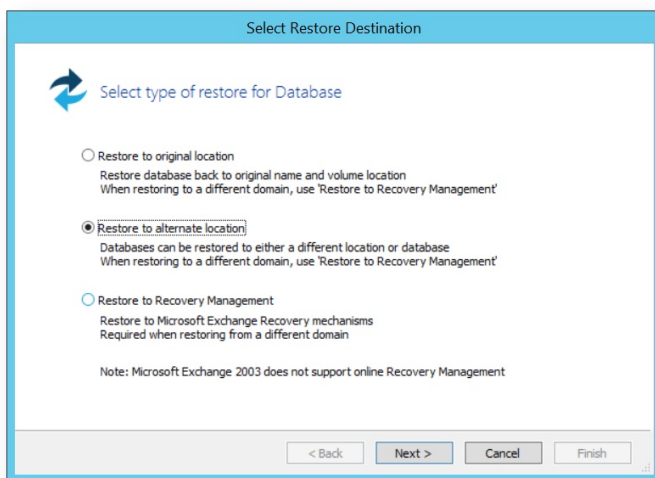
Macrium Reflect Server Plus allows you to restore databases to different names and locations with support for storage group and database creation.

1. Select the databases to restore.
2. Click **Restore to** (in this example) **Mailbox Database**.

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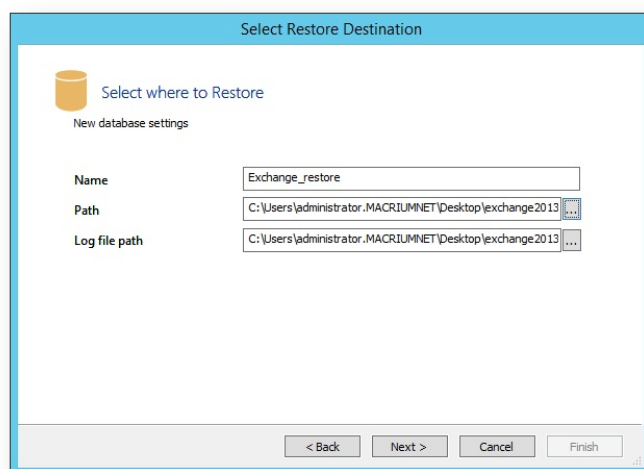
Select Restore Destination wizard begins:



3. Select **Restore to alternate location**.

4. Click **Next**.

5. Specify the database to restore to:



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Name:	Specify the name for the database
Path:	Specify the folder where you want the database restored.
Log file path:	Specify the folder where transaction log files are stored.

6. Click **Next**.
7. Review the information and click **Finish**.

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Restoring emails with Mailbox Restore

In Macrium Reflect Server Plus you can use Mailbox Restore to restore individual emails from a backup of Microsoft Exchange. This is useful if your backup contains some vital emails or attachments, but you don't want to have to restore the whole MS Exchange server in order to access them .

Mailbox Restore can restore emails, appointments, contacts, journal entries, notes and tasks in the same way.

Before you begin:

For Mailbox Restore to function, Microsoft Exchange MAPI and CDO must be installed on the server. These are present by default on Microsoft Exchange Server 2003. For Exchange 2007 or later, they can be downloaded from the following link:

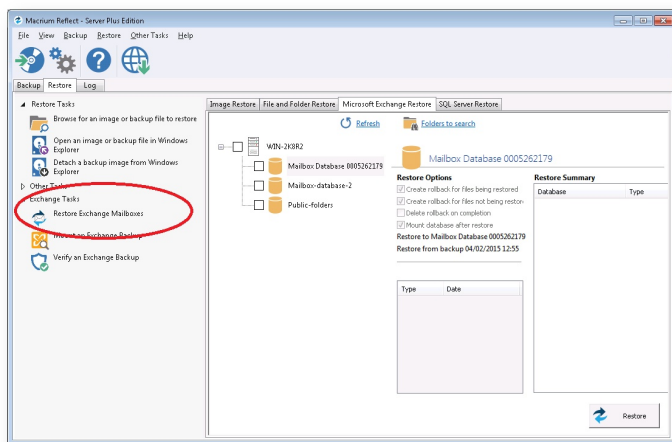
<http://www.microsoft.com/en-us/download/details.aspx?id=42040>

To restore an email using Mailbox Restore, the edition of Microsoft Exchange running on the target server must be the same as the original server. An email backed up on a server running Exchange Server 2007, for example, can be restored onto other servers running Exchange 2007, but not to a server running Exchange 2010.

Note: A mailbox needs to exist on the target server, with the same name as the original mailbox.

The user running Macrium Reflect must have full access permissions for the mailbox being restored to.

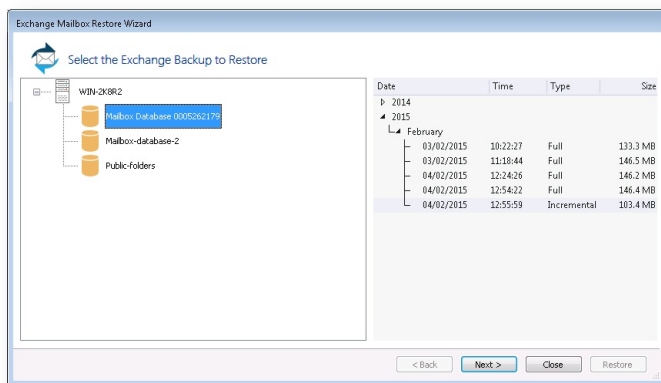
1. In **Restore**, select **Microsoft Exchange Restore**.
2. Select **Restore Exchange Mailboxes**.



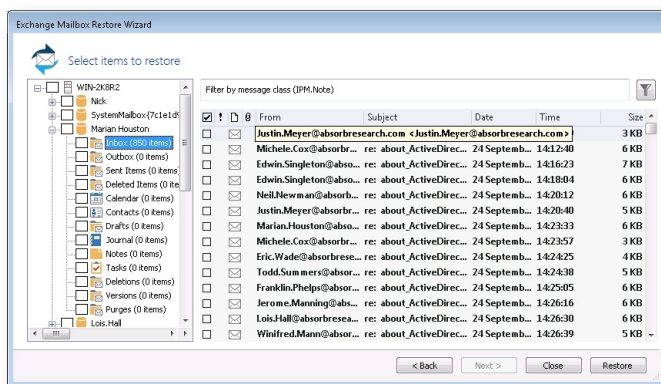
The **Exchange Mailbox Restore Wizard** appears.

3. Select the required message store / database to restore from and click **Next**.

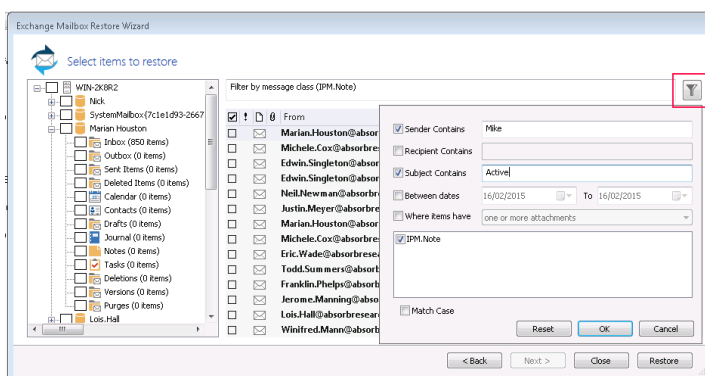
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4. Select required folder, or click appropriate folder to select required individual email to restore.



5. Click the filter button to filter the email list by **Sender, Recipient, Subject, Between dates**, or whether there are **attachments**.



6. When you have made all the required selections / deselections, click **OK**.
7. Click **Restore**.

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Setting up permissions for Mailbox Restore

MS Exchange 2007 or more recent

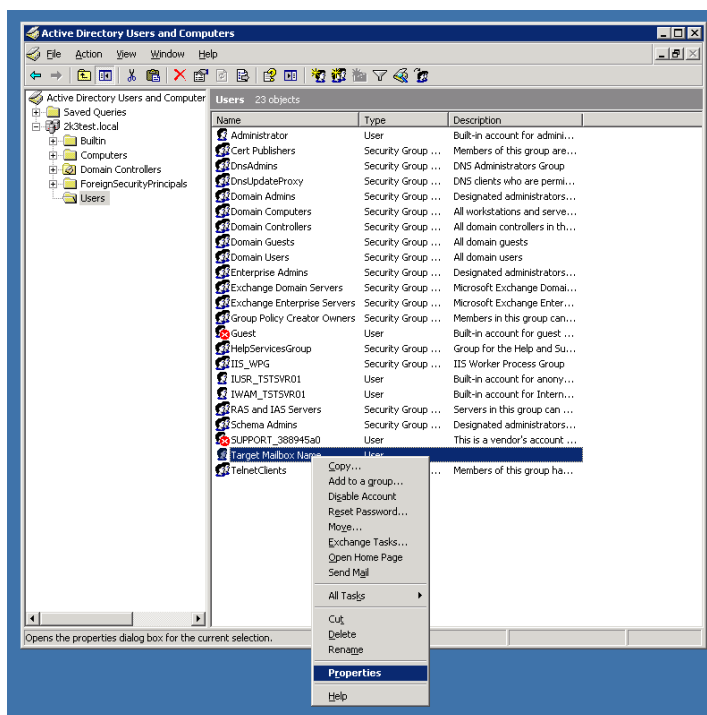
1. Open the Microsoft Exchange Management Shell as an administrator.
2. Run the following commands:

```
Add-MailboxPermission -user USERNAME -AccessRights FullAccess -  
InheritanceType All MAILBOX  
Add-ADPermission -user USERNAME -ExtendedRights Send-As MAILBOX  
Add-ADPermission -user USERNAME -ExtendedRights Receive-As MAILBOX
```

substituting USERNAME and MAILBOX with your own username and the name of the user of the target mailbox.

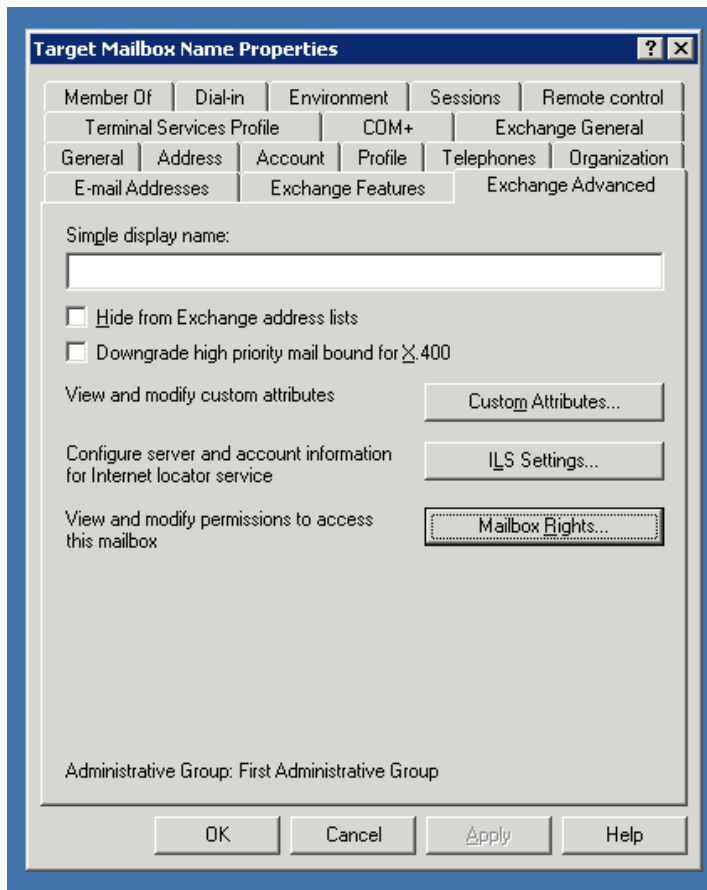
MS Exchange 2003

1. Click Start > Administrative Tools > Active Directory Users and Computers.
2. Under **Users**, right click on the user whose mailbox you wish to restore to, and click **Properties**.



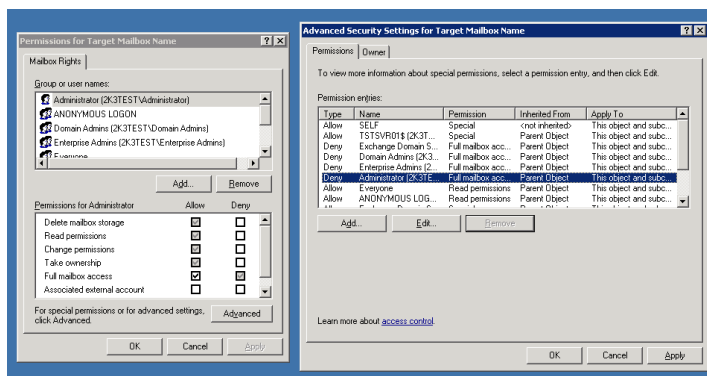
3. In **Exchange Advanced**, click **Mailbox Rights**.

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4. In the Permissions dialog, click **Advanced**, select your user name in the list, and click **Edit**.

If your user name does not appear on the list, then click **Add**, use the dialog to select your user name, then click **OK**.



5. Check **Full mailbox access - Allow**, and click **OK**.

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Permission Entry for Target Mailbox Name ? X

Object

This permission is inherited from the parent object.

Name: Administrator (2K3TEST\Administrator) Change...

Apply onto: This object and subcontainers

Permissions:	Allow	Deny
Delete mailbox storage	<input type="checkbox"/>	<input type="checkbox"/>
Read permissions	<input type="checkbox"/>	<input type="checkbox"/>
Change permissions	<input type="checkbox"/>	<input type="checkbox"/>
Take ownership	<input type="checkbox"/>	<input type="checkbox"/>
Full mailbox access	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Associated external account	<input type="checkbox"/>	<input type="checkbox"/>

☐ Apply these permissions to objects and/or containers within this container only Clear All

OK Cancel

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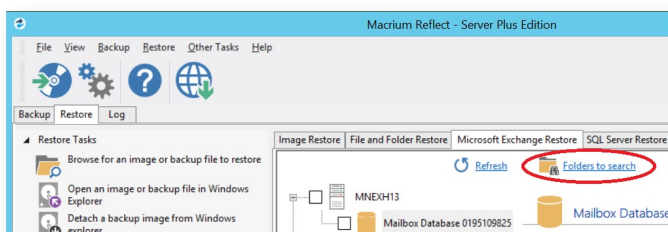
Adding MS Exchange search folders

Macrium Reflect Server Plus maintains a list of all Microsoft Exchange backup folders, these folders are queried in the Microsoft Exchange Restore view for storage groups/databases that can be restored.

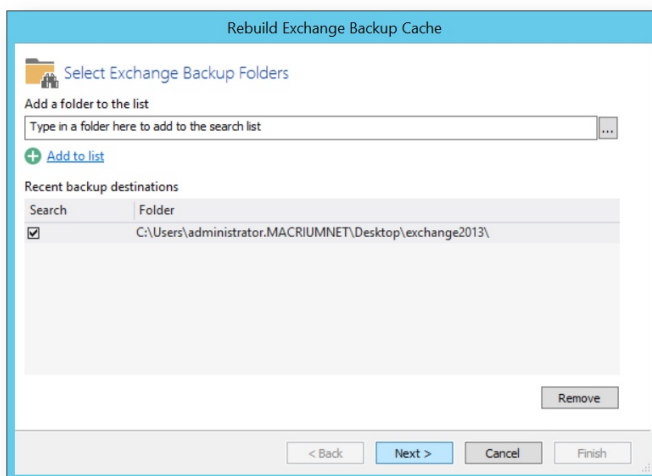


Note: Macrium Reflect Server Plus can discover backups of Microsoft Exchange made on different servers by using the following steps but only detects backups made from the same version of Microsoft Exchange. When restoring databases from a different server you must restore databases to Microsoft Exchange recovery mechanisms before migrating mailboxes using Microsoft Exchange.

1. Select **Folders To Search** at the top of the Microsoft Exchange Restore tab.

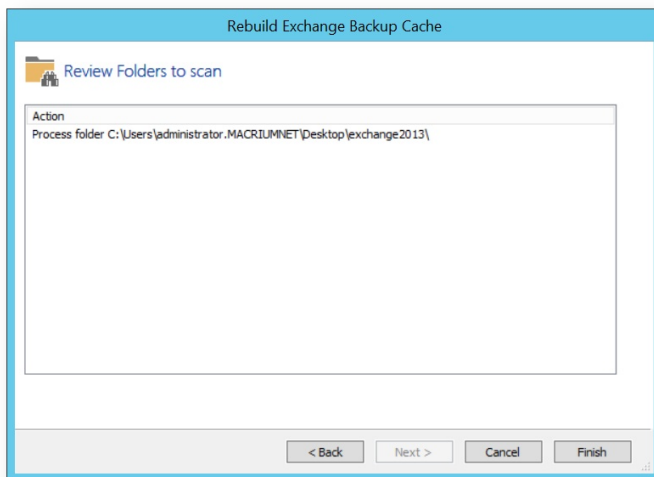


The **Rebuild Exchange Backup Cache** wizard displays.



2. To add additional folders to the search by either:
 - a. Typing a folder name into the edit box.
 - b. Clicking the browse button.
 - c. Selecting **Add to list** and browsing available folders.
3. Select required folders and click **Next**.

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4. Review the folders to scan.


5. Click **Finish**.


Macrium Reflect scans the specified folders for Microsoft Exchange backups and lists those available for restore in **Microsoft Exchange Restore**.


Restoring an MBR System image to UEFI/GPT

The Unified Extensible Firmware Interface (UEFI) is an interface between a computer's firmware and operating system. It is designed as a replacement for Basic Input/Output System (BIOS). UEFI supports hard disks with either master boot record (MBR) or the newer GUID Partition Table (GPT) system. GPT is a newer standard that supports disks larger than 2TiB and allows for more than four primary partitions per disk.

As UEFI and GPT are increasingly widespread, older images of MBR disks often need restoring to replacement UEFI / GPT systems.

 Rescue media created on Windows 7/8 operating systems is dual boot, meaning they boot in both MBR and UEFI mode. ***Boot your rescue media in UEFI mode.*** Consult your Motherboard user manual for information on how to do this.

 **Caution:** We assume there are no other hardware differences between the system being imaged and the system being restored to. For dissimilar hardware, use ReDeploy.

1. Boot into Windows PE.
2. Open a Windows command window. To open a command window click the icon  on the taskbar.
3. Type:

```
diskpart
```

4. Type:

```
list disk
```

5. Select the disk number that you want to restore to. For example:

```
select disk 0
```

6. Clean the selected disk:

```
clean
```

7. By default, "clean" creates an empty MBR disk. Convert it to GPT:

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```
convert gpt
```

8. Create the EFI partition:

```
create partition efi size=200
```

9. Format the EFI partition:

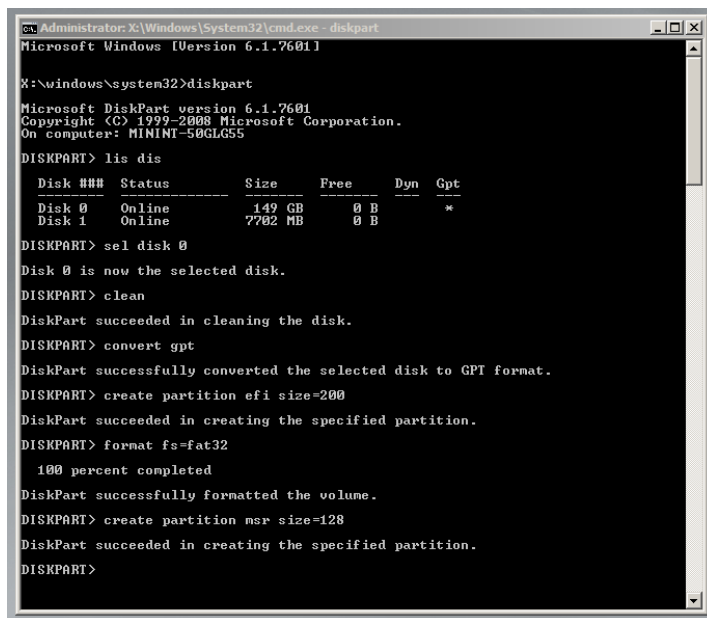
```
format fs=fat32
```

10. Create the MSR partition:

```
create partition msr size=128
```

11. Exit Diskpart:

```
exit
```



The screenshot shows a Windows command prompt window titled "Administrator: X:\Windows\System32\cmd.exe - diskpart". The window displays the output of the following commands:

```
Microsoft Windows [Version 6.1.7601]
X:\windows\system32>diskpart
Microsoft DiskPart version 6.1.7601
Copyright (C) 1999-2008 Microsoft Corporation.
On computer: MINIMI-50GLG55

DISKPART> lis dis
   Disk ###  Status      Size      Free      Dyn  Gpt
   -----  -
   Disk 0    Online       149 GB     0 B
   Disk 1    Online      7702 MB     0 B
   *

DISKPART> sel disk 0
Disk 0 is now the selected disk.

DISKPART> clean
DiskPart succeeded in cleaning the disk.

DISKPART> convert gpt
DiskPart successfully converted the selected disk to GPT format.

DISKPART> create partition efi size=200
DiskPart succeeded in creating the specified partition.

DISKPART> format fs=fat32
   100 percent completed
DiskPart successfully formatted the volume.

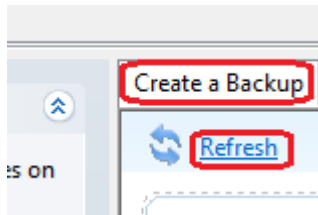
DISKPART> create partition msr size=128
DiskPart succeeded in creating the specified partition.

DISKPART>
```

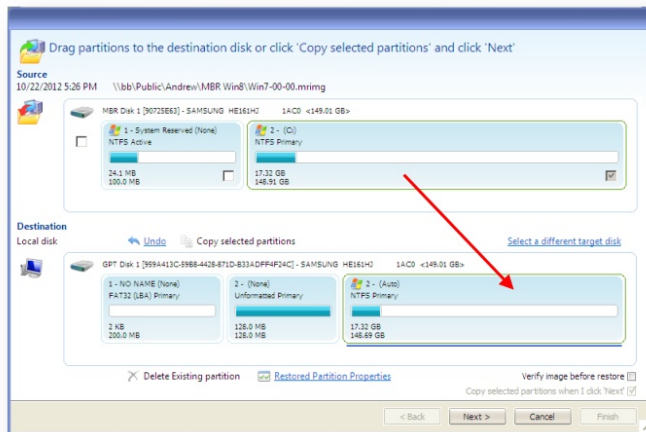
12. In Macrium Reflect, click **Backup** tab.

13. Click **Refresh** to read the newly initialized disk.

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14. Click **Restore** tab.
15. Select the image file, *drag and drop the imaged partitions* but *DO NOT* restore the MSR partition from the image file. In this example, only the C partition is restored to the target disk.



16. When the restore is complete, configure the UEFI boot files in the EFI system partition.

Follow the steps in the section **Fix Boot problems for GPT/UEFI Boot Systems** in the following KB article: [Fixing Windows boot problems](#) (see page 103)



You may need to edit the UEFI configuration to tell it to boot into the new GPT hard disk.


Restoring a UEFI/GPT System image to MBR

The Unified Extensible Firmware Interface (UEFI) is an interface between a computer's firmware and operating system. It is designed as a replacement for Basic Input/Output System (BIOS). UEFI supports hard disks with either master boot record (MBR) or the newer GUID Partition Table (GPT) system. GPT is a newer standard that supports disks larger than 2TiB and allows for more than four primary partitions per disk.

This article covers restoring a disk image of a UEFI/GPT system and enable the restored image to boot using legacy MBR booting.



Caution: We assume there are no other hardware differences between the system being imaged and the system being restored to. For dissimilar hardware, use ReDeploy.

1. Boot into Windows PE.
2. Open a Windows command window. To open a command window click the icon  on the taskbar.
3. Type:

```
diskpart
```

4. Type:

```
list disk
```

5. Select the disk number that you want to restore to. For example:

```
select disk 3
```



Please ensure that you use the correct disk number in the above command.

6. Clean the selected disk:

```
clean
```

7. Ensure that the target disk is MBR formatted

```
convert mbr
```

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8. Create the Microsoft System Reserved partition

```
create par pri size=300
```

9. Format the MSR partition:

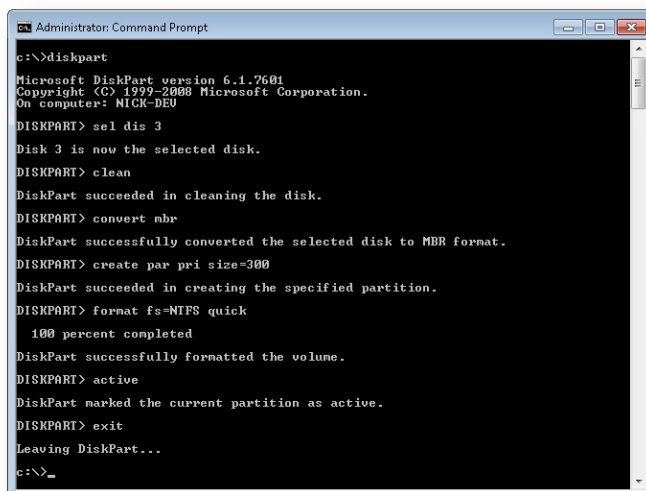
```
format fs=NTFS quick
```

10. Set the partition 'Active'

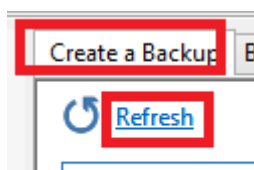
```
active
```

11. Exit Diskpart:

```
exit
```

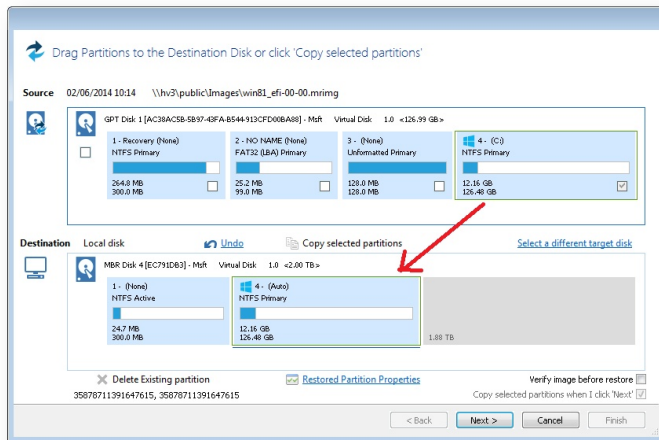


12. In Macrium Reflect, click **Backup** tab.
13. Click **Refresh** to read the newly initialized disk.



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14. Click **Restore** tab.
15. Select the image file, **drag and drop just the Windows System partition** to the free space on the target disk. In **this example**, only the 'C:' partition is restored to the target disk.



Note: You can click '**Restored Partition Properties**' to resize the restored partition to fill the new disk if you wish.

16. Follow the steps in the section **Fix boot problems on MBR/BIOS systems** in the following KB article: [Fixing Windows boot problems](#) (see page 101)



Note: You should select the newly created 300MB partition as the 'Active' partition when running 'Fix Boot Problems'

Bare metal restore of a dynamic disk system

Introduction

Dynamic disks are Microsoft's [LVM](#) implementation. It is analogous to RAID enabling volumes to be extended over more than one disk, be mirrored over multiple disks etc. Unlike RAID, it does not need any specific hardware.

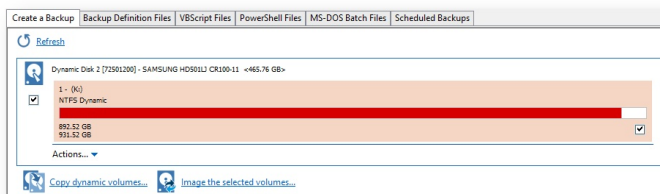
As dynamic volumes support many more than the 4 primary partitions of an MBR partitioning scheme but can still be booted (in mirrored or simple configurations), they are occasionally used for single disk configurations.

Non-Dynamic disks are known as Basic disks by Microsoft.

How Reflect images a Dynamic disk

Dynamic disk systems can be imaged by Macrium Reflect Home, Workstation and Server editions. The physical structure of the source dynamic volume is not stored in the image and so dynamic volumes restructures to the physical layout of the target disk when restored.

Dynamic volumes are differentiated from standard partitions by use of a contrasting color and the disk title.



How to restore a dynamic disk

Typically, the target will be same the dynamic disk from which the backup was taken; in which case the restore is automatically configured when the image is selected for restore. It is just as straightforward as the restore of a Basic disk.

There are some limitations if you wish to restore to an already configured dynamic volume:


1. Before the backup is started, the Dynamic disk initialization and Volume configuration must be have been completed by an external tool such as [Disk Management](#) or [diskpart](#) (both included with all versions of Windows).



Macrium Reflect v6 User Guide

Dynamic disk initialization and Volume configuration is not possible in the rescue environment, even with diskpart. This is a known limitation of Windows PE (read more [here](#) and [here](#)) as a result of not being able to persist the Dynamic disk state in the (possibly absent) host OS. If your target disk is not initialized, and you need to restore from the rescue environment, then you must restore to a Basic disk, and convert back to dynamic once you have booted your (restored) Windows system. See the next section for more details.

2. The restore is by volume. As part of the restore configuration, volumes to be restored must be "dragged" to already configured Dynamic volumes on your target disk. It is not possible to reconfigure the target volume size, so the "Restored partition properties" option is not available.

 You can also drag and drop dynamic volumes to Basic MBR or GPT partitioned or an uninitialized target disk. This enables you to convert a Dynamic disk back to Basic. This is not possible with Microsoft tools.

How to restore a bootable dynamic volume to an uninitialized disk


If your computer is not bootable, the restore must be run from the Reflect PE based rescue environment.

The process is complicated as it is not possible to create a Dynamic disk from the rescue environment.

Therefore, the recommended method is to restore up to the first 4 partitions from within the rescue environment ensuring the C: partition and your system reserved (if used) are included. Follow the restore steps, [here \(see page 208\)](#), noting that you **must drag each partition** from the backup layout to the target disk.


Note that if there is no target disk then start the PE command window (icon lower left). Then type

```
diskpart
list disks
```

 **Note:** If you don't see your target disk, then a driver is missing for your target mass storage interface. Please read about adding additional drivers [here](#).

Identify the target disk and note the disk number. Then type

```
sel disk <disk number>
clean
```

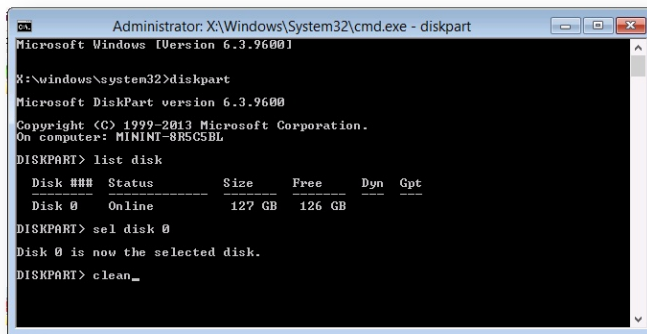
 **Note:** The clean command will reinitialize your disk. Any data will be lost. Please ensure that you select the correct disk!

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To update windows PE with the new disk configuration, type

```
rescan  
exit
```

Example diskpart session ...



