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1 Introduction to R-Studio for Mac

R-Studio is a family of powerful and cost-effective undelete and data recovery software. Empowered by new unique data recovery technologies, it is the most comprehensive data recovery solution for recovering files from FAT12/16/32, NTFS, exFAT, NTFS5 (created or updated by Windows NT/2000/XP/Vista/2008/7/8/8.1/10), ReFS (Resilient File System, a new local file system Microsoft has introduced in its Windows 2012 Server. ), HFS/HFS+ and APFS (Macintosh), Little and Big Endian variants of UFS1/UFS2 (FreeBSD/OpenBSD/NetBSD/Solaris), Ext2/3/4FS (Linux), and exFAT partitions. It functions on local and network disks, even if such partitions are formatted, damaged or deleted. Flexible parameter settings give you absolute control over the data recovery.

R-Studio Features
System Requirements
Contact Information and Technical Support
Data Recovery Using R-Studio
Basic File Recovery
Advanced Data Recovery
Mass File Recovery
Volume Sets and RAIDs
Data Recovery over Network
Text/Hexadecimal Editor
Technical Information and Troubleshooting
Working with the Third-Party Hardware
R-Studio Emergency
R-Studio Agent Emergency

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macOS: HFS, HFS+, HFSX, APFS, FAT/exFAT;  
Windows: FAT12, FAT16, FAT32, exFAT, NTFS, NTFS5, ReFS/ReFS2+ file (Resilient File System);  
Linux and UNIX: Ext2/3/4FS (created by Linux or other OS), and UFS1, UFS2, UFS BigEndian (used by the FreeBSD, OpenBSD, and NetBSD operating systems);  
CD/DVD/Images: ISO9660;  
Magnetic tape devices: UStar/Tar/CPIO/Pax (R-Studio Technician).  

Please note, that when a file is being deleted on the HFS, HFS+, HFSX file systems, the computer completely removes all system information on it, and there is no way to recover the deleted file except by using the Extra Search for Known File Types option. Nevertheless, R-Studio is able to read existing files from HFS, HFS+, and HFSX disks.

- Full access to the system disk even when the Apple’s System Integrity Protection is enabled.
- Support for known file types. R-Studio searches for files with known typical features of their structures allowing the user to search for files on devices with unknown files systems, including an HD, CD, DVD, floppy disk, Compact Flash Card, USB drive, ZIP drive, Memory Sticks, and other removable media.
- Scan process visualization. While scanning an object, R-Studio graphically shows items that have been found, including files of known types, FAT and NTFS MFT records, boot records, etc.
- Mass file recovery support.
- Support for estimation of chances for successful recovery.
- Support for file recovery lists - lists of files that can be exported from R-Studio, manually edited, and then loaded back. Files from such lists will be automatically marked for recovery.
- APM, Basic and GPT support. R-Studio supports all three partition schemes used to define the low-level organization of data on disks formatted for use with Macintosh computers.
- Dynamic disk support.
- Software RAID, volume set, and stripe set support. Support for RAID 6, RAID 5, and RAID 4 layouts. Support for custom RAID layouts. Parameters like block size and order, offsets, and even the number of stripe blocks can be explicitly specified. Custom RAID configurations can be saved.
- Support for Windows Storage Spaces, created by Windows 8/8.1 and Windows 10/Threshold 2/Anniversary/Fall Creators updates.
- Support for software Apple software RAIDs  
- Support for Apple CoreStorage/File Vault/Fusion Drive Volumes  
- Support for Linux mdadm Volumes  
- Support for Linux LVM/LVM2  
- RAID consistency check (check for valid data parity values).
- Hardware RAID, volume set, and stripe set support.
- Automatic RAID parameter recognition.
- Reverse RAIDs: A technique that decomposes real disk objects into virtual RAIDs. Then those components of reverse RAID scan be processed like real objects. They can be viewed, edited, imaged, copied to physical drives, etc. This technique also can re-construct data on the real parents of a virtual RAID. For example, it becomes possible to re-construct data on a missing disk.
- Virtual objects can be connected to the host system as read-only virtual drives. They can remain connected even then R-Studio has been closed.
- Creates image files for an entire hard drive, logical disk, or its part. Such image files can be processed like regular disks. Images can be either simple exact object copies (Plain images) compatible with the previous versions of R-Studio, or compressed images that can be compressed, split into several parts, and
password-protected. Such images are fully compatible with the images created by R-Drive Image, but incompatible with the previous versions of R-Studio. Images can be connected to the operating system as devices which makes their content accessible to any program including any other data recovery software.

- Advanced object copy. In addition to byte to byte copy of any object visible in the Drives panel, smart copy of partitions and hard drives is available.
- Recovers files on damaged or deleted partitions.
- Recovers compressed files (NTFS, NTFS5).
- Recovers encrypted files (NTFS5).
- Recovers alternative data streams (NTFS, NTFS5).
- Support for NTFS deduplication.
- Support for file system journal on the HFS+ and Ext3/4fs file systems.
- Support for soft updates journal on the UFS file system.
- Support for extended attributes on the HFS+, Ext3/4fs, and UFS file systems.
- Support for compressed files on the HFS+ file system.
- Extended file information (R-Studio Technician)
- Recognizes localized names.
- Recovered files can be saved on any (including network) disks visible by the host operating system.
- A hexadecimal disk and file editor supporting NTFS file non-resident attribute editing.
- Patterns (or templates) in the hexadecimal editor allowing for parsing the data according to specific data structure. Such patterns may be custom-created.
- File previewer to estimate recovery chances. It shows picture tiles and first frames of video files as icons, and supports a large number of video/audio/graphic/document file formats. These files can be played back without their respective applications installed.
- Enhanced remote host scanning procedure. In the new R-Studio network versions, data are analyzed on the remote host rather than on the home host, thereby the speed of recovery procedure greatly increases.
- Recovered files may be saved on a disk on a connected remote computer rather than be transferred over network to the local one. Saving recovered files on a remote computer may be useful when the remote computer has a healthy disk because you do not have to transfer files over network. It may be an external USB hard drive, for example.
- Forensic mode. (For the Technician version only).
- Support for third-party hardware. (For the Technician version only).
- R-Studio Emergency*. The R-Studio Emergency version starts from a floppy or compact disk when it is necessary to recover data on a computer, on which Windows cannot start up because its system files are corrupted or deleted.

*The R-Studio Emergency is a part of the R-Studio software package. When you buy an R-Studio single license you may run the R-Studio Emergency or/and install the R-Studio Windows version on one PC only and you may not transfer the licensed software to another PC.

R-Studio recovers files:
- That have been removed without Trash, or when Trash has been emptied;
- Removed by virus attack or power failure;
- After the partition with the files was reformatted, even for different file system;
• When the partition structure on a hard drive was changed or damaged. In this case, **R-Studio** can scan the drive trying to find previously existed partitions and recover files from found partitions.
• From disks with bad sectors. In this case, **R-Studio** can first copy the entire disk or its part into an image file and then process such image file.

**R-Studio** can create image files for an entire hard drive, logical disk, or its part. Such image files can be processed like regular disks. Images are very useful if there is a risk of total data loss due to hardware malfunction. If bad blocks are constantly appearing on a hard drive, the only way to save the data is to immediately create an image of that drive. All data search, scan and recovery can be done from this image.

To learn more about the **IntelligentScan** technology, go to the **IntelligentScan** topic.

### 1.2 System Requirements

- A Mac computer with Intel, PowerPC G5 or PowerPC G4 processors.
- At least 256 MB of RAM, a mouse, and enough disk space for recovered files, image files, etc.
- macOS Mojave (10.14), macOS High Sierra (10.13), macOS Sierra (10.12), OS X El Capitan (10.11), OS X Yosemite (10.10), Mavericks (10.9), OS X Mountain Lion (10.8), Mac OS X Lion (10.7), Mac OS X Snow Leopard (10.6).
- The administrative privileges are required to install and run R-Studio for Mac.
- A network connection for data recovering over network.

### 1.3 Contact Information and Technical Support

To obtain the latest version of **R-Studio**, go to:

- Product Site: [http://www.r-tt.com](http://www.r-tt.com)
- Sales Department: sales@r-tt.com

*Many specific data recovery cases are discussed in the R-TT’s **Data Recovery Guide**.*

**R-Studio** Technical Support Team is available 24 hours a day, seven days a week, and has an average response time less than 4 hours.

- Tech. Support: support@r-tt.com
- Send your support request to: [http://www.r-tt.com/SupportRequest.shtml](http://www.r-tt.com/SupportRequest.shtml)


R-tt Forum: [http://forum.r-tt.com](http://forum.r-tt.com)
1.4 R-Studio Main Panel

When R-Studio starts, its main panel appears on the desktop.

---

**Drives** panel:
You can select an object by clicking on it.
Properties tab:

This tab shows the properties of an object selected on the **Drives** panel.

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive Type</td>
<td>Physical Drive Disk</td>
</tr>
<tr>
<td>Name</td>
<td>APPLE Mac Pro 1,1 (2011) 500GB SSD</td>
</tr>
<tr>
<td>Offload</td>
<td>2019-08-04 17:43</td>
</tr>
<tr>
<td>R-Studio Driver</td>
<td>OS X</td>
</tr>
<tr>
<td>Size</td>
<td>997.6 GB</td>
</tr>
<tr>
<td>Sector Size</td>
<td>512 Bytes</td>
</tr>
<tr>
<td>S.M.A.R.T.</td>
<td>0</td>
</tr>
<tr>
<td>IO Mode</td>
<td>Default</td>
</tr>
<tr>
<td>Buffer Allocation</td>
<td>4096</td>
</tr>
<tr>
<td>Device Identification</td>
<td>APPLE</td>
</tr>
<tr>
<td>Product</td>
<td>HDD HTB1500A00662</td>
</tr>
<tr>
<td>Firmware</td>
<td>A5648562</td>
</tr>
<tr>
<td>Serial Number</td>
<td>0002A95E1B870D0</td>
</tr>
<tr>
<td>S.M.A.R.T. Properties</td>
<td>S.M.A.R.T.</td>
</tr>
<tr>
<td>Size</td>
<td>997.6 GB</td>
</tr>
<tr>
<td>Logical Sector Size</td>
<td>512 Bytes</td>
</tr>
<tr>
<td>Device Type</td>
<td>2.5&quot; 500GB SSD</td>
</tr>
<tr>
<td>Hardware</td>
<td>A5648562</td>
</tr>
<tr>
<td>Standard</td>
<td>ATAPI</td>
</tr>
<tr>
<td>Feature</td>
<td>S.M.A.R.T., APF, LBAAIL, NOID</td>
</tr>
<tr>
<td>Bus Type</td>
<td>Serial ATA</td>
</tr>
</tbody>
</table>

Depending on the selected object, information on this Properties tab may vary. The Properties tab names and values are described in detail on the [Properties tab](#) topic.

**Log panel**

**S.M.A.R.T. Info for a Hard Drive**

When a hard drive is selected on the **R-Studio** main panel, an additional **S.M.A.R.T.** tab will appear. You may view the hardware conditions of the drive.

**S.M.A.R.T.** (Self-Monitoring, Analysis and Reporting Technology) is a technology widely-used in hard drives and solid-state devices that monitors their reliability conditions to predict possible hardware failures.
S.M.A.R.T. panel

R-Studio for Mac Manual

S.M.A.R.T. Info for a Hard Drive

R-Studio shows hard drive S.M.A.R.T. states using their icons.

- **Normal**: This state indicates that the hard drive is in good conditions.

- **Warning**: This state indicates that some small problems with the disk are possible in the future, you may work with it but with cautions and regular check of these parameters. **Disk imaging** is strongly recommended.

- **Critical**: This state indicates that the hard drive conditions are critical and chances of hardware failure are great. The best recommendation for this case is to stop working with the disk and bring it to professional data recovery specialists. You may though continue to work with the disk at your own risk, but **disk imaging** is very strongly recommended.

When a hard drive is selected on the R-Studio main panel, an additional S.M.A.R.T. tab will appear. You may view the detailed S.M.A.R.T. data of the drive.
S.M.A.R.T. (Self-Monitoring, Analysis and Reporting Technology) is a technology widely-used in hard drives and solid-state devices that monitors their reliability conditions to predict possible hardware failures.

