



KnowledgeBase v7.2

Macrium Reflect v7.2 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](#).

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](#)
- [Backup, imaging and cloning](#)
- [Restoring and browsing](#)
- [Scheduling and Retention rules](#)
- [The Macrium Rescue Environment](#)
- [Macrium Image Guardian](#)
- [Macrium Changed Block Tracker](#)
- [Macrium viBoot](#)
- [Re-deploying to new hardware](#)
- [Macrium Reflect Server Plus for Exchange and SQL](#)
- [Command line operations with Macrium Reflect](#)
- [Generating scripts and batch files](#)
- [Backup Folder Synchronization](#)
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- [Converting a Physical machine to Virtual Machine](#)
- [Automatic System Restore](#)
- [Logging file changes for Incremental and Differential Images](#)
- [Backup to the cloud with Azure File Shares](#)
- [How to add an auto restore xml file to the rescue media](#)

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.

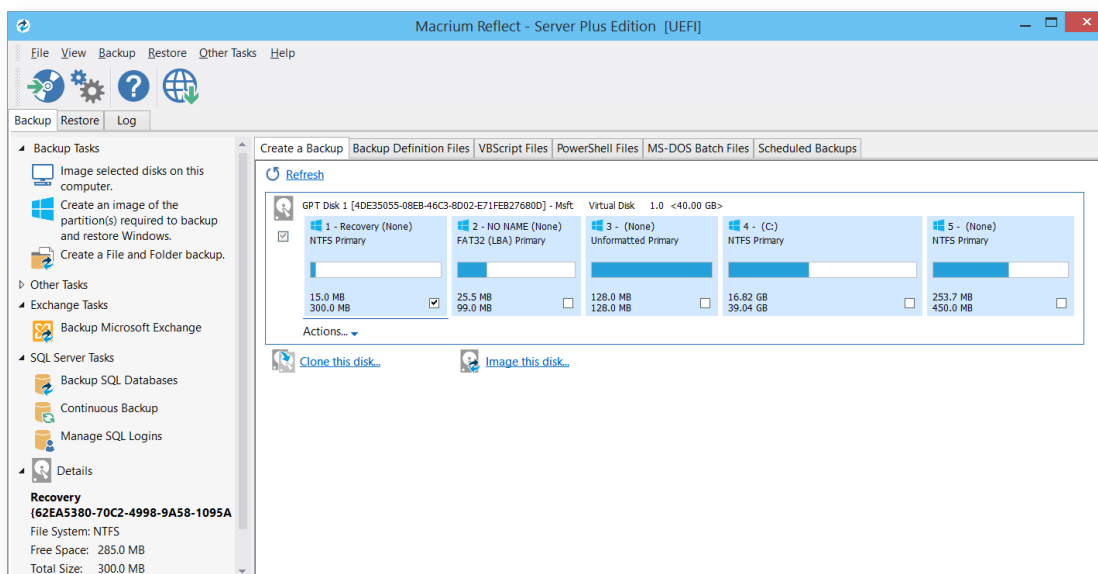
Summary

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.

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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.

This lightweight version of Windows is called the Windows Recovery Environment (also known as Windows RE or WinRE) and is supplied with Windows 7 and later operating systems. For Windows XP, Vista and systems without WinRE, Reflect will download the Windows Pre-installation Environment (also known as Windows PE or WinPE) directly from Microsoft.

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](#).

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](#).

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 **Full** image. A **Full** image file contains all of the data stored in the volume. Macrium Reflect provides two alternative methods of 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.

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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](#).

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

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](#).

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](#).

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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.

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](#) and [Browsing Macrium Reflect images and backups in Windows Explorer](#).

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.

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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](#).

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 in all paid editions of Macrium Reflect. This excludes the Free Edition and 30 day trials.

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](#)
- [Macrium Reflect Feature Comparison Chart](#)
- [Licensing Policy](#)
- [New in Version 7](#)
- [New in Macrium Reflect 7.1](#)
- [New in Macrium Reflect 7.2](#)
- [Upgrade FAQ](#)
- [Installing Macrium Reflect](#)
- [Installing and updating Macrium Reflect offline](#)
- [Installing a Macrium Reflect v6 to v7 Upgrade](#)
- [Macrium Reflect Quick Start](#)
- [Windows Explorer shell integration](#)
- [Reviewing your backup history](#)
- [Removing your License key when Upgrading your PC](#)
- [What is VSS, how does it work and why do we use it?](#)

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- Rapid Delta Clone - RDC
- Rapid Delta Restore - RDR

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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	Free	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, 5.0, 10 and Windows RE	✓	✓	✓	✓	✓
XP SP3/ Vista / 7 / 8 / 8.1 /10 / WHS compatibility	✓	✓	✓	✓	✓
Retention rules	✓	✓	✓	✓	✓
Recovery from Windows boot menu	✓	✓	✓	✓	✓
Differential backups	✓	✓	✓	✓	✓

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Feature \ Edition	Free	Home	Workstation	Server	Server Plus
Incremental backups		✓	✓	✓	✓
File and Folder backup		✓	✓	✓	✓
Email notification of backup status		✓	✓	✓	✓
Backup scripting		✓	✓	✓	✓
Password protection and encryption		✓	✓	✓	✓
Restore to dissimilar hardware with ReDeploy		✓	✓	✓	✓
Backup file Ransomware Protection with Image Guardian		✓	✓	✓	✓
Rapid Delta Restore (RDR) Rapid Delta Clone (RDC)		✓	✓	✓	✓

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Feature \ Edition	Free	Home	Workstation	Server	Server Plus
Changed Block Tracker (CBT)		✓	✓	✓	✓
Server 2003 SP2/2008 /2011/2012 /2012R2 /2016 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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Feature \ Edition	Free	Home	Workstation	Server	Server Plus
	Download 	Buy Now	Buy Now	Buy Now	Buy

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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 v7 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](#)

Support & Maintenance

Macrium Reflect v7 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 v7 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. v7.1 to v7.2) and Major updates (i.e. v7 to v8) 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. v7.1 to v7.2) will remain free, and access to the [Macrium Support Forum](#) and KnowledgeBase will still be available for all customers.

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

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

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

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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](#)

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End User License Agreement

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Definitions

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

"Computer" means a computer or a software-emulated computer (otherwise known as a "virtualized" computer).

"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.

"We" and **"us"** means Paramount Software UK Limited, a private limited company registered in England and Wales with registered number 02973414.

General

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Where you have minimum rights protected by law which we cannot restrict, you may do anything concerning Macrium Reflect® and/or the Documents which is consistent with those rights.

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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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Your right to use Macrium Reflect® and the Documents

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.

There are two (2) permitted "fair use" exceptions to these obligations:

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.

Where we refer to using Macrium Reflect® 'as normal' above, we are referring to use in accordance with the terms of this License.

Your right to use Macrium Reflect® and the Documents is not exclusive. This means that we may grant to other persons the same or similar rights as are granted to you in this License

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.

You must not transfer the rights you have under this License regarding Macrium Reflect® or the Documents to any other person, including by use of an assignment, license, sub-license, lease or trust. You must not sell, give, lend, rent, hire, distribute or otherwise make Macrium Reflect® or the Documents available to any other person or allow them to access or use Macrium Reflect® or the Documents in place of you.

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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You may copy Macrium Reflect® for back-up purposes, which may be stored on any media you so choose in a safe location. You may only copy the Documents where reasonably necessary to enable your permitted use of Macrium Reflect®.

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Macrium Reflect v7.2 User Guide

New in Version 7

Introduction

Macrium Reflect v7 includes powerful industry leading technologies to reduce image creation time using 'Changed Block Tracking' (CBT). v7 also includes Macrium viBoot 'instant virtualisation' that enables creation of a Hyper-V Virtual Machine with just a couple of clicks.

The user interface changes from v6 have been kept minimal and upgrading from v6 will be an easy process.

The main new features are listed below:

Changed Block Tracking (CBT)

Macrium Reflect Changed Block Tracker (MRCBT) reduces the amount of time it takes to perform incremental and differential images by monitoring the changes to an NTFS formatted volume in real-time. This is especially relevant when a file system contains very large files, such as virtual hard disk (VHD) files, where speed improvements are significant and can reduce the Incremental image time from hours to minutes or even seconds.



Note: CBT is not available for Windows XP or Server 2003.

[See here for more information on CBT](#)

Macrium viBoot

Macrium viBoot enables you, to instantly create, start and manage Microsoft Hyper-V virtual machines using one or more Macrium Reflect image files as the basis of the virtual machine storage sub-system.



Note: viBoot only supports **Microsoft's Hyper-V** running on a **minimum of Windows 8.0 or Windows Server 2012**.

[See here for more information on viBoot](#)

Task Scheduler 2.0

This is a 'behind the scenes' improvement over the Task Scheduler 1.0 implementation in Macrium Reflect v6.0 and overcomes the issues caused by problems with a [Windows 10 Anniversary Update bug](#).

[See here for more information](#)

Macrium Reflect v7.2 User Guide

Task Scheduler 2.0

This is a 'behind the scenes' improvement over the Task Scheduler 1.0 implementation in Macrium Reflect v6.0 and overcomes the issues caused by problems with a [Windows 10 Anniversary Update bug](#). Existing scheduled backups will be upgraded to Task Scheduler 2.0 on first run of Macrium Reflect v7.



Note: Windows XP only supports Task Scheduler 1.0.

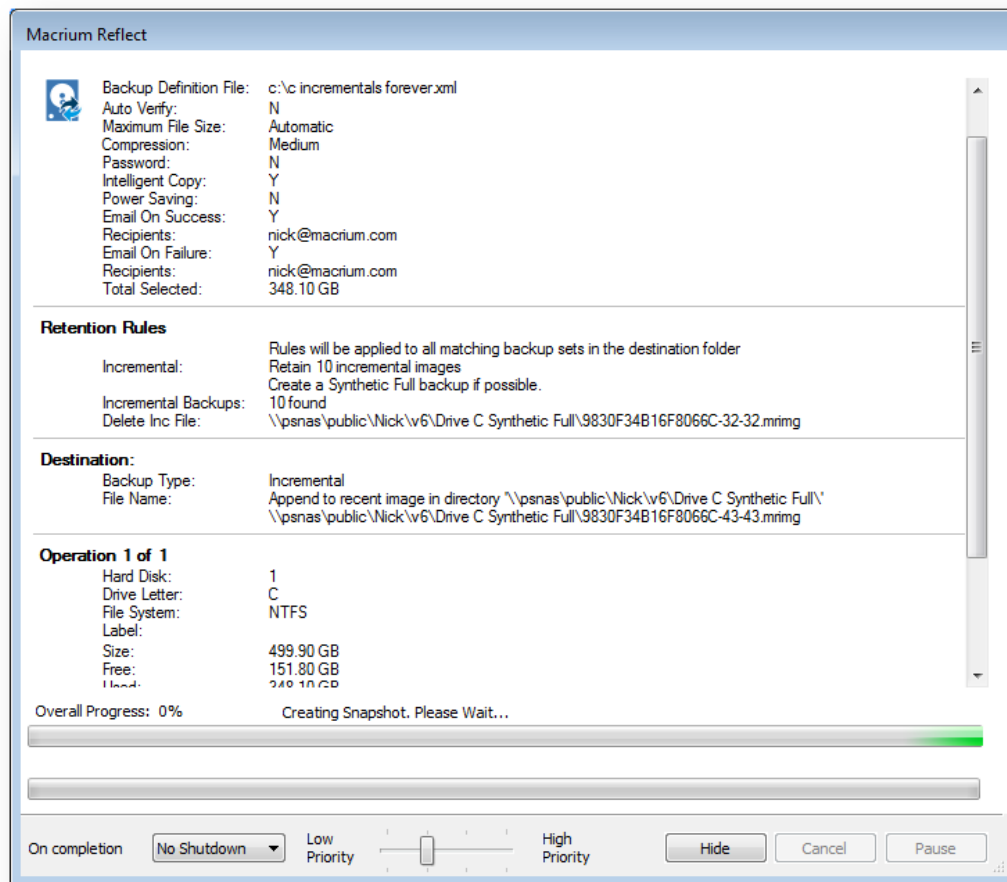
The scheduling options in Macrium Reflect are unchanged, however there are some important differences in the way scheduled tasks run.

All scheduled tasks, for all Windows Operating Systems including XP, now run using the built-in Windows SYSTEM account. It is no longer necessary to specify an Admin user account when creating a scheduled task and the option has been removed from the Macrium Reflect defaults. A new lightweight process, 'ReflectMonitor.exe', runs in the background and is started at user login. This process monitors for running scheduled backups and creates a system tray icon in the notification area when a running scheduled backup is detected. This overcomes two issues with Macrium Reflect v6 and earlier:

1. The notification icon is visible whatever the user account is running the backup. Previously the icon was only visible if the current logged on user was running the backup, either on schedule or interactively.
2. The ReflectMonitor backup window will also be populated with log information for backups that start before the user logs into Windows.

The ReflectMonitor progress window is identical to the backup run wizard in Macrium Reflect, so there's nothing new to be aware of here:

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In the event of the notification icon not being visible you can show the monitor dialog by pressing hot keys 'Ctrl' + 'Alt' + 'M'. This always opens the dialog and shows the currently running backup or the status of the last backup if none is running.

The hot key can be configured or disabled in the Windows registry:

Key	Name	Type	Value
HKLM\SOFTWARE\Macrium\Reflect\Settings	EnableHotKey	DWORD	0 or 1 - Default 0
HKLM\SOFTWARE\Macrium\Reflect\Settings	HotKey	DWORD	Virtual Key code - Default 0x4D



Note: Virtual key code must be a letter or a number key. The default 0x4D is letter 'M'

Macrium Reflect v7.2 User Guide

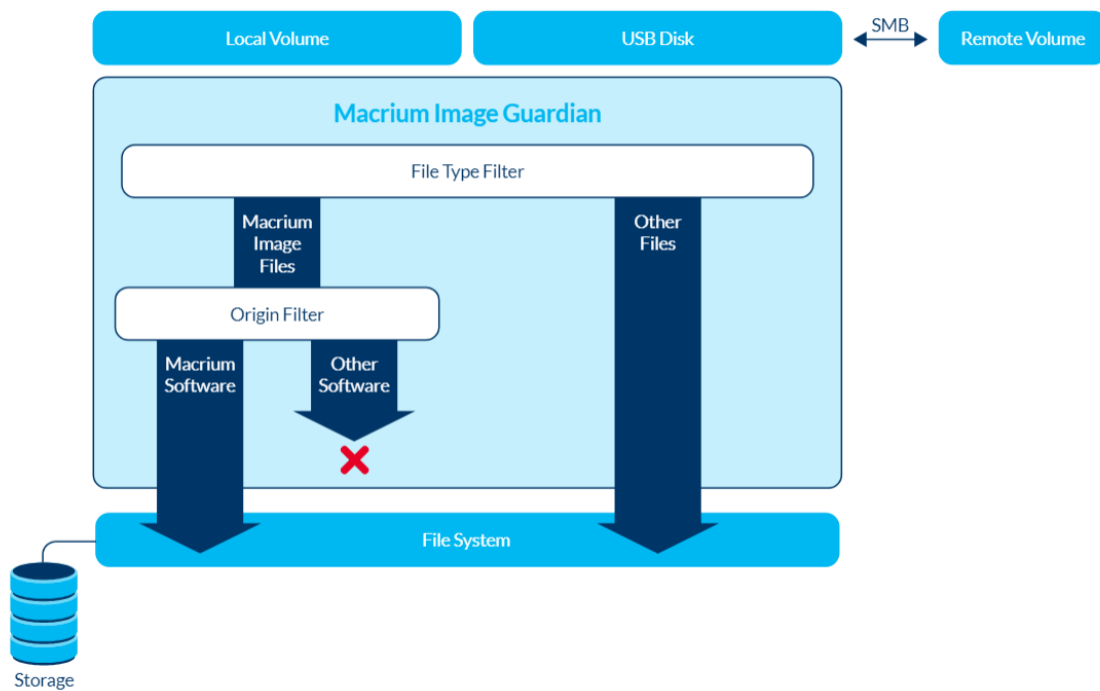
New in Macrium Reflect 7.1

Macrium Image Guardian

Macrium Image Guardian Overview

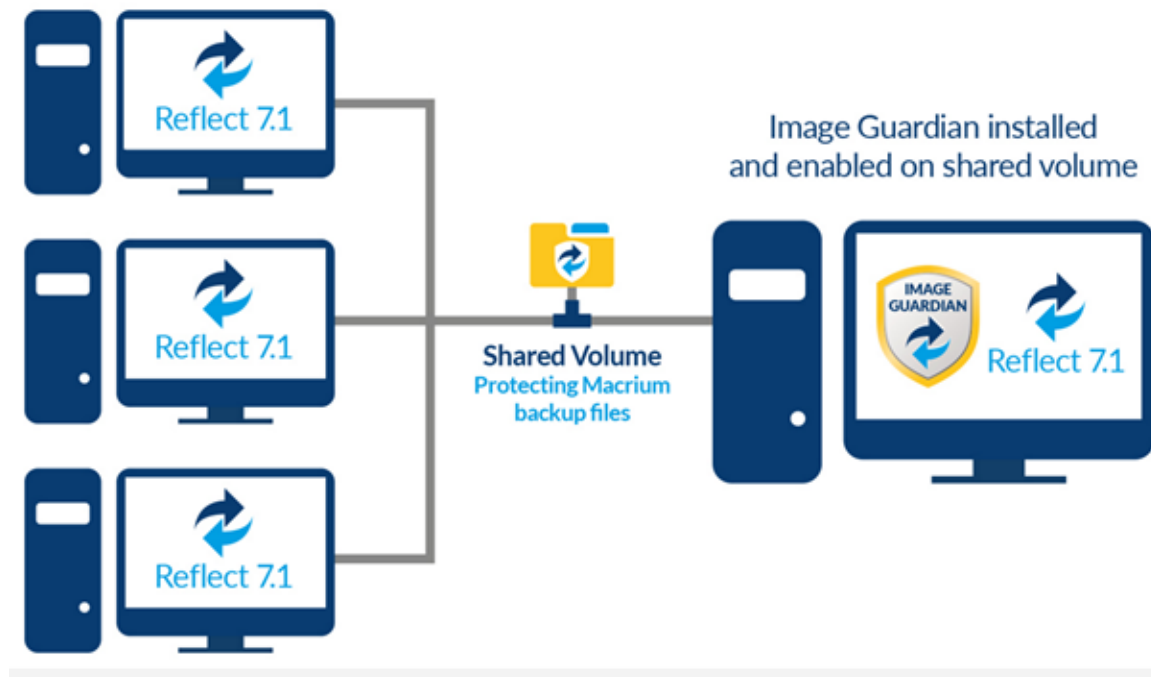
	Macrium Image Guardian protects your backup files from unauthorised modification. MIG grants write access to existing backups file for Macrium Reflect 7.1, any image tools created by us, and optionally, MS RoboCopy. All other process attempting to update existing backup files will be denied access. MIG protects local NTFS volumes and allows Macrium Reflect 7.1 and later to use the protected volume as a shared network resource.
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Macrium Image Guardian protection architecture



Macrium Image Guardian protecting backups in a networked environment

Macrium Reflect v7.2 User Guide



In the above illustration, the PC sharing the backup repository (Shared Volume) has a full install of Macrium Reflect, including **MIG**. A local drive is shared over the network and **MIG** has been enabled on that drive in the Macrium Reflect user interface.

The other PC's on the network can backup to this shared drive and **do not** require MIG to be installed. Backup file write access is automatically granted to Macrium Reflect 7.1, and later, write access for earlier versions of Macrium Reflect and other processes will fail.

The PC hosting the share with **MIG** installed can be used as a standalone Macrium Reflect installation. The protected drive will prevent unauthorised access to backup files on that drive if the local PC creates backups to the protected volume.

Macrium Reflect Free Edition

Now licensed for commercial as well as personal use.

We've relaxed the licensing for the Free Edition and it is now permitted to install and use this popular product in a commercial environment. Please note that this is still an unsupported product and, as always, we encourage upgrading for full functionality and support. Please see [Upgrade from Macrium Reflect 7 Free](#) for more information on the benefits of upgrading.

Windows 10 Task Scheduler compatibility

Macrium Reflect Free Edition now uses Windows Tasks Scheduler 2.0 API to overcome the problems with Windows 10 and the previous TS 1.0 API.

Macrium viBoot

Instant virtualisation of Macrium Images is now included in the Free Edition installer.

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New viBoot VHDX provider

When creating a new virtual machine **Macrium viBoot** will now create a Microsoft Virtual Hard Disk (.VHDX) file that's re-directed to an existing Macrium Image file (.MRIMG) and a differencing .VHDX that contains changes generated by the running Virtual Machine. Previously, a Macrium Image file was used to create a virtual SCSI disk which was then mounted in a Virtual Machine. The latest version is a huge improvement and offers greater persistence and performance. It also allows us to offer additional functionality in the future, such as compatibility with other virtualisation environments including VMWare and VirtualBox.

These new .VHDX files are stored in the designated Macrium viBoot Repository (default "C:\ProgramData\Macrium\viBoot" but configurable from within Macrium viBoot) and remain open until the Macrium viBoot virtual machine is deleted.

Improved handling of Volume Shadow copy Service (VSS) unresponsive errors

Previously, if VSS were to become unresponsive due to COM+ or VSS writer configuration issues then this could cause Images or File and Folder backups to hang indefinitely. When this happened, subsequent scheduled backups would permanently queue until either the hanging backup was ended in Task Manager or the PC rebooted.

7.1 includes a default 15 minute VSS timeout that will cause a "VSS Timeout" error message in the log followed by a retry without VSS Writers, or termination:

Backup aborted! - Failed To Create Volume Snapshot. VSS Timeout

The timeout can be changed by setting a registry entry. Please create this entry if it doesn't exist:

Key	HKEY_LOCAL_MACHINE\SOFTWARE\Macrium\Reflect\VSS
Name	CreateTimeOut
Type	DWORD
Value	900 (Default) number of seconds

Macrium Reflect Workstation Edition now logs Windows Events

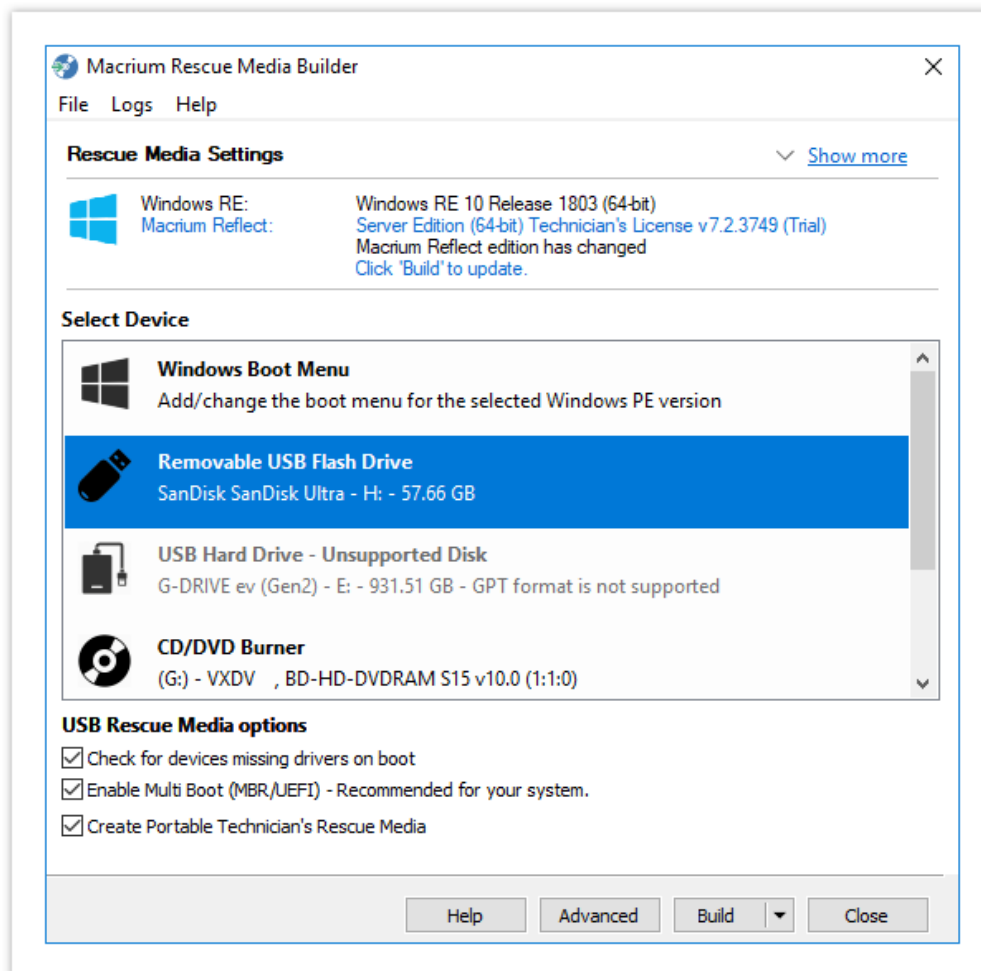
Previously, Macrium Reflect operational Windows Events were only logged for Macrium Reflect Sever and Sever Plus editions. Macrium Reflect Workstation edition now includes the same event logging.

New in Macrium Reflect 7.2

New Features

New Rescue Media builder includes Windows RE with WiFi Support

We've added a Rescue Media Builder (RMBuild) application with support for Windows Recovery Environment (WinRE) as well as the existing PE environments supported by Reflect 7.1 and earlier. WinRE supports WiFi and is available on most Windows installs without any further downloads.



See Also:	Rescue Media Builder How It Works
	Creating rescue media

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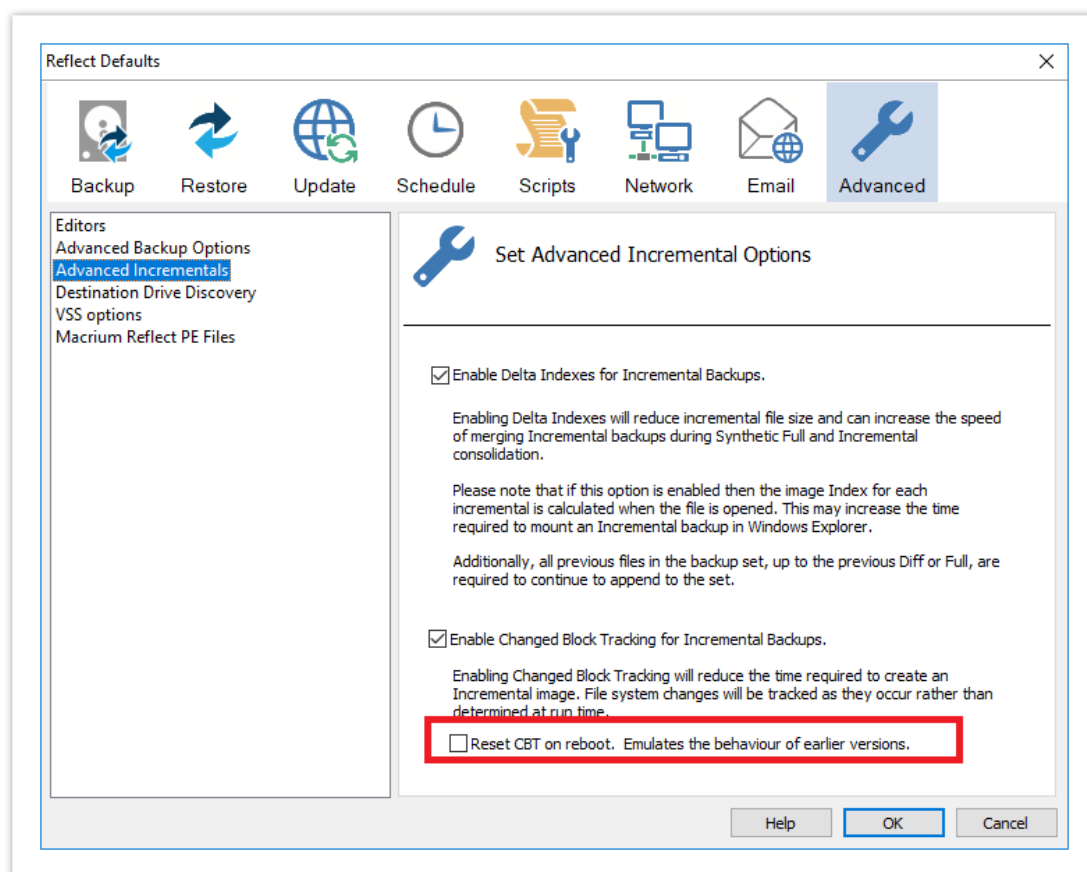
New Changed Block Tracker driver with support for Windows Restart Persistence

We've created a new Changed Block Tracker (CBT) driver that automatically upgrades the previous version when you install v7.2 with the CBT feature enabled....

Our original implementation of real-time block changes erred on the side of caution by resetting the tracking index whenever a volume was mounted. This meant that after Windows reboot an image was required to be created on a volume without using CBT before the benefit of CBT was available.

We've improved on this by reliably detecting whether NTFS volumes have been mounted without the CBT driver in the kernel stack. This applies to all Operating Systems that can mount NTFS volumes, including Linux. The operation of CBT has also been vastly improved by tracking changes in RAM rather than by flushing to disk. This also has a fail safe method to reset the CBT index should a power failure or other problem occur. We're confident that this implementation is class leading and robust.

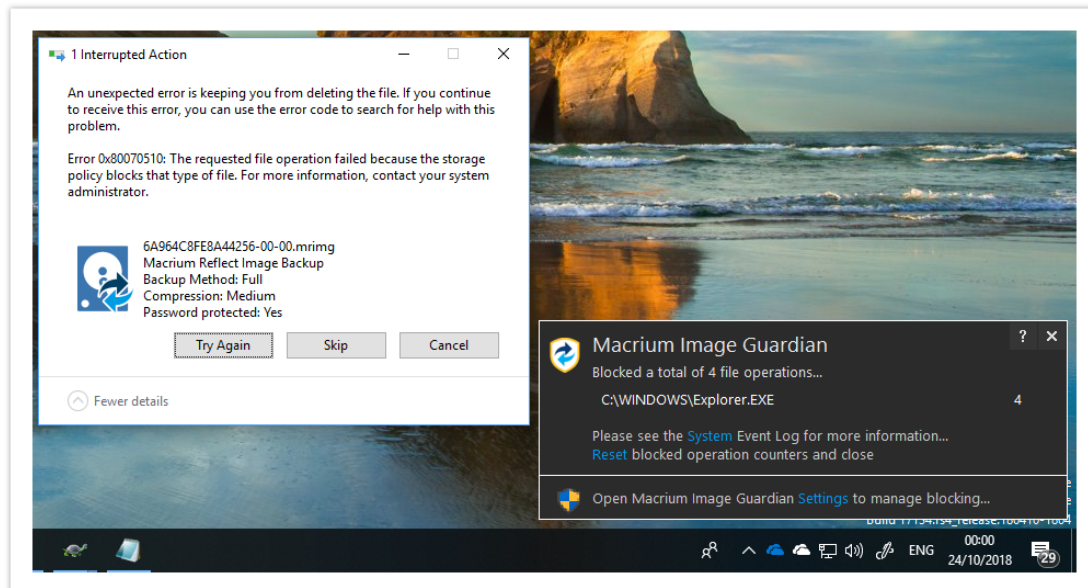
With that said, we understand that some customers prefer not to monitor changes over a mount/reboot so we've added a check-box to make CBT behave in a similar way to the current (v7.1) implementation....



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New Macrium Image Guardian driver with additional features and streamlined operation

MIG is now Windows kernel only!. Our Macrium Image Guardian (MIG) feature has been improved to remove the dependency on a Windows service and we've added popup notifications when a blocking event occurs. The popup shows blocking activity as it happens.



See Also: [MIG Notifications](#)

The Free Edition can now automatically 'convert' to a Trial by taking any of the features not available in the Free Edition

We realized that many of our Free Edition users are unaware that there are additional features available in the trial and paid for versions of Macrium Reflect. All 'premium' features, such as Image Guardian, Changed Bock Tracker, Incremental Images, Encryption.. etc..can now be activated and trialed for 30 days. After 30 days a further 7 day extension is offered. On expiration of the trial the functionality Macrium Reflect reverts to the Free Edition and Premium features will no-longer be available. We've tried to make this process as seamless and unobtrusive as possible without losing any of the functionality of Macrium Reflect Free.

See: [Free To Trial](#) upgrade dialogs

Macrium Reflect update notifications and downloads can now happen in the background

Recent history has shown that the current method of requiring Macrium Reflect to be running to alert of updates has proved ineffective. We've now added a systray icon in Window notification area to alert when an update is available to Macrium Reflect.

See: [Macrium Reflect Updater Settings](#)

Macrium Reflect v7.2 User Guide

New Warning and Cancelled backup completion results

We've also added the option for email notifications on Warnings as well as the existing Success and Failure results

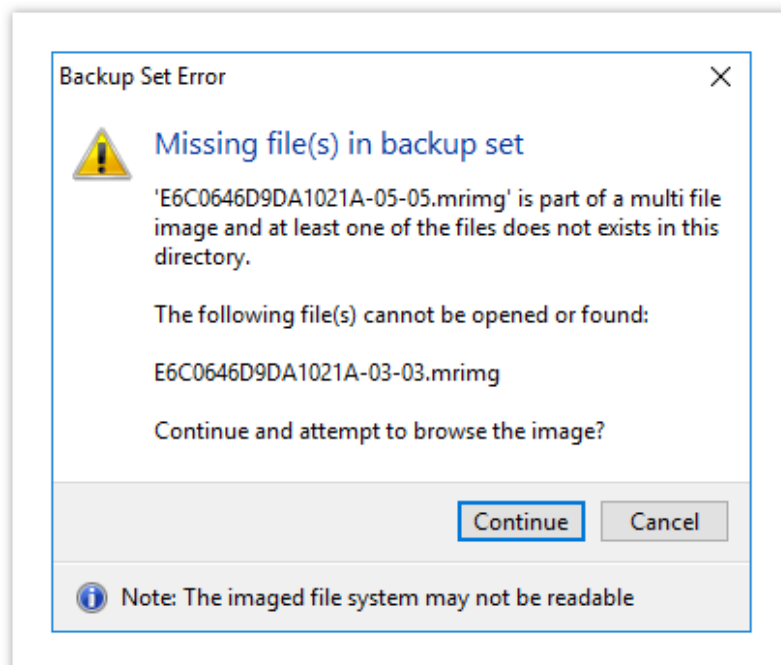
See: [Backup completion status](#)

Minor Enhancements

New - Mounting incomplete backup sets

We've noticed that some customers have frustratingly been unable to extract files from backup sets where at least one backup file in the image chain is broken or missing. We've now added the ability to attempt to browse a backup set that contains missing files.

When browsing an incomplete set you will be prompted to continue with the mount:



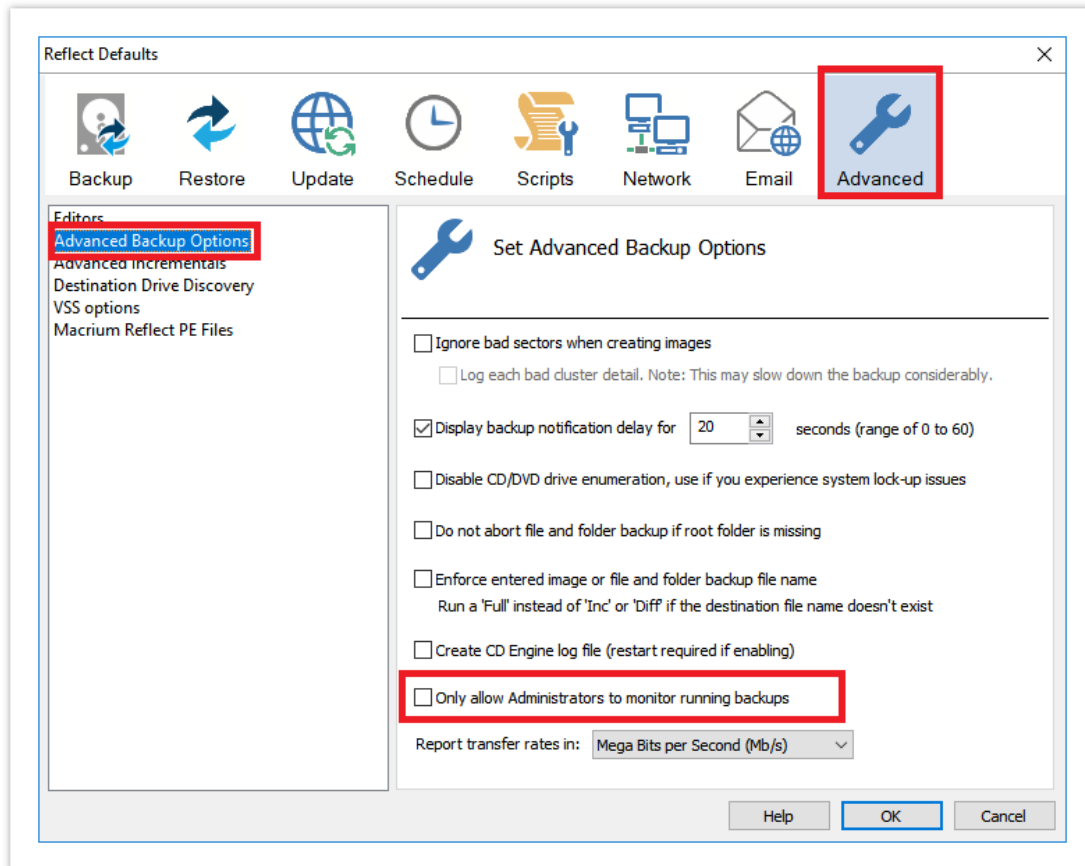
If the image set has missing backup files then it is possible that the data you are trying to recover is lost. It depends whether the missing file(s) contain critical data for mounting the file system and also whether the data you are attempting to recover was in the missing files. In most cases you may find that you files and data are completely recoverable.

New - Backup monitoring restriction

Customers with PCs and Servers that have multiple users, especial Windows Terminal Server customers, have complained that non-Administrators can interact with and cancel scheduled backups. We've now add an option to restrict ReflectUI.exe and REflectMonistor.exe to only run for users in the Administrators group.

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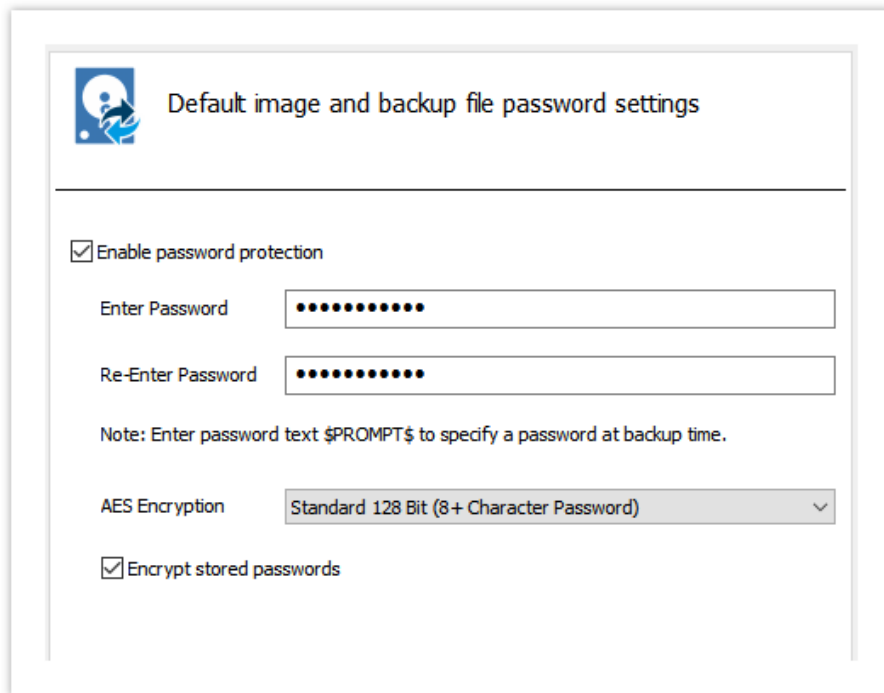
To activate take **Other Tasks' > 'Edit Defaults' > 'Advanced' > 'Advanced Backup Options'** and select **'Only allow Administrators to monitor running backups'**



The default for password protection is now AES 128 Bit.

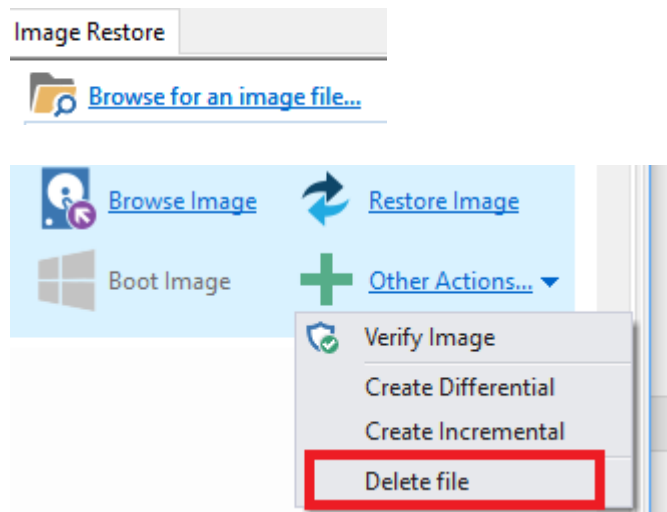
Previously the default password option was to exclude encryption from backup files and images. To improve security we've now made the default AES 128 bit. As before, you can increase this to 256 bit or disable AES if you wish.

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The 'Delete' functionality in Reflect is now available when 'Browse for an image file' is selected.

Previously the **'Other Actions' > 'Delete File'** menu was unavailable when **'Browse for an image file..'** was selected in the 'Restore Tab'...



This functionality is now available.

Bug fixes

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Backup Running Mutex

To prevent multiple backups running at the same time and conflicting with VSS and I/O operations on the source or target it's only possible to run one backup at a time. Simultaneous backups are 'queued' and run asynchronously. With v7.1 and earlier the Backup Running Mutex, that prevents other backups from running, was held open while the backup dialog was open, even if the backup had finished. This could lead to a 'stall' in scheduled tasks if an interactive backup wasn't closed at the end. This has now been corrected and the next backup will start as soon as the current backup has completed.

ReflectMonitor improvements

ReflectMonitor is a standalone exe that communicates via IPC to the running Reflect application to duplicate the backup dialog when backups, clones or restores are running. We have made the integration tighter to prevent some of the progress bars and other glitches that previously existed.

Server Plus - Large Exchange Backups

Server Plus copies backup data to a 3TB virtual NTFS file system. Some customers have experienced backup failure if the size of the backup data exceeds 3TB. We've now made the virtual file system size dynamically based on the amount of data and size of the source volume to overcome this problem. We've also improved the error messaging on backup failure to make it easier to troubleshoot problems.

BitLocker drive without a drive letter

On systems with unlocked BitLocker drives that aren't assigned a drive letter, a '[BitLocker Live Restore](#)' would always perform a 'Full Copy' restore rather than a '[Rapid Delta Restore \(RDR\)](#)'. This has been resolved.

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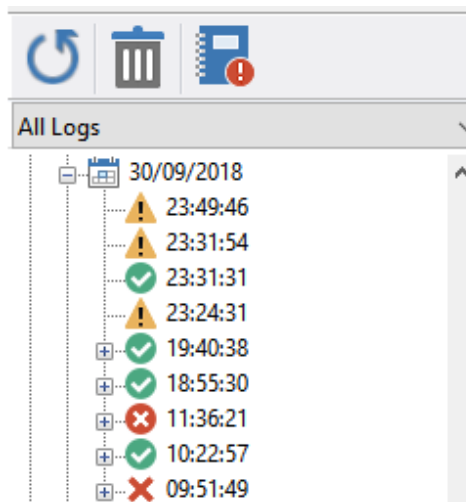
Backup completion status and email changes

v7.2 adds a **Warning and Cancelled completion results** for Images and File and Folder backups.

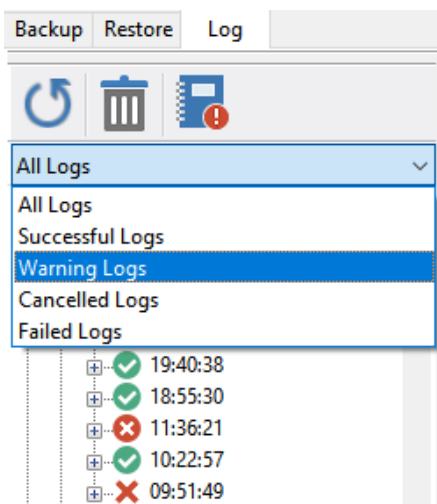
Warnings are generated for the following events:

- VSS failure and fallback to VSS without writers
- Bad sectors, if the default option is set to ignore them
- Consolidation failure for any reason
- Retention purge failure for any reason
- File and Folder backup file copy failure
- Incomplete backup set when creating non-delta incremental Images or File backups.

The Log tree now shows  Warnings and  Cancelled backups...



And can be filtered...



Warnings are clearly displayed in the log...

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Image ID - 4C0E7B7DED85220A

Imaging Summary

Backup Definition File:	C:\Users\Admin\Documents\Reflect\Quick.xml
Auto Verify:	N
Maximum File Size:	Automatic
Compression:	Medium
Password:	N
Intelligent Copy:	Y
Power Saving:	N
Email On Success:	Y
Recipients:	nick@macrium.com
Email On Warning:	Y
Recipients:	nick@macrium.com
Email On Failure:	N
Total Selected:	379.2 MB

Destination:

Backup Type:	Incremental
File Name:	Append to recent image in directory 'F:\warning\ F:\warning\4C0E7B7DED85220A-01-01.mrimg

Operation 1 of 1

Hard Disk 1

Differential Backups:	Linked incremental images will also be deleted 0 found Nothing to delete
Incremental:	Retain 2 incremental images The oldest incremental images may be consolidated
Incremental Backups:	3 found
Consolidation:	Merging 'DC37737EC0847840-01-01.mrimg' to 'DC37737EC0847840-02-02.mrimg' Warning: Failed to open 'F:\warning\DC37737EC0847840-01-01.mrimg' - The process cannot access the file because it is being used by another process. Successfully recovered from failed consolidation

Email Notifications

Recipients:
Email notification sent

Trial Edition

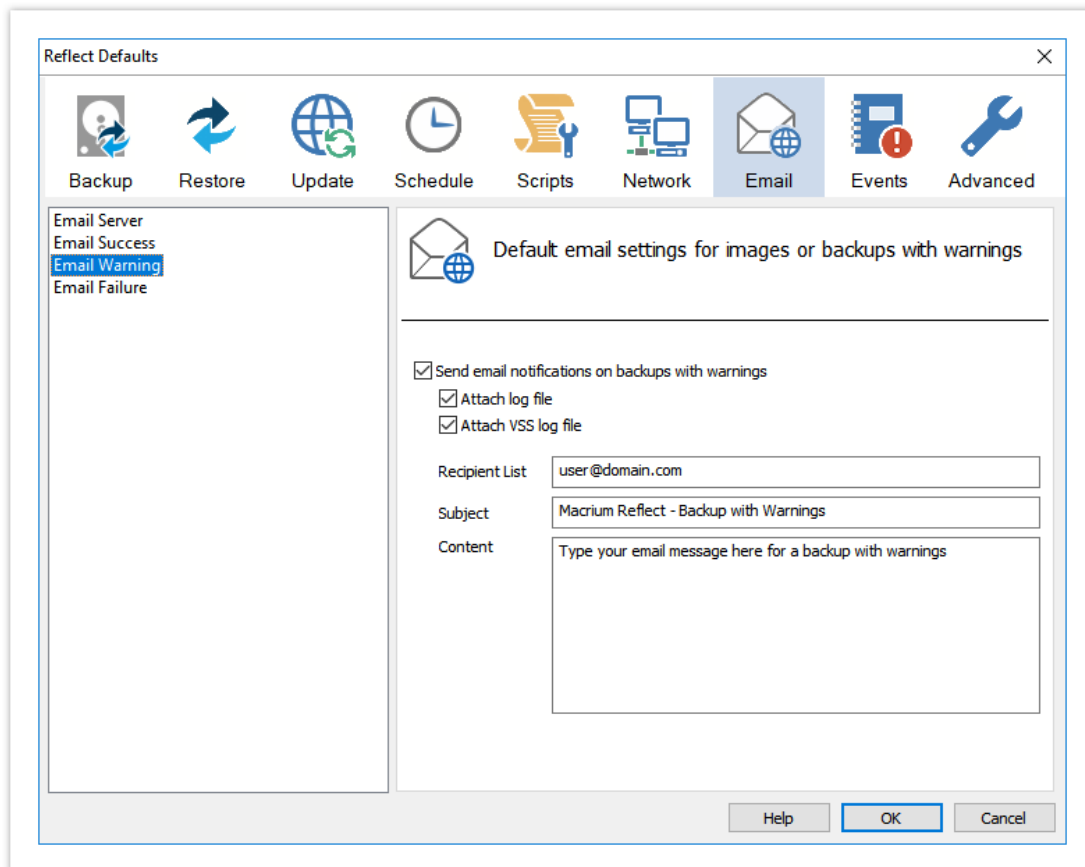
This Trial License will expire in 29 days
Premium features will not function after 31 October 2018



Image Completed with Warnings in 00:02:20

And can be sent using email notifications...

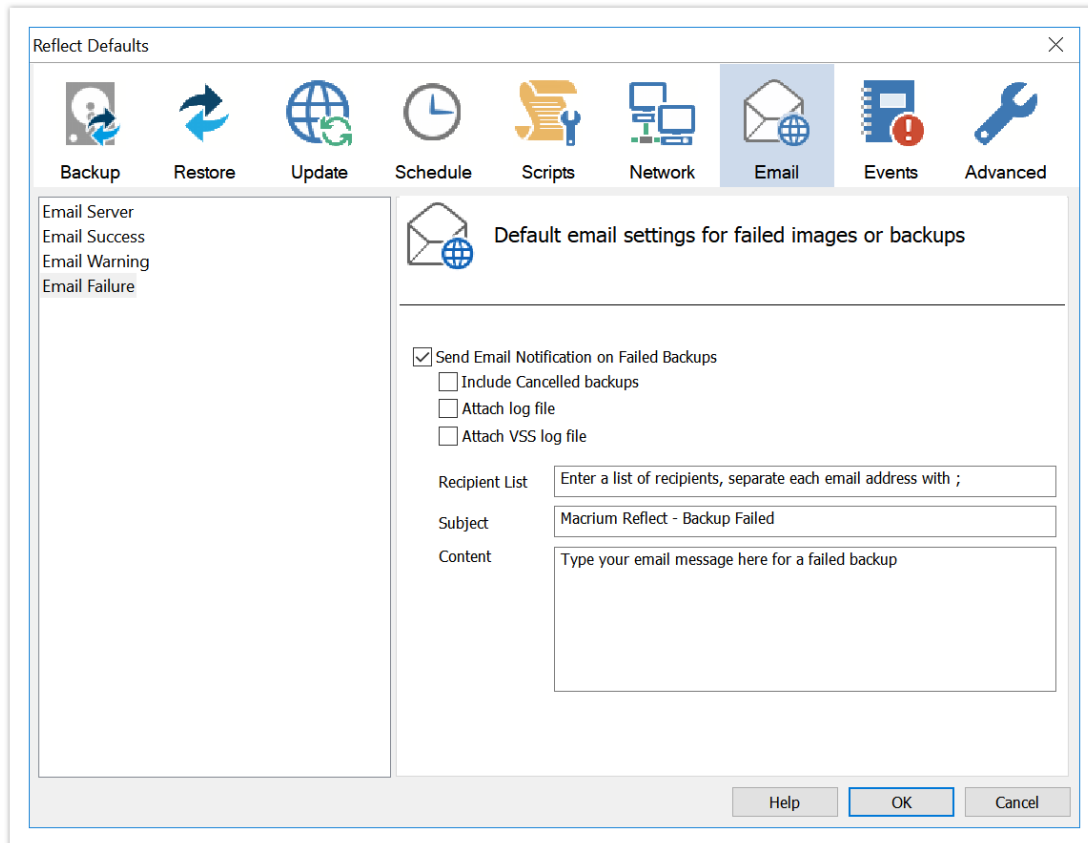
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Note: To ensure that existing backup email notifications don't miss warnings, if either a Success or Failure email notification is configured then **the backup definition will be automatically upgraded to include Warning notifications.**

Cancelled backups can be excluded from Failure email notification.

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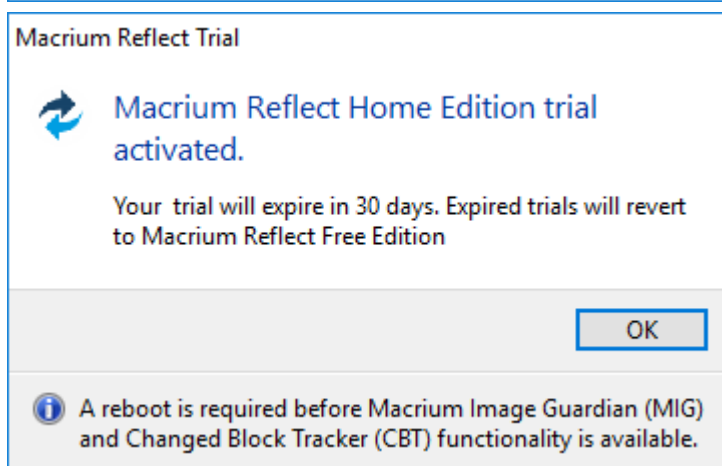
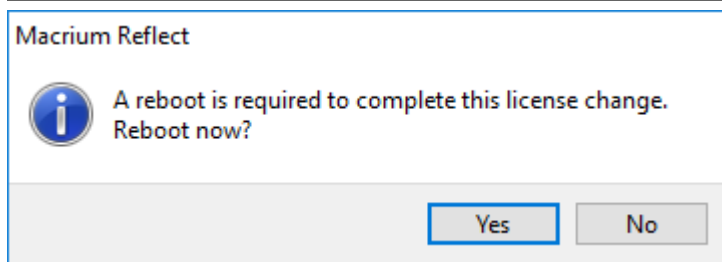
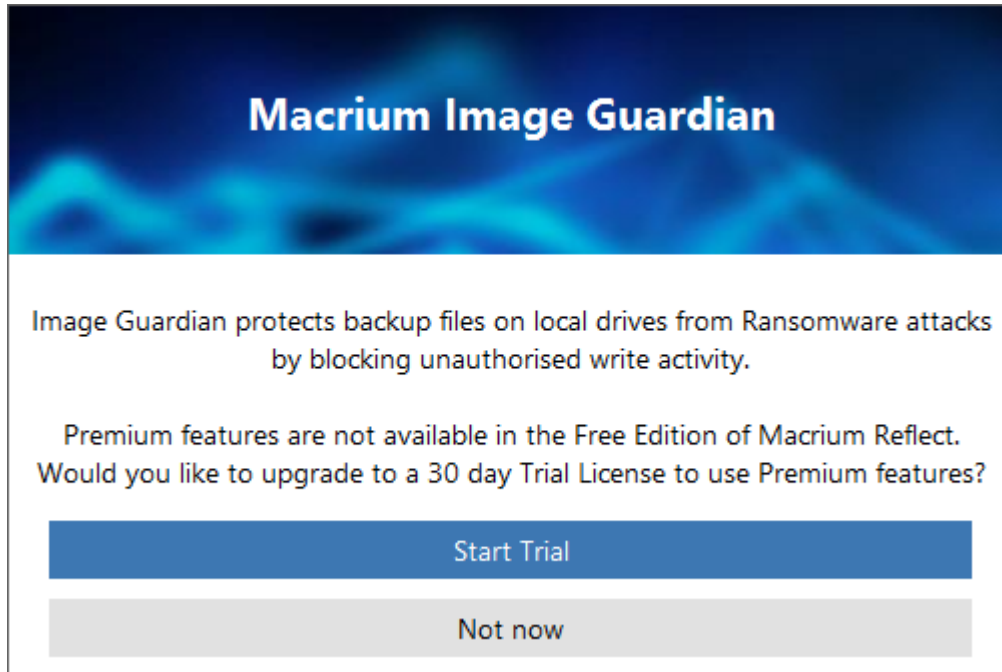


Note: Existing backup definitions will be upgraded to include Cancelled backup so the behaviour is unchanged.

Macrium Reflect v7.2 User Guide

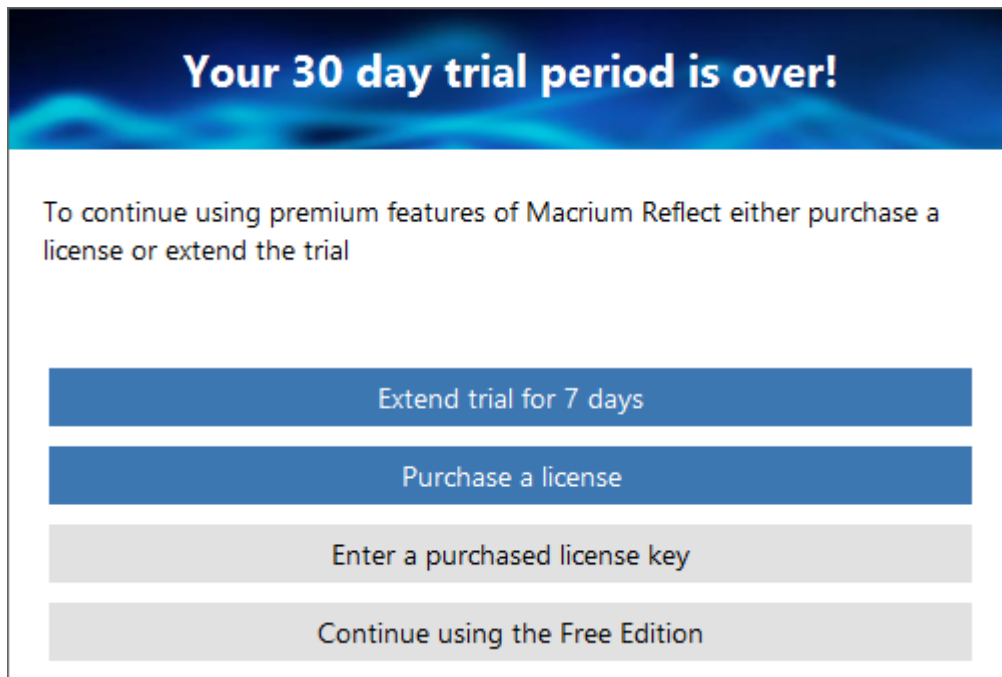
Free To Trial

The following dialog is displayed when you take a premium feature option in the Free Edition if there has been no Trial key on the system before. In this example it's MIG Settings...

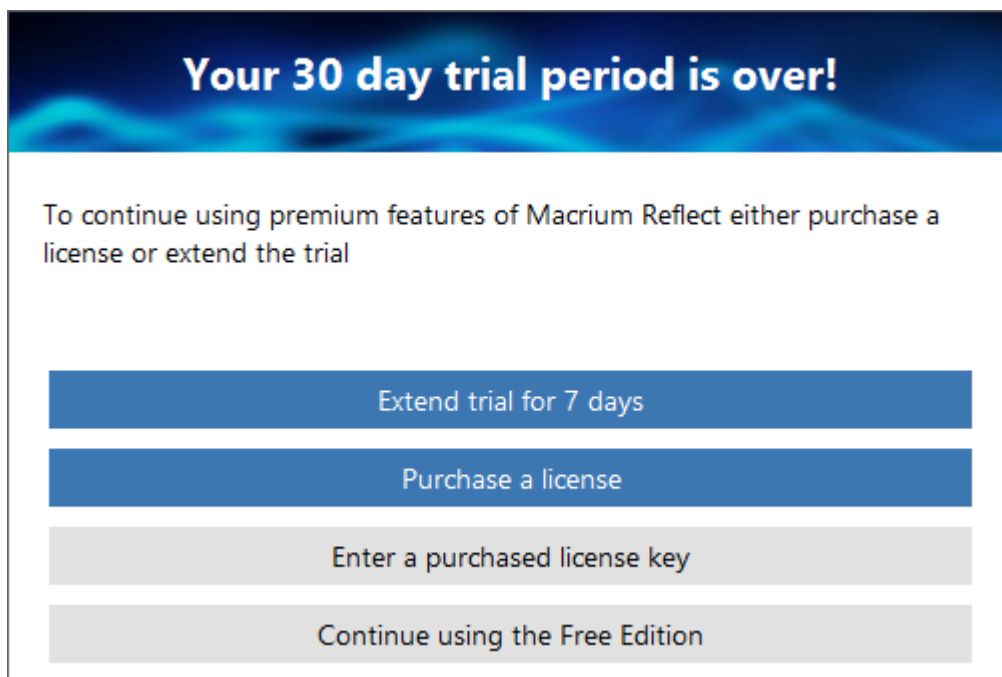


The following dialog is displayed at startup after the 30 trial has expired ...

Macrium Reflect v7.2 User Guide



The following dialog displayed after 30 day trial has expired and you've reverted to Free when taking MIG settings in Free Edition ..

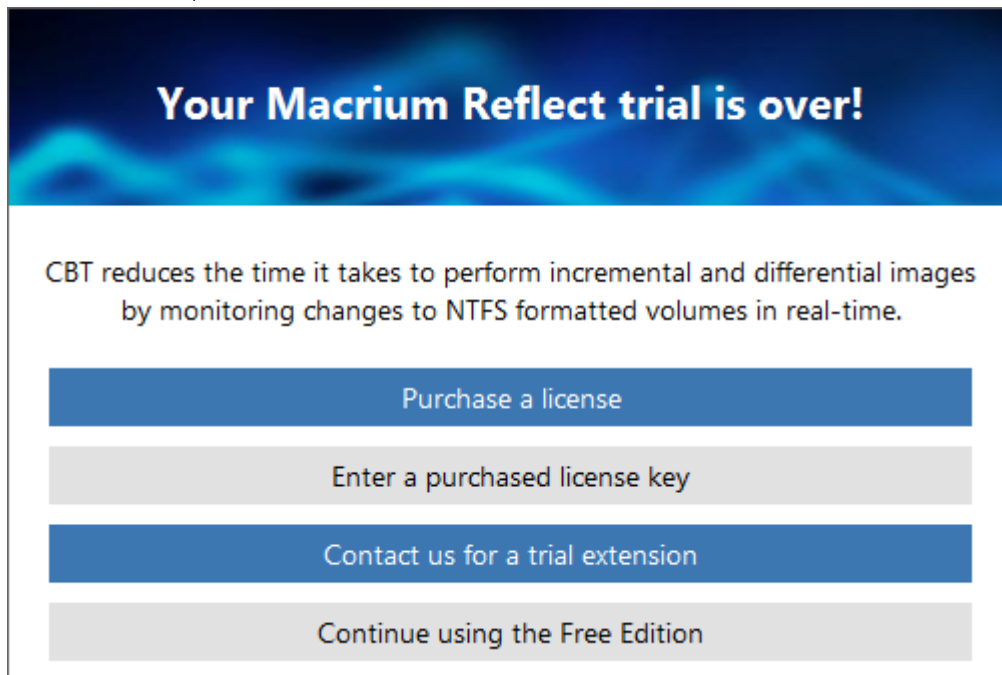


The following dialog displayed at startup after the 7 trial extension has expired...

Macrium Reflect v7.2 User Guide

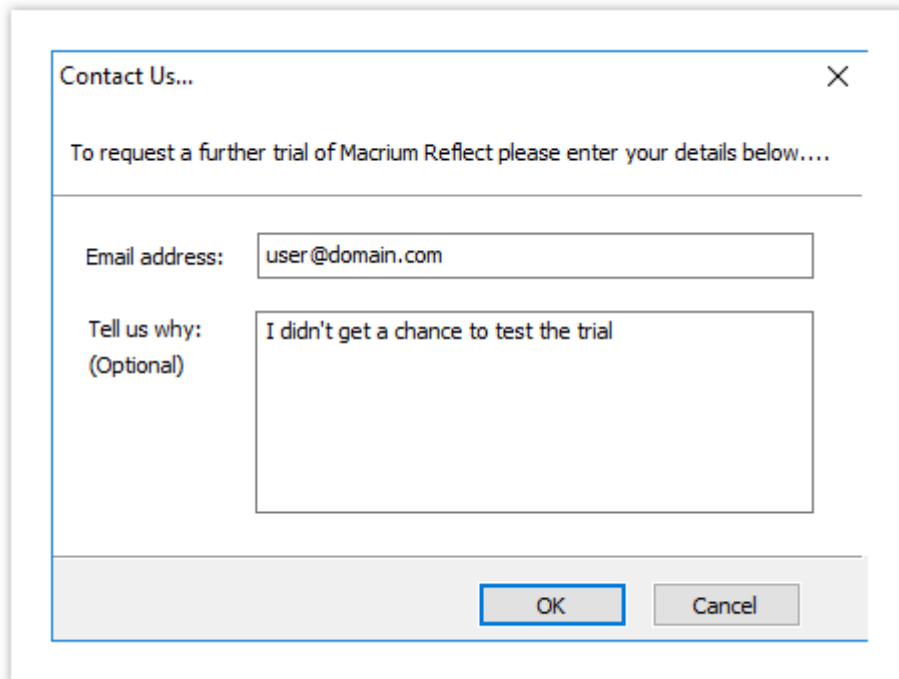


Continue as Free, reboot and take enable CBT on a volume...



'Contact us...' will show the following dialog...

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A screenshot of a 'Contact Us...' dialog box. The dialog has a title bar with a close button (X). Below the title bar, it says 'To request a further trial of Macrium Reflect please enter your details below....'. There are two input fields: 'Email address:' with the value 'user@domain.com' and 'Tell us why: (Optional)' with the value 'I didn't get a chance to test the trial'. At the bottom, there are 'OK' and 'Cancel' buttons.

Contact Us... X

To request a further trial of Macrium Reflect please enter your details below....

Email address: user@domain.com

Tell us why:
(Optional) I didn't get a chance to test the trial

OK Cancel

This will send an email to support@macrium.com with the following content..

Subject: Trial Extension Request

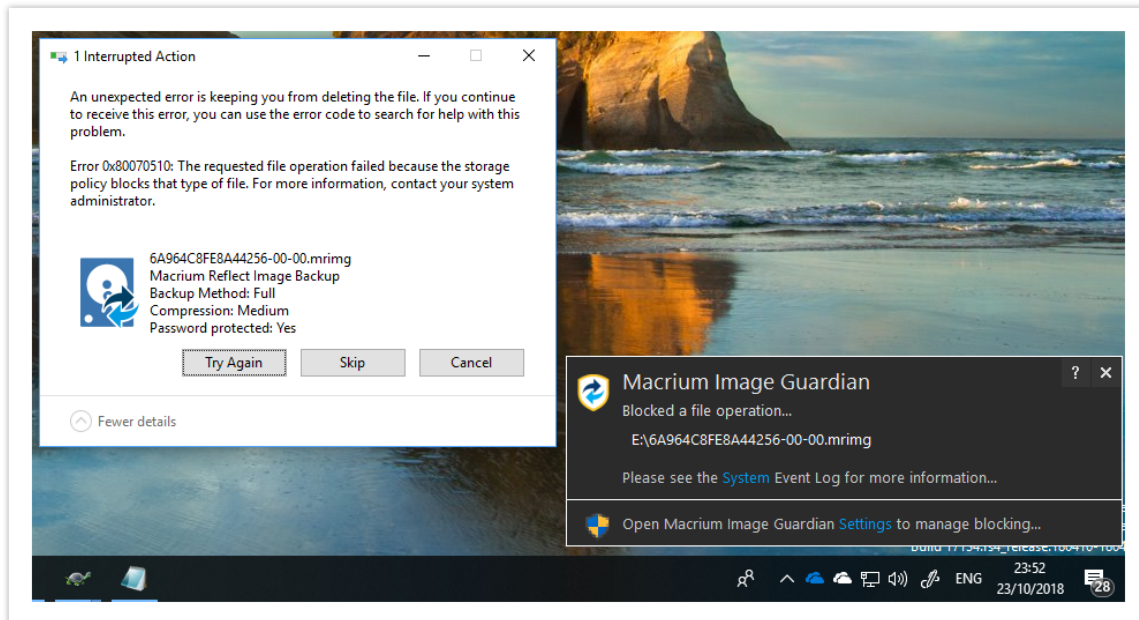
Contents: user@domain.com - I didn't get a chance to test the trial

Macrium Reflect v7.2 User Guide

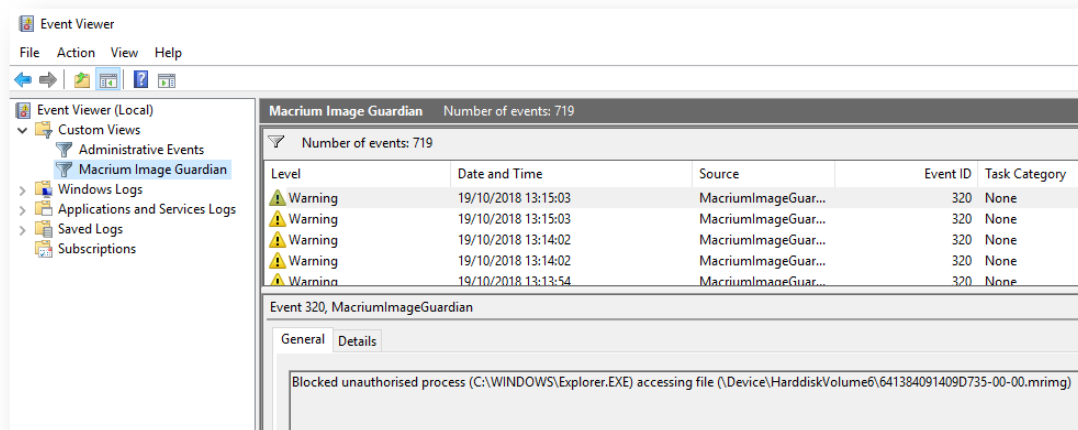
MIG Notifications

We've added real time popup notifications when Macrium Image Guardian blocks file access to a backup file.

When file access is blocked for the first time the file name is shown in the popup...

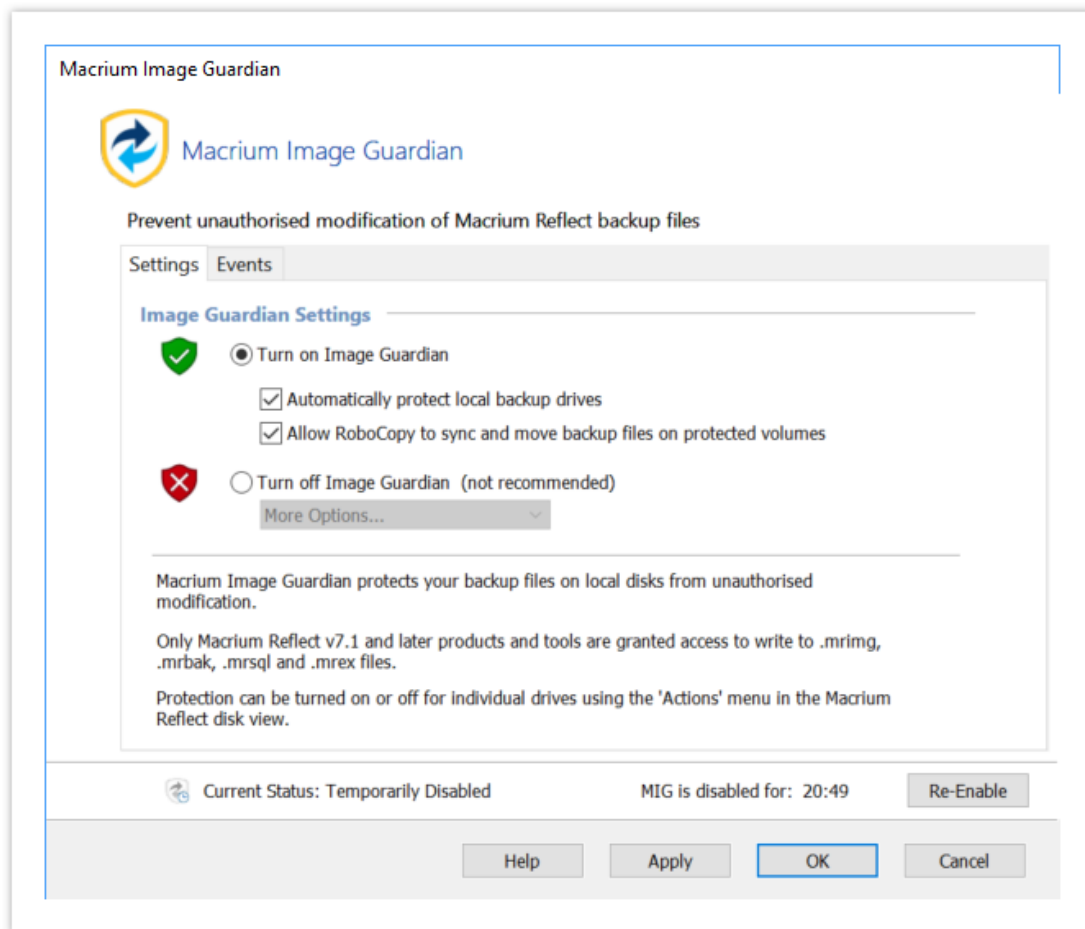


Click 'System' to open the Windows Event Viewer system messages showing a **custom view of MIG events**:



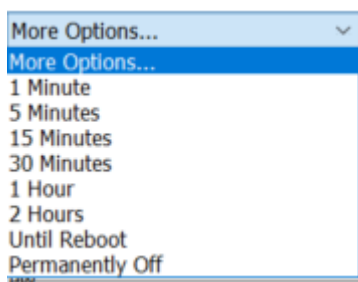
Click 'Settings' to open the MIG disable settings dialog:

Macrium Reflect v7.2 User Guide



Additional functionality over the v7.1 MIG settings dialog in Reflect include:

1. An **Apply** button to accept changes to the dialog immediately.
2. A **'More Options...'** drop down in the 'Turn off' selection:



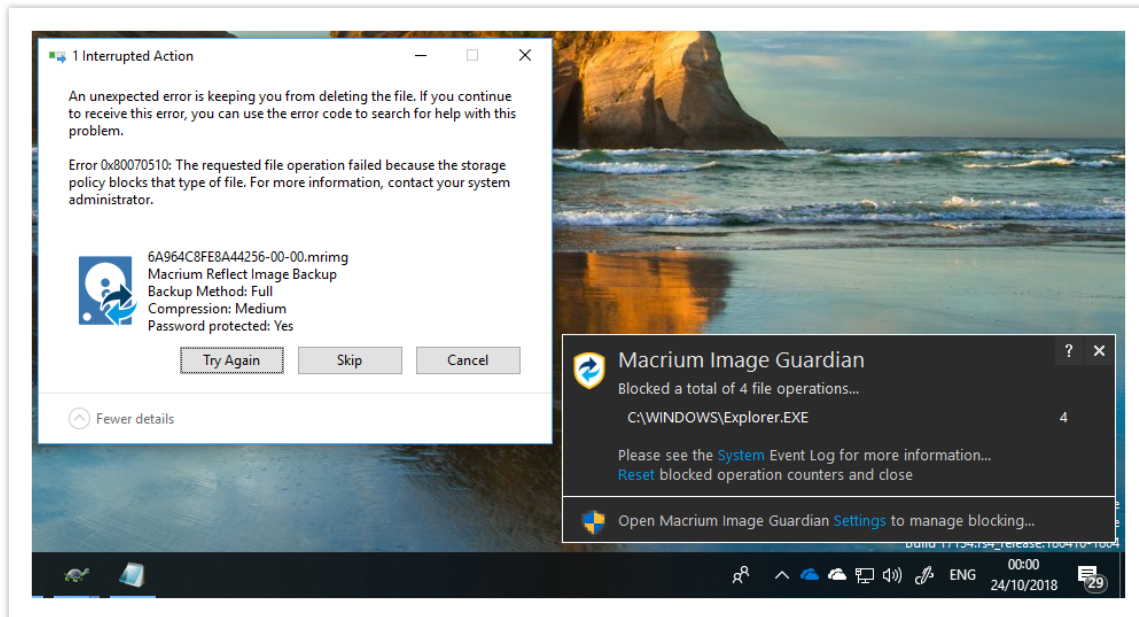
3. Live countdown if a temporary disable has been applied.
4. A **Re-Enable** button to cancel a temporary disable.
5. The MIG shield icons in the Reflect disk view will automatically update to Reflect the state of MIG.



Note: The same dialog can be displayed in Reflect by taking 'Other Tasks' > 'Macrium Image Guardian Settings'

Macrium Reflect v7.2 User Guide

When multiple access attempts are blocked the process that's been blocked will be shown in the popup, together with the number blocked attempts.



Click "**Reset**" to reset the blocked activity count.



Note: Windows Explorer deletion or modification activity may generate multiple blocked access events.

Why aren't you using the built-in Windows 10 toast notifications?

We decided to not use the built-in Windows 10 toast notifications because:

1. MIG blocking notifications should remain permanently on the screen until closed.
2. We need to support earlier Windows Operating systems.
3. Most importantly, we can add additional functionality to the notification Window such as menus and buttons for directly interacting with MIG settings.

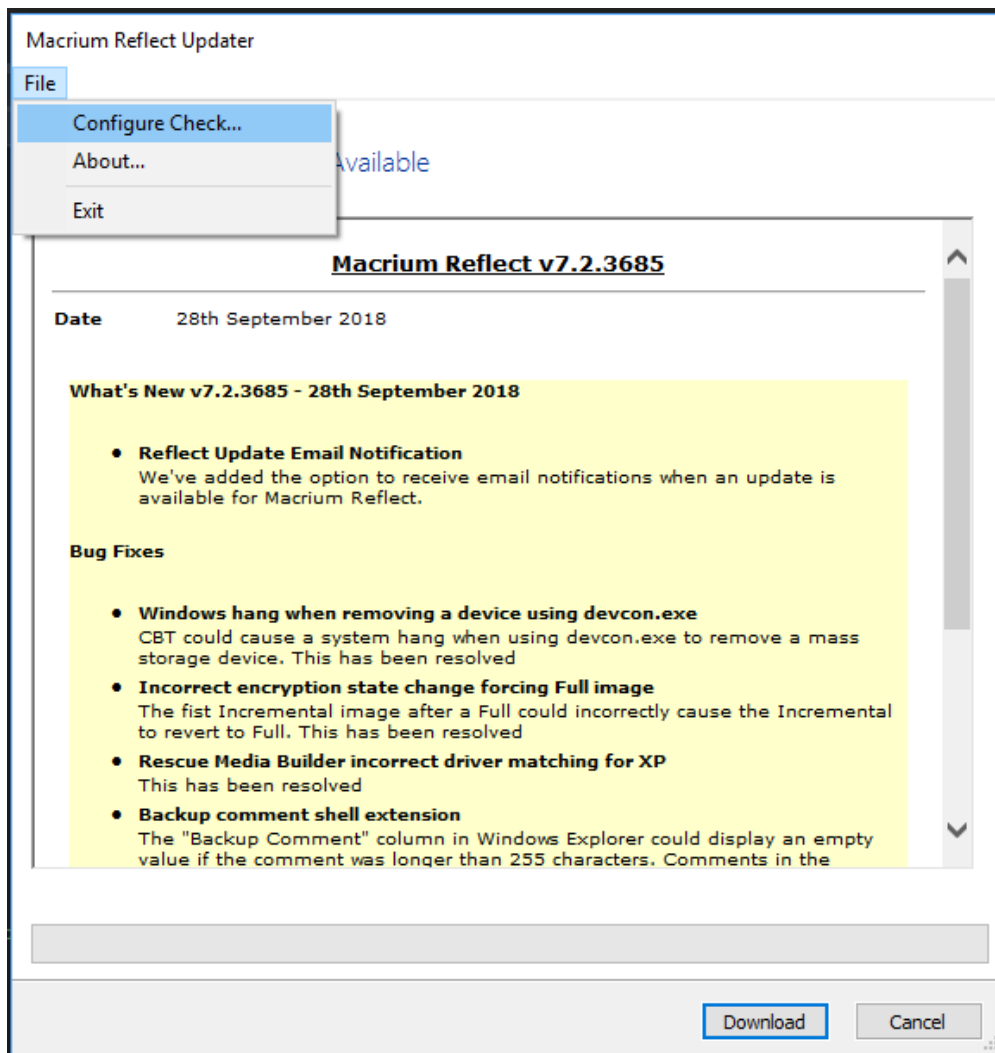
Macrium Reflect v7.2 User Guide

Macrium Reflect Updater Settings

In the **Macrium Reflect Updater** dialog take 'File' > 'Configure Check...'

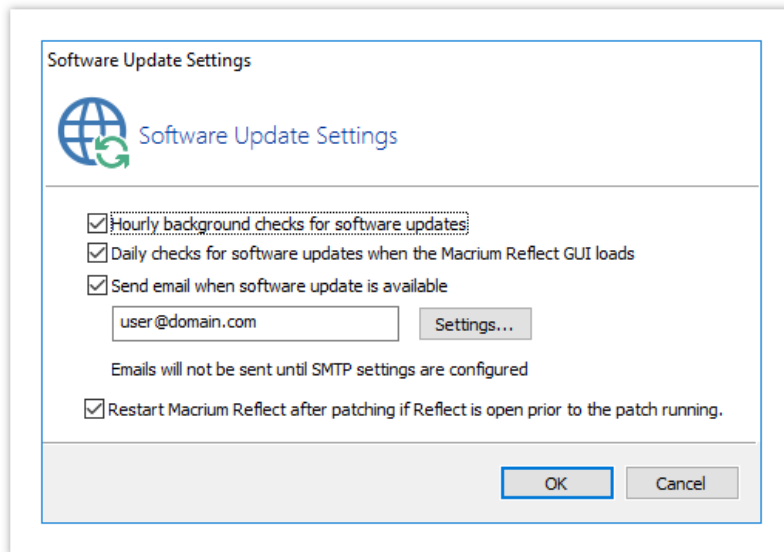


Note: The same options in the **Update Settings** dialog below are available by taking 'Other Tasks' > 'Edit Defaults...' > 'Update' and 'Help' > 'Configure update check..' in the Macrium Reflect UI



This displays the **Update Settings** dialog...

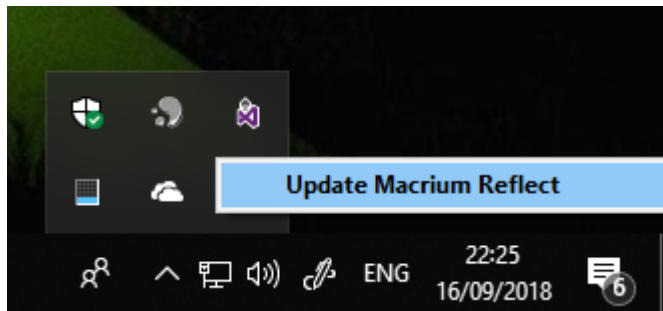
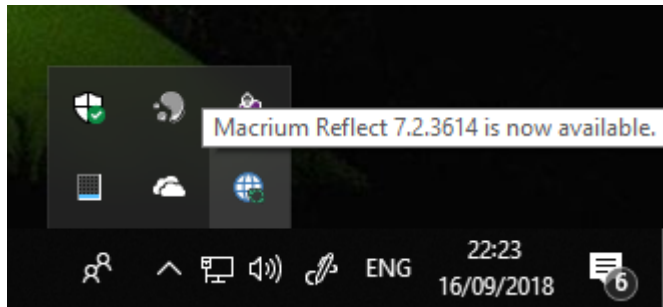
Macrium Reflect v7.2 User Guide



Setting	Description
Hourly background checks	The ReflectUI process will monitor for updates by checking every hour
Send email	If background check is enabled then an email is sent to the supplied email address when an update is found. • Only one email is sent for each update • SMTP server settings are the same settings setup in the Macrium Reflect defaults. This can be configured by clicking the 'Settings..' button,
Daily checks when Macrium Reflect GUI loads	A check is made once a day, when Macrium Reflect is started interactively.
Restart Macrium Reflect after patching	If the Reflect Updater process was launched by taking the 'Other Tasks' > 'Check for updates..' menu in Reflect then setting this option will automatically launch Reflect when the patching completes.

If background checking is enabled then an update icon is shown in the Windows notification area when an update is available. If enabled, the updater checks every hour.

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Click 'Update Macrium Reflect' to launch the 'Macrium Reflect Updater' dialog.

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Unique Registration Code

Registering your installation of **Macrium Reflect Free or Trial of Home, Server or Server Plus** requires entering a **Unique Registration Code** to confirm your registration.



Registration is mandatory for business installations and optional for home users.

The image shows a screenshot of the 'Macrium Reflect Server Plus Edition v7.2.3623 64 bit Setup' window. The window title bar includes the application name and a close button. The main content area is titled 'Registration' and 'Macrium Reflect commercial license registration'. It features the 'Reflect 7' logo. A message states: 'Commercial use of Macrium Reflect, including the Free Edition, requires registration'. Below this, there are two input fields: 'Email address' with the text 'user@domain.com' and 'Registration Code' with the text 'G6TN-2HT8'. A 'Get My Code' button is located next to the Registration Code field. Below the input fields, a note says: 'If you do not have a Registration code, click 'Get My Code' and an email will be sent with instructions'. Another note states: 'Your details will only be used in regard to Macrium products. You can unsubscribe at any time. For details visit www.macrium.com/privacy'. At the bottom, there are three buttons: '< Back', 'Next >', and 'Cancel'.

If you don't have a registration code or if you have previously registered but don't have the code handy then **click 'Get My Code'**.

If you haven't previously registered then you will be emailed a link to an online registration to continue:

For business users:

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Your image is everything

1

2

3

Enter Email

Add Details

Check Email

Please select the Edition you would like to download.

Server Plus

Please enter your email to register for trial support, and optionally for Macrium offers and news

user@domain.com

We will not use this to communicate with you until you have indicated your preferences. We will never sell or pass on your details to any third parties and you can unsubscribe at any time.

First Name

Last Name

Job Title

Company

Enter a location

Address Line 1

Postcode/Zip

City

State/Province/Region

United Kingdom

Phone

Would you like to receive occasional news about Macrium software?

☐ Yes Please

☐ No Thank You

You can read more about how we protect your privacy [here](#).

Close

Continue

For home users:



Your image is everything

1

2

3

Enter Email

Add Details

Check Email

Please enter an email (optional) to register or download

nick@glucom.com

We will not use this to communicate with you until you have indicated your preferences. We will never sell or pass on your details to any third parties and you can unsubscribe at any time.

You can read more about how we protect your privacy [here](#).

Close

Continue

If you have already registered or after completing the form above you will receive an email containing your Registration Code to enter in the installer.

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Thank you for your interest in Macrium Reflect.

Your Registration Code is : !*URC*!

This code is paired with your email address. Use copy and paste to enter it when prompted in the installer registration page.

For more information please see here:

<https://knowledgebase.macrium.com/display/KNOW7/Unique+Registration+Code>

We hope you find our software useful.

The Macrium Team

At any time, you can unsubscribe or update your communication options here.

https://www.macrium.com/consent?id=!*URC*!

Please read about how we protect your privacy here.

<https://www.macrium.com/terms-and-privacy-statement>

Macrium Reflect v7.2 User Guide

Upgrade FAQ

Introduction

This FAQ covers some of the commonly encountered queries regarding transitioning from Macrium Reflect v6 to v7.

How do I download the v7 Installer if I've purchased an upgrade?

Enter your v7 key in the Macrium Reflect download manager. Your v7 key will begin with 56-, 57-, 58- or 59.

Please see [Installing a Macrium Reflect v6 to v7 Upgrade](#)

What's the difference between the Home Edition and the Workstation Edition of Macrium Reflect v7?

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 v7 read and restore images created with Macrium Reflect v6?

Yes, v7 is backwards compatible with all Images and File and Folder backups created with earlier versions of Macrium Reflect.

Will I need to recreate my v6 backup XML definition files?

No, your v6 backup definition files will be loaded into v7 without any conversion.

Can Version 7 be installed over 6? Will both 6 and 7 be on the hard drive? Should 6 be uninstalled first?

Versions 6 and 7 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 6 rescue media is compatible with version 7 images, however, we recommend that you update to the latest v7 rescue media after installation..

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.*

Macrium Reflect v7.2 User Guide

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 6 license on another computer?

The v7 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 v6 license key will be revoked as part of the upgrade process.

Macrium Reflect v7.2 User Guide

Installing Macrium Reflect

Release Notes

The latest release notes for Macrium Reflect v7 can be found here: http://updates.macrium.com/reflect/v7/latest_release_notes.asp

 For additional information on upgrading v6 to v7 please see [Installing a Macrium Reflect v6 to v7 Upgrade](#)

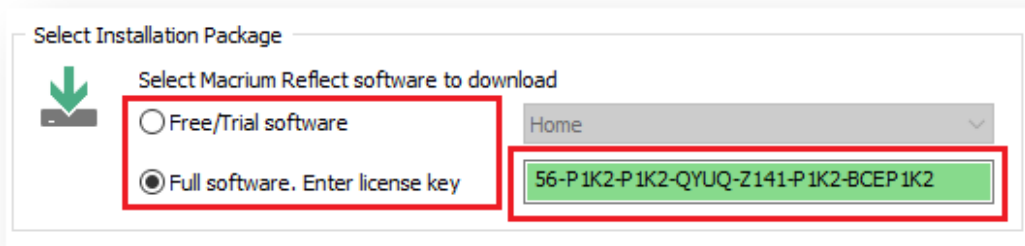
This article explains how to install Macrium Reflect on an Internet connected PC using the Macrium Reflect download agent.

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

- [Downloading Macrium Reflect Installer and PE Components](#)
- [Modifying the default selections](#)
- [Resolving Download Issues](#)
- [WinPE Download Locations](#)

Downloading Macrium Reflect Installer and PE Components

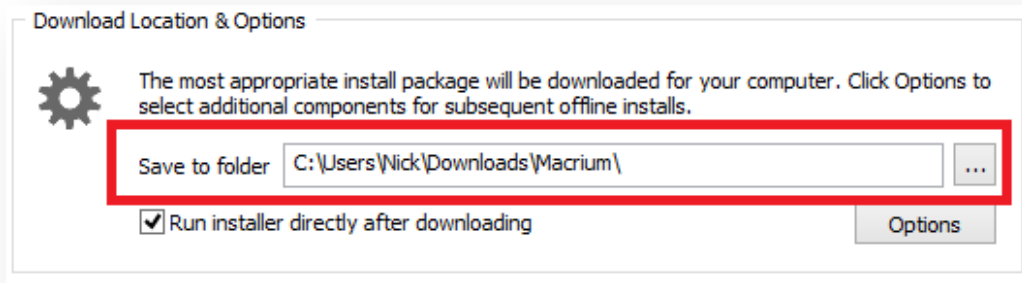
1. [Macrium Reflect Download Manager](#) and run it
2. If you have purchased Macrium Reflect then **Click 'Full Software'** and **enter a valid license key** to automatically download your purchased product.



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

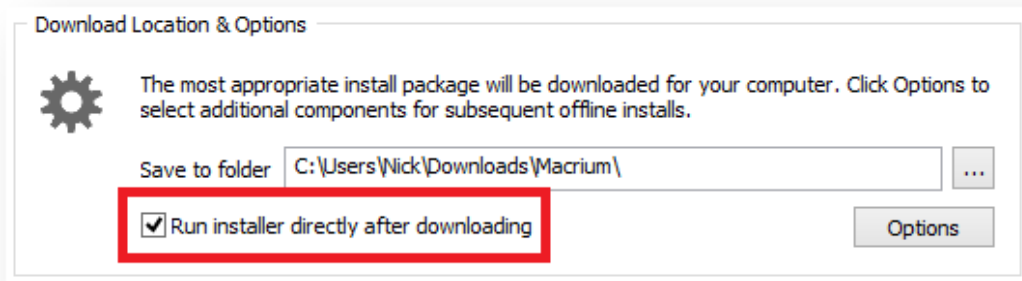
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3. **Enter the folder** where the downloads will be saved to or **Click '...'** to select a folder.



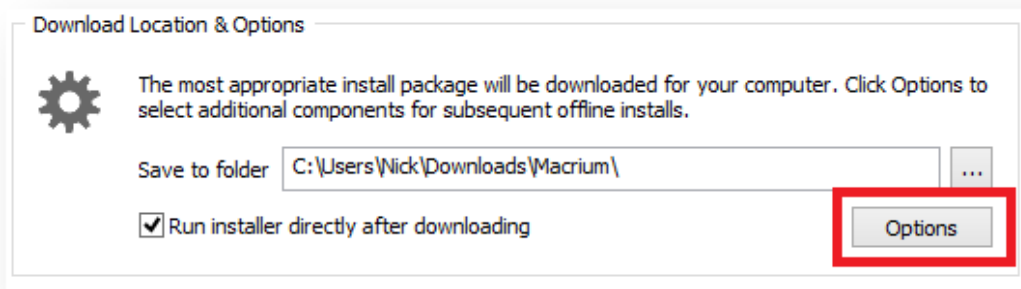
4. **Click 'Run installer directly after downloading'** to run the installation package as soon as the download completes successfully.

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):

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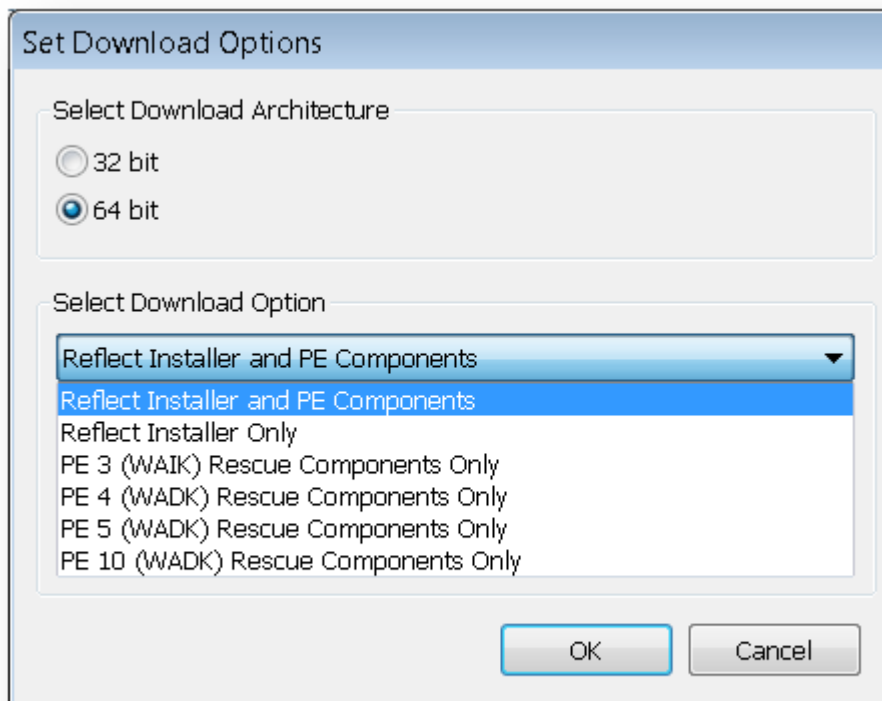


6. **Click Download** to start downloading your installation files.

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.



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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.						
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.

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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

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

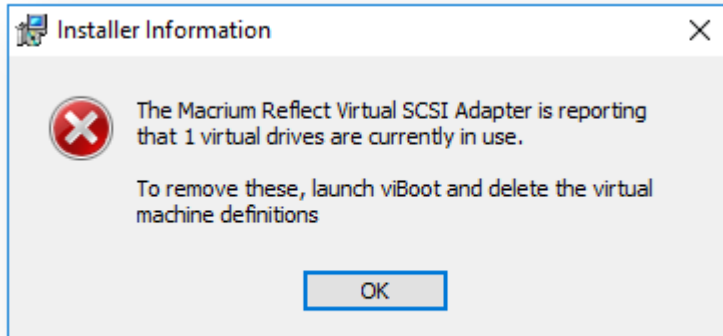
- WinPE 3 (WAIK) - Recommended for Windows 7 and earlier
- WinPE 3.1 Update (WAIK) - Recommended for Windows 7 and earlier
- WinPE 4 (WADK) - Recommended for Windows 8 and later
- WinPE 5 (WADK) - Recommended for Windows 8.1 and later
- WinPE 10 (WADK) - Recommended for Windows 10 and later

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viBoot installation error when upgrading from 7.0 to 7.1

Macrium Reflect v7.0 viBoot is not compatible with v7.1 viBoot. This means that any existing 7.0 viBoot Virtual Machines must be deleted prior to installing 7.1.

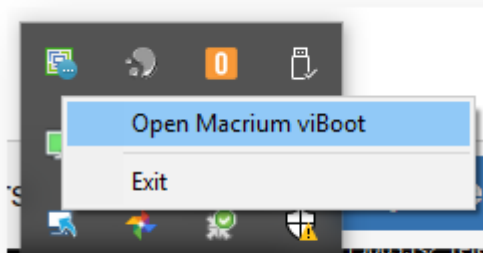
If existing 7.0 viBoot VMs remain during 7.1 installation then the installer will abort with the following message:



To correct this problem, **click 'OK'** to terminate the install and delete any existing VMs using the viBoot user interface.

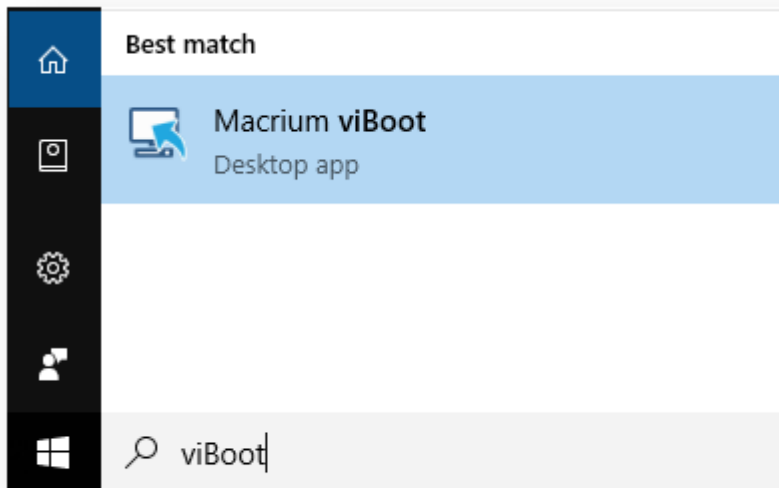
To launch viBoot and delete Virtual Machines

Right click on the viBoot icon in the TaskBar and **select 'Open Macrium viBoot'**

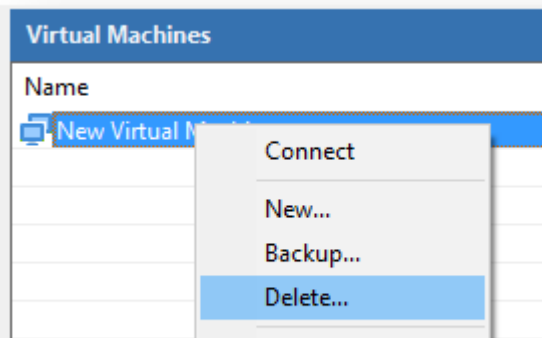


Or **type 'viBoot'** in the Windows search bar:

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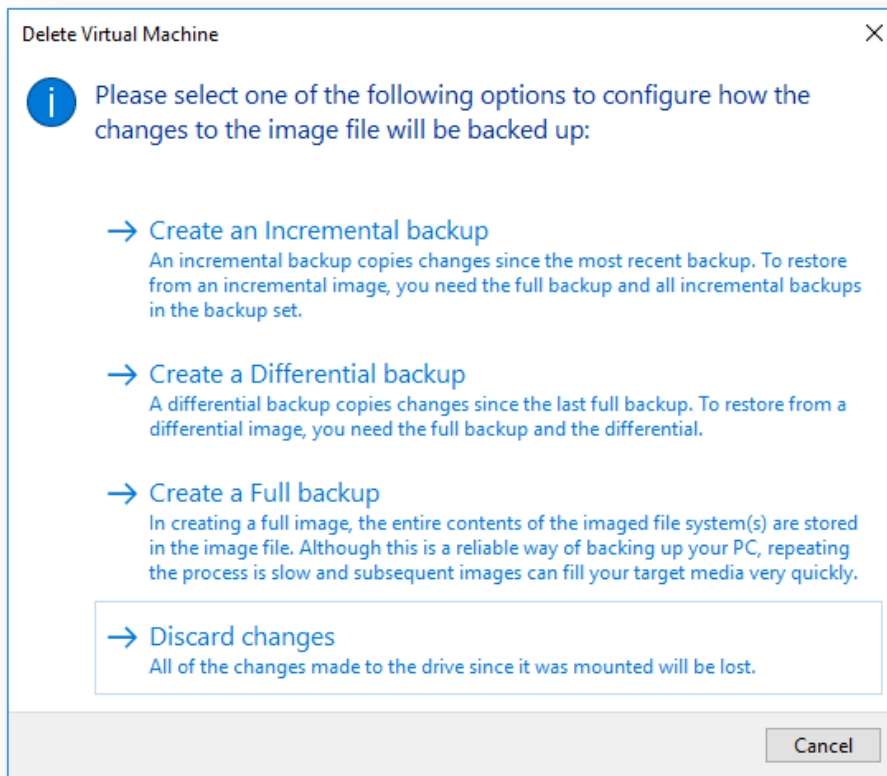


When the viBoot UI starts, **right click** on any existing VMs and **select 'Delete...'**



You will then be prompted to backup or discard changes in the VM

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i **Note:** This will lose any changed data in the VM(s), so if necessary take a 'Backup' option prior to deleting.

The Macrium Reflect v7.1 installation can now be started again

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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](#).

- Download the installer and PE components.
- Offline installation of your purchased license.
- Ensuring your software is up to date.
- How to identify the architecture of your target machine.

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



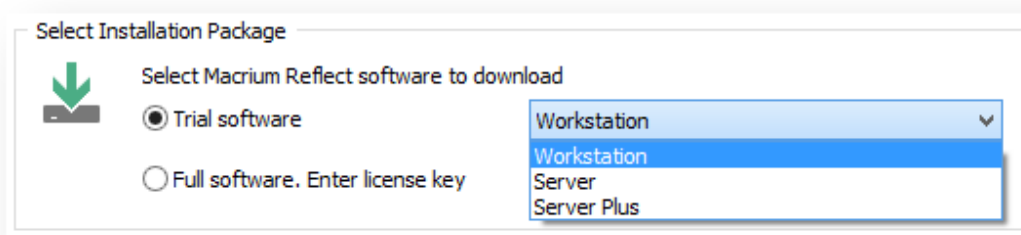
This article refers to the machine you wish to install Reflect on as the "target PC" and the machine connected to the Internet as the "online PC".

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.

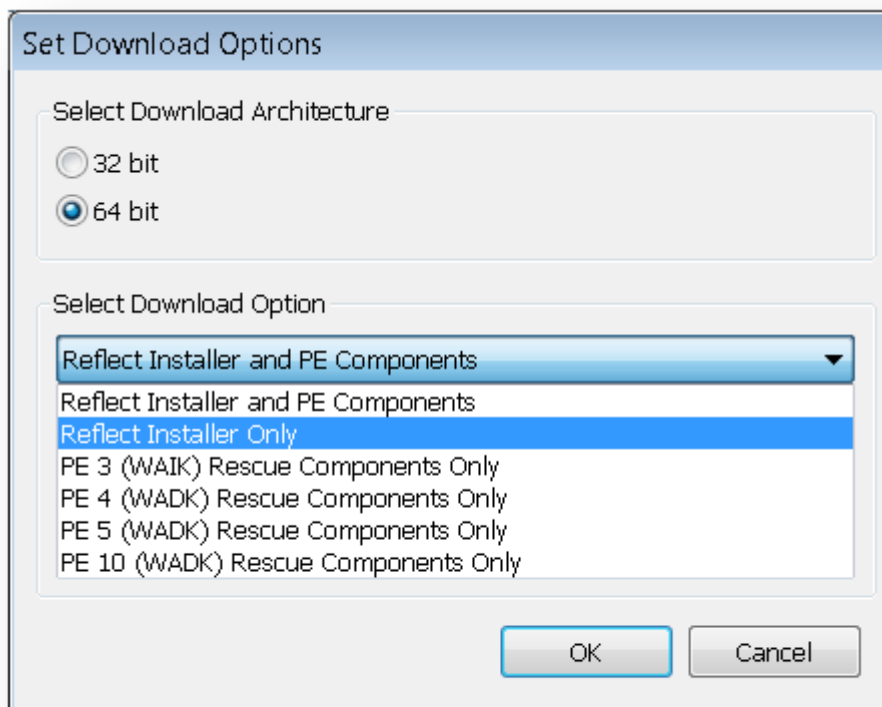
Download the [Macrium Reflect Download Agent](#) to your PC and run it.

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**.

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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	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.						
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						

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Option	Description
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](#).



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

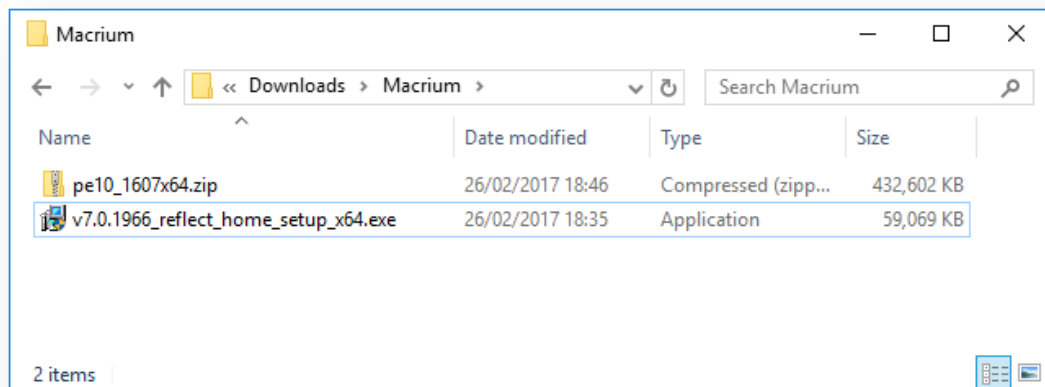
Select 'Reflect installer and PE components'. This will download the required files in **one** download step. **Click OK**, then **un-check "Run installer directly after downloading"**, and **Click download**.



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

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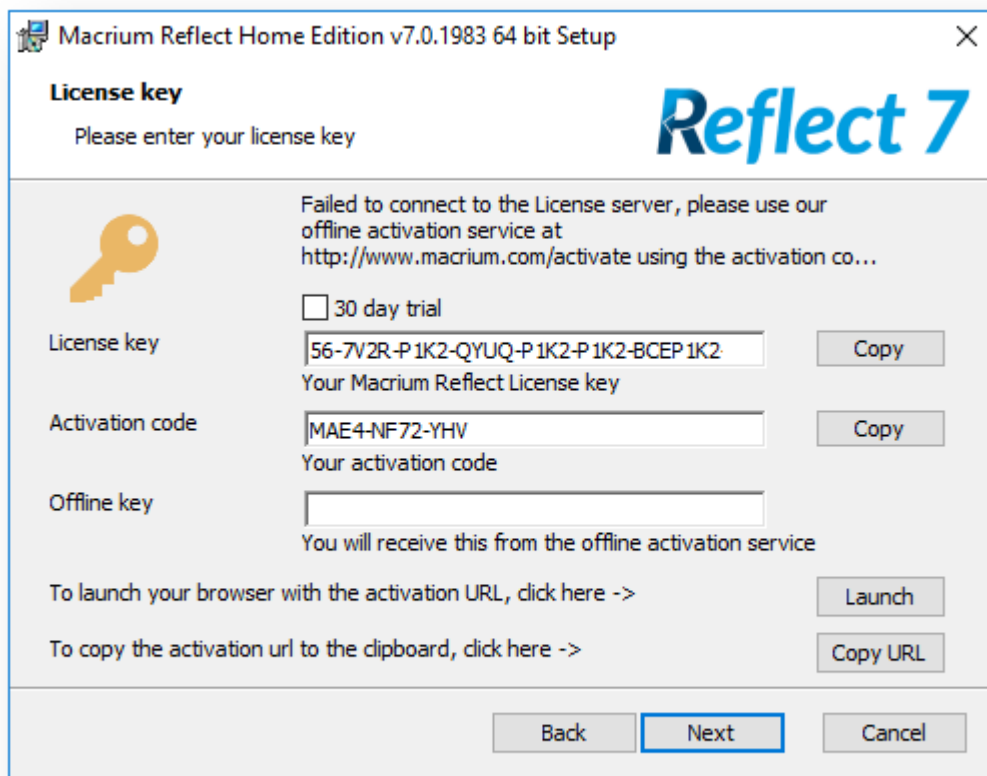
PE components zip file.

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.



Navigate to the registration server on your online PC and **enter your license key and activation code**.

Key Registration

Licence Key	56-P1K2-PVB4-QYUQ-P1K2-P1K2-BCEP1K2
Activation Code	MAE4-NF72-YHV

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

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

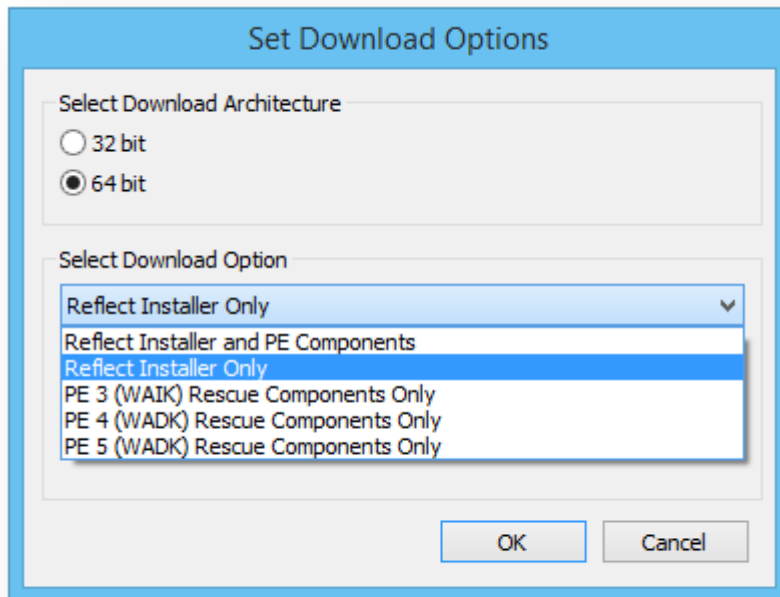
Macrium Reflect v7.2 User Guide

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.

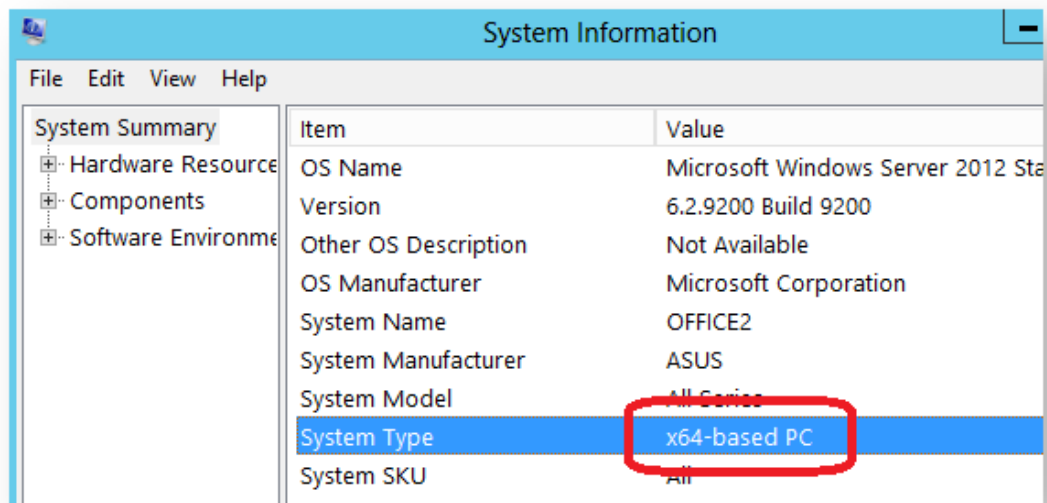


How to identify the architecture of your target machine.

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.

Macrium Reflect v7.2 User Guide



Macrium Reflect v7.2 User Guide

Installing a Macrium Reflect v6 to v7 Upgrade

This article explains how to download and install Macrium Reflect v7 using your v6 to v7 upgrade license key.

- License key format
- Upgrading to Macrium Reflect v7 from an existing v6 Installation with a free upgrade key.
- Upgrading to Macrium Reflect v7 from an existing v6 Installation using a purchased upgrade key
- Upgrading to Macrium Reflect v7 without an existing installation of v6
- Related articles

Macrium Reflect v7 includes powerful industry leading technologies to reduce image creation time using 'Changed Block Tracking' (CBT). v7 also includes Macrium viBoot 'instant virtualisation' that enables creation of a Hyper-V Virtual Machine with just a couple of clicks.

The user interface changes from v6 have been kept minimal and upgrading from v6 will be an easy process. See [New in Version 7](#) for more information.

Upgrade to v7

Enter you email address or v6 license key in the upgrade page

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 v6 keys

Product	Key format
v6 Home	36-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

Macrium reflect v7 and v6 to v7 upgrade keys

Macrium Reflect v7.2 User Guide

Product	Key format
v7 Home	56-XXXX-XXXX-XXXX-XXXX-XXXX-XXXXXXXX
v7 Workstation	57-XXXX-XXXX-XXXX-XXXX-XXXX-XXXXXXXX
v7 Server	58-XXXX-XXXX-XXXX-XXXX-XXXX-XXXXXXXX
v7 Server Plus	59-XXXX-XXXX-XXXX-XXXX-XXXX-XXXXXXXX

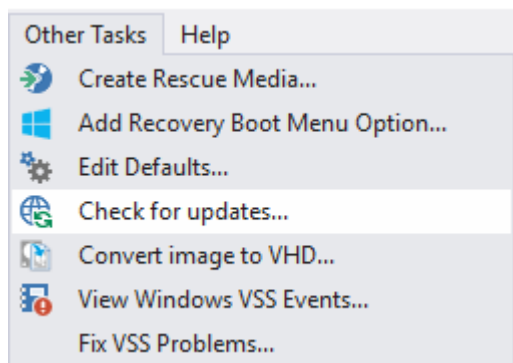
Upgrading to Macrium Reflect v7 from an existing v6 Installation with a free upgrade key.

Free upgrades to v7 from v6 are available to customers with an active Support and Maintenance subscription and for v6 keys purchased on or after 26th November 2016.



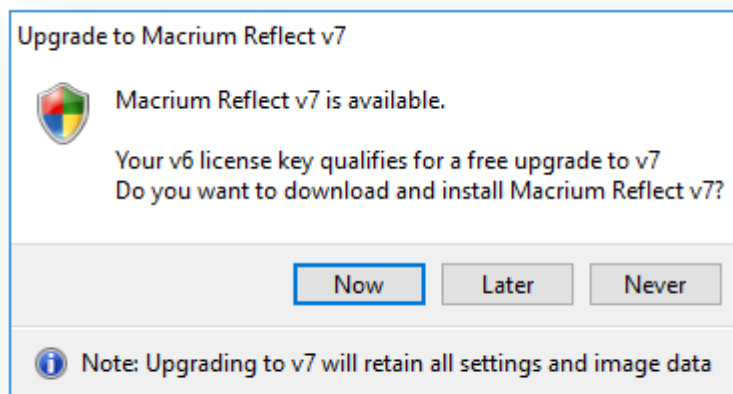
Before you begin, ensure that you are at the latest release of Macrium Reflect v6 by taking the **'Other Tasks' > 'Check for updates'** menu option.

1. Take the **'Other Tasks' > 'Check for updates'** menu option:



2. The following message prompt is displayed:

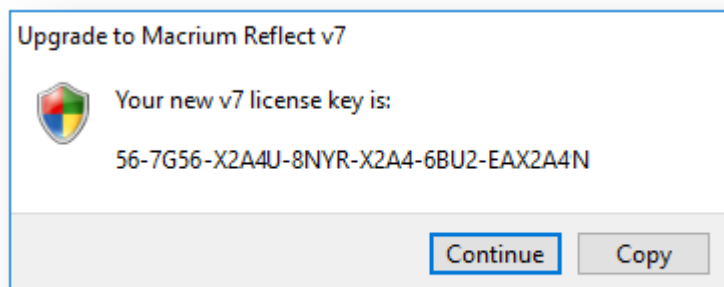
Macrium Reflect v7.2 User Guide



Click 'Now' to upgrade immediately.

Note: If you click 'Never' then further attempts to update your installation will only check for v6 updates. To override this **hold the 'Ctrl' key down** when you take the 'Check for updates..' menu option.

3. Your new key will be shown in the following message box:



To save your key for future reference, use the 'Copy' button to copy your new key to the Windows clipboard

Clicking '**Continue**' or '**Copy**' will download the Full Macrium Reflect v7 Installer for your purchased edition. The installer will start automatically.

Macrium Reflect v7.2 User Guide

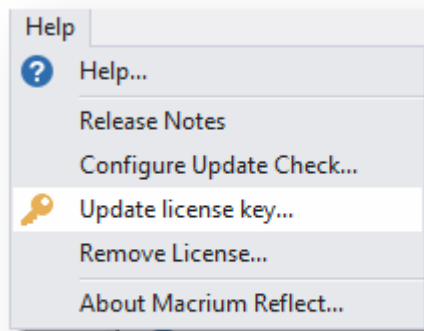
Upgrading to Macrium Reflect v7 from an existing v6 Installation using a purchased upgrade key

You can enter your purchased v6 to v7 upgrade license key directly into your Macrium Reflect v6 installation. This process will automatically upgrade your v6 key without you having to type it in again in the installer.



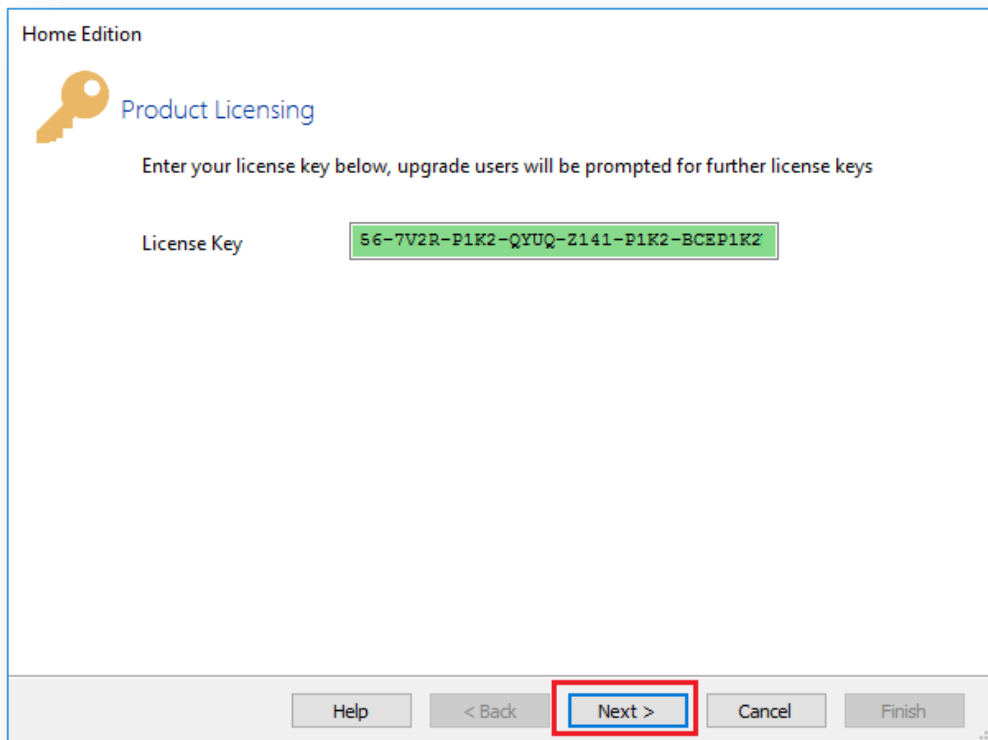
Before you begin, ensure that you are at the latest release of Macrium Reflect v6 by taking the '**Other Tasks**' > '**Check for updates**' menu option.

1. Take the '**Help**' > '**Update license key..**' menu option.



2. In the dialog that opens **enter your purchased v6 to v7 upgrade key**. This key will begin '56-', '57-', '58-' or '59-' depending on the edition:

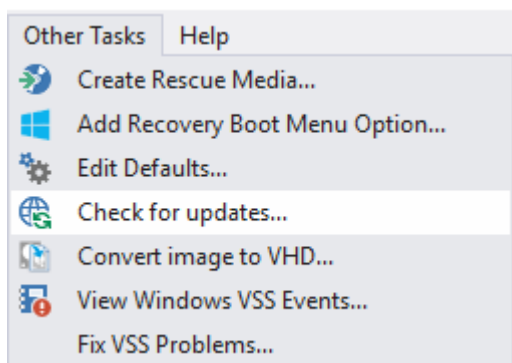
Macrium Reflect v7.2 User Guide



Click 'Next' and then 'Finish' to register your new v7 key.

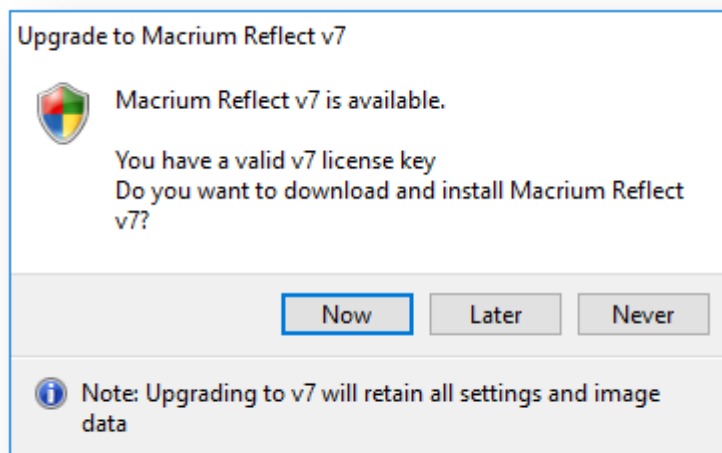
3. The final step is to download and run the v7 Installer. You can do this immediately or at a later stage if you wish

Take the 'Other Tasks' > 'Check for updates' menu option:



The following message prompt is displayed:

Macrium Reflect v7.2 User Guide



Click **'Now'** to download the Full Macrium Reflect v7 Installer for your purchased edition. The installer will start automatically.

Note: If you click **'Never'** then further attempts to update your installation will only check for v6 updates. To override this **hold the 'Ctrl' key down** when you take the 'Check for updates..' menu option.

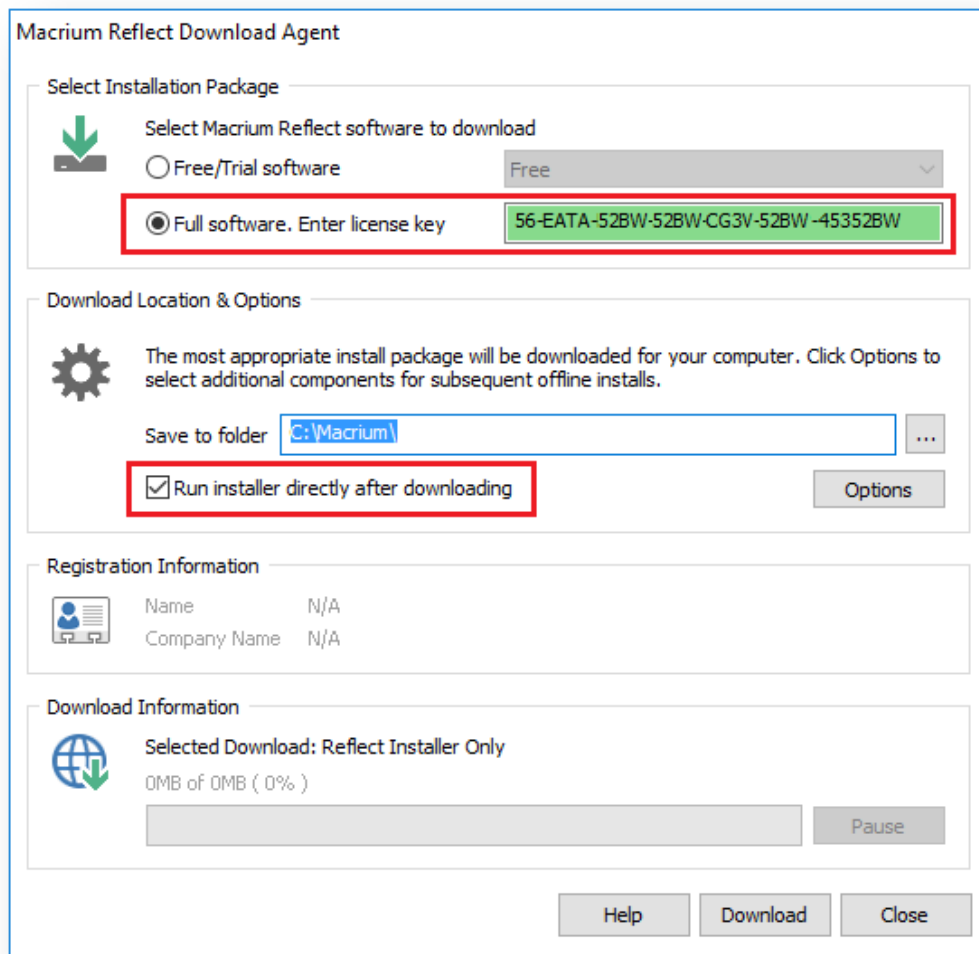
Upgrading to Macrium Reflect v7 without an existing installation of v6

If you have uninstalled v6 then you can download the installer using the Macrium Reflect download manager.

Note: This method will require you to enter the v6 key that you are upgrading the v7 installer

1. Download and run the Macrium Reflect download manager: Click '[ReflectDLFull.exe](#)' to download.
2. Enter your **v7 Key** in the download manager to download and run the v7 installer:

Macrium Reflect v7.2 User Guide



The image shows the 'Macrium Reflect Download Agent' window. It has four main sections: 'Select Installation Package', 'Download Location & Options', 'Registration Information', and 'Download Information'. In the 'Select Installation Package' section, the 'Full software. Enter license key' option is selected, and a license key is entered in the adjacent field. In the 'Download Location & Options' section, the 'Run installer directly after downloading' checkbox is checked. The 'Download Information' section shows a progress bar at 0% and a 'Pause' button. At the bottom are 'Help', 'Download', and 'Close' buttons.

Macrium Reflect Download Agent

Select Installation Package

Select Macrium Reflect software to download

☐ Free/Trial software Free

☒ Full software. Enter license key 56-EATA-52BW-52BW-CG3V-52BW-45352BW

Download Location & Options

The most appropriate install package will be downloaded for your computer. Click Options to select additional components for subsequent offline installs.

Save to folder C:\Macrium\

☒ Run installer directly after downloading Options

Registration Information

Name N/A

Company Name N/A

Download Information

Selected Download: Reflect Installer Only

OMB of OMB (0%)

Pause

Help Download Close

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

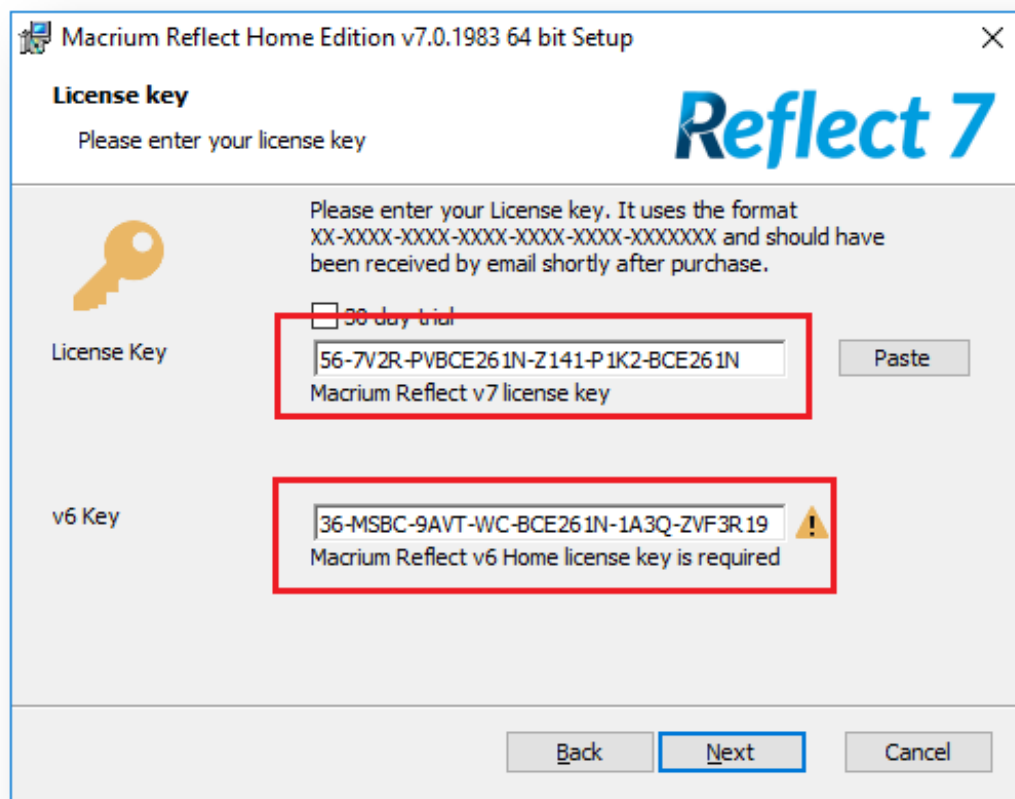


Note: You **must** enter your v7 key. If you enter your v6 key you will download the Macrium Reflect v6 installer

3. The installer will require you to enter both your new v7 upgrade key and your existing v6 key.

In the installer License Key page **enter your v7 Key** you will then be prompted to **enter your v6 key**:

Macrium Reflect v7.2 User Guide



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

Related articles

[Upgrade FAQ](#)

[Installing Macrium Reflect](#)

[Installing and updating Macrium Reflect offline](#)

[Troubleshooting installer issues](#)

Macrium Reflect v7.2 User Guide

Macrium Reflect Quick Start

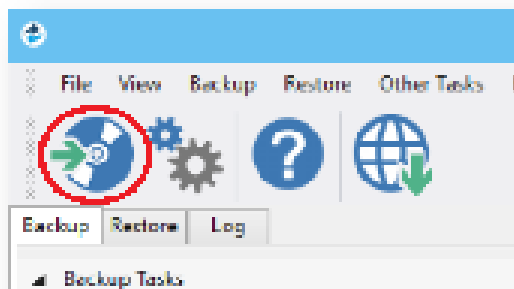
Macrium Reflect is intuitively designed and organised with simple to follow wizards guiding you through tasks. If you have never used backup software before, however, you might feel some trepidation, needing a little extra guidance to get you started.

- First create rescue media
- Imaging disks
- Backing up files and folders
- Cloning disks
- Scheduling, retention and disk space
- Restoring files and folders
- Restoring images
- ReDeploying computers
- Scripting backup processes
- Managing Macrium files in Windows

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.

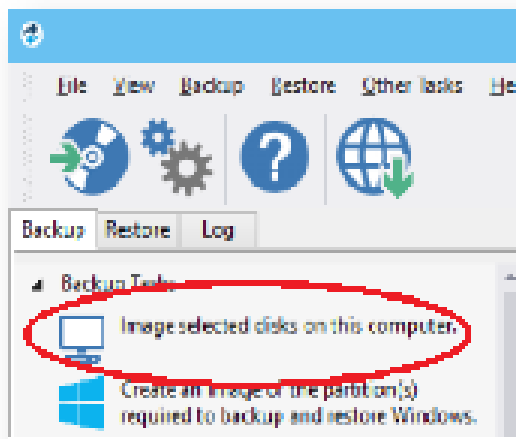


For further guidance see [Creating rescue media](#).