```
Administrator: X:\Windows\System32\cmd.exe - diskpart  
Microsoft Windows [Version 6.3.9600]  
X:\windows\system32>diskpart  
Microsoft DiskPart version 6.3.9600  
Copyright (C) 1999-2013 Microsoft Corporation.  
On computer: MININT-8B5G5BL  
DISKPART> list disk  


| Disk ### | Status | Size   | Free   | Dyn | Gpt |
|----------|--------|--------|--------|-----|-----|
| Disk 0   | Online | 127 GB | 126 GB |     |     |

  
DISKPART> sel disk 0  
Disk 0 is now the selected disk.  
DISKPART> clean_
```

Then use the refresh link in the backup tab. You should now be able to see the disk.

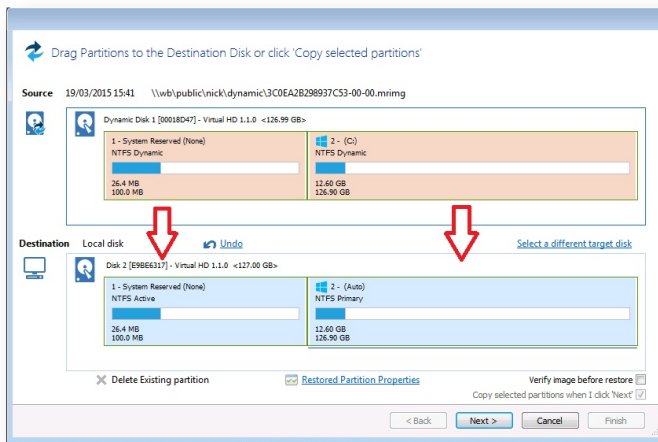


You should now be able to drag / drop up to 4 partitions from your image to your target disk.



If your Dynamic disk is UEFI / GPT configured, you will be able to restore all your partitions to a Basic GPT disk.

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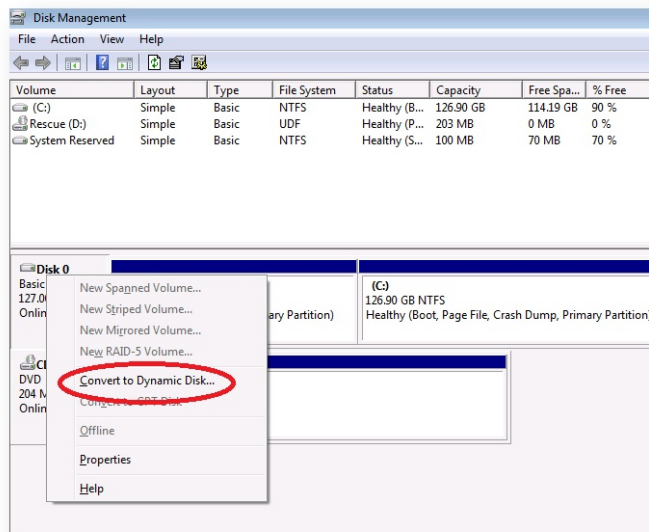


Once the restore has completed you should be able to reboot your computer, this time booting into your restored Windows system.



If your system doesn't reboot, you can use the fix boot problems feature.

You now have the choice of leaving your system as it is or converting back to Dynamic configuration. To do this, use Disk Management, right clicking on the disk and selecting "Convert to Dynamic Disk ...".



Once you have taken this step, if you have already restored all your volumes from the rescue environment, the restore task is complete.

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If you have further volumes to restore, you should use [Disk Management](#) (or [diskpart](#)) to create the new volumes of a large enough size to contain the partitions to be restored. You can then restore any additional partitions that could not be restored from the rescue environment.

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Drive letters assigned to restored or cloned partitions

This article explains how to change the drive letters of restored or cloned partitions during and after the restore or clone process.

How Windows assigns drive letters to mounted volumes (drives) on your system

Windows maintains driver letter persistence by storing a reference to each mounted volume and drive letter in the system registry using the following registry key

```
HKEY_LOCAL_MACHINE\SYSTEM\MountedDevices
```

<https://technet.microsoft.com/en-us/library/cc978525.aspx>

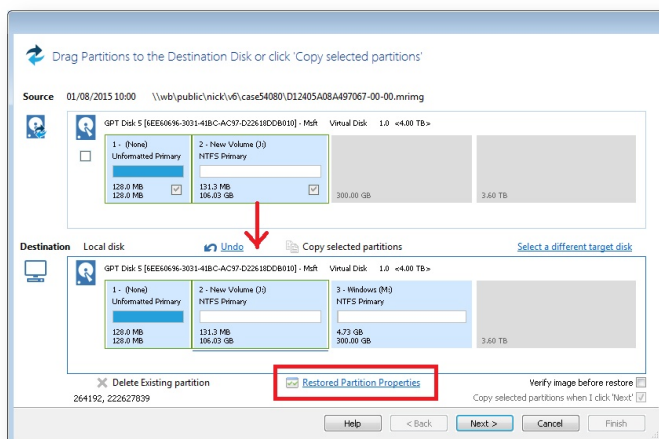


Note: When restoring using the **Windows PE** rescue media, the letters assigned to restored partitions are **temporary** for that Windows PE session only. When you **boot into the restored system**, drive letter assignments will be **exactly the same** as they were when the image was created.

Changing drive letters in the 'Restore Wizard' or 'Clone Wizard' when running Reflect in Windows

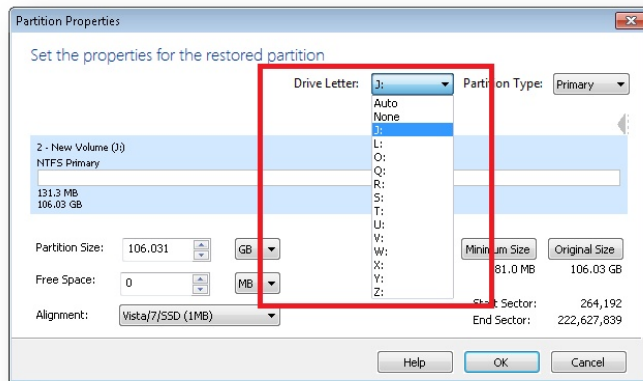
1. In the Restore Wizard **Click the 'Restored Partition Properties'** link after copying or dragging the partition to it's destination on the target disk:

Note: In the Clone Wizard **Click 'Cloned Partition Properties'.**



2. In the 'Partition Properties' dialog **click the 'Drive Letter' combo box:**

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Property	Description
Auto	Let Windows automatically assign the next available drive letter
None	No drive letter will be assigned to the restored partition
Letter	Select a drive letter to use from this list of free letters. The original drive letter will be selected by default.

Changing drive letters using the Windows Disk Management Console after restoring or cloning

Windows ships with a utility to maintain local drives and partitions called the **Windows Disk Management Console** (DMC). Using the DMC you can easily change the drive letters assigned to any partition on your system, (except for your system drive C:),

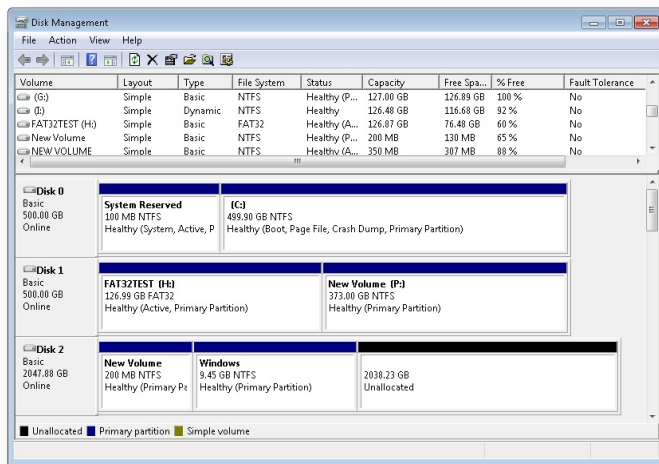
1. To start the Windows Disk Management Console

Click 'Start' or press the Windows Key, Type the following and press enter:

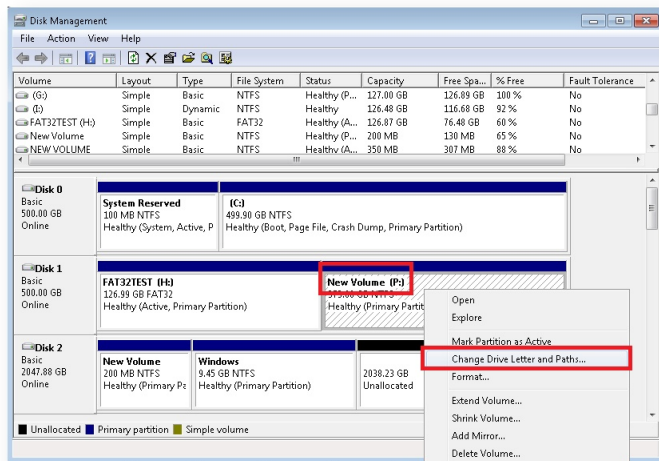
```
diskmgmt.msc
```

2. The DMC starts as shown below:

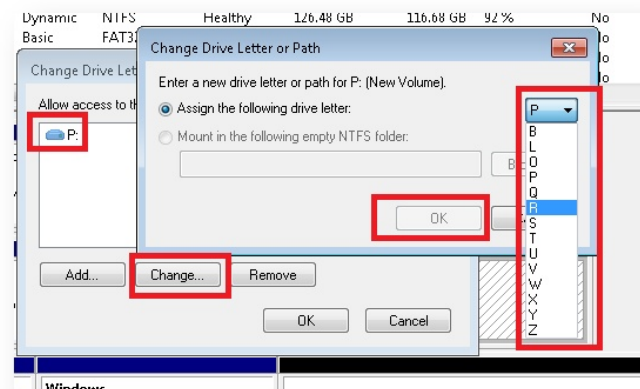
Macrium Reflect v6 User Guide



3. Right click on the partition that you want to change in the lower pane and select 'Change drive letters and paths':



4. In the dialog that opens, select the original drive letter, Click 'Change', Choose a new drive letter and finally Click 'OK'



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See also:

[Restoring and browsing \(see page 207\)](#)

[Restoring an image from within Windows \(see page 208\)](#)

[Restoring a System image from Windows \(see page 211\)](#)

[Modifying restore destination partition properties \(see page 214\)](#)

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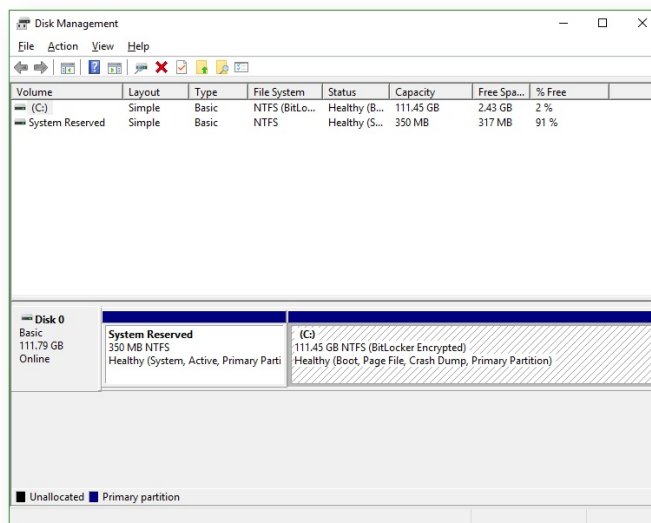
How to create a VHD and restore a backup to the VHD using Macrium Reflect



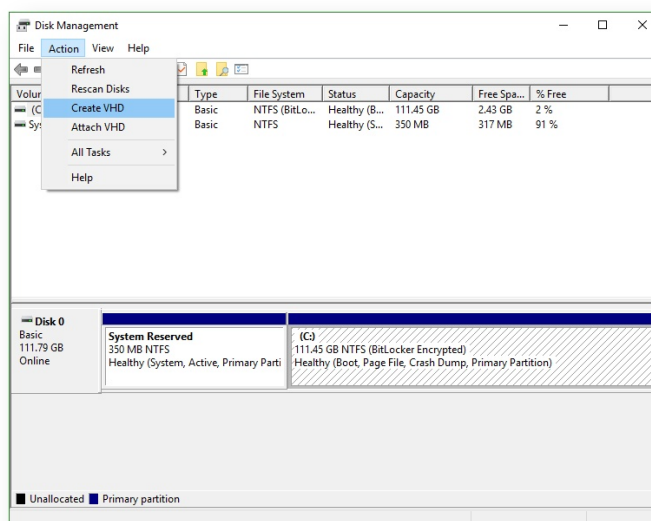
This article applies to Windows 7 and higher versions on Windows.

1. This section will take you through the creation of a VHD using the Windows Disk Management console and the mounting process.

a. Open Windows Disk Management console.

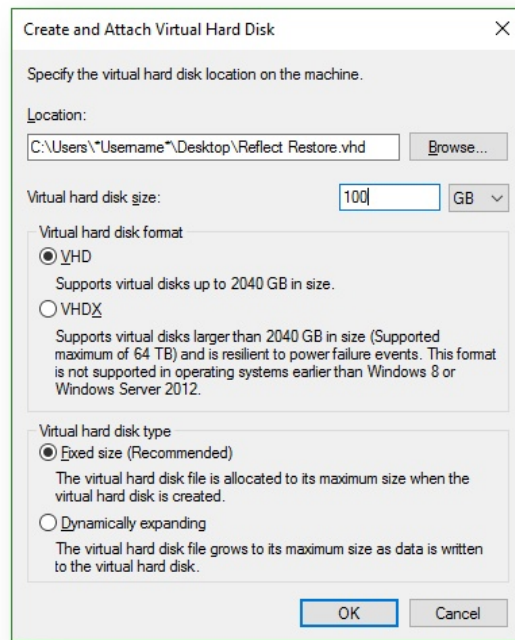


b. Click on Action followed by Create VHD.

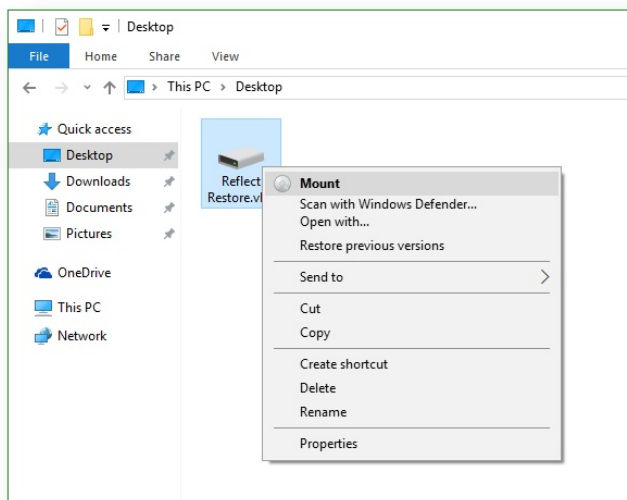


c. Set your desired options and click OK to generate the VHD at the set location.

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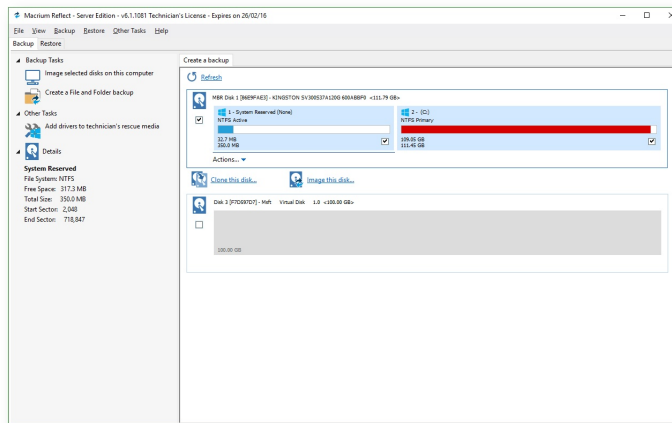
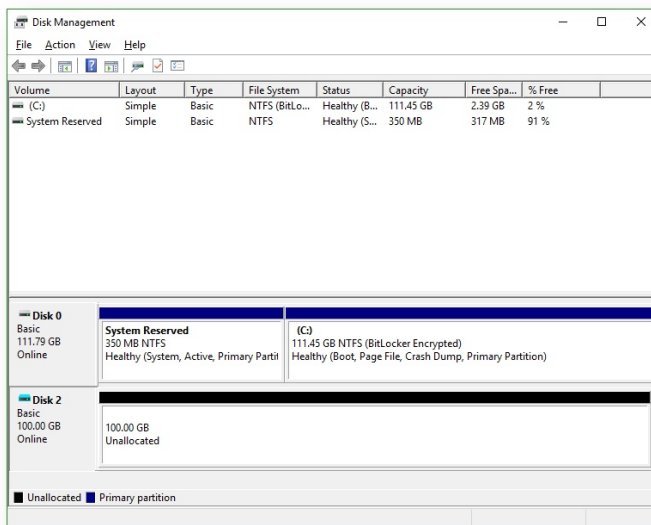


- d. Locate the VHD in Windows Explorer and mount it by right clicking the icon and **selecting the Mount** option.

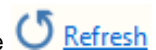


- e. Once Mounted, **Macrium Reflect Backup** tab and **Disk Management console** will now show the mounted VHD.

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If the **VHD** is not visible in Reflect after it has been mounted, please click the

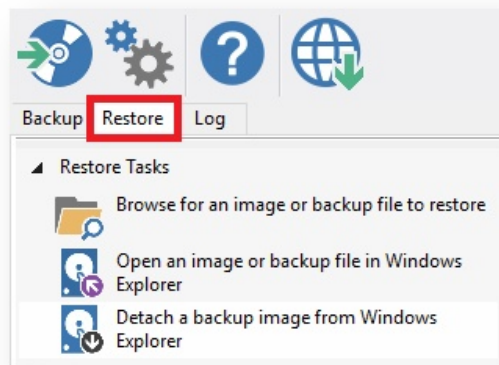


2. This section will take you through the restore process of your image to the VHD.

Before you begin: You must have a backup image of the disk ready to restore.

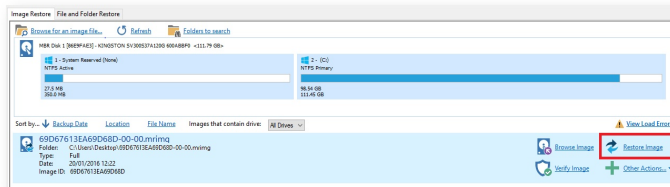
a. On the main screen, **select Restore**.

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Backup images available to be restored are shown in the main pane.

- b. Select the image you wish to restore and **click Restore Image**.



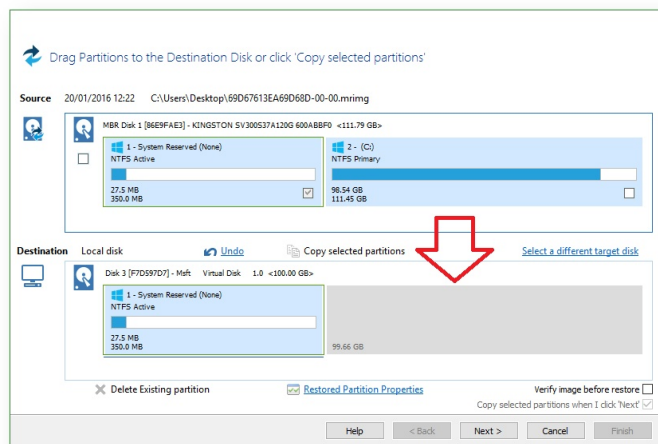
- c. The next dialog gives you the opportunity to modify the destination properties.

Moving and Resizing the restored partition

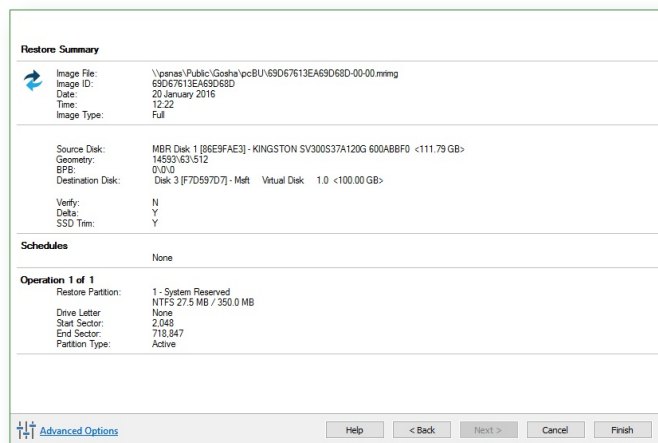
By default, partitions restore to their original locations if you **click 'Copy selected partitions'**. However, to drag partitions to different locations and resize them to use the available space. Simply drag the source partition to any available partition or free space on the target disk. You can also delete partitions on the target disk to make space. For more destination options and further information, see [Modifying restored partition properties](#) (see page 214).

Drag and drop the disk partitions from the **Source** image to the **Destination VHD**.

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d. Click **Next** to restore the image onto the VHD.



e. A summary screen is displayed confirming the choices that have been made, click **Finish**.



Note: You may need to run Macrium ReDeploy to enable a restored system image to boot into the Hyper-V VM. Please see [Re-deploying to new hardware \(see page 262\)](#) for more information.

Re-deploying to new hardware

From the rescue environment you can launch Macrium **ReDeploy** to adapt the recovered Windows system to its new environment whether that is a virtual machine or a different computer. With Macrium Reflect **ReDeploy**, you can restore an image to a replacement computer or even create virtual hard drives to virtualize the machine, a technique sometimes called Physical to Virtual or P2V.

Macrium **ReDeploy** is now included all editions of Macrium Reflect except for the Free Edition.

Further reading:

- [Re-deploying Windows to new hardware using Macrium ReDeploy \(see page 263\)](#)
- [Using Windows sysprep and deploying using Macrium Reflect \(see page 269\)](#)

Re-deploying Windows to new hardware using Macrium ReDeploy

Introduction

Macrium ReDeploy overcomes issues with Windows boot processes to run a Windows installation on new hardware. There are a variety of scenarios where you move a windows installation to a new machine, for example:

- Due to hardware failure or planned upgrade.
- Moving between a physical and a virtual machine (P2V / V2P).
- Changing a non-raid to a raid installation or legacy SATA to AHCI SATA.

Aspects of the Windows boot process can cause a boot failure after significant changes to the hardware, ReDeploy can overcome these.

Discovering hardware and association with matching device drivers is time consuming and must be undertaken while windows is being installed. It is skipped during a normal Windows boot making the boot delay acceptable.

Early in the boot process, the boot loader loads the Windows kernel (the core of the operating system) and the critical drivers required to get Windows up and running. If the new hardware configuration requires a new driver to read the disk containing the operating system then Windows will fail to boot.

When the kernel and critical drivers are loaded, the kernel starts. The kernel and its associated hardware abstraction layer (HAL) need to match the motherboard for best enabling. Drivers are optionally loaded to handle specific central processing unit (CPU) features. For a stable system, the driver needs to match the hardware, in this example, the CPU model.

ReDeploy detects changes to critical system features, locates relevant drivers and injects them into your Windows operating system so it boots.

ReDeploy makes the complex process of getting an off-line Windows operating system running, as easy and intuitive as possible. It does not, however, install the complete driver set for the new hardware. You can complete the driver installation for devices such as network and graphics adapters when your windows installation boots on your new hardware.

You need to run ReDeploy from the Windows PE Reflect rescue CD. This allows the new hardware to be detected and the configuration of the Windows system modified to enable it to boot.



Note: To transfer to a Windows Server install to new hardware use Macrium Reflect v6 Server edition for ReDeploy.

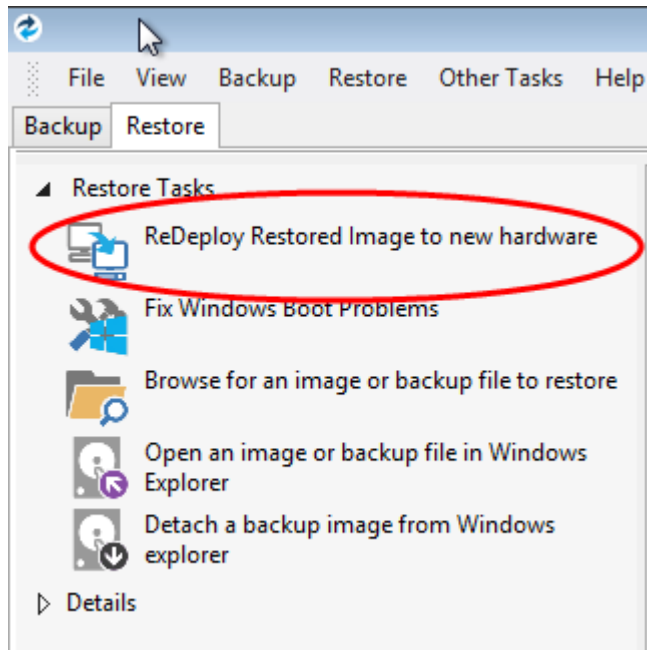
For non-server (workstation) installs use ReDeploy included with v6 Home, Workstation or the Server Edition. Please note that ReDeploy is not included in 30 trial versions of Macrium Reflect



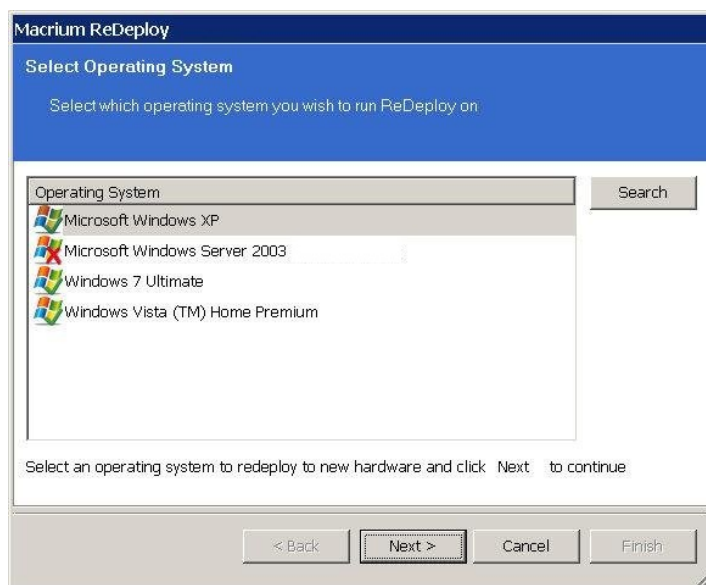
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Note: ReDeploy modifies an existing offline operating system to work with new hardware. Restore your system image to the PC being deployed before running ReDeploy. There is no need to reboot your PC after restoring an Image and before you run ReDeploy.

1. Boot the target PC with the Windows PE rescue CD or USB equivalent. (There is a link to a video on creating a Windows PE rescue CD at the bottom of this page).
2. Click **ReDeploy Restored Image to new hardware**.



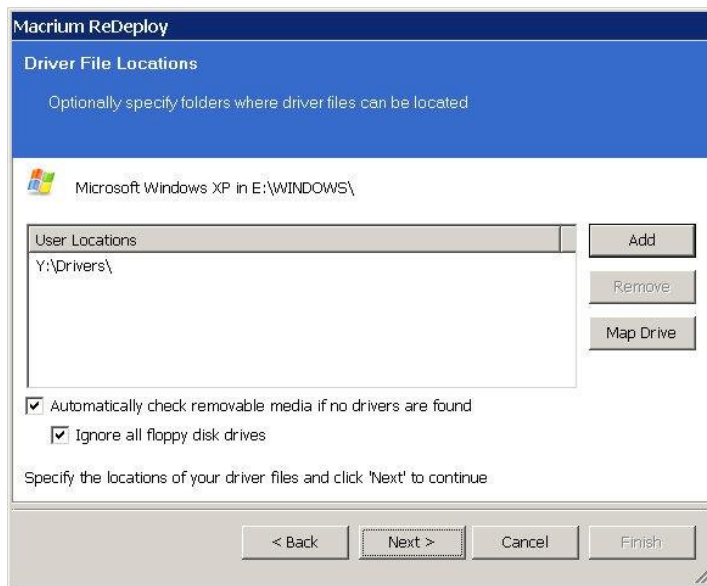
3. If you have a multi-boot system, then you will be presented with a list of operating systems, select the operating system to be redeployed. Click **Next**.



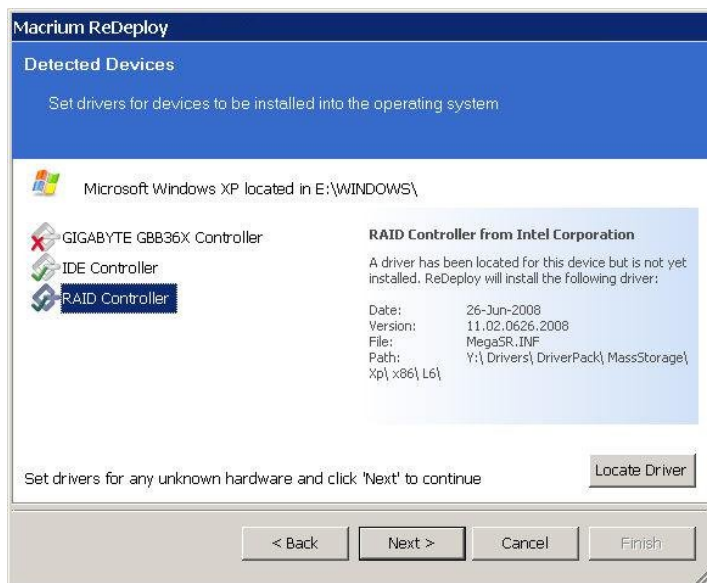
4. Specify driver locations for your mass storage devices (such as RAID card).

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- a. If you haven't already, insert a driver disk for the hardware you are going to boot from.
This will typically be the motherboard or RAID card driver CD.
 - b. Click **Add** to add driver locations.
You can also specify additional paths such as network folders.
 - c. Click **Map Drive** to add a network share.
 - d. Click **Next**.
5. ReDeploy searches through user specified driver locations. If none are specified or no matching drivers are found then it searches removable devices such as CD's and disk drives. ReDeploy also searches through Windows' database of drivers.



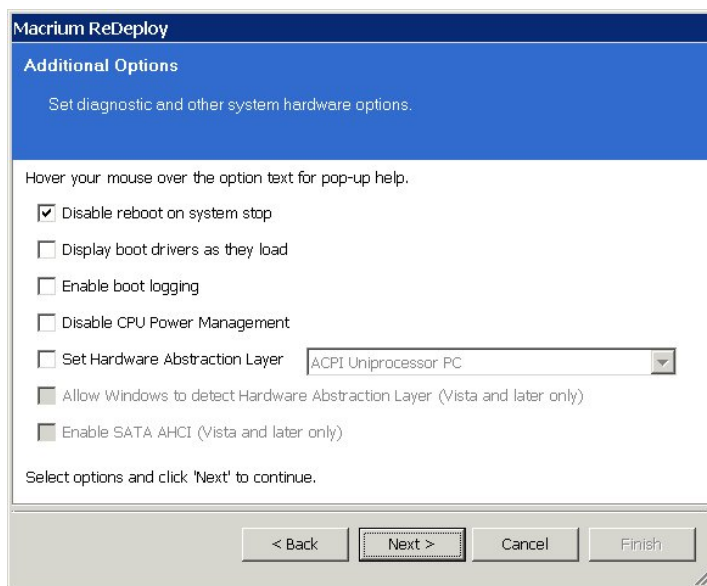
6. ReDeploy seeks drivers for all discovered mass storage devices and displays a list with details, Click **Next**.



For each mass storage device, there are three possibilities:

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- a. The driver is already installed. It might still need to be enabled at boot, this is done automatically.
 - b. The driver is located, either from a CD, user specified path or from the Windows database. This driver is installed on completion of ReDeploy.
 - c. No matching driver is located.
7. If no driver is located, or you choose to override the displayed driver, then use **locate driver** to manually specify an .inf file.
If you have multiple mass storage interfaces in your system, you only need to locate drivers for hardware that contains the Windows system and active partitions.
8. Review displayed options, leaving them as default if possible. Click **Next**.
If you are having trouble booting these options can help to resolve issues. For more information about them options see below:



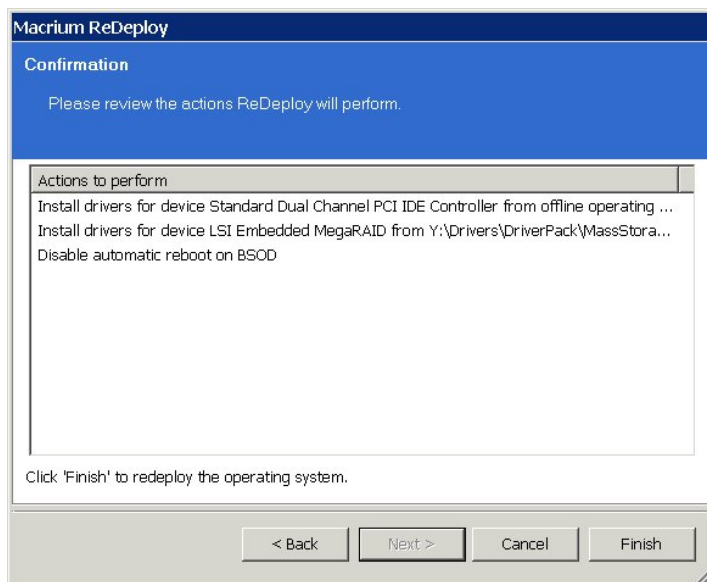
Option	Description
Disable reboot on system stop	Set this option to stop automatic rebooting if a blue screen of death (BSOD) occurs while Windows is loading or running. If this option is not set and Windows generates a BSOD, there will be no time to note the BSOD error codes.
Display boot drivers as they load	Set this option to show which drivers are being loaded as Windows loads. Once Windows is loading and running without issue this option can be reverted using the Windows MSCONFIG utility. You can use the Pause/Break key to freeze the list as it scrolls past, use space to un-pause.
Enable boot logging	Set this option to log drivers being loaded by Windows as it loads. The resulting log file 'ntblog.txt' can be found in the windows folder. Once Windows is loading and running without issue this option can be reverted using the Windows MSCONFIG utility.

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Option	Description
Disable CPU Driver	Set this option to disable CPU drivers. This may be useful if you see BSOD's in the selected HAL drivers or system lockup on entering standby or shutdown.
Set Hardware Abstraction Layer	Set this option to choose which Hardware Abstraction Layer is to be used in the selected Windows operating system. The recommended HAL for this machine is the one initially selected. If you have the incorrect HAL configured, your Windows installation is unstable and can cause random BSOD's or lock ups after Windows boots. In particular, if you are redeploying from or to Virtual Box with an advanced programmable interrupt controller (APIC) unchecked (the default) or very old physical hardware, set a new HAL.
Allow Windows to detect Hardware Abstraction Layer	Set this option to allow Windows to determine the best Hardware Abstraction Layer to use at boot time. This is a Vista and later only option.
Enable SATA AHCI	Set this option to enable support for generic SATA AHCI hardware. You will typically also need to enable an option in your BIOS for your mass storage hardware to operate in this mode. This is a Vista and later only option.

9. Review the actions to be performed and click **Finish** to apply them to the target operating system.

A log file **ReDeploy.log** saves to the drive containing the redeployed operating system.



After clicking **Finish** to inject drivers and apply your settings you see a confirmation dialog, and you can reboot your OS which should now be compatible with your new hardware.

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Note: Check there is a tick in the checkbox against **Check for unsupported devices each time the rescue media loads** before burning the Windows PE rescue CD, so that you can add additional drivers when you boot on new hardware.

Using Windows sysprep and deploying using Macrium Reflect

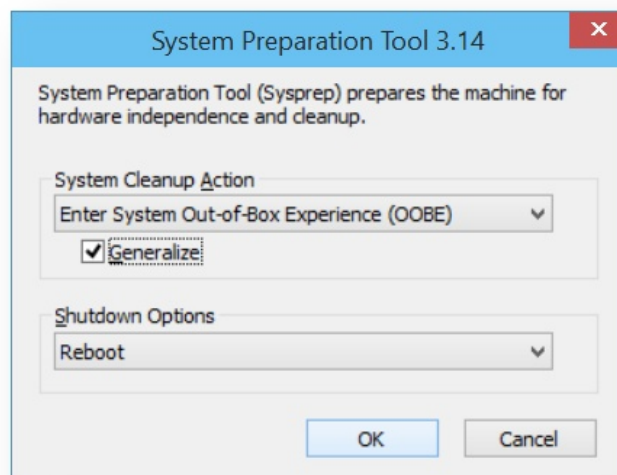
Using the [Windows sysprep](#) utility you can prepare a machine to be deployed across multiple other machines.

Windows provides a handy utility called **sysprep** which allows you to prepare a master PC image that is configured and set up to be deployed across multiple workstations. By running sysprep, Windows prepares the machine so that when installed on a workstation, the System Admin is prompted for Windows Activation and environment configuration, as if the PC has been installed from scratch.

To prepare a PC to be syspreped, ensure that it contains all the applications and configuration you want the deployed systems to have installed.

Note: Unless you have sufficient licenses for the machines you are deploying to, Reflect should be uninstalled from the PC that will be used for the base image. However, it is essential to have made a Windows PE based [Macrium Reflect rescue CD](#) (see page 69) on that PC first.

1. Run sysprep:
 - a. Open Windows Explorer and navigate to C:\Windows\System32\sysprep.
 - b. Run **sysprep.exe**.
 - c. Ensure that **System Cleanup Action** is set to **Out-of-Box Experience**, and that **Generalize** is checked as below.



- d. Shutdown options are your choice, selecting **Quit** ensures the system does not reboot or shutdown automatically.
 - e. Click **OK**.

This prepares the machine so that it can be deployed to other PCs.

2. Shutdown the PC and boot it to the Macrium Reflect rescue environment.
3. Take an image of the PC using Macrium Reflect and store it to a USB device or a network location.
4. When this is complete, you can deploy the image to the workstations you require.

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5. When the restore is complete, boot the new PC.

Windows asks for a new license key and some environment settings.

Macrium Reflect Server Plus for Exchange and SQL

This article is an introduction to **Macrium Reflect v6 Server Plus for Exchange and SQL**

Macrium Reflect v6 Server Plus has all the functionality of Macrium Reflect v6 Server and additional features for Microsoft Exchange servers and SQL servers.

To get you started the following are some useful tutorials:

- [Introduction to Macrium Reflect \(see page 7\)](#)

Microsoft Exchange guides:

- [Backing up Microsoft Exchange databases \(see page 149\)](#)
- [Restoring MS Exchange databases \(see page 231\)](#)
- [Restoring emails with Mailbox Restore \(see page 235\)](#)
- [Setting up permissions for Mailbox Restore \(see page 237\)](#)
- [Adding MS Exchange search folders \(see page 240\)](#)

Microsoft SQL guides:

- [Backing up MS SQL Databases \(see page 156\)](#)
- [Running continuous backup of SQL databases \(see page 197\)](#)
- [Restoring MS SQL \(see page 227\)](#)

Command line operations with Macrium Reflect

- Installing Macrium Reflect from the command line (see page 273)
- Using Macrium Reflect from the command line (see page 275)
- Verifying image and backup files from the command line (see page 278)

Installing Macrium Reflect from the command line

Introduction

This article explains how to install and uninstall on the command line

Applies to:

Macrium Reflect version 5.x and 6.x all editions and windows versions.

About the Macrium installation process

The macrium installer is msi based with an executable wrapper to ensure it is launched in the correct mode

Command line installation

In most cases, just invoking the installer interactively will be the most effective way to install Reflect. However, in some cases, particularly if the installation is to be automated across many PCs, it may be more desirable to enable the installation to complete without user intervention. To do this, first download the installer using [ReflectDL](#). Then invoke using the following options.