**Changing the program language**
You may select the language of **R-Studio** main panel. To do so, select an available language on **Change Language** on the **Help** menu.

**Panel view options**
You may set which panels and bars to enable/disable.

<table>
<thead>
<tr>
<th>Panel view options</th>
<th>To enable/disable:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toolbar</td>
<td>Select/clear Toolbar on the View menu</td>
</tr>
<tr>
<td>Toolbar Button Text</td>
<td>Select/clear Toolbar Button Text on the View menu</td>
</tr>
<tr>
<td>Status bar</td>
<td>Select/clear Status bar on the View menu</td>
</tr>
<tr>
<td>Device pane</td>
<td>Select/clear Device View on the View menu</td>
</tr>
<tr>
<td>Properties pane</td>
<td>Select/clear Properties View on the View menu</td>
</tr>
<tr>
<td>The Log panel</td>
<td>Select/clear Event Log on the View menu</td>
</tr>
<tr>
<td>Search results</td>
<td>Select/clear Find results on the View menu</td>
</tr>
</tbody>
</table>

If you have several tabs in the right pane, you may easily switch to any of the tab by selecting the View menu.

<table>
<thead>
<tr>
<th>Properties Tab</th>
<th>to view the Properties tab</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scan Information Tab</td>
<td>to view the Scan Information Tab tab</td>
</tr>
<tr>
<td>Parents Tab</td>
<td>to view the Parents tab</td>
</tr>
<tr>
<td>Properties</td>
<td>Select data types in which the data will be represented</td>
</tr>
</tbody>
</table>

- **Connect to Remote**
  Click this button to connect to a remote computer on a network.

- **Refresh**
  Click this button to refresh the panels.

- **Scan**
  Click this button to start scanning a selected object.

- **Fast Partition Search**
  Click this button to start **fast searching for lost and deleted partitions**.

- **Open Drive Files**
  Click this button to start searching for files on a selected object.
Open Image
Click this button to open a previously created image.

Create Image
Click this button to create an image of a selected area.

Create Region
Click this button to create a region on a selected disk.

Create Virtual RAID
Click this button to create a virtual volume set or RAID.
Select an appropriate type from the menu.

Options
Click this button to change options for the current operation.

Remove
Click this button to remove a selected object on the main panel.

Stop
Click this button to stop the current operation.

Sometimes, there may be a lot of similar objects on the Drives panel. Those may be components of a RAID, for example. You may turn numerical indexes for such objects to distinguish them better. Those indexes will appear before the object names on the Drives panel.

To turn the numerical indexes on/off, go to the Device item on the View menu, and select/clear:

<table>
<thead>
<tr>
<th>Index Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Show Physical Drives Indexes</td>
<td>to display the indexes only for hard drives</td>
</tr>
<tr>
<td>Show All Objects Indexes</td>
<td>to display the indexes for all objects on the Drives panel</td>
</tr>
</tbody>
</table>

You may select the units in which object's start and size are displayed.
To select the units

1. Select Devices on the View menu
2. Select the units in which you want to see object sizes.
   - You may select
     Show as Bytes
     Show as Sectors
     Show as Bytes and Sectors

Depending on the task R-Studio performs, its panel may vary. Those panels are described in appropriate topics. The Properties tab names and values are described in detail on the Properties tab topic.

The general settings can be set on the Settings dialog box.

You may also copy the object's information displayed on the Drives panel. Control-click the object on the necessary column and select Copy Device/Disk, Copy Label, and so on.

R-Studio has two operation modes:

File search on a partition (including recently found during disk scan).

In this mode, R-Studio analyzes MFTs on NTFS partitions, FATs on FAT partitions, and SuperBlocks on Ext2FS partitions. Then it displays all files which records have been found in the analyzed tables. Then recently deleted files, which records still remain, can be recovered. If files have not been found, that means that their records have been deleted. In this case, the disk must be scanned.

File search supports file masks and regular expressions. Multiple files in different folders can be found and recovered in one recover session.

R-Studio supports mass file recovery. There is no limit in the number of files that may be recovered during one session.

File or disk binary data can be viewed and edited in the text/hexadecimal editor. Also can be viewed and changed all attributes for NTFS files.

Disk scan, searching for partitions.

In this mode, R-Studio scans the entire disk or its part. Using a number of statistic and deterministic criteria known as the IntelligentScan technology, it determines existing or existed partitions on the disk, and their file systems. It is also possible to add new partition, by setting manually all required parameters.

A disk can be scanned through several successive scans, each with its own parameters. R-Studio accumulates the information from successive scans and keeps track of changes in the information obtained from different scans. The information obtained from the disc scan can be stored in a file. It may be loaded and processed later at any convenient time.

1.5 R-Studio Settings

You may specify some global setting for R-Studio on the Settings dialog box. You may reach it by selecting Preferences on the R-Studio menu.
## Main settings

<table>
<thead>
<tr>
<th>System Options</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Check for update</strong></td>
<td>If this box is selected, <strong>R-Studio</strong> will automatically check for updates.</td>
</tr>
<tr>
<td><strong>Debug Mode</strong></td>
<td>If this check box is selected, <strong>R-Studio</strong> displays an additional command <strong>Create FS Snapshot</strong> on the context menu for an object with a file system. An FS Snapshot contains system data for the file system only (file descriptions without file contents). If a problem appears, this snapshot can be sent to <strong>R-Studio</strong> technical support to identify the problem. This option greatly slows <strong>R-Studio</strong>.</td>
</tr>
<tr>
<td><strong>Auto-refresh Drive Tree</strong></td>
<td>If this box is selected, <strong>R-Studio</strong> automatically refreshes the list of connected disks. You may disable it if <strong>R-Studio</strong> experiences problems with connected devices.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Edit Options</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Enable Write</strong></td>
<td>If this check box is selected, <strong>R-Studio</strong> enables you to write any changes made in the <strong>Text/hexadecimal editor</strong>.</td>
</tr>
<tr>
<td><strong>Max changes buffer size</strong></td>
<td>Maximum amount of data stored for the <strong>Undo</strong> command in the <strong>Text/hexadecimal editor</strong>.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Notifications</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reset all hidden notifications</strong></td>
<td>This button enables all previously disabled notification and warning messages.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>User’s file types</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>File name</strong></td>
<td>Specifies a file name and path to the file where the descriptions of user's <strong>known file types</strong> are stored. You need to re-start <strong>R-Studio</strong> or</td>
</tr>
</tbody>
</table>
click the Reload User’s File Types button on the Known File Types tab for the new file to take effect.

User’s RAID layout

<table>
<thead>
<tr>
<th>File name</th>
<th>Specifies a file name and path to the file where the descriptions of user’s RAID layouts are stored</th>
</tr>
</thead>
</table>

HexView templates path

<table>
<thead>
<tr>
<th>Location</th>
<th>Specifies the path for pattern description files for Text/Hexadecimal editor.</th>
</tr>
</thead>
</table>

User’s file mask presets

<table>
<thead>
<tr>
<th>File name:</th>
<th>Specifies a file name and path to the file with file mask presets.</th>
</tr>
</thead>
</table>

### File Systems

**File Systems dialog box**

![File Systems settings](image)

- **Default encoding for HFS volumes**
  - Encoding
  - Select the national encoding for the HFS partitions

- **Default encoding for Ext2/Ext3/Ext4/UFS volumes**
  - Select the national encoding for the Ext2, Ext3, Ext4, and UFS partitions.

### Symbolic Links

*Settings are available in the Technician version only!*

**Symbolic links** (of symlinks for short) are object that contains references to other files or folders directory in the form of absolute or relative paths and that affect pathname resolution. For example, if a symlink `C:\ProgramData\Documents` points to `D:\Recovered Files\Root\Users\Public\Documents`, entering it will result in entering `D:\Recovered Files\Root\Users\Public\Documents`.
**Symbolic Links**

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Don't show symbolic links by default (Technician version)</td>
<td>If this option is selected, <strong>R-Studio</strong> hides all symbolic links by default. Only real objects will be visible. You may make them visible by clearing the Hide symbolic links option on the <strong>Mask</strong> dialog box.</td>
</tr>
<tr>
<td>Link conversion (Default)</td>
<td>If both an object and its symbolic link are selected for recovery, both the object and its symbolic link will be recovered. The file path in that symbolic link will be converted from absolute to relative. Example: If the object <code>C:\ProgramData\Documents</code> is a symbolic link to <code>C:\Users\Public\Documents</code>, it will be converted to a symbolic link to <code>..\Users\Public\Documents</code>. Therefore, the symbolic link will point to its object regardless of the place to which the object has been recovered.</td>
</tr>
<tr>
<td>Both an object and its symbolic link are selected for recovery:</td>
<td>Only the selected object will be recovered.</td>
</tr>
<tr>
<td>Only an object is selected for recovery:</td>
<td>The selected symbolic link will be recovered as a real object.</td>
</tr>
<tr>
<td>Only a symbolic link is selected for recovery:</td>
<td>Recovery as it is (Only in the Technician version)</td>
</tr>
<tr>
<td>Both an object and its symbolic link are selected for recovery:</td>
<td>If both an object and its symbolic link are selected for recovery, both the object and its symbolic link will be recovered. The file path in that symbolic link will remain the same. <strong>Example:</strong> The place to store recovered data: <code>D:\Recovered Files</code>. The object to recover: <code>C:\Users\Public\Documents</code> The symbolic link: <code>C:\ProgramData\Documents</code> After recovery:</td>
</tr>
</tbody>
</table>

© 2021 R-Tools Technology Inc.
The recovered object: D:\Recovered Files\Root\Users\Public\Documents
The recovered symbolic link: D:\Recovered Files\Root\ProgramData\Documents pointing to C:\Users\Public\Documents.
Therefore, if someone tries to enter to the symbolic link, the system will open the object C:\Users\Public\Documents, rather than recovered D:\Recovered Files\Root\Users\Public\Documents.

<table>
<thead>
<tr>
<th>Only an object is selected for recovery:</th>
<th>Only the selected object will be recovered.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Only a symbolic link is selected for recovery:</td>
<td>The symbolic link will be recovered as a symbolic link which may contain a path to a nonexistent object.</td>
</tr>
</tbody>
</table>

The [Data Recovery Topics](#) topic explains processing of symbolic links recovery in more detail.

### Log

**Log dialog box**

![Log Dialog Box](image)

**Log options**

<table>
<thead>
<tr>
<th>Maximum messages in the Event Log</th>
<th>Specifies the number of messages stored in the log file</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Logging</strong></td>
<td></td>
</tr>
<tr>
<td>Save log to file</td>
<td>If this checkbox is selected, <strong>R-Studio</strong> writes its log into a log file specified in the File name field.</td>
</tr>
<tr>
<td>File name</td>
<td>Specifies the file name of the log file. If that file already exists, the data will be appended to that file.</td>
</tr>
<tr>
<td><strong>Type</strong></td>
<td></td>
</tr>
<tr>
<td>Files</td>
<td>If this checkbox is selected, <strong>R-Studio</strong> logs all events with files.</td>
</tr>
<tr>
<td>File System</td>
<td>If this checkbox is selected, <strong>R-Studio</strong> logs all events with the file system.</td>
</tr>
<tr>
<td>Feature</td>
<td>Description</td>
</tr>
<tr>
<td>-----------</td>
<td>-------------</td>
</tr>
<tr>
<td>Partition</td>
<td>If this checkbox is selected, R-Studio logs all events with FAT.</td>
</tr>
<tr>
<td>Recover</td>
<td>If this checkbox is selected, R-Studio logs all events with the recovering processes.</td>
</tr>
<tr>
<td>Disk</td>
<td>If this checkbox is selected, R-Studio logs all events with disks.</td>
</tr>
<tr>
<td>Network</td>
<td>If this checkbox is selected, R-Studio logs all events with network operation.</td>
</tr>
</tbody>
</table>

**Severity**

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error</td>
<td>If this checkbox is selected, R-Studio adds error messages into its log.</td>
</tr>
<tr>
<td>Warning</td>
<td>If this checkbox is selected, R-Studio adds warning messages into its log.</td>
</tr>
<tr>
<td>Information</td>
<td>If this checkbox is selected, R-Studio adds information messages into its log.</td>
</tr>
<tr>
<td>Success</td>
<td>If this checkbox is selected, R-Studio adds success messages into its log.</td>
</tr>
</tbody>
</table>

NEVER WRITE A LOG FILE ON THE DISK FROM WHICH YOU RECOVER DATA!!!
Or you may obtain unpredictable results and lose all your data.