Imaging disks

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

Macrium Reflect v7.2 User Guide

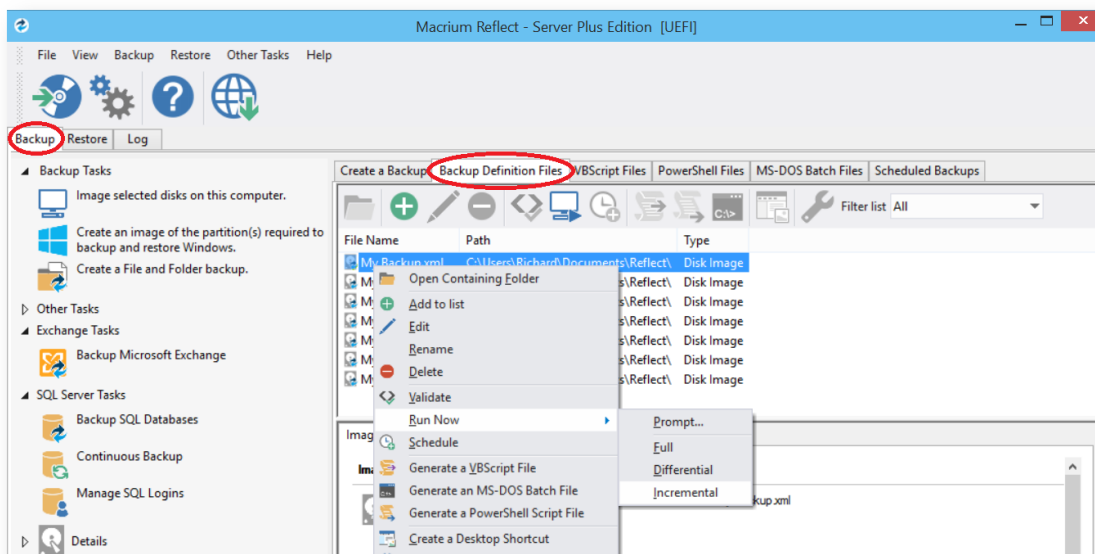


For further guidance see [Creating a backup of your computer](#).

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.

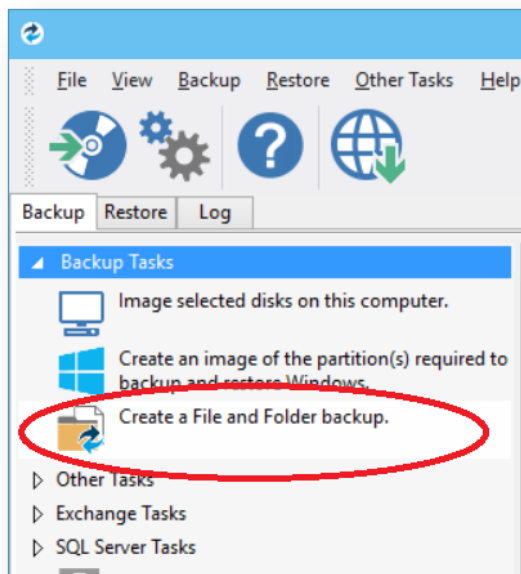


For more information see [Differential and incremental disk images](#).

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.

Macrium Reflect v7.2 User Guide



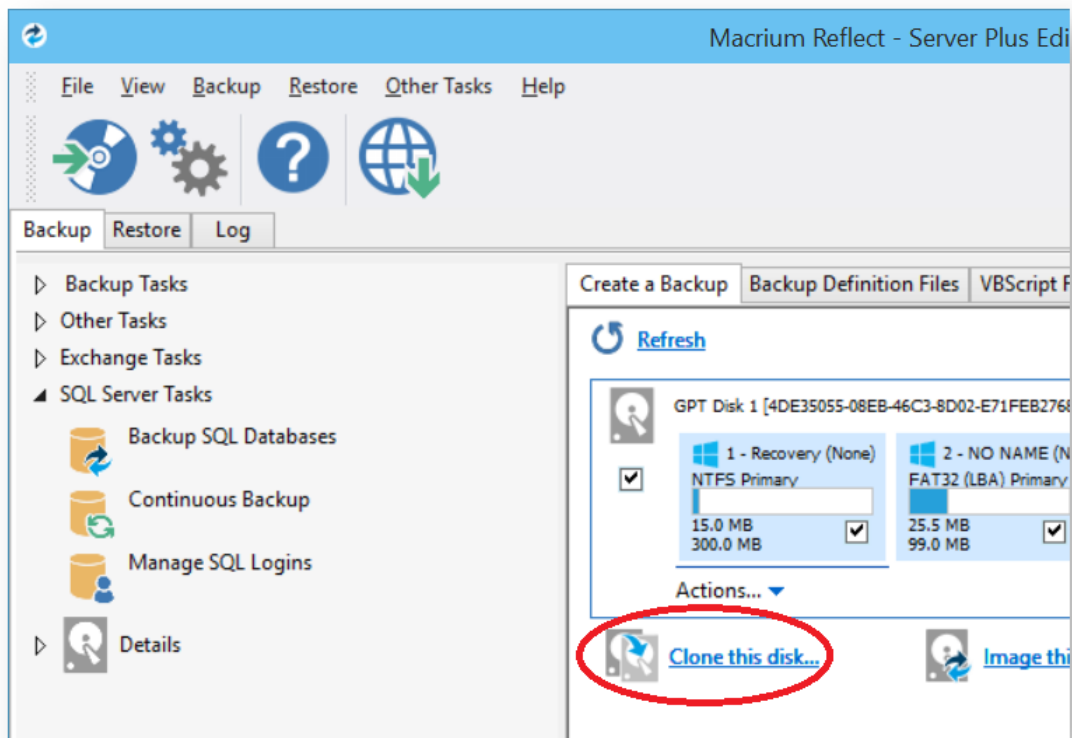
For more information see [Backing up files and folders](#).

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.

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

Macrium Reflect v7.2 User Guide



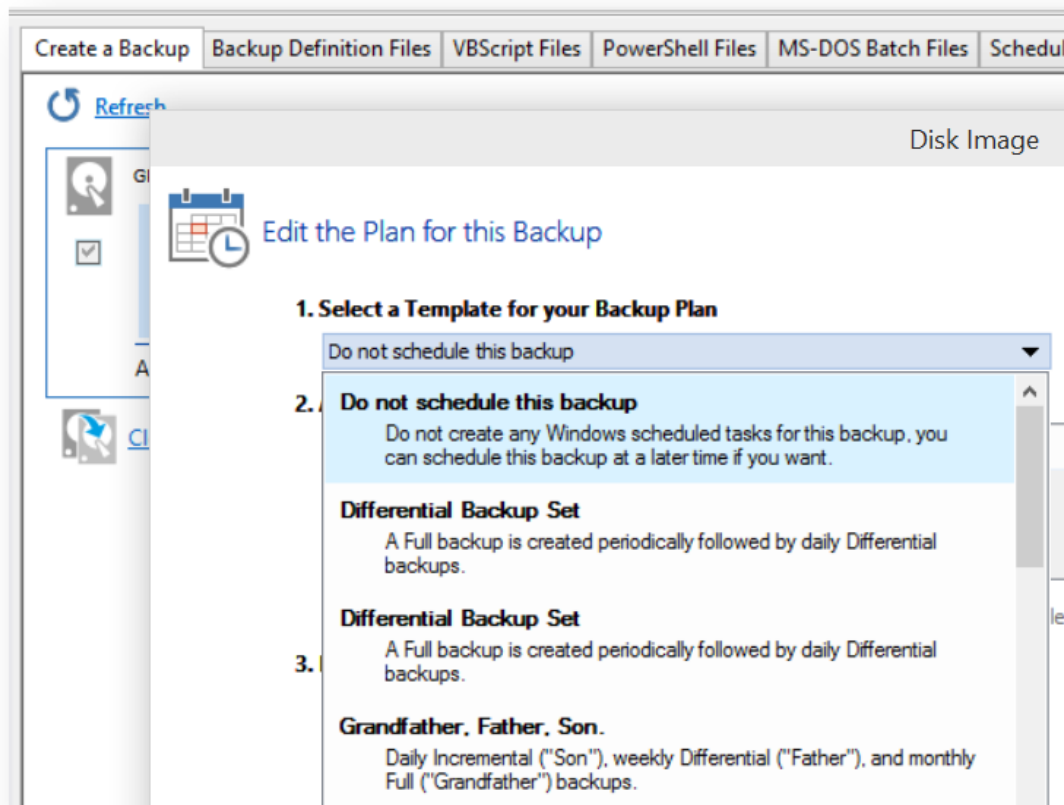
For more information see [Cloning a disk](#).

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.

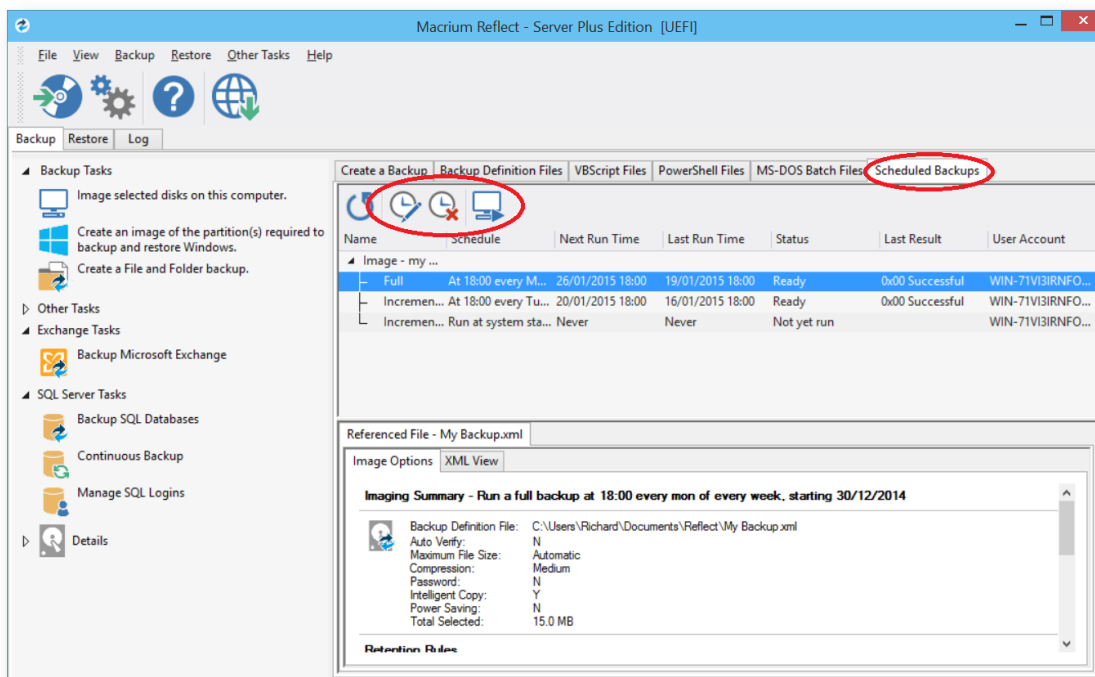
Click below **Select a Template for you Backup Plan** to select from industry best practice backup plans templates, quick-start backup plan templates or even templates that you have created. You can even skip over scheduling to simply take advantage of the retention rules for managing your disk space.

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You can then customize the plan to suit your needs.

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

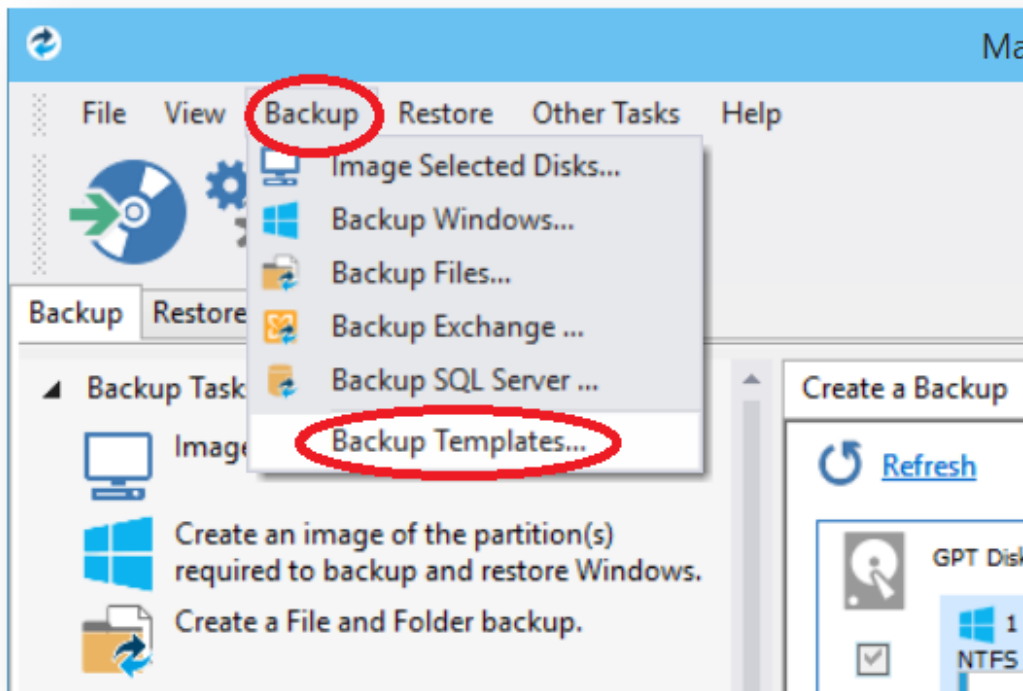


Macrium Reflect v7.2 User Guide

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...** .



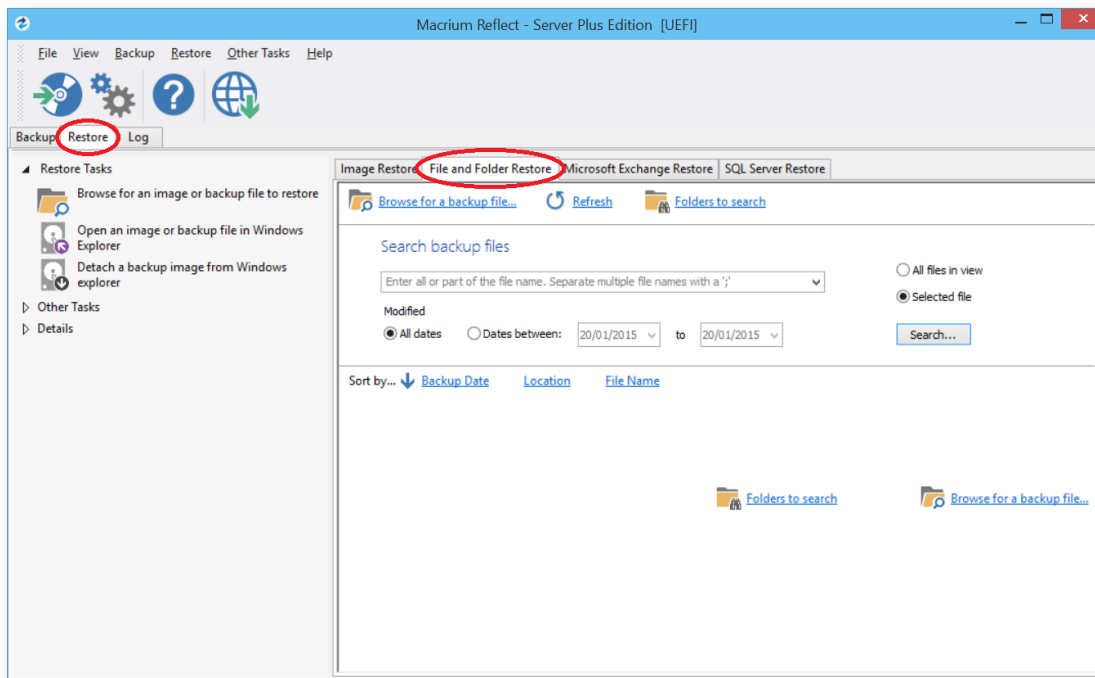
For more information about using backup templates see [Scheduling backups](#).

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

Restoring files and folders

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

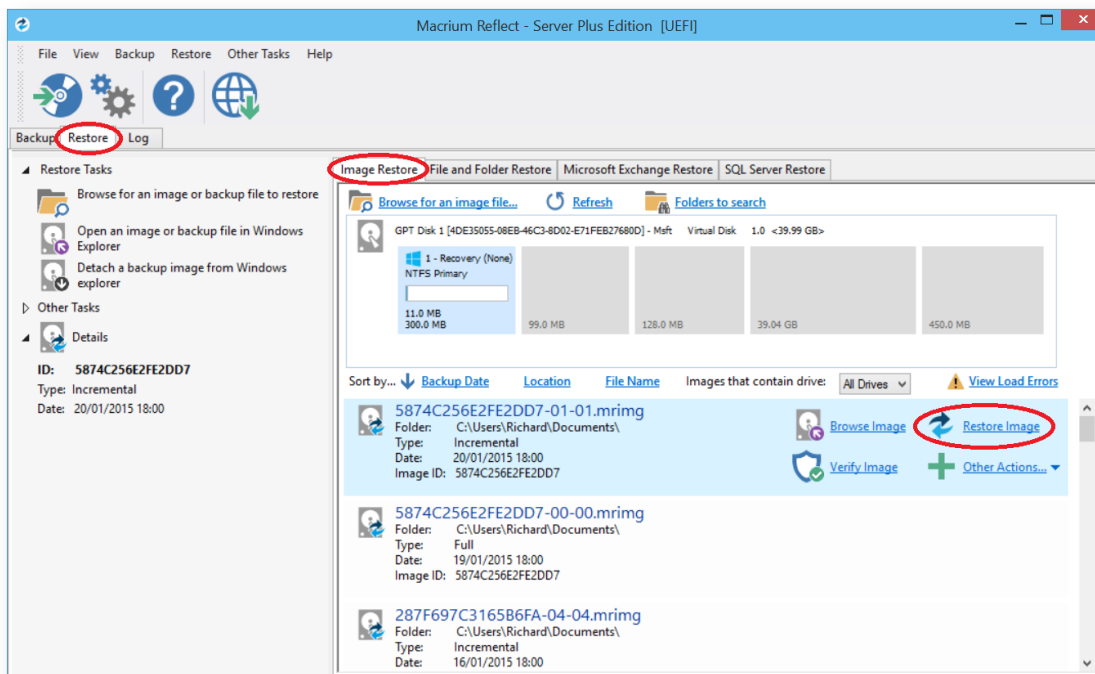
Macrium Reflect v7.2 User Guide



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

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](#).

Macrium Reflect v7.2 User Guide

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.

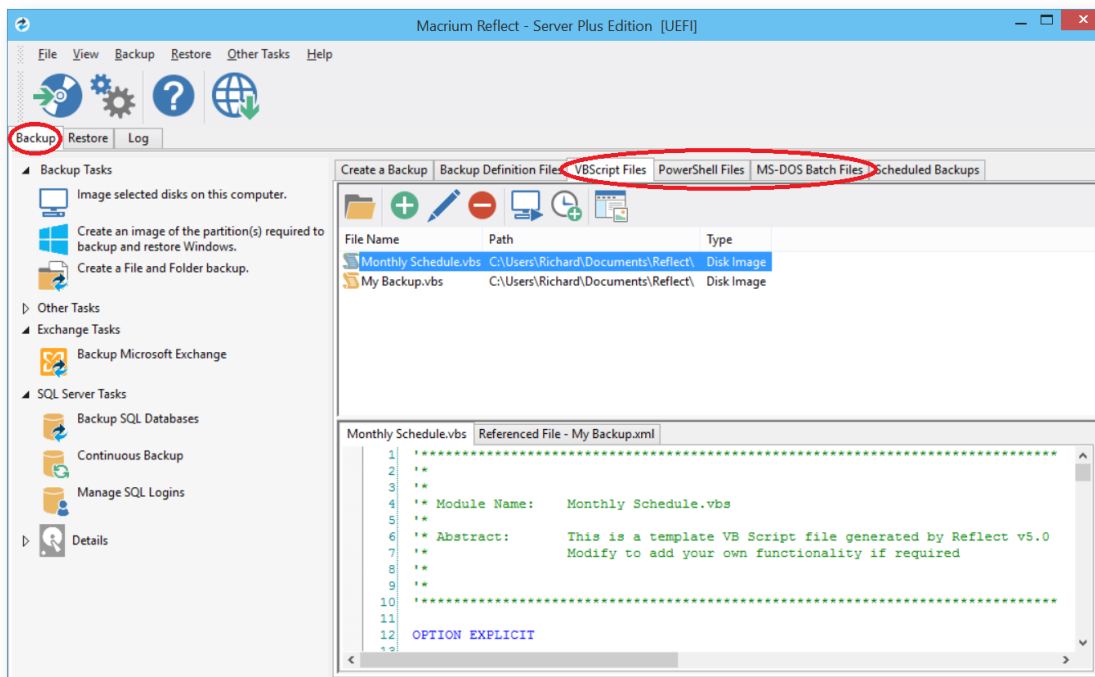
Note: There is no need to reboot your PC after restoring an Image and before you run ReDeploy.

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.
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](#).

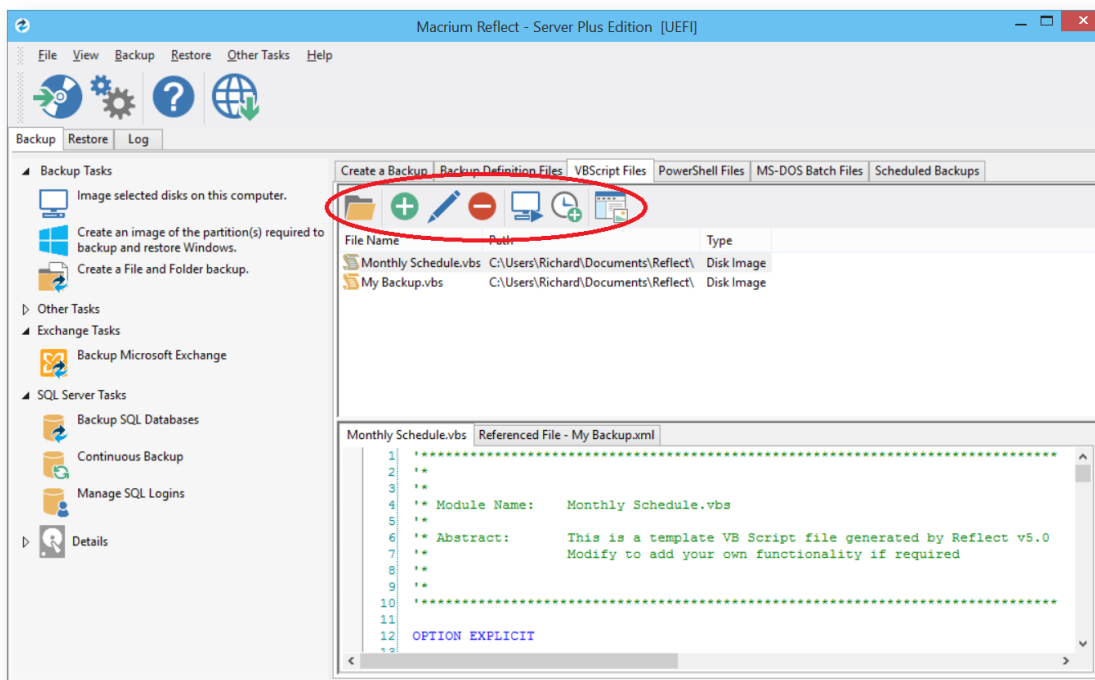
Scripting backup processes

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.

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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
- 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.

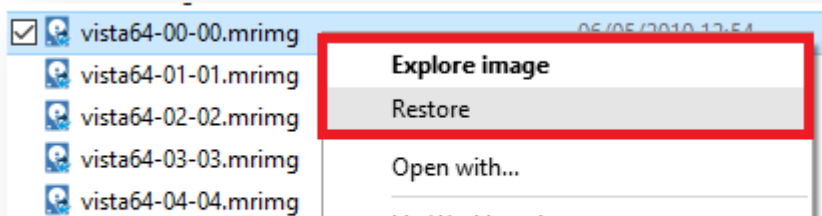
Windows Explorer shell integration

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

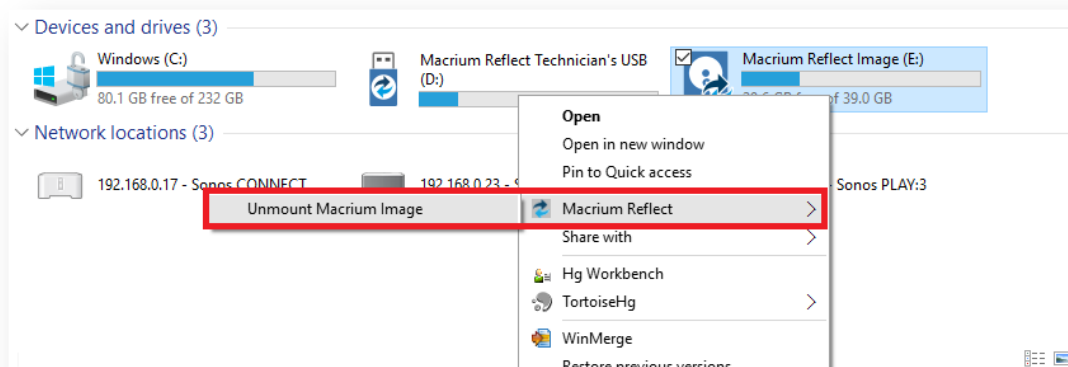
- Context sensitive menus
 - Windows Explorer columns
 - .mrimg and .mrbak file properties
 - File Infotips
 - Extended support for Reflect XML definition files
-

Context sensitive menus

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

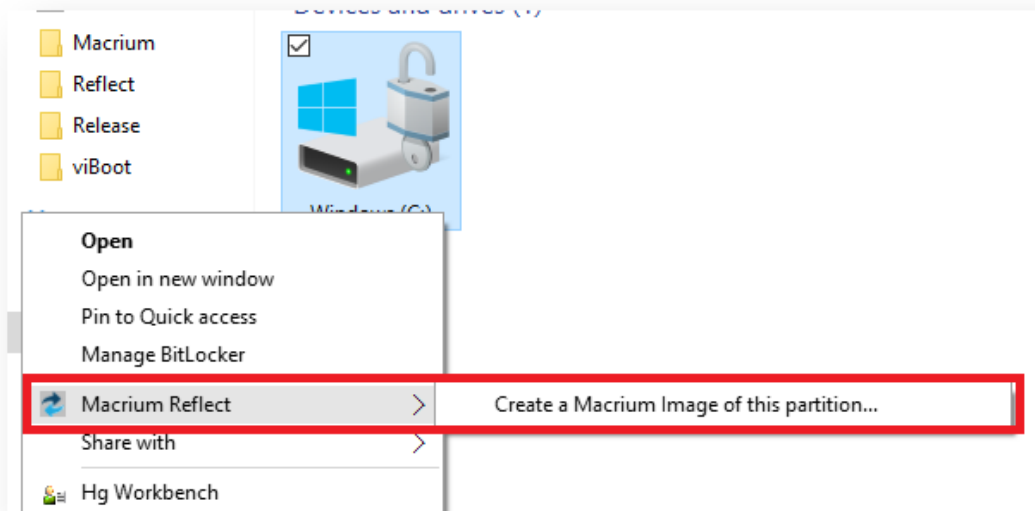


You can then right click on the disk to unmount the image



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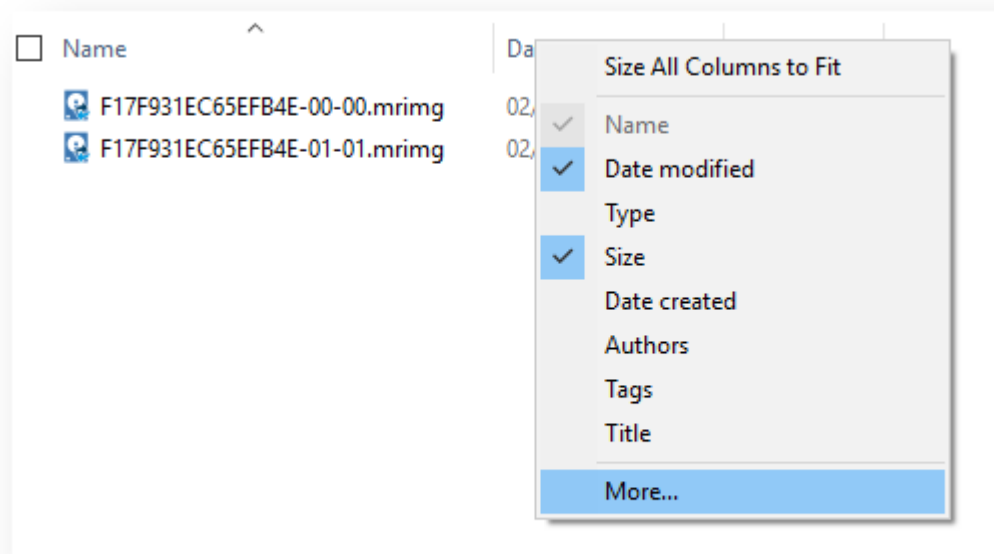
You can also image individual drives by **selecting the drive, right-clicking** and selecting the **Macrium Reflect** option then **Create a Macrium Image of this partition**



Windows Explorer columns

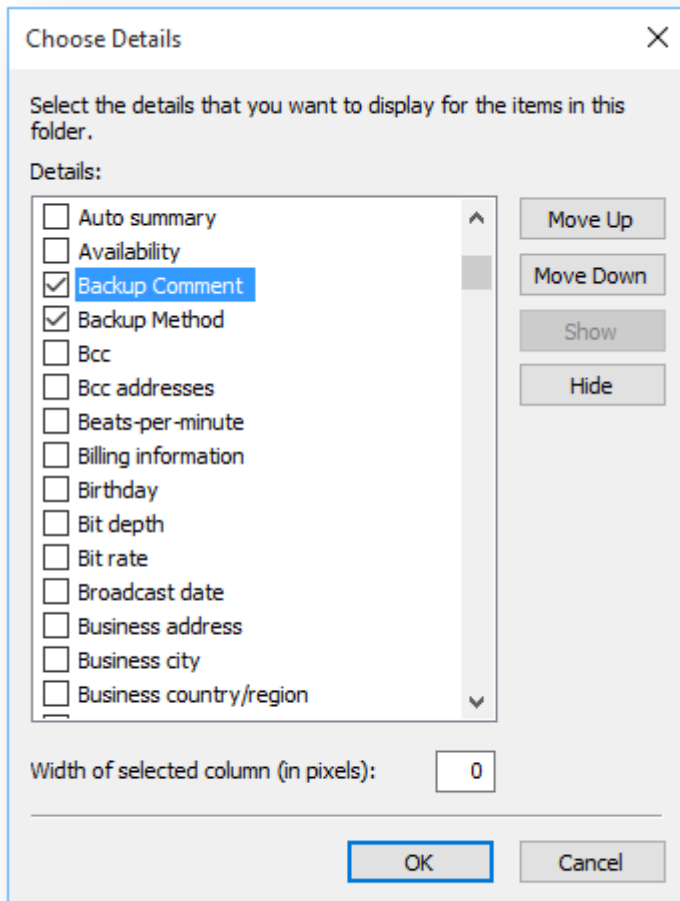
You can add columns in Windows Explorer to show the Backup Method and the comments stored with the backups.

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

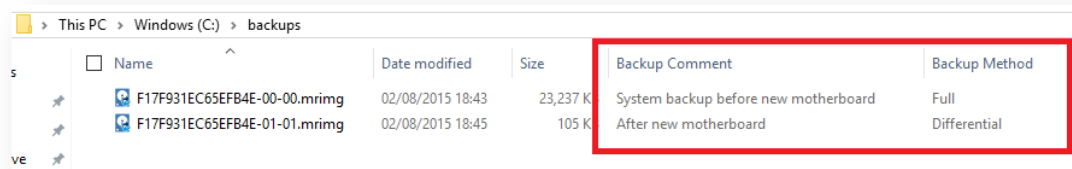


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Scroll and **select 'Backup Comment' and 'Backup Method':**



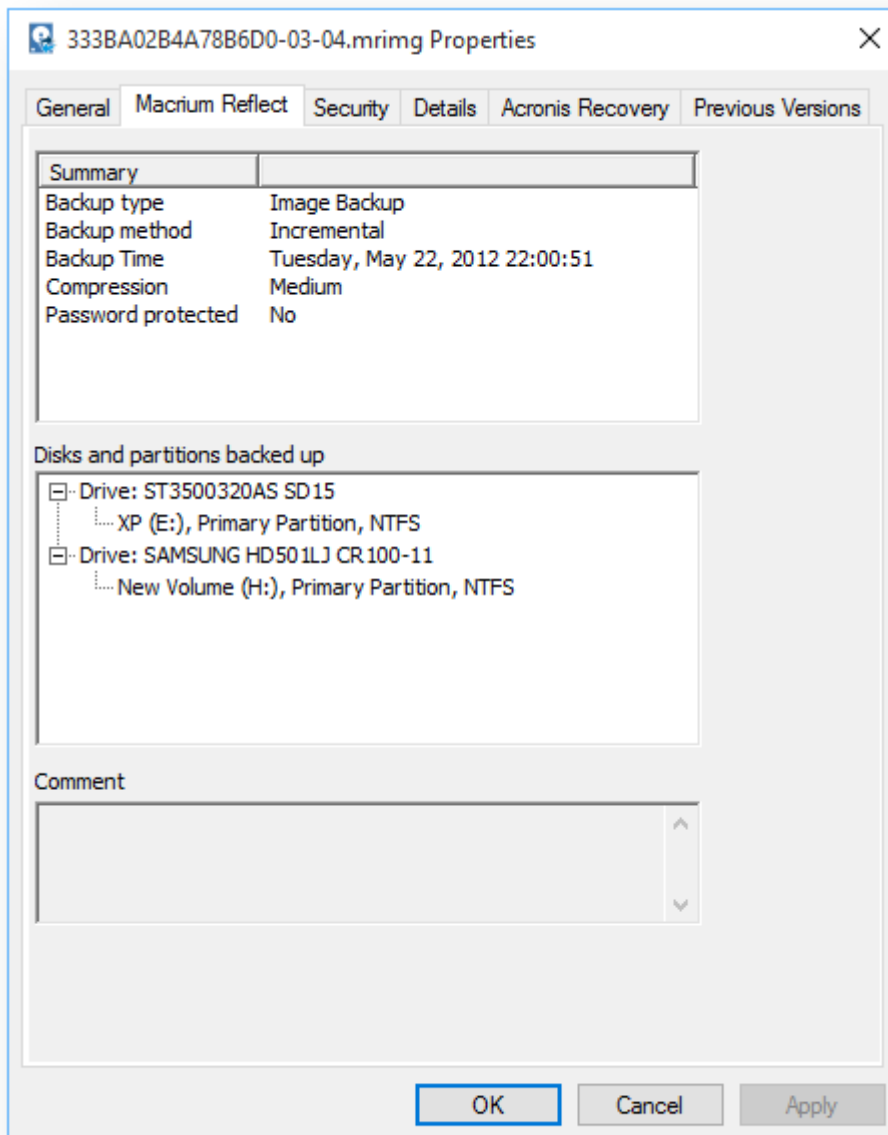
The columns are then added to the Explorer view:



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.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.



Macrium Reflect v7.2 User Guide

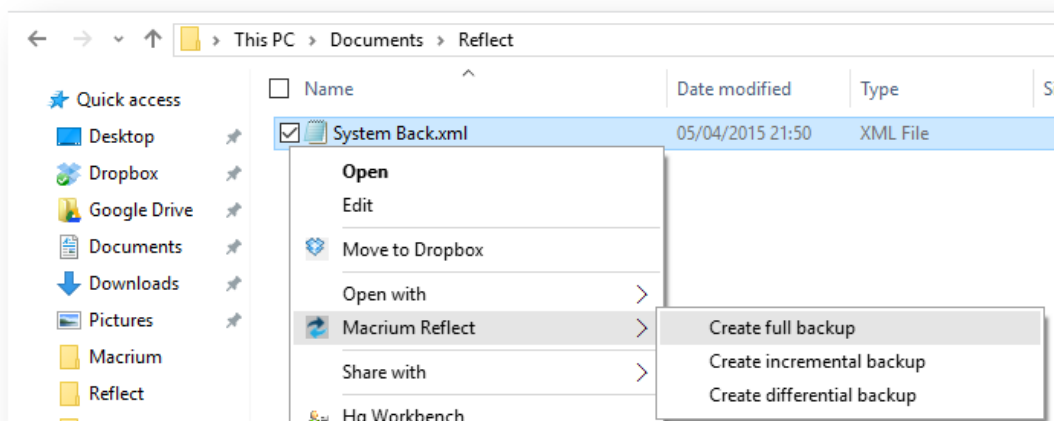
File Infotips

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.

File Name	Size	Format	Capacity
333BA02B4A78B6D0-00-00.mrimg	8:22	Disk Partition image	167,590,73...
333BA02B4A78B6D0-00-01.mrimg	2:20	Disk Partition image	254,948 KB
333BA02B4A78B6D0-00-02.mrimg	2:18	Disk Partition image	205,726 KB
333BA02B4A78B6D0-00-03.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
333BA02B4A78B6D01-06-07.mrimg	27/05/2012 22:19	Disk Partition image	1,006,385 KB

Extended support for Reflect XML definition files

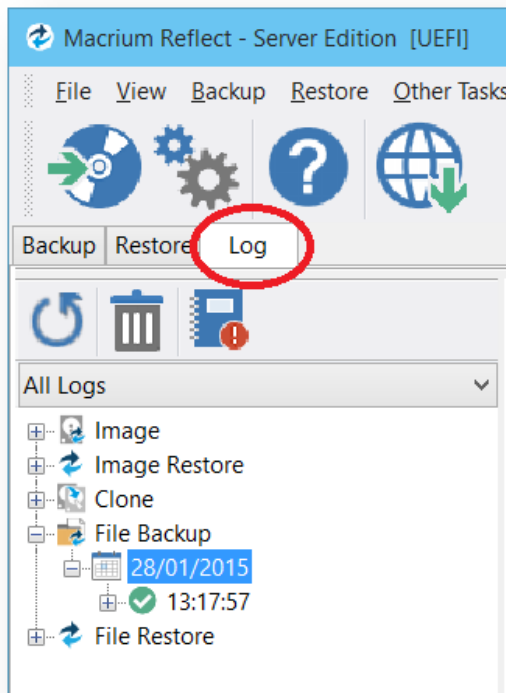
You can run full, differential and incremental backups by **right-clicking on XML definition files**. Select the Macrium Reflect option and then the backup type you wish to perform.



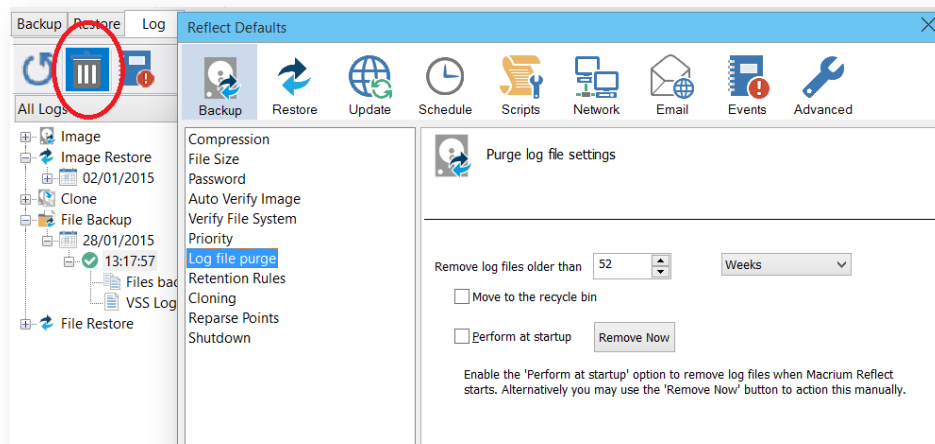
Reviewing your backup history

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**.



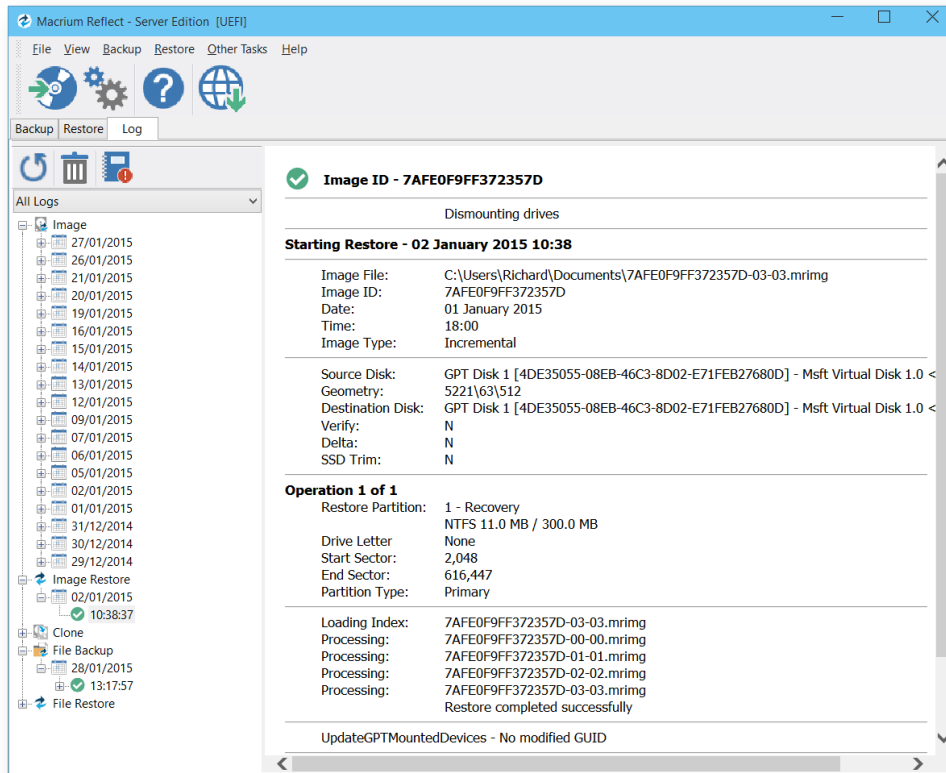
2. Clicking the **Delete old logs** icon will take you to the Log file purge settings, where you can select to remove old logs.



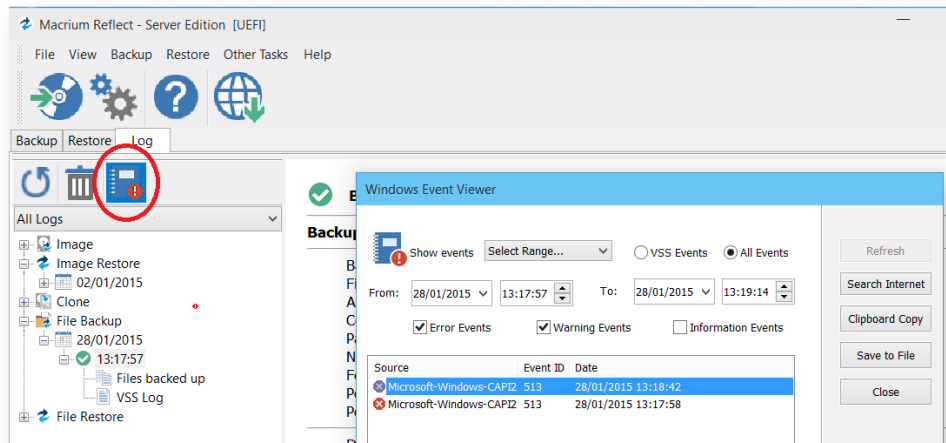
3. Make selection and click **OK**.

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4. Select the activity you want to review.



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.

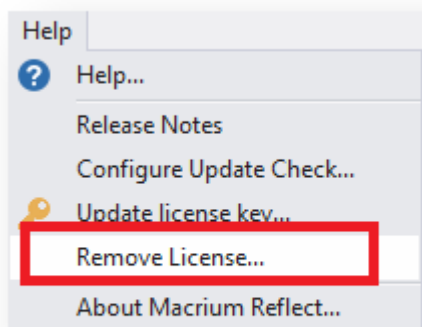
1. Make sure you have a record of your license key:

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>

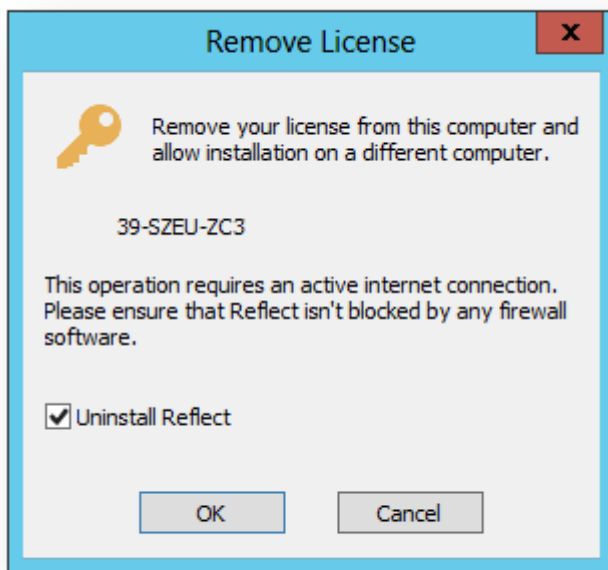
2. Remove your license key and uninstall Macrium Reflect:

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:

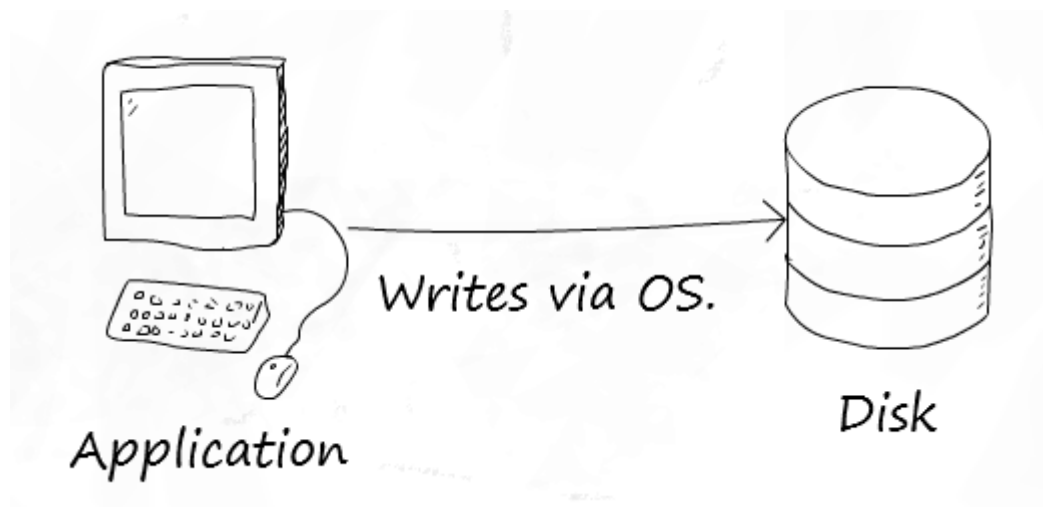
You can download installers and license keys by entering your email address here: <http://www.macrium.com/account/myorders.aspx>

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.

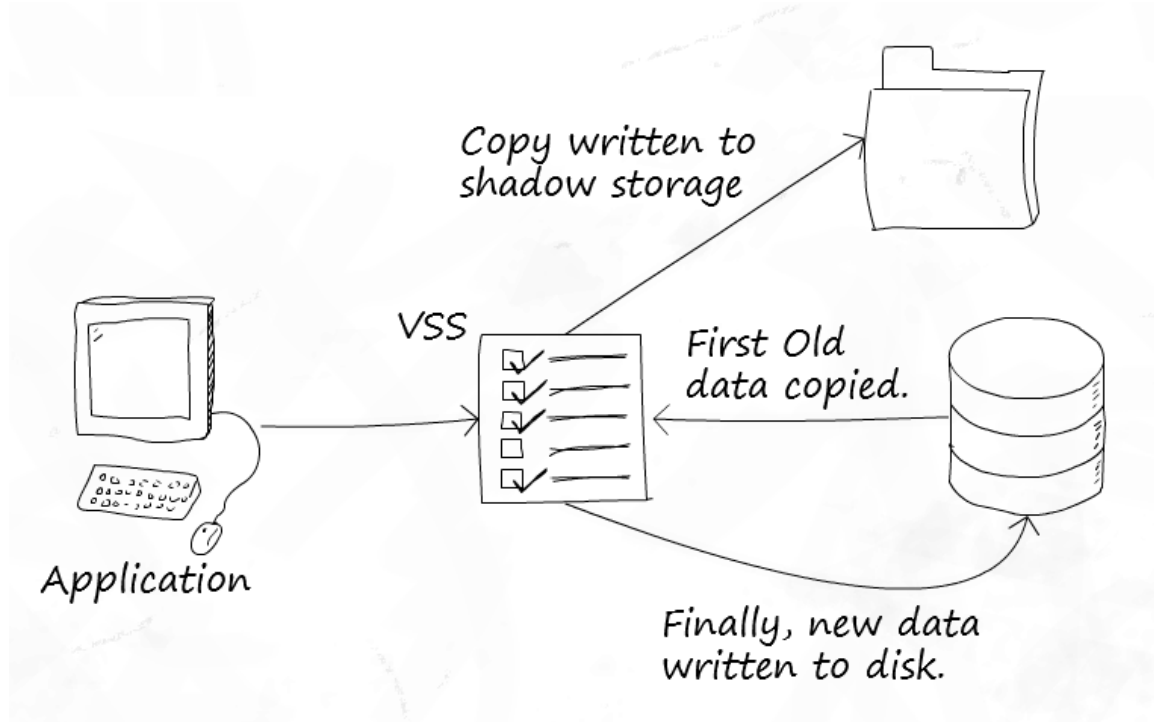
Reflect can take an image of a live system. How does this work?



A simple disk write

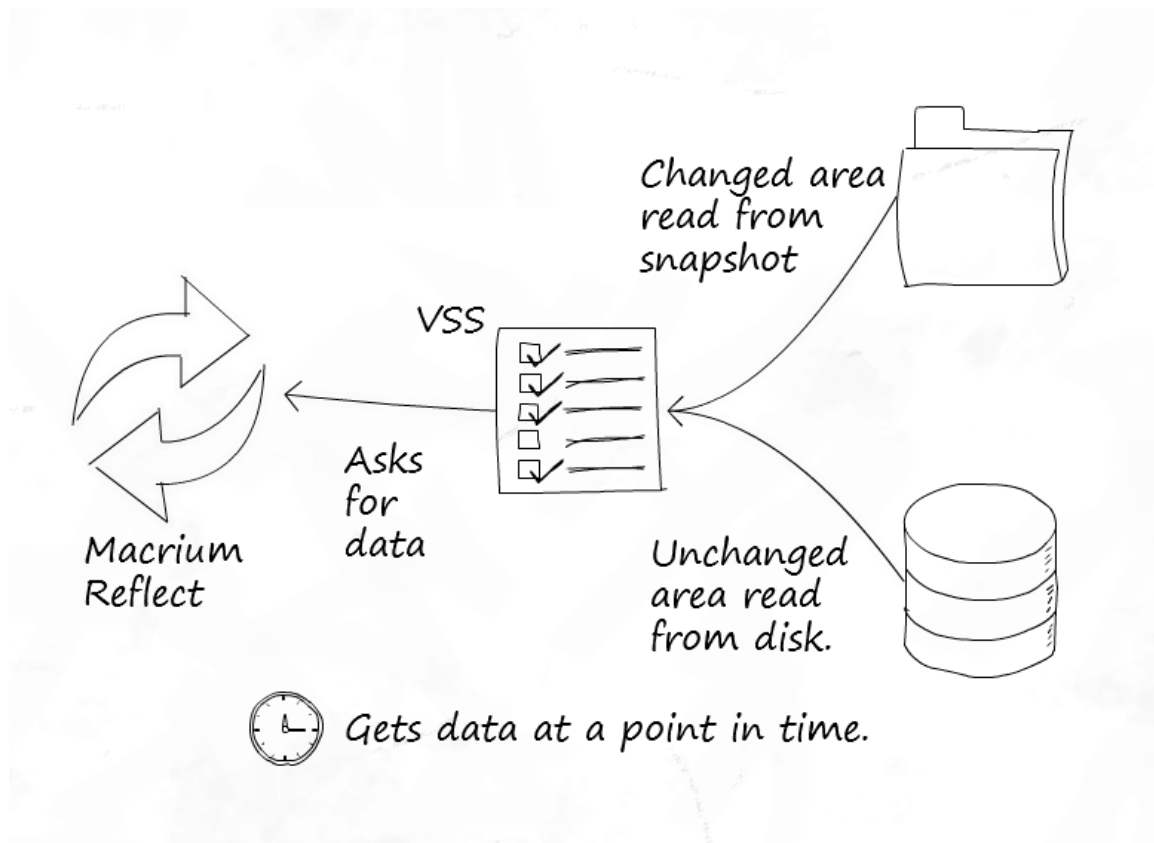
Internally Macrium Reflect relies on a Microsoft Windows component called VSS, which stands for Volume Shadow Storage. Microsoft's VSS operates by taking what is called a copy on write snapshot of your system. This allocates a small temporary storage space. Then, every time you write to a part of your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

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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.

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.

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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](#).

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.

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.

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](#) 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
- Manually running a job from a configured XML backup definition
- How backup sets are created and maintained
- Backing up files and folders
- Cloning a disk
- Backing up Microsoft Exchange databases
- Backing up MS SQL Databases
- Creating a disk image of a single drive or partition
- Differential and incremental disk images
- Creating desktop shortcuts for full, incremental and differential backups
- Checking VSS events when backups fail
- Alternative Locations For Backups
- Advanced Options
- Verifying image and backup files
- How to backup Hyper-V Cluster Shared Volumes

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.

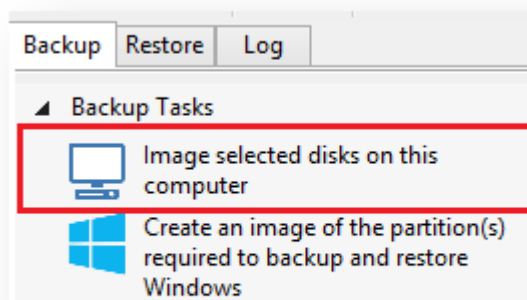
- Starting the Image Wizard
 - Setting the Image destination
 - Adding and Editing the Backup Plan
 - Displaying the Image settings
 - Saving the backup definition
 - Best practises for saving Macrium Reflect backup definition files
 - What's the problem?
 - Create a Disk Image video
-

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.

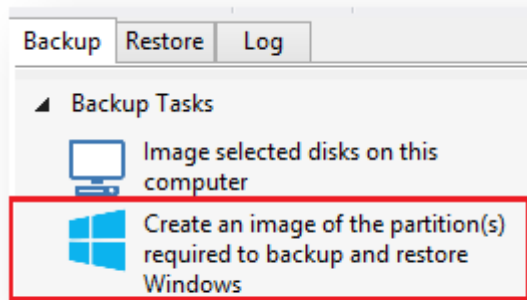


2. By selecting '**Create an image of the partition(s) required to backup and restore Windows**'.

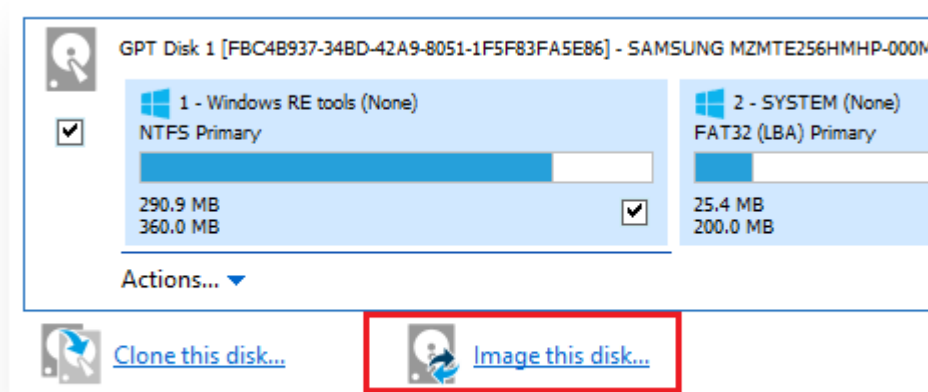
Using this option will choose all the partitions required to boot Windows. This may include hidden system partitions that are essential for Windows to start and run.

See: [Windows Partitions](#)

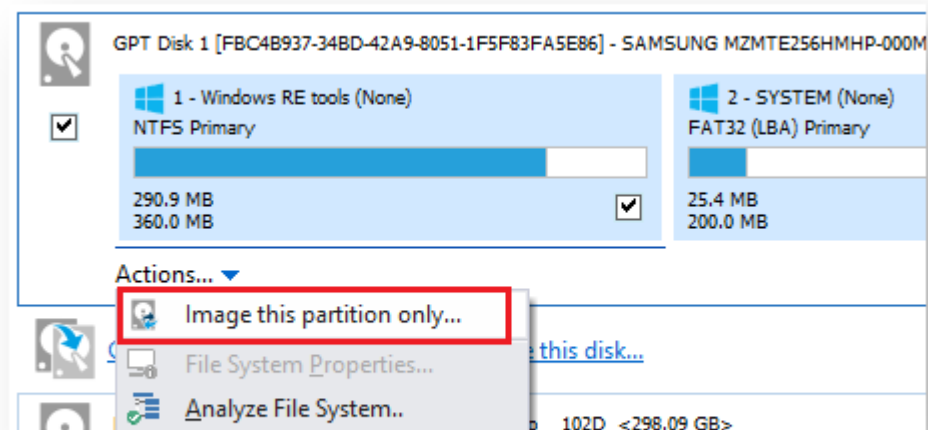
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3. By Selecting a disk in the application main Window and click '**Image this disk...**'.

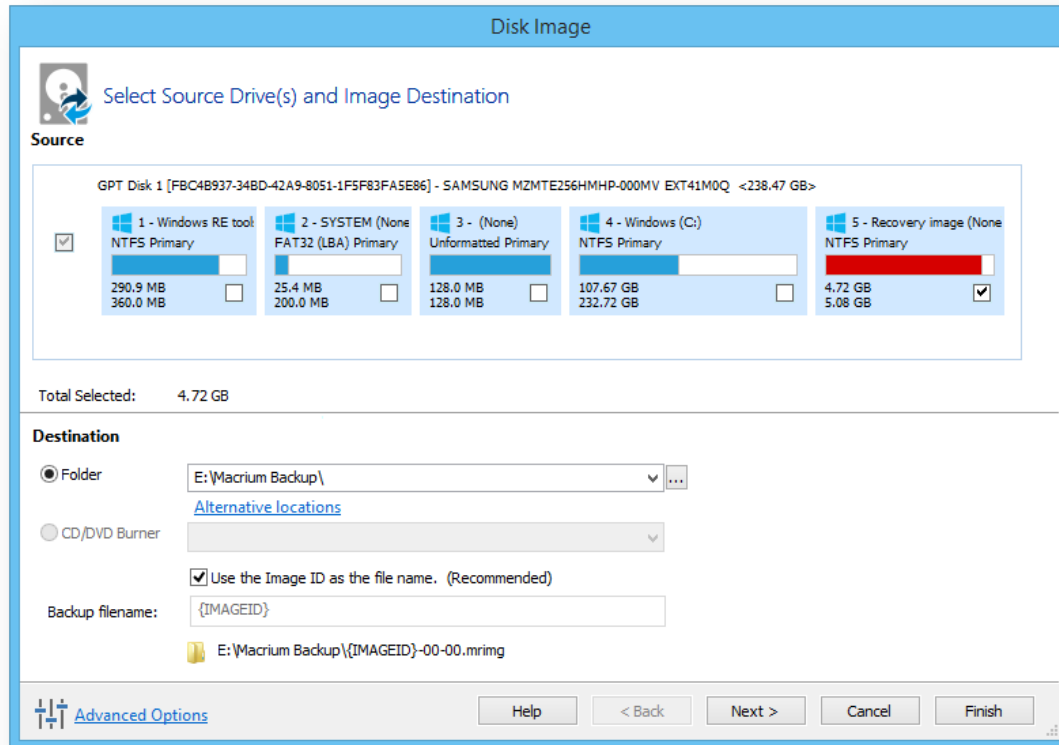


4. By Selecting a disk in the application main Window, click on a partition, then click '**Actions**' and select '**Image this partition only...**'



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.

[Alternative Locations](#) 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](#) 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.

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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.

Disk Image

Edit the Plan for this Backup

1. Select a Template for your Backup Plan

None

2. Add/Edit Schedules

Backup Type	Schedule
-------------	----------

Add Schedule Edit Schedule Delete Schedule

3. Define Retention Rules

Apply retention rules to matching backup sets in the target folder

Backup Type	Keep	Backups
☒ Full	12	Backups
☒ Differential	4	Backups
☒ Incremental	10	Backups

Create a Synthetic Full if possible

☐ Run the purge before backup.

☒ Delete the oldest backup set(s) if less than 5 GB on the target volume (minimum 1GB)

Advanced Options Help < Back Next > Cancel Finish

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:

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

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**.



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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

☒ Full	Keep	12	Backups
☒ Differential	Keep	4	Backups
☒ Incremental	Keep	10	Backups
Create a Synthetic Full if possible ☐			
☐ Run the purge before backup.			
☒ 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. 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. F = Full D = Differential I = Incremental

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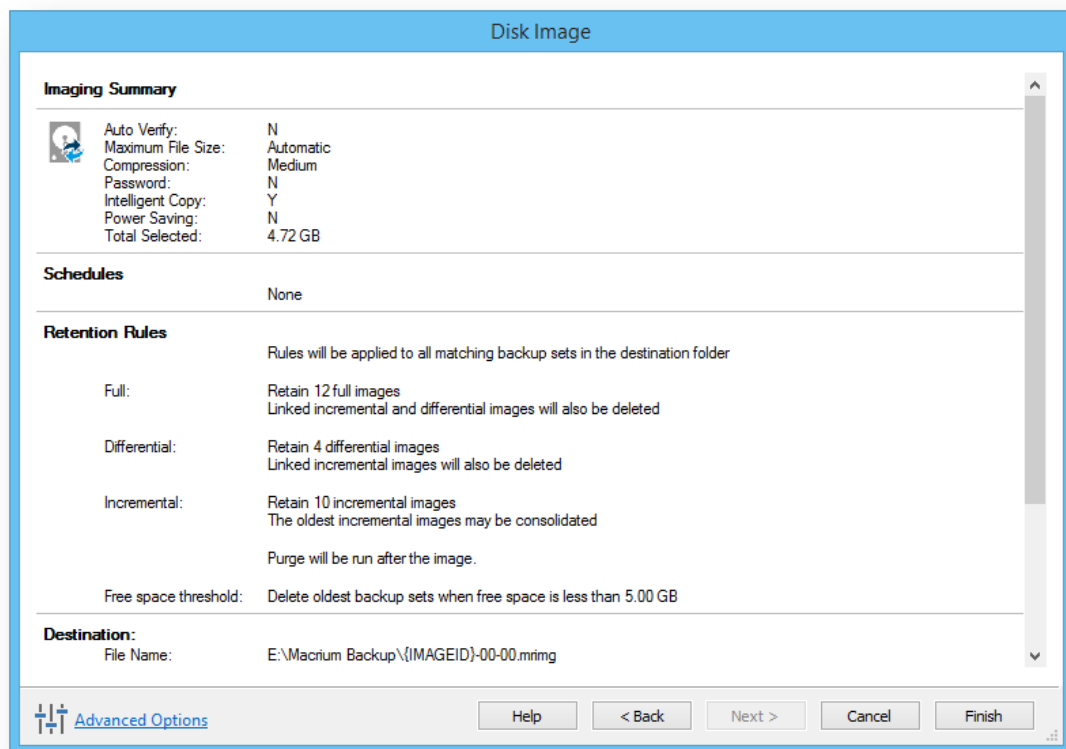
Option	Description																																																																								
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Create a Synthetic Full if possible	When purging Incremental backups, if the backup set only contains a Full backup followed by Incremental backups , then this 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	Select this option to run the retention rules before the current 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	Automatically remove the oldest backup set(s) in the target folder if the free space on the drive drops below the GB threshold. 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.																																																																								

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

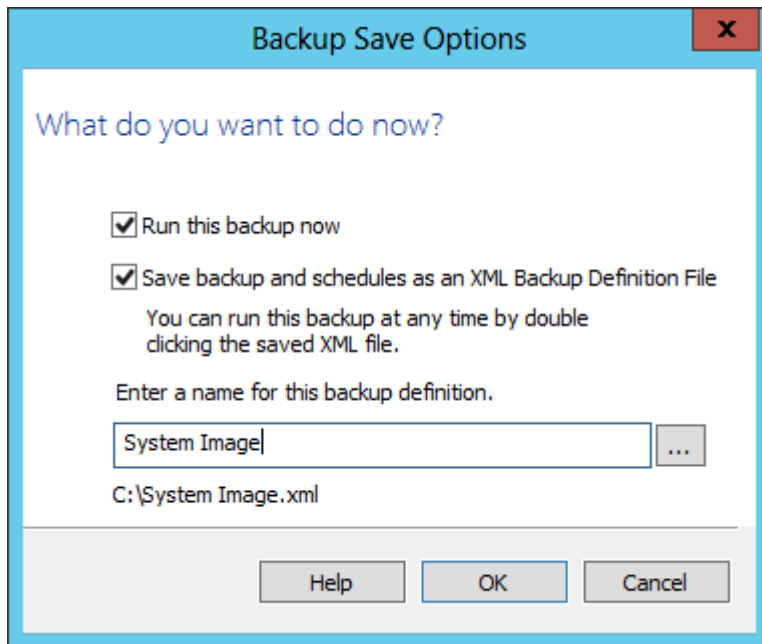
You are now given the opportunity to save the backup options.

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



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: • 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  Note: Always save your definition to a local drive and never to a password protected network share.

See also: [Manually running a job from a configured XML backup definition](#)

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Best practises for saving Macrium Reflect backup definition files

Regardless of your PC environment, leaving your backup definition files in an insecure location is bad practice. The effort required to ensure your files are secure is minimal and doesn't impede day to day usage of Macrium Reflect.

What's the problem?

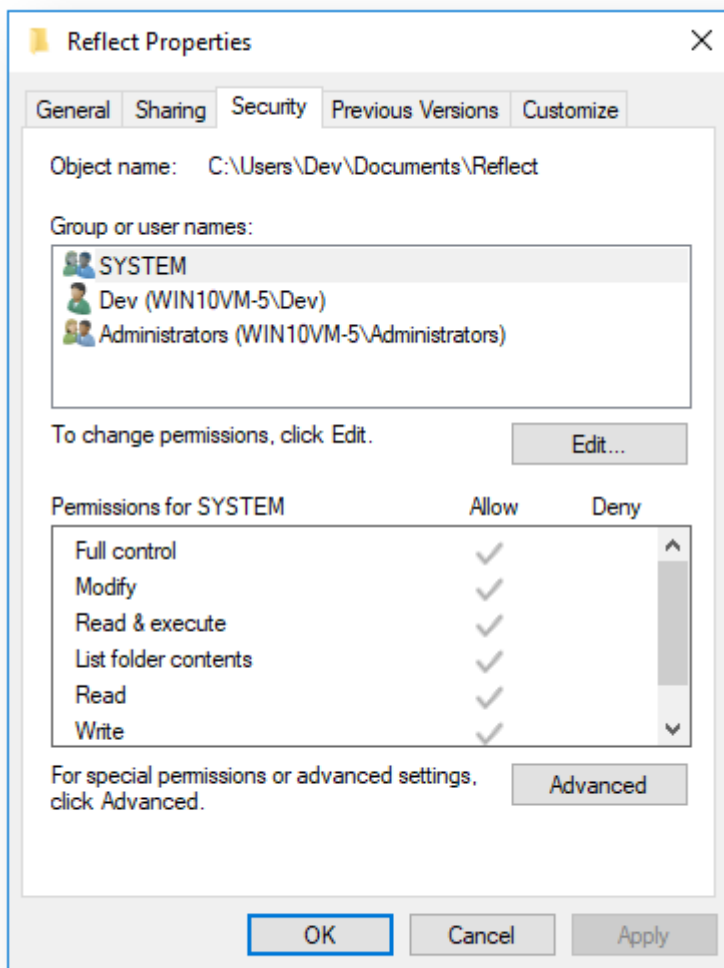
Backup definition (.xml) files are used to initiate backups either interactively by using Macrium Reflect directly, or as scheduled tasks using the Windows Tasks Scheduler. If you save your backup definitions to a publicly accessible folder then these can be edited by standard users and could potentially compromise your system. In addition, it's also possible to create batch files, either MS-DOS, PowerShell or VBScript, to automatically run during your backups as described [here](#). A restricted user with bad intentions could easily create a batch file to run with elevated privileges when a scheduled or interactive backup runs.

The default, and recommended, location for your backup definitions is folder '**C:\users\<USER NAME>\documents\reflect**'. When running Reflect for the first time this location is created and defaulted when saving. See [Backup Save Options](#) for more information on how to save your definitions.

This folder is automatically restricted for standard users and can only be accessed by Administrators and the local SYSTEM account.

To see assigned NTFS permissions **right click on any folder, select 'Properties' and click the 'Security' tab:**

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In the above example only SYSTEM, Dev (the Macrium Reflect user) and the Administrators group can access files contained in the folder. Standard users are denied access and cannot modify or create files.

We strongly recommend that, if not using the default location, you ensure that NTFS permissions are used to prevent unauthorised modification and creation of files in your backup definition folders.

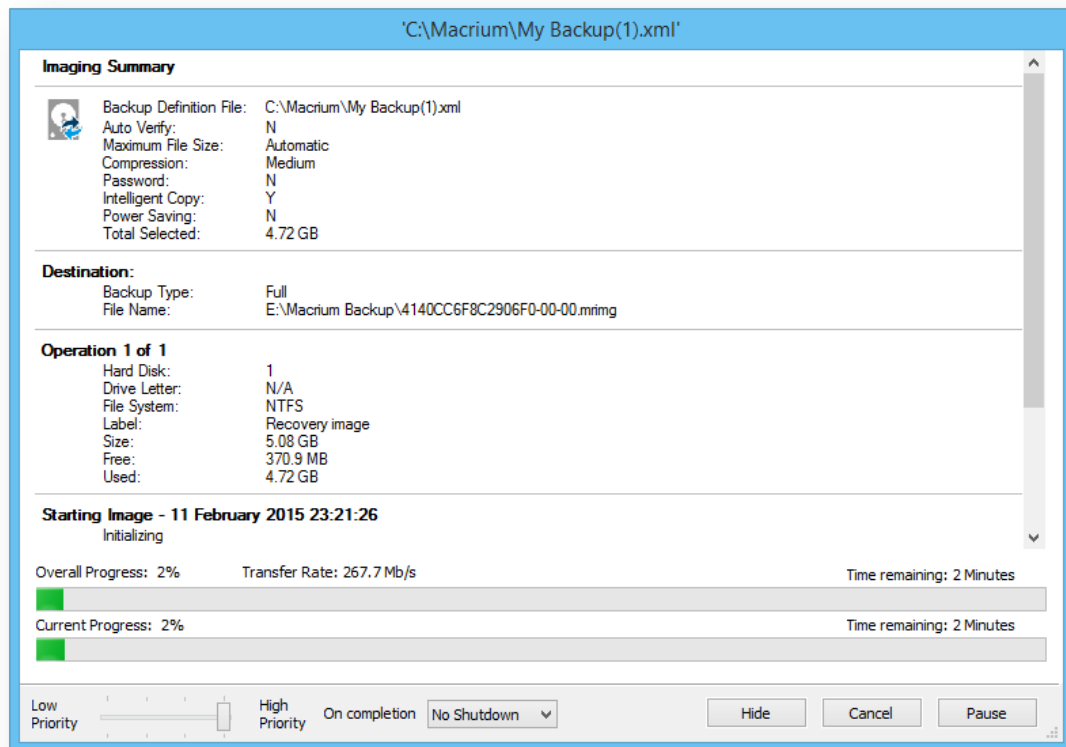
For more information on setting NTFS permissions for folders and files please see [Microsoft TechNet - How IT works NTFS Permissions](#)



Note: A popular misconception is that backup definition files should be saved to the same folder as your backup files. **This is incorrect.** Backup definitions are only required to create backups and have no other purpose. They are not required for restore.

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

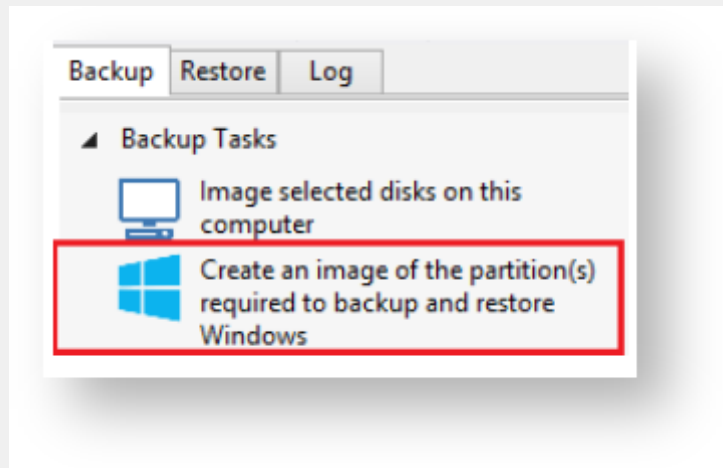
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Create a Disk Image video

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.

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Partition	Unique Identifier	Description
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.
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.

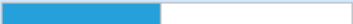


Note: MBR systems may also contains proprietary system recovery partitions, however, there are no unique identifiers for these partitions and they are not automatically included.

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Windows 7 MBR System

MBR Disk 1 [7A17827F] - Virtual HD 1.1.0 <500.00 GB>

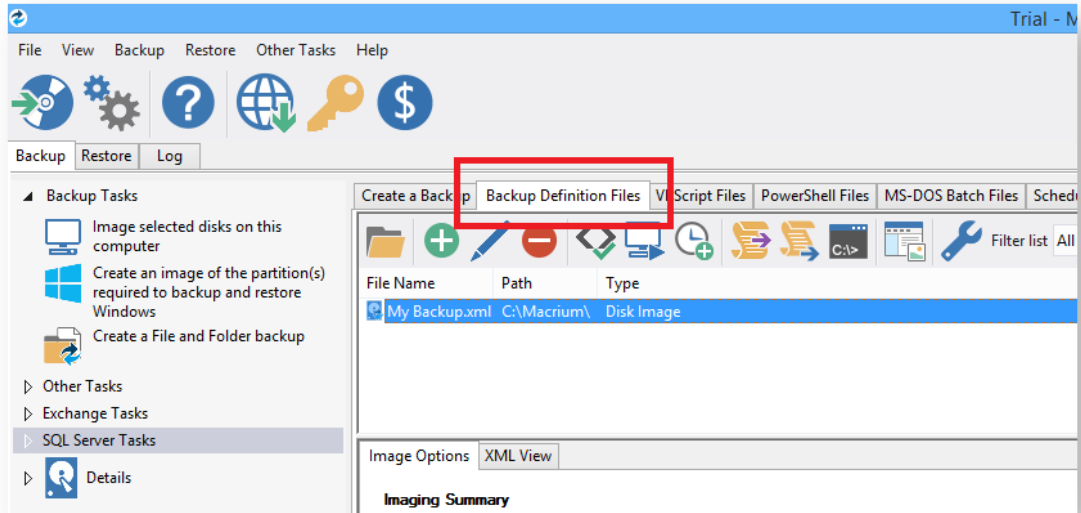
☒	 1 - System Reserved (None) NTFS Active	 2 - (C:) NTFS Primary
		
	46.0 MB 100.0 MB ☒	184.24 GB 499.90 GB ☒

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Manually running a job from a configured XML backup definition

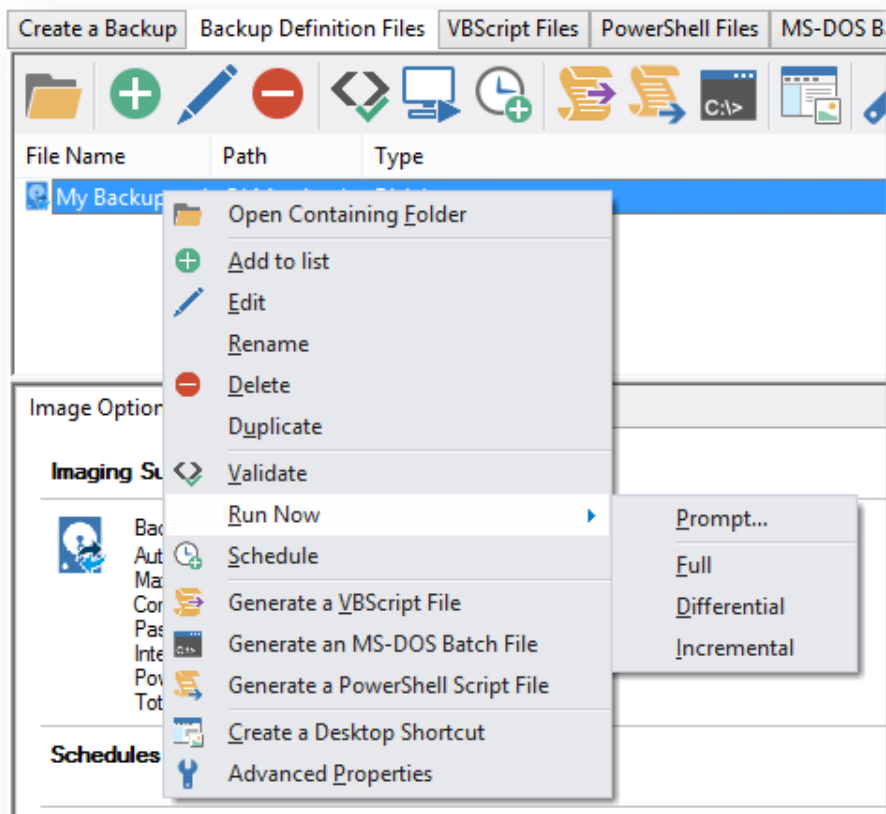
Macrium Reflect saves backup configurations using XML. Using an XML Definition you can schedule a backup, generate a VBScript file for complex scenarios or simply create a desktop shortcut so you can instantly run your backup by clicking the shortcut icon.

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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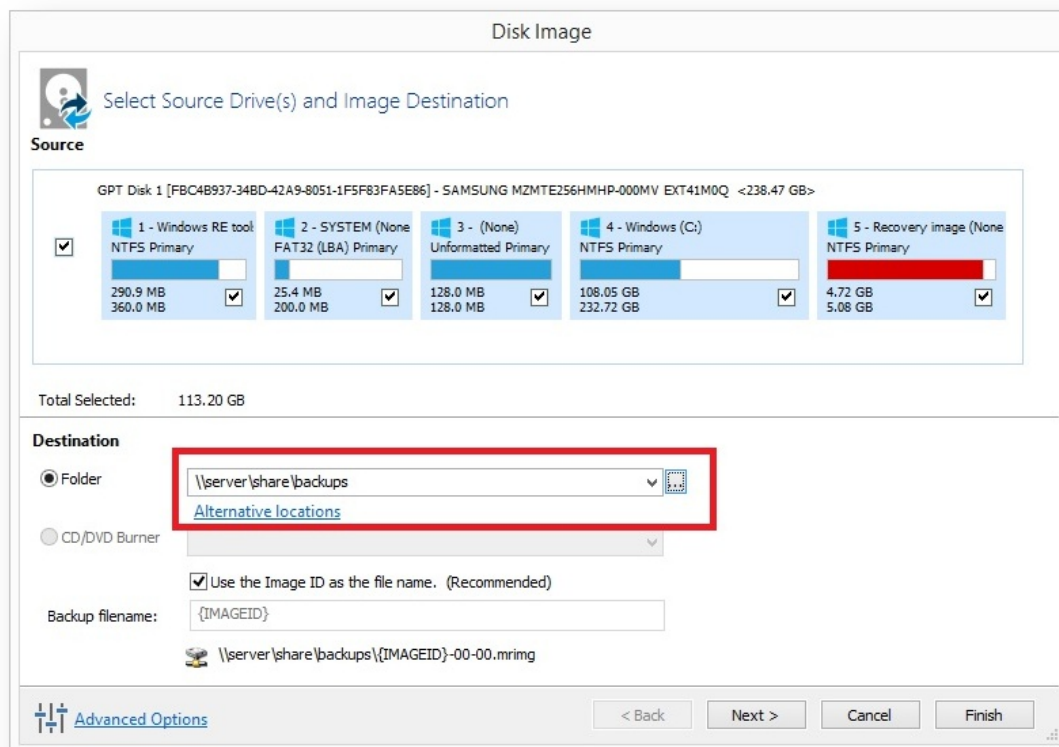
How backup sets are created and maintained

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](#)

How do I specify the backup target folder?

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

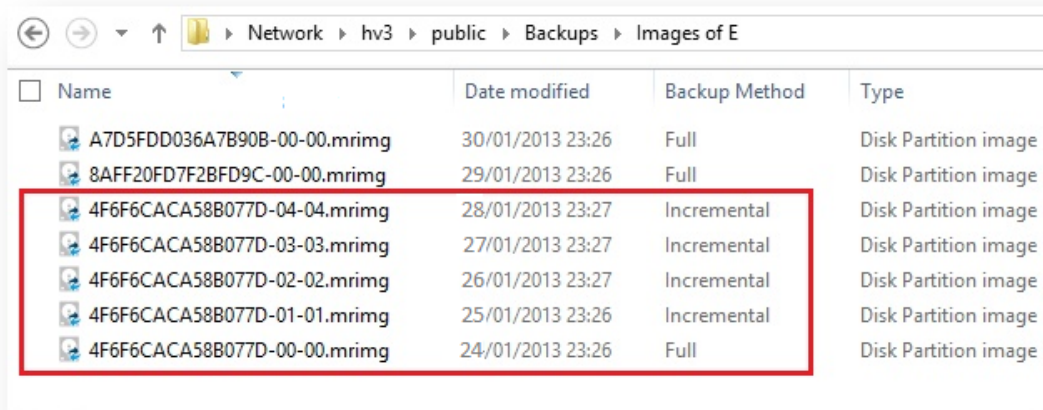


Similarly, for File and Folder backups, this is also on the first page of the backup wizard.

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:

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Name	Date modified	Backup Method	Type
A7D5FDD036A7B90B-00-00.mrimg	30/01/2013 23:26	Full	Disk Partition image
8AFF20FD7F2BFD9C-00-00.mrimg	29/01/2013 23:26	Full	Disk Partition image
4F6F6CACA58B077D-04-04.mrimg	28/01/2013 23:27	Incremental	Disk Partition image
4F6F6CACA58B077D-03-03.mrimg	27/01/2013 23:27	Incremental	Disk Partition image
4F6F6CACA58B077D-02-02.mrimg	26/01/2013 23:27	Incremental	Disk Partition image
4F6F6CACA58B077D-01-01.mrimg	25/01/2013 23:26	Incremental	Disk Partition image
4F6F6CACA58B077D-00-00.mrimg	24/01/2013 23:26	Full	Disk Partition image

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:

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

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

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

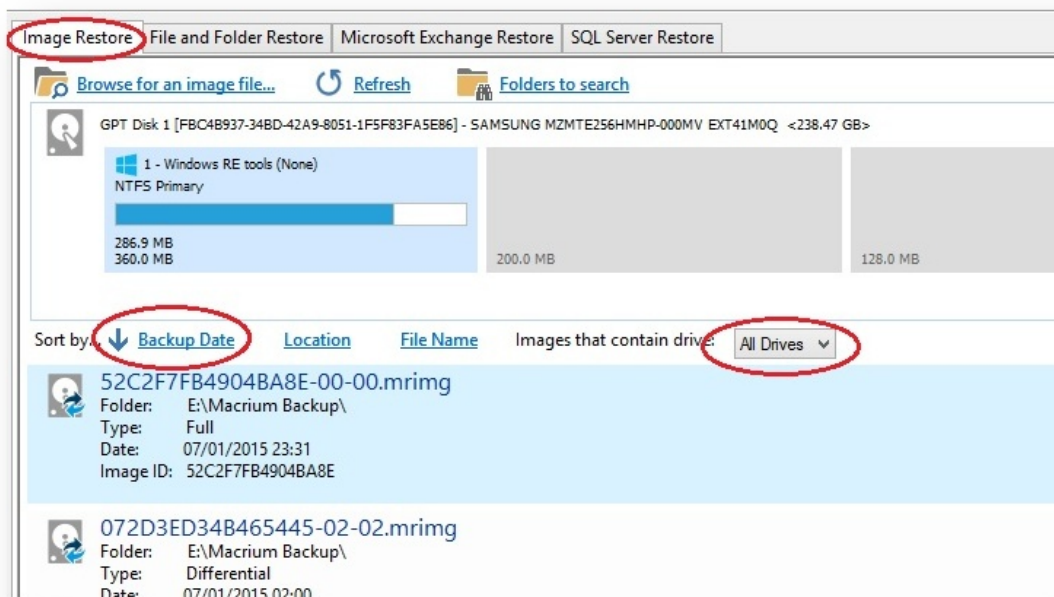
D407A9E1BF98D822-00-00.mring Drive: C: Created **1st Oct 2014**

Then the newly created image file will be **1EB112ABA7C3898-01-01.mring**. This is because file **1EB112ABA7C3898-00-00.mring** 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.mring** 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 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

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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](#)

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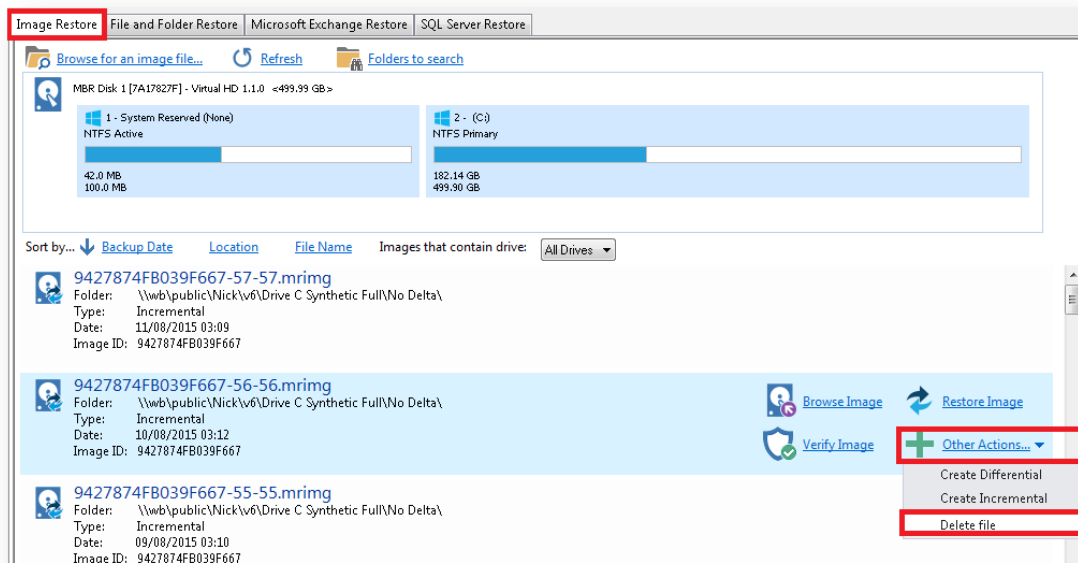
How to delete backup files

If you create only Full images or Full File and Folder backups then you can safely delete your .mrimg or .mrback 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](#).

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'**.

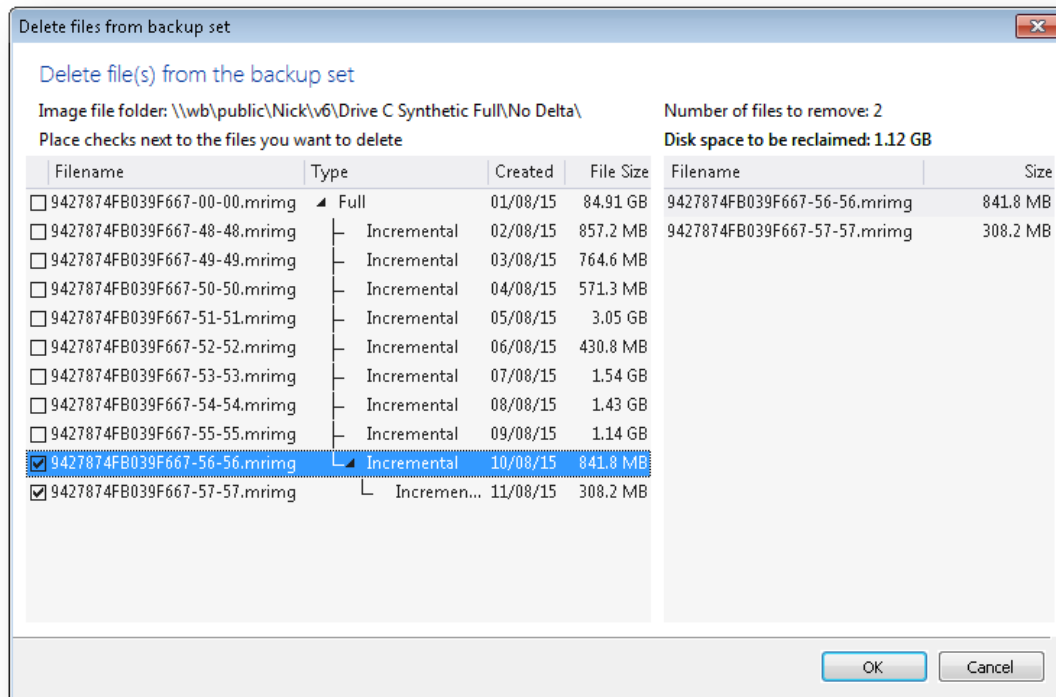


Please note that the 'Delete file' option will only be presented for a backup set.



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

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

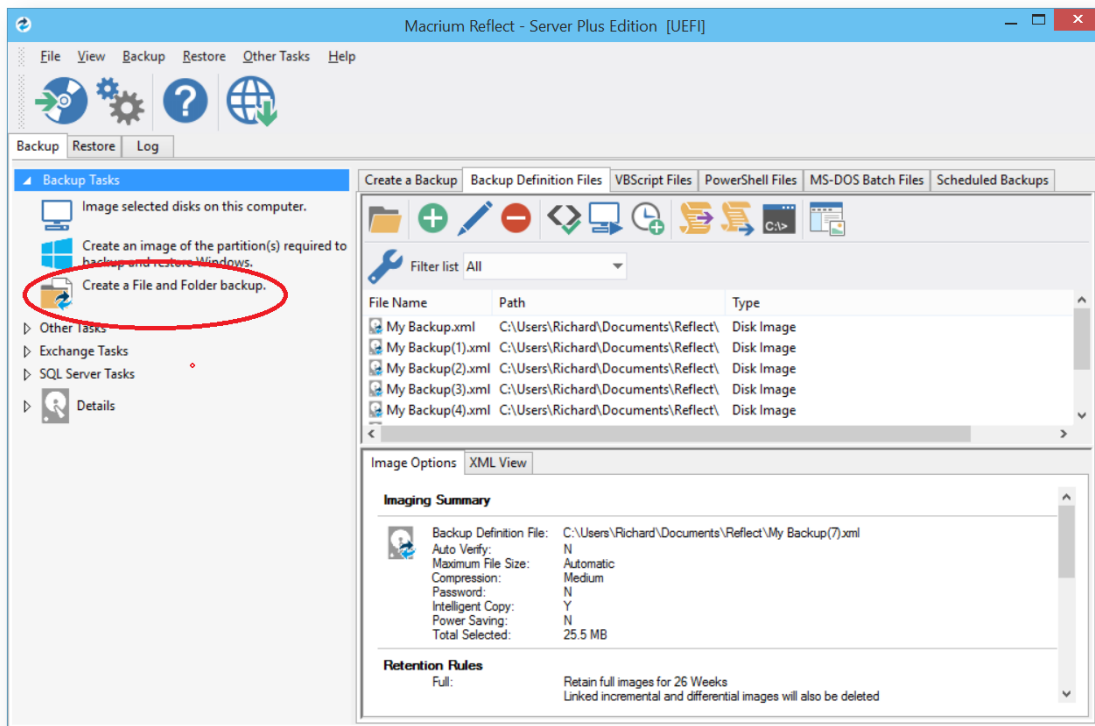
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Backing up files and folders

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.

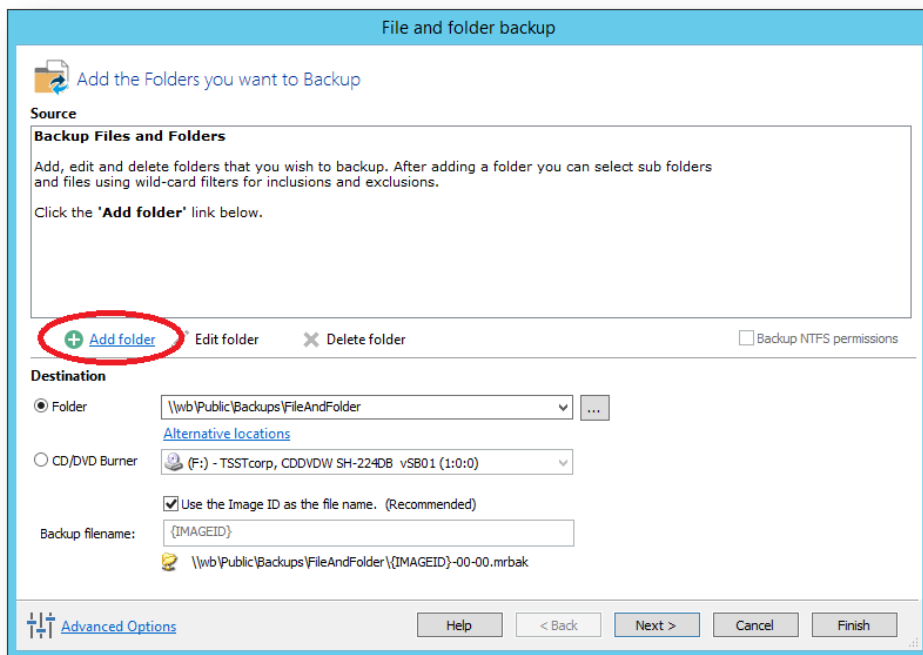
i To backup your Windows operating system, do not use a file and folder backup, use an image backup, see [Creating a backup of your computer](#). A file and folder backup is not suitable for restoring your Windows operating system.

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



2. Select **Add folder**.

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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

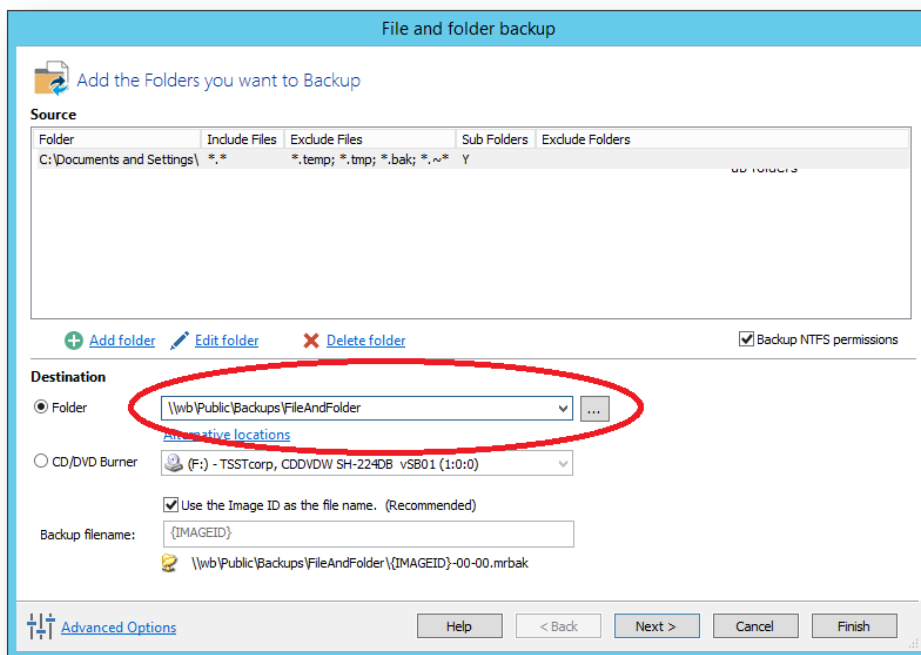
Select the folder you want to backup, or the folder containing the files you want to backup. Several different masks and wildcards can be specified to include specific files within the given directory or exclude other files.

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

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Option	Description
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 individual directories if necessary.
5. In the **Destination** section, specify where you want the backup to be made.



[Alternative Locations](#) 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 screenshot shows the 'File and folder backup' wizard in Macrium Reflect v7.2. The title bar says 'File and folder backup'. The main window has a blue header with a calendar icon and the text 'Edit the Plan for this Backup'. Below this, there are three steps: 1. Select a Template for your Backup Plan (with a dropdown menu set to 'None'), 2. Add/Edit Schedules (with a table for Backup Type and Schedule, and buttons for Add Schedule, Edit Schedule, and Delete Schedule), and 3. Define Retention Rules. Step 3 is currently active. It includes a dropdown for 'Apply retention rules to matching backup sets in the target folder', a table for retention rules (Full, Differential, Incremental) with 'Keep' counts (12, 4, 10) and 'Backups' counts (all set to 'Backups'), a checkbox for 'Create a Synthetic Full if possible', a checkbox for 'Run the purge before backup.', and a checkbox for 'Delete the oldest backup set(s) if less than 5 GB on the target volume (minimum 1GB)'. At the bottom, there are buttons for 'Help', '< Back', 'Next >', 'Cancel', and 'Finish', along with an 'Advanced Options' link.

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:

The screenshot shows the '3. Define Retention Rules' dropdown menu. It has three options: 'Apply retention rules to matching backup sets in the target folder' (selected), 'Apply retention rules to matching backup sets in the target folder', and '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.

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- 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

☒ Full	Keep	12	Backups
☒ Differential	Keep	4	Backups
☒ Incremental	Keep	10	Backups
Create a Synthetic Full if possible ☐			
☐ Run the purge before backup.			
☒ 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. 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. F = Full D = Differential I = Incremental

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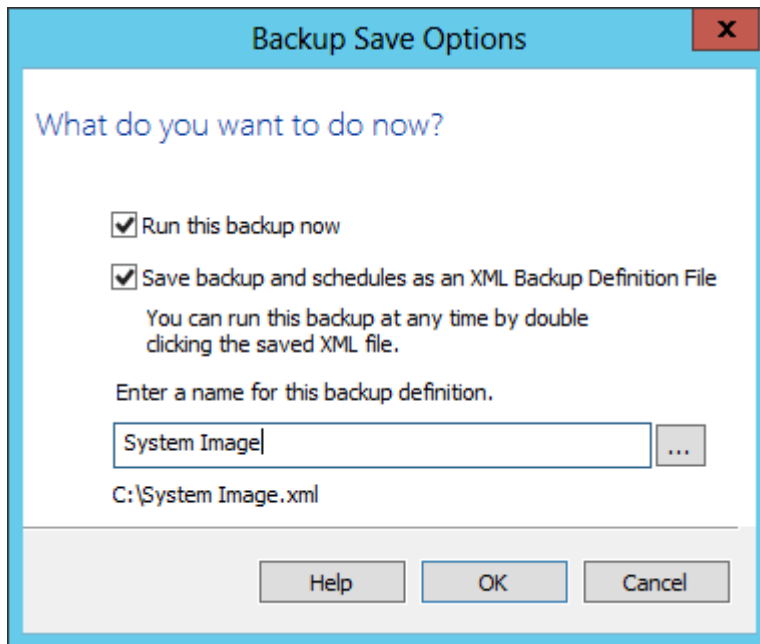
Option	Description																																																			
	<table><tr><td>M</td><td>T</td><td>W</td><td>T</td><td>F</td><td></td><td></td><td>M</td><td>T</td><td>W</td><td>T</td><td>F</td><td></td><td></td><td>M</td><td>T</td><td>W</td></tr><tr><td>F</td><td></td><td></td><td></td><td></td><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	Select this option to run the retention rules before the current 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	Automatically remove the oldest backup set(s) in the target folder if the free space on the drive drops below the GB threshold. 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.																																																			

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.


 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: • 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  Note: Always save your definition to a local drive and never to a password protected network share.

See also: [Manually running a job from a configured XML backup definition](#)

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Best practises for saving Macrium Reflect backup definition files

Regardless of your PC environment, leaving your backup definition files in an insecure location is bad practice. The effort required to ensure your files are secure is minimal and doesn't impede day to day usage of Macrium Reflect.

What's the problem?

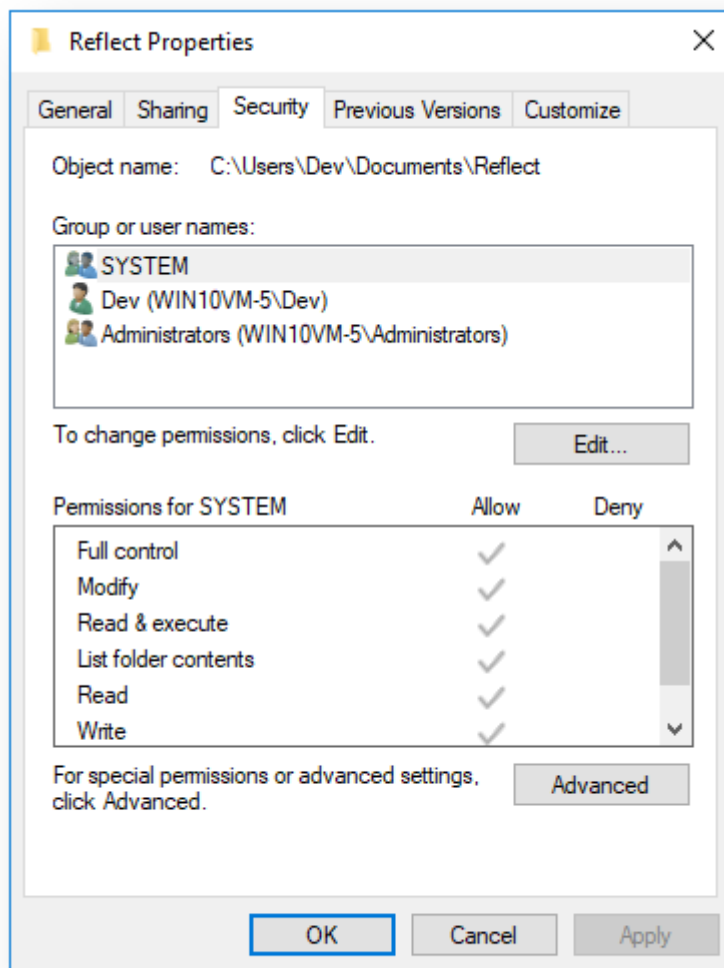
Backup definition (.xml) files are used to initiate backups either interactively by using Macrium Reflect directly, or as scheduled tasks using the Windows Tasks Scheduler. If you save your backup definitions to a publicly accessible folder then these can be edited by standard users and could potentially compromise your system. In addition, it's also possible to create batch files, either MS-DOS, PowerShell or VBScript, to automatically run during your backups as described [here](#). A restricted user with bad intentions could easily create a batch file to run with elevated privileges when a scheduled or interactive backup runs.

The default, and recommended, location for your backup definitions is folder '**C:\users\<USER NAME>\documents\reflect**'. When running Reflect for the first time this location is created and defaulted when saving. See [Backup Save Options](#) for more information on how to save your definitions.

This folder is automatically restricted for standard users and can only be accessed by Administrators and the local SYSTEM account.

To see assigned NTFS permissions **right click on any folder, select 'Properties' and click the 'Security' tab**:

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In the above example only SYSTEM, Dev (the Macrium Reflect user) and the Administrators group can access files contained in the folder. Standard users are denied access and cannot modify or create files.

We strongly recommend that, if not using the default location, you ensure that NTFS permissions are used to prevent unauthorised modification and creation of files in your backup definition folders.

For more information on setting NTFS permissions for folders and files please see [Microsoft TechNet - How IT works NTFS Permissions](#)



Note: A popular misconception is that backup definition files should be saved to the same folder as your backup files. **This is incorrect.** Backup definitions are only required to create backups and have no other purpose. They are not required for restore.

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

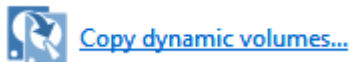
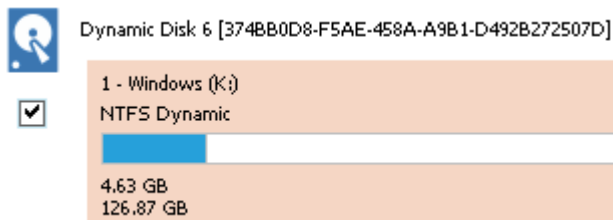
Windows cannot boot from a USB connected drive. This is a restriction imposed by Windows. If you clone your system disk to a USB connected external drive then, to boot your clone, the physical disk must be removed from the USB caddy and attached to your Motherboard SATA port.

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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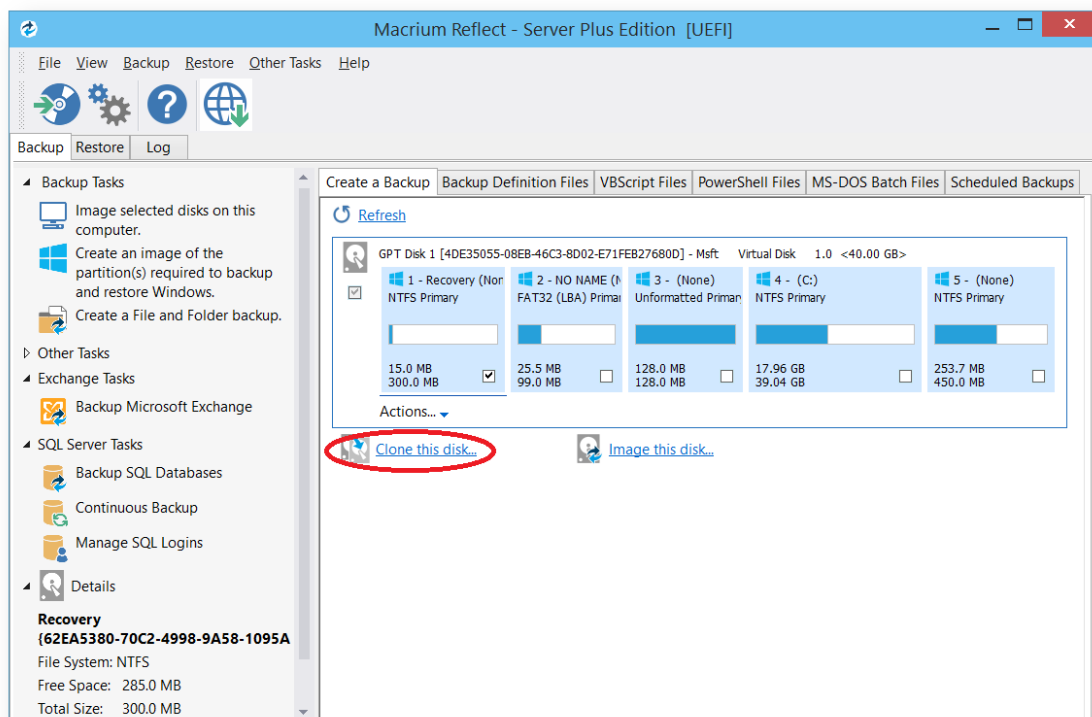
- A destination Dynamic Volume cannot be resized so the **'Cloned partition properties' link will not be available** if the destination is Dynamic.
- To convert Dynamic Volume(s) to standard partitions, select an unformatted or an MBR/GPT basic disk as the destination and use 'Drag and Drop' to copy 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](#)

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

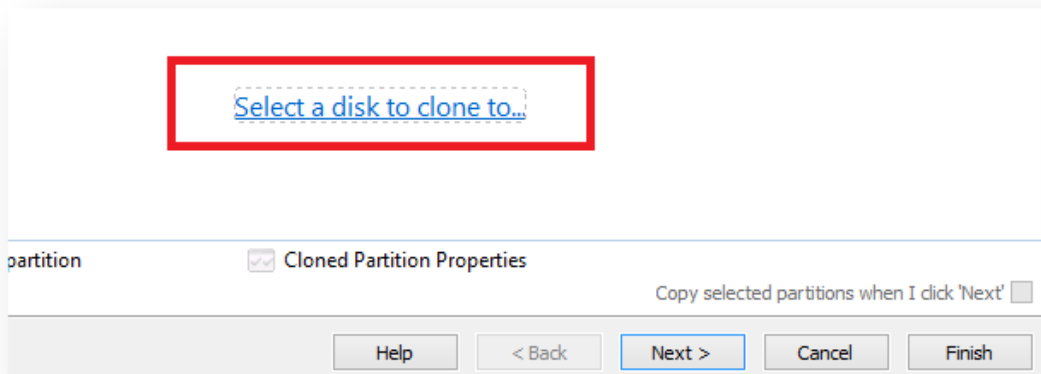


[Clone this disk...](#)

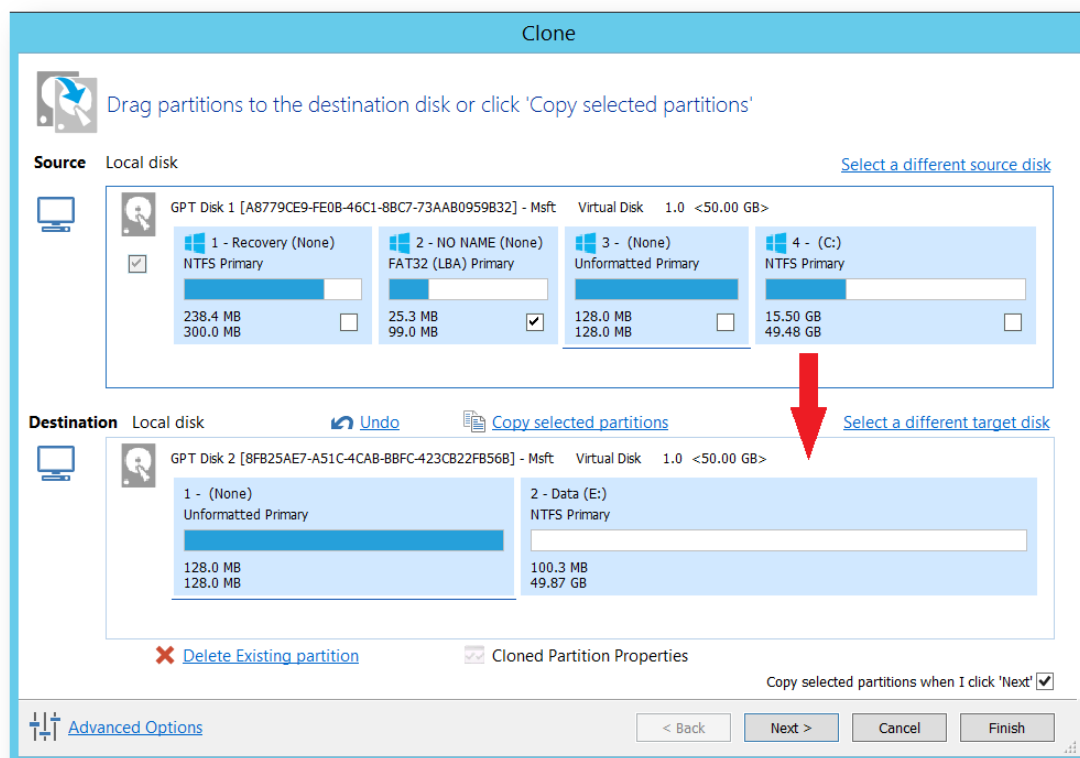


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2. In the wizard that opens Click **Select a disk to clone to...**

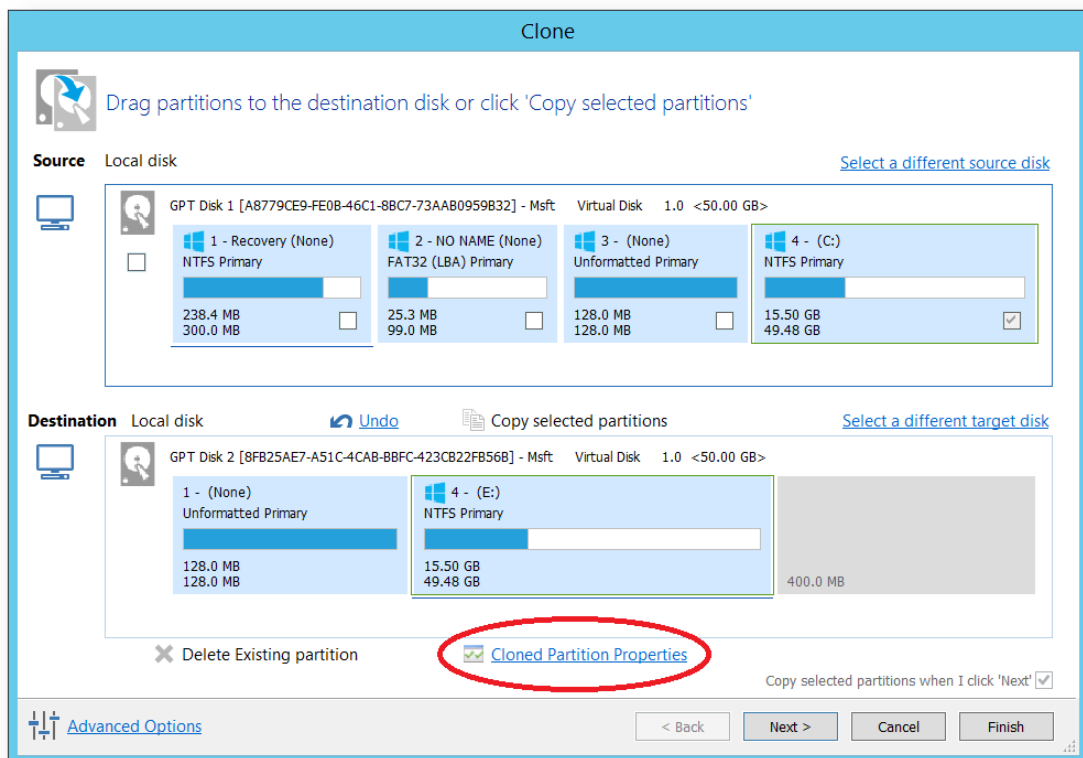


3. Select the hard disk you wish to clone to. In this case, there is only one disk available.
 4. If you do not want to modify the order or size of partitions of the clone, **click Next**. This is the default behavior.
- Alternatively, drag the partitions you want to clone, the red arrow below shows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



Becomes

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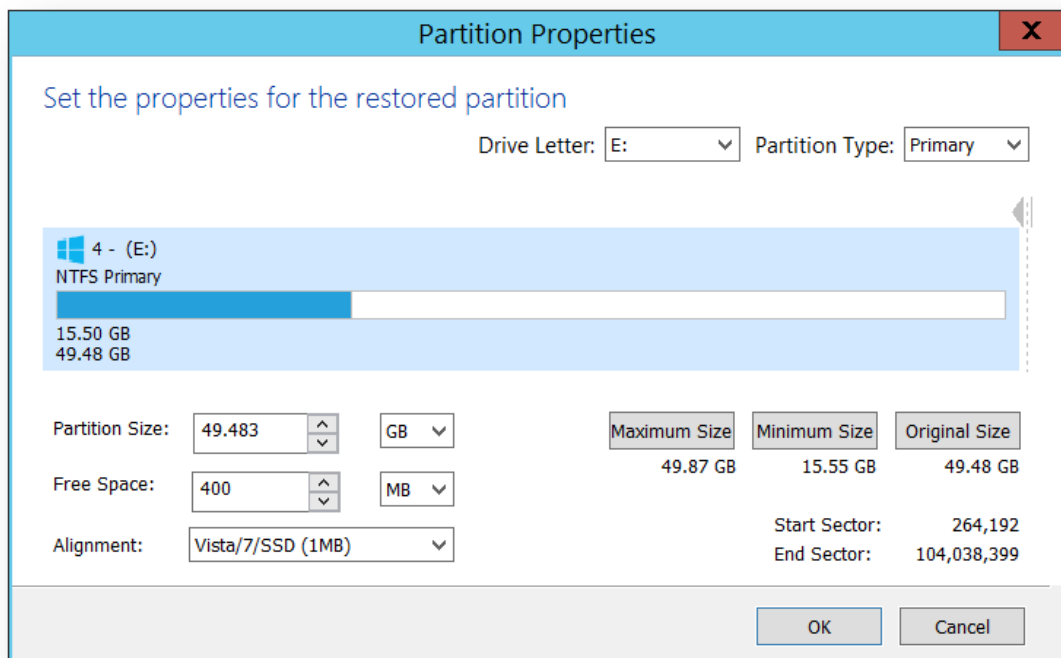
In this example, there is 400MB of free space after the copied partition. You can modify the size of each partition to fit the new disk if required.



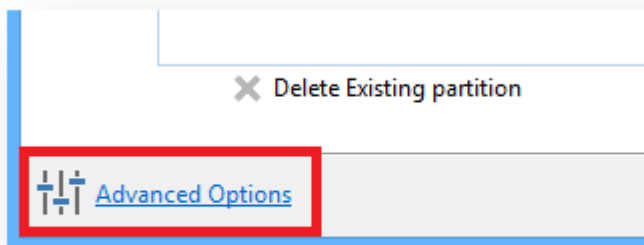
You can delete partitions on the target disk by selecting and clicking '**Delete existing partitions**'..

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**.

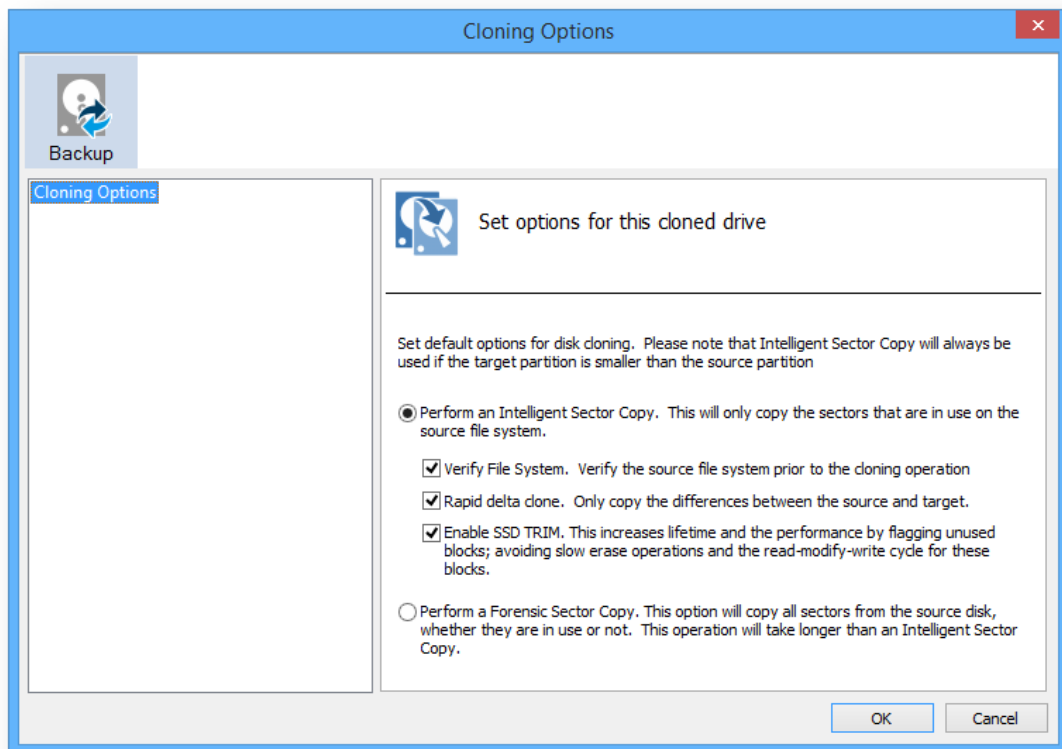
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6. Click **OK**.
7. If required, click **Advanced Options** to change settings for this clone:



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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.
Verify File System	Verifying the file system prior to cloning ensures that there are no file system errors transferred to the clone.  Please note that this may take several minutes to complete
Rapid Delta Clone	Copy only file system differences between the clone source and target. This increases cloning speed dramatically. Show more information on RDC... 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.

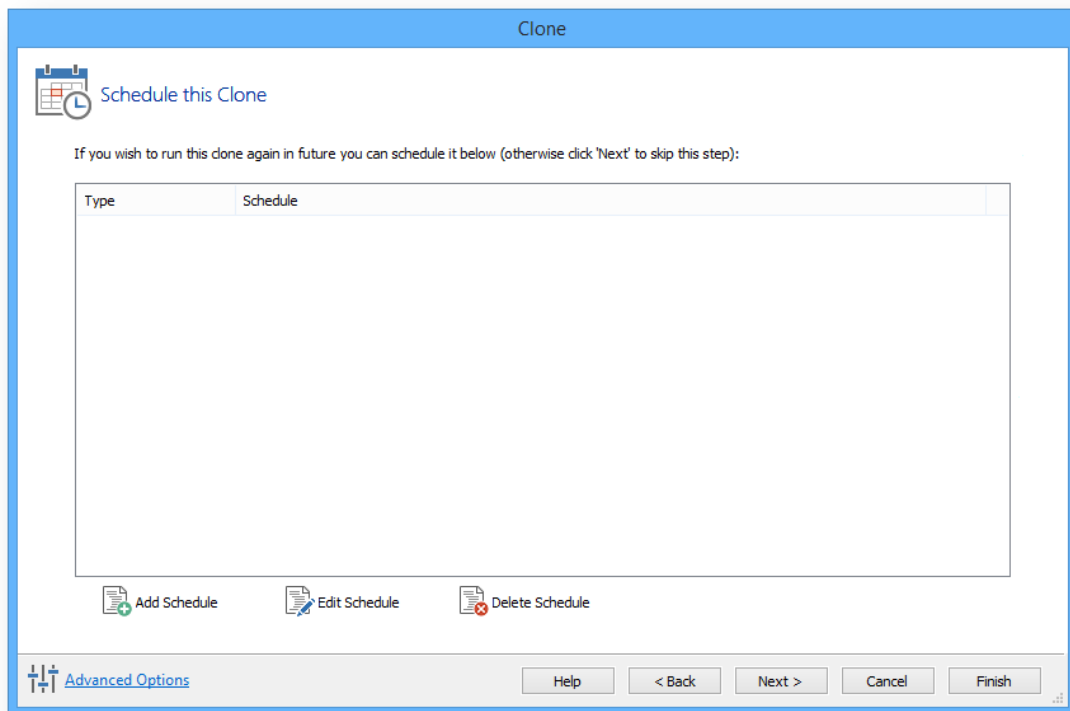
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Option	Description
	How does it work? The NTFS file system resident on the clone source is compared with file system on the target disk. The two file systems are first verified that they originated from the same format command and then the target NTFS 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.
Enable SSD TRIM	Enable SSD TRIM on the clone target to optimize the disk. Show more information on 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.
Forensic Sector Copy	Copy every sector from the source to the target disk partition.  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.

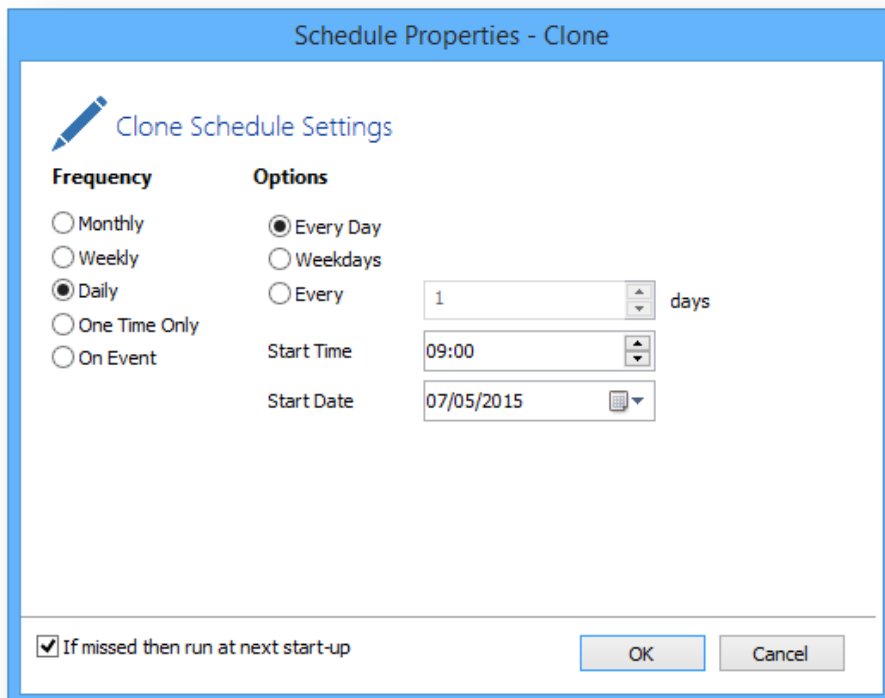
8. Click **Next**.

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

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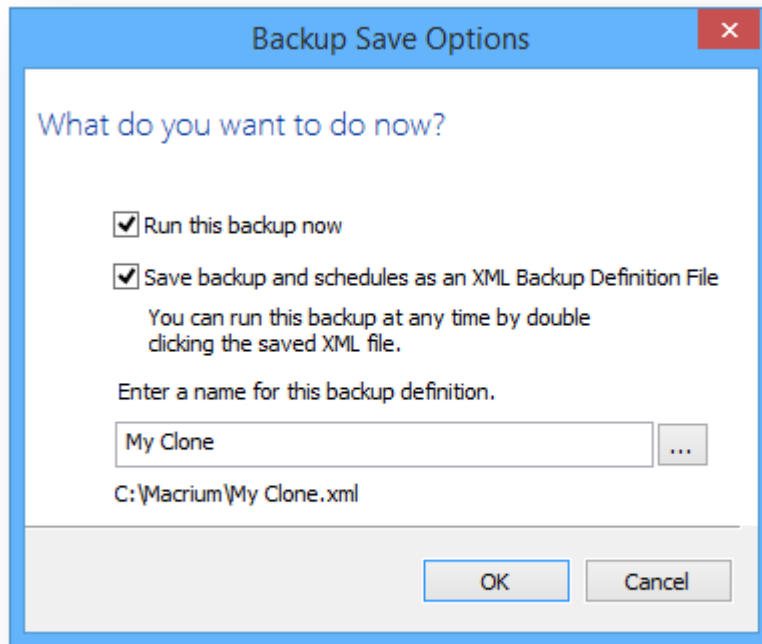
Click 'Add Schedule' to optionally schedule your clone



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Make any required changes and click **Next**.
For more information see [Scheduling backups](#).

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

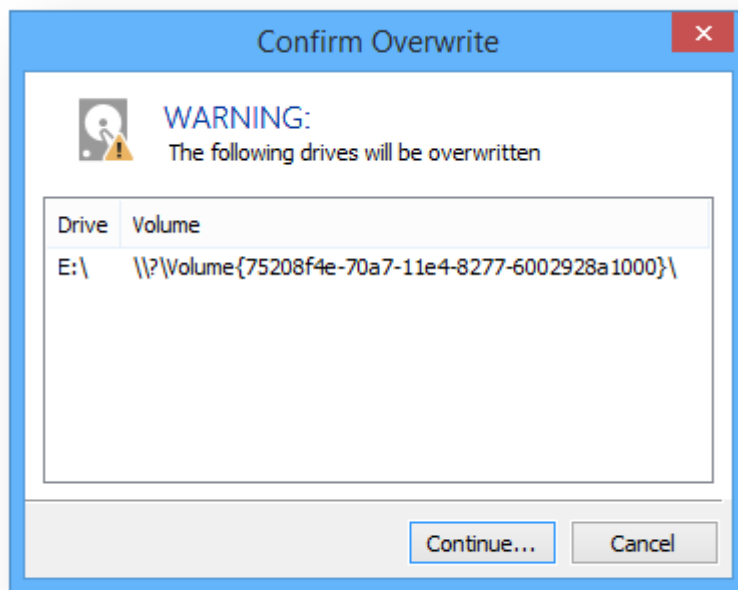


Note: You must save your backup definition if you have created Clone schedules. Your schedules cannot run if this step is missed.

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**.

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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

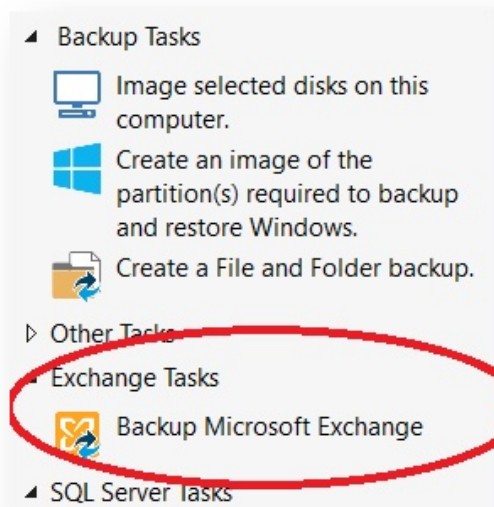
Backing up Microsoft Exchange databases

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

Note: Remote backups are not possible.

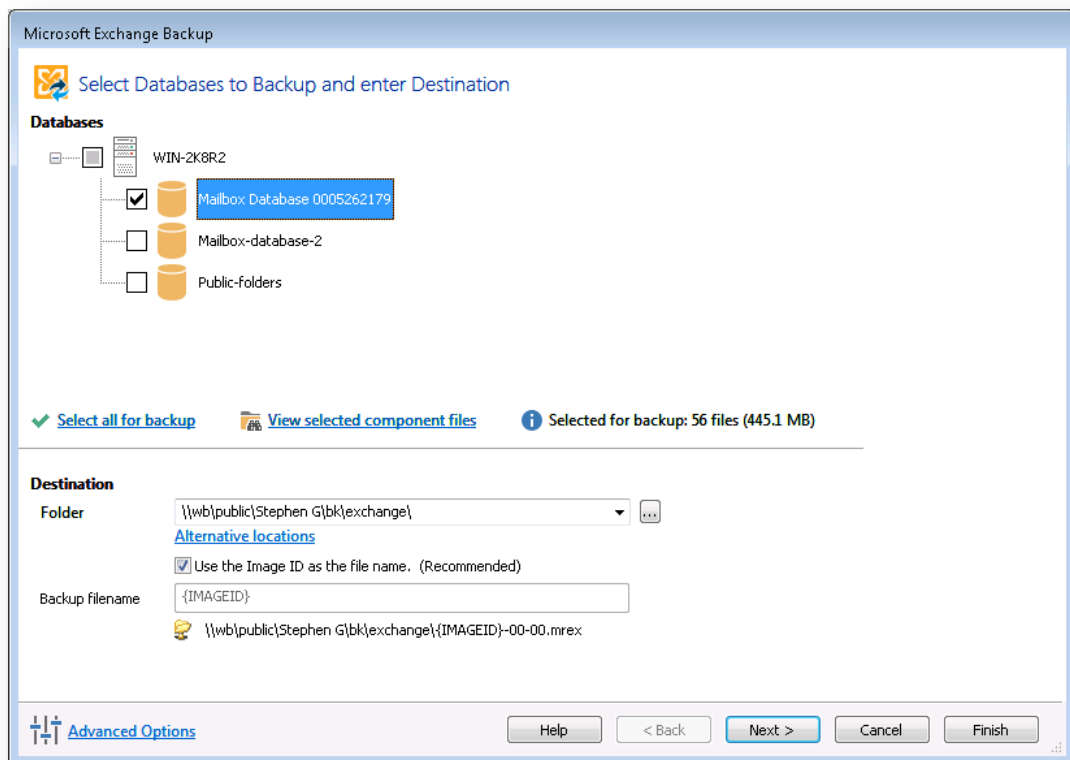
Before you begin: Macrium Reflect requires the Microsoft Exchange Information Store service to be installed and running in order for successful database backup to function.

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



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

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2. Select the items you want to backup:

- For Microsoft Exchange 2010 and later, select individual databases to backup.
- For Microsoft Exchange 2007 and earlier, select storage groups to backup, this includes all the databases in the selected storage group.

Caution

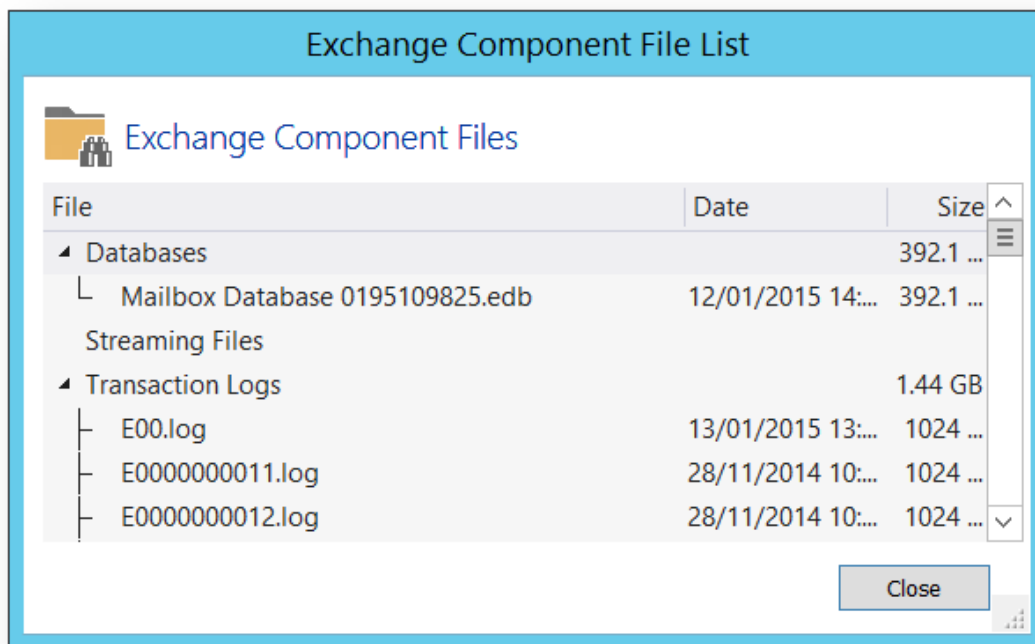
Unmounted Exchange databases are shown in the Microsoft Exchange Backup Wizard and can be selected for backup. However, VSS will not include unmounted databases in the snapshot and *the Exchange backup will fail*. To include these databases in the backup, either ensure the databases are mounted at point 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.