```
v6.X.XXX_reflect_server_setup_x64.exe /passive /l log.txt LICKEY=XX-XXXX-XXXX-XXXX-XXXX-XXXX-XXXX-XXXX
```

Or, if you have ordered multiple licenses, you can install them on multiple computers with the same command. If you run out of licenses, the install will fail.

```
v6.X.XXX_reflect_server_setup_x64.exe /passive /l log.txt ORDERREF=NNNNNNNNN  
ORDEREMAIL=sample_email@macrium.com
```

If the installation fails, consult the log file, specified by the /l parameter to discover why.

The above examples will display a progress bar. If you wish the install to be completely invisible, replace /passive with /qn.



1. The installer name will vary dependent on edition and platform.
2. This will only work with full (not upgrade) licenses.
3. An Internet connection is required.

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4. If you have made multiple orders, you can specify a colon separated list, eg ...

ORDERREF=NNNNNNNN:OOOOOOOO:PPPPPPP etc

They will be searched in the same order as specified.

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Using Macrium Reflect from the command line

You can retrieve a prompt for all the command line arguments by simply typing `reflect -h` from the command line.

Running a Backup

The command line form is as follows: `reflect.exe [-v | -e [-w] [-full | -inc | -diff] [xml filename]]` Explanations for the switches are as follows:

-h	This help text
-e	Execute the XML file. If no full / diff / inc qualifier is used, a full backup is performed by default.
-v	Validate the XML file and exit
-w	If Reflect is busy then wait until available otherwise exit immediately
-full	Run a full backup
-diff	Run a differential backup
-inc	Run an incremental backup
-pass	Password. Overrides the password saved in the xml file.



Please note that the XML file name is the fully qualified path.

Examples

To validate an XML file

```
reflect.exe -v "c:\backup.xml"
```

To execute an XML file

```
reflect.exe -e "c:\backup.xml"
```

To execute an XML file with wait if busy

```
reflect.exe -e -w "c:\backup.xml"
```

To execute an XML file and create an incremental image

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```
reflect.exe -e -inc "c:\backup.xml"
```

Mounting an image

reflect.exe [Path To Image File] -b [-auto -drives [Drives[s]] -pass [PASSWORD]] Explanations for the switches are as follows:

-b	Browse image
-auto	Automatically assign drive letters. If not specified then you will be prompted
- drives	A comma separated list of drive letters to use. If not specified then the next available letters are used
-pass	The password for protected image files

The image file name is the fully qualified path. If "LAST_FILE_CREATED" is specified then the last image created in the current Windows session is mounted.

Examples

To mount an image and prompt for a drive letter to use

```
reflect.exe "D:\901DBF91346B9A81-00-00.mrimg" -b
```

To mount all partitions in an image using the next available drive letter(s)

```
reflect.exe "D:\901DBF91346B9A81-00-00.mrimg" -b -auto
```

To mount all partitions for the last image created

```
reflect.exe "LAST_FILE_CREATED" -b -auto
```

To mount all partitions in an image using drive letters j,k,l

```
reflect.exe "D:\901DBF91346B9A81-00-00.mrimg" -b -auto -drives j,k,l
```

To mount all partitions in a password protected image using drive letters j,k,l

```
reflect.exe "D:\901DBF91346B9A81-00-00.mrimg" -b -auto -drives j,k,l -pass "PWD"
```

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Unmounting an image

```
reflect.exe [Drive Letter] -u
```

Explanations for the switches are as follows:

-u	Unmount image
----	---------------

If a drive letter isn't specified then all mounted images are unmounted

To unmount an image from drive letter 'j'

```
reflect.exe J -u
```

To unmount all mounted drives

```
reflect.exe -u
```

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Verifying image and backup files from the command line

Introduction

This article explains how to verify Macrium Reflect image and backup files using the standalone command line verification tool '**mrverify.exe**'. **mrverify.exe** supports individual file verification as well as folder and sub-folder file search and verification.

To verify backups using the Macrium Reflect user interface see: [Verifying image and backup files \(see page 172 \)](#)



Please use the link below to download:

<http://updates.macrium.com/reflect/utilities/mrverify.exe>



*Please note that **mrverify.exe** must be run from an Administrator command prompt. For instructions on how to do this please see [here](#).*

The following command line switches are supported:

```
mrverify.exe "full path to image file or folder" -p[--password] "password" -r[--recurse] -l[--logfile] "logfile name"
```

File name or path with wild card can be used. e.g;

```
d:\backups\*
```

or

```
d:\backups\1FF33614674A6438-00-00.mrimg
```

Switch	Description
-p OR --password	The optional password that was used to protect and/or encrypt the backup

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Switch	Description
-r OR --recurse	Scan all sub-folders if a folder is specified. The default is not to recurse.
-l OR --logfile	Full path to output log file. This file will be created for each run and contains the file name and verification status ' success ' or ' fail ' .
-s OR --set	Verify all files in the set. Use if verifying individual file s to ensure they can be restored. When verifying all files in a folder this isn't necessary. The default is not to verify the entire set.
-h OR --help	This help output

Examples:

```
mrverify.exe "d:\backups\1FF33614674A6438-00-00.mring"
```

```
mrverify.exe "d:\backups\1FF33614674A6438-00-00.mring" --set --password  
"mypassword" -l "c:\verifylog.txt"
```

```
mrverify.exe "d:\backups\*" --password "mypassword" -r -l "c:\verifylog.txt"
```

On success mrverify.exe will return '0'. If any file fails verification then the return code will be '1'.

The following success/failure text will be displayed in the command window and log:

Verify Success	The file contained no errors.
Verify Failure	The file could not be verified successfully. Try the verification process again using the Macrium Reflect user interface. This may give more information on the problem.
Backup set is not complete. At least one file may be missing	At least one backup file required to restore this file cannot be opened and/or located in the same folder. This message is displayed as a Warning or an Error failure condition if the --set command line switch is used.

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Password Error	The backup file is password protected and/or encrypted and the supplied password is not correct.
-----------------------	--

Generating scripts and batch files

Introduction

Macrium Reflect includes the ability to automatically create VBScript, PowerShell and MS-DOS source files to add pre and post backup functionality to your backup jobs. This enables system administrators to manage complex backup scenarios.

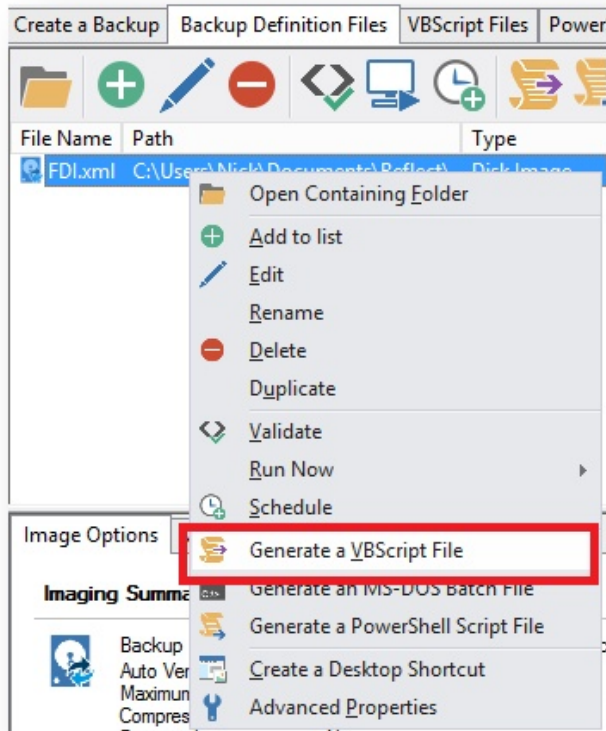
- [Generating a VBScript source file \(see page 282\)](#)
 - [Using VBScript to run sequential backups \(see page 292\)](#)
- [Generating an MS-DOS batch file \(see page 295\)](#)
- [Generating a PowerShell source file \(see page 298\)](#)

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Generating a VBScript source file

For an example of a generated VBScript source file please see [Example VBScript Source](#)

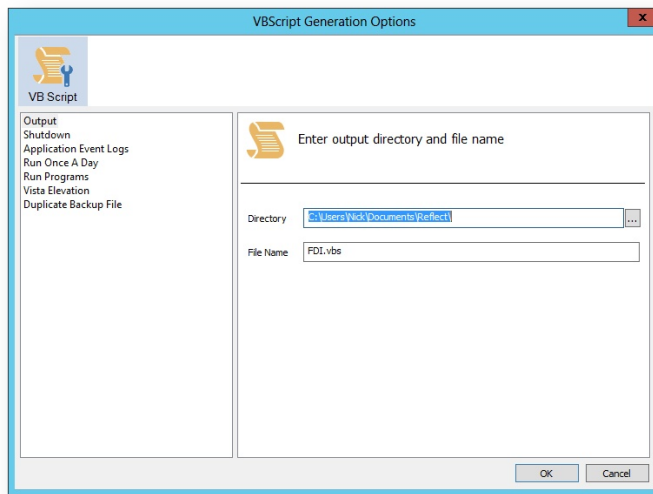
To generate a VBScript file select the 'XML Definition Files' tab on the main window then right click on a file and select '**Generate a VBScript file**'.



This opens the **VBScript Generation Options** dialog:

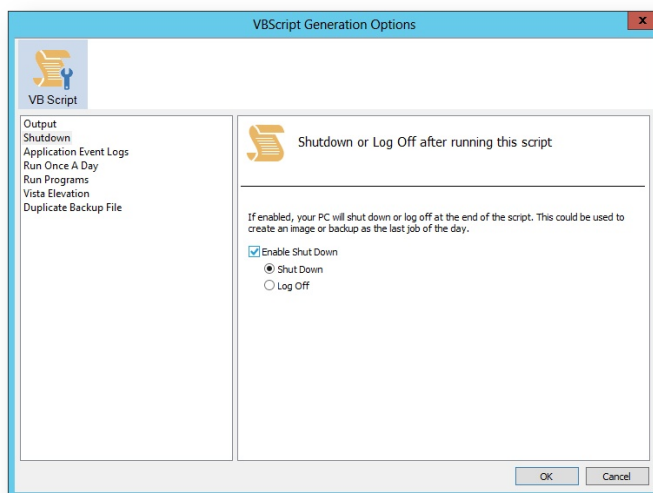
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Output



Property	Value
Directory	The folder where the source file is saved
File name	The name of the VBScript source file. This defaults to the XML file name with a .vbs extension

Shutdown



Generated code...

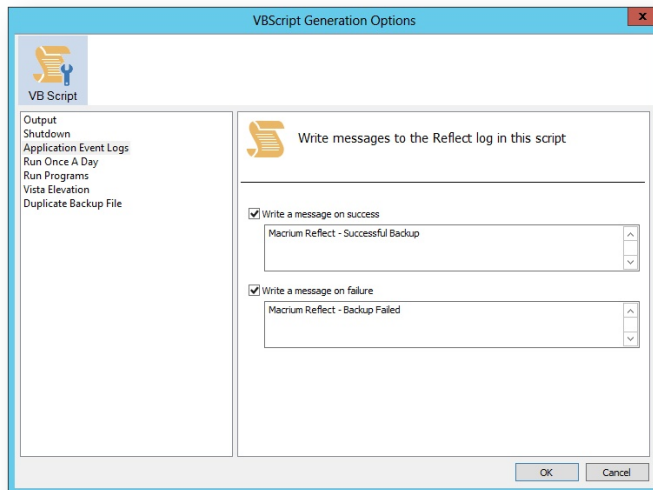
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```
' Issue shutdown command
objShell.Run "shutdown -s"
```

Property	Value
Enable Shut Down	Select to enable this property
Shut down	The PC will shut own at the end of the backup
Log Off	The user will be logged out at the end of the backup

Application Event logs

Please note that Macrium Reflect Server and Server Plus Edition includes Windows Event logging built-in.



Generated code...

```
if iReturnCode = 2 then
' Handle XML validation error
elseif iReturnCode = 1 then
' Handle backup error
    objShell.LogEvent 1, "Macrium Reflect - VBScript Backup Failed"
elseif iReturnCode = 0 then
' Everything OK
    objShell.LogEvent 0, "Macrium Reflect - Successful VBScript Backup"
end if
```

Property	Value
Write a message on success	Enable a Windows Event on successful backup

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Property	Value
	Enter the message text in the edit box below
Write a message on failure	Enable a Windows Event for failed backups
	Enter the message text in the edit box below



Note: The Windows Event logs generated by this script will have WSH (Windows Scripting host) as the message source

Level	Date and Time	Source	Task Category
Information	07/04/2015 14:15:35	WSH	None

Event 0, WSH

General Details

Macrium Reflect - Successful VBScript Backup

Log Name: Application

Source: WSH

Event ID: 0

Level: Information

User: N/A

Logged: 07/04/2015 14:15:35

Task Category: None

Keywords: Classic

Computer: Office2

Run Once a Day

VBScript Generation Options

VB Script

Output
Shutdown
Application Event Logs
Run Once a Day
Run Programs
Vista Elevation
Duplicate Backup File

Only run this script once a day

It can be useful to execute a script the first time you logon, logoff or shut down. Using this component you can be sure that an event triggered task only runs this script once a day.

☐ Run Once a Day.

OK Cancel

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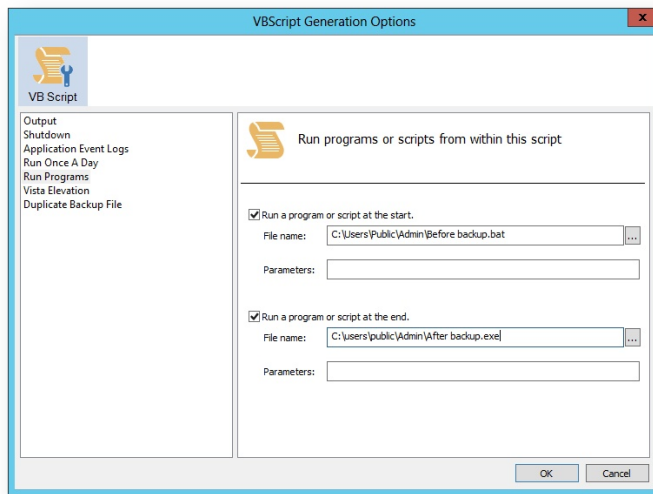
Generated code...

```
' The following function call ensures that this script only runs once a day
  If HasRunToday Then
    WScript.Quit
  End If
.....
'*****
' * Function: HasRunToday
' *
' * Purpose:  determines if this script has run today
' *
' *
' * Input:    None
' * Output:   true if has run today false otherwise
' *
'*****
Function HasRunToday
  Dim RegScriptKey
  Dim LastRunDate
  Dim objShell
  Set objShell = WScript.CreateObject("WScript.Shell")
  RegScriptKey = "HKCU\SOFTWARE\Macrium\Reflect\Scripts\" & WScript.
ScriptFullName & "\LastRun"
  'Check if script has run today
  ON ERROR RESUME NEXT
  LastRunDate = objShell.RegRead(RegScriptKey)
  If LastRunDate = cstr(Date) Then
    HasRunToday = true
  Else
    objShell.RegWrite RegScriptKey, Date,"REG_SZ"
    HasRunToday = false
  End If
  Set objShell = nothing
End Function
```

Property	Value
Run Once a Day	If selected, will only enable this script to run once per day. This is useful for example if you want a backup to happen at first login or shutdown.

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Run Programs



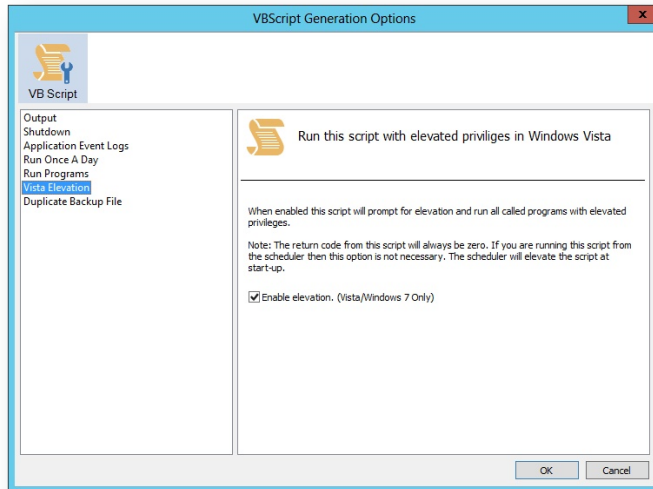
Generated code...

```
' Run program before backup
  objShell.Run "" "C:\Users\Public\Admin\Before backup.bat"", 1, true
' Do the backup
  ExitCode = Backup ("" "C:\Program Files\Macrium\Reflect\reflect.exe" -e -w
<BACKUP_TYPE> "C:\Users\Dev\Documents\Reflect\example.xml""")
' Run program after backup
  objShell.Run "" "C:\users\public\Admin\After backup.exe"", 1, true
```

Property	Value
Run a program or script at the start	Select to enable a program or script to run before the backup starts
File name	The path and executable file name
Parameters	Optional command line parameters for the program
Run a program or script at the start	Select to enable a program or script to run when the backup ends
File name	The path and executable file name
Parameters	Optional command line parameters for the program

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Vista Elevation



Generated code...

```
Sub VBMain()  
    Dim objShell  
    Dim ExitCode  
    ' Elevate this script for Admin privileges in Vista  
    Elevate  
    .....  
    '*****  
    '* Sub:      Elevate  
    '*  
    '* Purpose: Elevates this script for Vista UAC.  
    '*           This means that only one UAC Elevation prompt is displayed and  
    '*           functions/programs will not fail if they require admin privileges  
    '*  
    '* Input:   None  
    '* Output:  None  
    '*  
    '*****  
Sub Elevate  
    Dim ShellApp  
    Dim objShell  
    Dim objWshProcessEnv  
    ' Don't elevate if run from Windows Task Scheduler  
    If WScript.Arguments.Count > 0 Then  
        If WScript.Arguments.Item(0) = "-s" then  
            Exit Sub  
        End If  
    End If  
    Set objShell = WScript.CreateObject("WScript.Shell")  
    Set objWshProcessEnv = objShell.Environment("PROCESS")  
    If objWshProcessEnv("ELEVATED_APP") <> "True" Then  
        objWshProcessEnv("ELEVATED_APP") = "True"  
        Set ShellApp = CreateObject("Shell.Application")  
        Call ShellApp.ShellExecute(""" & WScript.FullName & """, "" &  
WScript.ScriptFullName & "" & " " & GetBackupTypeParameter, , "runas")  
        set ShellApp = nothing
```

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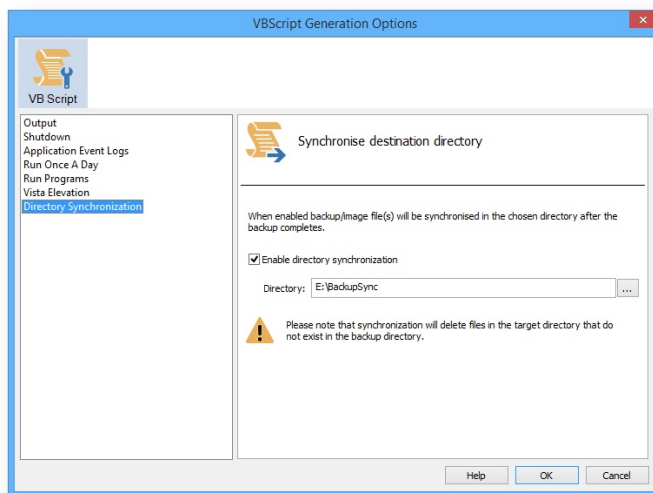
```

Set objWshProcessEnv = nothing
wscript.quit
End If
Set objWshProcessEnv = nothing
Set objShell = nothing
End Sub

```

Property	Value
Enable Elevation	If selected will enable UAC elevation for the entire script. This enables functions and programs to run outside the context of Macrium Reflect without requesting further elevation.

Directory Synchronization



Generated code...