### Known File Types

**Known File Types dialog box**

You may specify which **Known File Types** will be enabled/disabled by default. You may also specify known file types to search for during a specific scan session on the **Scan** dialog box.

**Known File Types**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reset</td>
<td>Click this button to reset the settings to the previous state. Active until the <strong>Apply</strong> button is clicked.</td>
</tr>
<tr>
<td>Select All</td>
<td>Click this button to select all file types in the list.</td>
</tr>
<tr>
<td>Clear All</td>
<td>Click this button to clear all file types in the list except some predefined ones.</td>
</tr>
<tr>
<td>Reload User's File Types</td>
<td>Click this button to apply new file types after the user's file types file has been changes from the <strong>Main</strong> tab.</td>
</tr>
<tr>
<td>Edit User's File Types</td>
<td>Click this button to add a new customer's Known File Type, or to edit already existing ones. See the <strong>Customizing File Types</strong> help page for more details.</td>
</tr>
</tbody>
</table>
Bad Sectors

Bad Sectors dialog box

![Bad Sectors dialog box](image)

Bad Sectors settings

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default read attempts</td>
<td>Specifies how many times R-Studio will try to read a bad sector. You may specify this parameter for each drive separately on the Properties tab. R-Studio treats bad sectors in the following way: It reads a certain part of disk (predefined by Windows) and - If Default read attempts is set to 0, the entire part with bad sectors will be filled with the specified pattern. - If Default read attempts is set to a non-zero value, R-Studio reads again that part sector by sector, repeating the attempts the specified number of times. If R-Studio still cannot read a bad sector, it fills the sectors with the specified pattern. In this case only the bad sectors will be filled with the pattern, but that extremely slows the disk read process. For example, if you set Default read attempts to 1, a bad sector will be read 2 times.</td>
</tr>
<tr>
<td>Set for all drives</td>
<td>Click this button to reset I/O Tries for all drives to the default value.</td>
</tr>
<tr>
<td>Pattern to fill bad blocks</td>
<td>Specifies a pattern R-Studio will use to fill bad sectors in files to recover, in images, or when showing data in the Text/Hexadecimal Editor. You may specify the pattern either in the ANSI or Hex data format. Note: R-Studio will never ever try to write anything on the disk from which data is to recover or an image is to create.</td>
</tr>
</tbody>
</table>
Memory Usage

Memory Usage dialog box

These settings control how much memory R-Studio uses for its work. They help preventing R-Studio from locking when trying to perform very memory-consuming tasks like scanning large disks or processing file systems with a lot of files.

Memory Usage settings

<table>
<thead>
<tr>
<th>Disable memory control</th>
<th>If this option is selected, the memory control is disabled.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automatic</td>
<td>If this option is selected, R-Studio will automatically stop performing the task when the amount of used memory reaches the specified value. You may specify the limit for either the virtual or physical memory.</td>
</tr>
</tbody>
</table>

You may see how much memory R-Studio actually uses on the Memory Usage dialog box.
1.6 High Sierra+: Running R-Studio for the First Time

When you start R-Studio for the first time on macOS High Sierra and higher, a System Extension Blocked warning message will appear.

System Extension Blocked message

At the same time R-Studio will throw its own message:

R-Studio Warning Message

If you need access to your system disk, click the Open Security Preferences button on any of the messages, go to the Security and Privacy preferences, and click the Allow button.

Security and Privacy preferences

R-Studio will start with full access to your system disk. You need to follow this procedure only once, next time R-Studio will start without these messages.

If you don’t want to unblock R-Studio, click the Exit button on the R-Studio's message. R-Studio will start and work properly, but without access to the system disk and when you start R-Studio next time, its message will appear again. You will be able to unblock the program if needed.
II Data Recovery Using R-Studio

File recovery from Apple computers with Secure Enclave.
Due to hardware implementation of data encryption, data recovery from Apple's Secure Enclave is currently impossible.

Secure Enclave

Secure Enclave is used in Intel-based Mac computers that contain the Apple T2 Security Chip and Mac computers with Apple silicon.

Many specific data recovery cases are discussed in the R-TT's Data Recovery Guide.
Depending on the situation, data recovery may vary:

1. **Recovery of deleted files that have resided on an existing logical disk**
   This can be done using Basic File Recovery.

2. **Recovery of files that have resided on a data disk with a damaged file system, or on a previously deleted or re-formatted partition**
   If the file system on such logical disk is damaged, the operating system does not see that logical disk as a partition without a valid file system. Such partition should be previously scanned. Also, it should be scanned if you want to recover data on a previously deleted or re-formatted partition.
   You may use Fast Search for Lost partitions if you want only to find partitions previously existed on the disk. It's much faster.
   When the partition is scanned, a number of recognized partitions will appear. R-Studio shows them in different colors depending on which elements of the partition have been found.

<table>
<thead>
<tr>
<th>Partition</th>
<th>An existing logical disk or partition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recognized9</td>
<td>Both boot records and file entries are found for this partition</td>
</tr>
<tr>
<td>Recognized11</td>
<td>Only file entries are found for this partition</td>
</tr>
<tr>
<td>Recognized10</td>
<td>Only boot records are found for this partition</td>
</tr>
<tr>
<td>Empty Space9</td>
<td>Empty space on the object</td>
</tr>
<tr>
<td>DeletedPart1</td>
<td>A deleted partition</td>
</tr>
<tr>
<td>Raw Files</td>
<td>Files that have been found using scan for known file types</td>
</tr>
</tbody>
</table>

Although such recognized partitions are virtual objects, files can be searched for and recovered from recognized partitions as from real logical disks using Basic File Recovery.
To successfully recover files from a recognized partition, it is necessary to find a right one which corresponds to the real logical disk on which the files resided. No strict rules can be applied to that, but the following considerations should be taken into account:

- If you are going to recover files from a **disk with a damaged file system**, most likely the right recognized partition will be a green one.
- If you are going to recover files from a previously deleted or re-formatted partition, most likely the right recognized partition will be a yellow one.

Also always check the recognized partition's file system, start point, and size. They should be the same for the recognized partition and real logical disk/partition. When in doubt, try to **preview** a couple of files from the recognized partition. If the files are seen correctly, this is the right partition.

**R-Studio Features**
- Contact Information and Technical Support
- Basic File Recovery
- Advanced Data Recovery
- Mass File Recovery
- Volume Sets and RAIDs
- Data Recovery over Network
- Text/Hexadecimal Editor
- Technical Information and Troubleshooting
- R-Studio Emergency
- R-Studio Agent Emergency

### 2.1 Basic File Recovery

**NEVER TRY TO SAVE RECOVERED FILES/FOLDERS TO THE SAME LOGICAL DISK WHERE THEY RESIDE!!!**

Or you may obtain unpredictable results and lose all of your data.

See the [Data Recovery Issues](#) topic for details.

Basic file recovery can be made for deleted files that has resided on an existing disk visible by the operating system. In all other cases, **Advanced Data Recovery** is required.

**To recover deleted files from a logical disk (recognized partition),**

1. **Double-click a logical disk on the R-Studio's Drives panel to enumerate files on the disk**

   - **Other ways to enumerate files**
     - Select the disk and click the **Open Drive Files** button,
     - Control-click the selected disk and select **Open Drive Files** on the contextual menu,
     - Select **Open Drive Files** on the **Drive** menu

   If you try to enumerate files on a hard drive or another object without a valid file system on it, a **Double-click a logical disk...** message will appear. Select a logical disk on the object or **scan** the object.

2. **R-Studio will change its panel showing the disk's folders/files structure**

   R-Studio analyzes data on the object and displays all files which records have been found in the analyzed tables. Then deleted files, which records still remain, can be recovered. If files have not been found, that means that their records have been deleted. To find such files, **Advanced Data Recovery** is required.
Please note that **R-Studio** shows only those files/folders that match a specified *file mask*.

**R-Studio Main panel**

![R-Studio Main panel](image)

### Panel view options

You may set which panels and bars to enable/disable. To enable/disable:

- **The Toolbar**
  - Select/clear *Toolbar* on the *View* menu

- **Toolbar Button Text**
  - Select/clear *Toolbar Button Text* on the *View* menu

- **The Status bar**
  - Select/clear *Status bar* on the *View* menu

- **The Folders panel**
  - Select/clear *Folders View* on the *View* menu

- **The Files panel**
  - Select/clear *Contents View* on the *View* menu

- **The Log panel**
  - Select/clear *Event Log* on the *View* menu

- **The Find Results panel**
  - Select/clear *Find Results* on the *View* menu

You may also arrange the data as required. On the *View* menu, select *Arrange* and then a required arrangement.

You may specify which columns will be visible on the *Files* panel. On the *View* menu, select *Contents Columns*, and select the columns you want to see.

Files can be shown as a list or as icons/tiles of different sizes.

*Files shown as icons/tiles*
File Information
You may view some information about a file. Right-click the file and select Get Info on the context menu.

Recovery chances
R-Studio shows its estimates of chances for successful file recovery in the Rec column.
**Folders** panel

- Deleted folder
- Marked folder (all child objects in this folder are marked)
- Partially marked folder (some child objects in this folder are marked)
- Cross-linked deleted folder (A FAT folder containing data which also belongs to other FAT folders.)
- Target of a symlinked folder
- Symlink to a folder
- Questionable deleted folder (A FAT folder found by R-Studio, but with apparently invalid content.)

**Files** panel:

- Deleted file:
- Marked deleted file
- Selected deleted file
- Target of a hard link
- Hard link to a file
You may also arrange the data as required: by their extensions, creation/modification time, or as a real file structure.

See **Find and Mark Multiple Files** for more details.
Stop
Click this button to stop the current operation.

Up
Click this button to move highlighting one folder up.

The Log panel will show how many files and folders are on the object, and their size. You may specify which events will be shown in the log pane by setting a log filter.

Note: Metafiles are the file system's internal files invisible to any user, or file system data, which R-Studio represents as files. These files do not contain user data directly. Unless you want to scrutinize a disk file system, do not restore them.

If the Too many files... message appears, you may temporarily stop file listing and browse through found files. Then you can resume file listing. You also may skip this file topic and continue. R-Studio will keep information about the entire file structure.

You may also copy the information about folders and files.

- For the folder (the Folders pane):
  - Click Copy Folder: To copy the folder's name
  - Click Copy Path: To copy the path to the folder

- For the file (the Contents pane):
  - Click Copy (Column Name): To copy the file's Name, Size, Created, etc., depending on which column is selected
  - Click Copy Path: To copy the file path.
  - Click Copy Selected Text: To copy all the columns of the selected file.

3 Select a file/folder to recover
You may select several files/folders in the same parent folder by pressing the Shift button and clicking the objects simultaneously.

Marking multiple files/folders from different parent folders manually:
Mark a file/folder to recover by clicking the box left to the object, or select Mark on the contextual menu. You may mark several files/folders in different parent folders. You may mark all objects in the folder by selecting Mark All on the Tools or contextual menu. To unmark an object, click the box left to the object once more or select Unmark on the contextual menu. You may unmark all objects in the folder by selecting Unmark All on the Tools or contextual menu.

The Log panel will show how many files and folders you have marked, and their total size.

R-Studio can search for a particular file. Go to the Searching for a File topic for details. If you need to find and mark many files, go to the Find and Mark Multiple Files topic for details.

File content may be previewed before recovery. Go to the Previewing Files topic for details.

If you do not find files that you want to recover:
Sometimes R-Studio can find the files but not the entire file paths to them. It puts such files into the Extra Found Files folder. Try to search for the files there. If that does not help, try to find them by using file search globally on the entire disk. Go to the Searching for a File topic for details.
If you still cannot find files that you want to recover but are sure they have existed on the logical disk, you need to use **Advanced Data Recovery** to find them.