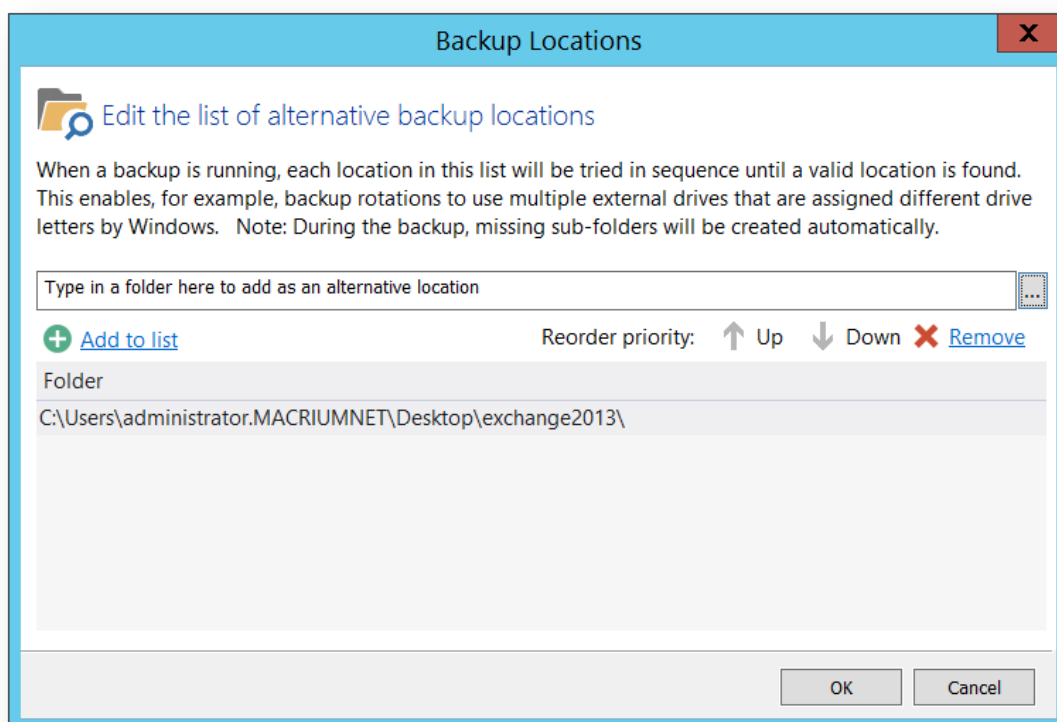
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4. Enter the **Destination Folder** for the backup.

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](#).

Microsoft Exchange Backup

[Edit the Plan for this Backup](#)

1. Select a Template for your Backup Plan

None

2. Add/Edit Schedules

Backup Type	Schedule
-------------	----------

Add Schedule Edit Schedule Delete Schedule

3. Define Retention Rules

☒ Full Keep 12 Backups

☒ Differential Keep 4 Backups

☒ Incremental Keep 10 Backups

Create a Synthetic Full if possible ☐

☐ Run the purge before backup.

☒ Delete the oldest backup set(s) if less than 5 GB on the target volume (minimum 1GB)

[Advanced Options](#) Help < Back Next > Cancel Finish

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

☒ Full Keep 12 Backups

☒ Differential Keep 4 Backups

☒ Incremental Keep 10 Backups

Create a Synthetic Full if possible ☐

☐ Run the purge before backup.

☒ 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	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. 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. F = Full D = Differential I = Incremental <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																																				
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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	Select this option to run the retention rules before the current 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.																																																			
	Automatically remove the oldest backup set(s) in the target folder if the free space on the drive drops below the GB threshold.																																																			

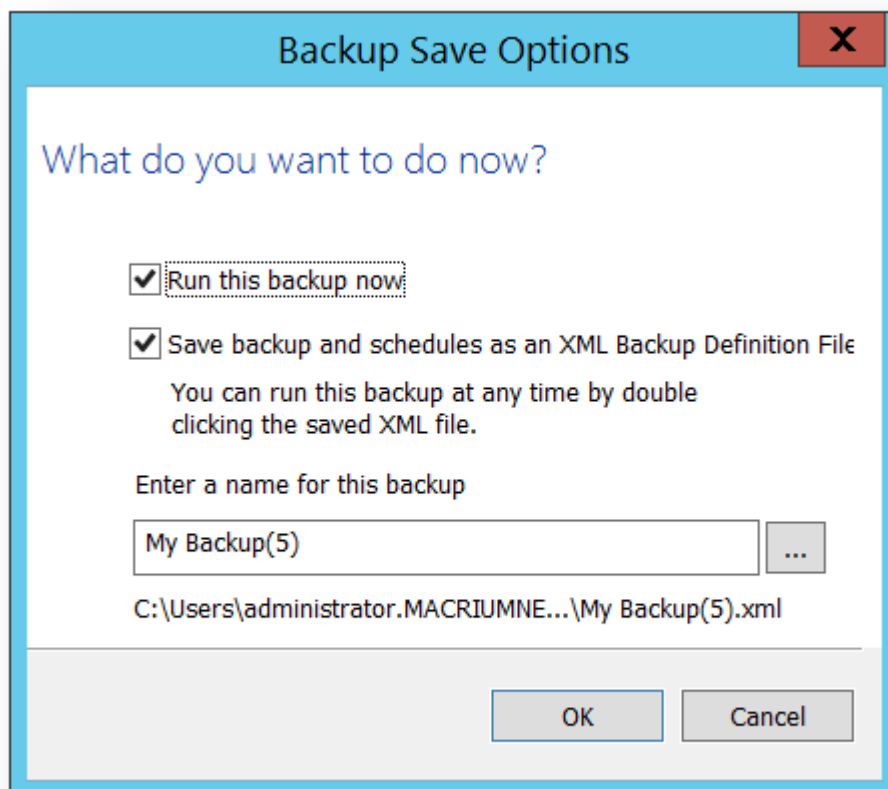
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Option	Description
Delete oldest backup set (s) if less than n GB	

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.

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

Backing up MS SQL Databases

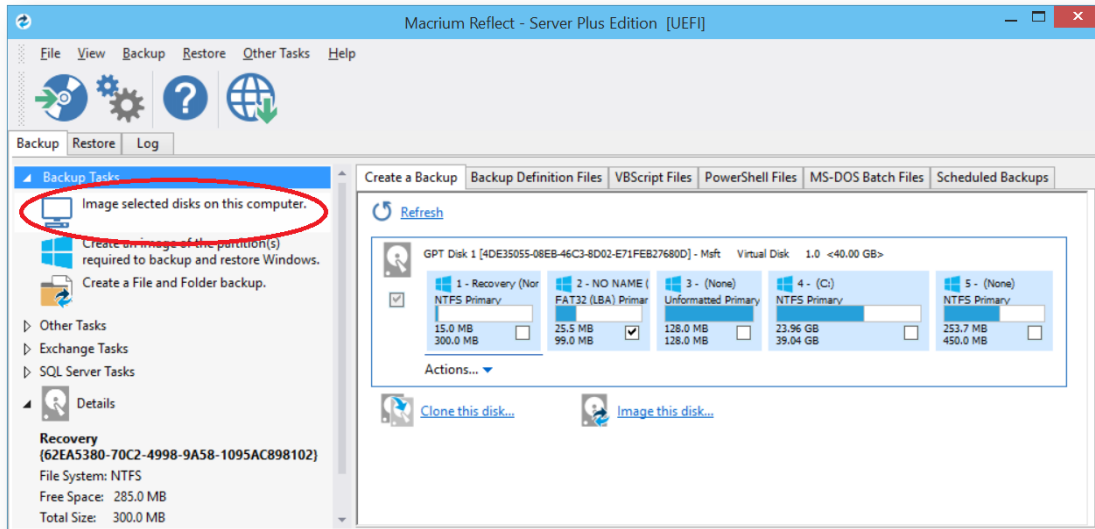
Error: RuntimeException occurred while performing an XHTML storage transformation (null)

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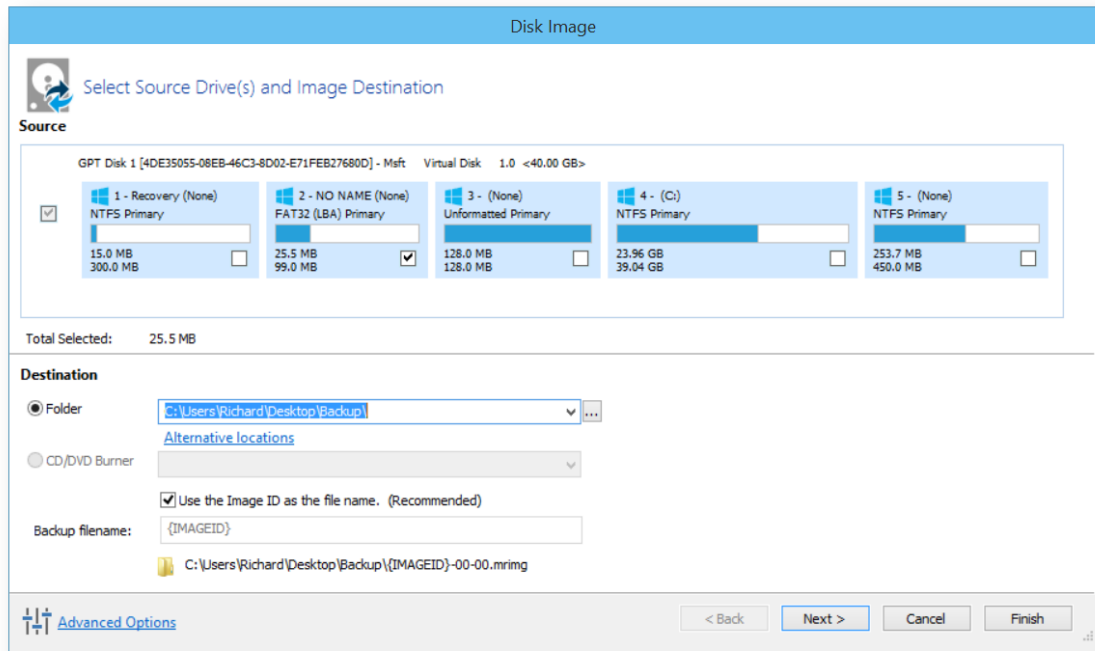
Creating a disk image of a single drive or partition

Using Microsoft Volume Shadow Copy Service (VSS) Macrium Reflect creates persistent images of your system.

1. Select **Image selected disks on this computer.**



2. The wizard starts. All partitions are displayed, select the required drives or partitions.



3. In the **Destination** section, select where to write the resultant image.

In this example, 'E drive' is used.

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- Click **Next**.
- If desired, edit the plan for the backup by making necessary selections.

Disk Image

Edit the plan for this backup, Click 'Next' to continue

Backup Plan Template
Do not schedule this backup

Schedules for this backup plan

Backup Type	Schedule
-------------	----------

Add Schedule Edit Schedule Delete Schedule

Retention Policy for the backup plan

Policy	How To Retain	Retention Count/Period
☐ Retain full backups	number of backups	12
☐ Retain differential backups	number of backups	10
☐ Retain incremental backups	number of backups	30

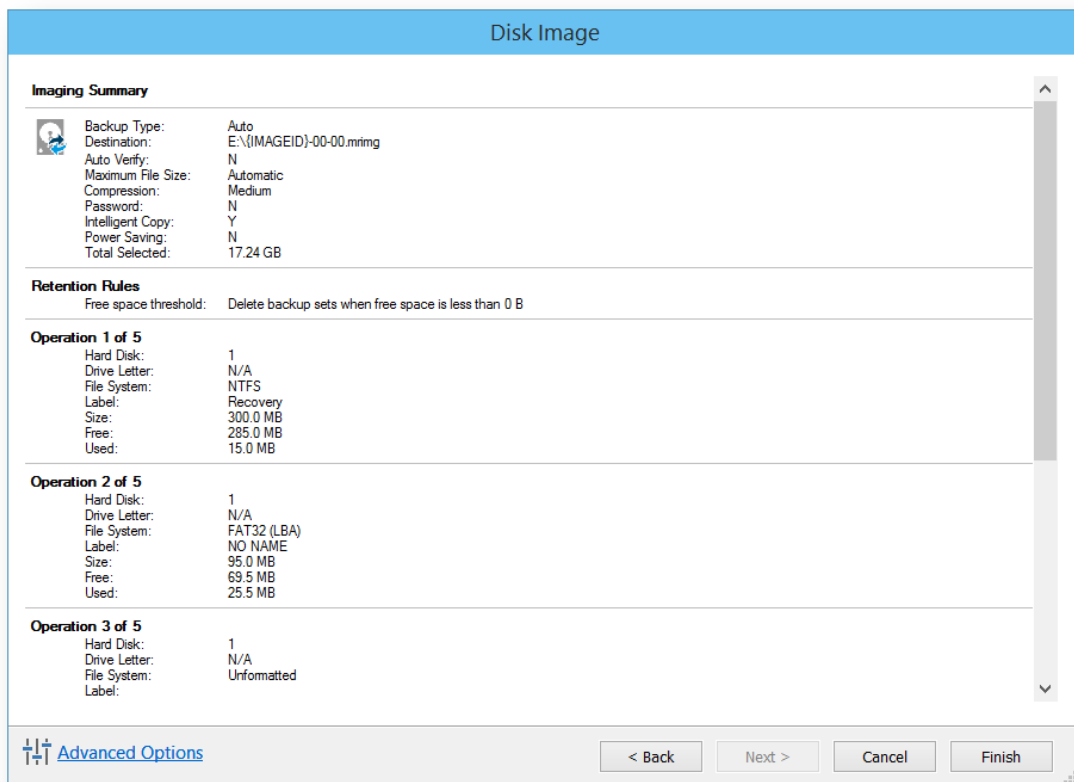
☐ Synthetic Full
☐ Purge before backup
☒ Delete the oldest backup set(s) if less than 0 GB on the target

< Back Next > Cancel Finish

For more information on editing the backup plan and advanced options see [Scheduling backups](#).

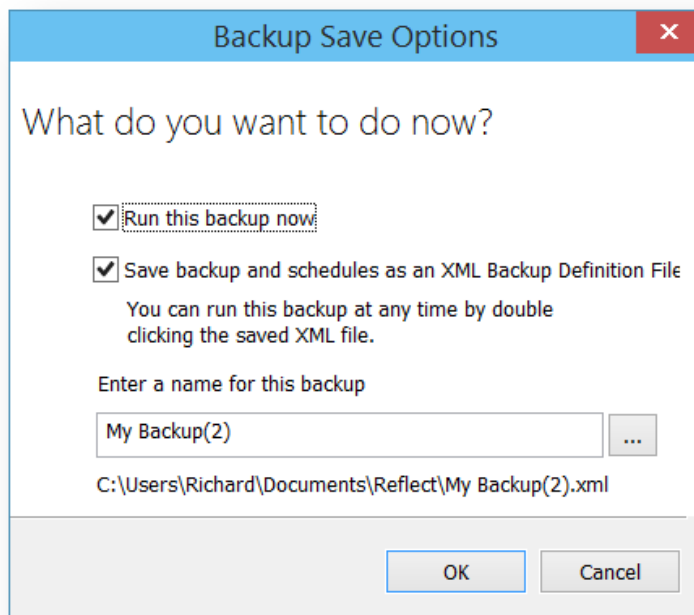
- Click **Next**.
- A summary screen displays detailing the settings used for this image.

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8. Click **Finish**.

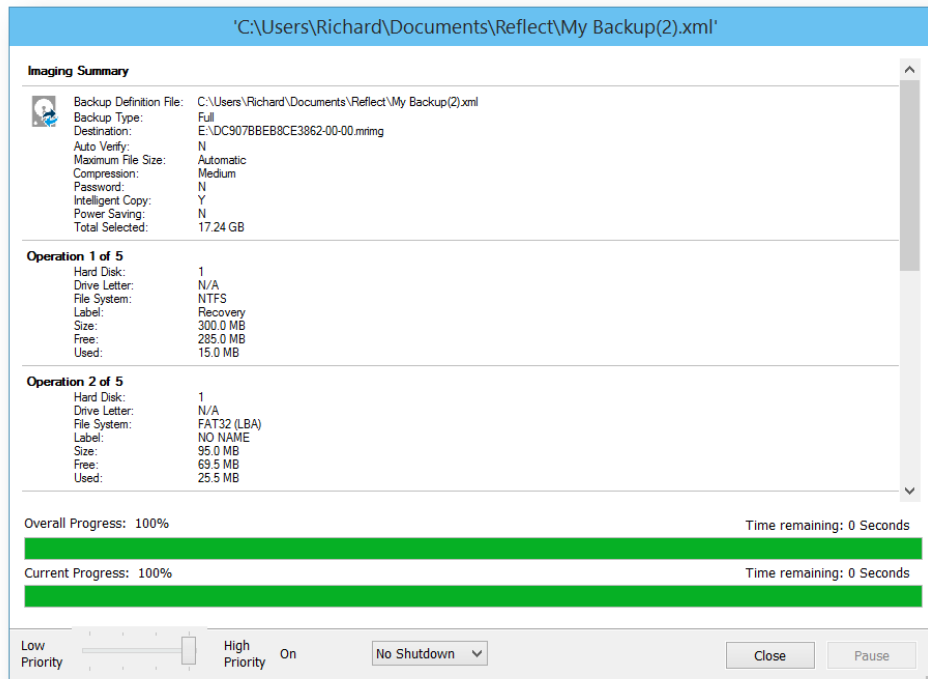
You are now given the opportunity to save the backup options.



9. If you want to run the backup at this point, click **OK**.

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Your system partitions are backed up to the chosen location.



10. When the image has completed, click **Close** to shut down the message box.

11. Click **Close** to close the backup window.

Macrium Reflect creates the backup.

See also: [Windows Partitions](#)

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](#)
- [Incremental Images](#)
- [Maintaining backup sets](#)
- [Selecting an incremental or differential backup](#)
- [Alternative method using an existing backup](#)

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:

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- 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.

Maintaining backup sets

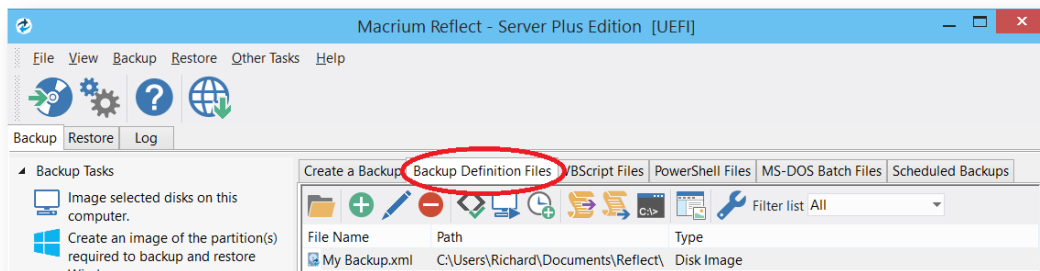
Maintaining backup sets can seem an onerous task, however, Macrium Reflect takes care of all the hard work for you. With Macrium Reflect you can schedule incremental or differential backups automatically. It is as simple as selecting the image you wish to restore and Macrium Reflect automatically selects 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 DefinitionsFiles**.



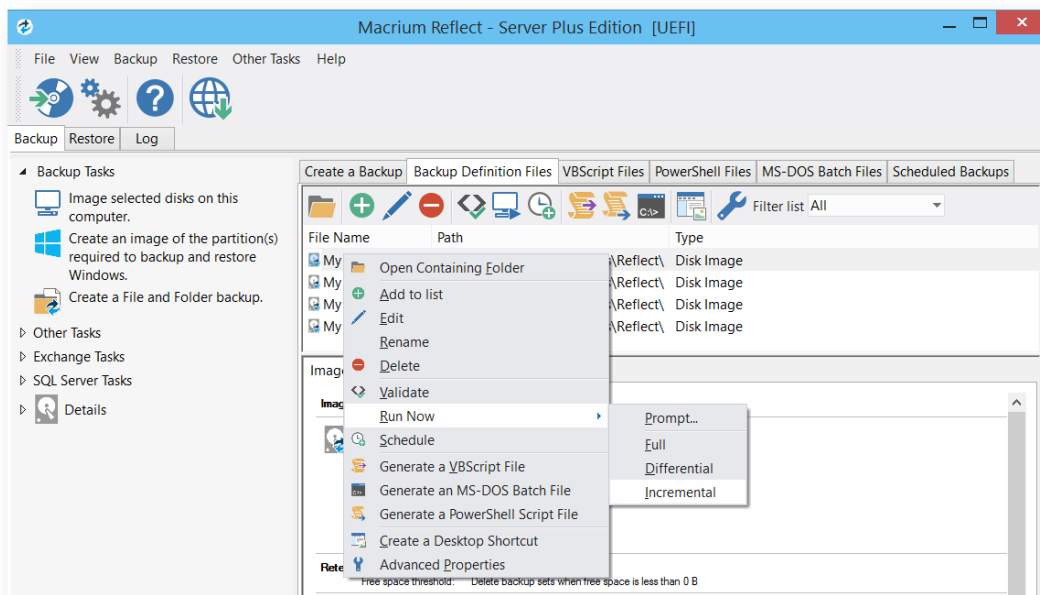
In this instance, there is one saved XML definitions file *MyBackup.xml* which contains the configuration required to back up the C drive.

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**.

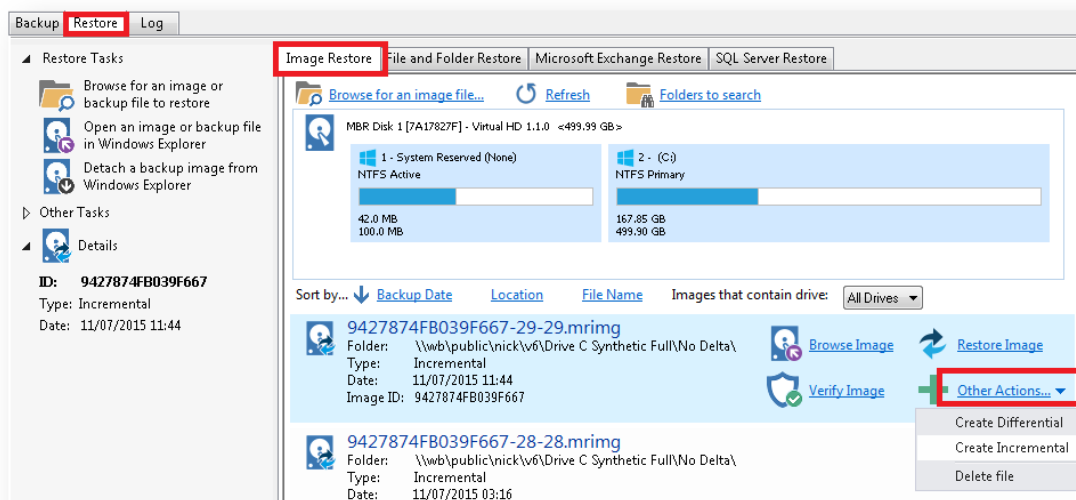
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4. Click **Finish**.
5. When the Image is complete close the dialog.

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'



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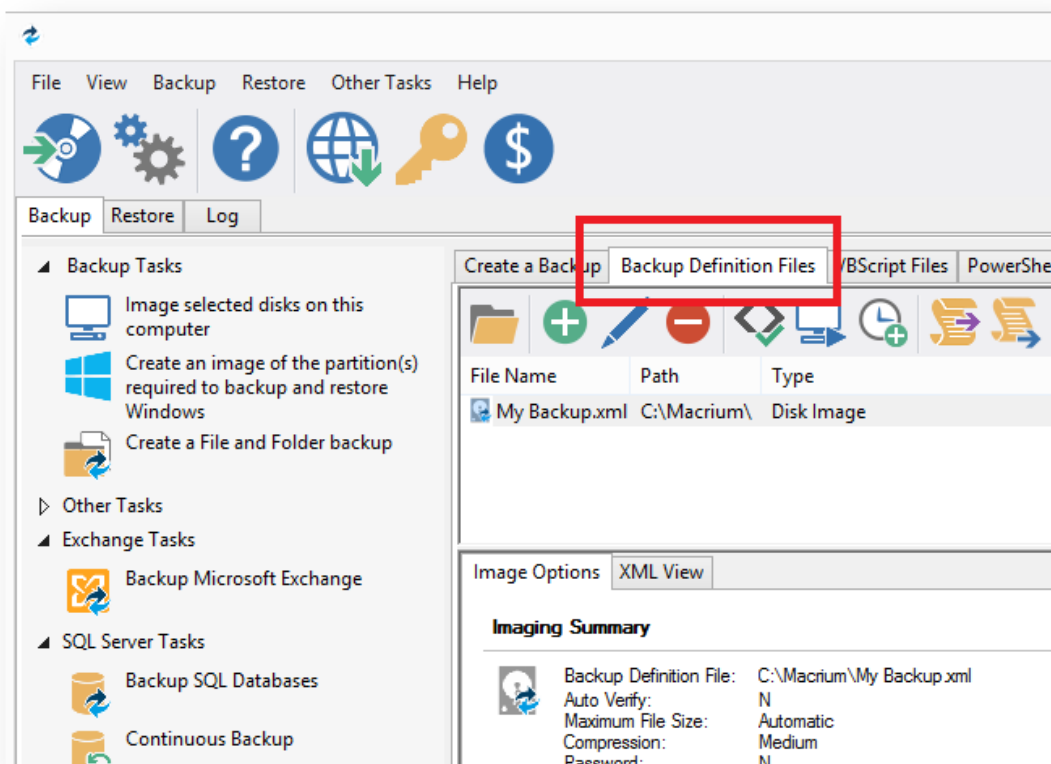
Creating desktop shortcuts for full, incremental and differential backups



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).

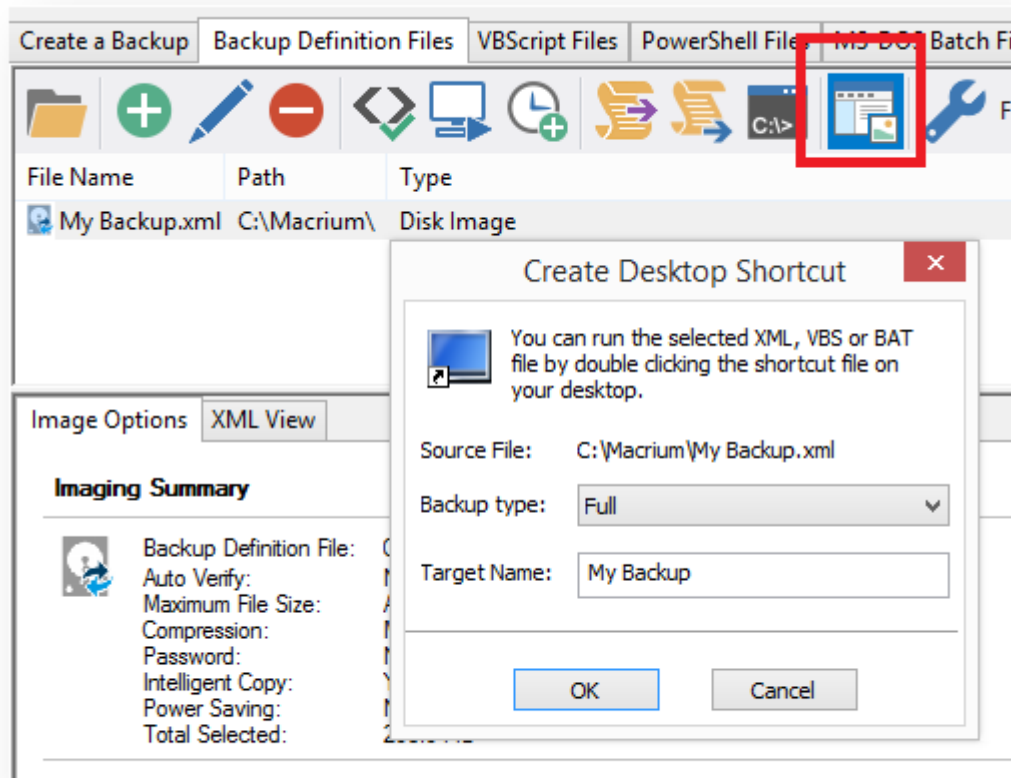
Pre-requisite: To create a desktop shortcut for your definitions files you must already have a backup definitions file. If required, follow the instructions in [Creating a backup image of your computer, drive or partitions](#).

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.

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



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

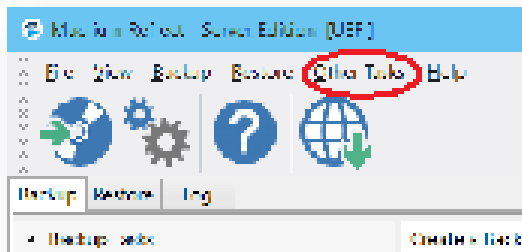
4. Click **OK**.

Checking VSS events when backups fail

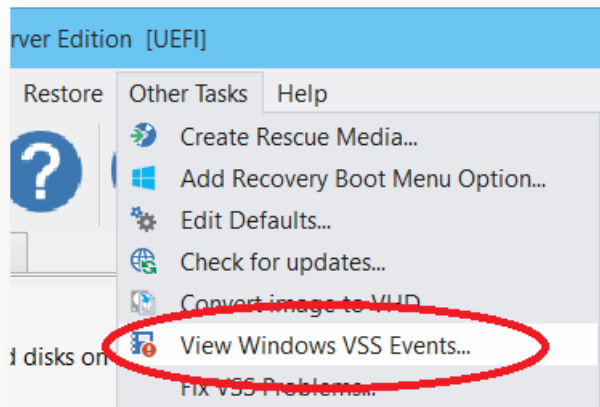
Macrium uses Volume Shadow Copy Service (VSS) to create its images and backups and windows keeps a log of VSS events. These events can give you information, useful if you are experiencing problems, such as backup failures.

View events to check what has occurred as follows.

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

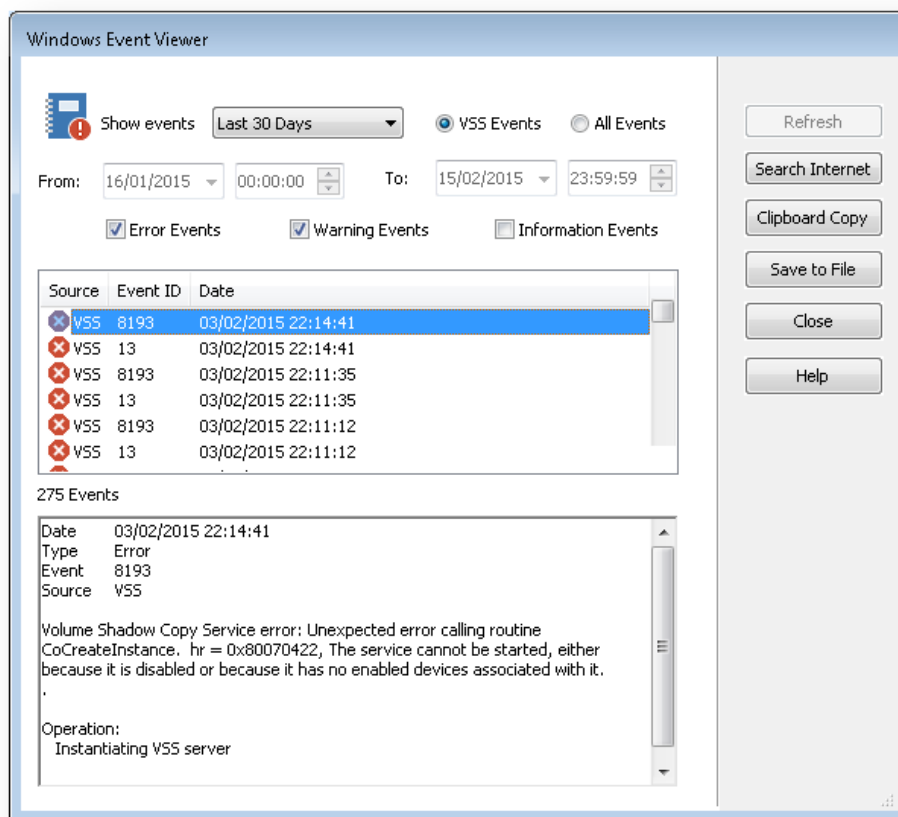


2. Click **View Windows VSS Events**.



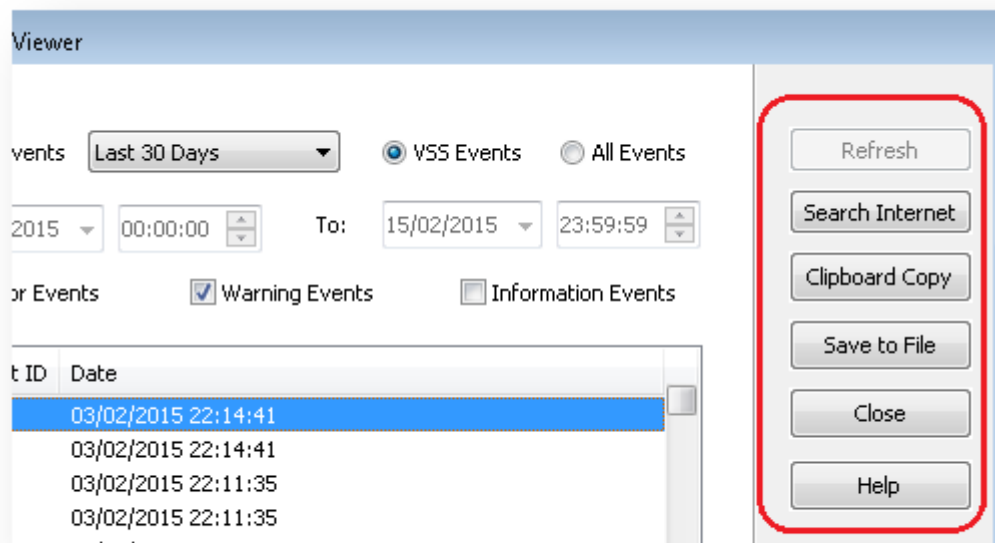
3. Select the parameters for your event search.
4. The viewer updates automatically displaying relevant information.

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5. If required, select an event and choose to:
 - a. Search Internet. This will open your default browser with search terms setup for the selected Windows error event.
 - b. Clipboard Copy. Useful for pasting into an email if you are contacting support.
 - c. Save to File.

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

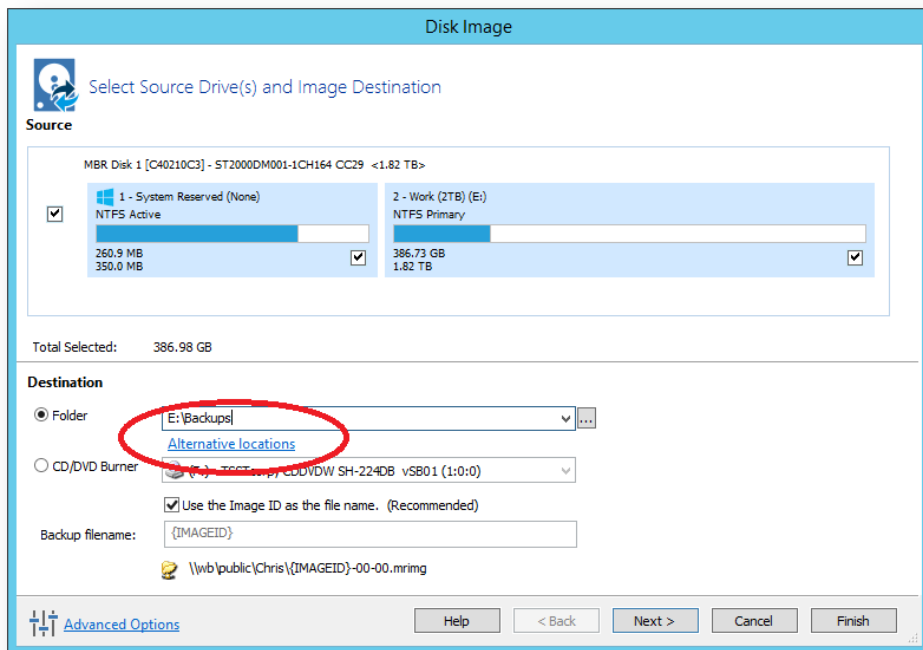
Alternative Locations For Backups

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.



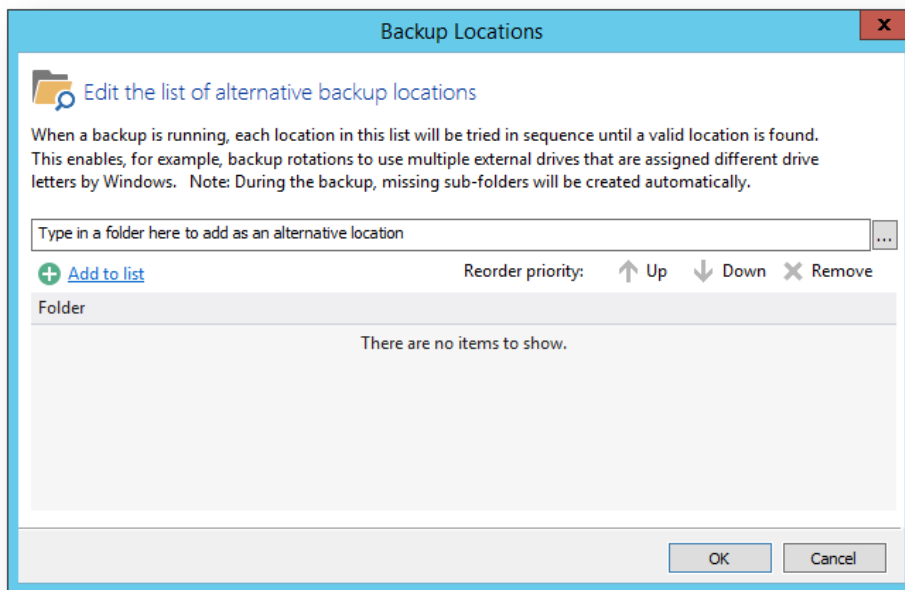
Alternative locations can also be used to provide backup rotations, for example, keeping an offsite backup, or as a fail safe for temporary unavailability of the primary backup destination.

1. Click **Alternative Locations**

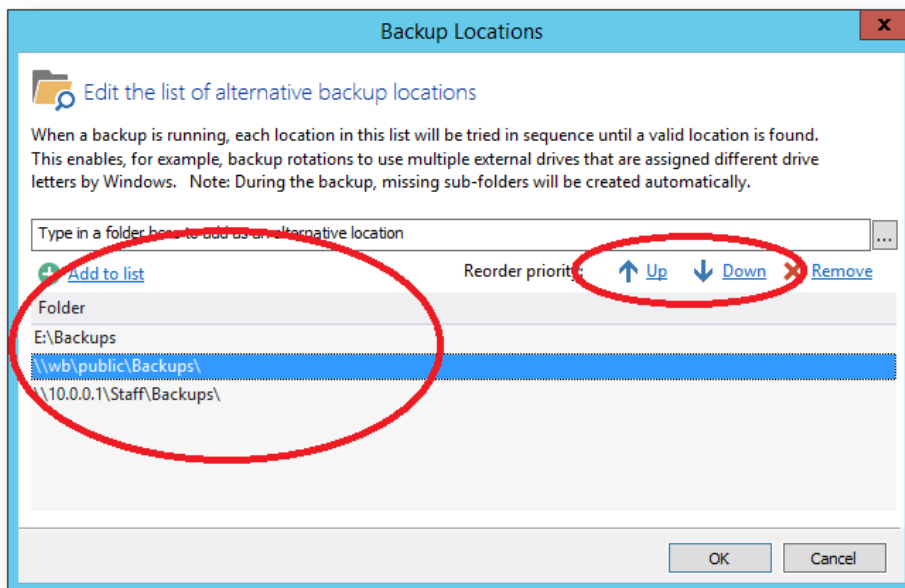


2. The **Backup Locations** dialog is shown.

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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**

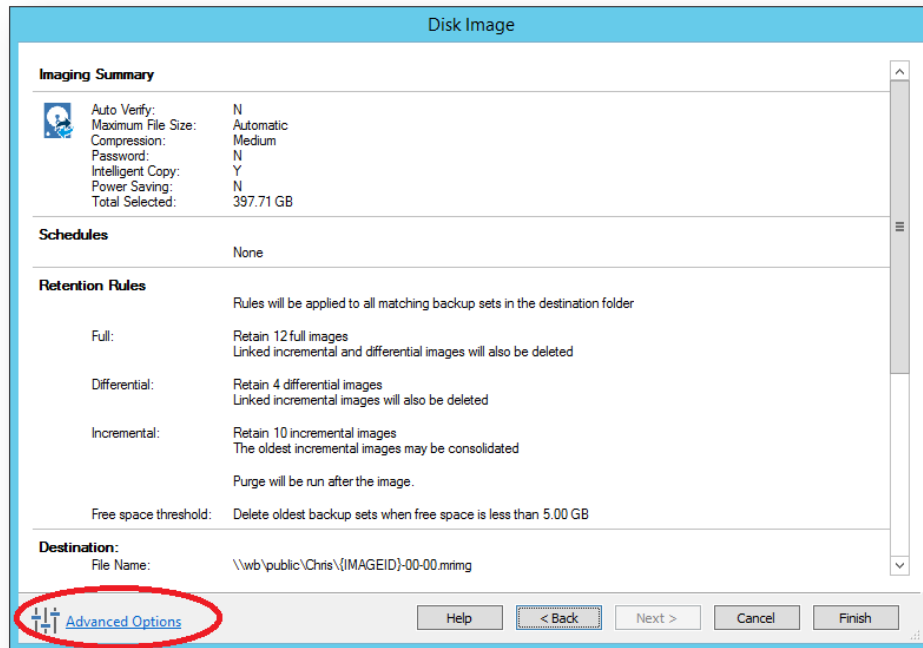


6. Remove a folder by selecting it and clicking **Remove**
7. Click **OK** when done

Advanced Options

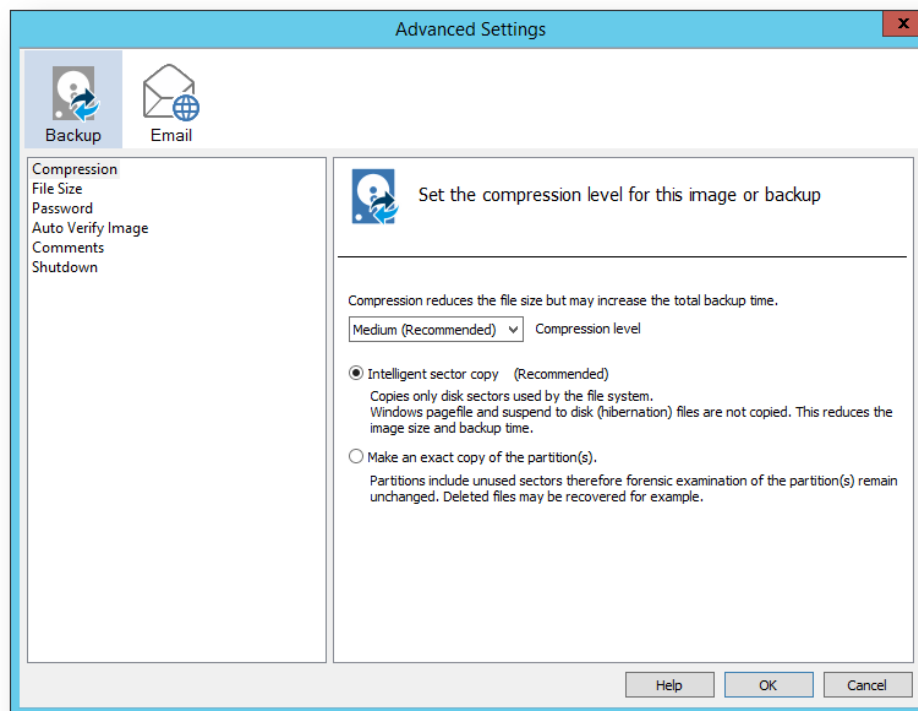
Advanced Options

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:

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Common Advanced Options - Available to all backup types except Cloning

Option	Description
Compression	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.

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Option	Description
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	Clone only sectors in use from the source disk. Further to this option: • 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.
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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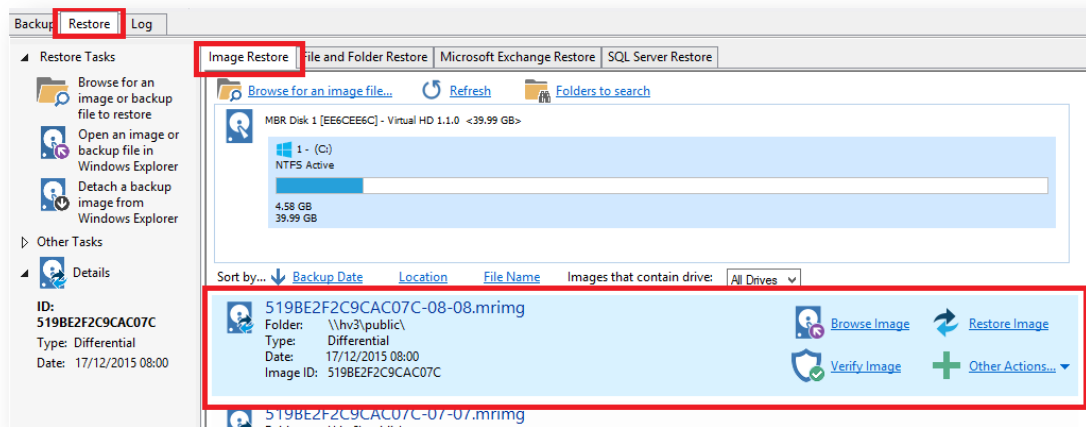
Verifying image and backup files

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](#)

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:

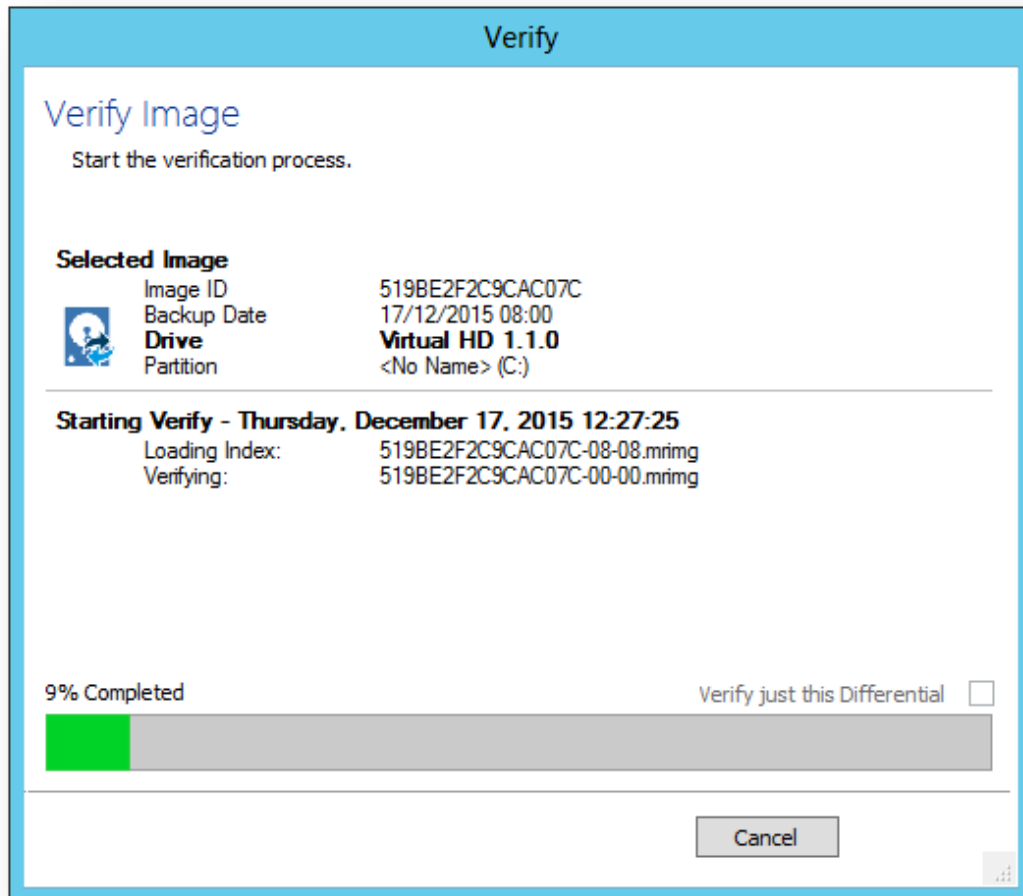


2. Click 'Verify':



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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'.**

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. **Earlier versions of Windows are not supported.**

You must use the **File and Folder restore functionality** 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 Snapshots 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 12, 2016 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:

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```
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-ee9c-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.

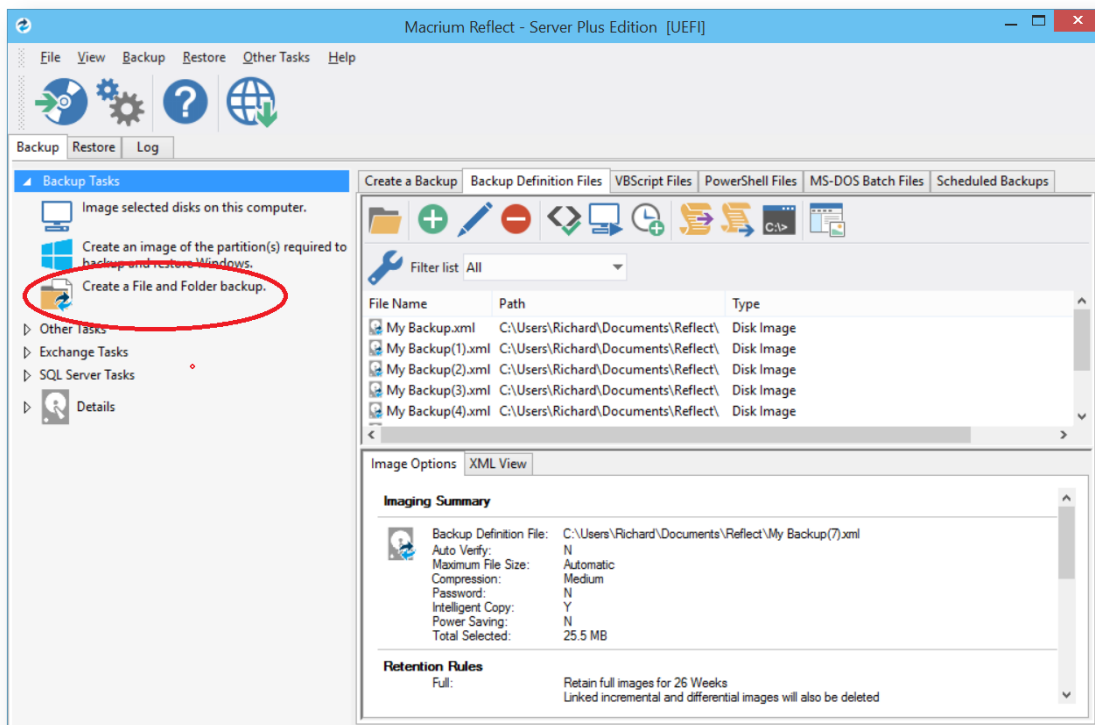
Note the Error message: **VSS failed for Cluster Shared Storage. Ensure that no folders outside of CSV mount points are included in this backup**

Folder:	C:\ClusterStorage\Volume1\VHD\
Include File Filter:	*.vhdx
Exclude File Filter:	*.temp; *.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:	*.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	
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	

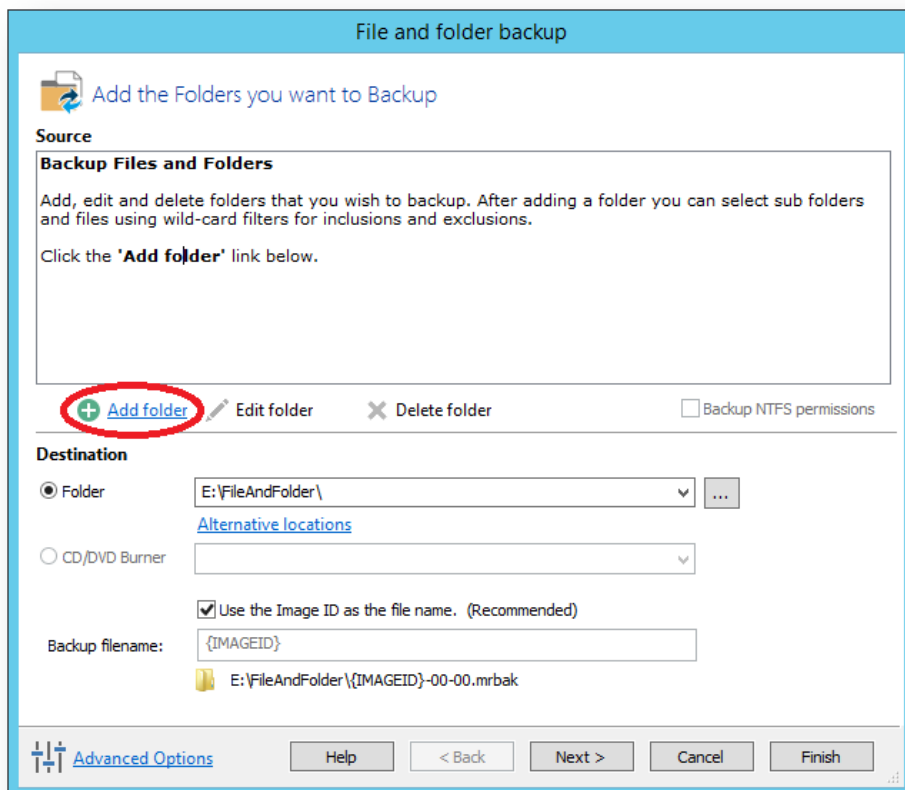
How to backup Cluster Shared Volumes

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

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2. Select 'Add folder'.



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The 'Select Folder to backup' dialog appears.

Select folder to backup

File and folder inclusion and exclusion masks

1. Folder to backup

C:\ClusterStorage\Volume1

☒ 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

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.

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

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Option	Description
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.

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File and folder backup

Add the Folders you want to Backup

Source

Folder	Include Files	Exclude Files	Sub Folders	Exclude Folders
C:\ClusterStorage\Volume1\	*,*	*.temp; *.tmp; *.bak; *.~*	Y	

+ Add folder Edit folder X Delete folder ☒ Backup NTFS permissions

Destination

☒ Folder E:\FileAndFolder\ ... [Alternative locations](#)

☐ CD/DVD Burner

☒ Use the Image ID as the file name. (Recommended)

Backup filename: {IMAGEID}

E:\FileAndFolder\{IMAGEID}-00-00.mrbak

Advanced Options Help < Back Next > Cancel Finish

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

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

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The screenshot shows the 'File and folder backup' wizard in Macrium Reflect v7.2. The title bar says 'File and folder backup'. The main window has a blue header with a calendar icon and the text 'Edit the Plan for this Backup'. Below this, there are three steps: 1. Select a Template for your Backup Plan (with a dropdown menu set to 'None'), 2. Add/Edit Schedules (with a table for Backup Type and Schedule, and buttons for Add Schedule, Edit Schedule, and Delete Schedule), and 3. Define Retention Rules. Step 3 is currently active. It includes a dropdown for 'Apply retention rules to matching backup sets in the target folder', a table for retention rules (Full, Differential, Incremental) with 'Keep' counts (12, 4, 10) and 'Backups' counts (all set to 'Backups'), a checkbox for 'Create a Synthetic Full if possible', a checkbox for 'Run the purge before backup.', and a checkbox for 'Delete the oldest backup set(s) if less than 5 GB on the target volume (minimum 1GB)'. At the bottom, there are buttons for 'Help', '< Back', 'Next >', 'Cancel', and 'Finish', along with an 'Advanced Options' link.

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:

The screenshot shows the '3. Define Retention Rules' dropdown menu. It has three options: 'Apply retention rules to matching backup sets in the target folder' (selected), 'Apply retention rules to matching backup sets in the target folder', and '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.

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- 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

☒ Full	Keep	12	Backups
☒ Differential	Keep	4	Backups
☒ Incremental	Keep	10	Backups
Create a Synthetic Full if possible ☐			
☐ Run the purge before backup.			
☒ 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. 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. F = Full D = Differential I = Incremental

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Option	Description																																																			
	<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																																				
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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	Select this option to run the retention rules before the current 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	Automatically remove the oldest backup set(s) in the target folder if the free space on the drive drops below the GB threshold. 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.																																																			

8. The next screen, **Summary**, gives the details of what is being backed up. Click **Finish**.

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](#)
- [Understanding partition alignment](#)
- [Browsing Macrium Reflect images and backups in Windows Explorer](#)
- [Restoring a file and folder backup](#)
- [Restoring MS SQL](#)
- [Restoring MS Exchange databases](#)
- [Restoring an MBR System image to UEFI/GPT](#)
- [Restoring a UEFI/GPT System image to MBR](#)
- [Bare metal restore of a Dynamic disk system](#)
- [Drive letters assigned to restored or cloned partitions](#)
- [Restore to VHD](#)

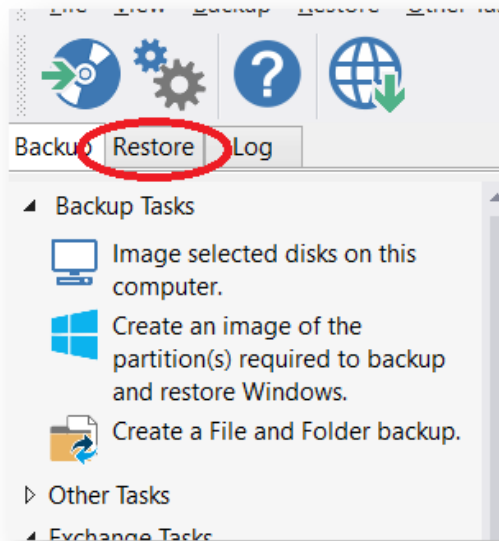
Restoring an image from within Windows

This topic is for restoring a data image. For restoring a system image see [Restoring a system image](#).

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.

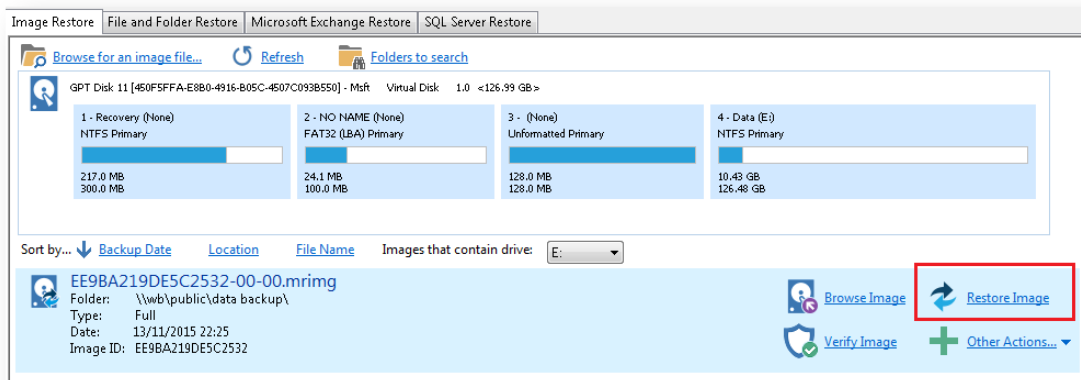
Before you begin: You must have a backup image of the disk ready to restore.

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**.

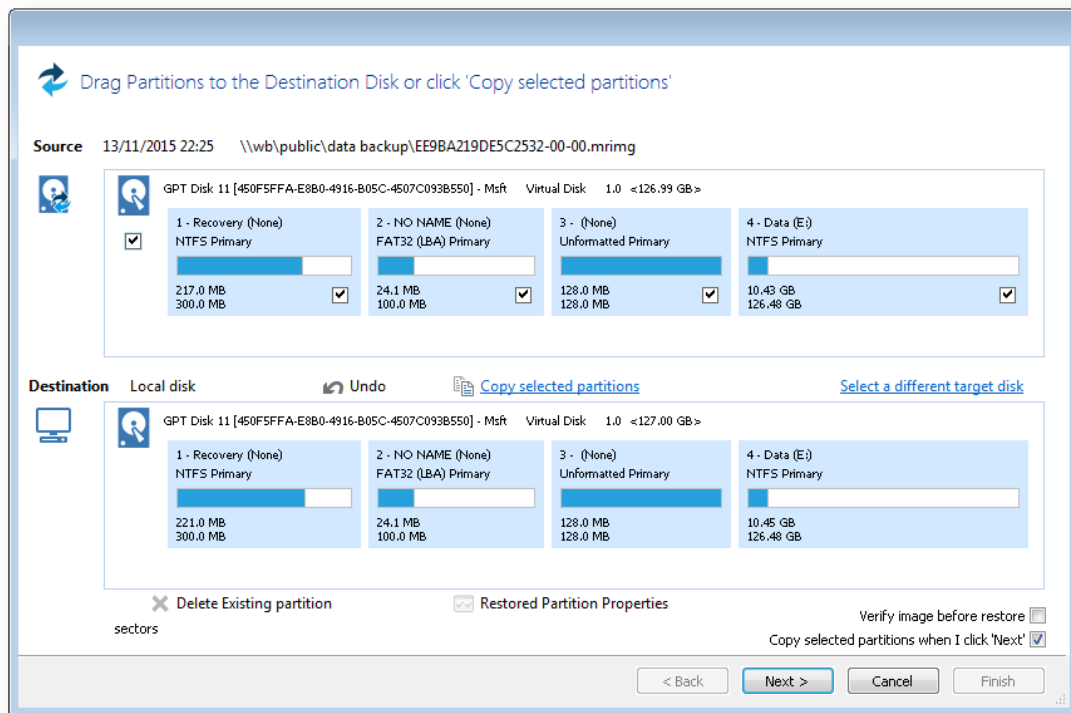


3. The next dialog gives you the opportunity to modify the destination properties.

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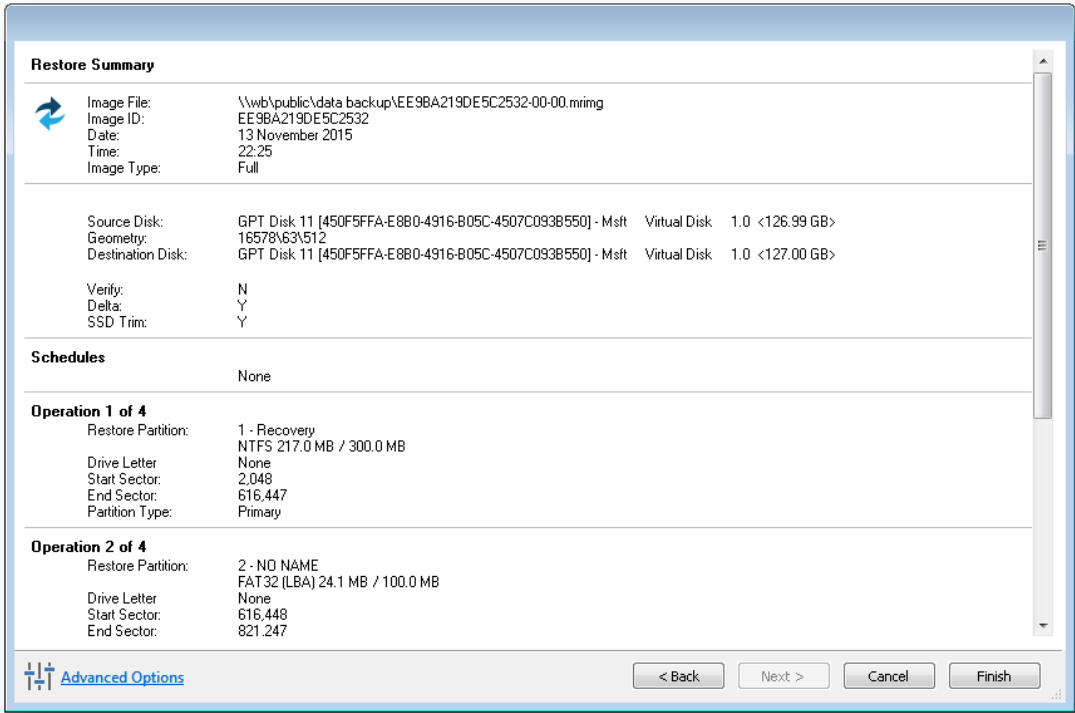
Moving and Resizing the restored partition

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](#).



4. Click **Next** to restore back to the original location.

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Restore Summary


 Image File: \\wb\public\data backup\EE9BA219DE5C2532-00-00.mimg
 Image ID: EE9BA219DE5C2532
 Date: 13 November 2015
 Time: 22:25
 Image Type: Full

Source Disk: GPT Disk 11 [450F5FFA-E8B0-4916-B05C-4507C093B550] - Msft Virtual Disk 1.0 <126.99 GB>
 Geometry: 16578\63\512
 Destination Disk: GPT Disk 11 [450F5FFA-E8B0-4916-B05C-4507C093B550] - Msft Virtual Disk 1.0 <127.00 GB>

Verify: N
 Delta: Y
 SSD Trim: Y

Schedules None

Operation 1 of 4

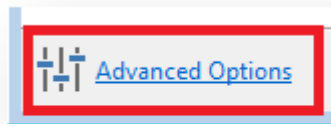
Restore Partition: 1 - Recovery
 NTFS 217.0 MB / 300.0 MB
 Drive Letter: None
 Start Sector: 2,048
 End Sector: 616,447
 Partition Type: Primary

Operation 2 of 4

Restore Partition: 2 - NO NAME
 FAT32 (LBA) 24.1 MB / 100.0 MB
 Drive Letter: None
 Start Sector: 616,448
 End Sector: 821,247

 [Advanced Options](#)

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
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.

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Option	Description
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.

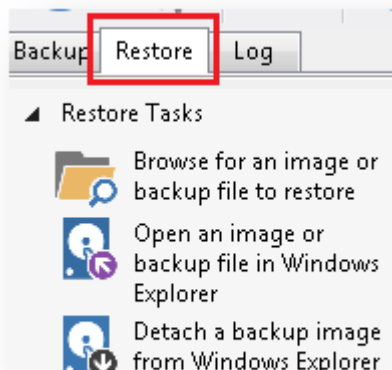
6. A summary screen is displayed confirming the choices that have been made, click **finish**.

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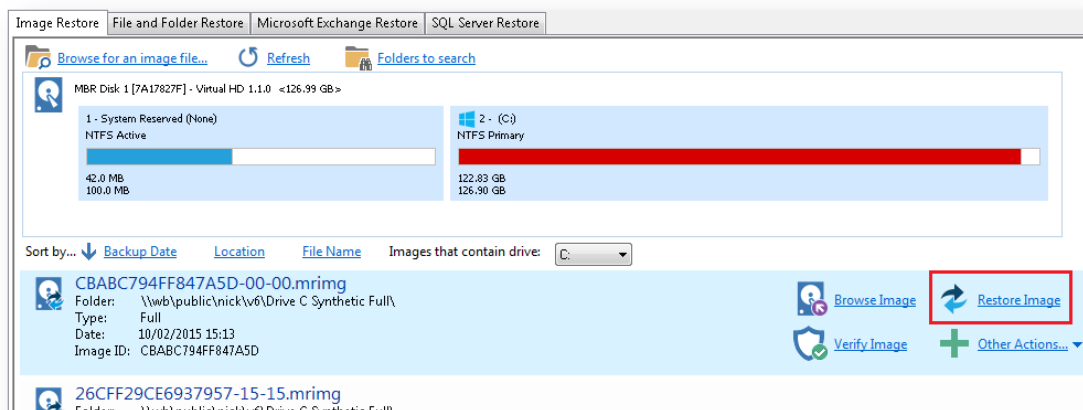
Restoring a System image from Windows

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**.

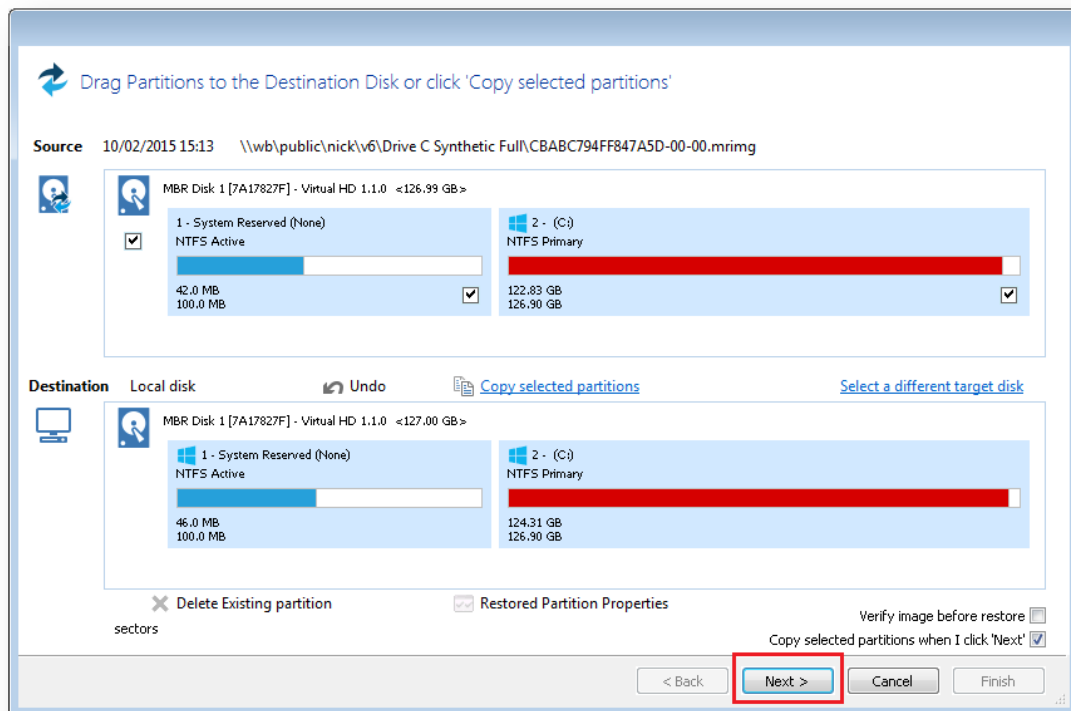


2. Select the required image and click **Restore Image**.



3. The next dialog gives you the opportunity to restore the image, click **Next** and select all defaults.

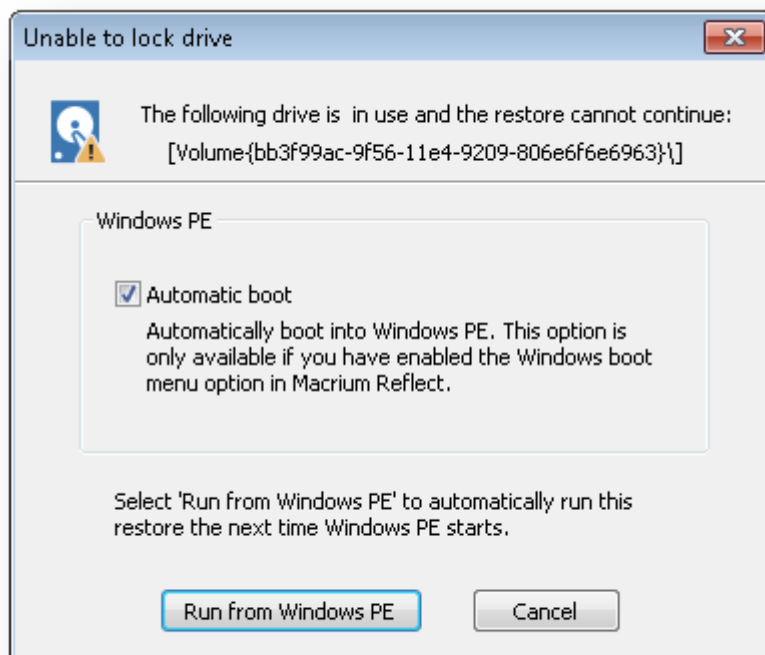
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Note: By default, partition(s) restore to their original locations. However, it is possible to restore to a different partition by using Drag and Drop. Simply drag the source partition to any available partition on the target disk. See [Modifying restored partition properties](#)

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**.

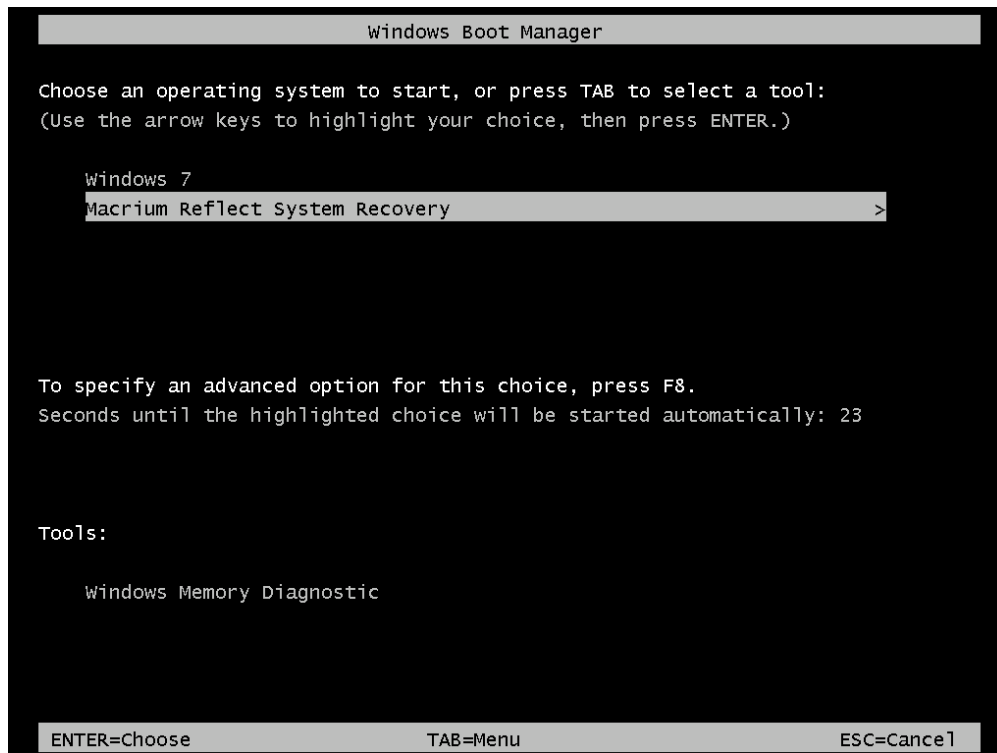
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Note: If the option for 'Automatic boot' is unavailable the please follow the steps [Adding a Boot Menu option for system Image recovery](#) and retry the restore.

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>.

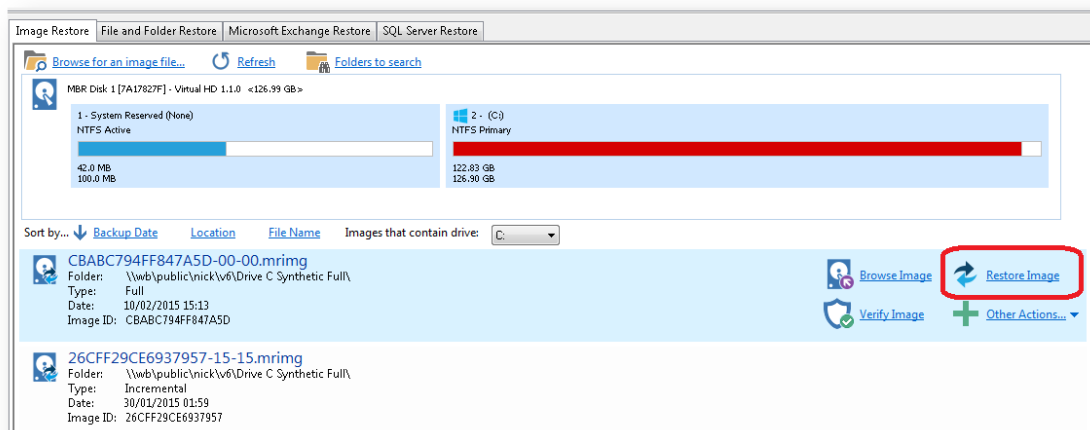
Solid State Disks (SSD) require partition alignment to 4KB boundaries for optimum performance and life. 1MB aligned partitions are aligned on 4KB boundaries so present no problem, however, CHS aligned partition are often aligned on 63 sectors (31.5KB) degrading SSD performance and life time considerably. 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.

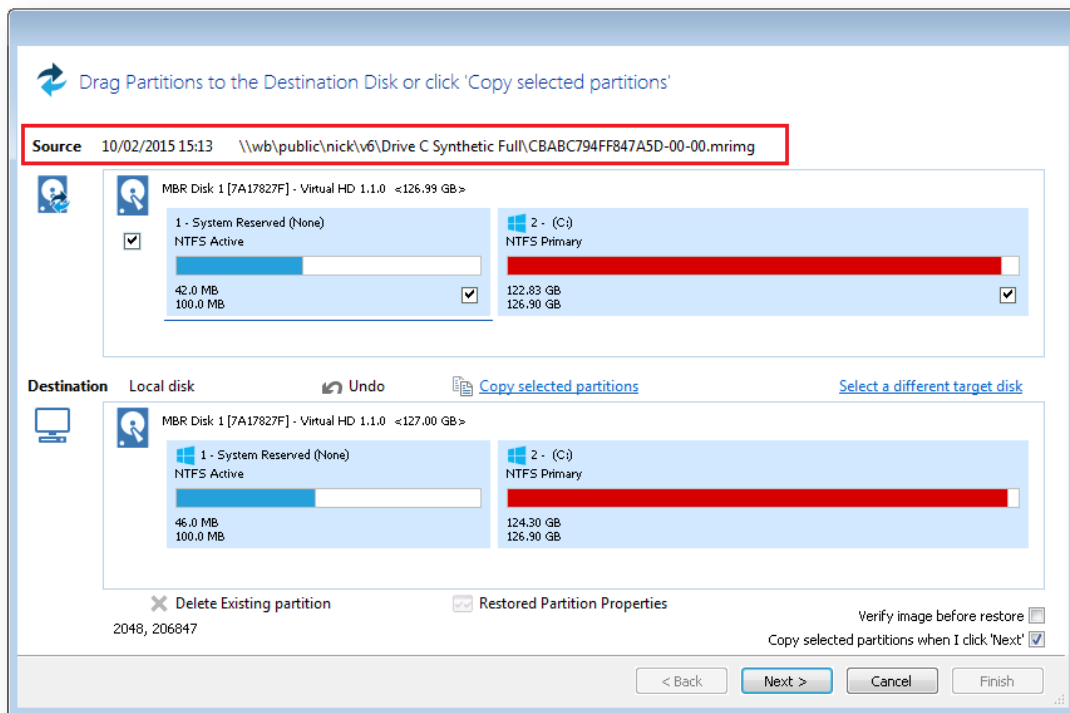
To modify the restore destination:

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.

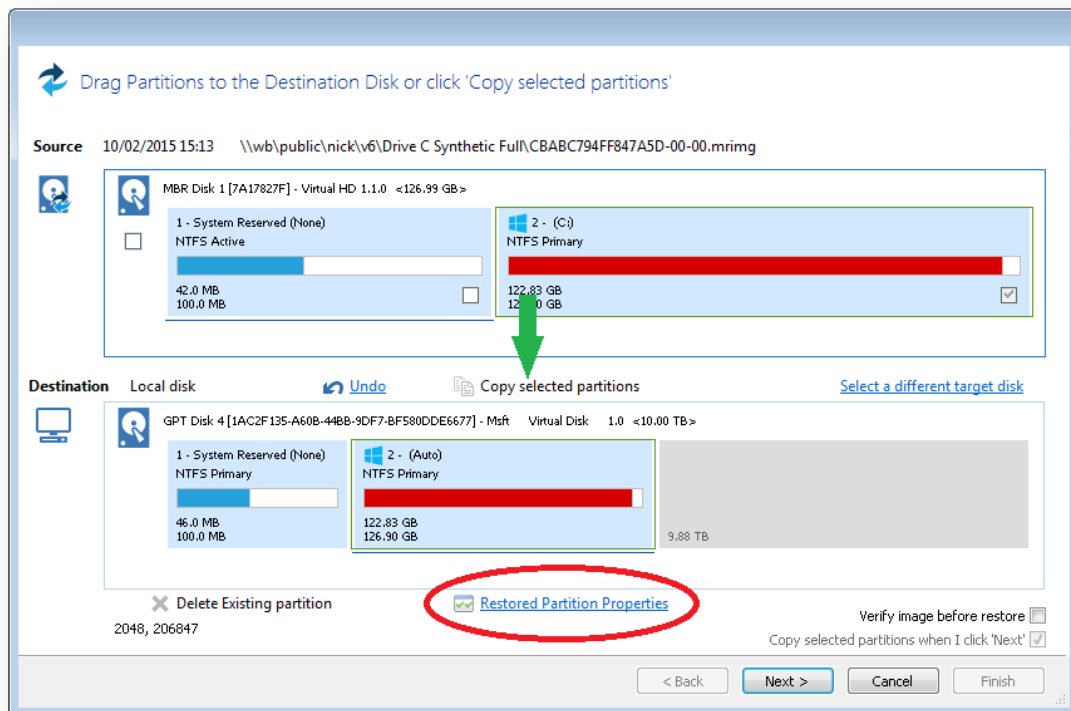
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3. Click **Select a different target disk** and select the required target disk.
4. If you have partitions on the target disk which you are sure can be deleted, select each one in turn and click **Delete Existing partition** to create empty space.
5. Drag the source partition onto the destination partition.

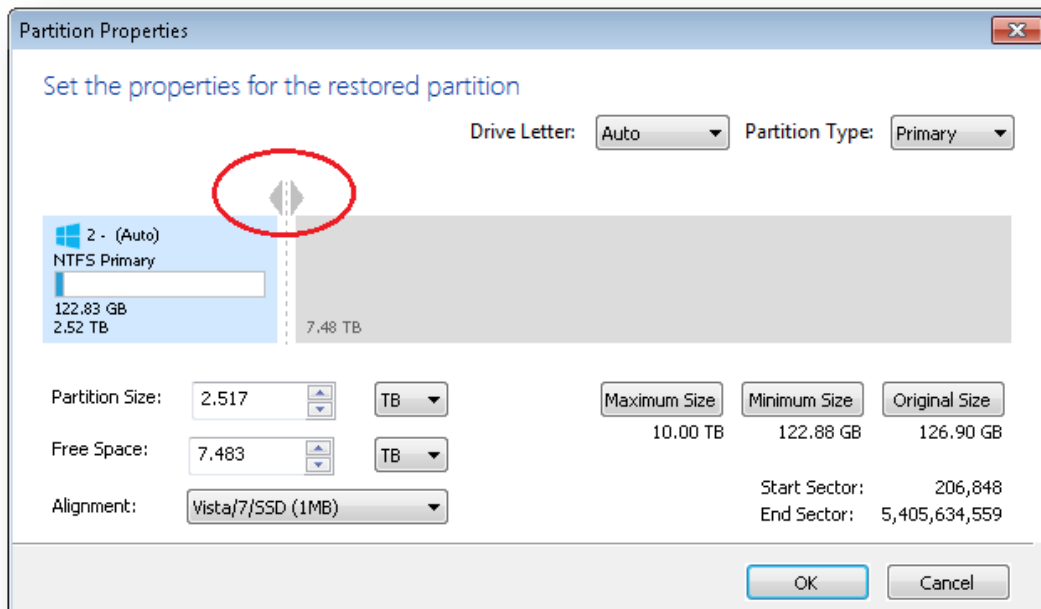
The partition locates to the first available free area of the new disk. In this case, partition 2.

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6. Click **Restored Partition Properties**.

The Partition Properties dialog appears for you to modify the size of the target partition.



7. There are a number of things you can do here:

- Modify the drive letter by selecting another from the list.

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- 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](#)

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 partitions 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.

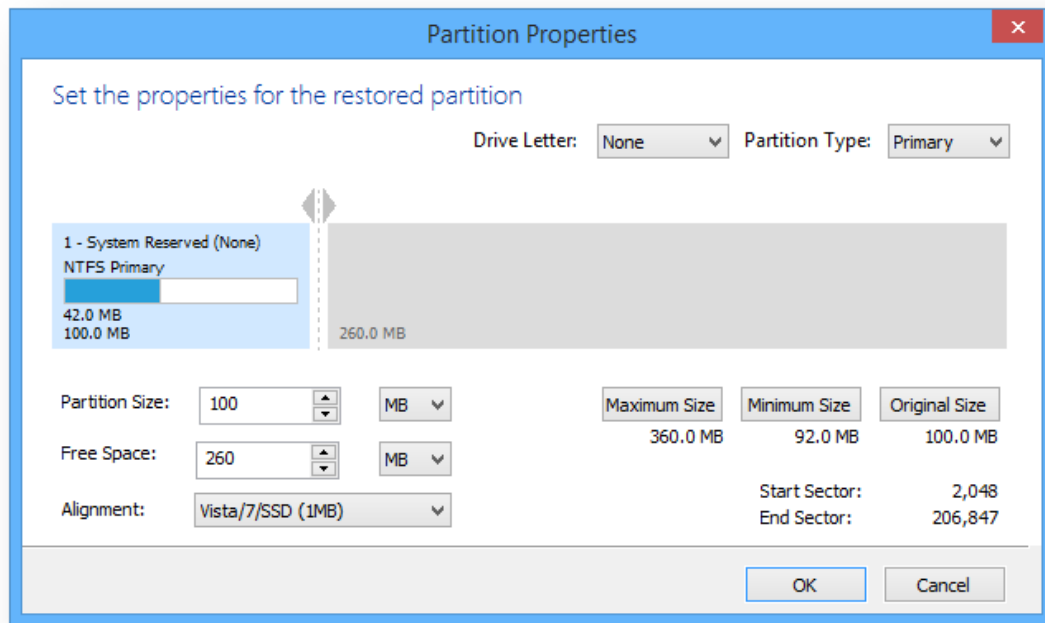


Note: This could be used to 'convert' and XP aligned partition for SSD alignment

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.

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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 *all* 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](#) 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](#)

There are several ways to mount / unmount an image:

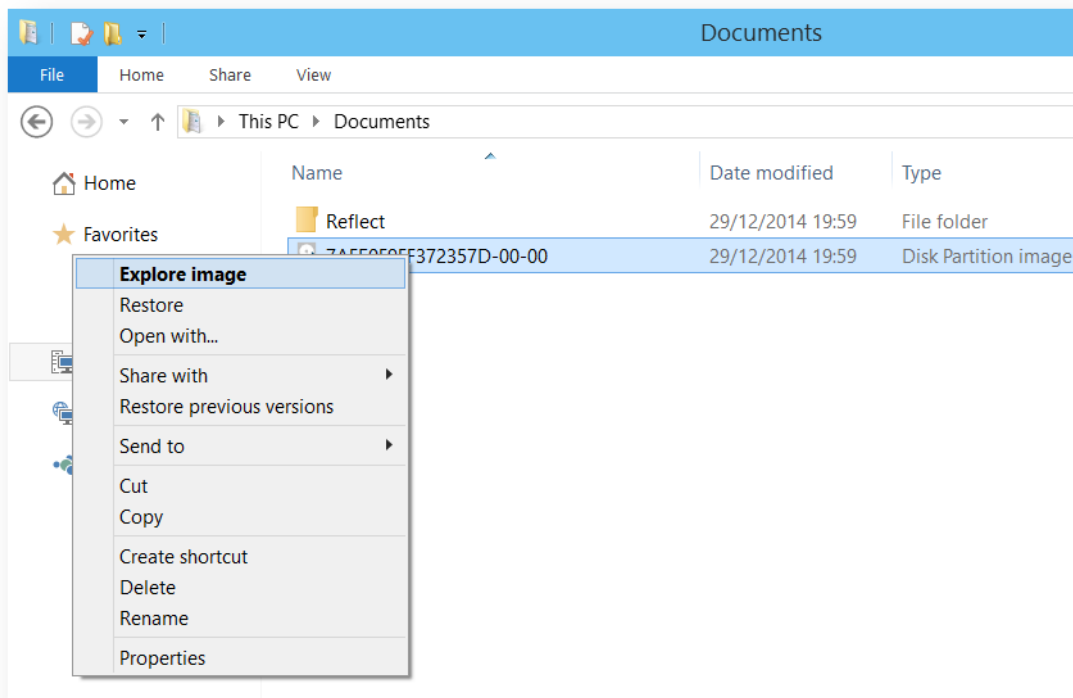
- [Mounting an image in Windows Explorer](#)
- [Using Macrium to mount an image](#)
- [Using Macrium Reflect Command Line Interface \(CLI\) to mount an image](#)
- [Unmounting a temporary mounted drive](#)

See also: [Browsing Linux Ext File System Images](#)

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**.

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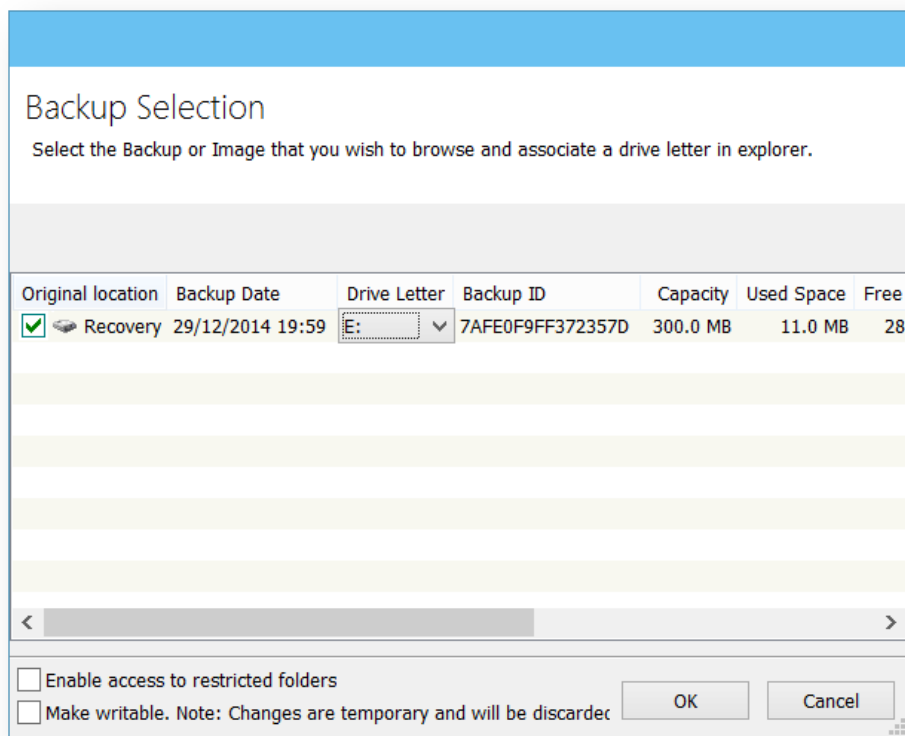


3. Select the partition you wish to mount and Click **OK**.

In this example, the image only contains one partition.

You can also select which **Drive Letter** you would like to be assigned.

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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.

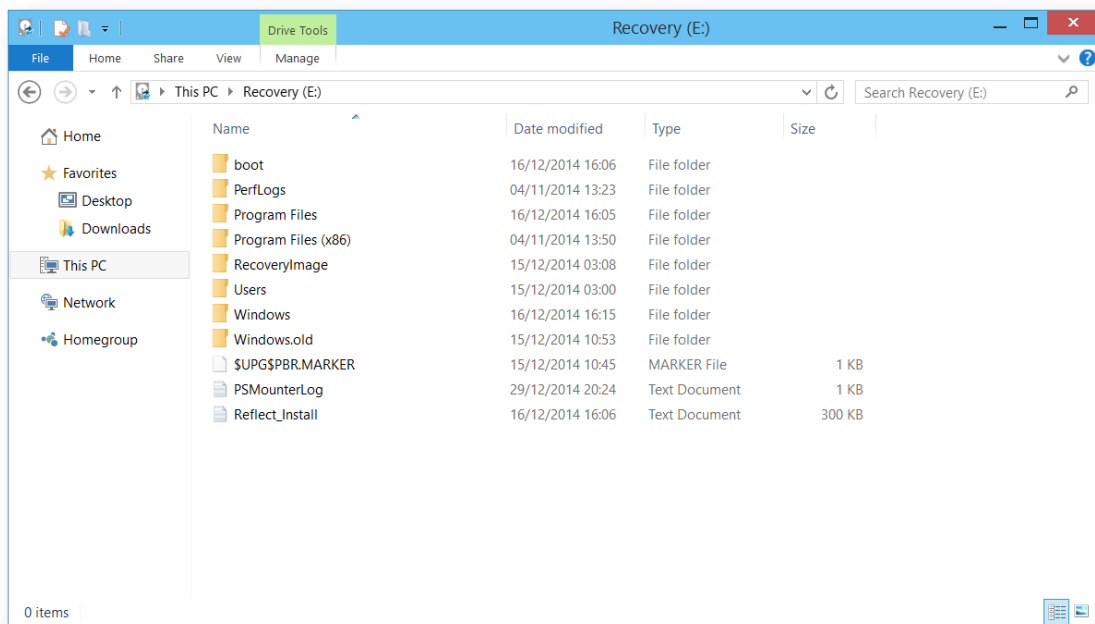
The option **Make writable** makes the mounted file system temporarily writable. This is useful when accessing files in the image where the opening application is required to write to the file. For example, Microsoft Virtual Hard Disk (.vhd) files can be mounted and files in the mounted backup can be recovered without having to restore the .vhd file first.



Note: Changes made to the mounted file system are temporary and are discarded when the image is unmounted.

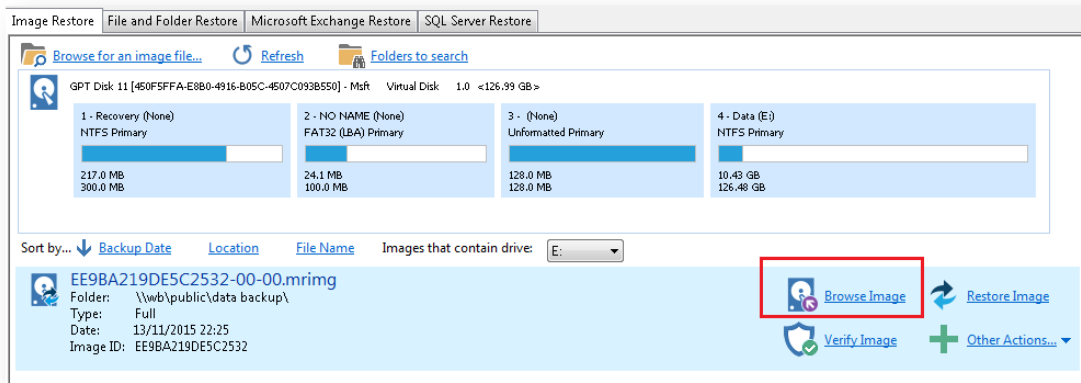
4. You can now navigate through the image in Windows Explorer.

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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:

Macrium Reflect v7.2 User Guide

```
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.  Note: To 'skip' mounting a partition use the Asterisk character instead of a drive letter
-pass	Use for password protected Image files, add password in inverted commas. e.g. -pass "password"

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

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```
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
```

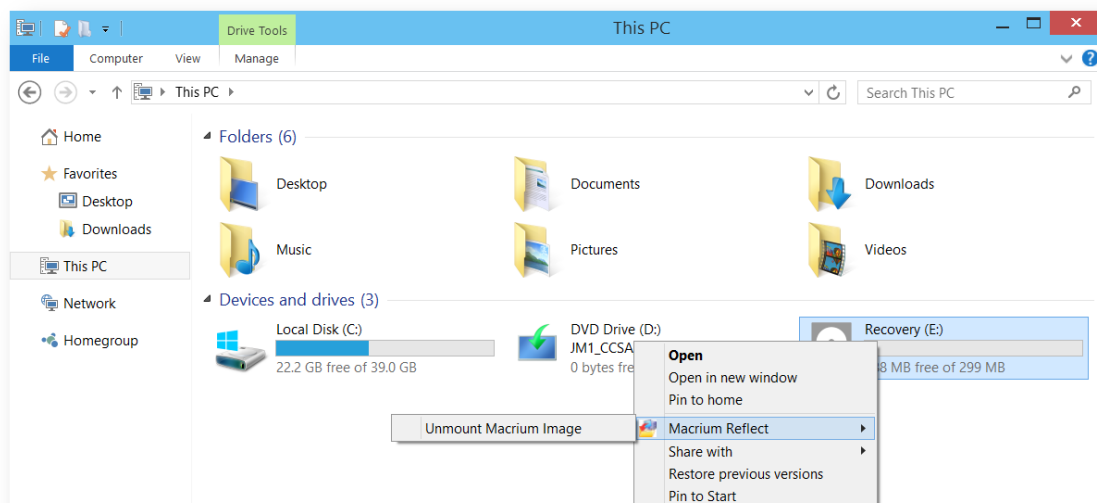
To mount all partitions in a password protected image using drive letters p,q,r where *pwd* is the password,(the password is case sensitive):

```
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:

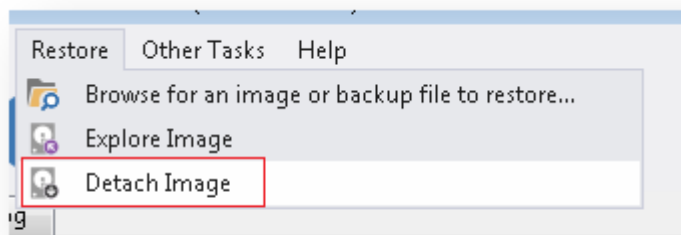
1. To detach a temporary mounted drive using Windows Explorer, right click the drive you wish to unmount.
2. Scroll to **Macrium Reflect**, click **Unmount Macrium Image**.



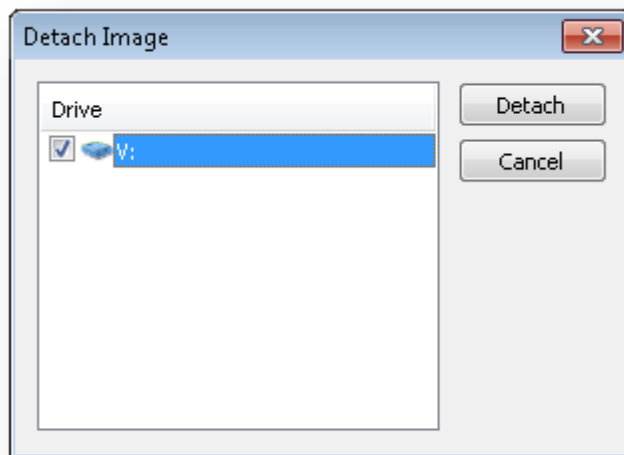
Using Macrium Reflect:

1. In the Macrium Reflect application, select **Restore** in the top menu.
2. Take the '**Restore**' > '**Detach Image**' menu option.

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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:

```
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
```

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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.

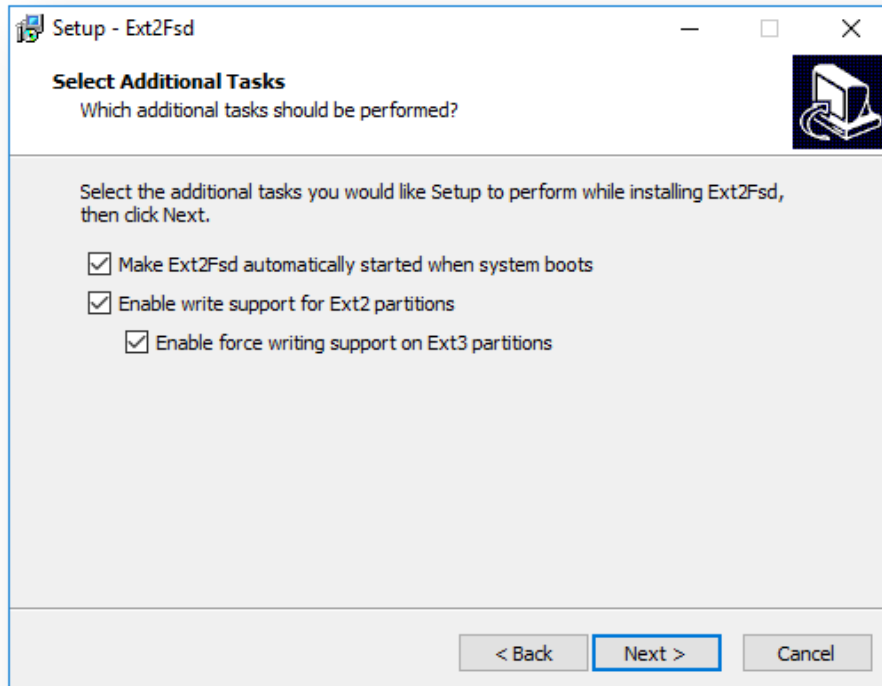
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Browsing Linux Ext File System Images

By default Windows doesn't recognise file systems formatted using Linux ext, however, Images containing Linux ext file systems can be browsed by using a free Windows driver.

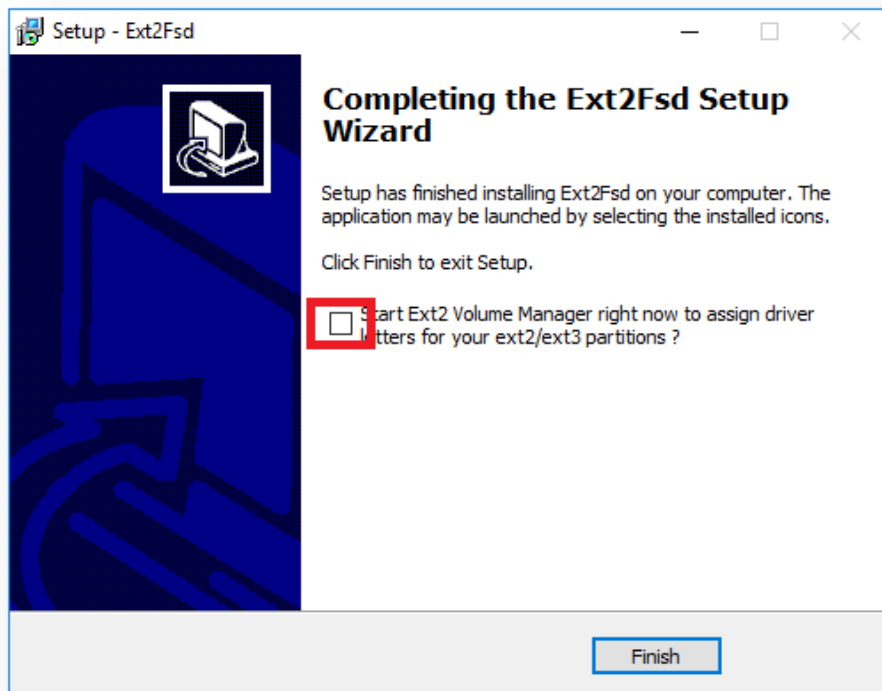
Download **Ext2Fsd** from here: <https://sourceforge.net/projects/ext2fsd/>

Once downloaded, run the installer accepting any defaults.

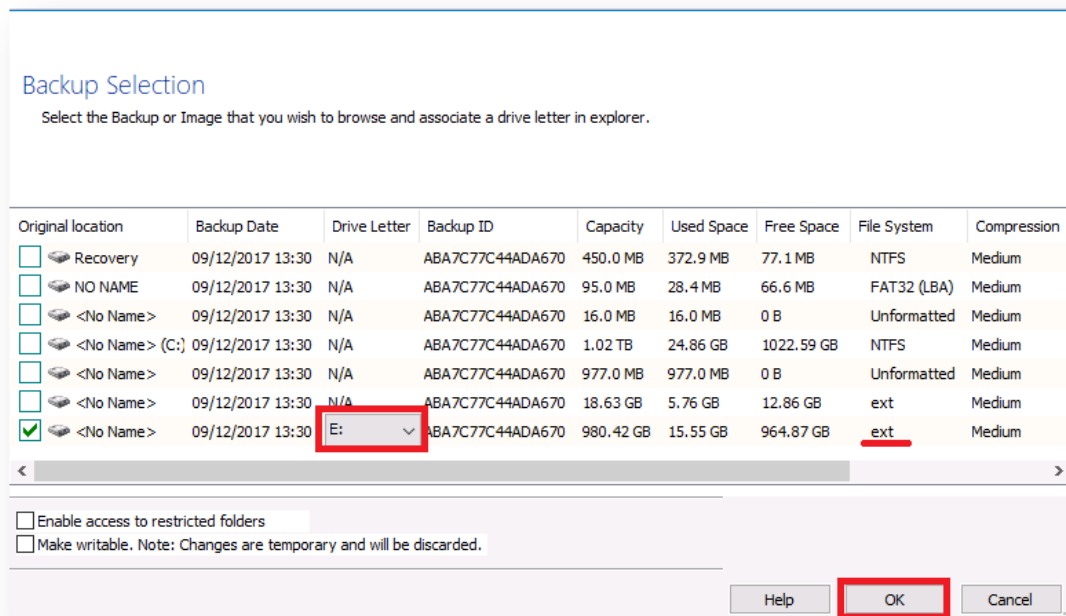


De-select launching the volume manager as this isn't required.

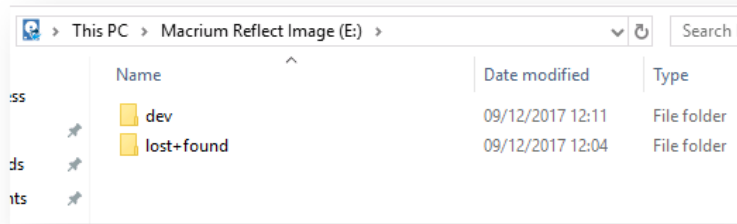
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Linux ext partitions in Macrium Reflect image files can now be mounted and explored.



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See also: [Linux ext file systems can show a larger used and total space in Macrium Reflect](#)

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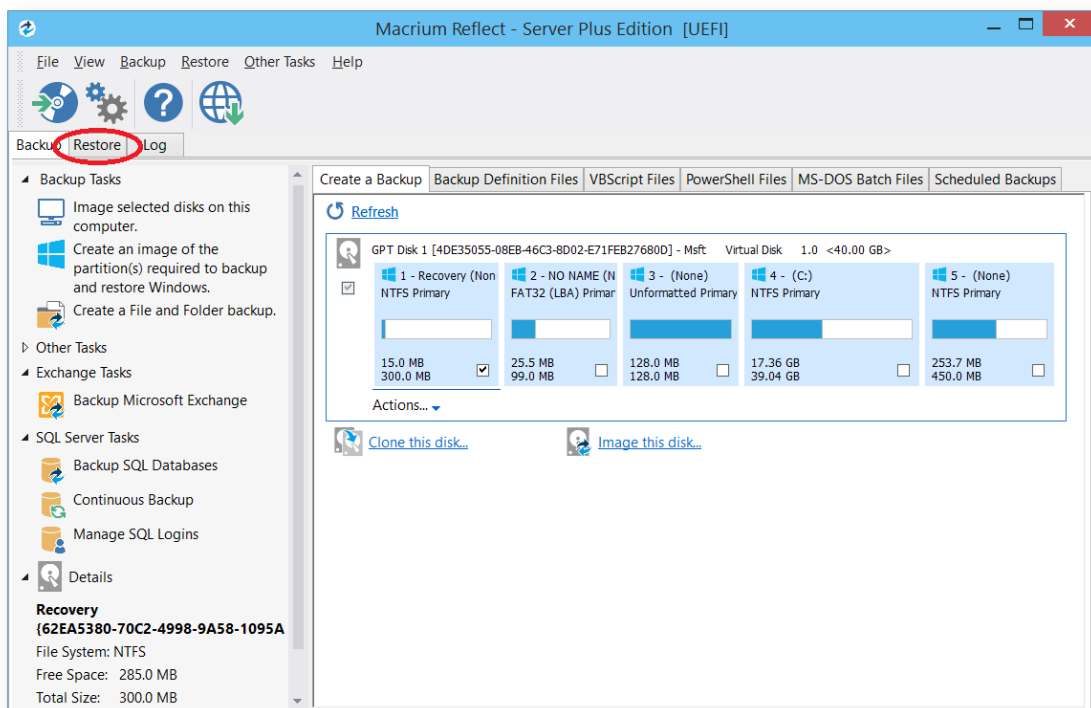
Restoring a file and folder backup

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](#) instead and use Windows Explorer to copy and paste them.



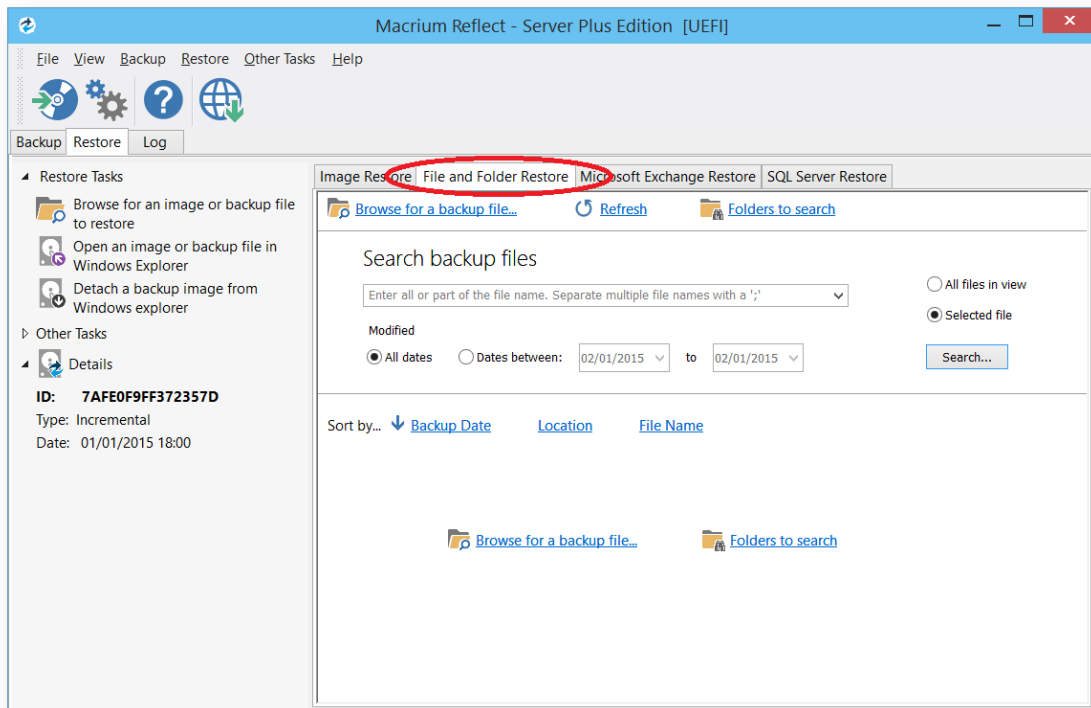
This tutorial is only for **File and Folder backups** and not image backups. For information on restoring image backups see [Restoring a system image](#).

1. Open Macrium Reflect and select the **Restore**.

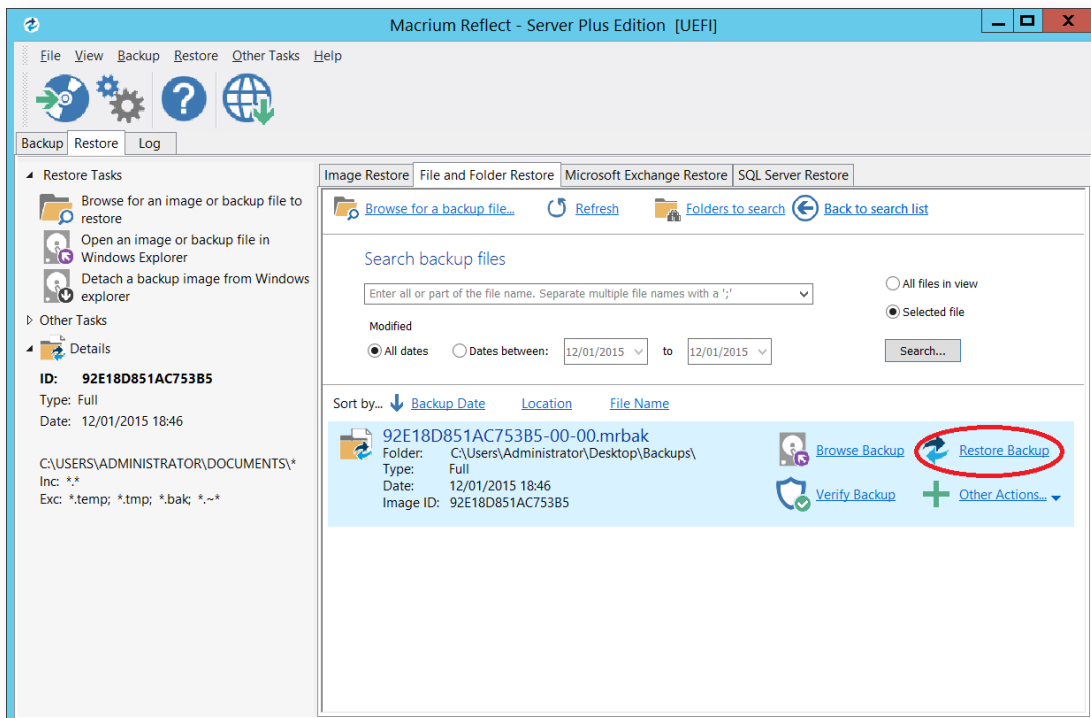


2. Select **File and Folder Restore**.

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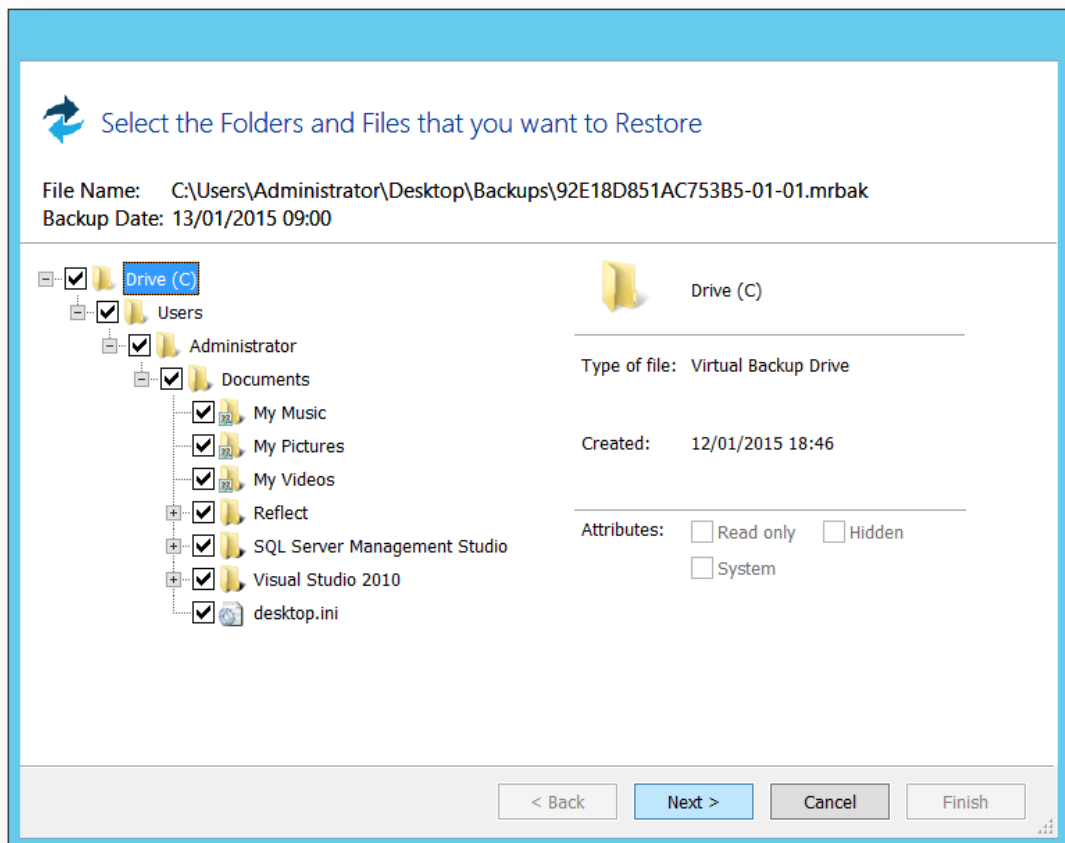


3. Select your backup, if none show select **Browse for a backup file...** and locate the file you want, it is added to the list of backups in the bottom half of the window.



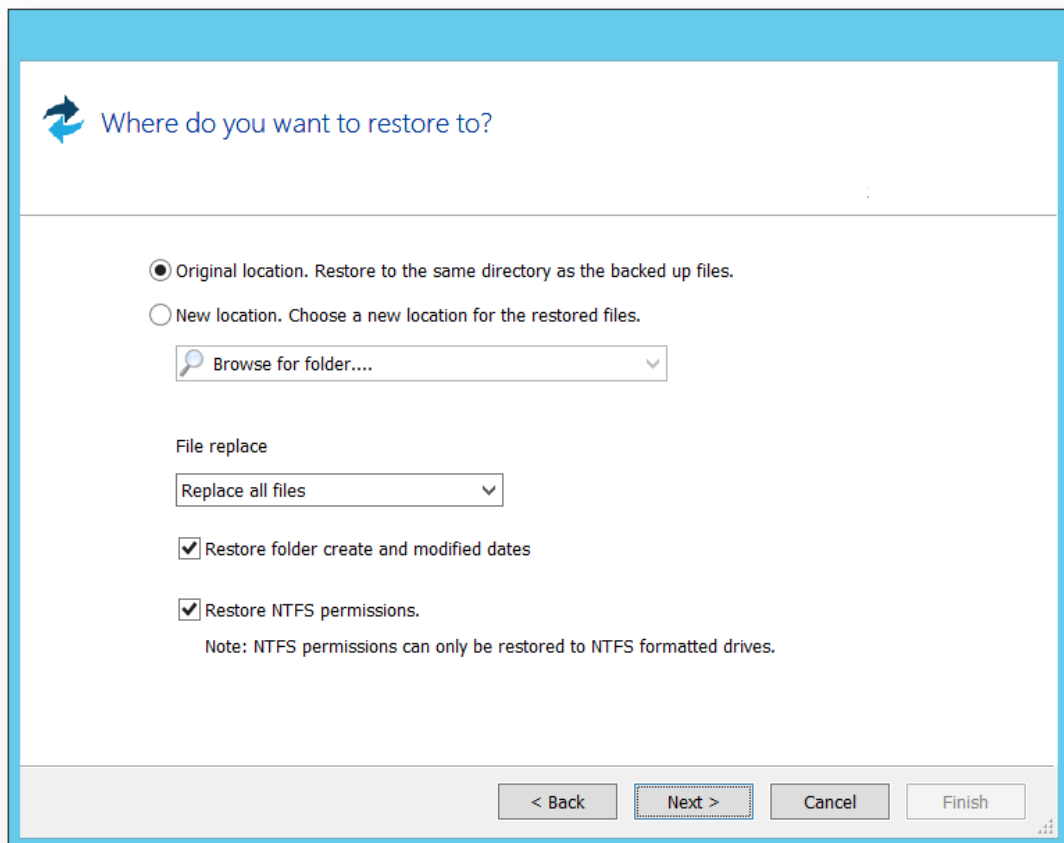
4. Click **Restore Backup**.

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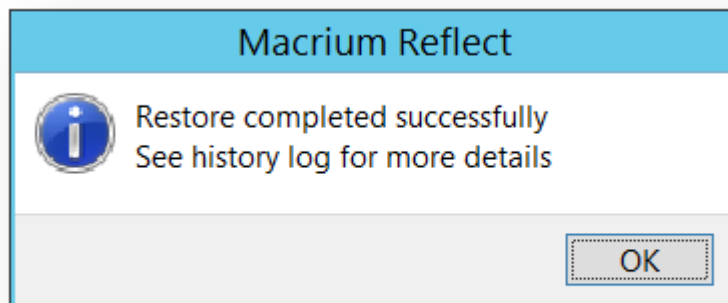


5. Select the files that to be restore. You may restore all the files as shown in this tutorial, or select individual directories and files you wish to restore.

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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**.



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Restoring MS SQL

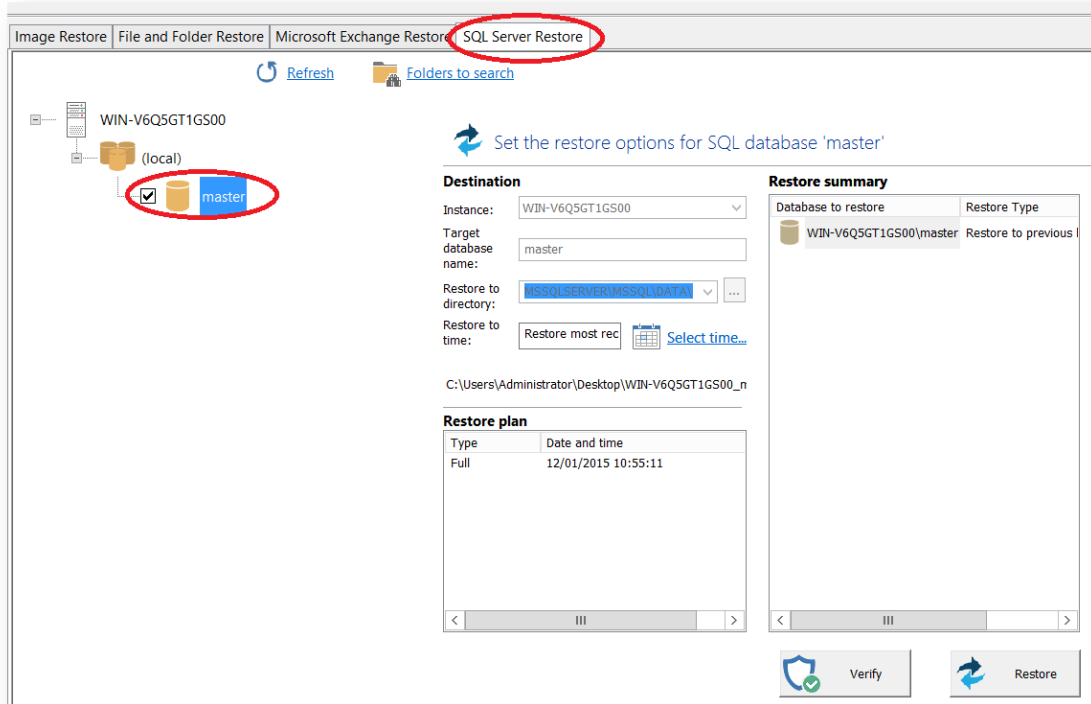
Macrium Reflect Server Plus offers a rich feature set for restoring backups taken of SQL databases.

- Restoring MS SQL to time of backup
- Restoring MS SQL to a point-in-time
- Restoring MS SQL to a different instance, folder or database name

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.

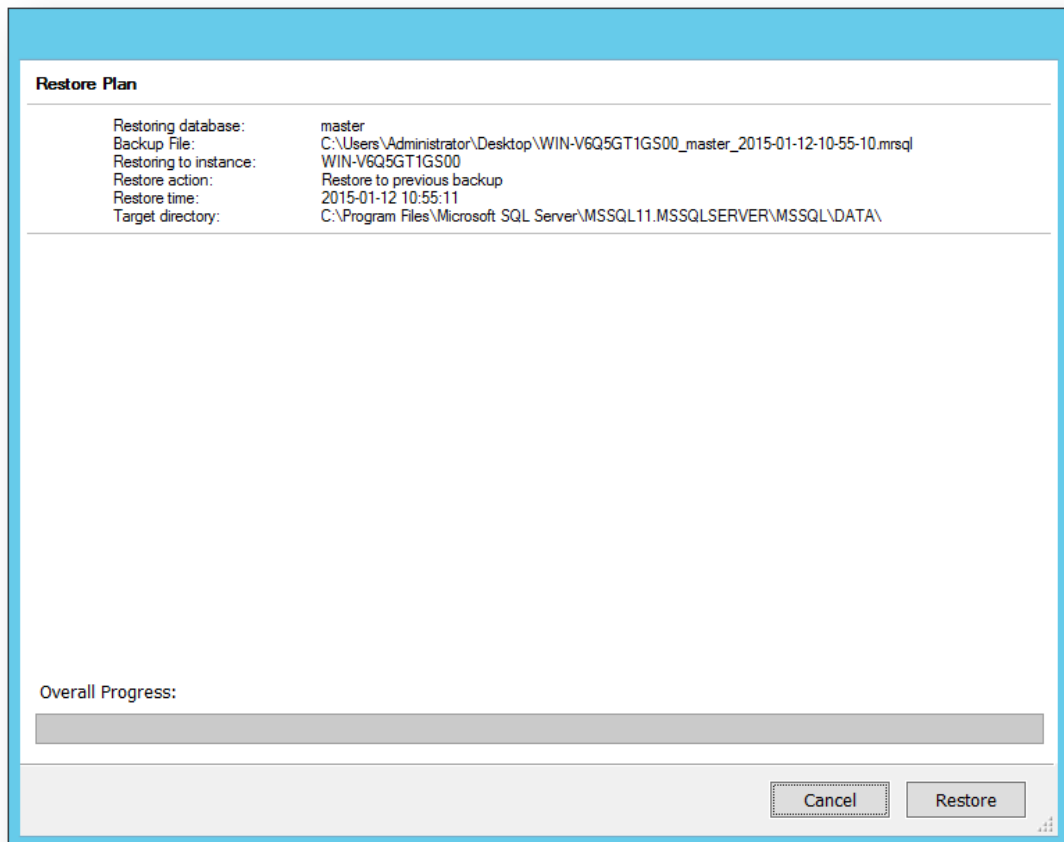
The middle of the screen shows controls for choosing the destination instance, database name and directory that contains the MDF and LDF files. The controls automatically default to the instance, database name and directory of the original backup. The latest backup is selected.

3. If you wish to restore to a different backup click **Select time...** and select the backup you wish to restore to.

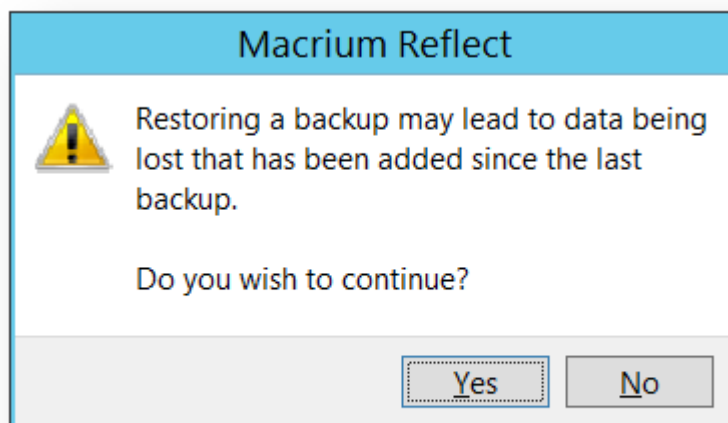
4. When you are happy with the selection, click **Restore**.

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5. Review the summary and click **Restore**.

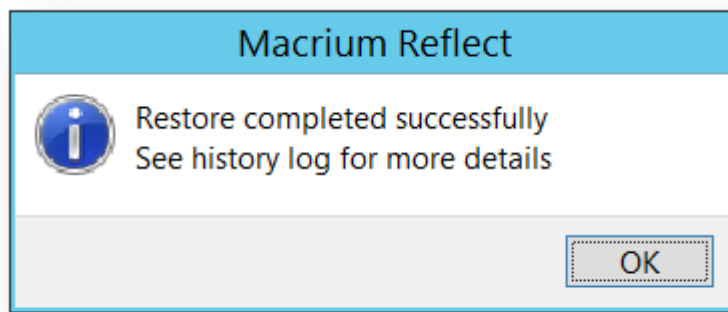


6. A warning box appears, if appropriate click **Yes** to continue with the restore.



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.

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Select restore time

Select the time you wish to restore to

☒ Restore to time of backup

☐ Restore to Current Time

☐ Restore to a specific date and time

Time: 12 Jan 2015 15:58:06 Now

Backup file: C:\Users\Administrator\Desktop\WIN-V6Q5GT1GS00_master_2015-01-12-15-58-05.mrsq

Backup date	Backup type
Mon 12/01/2015 15:58:06	Full
Mon 12/01/2015 10:55:11	Full

OK Cancel

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.

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.

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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

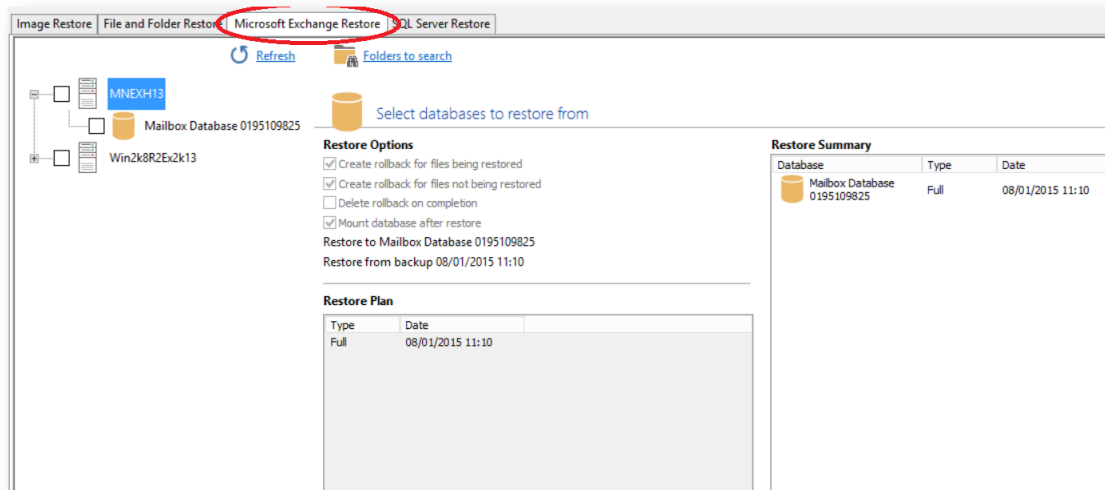
Macrium Reflect Server Plus can restore select databases back to your Microsoft Exchange Server providing the following restore scenarios:

- Restoring MS Exchange databases to time of backup
- Restoring MS Exchange databases to point in time
- Restoring MS Exchange databases to a different name or location

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.

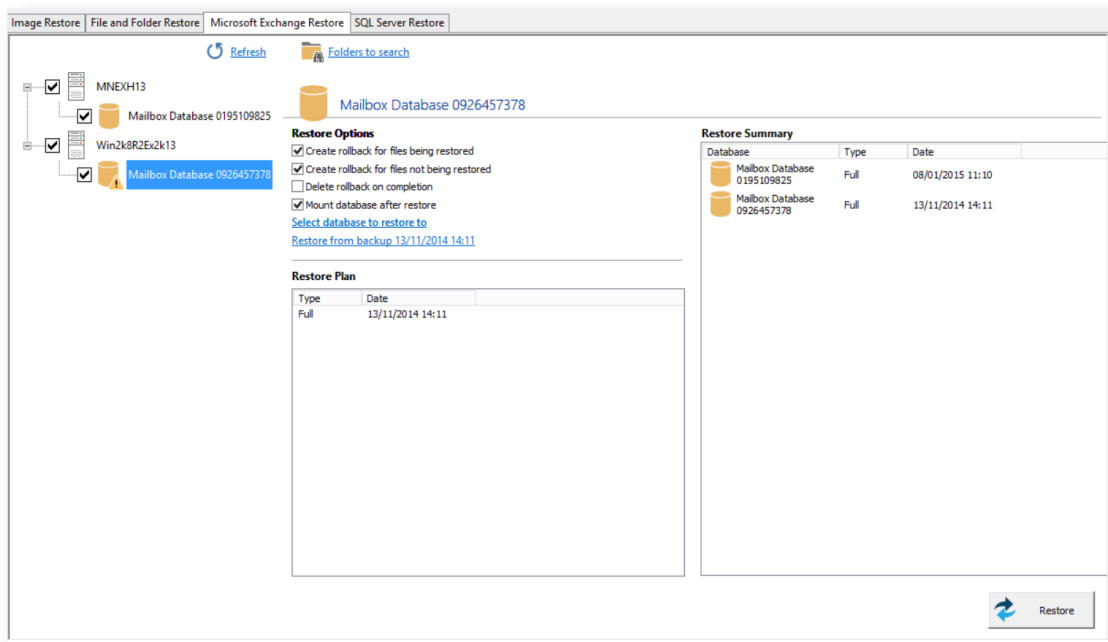


2. Select each database to restore. By default the most recent backup is selected.

Restore Plan shows the backup files selected.

Restore Summary lists all databases restoring and the date/time of the backup file to restore from.

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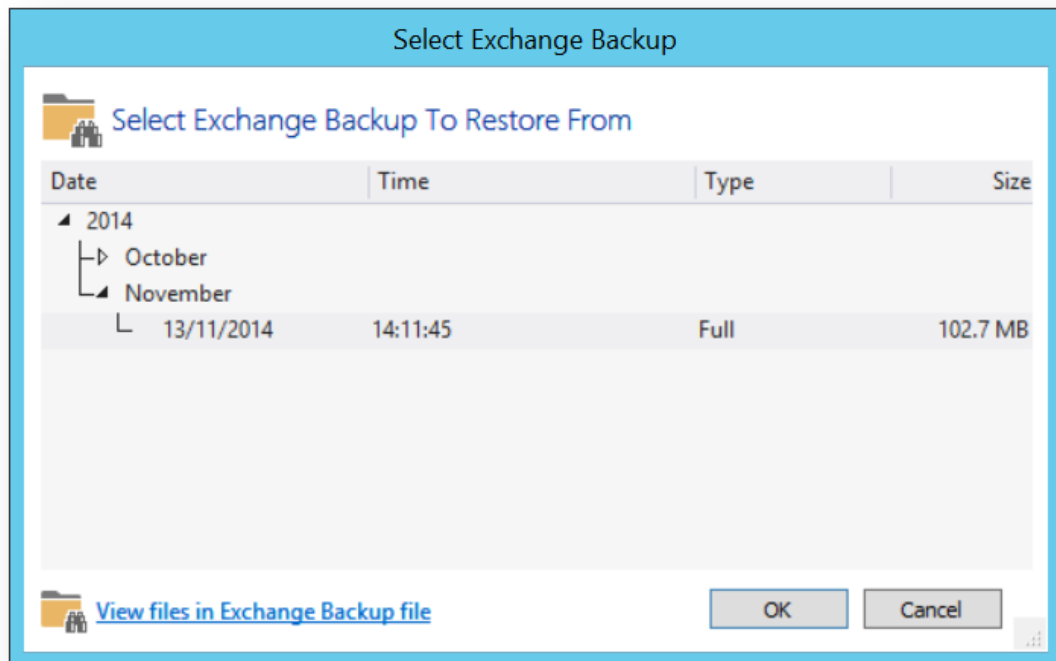
3. Click **Restore** to restore selected databases back to their original volume locations and database names.
4. Review the information and click **Restore**.

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.

1. Select the databases to restore.
2. For each database restoring, select **Restore from backup**.

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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.

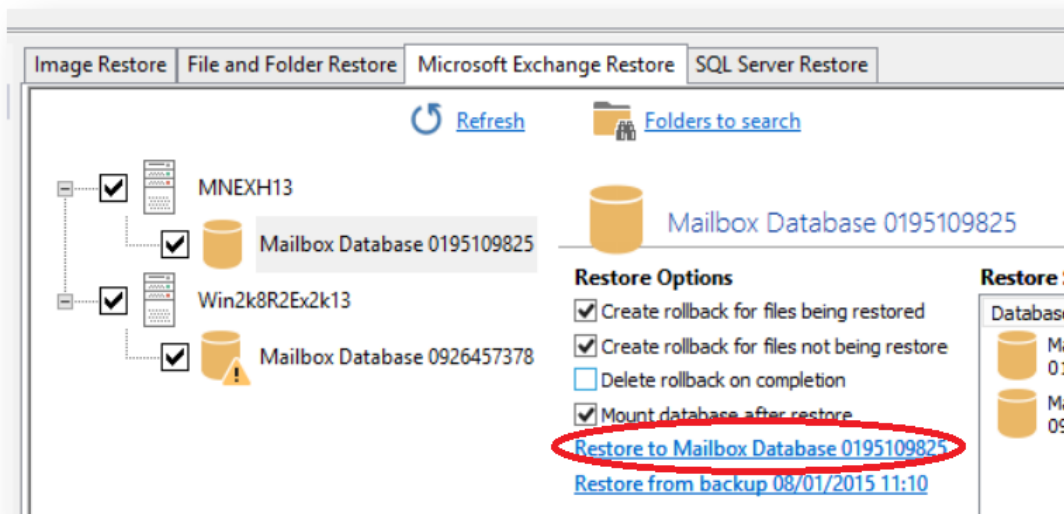
7. Review the information and click **Restore**.

Restoring MS Exchange databases to a different name or location

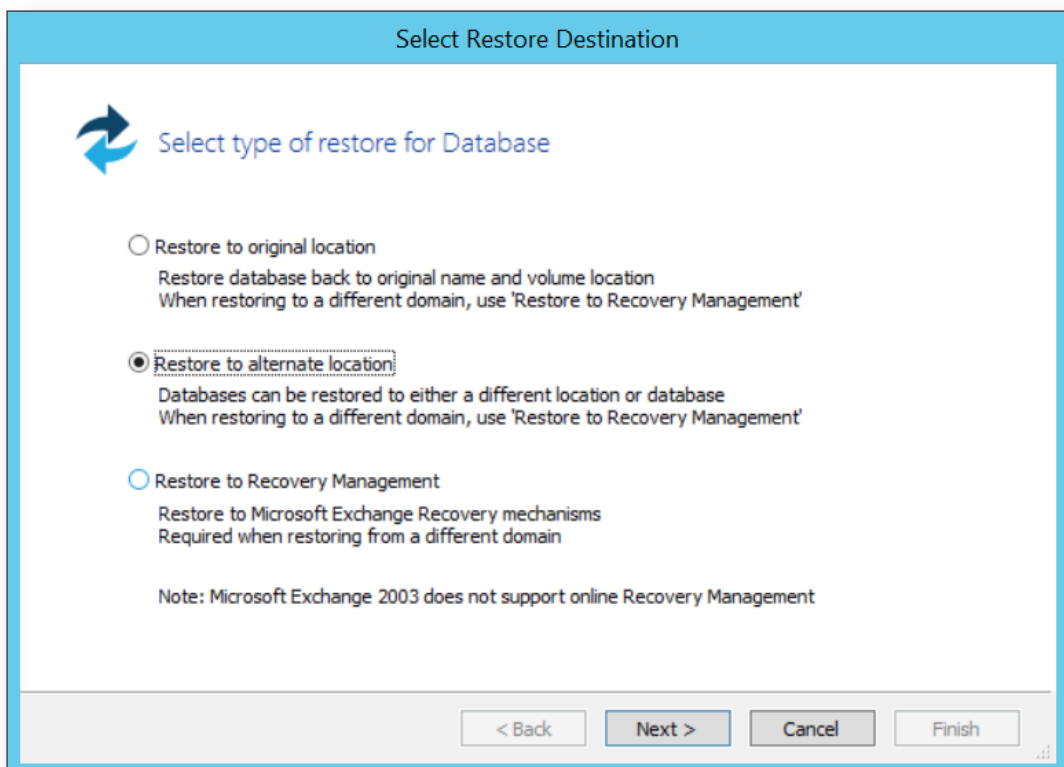
Macrium Reflect Server Plus allows you to restore databases to different names and locations with support for storage group and database creation.

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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Select Restore Destination

Select where to Restore

New database settings

Name: Exchange_restore

Path: C:\Users\administrator.MACRIUMNET\Desktop\exchange2013

Log file path: C:\Users\administrator.MACRIUMNET\Desktop\exchange2013

< Back Next > Cancel Finish

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.

- Click **Next**.
- 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:

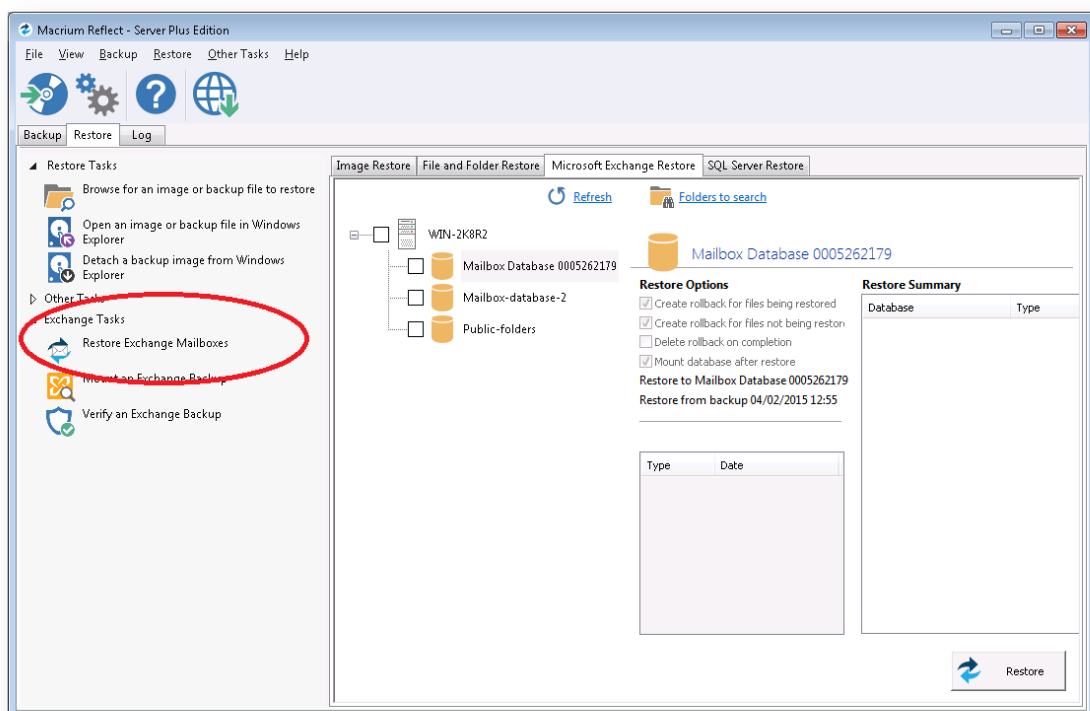
<http://www.microsoft.com/en-us/download/details.aspx?id=42040>

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.

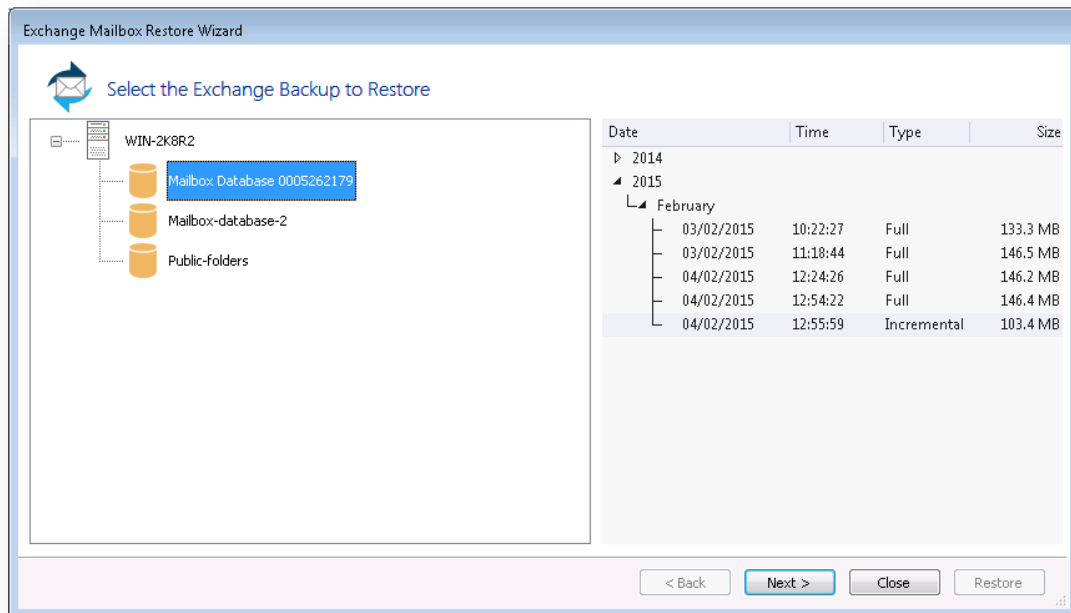
1. In **Restore**, select **Microsoft Exchange Restore**.
2. Select **Restore Exchange Mailboxes**.



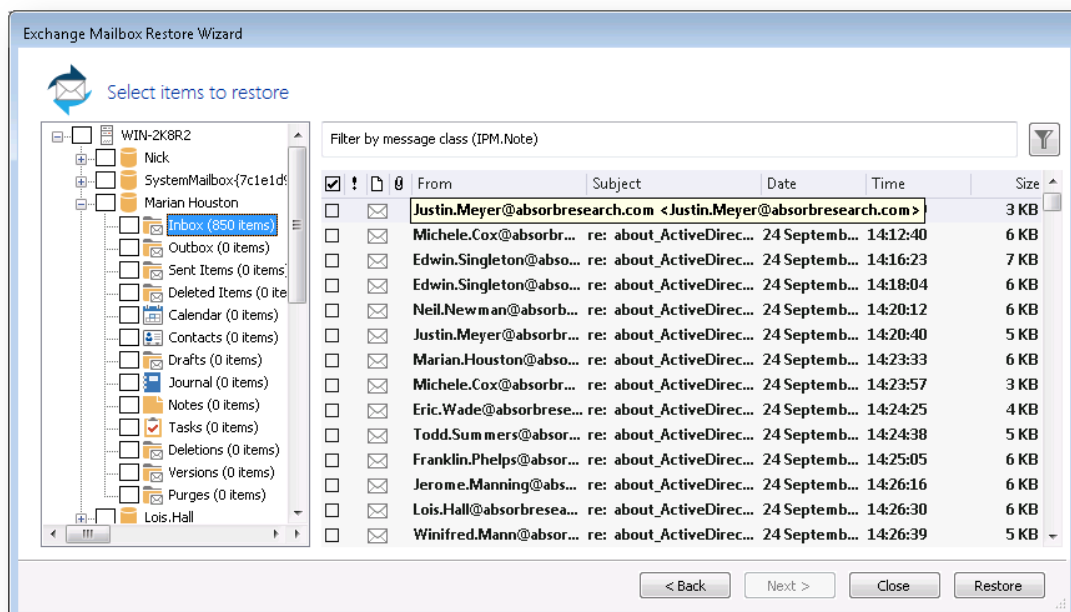
The **Exchange Mailbox Restore Wizard** appears.

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3. Select the required message store / database to restore from and click **Next**.

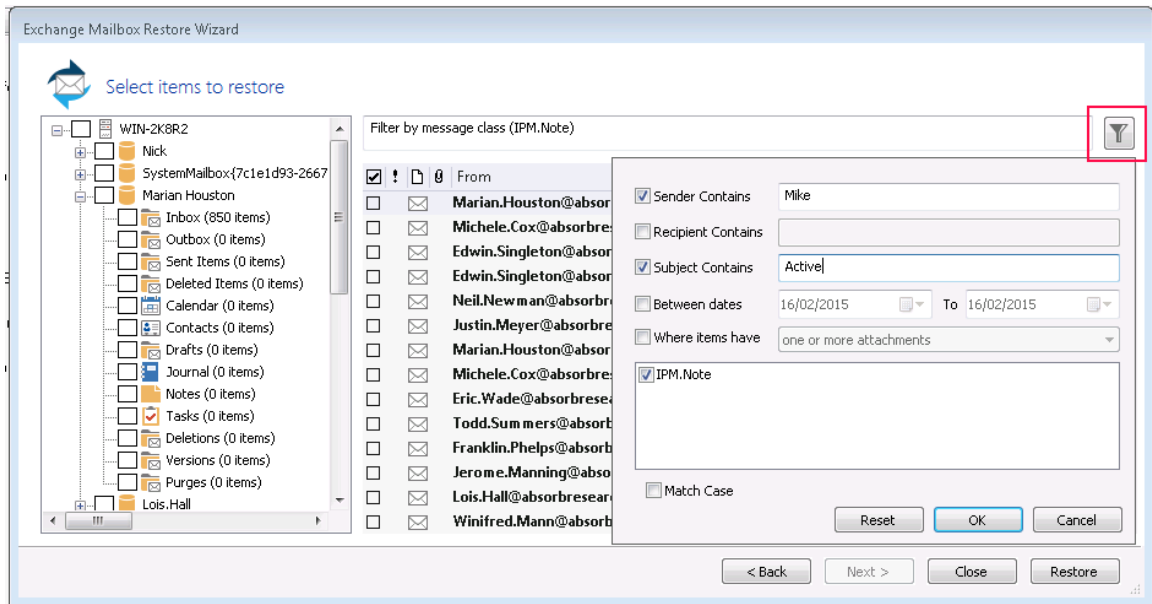


4. Select required folder, or click appropriate folder to select required individual email to restore.



5. Click the filter button to filter the email list by **Sender**, **Recipient**, **Subject**, **Between dates**, or whether there are **attachments**.

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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:

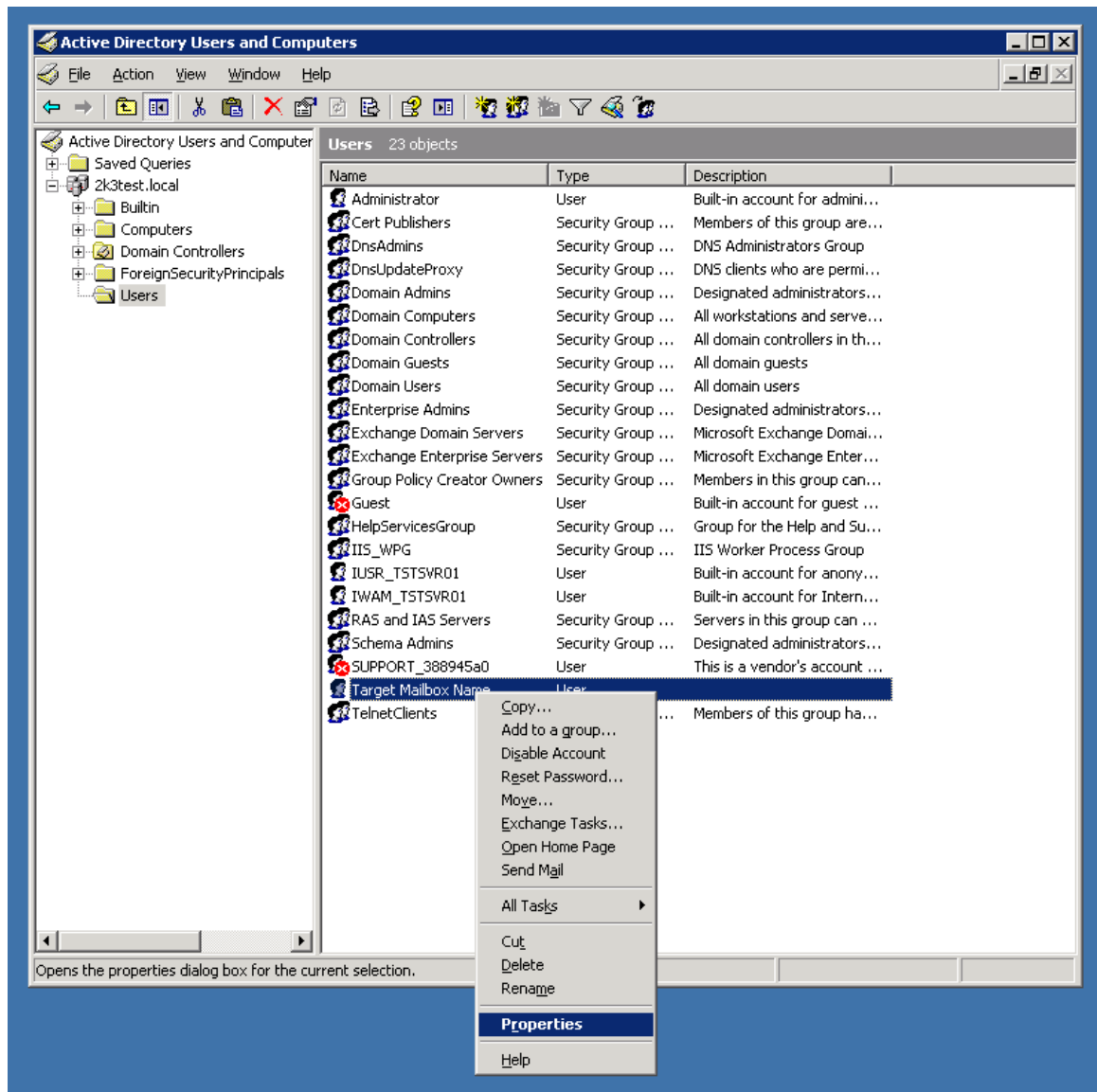
```
Add-MailboxPermission -user USERNAME -AccessRights FullAccess -  
InheritanceType All MAILBOX  
Add-ADPermission -user USERNAME -ExtendedRights Send-As MAILBOX  
Add-ADPermission -user USERNAME -ExtendedRights Receive-As MAILBOX
```

substituting USERNAME and MAILBOX with your own username and the name of the user of the target mailbox.

MS Exchange 2003

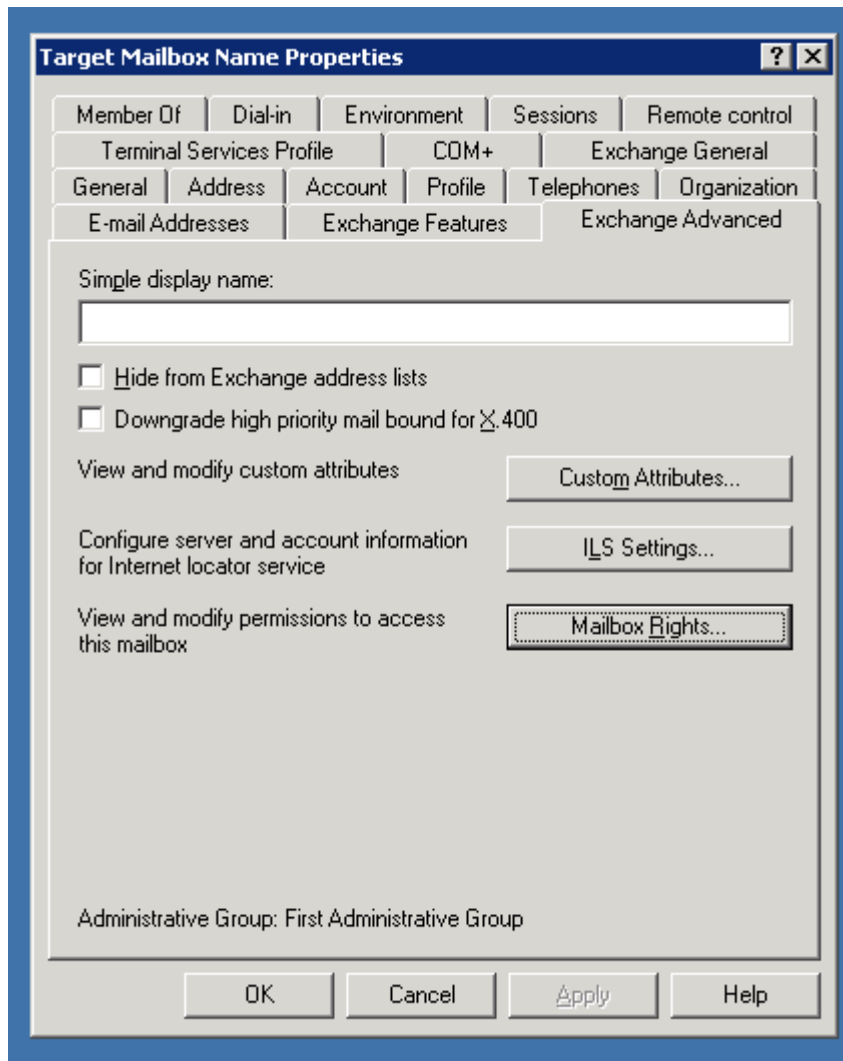
1. Click Start > Administrative Tools > Active Directory Users and Computers.
2. Under **Users**, right click on the user whose mailbox you wish to restore to, and click **Properties**.

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3. In **Exchange Advanced**, click **Mailbox Rights**.

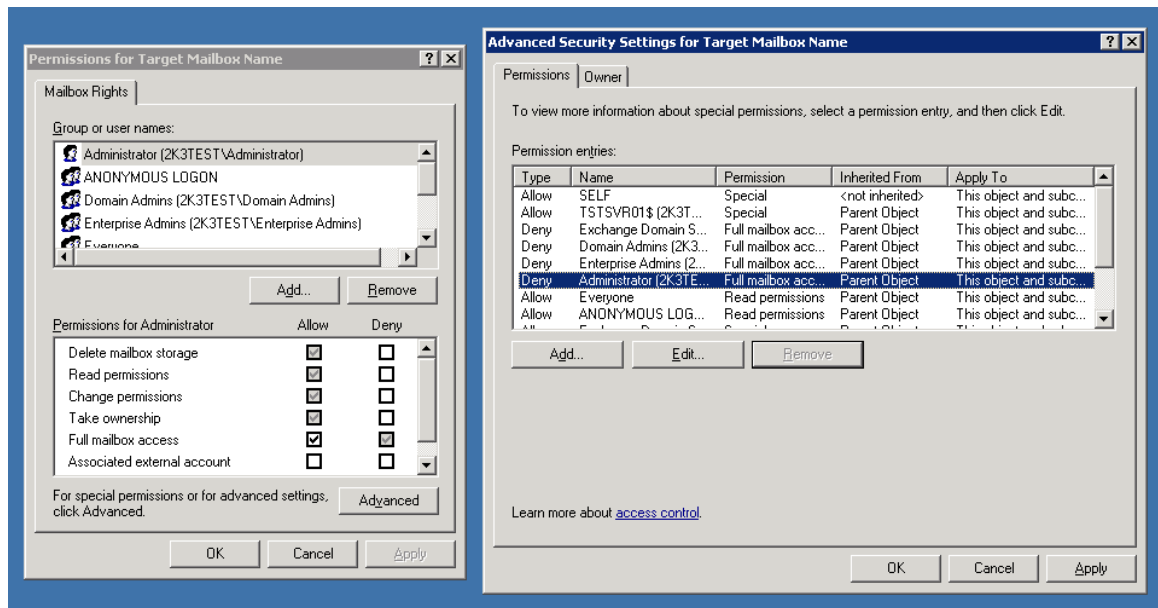
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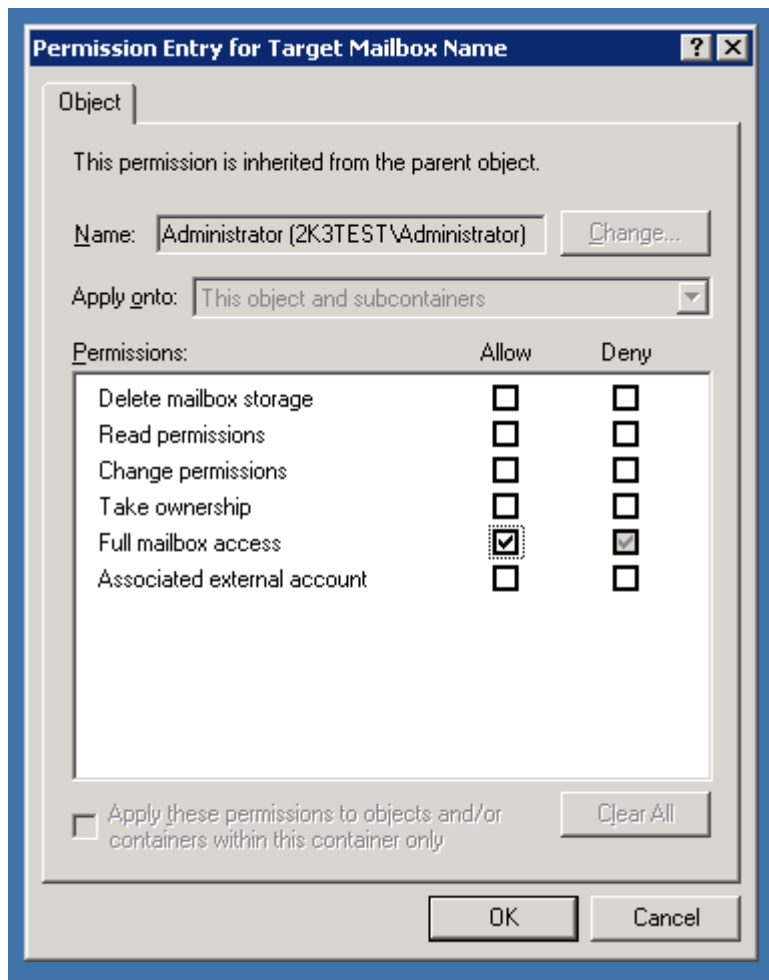
4. In the Permissions dialog, click **Advanced**, select your user name in the list, and click **Edit**.

If your user name does not appear on the list, then click **Add**, use the dialog to select your user name, then click **OK**.

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5. Check **Full mailbox access - Allow** , and click OK.



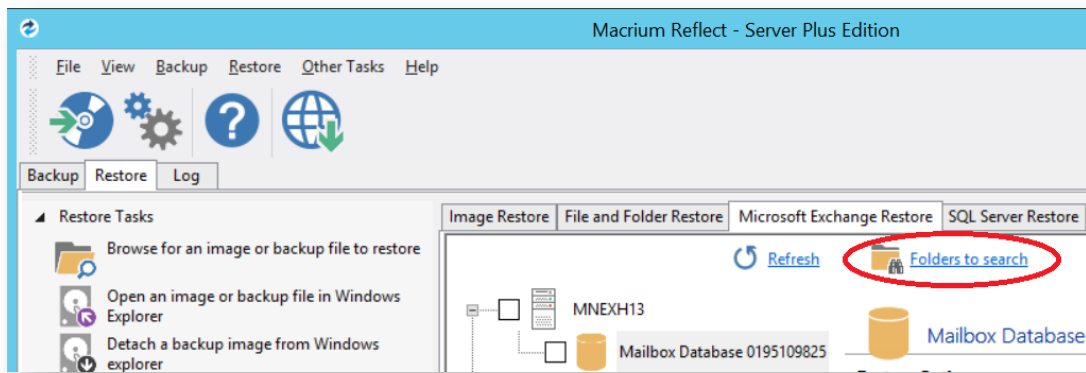
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Adding MS Exchange search folders

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.

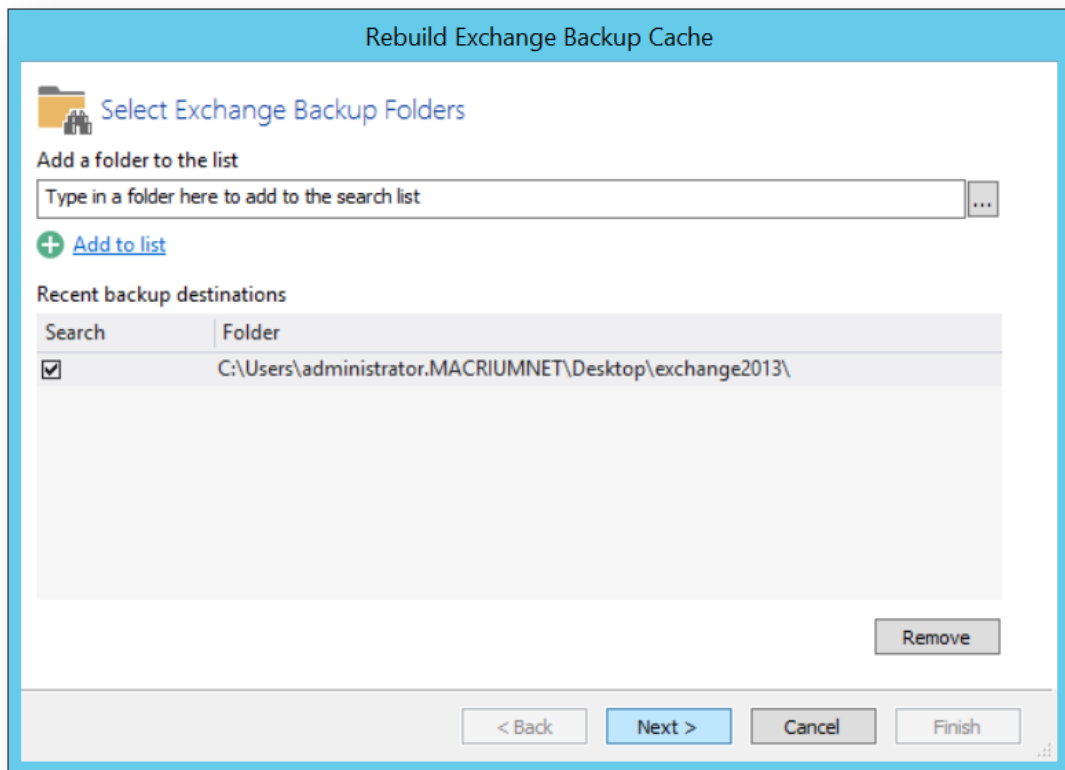
Note: Macrium Reflect Server Plus can discover backups of Microsoft Exchange made on different servers by using the following steps but only detects backups made from the same version of Microsoft Exchange. When restoring databases from a different server you must restore databases to Microsoft Exchange recovery mechanisms before migrating mailboxes using Microsoft Exchange.

1. Select **Folders To Search** at the top of the Microsoft Exchange Restore tab.



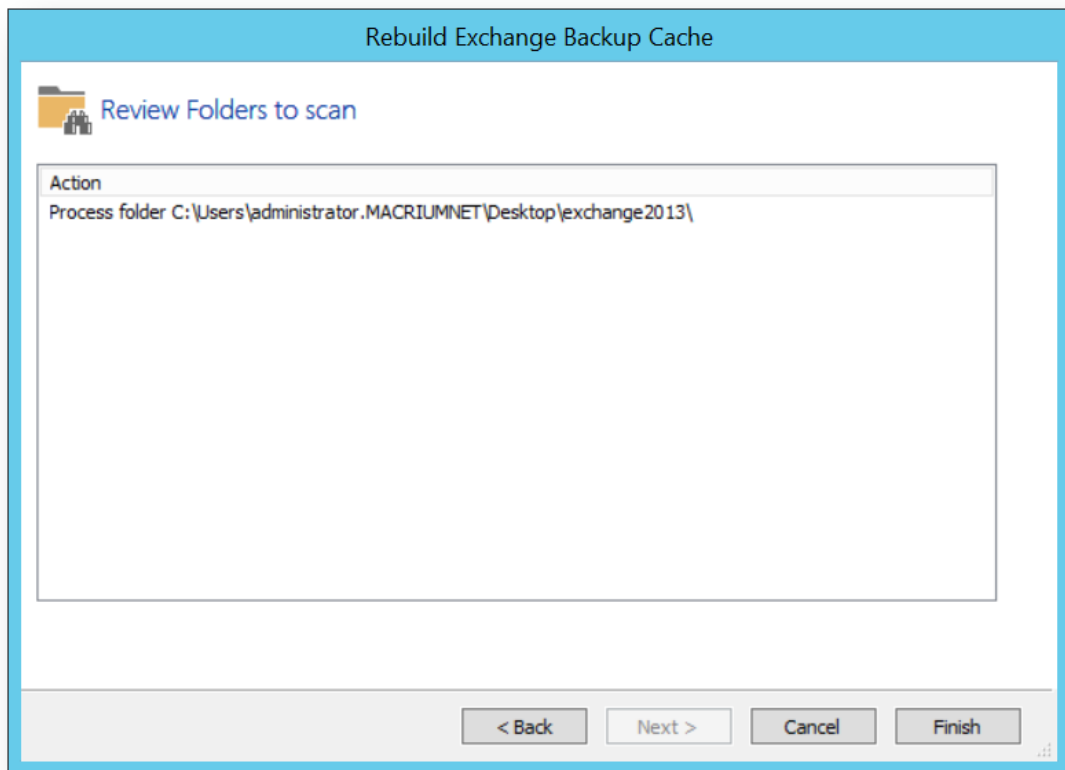
The **Rebuild Exchange Backup Cache** wizard displays.

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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**.

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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 and later is dual boot, meaning it boots 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
```

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```
Administrator: X:\Windows\System32\cmd.exe - diskpart
Microsoft Windows [Version 6.1.7601]

X:\windows\system32>diskpart

Microsoft DiskPart version 6.1.7601
Copyright (C) 1999-2008 Microsoft Corporation.
On computer: MININT-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.

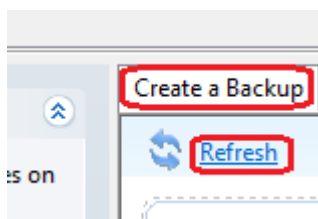
DISKPART> create partition efi size=200
DiskPart succeeded in creating the specified partition.

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.

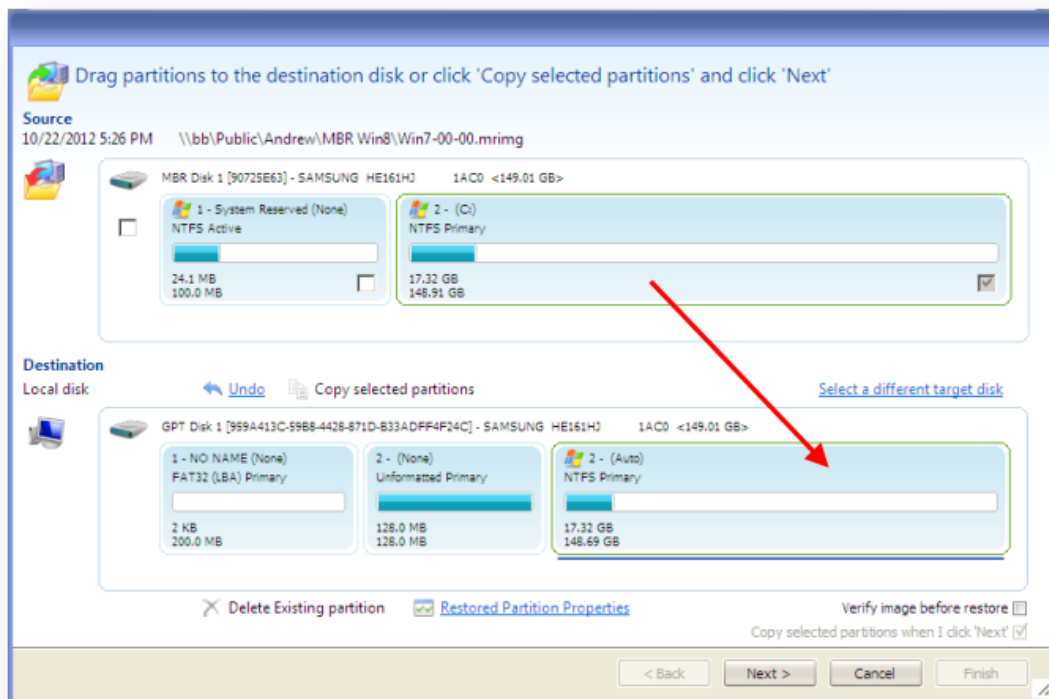
DISKPART>
```

12. In Macrium Reflect, click **Backup** tab.
13. Click **Refresh** to read the newly initialized disk.



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.

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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](#)



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:

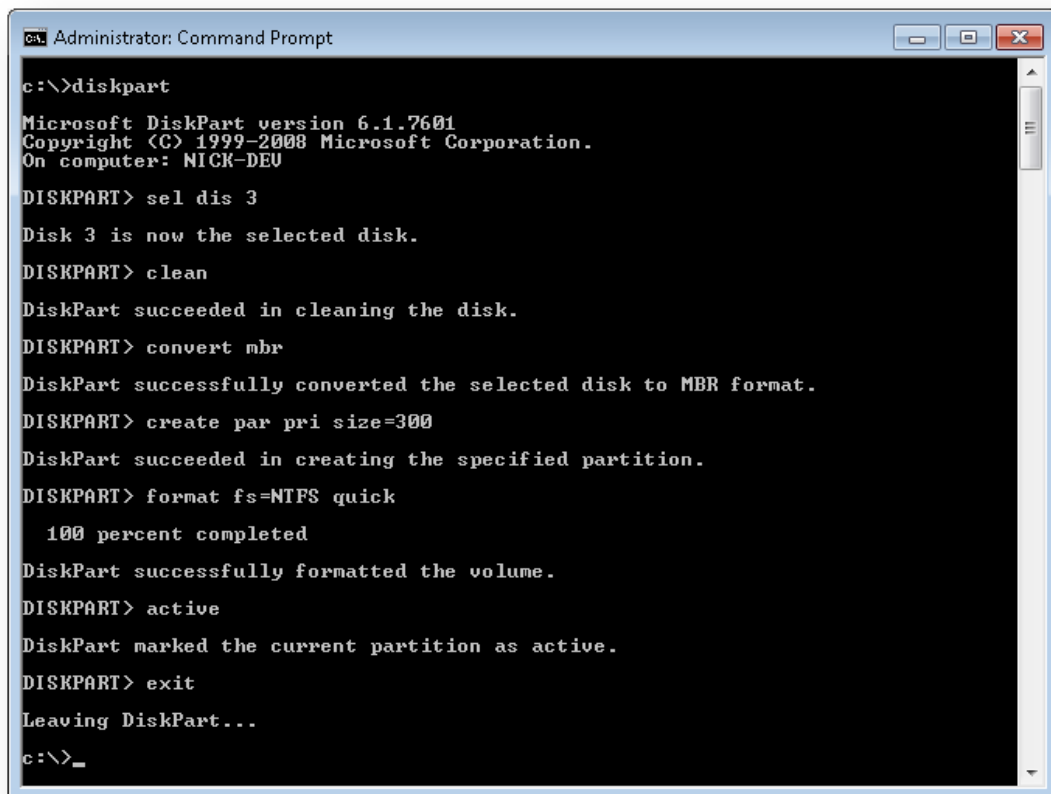
```
format fs=NTFS quick
```

10. Set the partition 'Active'

```
active
```

11. Exit Diskpart:

```
exit
```



```
Administrator: Command Prompt

c:\>diskpart

Microsoft DiskPart version 6.1.7601
Copyright (C) 1999-2008 Microsoft Corporation.
On computer: NICK-DEU

DISKPART> sel dis 3
Disk 3 is now the selected disk.

DISKPART> clean
DiskPart succeeded in cleaning the disk.

DISKPART> convert mbr
DiskPart successfully converted the selected disk to MBR format.

DISKPART> create par pri size=300
DiskPart succeeded in creating the specified partition.

DISKPART> format fs=NTFS quick
    100 percent completed
DiskPart successfully formatted the volume.

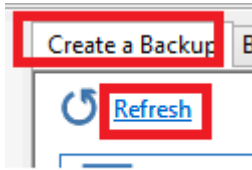
DISKPART> active
DiskPart marked the current partition as active.

DISKPART> exit
Leaving DiskPart...

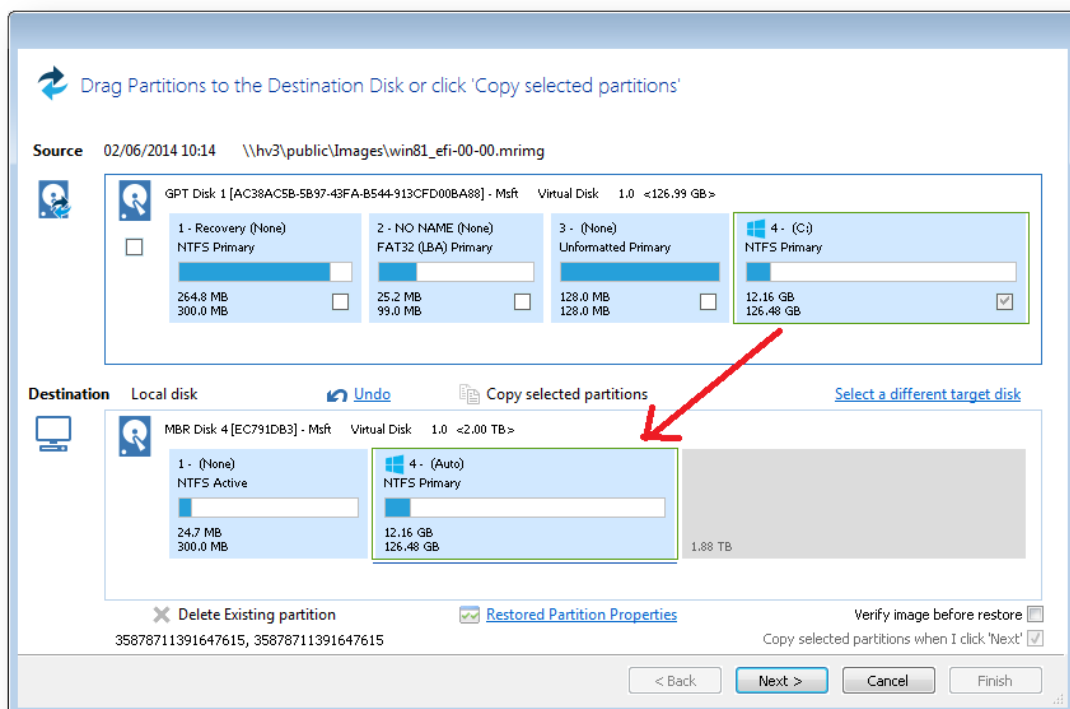
c:\>_
```

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12. In Macrium Reflect, click **Backup tab**.
13. Click **Refresh** to read the newly initialized disk.



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](#)



Note: You should select the newly created 300MB partition as the 'Active' partition when running 'Fix Boot Problems'

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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.

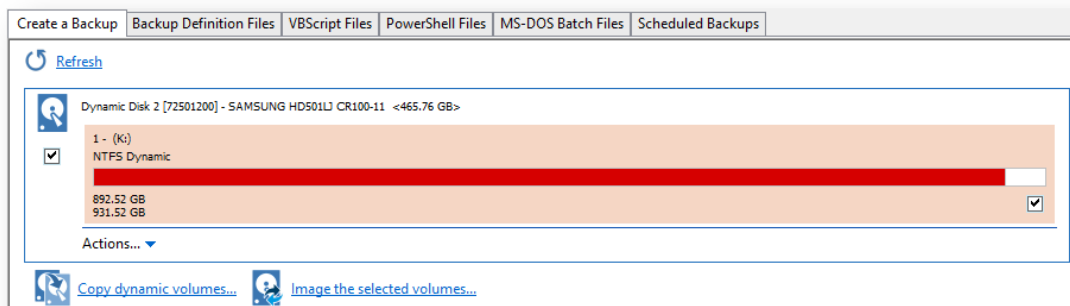
As dynamic volumes support many more than the 4 primary partitions of an MBR partitioning scheme but can still be booted (in mirrored or simple configurations), they are occasionally used for single disk configurations.

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).

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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](#), 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
```



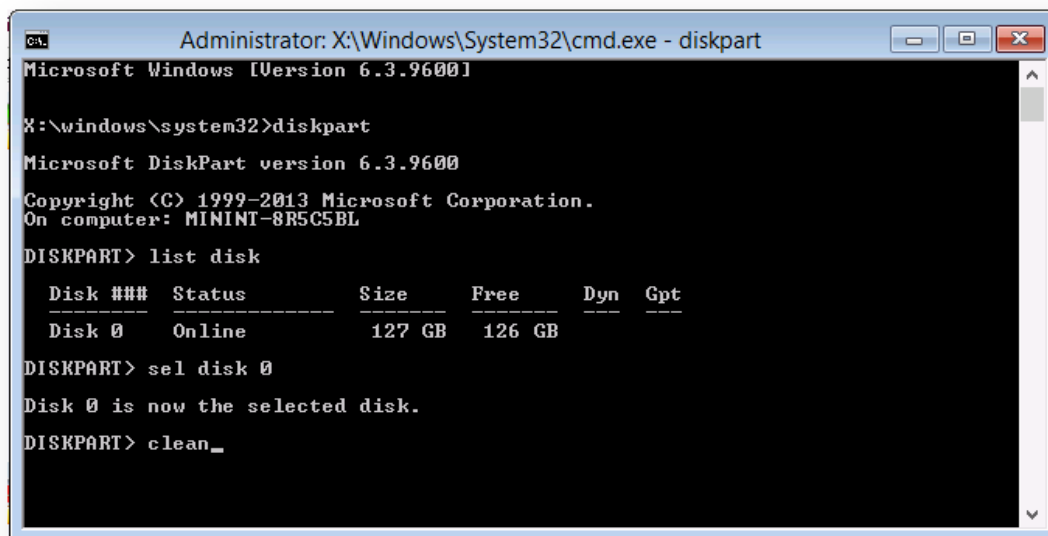
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Note: The clean command will reinitialize your disk. Any data will be lost. Please ensure that you select the correct disk!

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-8R5C5BL  
  
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.

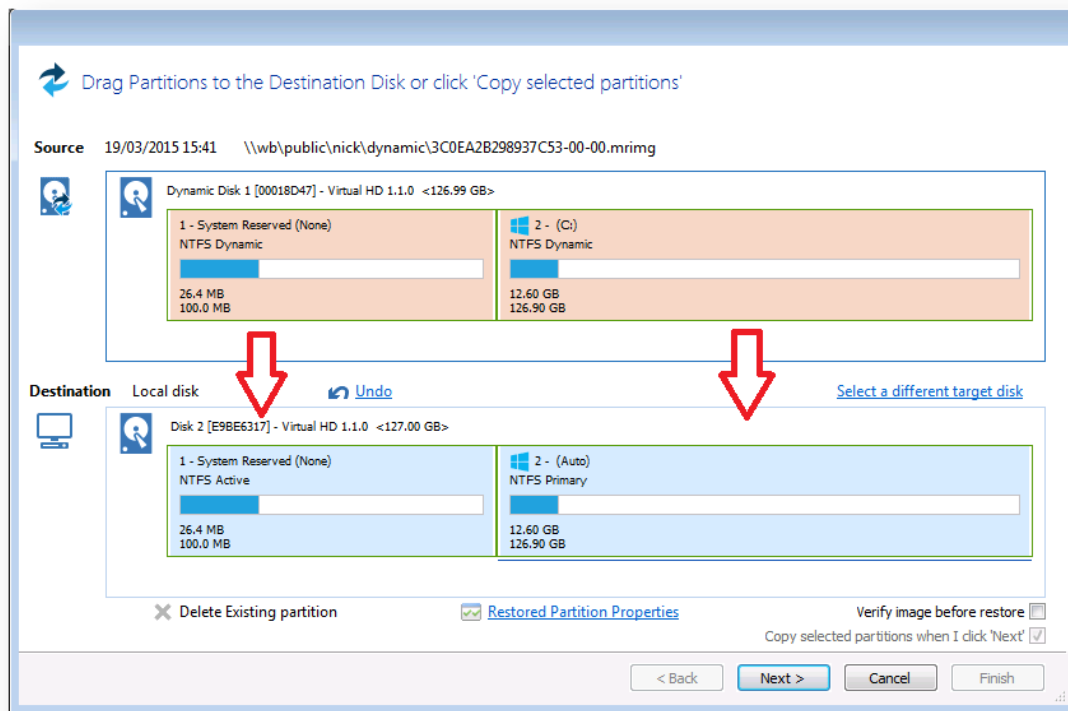


You should now be able to drag / drop up to 4 partitions from your image to your target disk.



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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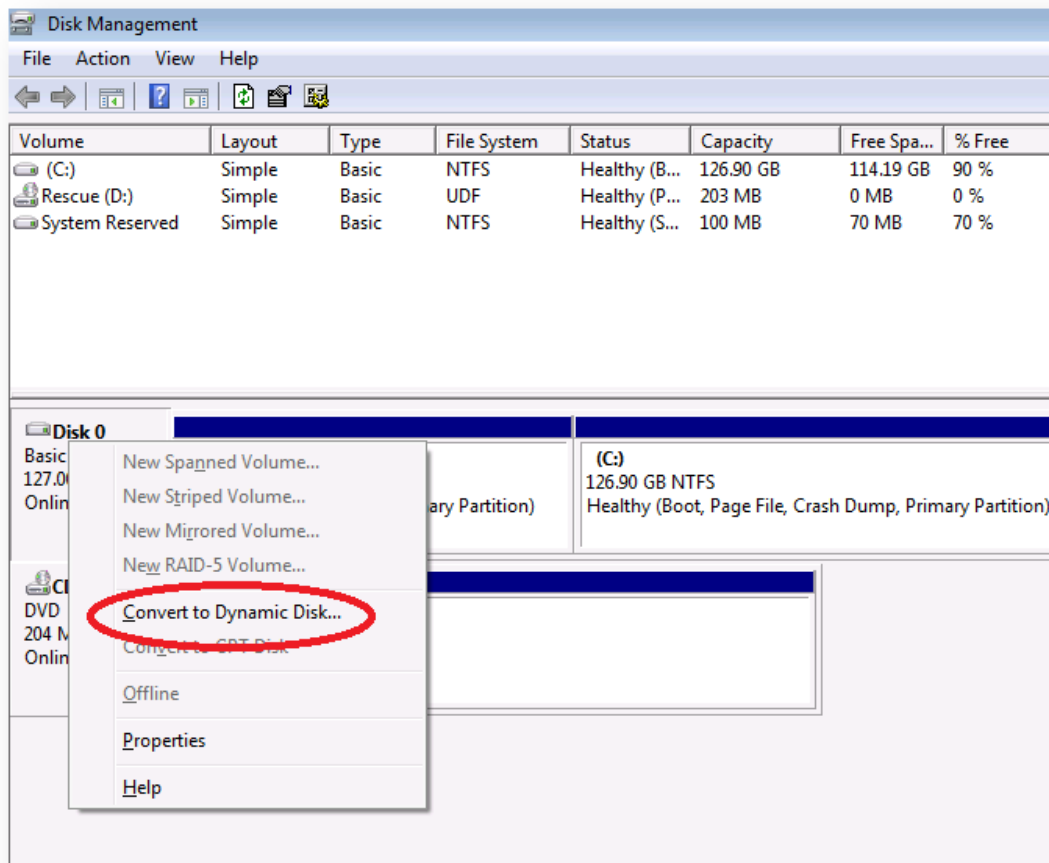
Once the restore has completed you should be able to reboot your computer, this time booting into your restored Windows system.



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 ...".

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Once you have taken this step, if you have already restored all your volumes from the rescue environment, the restore task is complete.

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.

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.

`/*<![CDATA[*] div.rbtoc1566554612120 {padding: 0px;} div.rbtoc1566554612120 ul {list-style: disc;margin-left: 0px;} div.rbtoc1566554612120 li {margin-left: 0px;padding-left: 0px;} /*]]>*/`

- How Windows assigns drive letters to mounted volumes (drives) on your system
- Changing drive letters in the 'Restore Wizard' or 'Clone Wizard' when running Reflect in Windows
- Changing drive letters using the Windows Disk Management Console after restoring or cloning

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>



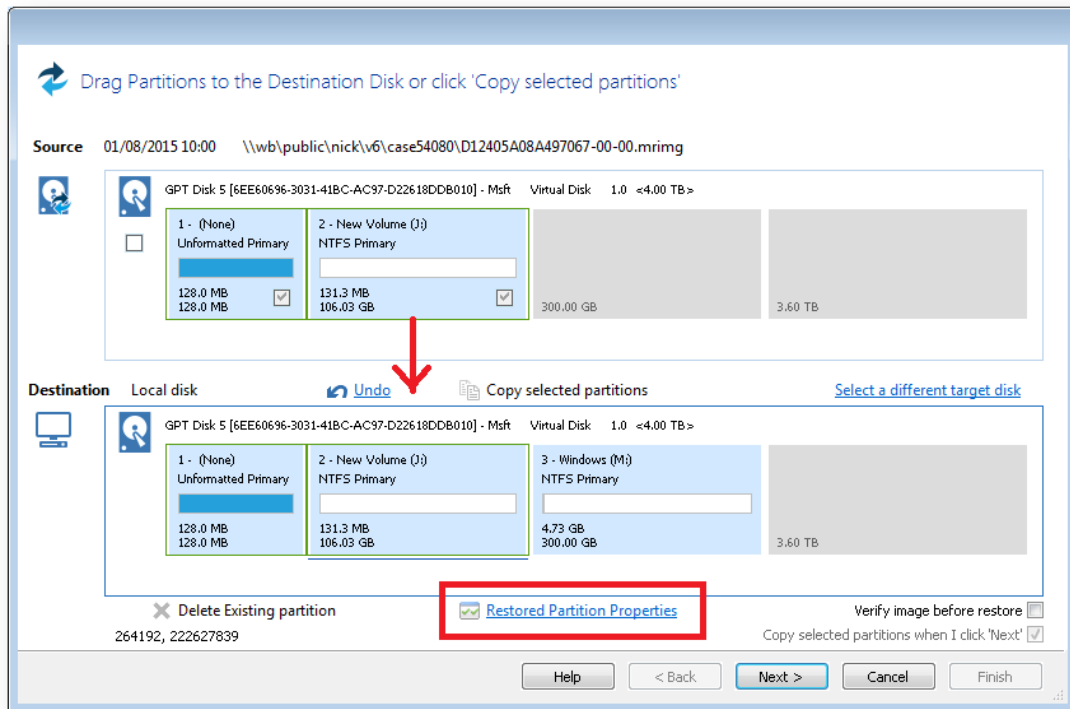
Note: When restoring using the **Windows PE** rescue media, the letters assigned to restored partitions are **temporary** for that Windows PE session only. When you **boot into the restored system**, drive letter assignments will be **exactly the same** as they were when the image was created.

Changing drive letters in the 'Restore Wizard' or 'Clone Wizard' when running Reflect in Windows

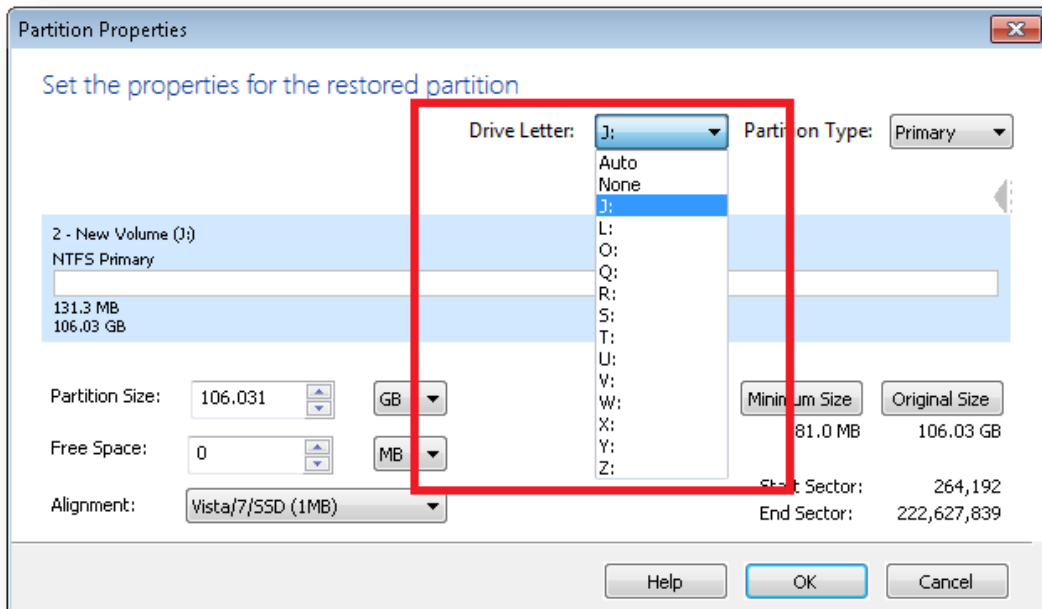
1. In the Restore Wizard **Click the 'Restored Partition Properties'** link after copying or dragging the partition to it's destination on the target disk:

Note: In the Clone Wizard **Click 'Cloned Partition Properties'**.

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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:),

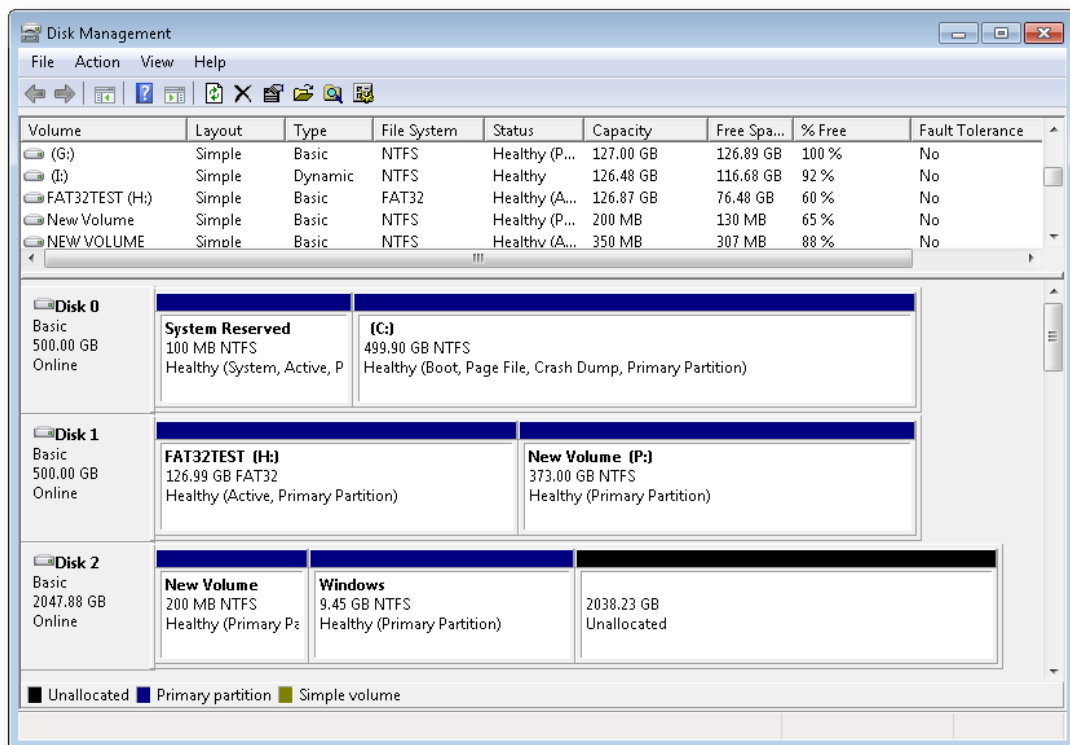
1. To start the Windows Disk Management Console

Click 'Start' or press the Windows Key, Type the following and press enter:

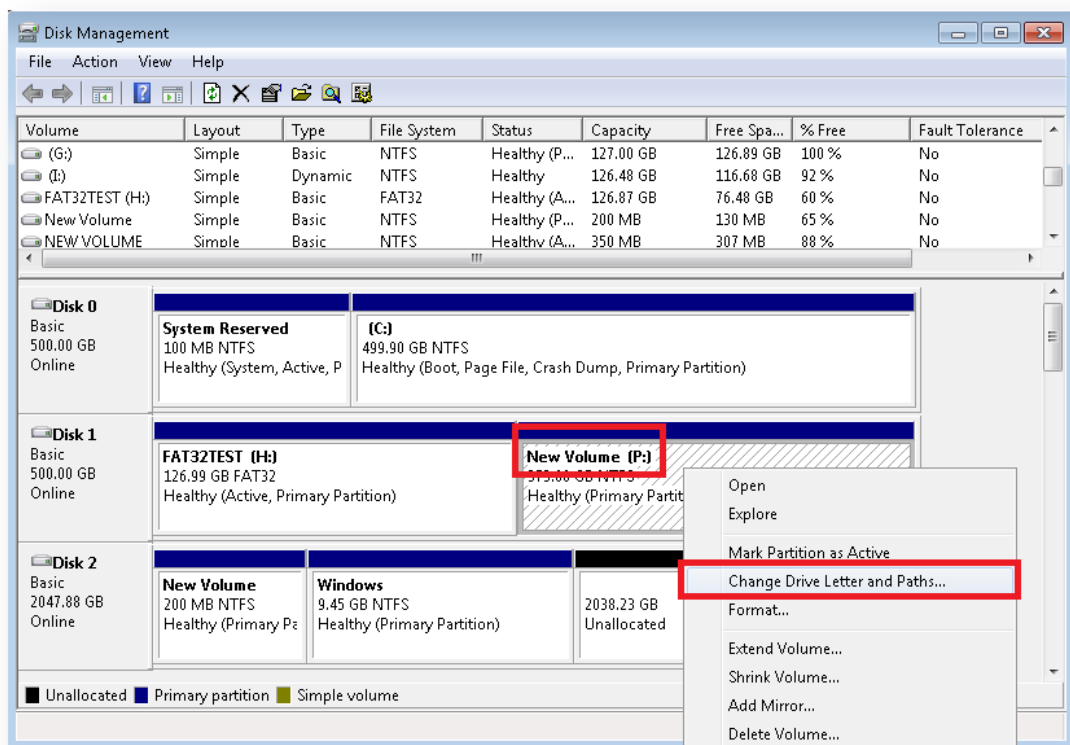
```
diskmgmt.msc
```

2. The DMC starts as shown below:

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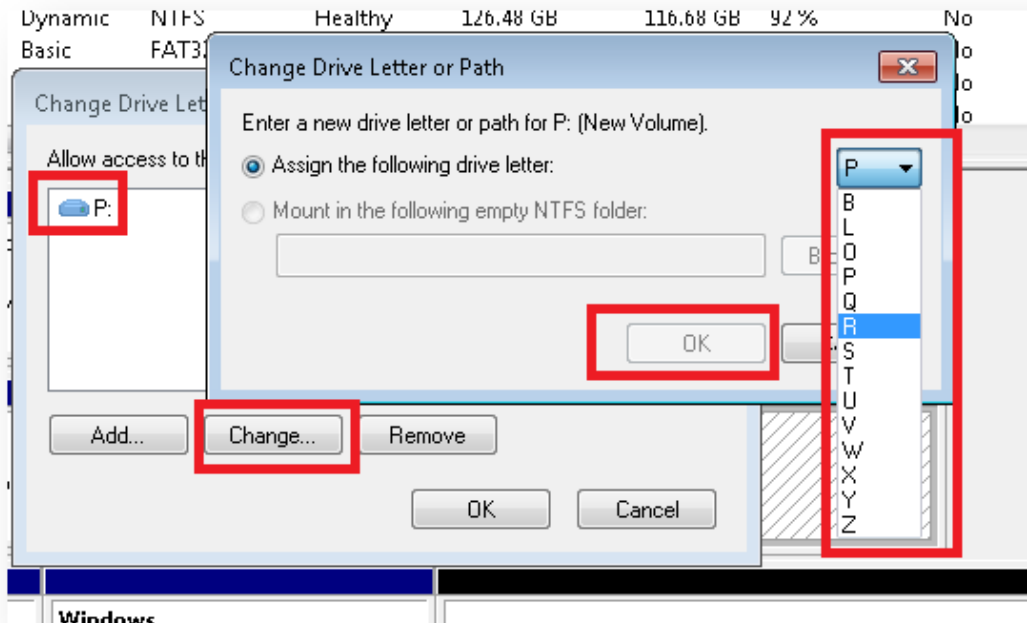


3. Right click on the partition that you want to change in the lower pane and select 'Change drive letters and paths':



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4. In the dialog that opens, **select** the original drive letter, **Click 'Change'**, **Choose** a new drive letter and finally **Click 'OK'**



See also:

[Restoring and browsing](#)

[Restoring an image from within Windows](#)

[Restoring a System image from Windows](#)

[Modifying restore destination partition properties](#)

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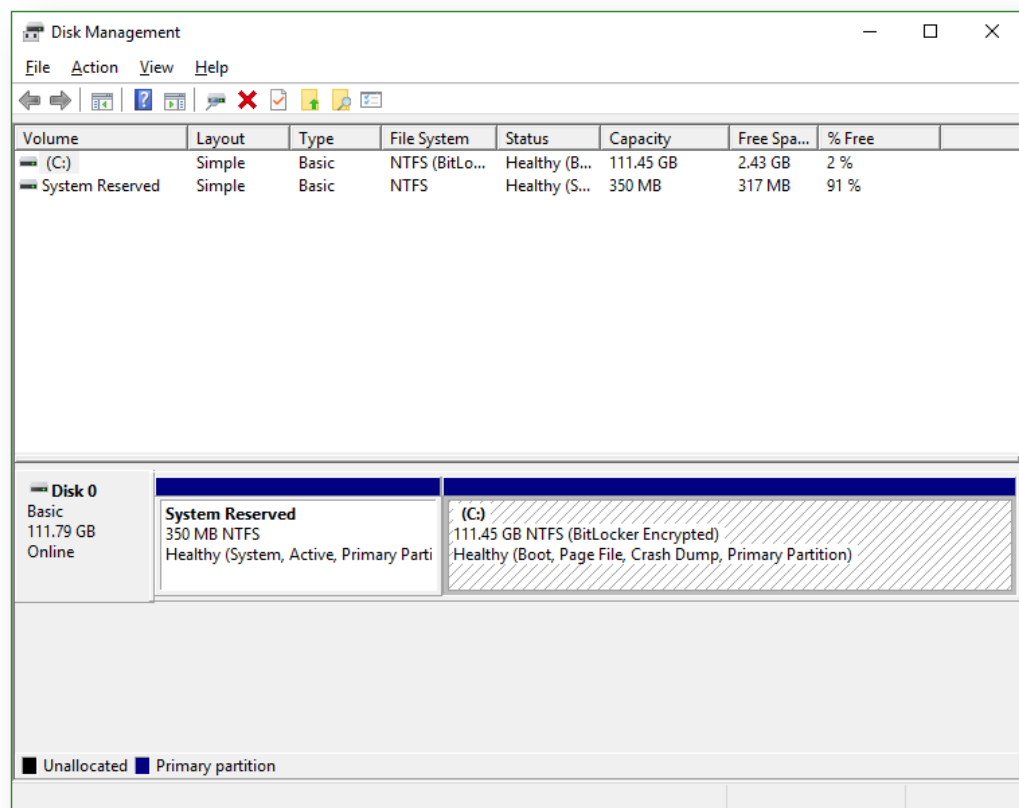
How to create a VHD and restore a backup to the VHD using Macrium Reflect.



This article applies to Windows 7 and higher versions on Windows.

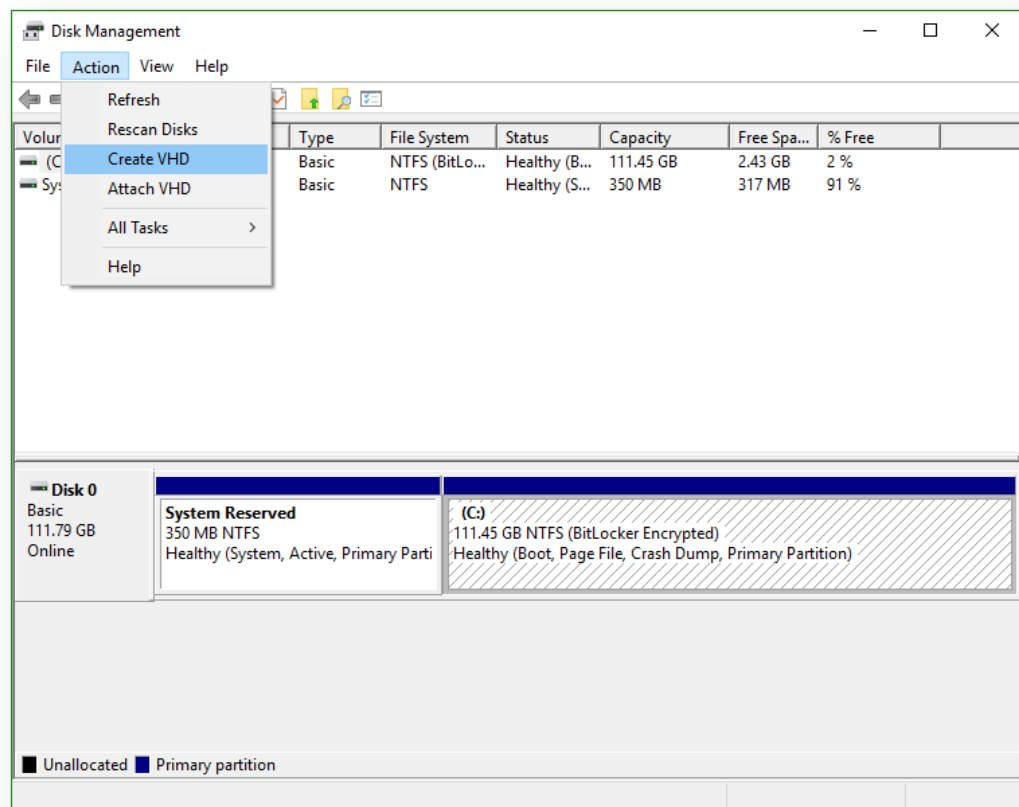
1. This section will take you through the creation of a VHD using the Windows Disk Management console and the mounting process.

a. **Open Windows Disk Management console.**

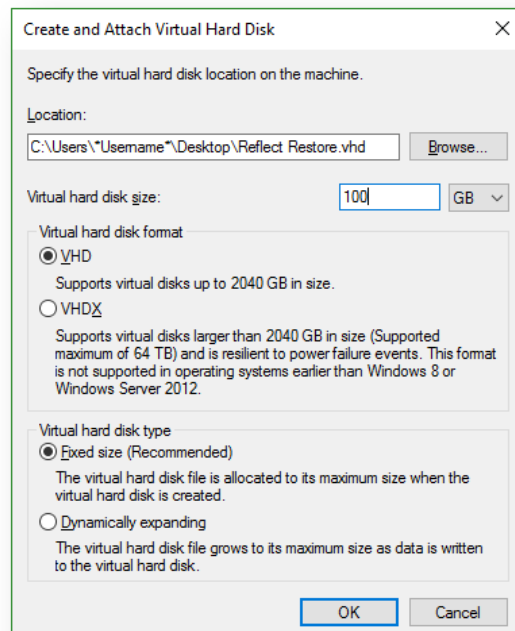


b. **Click on Action followed by Create VHD.**

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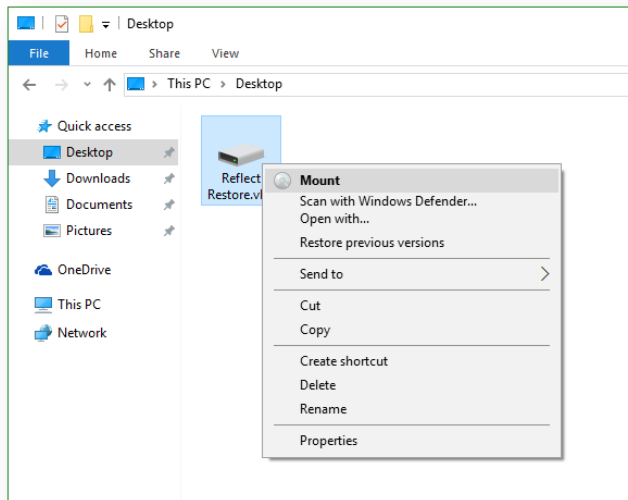


- c. Set your desired options and **clickOK** to generate the VHD at the set location.

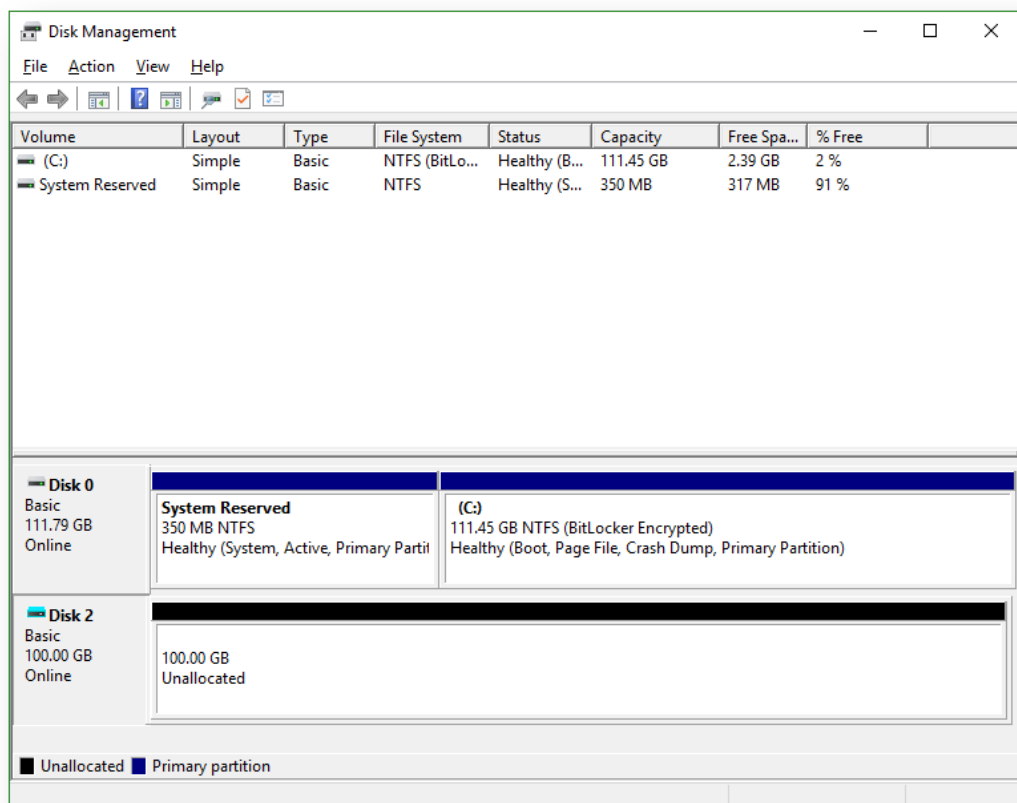


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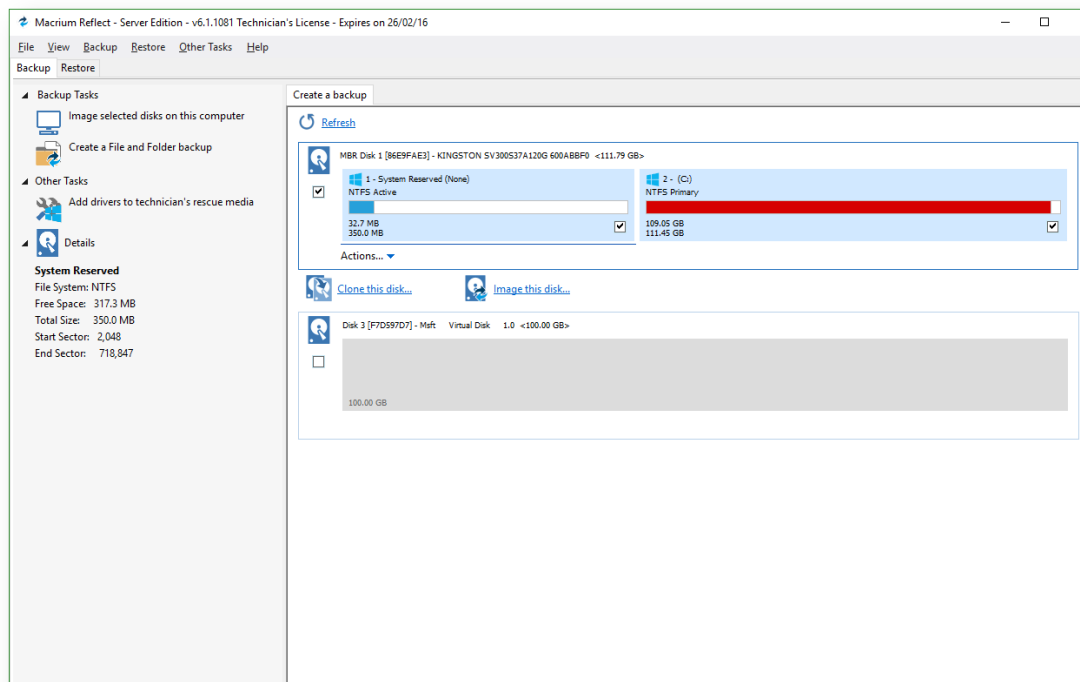
- d. Locate the VHD in Windows Explorer and mount it by right clicking the icon and **selecting the Mount** option.



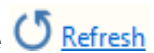
- e. Once Mounted, **Macrium Reflect Backup** tab and **Disk Management** console will now show the mounted VHD.



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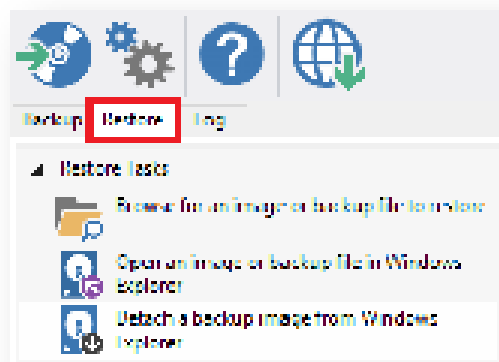
If the **VHD** is not visible in Reflect after it has been mounted, please click the



- 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.

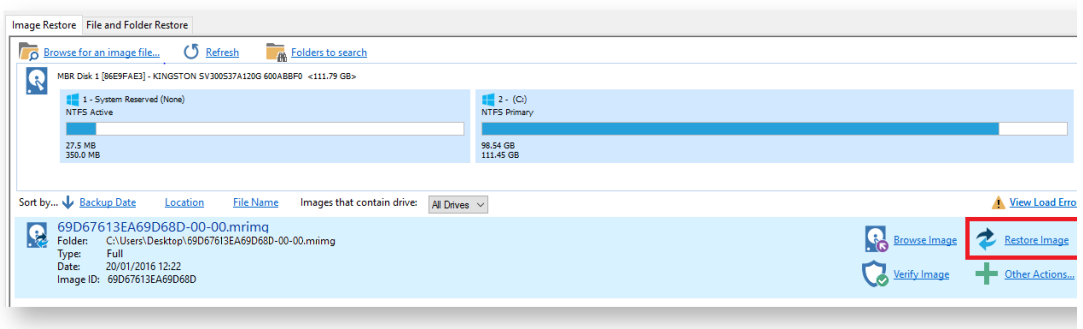
- On the main screen, **select Restore**.



Backup images available to be restored are shown in the main pane.

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

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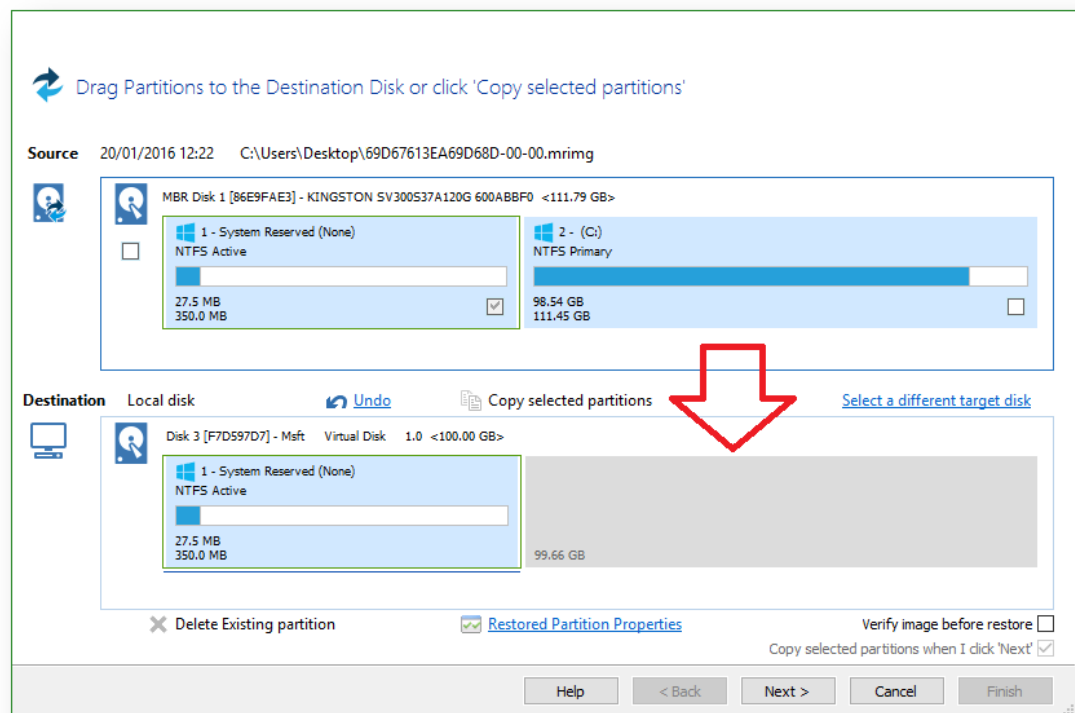


- c. The next dialog gives you the opportunity to modify the destination properties.

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](#).

Drag and drop the disk partitions from the **Source** image to the **Destination** VHD.



- d. Click **Next** to restore the image onto the VHD.

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Restore Summary



Image File:

Image ID:

Date:

Time:

Image Type:

\\psnas\Public\Gosha\pcBU\69D67613EA69D68D-00-00.mimg

69D67613EA69D68D

20 January 2016

12:22

Full

Source Disk:

Geometry:

BPB:

Destination Disk:

MBR Disk 1 [86E9FAE3] - KINGSTON SV300S37A120G 600ABBF0 <111.79 GB>

14593\63\512

0\0\0

Disk 3 [F7D597D7] - Msft Virtual Disk 1.0 <100.00 GB>

Verify:

Delta:

SSD Trim:

N

Y

Y

Schedules

None

Operation 1 of 1

Restore Partition:

Drive Letter:

Start Sector:

End Sector:

Partition Type:

1 - System Reserved

None

2,048

718,847

Active

 [Advanced Options](#)

Help

< Back

Next >

Cancel

Finish

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](#) for more information.

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.mrimg

Further reading:

- [Scheduling backups](#)
- [Configuring e-mail notifications](#)
- [Running continuous backup of SQL databases](#)
- [Which user name and password is used when scheduling a backup?](#)
- [Retention and consolidation](#)

Scheduling backups

Creating and Editing a Backup Plan

Edit the Plan for this Backup

1. Select a Template for your Backup Plan

None

2. Add/Edit Schedules

Backup Type	Schedule
-------------	----------

Add Schedule Edit Schedule Delete Schedule

3. Define Retention Rules

Apply retention rules to matching backup sets in the target folder

☒ Full	Keep	12	Backups
☒ Differential	Keep	4	Backups
☒ Incremental	Keep	10	Backups

Create a Synthetic Full if possible ☐

☐ Run the purge before backup.

☒ Delete the oldest backup set(s) if less than 5 GB on the target volume (minimum 1GB)

Advanced Options Help < Back Next > Cancel Finish

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.

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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.

Disk Image

Edit the Plan for this Backup

1. Select a Template for your Backup Plan

Grandfather, Father, Son.

2. Add/Edit Schedules

Backup Type	Schedule
Full	At 09:00 on the first Mon of every month, starting 02/03/2015
Differential	At 09:00 every Mon of every week, starting 02/03/2015
Incremental	At 09:00 every Mon, Tue, Wed, Thu, Fri of every week, starting 02/03/2015

Add Schedule Edit Schedule Delete Schedule

3. Define Retention Rules

Apply retention rules to matching backup sets in the target folder

☒ Full Keep 26 Weeks

☒ Differential Keep 4 Weeks

☒ Incremental Keep 10 Days

☒ Run the purge before backup.

☒ Delete the oldest backup set(s) if less than 5 GB on the target volume (minimum 1GB)

Advanced Options Help < Back Next > Cancel Finish

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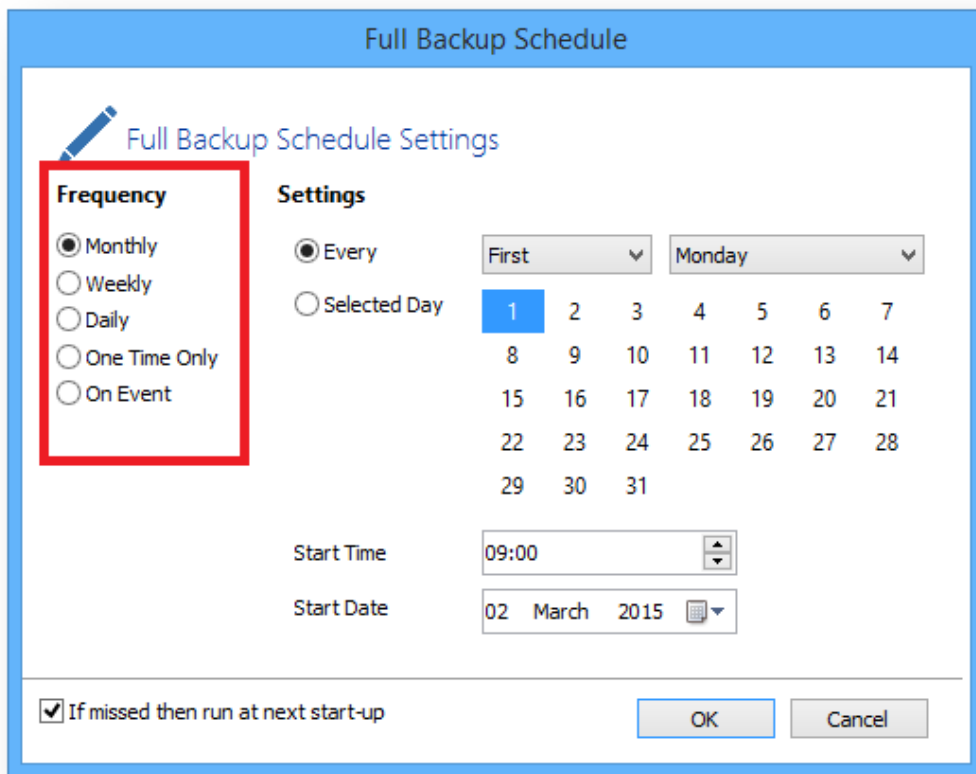
Resolving Scheduling Conflicts

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.



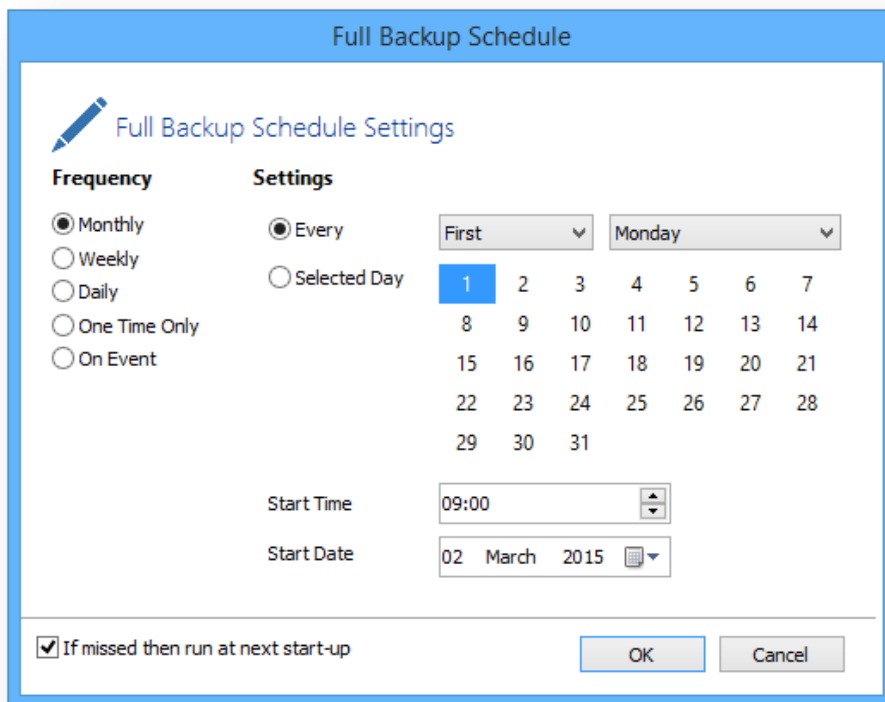
The image shows the 'Full Backup Schedule' dialog box. The 'Frequency' section is highlighted with a red rectangle and contains five radio button options: 'Monthly' (selected), 'Weekly', 'Daily', 'One Time Only', and 'On Event'. The 'Settings' section includes a radio button for 'Every' (selected) and a 'Selected Day' option. Below these are two dropdown menus: 'First' (set to '1') and 'Monday' (set to 'Monday'). A calendar grid shows the days of the month, with the 1st highlighted. Below the calendar are fields for 'Start Time' (09:00) and 'Start Date' (02 March 2015). At the bottom, there is a checkbox 'If missed then run at next start-up' which is checked, and 'OK' and 'Cancel' buttons.

3. Click **OK**.

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**.

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The dialog box is titled "Full Backup Schedule" and contains a sub-header "Full Backup Schedule Settings" with a pencil icon. It is divided into two main sections: "Frequency" and "Settings".

Frequency: Includes radio buttons for "Monthly" (selected), "Weekly", "Daily", "One Time Only", and "On Event".

Settings: Includes radio buttons for "Every" (selected) and "Selected Day".

Below "Every", there are two dropdown menus: "First" (set to "1") and "Monday" (set to "Monday").

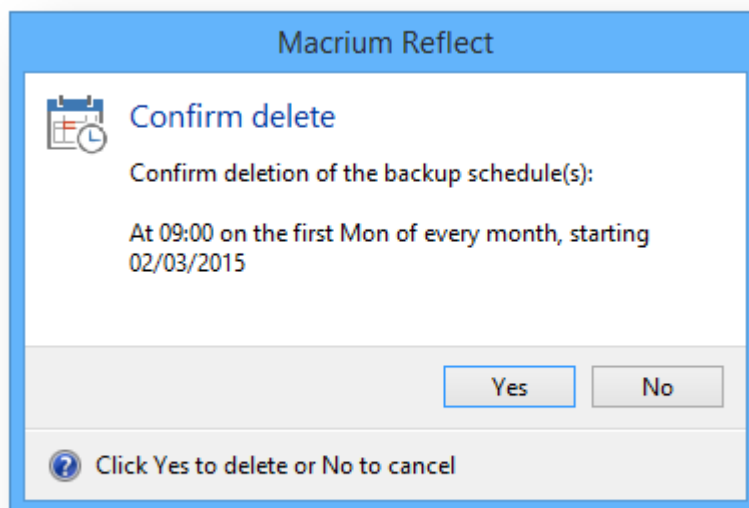
Below "Selected Day", there is a calendar grid showing days 1 through 31. The number "1" is highlighted in blue.

Below the calendar, there are two input fields: "Start Time" (set to "09:00") and "Start Date" (set to "02 March 2015").

At the bottom, there is a checkbox labeled "If missed then run at next start-up" which is checked. To the right are "OK" and "Cancel" buttons.

To delete a schedule:

1. Select the schedule you want to delete and click **Delete Schedule**.
2. A confirmation box appears, click **Yes**.



The dialog box is titled "Macrium Reflect" and contains a sub-header "Confirm delete" with a calendar icon. It says "Confirm deletion of the backup schedule(s):".

Below this, it displays the schedule details: "At 09:00 on the first Mon of every month, starting 02/03/2015".

At the bottom, there are two buttons: "Yes" and "No".

At the very bottom, there is a question mark icon and the text "Click Yes to delete or No to cancel".

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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.

The screenshot shows the 'Disk Image' window in Macrium Reflect. The 'Define Retention Rules' section is highlighted with a red box. It includes a dropdown menu for 'Apply retention rules to matching backup sets in the target folder'. Below this, there are three rows for backup types: Full, Differential, and Incremental. Each row has a 'Keep' checkbox, a numerical value in a spinner box, and a unit dropdown menu. The 'Full' row is set to 26 Weeks, 'Differential' to 4 Weeks, and 'Incremental' to 10 Days. There are also checkboxes for 'Run the purge before backup.' and 'Delete the oldest backup set(s) if less than 5 GB on the target volume (minimum 1GB)'. At the bottom, there are buttons for 'Help', '< Back', 'Next >', 'Cancel', and 'Finish'.

Backup Type	Schedule
Full	At 09:00 on the first Mon of every month, starting 02/03/2015
Differential	At 09:00 every Mon of every week, starting 02/03/2015
Incremental	At 09:00 every Mon, Tue, Wed, Thu, Fri of every week, starting 02/03/2015

Backup Type	Keep	Value	Unit
☒ Full	Keep	26	Weeks
☒ Differential	Keep	4	Weeks
☒ Incremental	Keep	10	Days

☒ Run the purge before backup.

☒ Delete the oldest backup set(s) if less than 5 GB on the target volume (minimum 1GB)

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:

The screenshot shows the '3. Define Retention Rules' dropdown menu. It contains three options: 'Apply retention rules to matching backup sets in the target folder', 'Apply retention rules to matching backup sets in the target folder', and 'Apply retention rules to all backup sets in the target folder'. The first two options are identical and are highlighted in blue.

- 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**.

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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

☒ Full	Keep	12	Backups
☒ Differential	Keep	4	Backups
☒ Incremental	Keep	10	Backups
Create a Synthetic Full if possible ☐			
☐ Run the purge before backup.			
☒ 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. 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.

Macrium Reflect v7.2 User Guide

Option	Description																																																			
	F = Full D = Differential I = Incremental <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	Select this option to run the retention rules before the current 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	Automatically remove the oldest backup set(s) in the target folder if the free space on the drive drops below the GB threshold. 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.																																																			

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.

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- **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

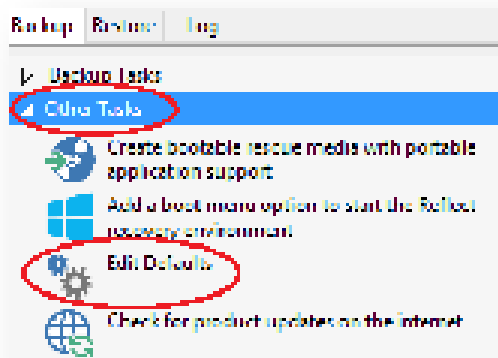
For many users, email notification of success or failure of a backup helps them keep on top of the status of their backups, particularly with scheduled backups which take place in the background.

- Program Defaults and SMTP Server settings
 - Email notification for existing individual backups
-

Program Defaults and SMTP Server settings

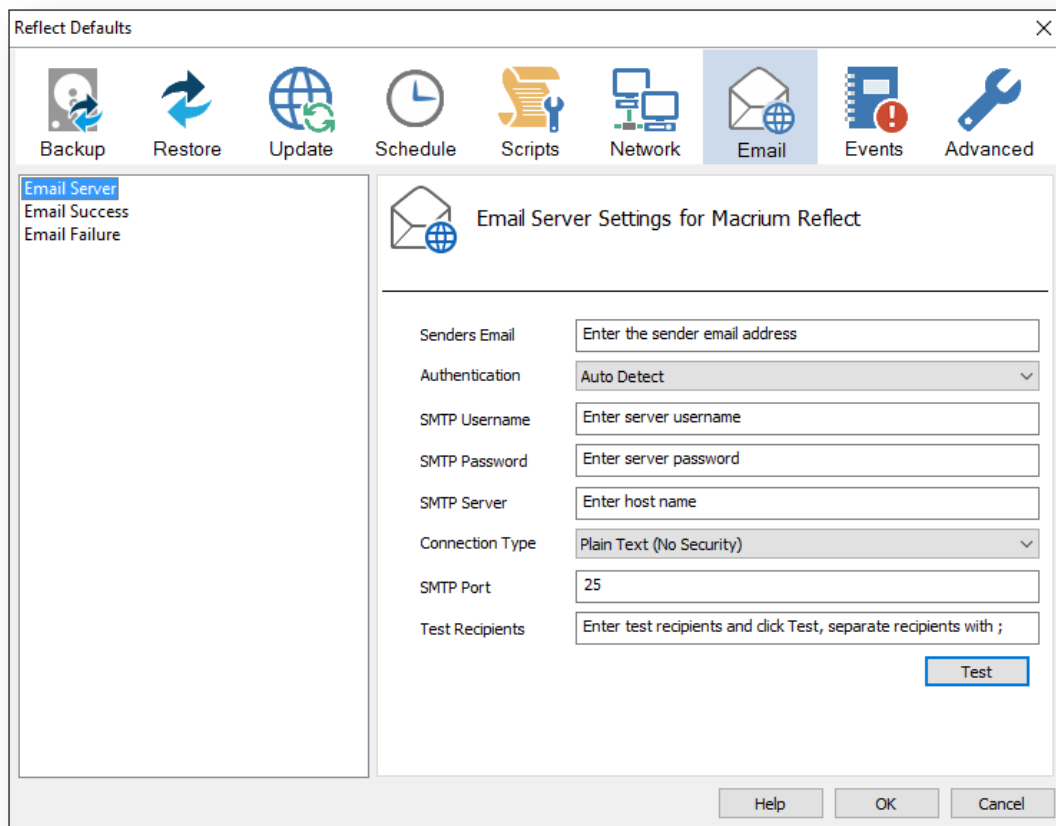
The default settings are used when creating new backup definitions

- From **Other Tasks** select **Edit Defaults**.

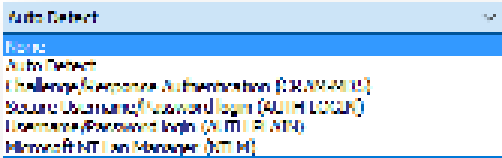


- Select **'Email' > 'Email Server'**.

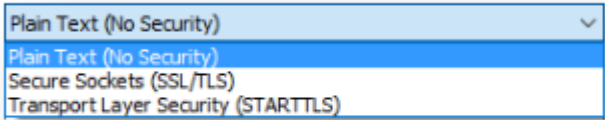
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Email Server options description:

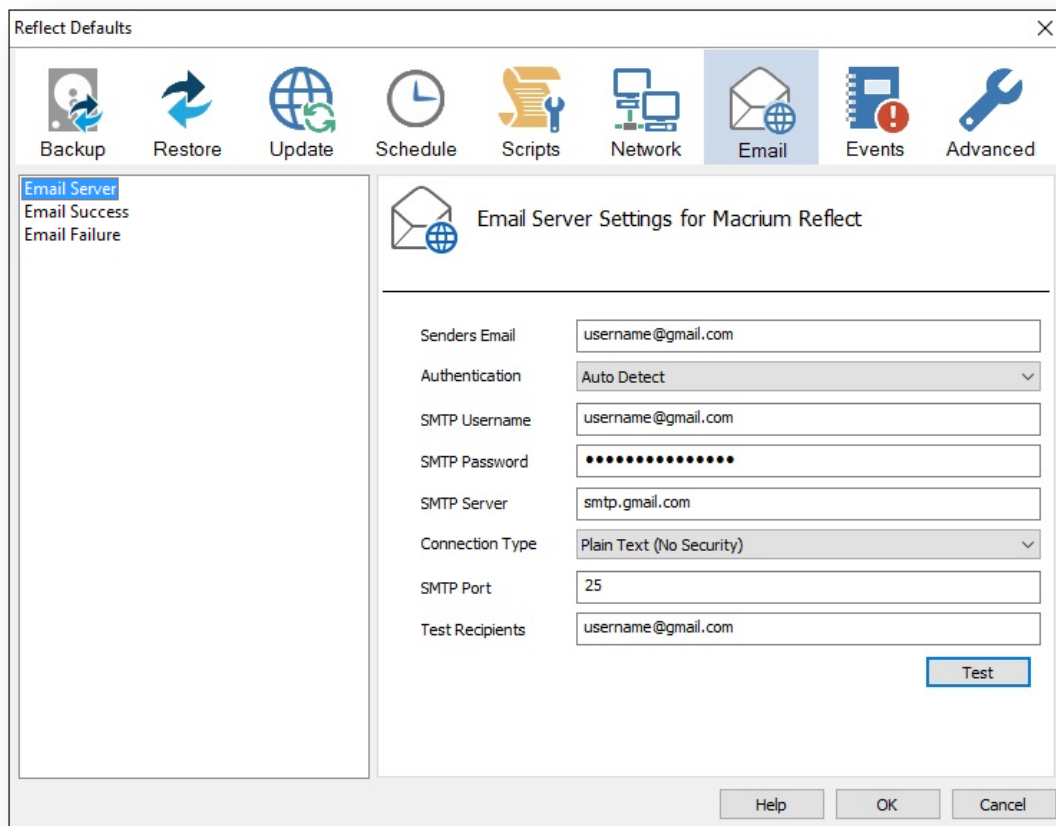
Option	Description
Senders Email	Your e-mail address associated with your ISP or Gmail account etc.  Note: If you use e-mail software such as MS Outlook, you can find the settings under Account Settings for e-mail address, user-name and Server.
Authentication	Authentication options are set by your email provider/server. 

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Option	Description
	Note: If you do not know your authentication settings, try Auto Detect .
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	This is the setting for the way Macrium Reflect will contact the Server.  Plain Text (No Security) Plain Text (No Security) Secure Sockets (SSL/TLS) Transport Layer Security (STARTTLS)  Note: These settings can be found from your email provider.
SMTP Port	This is associated with Connection Type and is the port number that the SMTP server is listening on.  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.

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- Click **OK** to finish.

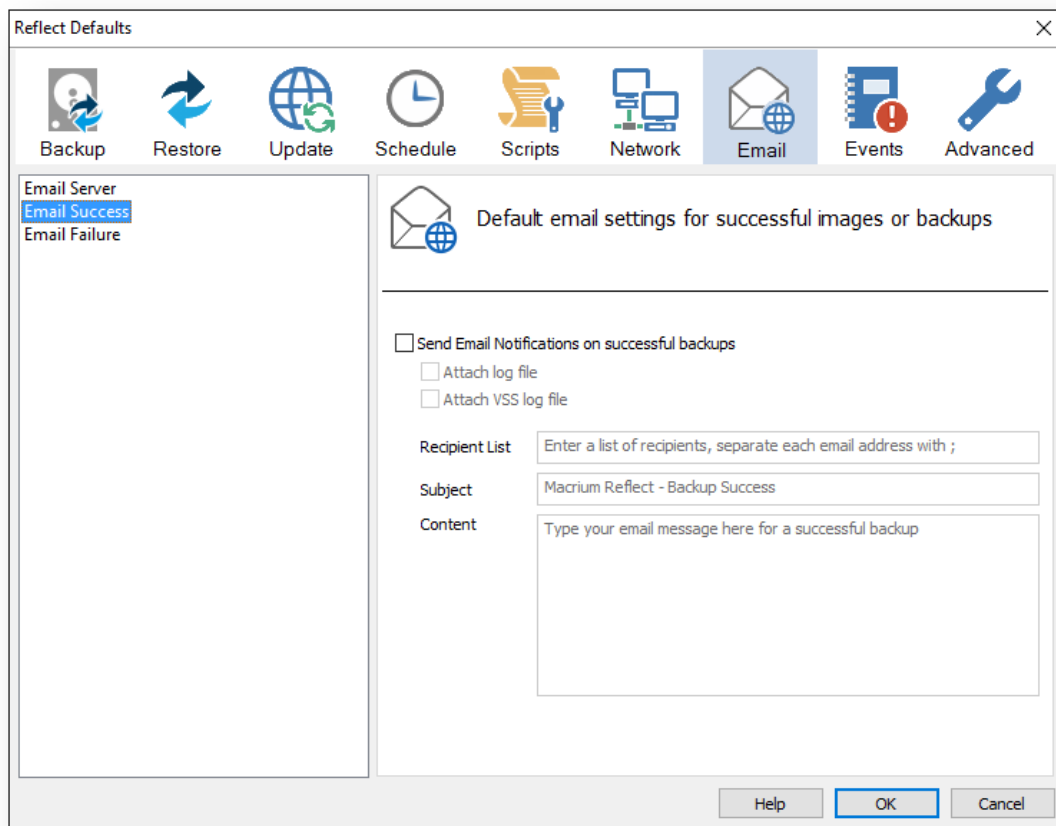


Note: If you are using your Gmail account then please see here: [Using Gmail SMTP Server for sending backup notification emails](#)

Email success settings define who receives emails regarding the success of a backup and what message they receive.

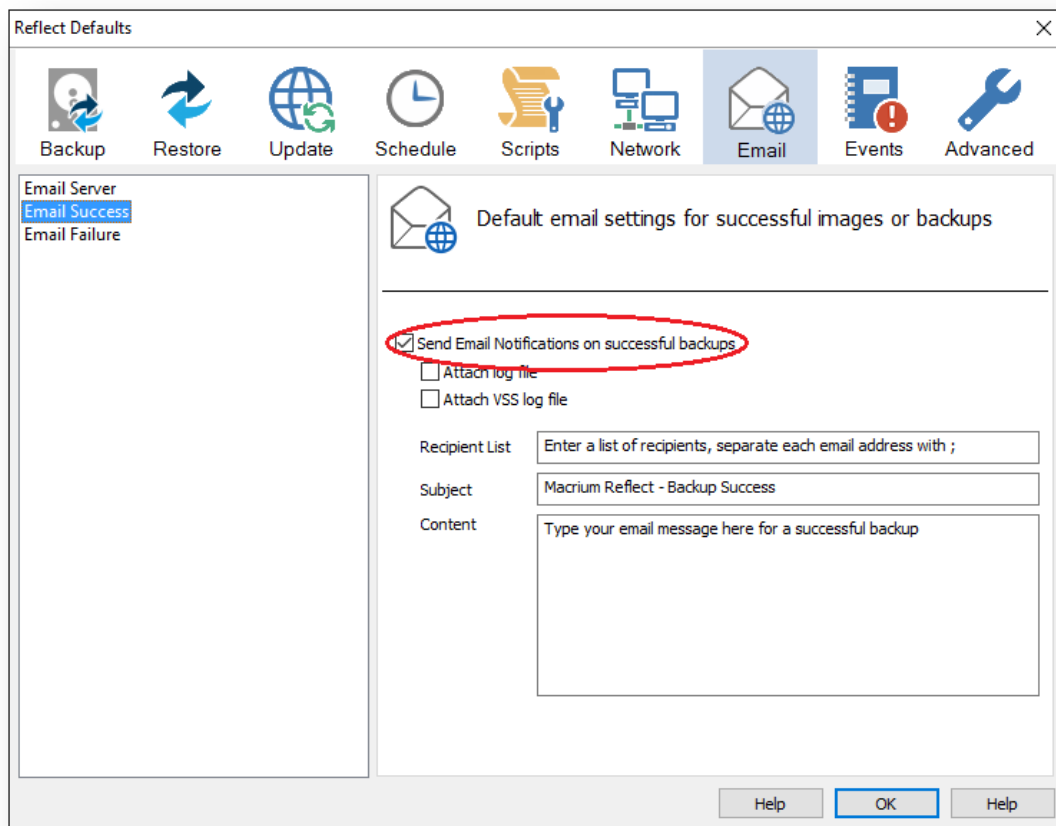
- Select **Email Success**

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- Select **Send Email Notifications on successful backups**.

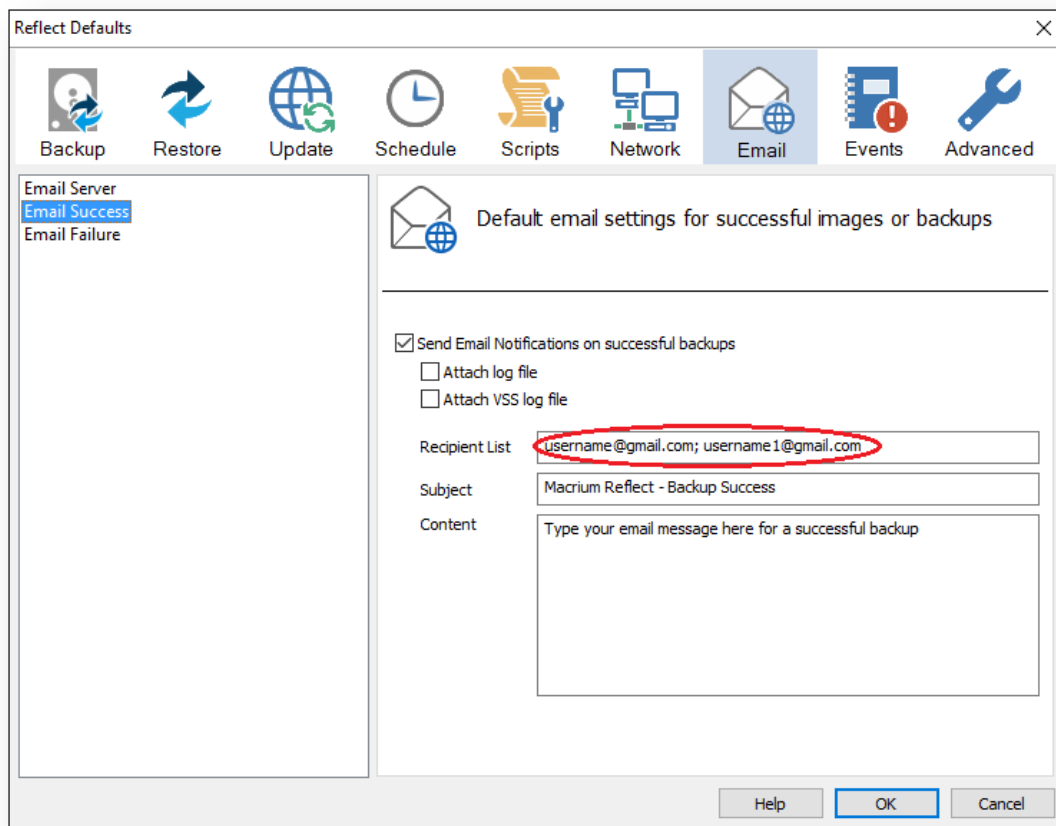
Macrium Reflect v7.2 User Guide



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.

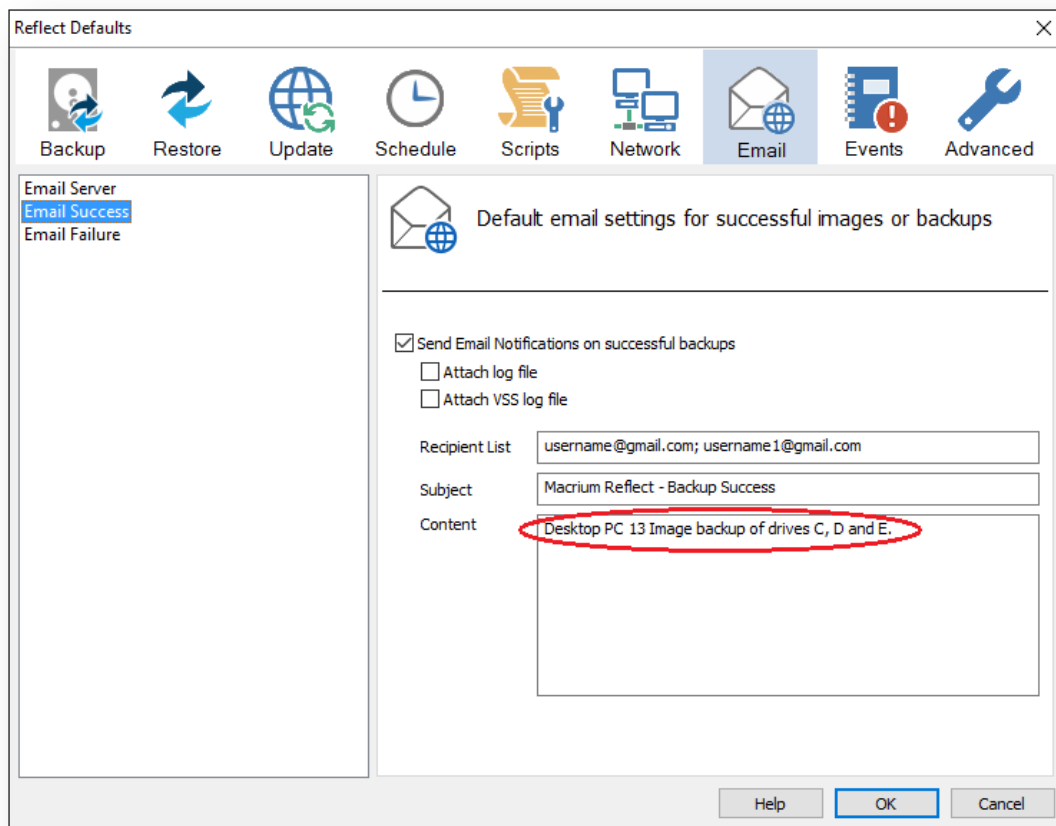
- Enter the email addresses of all recipients in **Recipient List**, separating each email address with a semi-colon.

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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.

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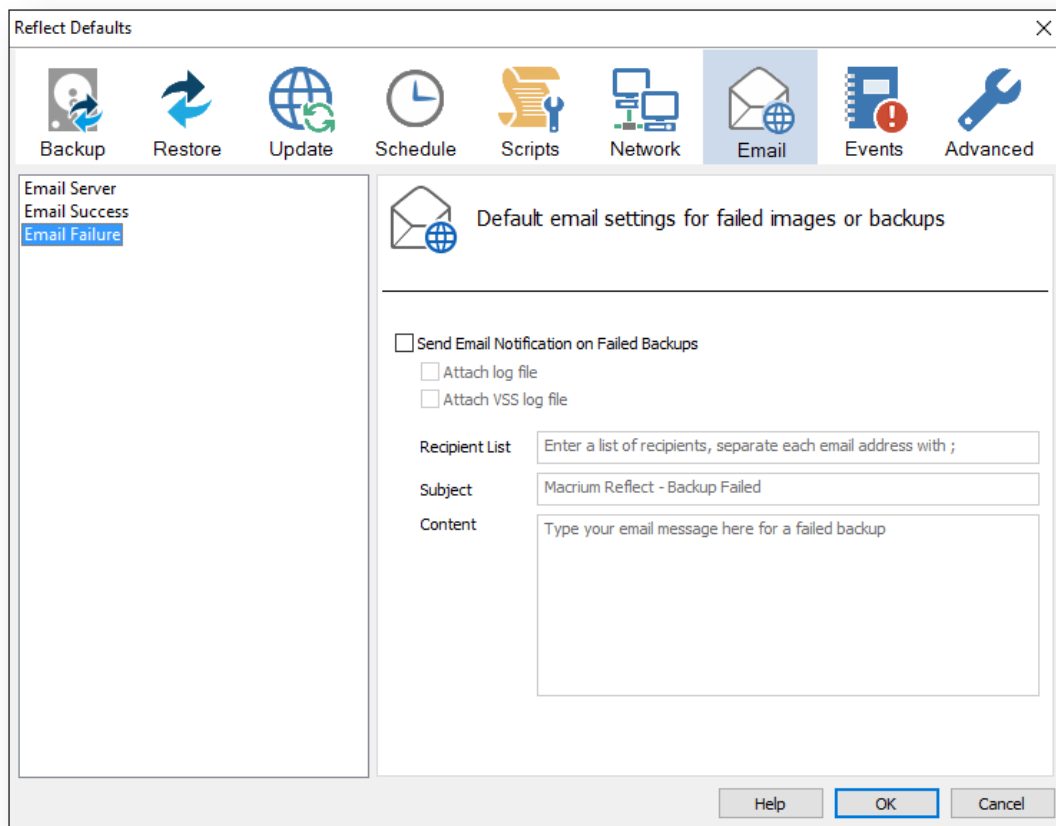


- Click **OK**.

Email failure settings define who receives emails regarding the failure of a backup and what message they receive.

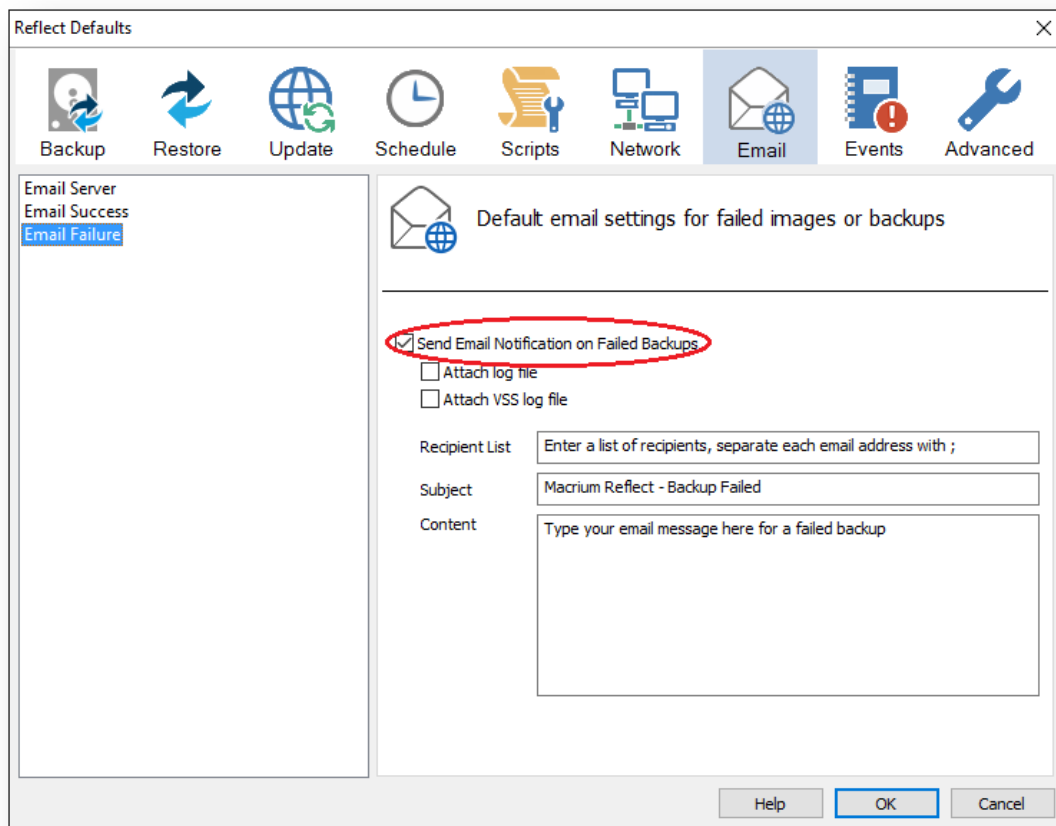
- Select **Email Failure**.

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- Select **Send Email Notification on Failed Backups**.

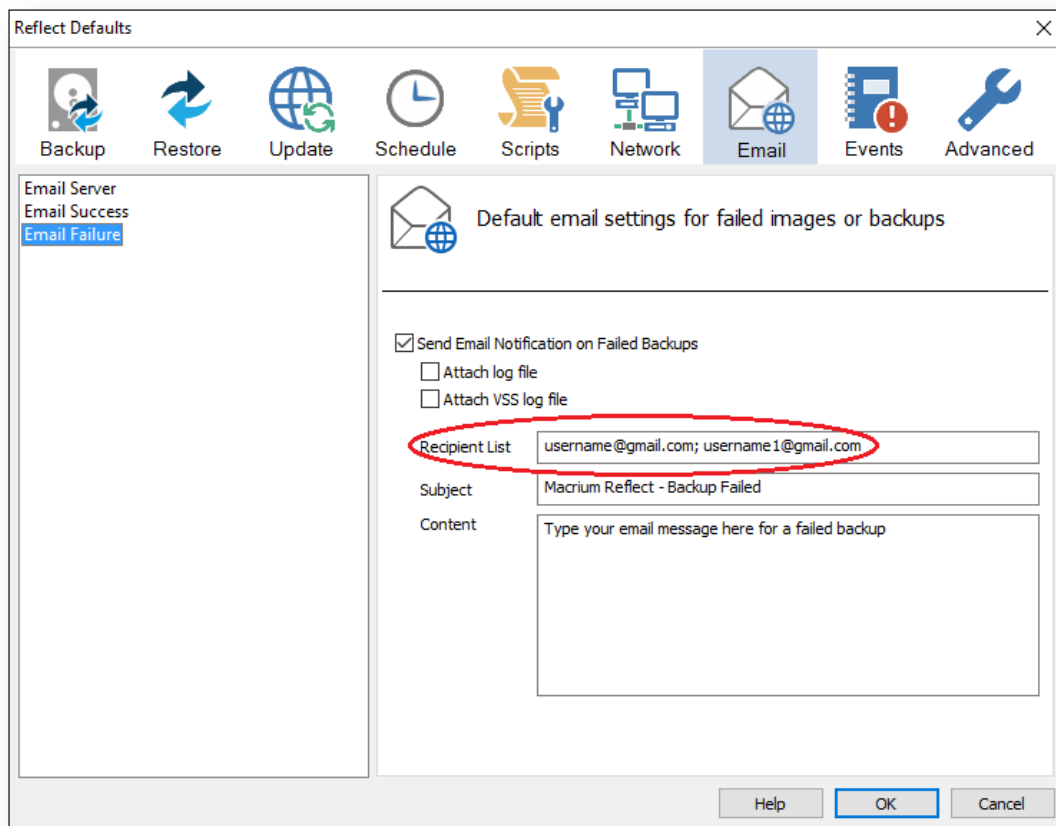
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Option	Description
Attach log file	Will attach the log file from the creation of the backup.
Attach VSS log file	Will attach the VSS log with the events made during the backup.

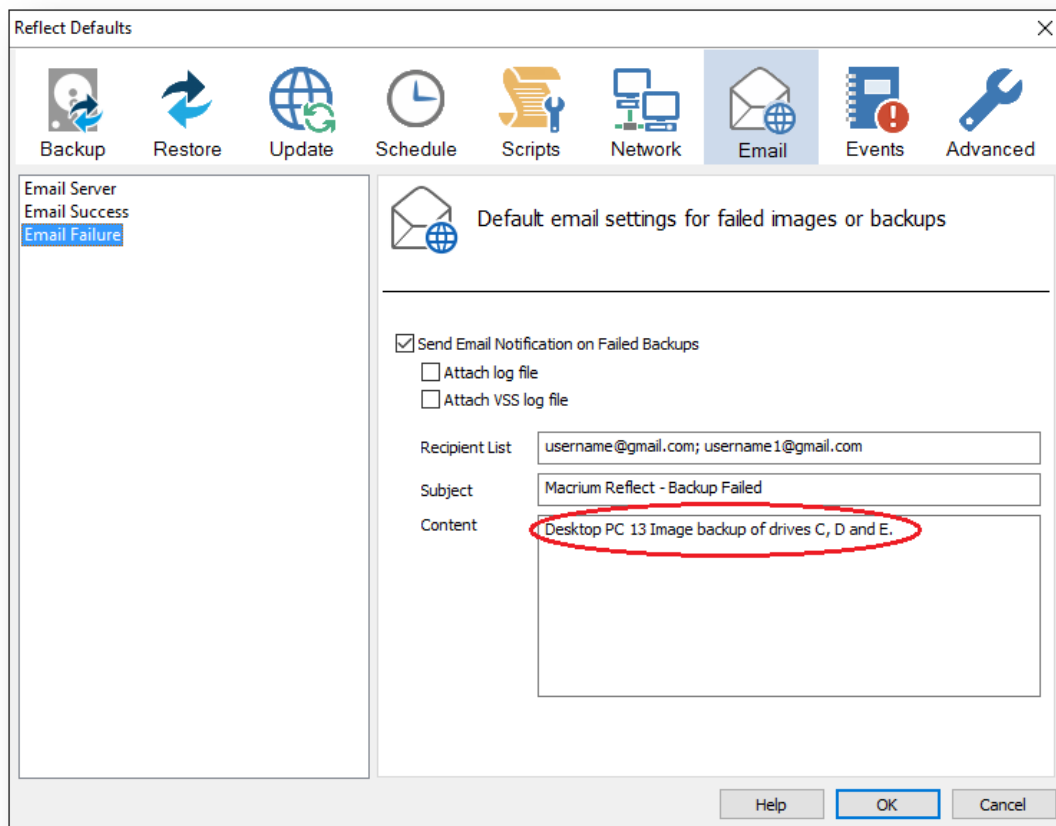
- Enter the email addresses of all recipients in **Recipient List**, separating each email address with a semi-colon.

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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.

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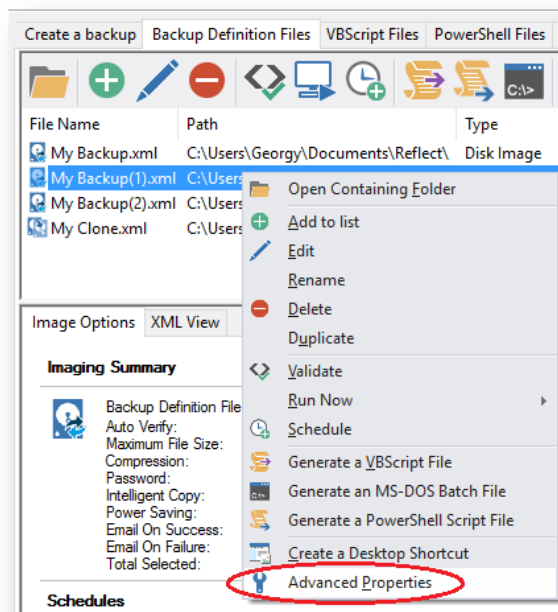


- Click **OK**.

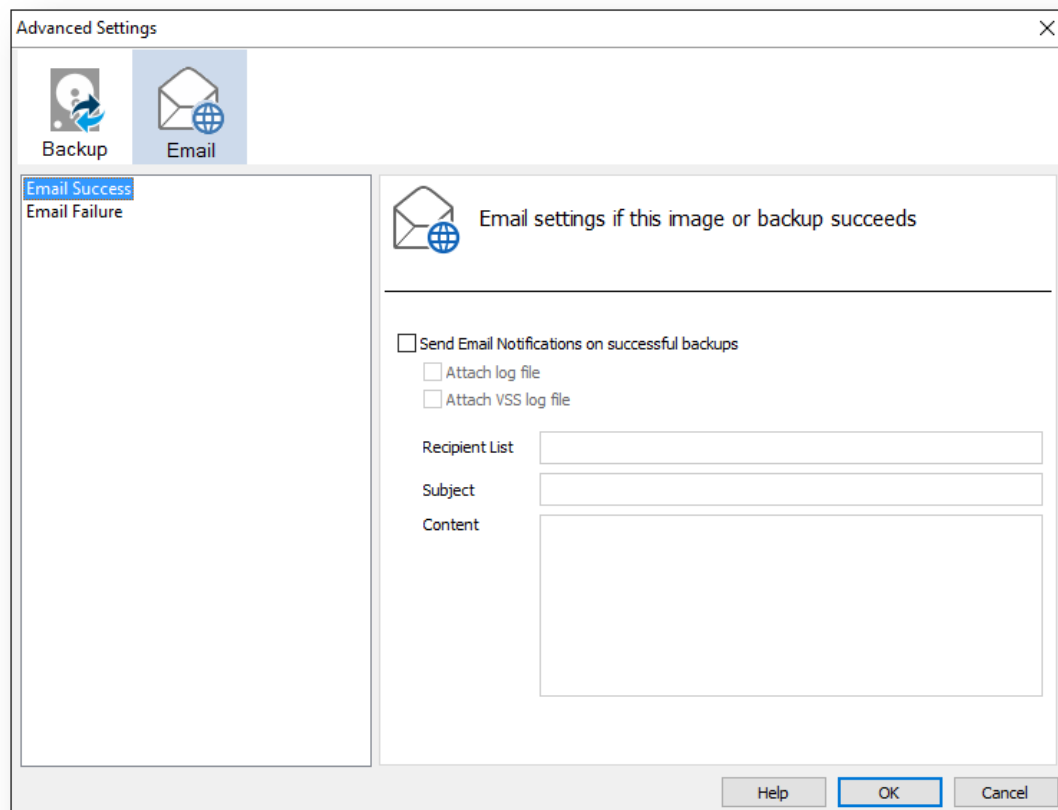
Email notification for existing individual backups

- 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.

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- Click **OK**.

Running continuous backup of SQL databases

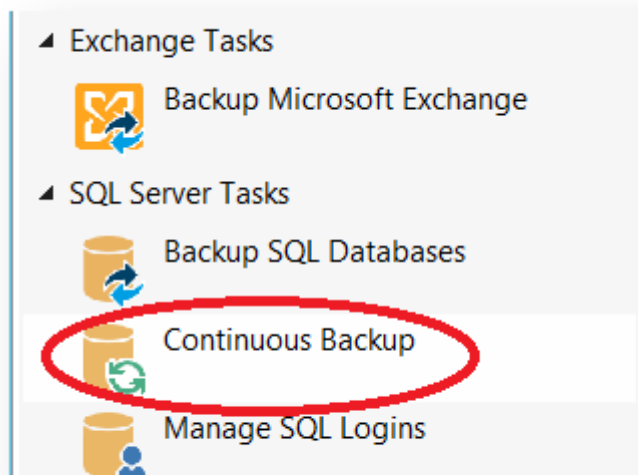
Running continuous backups of SQL databases ensures that frequent backups of your databases are taken at required time intervals. It is always possible, therefore, to restore your data to a point as close as possible to the failure point.