```

SynchroniseDirectories ExitCode, "C:\C++"
.....
' *****
' * Function: RobocopyExists
' *
' * Purpose: determines whether the program Robocopy can be called from the
' *           command line.
' *
' * Input:    None
' * Output:   boolean - true if Robocopy exists
' *
' *****
Function RobocopyExists()
    On Error Resume Next
    Dim objShell
    Dim objExec
    Set objShell = WScript.CreateObject("WScript.Shell")

```

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```
Set objExec = objShell.Exec ("robocopy.exe", 0)
If Err.Number = 0 Then
    RobocopyExists = True
Else
    RobocopyExists = False
End If
End Function
'*****
'* Function: SynchroniseDirectories
'*
'* Purpose: Copies all files created by the previous backup / image
'*           to a supplied directory. Uses Macrium environment variables to
'*           determine which files to copy.
'*
'* Input:    ExitCode - The exit code of the last backup
'*           strBackupDirectory - Directory to copy to
'*
'*****
Function SynchroniseDirectories(Byval ExitCode, Byval strSyncDirectory)
    Dim objShell
    Dim objWshProcessEnv
    Dim strEnvPrefix
    Dim strBackupDirectory
    Dim strCmdLine
    Dim iReturnCode
    Dim fs
    Dim objSyncFiles
    Dim objBackupDirectory
    Dim objSyncDirectory
    Dim objBackupFile
    Dim objSyncFile
    Dim strExtension
    Dim dateBackupFile
    Dim dateSyncFile
    ' Only copy files if backup was successful
    if ExitCode <> 0 Then
        Exit Function
    End If
    Set objShell = WScript.CreateObject("WScript.Shell")
    Set objWshProcessEnv = objShell.Environment("VOLATILE")
    ' Get the prefix for the last backup set
    strEnvPrefix = objWshProcessEnv("MACRIUM_PREFIX")
    ' Get the directory where we just created a backup
    strBackupDirectory = objWshProcessEnv(strEnvPrefix + "_DIRECTORY")
    If right(strBackupDirectory, 1) = "\" Then strBackupDirectory = left
(strBackupDirectory, len(strBackupDirectory)-1)
    If right(strSyncDirectory, 1) = "\" Then strSyncDirectory = left
(strSyncDirectory, len(strSyncDirectory)-1)
    If RobocopyExists Then
        strCmdLine = "robocopy ""<SOURCE>"" ""<DESTINATION>"" *.mr* /copy:DAT
/lev:0 /purge /r:0"
    Else
        ' Robocopy does not exist - using xcopy
        Set fs = CreateObject("Scripting.FileSystemObject")
        Set objBackupDirectory = fs.GetFolder(strBackupDirectory)
        Set objSyncDirectory = fs.GetFolder(strSyncDirectory)
        For Each objSyncFile in objSyncDirectory.Files
            strExtension = fs.GetExtensionName(objSyncFile)
            dateSyncFile = objSyncFile.DateLastModified
            If Left(strExtension,2) = "mr" Then
                ' Check if file has been deleted
            End If
        Next
    End If
End Function
```


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```

        If Not(fs.FileExists(strBackupDirectory+"\\"+objSyncFile.name)) Then
n
            fs.DeleteFile(objSyncFile)
        Else
            ' Check if file has been modified
            Set objBackupFile = fs.GetFile(strBackupDirectory+"\\"
+objSyncFile.name)
            dateBackupFile = objBackupFile.DateLastModified
            If DateDiff("m", dateBackupFile, dateSyncFile) <> 0 Then
                fs.DeleteFile(objSyncFile)
            End If
        End If
    End If
Next
    strCmdLine = "xcopy "<SOURCE>\"*.mr*" " "<DESTINATION>" /c /d /h /i /v
/y"
End If
    strCmdLine = Replace(strCmdLine,"<SOURCE>", strBackupDirectory)
    strCmdLine = Replace(strCmdLine,"<DESTINATION>", strSyncDirectory)
    iReturnCode = objShell.Run(strCmdLine,0,true)
    if iReturnCode <> 0 then
        ' Handle synchronisation error
        else
        ' Everything OK
        end if
    ' Clean up
        Set objShell = nothing
        Set objWshProcessEnv = nothing
    End Function

```

Property	Value
Enable file copy	If enabled will copy the files from the backup to the supplied destination
Directory	Enter the folder that you want to copy/archive your backup files to
Show Progress Dialog	If selected will show the file copy progress otherwise the copy will be silent

Click **'OK'** to generate the VBScript source file

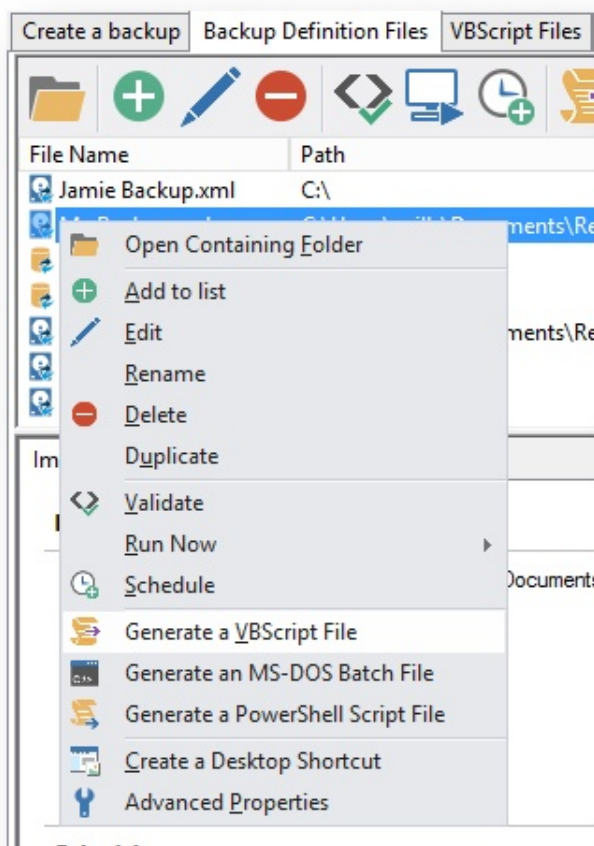
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Using VBScript to run sequential backups

Using VBScript you can schedule multiple backups or images and run them one after the other. This enables guaranteed execution sequence and additional functionality can be coded between backups and/or at the end of the sequence.

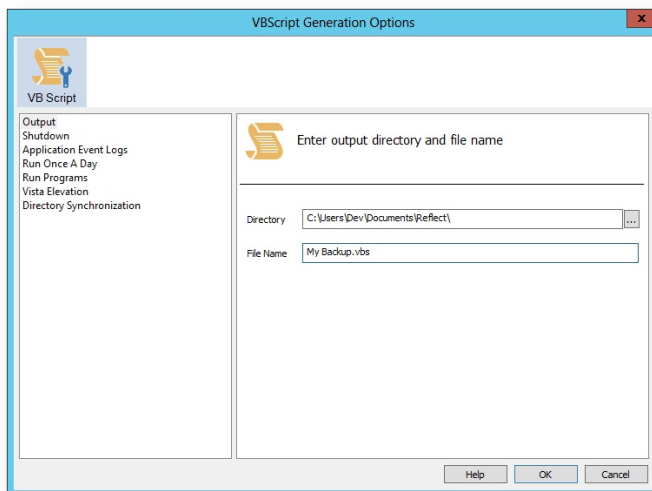
To create a VBScript to run backups sequentially

1. Step through the backup or image wizard and create the required XML backup definitions files.
2. In the Backup Definition Files tab, right-click a backup definition file and choose **Generate a VB Script File** from the short-cut menu.

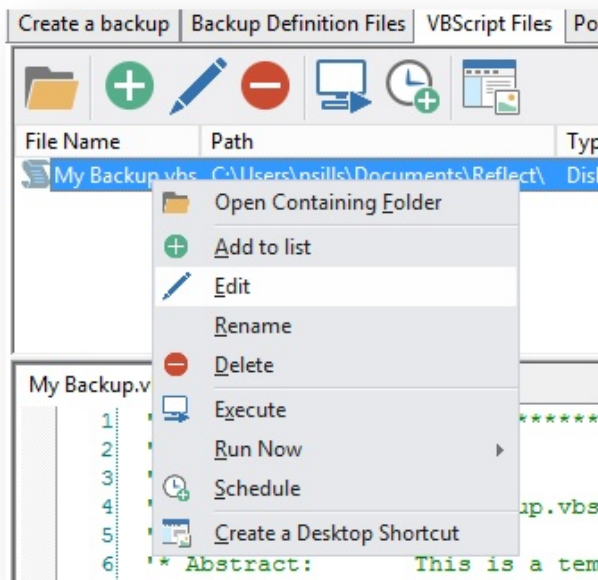


The VBScript generation dialog box appears.

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3. Leave the options as defaults but change the file name for clarity.
4. **Select the VBScript Files tab**, right-click the new file and **select Edit** from the short-cut menu.



The VBScript file opens in the system default text editor, generally this is Notepad.

5. For clarity, switch off word wrap. In notepad, choose **Edit > Word Wrap**.



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- Find the line of code that starts the backup and copy and paste it once for each backup or image you want to run.

The line looks like this:

```
ExitCode = Backup (""C:\Program Files\Macrium\Reflect\reflect.exe" -e -w  
<BACKUP_TYPE> "C:\Backups\backup1.xml" -g")
```

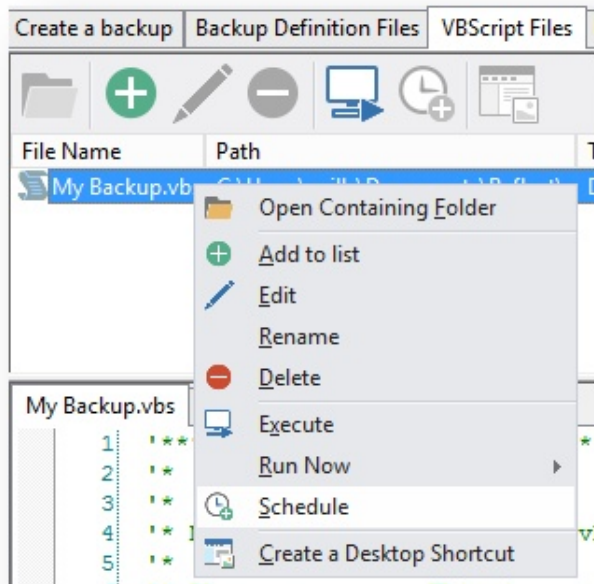
- For each copy of the line change the xml file name to represent the backup you want to run. For example:

```
ExitCode = Backup (""C:\Program Files\Macrium\Reflect\reflect.exe" -e -w  
<BACKUP_TYPE> "C:\Backups\backup1.xml" -g")  
ExitCode = Backup (""C:\Program Files\Macrium\Reflect\reflect.exe" -e -w  
<BACKUP_TYPE> "C:\Backups\backup2.xml" -g")  
ExitCode = Backup (""C:\Program Files\Macrium\Reflect\reflect.exe" -e -w  
<BACKUP_TYPE> "C:\Backups\backup3.xml" -g")
```

- Save the file.



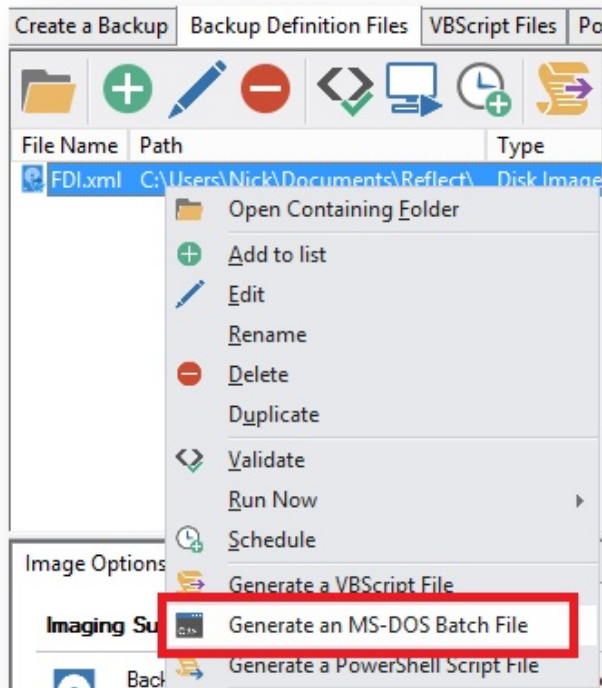
Note: VBScript files must be scheduled independently. If you have any existing schedules for the XML backup definitions above then disable or delete them. To schedule VBScript source files, **right click on the script and select 'Schedule'.**



Generating an MS-DOS batch file

For an example of a generated MS_DOS batch file please see: [Example MS-DOS Batch File](#)

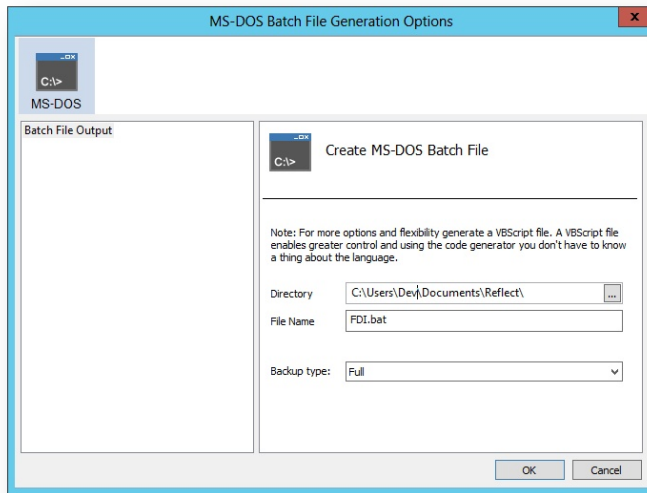
To generate a MS-DOS batch file select the 'XML Definition Files' tab on the main window then right click on a file and select '**Generate an MS-DOS Batch File**'.



This opens the **MS-DOS Batch Generation Options** dialog:

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Batch File Output



Generated code...

```
@echo off
REM *****
REM *
REM *
REM * Module Name:    FDI.bat
REM *
REM * Abstract:        This is a template MSDOS batch file generated by Reflect v5.0
REM *                  Modify to add your own functionality if required
REM *
REM *
REM *****
:again
"C:\Program Files\Macrium\Reflect\reflect.exe" -e -w -full "C:\Users\Dev\Documents\Reflect\FDI.xml"
if ERRORLEVEL 3 goto busy
if ERRORLEVEL 2 goto validation_error
if ERRORLEVEL 1 goto backup_error
if ERRORLEVEL 0 goto ok
:busy
REM Will never get here if '-w' switch is used
echo A backup or restore operation is in progress
goto again
:backup_error
REM User cancelling a backup or any other error
echo A Backup error has occurred
goto end
:validation_error
REM Command line or XML syntax errors
echo A validation error has occurred
goto end
:ok
echo ok!
goto end
```

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:end

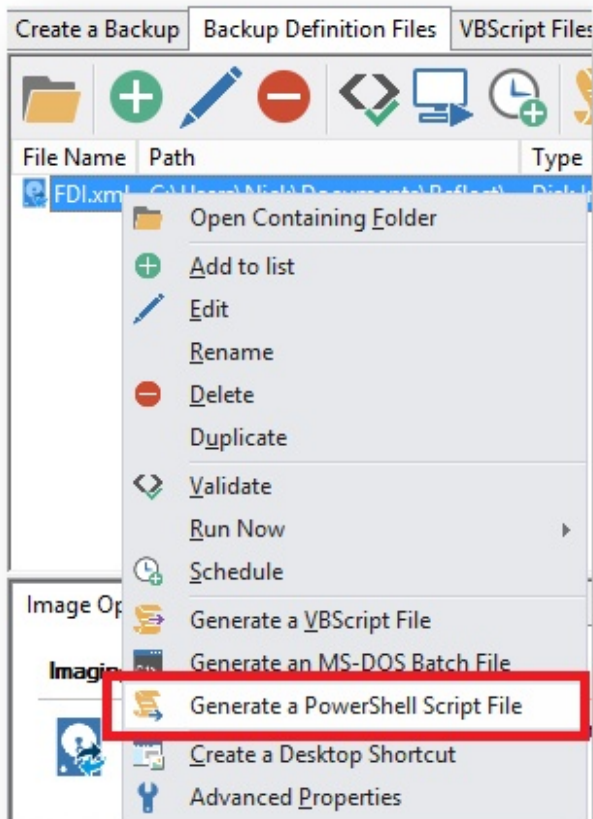
Property	Value
Directory	The folder where the batch source file is saved
File name	The name of the batch source file. This defaults to the XML file name with a .bat extension
Backup type	Choose from Full, Differential or Incremental.

Click **'OK'** to generate an MS-DOS batch file

Generating a PowerShell source file

For an example of a generated PowerShell source file please see: [Example PowerShell Source File](#)

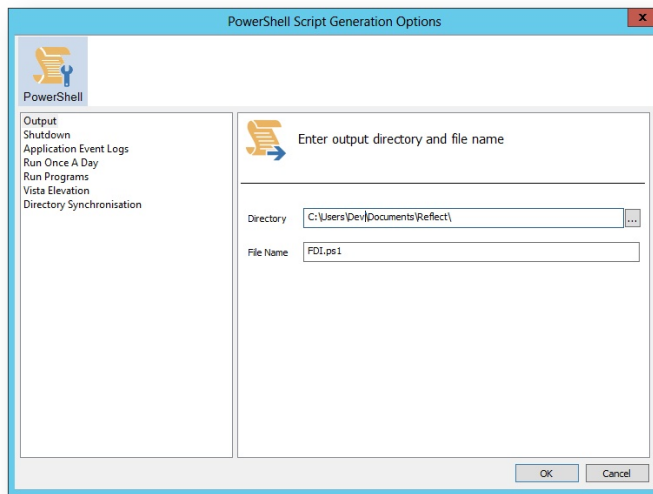
To generate a PowerShell file select the 'XML Definition Files' tab on the main window then right click on a file and select '**Generate a PowerShell Script File**'.



This opens the **PowerShell Script Generation Options** dialog:

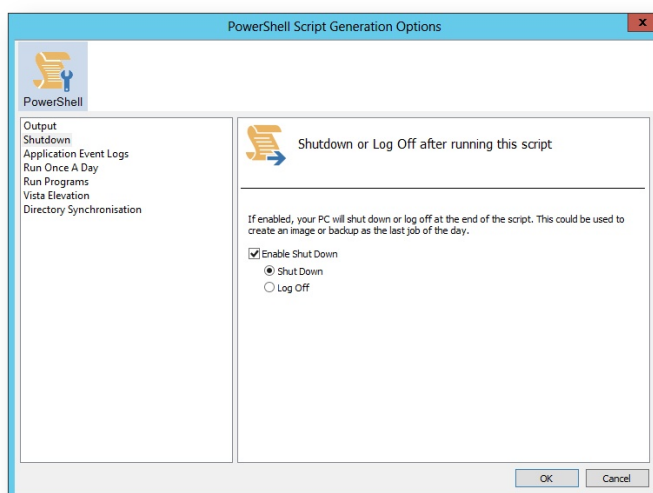
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Output



Property	Value
Directory	The folder where the source file is saved
File name	The name of the PowerShell source file. This defaults to the XML file name with a ..ps1 extension

Shutdown



Generated code...

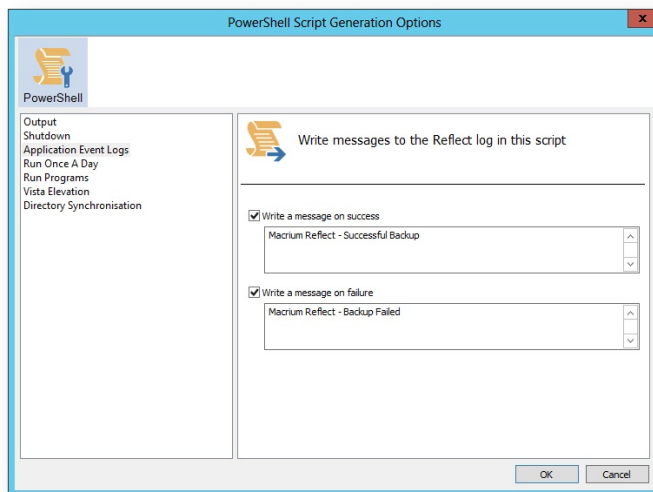
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```
Write-Host ' * Initiating shutdown... ' -NoNewLine;  
(Get-WMIObject Win32_OperatingSystem -ComputerName '.' -EnableAllPrivileges).  
Win32Shutdown(8);
```

Property	Value
Enable Shut Down	Select to enable this property
Shut down	The PC will shut own at the end of the backup
Log Off	The user will be logged out at the end of the backup

Application Event logs

Please note that Macrium Reflect Server and Server Plus Edition includes Windows Event logging built-in.



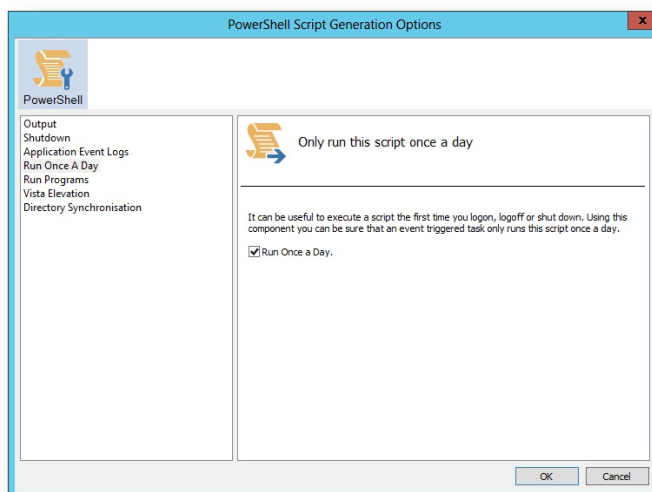
Generated code...

```
if ($?ExitCode -eq 0) # if backup completed successfully...  
{  
    Write-EventLog -EntryType Information -EventId 0 -LogName Application -Message  
    "Macrium Reflect - Successful Backup" -Source "Macrium Reflect"  
}  
if ($?ExitCode -ne 0) # if backup failed...  
{  
    Write-EventLog -EntryType Error -EventId 1 -LogName Application -Message "Macr  
ium Reflect - Backup Failed" -Source "Macrium Reflect"  
}
```

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Property	Value
Write a message on success	Enable a Windows Event on successful backup
	Enter the message text in the edit box below
Write a message on failure	Enable a Windows Event for failed backups
	Enter the message text in the edit box below

Run Once a Day



Generated code...

```

if (HasRunToday)
{
    Write-Host ' * Script already executed today. Exiting...';
    Write-Host 'Script finished with exit code 0.';
    Exit 0;
}

.....
#*****
#* Func: HasRunToday
#*
#* Desc: determines if this script has run today
#*
#*****
function HasRunToday()
{
    Write-Host ' * Checking last run time... ' -NoNewLine;
    $strRegPath = 'HKCU:\Software\Macrium\Reflect\Scripts';

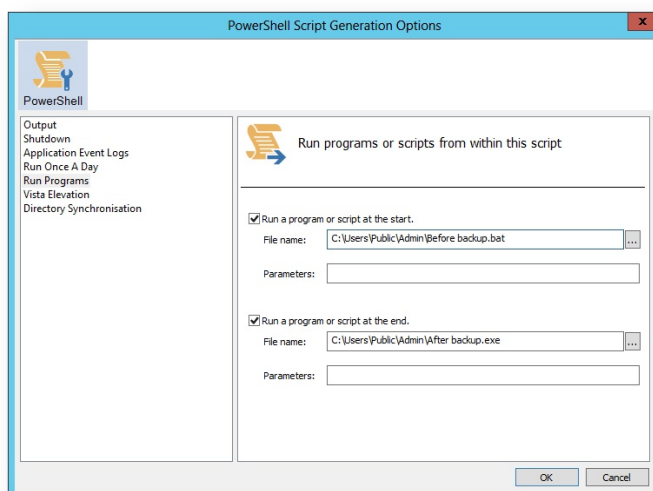
```

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```
$boolRanToday = $false;
$strDateToday = Get-Date -UFormat %Y%m%d;
if (Test-Path $strRegPath)
{
    try
    {
        $strLastRunDate = (Get-ItemProperty -Path $strRegPath -Name $strScript
Path -ErrorAction Stop).$strScriptPath
        if ($strLastRunDate -eq $strDateToday)
        {
            $boolRanToday = $true;
        }
    } catch { };
}
if (!$boolRanToday)
{
    Set-ItemProperty -Path $strRegPath -Name $strScriptPath -Value $strDateTod
ay;
}
Write-Host 'Done.';
return $boolRanToday;
}
```

Property	Value
Run Once a Day	If selected, will only enable this script to run once per day. This is useful for example if you want a backup to happen at first login or shutdown.

Run Programs



Generated code...

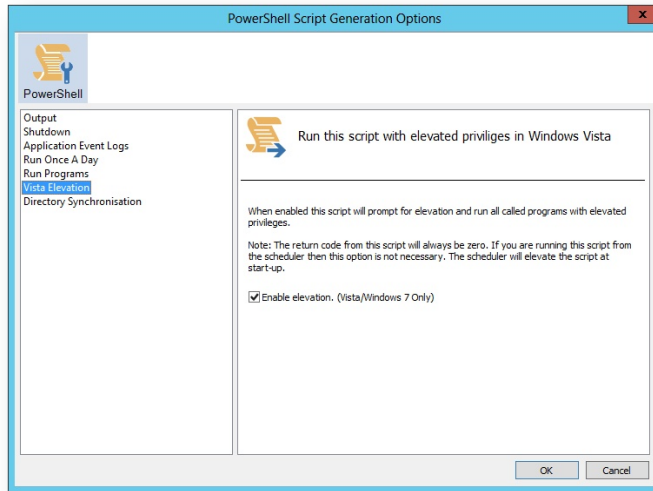
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```
Write-Host ' * Executing "at start" program... ' -NoNewLine;
$strRunAtStartApp = 'C:\Users\Public\Admin\Before backup.bat';
$strRunAtStartArgs = '';
if ([string]::IsNullOrEmpty($strRunAtStartArgs))
{
    Start-Process -FilePath $strRunAtStartApp;
}
else
{
    Start-Process -FilePath $strRunAtStartApp -ArgumentList $strRunAtStartArgs;
}
.....
Write-Host ' * Executing "at end" program... ' -NoNewLine;
$strRunAtEndApp = 'C:\Users\Public\Admin\After backup.exe';
$strRunAtEndArgs = '';
if ([string]::IsNullOrEmpty($strRunAtEndArgs))
{
    Start-Process -FilePath $strRunAtEndApp;
}
else
{
    Start-Process -FilePath $strRunAtEndApp -ArgumentList $strRunAtEndArgs;
}
```

Property	Value
Run a program or script at the start	Select to enable a program or script to run before the backup starts
File name	The path and executable file name
Parameters	Optional command line parameters for the program
Run a program or script at the start	Select to enable a program or script to run when the backup ends
File name	The path and executable file name
Parameters	Optional command line parameters for the program

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Vista Elevation



Generated code...

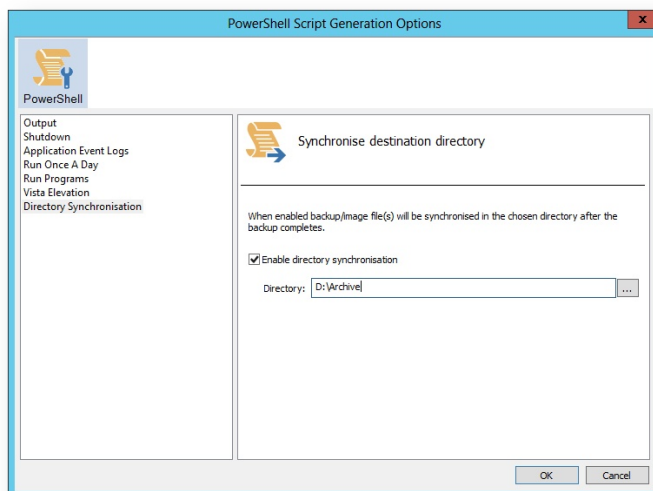
```
function Main()
{
    Write-Host 'PowerShell script for Macrium Reflect Backup Definition File';
    Write-Host "BDF: $strXmlFilePath";
    Elevate;
    .....
    *****
    #* Func: Elevate
    #*
    #* Desc: Elevates this script for UAC.
    #*       This means that only one UAC Elevation prompt is displayed and
    #*       functions/programs will not fail if they require admin privileges.
    #*
    *****
    function Elevate()
    {
        # Only elevate if not ran from the task scheduler.
        Write-Host ' * Checking elevated access rights... ' -NoNewLine;
        if (-Not $s)
        {
            # Check to see if we are currently running "as Administrator"
            if (!(Security.Principal.WindowsPrincipal][Security.Principal.WindowsIdentity]::GetCurrent()).IsInRole([Security.Principal.WindowsBuiltInRole]"Administrator"))
            {
                $ElevatedProcess = new-object System.Diagnostics.ProcessStartInfo "PowerShell
1";
                # Specify the current script path and name as a parameter
                $strType = GetBackupTypeParameter;
                $ElevatedProcess.Arguments = "-ExecutionPolicy Bypass & '" + $script:
MyInvocation.MyCommand.Path + "' $strType";
                # Indicate that the process should be elevated
                $ElevatedProcess.Verb = "runas";
                # Start the new process
            }
        }
    }
}
```

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```
[System.Diagnostics.Process]::Start($ElevatedProcess);  
# Exit this unelevated script with exit code for "Error: Not elevated"  
Exit 3;  
}  
}  
Write-Host 'Done.';  
}
```

Property	Value
Enable Elevation	If selected will enable UAC elevation for the entire script. This enables functions and programs to run outside the context of Macrium Reflect without requesting further elevation.

Directory Synchronization



Generated code...

```
if ($iExitCode -eq 0) # if backup completed successfully...  
{  
    $strBackupDir = GetLastBackupPath;  
    if (![string]::IsNullOrEmpty($strBackupDir))  
    {  
        SynchroniseDirectories $strBackupDir 'D:\Archive';  
    }  
}  
.....  
*****  
#* Func: SynchroniseDirectories  
#*  
#* Desc: Copies all Macrium Reflect files to a supplied directory.  
#*  
*****  
function SynchroniseDirectories($strSrcDir, $strDstDir)
```

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```
{
Write-Host ' * Synchronising directories... ' -NoNewLine;
if (Get-Command robocopy -ErrorAction SilentlyContinue)
{
    # robocopy is available...
    # /copy:DAT - D:Data
    #           A:Attributes
    #           T:Time stamps
    # /purge    - deletes destination files and directories that no longer
    #             exist in the source
    # /lev:0    - Does not copy subdirectories
    &robocopy $strSrcDir $strDstDir *.mr* /copy:DAT /lev:0 /purge /r:0 | Out-Null
}
else
{
    # Fall back to xcopy...
    # Delete files from the target directory not present in the source directory
    $strDstDirChildren = $strDstDir+"\*";
    Get-ChildItem $strDstDirChildren -include "*.mr*" | Foreach-Object {
        $strMaybeDeletedSrcFile = $strSrcDir + '\' + $_.Name;
        if (-not (Test-Path $strMaybeDeletedSrcFile))
        {
            Remove-Item $_
        }
        else
        {
            $SrcFileTime = [datetime](Get-ItemProperty -Path $strMaybeDeletedSrcFile -
Name LastWriteTime).lastwritetime;
            $DstFileTime = [datetime](Get-ItemProperty -Path $_.FullName
Name LastWriteTime).lastwritetime;
            $SrcFileTimeString = $SrcFileTime.ToString("yyyMMddHHmmss")
            $DstFileTimeString = $DstFileTime.ToString("yyyMMddHHmmss")
            if ($SrcFileTimeString -ne $DstFileTimeString)
            {
                Remove-Item $_
            }
        }
    }
    # /c - Continues copying even if errors occur.
    # /d - Date check; only copies if file does not exist or is older.
    # /h - Copies hidden and system files.
    # /i - If the destination does not exist, and you are copying more than one
    #       file, this switch assumes that the destination is a folder.
    # /v - Verifies each new file.
    # /y - Overwrites existing files without prompting.
    &xcopy $strSrcDir\*.mr* $strDstDir /c /d /h /i /v /y | Out-Null
}
Write-Host 'Done.';
}
```

Property	Value
Enable directory synchronization	If enabled will use the MS utility RoboCopy to synchronize the backup target directory with the supplied directory.

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Property	Value
Directory	Enter the folder that you want to synchronize your backup files to

Click **'OK'** to generate the PowerShell source file

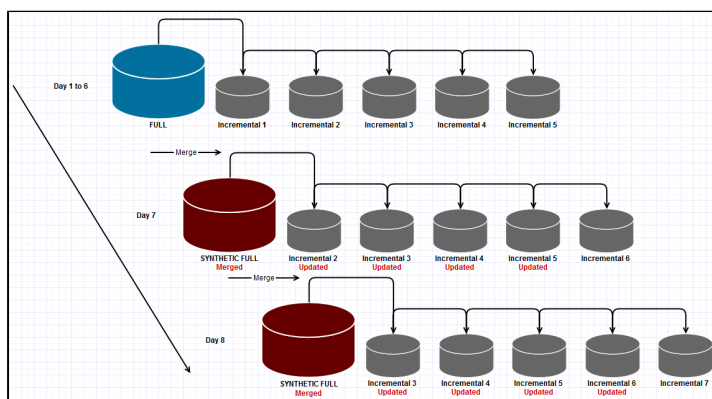
Backup Folder Synchronization



Note: This article refers to backup sets that are **not** using **Delta Incremental indexes**. Please see [Delta Indexes for Incremental Backups](#)

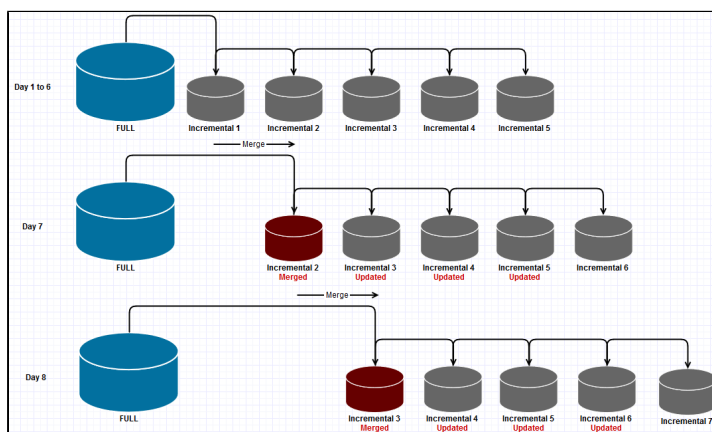
When backup sets are consolidated by either creating Synthetic Full images or merging Incremental images, subsequent Incremental images in the chain are updated to reflect the consolidation. This can be observed by looking at the file modification time stamps in Windows Explorer.

Example 1: Synthetic Full - Retain 5 Incrementals



In this example, when the 6th Incremental is created the Full image is merged with the first Incremental and existing Incremental images 2 to 5 are updated to indicated that Incremental 1 is no-longer in the backup chain by modifying the file index. This process is repeated for each subsequent Incremental that is run.

Example 2: Incremental Merge - Retain 5 Incrementals



In this example, when the 6th Incremental is created, the first Incremental is merged with the second and existing Incremental images 3 - 5 are updated to indicated that Incremental 1 is no-longer in the backup chain by modifying the file index. This process is repeated for each subsequent Incremental that is run.



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When creating duplicate copies of Image files it is essential to **synchronize all files in the backup set** rather than just copy the most recently created file.

Using RoboCopy to synchronize folders

Windows ships with a file copy utility called '**Robust File Copy**' or **RoboCopy**. Robocopy can easily synchronize two folders and ensure that copies are kept up to date.

The following command line will synchronize all Macrium Reflect files in "D:\BackupFolder" with "E:\BackupSyncFolder"


```
Robocopy "D:\BackupFolder" "E:\BackupSyncFolder" *.mr* /copy:DAT /lev:0 /purge
```

Switch	Description
.mr	Only copy Macrium Reflect .mring and .mrbak files
/copy:DAT	Copy Data, Attributes, and Time stamps
/lev:0	Copy only this folder. Do not copy lower level folders
/purge	Delete destination files and directories that no longer exist in the source.