4. **Click the Recover or Recover Marked button**

- **Other ways to recover selected files**
  - Control-click the selected file/folder and select **Recover** or **Recover Marked** on the contextual menu, or
  - Select **Recover** or **Recover Marked** on the **File** menu

5. **Specify recover options and output folder on the Recover dialog box and click the OK button**

**Recover dialog box**

If you have another computer connected to **R-Studio** over network, the **Recover** dialog box will be slightly different. See **Data recovery over network** for details.

**Recover (Advanced) dialog box**

<table>
<thead>
<tr>
<th><strong>Recover options</strong></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recover all marked files</td>
<td>All files, regardless of the applied mask, will be recovered.</td>
</tr>
<tr>
<td>Recovered only masked marked files</td>
<td>Only files matching the applied mask will be recovered.</td>
</tr>
<tr>
<td>Condense successful restoration events</td>
<td>If this check box is selected, <strong>R-Studio</strong> will display only error and warning messages in its <strong>Log</strong>.</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Restore folder structure</td>
<td>If this check box is selected, <strong>R-Studio</strong> recovers the entire path to the selected object.</td>
</tr>
<tr>
<td>Restore from root</td>
<td>If this check box is selected, <strong>R-Studio</strong> recovers the entire path to the selected object starting from the root folder of the disk.</td>
</tr>
<tr>
<td>Recover metafiles</td>
<td>If this check box is selected, <strong>R-Studio</strong> recovers disk metafiles. Metafiles are the file system's internal files invisible to any user, or file system data, which <strong>R-Studio</strong> represents as files. These files do not contain user data directly. Unless you want to scrutinize a disk file system, do not restore them.</td>
</tr>
<tr>
<td>Recover alternative data streams</td>
<td>If this check box is selected, <strong>R-Studio</strong> recovers alternative data streams for file systems that support them. Has no effect on FAT files. See <strong>Extended Information Recovery</strong> for the NTFS file system, and <strong>Data Recovery on HFS/HFS+ File System</strong> for the Mac computers.</td>
</tr>
<tr>
<td>Recover security</td>
<td>If this check box is selected, <strong>R-Studio</strong> recovers security attributes for NTFS files. Has no effect on FAT files. See <strong>Extended Information Recovery</strong> for details.</td>
</tr>
<tr>
<td>Recover extended attributes</td>
<td>If this check box is selected, <strong>R-Studio</strong> recovers extended (HPFS) file attributes.</td>
</tr>
<tr>
<td>Recover real folders structure</td>
<td>Enabled when the files are sorted by their extensions or date. See <strong>Find and Mark Multiple Files</strong> for details. If this check box is selected, <strong>R-Studio</strong> recovers the real folders/files structure on the disk rather than that of sorted files.</td>
</tr>
<tr>
<td>Skip files with bad sectors</td>
<td>If this check box is selected, <strong>R-Studio</strong> skips files with bad sectors and displays their list on the <strong>files with bad sectors</strong> dialog box when the recovery has been completed. You may separately decide later what to do with those files. See <strong>Bad sectors</strong> for details. If this check box is cleared, <strong>R-Studio</strong> tries to read those sectors several times (specified on the <strong>Settings/Bad Sectors</strong> dialog box), and, if fails, fills bad sectors in the recovered file with the pattern specified on the same box. Information about such files will appear in the <strong>Log</strong>.</td>
</tr>
<tr>
<td>Do not recover duplicate files from Extra Found Files</td>
<td>If this check box is selected, <strong>R-Studio</strong> does not recover files from Extra Found Files (raw files) that coincide with files recovered from the file system.</td>
</tr>
<tr>
<td>Ignore file mask</td>
<td>If this check box is selected, <strong>R-Studio</strong> recovers all content of a selected folder, ignoring a specified <strong>File Mask</strong>.</td>
</tr>
<tr>
<td>Open local folder (folders) when done</td>
<td>If this check box is selected, the folder with recovered files will be opened upon recovery completion.</td>
</tr>
</tbody>
</table>
If you want to recover multiple files at once, go to the Recover Multiple Files for more information.

**R-Studio Technician**

### Recover (Additional Output Folders) dialog box

#### Additional Output Folders

- **Additional Output Folders**
  - Additional output folders where recovered files will be stored when R-Studio runs out of space.

  **NEVER TRY TO SAVE RECOVERED FILES/FOLDERS TO THE SAME LOGICAL DISK WHERE THEY RESIDE!!!**

  Or you may obtain unpredictable results and lose all of your data.

### Recover (Post Actions) dialog box

#### Post Actions Options

- **Shutdown the computer on task completion**
  - If this check box is selected, R-Studio will shut down your computer when file recovery has been completed. The program will warn you if any option on the Advanced tab is set to Prompt.
E-Mail notifications

If this check box is selected, **R-Studio** will inform you about the outcome of the operation via email.

If a file to be recovered appears to have an invalid name, a **Broken File Name** dialog box will appear. You may correct the name and resume file recovery.

### Broken File Name dialog box

![Broken File Name dialog box](image)

#### Broken File Name properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>File name</td>
<td>Shows the current incorrect file name.</td>
</tr>
<tr>
<td>New name</td>
<td>Field for a new file name.</td>
</tr>
<tr>
<td>Edit broken symbols only</td>
<td>If this check box is selected, only invalid symbols may be corrected</td>
</tr>
<tr>
<td>Change all invalid symbols to</td>
<td>If this check box is selected, all invalid symbols will be changed to the specified symbol</td>
</tr>
</tbody>
</table>

#### Buttons

<table>
<thead>
<tr>
<th>Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rename</td>
<td>Click to resume file recovery</td>
</tr>
<tr>
<td>Rename All</td>
<td>Click to resume file recovery. All other files will be renamed according to the specified rule.</td>
</tr>
<tr>
<td>Skip</td>
<td>Click to skip this file</td>
</tr>
<tr>
<td>Skip All</td>
<td>Click to skip all files and stop file recovery</td>
</tr>
</tbody>
</table>

If there is no space available for the recovered files, the **There is not enough space on the disk** dialog box will appear. You may either select other place to store the files, skip that particular file or abort the recovery process.

### There is not enough space on the disk dialog box

![There is not enough space on the disk dialog box](image)

* **R-Studio** will recover the selected/marked files/folders to the specified folder and show the results in the Log pane.

The **Recovery progress** indicator will show the log and progress of recovery process.

**Recovery progress** indicator
Note: R-Studio recovers files from Ext2FS partitions, but writes it to FAT or NTFS local disks. Or you may write such files to network disks. R-Studio successfully recovers files from Ext2FS partitions except its security attributes. R-Studio recovers symlinks as files containing the path to files which symlinks point to.

Searching for a File
Finding Previous File Versions
Previewing Files
File Masks
Regular Expressions
Event Log

2.1.1 Searching for a File

R-Studio can find a particular file, if it is difficult to find it manually on the Folders or Files panel. You can also automatically mark all found files.

To search for a file,

1. Click the Find button

   Other ways to search for the file
   - Control-click a folder and select Find on the contextual menu, or
   - Select a folder and select Find on the Tools menu

2. Specify a file to be found and its options on the Find dialog box, and click the OK button

   Note that a File Mask may be applied.

Find/Mark dialog box

Find/Mark options

You may specify how to treat specified strings. Please note that R-Studio stores previously entered search strings.
<table>
<thead>
<tr>
<th><strong>Files</strong></th>
<th>If this option is selected, <strong>R-Studio</strong> treats specified strings as file names. Use ? for one unspecified character and * for an unlimited number of them to specify file masks.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>File Extensions</strong></td>
<td>If this option is selected, <strong>R-Studio</strong> treats specified strings as file extensions.</td>
</tr>
<tr>
<td><strong>Regular Expressions</strong></td>
<td>If this option is selected, <strong>R-Studio</strong> treats specified strings as regular expressions.</td>
</tr>
<tr>
<td><strong>All Files</strong></td>
<td>If this option is selected, <strong>R-Studio</strong> applies Advanced Options to all files.</td>
</tr>
<tr>
<td><strong>Match case</strong></td>
<td>If this check box is selected, <strong>R-Studio</strong> makes a case-sensitive search.</td>
</tr>
<tr>
<td><strong>Look at</strong></td>
<td>If this check box is selected, <strong>R-Studio</strong> includes files into a search.</td>
</tr>
<tr>
<td><strong>Files</strong></td>
<td>If this check box is selected, <strong>R-Studio</strong> includes files into a search. Disables when the Mark/Unmark All option is selected.</td>
</tr>
<tr>
<td><strong>Folders</strong></td>
<td>If this check box is selected, <strong>R-Studio</strong> includes folders into a search.</td>
</tr>
<tr>
<td><strong>Deleted files</strong></td>
<td>If this check box is selected, <strong>R-Studio</strong> makes a search among deleted files/folders.</td>
</tr>
<tr>
<td><strong>Existing files</strong></td>
<td>If this check box is selected, <strong>R-Studio</strong> makes a search among existing files/folders.</td>
</tr>
<tr>
<td><strong>Look in</strong></td>
<td>Specifies where <strong>R-Studio</strong> searches for, and marks, files. It can look for them on the Entire disk, or in/from a certain folder. You may specify the starting folder for the search.</td>
</tr>
<tr>
<td><strong>Advanced options</strong></td>
<td>If this check box is selected, <strong>R-Studio</strong> will use the advanced options.</td>
</tr>
<tr>
<td><strong>Size from/up to</strong></td>
<td>Specifies file size limits. See the <strong>Data Formats and Multipliers</strong> topic for more details on data formats.</td>
</tr>
<tr>
<td><strong>File Id</strong></td>
<td>Specifies File Id that <strong>R-Studio</strong> assigns to a file.</td>
</tr>
<tr>
<td><strong>Recovery Chances</strong></td>
<td>Specifies files with certain recovery chances.</td>
</tr>
<tr>
<td><strong>Date</strong></td>
<td>Specifies file date boundaries. Dates for Modified, Created, and Last Accessed timestamps may be set separately.</td>
</tr>
<tr>
<td><strong>Find/Mark options</strong></td>
<td>The <strong>Set for all</strong> button sets the specified data for all fields.</td>
</tr>
<tr>
<td><strong>Find/Mark options</strong></td>
<td>Specify what <strong>R-Studio</strong> does with the found files. The Find first/previous/next/last options. <strong>R-Studio</strong> stops at the first/previous/next/last file that matches the specified search criteria.</td>
</tr>
</tbody>
</table>
Find all files. **R-Studio** searches for all files that matches the specified search criteria. The search results appear on the **Find Results** panel.

Mark/Unmark All. **R-Studio** marks/unmarks all files that match the search criteria. When these options are selected, **R-Studio** marks/unmarks files only, not folders, regardless of what Look at: Folders specifies.

Please note, that when performing a new find and mark/unmark task, **R-Studio** does not takes into consideration the previous marked/unmarked state of files. For example, if you first mark all *doc* files, and then all *txt* files, all *doc* files remain marked, too. To unmark them, you should specify *doc* once again and select Unmark files.

| Find/mark objects only in real paths, ignore links to folders | If this check box is selected, links to folders will be treated as real folders: they will appear among search results or marked objects. |

> **R-Studio will show/mark the found file(s)**

If you need to find and mark many files, go to the [Find and Mark Multiple Files](#) topic for details.

**To repeat the search,**

* Click the **Find Next** or **Find Previous** buttons

  \[ Other ways to repeat the search \]

  • control-click a folder and select **Find Next** or **Find Previous** on the contextual menu
  or

  • Select a folder and select **Find Next** or **Find Previous** on the **Tools** menu

**To find all files and show them on the Find Results panel,**

* Select **Find all** on the on the **Find** dialog box,

  or

  select **Find all** on the **Tools** menu

> **R-Studio will show the found files on the Find Results panel**

You may do the following actions on the found files:

**Recover, Mark, Preview**

by control-clicking the found file and selecting the appropriate item in the contextual menu.

### 2.1.2 Finding Previous File Versions

**R-Studio** can find previous versions of files. It searches for them in the file's current folder and in **Extra Found Files**.