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.

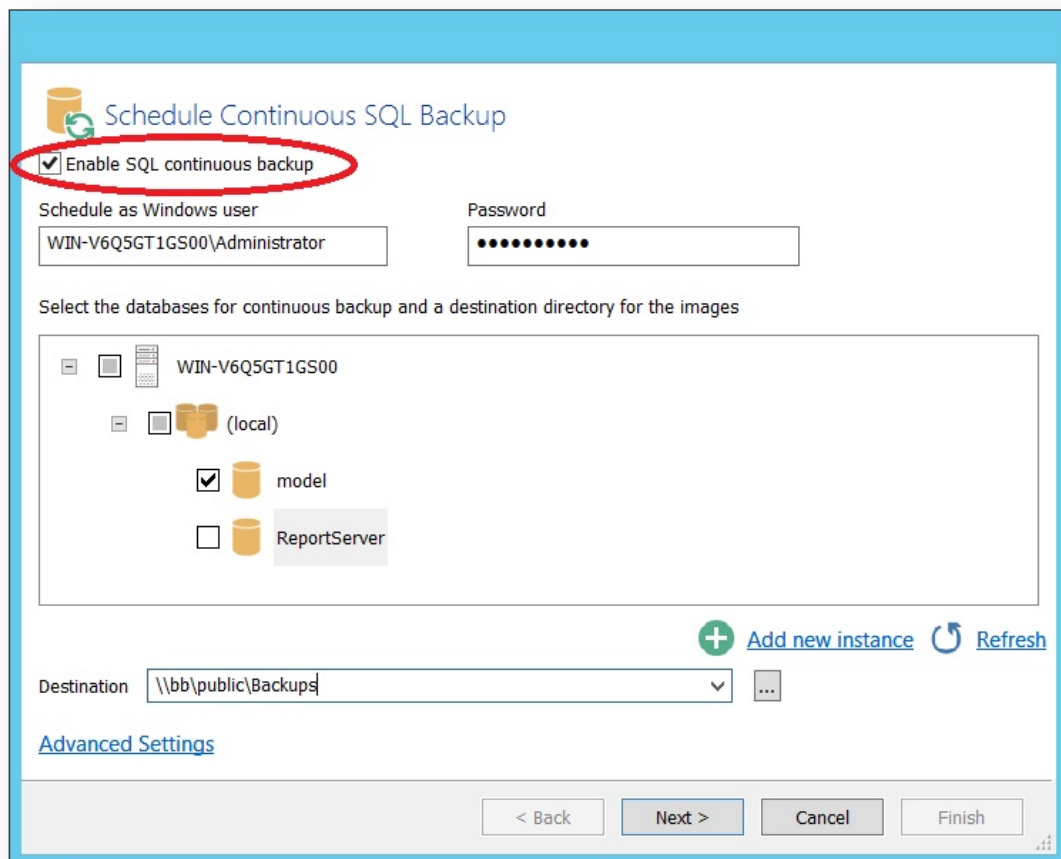
You can not run continuous backup on databases that are not running the Full Recovery Model.

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**.

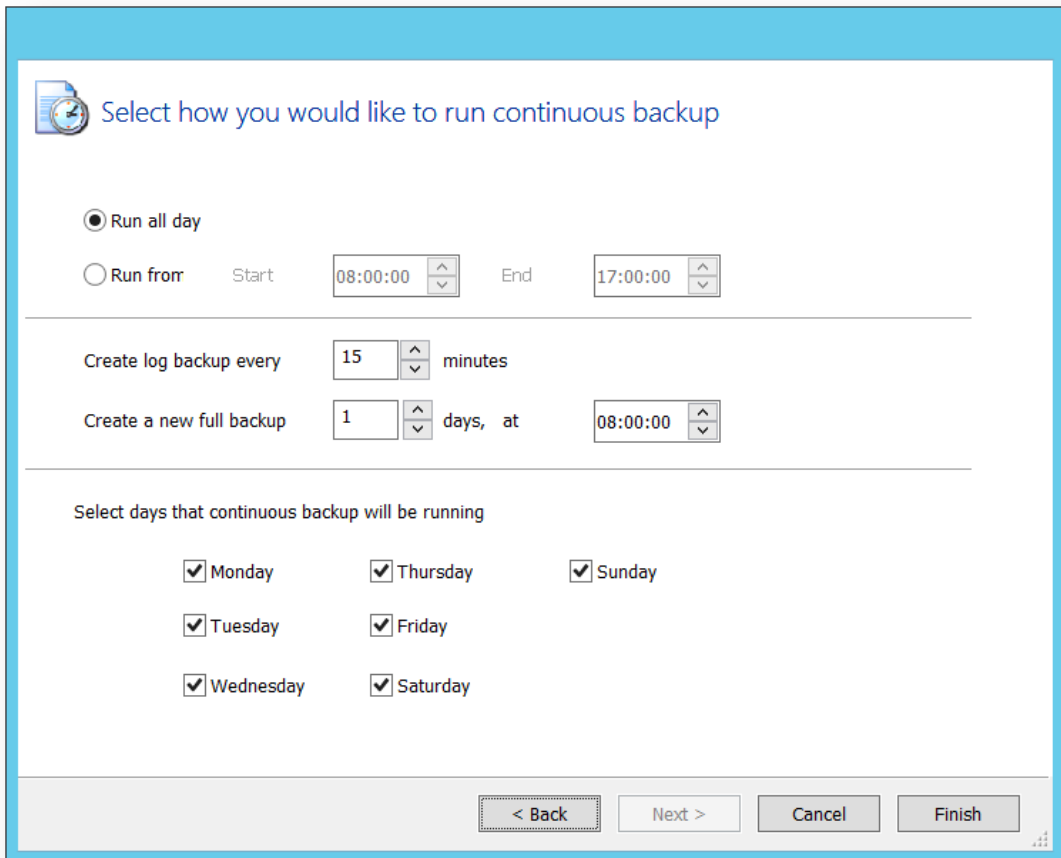
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4. Select the databases you wish to add to continuous backup.
You can select databases from multiple SQL instances.
5. If required, click **Advanced** Settings to change the compression, password and email option.
6. Click **Next**.

The dialog **Select how you would like to run continuous backup** appears.

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The screenshot shows the 'Select how you would like to run continuous backup' dialog box in Macrium Reflect v7.2. The dialog has a light blue header and a white body. At the top left is a clock icon. The title is 'Select how you would like to run continuous backup'. There are two radio buttons: 'Run all day' (selected) and 'Run from'. Below 'Run from' are 'Start' and 'End' time pickers set to 08:00:00 and 17:00:00 respectively. Below these are two rows of settings: 'Create log backup every' set to 15 minutes, and 'Create a new full backup' set to 1 day at 08:00:00. At the bottom is a section 'Select days that continuous backup will be running' with checkboxes for all seven days of the week, all of which are checked. At the very bottom are four buttons: '< Back' (disabled), 'Next >' (disabled), 'Cancel', and 'Finish'.

Select how you would like to run continuous backup

☒ Run all day

☐ Run from Start 08:00:00 End 17:00:00

Create log backup every 15 minutes

Create a new full backup 1 days, at 08:00:00

Select days that continuous backup will be running

☒ Monday ☒ Thursday ☒ Sunday

☒ Tuesday ☒ Friday

☒ Wednesday ☒ Saturday

< Back Next > Cancel Finish

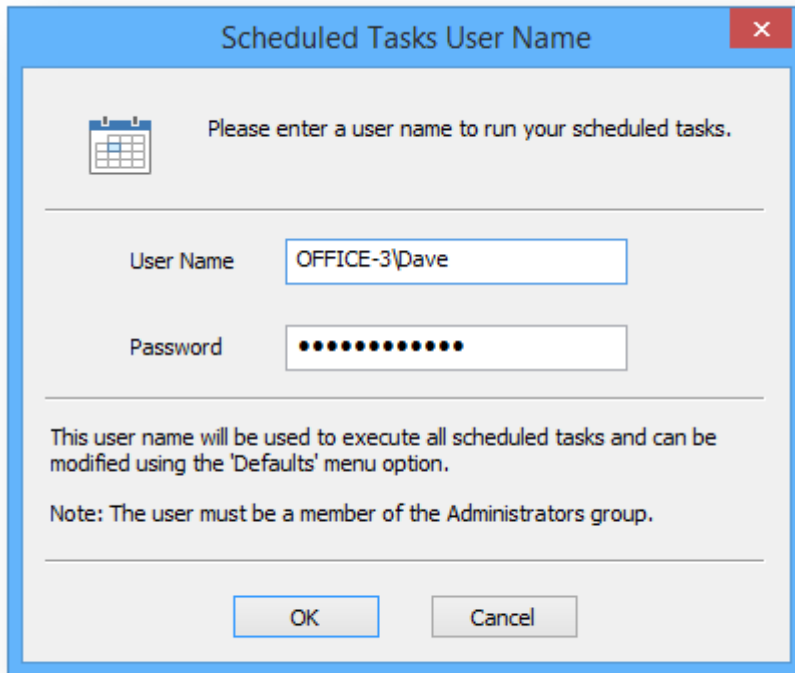
By default, **Run all day** is selected.

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**.

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.

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:

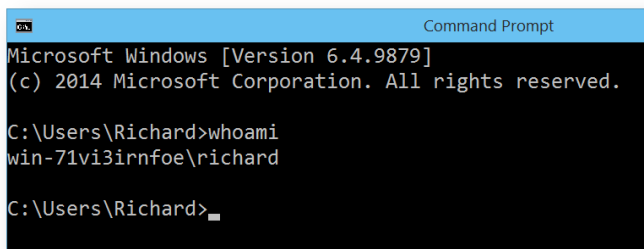
cmd

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:

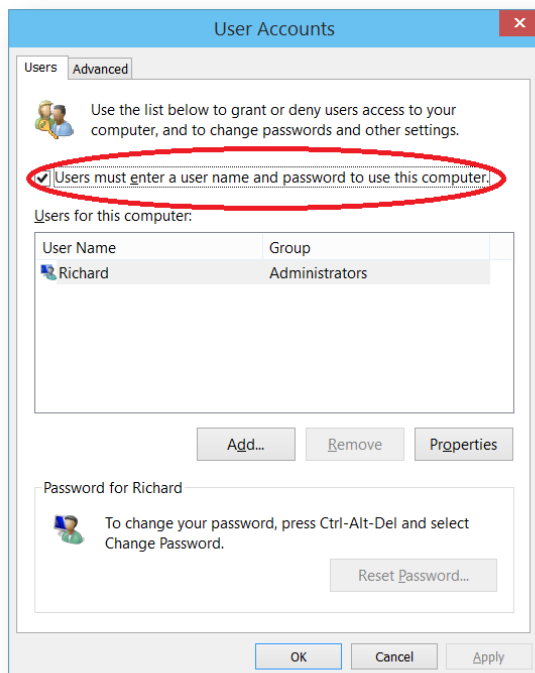
Windows XP

```
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**.

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 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 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	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

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

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
--- I I F I I

M T W T F
F I I I I

M	T	W	T	F	M
F	I	I	I	I	I
->F	I	I	I	I	I

```

M T W T F      M T
  F I I I      I I
-->F I I      I I

```

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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 Plan Templates** for easy reuse. The following are default templates:

Grandfather, Father, Son.

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

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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

The Macrium Rescue Environment



Caution

The first thing you need to do after 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 the Windows Recovery Environment (also known as Windows RE or WinRE) and is supplied with Windows 7 and later operating systems. For Windows XP, Vista and systems without WinRE, Reflect will download the Windows Pre-installation Environment (also known as Windows PE or WinPE) directly from Microsoft.

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 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 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 2/3 interfaces are supported by default.

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:

- [Rescue Media Builder - How It Works](#)
- [Creating rescue media](#)

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- Adding a Boot Menu option for system Image recovery
- Preparing a USB stick for Windows PE
- Creating a bootable Windows PE USB stick
- Accessing network shares in Windows PE
- Technicians portable application support
- Adding device drivers to Windows PE
- About Adding Drivers to WinPE Rescue Media
- Fixing Windows boot problems
- Updating rescue media to include additional hardware drivers
- Adding iSCSI support to Windows PE
- Adding BitLocker support to Windows PE
- Restoring an image from within the Rescue Media

Rescue Media Builder - How It Works

RMBuild.exe

v7.2 of Macrium Reflect includes a new Rescue media builder user interface that offers:

- **Simplified** user interface with one click build for most scenarios
- **Windows RE support.** Windows RE is usually available as a no download option on the majority Windows installations from Windows 7 and later.

For the majority of PCs, **Windows 10 WinRE adds WiFi support** when booted in the rescue media.



Note: A few WiFi adapters are unsupported. The vast majority of adapters will be automatically supported and will automatically connect using a WiFi profile copied from Windows during the build process.

- **Windows PE 10 1709**
- **New network TaskBar icon and management UI** in PE/RE. **Right click on the Network icon** to open the UI.

The Rescue Media Builder executable '**RMBuild.exe**' is located in the Macrium Reflect installation folder, usually 'C:\Program Files\Macrium\Reflect'. **RMBuild.exe** can be launched independently or by taking the Rescue Media build menu option in **Macrium Reflect**.

RMBuild.exe depends on the following files:

Description	Architecture	File name
DVD/CD Support	32 Bit	PrimoBurner.dll
	64 Bit	PrimoBurnerx64.dll
Free Edition	32 Bit	WaikFiles00x86.exe
	64 Bit	WaikFiles00x64.exe
Home/Workstation Edition	32 Bit	WaikFiles15x86.exe
	64 Bit	WaikFiles15x64.exe
Server Edition	32 Bit	WaikFiles20x86.exe

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Description	Architecture	File name
	64 Bit	WaikFiles20x64.exe
Server Plus Edition	32 Bit	WaikFiles25x86.exe
	64 Bit	WaikFiles25x64.exe



Note: RMBuild.exe requires Macrium Reflect to be installed.

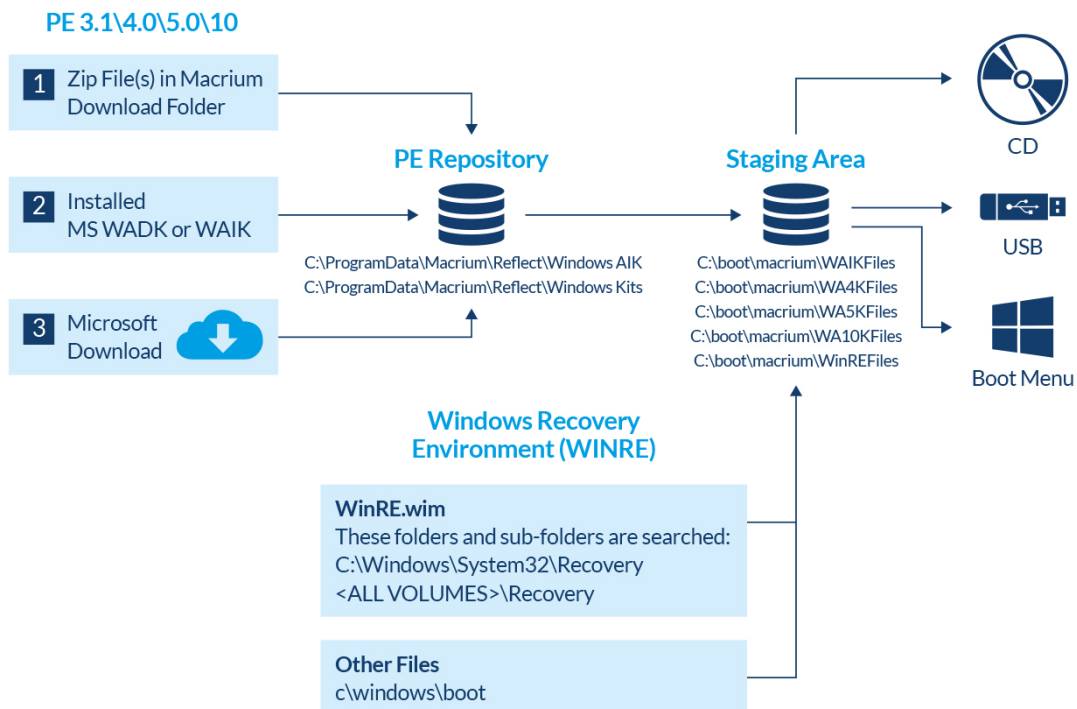
Windows Image File (WIM) and toolset files location

For **Windows PE 3.1/4.0/5.0/10** the files required to build the Macrium Rescue media are copied from the **Input location** to the **Repository**. The **Repository** is then used to populate the **Staging Area** when rescue media is built from scratch or stale.

For the **Windows Recovery Environment (WinRE)** the required files are located on the current system and copied to the **Staging Area** when rescue media is built from scratch or stale.

The **Staging Area** provides the files for the **Boot Menu** and for creating **ISO/DVD/CD and USB** boot media.

Macrium Rescue Environment



Windows PE 3.1/4.0/5.0/10

Required files to populate the **PE Repository** are searched for in the following sequence...

1. **PE Zip files:** - PE zip files(s) containing the Windows Image (WIM) file and toolset files are saved to the Macrium download folder by the Reflect download manager ReflectDL.exe.

The default location is 'C:\users\<USER>\Downloads\Macrium'

Windows PE	File Name
PE 3.1	pe3x64.zip pe3x86.zip
PE 4.0	pe4x64.zip pe4x86.zip
PE 5.0	pe5x64.zip pe5x86.zip
PE 10	pe10_1709x64.zip pe10_1709x86.zip

2. **WAIK/WADK** - Windows is searched for installations of the **Windows® Automated Installation Kit (AIK)** for PE 3.1 or the **Windows® Assessment and Deployment Kit (Windows ADK)**. These products contain the Windows Image File (WIM) and tools to create the rescue media.

<https://docs.microsoft.com/en-us/windows-hardware/get-started/adk-install>

<https://www.microsoft.com/en-us/download/details.aspx?id=5753>



Note: The **WADK** and **WAIK** download is several GB. It isn't necessary to manually install these products unless you are having problems with the automated download.

3. **Automated Download** - Finally, any missing files are automatically downloaded directly from Microsoft and copied to the **PE Repository**.



Note: If there is no Internet connection at this stage then the build process will fail.

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PE Repository

Files located in **1.** above are copied to the PE repository in the following folders.

PE Version	Location
3.1	C:\ProgramData\Macrium\Reflect\Windows AIK
4.0	C:\ProgramData\Macrium\Reflect\Windows Kits\8.0
5.0	C:\ProgramData\Macrium\Reflect\Windows Kits\8.1
10	C:\ProgramData\Macrium\Reflect\Windows Kits\10

Windows Recovery Environment (WinRE)

Files for the **Windows Recovery** rescue environment are pre-existing and located on the local file system.

The following **folders, and sub-folders** are searched for file **WinRE.wim**

C:\Windows\System32\Recovery

<ALL VOLUMES>\Recovery

If multiple copies of **WinRE.wim** are found then each WIM is examined and the WIM that contains the most recent Windows OS is copied to the **Staging Area**.

Additional toolset files are copied from folder '**C:\Windows\Boot**'

Staging Area

The Staging Area is re-populated each time the rescue media is re-built. Immediately after the Windows Image (WIM) file is copied to the Staging Area, it is mounted and the current version of Macrium Reflect is copied to the WIM file system along with required components and additional files extracted from **WaikFilesxNNnnn.exe**.

PE Version	Location
3.1	C:\boot\macrium\WAIKFiles
4.0	C:\boot\macrium\WA4KFiles
5.0	C:\boot\macrium\WA5KFiles
10	C:\boot\macrium\WA10KFiles

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PE Version	Location
WinRE	C:\boot\macrium\WinREFiles

Output

When the '**Build**' button is clicked files are copied from the **Staging Area** to the rescue media target. For the **Boot menu**, the **Windows Boot Configuration Data (BCD)** is updated to add a '**Macrium Reflect System Recovery**' menu option which loads the Windows Image File (WIM) directly from the Staging Area.

For more information on the Windows BCD please see here: https://en.wikipedia.org/wiki/Windows_Vista_startup_process

Creating rescue media

- Main User Interface
- Boot Menu Options
- USB Rescue Media Options
- ISO/CD/DVD Rescue Media Options
- Advanced Options
- USB Flash Drive Formatting

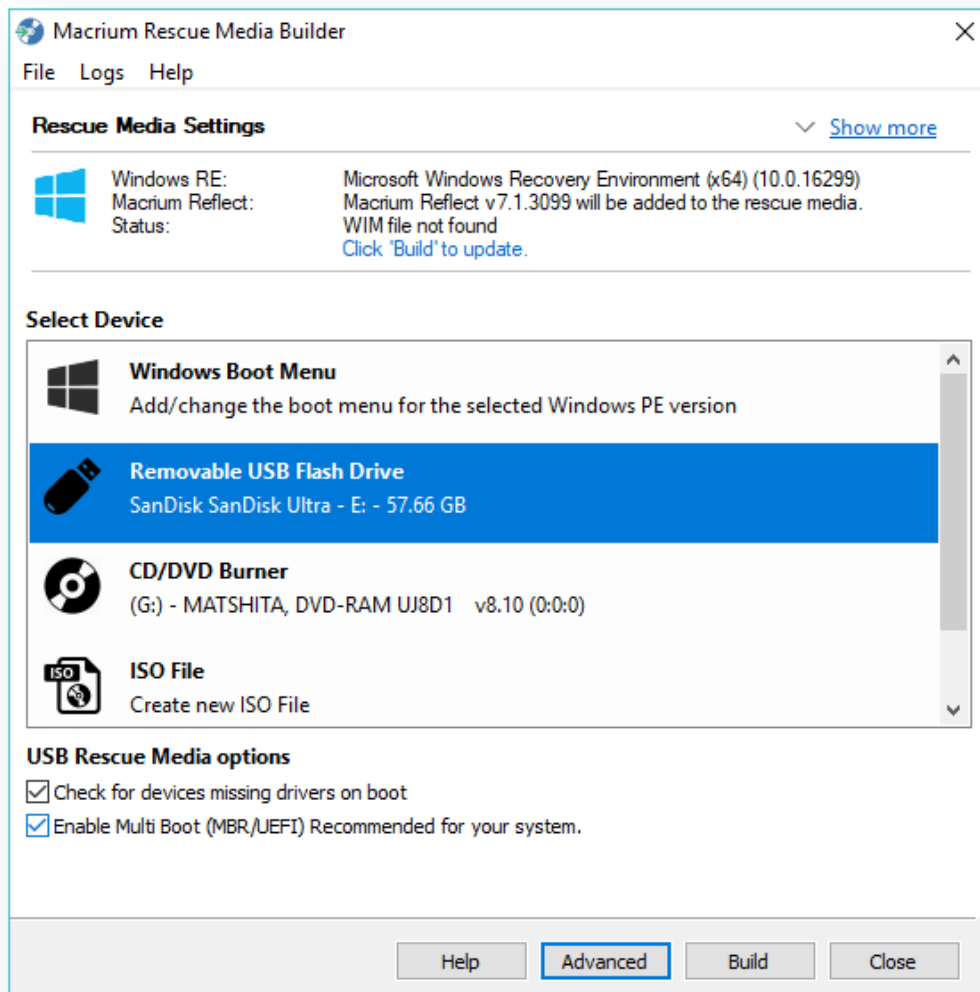
Main User Interface

Macrium Rescue Media Builder provides a simple interface to allow for quick rescue media generation by selecting where the rescue media will be generated and then clicking a **'Build'** button.

All options for the rescue media will be suitably defaulted based on existing rescue media builds and a scan of the operating system environment.

1. Choose a rescue media target under **'Select Device'**
2. Click **'Build'**

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The '**Header**' area shows the currently selected Windows PE/RE version and settings. '**Show more**' expands the view to show the selected Advanced options.

Rebuilding the Windows Image File (WIM)

If the Rescue media needs rebuilding then this will be indicated in the header area. Reasons for rebuilding:

- **A later version of Macrium Reflect** is available and needs to be added to the build.
- **A later version of Windows RE** is available. A Windows update can cause the installed version of Windows RE to be updated.
- **Any 'Advanced' settings that have changed** since the rescue media was last built. If you click 'Show more' these settings will be highlighted in blue text.
- **A 'Custom WIM' file has changed** since the last build.
- **The 'Boot\Macrium\Drivers' sub folder** contains new or changed driver files.

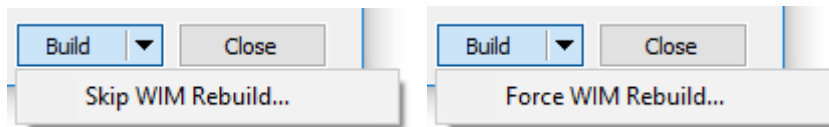
Pressing 'Build' will re-populate the Staging Area, mount the WIM and copy the relevant files before dismounting the WIM and continuing with the build target operation.

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WIM Rebuild Override

Overriding the default WIM rebuild behaviour may be useful to create rescue media without updating to a later release of Macrium Reflect, or, to force a rebuild to troubleshoot corrupt or non-booting rescue media or boot menu option.

The default WIM rebuild action can be overridden by **pressing the 'Ctrl' key**. Once pressed, and if appropriate, the 'Build' button becomes a 'Split' button showing either a **'Skip WIM Rebuild...'** or a **'Force WIM Rebuild...'** menu option, the opposite of the default 'Build' button behaviour. .



The override menu is not displayed in the following scenarios:

1. The **'Remove boot menu'** option is selected. WIM operations are not relevant in this case.
2. The **WIM needs rebuilding** and the **'Current boot menu'** option is selected. In this case, the default operation of rebuilding the WIM is the only operation relevant and available.

The **'Select Device'** area shows a list of possible ways the rescue media can be created.

Target	Description
Windows Boot Menu	Will either add, update or remove an entry from the Windows Boot Menu, select from the 'Boot Menu Options' for the desired action.
USB Flash Drive	Creates the rescue environment on an external USB flash drive. At least one partition is required on the drive with enough space for the rescue media files or the disk should be empty of partitions but be large enough for a new partition to accommodate the rescue media files.
USB HDD	Creates the rescue environment on an external USB HDD. As with the USB Flash Drive option a partition must be available with enough space or there should be enough space to create a new partition.
ISO File	Creates an ISO file suitable for either burning with third party software or booting a virtual machine from.



Note: In the case of external USB Flash/HDD the creation process is non destructive. No existing partition will be removed from the disk, only files added to an existing partition or a new partition created.

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Boot Menu Options

Selecting the '**Windows Boot Menu**' device will offer the following options

Option	Description
No boot menu	Do not add a boot menu option to the Windows boot menu.  Note: This option is not visible if a Macrium Reflect rescue environment exists in the Windows boot menu
Add boot menu	Add the currently selected WinPE/WinRE environment as a Windows boot menu item. A description of the current environment can be seen to right of this option. Also, review the 'Header' area further up in this document.
Remove boot menu	Remove the currently configured Macrium Reflect rescue environment Windows boot menu item.
Current boot menu	Retain the currently configured Macrium Reflect rescue environment Windows boot menu item.

USB Rescue Media Options

Selecting either '**Removable USB Flash Drive**' or '**Removable USB Hard Drive**' device will offer the following options

Option	Description
Check for devices missing drivers on boot	Scans for Mass storage or network controllers that do not have driver support and show a dialog to assist with adding and loading drivers.
Enable Multi Boot (MBR /UEFI)	Enables USB media to boot on both MBR and UEFI systems.
Create Portable Technicians Rescue Media	Adds support for running the 'Technicians Portable' form of Macrium Reflect rescue environment.  Note: This will require a valid Technicians license key

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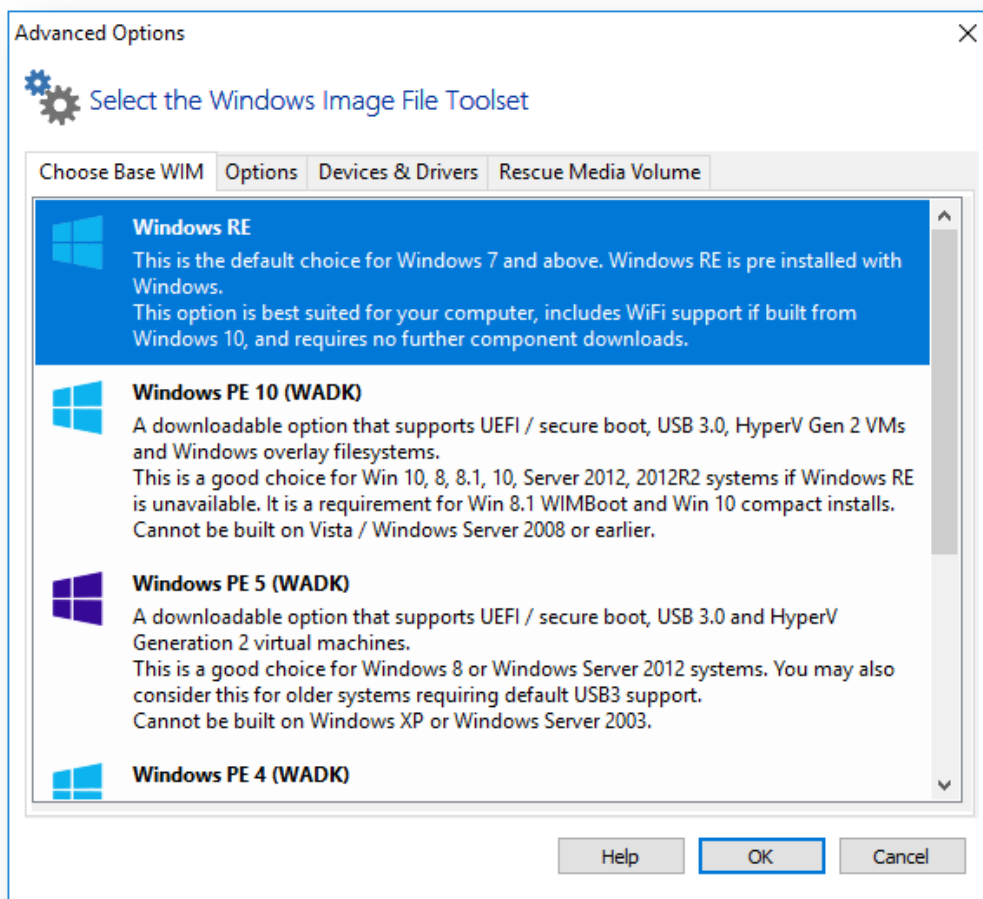
ISO/CD/DVD Rescue Media Options

Selecting 'ISO File' or 'CD/DVD Burner' device will offer the following options

Option	Description
Check for devices missing drivers on boot	Scans for Mass storage or network controllers that do not have driver support and show a dialog to assist with adding and loading drivers.
Prompt for key press to continue boot sequence	Shows a simple prompt during boot, pressing any key will boot from the ISO media and not pressing any key will boot from the normal volume.

Advanced Options

The '**Advanced**' button opens options to change PE version and choose additional features for the rescue media build.



What version of Windows PE should I choose?

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The default Windows PE version selected on a fresh installation:

OS	Default Rescue Environment
Windows XP/Server 2003	Windows PE 3.1
Windows 7/Server 2008	Windows RE if available otherwise Windows PE 3.1
Windows 8.0/8.1/Server 2012/R2	Windows RE if available otherwise Windows PE 5
Windows 10/Server 2016./17	Windows RE if available otherwise Windows PE 10

You should ensure that your rescue media can access your System drive and also your backup location. The default option selects **Windows RE** if available. If Windows RE is not supported or cannot be located then the Windows PE version is selected that is the best match for your Windows operating system (*see table above*). 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.



Note: For Windows 7 systems with USB 3.0 ports it may be necessary to use PE 5.0 or PE 10.0 to enable USB 3.0 in the rescue media

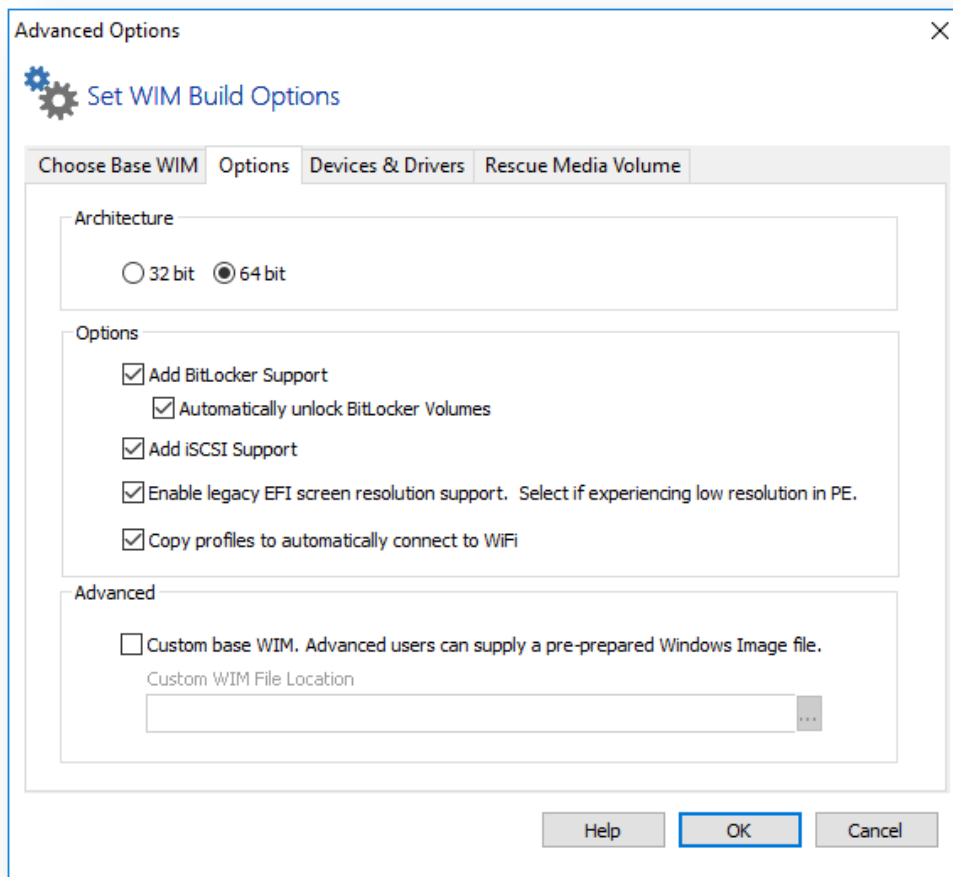
PE version	Description
Windows RE	This is the default choice for Windows 7 and above. Windows RE is pre installed with Windows. If available, this option is best suited for your computer, includes WiFi support if built with Windows 10 and requires no further component downloads. Note: Not available for Windows XP/Vista or for later Operating Systems if Windows RE cannot be located.
Windows PE 10.0	Based on Windows 10. Supports UEFI / secure boot, USB 3.0, HyperV Gen 2 VMs and Windows overlay file systems. This is a good choice for Win 8, 8.1, 10, Server 2012, 2012R2 systems if Windows RE is unavailable. Windows PE 10 supports Windows 8.1 WIMBoot technology and Windows 10 'Compact Install'. Both of these installation types are rare but may be used on Windows Tablet PCs with limited disk space. Note: The Windows PE 10.0 download option is not available if you are running Windows XP, Vista or Server 2003/2008

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version	
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 if Windows RE is unavailable. You may also consider this for older systems requiring default USB3.0 support.  Note: The Windows PE 5.0 download option is not available if you are running Windows XP or Server 2003.
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 your require PE 5.0 features on Windows XP or Server 2003.
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 if Windows RE is unavailable.  Note: USB 3.0 support is not included.  Note: Some very early Windows XP systems may not meet the minimum requirements to boot Windows PE.

 **Note:** If you have already built rescue media with an earlier version of Macrium Reflect then that PE version will be defaulted

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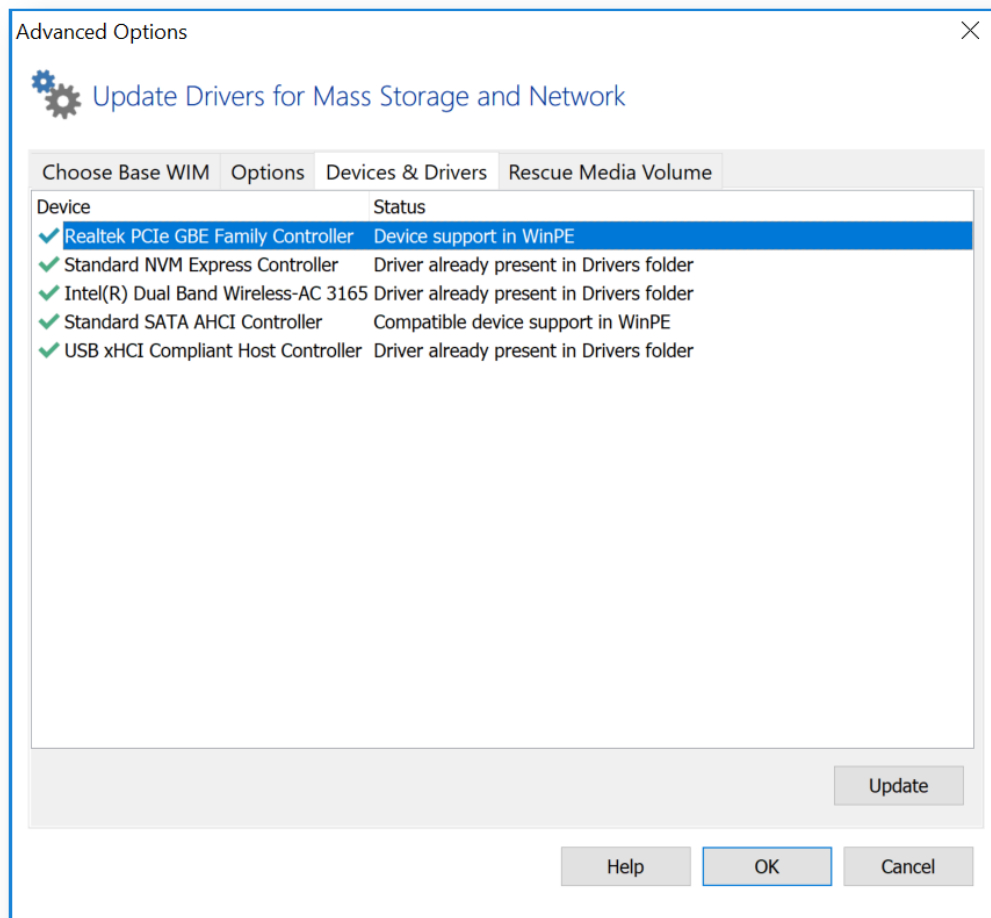


Option	Description	
Architecture	Choose from 32 or 64 bit. WinRE is only available for the same architecture as the current Windows OS.  It's only necessary to choose an alternative architecture when creating rescue media to boot a different PC.	
iSCSI Support	Enables restoration and clones to iSCSI connected disks. Please note that adding these components may several minutes to the creation process. See Adding iSCSI support to Windows PE for more information on using iSCSI in Windows PE	
BitLocker	Add Support	Add the components required to run 'managebde.exe' and unlock BitLocker drives to Windows PE.
		Automatically unlocked BitLocker drives when the rescue media starts.

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Option	Description
	Auto Unlock Also see: Adding BitLocker support to Windows PE and BitLocker Restore/Clone Outcomes
Legacy EFI Screen Resolution	Select this option if you are experiencing very low, less than 1024 x 768, screen resolution in PE 10 or WinRE. Some early UEFI BIOS chipsets are incompatible with Windows 10 Pre-Installation Environment graphics output. Selecting this option will cause the PE 5.0 EFI microcode to be used instead of PE 10 when starting the rescue environment.
Copy WiFi Profiles	Select this option to copy WiFi profiles, including passwords, to the rescue media. If possible a WiFi connection will be automatically established when Windows RE starts.  Note: This option, and WiFi support, is only available in Windows RE 10. WiFi profiles are encrypted to prevent unauthorised access.
Custom base WIM	Use your own customized WIM for the rescue media. This is an advanced topic not covered in this help.

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Mass Storage and Network devices will be listed showing the current state of driver support. Drivers can be added for devices missing driver support as well as updating drivers previously added to the rescue media.

The status of a device can be one of the following

Device Status	Meaning
Device Detected	The device has no drivers and will not function in WinPE/WinRE. If you require this device then drivers should be added.
Device support in WinPE	The device has a supporting driver in WinPE/WinRE. Generally you do not need to update this form of driver.
Compatible device support in WinPE	The device has a compatible driver in WinPE/WinRE. Again, this driver generally does not require updating.
	A driver has been previously added to the Macrium Reflect rescue media for this device.

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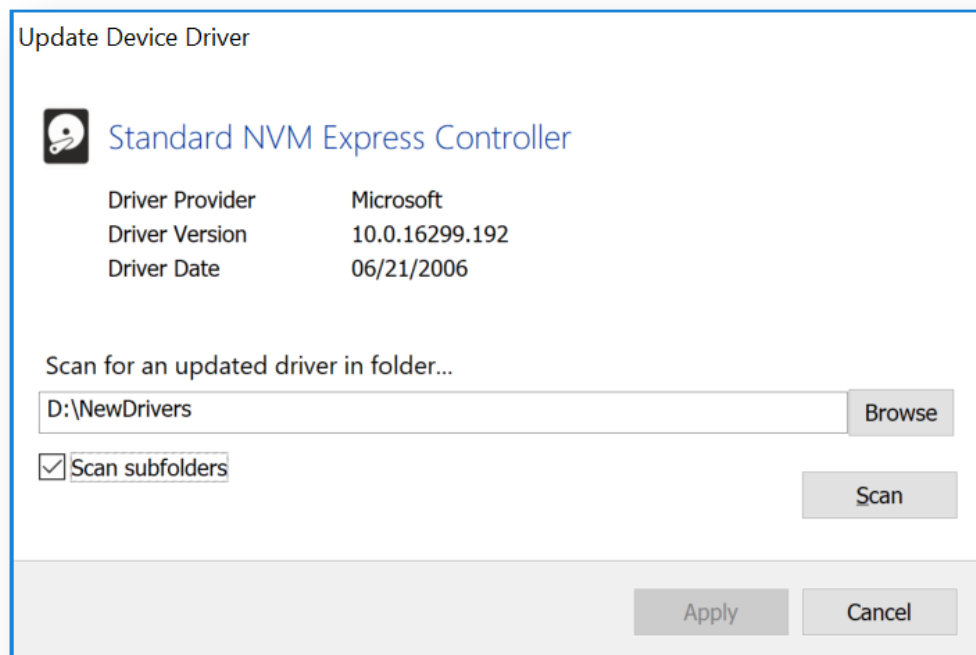
Device Status	Meaning
Driver already present in Drivers folder	
Copy host driver	For Vista based and later operating systems if a device is found without driver support then the operating system will be scanned for a compatible driver. If discovered the host OS driver will be added to the rescue media.  Note: If no compatible device is found then the status will remain at Device Detected

How To Update Drivers

Note: Click Update or double click a device to add or update a driver for a device.

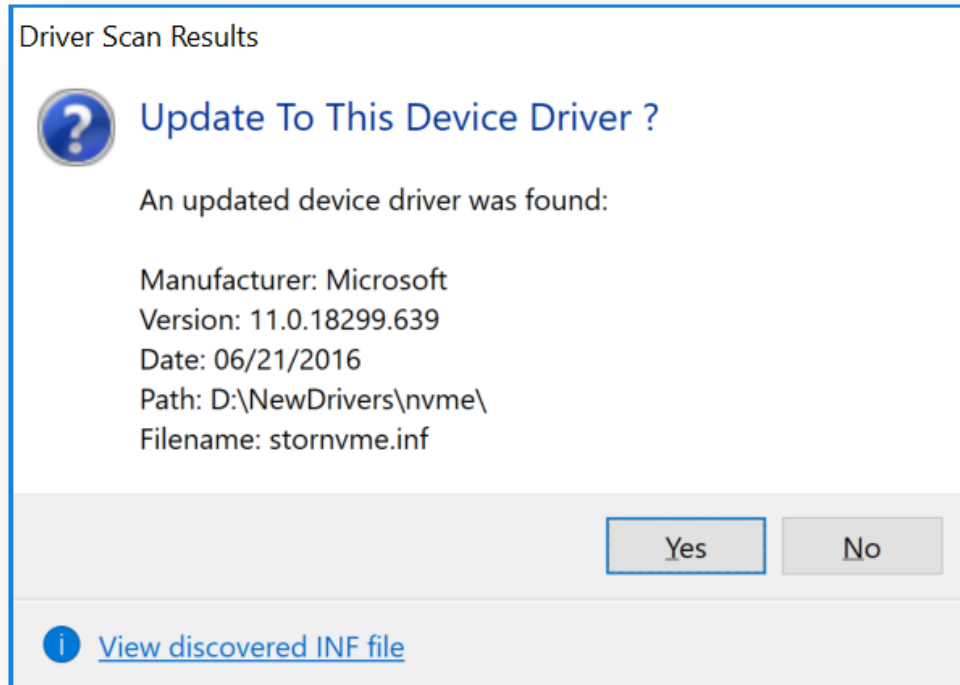
WiFi Device Support

Note: WiFi device support will only be available in WinRE based rescue environments, even if drivers are added for the device.



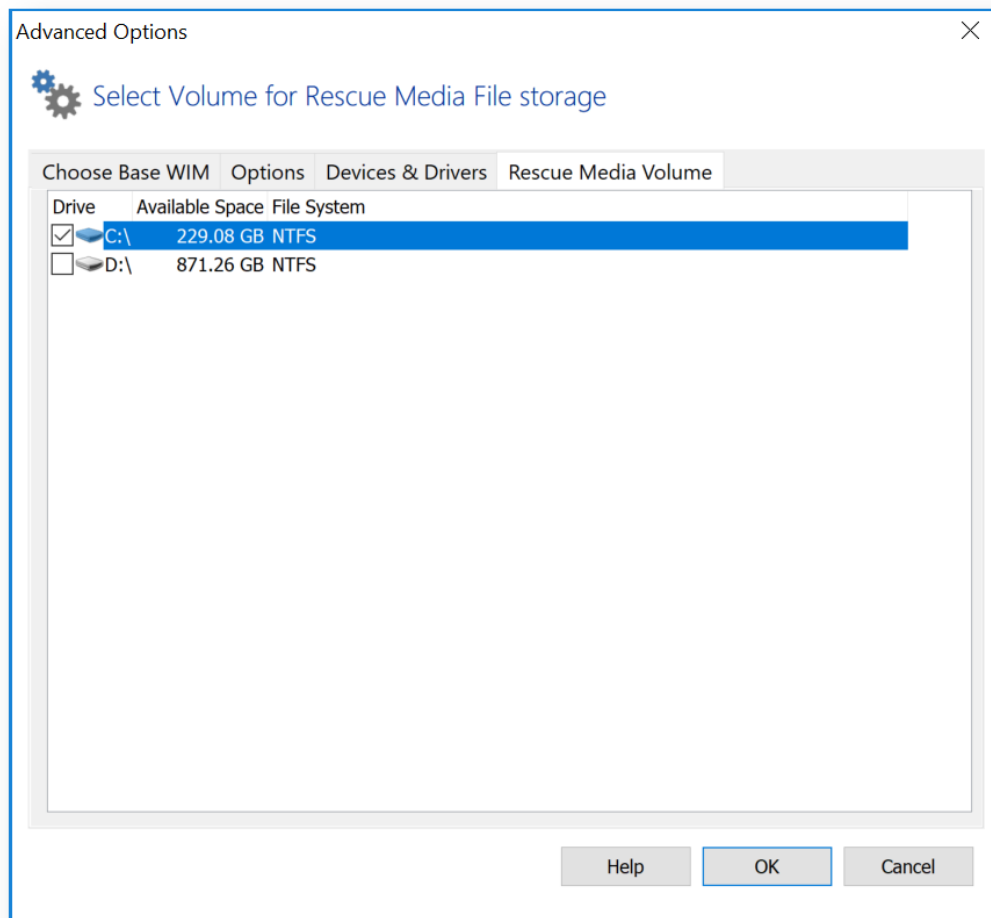
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This dialog will show the current driver information for a device. To update the driver, click Browse, select a folder and click the Scan button (optionally select to scan subfolders before starting the scan). The folder will be checked for an updated driver based on either version number or date and if discovered, a prompt will be shown for update confirmation.



Once an updated driver has been found and selected, click Apply to save the updated driver or Cancel to retain the current driver.

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Macrium Reflect Rescue Media files can be stored on a different volume, this tab allows for selection of the preferred volume. Select a volume by clicking the check box and then Click OK. Rescue media files will now be stored on that volume, any existing Macrium Reflect rescue media files from previous builds will be moved to a newly selected volume.



Note: This option is not available in Windows XP

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USB Flash Drive Formatting

	The following partition is required on the USB flash drive for booting the Macrium Reflect rescue media:		
	Boot	Type	Min Partition Size
	Multi-Boot MBR / UEFI	FAT32	1.2 x Size of Rescue Media PE files
	MBR Only	FAT32 or NTFS	1.2 x Size of Rescue Media PE files

The Rescue Media PE files vary in size dependant on PE/RE version. 1GB will be sufficient for all PE and RE versions as of May 2018. If there is insufficient free space then the build may fail.

Rescue Media Builder will first attempt to non-destructively copy the PE/RE files to an existing partition, then non-destructively create a new partition if necessary. If this is not possible then you will be prompt to destructively format the drive.

The Flash drive is prepared and files copied according to the following steps...

1. The flash media is first searched for a partition of sufficient size and the required file system type as defined in the above table. If found then the **PE/RE files are copied to the Flash drive.**



Note:

For **Multi-Boot** (MBR/UEFI) rescue media the suitable partition is determined in the following sequence:

The current '**Active**' partition is checked for suitability.

If not found, the first suitable FAT32 partition is used. This partition is then marked 'Active'

For **non Multi-Boot** (MBR) rescue media the suitable partition is determined in the following sequence:

The current '**Active**' partition is checked for suitability.

If not found, the first suitable FAT32 partition is used. This partition is then marked 'Active'

If not found, the first suitable NTFS partition is used. This partition is then marked 'Active'

2. If no suitable partition/file system is found and the rescue media creation is **Multi-Partition Aware** then the flash drive is searched to locate unallocated space to create a **1GB FAT32 partition.**

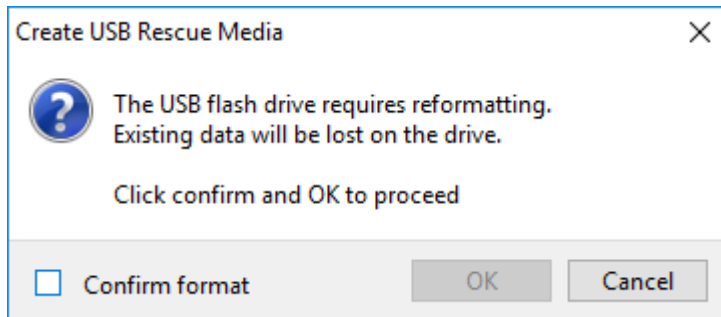
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 USB flash Rescue media is considered **Multi-Partition Aware** if the **host OS is Windows 10 Release 1709 or later** and the target **Win PE/REWIM** is also **Windows 10 Release 1709 or later**. In all other cases only a single partition will be allowed on flash media.

There can be a maximum of 4 primary partitions on the drive.

If a partition is successfully created and formatted then it is marked '**Active**' and the **PE/RE files are copied**.

3. If the rescue media creation is **not** Multi-Partition Aware or if the partition in step 2 cannot be created then **Rescue Media Builder** will prompt to format the Flash Drive. This is destructive and **all existing data will be lost on the drive**:



Partition and File System Created

Multi-Partition Aware	Type	Size
Y	FAT32	1GB
N	FAT32	32GB or the maximum size of the flash drive

If a partition is successfully created and formatted then it is marked '**Active**' and the **PE/RE files are copied**.

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Adding a Boot Menu option for system Image recovery

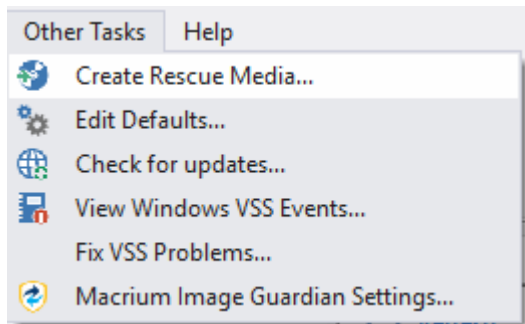
Adding a Macrium Reflect Windows boot menu enables direct access to the Macrium Windows PE recovery environment without the need to burn a DVD or USB Flash drive.



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

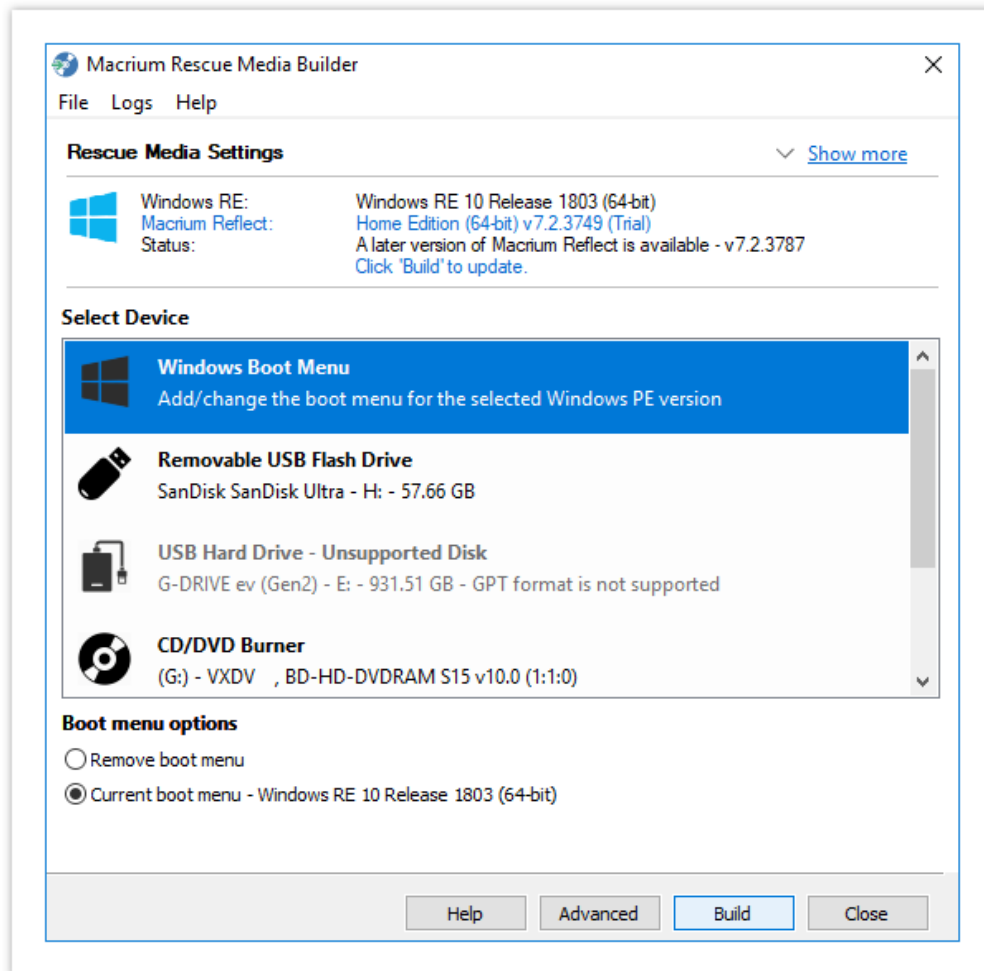
You can add a **Macrium Reflect System Recovery** menu option to your PC boot menu. By doing this you can restore a system image (the C drive) without a recovery CD.

1. Take the '**Other Tasks**' > '**Create Rescue Media...**' menu option



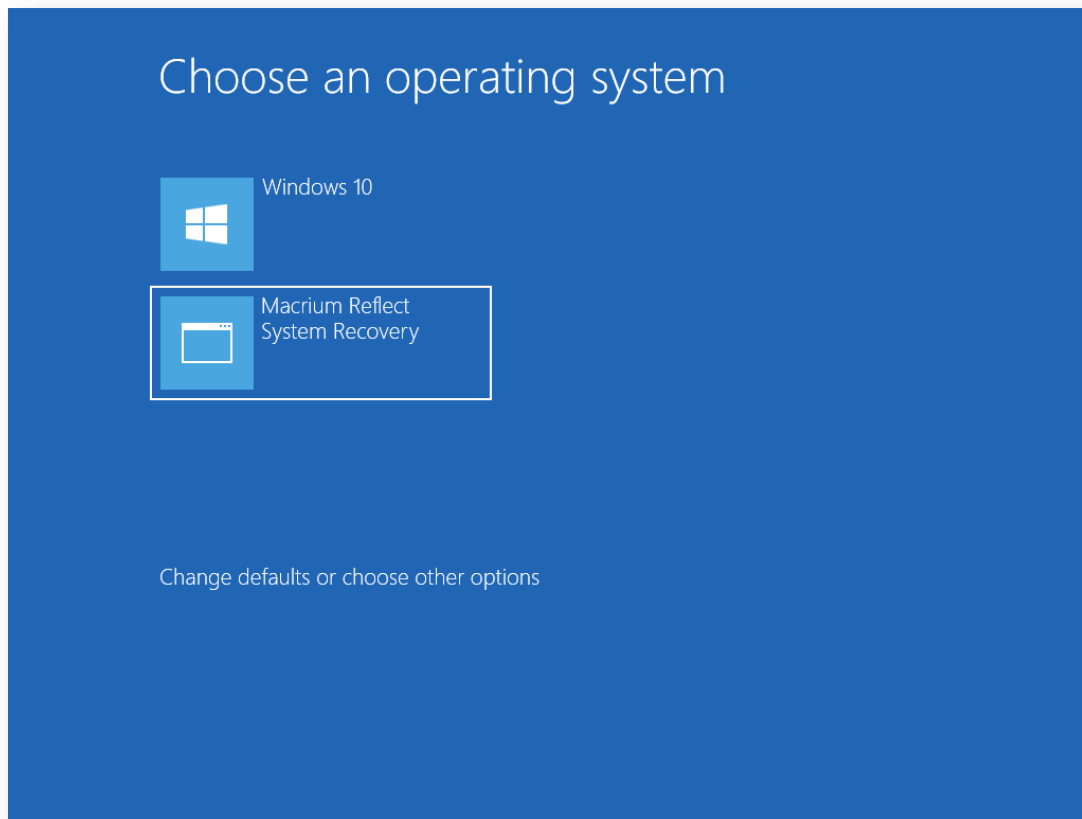
2. Select '**Windows Boot Menu**' in the device list and click '**Build**'

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The Macrium recovery boot menu option - Windows 10



Preparing a USB stick for Windows PE

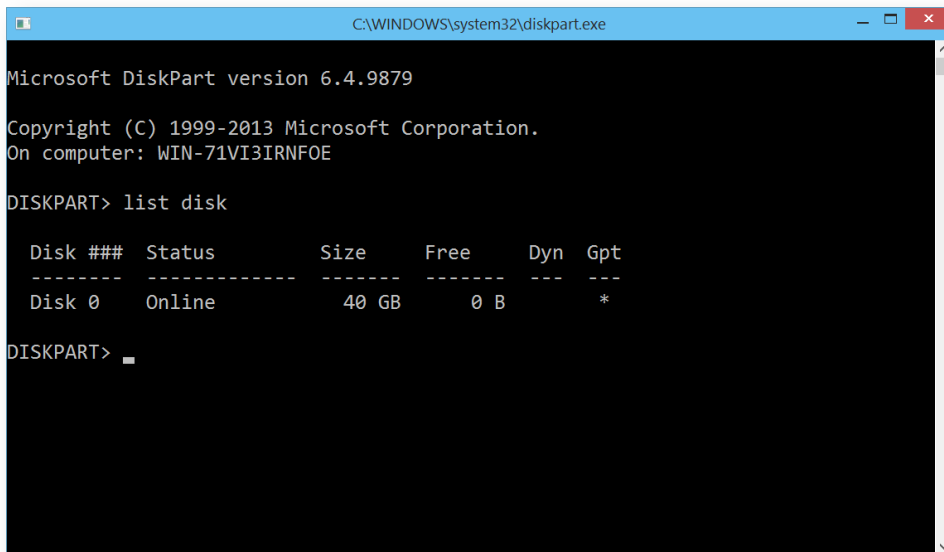
To use a USB stick as a boot device, Windows requires a Master Boot Record (MBR) however some USB sticks are shipped without one and with just a single partition. The USB stick, therefore, needs formatting but the standard Windows format option does not prepare the disk correctly as it does not create 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           *
```

4. Identify the disk number of your USB stick.



Please ensure that you correctly identify your USB stick.

5. Type:

```
select disk <n>
```

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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.



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
```

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once the format command has completed to exit diskpart.

11. Type:

```
exit
```

Again to close the command prompt.

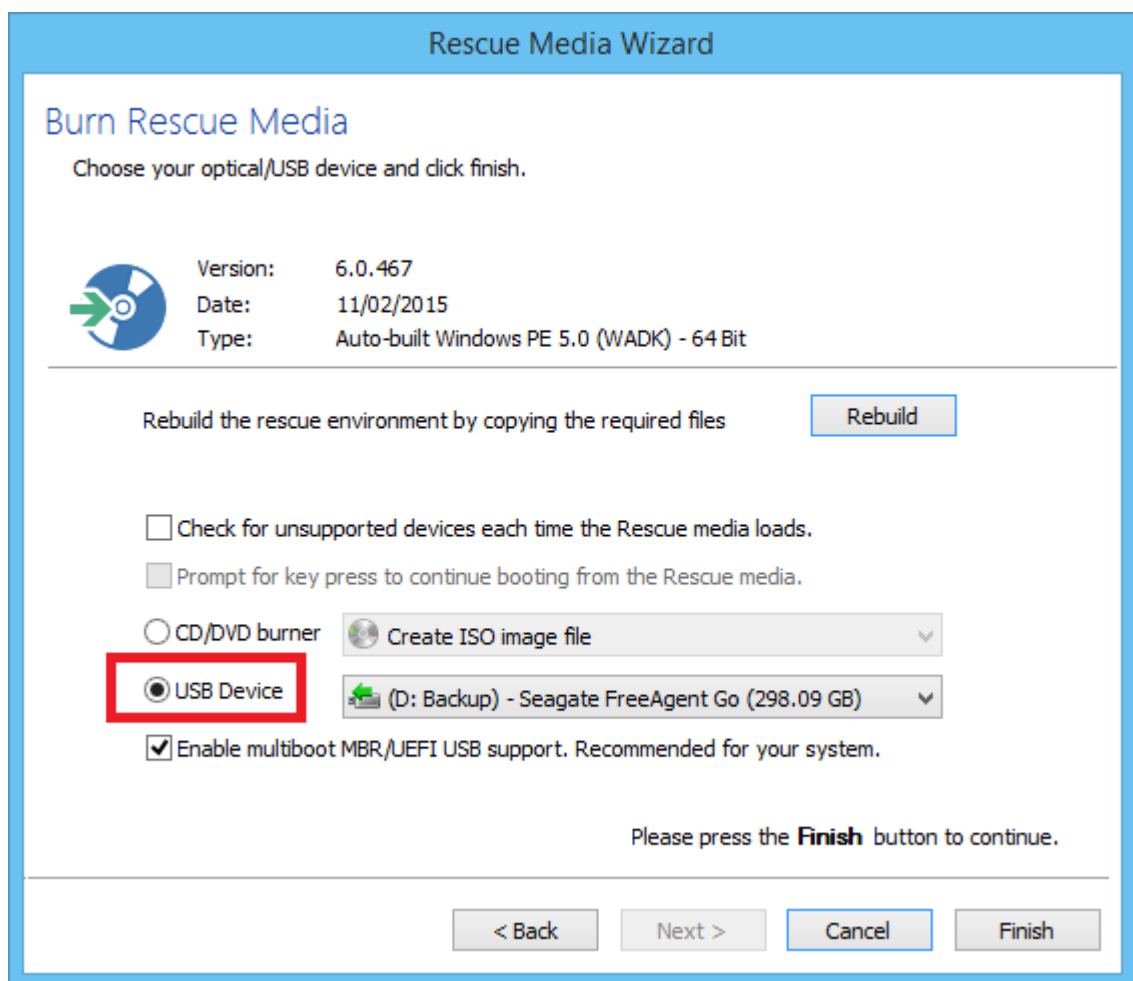
See also: [Troubleshooting USB rescue media](#)

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
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](#)

Macrium Reflect v7.2 User Guide

	Troubleshooting USB rescue media
--	----------------------------------

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'

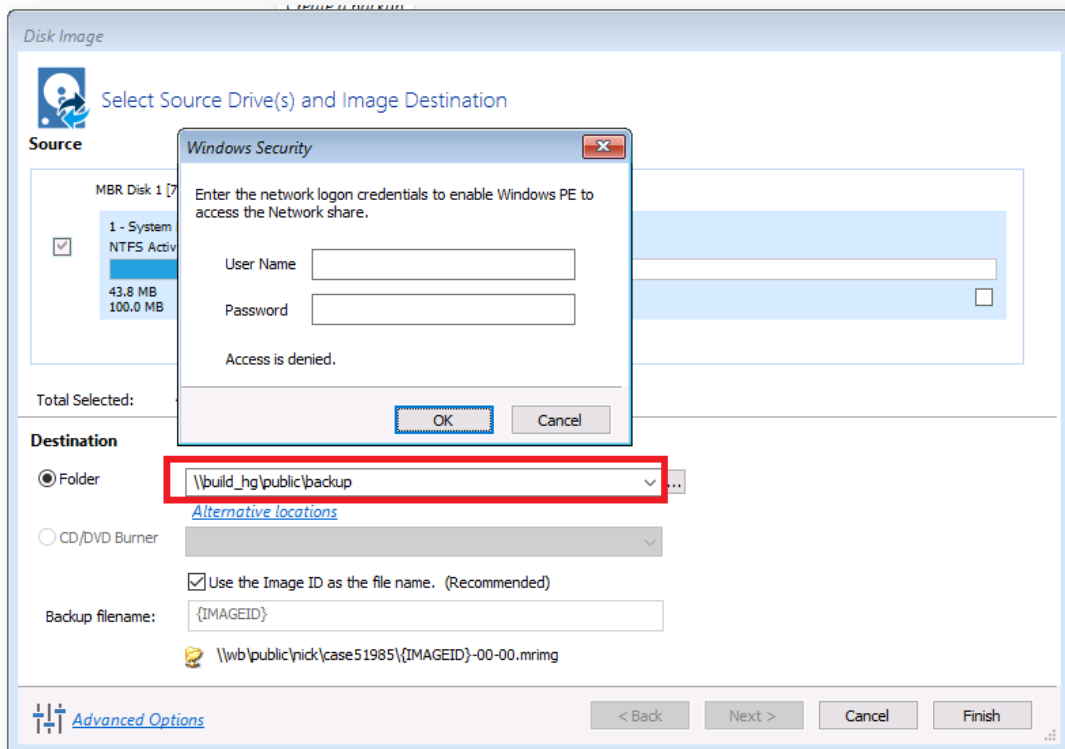
This is not required for earlier versions of Windows PE.

- [Accessing the network when creating an image in PE](#)
- [Accessing the network when restoring an image in PE](#)

Accessing the network when creating an image in PE

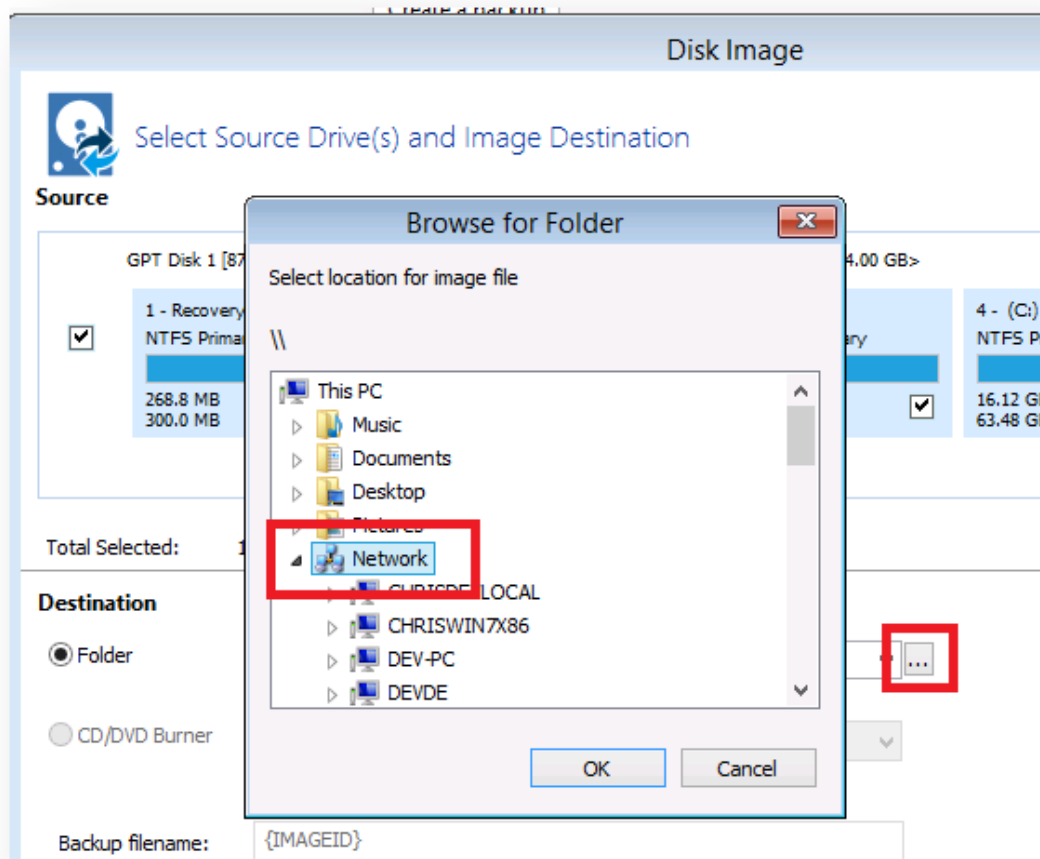
1. In the image wizard **enter the \\server\share\folder path** in the backup destination page. You will be prompted for login credentials if the share is password protected:

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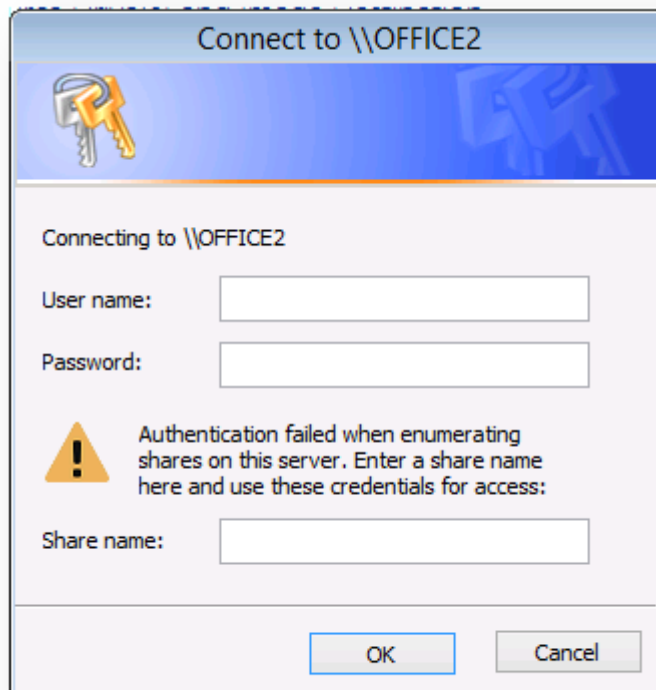
2. Alternatively, **click the '...' browse button** to browse the network for the shared folder:

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

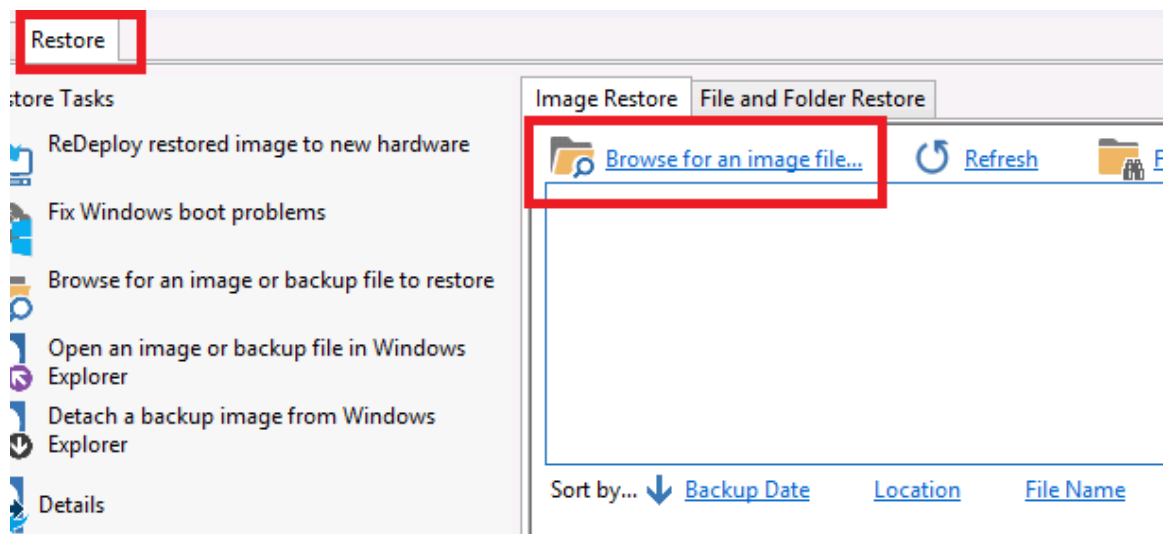
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 Leave the 'Share Name' field empty for root level authentication of the server.

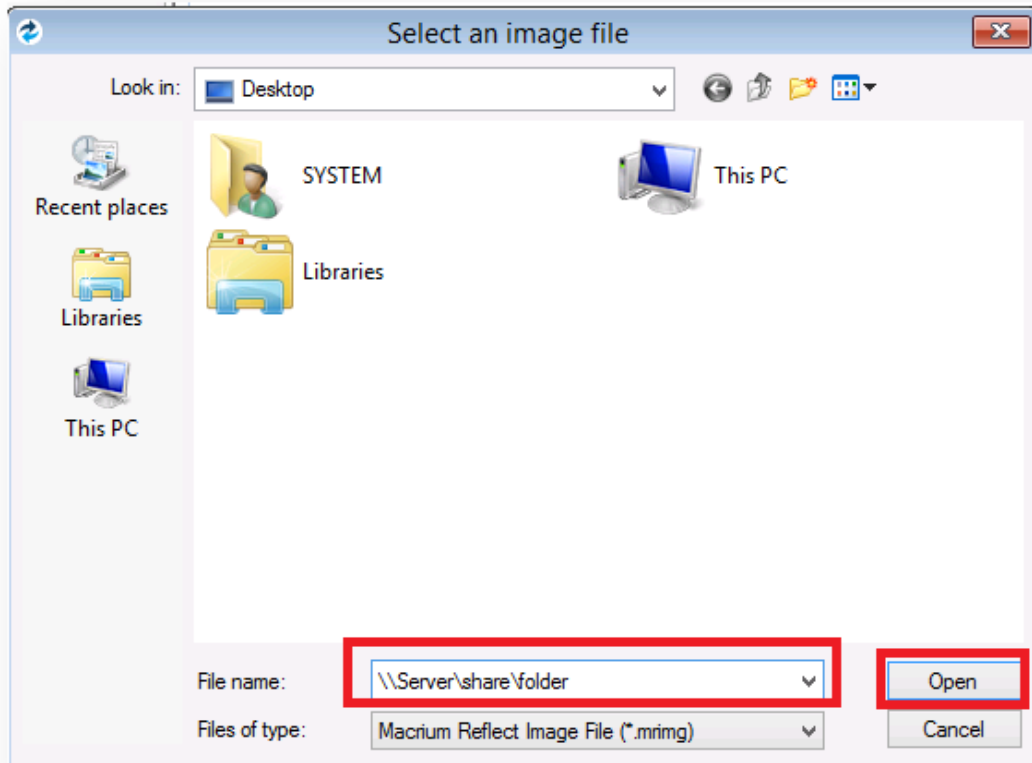
Accessing the network when restoring an image in PE

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



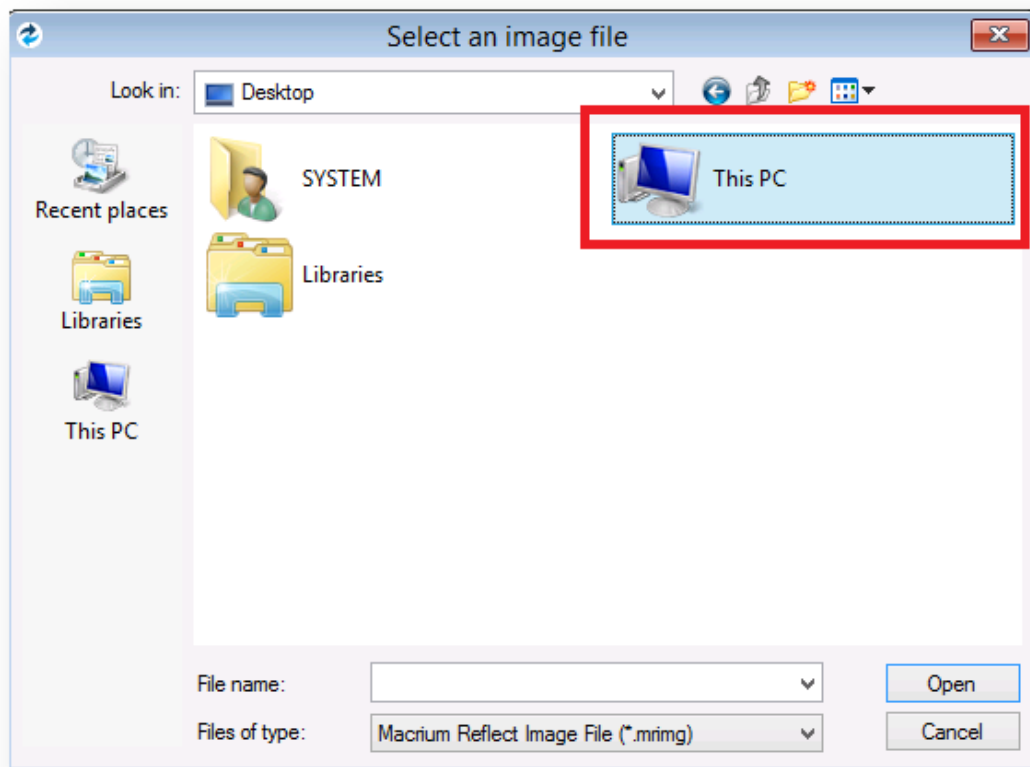
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2. In the browse dialog that opens **type the UNC path of the network share** that you want to access:



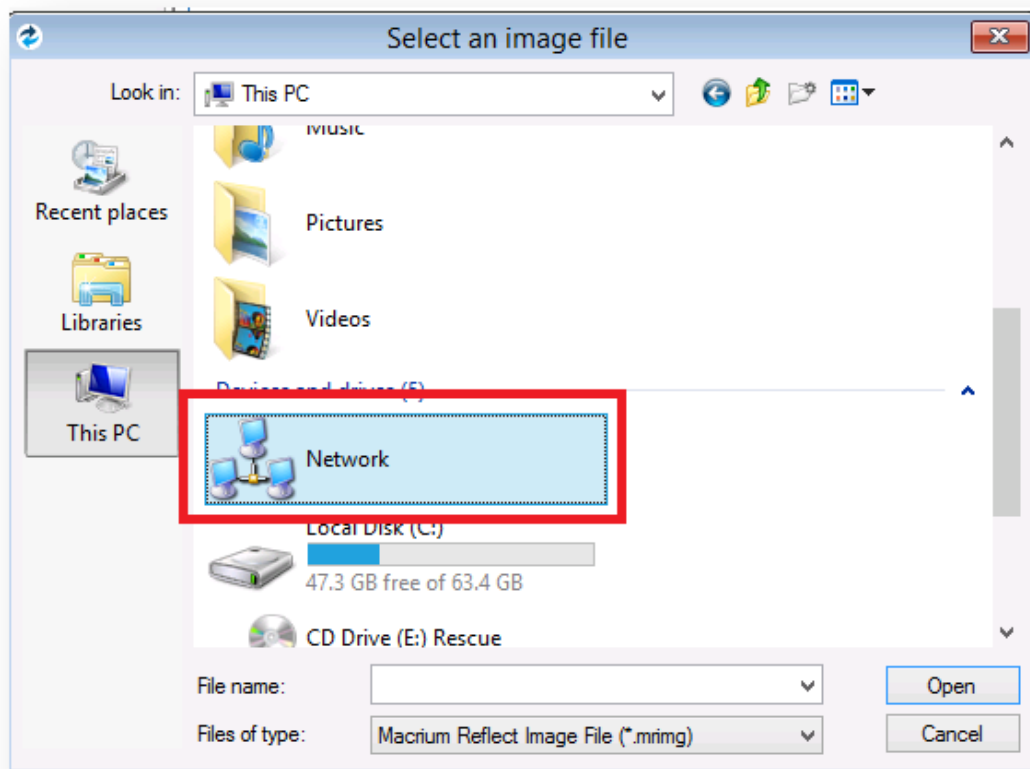
3. Alternatively, **click 'This PC'**:

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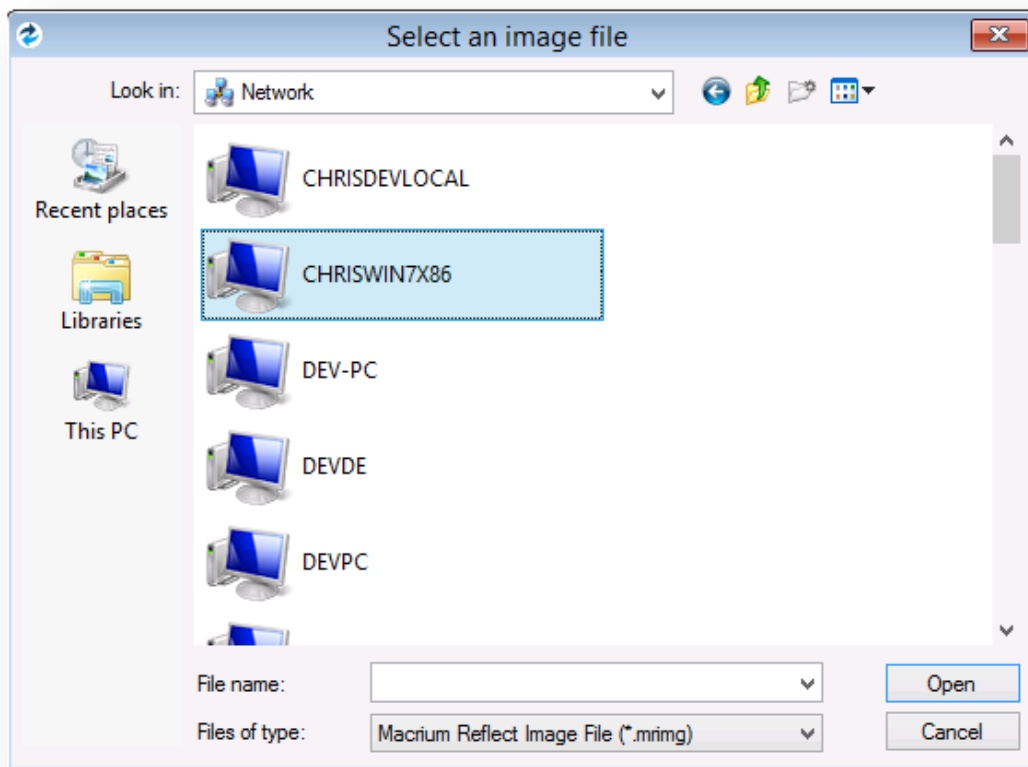
4. Scroll down and **double click 'Network'**:

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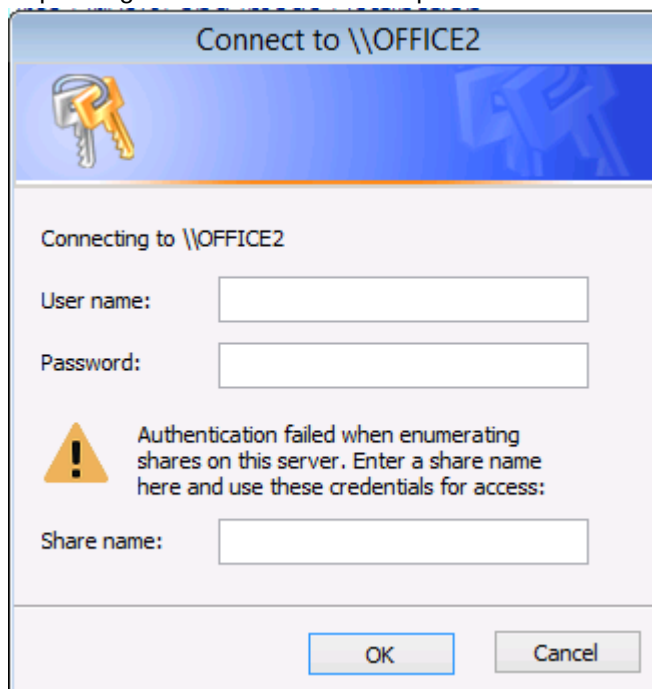


5. **Expand the network server** that contains the share you want to access:

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



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

See also: [Resolving network issues in Windows PE](#)

Technicians portable application support



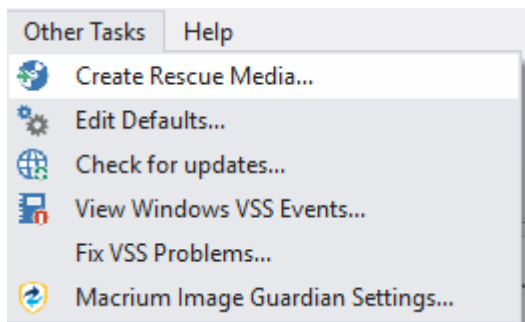
Applies to Server Edition Technician's License only.

Note: Technician's Portable Application USB sticks, Optical media and ISO image files expire when your license for Technician's product expires. You need to recreate your USB stick / ISO image file 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, mounted ISO image file or optical media. The media 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.

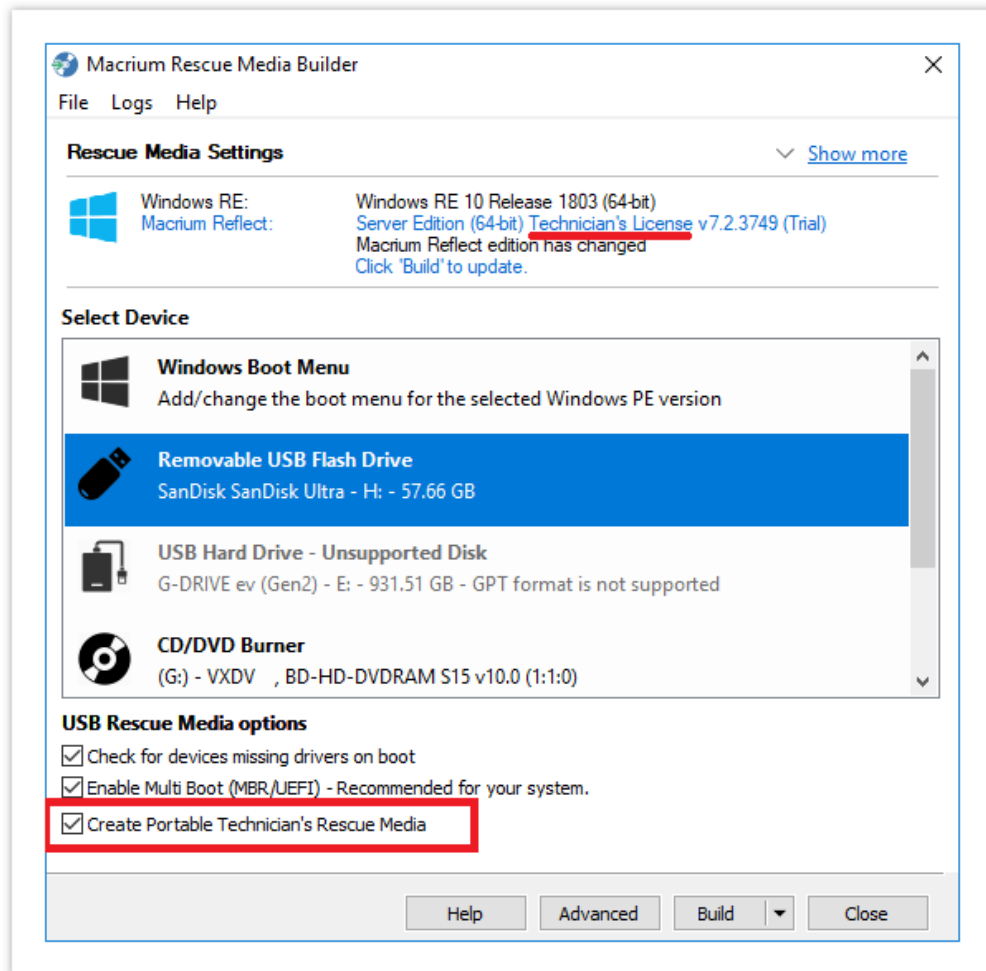
Creating a technician's USB stick

1. Take the '**Other Tasks**' > '**Create Rescue Media...**' menu option.



2. Select **USB Device**, **CD/DVD Burner** or **ISO File** as your target media.
3. Check **Create a Technician's Rescue Media**.

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4. Click **Build**.

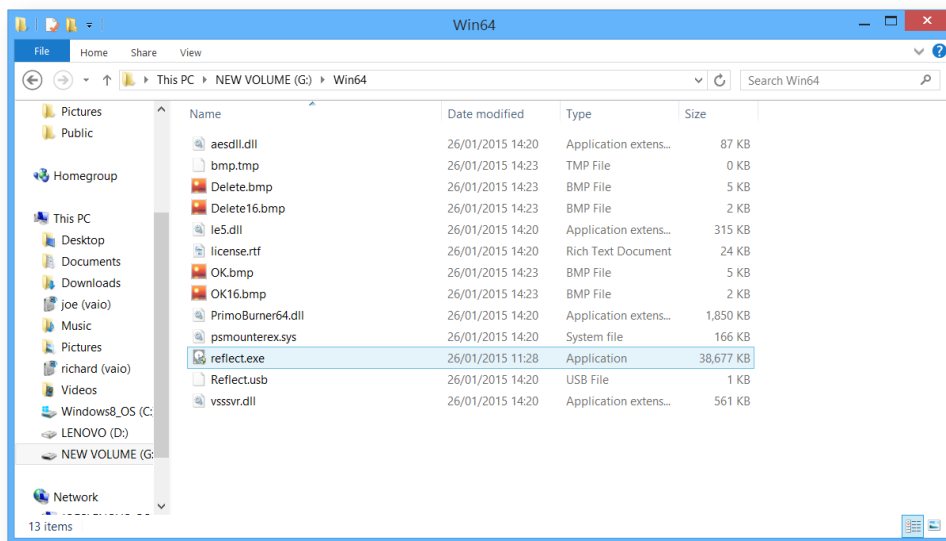
Launching Macrium Reflect from the USB or ISO image

1. Insert the USB or Optical media file and 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.

The media 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.

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Adding drivers to the portable PE environment

You can add drivers directly to the Windows PE rescue environment by booting into Windows PE and taking **Restore > View Unsupported Devices**. For more information see [Adding device driver software](#)

Adding drivers in Windows

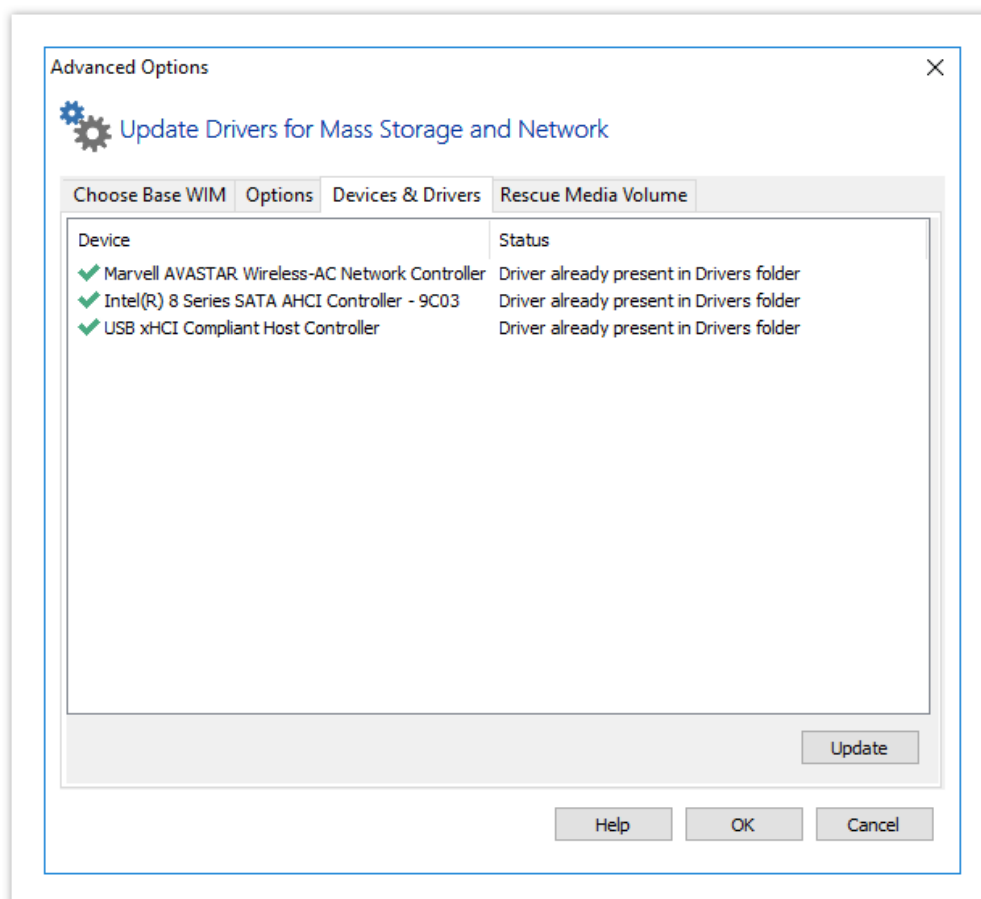
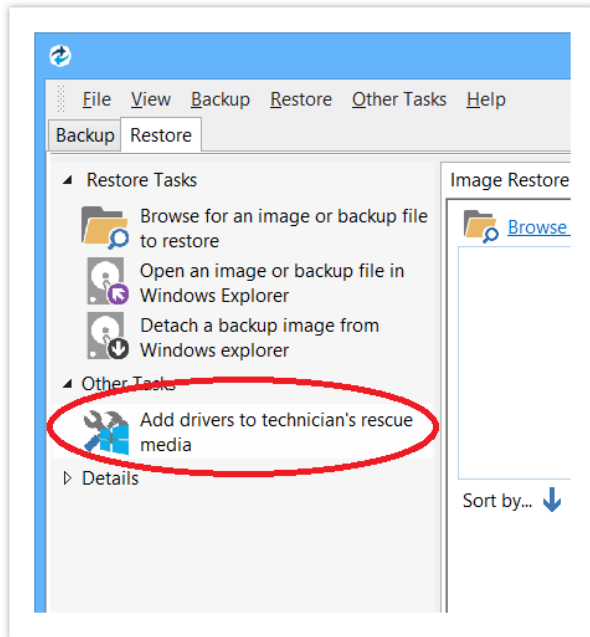


Please note that this option is not accessible when booted in the PE environment and is only available in Windows.

The portable edition of Reflect offers the ability to copy any missing drivers from the current system. To do this:

1. Select the **Add Drivers to technician's rescue media** option from the other tasks group on either the **backup** or **restore** tabs.

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Adding device drivers to Windows PE

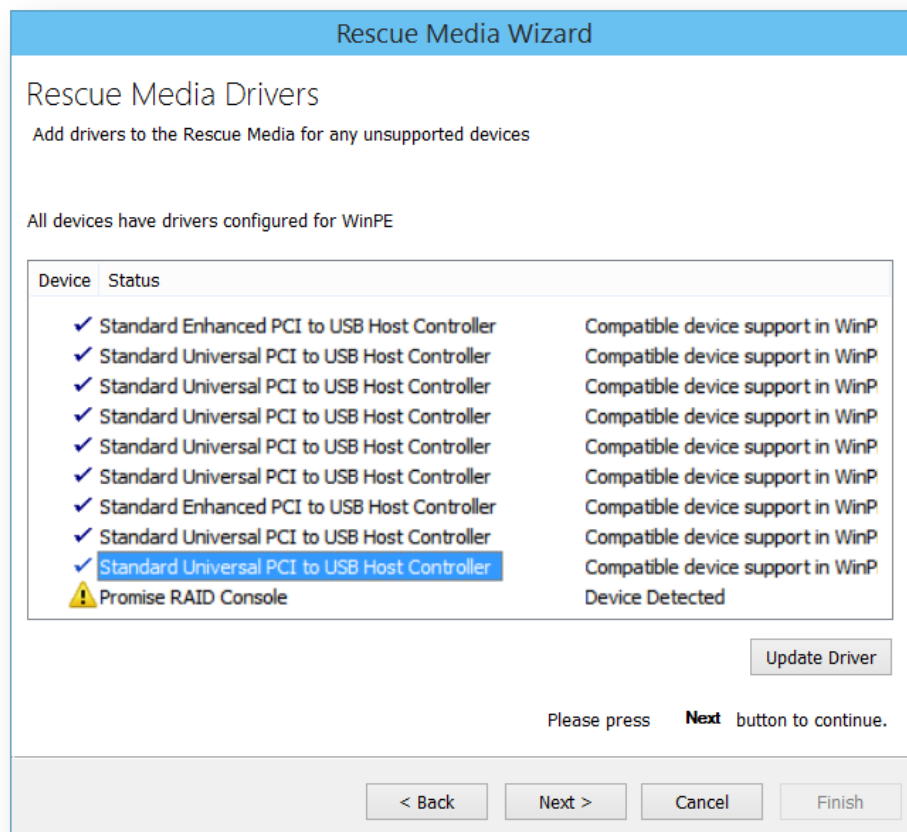
Windows PE (WinPE) is packaged with a large collection of drivers but there are many devices that are not part of the WinPE list of drivers. If your device is not listed you must add its driver so WinPE recognizes it and communicates with your device.



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.

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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.

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.

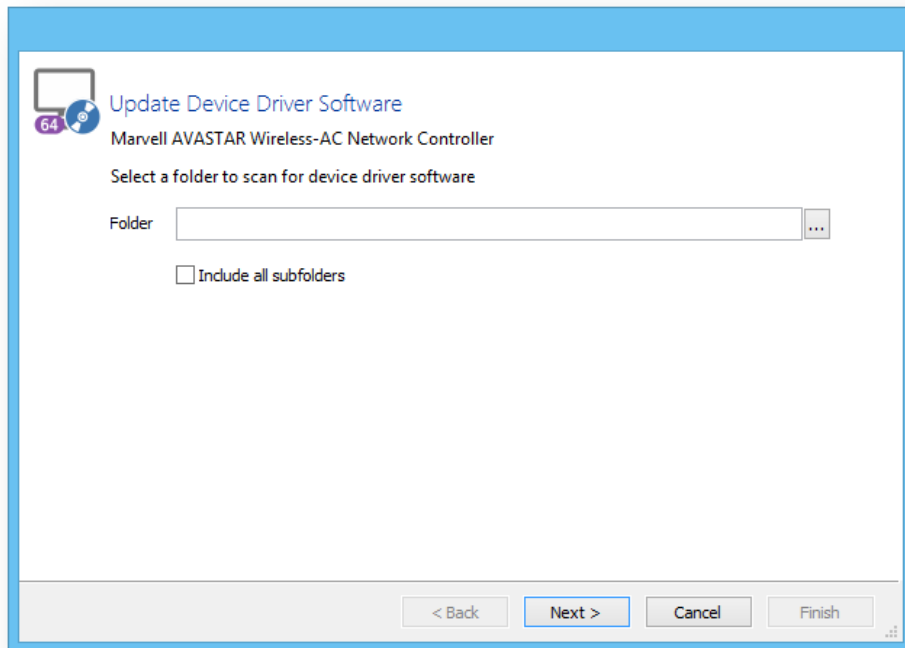
You can find driver install packages in several places. Most manufacturers create a driver folder on the hard drive of a new PC, often named after the manufacturer. If this is not present, you can download drivers from the device or PC vendor's website. For older PCs, manufacturers of devices and motherboards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

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3. Select a folder.

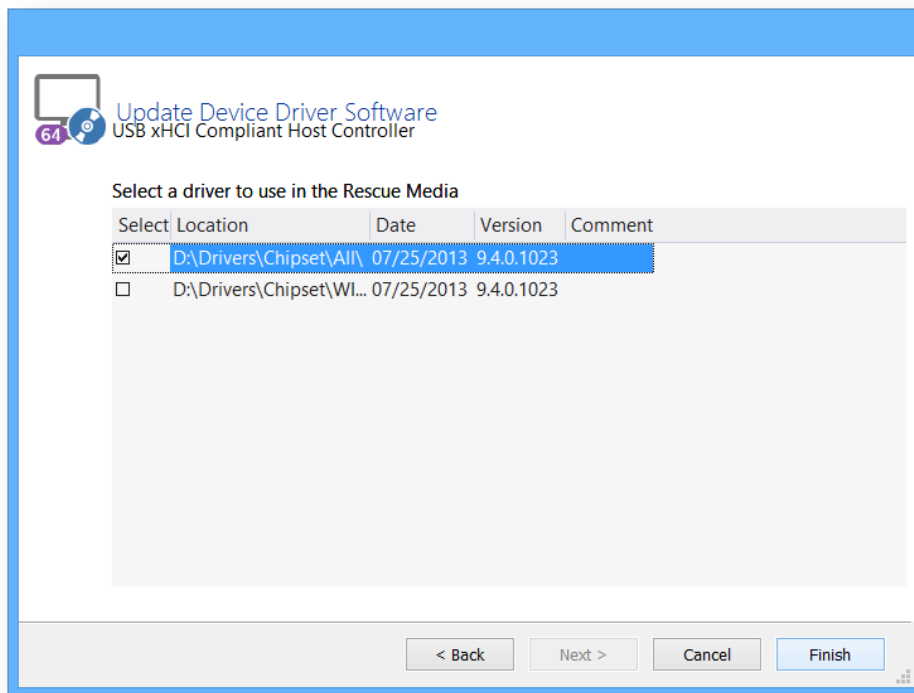
4. Click **Next**.

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.

- Fix boot problems on MBR/BIOS systems
- Fix Boot problems for GPT/UEFI Boot Systems

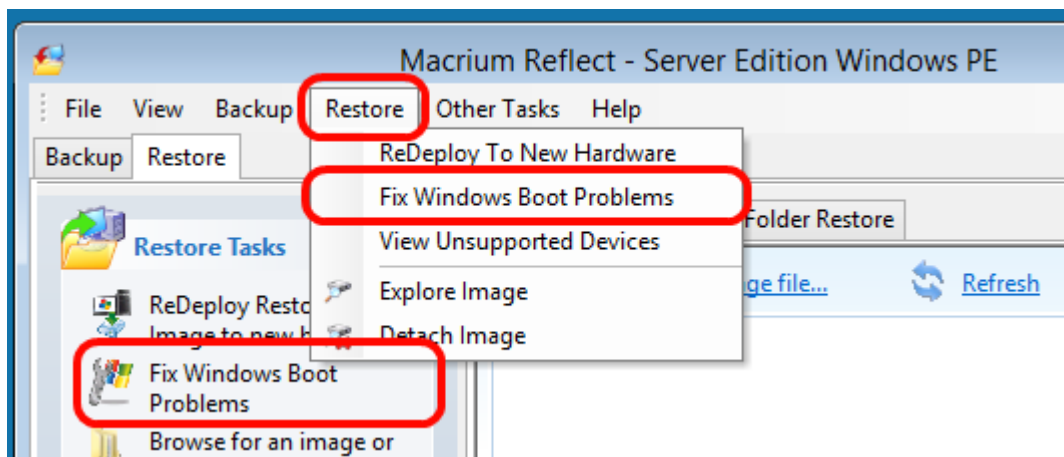
When restoring an image or cloning a HD there can be situations where Windows is unable to boot due to incorrect boot configuration. This article explains how Reflect enables you to resolve these situations.

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

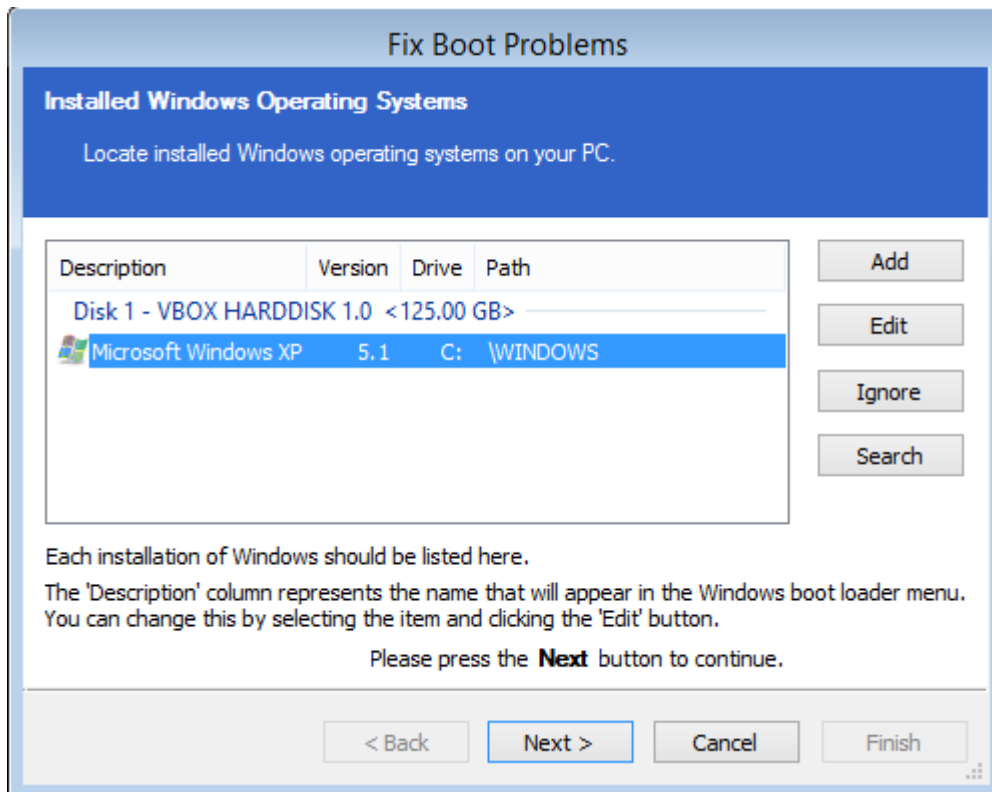
Fix Windows boot problems is available in the Windows PE Rescue media environment. To fix Windows boot problems, start your computer with your rescue media inserted. Then, after a restore or clone, to use fix boot problems:

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

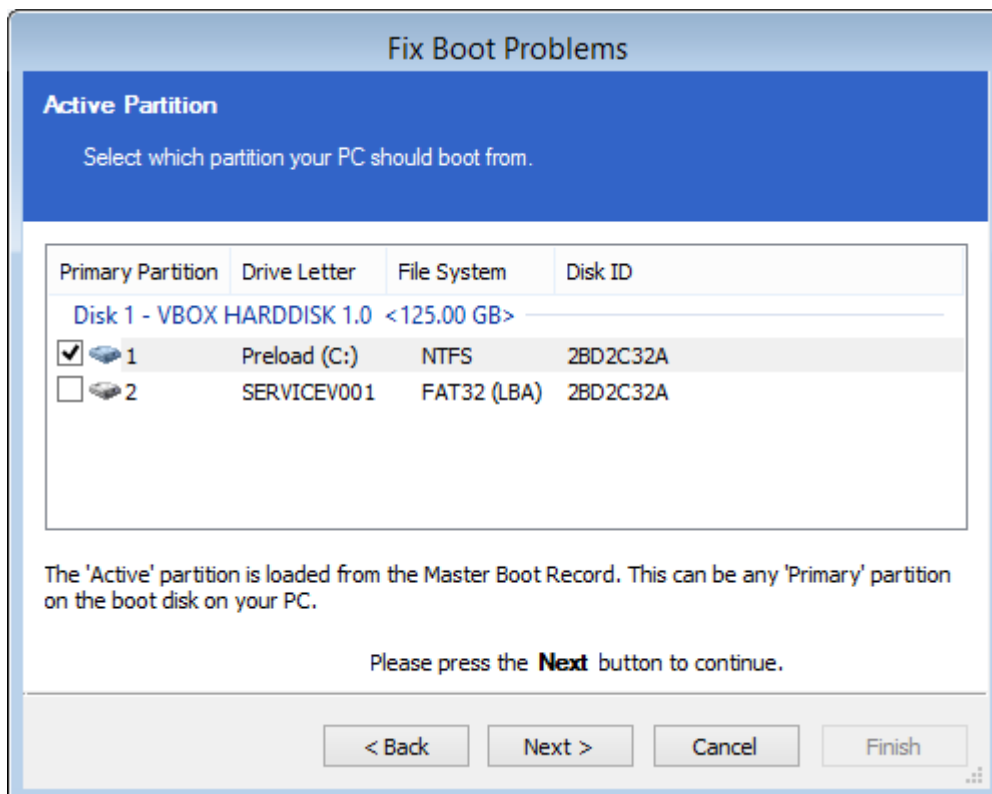


2. The Fix boot problems wizard will then open.
3. You will be presented with a list of Windows Installs, which the wizard detects. **Verify** these are correct. If the wizard has not automatically detected your Windows install, **add it** using the buttons on the right. You can also **correct any details**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

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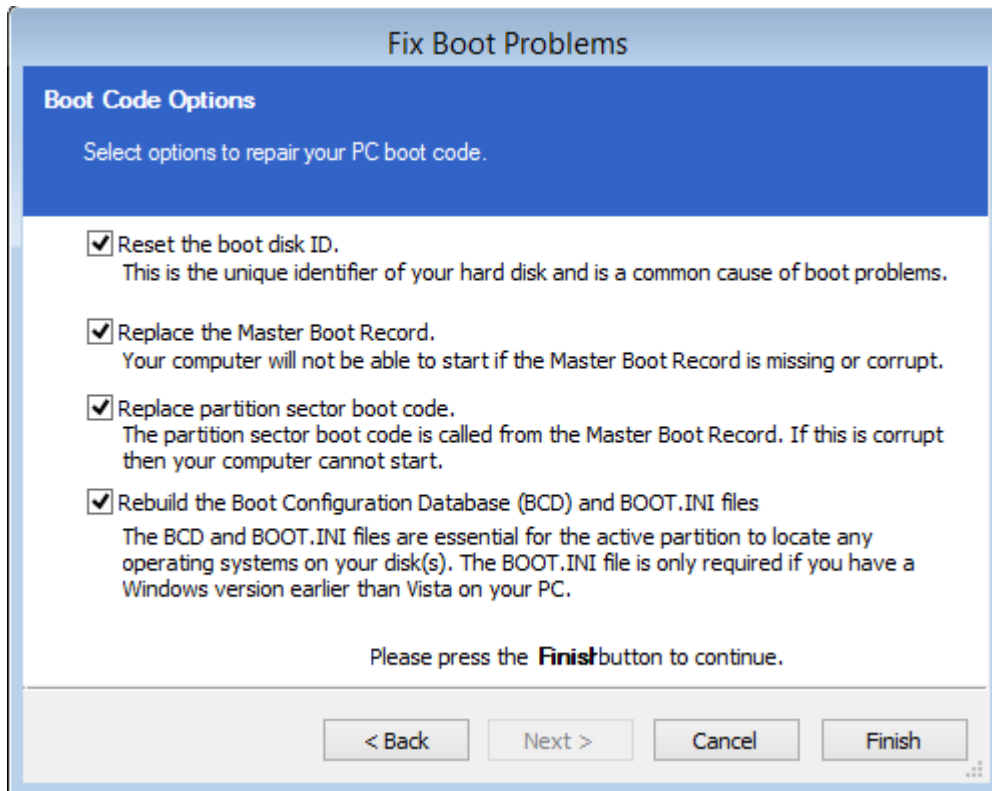


4. **Select the active partition.** The wizard automatically selects the boot disk for the relevant Windows install, but you can change this if you are using an alternative setup:



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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.



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.**

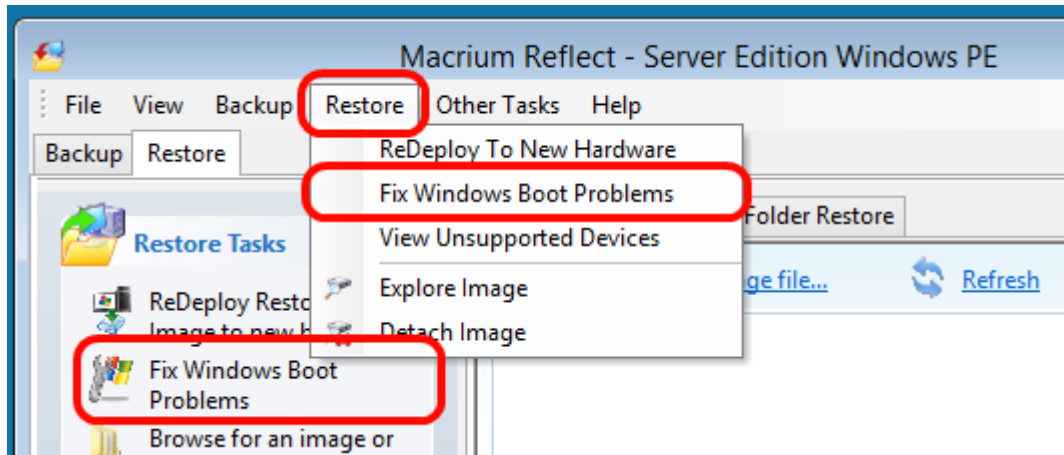
7. Your system will now boot.

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:

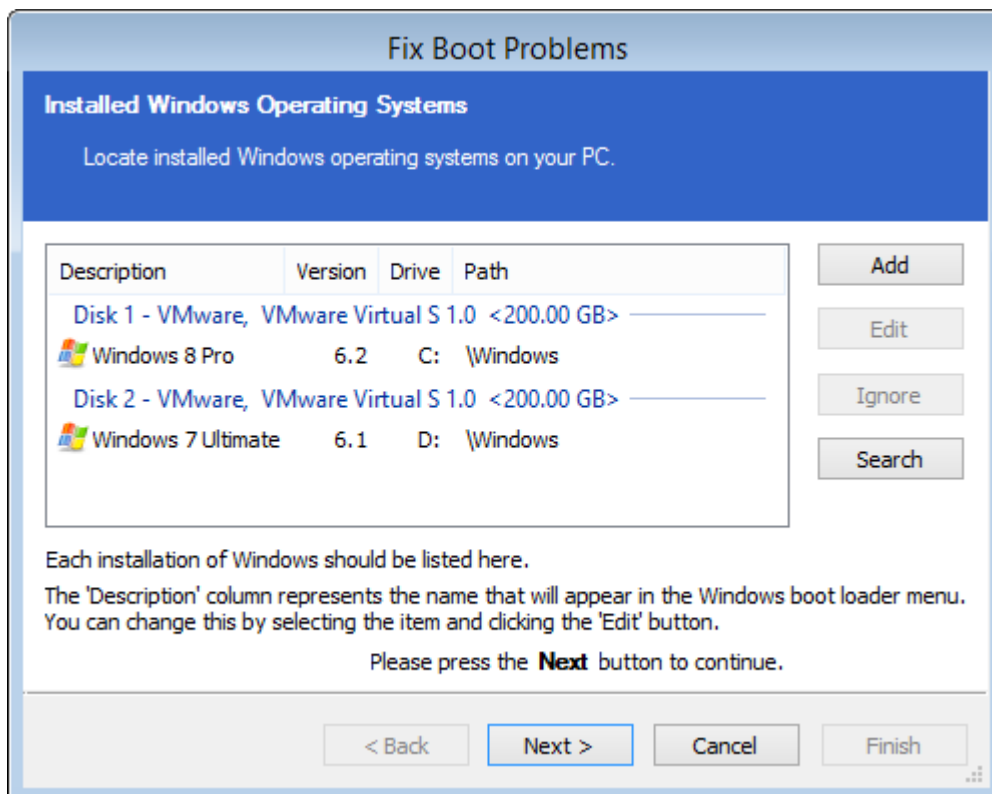
1. **Select** the restore menu, then **select** fix boot problems. Alternatively, **choose** the restore tab then under restore tasks **select** Fix Windows Boot Problems.

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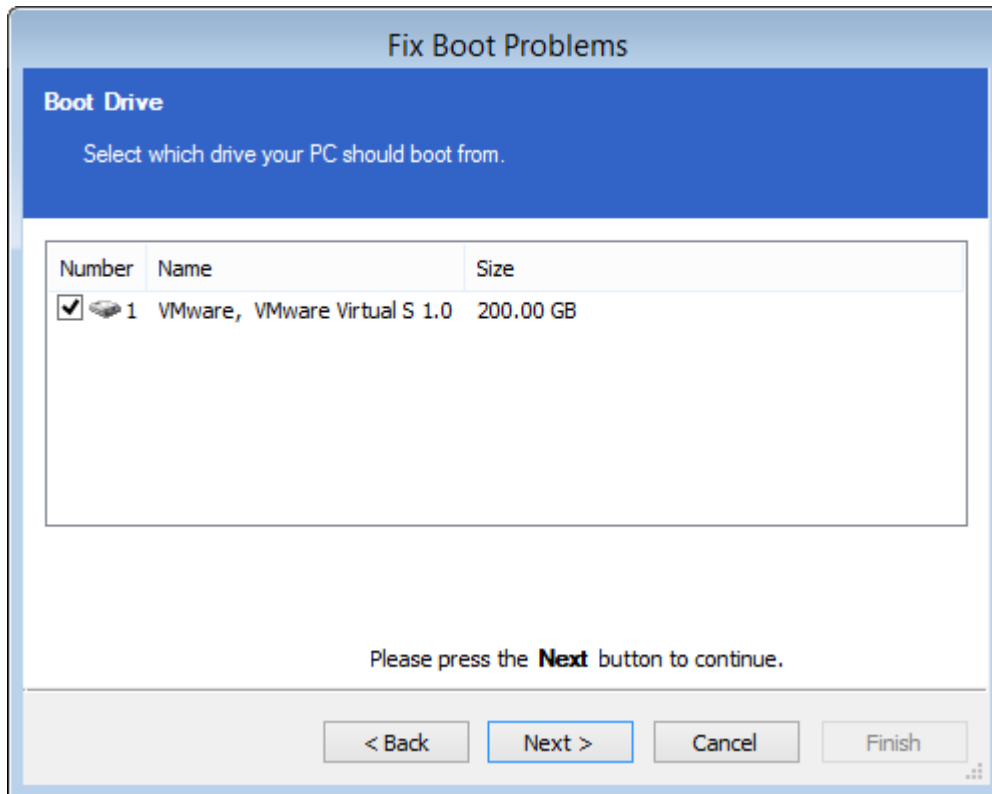
2. The Fix boot problems wizard will then open.

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.



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**.

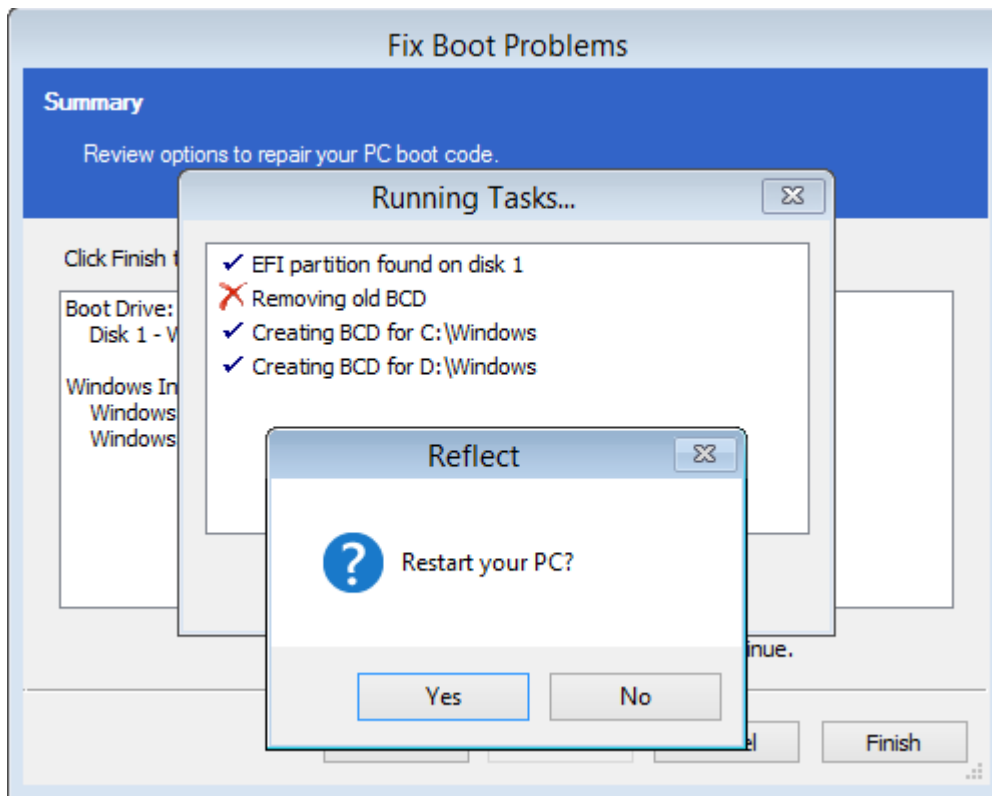
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5. The wizard will then display a summary screen. **Press Next.**

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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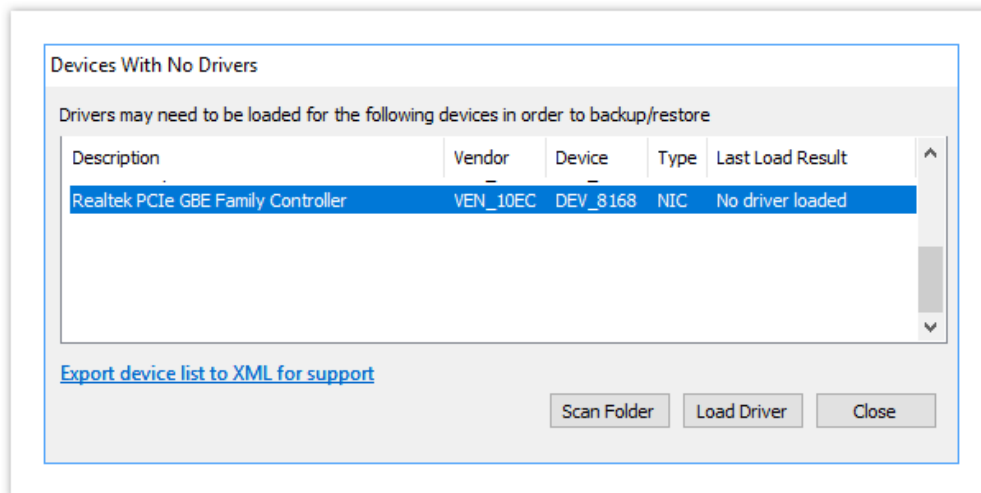


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Updating rescue media to include additional hardware drivers

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 Load 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 **'Scan Folder'**. The selected folder structure will be searched 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.

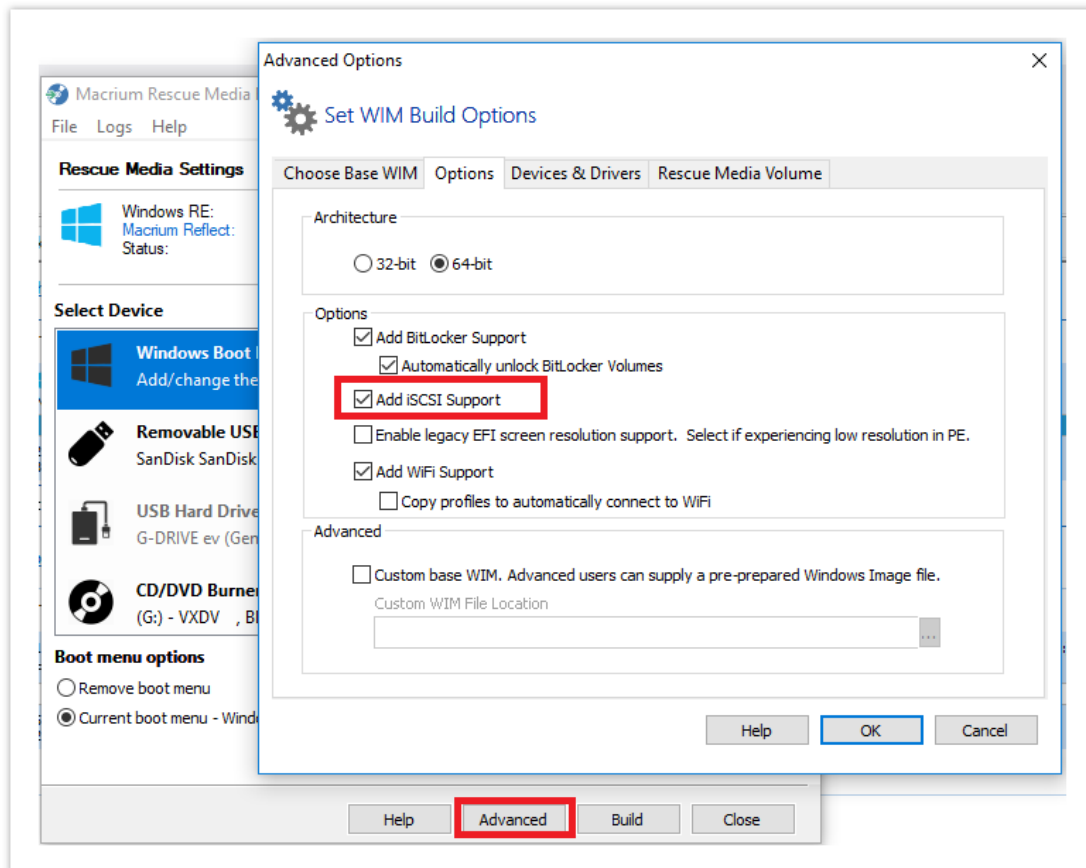
When loading drivers Macrium Reflect will check for device support in INF files and if found will attempt to load the driver. It is important that all the files that the driver package consist of should be present in the same folder as the INF file. There will definitely need to be the .SYS file for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

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 **'Add iSCSI Support'** option selected.



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

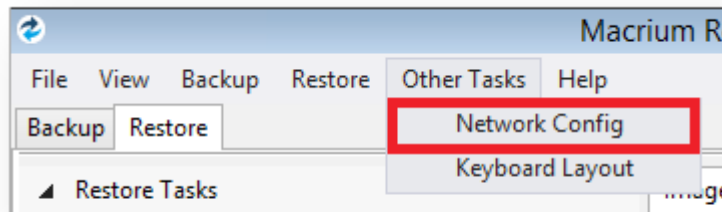


The command line can be accessed by clicking the black icon on the bottom left corner of your screen.

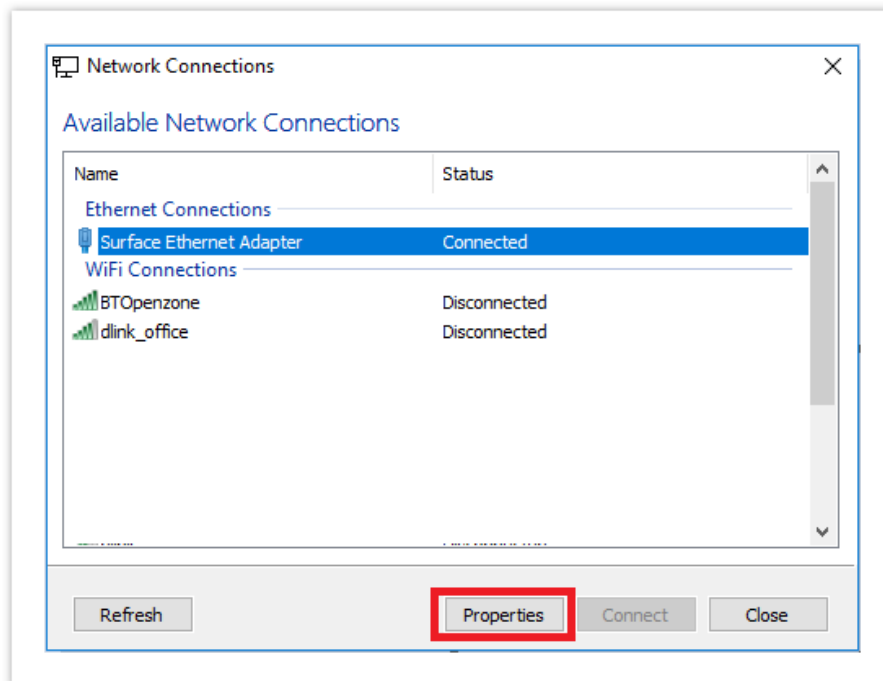
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3. You will need to change the IP address of your Windows Pre-installation Environment to the same IP address that is configured on your Windows Host in order to be authenticated by the iSCSI target since unknown IP addresses will result in a timeout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

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



4. **Select** the connected network adapter and **click 'Properties'**.



5. In Network Adapter Properties **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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Network Adapter Properties

Surface Ethernet Adapter

Address Settings

☐ Obtain an IP address automatically Renew

☒ Use the following IP address

IP Address: 10 . 17 . 0 . 15

Subnet Mask: 255 . 255 . 0 . 0

Gateway: 10 . 0 . 0 . 1

DNS Settings

☐ Obtain a DNS server automatically

☒ Use the following DNS server address

Preferred DNS Server: 10 . 0 . 0 . 1

Alternate DNS: 255 . 255 . 255 . 255

Apply Cancel

6. In the command window type “**net start msiscsi**” to enable the Microsoft iSCSI server:

```
Administrator: X:\Windows\System32\cmd.exe
Microsoft Windows [Version 6.3.9600]

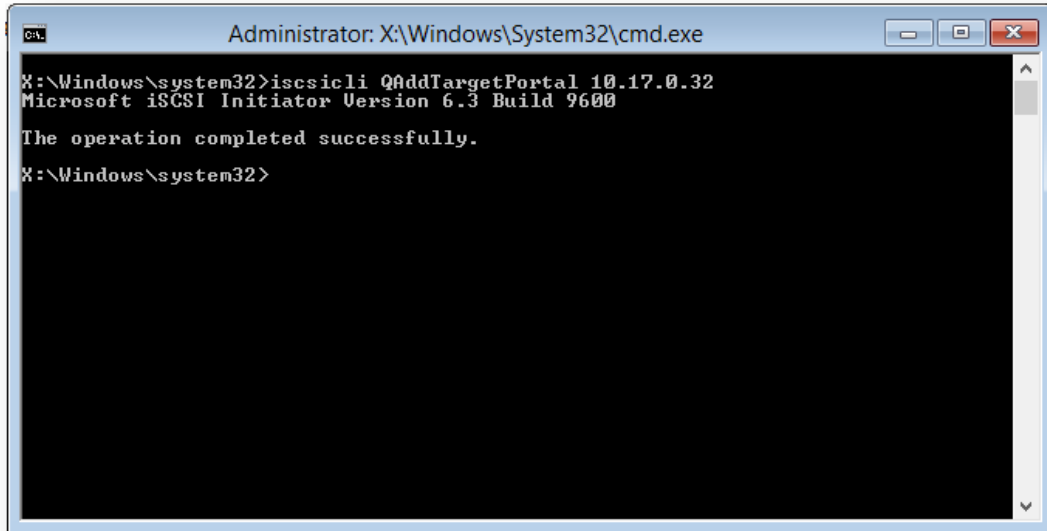
X:\Windows\system32>net start msiscsi
The Microsoft iSCSI Initiator Service service is starting.
The Microsoft iSCSI Initiator Service service was started successfully.