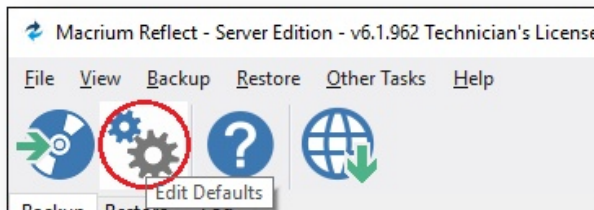
Macrium Reflect can generate VBScript and PowerShell scripts to automatically synchronize your backup sets directly after each run.

VBScript	Generating a VBScript source file (see page)
PowerShell	Generating a PowerShell source file (see page)

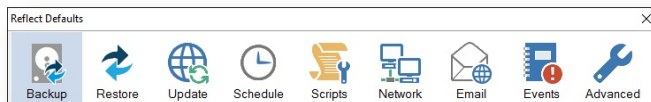
Macrium Reflect default settings

 The Macrium Reflect default settings allow you to set the default values used when creating a new backup definition.


1. To edit default settings from the main toolbar click the 'Cog' icon as shown below.



2. Select the area you want to amend.




3. When you are happy with your selections click **OK**.

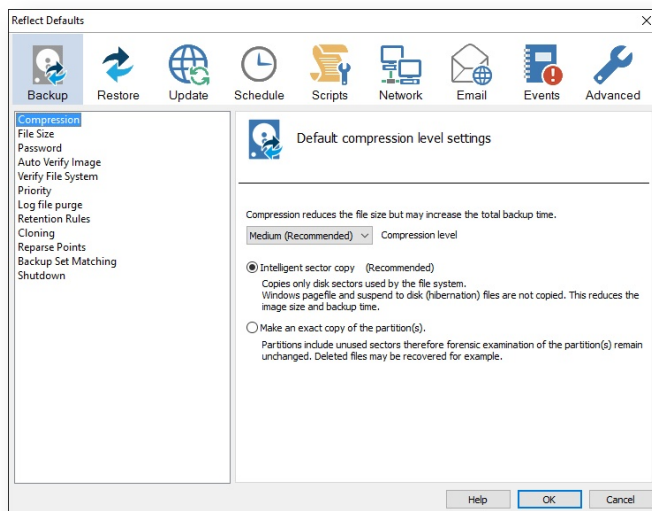
 To change existing definition, right click on the definition and select 'Advanced Properties'.

Default Backup settings

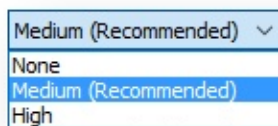
Compression is used to reduce the file size of the completed backup.

 These options set the defaults for a new backup.

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- Three levels of compression can be chosen, the higher the compression level the smaller the backup file will be:




Reducing the file size may increase the total backup time.

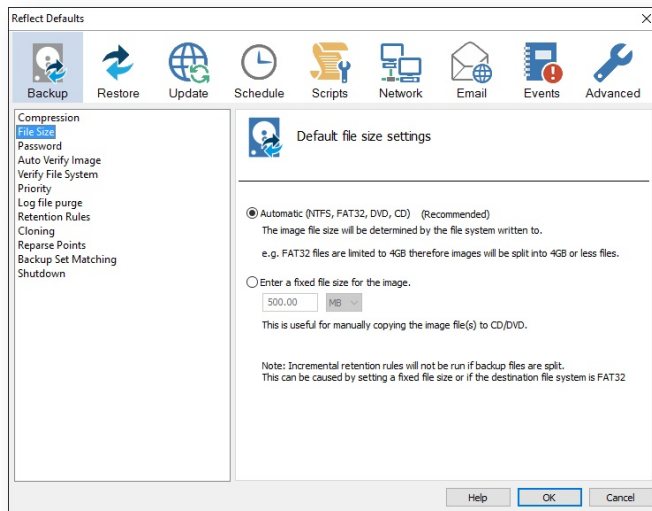
Compression allows you to chose an Intelligent sector copy or a Forensic copy of the partitions.


Option	Description
Intelligent Sector Copy	<p>Only backup the sectors that are being used by data on the disk. Pagefile (pagefile.sys) and hibernation (hiberfil.sys) will also be excluded.</p> <div>  This reduces the time it takes for the backup to complete. </div>
Forensic Copy	Backup every sector.


File size options are used to select between automatic or fixed file size for an image.

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 These options set the defaults for a new backup.



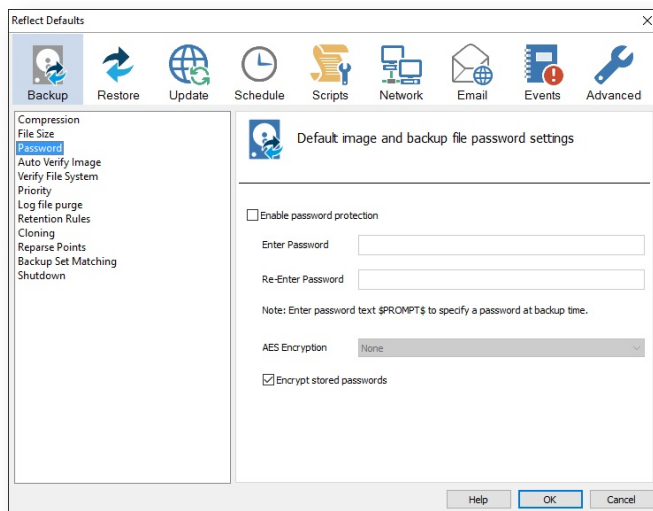
 Incremental Retention Rules will not be run if backup files are split. This can be caused by setting a fixed size or if the destination file system is FAT32.

Option	Description
Automatic (Recommended)	<p>Let the system decide on how large the images are going to be created dependent on file system (NTFS, FAT32, DVD, CD)</p> <div>  e.g FAT32 files are limited to 4GB therefore images are going to be split into 4GB or less files. </div>
Fixed file size	Create Images that will be split into many fixed size files. This is useful when copying Image files to CD/DVDs.

Password option is used to enable password protection.

 These options set the defaults for a new backup.

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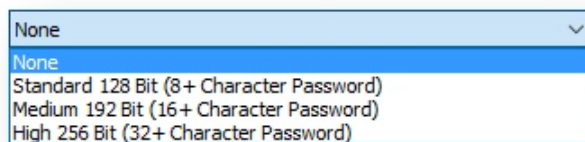


- With the **Password** option turned on all the images created will require a password before they can be browsed or restored.



Enter password text \$PROMPT\$ to specify a password at backup time.

- AES Encryption levels can be chosen when adding a password:



AES 256 bit encryption is the highest level of encryption available.

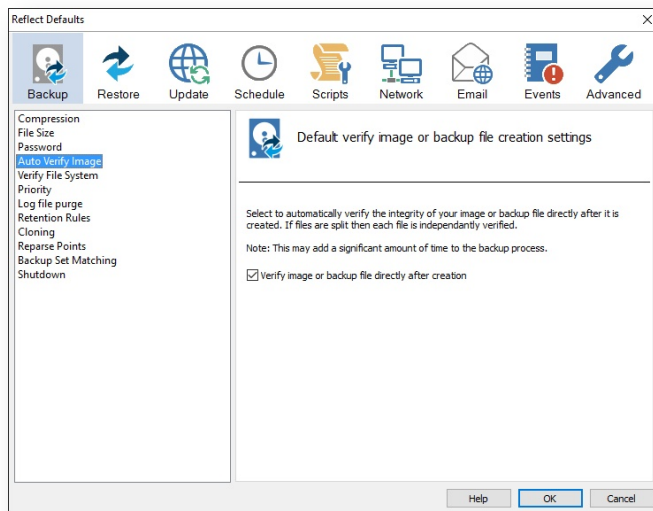
Option	Description
Enable password protection	Enables protection of your image files.
Encrypt stored passwords	Passwords saved in your backup definition will be encrypted.

Auto Verify Image allows automatic verification of images after they are created.



These options set the defaults for a new backup.

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This can add a significant amount of time to the backup process.

Option	Description
Verify image	Images will be verified automatically when the backup completes.



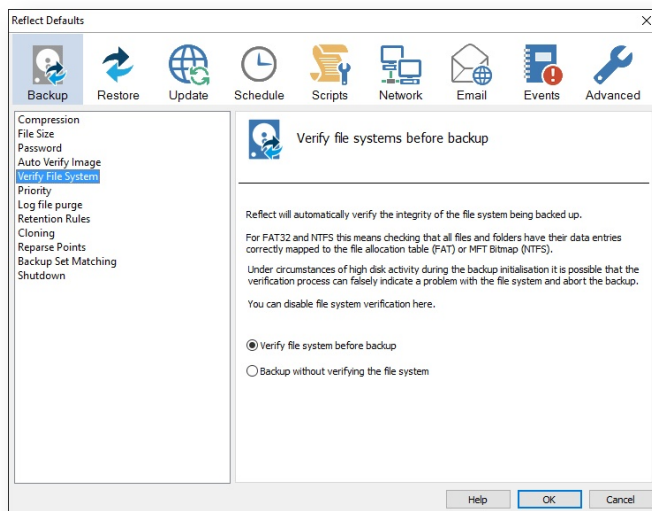
For more information on image verification please see [Understanding Image Verification Failures](#)

Verify File System is used to check the integrity of the file system before a backup.



These options set the defaults for a new backup.

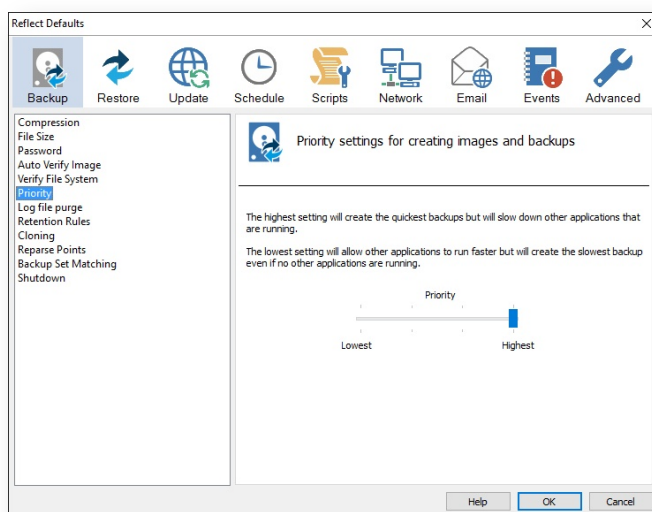
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- Reflect will automatically verify the integrity of the file system being backed up.
For FAT32 and NTFS this means checking that all files and folders have their data entries correctly mapped to the file allocation table (FAT) or MFT Bitmap (NTFS).

Option	Description
Verify file system before backup	Verify the file system on your disk prior to the backup; this will increase the time taken to complete your backup.
Backup without verifying the file system	Backup without verifying, thus making your backup a little quicker.

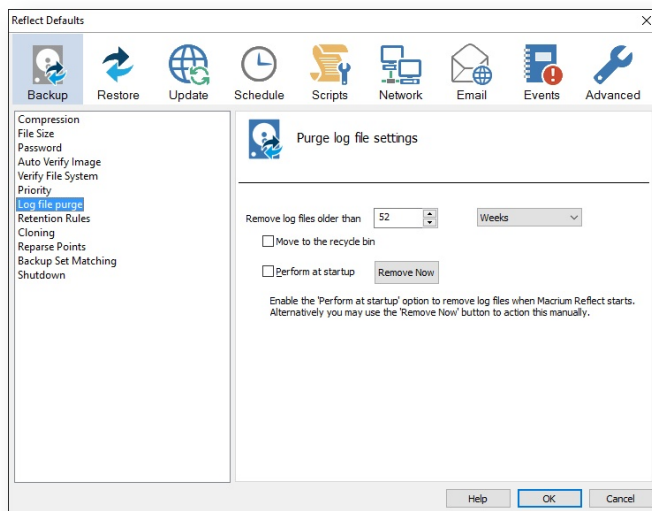
Priority is used to change the CPU priority for images and backups.



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Option	Description
Highest	Your backup will take less time to complete and may slow down other applications.
Lowest	Your backup may take longer to complete but it will have less effect on other running applications.

Log file purge option enables you to manage the retention of your backup logs.



Option	Description
Remove log files	Choose number of days of weeks
Move to Recycle Bin	Deleted logs will be moved to the Recycle Bin.
Perform at startup	Logs will be deleted when Reflect starts up.



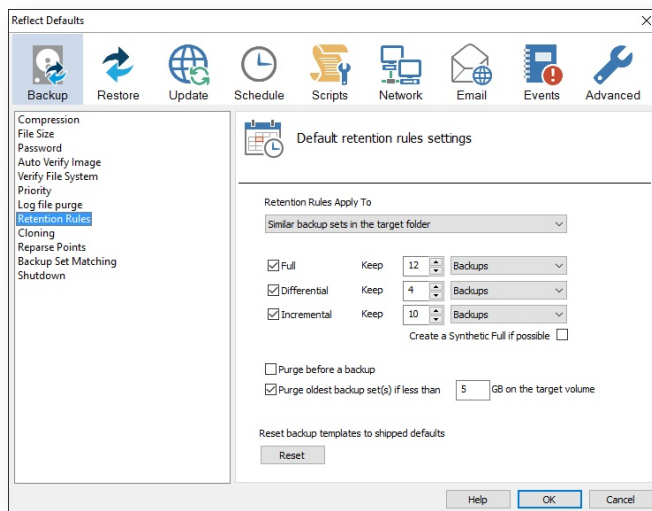
You can press the **Remove Now** button to remove the logs manually at any time.

Retention Rules are used to define how long you want to keep different backup types (Incremental, Differential and Full).



These options set the defaults for a new backup.

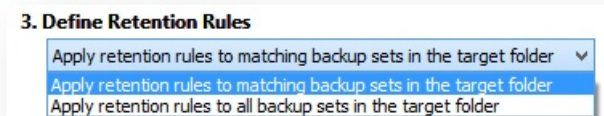
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The new Macrium Reflect retention rules provide a powerful and flexible way to manage the lifetime and storage space used by your backups.

Choose how backups are matched and retention rules are applied to the target folder

Retention rules are applied to the target folder of the backup by selecting one of two options:



1. Apply retention rules to matching backup sets in the target folder.

Disk Images are purged if they contain **exactly the same Partitions** as the current Image. Partitions are identified using the unique **Disk ID** stored in sector 0 of the disk and the **Partition sector offset**.

Note: For GPT disks the unique GPT disk GUID is used instead of the Disk ID

For **File and Folder** backups retention rules are applied according to the '**Backup Set Matching**' option select in the '**Advanced Properties**' for this backup.

2. Apply retention rules to all backup sets in the target folder. All backup sets in the target folder of the same type (Disk Image or File and Folder) are purged according the retention rules.

Note: This option uses the same logic as Macrium Reflect v5


Select the age or number of backup types that you wish to keep

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<input checked="" type="checkbox"/> Full	Keep	12	Backups
<input checked="" type="checkbox"/> Differential	Keep	4	Backups
<input checked="" type="checkbox"/> Incremental	Keep	10	Backups
Create a Synthetic Full if possible <input type="checkbox"/>			
<input type="checkbox"/> Run the purge before backup.			
<input checked="" type="checkbox"/> Delete the oldest backup set(s) if less than 5 GB on the target volume (minimum 1GB)			

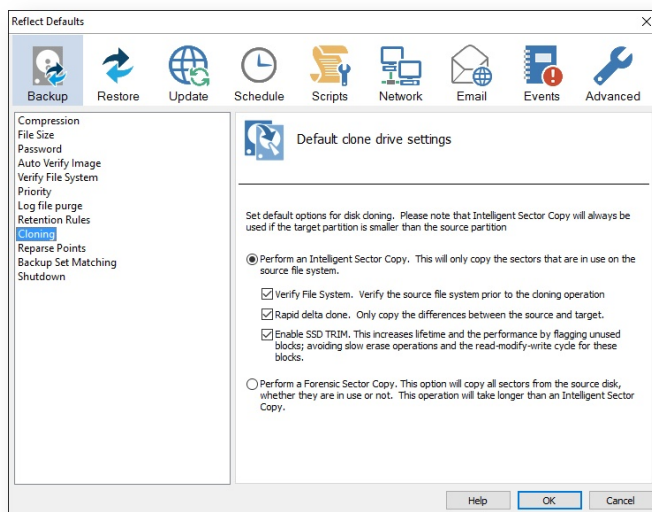
Option	Description																																																						
Full	When deleting Full backups all linked incremental and Differential backups in the same backup chain (set) are also deleted This operation will delete the entire backup set.																																																						
Differential	When deleting Differential backups all linked incremental backups in the same backup chain (set) are also deleted.																																																						
Incremental	<p>When deleting Incremental backups the integrity of the backup set is maintained by ensuring that the chain is never broken. This is achieved by merging older Incremental backups when required.</p> <p>In the example below, before retention, there is 1 Full backup, 1 Differential backup and 6 Incremental backups. The retention rules are set to retain 4 incremental backups. After retention, the most recent 4 incremental backups are retained. Deleting the oldest 2 incrementals would cause the backup chain to be invalid as the oldest retained incremental requires the previous 2 incremental backups to complete the chain. To ensure backup integrity the 2 older incremental backups are consolidated with it to create a new incremental backup.</p> <p>F = Full D = Differential I = Incremental</p> <table><tr><td>M</td><td>T</td><td>W</td><td>T</td><td>F</td><td></td><td></td><td>M</td><td>T</td><td>W</td><td></td><td>T</td><td>F</td><td></td><td></td><td>M</td><td>T</td><td>W</td></tr><tr><td>F</td><td></td><td></td><td></td><td></td><td></td><td></td><td>D</td><td>I</td><td>I</td><td></td><td>I</td><td>I</td><td></td><td></td><td>F</td><td>I</td><td>I</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>--</td><td>-></td><td></td><td>I</td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>	M	T	W	T	F			M	T	W		T	F			M	T	W	F							D	I	I		I	I			F	I	I									--	->		I						
M	T	W	T	F			M	T	W		T	F			M	T	W																																						
F							D	I	I		I	I			F	I	I																																						
								--	->		I																																												
Create a Synthetic Full if possible	When purging Incremental backups, if the backup folder only contains a Full backup followed by Incremental backups , then this option causes the Full backup to be 'rolled forward' to create a Synthetic Full backup . This is also known as Incremental Forever .																																																						
	Select this option to run the retention rules before the current backup.																																																						


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Option	Description
Run the purge before the backup	<p>Note: in Macrium Reflect v5 the current backup set wasn't included in the purge calculation when purging before the current backup. In v6 the current backup set IS included. This means that if you set the retention count to 1 Full backup then all of your backups will be deleted and a new Full backup created.</p>
Delete oldest backup set(s) if less than n GB	<p>Automatically remove the oldest backup set(s) in the target folder if the free space on the drive drops below the GB threshold.</p> <p> Note: The free space threshold is actioned dynamically. If the free space available drops below the threshold then the running backup is temporarily paused while older backup sets are purged.</p>







Cloning

 These options set the defaults for a new clone.



Option	Description
Perform an Intelligent Sector Copy	<p>Only backup the sectors that are being used by data on the disk. Pagefile (pagefile.sys) and hibernation (hiberfil.sys) will also be excluded.</p> <p> This reduces the time it takes for the clone to complete.</p>

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Option	Description								
	<table> <tr> <th>Option</th><th>Description</th></tr> <tr> <td>Verify File System</td><td>Reflect will verify the integrity of your file system; Verification check that all files and folders data entries are correctly mapped to the file allocation table (FAT) or MFT Bitmap (NTFS)</td></tr> <tr> <td>Rapid Delta Clone</td><td> <p>As with Rapid Delta Restore (RDR) the concept of RDR has been something that has been thought about for quite some time here at Macrium Software. We wanted to build a clone solution that would effectively and rapidly copy only the differences between the source and target file systems. The advantage of this is obvious, RDC offers similar a performance increase as an Incremental disk image offers over a Full image and enables regular clones to be a viable and fast DR solution.</p> <p>How does it work?</p> <p>The NTFS file system resident on the clone source is compared with file system on the target disk. The two file systems are first verified that they originated from the same format command and then the target NTFS file system structures are analyzed for differences. All the NTFS file system structures are copied to the target disk and any that do not exist or have been modified on the target disk cause the data records for each NTFS file or object to be copied as well. The result is an 'Incremental' clone applying only file system changes detected between the source and the target.</p> <div>  Note: RDC works with NTFS file systems only. All other file systems will perform a full clone </div> <div>  Note: RDC is not available when shrinking partitions during a clone. </div> </td></tr> <tr> <td>Enable SSD TRIM</td><td>This features provides automated SSD optimization resulting enhanced SSD performance and longevity. Writing to an unused block is much quicker than an in-use block as it avoids both the slow erase operation and the read-modify-write cycle. This results an increase of both the lifetime and the performance of the device. It is effective for all windows operating systems, even those that support SSD trim natively as the file system driver can only TRIM blocks on de-allocation; it cannot TRIM blocks written by another process. It is also effective for USB attached SSDs.</td></tr> </table>	Option	Description	Verify File System	Reflect will verify the integrity of your file system; Verification check that all files and folders data entries are correctly mapped to the file allocation table (FAT) or MFT Bitmap (NTFS)	Rapid Delta Clone	<p>As with Rapid Delta Restore (RDR) the concept of RDR has been something that has been thought about for quite some time here at Macrium Software. We wanted to build a clone solution that would effectively and rapidly copy only the differences between the source and target file systems. The advantage of this is obvious, RDC offers similar a performance increase as an Incremental disk image offers over a Full image and enables regular clones to be a viable and fast DR solution.</p> <p>How does it work?</p> <p>The NTFS file system resident on the clone source is compared with file system on the target disk. The two file systems are first verified that they originated from the same format command and then the target NTFS file system structures are analyzed for differences. All the NTFS file system structures are copied to the target disk and any that do not exist or have been modified on the target disk cause the data records for each NTFS file or object to be copied as well. The result is an 'Incremental' clone applying only file system changes detected between the source and the target.</p> <div>  Note: RDC works with NTFS file systems only. All other file systems will perform a full clone </div> <div>  Note: RDC is not available when shrinking partitions during a clone. </div>	Enable SSD TRIM	This features provides automated SSD optimization resulting enhanced SSD performance and longevity. Writing to an unused block is much quicker than an in-use block as it avoids both the slow erase operation and the read-modify-write cycle. This results an increase of both the lifetime and the performance of the device. It is effective for all windows operating systems, even those that support SSD trim natively as the file system driver can only TRIM blocks on de-allocation; it cannot TRIM blocks written by another process. It is also effective for USB attached SSDs.
Option	Description								
Verify File System	Reflect will verify the integrity of your file system; Verification check that all files and folders data entries are correctly mapped to the file allocation table (FAT) or MFT Bitmap (NTFS)								
Rapid Delta Clone	<p>As with Rapid Delta Restore (RDR) the concept of RDR has been something that has been thought about for quite some time here at Macrium Software. We wanted to build a clone solution that would effectively and rapidly copy only the differences between the source and target file systems. The advantage of this is obvious, RDC offers similar a performance increase as an Incremental disk image offers over a Full image and enables regular clones to be a viable and fast DR solution.</p> <p>How does it work?</p> <p>The NTFS file system resident on the clone source is compared with file system on the target disk. The two file systems are first verified that they originated from the same format command and then the target NTFS file system structures are analyzed for differences. All the NTFS file system structures are copied to the target disk and any that do not exist or have been modified on the target disk cause the data records for each NTFS file or object to be copied as well. The result is an 'Incremental' clone applying only file system changes detected between the source and the target.</p> <div>  Note: RDC works with NTFS file systems only. All other file systems will perform a full clone </div> <div>  Note: RDC is not available when shrinking partitions during a clone. </div>								
Enable SSD TRIM	This features provides automated SSD optimization resulting enhanced SSD performance and longevity. Writing to an unused block is much quicker than an in-use block as it avoids both the slow erase operation and the read-modify-write cycle. This results an increase of both the lifetime and the performance of the device. It is effective for all windows operating systems, even those that support SSD trim natively as the file system driver can only TRIM blocks on de-allocation; it cannot TRIM blocks written by another process. It is also effective for USB attached SSDs.								
	Backup every sector.								

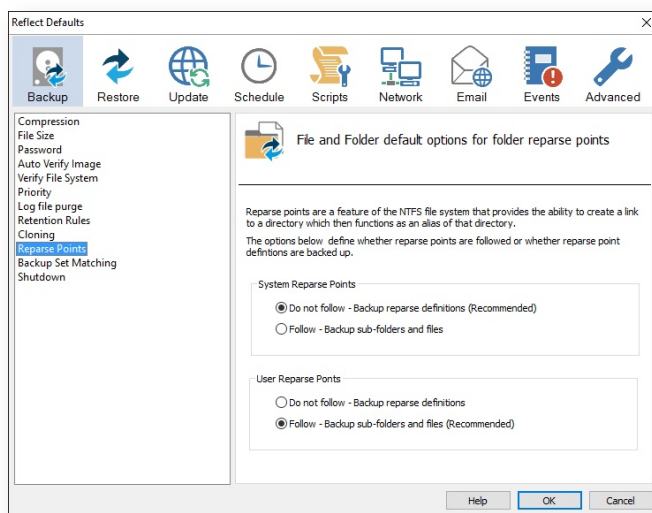
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Option	Description
Perform a Forensic Sector Copy	This can add a significant amount of time to the backup process.

Reparse Points options are used to include or exclude Reparse Points from a backup.



These options set the defaults for a new backup.



- Reparse points are a feature of the NTFS file system that provides the ability to create a link to a directories which then fictions as an alias of that directory.



e.g. Reparse point is the folder "Documents and Settings" which when followed points (or expands) to a number of other folders. If followed then all folders the reparse point "contents" will be included in the backup.

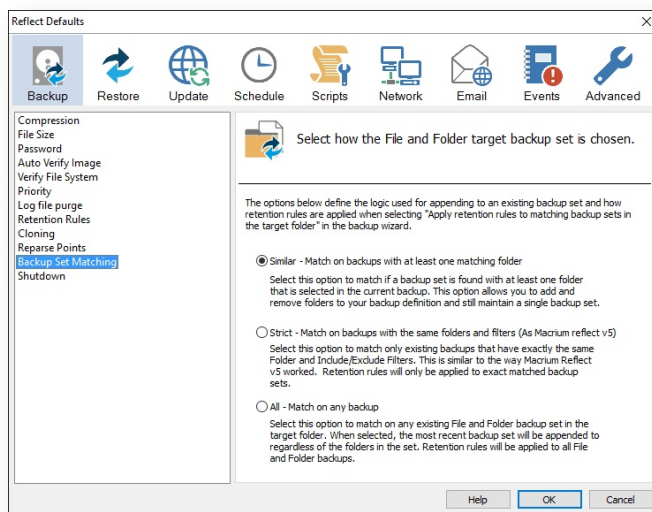
The options below define whether reparse points are followed or whether reparse point definitions are backed up:

Option	Description
System Reparse Points	Do not follow Only backup the Reparse Definitions (Recommended)
	Follow Backup all the Reparse Points

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Option	Description	
User Reparse Points	Do not follow	Backup the Reparse Definitions
	Follow	Backup all the Reparse Points (Recommended)

Backup Set Matching options sets rules for retention that is going to be applied to your backup sets.



- The options below define the logic used for appending to an existing backup set and how retention rules are applied when selecting 'Apply retention rules to matching backup sets in the target folder' in the backup wizard.

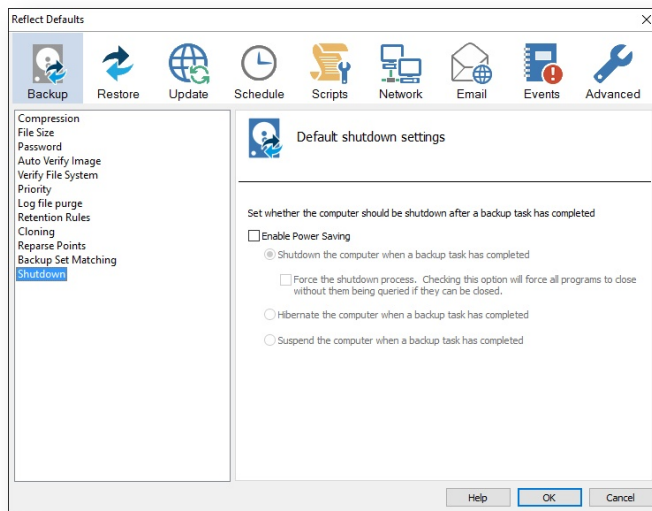
Option	Description
Similar - Match on backups with at least one matching folder	Add and remove folders in your backup definition and still maintain a single backup set.
Strict - Match on backups with the same folders and filters (As Macrium Reflect v5)	Retention rules will only be applied to exact matched backup sets.
All - Matching on any backup	Retention rules will be applied to all File and Folder backups.


Shutdown sets whether the computer should be shutdown after a backup task has completed.



These options set the defaults for a new backup.


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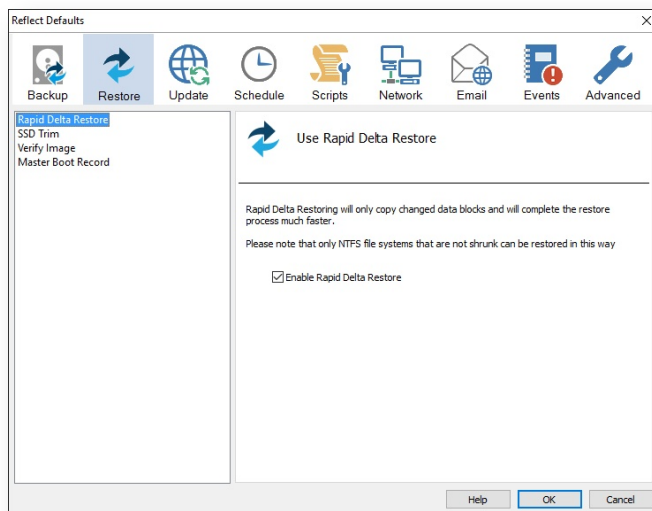
Option	Description
Shutdown	<p>This will Shutdown your computer after the backup is complete.</p> <div> A sub-option can be enabled to Force the shutdown process - All programs will be forced to close without being queried.</div>
Hibernate	This will Hibernate your computer after the backup is complete
Suspend	This will put your computer to Sleep after the backup is complete.

Default Restore settings

Rapid Delta Restore will only restore the changed data blocks and not the whole backup file.

 These options set the defaults for a new backup.

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Enabling Rapid Delta Restore decreases the time it will take to restore a backup. Only NTFS file systems that are not shrunk can be restored this way.

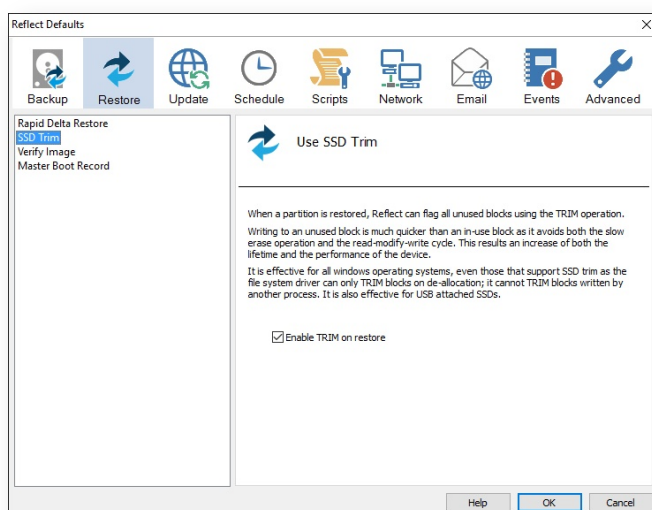


To find out more about RDR please [click here](#).

SSD Trim option enables SSD TRIM on restore.




These options set the defaults for a restore.