File versions are searched for using file size. If the size of a files is within 10% of the original filesize, the following conditions are checked:

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Legend</th>
</tr>
</thead>
<tbody>
<tr>
<td>File name</td>
<td>N</td>
</tr>
<tr>
<td>File extension</td>
<td>E</td>
</tr>
<tr>
<td>Recognized file type</td>
<td>T</td>
</tr>
</tbody>
</table>
To search for previous file versions,

1. Control-click the file and select Find Previous Versions of the File on the contextual menu

   - R-Studio will show the files in the list:

     File versions

     ![File versions screenshot]

   This technique can be used to find deleted original files after attacks of file encrypting viruses.

2.1.3 Previewing Files

R-Studio has a built-in file previewer that allows you to preview both existing and deleted files. You may use this feature to estimate recovery or a file to be recovered.

While previewing a file in the external viewer, you may recover it or mark the file for recovery using Previewer buttons.

Previewer buttons

- Mark for recovery, Previous file, Next file, Recover

To preview a file

1. Control-click a file to preview on the Files panel and select Preview on the contextual menu

   - Other ways to preview the file
     - Select the file on the Files panel and click the Preview button,
     - Select the file on the Files panel and select Preview on the File menu

2. R-Studio will show the content of the file

   If you have several files open in the previewer, you may instantly close all of them by selecting Close All Previews on the File menu.
File Previewer for Pictures:
Pictures can be previewed either as tiles within the main window of R-Studio or in an external previewer.

Within the main window as tiles:
Tile size can be changed.

Pictures as tiles

In the external viewer:
Picture files can be zoomed in/out and rotated.

Picture file previewer

File Previewer for Video and Audio files:
Video and audio files can be played even without their respective application installed.
Video file previewer

File Previewer for Microsoft/Open/Libre Office Documents:
Documents can be shown (including embedded pictures) even without their respective applications installed. They can be zoomed in/out for better viewing.

Microsoft/ Open/ Libre Office document previewer

File Previewer for Adobe Acrobat PDF Files:
Files can be shown even without Adobe Acrobat installed.
The previewer allows the users to jump to a required page, zoom the document, and search for a required text.

Adobe Acrobat pdf document previewer
The files can be shown in different layouts and rotated. Click the View menu and select the required options.

**Supported File Types:**

<table>
<thead>
<tr>
<th>Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MS Office</strong> and <strong>Open/Libre Office</strong> files, even without the programs installed:</td>
</tr>
<tr>
<td>- Word/Writer documents: docx;</td>
</tr>
<tr>
<td>- Excel/Calc spreadsheets: xlsx;</td>
</tr>
<tr>
<td>- PowerPoint presentation: pptx.</td>
</tr>
<tr>
<td><strong>Office 97-2003</strong>, without the program installed:</td>
</tr>
<tr>
<td>- Word documents: doc;</td>
</tr>
<tr>
<td>- Excel spreadsheets xlsx;</td>
</tr>
<tr>
<td>- PowerPoint presentation ppt.</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Multimedia Files</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Video formats:</strong></td>
</tr>
<tr>
<td>AIFF, ASF, AVI, BFI, CAF, FLV, GIF, GXF, HLS, QuickTime, 3GP, MP4, Matroska, Maxis XA, MPEG-DASH, MPEG program stream, MPEG transport stream (including AVCHD), MXF, Material eXchange Format, SMPTE, MSN Webcam stream, NUT, Ogg, OMA, RL2, TXD, WTV.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Audio formats:</th>
</tr>
</thead>
<tbody>
<tr>
<td>8SVX, AAC, AAC+, AC-3, ADPCM, AMR-NB, AMR-WB, Amazing Studio PAF Audio, Apple lossless audio, QuickTime, ATRAC, CELT, DCA (DTS Coherent Acoustics), DPCM, DSD (Direct Stream Digital), DSP Group TrueSpeech, DST (Direct Stream Transfer), DV audio, FLAC (Free Lossless Audio Codec), G.723.1, G.729, GSM, IAC (Indeo Audio Coder), iLBC (Internet Low Bitrate Codec), IMC (Intel Music Coder), Interplay ACM, MACE (Macintosh Audio Compression/Expansion), MACE (Macintosh Audio Compression/Expansion), MLP (Meridian Lossless Packing), Monkey’s Audio, MP1 (MPEG audio layer 1), MP2 (MPEG audio layer 2), MP3 (MPEG audio layer 3), MPEG-4 Audio Lossless Coding (ALS), Musepack SV7/SV8, Nellymoser Asao, AVC (Audio for Video Codec), PCM A-law/mu-law, QCELP / PureVoice, QDesign Music Codec, RealAudio, Vorbis, Voxware MetaSound, WavPack, Westwood Audio, Windows Media Audio, Xbox Media Audio.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Graphic files (with file extensions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3DS Max thumbnail (max), AAA logo (bpr), ACE texture (ace), ADEX (img, rle), AIM Grey Scale (ima, im), AIPD image (aipd), ARF (arf), AT&amp;T Group 4 (att), AT&amp;T multigen (icn), AVHRR Image (sst), AVT RAW (raw), AWD (awd), Ability Photopaint Image (apx), Access (g4, acc), Aces200 (ace), Acorn Sprite (acorn), AdTech perfectfile (adt), Adobe Illustrator (ai), Adobe PhotoParade(images) (php), Adobe Photoshop (psd), Advanced Art Studio (ocp, art, pic), AirNav (anv), Album bébé (firm), Alias Image File (pix, als, alias), Alpha Microsystems BMP (bmp), Amapi (2d), Amica Paint (ami, [b]), Amiga IFF (iff, blk), Amiga icon (info), Amstrad Cpc Screen (cpc), Analyze (avw), Analyze-7 (img), Andrew Toolkit raster object (atk), Apollo HDRU (hdr, hdr, gn), ArcInfo Binary (hdr), Art Director (art), Artisan (art).</td>
</tr>
</tbody>
</table>
Artist 64 (a64), Artrage (ptg), Artweaver Document (awd), Astronomical Research Network (arn), Atari grafik (pcp), Aurora (sim), Auto F/X (afx), AutoCAD DWG (dwg, dwt), AutoCAD DXF (dxf), Autocad CAD-Camera (img), Autodesk Animator (fli, flc), Autodesk QuickCAD thumbnail (cad), Autodesk SKETCH thumbnail (skf), Autodesk SketchUp component (skp, skb), Autologic (gm, gm2, gm4), Award Bios Logo (epa), Axialis Screensaver(images) (ssp), B3D(images) (b3d), BFLI (bfl, bflf, fl, flp, afl), BIOS FringeProcessor (msk, img, raw, flt), BLP textures (blp), BMF (bmf), BSB/KAP (kap), BYU SIR (sir), Bert's Coloring (bmg, ibg), Bfx Bitware (bfx), Bio-Rad confocal (pic), Blazing Paddles (pi), Bob Raytracer (bob), Brender (pix), Brooktrout 301 (brk, 301, brr), Brother Fax (uni), Buttonz & Tilez texture (til), CALS Raster (cal, calg, png, mil), CDU Paint (cdu), CGM (cgm), CImage (dsi), CMU Window Manager (cnu), CP8 256 Gray Scale (cp8), CSV (csv), Calamus (cpi, crg), Camera RAW (raw), Canon EOS-1D Mark II RAW (cr2), Canon Navigator Fax (cap), Canon PowerShot (crw), Cartes Michelin (big), Casio QV-10/100 Camera (cam), Casio RAW (bay, raw), Chinin ES-1000 digital camera (cmt), Cisco IP Phone (cip), Cloe Ray-Tracer (clo, cloe), ColoRX (rix, sci, scx, sc?), CompW (wm), ComputServe GIF (gif, gifi), Computer Eyes, Digital Vision (ce), ComputerEyes Raw (ce1, ce2), Contax RAW (bay, raw), Corel DRAW Bitmap(preview) (cdr), Corel DRAW Pattern(preview) (pat), Corel Flow(preview) (bmf), Corel Metafile Exchange(preview) (cmx), Corel PhotoPaint 6.0 (cpt), CoverDesigner(images) (ncd), CoverDesigner Template(images) (ncr), Crayola (art), Creative PC-CAM RAW (bay, raw), DBW Render (), DIV Game Studio Map (map), DIV Game Studio Multi Map (fpg), DKB Ray-Tracer (dis), DNG (dng), DPX (dpx), Dali Raw (sd0, sd1, sd2), Datacopy (img), Degas & Degas Elite (p1c, p1c1, p2c, p2b, pib3, pib3, pib4, pib4, pib6), Deluxe Paint, Electronic Arts (lbn, lbnm), Dicom (dcm, acr, dic, dicom, dc3), Digital F/X (tdim), Digital Research(GEM Paint) (img, gem), Direct Draw Surface (dds), Discorp CMP Image (cmp), DjVu (djvu, djv, iw4), DolphinEd (dol), Doodle Atari (doo), Doodle C64 (dd), Doodle C64 (compressed) (jj), Dr Halo (cut), Draz Paint (drz), EA Sports FSH (fsh), EPS Interchange Format (epi, ept), ERI-chan(Entis Rasterized Image) (eri), ESM Software Pix (pix), Ecchi (ecc), Eclipse (tile), Edmics (c4), Egg Paint (tep), Electric Image (ei, eidi), Embroidery (bmc), Encapsulated Postscript (ps, eps), Encapsulated Postscript (preview) (eps), Enhance Simplex (esm), Enhanced Compressed Wavelet (ecw), Epson RAW (erf), Eroica (eif), Everex Everfax (efx, ef3), Explore(TDI) & Maya (iff, tdi), FIF(Iterated System) (iff), FIT (fit), Face Painter (fpt), Fast Piecewise-constant (fpc), Fax Group 3 (g3, fak), Fax man (fim), Faxable PCX (fxc), Faxable TIFF (ftf), Fenix Map (map), Fenix Multi Map (fpg), FileMagic (mag), Flash Image (fi), FlashCam Frame (ncy), FlashPix Format (fpx), Flexible Image Transport System (fits, fits, fit), Foculus RAW (bay, raw), Fossana Grafik (bsg), Fremont Fax96 (f69), Fuji S2 RAW (raf), Fun Painter II (fp2, fun), Fun Photor (fpr), Fuzzy bitmap (fbm, cbm), GR516 (g16), Gamma Fax (gfn), GeoPaint (geo), Gfa Raytrace (sul), GigaPaint Hi-res (gh), GigaPaint Multi (gig), Gimp Bitmap (xcf), Gimp Brush (gbg), Gimp Icon (ico), Gimp Pattern (pat), GoDot (4bt, 4bit, clb), GunPaint (gun, ifl), HD Photo (wpd, hdp), HDRI (hdr, hdr1), HF (hfl), HP-48/49 GROB (gro, grb), HP-49 OpenFire (gro2, gro4), HPGL-2 (hp, hpg, hpl, hplg, hplg2, g2, prn, prn, sprl), HRU (hru), HSI Raw (raw), Half-Life Model (mdl), Hasselblad RAW (3fr), Hayes JT Fax (jtf), Hemera Photo Image (hpi), Hemera Thumbs (hta), Heretic II MipMap (m8), Hi-Eddi (hed), Hi-res (hir, hbm), HomeWork Texture (hlf), IBM Kips (kps), IBM Printer Page Segment (pse), IM5(Visilog) (imin), IMNET Image (int), IODA (ica, ioca, mod), IP Lab (ipl), IPod thumb (iibmmb), ISS (iss), IcoFX (ifx), Icon Library (icl), Imacon/Hasselblad RAW (fji), Image Capture Board (icb), Image Magick file (mil, miff), Image Speeder (ish), Image System(Hires) (ish), Image System(Multicolor) (ism), Image Systems RLC2 Graphic (rlg), ImageLab (b&w, b_w), ImagePro Sequence (seq), Imaging Fax (g3n), Imaging Technology (img), Img Software Set (img), InShape (iim), InterPaint(Hires) (iph), InterPaint(Multicolor) (ipt), Intergraph
2.1.4 File Masks

R-Studio shows only those files/folders that match the specified file mask. File mask affects files/folders that are processed by the Recover and Find commands.