X:\Windows\system32>
```

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- 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.



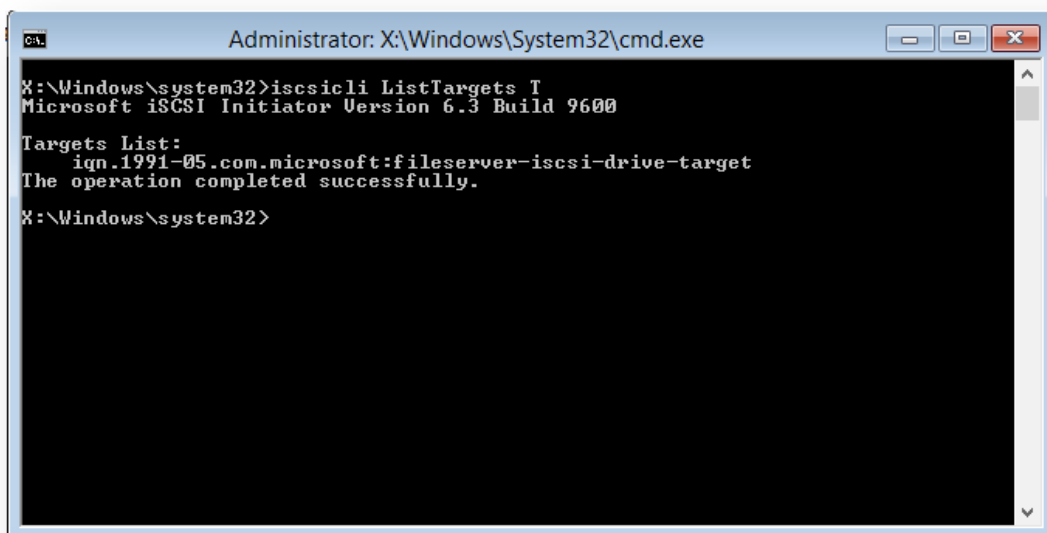
```
Administrator: X:\Windows\System32\cmd.exe

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

- 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

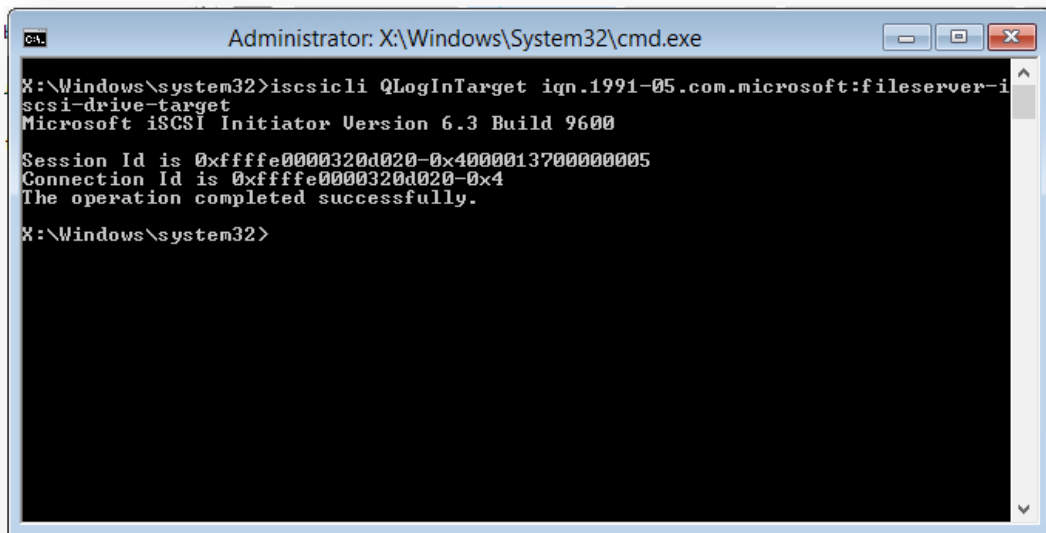
Targets List:
  iqn.1991-05.com.microsoft:fileserver-iscsi-drive-target
The operation completed successfully.
X:\Windows\system32>
```

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

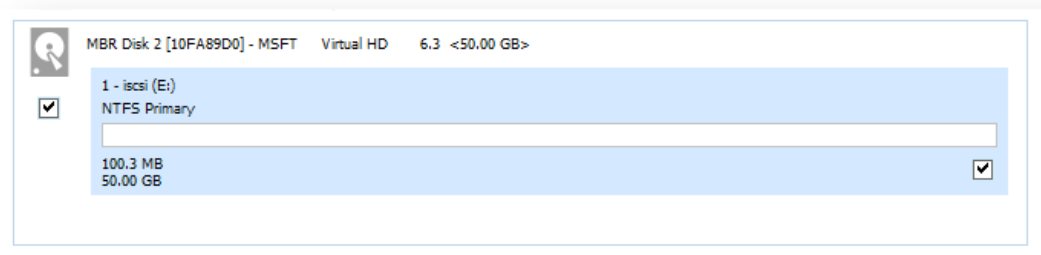
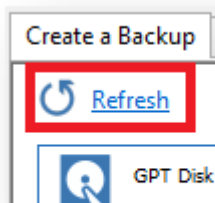
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This target name is used to logon and access the iSCSI Virtual Disk.

9. 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 .



10. 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



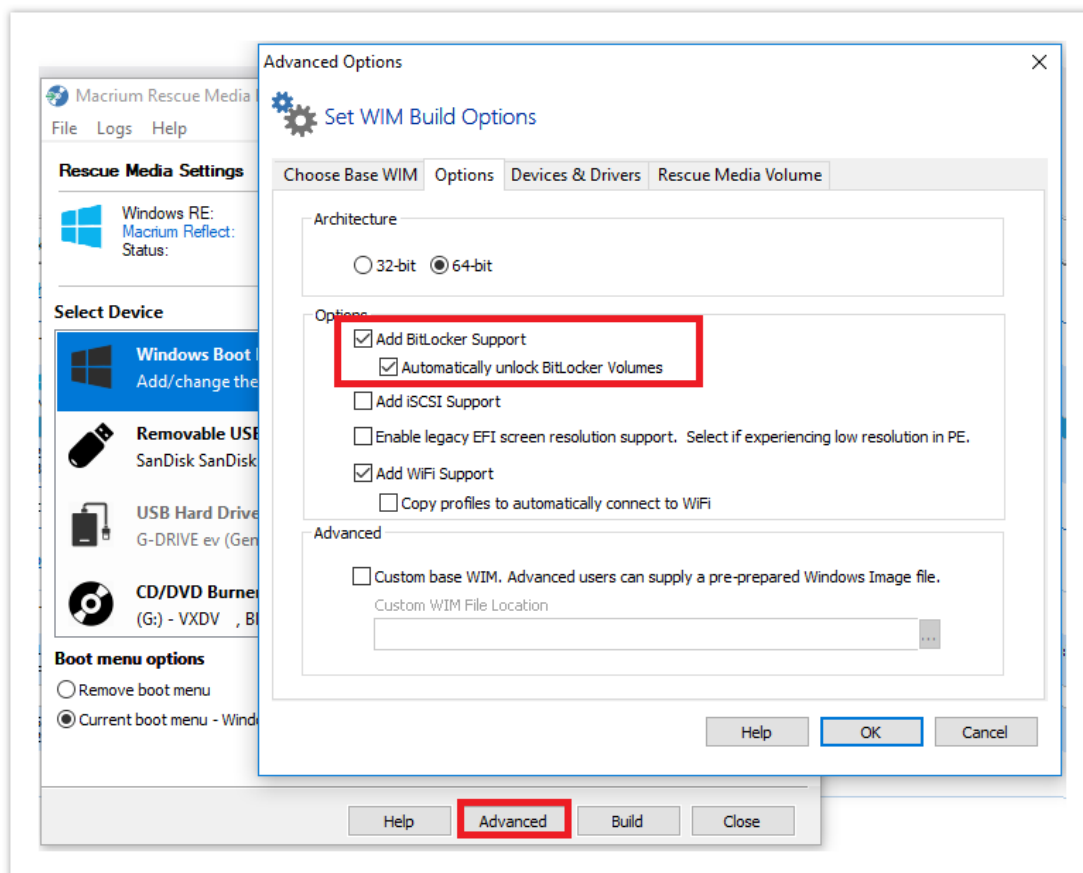
Note: It isn't absolutely necessary to unlock a BitLocker encrypted drive when restoring an image of the encrypted partition. The partition will restore without problems but will require re-encrypting on reboot.

Unlocking the drive in Windows PE enables intelligent sector copy imaging and cloning, [RapidDelta Restore \(RDR\)](#) and also free access to the drives contents using PE Explorer. In addition, restoring to an unlocked drive will retain the encryption status of the drive when rebooting.

Automatically unlocking BitLocker encrypted drives

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

In the [Rescue Media Builder](#) select '**Add BitLocker Support**' and '**Automatically unlock BitLocker Volumes**'.



When Windows PE starts any BitLocker locked drives that were attached when the recovery media was created it will automatically unlock them.

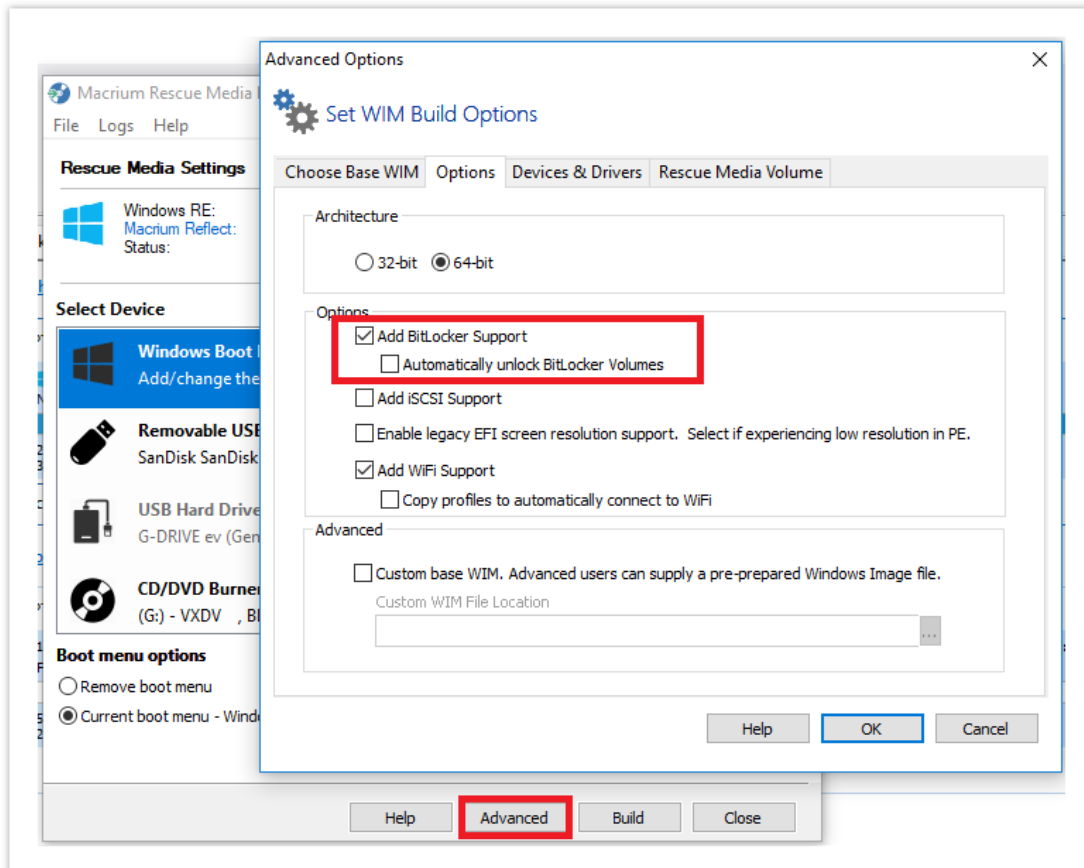
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Unlocking BitLocker encrypted drives using a USB stick

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.

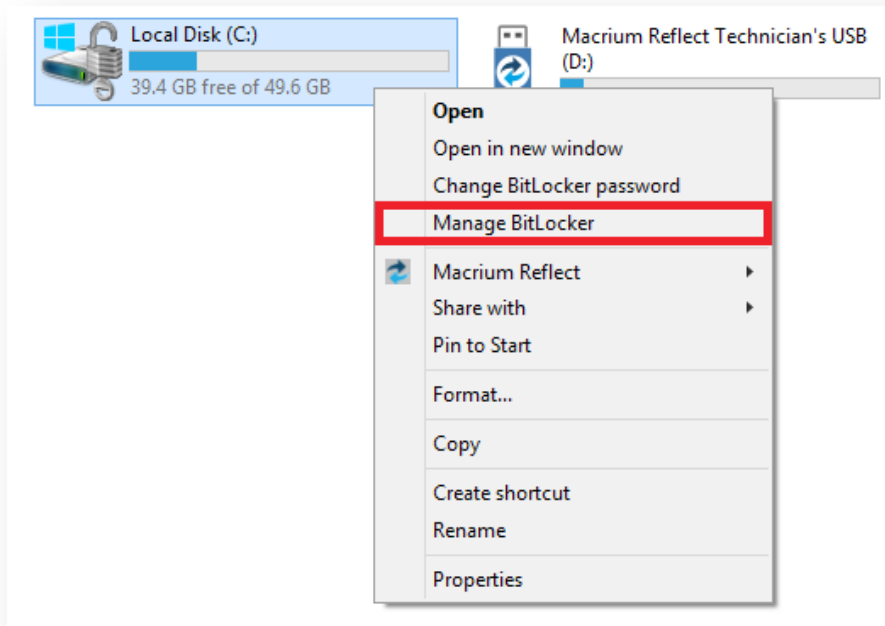
An alternative method is to **de-select** the '**Automatically unlock BitLocker encrypted drives**' option in the Rescue Media Builder:



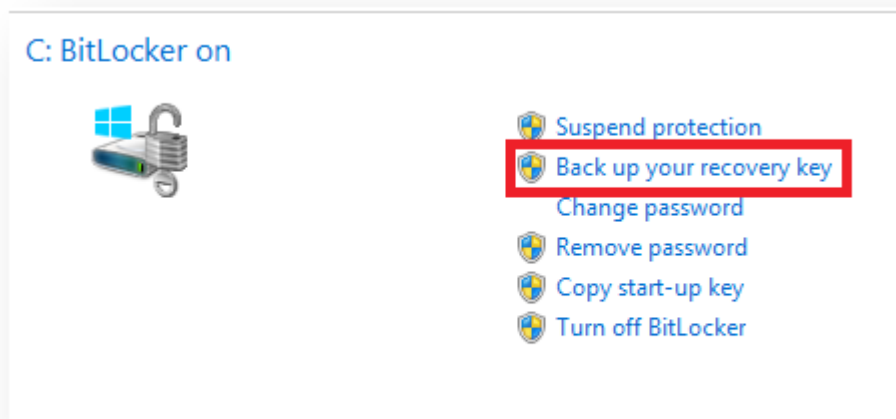
You can then save BitLocker Encryption Key files (.BEK) and/or BitLocker password TXT files to the root of any USB stick. This could also be a Windows PE rescue media USB stick.

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

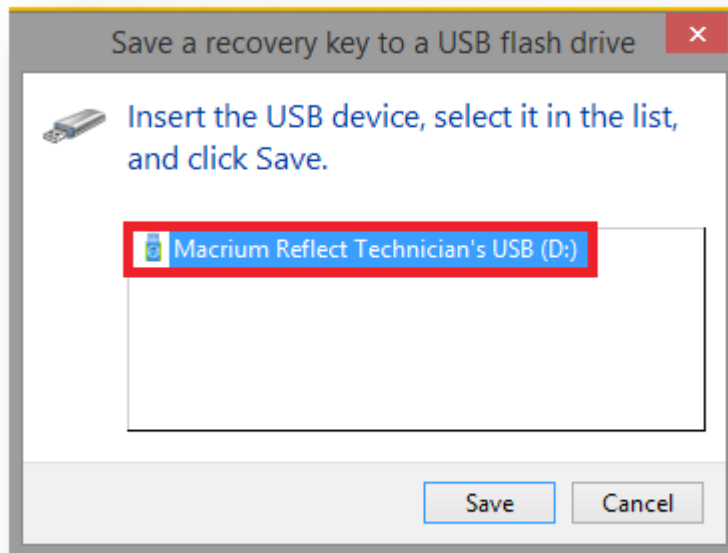
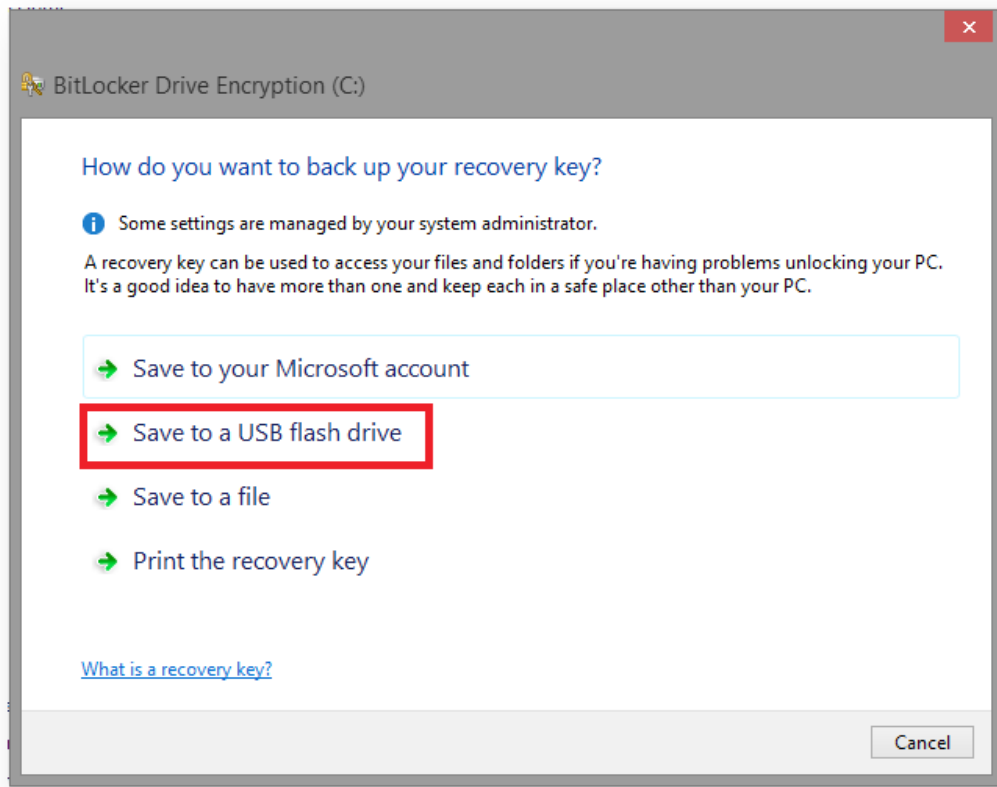


2. In the newly opened window click **'Back up your recovery key'**



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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.



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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.

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](#).

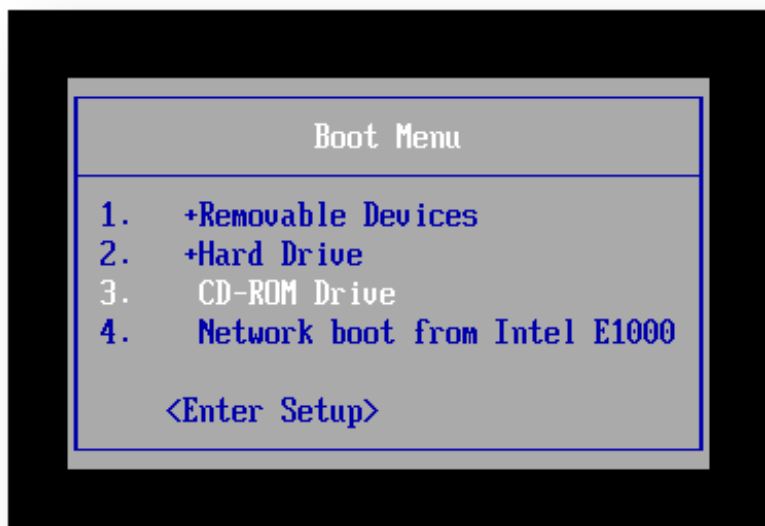
If the image contains only data, restoring it is very simple using Macrium Reflect. You can restore it back to its original location without interrupting the operating system.

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.

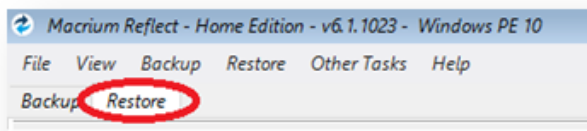


Boot selection button differs from one PC manufacturer to another, best way to find out the **Boot selection** menu on your PC is to consult the motherboard manual provided by the manufacturer.



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.

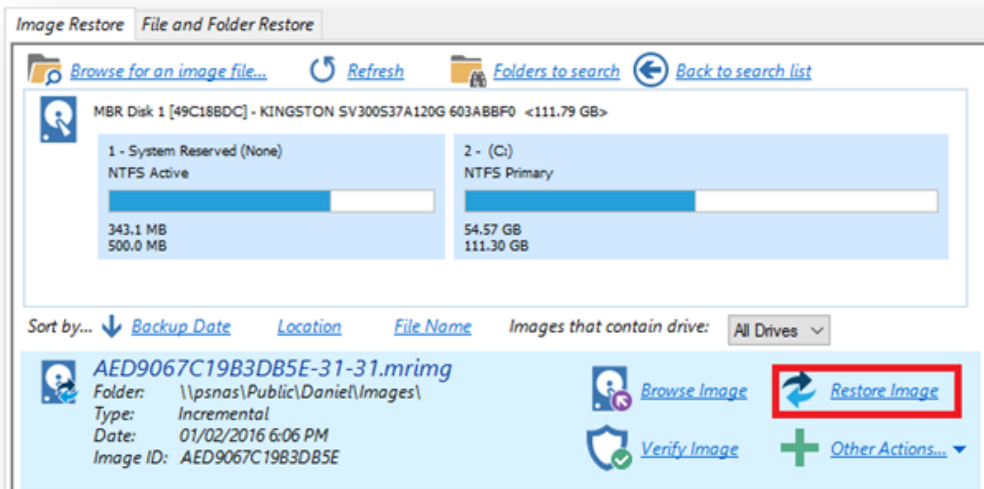
2. When You have loaded into windows PE, **selectRestore**



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

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



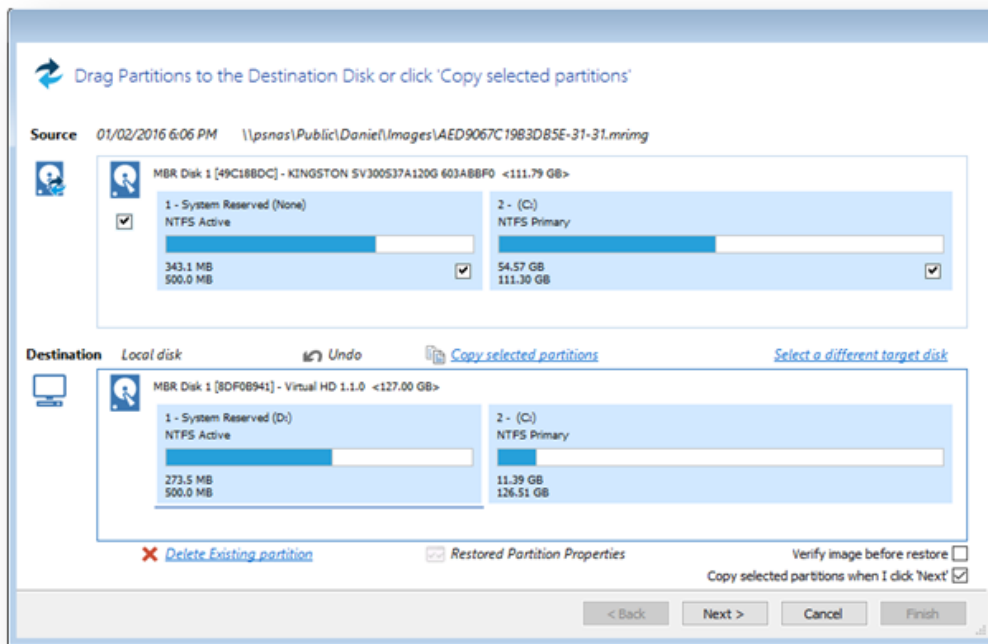
If you cannot find the backup image you would like to use in the provided list, select “**Browse for an image file...**” on the menu at the top and look through the windows explorer to find it.

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

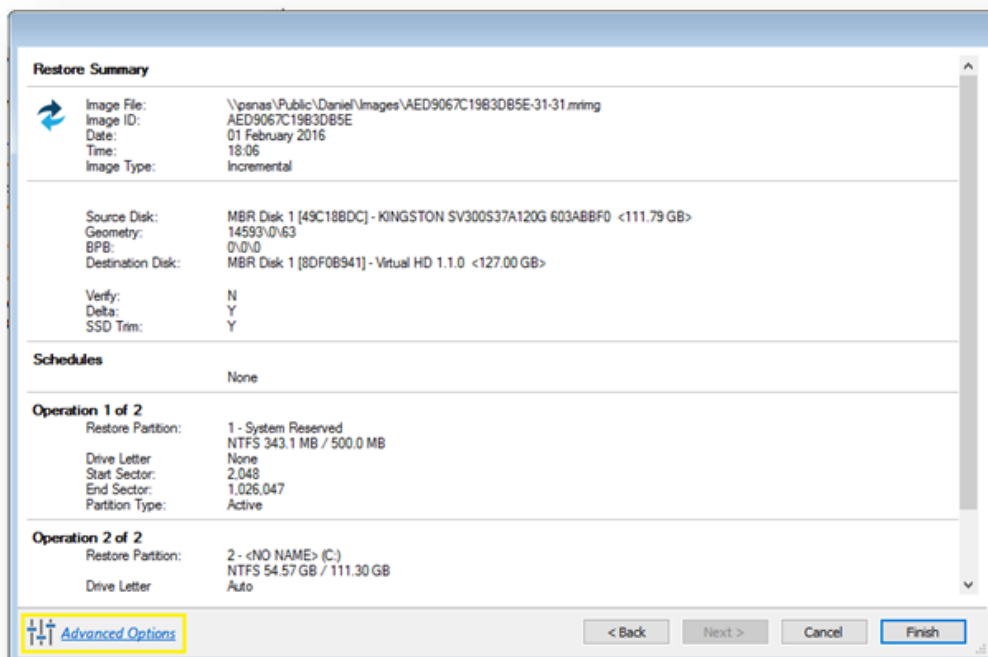
Moving and Resizing the restored partition

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](#).

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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:

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Option	Description
Rapid Delta Restore:	Copy only changed data blocks to complete the restore process more quickly See: Rapid Delta Restore - RDR
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.

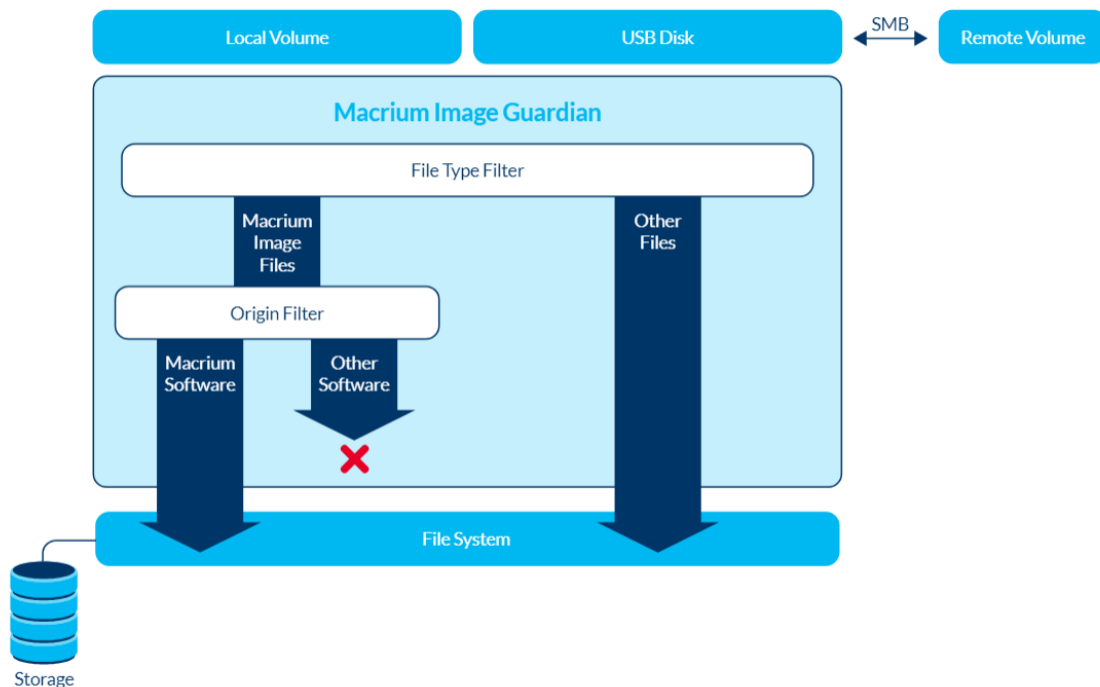
Macrium Image Guardian

- Macrium Image Guardian Overview
- Protected File Access
- Installing Macrium Image Guardian
- Activating Macrium Image Guardian
- Macrium Image Guardian Events
- Enabling and Disabling MIG on NTFS Volumes

Macrium Image Guardian Overview

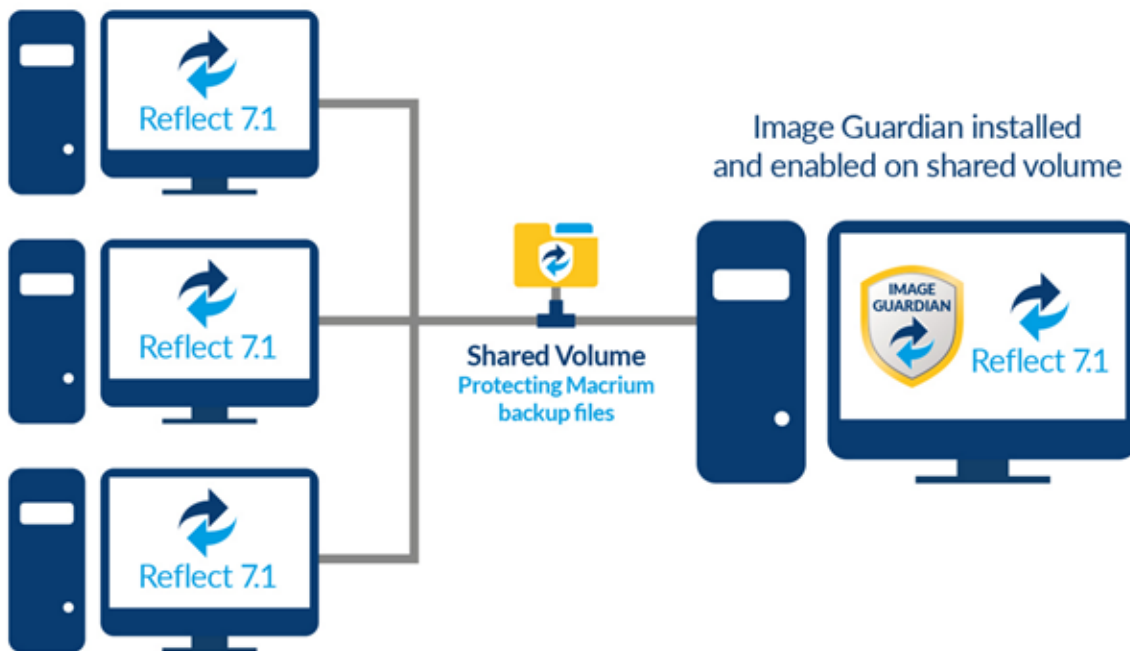
	Macrium Image Guardian protects your backup files from unauthorised modification. MIG grants write access to existing backups file for Macrium Reflect 7.1, any image tools created by us, and optionally, MS RoboCopy. All other process attempting to update existing backup files will be denied access. MIG protects local NTFS volumes and allows Macrium Reflect 7.1 and later to use the protected volume as a shared network resource.
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Macrium Image Guardian protection architecture



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Macrium Image Guardian protecting backups in a networked environment



In the above illustration, the PC sharing the backup repository (Shared Volume) has a full install of Macrium Reflect, including **MIG**. A local drive is shared over the network and **MIG** has been enabled on that drive in the Macrium Reflect user interface.

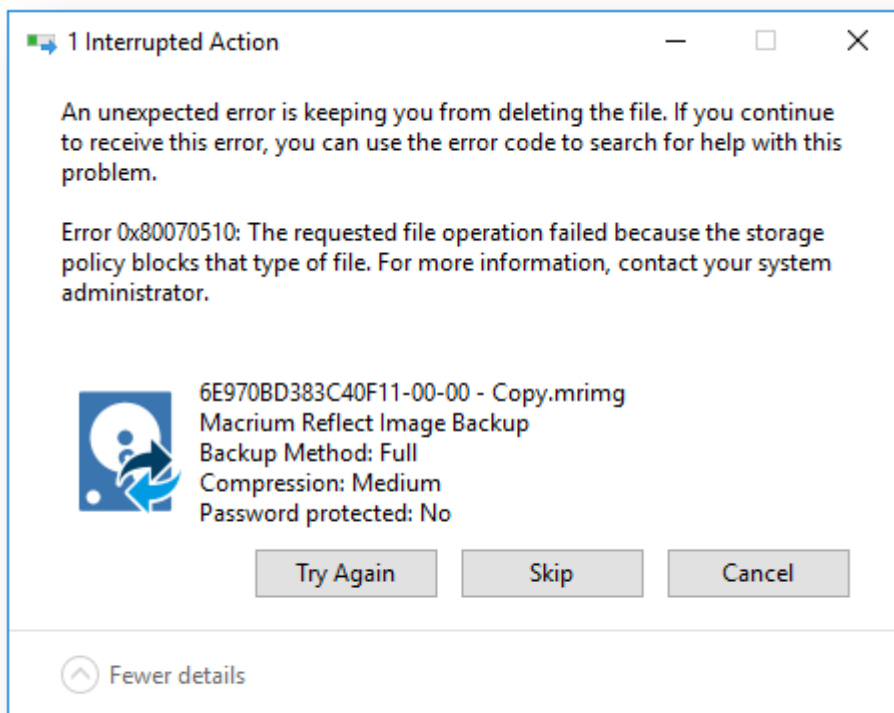
The other PC's on the network can backup to this shared drive and **do not** require MIG to be installed. Backup file write access is automatically granted to Macrium Reflect 7.1, and later, write access for earlier versions of Macrium Reflect and other processes will fail.

The PC hosting the share with **MIG** installed can be used as a standalone Macrium Reflect installation. The protected drive will prevent unauthorised access to backup files on that drive if the local PC creates backups to the protected volume.

Protected File Access

Macrium Image Guardian will protect all existing local backup files from unauthorised modification or deletion. All such activity will be blocked with **error 0x80070510 - Storage policy block**.

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Protected File Types

The following file extensions are protected by Macrium Image Guardian.

Extension	Backup Type
.mrimg	Macrium Reflect image files
.mrbak	Macrium Reflect File and Folder backup files
.mrex	Macrium Reflect Exchange backup files
.mrsql	*Macrium reflect SQL backup files



***Note:** SQL backup files can only be created to a protect volume by Macrium Reflect running on the **local PC**. Network write access will be blocked for all processes, including Macrium Reflect. This limitation will be removed in a future update.

Windows File operations on Macrium Backup files

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Macrium Image Guardian will block opening of backup files for modification or delete, The following lists some of the operations and special considerations if you are maintaining the location and life of Macrium backup files outside of Macrium Reflect.

1. **Windows Explorer Copy.** New backup files can be created on a protected volume as the result of a **Windows Explorer** copy operation.

Copying a file to the same folder as the original will be blocked on local file systems. Duplicate files in the same folder is undesirable and should be avoided. The identity of the backup file will be duplicated and this can lead to unpredictable results in Macrium Reflect.

2. **DOS Commands. COPY, MOVE, and XCOPY.** These commands will succeed where the result of the operation is a new file. Overwriting or deleting existing backup files will fail.
3. **RoboCopy.** RoboCopy.exe can copy, move and synchronise folders. For more information on RoboCopy parameters please see here: [https://technet.microsoft.com/en-us/library/cc733145\(v=ws.11\).aspx](https://technet.microsoft.com/en-us/library/cc733145(v=ws.11).aspx)

Some RoboCopy parameters may perform delete file and overwrite operations on your backup files and have special functionality in MIG if the '**Allow RoboCopy to sync and move backup files on protected volumes**' option is enabled:

Image Guardian Settings



☒ Turn on Image Guardian

☒ Automatically protect local backup drives

☒ Allow RoboCopy to sync and move backup files on protected volumes

Parameter	Rule
/MOVE /MOV	If the source folder is on a protected volume then the /MOVE /MOV parameters will only delete backup files in the source folder if the destination folder is also on a protected volume. This ensures that existing files cannot be moved to an unprotected volume and compromised.
/MIR /PURGE	If the target folder is on a protected volume then the /MIR /PURGE parameters will only delete backup files in the target folder if both of the following conditions are true: a. The source folder is a backup destination in any saved backup definition xml file. b. The target folder is not a backup destination in any saved backup definition xml file This ensures that the synchronisation operation cannot inadvertently, or otherwise, delete files in a folder that is used as a backup destination in Macrium Reflect.

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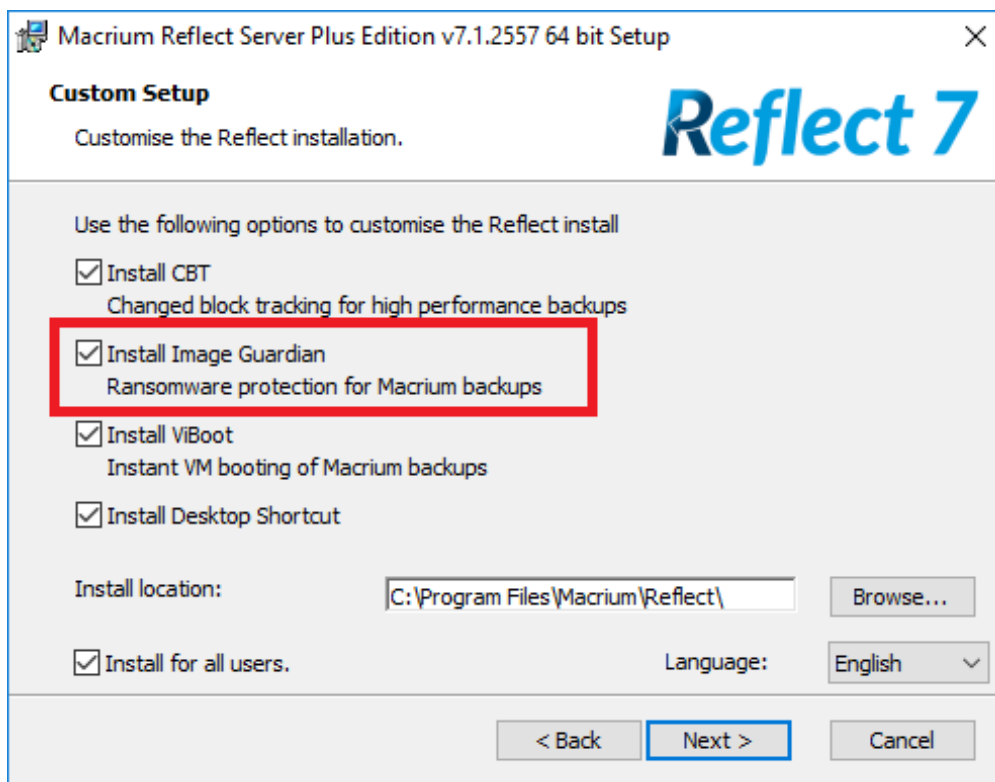
Parameter	Rule
All overwrite operations	If the result of any parameter is to overwrite an existing backup file on a protected volume then this will only be allowed if the target folder is not a backup destination in any saved backup definition xml file.

RoboCopy and Network Shares

If the **source of a /MOVE /MOV or target of a /MIR /PURGE** operation is a **MIG protected volume on a network share** then all delete operations are **blocked**. This is because RoboCopy 'Rules' can only be applied if the Windows session that's opening the files is the same Windows session that's running RoboCopy. In the case of a network share, the remote computer is opening the files and will block all delete operations.

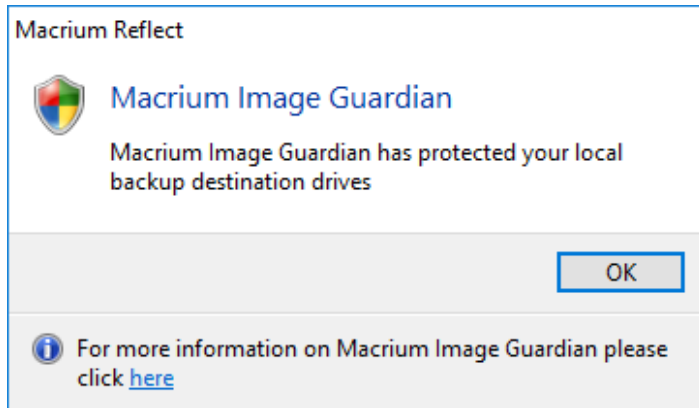
Installing Macrium Image Guardian

MIG is an optional component in the Macrium Reflect installer, It is selected by default and is available for Windows 7 and above in all editions of Macrium Reflect except for the Free Edition.



After installation, if **MIG has automatically protected any local back drives for existing backup definitions** then the following message box is displayed the first time Macrium Reflect is started:

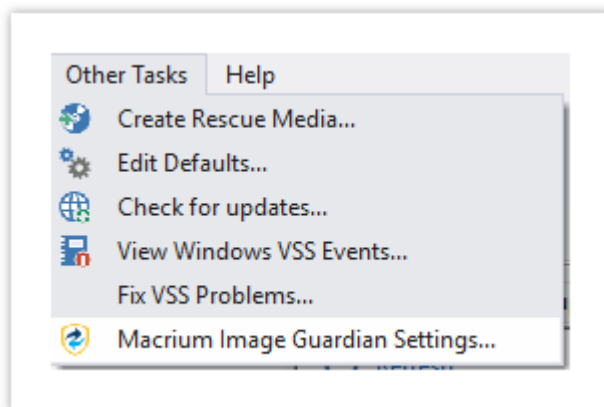
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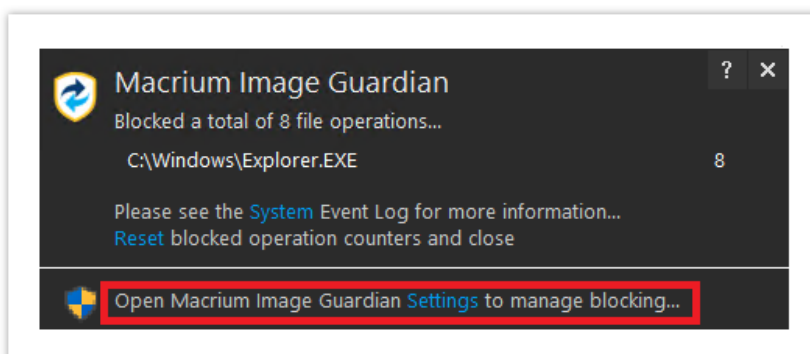
Activating Macrium Image Guardian

MIG is active directly after installation and will automatically protect backup destination drives.

To turn MIG on, off or temporarily disable **take the 'Other Tasks' > 'Macrium Image Guardian Settings..'** menu option.

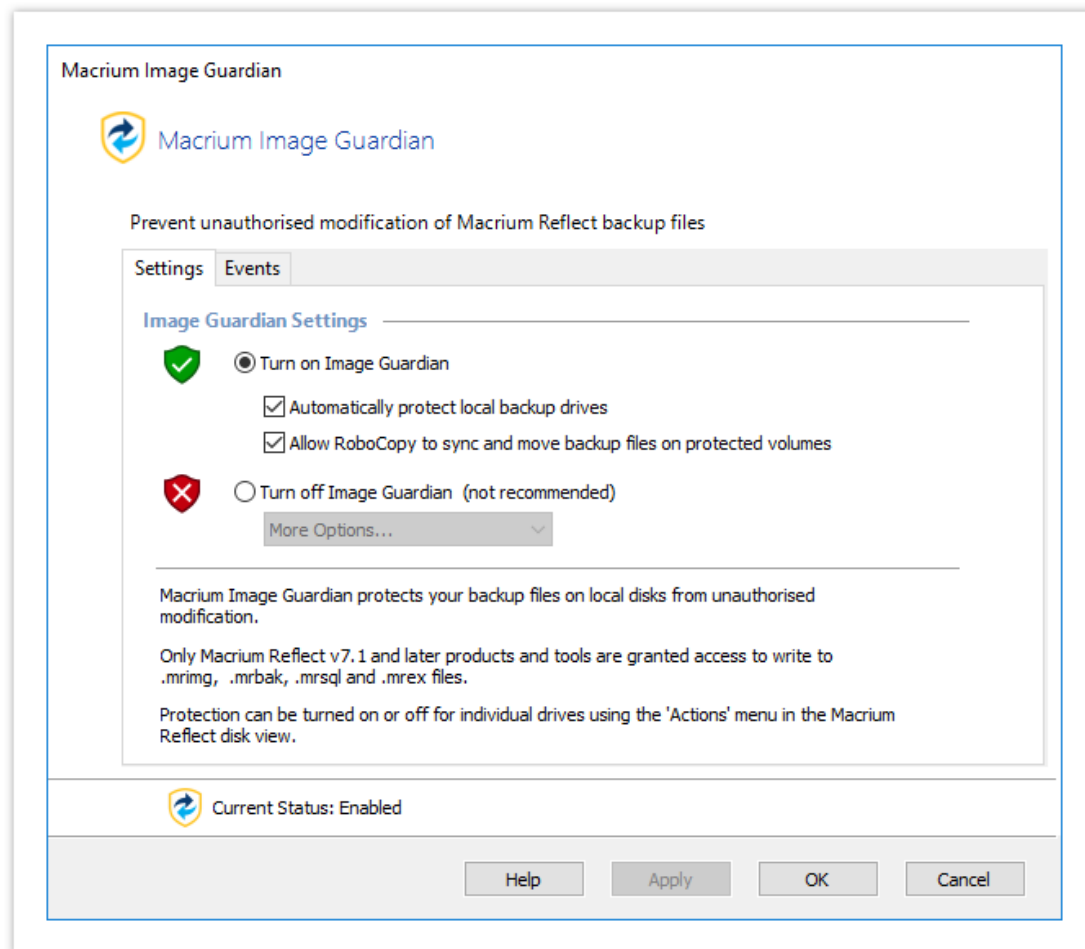


You can also activate the MIG Settings dialog by **clicking 'Settings'** in the MIG blocked activity popup.



The MIG Settings dialog

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Turn on Image Guardian	Starts the Image Guardian Service
Automatically protect local backup drives	When turned on, all saved backup definitions are searched and Image Guardian is enabled for local backup drives When creating a new backups, unprotected target drives will be automatically protected by enabling Image Guardian on the drive. When the PC is restarted, Image Guardian will be re-enabled on all backup drives. This prevents accidentally leaving your drives unprotected by manually turning protection off.
Allow RoboCopy to sync and move backup files on protected volumes	Enables the MS utility RoboCopy to delete and overwrite backup files on protected volumes with the /MOV , /MOVE , /PURGE and /MIR parameters.

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	<table> <tr> <th>Parameter</th><th>Rule</th></tr> </table>	Parameter	Rule		
Parameter	Rule				
	<table> <tr> <td> /MOVE /MOV </td><td> If the source folder is on a protected volume then the /MOVE /MOV parameters will only delete backup files in the source folder if the destination folder is also on a protected volume. This ensures that existing files cannot be moved to an unprotected volume and compromised. </td></tr> </table>	/MOVE /MOV	If the source folder is on a protected volume then the /MOVE /MOV parameters will only delete backup files in the source folder if the destination folder is also on a protected volume. This ensures that existing files cannot be moved to an unprotected volume and compromised.		
/MOVE /MOV	If the source folder is on a protected volume then the /MOVE /MOV parameters will only delete backup files in the source folder if the destination folder is also on a protected volume. This ensures that existing files cannot be moved to an unprotected volume and compromised.				
	<table> <tr> <td> /MIR /PURGE </td><td> If the target folder is on a protected volume then the the /MIR /PURGE parameters will only delete backup files in the target folder if both of the following conditions are true: 1. The source folder is a backup destination in any saved backup definition xml file. 2. The target folder is not a backup destination in any saved backup definition xml file This ensures that the synchronisation operation cannot inadvertently, or otherwise, delete files in a folder that is used as a backup destination in Macrium Reflect. </td></tr> </table>	/MIR /PURGE	If the target folder is on a protected volume then the the /MIR /PURGE parameters will only delete backup files in the target folder if both of the following conditions are true: 1. The source folder is a backup destination in any saved backup definition xml file. 2. The target folder is not a backup destination in any saved backup definition xml file This ensures that the synchronisation operation cannot inadvertently, or otherwise, delete files in a folder that is used as a backup destination in Macrium Reflect.		
/MIR /PURGE	If the target folder is on a protected volume then the the /MIR /PURGE parameters will only delete backup files in the target folder if both of the following conditions are true: 1. The source folder is a backup destination in any saved backup definition xml file. 2. The target folder is not a backup destination in any saved backup definition xml file This ensures that the synchronisation operation cannot inadvertently, or otherwise, delete files in a folder that is used as a backup destination in Macrium Reflect.				
	<table> <tr> <td> All overwrite operations </td><td> If the result of any parameter is to overwrite an existing backup file on a protected volume then this will only be allowed if the target folder is not a backup destination in any saved backup definition xml file. </td></tr> </table>	All overwrite operations	If the result of any parameter is to overwrite an existing backup file on a protected volume then this will only be allowed if the target folder is not a backup destination in any saved backup definition xml file.		
All overwrite operations	If the result of any parameter is to overwrite an existing backup file on a protected volume then this will only be allowed if the target folder is not a backup destination in any saved backup definition xml file.				
	 RoboCopy and Network Shares If the source of a /MOVE /MOV or target of a /MIR /PURGE operation is a MIG protected volume on a network share then all delete operations are blocked. This is because RoboCopy 'Rules' can only be applied if the Windows session that's opening the files is the same Windows session that's running RoboCopy. In the case of a network share, the remote computer is opening the files and will block all delete operations.				
Turn off Image Guardian	Turns off the Image Guardian service. Optionally select from the list of further options: <table> <tr> <td> 1 Minute to 2 Hours </td><td> Select to temporarily disable MIG for the selected time </td></tr> <tr> <td></td><td> MIG will remain 'Off' until the next Windows reboot. </td></tr> </table>	1 Minute to 2 Hours	Select to temporarily disable MIG for the selected time		MIG will remain 'Off' until the next Windows reboot.
1 Minute to 2 Hours	Select to temporarily disable MIG for the selected time				
	MIG will remain 'Off' until the next Windows reboot.				

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	Restart service on reboot	
	Permanently Off	When 'Turn off Image Guardian' is selected, 'Permanently Off' is the defaulted option if MIG is currently enabled and nothing is selected in the 'More Options...' list. Otherwise, selecting this option will cancel any temporary disable settings and turn off MIG.



Note: Clicking 'Apply' will immediately change MIG and update the status text:.

The **status area** above the buttons shows the current status of MIG.

 Current Status: Enabled

 Current Status: Disabled

 Current Status: Disabled Until Reboot

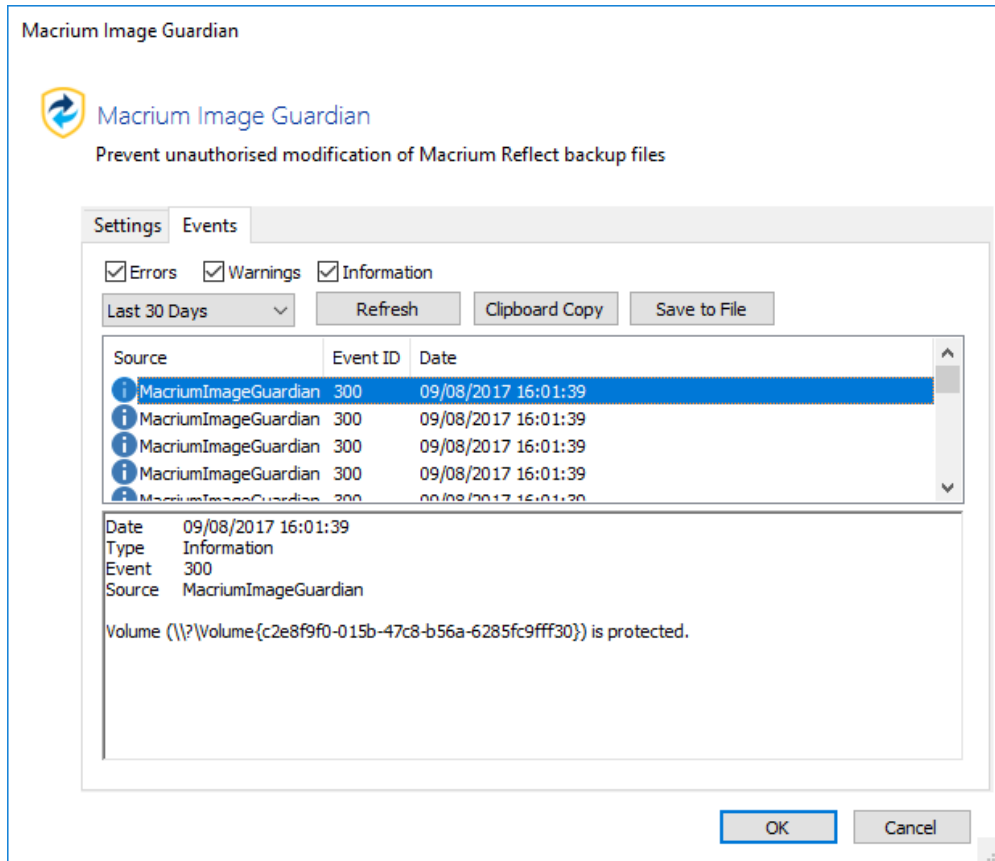
 Current Status: Temporarily Disabled MIG is disabled for: 04:28 Re-Enable

Clicking 'Re-Enable' will immediately cancel the outstanding temporary disable and turn MIG 'On'.

Macrium Image Guardian Events

To view Image Guardian windows events, take the 'Other Tasks' > 'Macrium Image Guardian Settings..' menu option and select the 'Events' tab:

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Number	Event Name	Severity	Description
100	EVT_MIG_SERVICE_STARTED	Informational	Image Guardian service started
110	EVT_MIG_DRIVER_STARTED_BY_SERVICE	Informational	Image Guardian driver started by service
200	EVT_MIG_SERVICE_STOPPED	Informational	Image Guardian service stopped
300	EVT_MIG_VOLUME_PROTECTED	Informational	Volume (\\?\Volume{6a2d53fe-c79a-11e1-b189-806e6f6e6963}\) is protected
310	EVT_MIG_BLOCK_VERIFICATION_FILE_ACCESS	Informational	Blocking process (processname.exe) creating verification file as process is not Macrium certified
320	EVT_MIG_BLOCKED_FILE_ACCESS	Warning	

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Number	Event Name	Severity	Description
			Blocked unauthorised process (processname.exe) accessing file (\\?\Volume{6a2d53fe-c79a-11e1-b189-806e6f6e6963}\Folder\filename.mring)
330	EVT_MIG_USER_PROTECTED_VOLUME	Informational	User has enabled Image Guardian on volume (\\?\Volume{6a2d53fe-c79a-11e1-b189-806e6f6e6963}\)
340	EVT_MIG_USER_DISABLED_VOLUME	Informational	User has disabled Image Guardian on volume (\\?\Volume{6a2d53fe-c79a-11e1-b189-806e6f6e6963}\)
500	EVT_MIG_ERROR_BAD_EVENT	Error	Error could not open Image Guardian verification event. Error code = 123
510	EVT_MIG_ERROR_PROTECTING_VOLUME	Error	Error protecting volume (\\?\Volume{6a2d53fe-c79a-11e1-b189-806e6f6e6963}\). Error code = 123
520	EVT_MIG_ERROR_UNPROTECTING_VOLUME	Error	Error unprotecting volume (\\?\Volume{6a2d53fe-c79a-11e1-b189-806e6f6e6963}\). Error code = 123

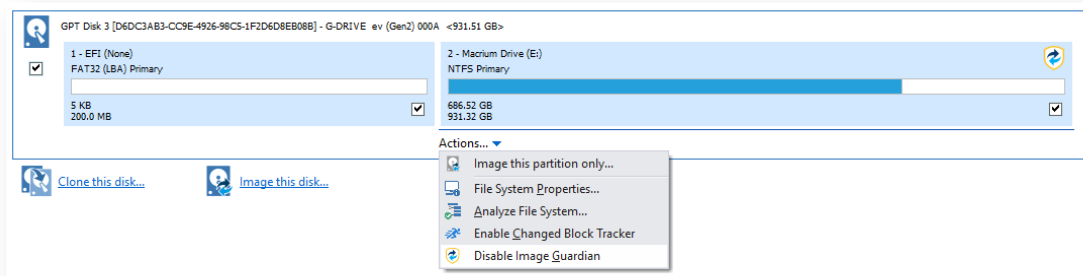


When an unauthorised process attempts to write to, delete or rename a Macrium backup file the action will be blocked and Windows Event 320 will be generated

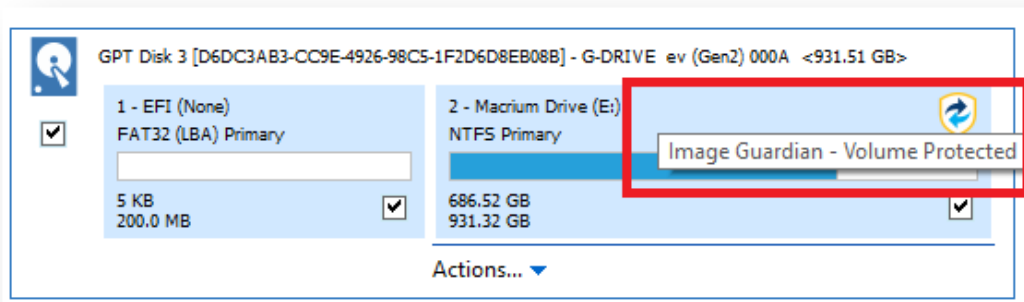
Enabling and Disabling MIG on NTFS Volumes

MIG can be enabled or disabled on any **NTFS volume** by using the '**Actions**' menu in the Macrium Reflect main window.

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A **MIG** shield indicates that a volume is protected:



Automatic Protection

Please note that if the option to '**Automatically protect local backup drives**' is selected in the MIG settings dialog, then **unprotected volumes** will be **automatically protected** when the next backup runs to the volume, or on reboot, if the volume contains the path of a backup destination saved in a backup definition.

Why MIG isn't available for 3rd party NAS devices

A frequent question asked about [Macrium Image Guardian](#) is why popular NAS devices aren't supported. This is an obvious question but misses a fundamental understanding of how network storage works.

Unlike Windows shares, NAS devices have their own proprietary operating systems. Each NAS device is effectively a computer with its own file system and sharing control software. It isn't possible to control the way files are stored on NAS devices without installing a low level device driver specialised for each different NAS OS, usually Linux based. This also assumes that the NAS manufacturer has allowed 3rd party suppliers access to install file system drivers. It's a similar scenario to installing popular Anti-Virus software directly on a NAS, it isn't possible.

With that said, we are open to working with NAS manufacturers, and should a method of complementing a NAS file system be possible, we will certainly be involved.

Macrium Changed Block Tracker

Macrium Reflect Changed Block Tracker (MRCBT) reduces the amount of time it takes to perform incremental and differential images by monitoring the changes to an NTFS formatted volume in real-time. This is especially relevant when a file system contains very large files, such as virtual hard disk (VHD) files, where speed improvements are significant and can reduce the Incremental image time from hours to minutes or even seconds.

Implemented as a kernel mode filter driver, sitting below the NTFS file system driver, MRCBT is able to intercept all I/O requests to the logical volume and maintain a record of which blocks have changed.

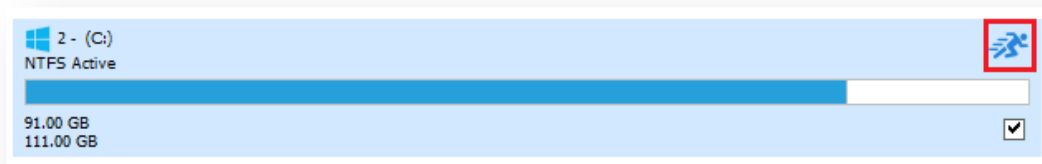
Traditionally, Macrium Reflect has detected changes to the file system by comparing the NTFS Master File Table (MFT) on the source volume, with the MFT of the most recent image in the backup set. While this method is one of the quickest solutions available, we do not consider it an optimal solution when used in a continuous incremental scenario, especially if multi-GB files are present in the file system.

In addition to numerous performance improvements, starting with version 7.2, MRCBT tracks TRIM events. This events are generated by NTFS when a file is deleted or moved and are used by MRCBT to optimize the image by excluding the relevant blocks from the backup.

When MRCBT is first enabled, it captures an internal NTFS attribute that represents the number of times that the file-system has been restarted. By tracking changes to this value, MRCBT can detect if a volume has been modified in any environment where MRCBT is not operating (e.g. on another computer or operating system).

When MRCBT is enabled and Reflect detects that the Restart attribute correctly sequenced, the subsequent incremental and differential image can be generated by comparing the changed block database (created by MRCBT) on the logical volume with that stored in the previous image in the chain. This is indicated by a blue running-man icon displayed in the Reflect UI (see image below).

If Reflect detects that the Restart attribute is not correctly sequenced, the subsequent incremental or differential image will be generated using the traditional method. This is indicated by a grey running-man icon displayed in the Reflect UI.



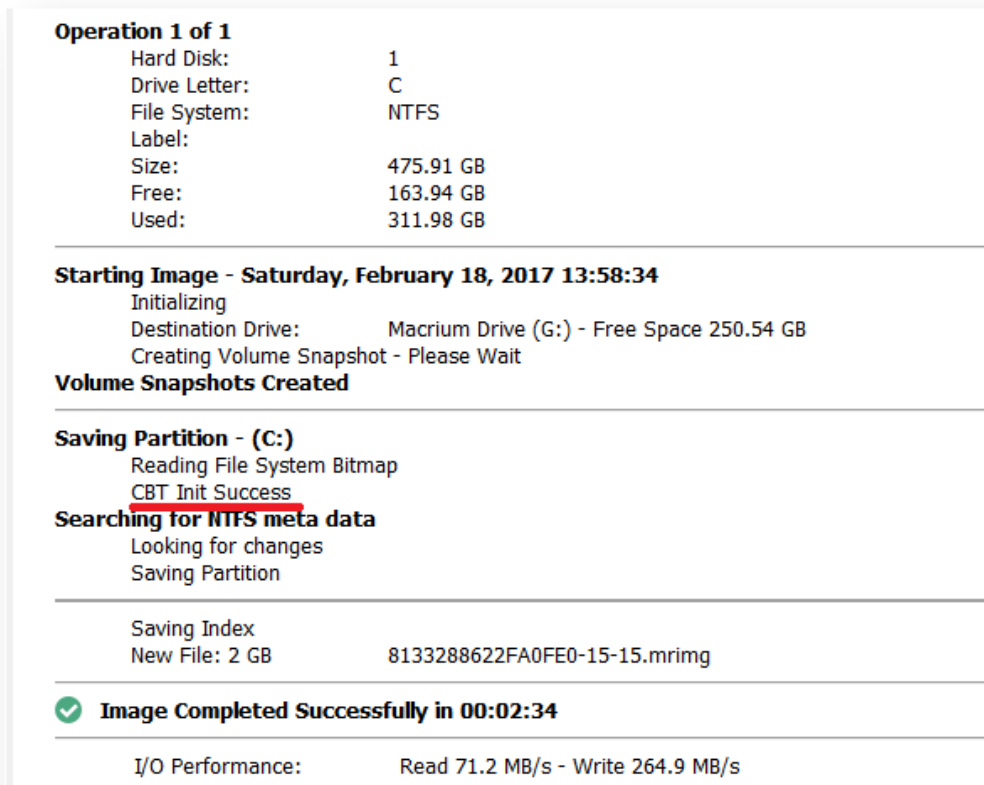
A reboot is required after installing Macrium Reflect to enable CBT. You can create images without rebooting but CBT will only be enabled after a restart.

The NTFS Restart attribute is a fundamental component of the NTFS file-system and has been supported by all Linux and Apple operating systems dating back several years.

Due to technical limitations with Windows XP, Macrium Reflect Changed Block Tracker will only work on Windows Vista and higher operating systems.

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When MRCBT is being used to generate an Incremental or Differential image of the volume, you will see the following line in the Image log:

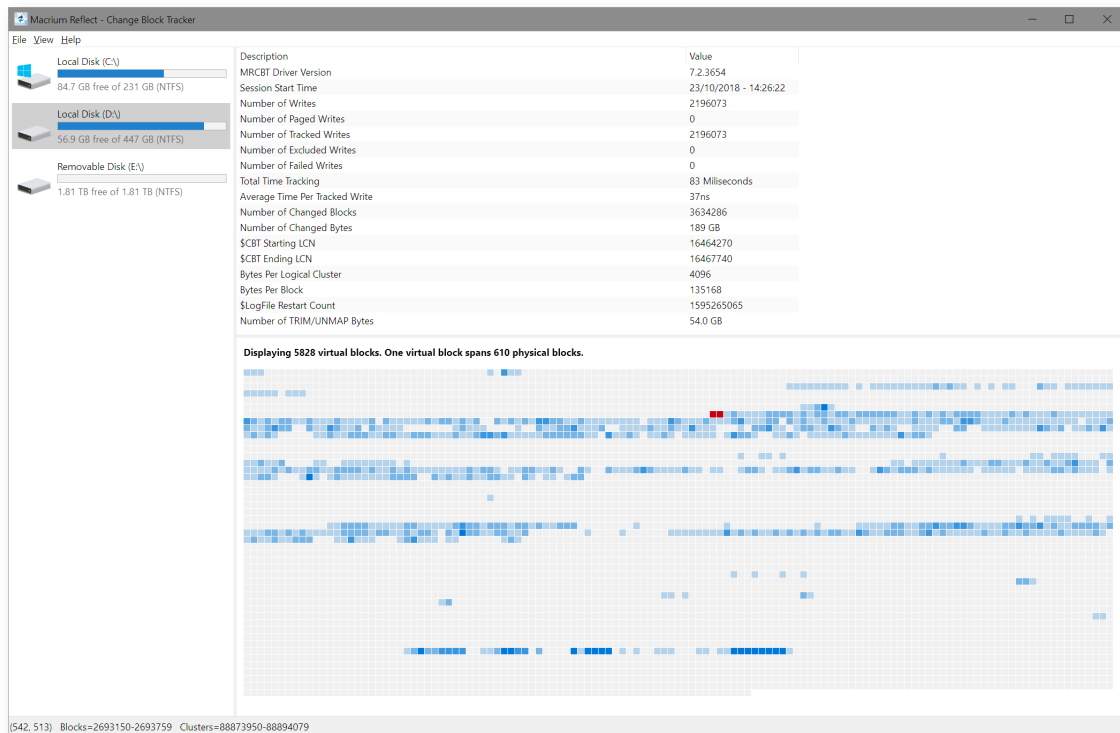


CBT Init Success indicates that the Incremental is using the CBT driver. Note that the **'Looking For Changes'** operation will be nearly instantaneous with no progress shown.

Macrium CBT Driver Tools

Macrium CBT Driver Tools is a small Windows utility to install and monitor the Macrium CBT driver. Macrium CBT Driver Tools provides the user with a visual representation of the changed blocks and of the various performance metrics reported by the kernel mode driver. **Macrium Driver Tools** can be found here: C:\Program Files\Macrium\Reflect\MrCBTTools.exe

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Selecting a drive shows performance metrics and tracked block information for the chosen drive. The darker shades indicate a higher percentage of changed blocks.

Note: The red blocks indicate the physical location of the MRCBT tracking file on the volume. This view will be reset when a Macrium Reflect backup of the volume is started.

Clicking on one of the shaded blocks will cause Macrium Driver Tools to display a list of files that are currently using the clusters within the block.

Performance Metrics

Metric	Name	Description
	Session Start Time	The date and time that MRCBT started monitoring the volume. This value will be reset when the volume is mounted, normally when Windows is restarted.
	Number of Writes	The total number of write operations on the volume that MRCBT has monitored since the session started.
	Number of Paged Writes	The total number of write operations on the volume, flagged as PAGING_IO, that MRCBT has monitored since the session started.
	Number of Tracked Writes	The total number of write operations on the volume that MRCBT has tracked since the session started.

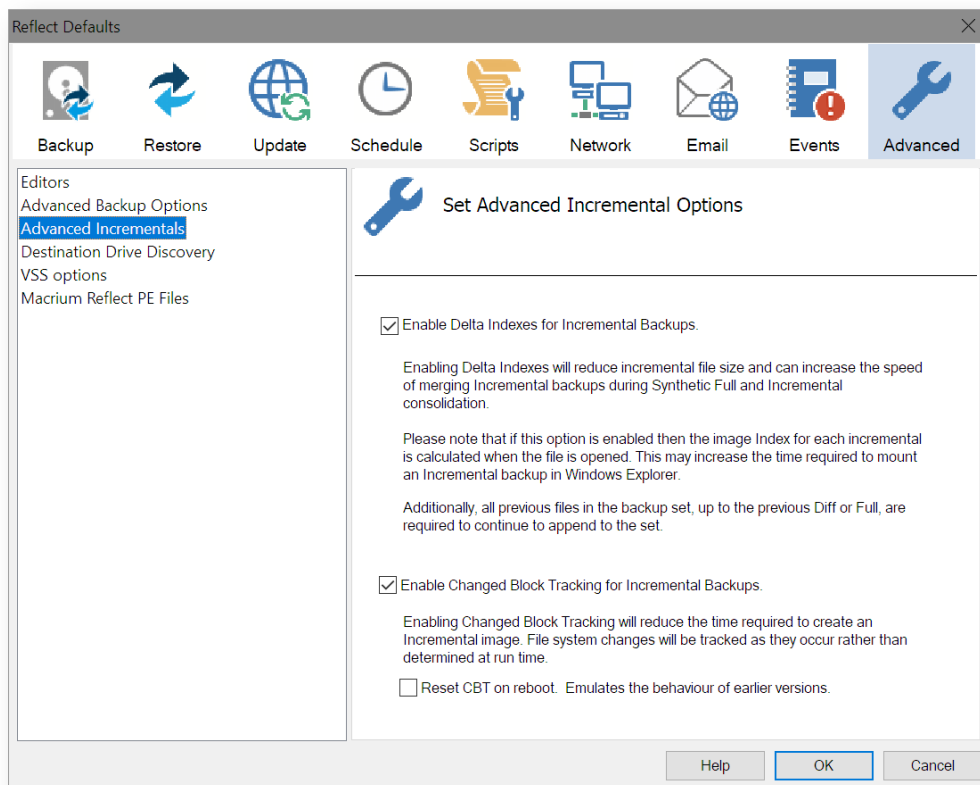
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Number of Excluded Writes	The total number of write operations on the volume that MRCBT has excluded, due to already having a record of a change to that disk area, since the session started.
Number of Failed Writes	The total number of write operations on the volume that MRCBT has failed to track since the session started. NOTE: If this value is anything other than zero, Macrium Reflect will fall back to the normal method of generating an incremental backup.
Time Tracking	The total length of time that MRCBT has taken to track writes on the volume since the session started.
Average Time Per Tracked Write	The average length of time that MRCBT is taking to track each write operation on the volume since the session started.
Number of Changed Blocks	The total number of changed blocks on the volume since the session started.
Number of Changed Bytes	The total number of changed bytes on the volume since the session started.
\$CBT Starting LCN	The first Logical Cluster Number (LCN) of the MRCBT tracking file.
\$CBT Ending LCN	The last Logical Cluster Number (LCN) of the MRCBT tracking file.
Bytes Per Logical Cluster	The number of bytes per logical cluster for the volume, as reported by NTFS.
Bytes Per Block	The number of bytes per block, as reported by Macrium Reflect.
\$LogFile Restart Count	The current value of the NTFS \$LogFile Restart Count.
Number of TRIM /UNMAP Bytes	The number of bytes that have been affected by a TRIM or UNMAP event.

Enabling and disabling CBT

CBT is enabled by default. You can change whether CBT is enabled or disabled by selecting **“Enable Changed Block Tracking for Incremental Backups”** check-box in the **“Advanced Incrementals”** page of the **“Reflect Defaults”** dialog box.

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Note: You can enable or disable CBT at any time without affecting your Image sets.

We recommend enabling the Delta Indexes for Incremental Backups option as this will produce the smallest incremental image files in the shortest amount of time. Please see [Delta Indexes for Incremental Backups](#)

Macrium viBoot

Macrium viBoot

Macrium viBoot enables you, to instantly create, start and manage Microsoft Hyper-V virtual machines using one or more Macrium Reflect image files as the basis of the virtual machine storage sub-system.

At a minimum, viBoot enables you to boot into the images you have made using Macrium Reflect, for validation purposes, or to retrieve data from old applications stored on a bootable image. At an enterprise level, you could recover an entire network environment in minutes.

Macrium viBoot is now built upon new technology that allows it to instantly present a Macrium Reflect image file as a Microsoft Virtual Disk (.VHDX) file.

When creating a new virtual machine Macrium viBoot will create two Microsoft Virtual Hard Disk (.VHDX) files for each of the disks described within the selected Macrium Image file. The first VHDX file is incomplete and only contains enough information to describe the disk layout and a signature to mark it as a Macrium viBoot VHDX. The data for the disk is retrieved from the Macrium Image File by the Macrium Virtual Disk Provider filter driver as required. Because the data is not stored with the VHDX, it size will never exceed a few megabytes. The second VHDX file is a standard differencing disk that will receive any modifications made to during the lifetime of the virtual machine.

As with any differencing VHDX, this file can grow dramatically in size, depending on the usage of the virtual machine.

These VHDX files are stored in the designated Macrium viBoot repository and remain open until the Macrium viBoot virtual machine is deleted from within viBoot.



Note: The default location for the viBoot VHDX files is **C:\ProgramData\Macrium\viBoot**. This is configurable from within the Macrium viBoot UI.



Note: viBoot only supports **Microsoft's Hyper-V** running on a **minimum** of **Windows 8.0 or Windows Server 2012**.

Booting an image directly from Macrium Reflect

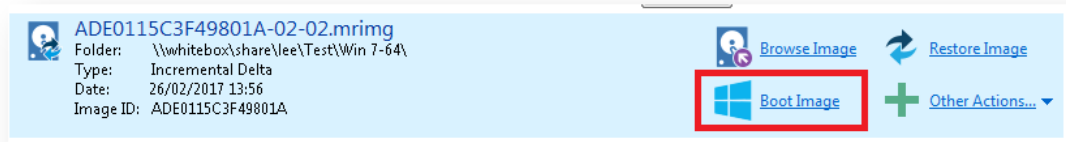
An image that contains the Windows System and Boot partition(s) can be directly booted from the 'Restore' view in Macrium Reflect.

Boot architecture	Partitions
MBR - Master Boot Record	

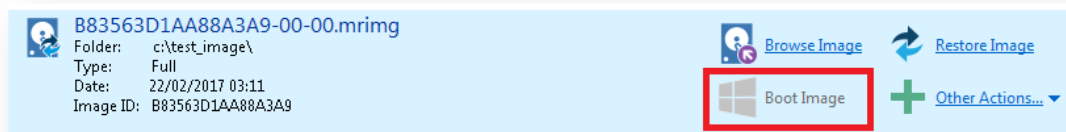
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Boot architecture	Partitions
	Boot partition: This may be the same partition as drive 'C:' but is likely to be a separate small (100 to 300 MB) partition named the Microsoft System Reserved partition or MSR. Windows partition: This is the partition that contains the Windows OS and will be drive C:
UEFI - Unified Extensible Firmware Interface	UEFI System Partition: A small FAT32 formatted partition that doesn't have a drive letter. Windows partition: This is the partition that contains the Windows OS and will be drive C:

If an image contains the partitions required for booting then the image will show an active 'Boot Image' Link:

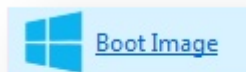


Otherwise the link will be disabled:



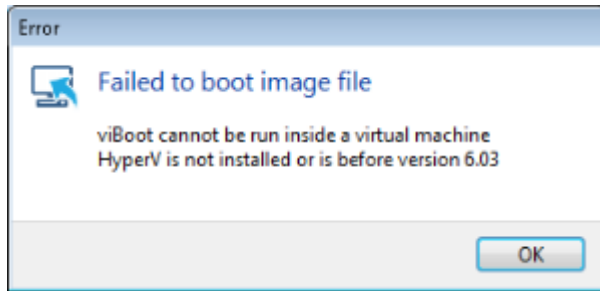
To boot an image directly with viBoot.

1. Click the 'Restore tab'.
2. Select the bootable image.
3. Click the 'Boot Image' link.

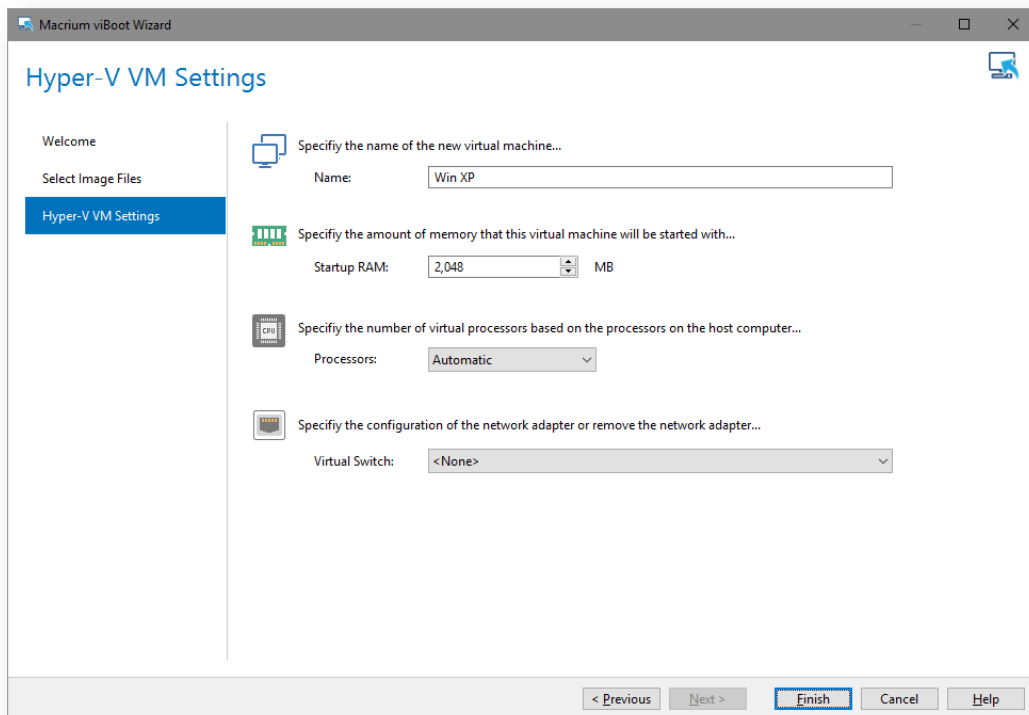


Note: If viBoot cannot run on your Windows installation then you will receive an error message indicating the reason(s):

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4. If viBoot can launch, the viBoot **Hyper-V settings dialog** will start.



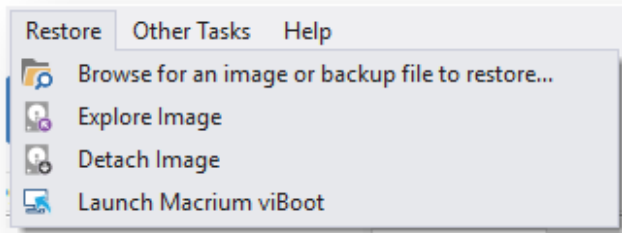
5. Make any changes to the VM properties and **click 'Finish'**

The VM will now start and boot directly into Windows.

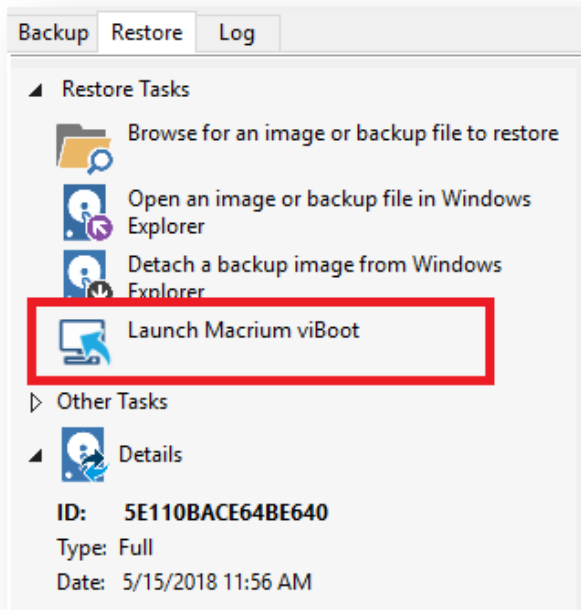
Starting the viBoot create Virtual Machine Wizard from Macrium Reflect.

Take the '**Restore**' > '**Launch Macrium viBoot**' menu option

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Or, click the '**Launch Macrium viBoot**' task link on the Restore tab.

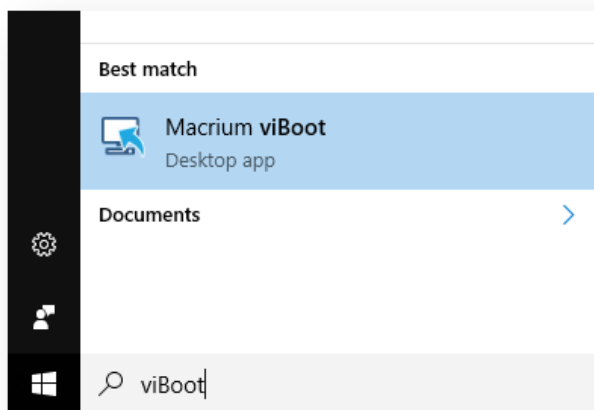


This will start the the viBoot Virtual Machine User Interface.

Launching viBoot as a standalone application

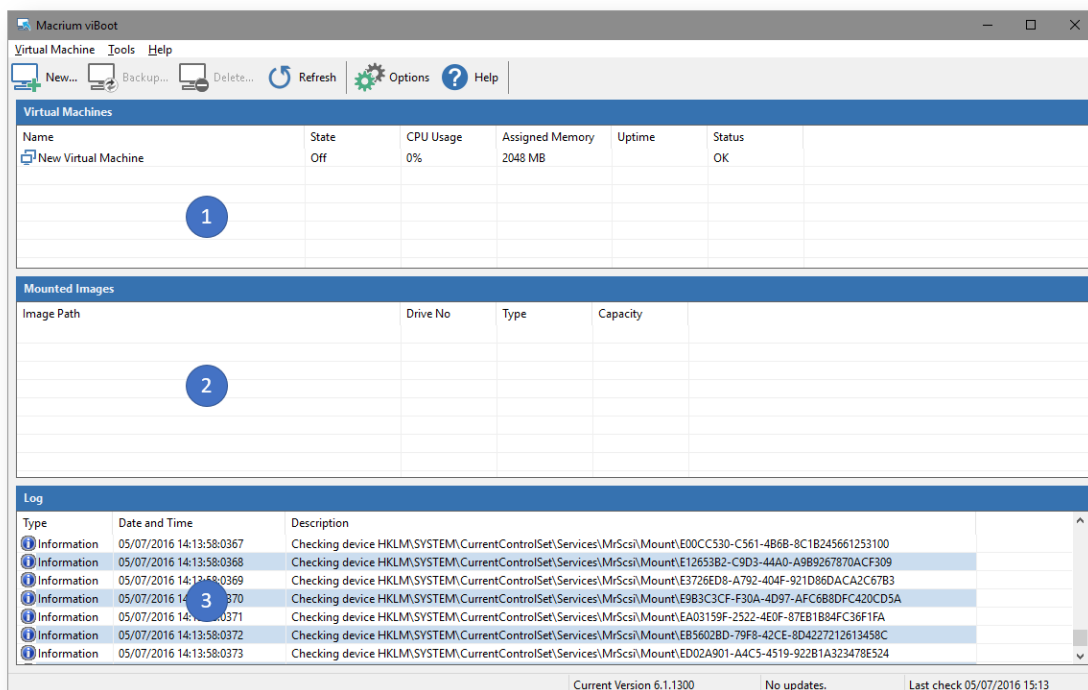
viBoot is installed by default during the standard Macrium Reflect installation and can be started using the installed shortcut:

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Main Window

The Macrium viBoot main window allows you to see at a glance, which Macrium Reflect image files you have mounted (2), and which virtual machines are connected to those drives (1).



The “Virtual Machines” **view (1)**, displays the name of the viBoot created virtual machine, the current state of the virtual machine (Off, Running, etc) and the current CPU usage of the virtual machine. Selecting a Hyper-V virtual machine in the “Virtual Machines” view (1) will update the “Mounted Images” view (2) to list the Macrium Reflect images that are being referenced by the virtual machine.

The “Mounted Images” **view (2)**, displays the path of the image file(s) used to create the virtual drive(s), the physical drive number assigned to the drive by Windows, the partition type of the drive (MBR or GPT) and the drive capacity.

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The "Log" **view (3)**, shows a record of the actions taken by viBoot.

Macrium viBoot can only monitor the state of virtual machines and drives while it is running. Clicking the Windows close button will minimize viBoot.

Main Window Commands

Macrium viBoot menu:

Menu Item	Sub Menu Item	Description
Virtual Machine	<u>C</u> onnect	Connect to a virtual machine.
	<u>N</u> ew...	Displays the viBoot Wizard which allows you to create a new virtual machine.
	<u>D</u> elete...	Deletes the currently selected virtual machine.
	<u>S</u> tart	Starts the currently selected virtual machine.
	Sh <u>u</u> t down	Shuts down the currently selected virtual machine.
	T <u>u</u> rn off	Turns off the currently selected virtual machine.
	Pa <u>s</u> se	Pauses the currently selected virtual machine.
	<u>R</u> eset	Resets the currently selected virtual machine.
	<u>E</u> xit	Exit the Macrium viBoot application.
Tools	<u>L</u> og	Toggles the display of the Log window.
	<u>O</u> ptions...	Configure the virtual machine repository folder, and logging options.
	<u>R</u> efresh	Instructs viBoot to refresh it's view of the virtual machines and mounted images.
Help	<u>C</u> ontents...	Displays this help content.
	<u>A</u> bout Macrium viBoot...	Displays the viBoot version and copyright notice.

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Tip

You can right-click on the virtual machine pane to display the "Virtual Machine" menu as a context menu.

Macrium viBoot toolbar:

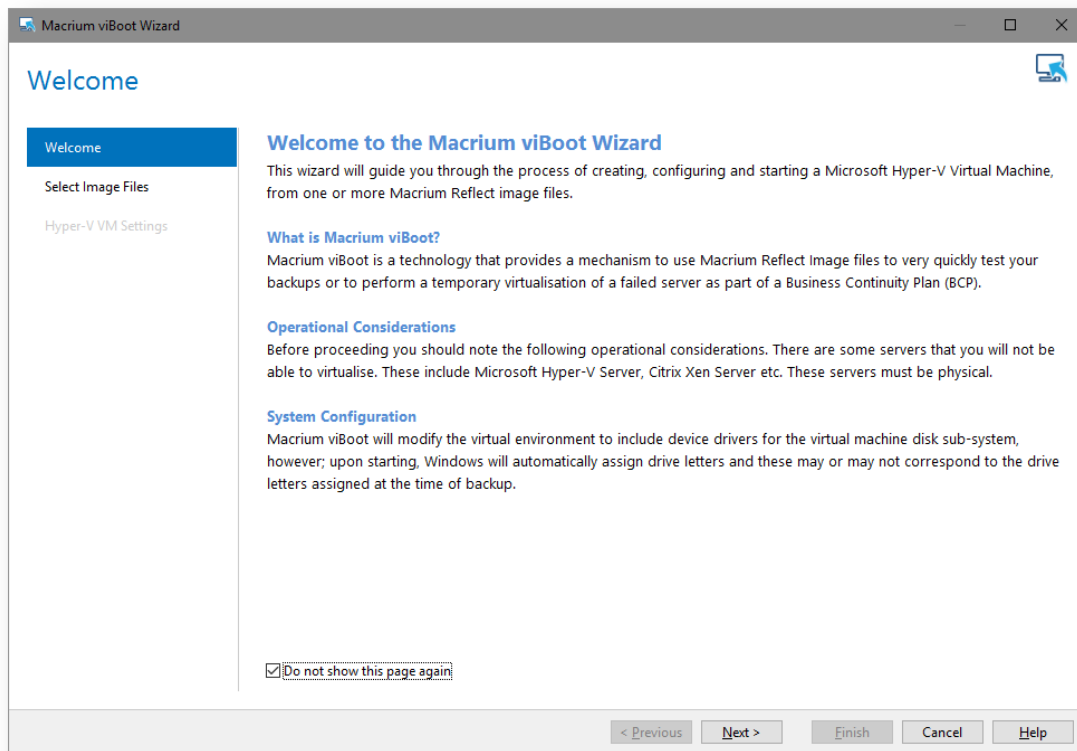
	New - Displays the viBoot Wizard which allows you to create a new virtual machine.
	Deletes the currently selected virtual machine.
	Refresh the list virtual machines and states.
	Options - Configure the virtual machine repository folder, and logging options.
	Help - Displays this help content.

Macrium viBoot Wizard

The Macrium viBoot Wizard will configure and start a Microsoft Hyper-V virtual machine from one or more Macrium Reflect image files.

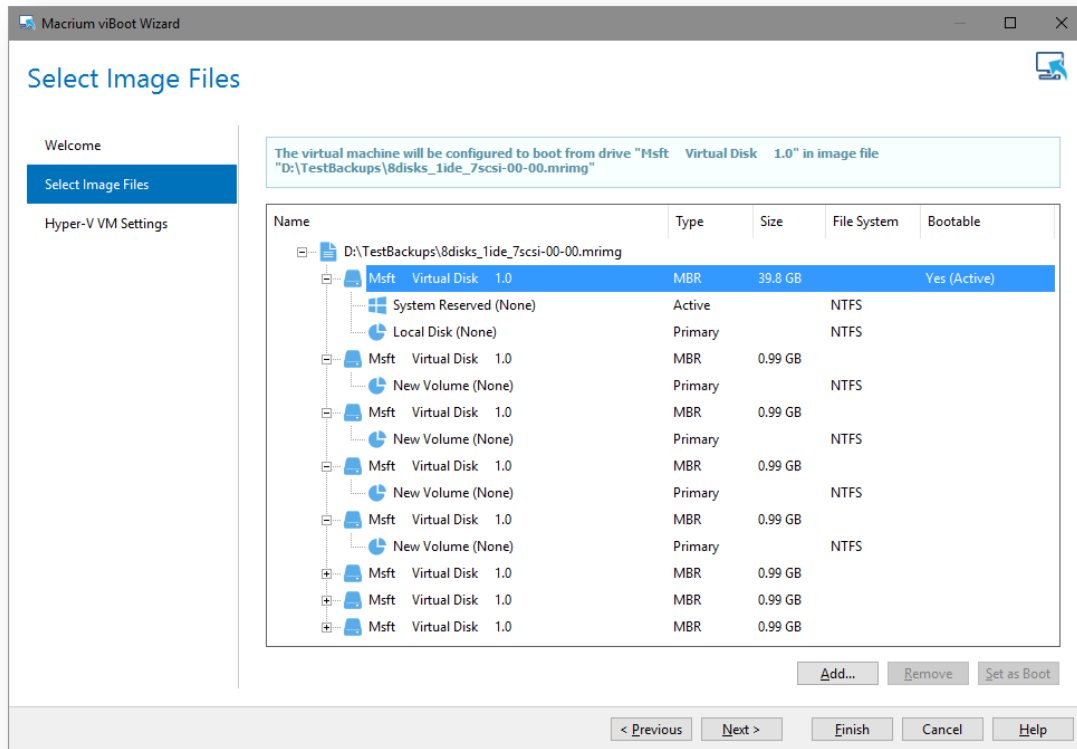
The "Welcome" page provides a brief introduction and explains some of the limitations of virtualization.

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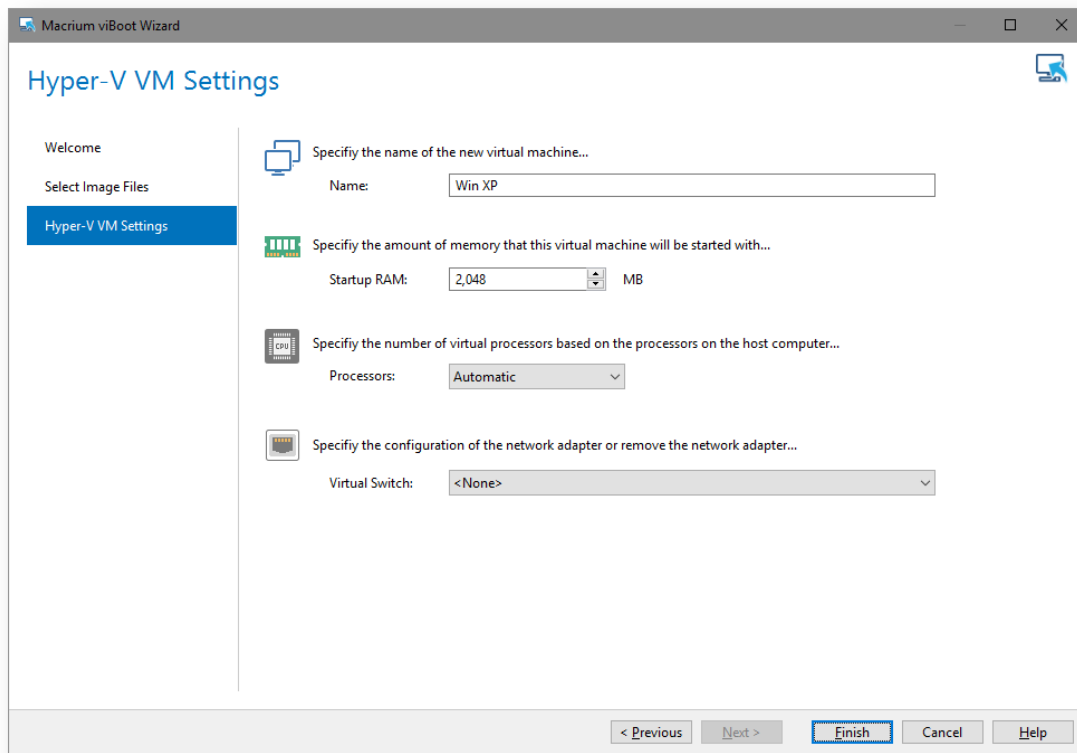
Select Image Files allows you to add one or more Macrium Reflect image files to be used for the virtual machine.



The first boot-able disk will be marked as the boot disk. If there are multiple disks that are boot-able, these can be set to be the boot disk by selecting the disk and clicking the "Set as Boot" button.

Hyper-V VM Settings allows you to configure the virtual machine. The RAM and CPU are limited to match the host computer. If the number of processors is set to "Automatic", viBoot will interrogate the Windows settings from the image files to set the correct number of processors. A Virtual Switch of "<None>" ensures that the new virtual machine is not connected to the network.

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Please note that no changes whatsoever, are made to the original image files.

Options

The “Options” button on the Macrium viBoot main toolbar, will display the “Options” dialog box. From here you can modify some of the behavior of Macrium viBoot.

The “Virtual Machine Repository” specifies the folder that Macrium viBoot will use to store Virtual Machine configurations and the virtual machine drive cache.

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The screenshot shows the 'Options' dialog box in Macrium Reflect. It has a title bar with 'Options' and a close button. The 'Virtual Machine Repository' section contains a text box with the path 'C:\ProgramData\Macrium\viBoot' and a browse button (...). Below it is a note: 'NOTE: Some Virtual Machines may require large amounts of storage. It is recommended that you have enough free space to accomodate the total capacity of the drives you intend to mount.' The 'Logging' section is checked. It shows the log file path 'C:\Users\mappleby\AppData\Local\Temp\Macrium\'. There are three settings: 'Log level' set to 'Critical', 'Days to keep' set to '16', and 'Maximum number of files' set to '100'. The 'Maximum log file size (MB)' is also set to '100'. At the bottom are 'OK', 'Cancel', and 'Help' buttons.

Options

Virtual Machine Repository

Defines the base folder that Macrium viBoot will use to store Virtual Machine configurations and the virtual drive cache. The performance of the drive(s) where this folder resides, will directly affect the performance of the Virtual Machines.

C:\ProgramData\Macrium\viBoot ...

NOTE: Some Virtual Machines may require large amounts of storage. It is recommended that you have enough free space to accomodate the total capacity of the drives you intend to mount.

☒ **Logging**

The log file is written to "C:\Users\mappleby\AppData\Local\Temp\Macrium\".

Log level: Critical Days to keep: 16

Maximum number of files: 100 Maximum log file size (MB): 100

OK Cancel Help

Macrium viBoot writes a log of actions taken by the application. This file is saved to "%LOCALAPPDATA%\Temp\Macrium". The log file is configured by the following options:

Log level - Controls type of information written to the log file:

- Critical
- Error
- Warning
- Information
- Debug

Maximum number of files - Number of log files to keep before purging. A value of zero will disable this check.

Days to keep - Log files older than the specified number will be purged. A value of zero will disable this check.

Maximum log file size(MB) - Maximum file size for the log file, before a new log file is created. A value of zero will disable this check.

Macrium viBoot demonstration video

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 in all paid editions of Macrium Reflect. This excludes the Free Edition and 30 day trials.

Further reading:

- [Re-deploying Windows to new hardware using Macrium ReDeploy](#)
- [Using Windows sysprep and deploying using Macrium Reflect](#)

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 Server edition for ReDeploy.

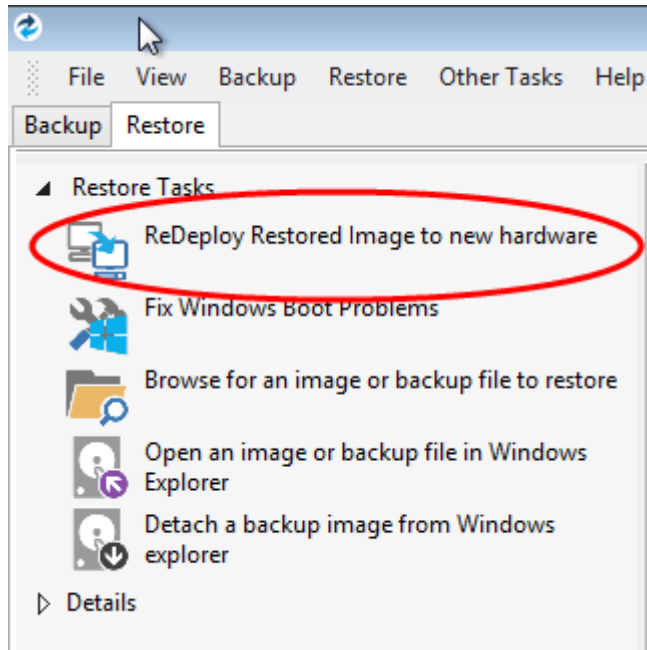
For non-server (workstation) installs use ReDeploy included with Home, Workstation or the Server Edition. Please note that ReDeploy is not included in 30 trial versions of Macrium Reflect



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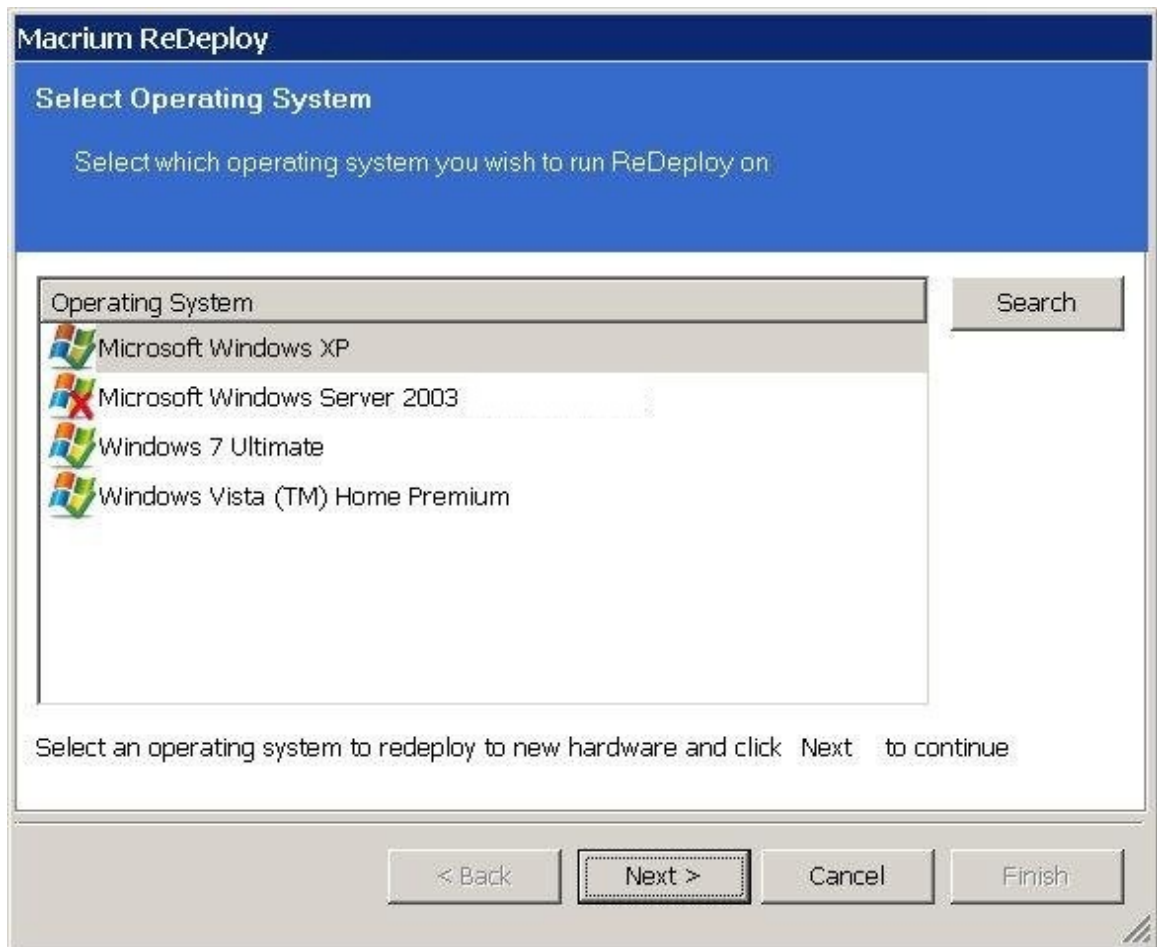
Note: ReDeploy modifies an existing offline operating system to work with new hardware. Restore your system image to the PC being deployed before running ReDeploy. There is no need to reboot your PC after restoring an Image and before you run ReDeploy.

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**.



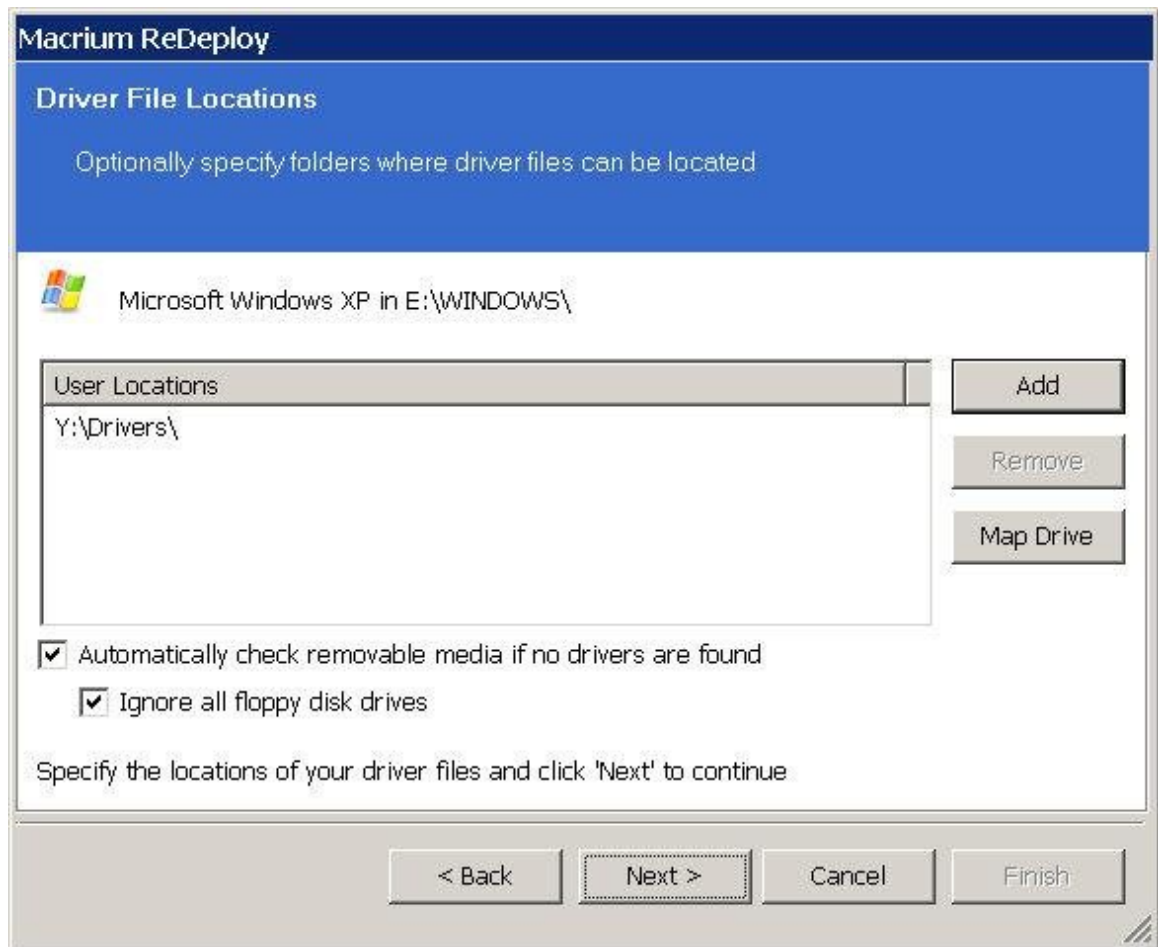
3. If you have a multi-boot system, then you will be presented with a list of operating systems, select the operating system to be redeployed. Click **Next**.

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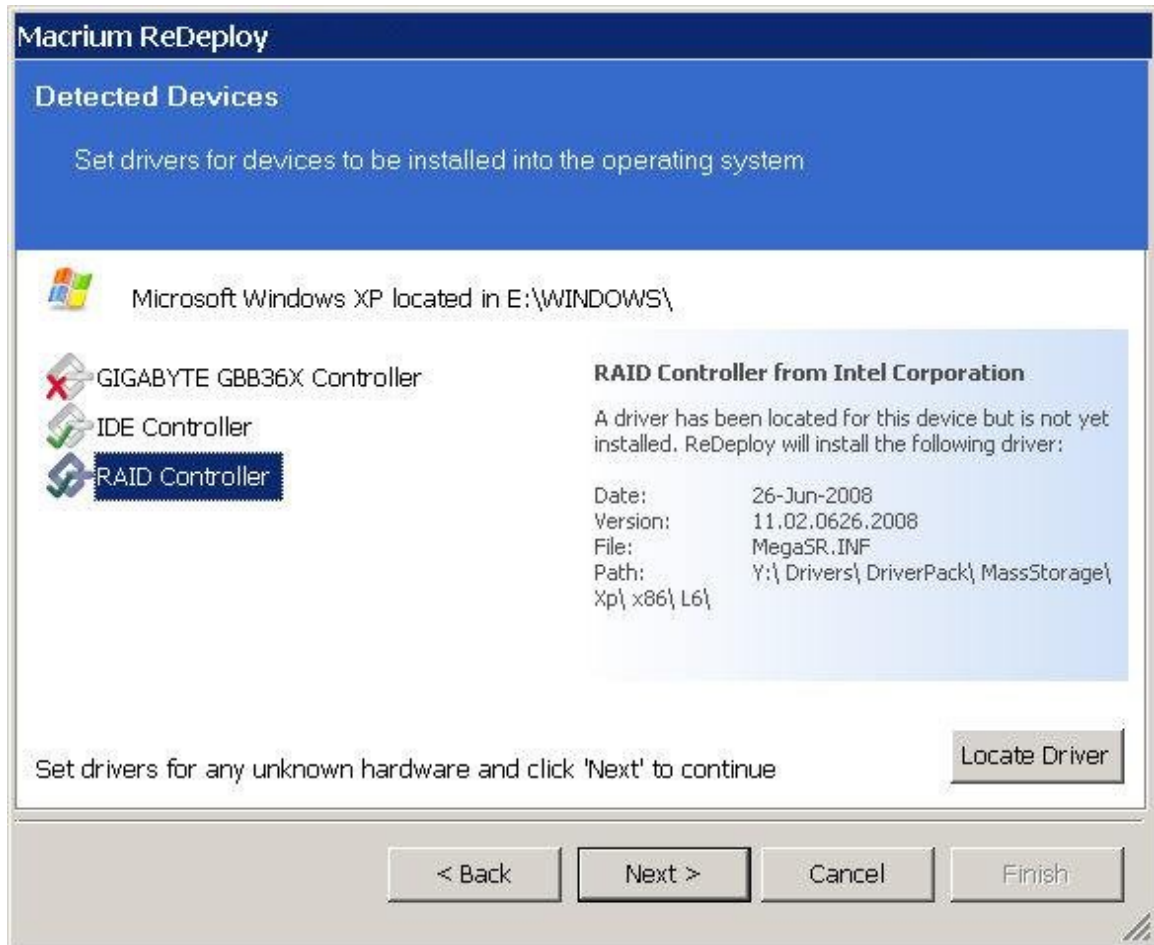
4. Specify driver locations for your mass storage devices (such as RAID card).
 - a. If you haven't already, insert a driver disk for the hardware you are going to boot from. This will typically be the motherboard or RAID card driver CD.
 - b. Click **Add** to add driver locations. You can also specify 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.

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6. ReDeploy seeks drivers for all discovered mass storage devices and displays a list with details, Click **Next**.

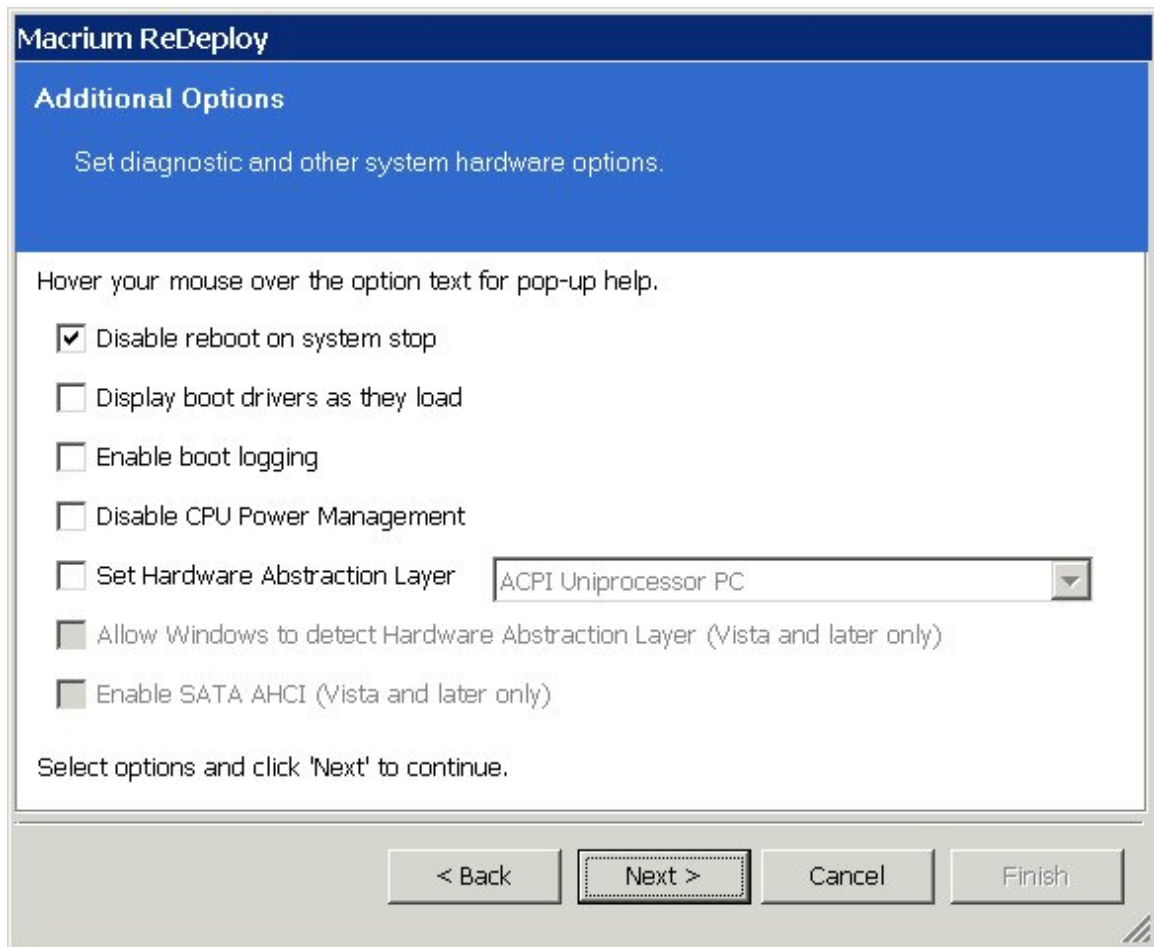
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For each mass storage device, there are three possibilities:

- 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:

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The image shows a screenshot of the 'Macrium ReDeploy' window, specifically the 'Additional Options' tab. The window has a blue header bar with the title 'Macrium ReDeploy'. Below the header, the tab is titled 'Additional Options' in white text. The main area has a blue background with the text 'Set diagnostic and other system hardware options.' in white. Below this, there is a white area with the instruction 'Hover your mouse over the option text for pop-up help.' followed by a list of options with checkboxes. The options are: 'Disable reboot on system stop' (checked), 'Display boot drivers as they load' (unchecked), 'Enable boot logging' (unchecked), 'Disable CPU Power Management' (unchecked), 'Set Hardware Abstraction Layer' (unchecked) with a dropdown menu showing 'ACPI Uniprocessor PC', 'Allow Windows to detect Hardware Abstraction Layer (Vista and later only)' (unchecked), and 'Enable SATA AHCI (Vista and later only)' (unchecked). At the bottom of the white area, it says 'Select options and click 'Next' to continue.' Below the white area is a grey bar with four buttons: '< Back', 'Next >', 'Cancel', and 'Finish'. The 'Next >' button is highlighted with a dashed border.

Macrium ReDeploy

Additional Options

Set diagnostic and other system hardware options.

Hover your mouse over the option text for pop-up help.

- ☒ Disable reboot on system stop
- ☐ Display boot drivers as they load
- ☐ Enable boot logging
- ☐ Disable CPU Power Management
- ☐ Set Hardware Abstraction Layer: ACPI Uniprocessor PC
- ☐ Allow Windows to detect Hardware Abstraction Layer (Vista and later only)
- ☐ Enable SATA AHCI (Vista and later only)

Select options and click 'Next' to continue.

< Back Next > Cancel Finish

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.
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.

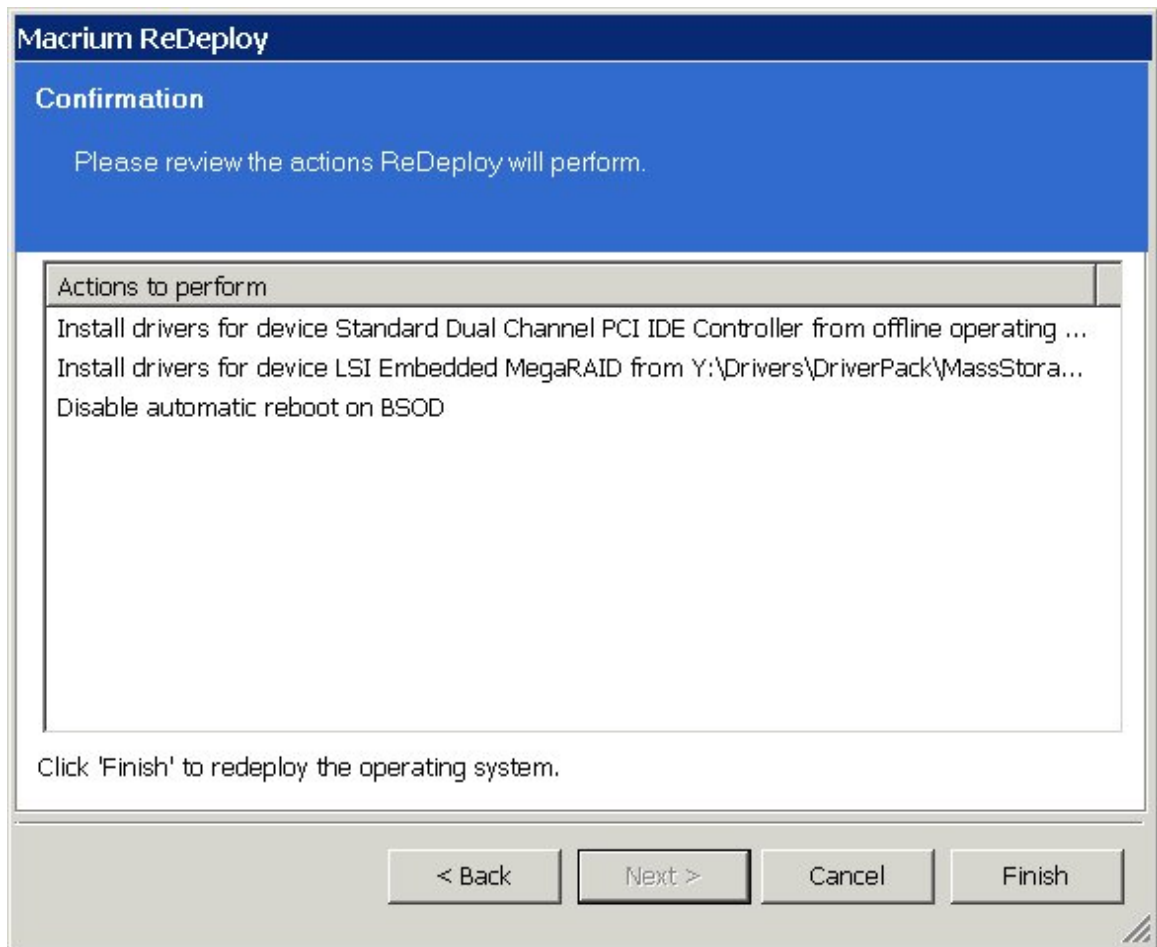
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Option	Description
Set Hardware Abstraction Layer	Set this option to choose which Hardware Abstraction Layer is to be used in the selected Windows operating system. The recommended HAL for this machine is the one initially selected. If you have the 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.

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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.



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.

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Using Windows sysprep and deploying using Macrium Reflect

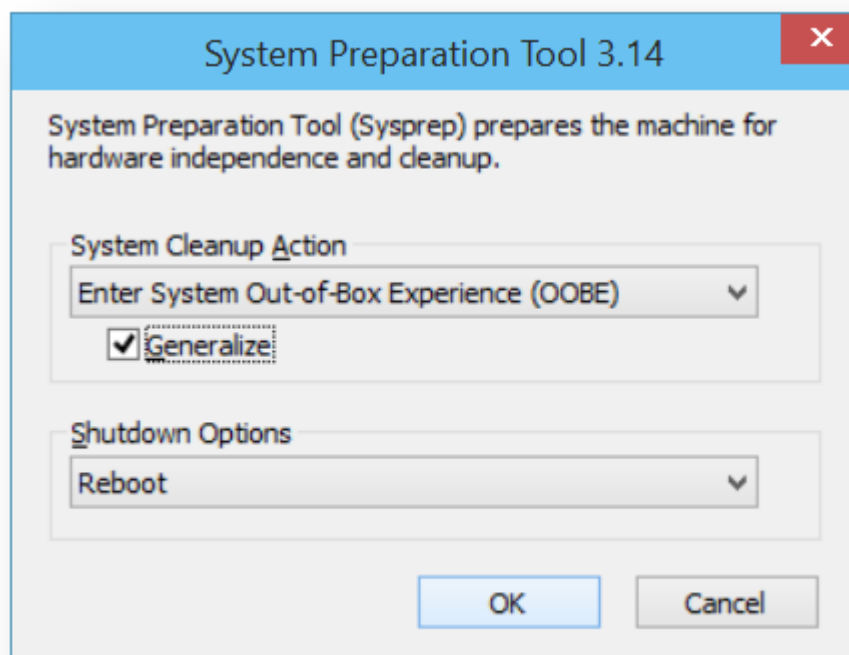
Using the [Windows sysprep](#) utility you can prepare a machine to be deployed across multiple other machines.

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](#) 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**.

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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.
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 v7 Server Plus for Exchange and SQL**

Macrium Reflect v7 Server Plus has all the functionality of Macrium Reflect v7 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](#)

Microsoft Exchange guides:

- [Backing up Microsoft Exchange databases](#)
- [Restoring MS Exchange databases](#)
- [Restoring emails with Mailbox Restore](#)
- [Setting up permissions for Mailbox Restore](#)
- [Adding MS Exchange search folders](#)

Microsoft SQL guides:

- [Backing up MS SQL Databases](#)
- [Running continuous backup of SQL databases](#)
- [Restoring MS SQL](#)

Command line operations with Macrium Reflect

- Installing Macrium Reflect from the command line
- Using Macrium Reflect from the command line
- Verifying image and backup files from the command line

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, 6.x and 7.x.

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.

```
v7.X.XXX_reflect_server_setup_x64.exe /passive /l log.txt LICKEY=XX-XXXX-XXXX-XXXX-XXXX-XXXX-XXXX-XXXXXX
```

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.

```
v7.X.XXX_reflect_server_setup_x64.exe /passive /l log.txt ORDERREF=NNNNNNNN 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.

To make sure that the installation won't restart your computer on completion, a no restart parameter can be added.

```
v7.X.XXX_reflect_server_setup_x64.exe /passive /l log.txt LICKEY=XX-XXXX-XXXX-XXXX-XXXX-XXXX-XXXXXX /norestart
```

Adding any parameters mentioned below to your install script will omit the feature from being installed.

The example below shows a version of the install script that will omit MIG from installing with Reflect:

```
NOIMAGEGUARDIAN=YES  
NOVIBOOT=YES  
NOCBT=YES  
NODESKTOPSHORTCUT=YES
```

eg.

```
v7.X.XXX_reflect_server_setup_x64.exe /passive /l log.txt LICKEY=XX-XXXX-XXXX-XXXX-XXXX-XXXX-XXXXXX NOIMAGEGUARDIAN=YES
```

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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"
```

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To execute an XML file and create an incremental image

```
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"
```

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 unmmounted**Examples**

To unmount an image from drive letter 'j'

```
reflect.exe J -u
```

To umnount 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](#)



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
	Scan all sub-folders if a folder is specified. The default is not to recurse.

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Switch	Description
-r OR --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 files 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

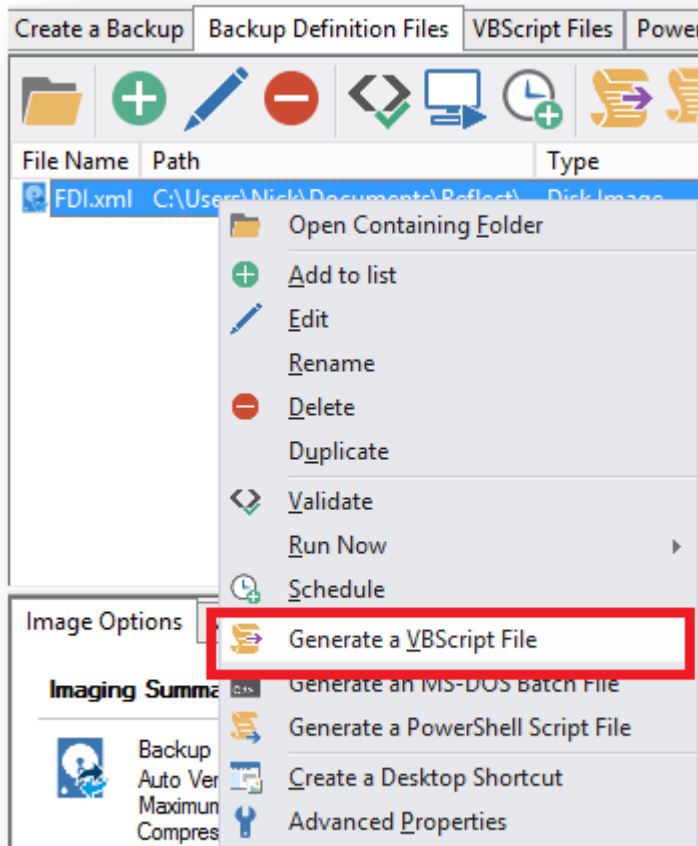
Macrium Reflect includes the ability to automatically create VBScript, PowerShell and MS-DOS source files to add pre and post backup functionality to your backup jobs. This enables system administrators to manage complex backup scenarios.

- Generating a VBScript source file
 - Using VBScript to run sequential backups
 - Generating an MS-DOS batch file
 - Generating a PowerShell source file
-

Generating a VBScript source file

For an example of a generated VBScript source file please see [Example VBScript Source](#)

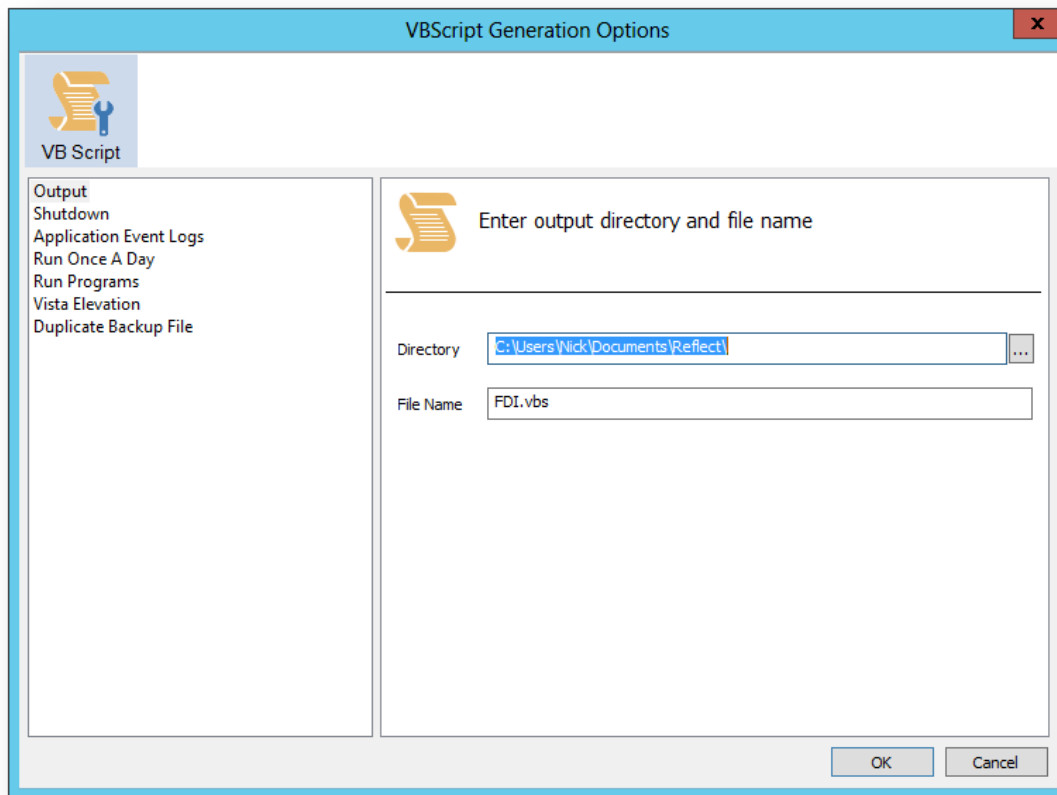
To generate a VBScript file select the 'XML Definition Files' tab on the main window then right click on a file and select '**Generate a VBScript file**'.



This opens the **VBScript Generation Options** dialog:

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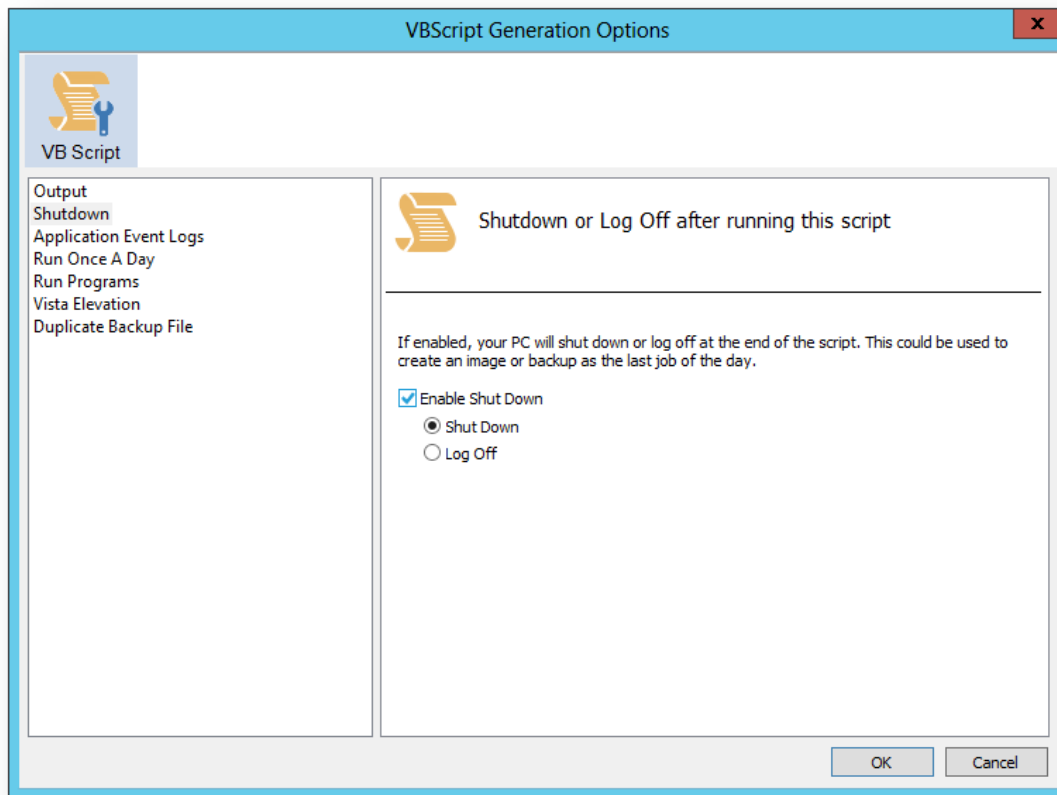
Output



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

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Shutdown



Generated code...

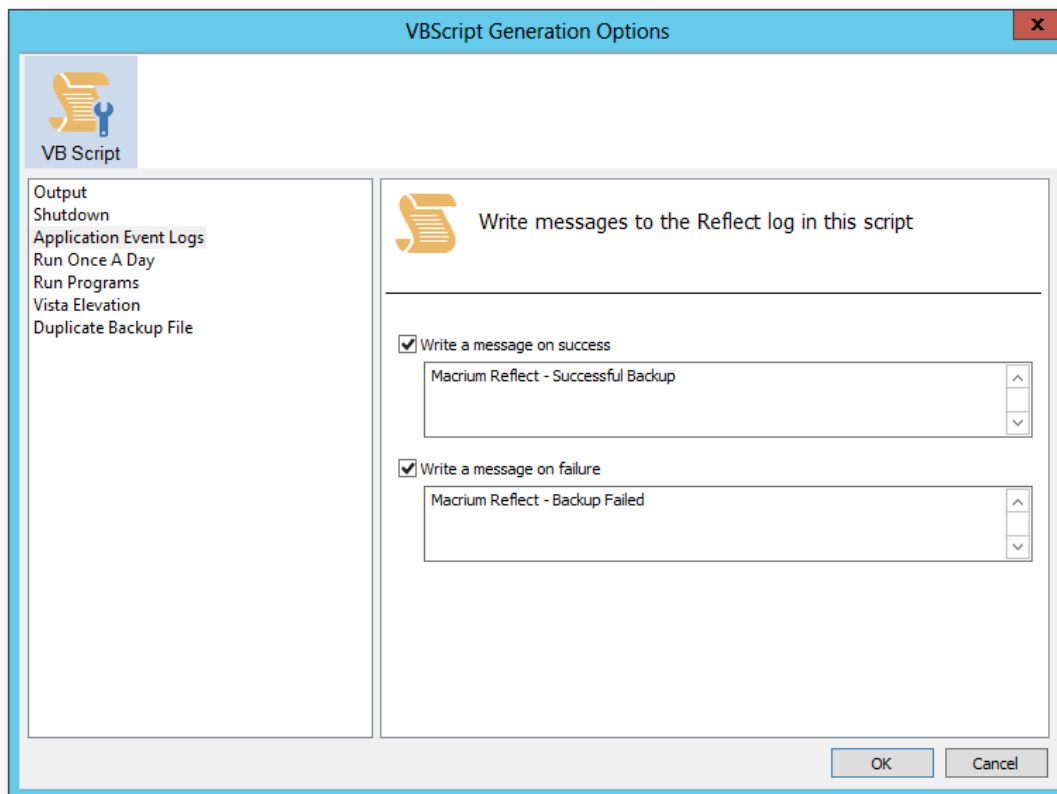
```
' Issue shutdown command  
objShell.Run "shutdown -s"
```

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.

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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
	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

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Note: The Windows Event logs generated by this script will have WHS (Windows Scripting host) as the message source

Level	Date and Time	Source	Task Category
Information	07/04/2015 14:15:35	WHS	None

Event 0, WHS

General

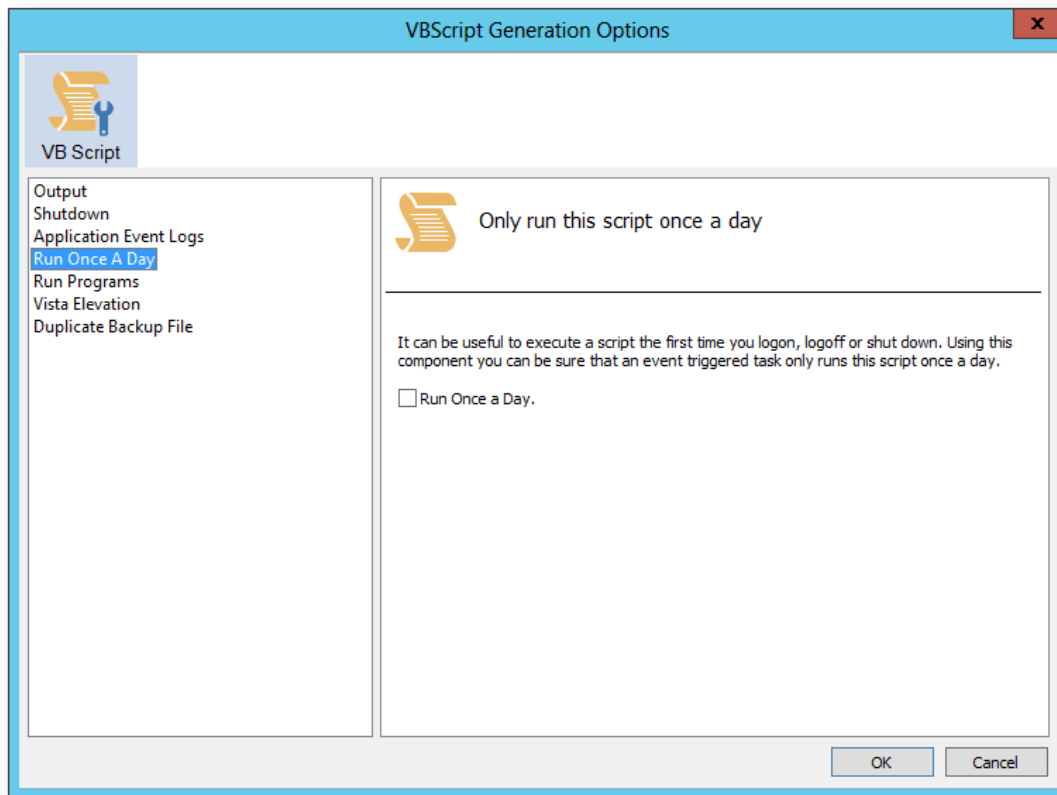
Details

Macrium Reflect - Successful VBScript Backup

Log Name:	Application	Logged:	07/04/2015 14:15:35
Source:	WHS	Task Category:	None
Event ID:	0	Keywords:	Classic
Level:	Information	Computer:	Office2
User:	N/A		

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Run Once a Day



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"
```

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```
'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.