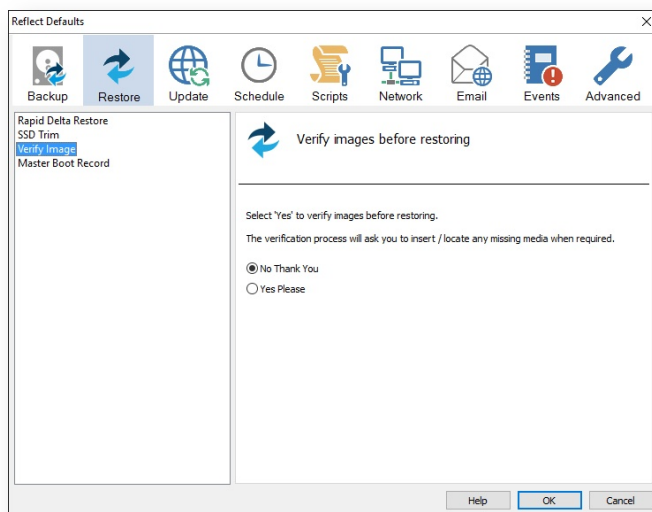


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- When a partition is restored, Reflect can flag all unused blocks using the TRIM operation. Writing to an unused block is much quicker than an in-use block as it avoids both the slow erase operation and the read-modify-write cycle. This results in an increase of both the lifetime and the performance of the device.
It is effective for all Windows operating systems, even those that support SSD trim as the file system driver can only TRIM blocks on de-allocation; it cannot TRIM blocks written by another process. It is also effective for USB attached SSDs.

Verify Image option verifies images before restoring.


 These options set the defaults for a restore.



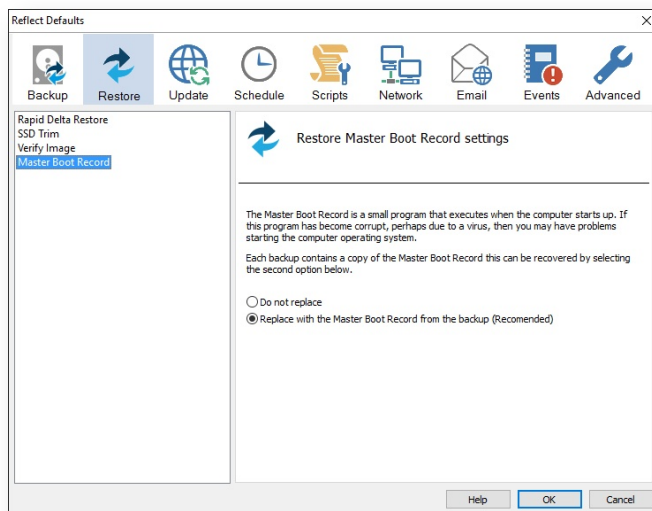
Option	Description
No Thank You	Reflect will not verify your images before the Restore process.
Yes Please	Reflect will verify your images before the Restore process.

 The verification process will ask you to insert / locate any missing media when required.

Master Boot Record options select whether to recover and replace the Master boot record from the backup.

 These options set the defaults for a restore.

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- Master Boot Record is a small program that executes when the computer starts up. If this program has become corrupt, perhaps due to a virus, then you may have problems starting the computers operating system.

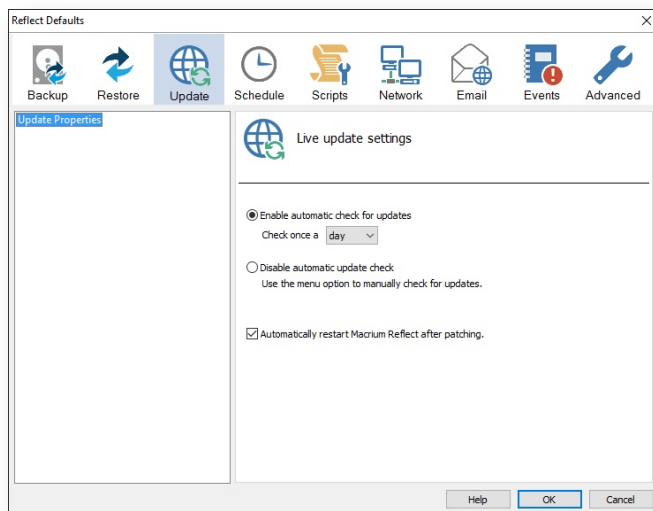
Each backup contains a copy of the Master Boot Record that can be recovered by selecting the second option below:

Option	Description
Do not replace	Original MBR will be kept without replacing it with the MBR contained in the backup image.
Replace	MBR is replaced with the MBR from the the backup image.

Update Settings

Update options establish rules for updating Reflect.

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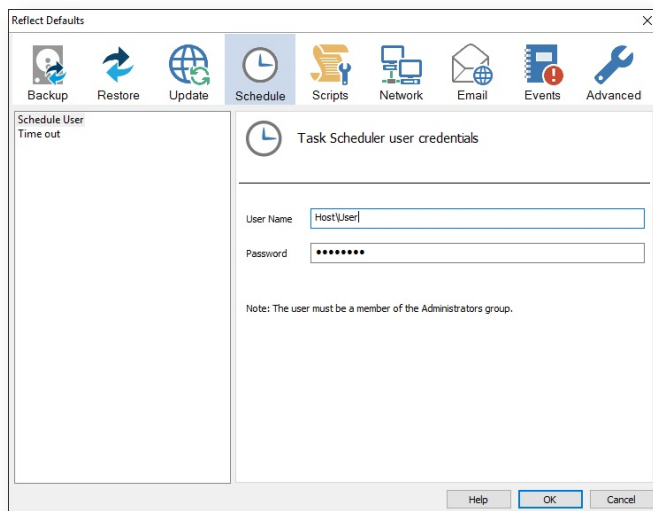


Option	Description
Enable automatic check for updates	Chose when Reflect checks for updates. <input checked="" type="radio"/> Enable automatic check for updates Check once a <div><div>day</div><div>day</div><div>week</div><div>month</div></div>
Disable automatic update check	Reflect will not check for updates automatically; updates will need to be manually checked for by using the update button.
Automatically restart Reflect after patching	Reflect will automatically restart once the update has been downloaded and installed.

Schedule Settings

Schedule User options set the user credentials for schedules.

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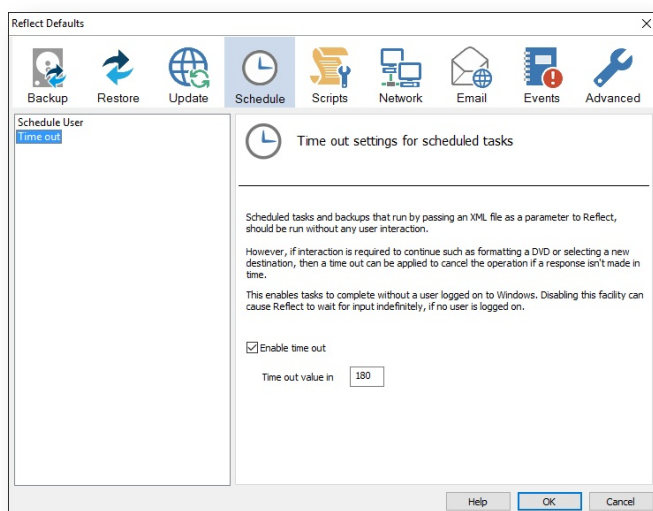


Option	Description
Username	Enter the Username that will authenticate your scheduled jobs; if on a domain enter the convention of ' domain\username '
Password	Enter the Password for the user entered above.



The user must be a member of the **Administrators** group.

Time Out options are set to establish time out for scheduled tasks, for example, if you needed to format a DVD.



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- Scheduled tasks and backups that run by passing an XML file as a parameter to Reflect, should be run without any user interaction.

However, if interaction is required to continue such as formatting a DVD or selecting a new destination, then a time out can be applied to cancel the operation if a response isn't made in time.

This enabled tasks to complete without a user logged on to Windows. Disabling this facility can cause Reflect to wait for input indefinitely, if no user is logged on.



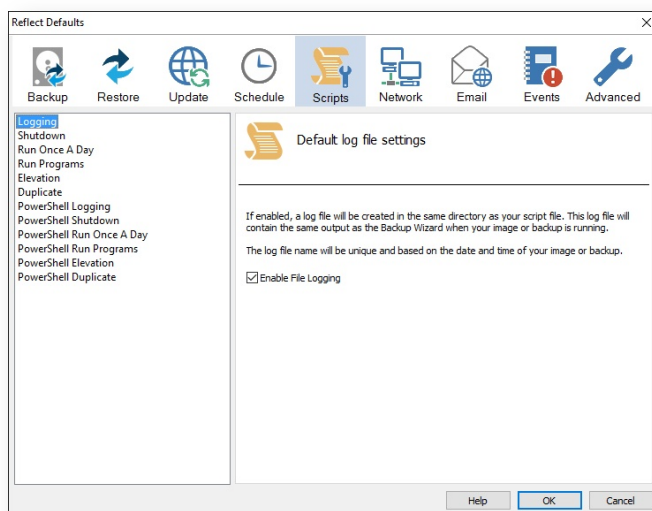
For more information on creation of schedules, please see [Scheduling backups \(see page 183\)](#).

Scripts

VBScript Logging options enable file logging in the same directory as your script file.



These options set the defaults for a script.



- If enabled, the log file created will contain the same output as the Backup Wizard when your image or backup is running.

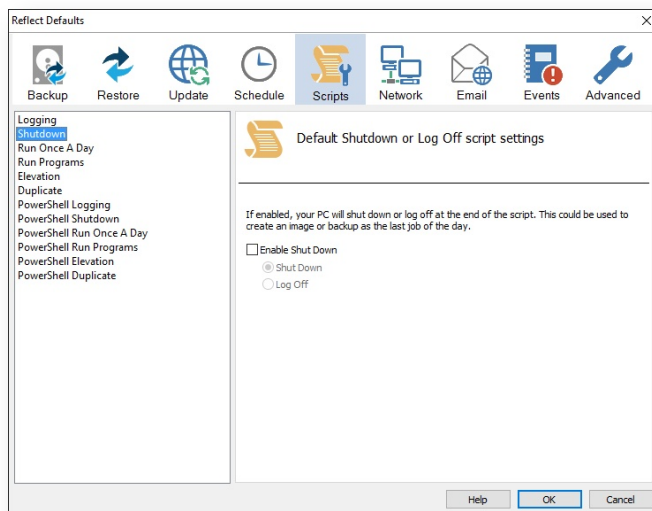
The log file name will be left unique and based on the date and time of your image or backup.


VBScript Shutdown option sets whether the PC should shutdown or log off at the end of the script.



These options set the defaults for a script.

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 This could be used when creating a backup as the last job of the day.

Generated code...

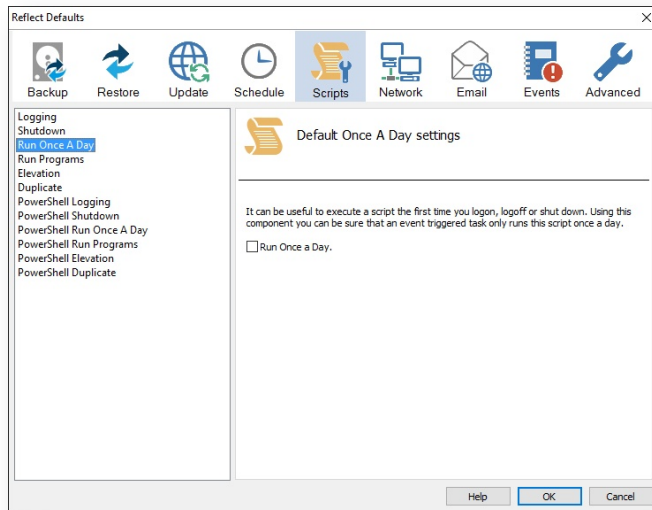
```
' Issue shutdown command
objShell.Run "shutdown -s"
```

Option	Description
Shut Down	<input checked="" type="checkbox"/> Enable Shut Down <input checked="" type="radio"/> Shut Down <input type="radio"/> Log Off Your PC will shutdown after the script has been ran.
Log Off	<input checked="" type="checkbox"/> Enable Shut Down <input type="radio"/> Shut Down <input checked="" type="radio"/> Log Off Your PC will Log Off after the script has been ran.

VBScript Run Once A Day option executes a script the first time you logon, logoff or shutdown.

 These options set the defaults for a script.

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Generated code...

```
' The following function call ensures that this script only runs once a day
  If HasRunToday Then
    WScript.Quit
  End If
. . . . .
' *****
' * Function: HasRunToday
' *
' * Purpose:  determines if this script has run today
' *
' *
' * Input:    None
' * Output:   true if has run today false otherwise
' *
' *****
Function HasRunToday
  Dim RegScriptKey
  Dim LastRunDate
  Dim objShell
  Set objShell = WScript.CreateObject("WScript.Shell")
  RegScriptKey = "HKCU\SOFTWARE\Macrium\Reflect\Scripts\" & WScript.
ScriptFullName & "\LastRun"
  'Check if script has run today
  ON ERROR RESUME NEXT
  LastRunDate = objShell.RegRead(RegScriptKey)
  If LastRunDate = cstr(Date) Then
    HasRunToday = true
  Else
    objShell.RegWrite RegScriptKey, Date,"REG_SZ"
    HasRunToday = false
  End If
  Set objShell = nothing
End Function
```

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Option	Description
Run once a day	<input checked="" type="checkbox"/> Run Once a Day. The script will run only once a day.

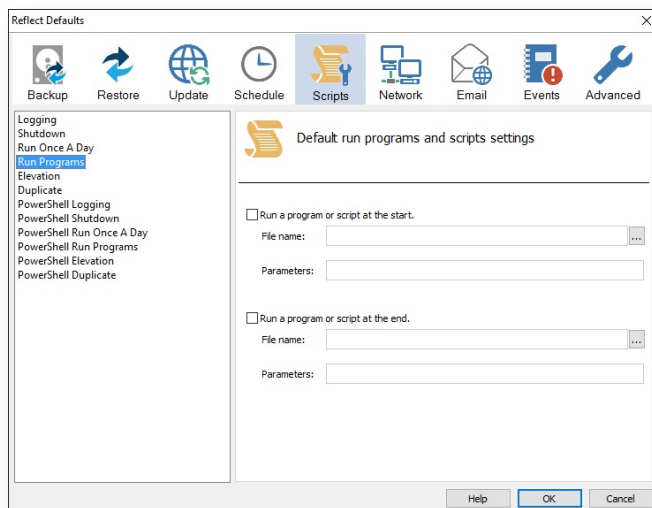


This is useful if you want a backup to happen at first login or shutdown.

VBScript Run Programs selects programs or scripts to run at the start or end of the script.



These options set the defaults for a script.



Generated code...

```
' Run program before backup
objShell.Run " "C:\Users\Public\Admin\Before backup.bat"", 1, true
' Do the backup
ExitCode = Backup ( " "C:\Program Files\Macrium\Reflect\reflect.exe" -e -w
<BACKUP_TYPE> "C:\Users\Dev\Documents\Reflect\example.xml" " " )
' Run program after backup
objShell.Run " "C:\users\public\Admin\After backup.exe"", 1, true
```

Option	Description
File name	Write the path and executable file name that you wish to run at the start of the script.

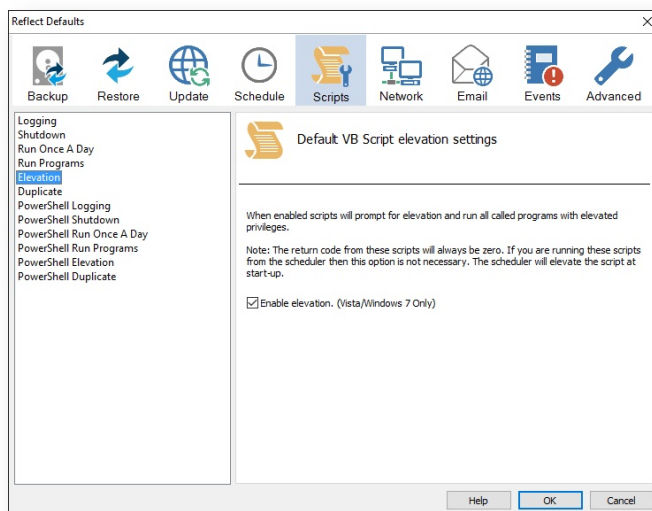
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Option	Description
Parameters	Include optional command line parameters for the program.
File name	Write the path and executable file name that you wish to run at the end of the script.
Parameters	Include optional command line parameters for the program.

VBScript Elevation is used for Vista and later, to run all programs with elevated privileges.



These options set the defaults for a script.



Generated code...

```

Sub VBMain( )
    Dim objShell
    Dim ExitCode
    ' Elevate this script for Admin privileges in Vista
    Elevate
    .....
    ' *****
    ' * Sub:      Elevate
    ' *
    ' * Purpose: Elevates this script for Vista UAC.
    ' *           This means that only one UAC Elevation prompt is displayed and
    ' *           functions/programs will not fail if they require admin privileges
    ' *
    ' * Input:   None
    ' * Output:  None

```

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```
' *
' *****
Sub Elevate
    Dim ShellApp
    Dim objShell
    Dim objWshProcessEnv
    ' Don't elevate if run from Windows Task Scheduler
    If WScript.Arguments.Count > 0 Then
        If WScript.Arguments.Item(0) = "-s" then
            Exit Sub
        End If
    End If
    Set objShell = WScript.CreateObject("WScript.Shell")
    Set objWshProcessEnv = objShell.Environment("PROCESS")
    If objWshProcessEnv("ELEVATED_APP") <> "True" Then
        objWshProcessEnv("ELEVATED_APP") = "True"
        Set ShellApp = CreateObject("Shell.Application")
        Call ShellApp.ShellExecute(""" & WScript.FullName & """ & """, "" & WScript.ScriptFullName & """, "" & GetBackupTypeParameter, , "runas")
        set ShellApp = nothing
        Set objWshProcessEnv = nothing
        wscript.quit
    End If
    Set objWshProcessEnv = nothing
    Set objShell = nothing
End Sub
```



The return code from these scripts will always be zero. If you are running these scripts from the scheduler then this option is not necessary. The scheduler will elevate the script at startup.

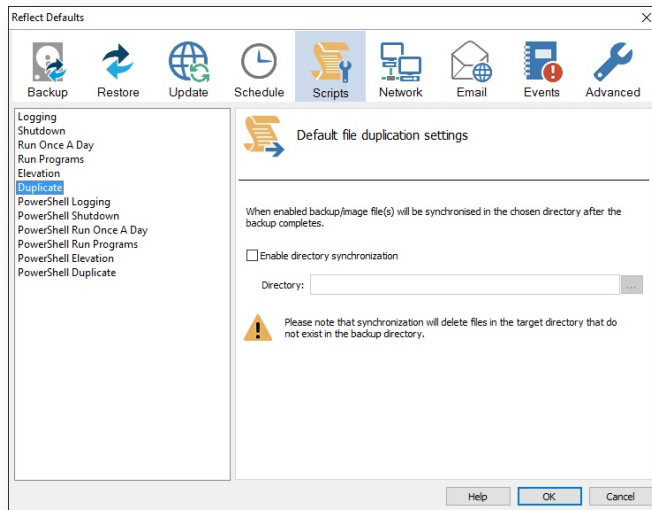
Option	Description
Enable Elevation	<p>Enables UAC elevation for the entire script.</p> <div> This enables functions and programs to run outside the context of Macrium Reflect without requesting further elevation. </div>

VBScript Duplicate option creates a copy of the backup to a chosen directory when the backup completes



These options set the defaults for a script.

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Generated code...

```
SynchroniseDirectories ExitCode, "C:\C++"

.....
' *****
' * Function: RobocopyExists
' *
' * Purpose: determines whether the program Robocopy can be called from the
' *           command line.
' *
' * Input:    None
' * Output:   boolean - true if Robocopy exists
' *
' *****

Function RobocopyExists()
    On Error Resume Next
    Dim objShell
    Dim objExec
    Set objShell = WScript.CreateObject("WScript.Shell")
    Set objExec = objShell.Exec ("robocopy.exe", 0)
    If Err.Number = 0 Then
        RobocopyExists = True
    Else
        RobocopyExists = False
    End If
End Function

' *****
' * Function: SynchroniseDirectories
' *
' * Purpose: Copies all files created by the previous backup / image
' *           to a supplied directory. Uses Macrium environment variables to
' *           determine which files to copy.
' *
' * Input:    ExitCode - The exit code of the last backup
' *           strBackupDirectory - Directory to copy to
' *
' *****

Function SynchroniseDirectories(Byval ExitCode, Byval strSyncDirectory)
```

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```
Dim objShell
Dim objWshProcessEnv
Dim strEnvPrefix
Dim strBackupDirectory
Dim strCmdLine
Dim iReturnCode
Dim fs
Dim objSyncFiles
Dim objBackupDirectory
Dim objSyncDirectory
Dim objBackupFile
Dim objSyncFile
Dim strExtension
Dim dateBackupFile
Dim dateSyncFile
' Only copy files if backup was successful
if ExitCode <> 0 Then
    Exit Function
End If
Set objShell = WScript.CreateObject("WScript.Shell")
Set objWshProcessEnv = objShell.Environment("VOLATILE")
' Get the prefix for the last backup set
strEnvPrefix = objWshProcessEnv("MACRIUM_PREFIX")
' Get the directory where we just created a backup
strBackupDirectory = objWshProcessEnv(strEnvPrefix + "_DIRECTORY")
If right(strBackupDirectory, 1) = "\" Then strBackupDirectory = left(
(strBackupDirectory, len(strBackupDirectory)-1)
If right(strSyncDirectory, 1) = "\" Then strSyncDirectory = left
(strSyncDirectory, len(strSyncDirectory)-1)
If RobocopyExists Then
    strCmdLine = "robocopy "<SOURCE>" "<DESTINATION>" *.mr* /copy:DAT
/lev:0 /purge /r:0"
Else
    ' Robocopy does not exist - using xcopy
    Set fs = CreateObject("Scripting.FileSystemObject")
    Set objBackupDirectory = fs.GetFolder(strBackupDirectory)
    Set objSyncDirectory = fs.GetFolder(strSyncDirectory)
    For Each objSyncFile in objSyncDirectory.Files
        strExtension = fs.GetExtensionName(objSyncFile)
        dateSyncFile = objSyncFile.DateLastModified
        If Left(strExtension,2) = "mr" Then
            ' Check if file has been deleted
            If Not(fs.FileExists(strBackupDirectory+"\ "+objSyncFile.name)) Then
                fs.DeleteFile(objSyncFile)
            Else
                ' Check if file has been modified
                Set objBackupFile = fs.GetFile(strBackupDirectory+"\ "+
objSyncFile.name)
                dateBackupFile = objBackupFile.DateLastModified
                If DateDiff("m", dateBackupFile, dateSyncFile) <> 0 Then
                    fs.DeleteFile(objSyncFile)
                End If
            End If
        End If
    Next
    strCmdLine = "xcopy "<SOURCE>\*.mr*" "<DESTINATION>" /c /d /h /i /v
/y"
End If
strCmdLine = Replace(strCmdLine,<SOURCE>, strBackupDirectory)
strCmdLine = Replace(strCmdLine,<DESTINATION>, strSyncDirectory)
```

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```
iReturnCode = objShell.Run(strCmdLine,0,true)
if iReturnCode <> 0 then
' Handle synchronisation error
else
' Everything OK
end if
' Clean up
Set objShell = nothing
Set objWshProcessEnv = nothing
End Function
```

Option	Description
Enable file copy	If enabled the backup will create a copy of the files from the backup to the supplied destination.
Directory	Here you will need to enter the folder that you want to copy/archive your backup files to.

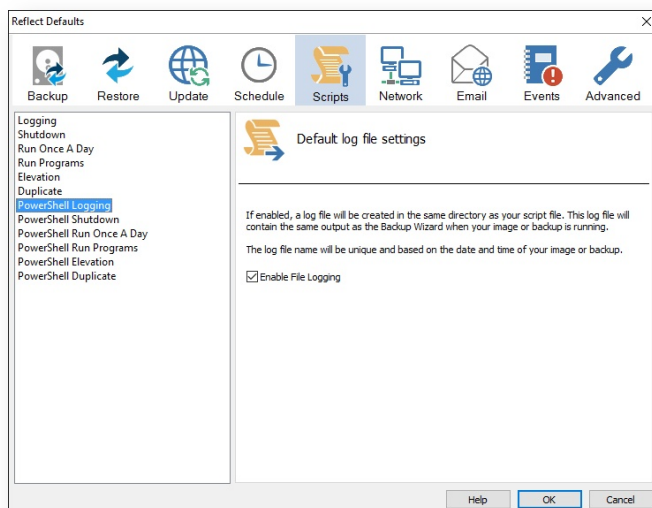


Please note that the synchronization will delete files in the target directory that do not exist in the backup directory.

Powershell Logging options enable file logging in the same directory as your script file.




These options set the defaults for a script.

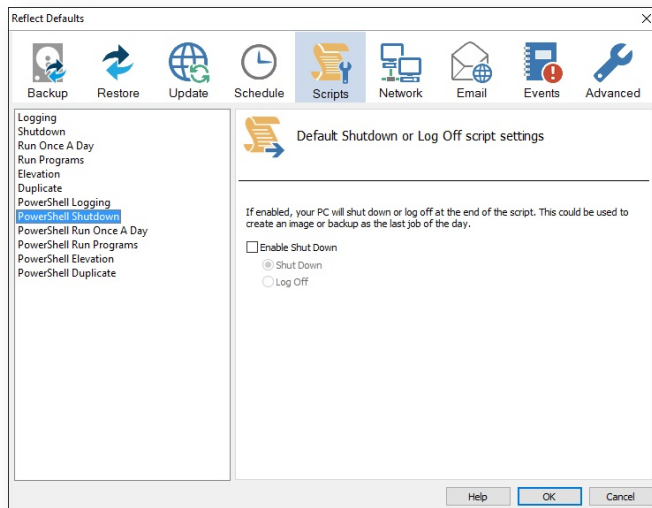


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- If enabled, the log file created will contain the same output as the Backup Wizard when your image or backup is running.
The log file name will be left unique and based on the date and time of your image or backup.

Powershell Shutdown option sets whether the PC should shutdown or log off at the end of the script.

 These options set the defaults for a script.




Generated code...

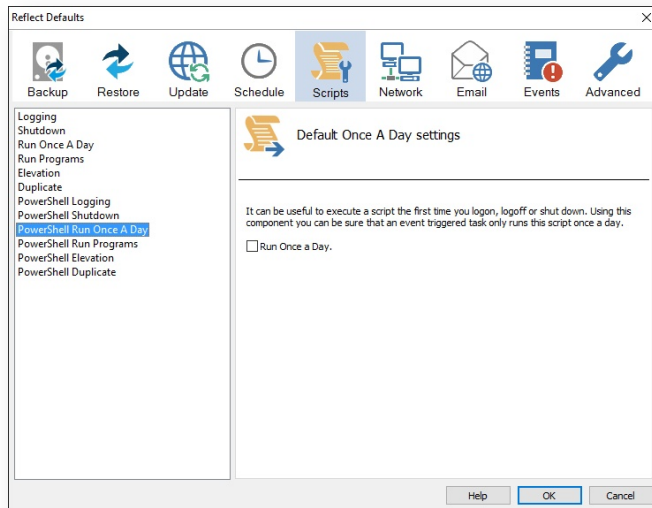
```
Write-Host ' * Initiating shutdown... ' -NoNewLine;
(Get-WMIObject Win32_OperatingSystem -ComputerName '.' -EnableAllPrivileges).
Win32Shutdown(8);
```

Option	Description
Shut Down	<input checked="" type="checkbox"/> Enable Shut Down <input checked="" type="radio"/> Shut Down <input type="radio"/> Log Off Your PC will shutdown after the script has been ran.
Log Off	<input checked="" type="checkbox"/> Enable Shut Down <input type="radio"/> Shut Down <input checked="" type="radio"/> Log Off Your PC will Log Off after the script has been ran.

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Powershell Run Once A Day option executes a script the first time you logon, logoff or shutdown.

 These options set the defaults for a script.



Generated code...

```
if (HasRunToday)
{
    Write-Host ' * Script already executed today. Exiting...';
    Write-Host 'Script finished with exit code 0.';
    Exit 0;
}

.....
#*****
#* Func: HasRunToday
#*
#* Desc: determines if this script has run today
#*
#*****
function HasRunToday()
{
    Write-Host ' * Checking last run time... ' -NoNewLine;
    $strRegPath    = 'HKCU:\Software\Macrium\Reflect\Scripts';
    $boolRanToday  = $false;
    $strDateToday  = Get-Date -UFormat %Y%m%d;
    if (Test-Path $strRegPath)
    {
        try
        {
            $strLastRunDate = (Get-ItemProperty -Path $strRegPath -Name $strScript
Path -ErrorAction Stop).$strScriptPath
            if ($strLastRunDate -eq $strDateToday)
            {
                $boolRanToday = $true;
            }
        }
    }
}
```

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```


    }
    } catch { };
}
if (!$boolRanToday)
{
    Set-ItemProperty -Path $strRegPath -Name $strScriptPath -Value $strDateToday;
}
Write-Host 'Done.';
return $boolRanToday;
}

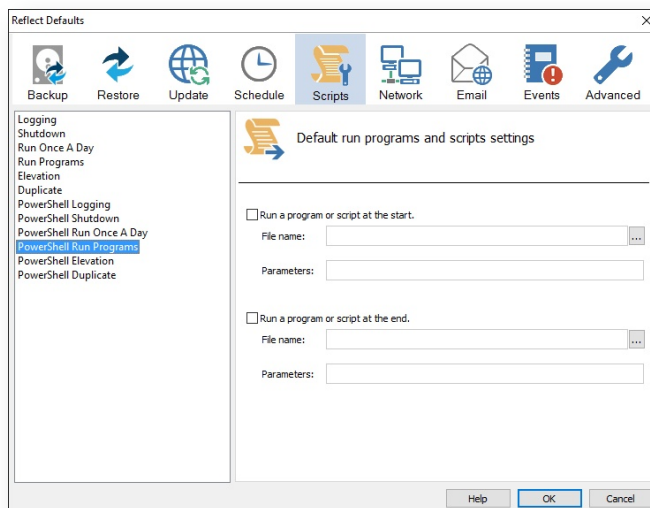
```

Option	Description
Run once a day	<input checked="" type="checkbox"/> Run Once a Day. The script will run only once a day.

 This is useful if you want a backup to happen at first login or shutdown.

Powershell Run Programs selects programs or scripts to run at the start or end of the script.

 These options set the defaults for a script.



Generated code...

```

Write-Host ' * Executing "at start" program... ' -NoNewLine;
$strRunAtStartApp = 'C:\Users\Public\Admin\Before backup.bat';
$strRunAtStartArgs = '';

```

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```
if ([string]::IsNullOrEmpty($strRunAtStartArgs))
{
    Start-Process -FilePath $strRunAtStartApp;
}
else
{
    Start-Process -FilePath $strRunAtStartApp -ArgumentList $strRunAtStartArgs;
}
.....
Write-Host ' * Executing "at end" program... ' -NoNewLine;
$strRunAtEndApp = 'C:\Users\Public\Admin\After backup.exe';
$strRunAtEndArgs = '';
if ([string]::IsNullOrEmpty($strRunAtEndArgs))
{
    Start-Process -FilePath $strRunAtEndApp;
}
else
{
    Start-Process -FilePath $strRunAtEndApp -ArgumentList $strRunAtEndArgs;
}
```

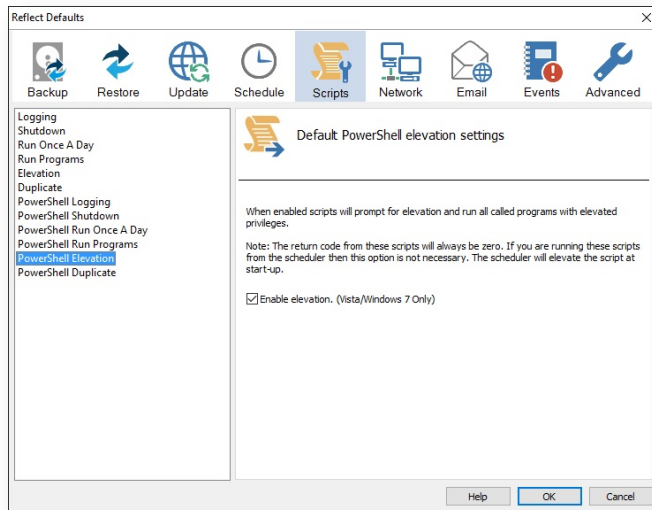
Option	Description
File name	Write the path and executable file name that you wish to run at the start of the script.
Parameters	Include optional command line parameters for the program.
File name	Write the path and executable file name that you wish to run at the end of the script.
Parameters	Include optional command line parameters for the program.

Powershell Elevation is used for Vista and later, to run all programs with elevated privileges.



These options set the defaults for a script.

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Generated code...