To specify a file mask,

1. Click the File Mask button
Other ways to specify the file mask

- Control-click a folder and select File Mask on the contextual menu
- Select the folder and select File Mask on the Tools menu

Specify the file mask on the File mask dialog box and click the OK button

Mask dialog box

File mask options
You may specify options for All Files, File Extensions, Files, and Regular Expressions

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Match case</td>
<td>If this check box is selected, R-Studio makes a case-sensitive search.</td>
</tr>
<tr>
<td>Show empty folders</td>
<td>If this check box is selected, R-Studio will show folders with no files in them.</td>
</tr>
<tr>
<td>Deleted files</td>
<td>If this check box is selected, R-Studio makes a search among deleted files/folders.</td>
</tr>
<tr>
<td>Existing files</td>
<td>If this check box is selected, R-Studio makes a search among existing files/folders.</td>
</tr>
<tr>
<td>Hide symbolic links</td>
<td>If this check box is selected, R-Studio hides all symbolic links. It may be selected by default if the Don't show symbolic links by default option is selected on the Settings dialog box.</td>
</tr>
<tr>
<td>Use advanced options</td>
<td>If this check box is selected, R-Studio will use the advanced options, even when they are hidden.</td>
</tr>
</tbody>
</table>

Advanced Options

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size from/up to</td>
<td>Specifies file size limits. See the Data Formats and Multipliers topic for more details on data formats.</td>
</tr>
<tr>
<td>Date</td>
<td>Specifies file date boundaries. Dates for Modified, Created, and Last Accessed timestamps may be set separately.</td>
</tr>
</tbody>
</table>

The Set for all button sets the specified data for all fields.

R-Studio will show only those files that match the specified file masks

Mask presets
You may set various presets with different file masks. Just click on the Plus button to add the data from the dialog box to the presets. You may also give presets names, delete them, and store them permanently.
2.1.5  Regular Expressions

Regular expression is a notation for patterns of text, as opposed to exact strings of characters. The notation uses literal characters and metacharacters. Every character which does not have special meaning in the regular-expression syntax is a literal character and matches an occurrence of that character. For example, letters and numbers are literal characters. A metacharacter is a symbol with special meaning (an operator or delimiter) in the regular-expression syntax.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>.</td>
<td>Wildcard: any character</td>
</tr>
<tr>
<td>*</td>
<td>Repeat: zero or more occurrences of previous character or class</td>
</tr>
<tr>
<td>^</td>
<td>Line position: beginning of line</td>
</tr>
<tr>
<td>$</td>
<td>Line position: end of line</td>
</tr>
<tr>
<td>[class]</td>
<td>Character class: any character in the set</td>
</tr>
<tr>
<td>[^class]</td>
<td>Inverse class: any character not in the set</td>
</tr>
<tr>
<td>[x-y]</td>
<td>Range: any characters within the specified range</td>
</tr>
<tr>
<td>\x</td>
<td>Escape: literal use of metacharacter x</td>
</tr>
<tr>
<td>&lt;xyz&gt;</td>
<td>Word position: beginning of the word</td>
</tr>
<tr>
<td>xyz&gt;</td>
<td>Word position: end of the word</td>
</tr>
</tbody>
</table>

For example, the following regular expression .* matches any string of characters, ^a matches any string beginning with character a.

2.1.6  Event Log

R-Studio logs and displays events in the Log panel. You may set a Log filter to display only needed information and to write it to a log file. You may specify the log settings on the Settings dialog box.

You may clear or save the log.

R-Studio logs and displays events in the Log panel. You may set a Log filter to display only needed information and to write it to a log file. You may specify the log settings on the Settings dialog box.

You may clear or save the log.

To clear the log,
* Control-click the Log panel and select Clear Log on the contextual menu.

To save the log to a file,
* Control-click the Log panel and select Save Log to File on the contextual menu.

2.2  Advanced Data Recovery

This chapter explains how to perform advanced data recovery operations.

- Disk Scan
- Fast-Search-for-Lost-Partition
- Customizing File Types
- Customizing File Types-I
- Customizing File Types-II
- Regions
- Exclusive Regions
- Images
Object Copy

2.2.1 Disk Scan

In order to completely analyze data structure on an object, it must be scanned. Any object on the Drives panel can be scanned. In addition, you may create a region to scan only a part of an object. The Regions topic explains how to create and work with regions. Scan is also greatly improves estimations for chances of successful file recovery.

You may select scan area and some other scan parameters. Scan information may be saved to a file and later this file may be opened.

You may save scan information on the remote computer if necessary.

Attention: Scanning large areas may be a very lengthy process!

NEVER TRY TO SAVE SCAN INFORMATION TO THE OBJECT BEING SCANNED!!!

Or you may obtain unpredictable results and lose all of your data.

To scan an object

1. Select an object on the R-Studio's Drives panel
2. Click the Scan button
   - Other ways to start scan
     - Control-click the selected disk and select Scan on the contextual menu,
     - or
     - Select Scan on the Drive menu
3. Specify the required parameters on the Scan dialog box and click the Scan button

Scan dialog box

Scan options

| Disk Size: | Shows the size of the object to be scanned |
| Start:     | Sets the start point of the area to be scanned. |
| Size:      | Sets the size of the area to be scanned. |
| Numbers in these fields can be in bytes or sectors. See the Data Formats and Multipliers topic for more details on data formats. |
| File Systems: | Specifies the file systems which objects are to be searched for. Current version supports: FAT, NTFS, exFAT, ReFS, Ext2FS/3FS, HFS, APFS, and UFS file systems. |
Please note that if you need to scan an HFS, HFS+, or HFSX disk, always enable the Extra search for Known File Types option. This is very important because when files are being deleted on the HFS, HFS+, HFSX file systems, the computer completely removes all system information on them, and there is no way to recover the deleted files except by using the Extra Search for Known File Types option.

<table>
<thead>
<tr>
<th>Extra search for Known File Types</th>
<th>Enables search for Known File Types.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Save scan Info to File:</td>
<td>If this checkbox is selected, <strong>R-Studio</strong> will save scan information to a specified file. Later this file may be opened. Please note, that this option does not save actual disk data, only information on disk data structure gathered during disk scan.</td>
</tr>
<tr>
<td>Simple view</td>
<td>If this option is selected, <strong>R-Studio</strong> will show only scan progress.</td>
</tr>
<tr>
<td>Detailed view</td>
<td>If this option is selected, <strong>R-Studio</strong> will show graphic representation on objects found during scan.</td>
</tr>
<tr>
<td>None</td>
<td>If this option is selected, <strong>R-Studio</strong> will not show the <strong>Scan Information</strong> tab during scan.</td>
</tr>
</tbody>
</table>

**Buttons**

<table>
<thead>
<tr>
<th>Scan</th>
<th>Starts scanning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced</td>
<td>Activates advanced scan options</td>
</tr>
<tr>
<td>Known File Types...</td>
<td>Selects file types that <strong>R-Studio</strong> will recognize during the disk scan.</td>
</tr>
<tr>
<td>Cancel</td>
<td>Closes the dialog box</td>
</tr>
</tbody>
</table>

**NEVER TRY TO SAVE SCAN INFORMATION TO THE OBJECT BEING SCANNED!!!**

**Or you may obtain unpredictable results and lose all of your data.**

If a remote computer is connected for **Data Recovery over Network**, the **Scan** dialog box will have a different look

![Scan dialog box](image)

and the **Save Scan Information File** dialog box will appear when you select a place to store scan info. You may save it to the local or remote computer.
**Known File Types:** While scanning, **R-Studio** can recognize the data’s particular file type. Using such information, **R-Studio** can obtain more information about data/file structure on the object being scanned. By default, **R-Studio** tries to recognize the default list of supported file types specified on the Known File Types tab of the **Settings** panel, greatly increasing time required for the scan. You may reduce it by selecting only those file types that you need. Click the Known File Types... button and select the required file types on the File Types dialog box. These selections will be applied to that scan session only.

**File Types dialog box**

- **Known File Types**
  - Set as Default: Click this button to set the current list of selected file types as default values.
  - Revert to Default: Click this button to revert the default settings specified on the Known File Types tab of the **Settings** panel.
  - Reset to Recommended: Click this button to revert to factory-preset default settings.
  - Select All: Click this button to select all file types in the list.
  - Clear All: Click this button to clear all file types in the list except some predefined ones.

**List of known file types**

|-------------------|-------------------------|----------------------------|---------------------------|----------------------------------|

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<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Lotus Organizer: .or5</td>
<td>Lotus Word Pro Document: .lwp</td>
<td>Microsoft Office Open XML Document</td>
<td>Microsoft OneNote section file: .one</td>
</tr>
<tr>
<td>WordPerfect Document: .doc</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Document: E-book**

| Chaoxing SSReader eBook: .pdg | EPUB eBook: .epub | FB2 eBook: .fb2 | MOBI eBook: .mobi | Microsoft Money Data: .mny |
| Microsoft Reader eBook: .lit | Microsoft Reader eBook annotations: .ebo | | | |

**Document: Spreadsheet**

|---------------------------------------|---------------------------------|-------------------------------------|-------------------------------------|

**Document: Database**

| **Microsoft Access 2007 Database:** .accdb | **Microsoft Access Database:** .mdb | **Microsoft SQL Log:** .ldf | **Microsoft SQL Database:** .mdf |
| **MySQL Database Dictionary:** .frm | **MySQL database:** .myi | **Omnis Studio Library:** .lbs | **Omnis Studio Database:** .df1 |
| **OpenOffice Base document:** .odb | **dBase III Database:** .dbf |

**Document: Financial**
- **Microsoft Money Data:** .mny
- **QuickBooks Backup File:** .qbb
- **QuickBooks Primary Data File:** .qbw
- **Quicken Data:** .qdf
- **TurboTax return file:** .tax

**Internet-related files**
- **Compiled HTML file:** .chm
- **Internet shortcut:** .url
- **Microsoft Outlook Personal Folder:** .pst
- **Microsoft Outlook/Inbox offline folder:** .ost
- **Mozilla Firefox browser extension:** .xpi
- **Mozilla Mail Summary file:** .msf
- **Outlook Express Messages:** .dbx
- **The Bat! Address book:** .abd
- **The Bat! Message Base:** .tbb
- **Windows Address Book:** .wab
- **XML document (Unicode):** .xml

**Email**
- **E-Mail Message:** .eml
- **Microsoft Outlook Personal Folder:** .pst
- **Microsoft Outlook Inbox offline folder:** .ost
- **Mozilla Mail Summary file:** .msf
- **Outlook Express Messages:** .dbx
- **The Bat! Address book:** .abd
- **The Bat! Message Base:** .tbb
- **The Bat! Message Index:** .tbi
- **Windows Address Book:** .wab

**Font**
- **Adobe PostScript Font:** .pfb
- **Adobe Printer Font:** .pfm
- **BDF Unix font:** .bdf
- **BGI font:** .chr
- **CPI DOS font:** .cpi
- **OpenType font:** .otf
- **TrueType Font:** .ttf
- **Windows System Font:** .fon

**Graphics/Picture**
- **AVHRR Satellite image:** .sst
- **Adobe Lightroom preview:** .lrprev
- **Adobe Photoshop image:** .psd
- **Agfa/Matrix Scodl Image:** .scd
- **Alias Wavefront Raster Image:** .rla
- **Amiga icon:** .info
- **ArcView Shape:** .shp
- **AutoCAD Binary Image:** .dxf
- **AutoCAD Drawing:** .dwg
- **AutoCAD Image:** .dxf
- **Autodesk Animator Pro color palette:** .col
- **Autodesk Animator Pro Image:** .pic
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<td>ZSoft PCX Image: .pcx</td>
<td>iPhoto Image: .attr</td>
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**Multimedia: Audio Files**