Run Programs

VBScript Generation Options

VB Script

Output
Shutdown
Application Event Logs
Run Once A Day
Run Programs
Vista Elevation
Duplicate Backup File

Run programs or scripts from within this script

☒ Run a program or script at the start.

File name: C:\Users\Public\Admin\Before backup.bat

Parameters:

☒ Run a program or script at the end.

File name: C:\users\public\Admin\After backup.exe

Parameters:

OK Cancel

Generated code...

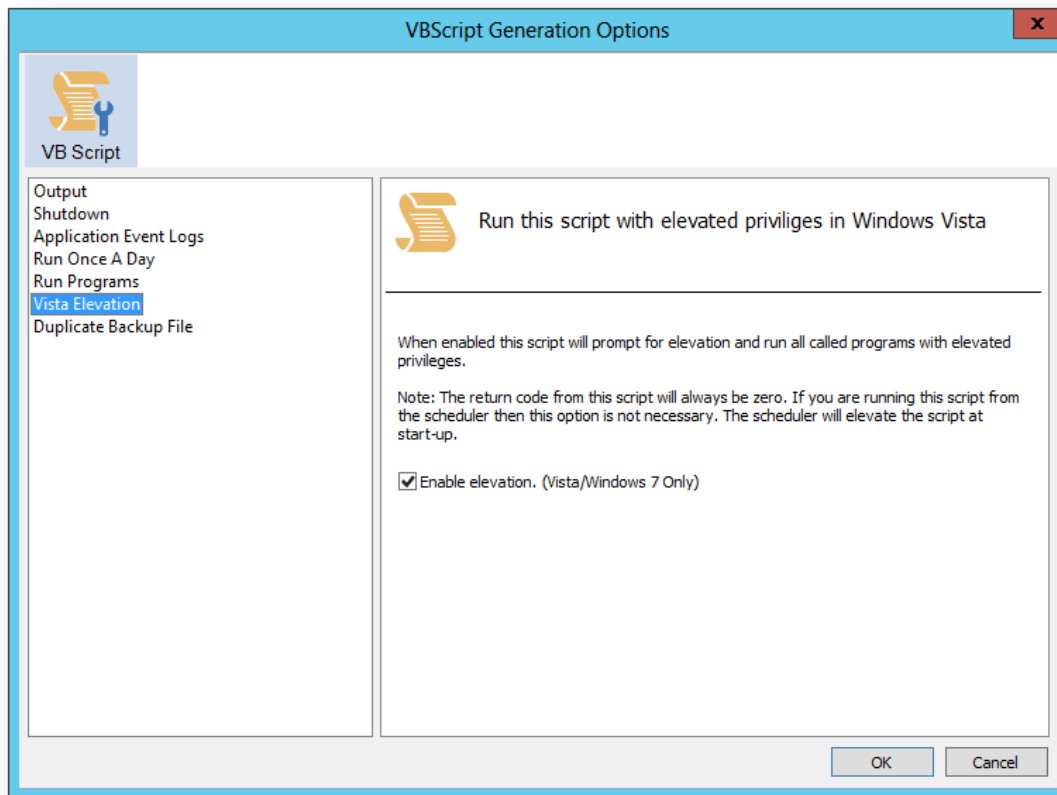
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```
' Run program before backup
  objShell.Run ""C:\Users\Public\Admin\Before backup.bat"", 1, true
' Do the backup
  ExitCode = Backup ("C:\Program Files\Macrium\Reflect\reflect.exe" -e -w
<BACKUP_TYPE> "C:\Users\Dev\Documents\Reflect\example.xml")
' 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
```

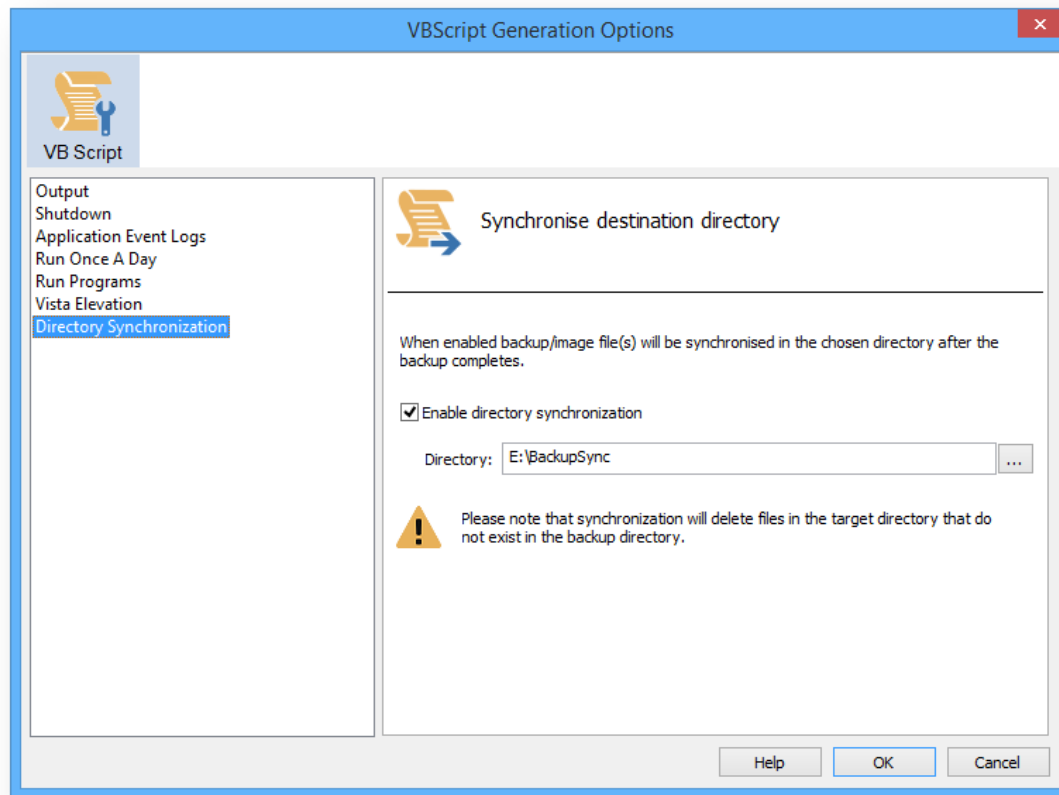
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```
If WScript.Arguments.Count > 0 Then
    If WScript.Arguments.Item(0) = "-s" then
        Exit Sub
    End If
End If
Set objShell = WScript.CreateObject("WScript.Shell")
Set objWshProcessEnv = objShell.Environment("PROCESS")
If objWshProcessEnv("ELEVATED_APP") <> "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
```

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.

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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")
    Set objExec = objShell.Exec ("robocopy.exe", 0)
    If Err.Number = 0 Then
        RobocopyExists = True
    Else
        RobocopyExists = False
    End If
End Function
```

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```
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
                If Not(fs.FileExists(strBackupDirectory+"\\"+objSyncFile.name)) Then
                    fs.DeleteFile(objSyncFile)
                Else
                    ' Check if file has been modified

```

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```
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 directory synchronization	If enabled will use the MS utility RoboCopy to synchronize the backup target directory with the supplied directory.
Directory	Enter the folder that you want to copy/archive your backup files to

Click **'OK'** to generate the VBScript source file

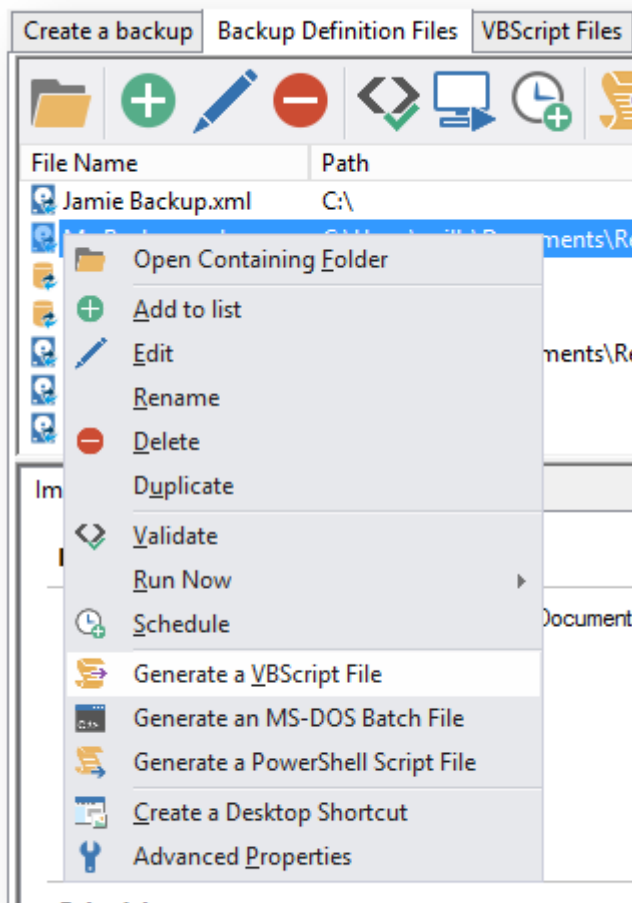
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Using VBScript to run sequential backups

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.

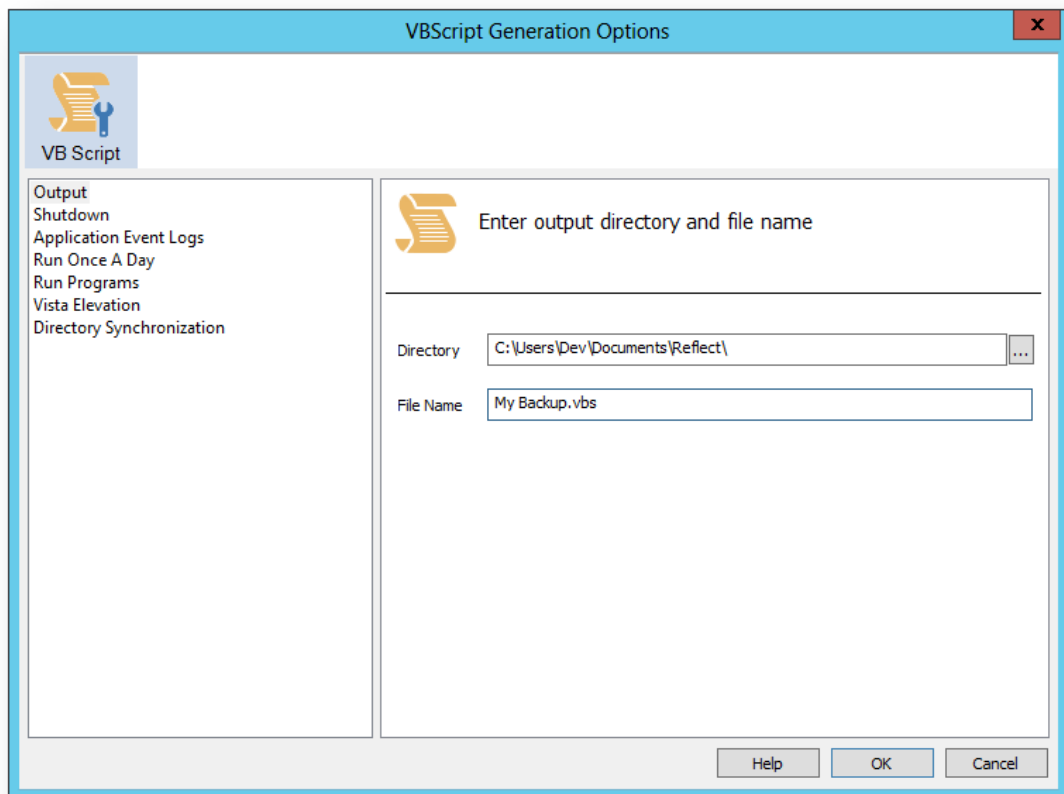
To create a VBScript to run backups sequentially

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.



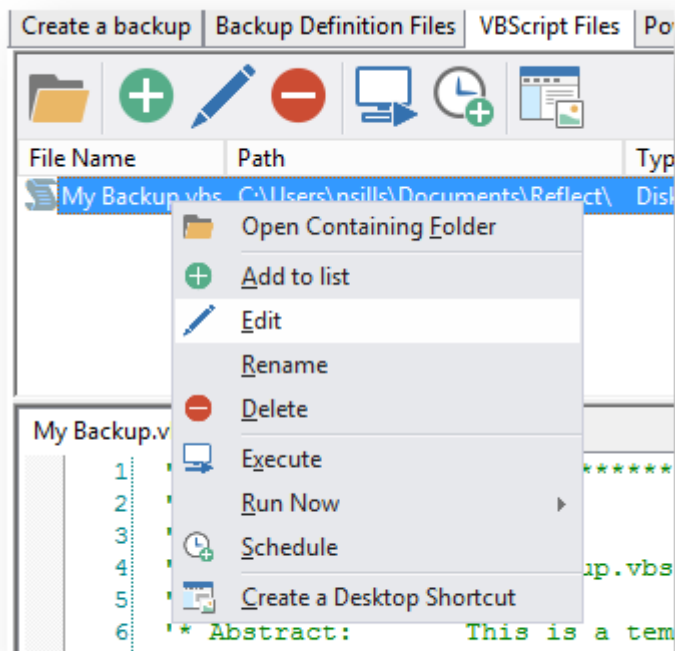
The VBScript generation dialog box appears.

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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.

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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**.



6. 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")
```

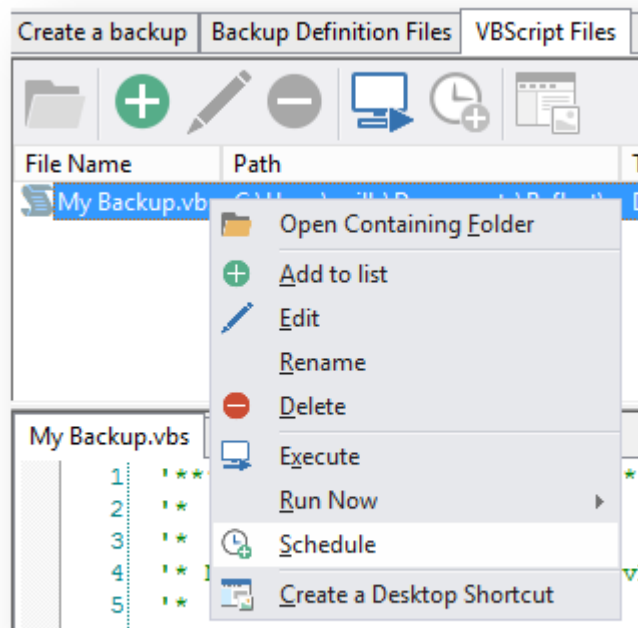
7. For each copy of the line change the xml file name to represent the backup you want to run. For example:

```
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")
```

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8. Save the file.

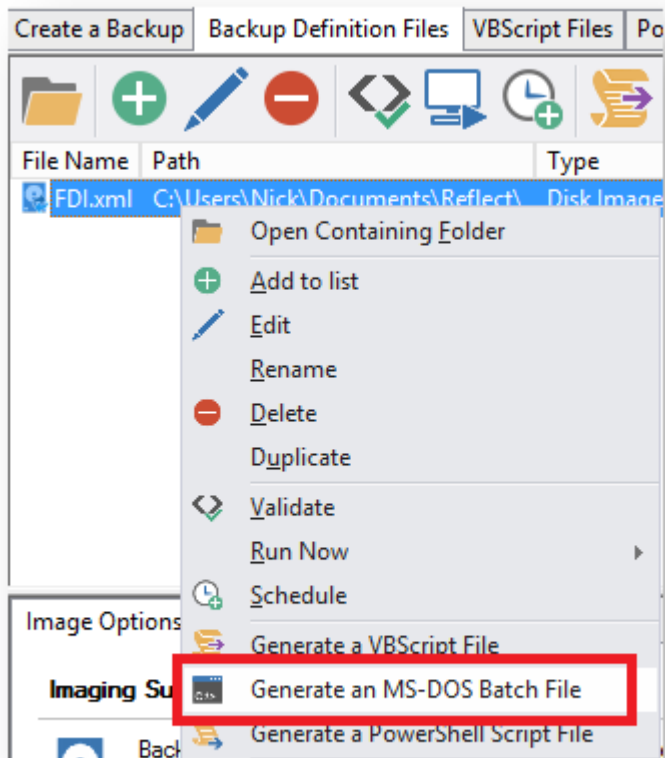
Note: VBScript files must be scheduled independently. If you have any existing schedules for the XML backup definitions above then disable or delete them. To schedule VBScript source files, **right click on the script and select 'Schedule'.**



Generating an MS-DOS batch file

For an example of a generated MS_DOS batch file please see: [Example MS-DOS Batch File](#)

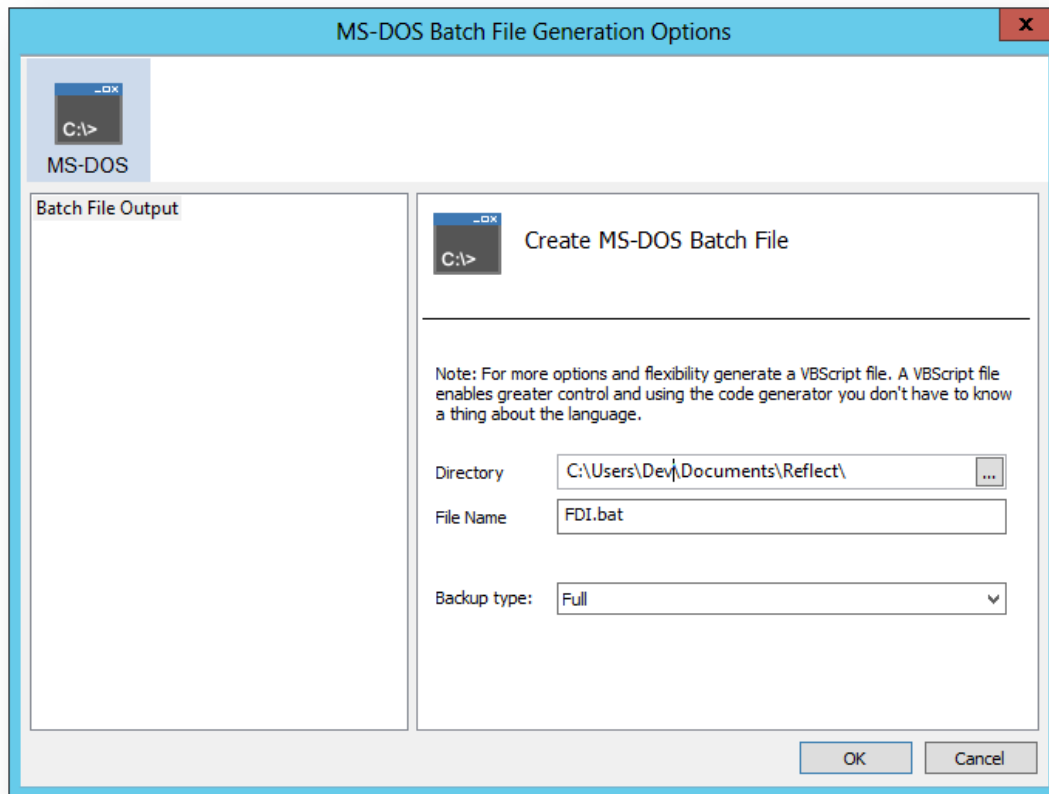
To generate a MS-DOS batch file select the 'XML Definition Files' tab on the main window then right click on a file and select '**Generate an MS-DOS Batch File**'.



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
```

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```
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
:end
```

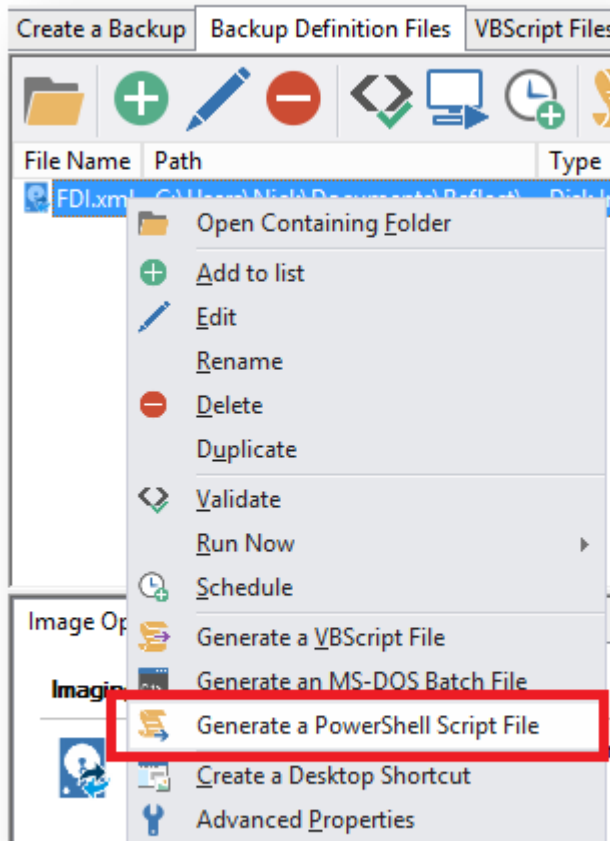
Property	Value
Directory	The folder where the batch source file is saved
File name	The name of the batch source file. This defaults to the XML file name with a .bat extension
Backup type	Choose from Full, Differential or Incremental.

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](#)

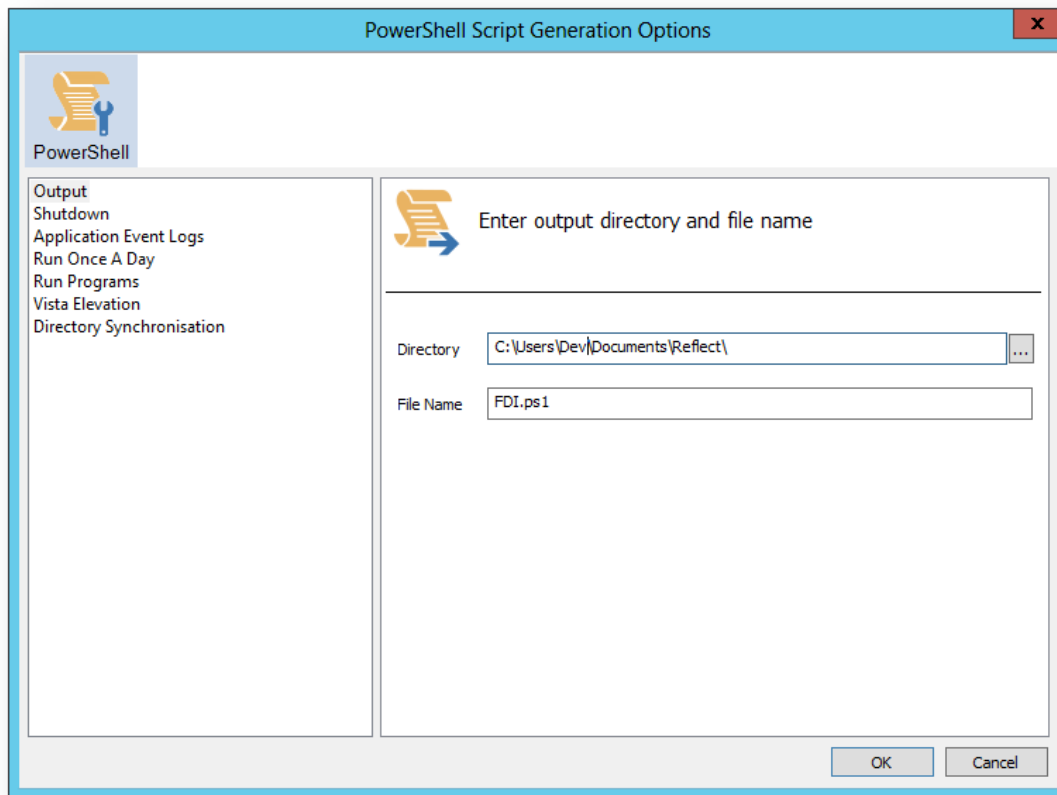
To generate a PowerShell file select the 'XML Definition Files' tab on the main window then right click on a file and select '**Generate a PowerShell Script File**'.



This opens the **PowerShell Script Generation Options** dialog:

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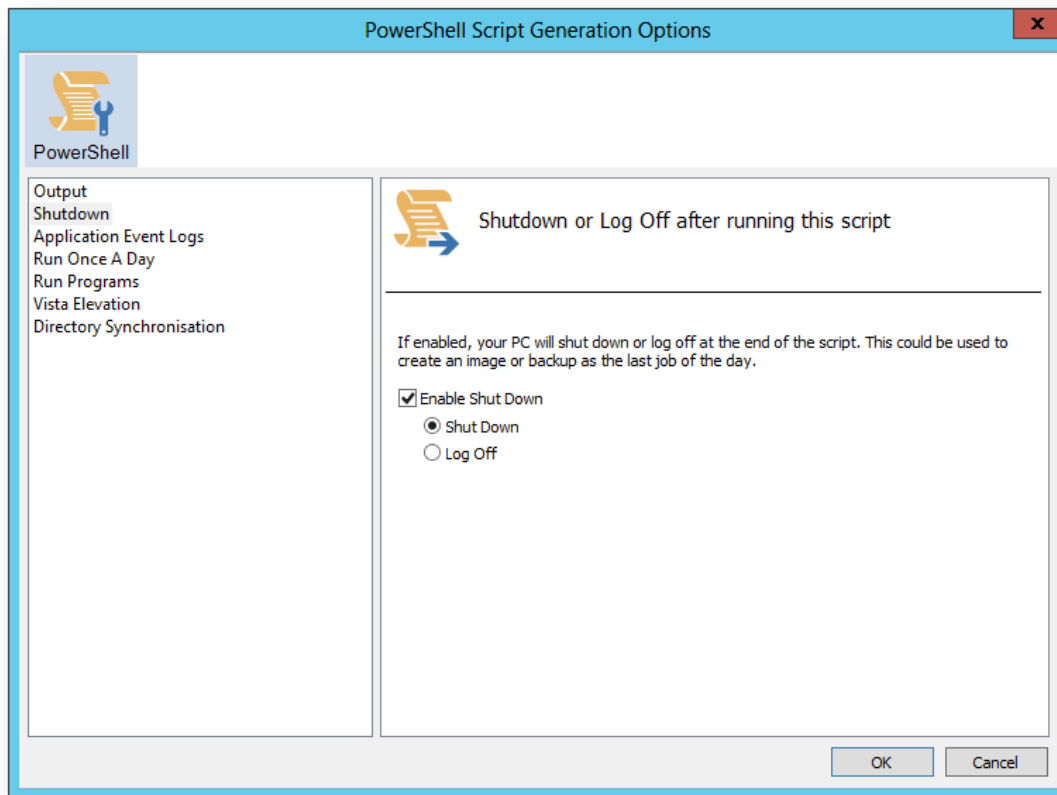
Output



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

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Shutdown



Generated code...

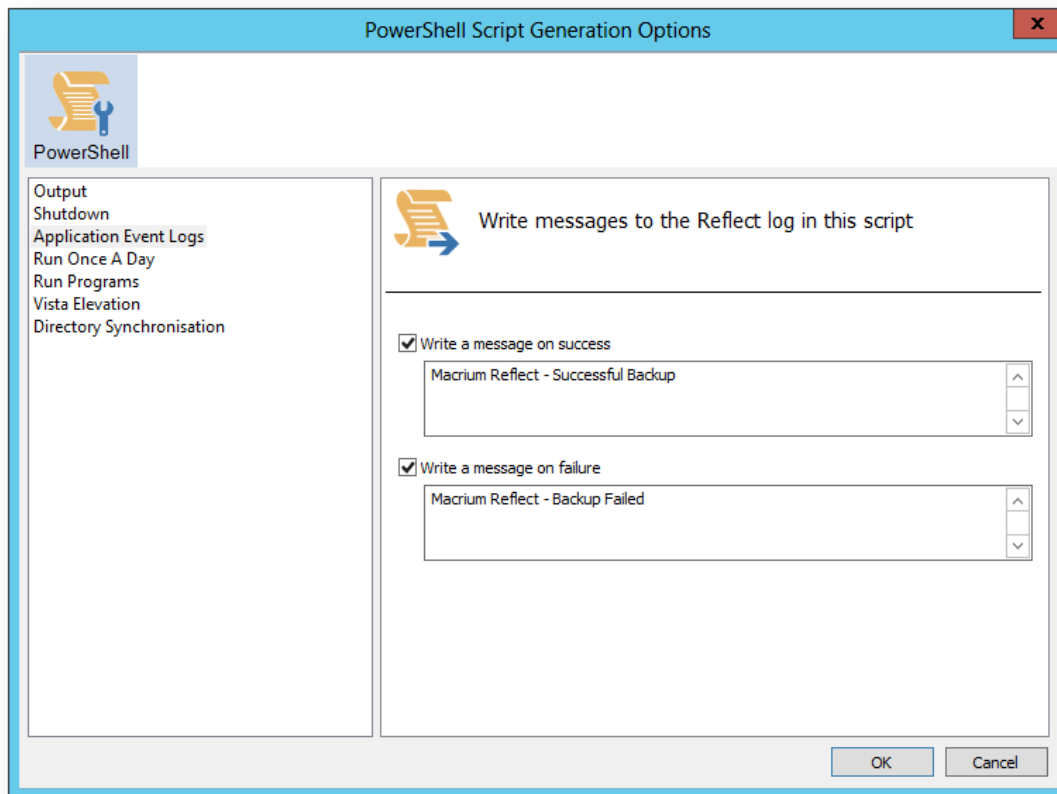
```
Write-Host ' * Initiating shutdown... ' -NoNewLine;  
(Get-WMIObject Win32_OperatingSystem -ComputerName '.' -EnableAllPrivileges).  
Win32Shutdown(8);
```

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.

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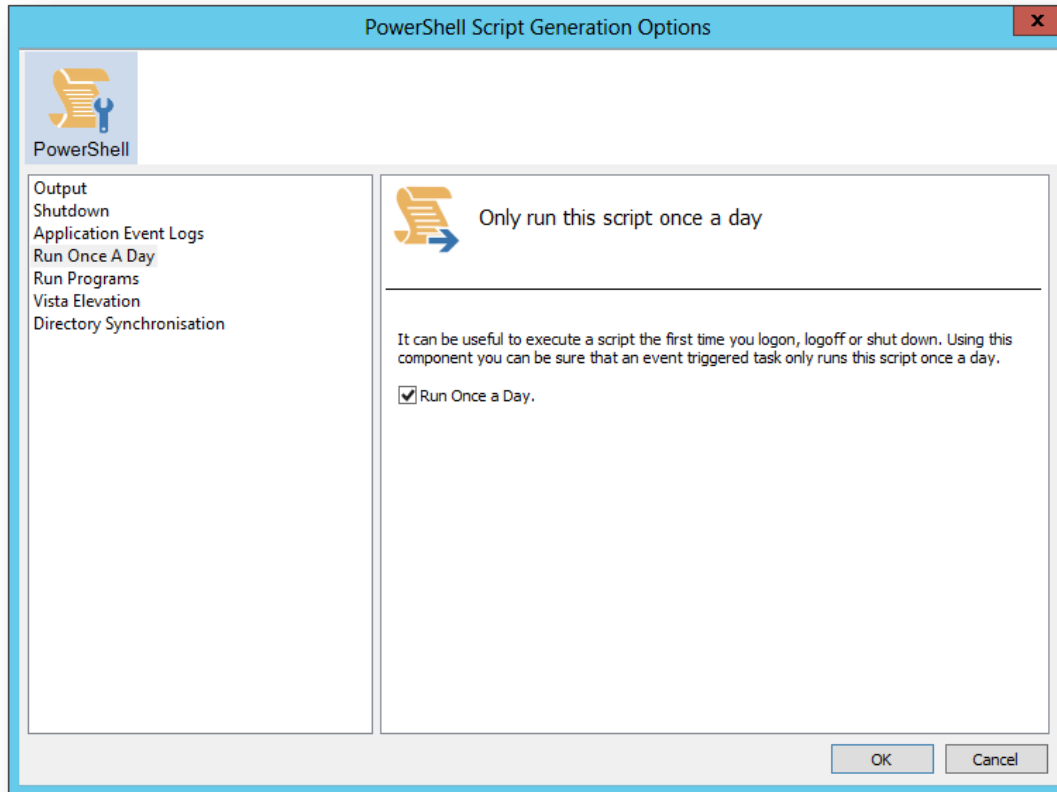


Generated code...

```
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"
}
```

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';
    $boolRanToday  = $false;
    $strDateToday  = Get-Date -UFormat %Y%m%d;
    if (Test-Path $strRegPath)
    {
```

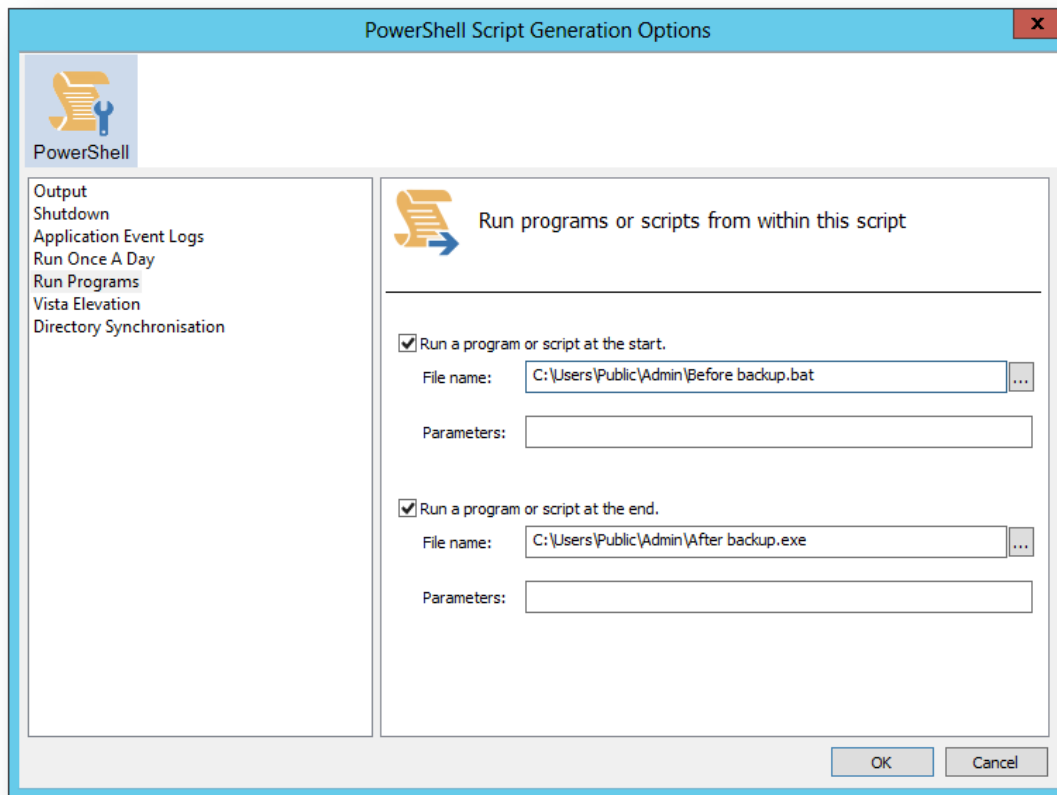
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```
try
{
    $strLastRunDate = (Get-ItemProperty -Path $strRegPath -Name $strScript
Path -ErrorAction Stop).$strScriptPath
    if ($strLastRunDate -eq $strDateToday)
    {
        $boolRanToday = $true;
    }
} catch { };
if (!$boolRanToday)
{
    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.

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Run Programs



Generated code...

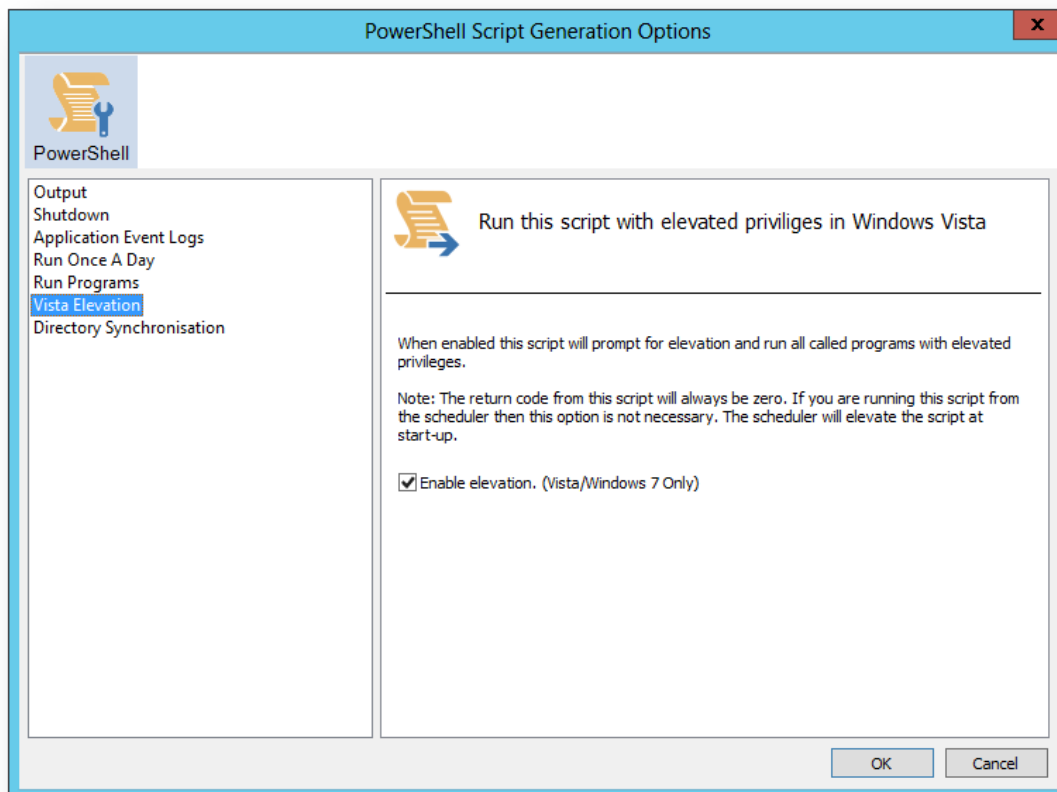
```
Write-Host ' * Executing "at start" program... ' -NoNewLine;
$strRunAtStartApp = 'C:\Users\Public\Admin\Before backup.bat';
$strRunAtStartArgs = '';
if ([string]::IsNullOrEmpty($strRunAtStartArgs))
{
    Start-Process -FilePath $strRunAtStartApp;
}
else
{
    Start-Process -FilePath $strRunAtStartApp -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;
```

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}

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

Vista Elevation



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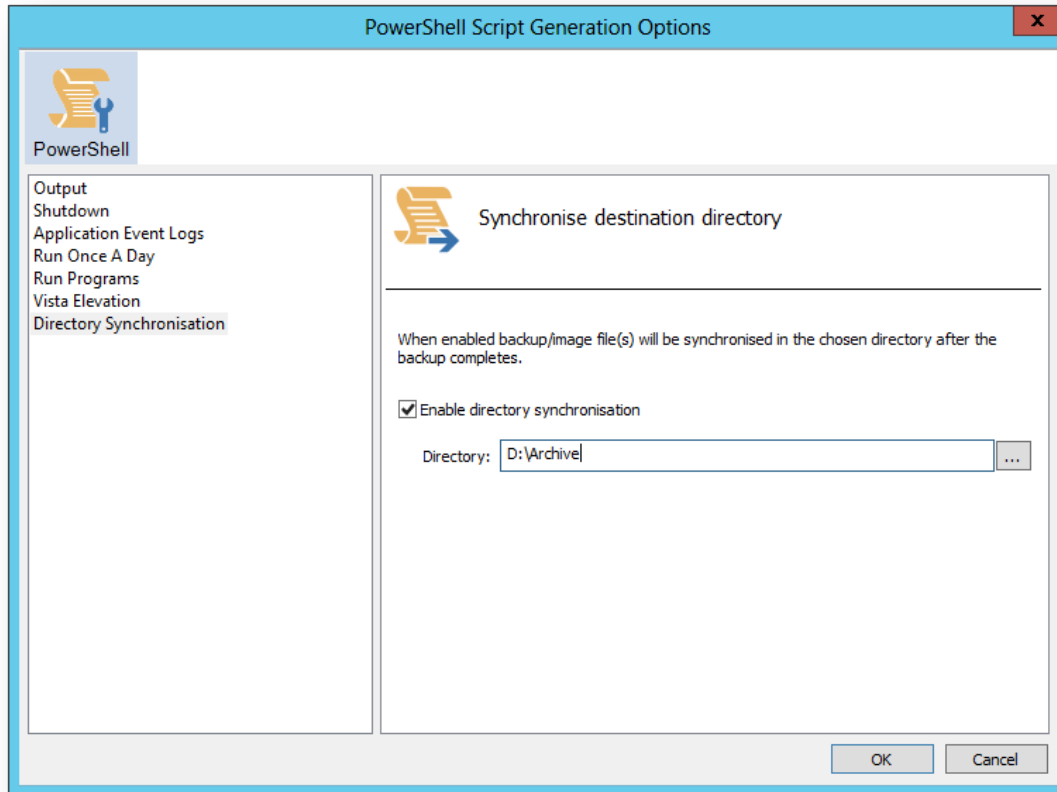
Generated code...

```
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"
                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.

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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)
{
    Write-Host ' * Synchronising directories... ' -NoNewLine;
    if (Get-Command robocopy -ErrorAction SilentlyContinue)
    {
        # robocopy is available...
        # /copy:DAT - D:Data
    }
}
```

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```
#           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.
Directory	Enter the folder that you want to synchronize your backup files to

Click 'OK' to generate the PowerShell source file

Backup Folder Synchronization

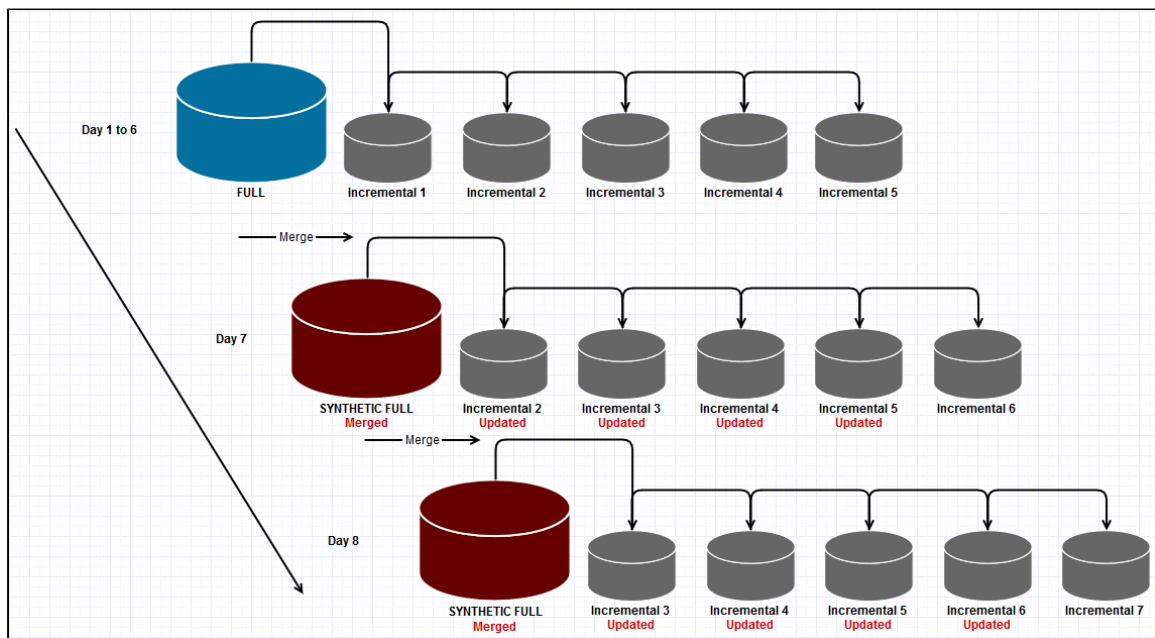


Note: This article refers to backup sets that are **not** using **Delta Incremental indexes**. Please see [Delta Indexes for Incremental Backups](#)

All backups apart from **MS Exchange** and **SQL** can use Delta Incremental indexes

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.

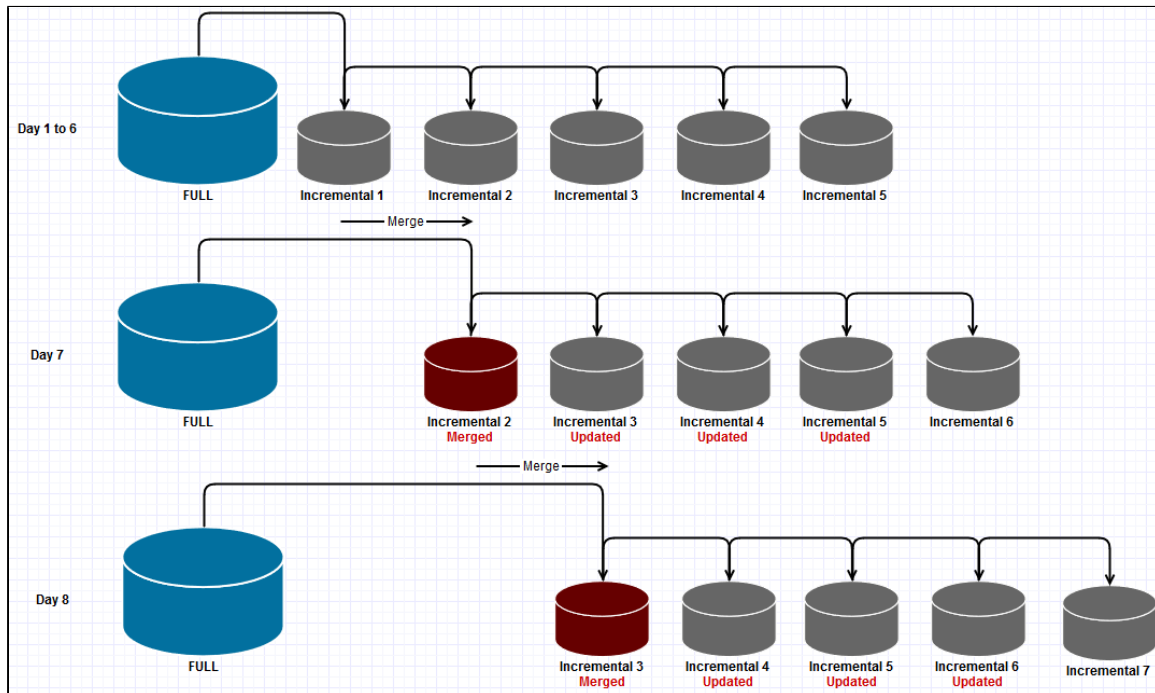
Example 1: Synthetic Full - Retain 5 Incrementals



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

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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.



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

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Switch	Description
/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.

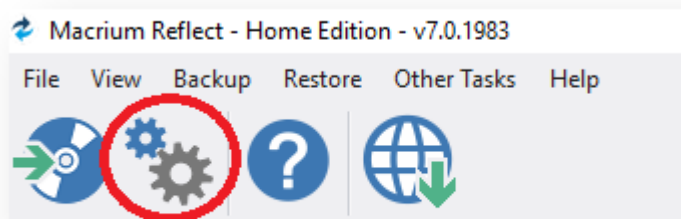
VBScript	Generating a VBScript source file
PowerShell	Generating a PowerShell source file

Macrium Reflect Default settings

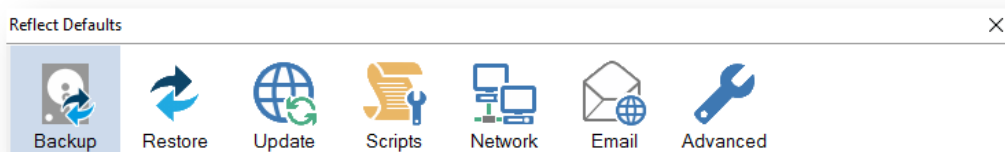


The Macrium Reflect default settings allow you to set the default values used when creating a new backup definition.

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**.



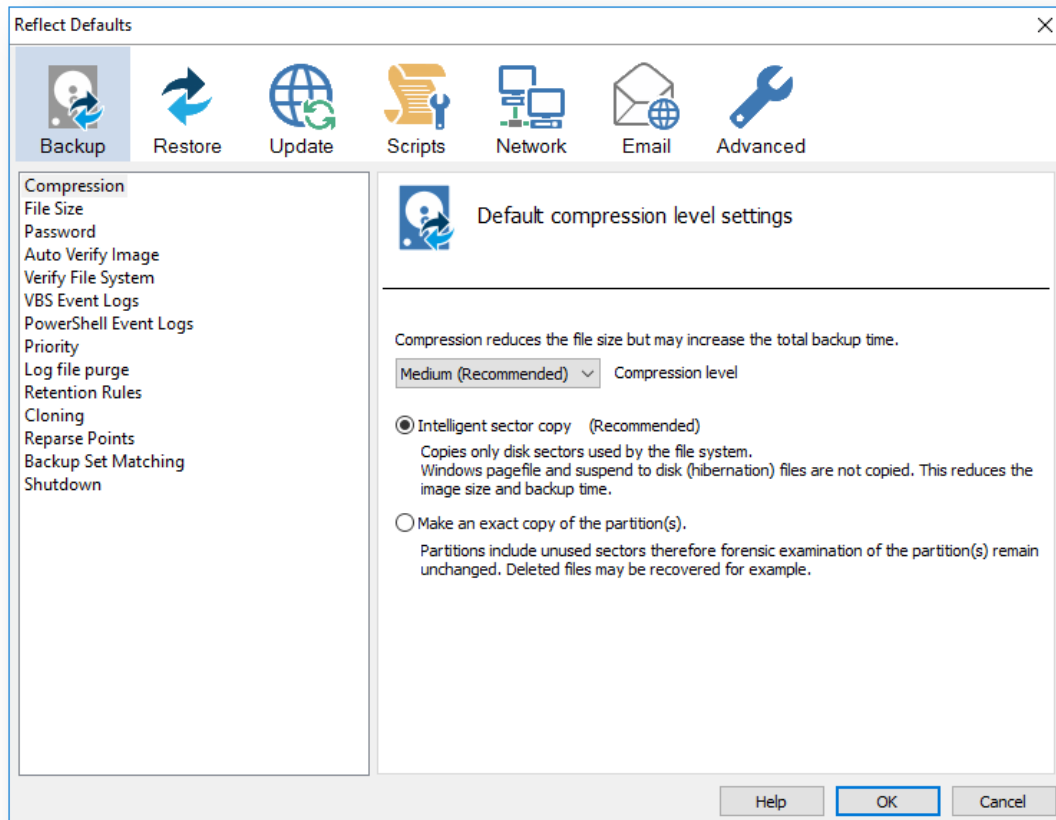
To change existing definition, right click on the definition and select 'Advanced Properties'.

- Default Backup settings
- Default Restore settings
- Update Settings
- Scripts
- Email Settings
- Events
- Advanced

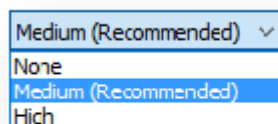
Default Backup settings

Compression is used to reduce the file size of the completed backup.

 These options set the defaults for a new backup.



- 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.

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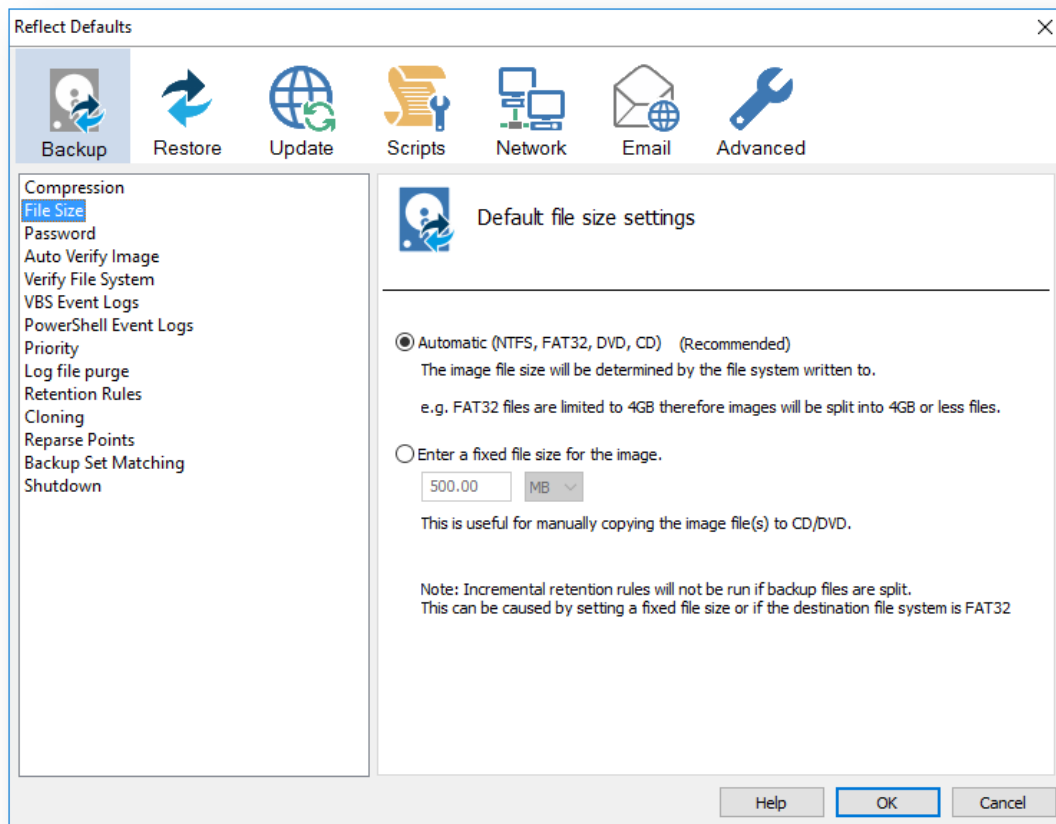
Compression allows you to choose an Intelligent sector copy or a Forensic copy of the partitions.

Option	Description
Intelligent Sector Copy	Only backup the sectors that are being used by data on the disk. Pagefile (pagefile.sys) and hibernation (hiberfil.sys) will also be excluded.  This reduces the time it takes for the backup to complete.
Forensic Copy	Backup every sector.

File size options are used to select between automatic or fixed file size for an image.



These options set the defaults for a new backup.



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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.

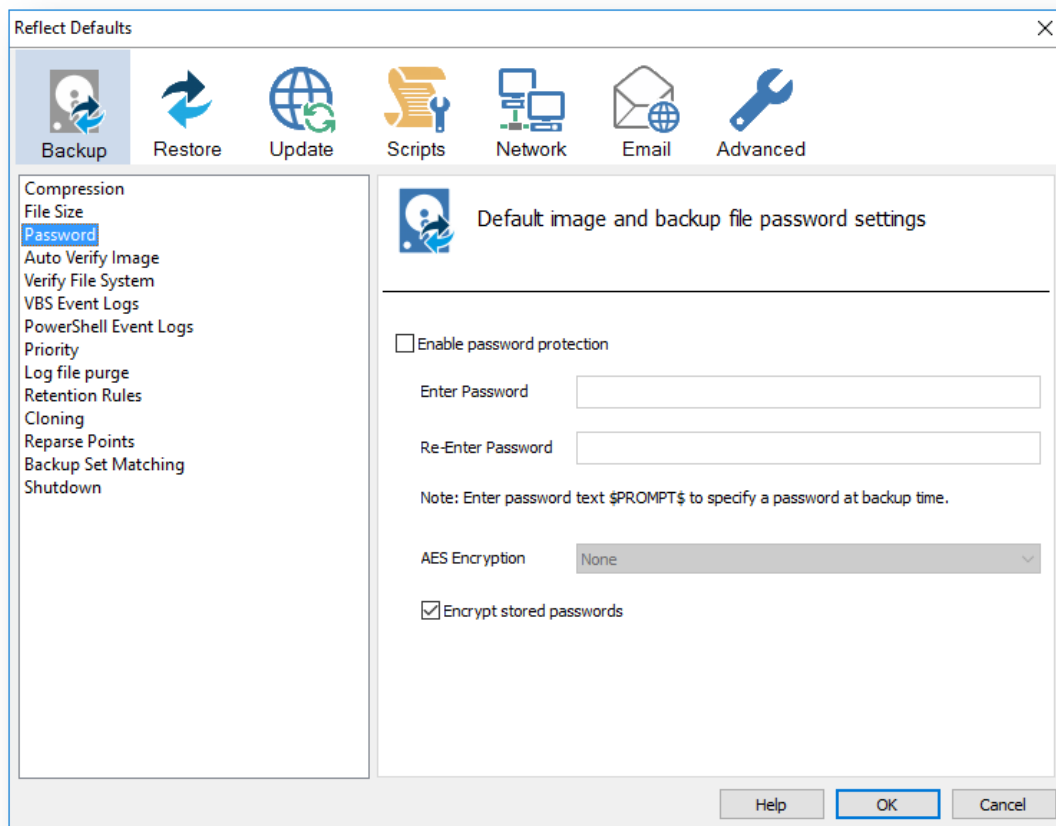
Option	Description
Automatic (Recommended)	Let the system decide on how large the images are going to be created dependent on file system (NTFS, FAT32, DVD, CD)  e.g FAT32 files are limited to 4GB therefore images are going to be split into 4GB or less files.
Fixed file size	Create Images that will be 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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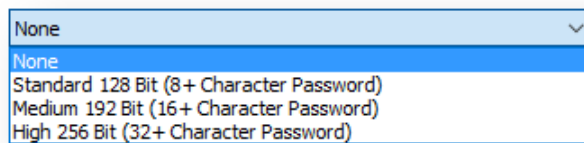


- With the **Password** option turned on all the images created will require a password before they can be browsed or restored.



Enter password text \$PROMPT\$ to specify a password at backup time.

- AES Encryption levels can be chosen when adding a password:



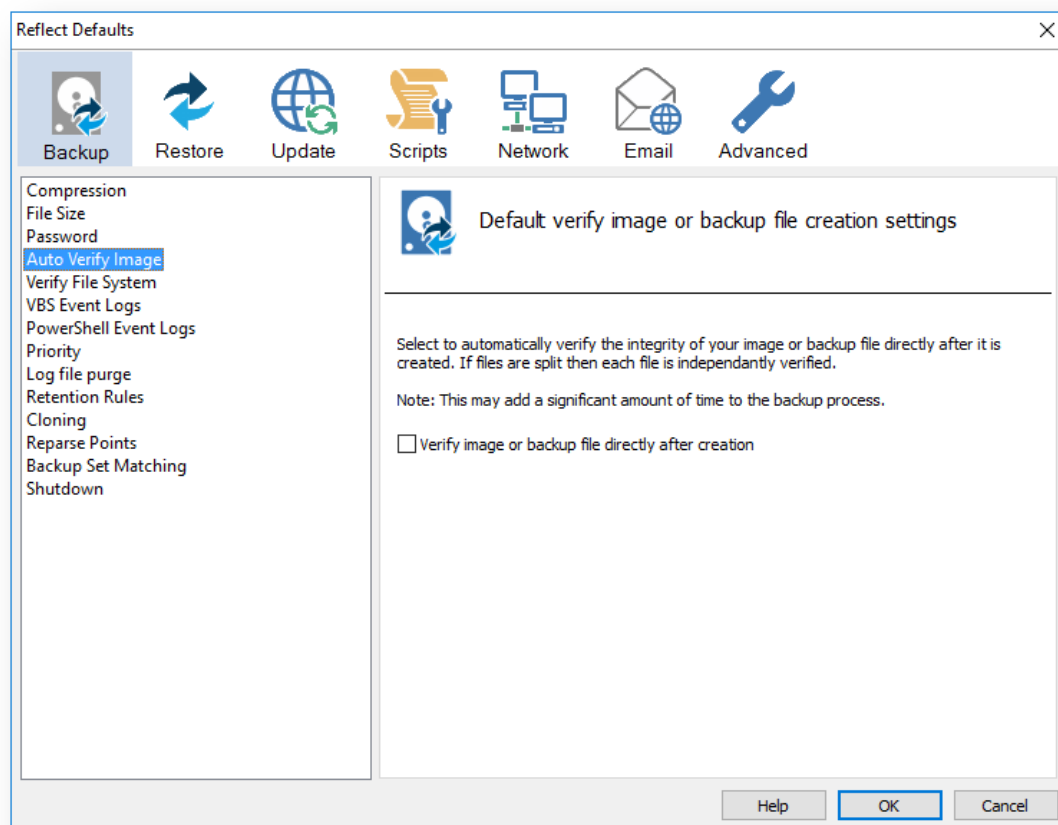
AES 256 bit encryption is the highest level of encryption available.

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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.



 This can add a significant amount of time to the backup process.

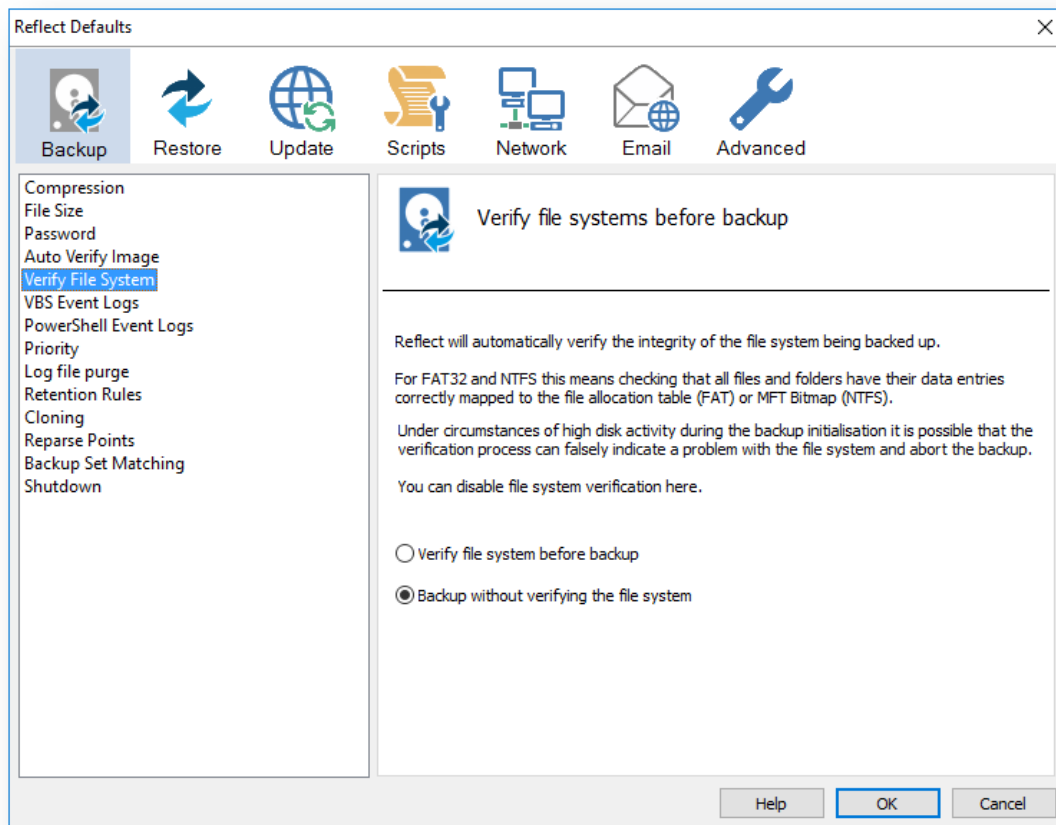
Option	Description
Verify image	Images will be verified automatically when the backup completes.

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 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.



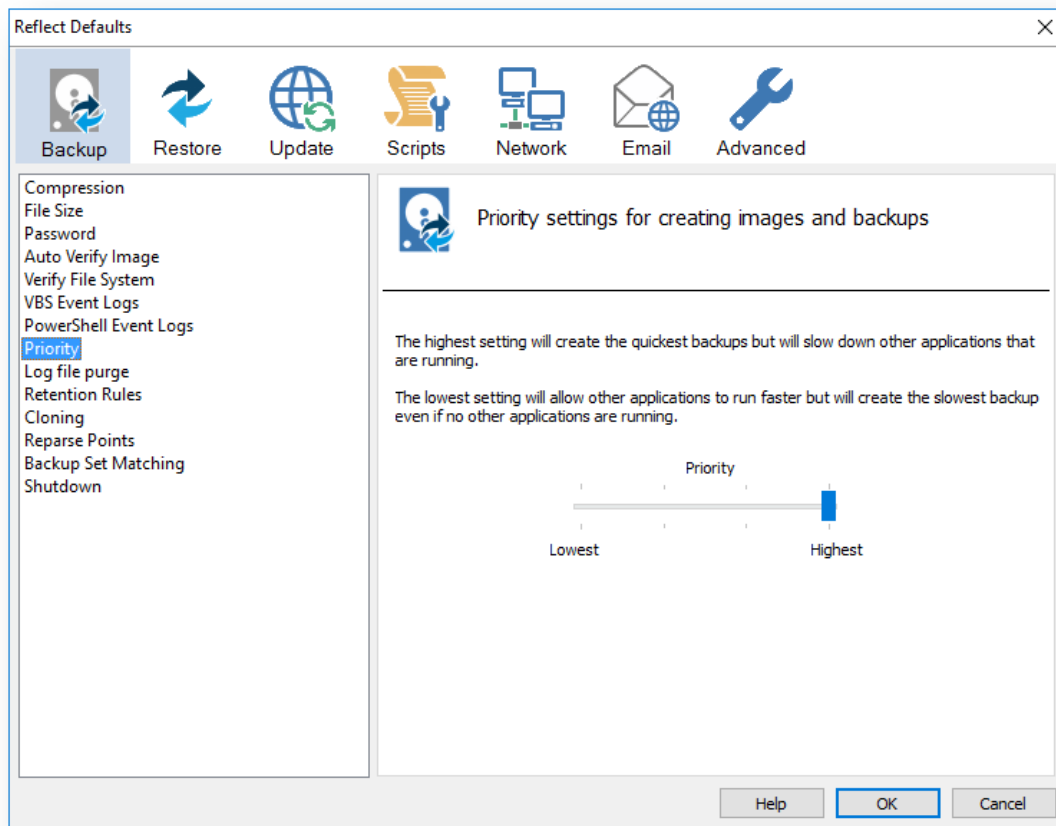
- Reflect will automatically verify the integrity of the file system being backed up.
For FAT32 and NTFS this means checking that all files and folders have their data entries correctly mapped to the file allocation table (FAT) or MFT Bitmap (NTFS).

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, thus making your backup a little quicker.

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Option	Description
Backup without verifying the file system	

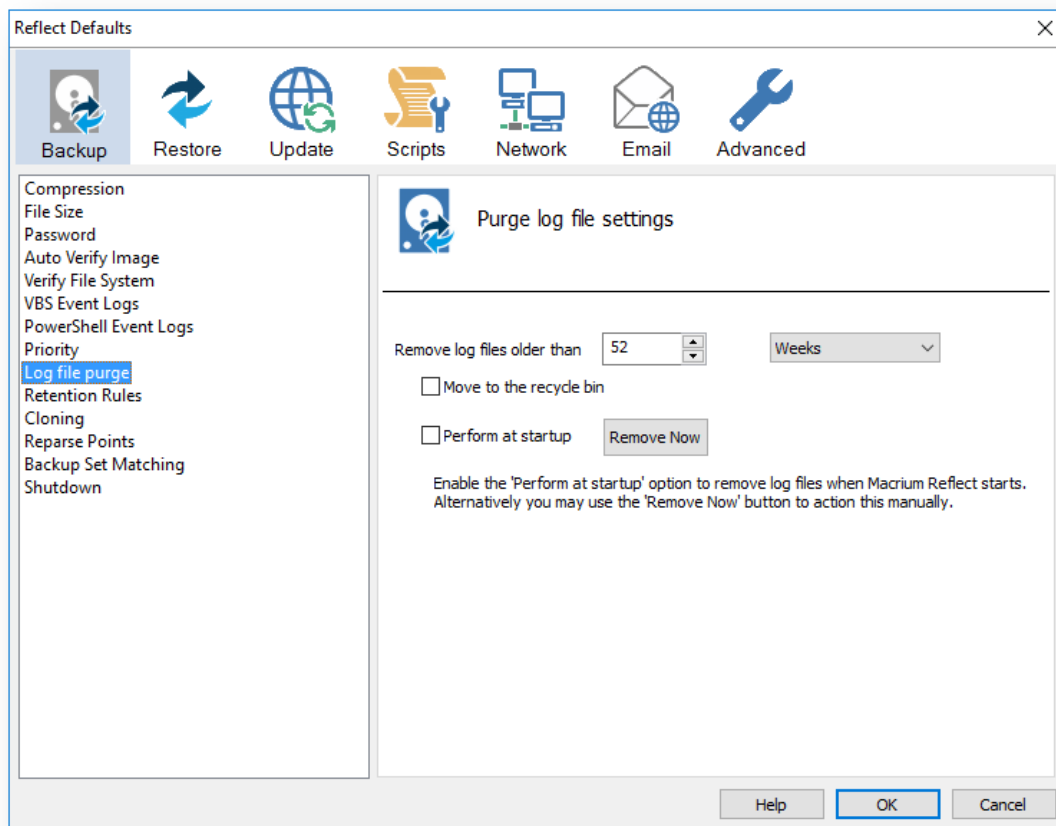
Priority is used to change the CPU priority for images and backups.



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.

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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.



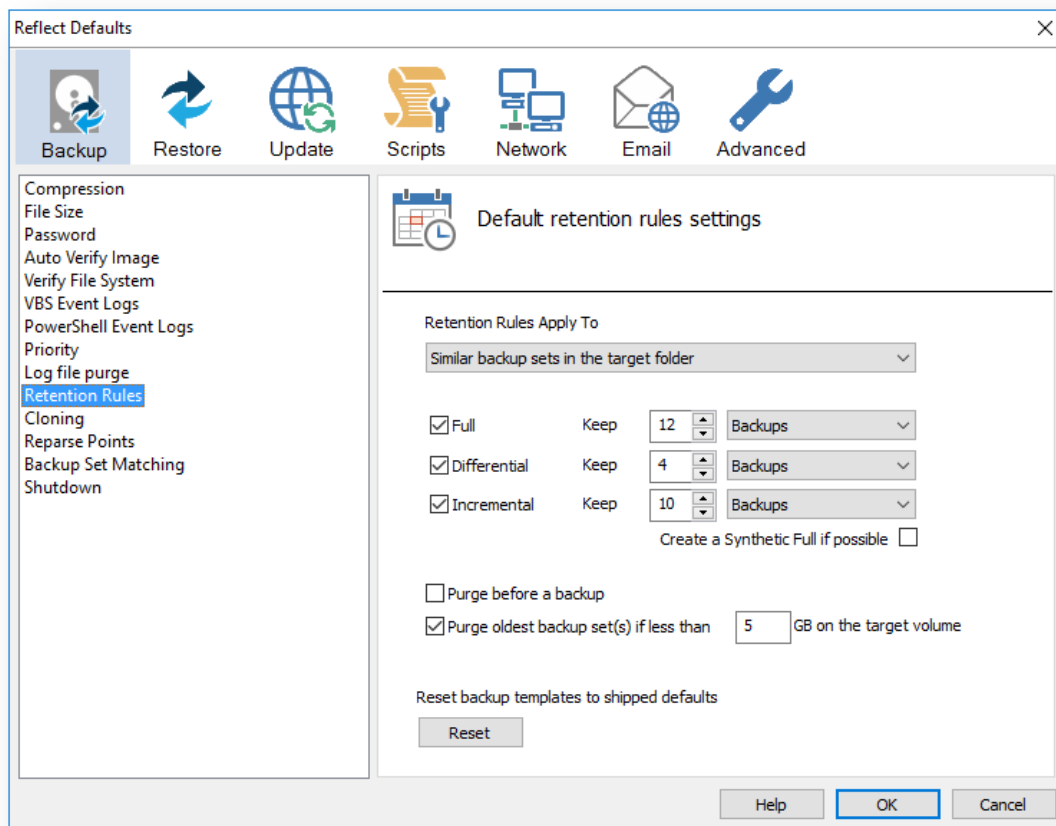
You can press the **Remove Now** button to remove the logs manually at any time.

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:

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

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

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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

☒ Full	Keep	12	Backups
☒ Differential	Keep	4	Backups
☒ Incremental	Keep	10	Backups
Create a Synthetic Full if possible ☐			
☐ Run the purge before backup.			
☒ 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. 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. F = Full D = Differential I = Incremental

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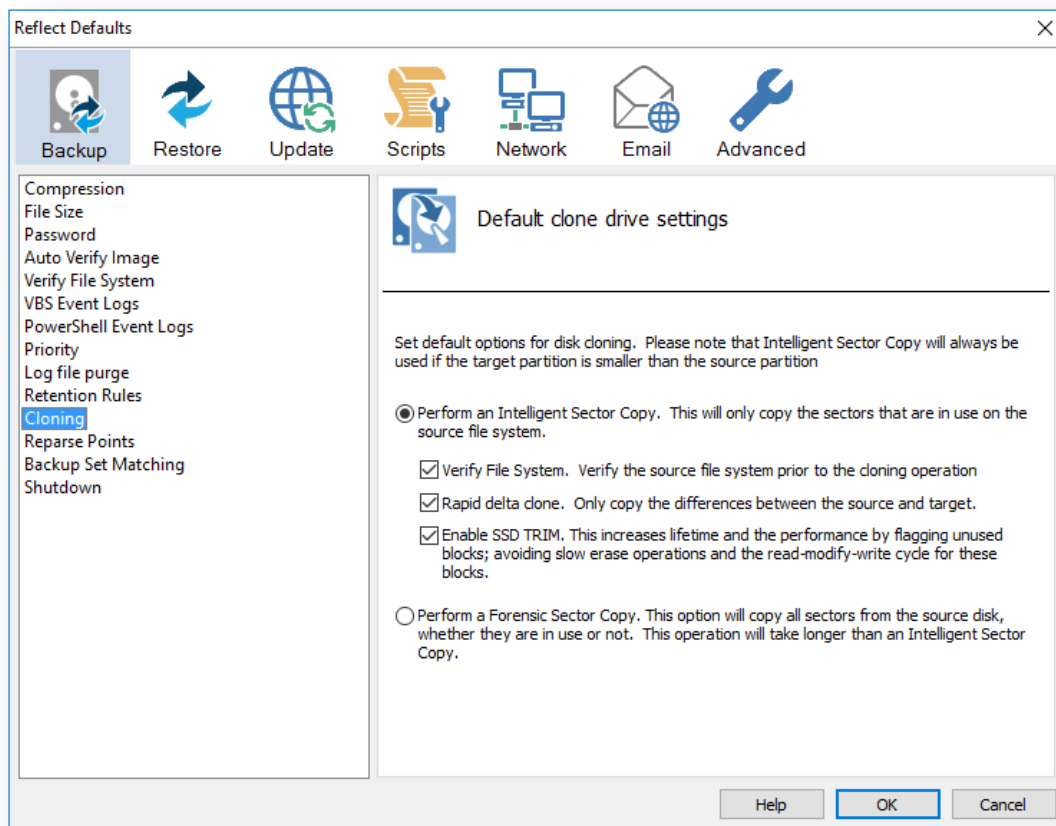
Option	Description																																																						
	<table><tr><td>M</td><td>T</td><td>W</td><td>T</td><td>F</td><td></td><td></td><td>M</td><td>T</td><td>W</td><td></td><td>T</td><td>F</td><td></td><td></td><td>M</td><td>T</td><td>W</td></tr><tr><td>F</td><td></td><td></td><td></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 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	Select this option to run the retention rules before the current 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	Automatically remove the oldest backup set(s) in the target folder if the free space on the drive drops below the GB threshold. 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.																																																						

Cloning



These options set the defaults for a new clone.

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Option	Description						
Perform an Intelligent Sector Copy	Only backup the sectors that are being used by data on the disk. Pagefile (pagefile.sys) and hibernation (hiberfil.sys) will also be excluded.  This reduces the time it takes for the clone to complete. <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></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	
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							

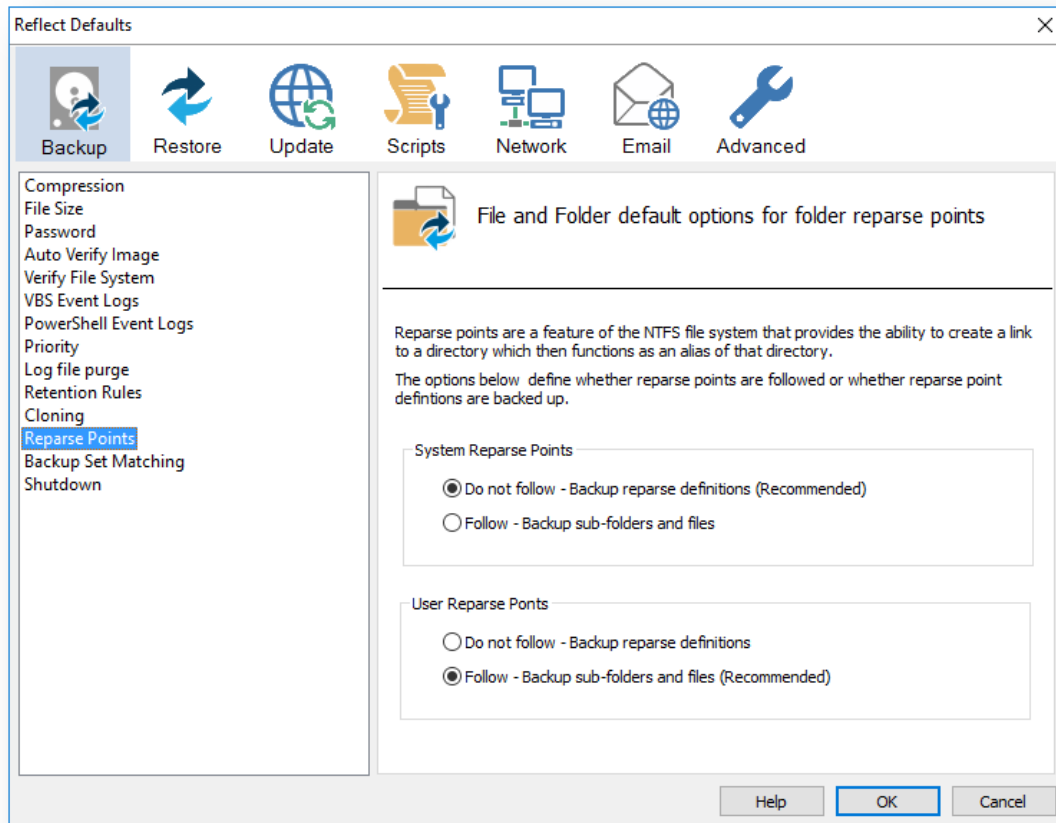
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Option	Description						
	<table> <tr> <th>Option</th><th>Description</th></tr> <tr> <td></td><td> As with Rapid Delta Restore (RDR) the concept of RDR has been something that has been thought about for quite some time here at Macrium Software. We 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. 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. </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		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. 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.	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.
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Perform a Forensic Sector Copy	Backup every sector.  This can add a significant amount of time to the backup process.						

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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.

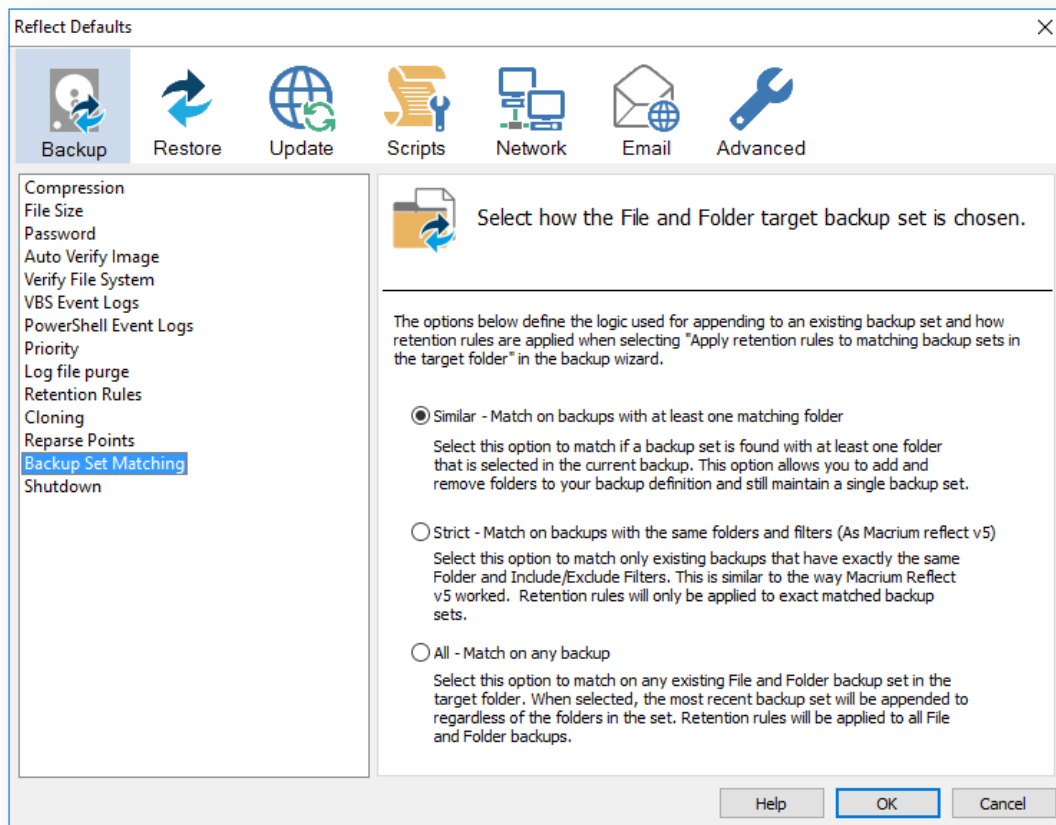
The options below define whether reparse points are followed or whether reparse point definitions are backed up:

Option	Description	
System Reparse Points	Do not follow	Only backup the Reparse Definitions (Recommended)
	Follow	Backup all the Reparse Points

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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.

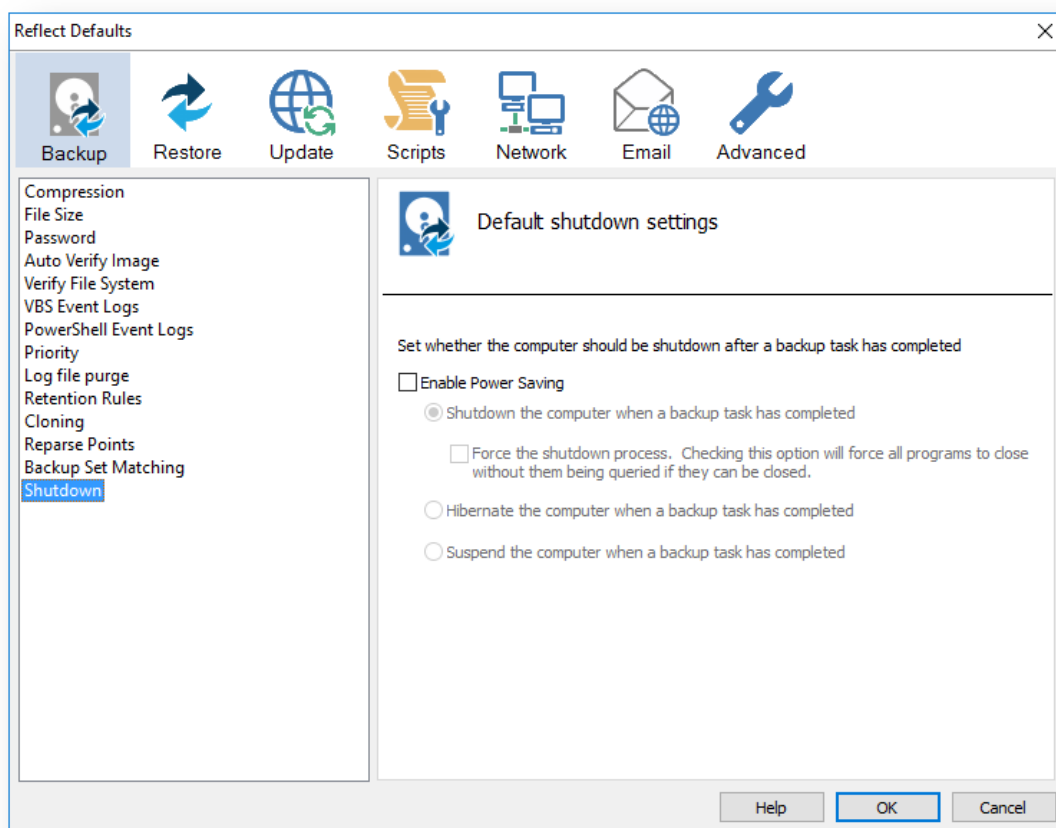
Option	Description
Similar - Match on backups with at least one matching folder	Add and remove folders in your backup definition and still maintain a single backup set.
Strict - Match on backups with the same folders and filters	Retention rules will only be applied to exact matched backup sets.

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Option	Description
(As Macrium Reflect v5)	
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.



Option	Description
Shutdown	This will Shutdown your computer after the backup is complete.  A sub-option can be enabled to Force the shutdown process - All programs will be forced to close without being queried.

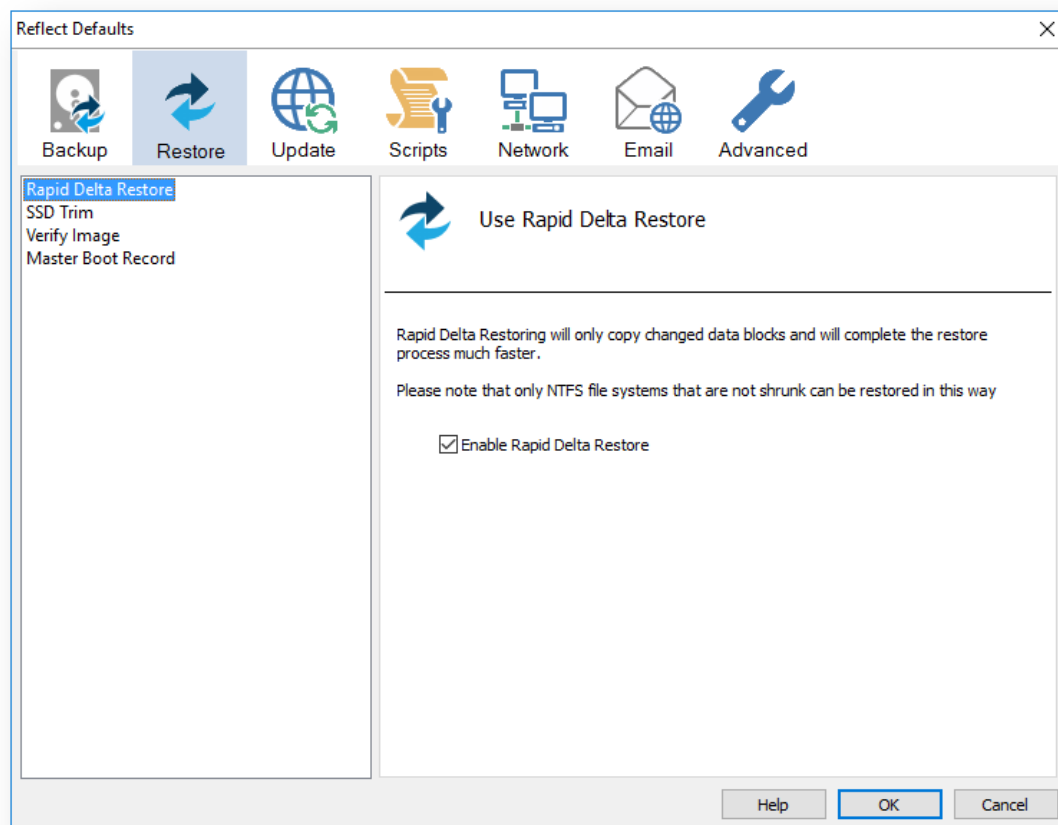
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Option	Description
Hibernate	This will Hibernate your computer after the backup is complete
Suspend	This will put your computer to Sleep after the backup is complete.

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.



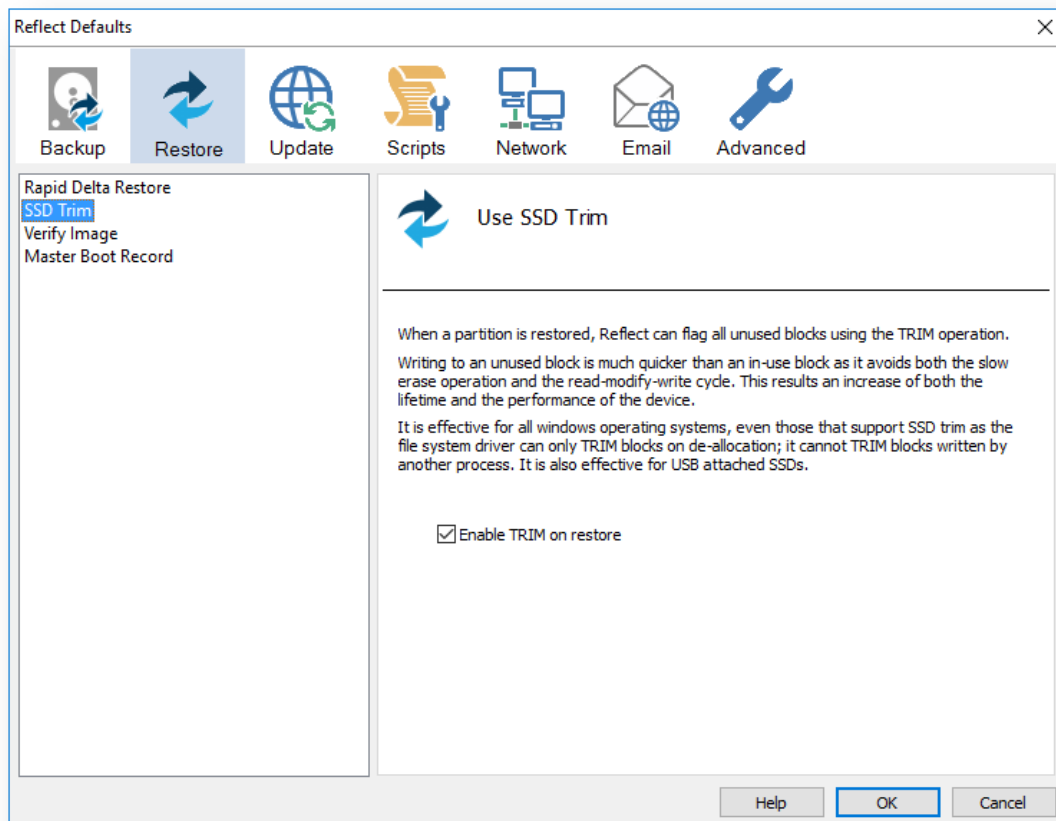
 Enabling Rapid Delta Restore decreases the time it will take to restore a backup. Only NTFS file systems that are not shrunk can be restored this way.

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 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.

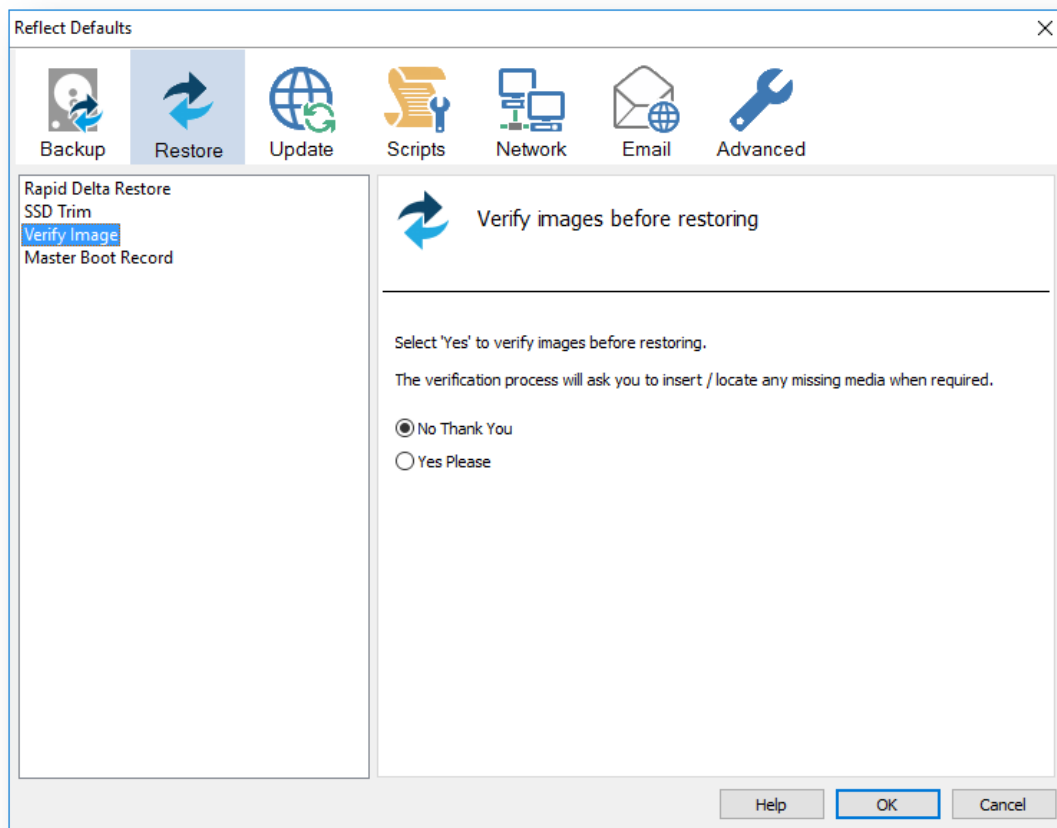


- When a partition is restored, Reflect can flag all unused blocks using the TRIM operation. Writing to an unused block is much quicker than an in-use block as it avoids both the slow erase operation and the read-modify-write cycle. This results an increase of both the lifetime and the performance of 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.

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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.



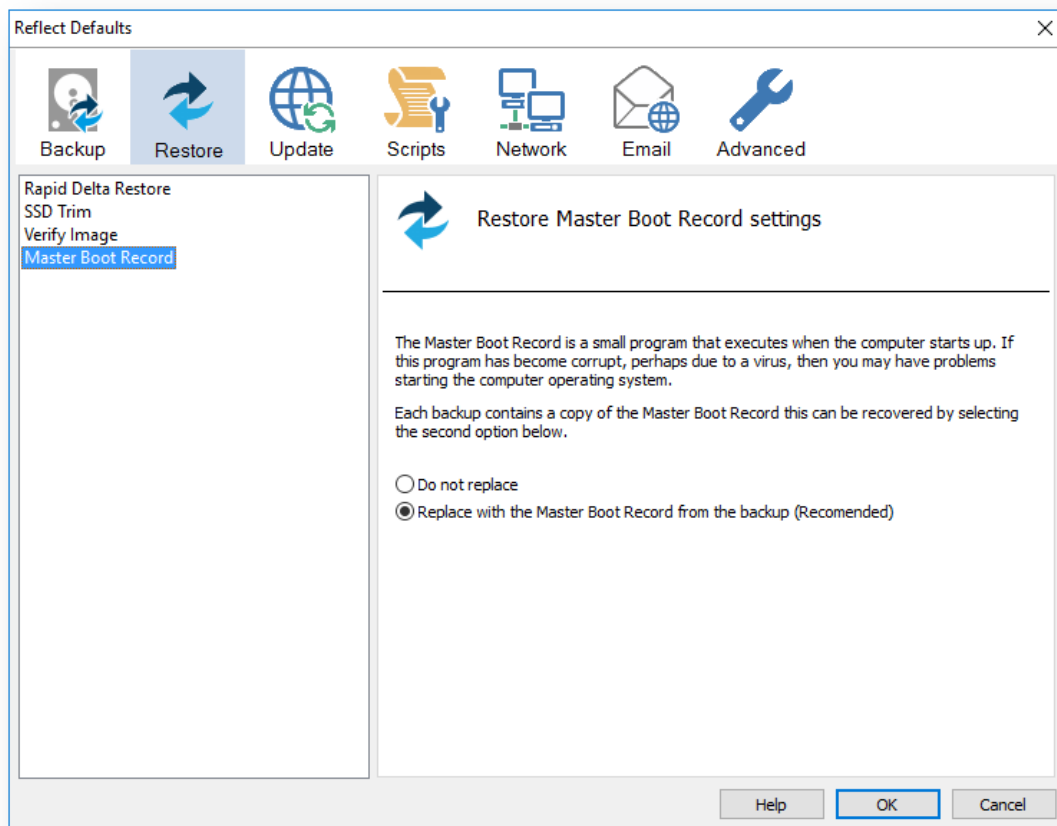
The verification process will ask you to insert / locate any missing media when required.

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.

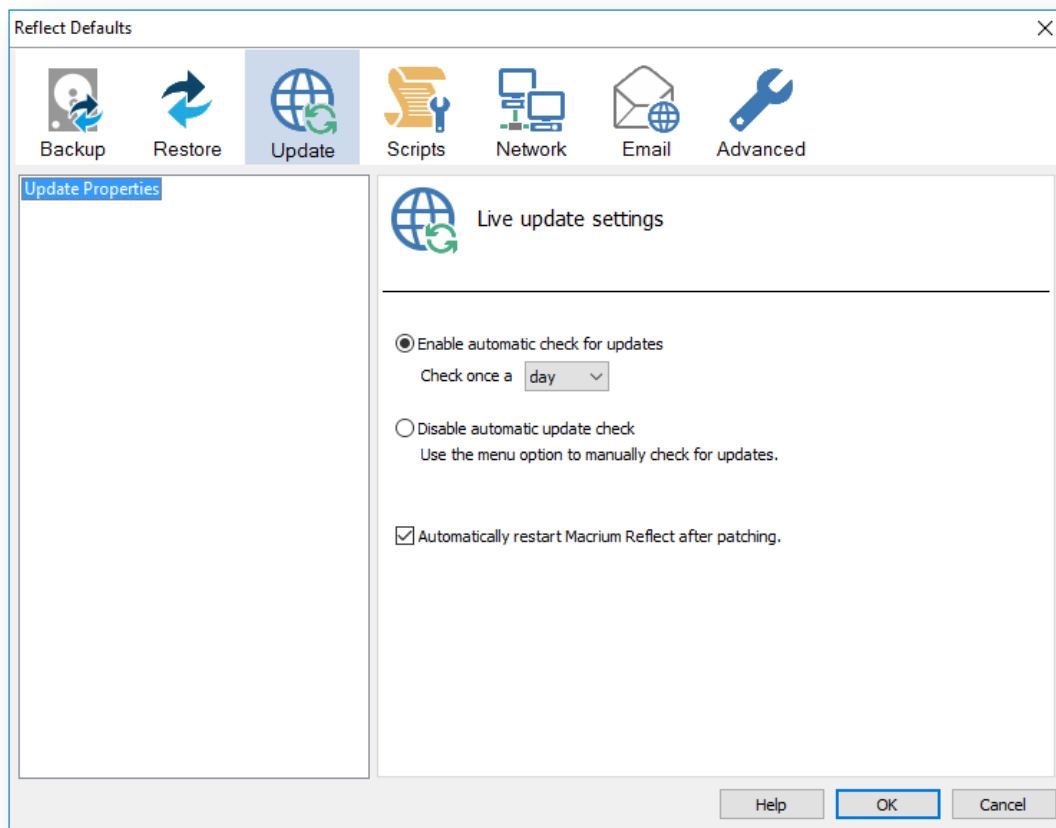
Each backup contains a copy of the Master Boot Record that can be recovered by selecting the second option below:

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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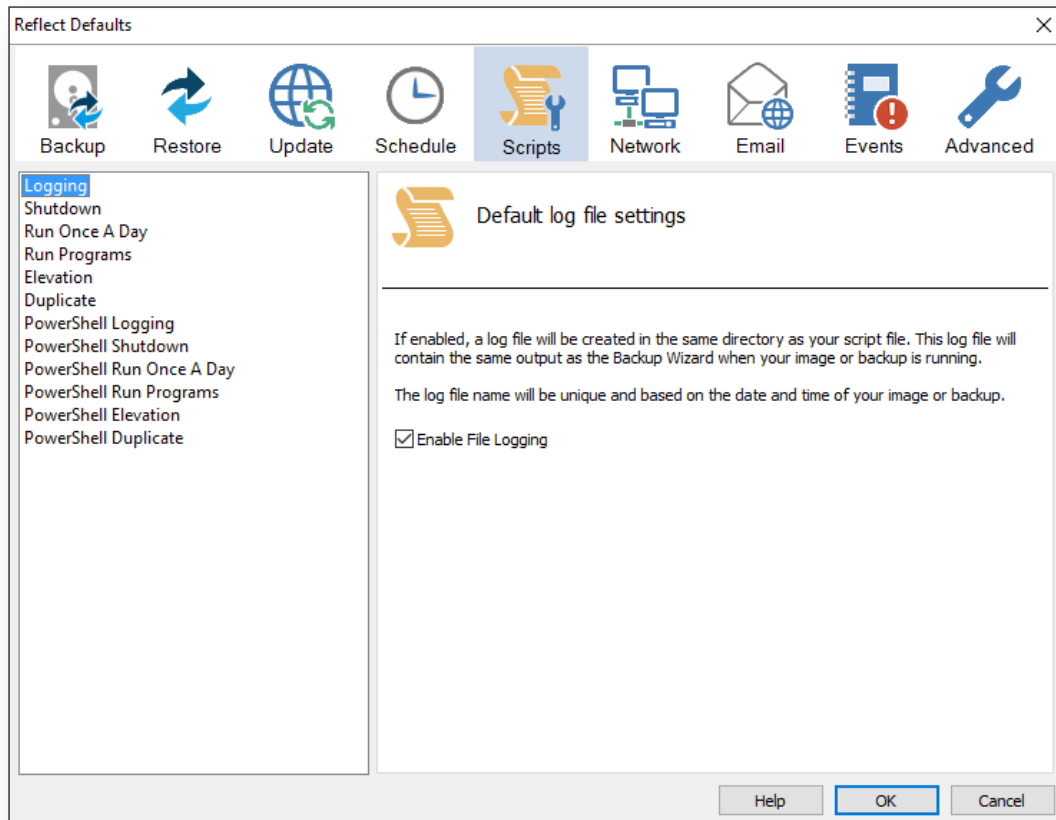


Option	Description
Enable automatic check for updates	Chose when Reflect checks for updates. ☒ Enable automatic check for updates Check once a day (dropdown menu)
Disable automatic update check	Reflect will not check for updates automatically; updates will need to be manually checked for by using the update button.
Automatically restart Reflect after patching	Reflect will automatically restart once the update has been downloaded and installed.

Scripts

VBScript Logging options enable file logging in the same directory as your script file.

 These options set the defaults for a script.

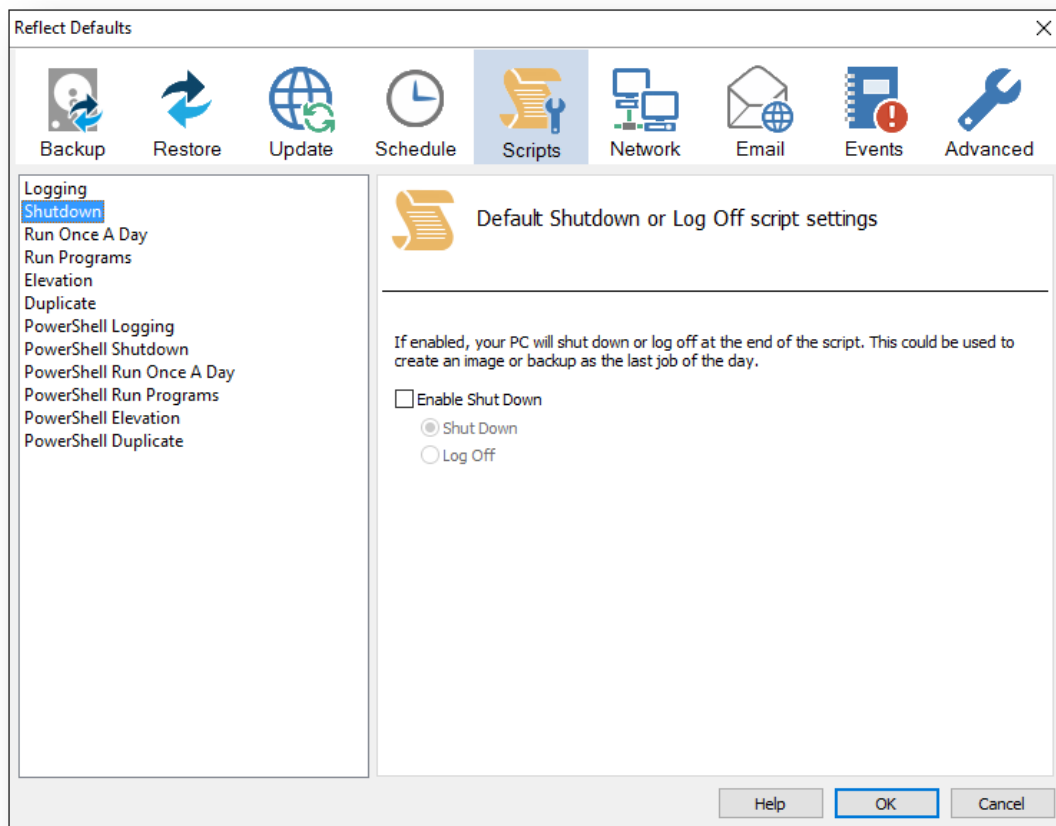


- If enabled, the log file created will contain the same output as the Backup Wizard when your image or backup is running.
The log file name will be left unique and based on the date and time of your image or backup.

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	☒ Enable Shut Down ☒ Shut Down ☐ Log Off Your PC will shutdown after the script has been ran.
Log Off	

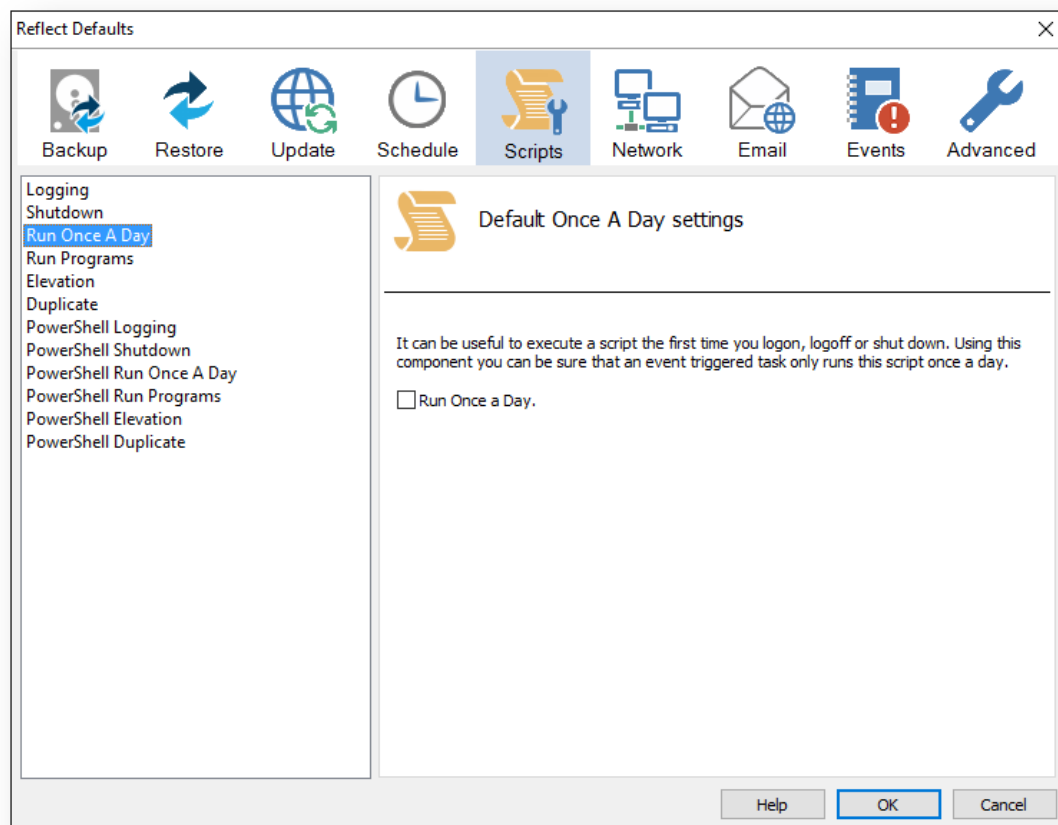
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Option	Description
	☒ Enable Shut Down ☐ Shut Down ☒ Log Off Your PC will Log Off after the script has been ran.

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.



Generated code...

```
' The following function call ensures that this script only runs once a day
  If HasRunToday Then
    WScript.Quit
  End If
. . . . .
! *****
```

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```

'* 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

```

Option	Description
Run once a day	☒ Run Once a Day. The script will run only once a day.



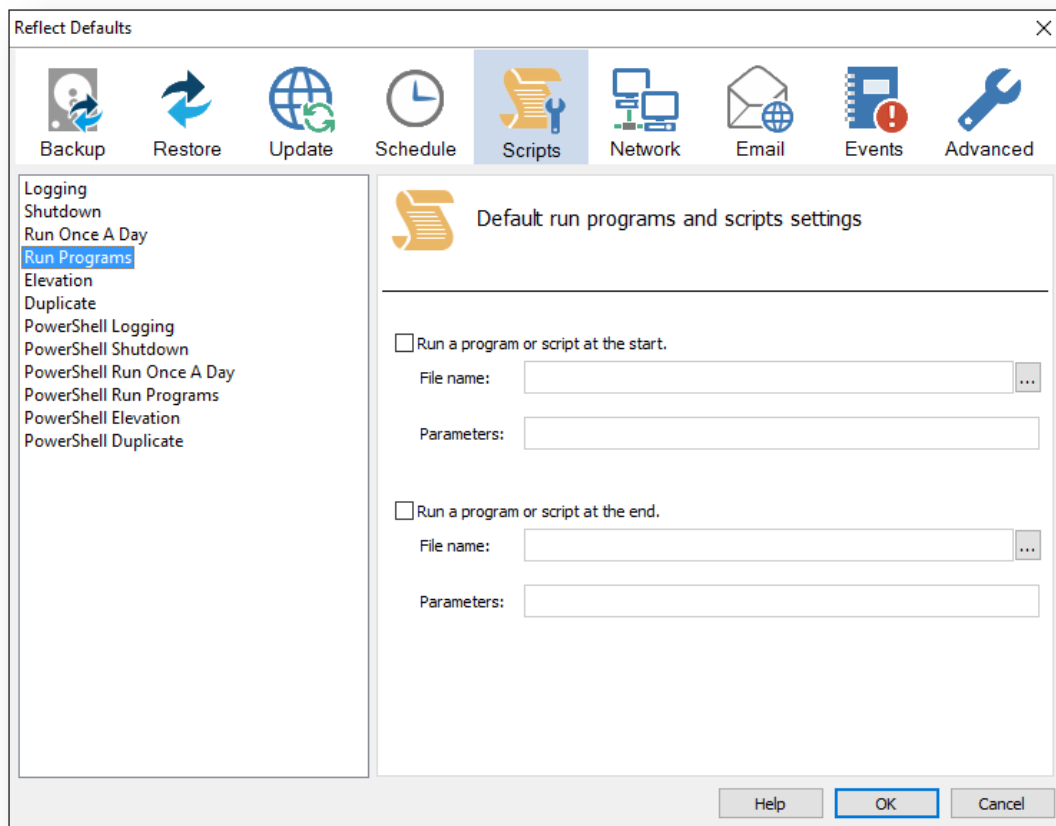
This is useful if you want a backup to happen at first login or shutdown.

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.

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Generated code...

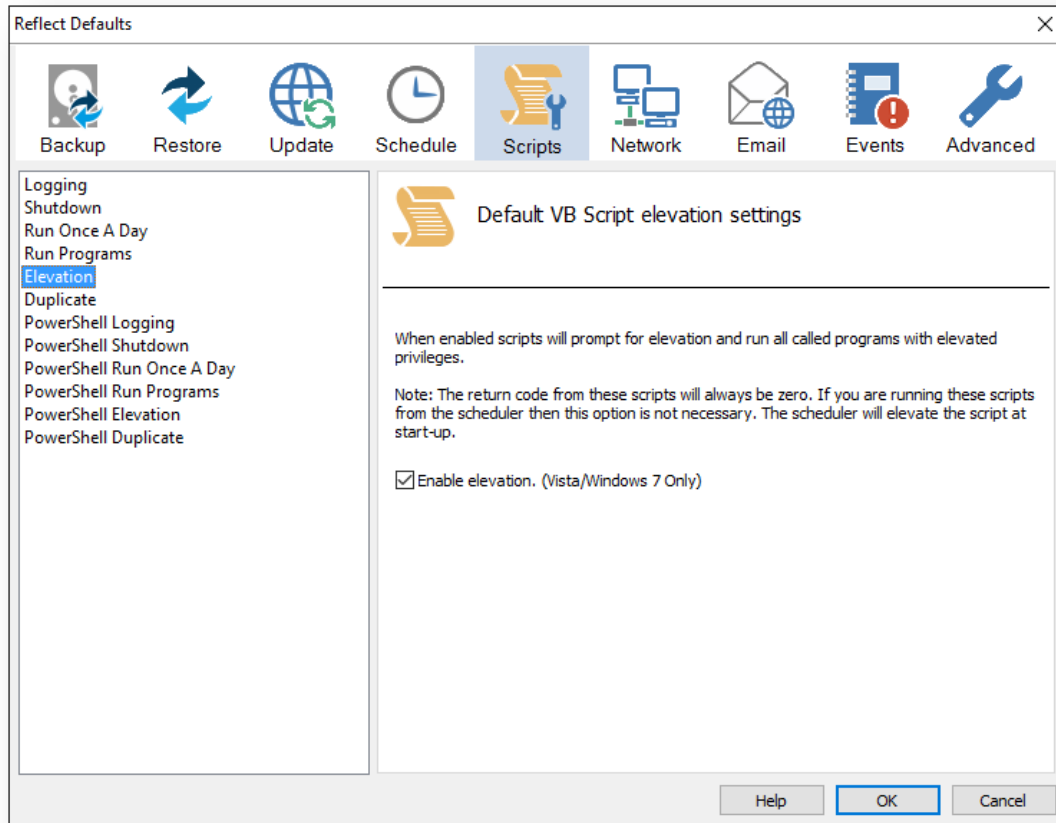
```
' Run program before backup
  objShell.Run ""C:\Users\Public\Admin\Before backup.bat"", 1, true
' Do the backup
  ExitCode = Backup ("C:\Program Files\Macrium\Reflect\reflect.exe" -e -w
<BACKUP_TYPE> "C:\Users\Dev\Documents\Reflect\example.xml")
' Run program after backup
  objShell.Run ""C:\users\public\Admin\After 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.
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.

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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  
    ' *  
End Sub
```

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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.

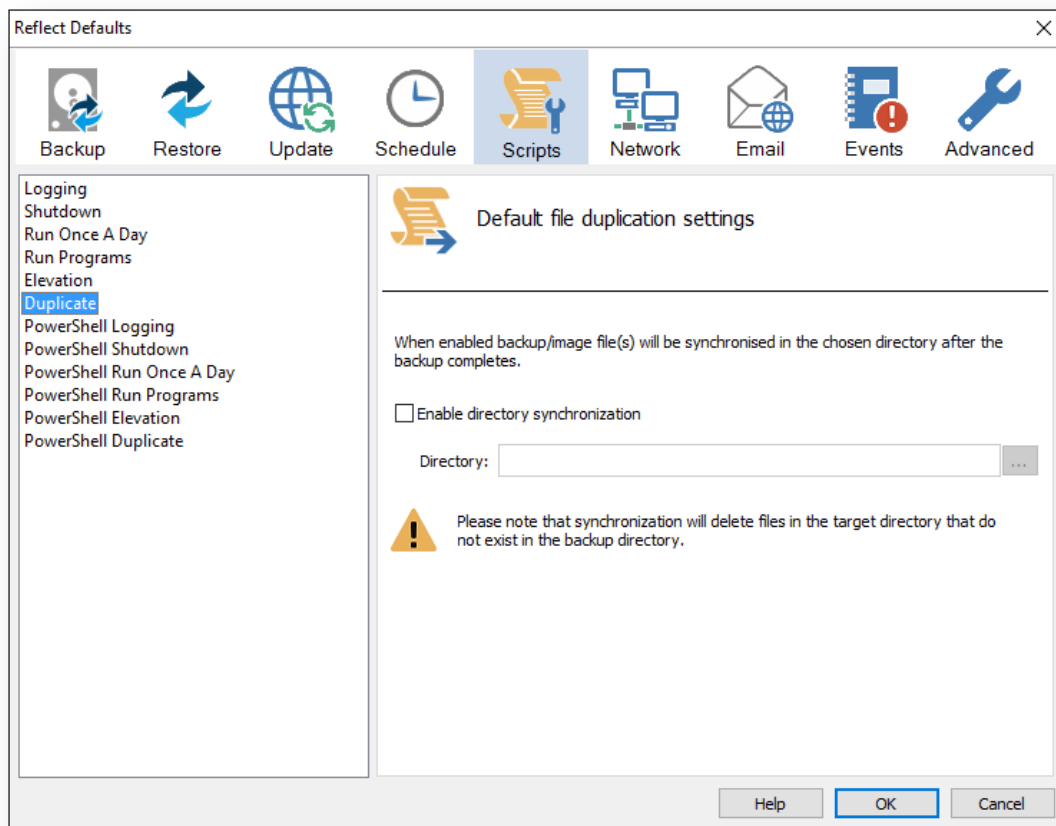
Option	Description
Enable Elevation	Enables UAC elevation for the entire script. This enables functions and programs to run outside the context of Macrium Reflect without requesting further elevation.

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
```

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```
*****
'* 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
                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)
                End If
            End If
        Next
    End If
End Function
```

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```

        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

```

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.



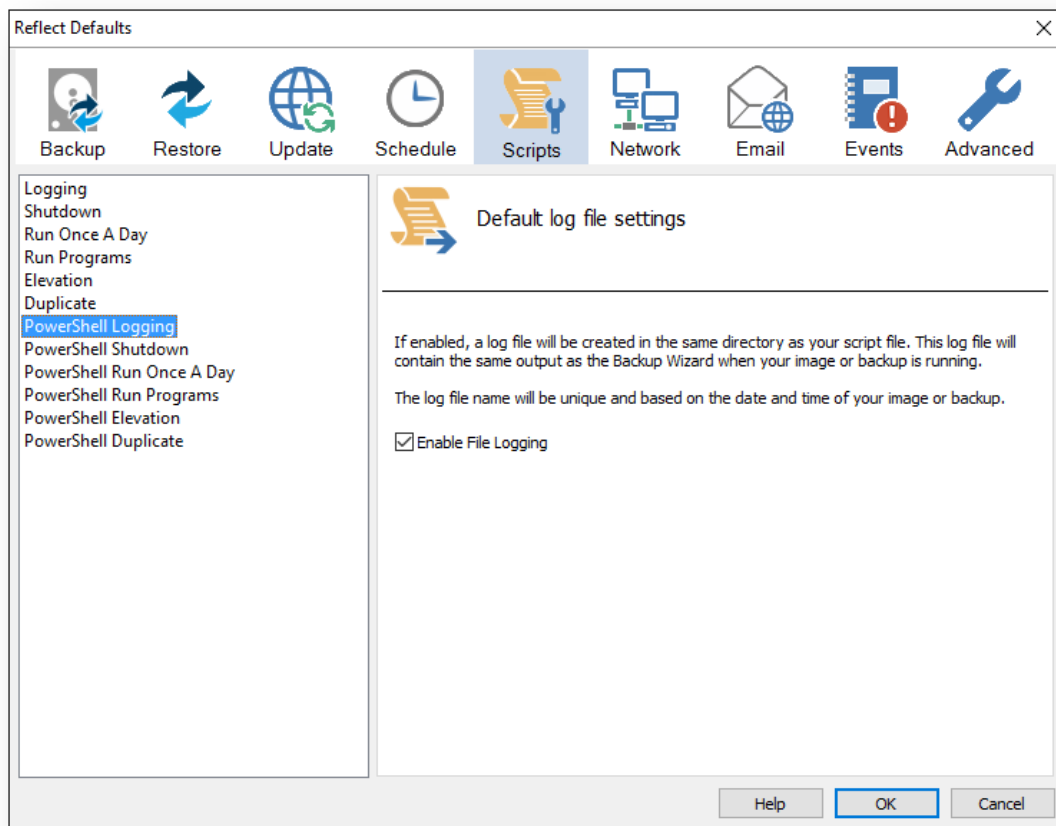
Please note that the synchronization will delete files in the target directory that do not exist in the backup directory.

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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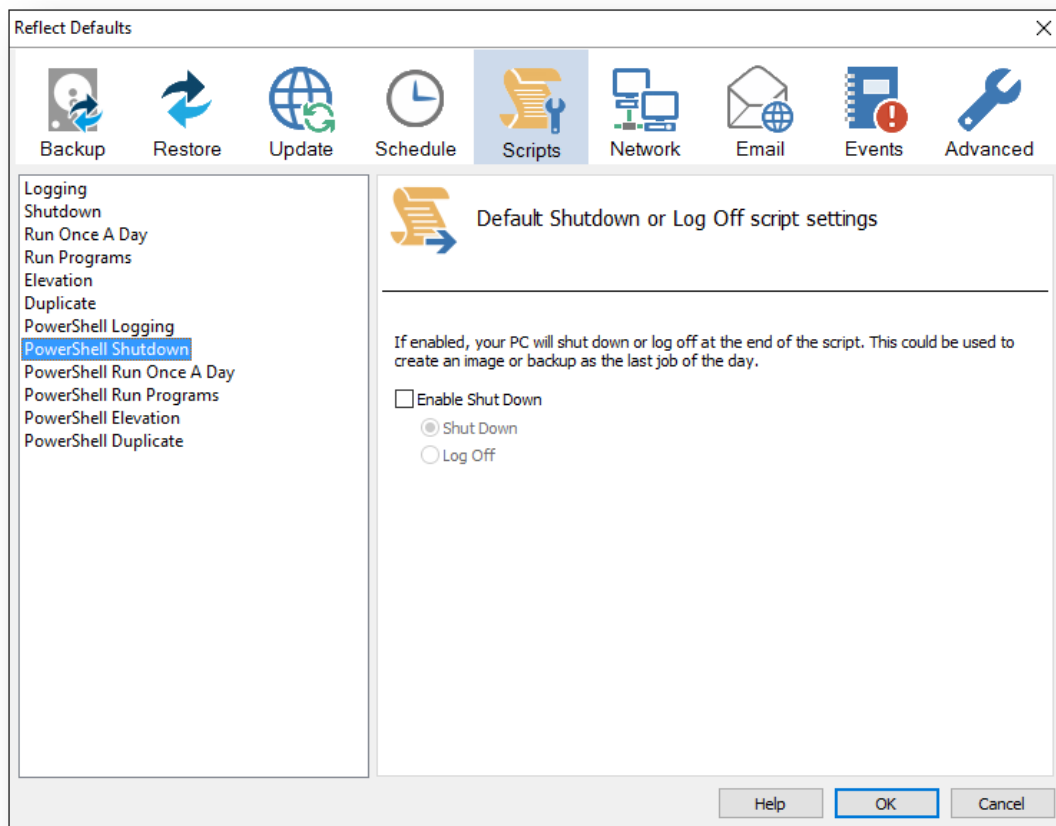


- If enabled, the log file created will contain the same output as the Backup Wizard when your image or backup is running.
The log file name will be left unique and based on the date and time of your image or backup.

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.

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Generated code...

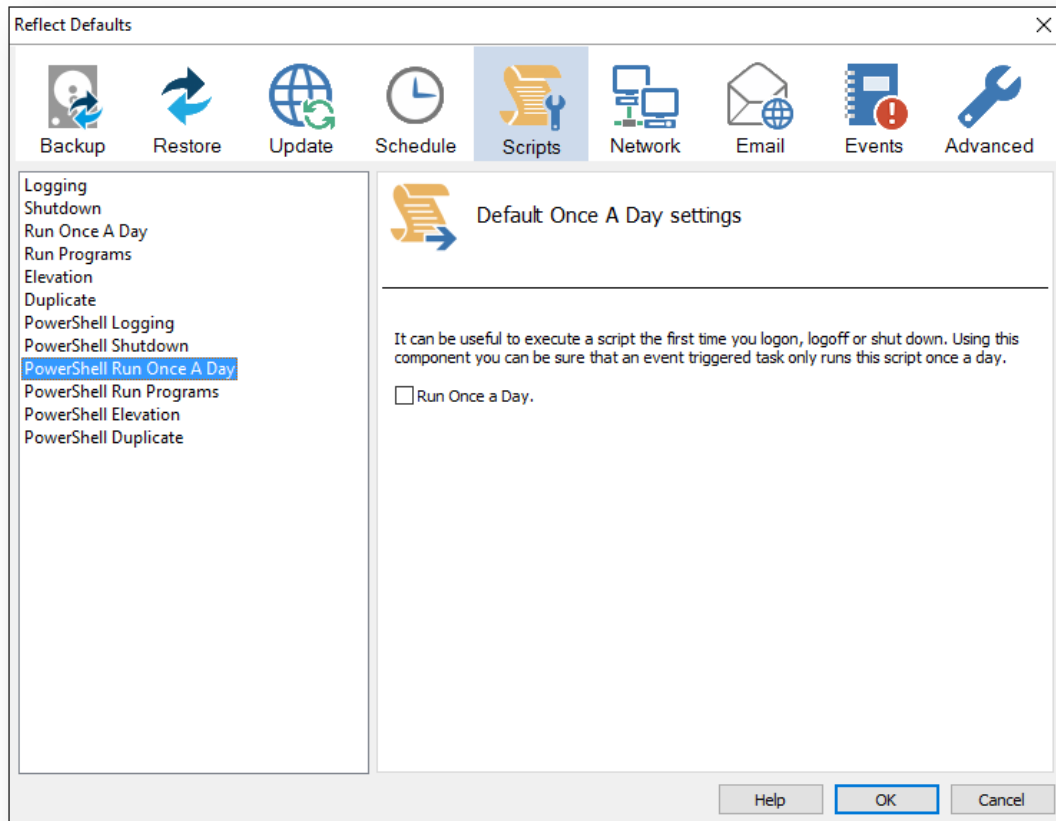
```
Write-Host ' * Initiating shutdown... ' -NoNewLine;
(Get-WMIObject Win32_OperatingSystem -ComputerName '.' -EnableAllPrivileges).
Win32Shutdown(8);
```

Option	Description
Shut Down	☒ Enable Shut Down ☒ Shut Down ☐ Log Off Your PC will shutdown after the script has been ran.
Log Off	☒ Enable Shut Down ☐ Shut Down ☒ 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';
```

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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;
}
```

Option	Description
Run once a day	☒ Run Once a Day. The script will run only once a day.