```
function Main()
{
    Write-Host 'PowerShell script for Macrium Reflect Backup Definition File';
    Write-Host "BDF: $strXmlFilePath";
    Elevate;

    .....
    *****
    #* Func: Elevate
    #*
    #* Desc: Elevates this script for UAC.
    #*      This means that only one UAC Elevation prompt is displayed and
    #*      functions/programs will not fail if they require admin privileges.
    #*
    *****
    function Elevate()
    {
        # Only elevate if not ran from the task scheduler.
        Write-Host ' * Checking elevated access rights... ' -NoNewLine;
        if (-Not $s)
        {
            # Check to see if we are currently running "as Administrator"
            if (!(Security.Principal.WindowsPrincipal)[Security.Principal.
WindowsIdentity]::GetCurrent()).IsInRole([Security.Principal.WindowsBuiltInRole]"A
dministrator"))
            {
                $ElevatedProcess = new-object System.Diagnostics.ProcessStartInfo "PowerShel
l";

                # Specify the current script path and name as a parameter
                $strType = GetBackupTypeParameter;
                $ElevatedProcess.Arguments = "-ExecutionPolicy Bypass & '" + $script:
MyInvocation.MyCommand.Path + "' $strType";
                # Indicate that the process should be elevated
                $ElevatedProcess.Verb = "runas";
                # Start the new process
                [System.Diagnostics.Process]::Start($ElevatedProcess);
                # Exit this unelevated script with exit code for "Error: Not elevated"
```

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```

        Exit 3;
    }
}
Write-Host 'Done.';
}

```



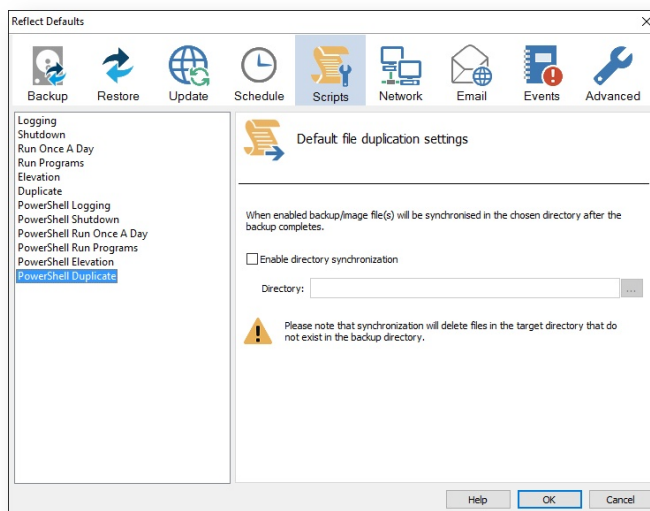
The return code from these scripts will always be zero. If you are running these scripts from the scheduler then this option is not necessary. The scheduler will elevate the script at startup.

Option	Description
Enable Elevation	<p>Enables UAC elevation for the entire script.</p> <div> This enables functions and programs to run outside the context of Macrium Reflect without requesting further elevation. </div>

Powershell Duplicate option creates a copy of the backup to a chosen directory when the backup completes.



These options set the defaults for a script.



Generated code...

```
if ($?ExitCode -eq 0) # if backup completed successfully...
```

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```
{
    $strBackupDir = GetLastBackupPath;
    if (![string]::IsNullOrEmpty($strBackupDir))
    {
        SynchroniseDirectories $strBackupDir 'D:\Archive';
    }
}

.....
#####
#* Func: SynchroniseDirectories
#*
#* Desc: Copies all Macrium Reflect files to a supplied directory.
#*
#####
function SynchroniseDirectories($strSrcDir, $strDstDir)
{
    Write-Host ' * Synchronising directories... ' -NoNewLine;
    if (Get-Command robocopy -ErrorAction SilentlyContinue)
    {
        # robocopy is available...
        # /copy:DAT - D:Data
        #           A:Attributes
        #           T:Time stamps
        # /purge    - deletes destination files and directories that no longer
        #               exist in the source
        # /lev:0    - Does not copy subdirectories
        &robocopy $strSrcDir $strDstDir *.mr* /copy:DAT /lev:0 /purge /r:0 | Out-Null
    }
    else
    {
        # Fall back to xcopy...
        # Delete files from the target directory not present in the source directory
        $strDstDirChildren = $strDstDir+"\*";
        Get-ChildItem $strDstDirChildren -include "*.mr*" | Foreach-Object {
            $strMaybeDeletedSrcFile = $strSrcDir + '\' + $_.Name;
            if (-not (Test-Path $strMaybeDeletedSrcFile))
            {
                Remove-Item $_
            }
            else
            {
                $SrcFileTime = [datetime](Get-ItemProperty -Path $strMaybeDeletedSrcFile -
Name LastWriteTime).lastwritetime;
                $DstFileTime = [datetime](Get-ItemProperty -Path $_.FullName -
Name LastWriteTime).lastwritetime;
                $SrcFileTimeString = $SrcFileTime.ToString("yyMMddHHmmss")
                $DstFileTimeString = $DstFileTime.ToString("yyMMddHHmmss")
                if ($SrcFileTimeString -ne $DstFileTimeString)
                {
                    Remove-Item $_
                }
            }
        }
    }
    # /c - Continues copying even if errors occur.
    # /d - Date check; only copies if file does not exist or is older.
    # /h - Copies hidden and system files.
    # /i - If the destination does not exist, and you are copying more than one
    #       file, this switch assumes that the destination is a folder.
    # /v - Verifies each new file.
    # /y - Overwrites existing files without prompting.
    &xcopy $strSrcDir\*.mr* $strDstDir /c /d /h /i /v /y | Out-Null
}
```

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```
}
Write-Host 'Done.';
}
```

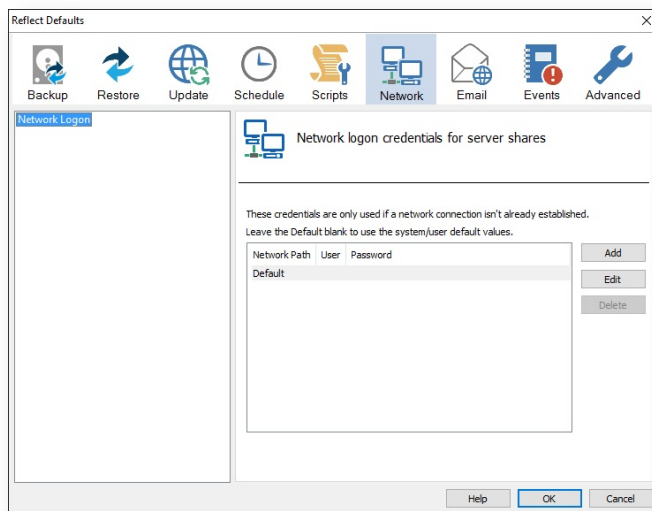
Option	Description
Enable file copy	If enabled the backup will create a copy of the files from the backup to the supplied destination.
Directory	Here you will need to enter the folder that you want to copy/archive your backup files to.



Please note that the synchronization will delete files in the target directory that do not exist in the backup directory.

Network Settings

Windows contains a [Network Credentials cache](#) that enables network authentication details (User name and password) to be saved and re-used to logon automatically. However, scheduled tasks are run in Windows 'batch mode' and do not have access to saved credentials. Because of this you must enter network login details in the Macrium Reflect defaults to enable scheduled tasks to access and write to password protected network shares.



Option	Description
Add	Add network logon details for a new network location
Edit	Edit an existing location.

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Option	Description
	<p>Note: The 'Default' location logon details will be used for all shares that aren't explicitly added.</p>
Delete	Remove logon credentials

Add / Edit

Network Location Details

Specify credentials for a specific network path using the fields below

server\share: \\NAS\public

Username: Network\User

Password: [masked]

OK Cancel

Option	Description
\\Server\share	Enter the UNC path to the root of the network share. Do not enter any sub-folders in the path
Username	Enter the authenticated user that has access to the share
Password	Enter the users password.

You can also **select 'Default'** and **click 'Edit'** to provide default credentials to be used for all network shares:

Network Location Details

Specify credentials for a specific network path using the fields below

server\share: [empty]

Username: Network\User

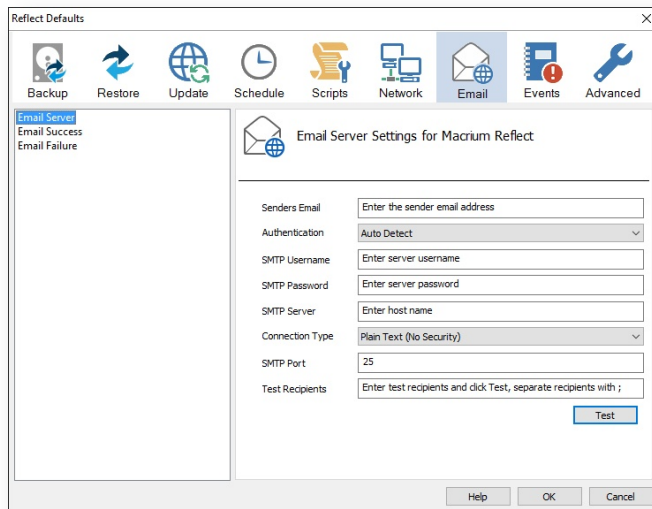
Password: [masked]

OK Cancel


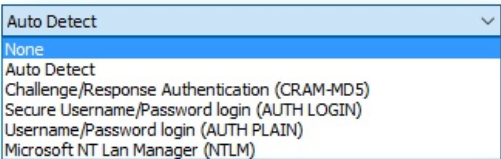

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Email Settings

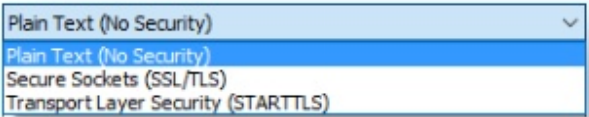


- For many users, email notification of success or failure of a backup helps them keep on top of the status of their backups, particularly with scheduled backups which take place in the background.
- Select '**Email**' > '**Email Server**'.



Email Server options description:

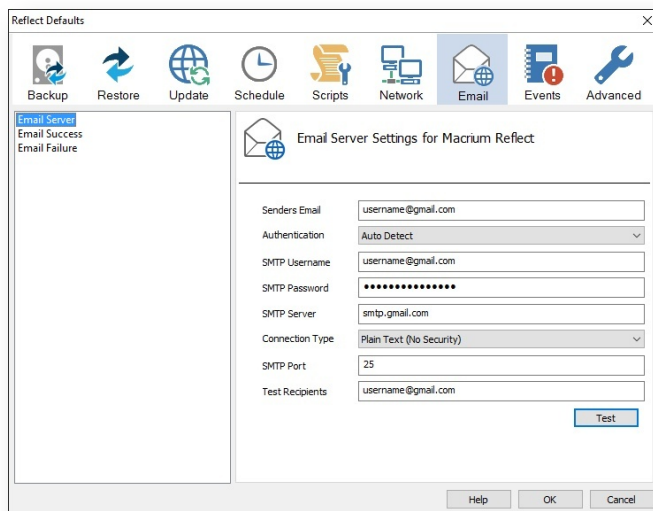
Option	Description
Senders Email	<p>Your e-mail address associated with your ISP or Gmail account etc.</p> <div> Note: If you use e-mail software such as MS Outlook, you can find the settings under Account Settings for e-mail address, user-name and Server.</div>
Authentication	<p>Authentication options are set by your email provider/server.</p> <div></div> <div> Note: If you do not know your authentication settings, try Auto Detect.</div>

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Option	Description
SMTP Username	The user name associated with your e-mail account. This is essentially your email address.
SMTP Password	This is the password for your e-mail Server.
SMTP Server	This is the outgoing / SMTP Server setting or IP address.
Connection Type	<p>This is the setting for the way Macrium Reflect will contact the Server.</p>  <div>  <p>Note: These settings can be found from your email provider.</p> </div>
SMTP Port	<p>This is associated with Connection Type and is the port number that the SMTP server is listening on.</p> <div>  <p>Note: These settings can be found from your email provider.</p> </div>
Test Recipients	This option is used to test the configured settings; enter your e-mail address in that field and click Test to send a test message to your email.

The following examples show completed Server settings for a typical ISP.

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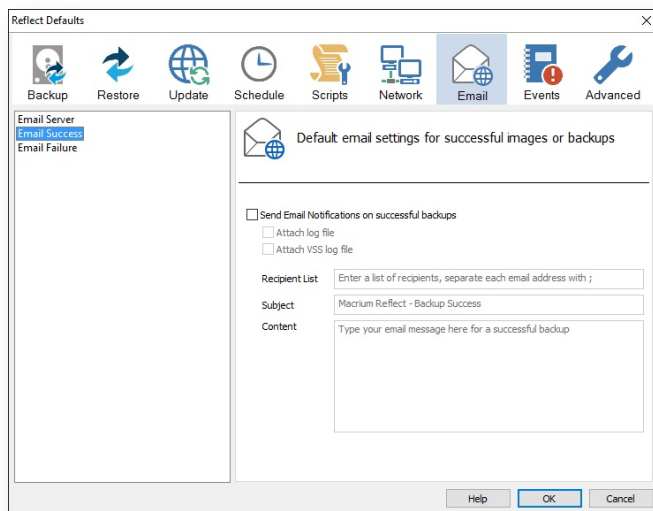
- Click **OK** to finish.



Note: If you are using your Gmail account then please see here: [Using Gmail SMTP Server for sending backup notification emails](#)

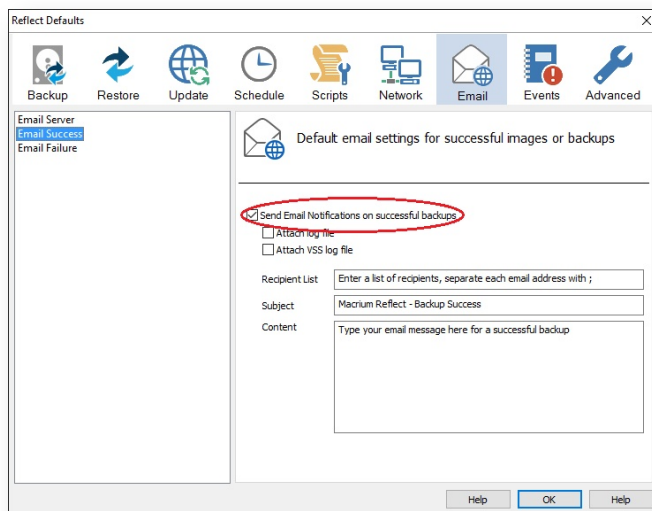
Email success settings define who receives emails regarding the success of a backup and what message they receive.

- Select **Email Success**



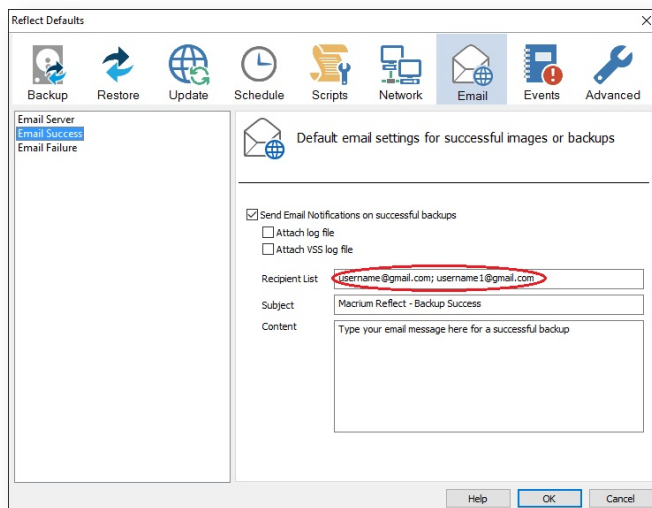
- Select **Send Email Notifications on successful backups**.

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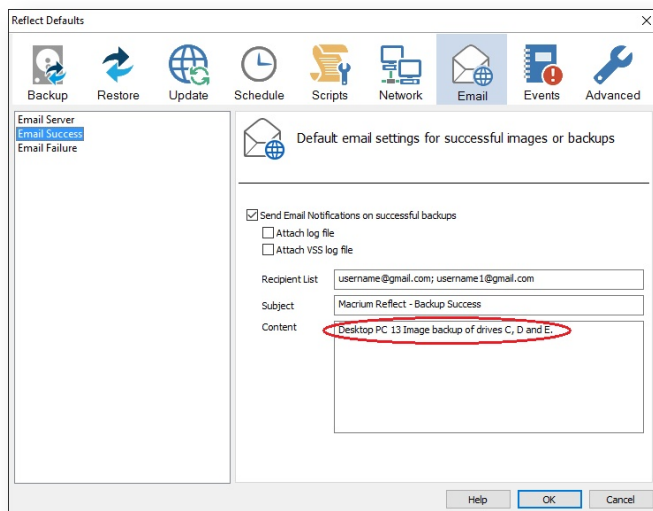
Option	Description
Attach log file	Will attach the log file from the creation of the backup.
Attach VSS log file	Will attach the VSS log with the events made during the backup.

- Enter the email addresses of all recipients in **Recipient List**, separating each email address with a semi-colon.



- Enter the subject for the email in **Subject**.
- Enter a message to be sent regarding the email in **Content**, include the PC that generated the success is identified.

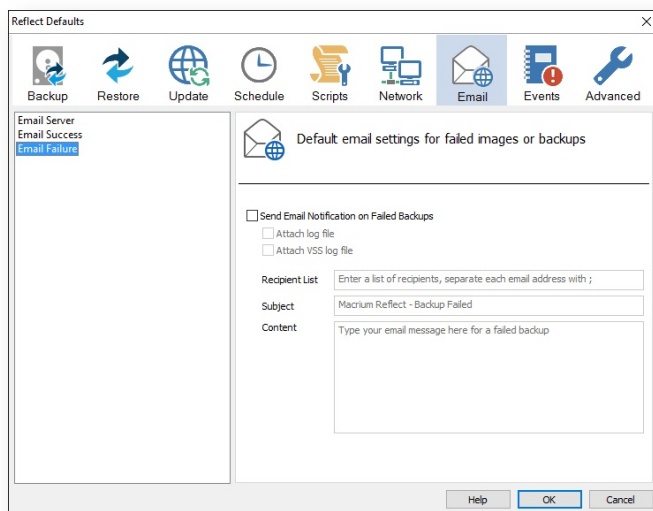
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- Click **OK**.

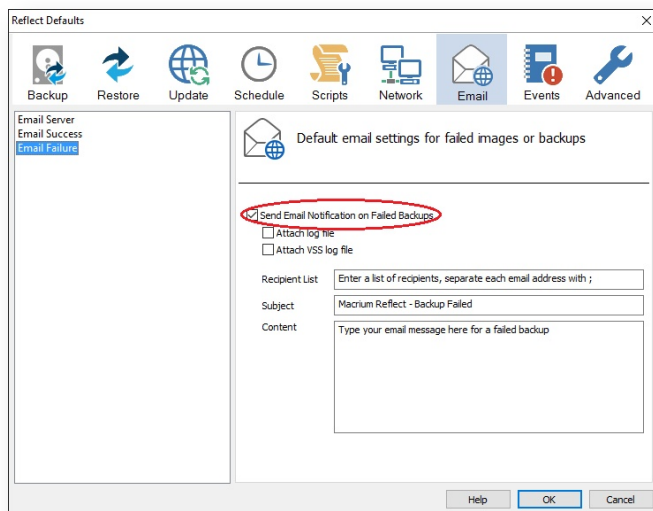
Email failure settings define who receives emails regarding the failure of a backup and what message they receive.

- Select **Email Failure**.



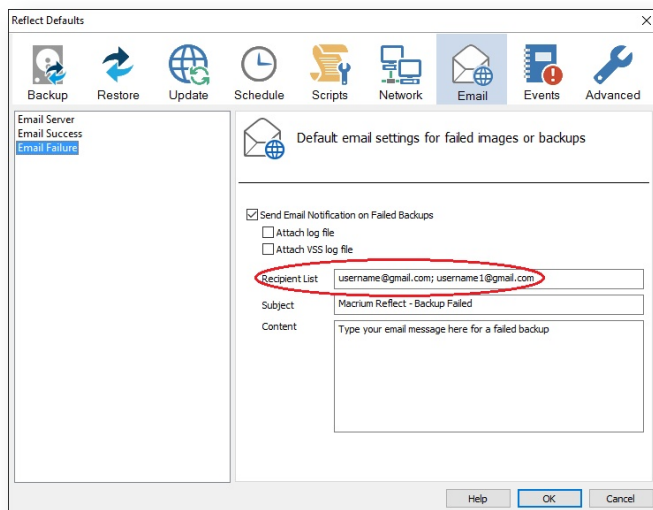
- Select **Send Email Notification on Failed Backups**.

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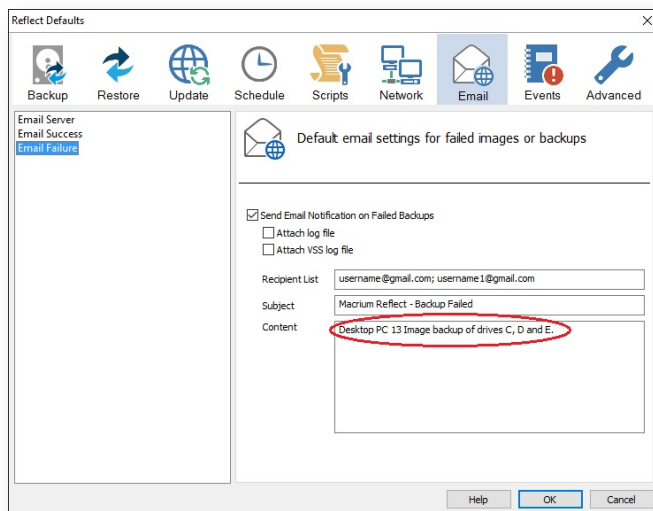
Option	Description
Attach log file	Will attach the log file from the creation of the backup.
Attach VSS log file	Will attach the VSS log with the events made during the backup.

- Enter the email addresses of all recipients in **Recipient List** , separating each email address with a semi-colon.



- Enter the subject for the email in **Subject**.
- Enter a message to be sent regarding the email in **Content**, include the PC that generated the success is identified.

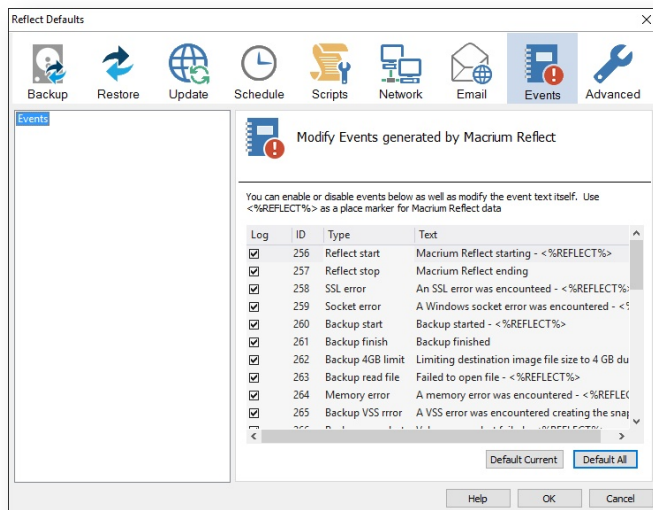
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- Click **OK**.

Events

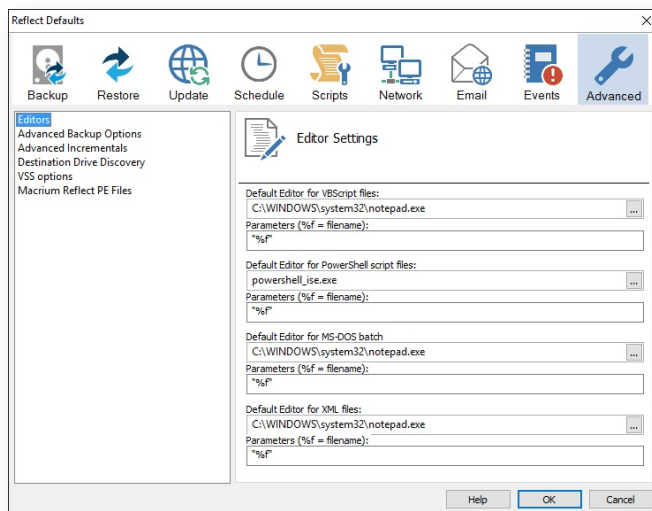
Enable or disable Windows Events generated by Macrium Reflect.



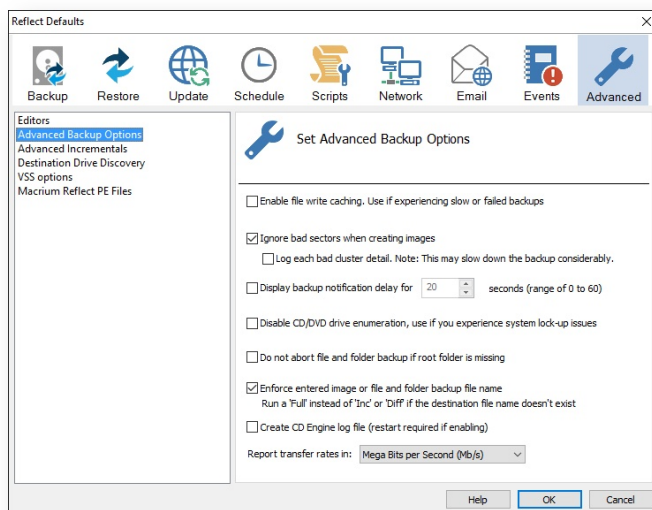
Advanced

Editor settings are used to amend the default editor settings for; VBScript files, Powershell script files, MS-DOS batch and XML.

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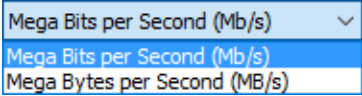


Advanced Backup Options are used to modify your backup options.



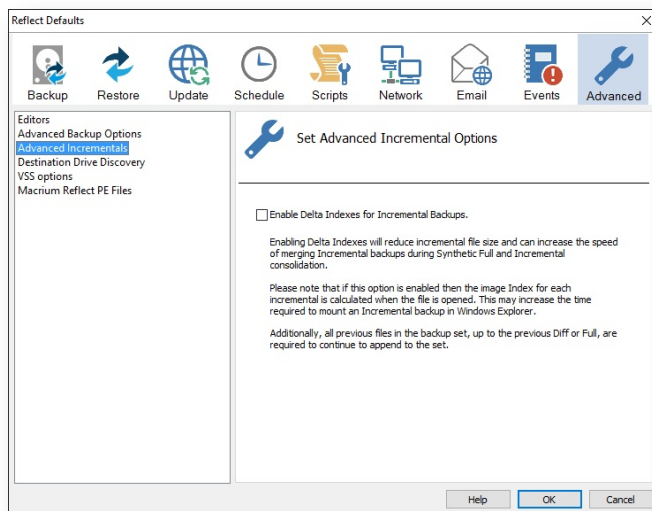
Option	Description
Enable file write caching	Is useful if experiencing slow or failed backups.
Ignore bad sectors when creating images.	Damaged disks may still be imaged if this option is selected.
	Changes the time delay windows is displayed before a scheduled backup starts.

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Option	Description
Display backup notification delay for set number of seconds.	
Disable CD/DVD drive enumeration	This option is useful if experiencing system lockup issues.
Do not abort a file and folder backup if a root folder is missing.	Enabling this option will allow your File and Folder backup to continue even if a root folder of the backup is missing.
Enforce an entered image or File and Folder backup file name.	<p>Normally, if you run an Incremental or Differential image of say drive 'C', the target folder is searched for a recent backup set for the same source (Drive 'C'). The backup set is then appended to. The file name you have chosen for the backup will not be used in this matching process.</p> <p>If you enter your own file name and select " Enforce entered image or file and folder backup file name" then only backup sets using the same file name and for the same source will be appended to, if none is found then a new full will be created.</p>
Create a CD Engine log file	Turning this option on allows reflect to create additional logs that can be used for troubleshooting created CD/DVD Rescue Media.
Report transfer rates.	<p>Will allow you to change the way transfer rates are reported in.</p> 

Advanced Incremental options are used for enabling Delta Indexes for Incremental backups

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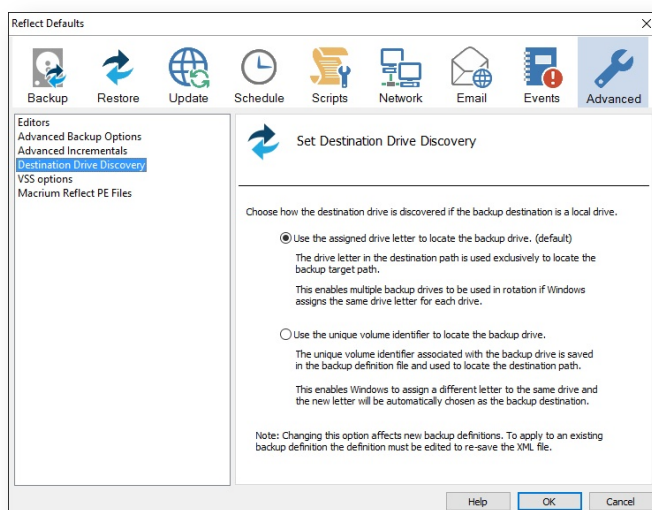


- Enabling **Delta indexes** will reduce incremental file size and can increase the speed of merging Incremental backups during Synthetic Full and Incremental consolidation.
Additionally, all previous files in the backup set, up to the previous Diff or Full, are required to continue to append to the set.



If this option enabled then the image Index for each incremental is calculated when the file is opened. This may increase the time required to mount an Incremental backup in Windows Explorer.

Destination Drive Discovery options change the way your destination drive is being discovered if the destination is a local drive.

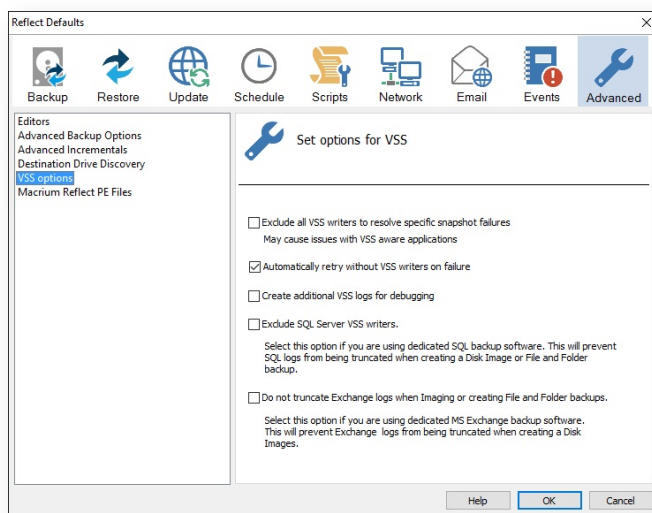



Changing the option affects new backup definitions. To apply to an existing backup definition, the definition XML file needs to be opened and re-saved by clicking 'Finish'.