<p>| AIFF Sound: .aif             | AVR Sound: .avr                 | AY Chip music: .ay         | AdLib Tracker 2 module: .a2m |
| Advanced Streaming Format file: .asf | Audacity audio: .au             | AudioCD file: .cda         | Battery 3 sample: .nov      |
| CMF music: .cmf              | Common Loudspeaker Binary: .cf1 | Creative voice file: .voc  | DiamondWare sound: .dwd     |
| Digital Speech File: .dss    | Digital voice file: .dvf         | EA ASF/MUS audio file: .asf| Extended M3U playlist: .m3u |
| FLAC audio file: .fla, .flac | KaraBox sound: .mkf             | La Lossless audio file: .la| Liquid Audio File: .la1     |
| MIDI Instrument definition: .idf| MIDI music: .mid              | MIDI stream: .mds          | MPEG Layer I audio file: .mpg |
| MPEG Layer II audio file: .mp2| MPEG Layer III audio file: .mp3| MUS music: .mus            | Monkeys audio file: .ape    |
| Ogg Vorbis audio file: .ogg  | OptimFROG audio file: .ofr     | Portable Sound Format: .psf| RIFF MIDI music: .rmi       |
| RK Audio sound: .rka         | Sierra AUD sound: .aud         | Sony OpenMG audio file: .oma| Super NES audio file: .spc  |
| TTA audio file: .tta         | VQF sound: .vqf                 | WavPack audio file: .wv    | Westwood AUD sound: .aud    |</p>
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<td>aPac audio file: .apc</td>
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<td>ZyXEL sound: .zyx</td>
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<td>DVM video: .dvm</td>
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<td>Director video: .dcr</td>
<td>DeluxePaint animation: .anm</td>
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<td>Nullsoft Video: .nsv</td>
<td>Mathematica Video: .nup</td>
<td>Compress archive: .z</td>
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<td>SGI movie format: .mv</td>
<td>QuickTime video: .mov</td>
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<td>Smacker video: .smk</td>
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<td>Sony Movie Player video: .mpv</td>
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<td>Vivo streaming video: .viv</td>
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<td>Material Exchange File: .mxf</td>
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<td>RIFF Multimedia File</td>
<td>RIFF Multimedia File</td>
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<td>RIFF Multimedia File</td>
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<td>Android Package: .apk</td>
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**Executable/Library/DLL**

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<td>UEFI Executable .efi</td>
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### Other file types

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<tr>
<td>Kaspersky Anti-Virus data base</td>
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<td>NHTSA UDS-1992 crash test result</td>
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<td>XNA Game Data</td>
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**Note:** Using scan for Known File Types, **R-Studio** can successfully recover only un-fragmented files. You may also specify your own file types for scanning. See [Customizing File Types](#) for details. User-defined file types precede over built-in ones, if their definitions overlap.
You may set the defaults for known file types on the **R-Studio Settings**.

**R-Studio Technician**

**Scan (Post Actions) dialog box**

![Post Actions Options](image)

**Post Actions Options**

- **Shutdown the computer on task completion**
  - If this check box is selected, **R-Studio** will shut down your computer when scan has been completed. You should select the **Save to file** checkbox and specify a place to save scan info to activate this option.

- **E-Mail notifications**
  - If this check box is selected, **R-Studio** will inform you about the outcome of the operation via email.

4 **R-Studio** starts scanning the object, and its panel will show information about new found objects:

![R-Studio Main panel](image)
The **Log** pane will show scan progress. Scan may be stopped by clicking the **Stop** button on the toolbar. Later the scan process may be resumed with different scan parameters. Some scan parameters may also be changed during the scan process. Click the **Options** button and change them on the **Scanning** dialog box.

To see the information about a newly found object, simply click it on the **Drives** panel. Click this link to see the information about the object **Recognized3**.
When an object is scanned, a number of Recognized partitions will appear. R-Studio shows them in different colors depending on which elements of the partition have been found.

<table>
<thead>
<tr>
<th>Partition</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partition 1</td>
<td>An existing logical disk or partition</td>
</tr>
<tr>
<td>Recognized 9</td>
<td>Both boot records and file entries are found for this partition</td>
</tr>
<tr>
<td>Recognized 11</td>
<td>Only file entries are found for this partition</td>
</tr>
<tr>
<td>Recognized 10</td>
<td>Only boot records are found for this partition</td>
</tr>
<tr>
<td>Empty Space 9</td>
<td>Empty space on the object</td>
</tr>
<tr>
<td>Deleted Partition 1</td>
<td>A deleted partition</td>
</tr>
<tr>
<td>Raw Files</td>
<td>Files that have been found using scan for known file types.</td>
</tr>
</tbody>
</table>

Although such recognized partitions are virtual objects, files can be searched for and recovered from recognized partitions as from real logical disks using Basic File Recovery.

All scanned information may be deleted on the contextual menu for a scanned object.

Scan information may be saved in a file. Previously saved scan information may be loaded. This can be done on the Drive or contextual menu for a selected object.

**Resuming incomplete scans or scanning the object with different parameters**

You may resume the scan of an incompletely scanned object or rescan the already scanned object with different parameters. The Scan dialog will be a little bit different in this case.

![Scan dialog box for incomplete scans](image)

You may rescan the entire disk, scan unscanned areas, or scan an explicitly specified area.
Scan of multiple areas
You may simultaneously scan several successive or overlapping areas. Click the Advanced button, specify an offset and size for a new area to scan on the Advanced Scan dialog box and click the Add button. You may specify and add several scan areas. You may select which areas should be scanned. Selected scan areas can be merged. Right-click a necessary area and select either Merge Down, Merge Down All, and Merge Selected. You may also select/unselect unscanned areas.

Advanced Scan dialog box

R-Studio accumulates the information from successive scans and keeps track of changes in this information obtained from different scans.
You may manage the areas

Managing scan information
Scan information may be saved to a file. Previously saved scan information may be loaded.

To save scan information
1. Select an object on the R-Studio Drives panel
2. Select Save Scan Information on the Drive or contextual menu and save the scan information in a file
   The default file extension is *.scn.
   If a remote computer is connected for Data Recovery over Network, the Save Scan Information File dialog box will appear when you select a place to store scan info. You may save it to the local or remote computer.

To load scan information
1. Select an object on the R-Studio Drives panel
2. Select Open Scan Information on the Drive or contextual menu and select the required file with the scan information
   The default file extension is *.scn.
If a remote computer is connected for **Data Recovery over Network**, the **Open Scan Information File** dialog box will appear when you select a place to load scan info from. You may load it from the local or remote computer.

> The scan information will appear in the **Drives** panel

**To remove scan information**

1. Select an object on the R-Studio **Drives** panel
2. Select **Remove Scan Information** on the Drive or contextual menu

> The scan information will disappear from the **Drives** panel

**NEVER TRY TO SAVE SCAN INFORMATION ON THE OBJECT BEING SCANNED!!!**

Or you may obtain unpredictable results and lose all your data.

### 2.2.2 Fast Search for Lost Partitions

Disk scan gives very detailed and accurate results but takes long time. If you want to find only partitions previously existed on the disk you may use fast search for lost partitions which is much faster.

**To perform fast search for lost partitions,**

1. Select an object on the R-Studio's **Drives** panel
Fast search for lost partitions

2 Click the Fast Partition Search button

R-Studio will start searching for lost partitions showing its progress.

Fast search for lost partitions
> **R-Studio** will show fast found partitions in blue.

**Fast search for lost partitions**

You may control-click the partition and select Complete scan to scan the entire disk.

### 2.2.3 Customizing File Types

You may create your own known file types and add their file signatures for scanning in Known File Types. They will appear in their respective folders on the File Types dialog box.

You can do that either by using the R-Studio’s graphic interface or by direct editing the known file description file specified on the R-Studio Main settings dialog box.

**Creating a Known File Types using a Graphic User’s Interface**

The easiest way to add your own is to use the R-Studio’s graphic interface.

To create a Known File Type,

1. On the Known File Types settings dialog box, click the Edit User’s File Types... button

   The Edit User’s File Types dialog box will appear
2 Click the Create File Types button and specify File type properties

**Edit User’s File Types dialog box**

<table>
<thead>
<tr>
<th>File Types properties</th>
<th>id</th>
<th>group</th>
<th>description</th>
<th>features</th>
<th>extension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required Digital file type identifier. Should be unique for each custom file type.</td>
<td>digit</td>
<td>string</td>
<td>Optional Specifies a file type group in which found files will appear. You may specify either your own groups or select those predefined on the File Types dialog box.</td>
<td>NO_SCAN TXT_ANSI TXT_UNICODE</td>
<td>&lt;string&gt;</td>
</tr>
</tbody>
</table>
3 Click the Add Signature button, specify the signature parameters, and click the Save button.

**Edit User’s File Types dialog box**

<table>
<thead>
<tr>
<th>File signature properties</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Begin</strong></td>
</tr>
<tr>
<td><strong>End</strong></td>
</tr>
<tr>
<td><strong>AND</strong></td>
</tr>
<tr>
<td><strong>OR</strong></td>
</tr>
<tr>
<td><strong>From</strong></td>
</tr>
<tr>
<td><strong>To</strong></td>
</tr>
</tbody>
</table>

You may specify as many signatures as you need. Moreover, you may specify subgroups within a signature using the **Add Subgroup** button. The structure of such possible subgroups is described on the **Customizing File Types-II** help page.

The newly specified file type will appear on the **Edit User’s File Types** dialog box and the **File Types** dialog box.

**Edit User’s File Types dialog box**

2.2.4 Customizing File Types-I

The syntax of signature description is similar to that of the XML language. They are stored in an .xml file the path to which is specified on the **Setting** dialog box.

More advanced features are described in **Customizing File Types-II**.
Signature file example

```xml
<?xml version="1.0" encoding="utf-8"?>
<FileTypeList>
  <!-- Search for NTFS MFT -->
  <FileType id="5626" group="System Files" description="MFT" features="TXT_ANSI TXT_UNICODE">
    <Signature offset="0" from="begin" count="1">FILE</Signature>
    <Signature offset="7" from="end" count="1">$\x00M\x00F\x00T</Signature>
  </FileType>
</FileTypeList>
```

File structure

File header

The file starts with a standard XML header

```xml
<?xml version="1.0" encoding="utf-8"?>
```

Section FileTypeList

<FileTypeList>
  It requires a closing element </FileTypeList>.

Section FileType

This is a description of each file signature.

Attributes:

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Type</th>
<th>Required</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>id</td>
<td>&lt;u32&gt;</td>
<td>Required</td>
<td>Digital file type identifier. Should be unique for each file type.</td>
</tr>
<tr>
<td>group</td>
<td>&lt;string&gt;</td>
<td>Optional</td>
<td>Specifies a file type group in which found files will appear. You may specify either your own groups or those predefined on the File Types dialog box. Default: unknown</td>
</tr>
<tr>
<td>description</td>
<td>&lt;string&gt;</td>
<td>Optional</td>
<td>Brief file description. Default: null (no description)</td>
</tr>
<tr>
<td>features</td>
<td>NO_SCAN</td>
<td>Optional</td>
<td>Additional properties of the file type. If you want to specify several properties, they should be separated by a space. Default: 0</td>
</tr>
<tr>
<td></td>
<td>TXT_ANSI</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TXT_UNICODE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>extension</td>
<td>&lt;string&gt;</td>
<td>Optional</td>
<td>File extension. Default: null (no extension)</td>
</tr>
</tbody>
</table>

File type properties flags

<table>
<thead>
<tr>
<th>Flag</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO_SCAN</td>
<td>Not to be scanned for. If this flag is used, R-Studio will not search for such file type. Such files will be shown when sorting files by their extensions.</td>
</tr>
<tr>
<td>TXT_ANSI</td>
<td>The file can viewed as ANSI text. If this flag is specified, the file can be correctly represented as an ANSI text. When previewing, this file will be immediately sent to Text/Hexadecimal Editor.</td>
</tr>
<tr>
<td>TXT_UNICODE</td>
<td>File can viewed as UNICODE text. If this flag is specified, the file can be correctly represented as a UNICODE text. When previewing, this file will be immediately sent to</td>
</tr>
</tbody>
</table>

© 2021 R-Tools Technology Inc.
This section can contain an unlimited number of the Signature elements. If there are several Signature elements, that means that all those signatures are simultaneously present in the file. Such signatures should have different offset attributes and they should not overlap.

**Element Signature**

The element contains a string value of the file signature consisting of ASCII characters and hex bytes in the \xhh format, where hh is a hexadecimal byte code. If there is not a hexadecimal number after \x, \x are treated as a part of the string section of the signature.