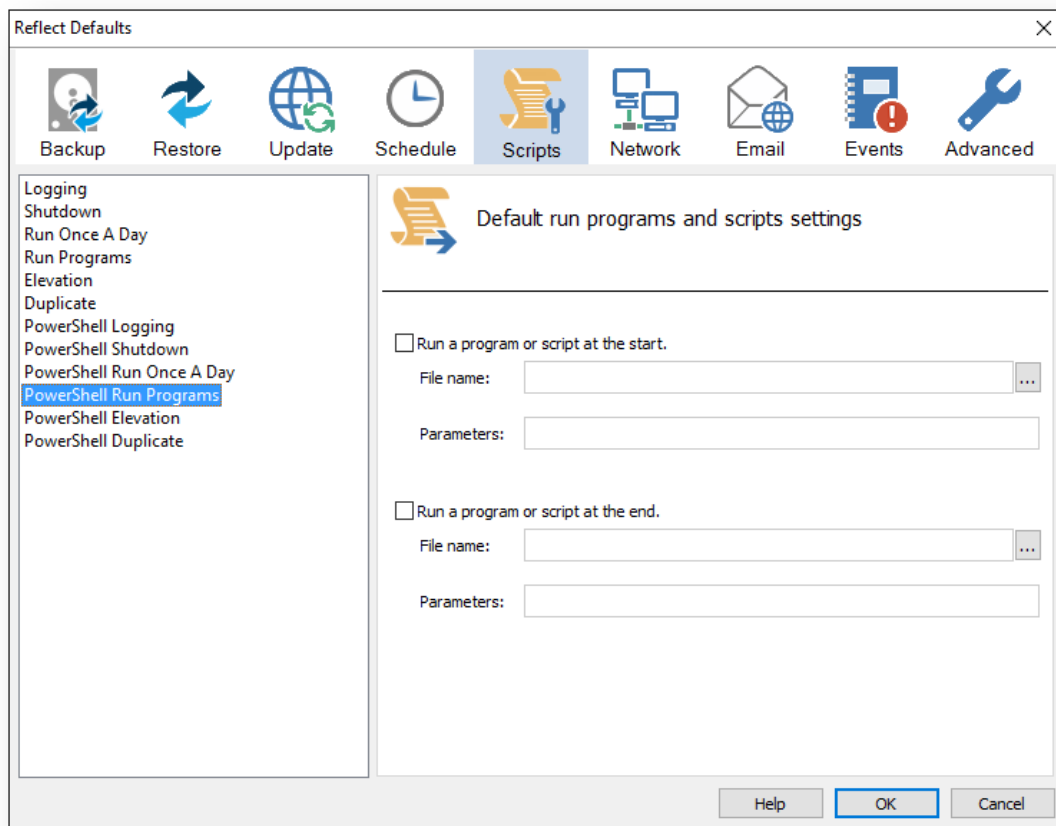
This is useful if you want a backup to happen at first login or shutdown.

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.

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Generated code...

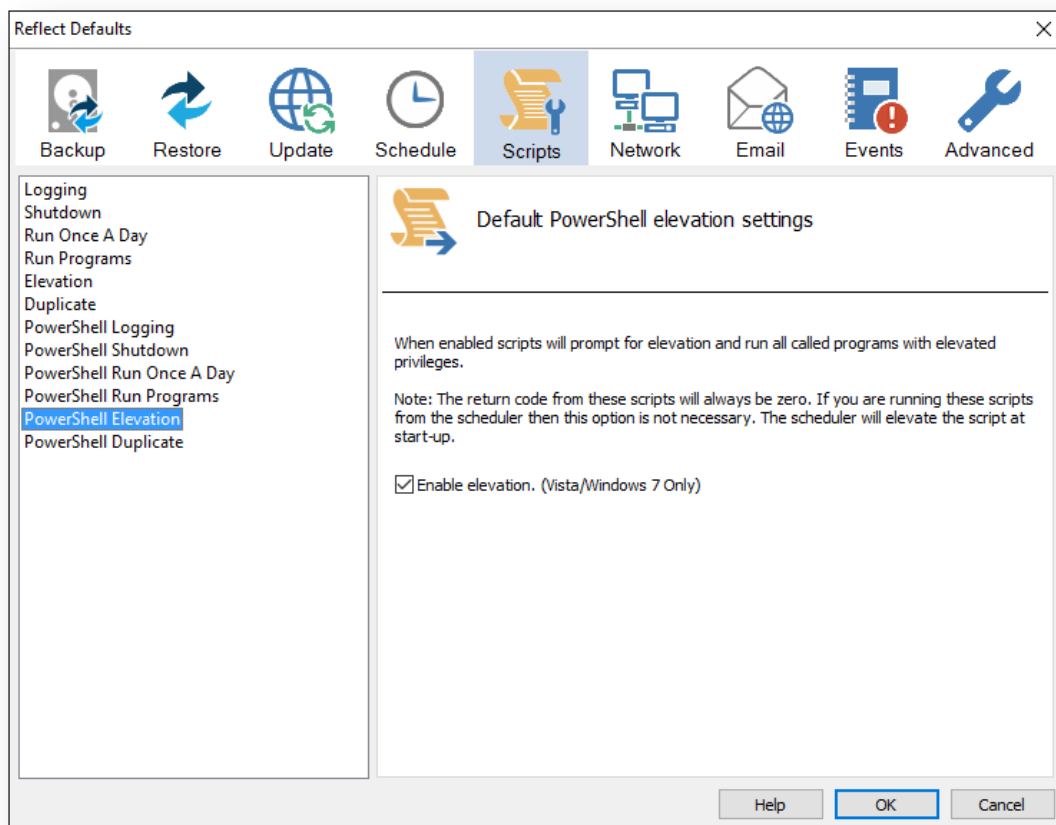
```
Write-Host ' * Executing "at start" program... ' -NoNewLine;
$strRunAtStartApp = 'C:\Users\Public\Admin\Before backup.bat';
$strRunAtStartArgs = '';
if ([string]::IsNullOrEmpty($strRunAtStartArgs))
{
    Start-Process -FilePath $strRunAtStartApp;
}
else
{
    Start-Process -FilePath $strRunAtStartApp -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;
}
```

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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.



Generated code...

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```
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
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
                $ElevatedProcess.Verb = "runas";
                # Start the new process
                [System.Diagnostics.Process]::Start($ElevatedProcess);
                # Exit this unelevated script with exit code for "Error: Not elevated"
                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.

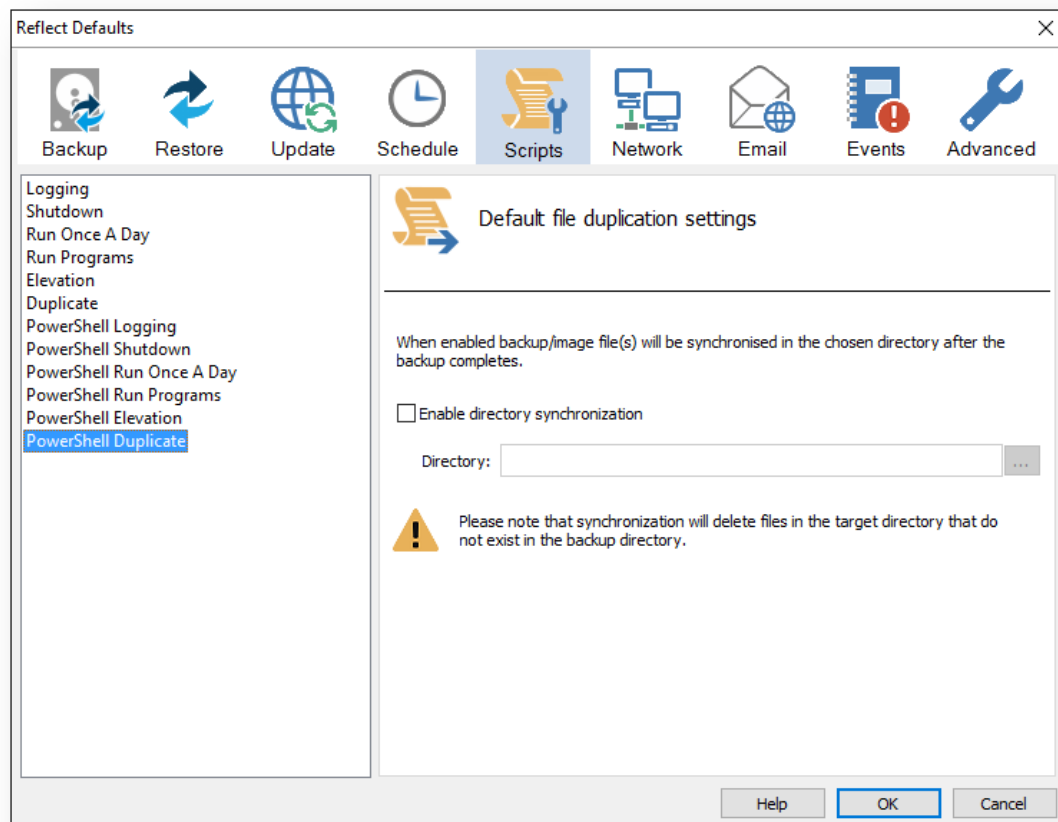
Option	Description
Enable Elevation	Enables UAC elevation for the entire script.  This enables functions and programs to run outside the context of Macrium Reflect without requesting further elevation.

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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 ($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.
##*
```

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```

#*****
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("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.';
}

```

Option	Description
Enable file copy	If enabled the backup will create a copy of the files from the backup to the supplied destination.

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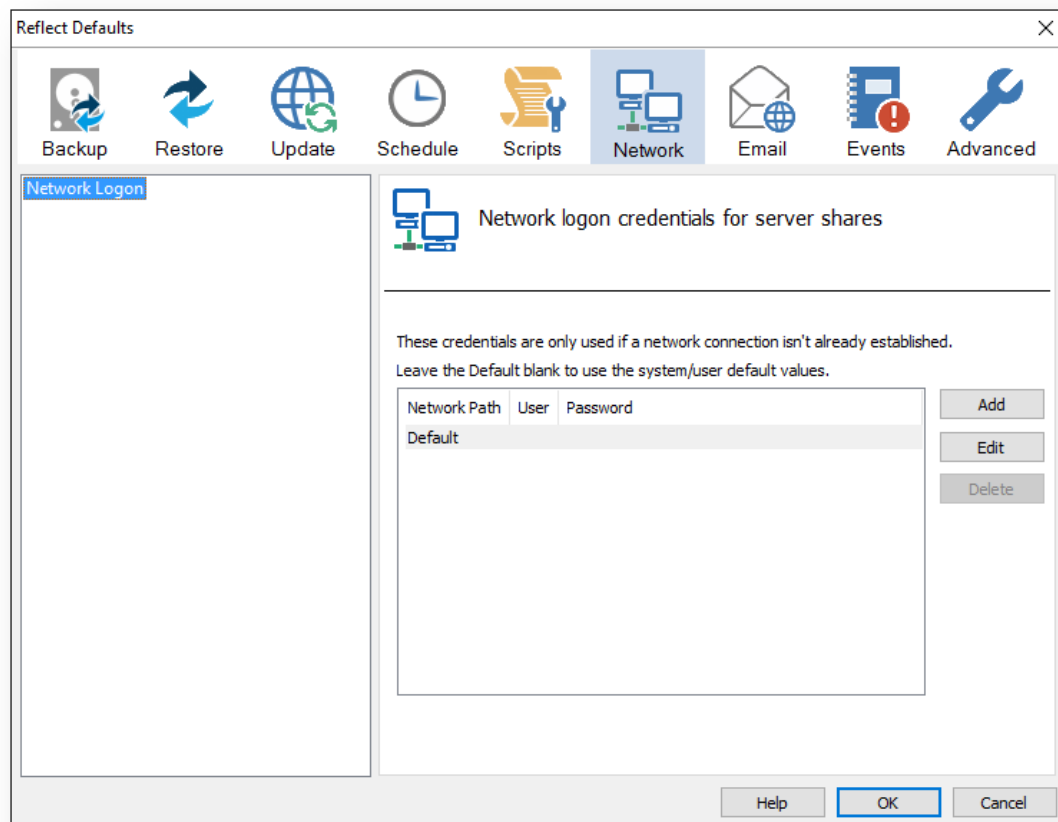
Option	Description
Directory	Here you will need to enter the folder that you want to copy/archive your backup files to.



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

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Option	Description
Edit	Edit an existing location.  Note: The 'Default' location logon details will be used for all shares that aren't explicitly added.
Delete	Remove logon credentials

Add / Edit

Network Location Details

Specify credentials for a specific network path using the fields below

\\server\share

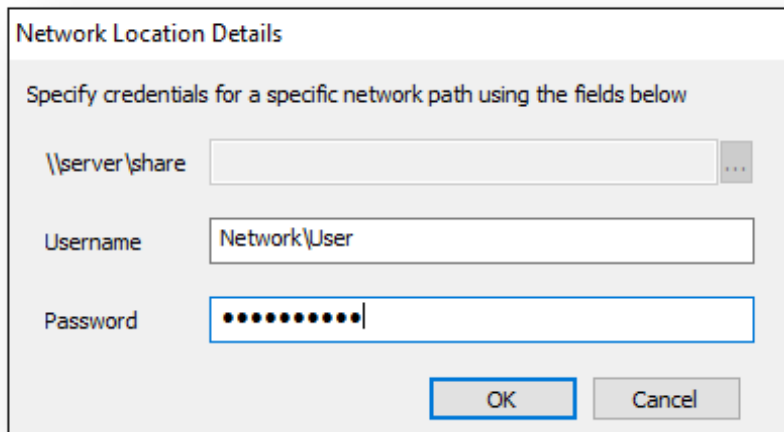
Username

Password

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:

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The image shows a 'Network Location Details' dialog box. It has a title bar with the text 'Network Location Details'. Below the title bar, there is a subtitle 'Specify credentials for a specific network path using the fields below'. There are three input fields: 'Server' with the text '\\server\share', 'Username' with the text 'Network\User', and 'Password' with a masked password represented by dots. At the bottom right, there are two buttons: 'OK' and 'Cancel'.

Network Location Details

Specify credentials for a specific network path using the fields below

Server: \\server\share

Username: Network\User

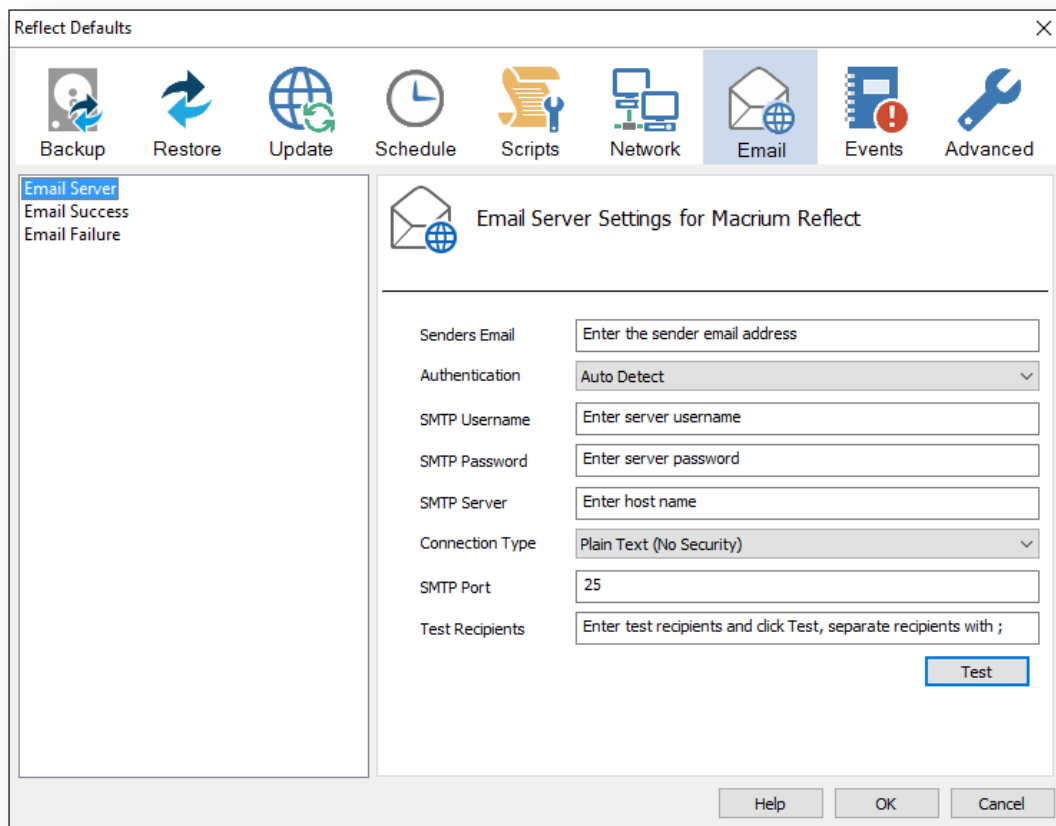
Password: [Masked]

OK Cancel

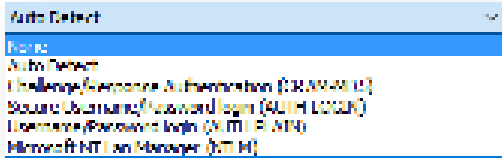
Email Settings

- 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**'.

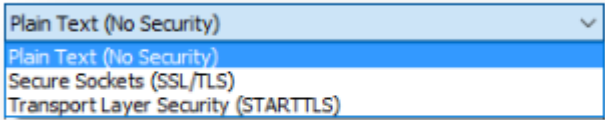
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Email Server options description:

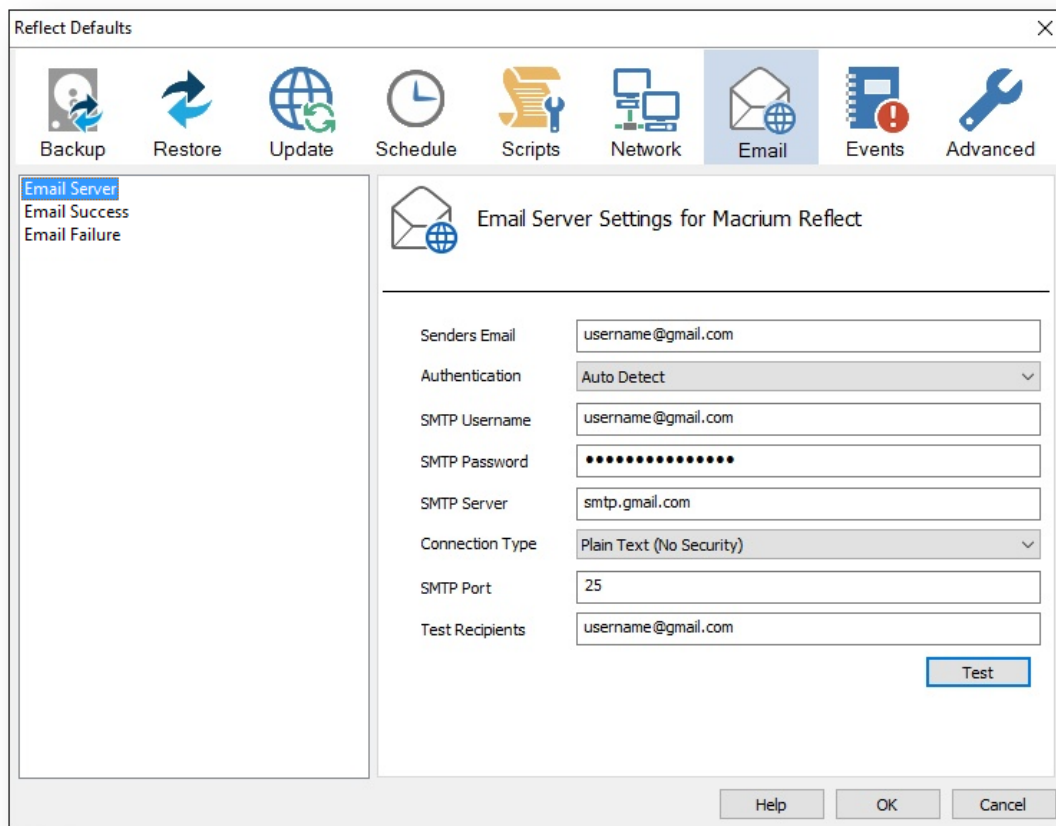
Option	Description
Senders Email	Your e-mail address associated with your ISP or Gmail account etc.  Note: If you use e-mail software such as MS Outlook, you can find the settings under Account Settings for e-mail address, user-name and Server.
Authentication	Authentication options are set by your email provider/server. 

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Option	Description
	Note: If you do not know your authentication settings, try Auto Detect .
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	This is the setting for the way Macrium Reflect will contact the Server.  Plain Text (No Security) Plain Text (No Security) Secure Sockets (SSL/TLS) Transport Layer Security (STARTTLS)  Note: These settings can be found from your email provider.
SMTP Port	This is associated with Connection Type and is the port number that the SMTP server is listening on.  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.

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- Click **OK** to finish.

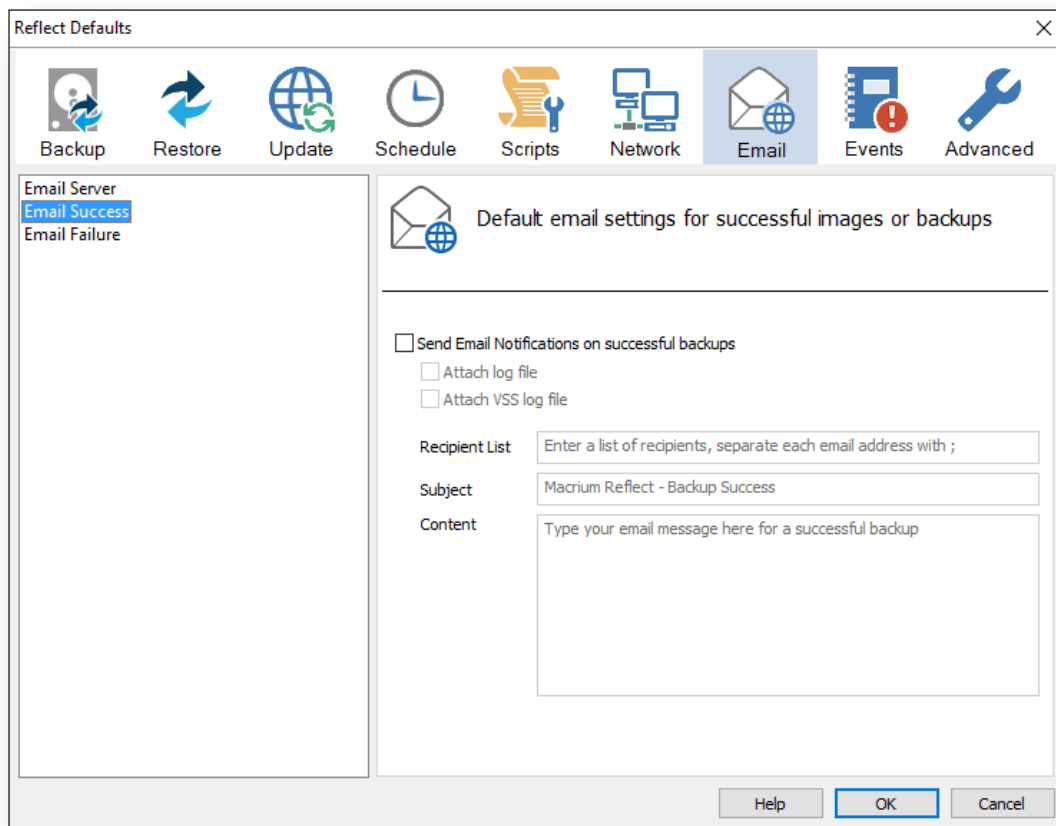


Note: If you are using your Gmail account then please see here: [Using Gmail SMTP Server for sending backup notification emails](#)

Email success settings define who receives emails regarding the success of a backup and what message they receive.

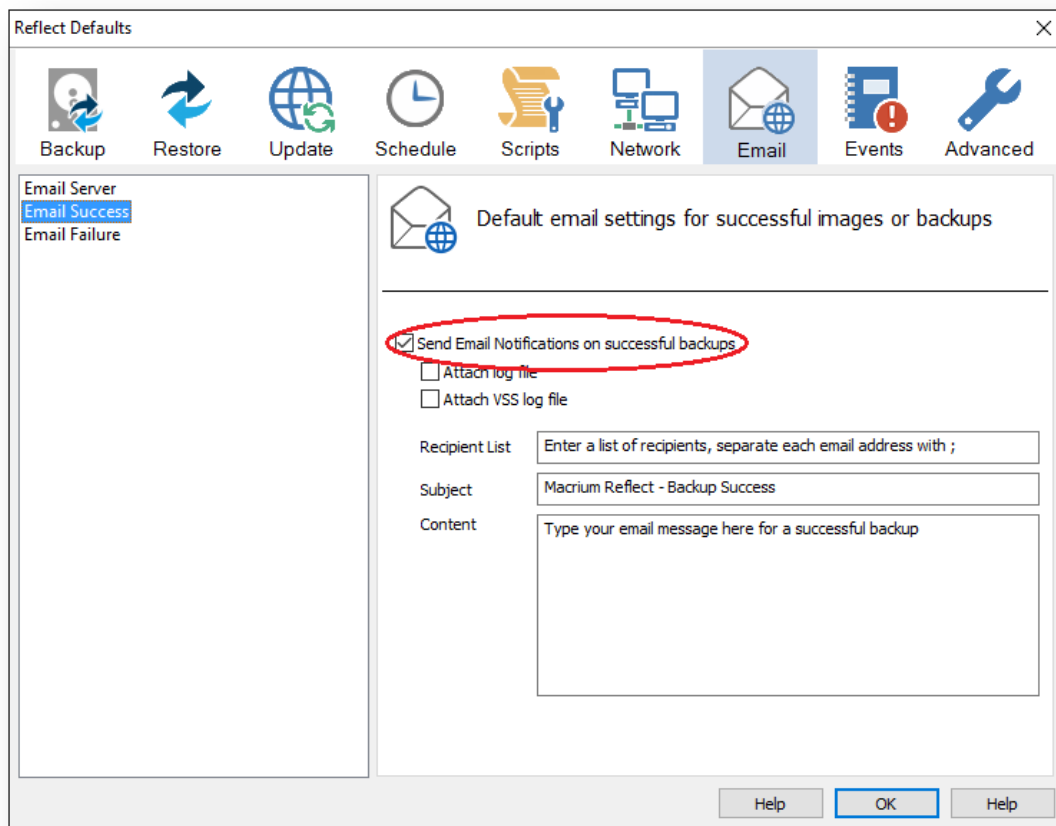
- Select **Email Success**

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- Select **Send Email Notifications on successful backups**.

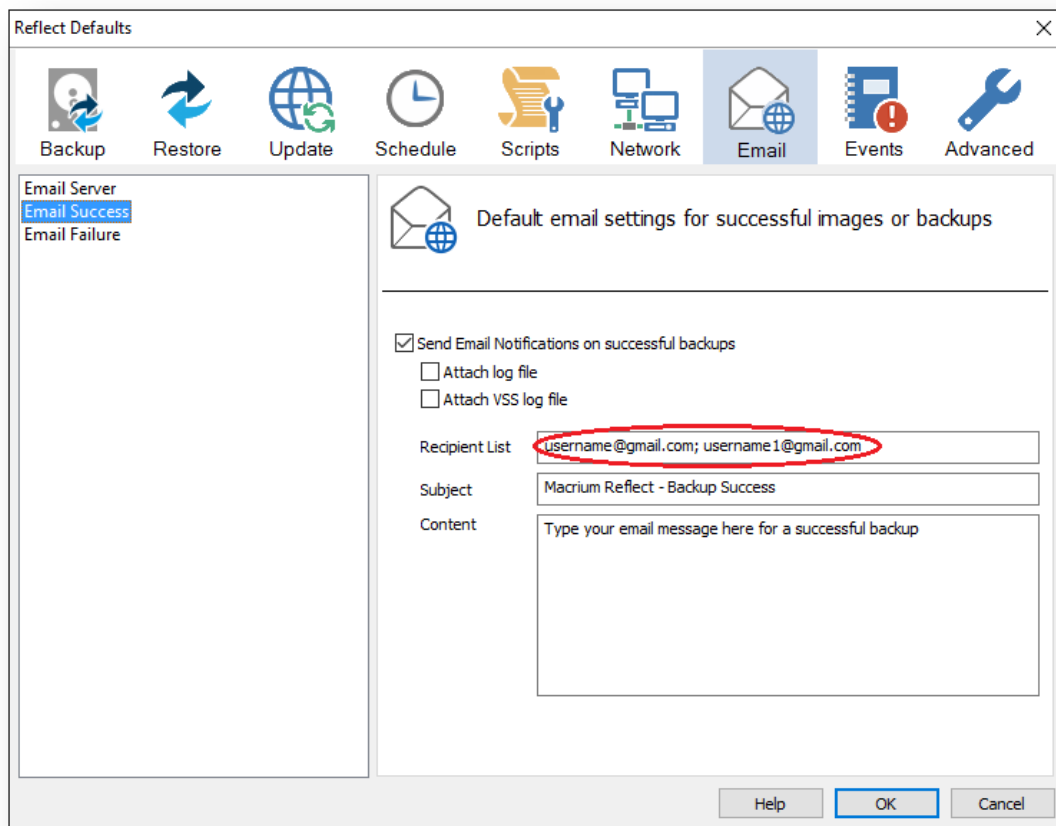
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Option	Description
Attach log file	Will attach the log file from the creation of the backup.
Attach VSS log file	Will attach the VSS log with the events made during the backup.

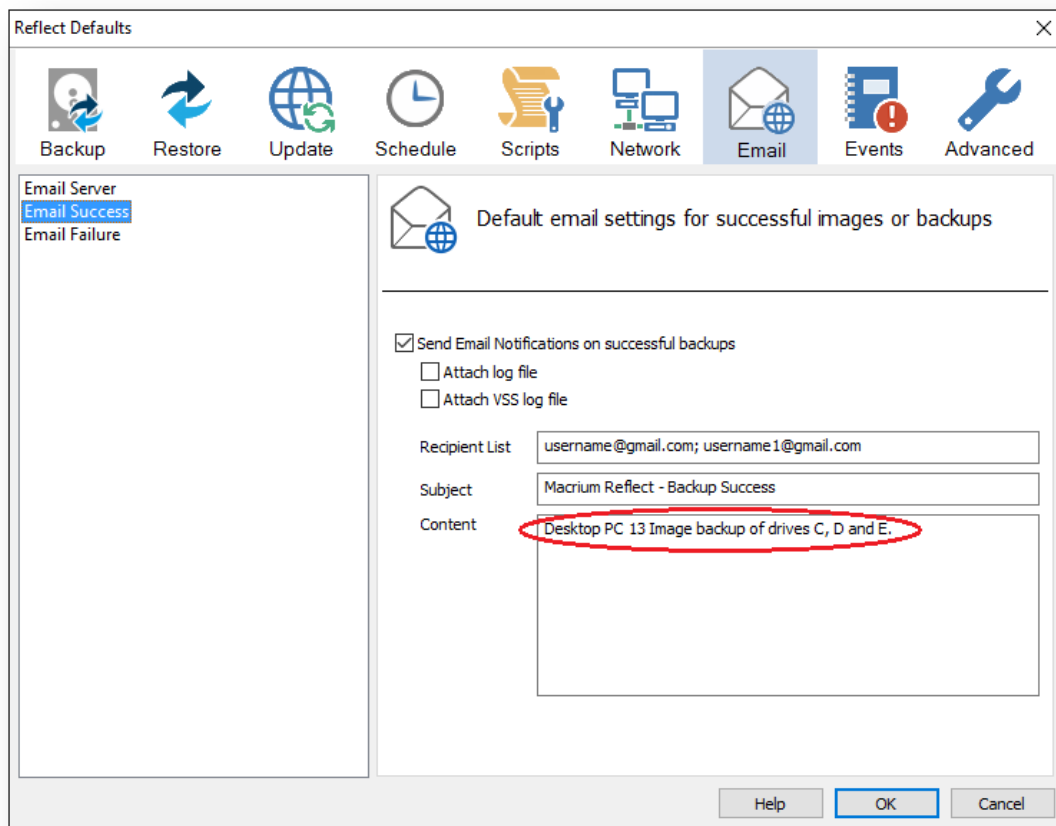
- Enter the email addresses of all recipients in **Recipient List**, separating each email address with a semi-colon.

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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.

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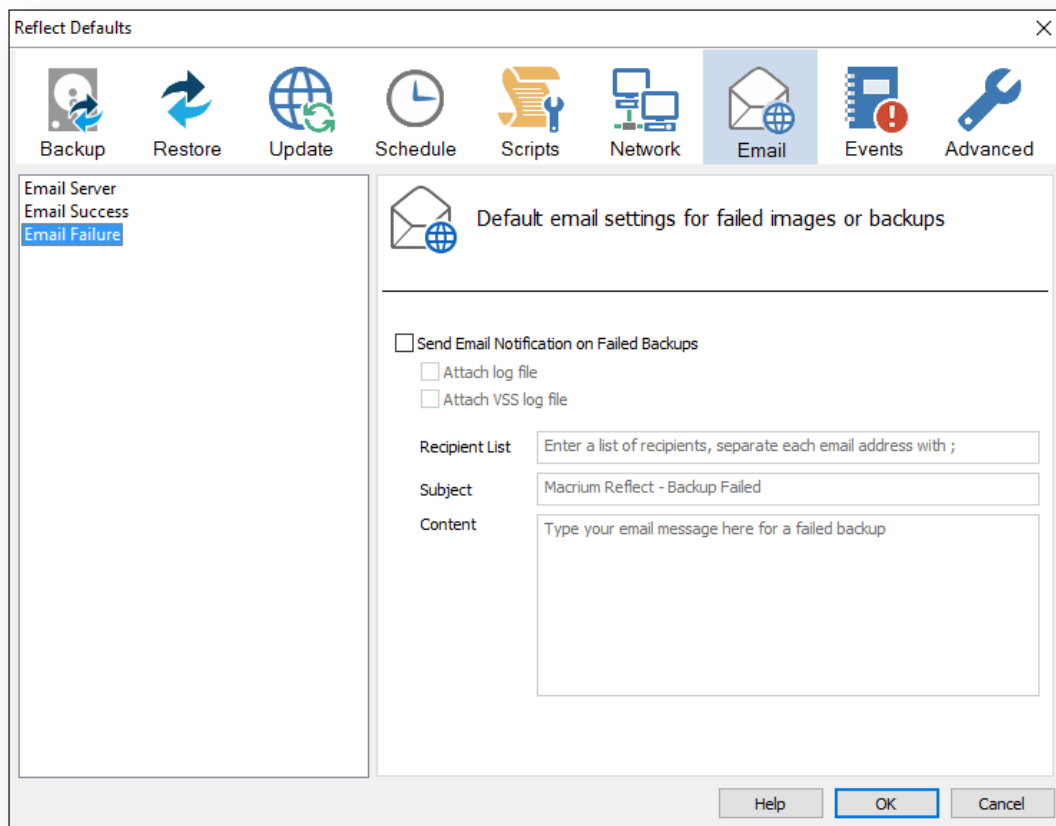


- Click **OK**.

Email failure settings define who receives emails regarding the failure of a backup and what message they receive.

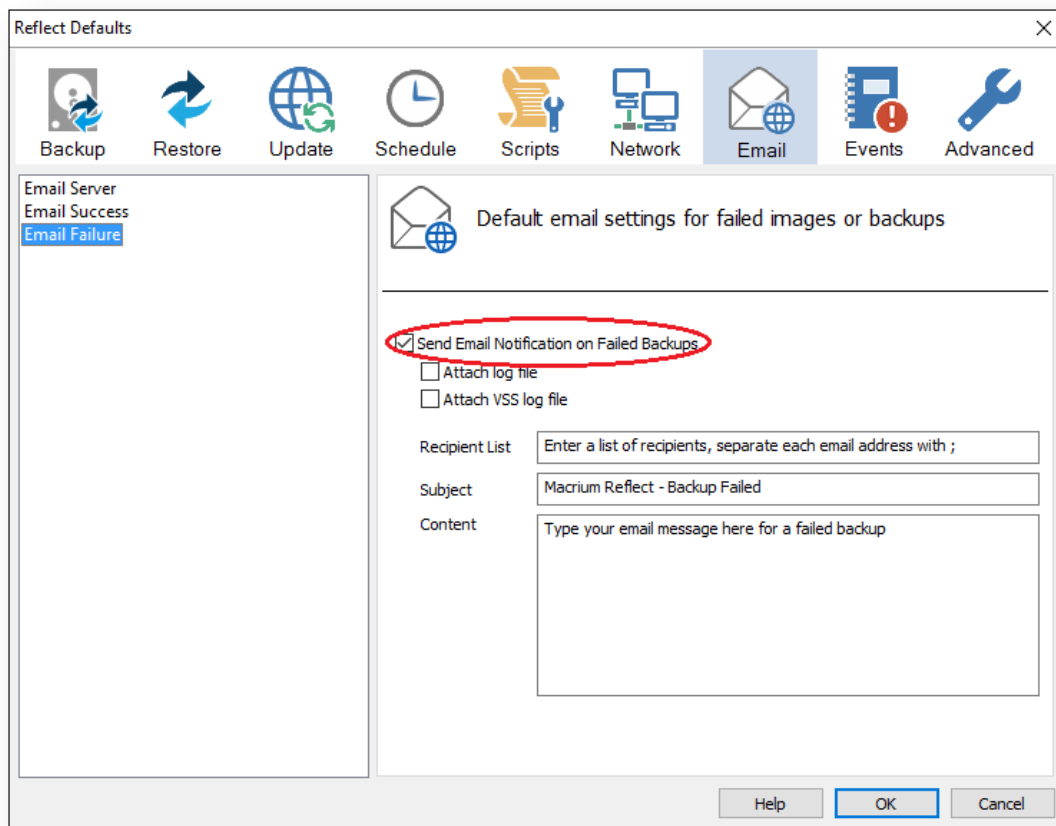
- Select **Email Failure**.

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- Select **Send Email Notification on Failed Backups**.

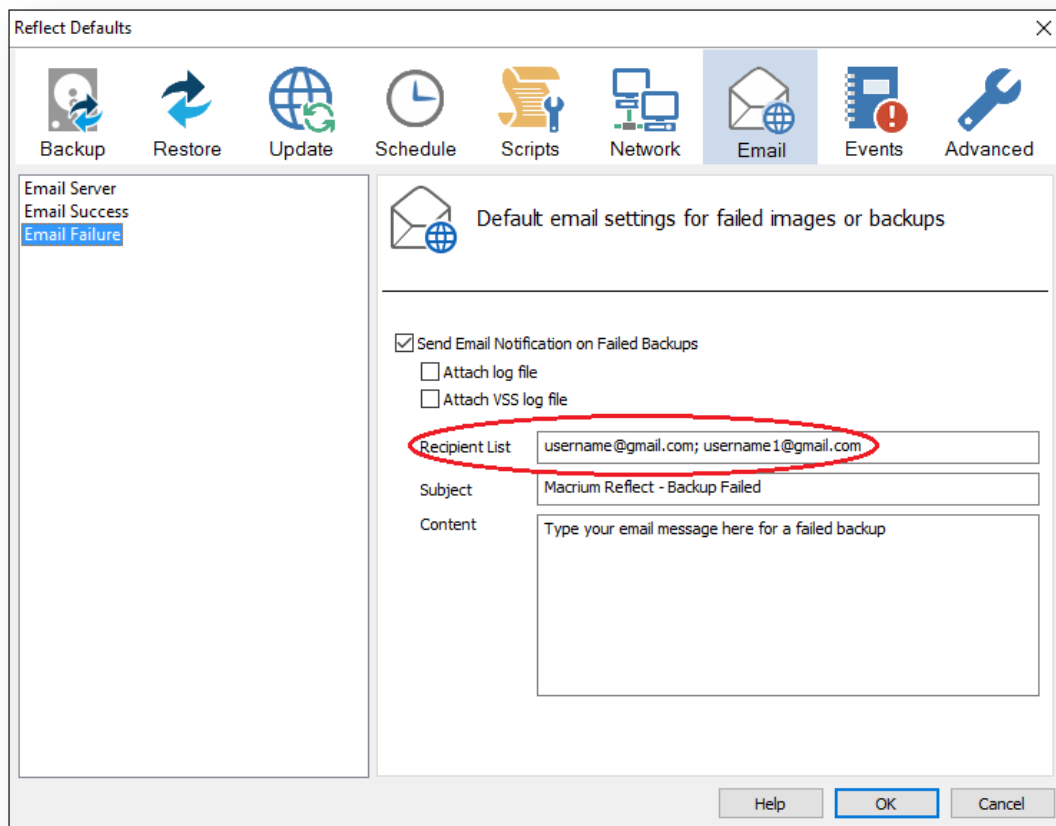
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Option	Description
Attach log file	Will attach the log file from the creation of the backup.
Attach VSS log file	Will attach the VSS log with the events made during the backup.

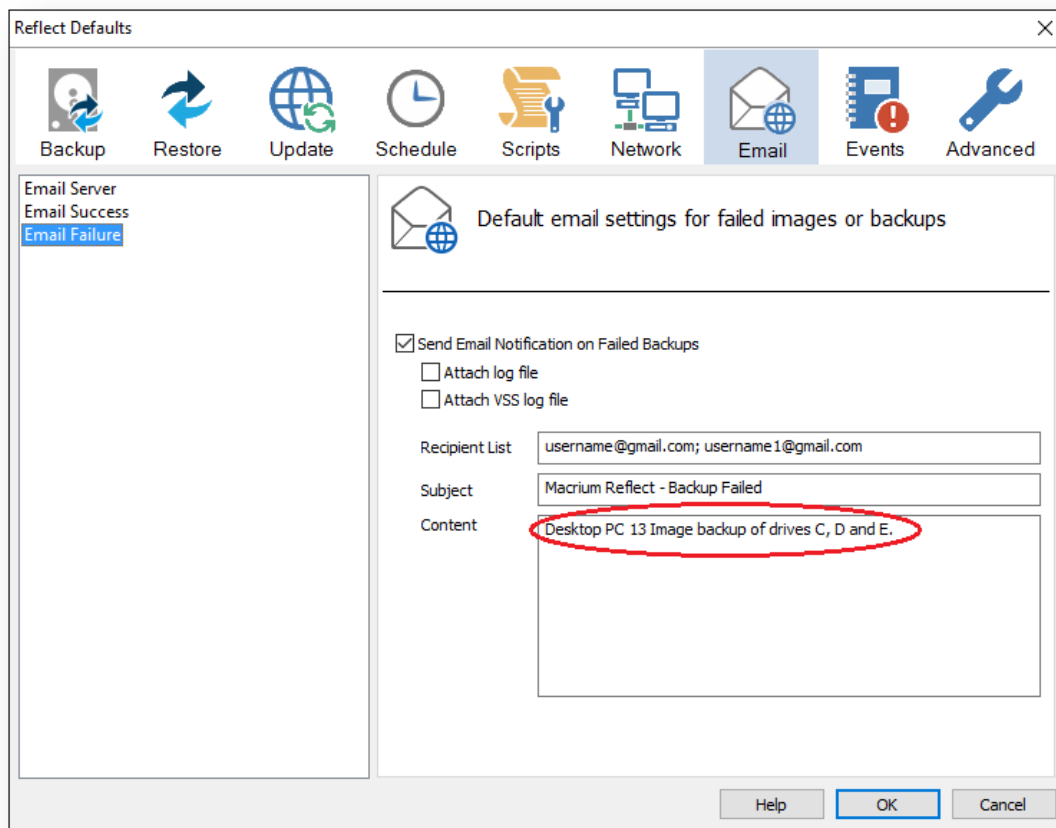
- Enter the email addresses of all recipients in **Recipient List**, separating each email address with a semi-colon.

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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.

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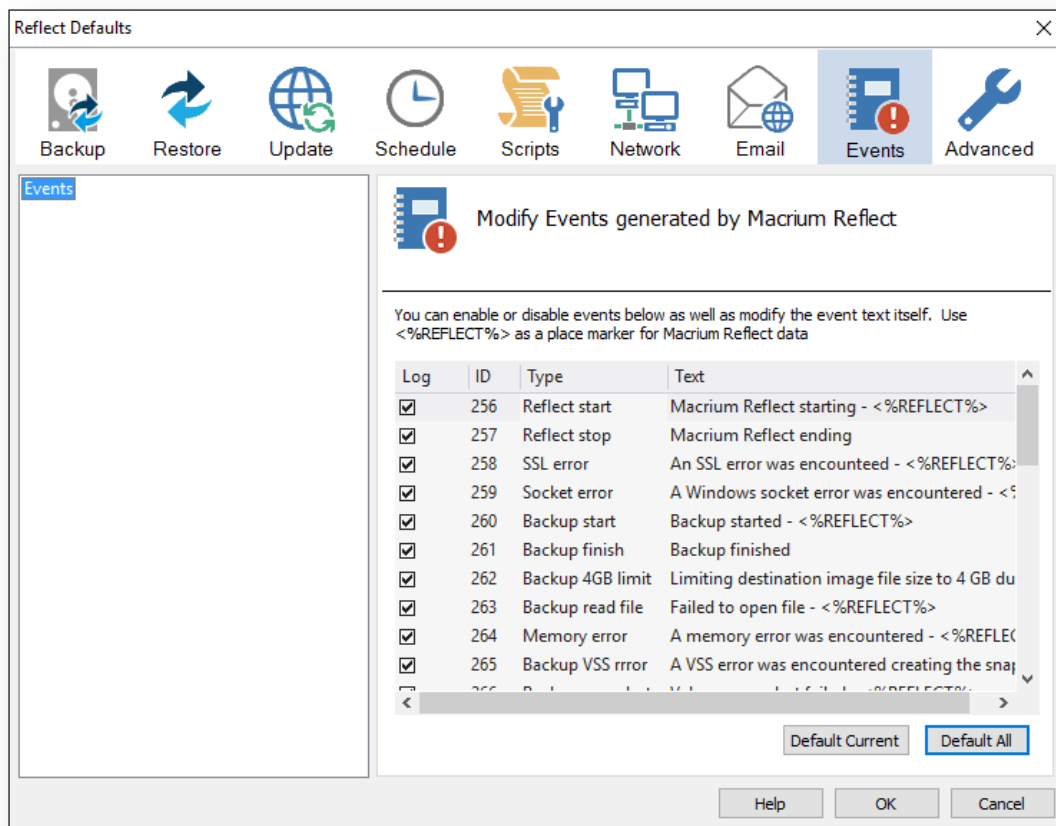


- Click **OK**.

Events

Enable or disable Windows Events generated by Macrium Reflect.

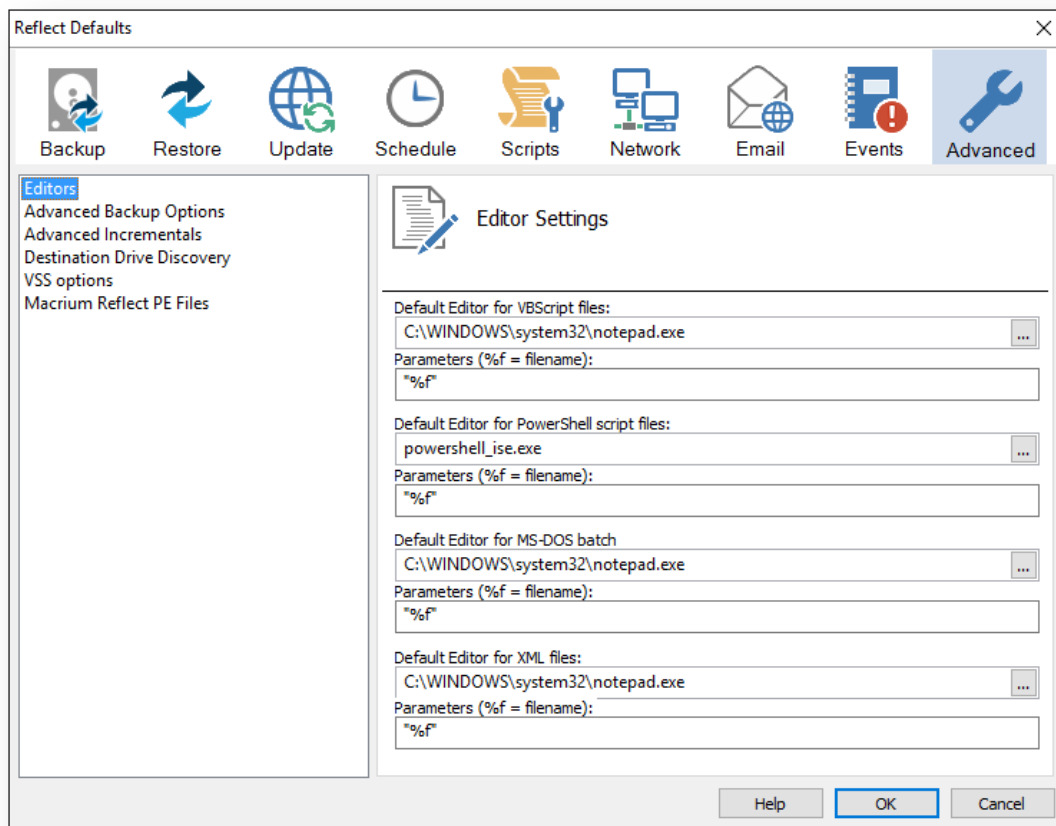
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Advanced

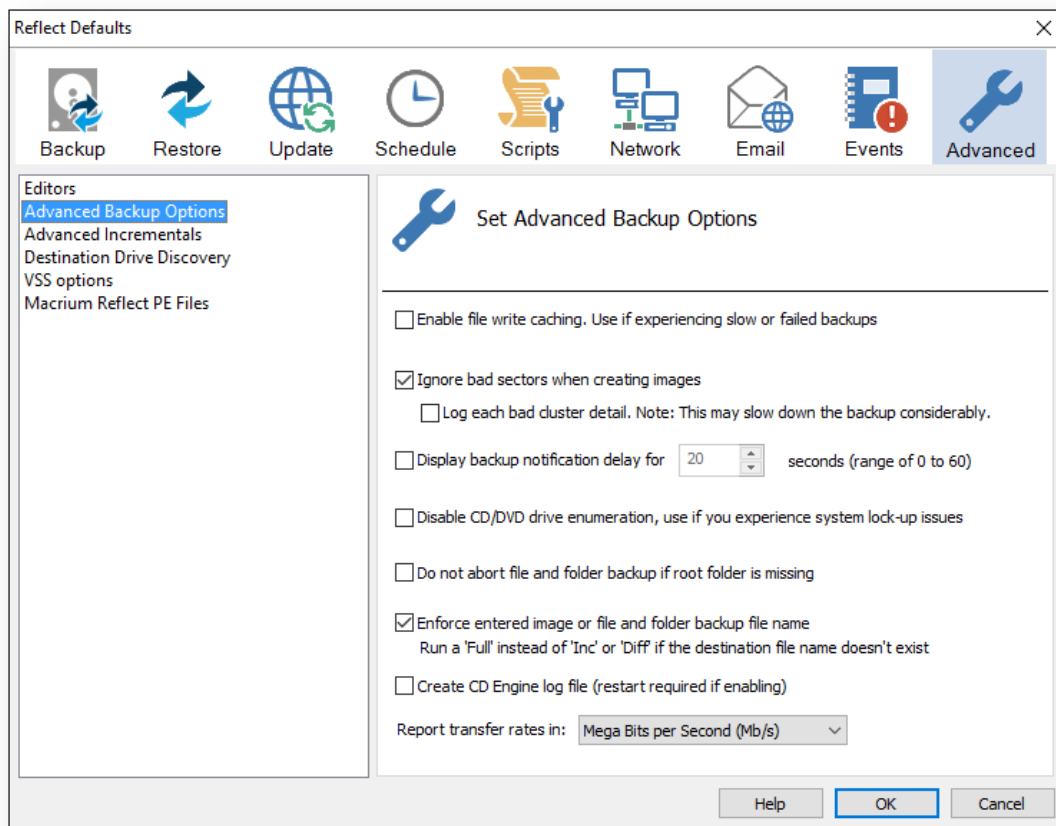
Editor settings are used to amend the default editor settings for; VBScript files, Powershell script files, MS-DOS batch and XML.

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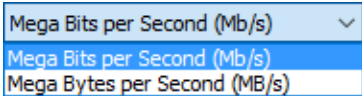
Advanced Backup Options are used to modify your backup options.

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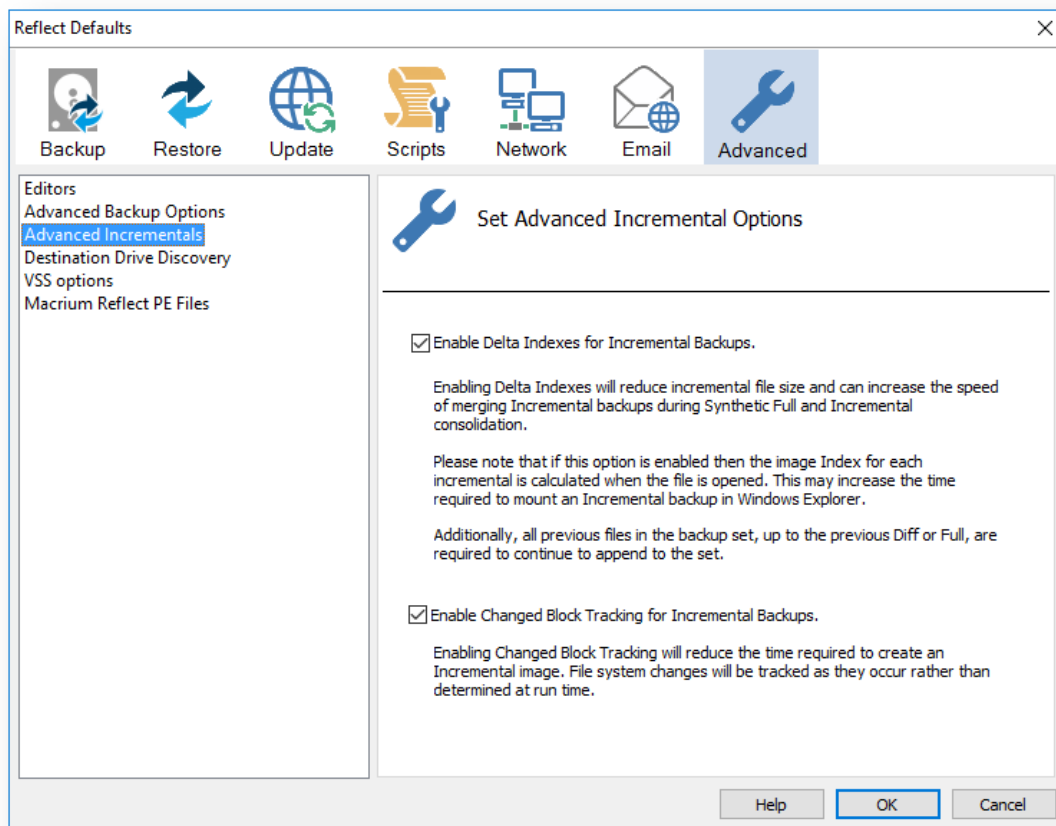
Option	Description
Enable file write caching	Is useful if experiencing slow or failed backups.
Ignore bad sectors when creating images.	Damaged disks may still be imaged if this option is selected.
Display backup notification delay for set number of seconds.	Changes the time delay windows is displayed before a scheduled backup starts.
Disable CD/DVD drive enumeration	This option is useful if experiencing system lockup issues.
	Enabling this option will allow your File and Folder backup to continue even if a root folder of the backup is missing.

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Option	Description
Do not abort a file and folder backup if a root folder is missing.	
Enforce an entered image or File and Folder backup file name.	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. 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.
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.	Will allow you to change the way transfer rates are reported in. 

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.

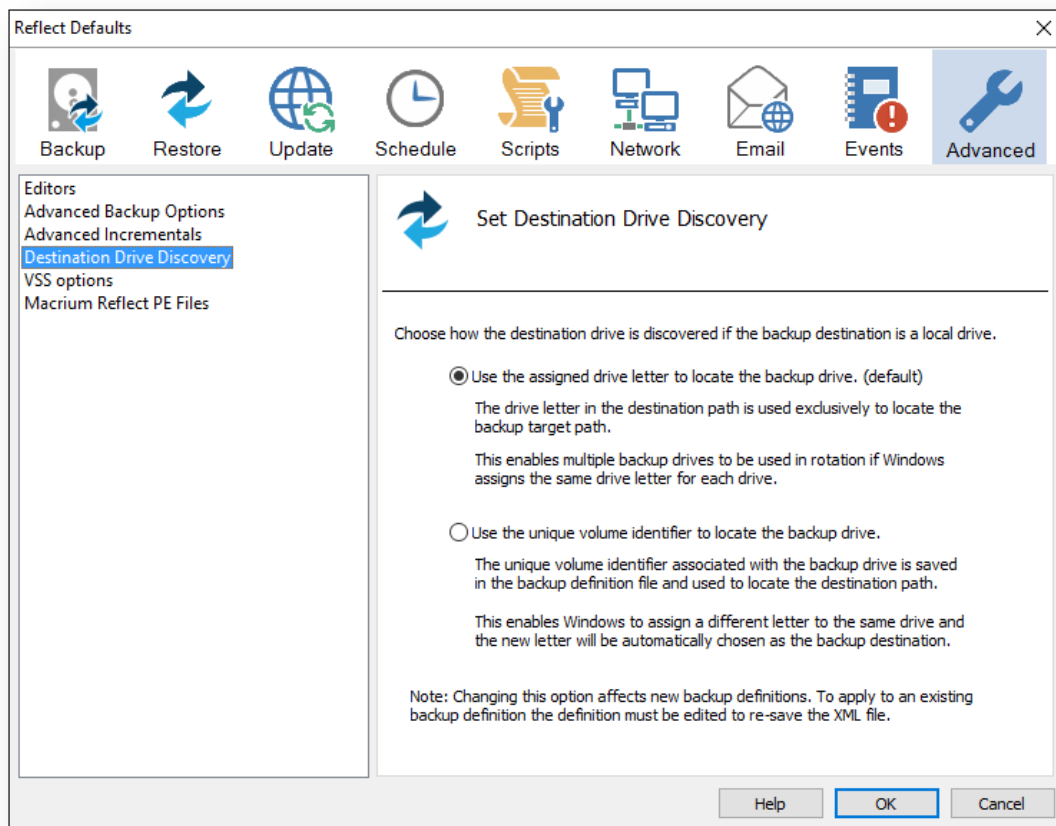


If this option enabled then the image Index for each incremental is calculated when the file is opened. This may increase the time required to mount an Incremental backup in Windows Explorer.

For information on Changed Block Tracker [please see here](#)

Destination Drive Discovery options change the way your destination drive is being discovered if the destination is a local drive.

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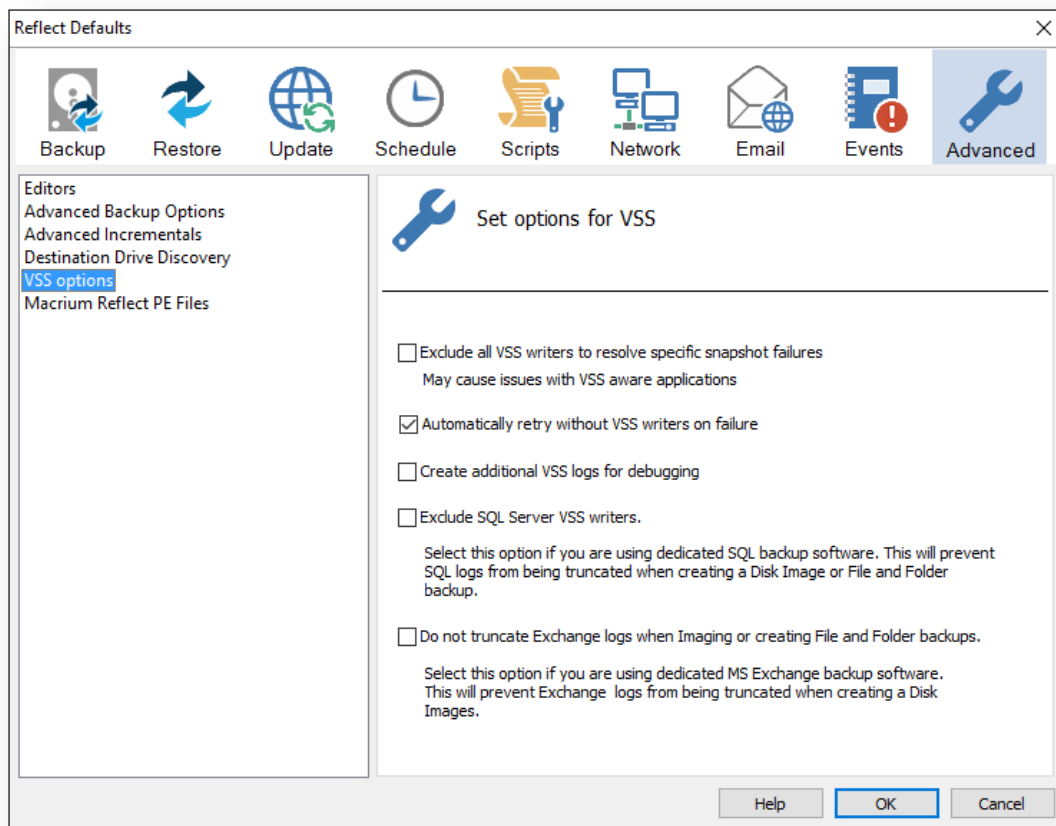


Changing the option affects new backup definitions. To apply to an existing backup definition, the definition XML file needs to be opened and re-saved by clicking 'Finish'.

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 is 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

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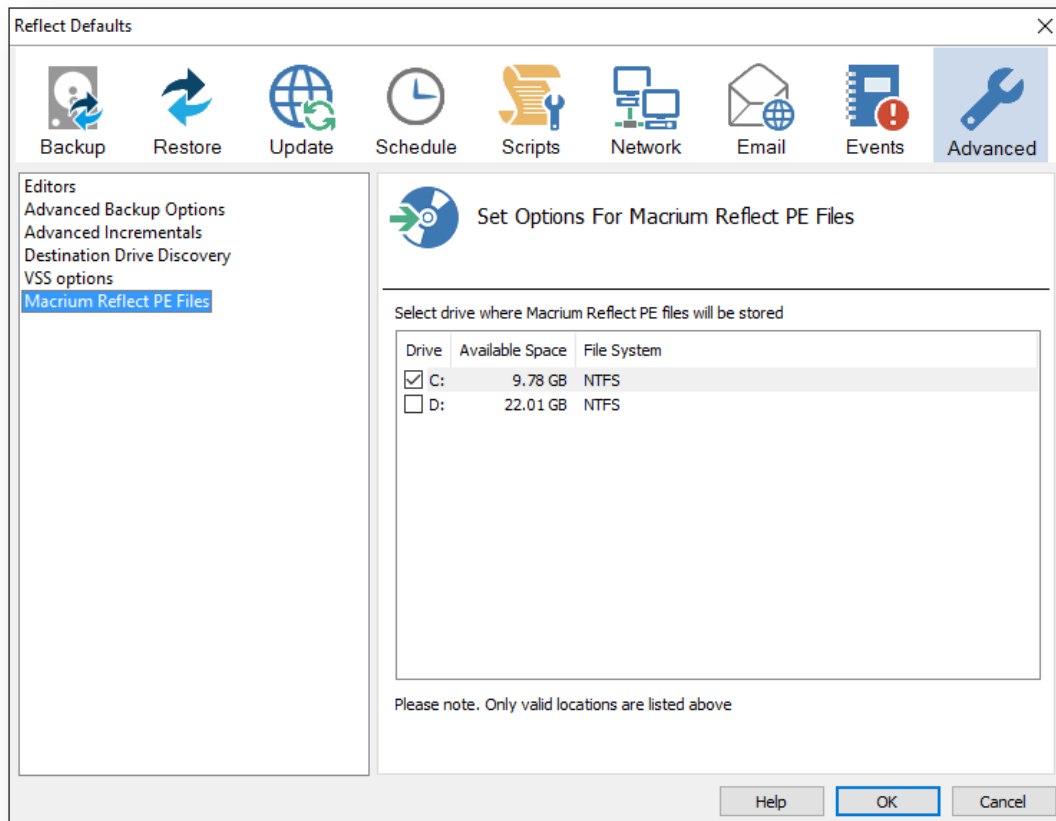


Option	Description
Exclude all VSS writers to resolve specific snapshot failures.	This option will disable VSS writers. Due to Windows system configuration issues, VSS writers are the cause of some backup failures.  This may cause issues with other VSS aware applications.
Automatically retry without 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.
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.

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Option	Description
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.

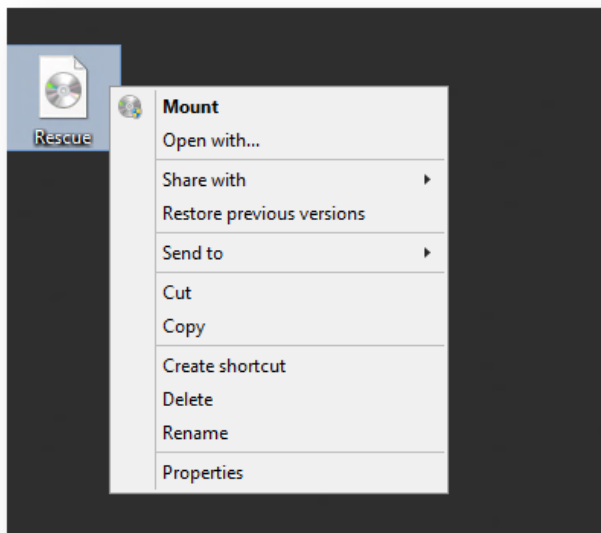


In order to use this technology you will need to have purchased the Macrium Reflect Technicians Deployment License.

If you wish to obtain this license please [click here](#) for further details.

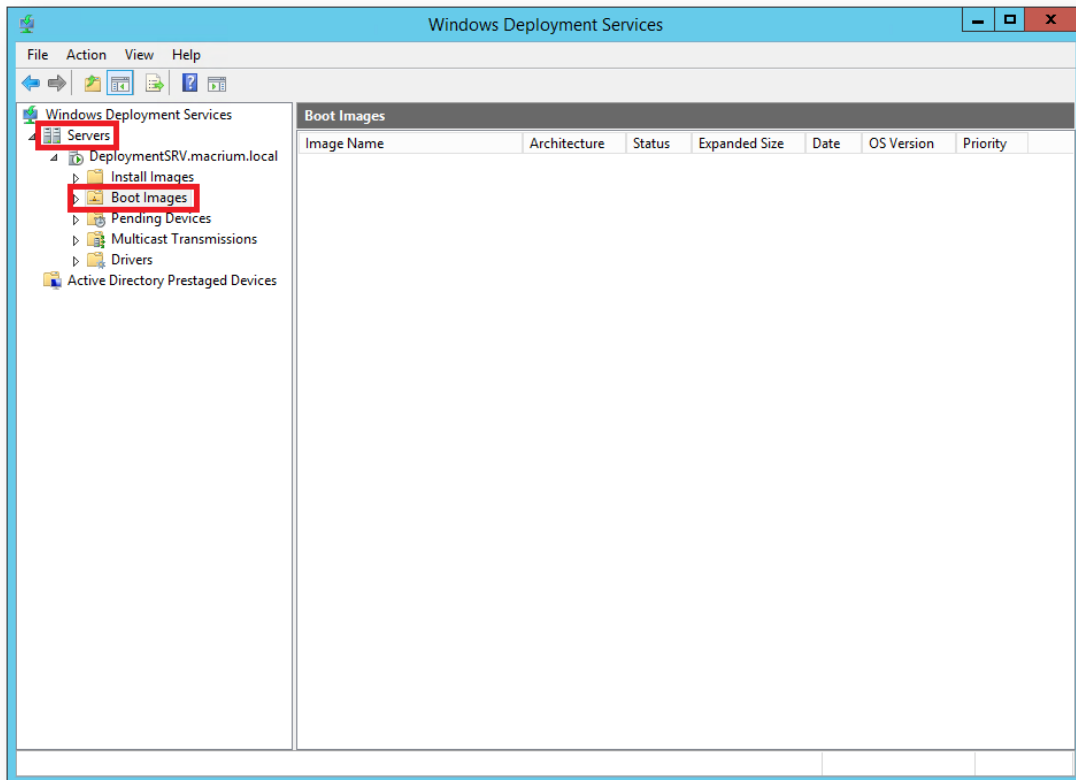
Before you begin: You will need to have set up a Windows Deployment Services Server and created a rescue media ISO image file. See [Creating rescue media](#).

1. **Mount** the **Rescue Media Image** that was created earlier.



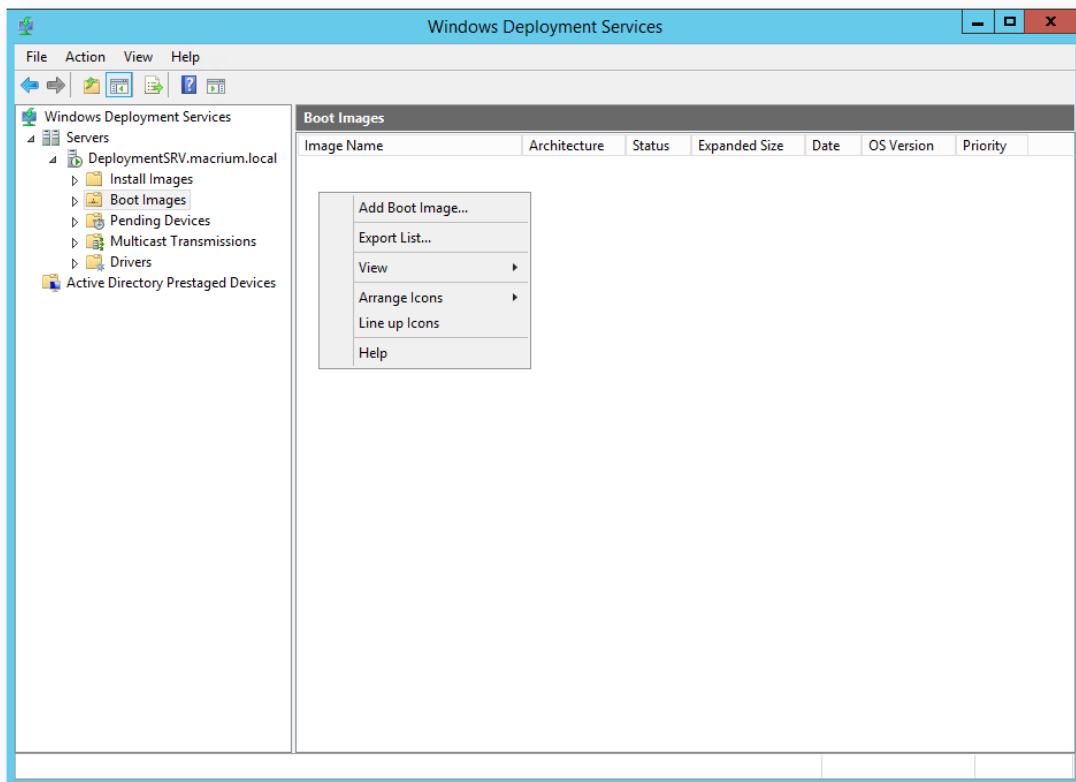
2. **Open** Windows Deployment Services and **select 'Servers > Boot Images'**

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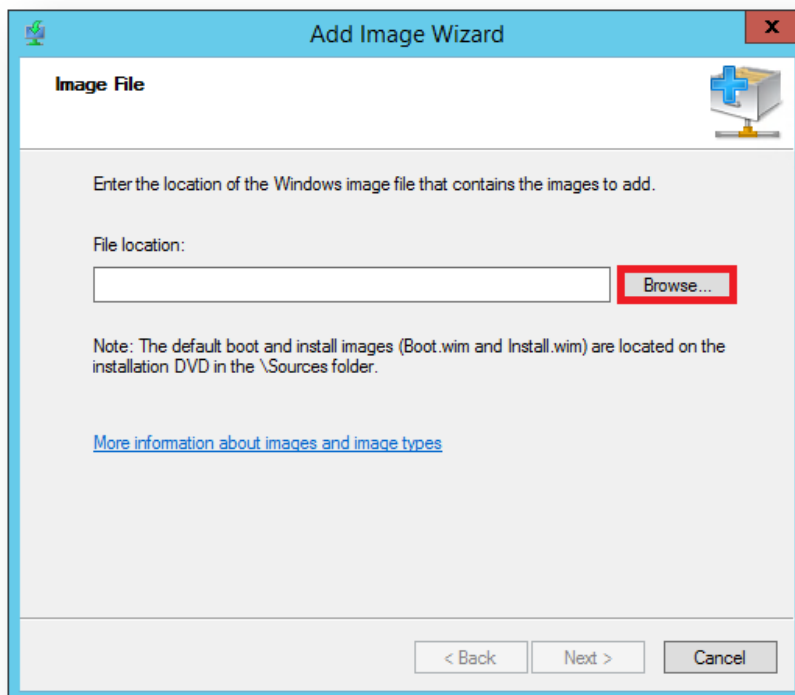


3. **Right click** the right pane and **click 'Add Boot Image...'**

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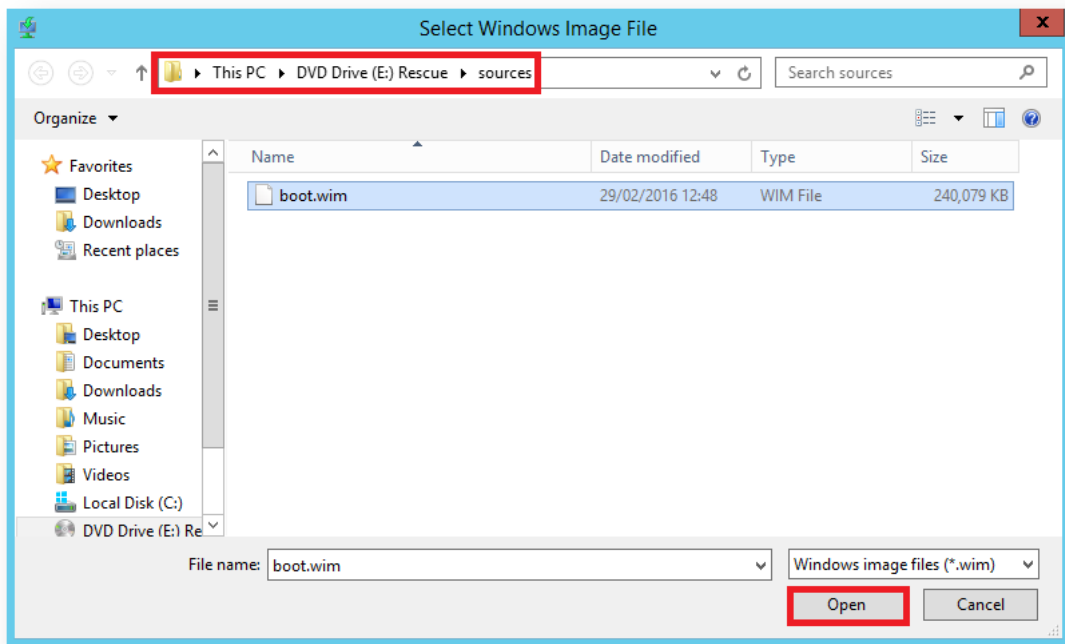


4. In the **Wizard** you can **browse** for a location of the **bootable WIM**.

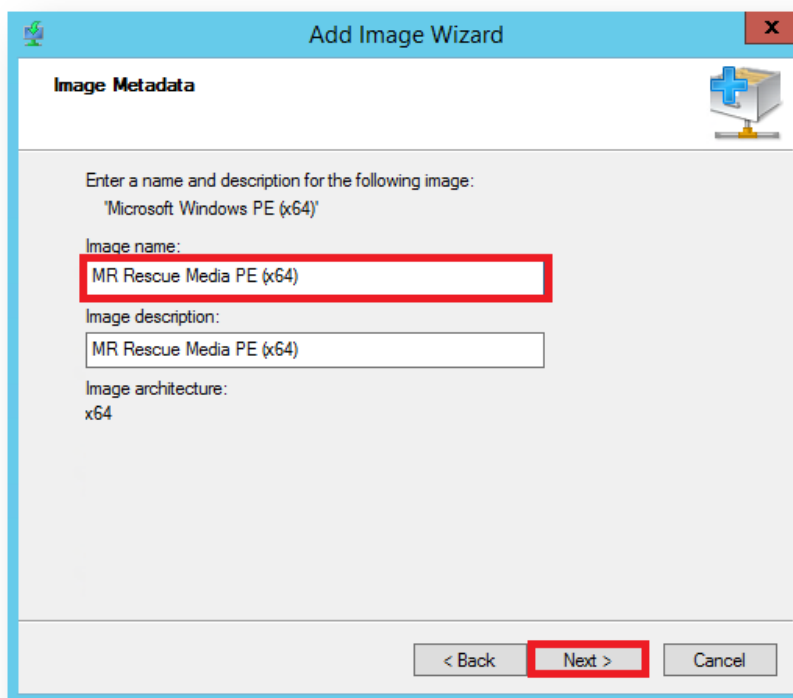


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5. Locate 'boot.wim' in the 'sources' folder of the mounted Rescue Media Image and click 'Open' then 'Next'.

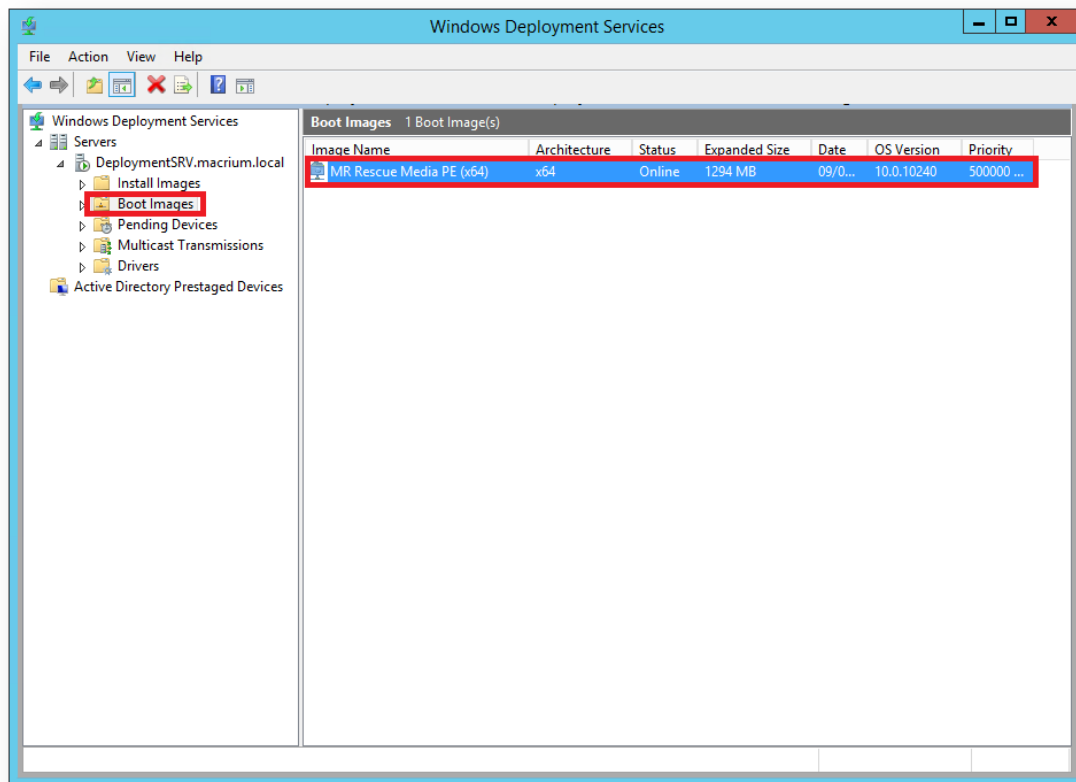


6. Name your boot image and click 'Next' twice.



7. Once finished you will see the bootable image in the 'Boot Images' section of Windows Deployment Services console.

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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** located in the Macrium Reflect v7.2 install folder.

This is usually '**C:\Program Files\Macrium\Reflect\consolidate.exe**'.

Users of earlier version of Macrium Reflect can download the consolidation tool from here:

Download:	http://updates.macrium.com/reflect/utilities/consolidate.exe
Version:	v7.1.2917
Date:	27th February 2018

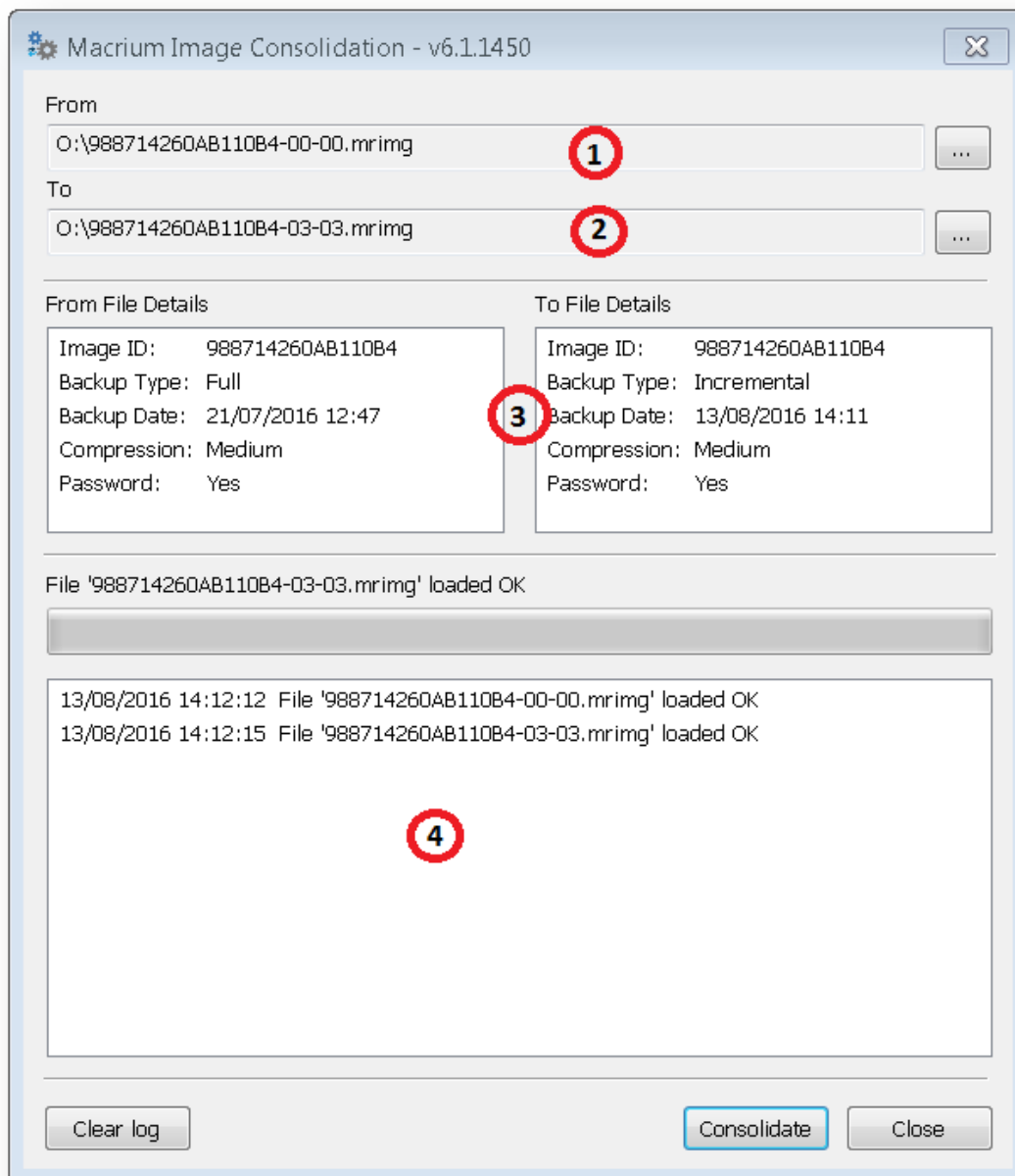
Using Macrium Image Consolidation

To Launch Macrium Image Consolidation **double click** '**consolidate.exe**' in Windows Explorer.



'**consolidate.exe**' is a standalone executable that does not require installing.

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Area	Description		
1	Enter the 'From' backup file for the consolidation process, or click '...' to browse. This is usually the Full backup, ending in '00-00.mring', but can be an Incremental file. Valid Macrium backup file types are: <table border="1"> <tr> <td>Image files:</td><td>.mring</td></tr> </table>	Image files:	.mring
Image files:	.mring		

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Area	Description				
	<table><tr><td>File and Folder backup files:</td><td>.mrbak</td></tr><tr><td>Exchange backup files:</td><td>.mrex</td></tr></table>	File and Folder backup files:	.mrbak	Exchange backup files:	.mrex
File and Folder backup files:	.mrbak				
Exchange backup files:	.mrex				
2.	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. Click 'Consolidate' to begin the consolidation process.				
3.	Basic information about the backup files.				
4.	The output Window. This is populated after clicking 'Consolidate' and contains detailed information about the consolidation process.				

 **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](#) 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
```

- The backup set cannot contain any Differential backups.

Error output:

```
The backup set contains Differential backups
```


Converting a Physical machine to Virtual Machine



Links have been added to each applicable step to explain the step in greater detail.

1. Using Macrium Reflect [take an image of your physical machine](#).
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](#) on to the Virtual Hard Disk attached to your VM.
6. Without exiting the Rescue Media, run the [ReDeploy](#) option.
7. Detach the ISO from your VM and reboot it.

Automatic System Restore

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

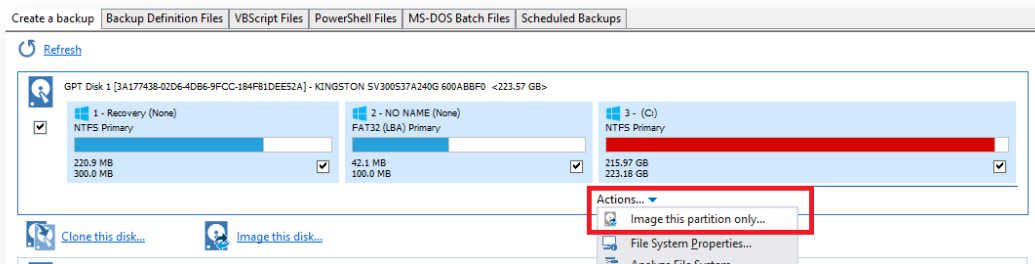
The first step is to add the Macrium boot menu. Take 'Other Tasks' > 'Add Recovery Boot Menu' in Macrium reflect and follow the instructions here: [Adding a Boot Menu option for system Image recovery](#).



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.

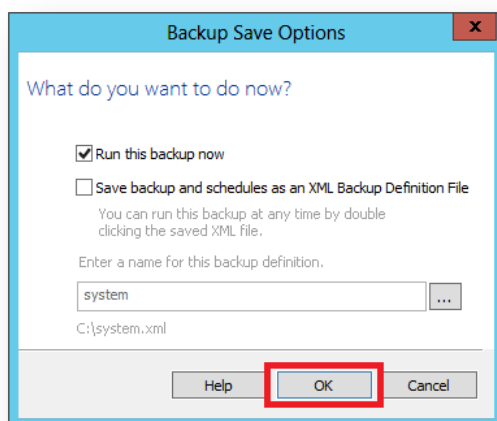
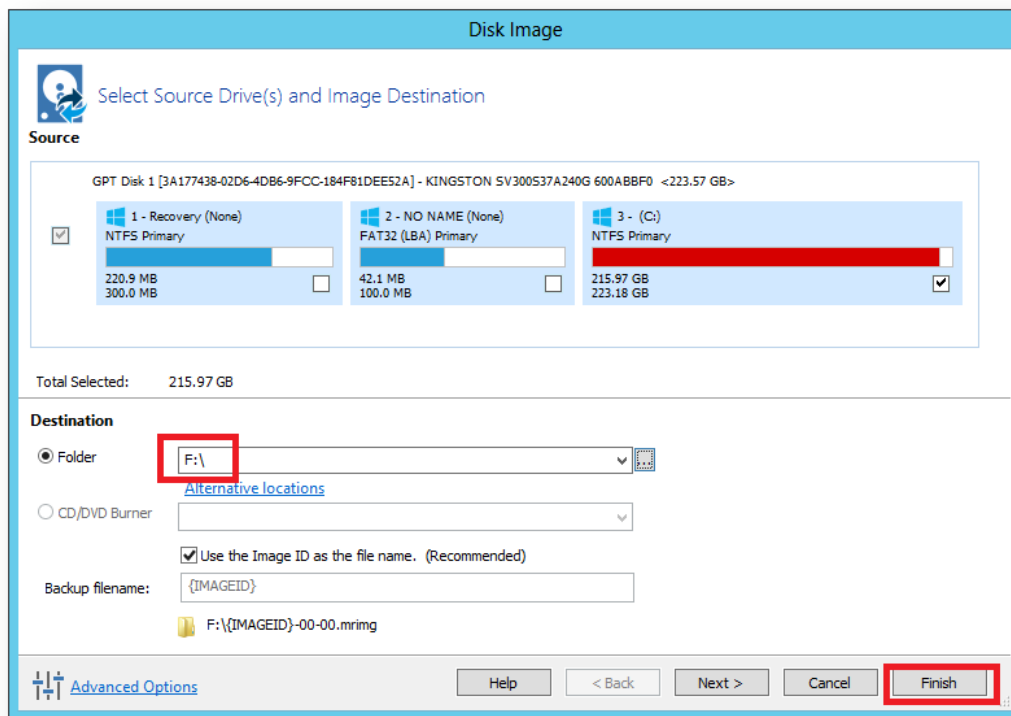
Create an image of drive C:

1. Start Macrium Reflect, **select 'Image this partition only...'** for drive C.

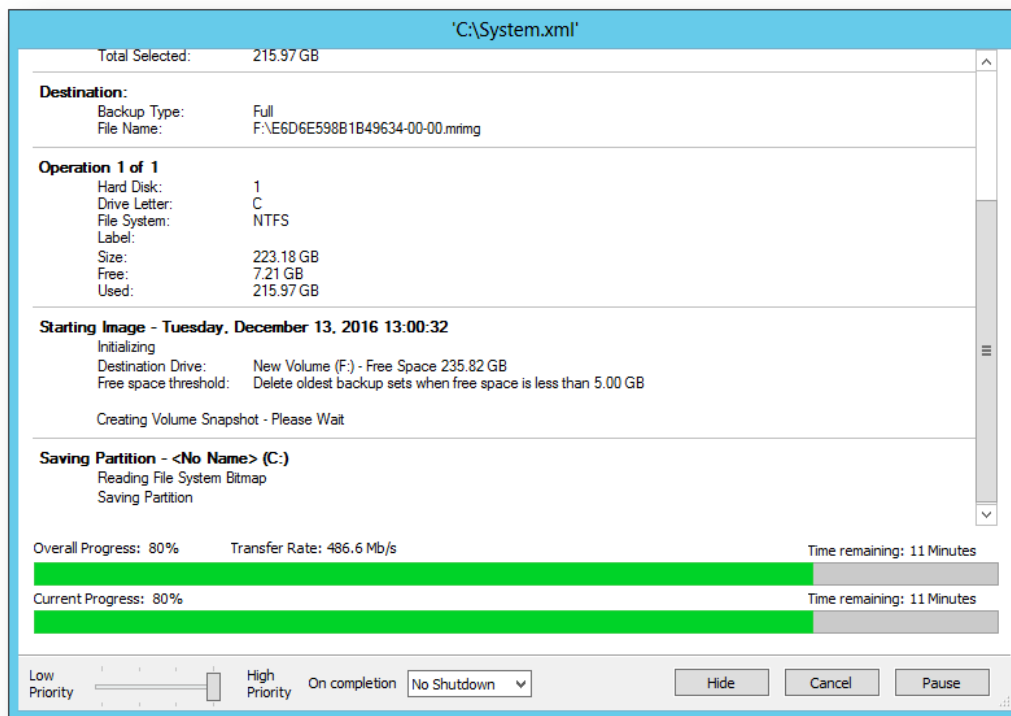


2. Choose a location that will be accessible when the recovery media boots, this could be a spare partition on an internal drive or an external USB disk or flash drive.
In this example we'll choose drive 'F:\', an internal partition.

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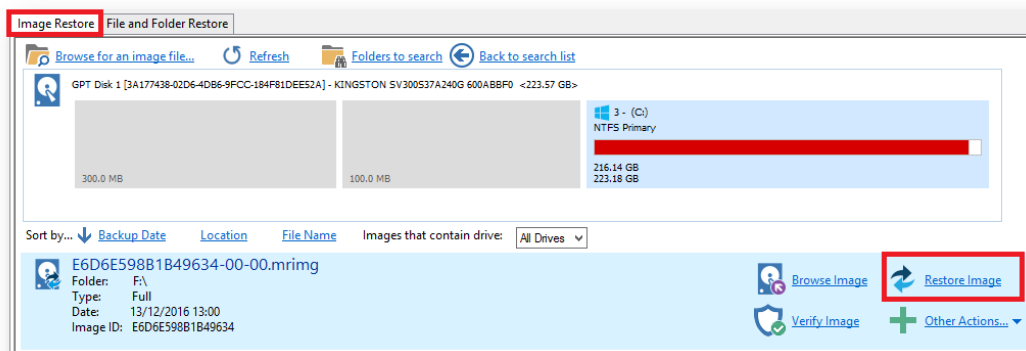
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Prepare the auto restore XML file

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.

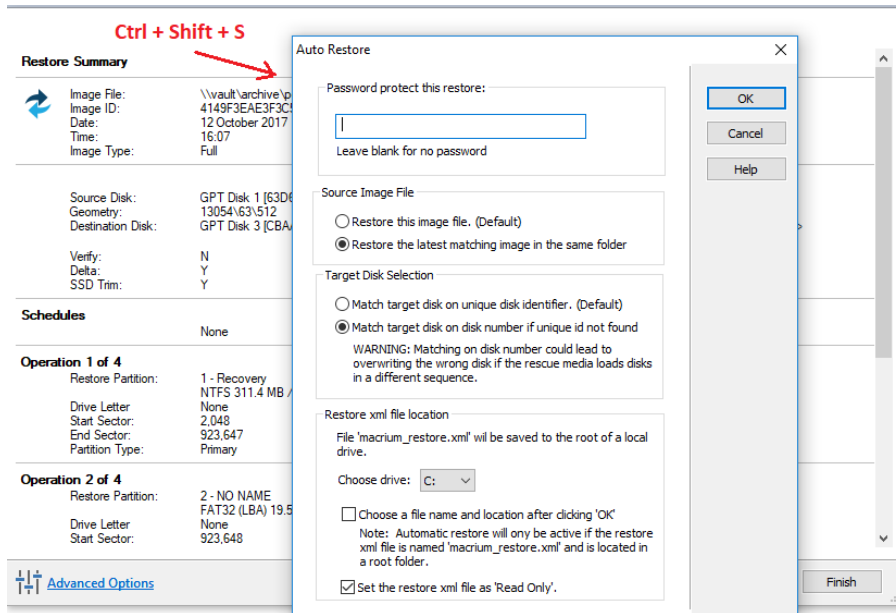
Start Macrium Reflect, click the 'Restore' tab, select the image created above and click the 'Restore Image' link



Launch the 'Auto Restore' Dialog.

To launch this dialog **press the 'Ctrl + Shift + S' together in the last page of the restore Wizard.**

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This dialog will prompt for options to automatically restore the selected image file at a later time using the Windows PE rescue media. When **'OK'** is clicked a restore definition xml file will be saved.

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Auto Restore

Password protect this restore:

Leave blank for no password

Source Image File

☒ Restore this image file. (Default)

☐ Restore the latest matching image in the same folder

Target Disk Selection

☒ Match target disk on unique disk identifier. (Default)

☐ Match target disk on disk number if unique id not found

Disk Number: 1 (Note: Disks start at no. 1)

WARNING: Matching on disk number could lead to overwriting the wrong disk if the rescue media loads disks in a different sequence.

Restore xml file location

File 'macrium_restore.xml' will be saved to the root of a local drive.

Choose drive: C:

☐ Choose a file name and location after clicking 'OK'

Note: Automatic restore will only be active if the restore xml file is named 'macrium_restore.xml' and is located in a root folder.

☐ Set the restore xml file as 'Read Only'.

OK

Cancel

Help

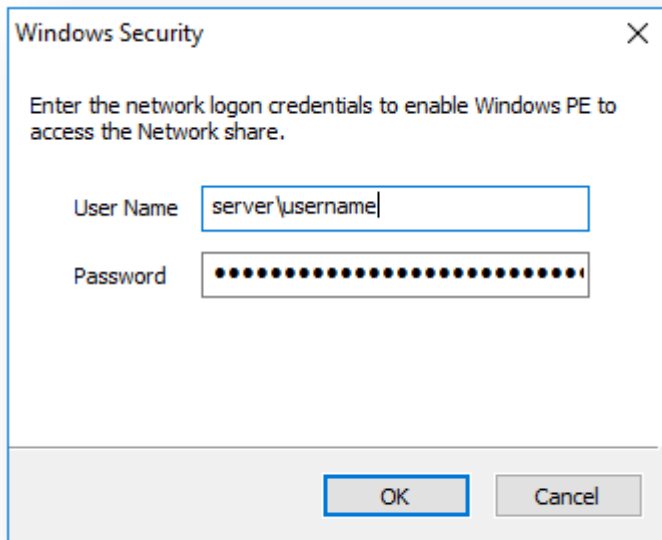
Option	Description
Password:	Enter a password to protect against accidental or unauthorised running of this restore.
Source Image File:	Restore this image file: This is the default operation. The image file selected will be used as the restore source. Restore the latest matching image in the same folder: The image folder will be searched for any image files that contain the partitions being restored. The latest backup date is chosen as the restore source.

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Option	Description
Target Disk Selection:	Match target disk on unique identifier: This is the default operation. The unique disk id is used to ensure that the correct disk is restored to. Match target disk on disk number if unique id is not found: This option will not fail the restore if the target unique disk id cannot be found. The default number is the current number of the target disk but you can choose an alternative disk number if it's known that the number of the disk is different in the restore environment. Use with caution as Windows PE can enumerate disks in a different sequence and cause the wrong disk to be restored to, however, this won't be an issue if your system has only one local disk.
Restore xml file location	Choose drive: Select from a list of local drives to save the restore definition file. The file will be saved in the root folder of the chosen drive and will be named 'macrium_restore.xml' Choose a file name and location: If selected, a file 'save As' dialog will be shown when the 'OK' button on this dialog is clicked. This enables saving the restore definition file to any file name and to any folder.  Note: For auto restore to operate the restore definition must be named 'macrium_restore.xml' and be located on a root folder on a local drive. Saving to a different name and/or location enables you to prepare several restore definitions for later use. Set the restore xml file as 'Read Only': At the end of an auto restore the restore definition is automatically deleted. Setting the definition as 'Read Only' prevents deletion and enables re-running of the same restore each time Windows PE starts.

If the image file is located on a network share then you'll be prompted to enter the authentication details:

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How auto restore works

Local drives are scanned (from A to Z) for a restore definition '**macrium_restore.xml**' file in each drive root folder. Macrium Reflect will use the first restore definition found. This can be any local drive, including USB flash drives or optical media.

The restore definition contains instructions to locate the image file to restore from and the target disk to restore to.

It is imperative that the correct image file is restored to the intended disk. To ensure that there are no nasty surprises after restoring, Macrium Reflect will use unique disk identifiers and sector offsets to match the source and target of the restore.

Locating the source image file folder

The default behaviour is to read the image file specified in the **<file_name>** xml node. However, It's possible that Windows PE has assigned different drive letters to local drives, in this case the following procedure is followed.

- All local drives are scanned for a 'Marker' file that is created when the restore definition is saved. This Marker file has the following file name format: '**Macrium_restore_{GUID}.txt**', where the GUID (Globally Unique Identifier) is retrieved from the '**<search node>**' in the restore xml.

```
<search guid="{0D6B46C4-A5ED-4578-A9C0-5539B0AB94A0}">Y</search>

<file_name>D:\backups\auto_restore\4E855CB463979BC9-01-01.mring</file_name>
```

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If the marker file isn't found in the **path** specified in the **<file_name>** xml node then all local drives are searched for the marker file in the same sub folder. If the marker file is found then that folder will be searched for the image file to restore.

- If no Marker file is found or is not specified in the xml then all local drive are scanned (from A to Z) to locate any images in the folder specified by the '**<file_name>**' xml node that contain images to restore.



Note: If the image file is located on a network path then no searching is required. Network paths are unambiguous and absolute.

Locating the correct source image file

The default behaviour is to read the specified image file in the folder in the '**<image_file>**' xml node. However, if '**Restore the latest matching image in the same folder**' is selected in the Auto Restore dialog then the following procedure is followed:

Source Image File

- ☐ Restore this image file. (Default)
- ☒ Restore the latest matching image in the same folder

xml attribute **find_recent="Y"** is added to the **<file_name>** xml node.

```
<file_name find_recent="Y">D:\backups\auto_restore\4E855CB463979BC9-01-01.mrimg</file_name>
```

All **matching** backup sets are loaded in the image file folder and the most recent backup date is selected and used for the restore. A **matching** backup set has the same disk and partitions specified in the restore definition file.

```
<restore_definition>
  <properties>
    <source_disk id="3A177438-02D6-4DB6-9FCC-184F81DEE52A">1</source_disk>
  </properties>

  <operation id="1">
    <type>copy</type>
    <copy>
      <source>
        <partition start_sector="2048" end_sector="616447">1</partition>
      </source>
    </copy>
  </operation>
</restore_definition>
```

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A matching image file contains the same disk identifier and partition start and end sectors as well as partition number.

e.g, In this case **Disk identifier 3A177438-02D6-4DB6-9FCC-184F81DEE52A** and **partition number 1** with **start sector 2048** and **end sector 616447**

Locating the restore target disk

The default behaviour is to select the target disk by matching the unique disk identifier specified in the **<target_disk>** xml node. However, if **'Match target disk number if unique id not found'** is selected in the Auto Restore dialog then the following procedure is followed:

Target Disk Selection

☐ Match target disk on unique disk identifier. (Default)

☒ Match target disk on disk number if unique id not found

WARNING: Matching on disk number could lead to overwriting the wrong disk if the rescue media loads disks in a different sequence.

xml attribute **number_fallback="Y"** is added to the **<target_disk>** xml node.

```
<target_disk id="3A177438-02D6-4DB6-9FCC-184F81DEE52A" number_fallback="Y">1</target_disk>
```

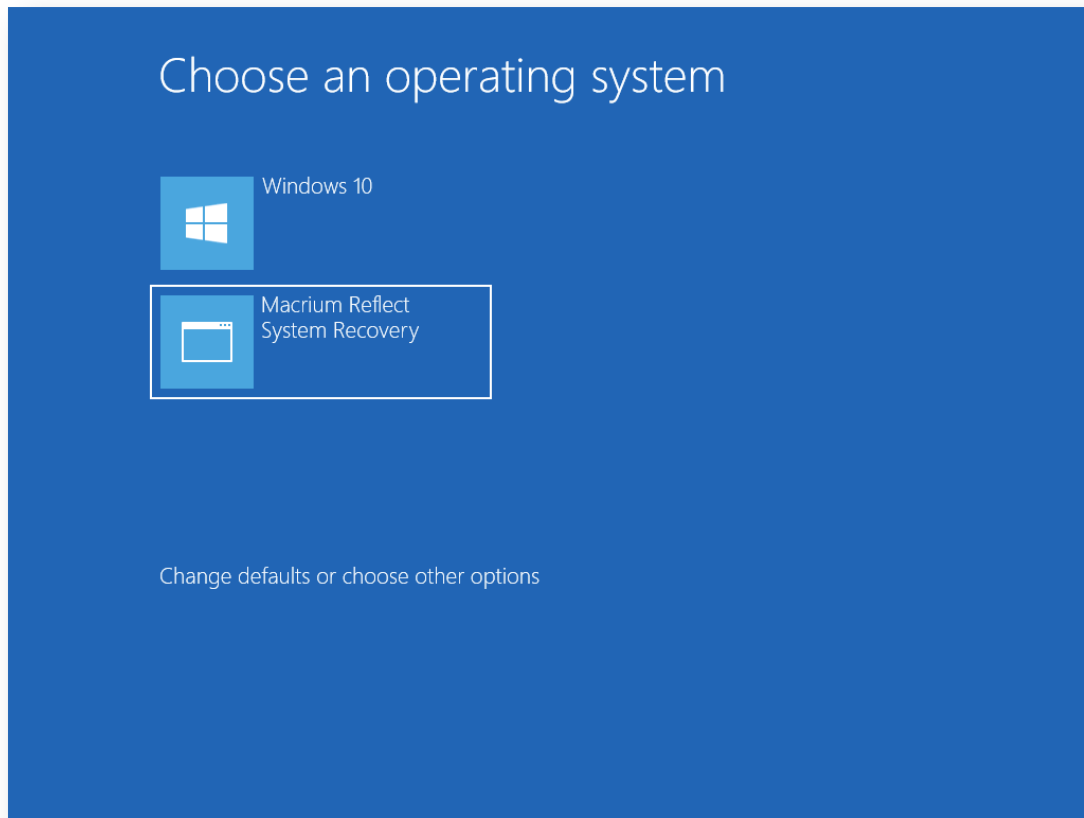
The restore target disk is matched on disk number if a disk cannot be matched using the unique identifier.



Please use this option with caution as Windows PE may load disks in a different sequence to regular Windows. This may cause the wrong disk to be restored to.

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: In Macrium Reflect v7, this functionality is only available if Changed Block tracker (CBT) is disabled. Take **'Other Tasks' > 'Edit Defaults' > 'Advanced' > 'Advanced Incrementals'** and **un-check 'Enable Changed Block Tracker'**

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](#)

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.

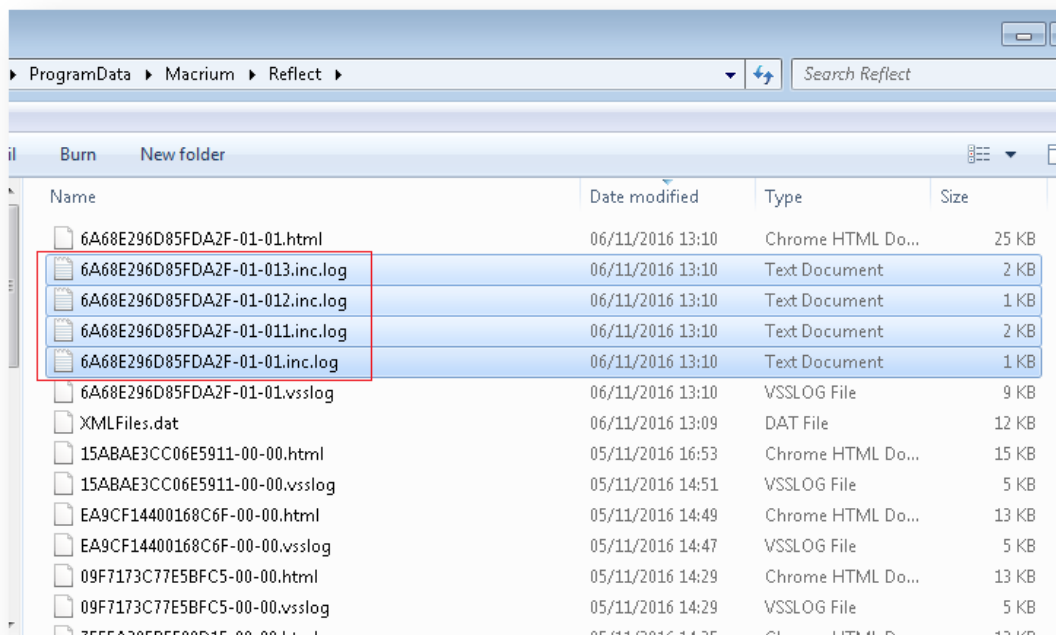


This may increase the time taken to backup and **should only be used for diagnosis.**

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.
SQLEXPRESS \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
```

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```
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
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.

Backup to the cloud with Azure File Shares



Azure Files offers fully managed file shares in the cloud that are accessible via the industry standard Server Message Block (SMB) protocol.

Share access is fully secure using end to end AES encryption utilised in the SMB 3.0 protocol and **can be used directly for Macrium Reflect backup and restore and Site Manager repositories.**



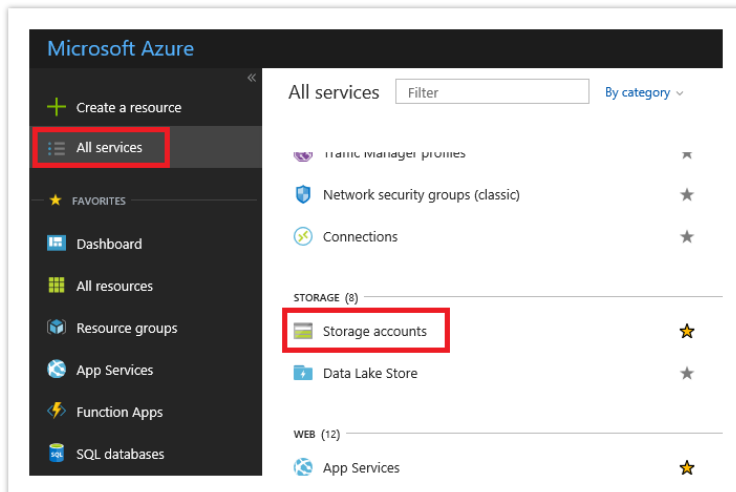
Note: SMB 3.0 is available with **Windows 8.1 or later and Windows Server 2012 or later** operating systems. **Earlier versions of Windows cannot mount Azure shares.**

Port 445 (TCP outbound) must be open to allow communication with Azure file shares. If you have problems **please check that your ISP isn't blocking this port.**

How to setup an Azure File Share

It's easy and takes just 5 minutes! If you don't currently have an Azure account then it's easy to set one up. There's a Free tier and currently a free credit for full access when you first enrol. Please see here for more information:
<https://azure.microsoft.com>

In the Azure Dashboard **select 'All Services'** then scroll to and **select 'Storage Accounts'** in the 'Storage' group:



Click the 'Add' button to reveal the share creation options.

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Home > Storage accounts > Create storage account

Storage accounts
paramountsoftwareukltd

+ Add Edit columns More

Filter by name...

NAME ↑↓

lab4956

Create storage account

The cost of your storage account depends on the usage and the options you choose below.
[Learn more](#)

* Name ⓘ
macriumofficebackups ✓
.core.windows.net

Deployment model ⓘ
Resource manager Classic

Account kind ⓘ
Storage (classic) ▾

* Location
West Europe ▾

Replication ⓘ
Read-access geo-redundant storage (RA-... ▾

Performance ⓘ
Standard Premium

* Subscription
Visual Studio Professional ▾

* Resource group
☒ Create new ☐ Use existing
backups ✓

☒ Pin to dashboard

Create Automation options

You must provide a **unique name**, across all Azure shares, for your share URL. I've used 'macriumofficebackups' for this example.

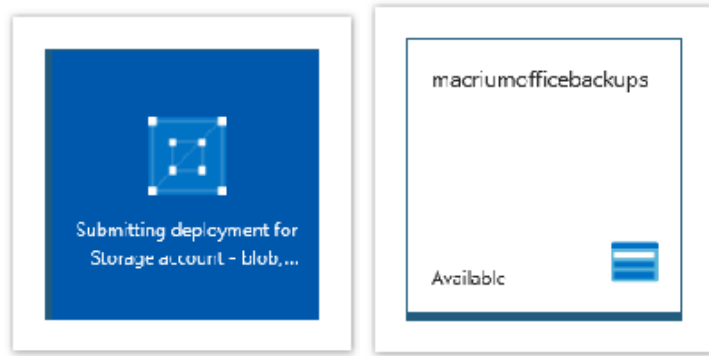
Select the 'Classic' deployment model to keep things simple.

Create a **new** and appropriately named '**Resource Group**'. I've used 'backups'.

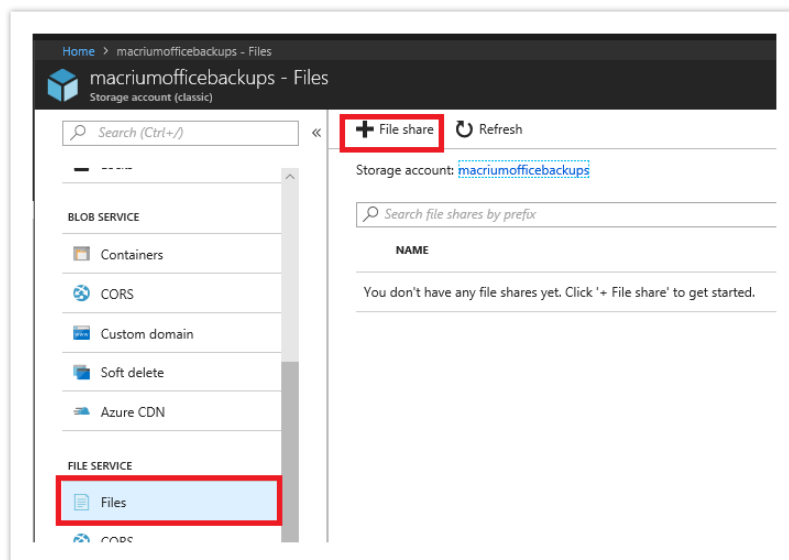
Select 'Pin to dashboard' for easy access.

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Finally, **click 'Create'** and you'll see the following activity widget on the dashboard followed by a new storage tile after a few seconds:



Click the new storage tile, select 'Files' in the storage account selections pane that opens, then click 'Add File Share'

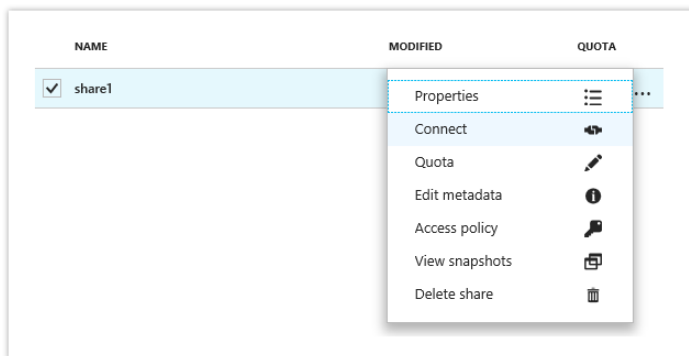


Give your share a **meaningful name** and **set the size**. The max is 5TB / 5120 GB:

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The screenshot shows a dialog box titled 'New file share'. At the top, there are two buttons: '+ File share' and 'Refresh'. Below the title bar, the text 'New file share' is displayed. There are two input fields: the first is labeled '* Name' and contains the text 'share1' with a green checkmark to its right; the second is labeled 'Quota' with an information icon and contains the text '5120' with a green checkmark to its right. Below the input fields, there are two buttons: 'OK' and 'Cancel'. The unit 'GB' is displayed to the right of the 'Quota' field.

Click the '...' menu on the new share and **select 'Connect'**



You'll be presented with several scripts and command line options to connect to your new share from anywhere in the world

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Connect

share1

Connecting from Windows

Drive letter

Z

To connect to this file share from a Windows computer, run these PowerShell commands:

```
$acctKey = ConvertTo-SecureString -
String "4FkHLDrmoaos2IYkwnLIR8Ls+6nVVATPlaMoCEWa1j6
GfvnHMDfAaVmFDA4IQkCztn4YPObl2Lc+lfXWZPjQw==" -
AsPlainText -Force
$credential = New-Object
```

Alternatively, run this command if the key doesn't begin with a forward slash:

```
net use Z:
\\macriumofficebackups.file.core.windows.net\share1 /u:AZURE\
macriumofficebackups
4FkHLDrmoaos2IYkwnLIR8Ls+6nVVATPlaMoCEWa1j6GfvnHMDf
AaVmFDA4IQkCztn4YPObl2Lc+lfXWZPjQw==
```

When connecting from a computer from outside Azure, remember to open outbound TCP port 445 in your local network. Some Internet service providers may block port 445. Check with your service provider for details.

[Learn more about Azure File Storage with Windows](#)

Connecting from Linux

To connect to this file share from a Linux computer, run this command:

```
sudo mount -t
cifs //macriumofficebackups.file.core.windows.net/share1
[mount point] -o
vers=3.0,username=macriumofficebackups,password=4FkHLDr
moaos2IYkwnLIR8Ls+6nVVATPlaMoCEWa1j6GfvnHMDfAaVmFD
A4IQkCztn4YPObl2Lc+lfXWZPjQw==,dir_mode=0777,file_mod
e=0777,sec=ntlmssp
```

The Linux SMB3 client doesn't support share level encryption yet, so mounting a file share in Linux only works from virtual machines running in the same Azure region as the file share.

[Learn more about Azure File Storage with Linux](#)

We just need to **select and copy the share path, username and password text from 'net use' command**:

Your details will obviously be different, but for this example:

Share path:	\\macriumofficebackups.file.core.windows.net\share1
User:	AZURE\macriumofficebackups
Password:	4FkHLDrmoaos2IYkwnLIR8Ls+6nVVATPlaMoCEWa1j6GfvnHMDfAaVmFDA4IQkCztn4YPObl2Lc+lfX

v9

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Creating the share is now complete and you have enough information to **connect to Azure for backup and restore from Macrium Reflect and for creating Site Manager repositories.**

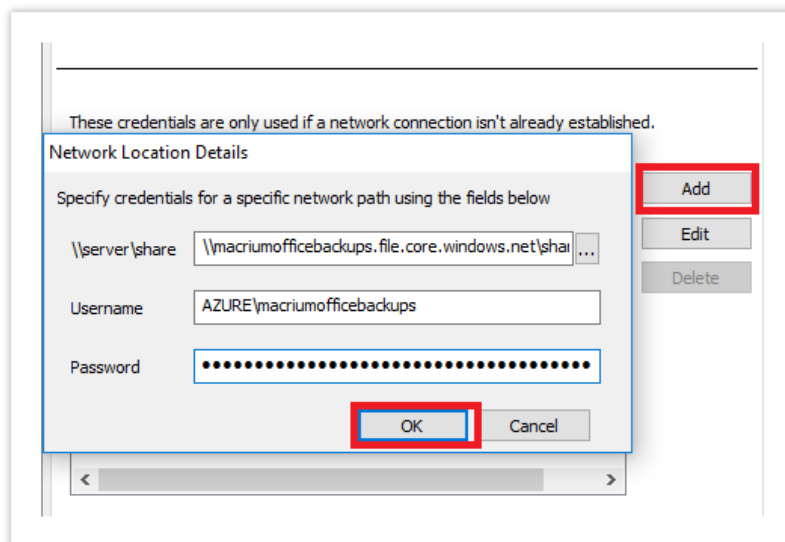
More details on other setup methods and options can be found here: <https://docs.microsoft.com/en-us/azure/storage/files/storage-how-to-create-file-share>

How to connect to the Azure Share in Macrium Reflect

Connecting is simple! Once you have the share details copied from the steps above you can begin backing up to the cloud in exactly the same way as you would any local network share.

Take the **'Other Tasks' > 'Edit Defaults' > 'Network'** menu option in Reflect.

Click **'Add'** and enter the **Azure share user name and password** then click **OK**.



You can now **backup directly to the cloud by entering the Azure share path** plus any sub folder if you want to:

In this example we're imaging directly to: \\macriumofficebackups.file.core.windows.net\share1\july_backups

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Disk Image

Select Source Drive(s) and Image Destination

Source

MBR Disk 1 [12A23975] - Samsung SSD 850 PRO 512GB EXM04B6Q <476.94 GB>

1 - System Reserved (H:)	2 - (C:)	3 - (None)
NTFS Active	NTFS Primary	NTFS Primary
95.1 MB	429.56 GB	382.6 MB
500.0 MB	475.99 GB	465.0 MB

Total Selected: 95.1 MB

Destination

☒ Folder \\macriumofficebackups.file.core.windows.net\share1\july_backups ...

[Alternative locations](#)

☐ CD/DVD Burner

☒ Use the Image ID as the file name. (Recommended)

Backup filename: {IMAGEID}

\\macriumvault.file.core.windows.net\reflect\{IMAGEID}-00-00.mring

[Advanced Options](#) Help < Back Next > Cancel Finish

Sucess!

Destination:

Backup Type: Full

File Name: \\macriumofficebackups.file.core.windows.net\share1\july_backups\7E7BD60A552280C9-00-00.mring

Attempting to connect to: '\\macriumofficebackups.file.core.windows.net\share1\july_backups'

Operation 1 of 1

Hard Disk: 1

Drive Letter: H

File System: NTFS

Label: System Reserved

Size: 500.0 MB

Free: 404.9 MB

Used: 95.1 MB

Starting Image - Tuesday, July 03, 2018 13:45:14

Initializing

Destination Drive: Free Space 5.00 TB

Free space threshold: Delete oldest backup sets when free space is less than 5.00 GB

Creating Volume Snapshot - Please Wait

Saving Partition - System Reserved (H:)

Reading File System Bitmap

Saving Partition

Saving Index

Overall Progress: 91% Transfer Rate: 55.9 Mb/s Time remaining: N/A

Current Progress: 91% Time remaining: 01 Seconds

Low Priority High Priority On completion: No Shutdown Hide Cancel



Note: When your login credentials are saved in the Reflect defaults you can even perform an **unattended system restore** and the **rescue media** will automatically connect to **Azure** for you.

How to add an auto restore xml file to the rescue media

If you've purchased a [Macrium Reflect Deployment Kit License](#) then to assist with deploying images it may be desirable to automate the restore of a 'Golden' Image by adding the Macrium Reflect auto restore xml file directly to the Windows Image (WIM) file used by the rescue media or by a PXE deployment server.

Create your auto restore XML using your 'Golden' image by **simulating a restore and pressing 'Ctrl' + 'Shift' + 'S'** on the **final restore wizard page** as describe below:

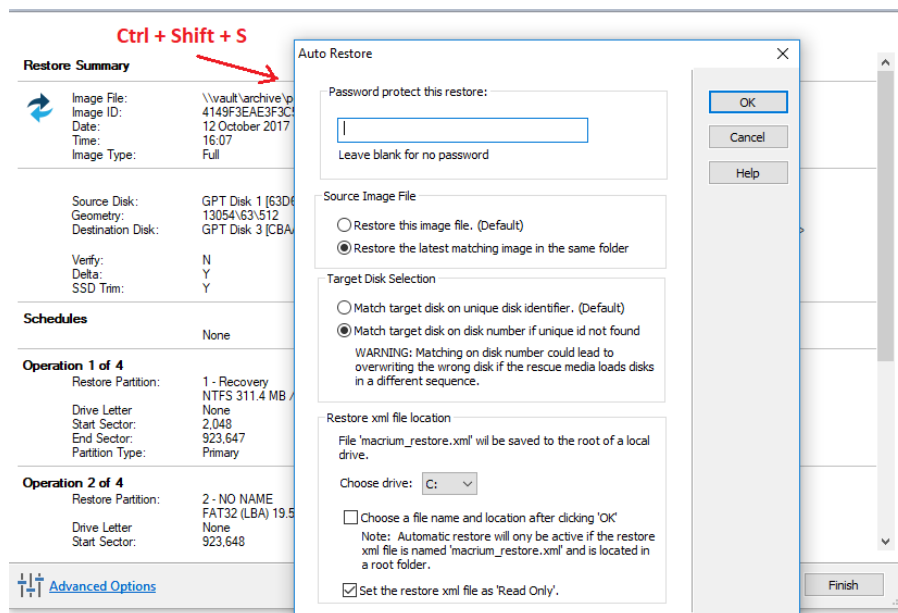


Note: The steps below to create the 'Golden' Image and 'macrium_restore.xml' can be run in Windows PE if required.

Ensure that the Image file is located on an accessible network share if you intend to deploy using PXE

Click here to show the Auto Restore dialog...

To launch this dialog **press the 'Ctrl + Shift + S'** together in the **last** page of the restore Wizard.



This dialog will prompt for options to automatically restore the selected image file at a later time using the Windows PE rescue media. When **'OK'** is clicked a restore definition xml file will be saved.

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Auto Restore

×

Password protect this restore:

Leave blank for no password

Source Image File

☒ Restore this image file. (Default)
 ☐ Restore the latest matching image in the same folder

Target Disk Selection

☒ Match target disk on unique disk identifier. (Default)
 ☐ Match target disk on disk number if unique id not found

Disk Number:

1

(Note: Disks start at no. 1)

WARNING: Matching on disk number could lead to overwriting the wrong disk if the rescue media loads disks in a different sequence.

Restore xml file location

File 'macrium_restore.xml' will be saved to the root of a local drive.

Choose drive:

C:

☐ Choose a file name and location after clicking 'OK'

Note: Automatic restore will only be active if the restore xml file is named 'macrium_restore.xml' and is located in a root folder.

☐ Set the restore xml file as 'Read Only'.

OK

Cancel

Help

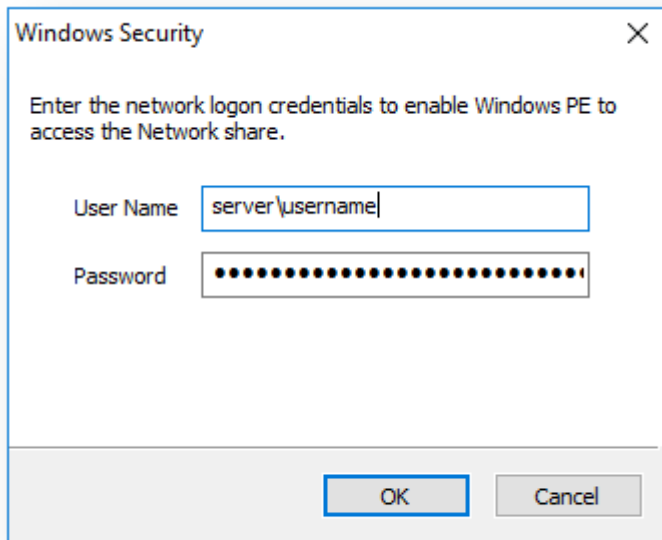
Option	Description
Password:	Enter a password to protect against accidental or unauthorised running of this restore.
Source Image File:	Restore this image file: This is the default operation. The image file selected will be used as the restore source. Restore the latest matching image in the same folder: The image folder will be searched for any image files that contain the partitions being restored. The latest backup date is chosen as the restore source.

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Option	Description
Target Disk Selection:	Match target disk on unique identifier: This is the default operation. The unique disk id is used to ensure that the correct disk is restored to. Match target disk on disk number if unique id is not found: This option will not fail the restore if the target unique disk id cannot be found. The default number is the current number of the target disk but you can choose an alternative disk number if it's known that the number of the disk is different in the restore environment. Use with caution as Windows PE can enumerate disks in a different sequence and cause the wrong disk to be restored to, however, this won't be an issue if your system has only one local disk.
Restore xml file location	Choose drive: Select from a list of local drives to save the restore definition file. The file will be saved in the root folder of the chosen drive and will be named 'macrium_restore.xml' Choose a file name and location: If selected, a file 'save As' dialog will be shown when the 'OK' button on this dialog is clicked. This enables saving the restore definition file to any file name and to any folder.  Note: For auto restore to operate the restore definition must be named 'macrium_restore.xml' and be located on a root folder on a local drive. Saving to a different name and/or location enables you to prepare several restore definitions for later use. Set the restore xml file as 'Read Only': At the end of an auto restore the restore definition is automatically deleted. Setting the definition as 'Read Only' prevents deletion and enables re-running of the same restore each time Windows PE starts.

If the image file is located on a network share then you'll be prompted to enter the authentication details:

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How auto restore works

Local drives are scanned (from A to Z) for a restore definition '**macrium_restore.xml**' file in each drive root folder. Macrium Reflect will use the first restore definition found. This can be any local drive, including USB flash drives or optical media.

The restore definition contains instructions to locate the image file to restore from and the target disk to restore to.

It is imperative that the correct image file is restored to the intended disk. To ensure that there are no nasty surprises after restoring, Macrium Reflect will use unique disk identifiers and sector offsets to match the source and target of the restore.

Locating the source image file folder

The default behaviour is to read the image file specified in the **<file_name>** xml node. However, It's possible that Windows PE has assigned different drive letters to local drives, in this case the following procedure is followed.

- All local drives are scanned for a 'Marker' file that is created when the restore definition is saved. This Marker file has the following file name format: '**Macrium_restore_{GUID}.txt**', where the GUID (Globally Unique Identifier) is retrieved from the '**<search node>**' in the restore xml.

```
<search guid="{0D6B46C4-A5ED-4578-A9C0-5539B0AB94A0}">Y</search>
<file_name>D:\backups\auto_restore\4E855CB463979BC9-01-01.mring</file_name>
```

If the marker file isn't found in the **path** specified in the **<file_name>** xml node then all local drives are searched for the marker file in the same sub folder. If the marker file is found then that folder will be searched for the image file to restore.

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- If no Marker file is found or is not specified in the xml then all local drive are scanned (from A to Z) to locate any images in the folder specified by the '<file_name>' xml node that contain images to restore.



Note: If the image file is located on a network path then no searching is required. Network paths are unambiguous and absolute.

Locating the correct source image file

The default behaviour is to read the specified image file in the folder in the '<image_file>' xml node. However, if '**Restore the latest matching image in the same folder**' is selected in the Auto Restore dialog then the following procedure is followed:

Source Image File

- ☐ Restore this image file. (Default)
- ☒ Restore the latest matching image in the same folder

xml attribute **find_recent="Y"** is added to the **<file_name>** xml node.

```
<file_name find_recent="Y">D:\backups\auto_restore\4E855CB463979BC9-01-01.mrimg</file_name>
```

All **matching** backup sets are loaded in the image file folder and the most recent backup date is selected and used for the restore. A **matching** backup set has the same disk and partitions specified in the restore definition file.

```
<restore_definition>
  <properties>
    <source_disk id="3A177438-02D6-4DB6-9FCC-184F81DEE52A">1</source_disk>
  </properties>
  <operation id="1">
    <type>copy</type>
    <copy>
      <source>
        <partition start_sector="2048" end_sector="616447">1</partition>
      </source>
    </copy>
  </operation>
</restore_definition>
```

A matching image file contains the same disk identifier and partition start and end sectors as well as partition number.

e.g, In this case **Disk identifier 3A177438-02D6-4DB6-9FCC-184F81DEE52A** and **partition number 1** with **start sector 2048** and **end sector 616447**

Locating the restore target disk

The default behaviour is to select the target disk by matching the unique disk identifier specified in the **<target_disk>** xml node. However, if **'Match target disk number if unique id not found'** is selected in the Auto Restore dialog then the following procedure is followed:

Target Disk Selection

- ☐ Match target disk on unique disk identifier. (Default)
- ☒ Match target disk on disk number if unique id not found
- WARNING: Matching on disk number could lead to overwriting the wrong disk if the rescue media loads disks in a different sequence.

xml attribute **number_fallback="Y"** is added to the **<target_disk>** xml node.

```
<target_disk id="3A177438-02D6-4DB6-9FCC-184F81DEE52A" number_fallback="Y">1</target_disk>
```

The restore target disk is matched on disk number if a disk cannot be matched using the unique identifier.



Please use this option with caution as Windows PE may load disks in a different sequence to regular Windows. This may cause the wrong disk to be restored to.

Next we need to mount the Windows Image (WIM) file and copy the 'macrium_restore.xml' file to the root of the image.

1. From within Windows (not PE), **create an empty folder** anywhere on your C: drive that will be used to mount the WIM file. In this example we'll use 'C:\Boot\Mount'.
2. Open a command prompt with elevated privileges and **type the following command**:

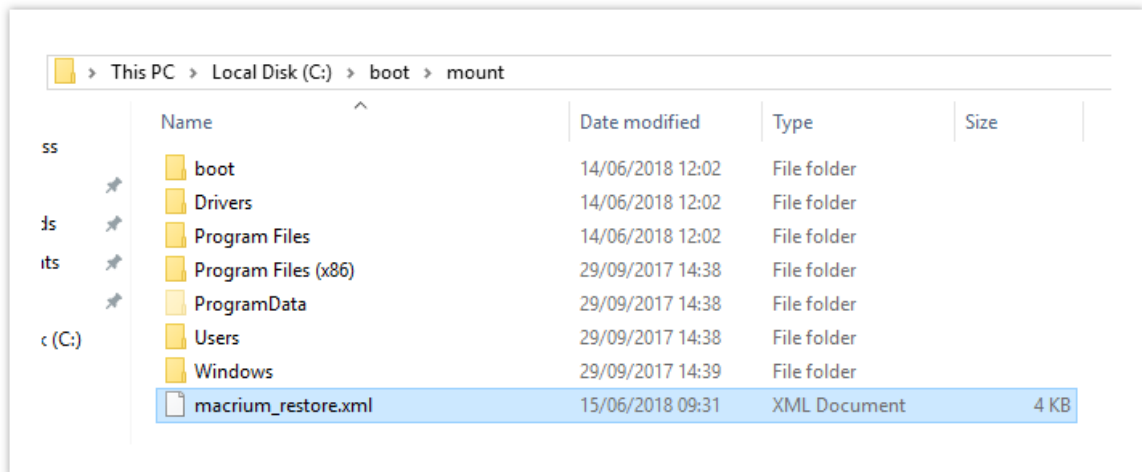
```
DISM /Mount-image /imagefile:C:\boot\macrium\WA10KFiles\media\sources\boot.wim /index:1 /MountDir:"c:\boot\mount"
```



Note: The location of the WIM in this case is the default location for the Windows PE 10 WIM file. Please update as necessary in your own command.

3. **Open the mounted folder** in Windows Explorer and **copy the 'macrium_restore.xml' file** to the root.

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Note: After copying the file close Windows Explorer so that there are no locks on the open folder.

4. Type the following commands in the command prompt:

```
Dism /Unmount-image /MountDir:"c:\boot\mount" /Commit
Dism /Cleanup-wim
```

5. Once complete the WIM file can be copied to a deployment server or USB stick and used to initiate an automatic restore.