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Option	Description
Use the assigned drive letter to locate the backup drive (default)	The drive letter in the destination path is used exclusively to locate the backup target path. Multiple backup drives can be used in rotation if Windows assigns the same drive letter for each drive.
Use the unique volume identifier to locate the backup drive	The unique volume identifier associated with the backup drive is saved in the backup definition file and used to locate the destination path. Windows will assign a different letter to the same drive and the new letter will be automatically chosen as the backup destination.

VSS Options are used to set options for VSS

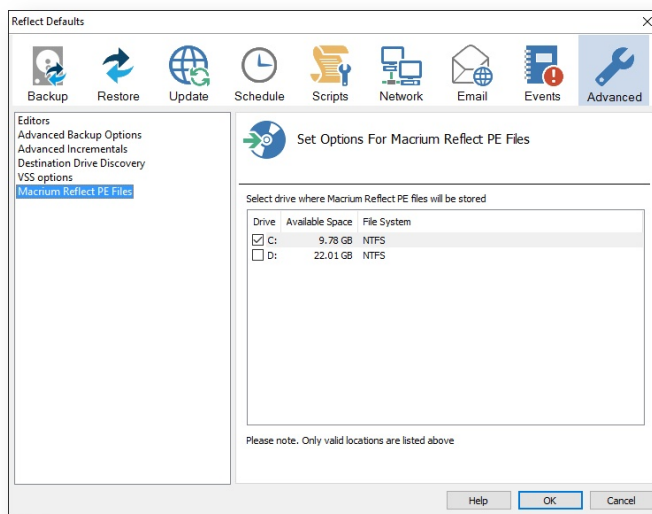


Option	Description
Exclude all VSS writers to resolve specific snapshot failures.	This option will disable VSS writers. Due to Windows system configuration issues, VSS writers are the cause of some backup failures. <div>  This may cause issues with other VSS aware applications. </div>
Automatically retry without VSS writers on failure	Reflect will try to create a backup of your system without using VSS; this option is useful when experiencing VSS related errors.
Create additional VSS logs for debugging.	Each backup will create additional VSS logs that can be used in order to troubleshoot VSS related issues when creating backups.

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Option	Description
Exclude SQL Server writers.	Select this option if you are using dedicated SQL backup software. This will prevent SQL logs from being truncated when creating a Disk Image or File and folder backup.
Do not truncate Exchange logs when imaging or creating file and folder backups.	Select this option if you are using dedicated MS Exchange backup software. This will prevent Exchange logs from being truncated when creating a Disk Images.

Macrium Reflect PE Files options are used to select the drive where Macrium Reflect PE files will be stored.



- If your system contains multiple drives you can choose on what Drive Macrium Reflect PE files are saved.

PXE Deployment

This article will take you through PXE deployment of the Rescue Media.

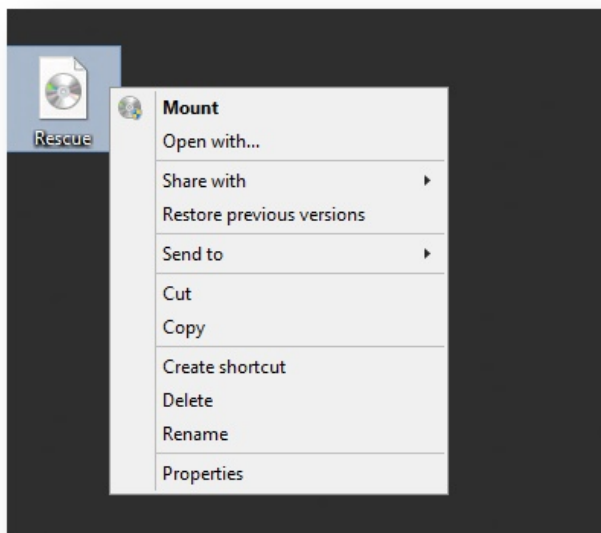


In order to use this technology you will need to have purchased the Macrium Reflect Technicians Deployment License.

If you wish to obtain this license please [click here](#) for further details.

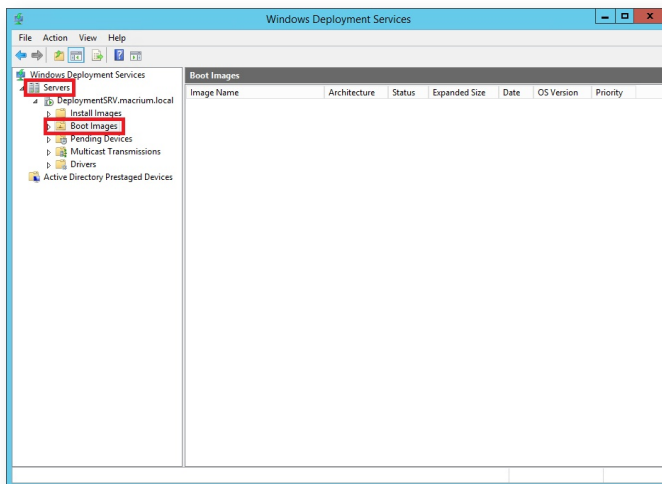
Before you begin: You will need to have set up a Windows Deployment Services Server and created a rescue media ISO image file. See [Creating rescue media](#) (see page 69).

1. **Mount the Rescue Media Image** that was created earlier.

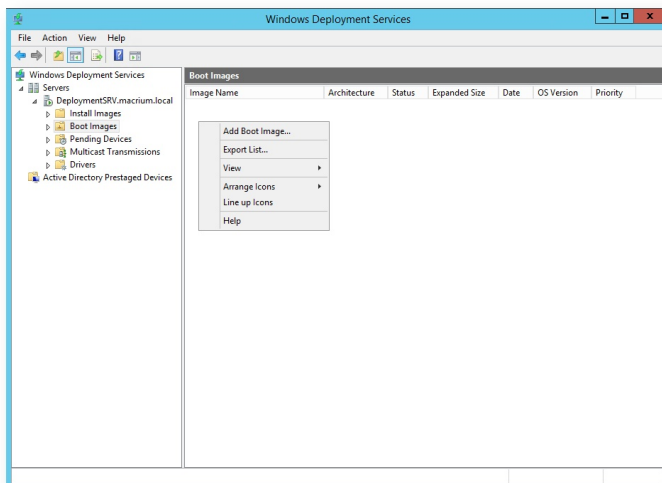


2. **Open** Windows Deployment Services and **select 'Servers > Boot Images'**

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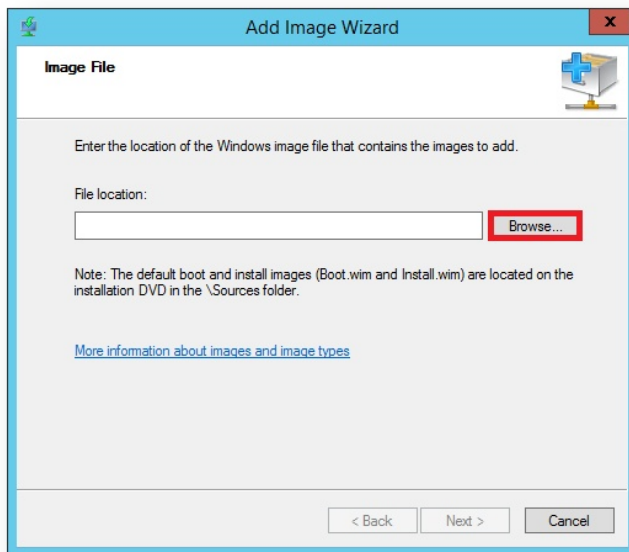


3. Right click the right pane and click 'Add Boot Image...'

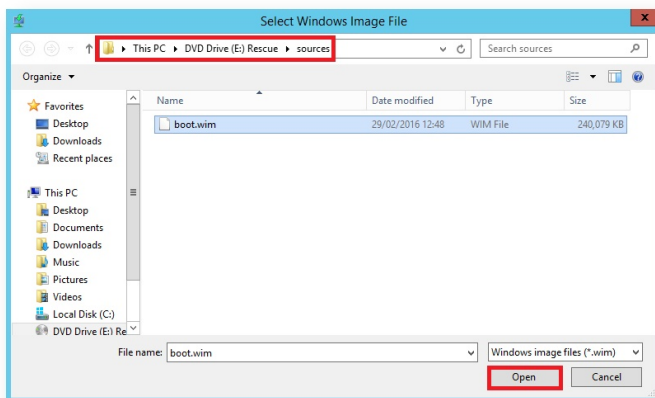


4. In the **Wizard** you can **browse** for a location of the **bootable WIM**.

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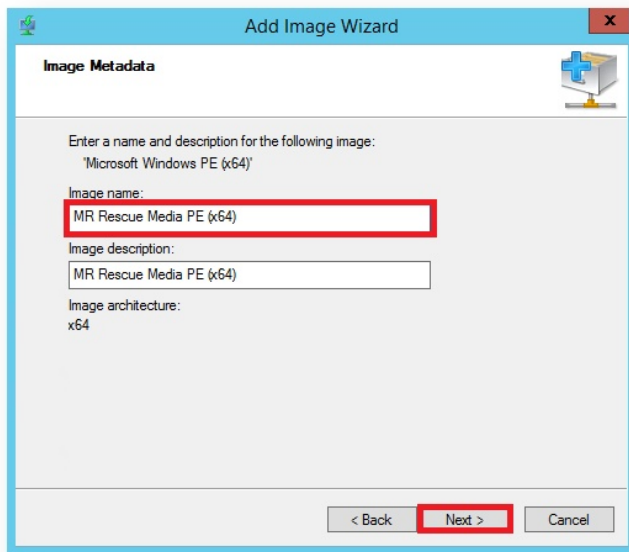


5. **Locate 'boot.wim'** in the **'sources'** folder of the mounted Rescue Media Image and **click 'Open'** then **'Next'**.

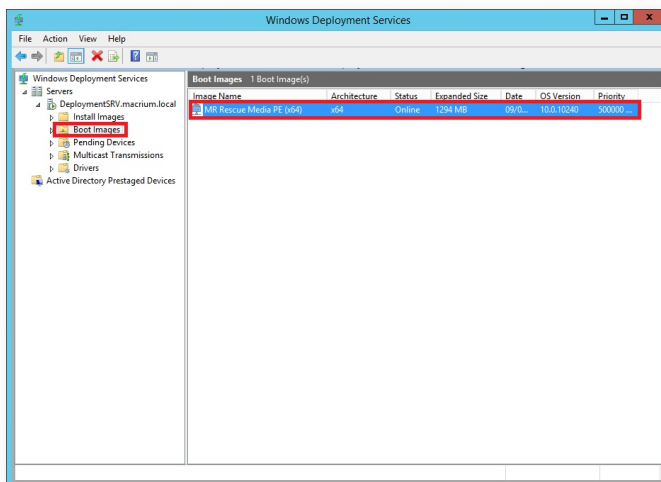


6. **Name your boot image** and **click 'Next'** twice.

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7. Once finished you will see the bootable image in the '**Boot Images**' section of Windows Deployment Services console.



You will now be able to boot PCs on your network with the Macrium Reflect Rescue Media.

Standalone backup set consolidation

It can be useful to independently consolidate multiple files in a backup set into a single Full or to consolidate a group of Incremental backups. This helps to conserve disk space and can be used when archiving your backups to optimize the number of backups being copied.

Independent consolidations can be run without creating a backup or launching Macrium Reflect by running a small utility **Macrium Image Consolidation**:

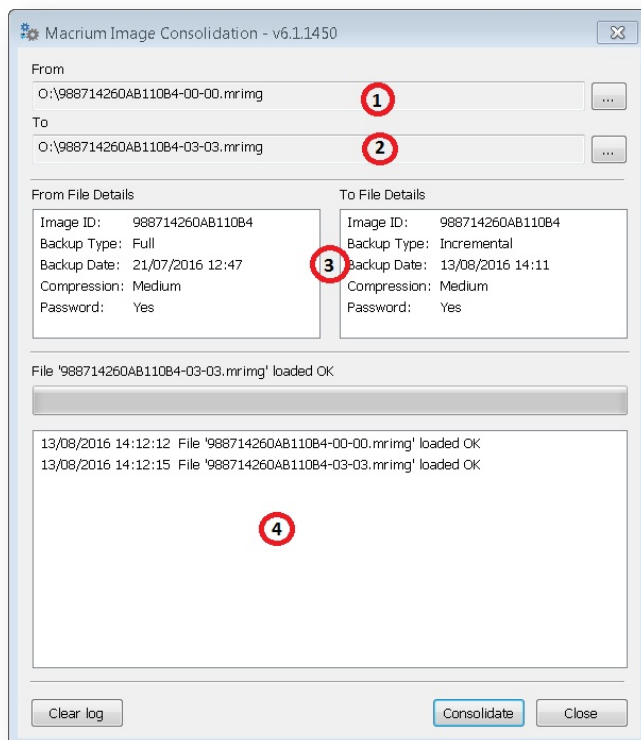
Download: <http://updates.macrium.com/reflect/utilities/consolidate.exe>

Using Macrium Image Consolidation

To Launch Macrium Image Consolidation **double click 'consolidate.exe'** in Windows Explorer.



'**consolidate.exe**' is a standalone executable that does not require installing.



Area	Description
1	

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Area	Description						
	<p>Enter the 'From' backup file for the consolidation process, or click '...' to browse. This is usually the Full backup, ending in '00-00.mrimg', but can be an Incremental file.</p> <p>Valid Macrium backup file types are:</p> <table><tr><td>Image files:</td><td>.mrimg</td></tr><tr><td>File and Folder backup files:</td><td>.mrbak</td></tr><tr><td>Exchange backup files:</td><td>.mrex</td></tr></table>	Image files:	.mrimg	File and Folder backup files:	.mrbak	Exchange backup files:	.mrex
Image files:	.mrimg						
File and Folder backup files:	.mrbak						
Exchange backup files:	.mrex						
2.	<p>Enter the 'To' file for the consolidation process, or click '...' to browse. This must be in the same backup set as 1. and must have been created after the backup in 1.</p> <p>Click 'Consolidate' to begin the consolidation process.</p>						
3.	<p>Basic information about the backup files.</p>						
4.	<p>The output Window. This is populated after clicking 'Consolidate' and contains detailed information about the consolidation process.</p>						



Note: Selecting a '**Full**' image for the '**From**' backup file will create a consolidated '**Synthetic Full**' image.

Restrictions when choosing the 'From' and 'To' backup files.

- Each file must be from the same backup set. See [How backup sets are created and maintained](#) (see page 130) for more information on sets.

Error output:

```
From and To files are from a different backup set.
```

- The 'To' file must have been created after the from file.

Error output:

```
From file is more recent than the To file
```

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- The backup set cannot contain any Differential backups.

Error output:

```
The backup set contains Differential backups
```

Converting a Physical machine to Virtual Machine

This knowledgeable article will guide you through the steps needed to convert a physical machine to a virtual machine.



Links have been added to every applicable step to explain the step in greater detail if need.

1. Using Macrium Reflect [take an image of your physical machine](#) (see page 119). (see page 119)
2. Once you have an image, [create a Rescue Media ISO image](#).
3. Create a Virtual Machine using your preferred hypervisor (Hyper-V, VMware, Virtual box...), assigning to it a vCPU, Memory and a Virtual Hard Disk.
4. Boot the VM using the created Rescue Media ISO image.
5. From the booted Rescue Media [restore your image](#) (see page 115) on to the Virtual Hard Disk attached to your VM.
6. Without exiting the Rescue Media, run the [ReDeploy](#) (see page 263) option.
7. Detach the ISO from your VM and reboot it.

Automatic System Restore



Note: These steps require **Macrium Reflect v6.3** or later. To upgrade to the latest release **take the 'Other Tasks' > 'Check for updates' menu option.**

This article describes the steps involved to setup a 'one-click' system restore. Using Macrium Reflect you can automatically and easily return a Windows PC to a previously imaged system recovery point.

- System restore is completed without any user interaction during the restore process.
- Using Rapid Delta Restore (RDR) recovery is fast!
- BitLocker encrypted drives can be restored without requiring re-encryption after restore.
- The restore can be password protected to prevent accidental or unauthorised recovery.

Add the Macrium recovery boot menu

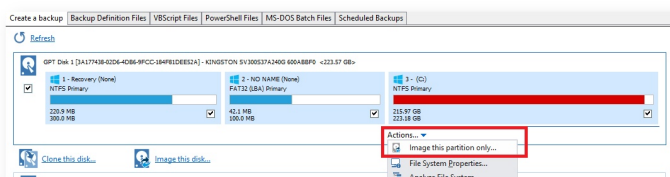
The first step is to add the Macrium boot menu. Take 'Other Tasks' > 'Add Recovery Boot Menu' in Macrium reflect and follow the instructions here: [Adding a boot menu option for system Image recovery \(see page 82\).](#)



Adding a boot menu is optional but will enable simple one-click restore when the PC starts. Without a boot menu you can still automatically restore by booting into optical rescue media or an external USB drive.

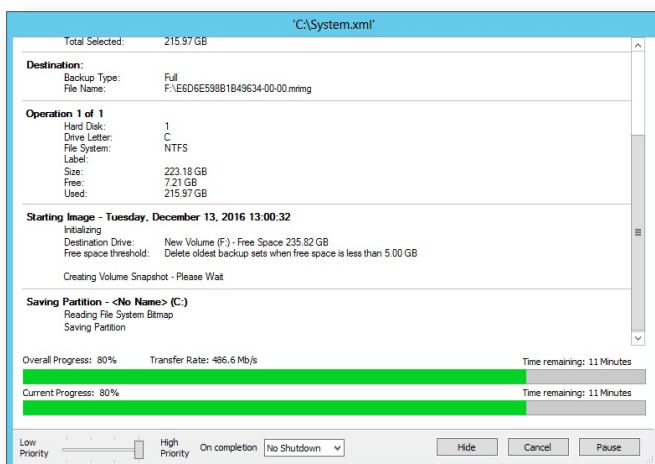
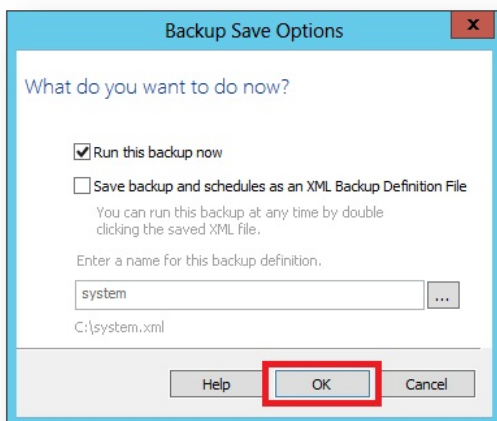
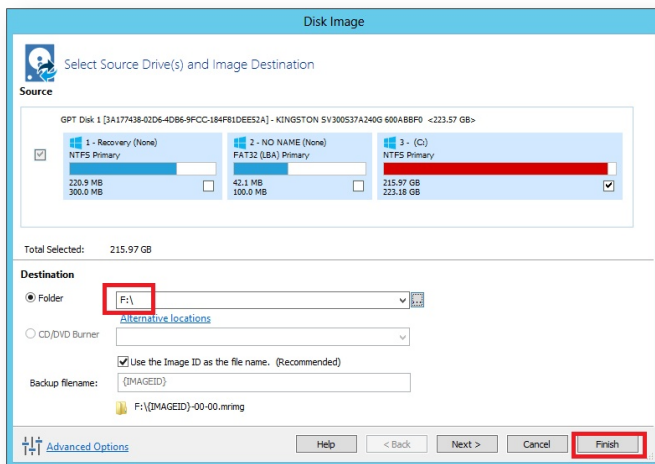
Create an image of drive C:

1. Start Macrium Reflect, select 'Image this partition only...' for drive C.



2. Choose a location that will be accessible when the recovery media boots, this could be a spare partition on an internal drive or an external USB disk or flash drive.
In this example we'll choose drive 'F:\', an internal partition.

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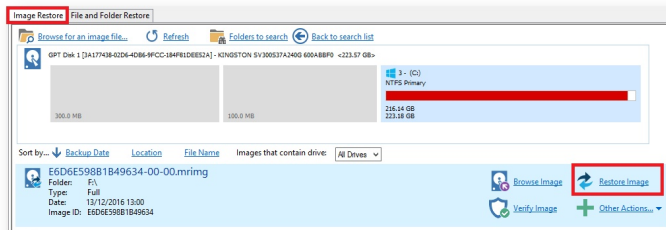


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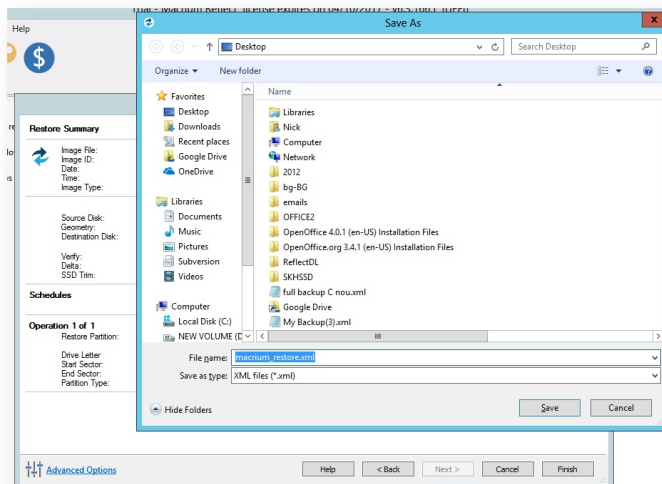
Prepare the auto restore XML file

Once the image completes we can prepare the xml file to automatically restore the image. To do this we need to step through the restore wizard but we aren't going to start the restore.

1. Start Macrium Reflect, click the 'Restore' tab, select the image created above and click the 'Restore Image' link.



2. In the Wizard that opens, click through to the final wizard page and press the Ctrl+Shift+S keys together.



In the save dialog that opens, **save the file 'macrium_restore.xml'** to the **root** of any local drive that is accessible when Windows PE starts,
In this example we're saving to the root of the same drive that contains the image file, drive 'F:'.

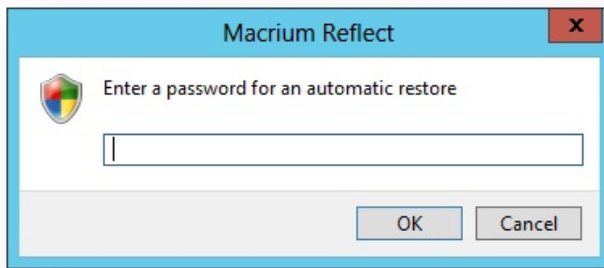


Note: Do not save to drive C: as this drive be overwritten during the restore process.

Password protect the restore

The auto restore can be password protected for security. Instead of Ctrl+Shift+S **press Ctrl+Shift+P** and a **Password dialog is displayed:**

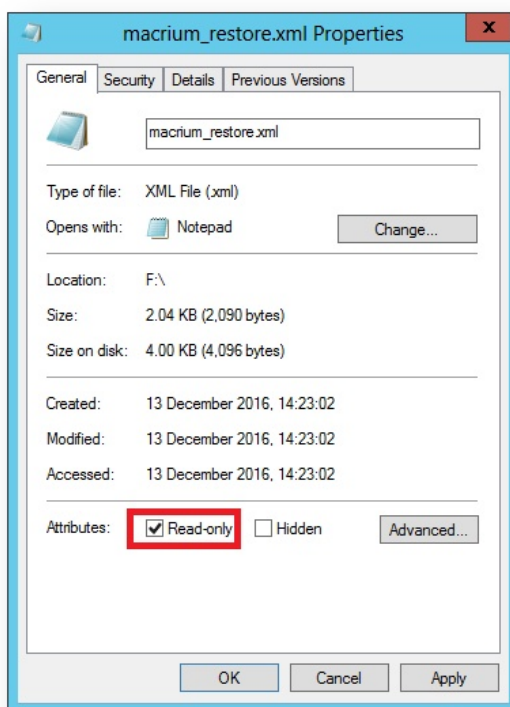
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After entering a password you'll be prompted with the 'Save As' dialog as shown above. This password must be entered to start the restore process.

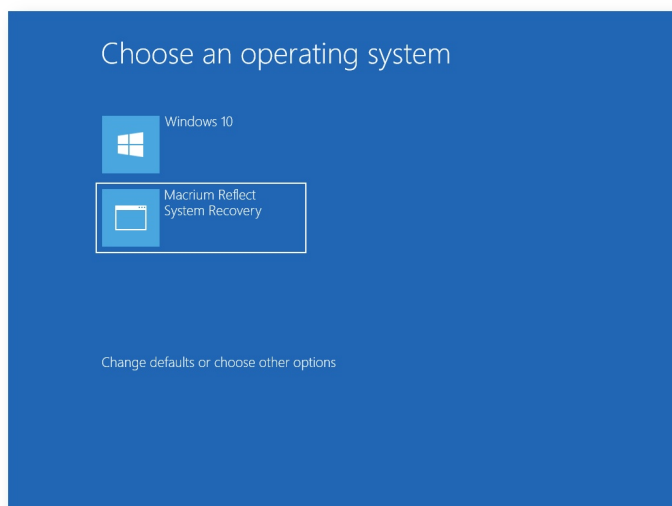
3. Finally, **Open Windows Explorer**, navigate to '**macrium_restore.xml**' and **make the file read-only**, This ensures that the restore can be repeated. If the file is not read-only it will be deleted as soon as the restore starts.

Right click on 'Macrium_Restore.xml', select 'Properties', click 'Read-only' and click 'OK':



That's it! Now whenever you take the Macrium System Recovery boot menu option your system will be automatically restored using the image created above.

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Logging file changes for Incremental and Differential Images

Your Windows operating system and installed applications can create many changes 'under the hood' without you knowing about it. This can cause Incremental or Differential images to be substantially larger than expected. This article describes a feature in Macrium Reflect to log files that have been changed in each Incremental or Differential image.



Note: Macrium Reflect must be at **v6.3** or later. Please take the '**Other Tasks**' > '**Check for updates**' menu option in Reflect if you are running an earlier release.

What are Incremental and Differential Images?

Incremental images will only backup data blocks that have changed since the last Image or, in the case of Differential, Full image in the backup set. Images are created at File System cluster level and each block is MD5 hashed and compared. Blocks with the same hash signature aren't included in the Differential or Incremental image file. A data block is usually 16 clusters in length.

See also: [How backup sets are created and maintained \(see page 130\)](#)

How to show changed files

If the following registry entry is set, Reflect will perform a reverse 'look-up' to identify the file for each cluster that is backed up.

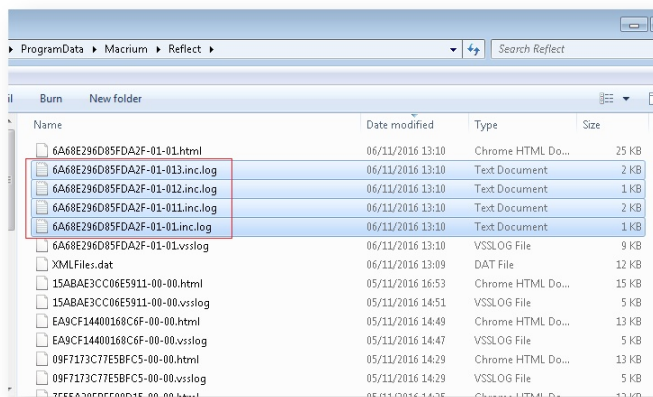


This may increase the time taken to backup and **should only be used for diagnosis**.

Key:	HKEY_LOCAL_MACHINE\SOFTWARE\Macrium\Reflect\Settings
Name:	LogIncrementalChanges
Type:	DWORD
Value:	1

Once the registry entry is set, **perform another Differential or Incremental Image** and, once complete, **delete the registry entry created above**. Then use Windows Explorer to **navigate to: 'C:\ProgramData\Macrium\Reflect'** in Windows Explorer and **sort by Modified Date**:

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In addition to the normal '.html' and '.vsslog' files you will also see files with '.inc.log' at the end. There will be one for each NTFS partition in the Differential or Incremental.

The first file, **{IMAGEID}-XX-YY.inc.log**, is the log for the first NTFS partition, the next file is , **{IMAGEID}-XX-YY1.inc.log** and,

in the above example, **{IMAGEID}-XX-YY3.inc.log** is the last last NTFS partition in the image.

Example log output

```
MFT Record - 32 - .\ $Extend\ $RmMetadata\ $TxfLog\ $TxfLog.blf
MFT Record - 34 - .
.\ $Extend\ $RmMetadata\ $TxfLog\ $TxfLogContainer00000000000000000002
MFT Record - 38 - .\ Windows\ Prefetch\ AgGlglobalHistory.db
MFT Record - 39 - .\ Windows\ Prefetch\ AgGlfaultHistory.db
MFT Record - 43 - .\ Windows\ Prefetch\ AgRobust.db
MFT Record - 45 - .\ Windows\ Prefetch\ AgGlfgAppHistory.db
MFT Record - 1236 - .\ Windows\ SoftwareDistribution\ SelfUpdate\ WuPackages.xml
MFT Record - 1333 - .\ Program Files (x86)\ TeamViewer\ Version8\ TeamViewer8_Logfile.
log
MFT Record - 1353 - .\ ProgramData\ Microsoft\ RAC\ PublishedData\ RacWmiDatabase.sdf
MFT Record - 1592 - .\ Users\ Dev\ AppData\ Local\ Google\ Chrome\ User
Data\ Default\ Current Session
MFT Record - 1783 - .\ Program Files\ Microsoft SQL Server\ MSSQL10.
SQL EXPRESS\ MSSQL\ Log\ ERRORLOG
MFT Record - 13900 - .\ Windows\ System32\ winevt\ Logs\ Microsoft-Windows-
PrintService%4Admin.evtx
MFT Record - 15637 - .\ Windows\ WindowsUpdate.log
MFT Record - 15741 - .\ Windows\ System32\ winevt\ Logs\ Microsoft-Windows-Windows
Defender%4Operational.evtx
MFT Record - 15743 - .\ Windows\ System32\ winevt\ Logs\ Microsoft-Windows-Windows
Defender%4WHC.evtx
MFT Record - 15755 - .\ Users\ Dev\ AppData\ Local\ Google\ Chrome\ User
Data\ Default\ IndexedDB\ http_localhost_2904.indexeddb.levelldb\ LOG
MFT Record - 15868 - .\ Windows\ bootstat.dat
MFT Record - 21541 - .\ Windows\ security\ database\ secedit.sdb
MFT Record - 21544 - .\ Windows\ ServiceProfiles\ LocalService\ NTUSER.DAT
MFT Record - 21565 - .\ Windows\ ServiceProfiles\ NetworkService\ NTUSER.DAT
```

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```
MFT Record - 22562 - .  
.\Windows\ServiceProfiles\NetworkService\AppData\Local\Temp\MpCmdRun.log  
MFT Record - 22649 - .\Windows\System32\7B296FB0-376B-497e-B012-9C450E1B7327-5P-1.  
C7483456-A289-439d-8115-601632D005A0  
MFT Record - 22650 - .\Windows\System32\7B296FB0-376B-497e-B012-9C450E1B7327-5P-0.  
C7483456-A289-439d-8115-601632D005A0
```

And so on.....

Each log file lists the MFT record and full path name to the file(s) that have changed.



There will be many MFT metadata files (prefixed by '\$') that are not visible to Windows Explorer or any other windows utilities, but these are always included (if changed) in Diff/Inc image files.



Please note that this doesn't mean that all clusters in the listed files have changed it means that the file clusters are scanned and differences have been detected.