**Attributes:**

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Type</th>
<th>Optional</th>
<th>Description</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>offset</td>
<td>&lt;u16&gt;</td>
<td>Optional</td>
<td>Decimal offset for the signature.</td>
<td>Default: 0</td>
</tr>
<tr>
<td>count</td>
<td>&lt;u16&gt;</td>
<td>Optional</td>
<td>Decimal number specifying the number of signatures of the same length. Used when several signatures of the same length starting with the same offset can be present in a file. In this case they should be sequentially written in the element, and the size attribute specifies the length of signature. count*size should be equal to the number of bytes in the element. If only one signature can be on this offset, count should be equal &quot;1&quot;, and size should be equal to the length (the number of bytes) of the signature.</td>
<td>Default: 1</td>
</tr>
<tr>
<td>size</td>
<td>&lt;u16&gt;</td>
<td>Optional</td>
<td>Decimal number specifying the number of bytes in the signature.</td>
<td>Default: the number of bytes written in the element.</td>
</tr>
<tr>
<td>from</td>
<td>begin</td>
<td>Optional</td>
<td>Specifies from where the offset is calculated.</td>
<td>Default: begin</td>
</tr>
<tr>
<td></td>
<td>end</td>
<td></td>
<td>If end, the offset is from the end of file to the first byte of the signature. That is, if the signature is two bytes long, the offset value should be 2.</td>
<td></td>
</tr>
</tbody>
</table>

**Comments**

<!-- Comment string -->

An XML standard string for a comment.

2.2.5 Customizing File Types-II

Currently R-Studio supports two versions of file type descriptions. Version 2 extends legacy Version 1 by adding variable signature offsets and AND/OR combination of several signatures in one file type. The version of
file type description is specified by the version attribute of the FileTypeList section. Version 1 is the default option.

**File structure**

*Elements common to Versions 1 and 2 of file type description*

**File header**

The file starts with a standard XML header

```xml
<?xml version="1.0" encoding="utf-8"?>
```

**Section FileTypeList**

```xml
<FileTypeList>
  <FileType id="2" group="archive" description="ARJ Archive" extension="arj">
    <Signature offset="3" count="1">Abc\x5c\x04</Signature>
    <Signature offset="9" count="2">\x23\x01\xf4</Signature>
  </FileType>
</FileTypeList>
```

**Section FileType**

This is a description of each file signature.

**Attributes:**

<table>
<thead>
<tr>
<th>id</th>
<th>&lt;u32&gt;</th>
<th>Required</th>
<th>Digital file type identifier. Should be unique for each file type.</th>
</tr>
</thead>
<tbody>
<tr>
<td>group</td>
<td>&lt;string&gt;</td>
<td>Optional</td>
<td>Specifies a file type group in which found files will appear. You may specify either your own groups or those predefined on the File Types dialog box. See the table below.</td>
</tr>
<tr>
<td>description</td>
<td>&lt;string&gt;</td>
<td>Optional</td>
<td>Brief file description</td>
</tr>
<tr>
<td>features</td>
<td>NO_SCAN, TXT_ANSI, TXT_UNICODE</td>
<td>Optional</td>
<td>Additional properties of the file type. If you want to specify several properties, they should be separated by a space.</td>
</tr>
</tbody>
</table>
**File type properties flags**

<table>
<thead>
<tr>
<th>Flag</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO_SCAN</td>
<td>Not to be scanned for. If this flag is used, R-Studio will not search for such file type. Such files will be shown when sorting files by their extensions.</td>
</tr>
<tr>
<td>TXT_ANSI</td>
<td>The file can be viewed as ANSI text. If this flag is specified, the file can be correctly represented as an ANSI text. When previewing, this file will be immediately sent to Text/hexadecimal editor.</td>
</tr>
<tr>
<td>TXT_UNICODE</td>
<td>The file can be viewed as UNICODE text. If this flag is specified, the file can be correctly represented as a UNICODE text. When previewing, this file will be immediately sent to Text/hexadecimal editor.</td>
</tr>
</tbody>
</table>

**List of predefined file type groups**

<table>
<thead>
<tr>
<th>Group</th>
<th>Name on the File Types dialog box.</th>
</tr>
</thead>
<tbody>
<tr>
<td>archive</td>
<td>Archive Files</td>
</tr>
<tr>
<td>graphics</td>
<td>Graphics/Picture</td>
</tr>
<tr>
<td>internet</td>
<td>Internet-related files</td>
</tr>
<tr>
<td>multimedia</td>
<td>Multimedia Files</td>
</tr>
<tr>
<td>audio</td>
<td>Multimedia: Audio Files</td>
</tr>
<tr>
<td>video</td>
<td>Multimedia: Video Files</td>
</tr>
<tr>
<td>font</td>
<td>Font</td>
</tr>
<tr>
<td>document</td>
<td>Document</td>
</tr>
<tr>
<td>doc_database</td>
<td>Document: Database</td>
</tr>
<tr>
<td>doc_sheet</td>
<td>Document: Spreadsheet</td>
</tr>
<tr>
<td>exe</td>
<td>Executable/Library/DLL</td>
</tr>
<tr>
<td>unknown</td>
<td>Other file types</td>
</tr>
</tbody>
</table>

This section can contain an unlimited number of the Signature elements. If there are several Signature elements, that means that all those signatures are simultaneously present in the file. Such signatures should have different offset attributes and they should not overlap.

**Element Signature**

The element contains a string value of the file signature consisting of ASCII characters and hex bytes in the \xhh format, where hh is a hexadecimal byte code. If that is not a hexadecimal number after \x, \x are treated as a part of the string section of the signature.

**Attributes:**

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>offset</td>
<td>Optional Decimal offset for the signature</td>
</tr>
<tr>
<td>count</td>
<td>Optional Decimal number specifying the number of signatures of the same length. Used when several signatures of the same length starting with the same offset can be present in a file. In this case they should be sequentially written in the element, and the size attribute specifies the length of signature. count*size should be</td>
</tr>
<tr>
<td></td>
<td>Default: 0</td>
</tr>
</tbody>
</table>

|           | Default: 1                                                                  |
|           |                                                                               |
equal to the number of bytes in the element. If only one signature can be on this offset, count should be equal to "1", and size should be equal to the length (the number of bytes) of the signature.

<table>
<thead>
<tr>
<th>Field</th>
<th>Type</th>
<th>Default</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>size</td>
<td>&lt;u16&gt;</td>
<td>Optional</td>
<td>Decimal number specifying the number of bytes in the signature.</td>
</tr>
<tr>
<td>from</td>
<td>begin, end</td>
<td>Optional</td>
<td>Specifies from where the offset is calculated. If end, the offset is from the end of file to the first byte of the signature. That is, if the signature is two bytes long, the offset value should be 2. Default: begin</td>
</tr>
</tbody>
</table>

**Version 2 of file type description**

**Signature file example**

```xml
<?xml version="1.0" encoding="utf-8"?>
<FileTypeList version="2.0">
  <FileType id="5626" group="_Test" description="Test file" extension="tst">
    <Begin combine="and">
      <Signature from="0" to="20">ABC</Signature>
      <Signature offset="1">CDEFG</Signature>
      <AND>
        <Signature offset="0">DE</Signature>
        <Signature offset="0">RTD</Signature>
        <OR>
          <Signature offset="12">CP</Signature>
          <Signature offset="16">RTD</Signature>
        </OR>
      </AND>
    </Begin>
    <End combine="or">
      <Signature from="3" to="20">ABC</Signature>
      <Signature offset="5">CDEFG</Signature>
      <AND>
        <Signature offset="2">DE</Signature>
        <Signature offset="3">RTD</Signature>
        <OR>
          <Signature offset="12">CP</Signature>
          <Signature offset="16">RTD</Signature>
        </OR>
      </AND>
    </End>
  </FileType>
</FileTypeList>
```
Section FileType
This is a description of each file signature.

Attributes:
Similar to those in Version 1.
The section can contain one element Begin and one End. It should contain at least one of them.

Example
```xml
<FileTypeList version="2.0">
  <FileType id="2" group="archive" description="ARJ Archive" extension="arj">
    <Begin [attributes]>
      ...
    </Begin>
    <End [attributes]>
      ...
    </End>
  </FileType>
</FileTypeList>
```

Sections Begin and End
Specify the positions of file type signatures in the file.

Attributes

<table>
<thead>
<tr>
<th>combine</th>
<th>and or</th>
<th>Optional</th>
<th>Shows the order of the logical operation (union or intersection)</th>
<th>Default: and</th>
</tr>
</thead>
</table>

These sections can contain one of several elements Signature. And one or several elements OR or AND. If there are several elements inside the section they are combined according to the attribute combine.

Example:
```xml
<FileTypeList version="2.0">
  <FileType id="2" group="archive" description="ARJ Archive" extension="arj">
    <Begin combine="or">
      <Signature [attributes]> ... </Signature>
      ...
      <Signature [attributes]> ... </Signature>
      <AND>
        ...
      </AND>
      <OR>
        ...
      </OR>
    </Begin>
    <End>
    <OR>
      ...
    </OR>
    <AND>
      ...
    </AND>
    <Signature [attributes]> ... </Signature>
    ...
  </FileType>
</FileTypeList>
```
Sections **AND** and **OR**

These sections can contain one of several elements **Signature**. And one or several elements **OR** or **AND**. If there are several elements inside the section they are combined according to the section type (logical **AND** or **OR**).

**Example:**

```xml
<FileTypeList version="2.0">
  <FileType id="2" group="archive" description="ARJ Archive" extension="arj">
    <Begin>
      <Signature [attributes]> ... </Signature>
      ... 
      <Signature [attributes]> ... </Signature>
      <AND>
        <Signature [attributes]> ... </Signature>
        <OR>
          <Signature [attributes]> ... </Signature>
          <AND>
            <Signature [attributes]> ... </Signature>
            <Signature [attributes]> ... </Signature>
          </AND>
          <OR>
            <Signature [attributes]> ... </Signature>
            <Signature [attributes]> ... </Signature>
          </OR>
        </OR>
        <Signature [attributes]> ... </Signature>
      </AND>
    </Begin>
  </FileType>
</FileTypeList>
```

**Element **Signature**

The element contains a string value of the file signature consisting of ASCII characters and hex bytes in the \xhh format, where hh is a hexadecimal byte code. If that is not a hexadecimal number after \x, \x are treated as a part of the string section of the signature.

**Attributes:**

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Type</th>
<th>Optional</th>
<th>Description</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>offset</td>
<td>&lt;u16&gt;</td>
<td>Optional</td>
<td>Decimal offset for the signature</td>
<td>Default: 0</td>
</tr>
<tr>
<td>from</td>
<td>&lt;u16&gt;</td>
<td>Optional</td>
<td>Decimal number specifying the leftmost possible offset for the file signature. Ignored if the offset attribute is specified.</td>
<td>Default: undefined</td>
</tr>
<tr>
<td>to</td>
<td>&lt;u16&gt;</td>
<td>Optional</td>
<td>Decimal number specifying the rightmost possible offset for the file signature. Ignored if the offset attribute is specified.</td>
<td>Default: undefined</td>
</tr>
<tr>
<td>size</td>
<td>&lt;u16&gt;</td>
<td>Optional</td>
<td>Decimal number specifying the number of bytes in the signature.</td>
<td>Default: the number of bytes written in the element.</td>
</tr>
</tbody>
</table>
2.2.6 Regions

Scanning large objects may take a long time. Sometimes, only smaller area of a disk needs to be scanned or searched for files. Such area is called a region. A region can be created on any object in the R-Studio's Drives panel.

Created regions can be scanned, and files on them can be recovered in the same way as from hard drives or logical disks.

Created regions can be deleted.

Note: R-Studio does not create anything real on the disk. Regions are virtual objects that do not affect actual data on the disk.

To create a region

1. Select an object on the R-Studio's Drives panel and click the Create Region button

   * Other ways to create the region
     - Control-click the selected object and select Create Region on the contextual menu
     - Select the object and select Create Region on the Create menu

2. Specify required parameters on the Create region dialog box and click the Create button

   Create region dialog box

   ![Create region dialog box]

   - Region options
     - Disk size: Shows size of the object where the region is to be created. The region cannot be larger than this size.
     - Start: Start point of the region
     - Size: Size of the region. Cannot be larger than Disk size.

     Numbers in these fields can be in bytes or sectors. See the Data Formats and Multipliers topic for more details on data formats.

   > A Region object will appear on the Drives panel.
To change the size of a region
* Control-click the Region on the R-Studio Drives panel, select Edit on the shortcut menu, and enter a new size on the Edit Region dialog box.

To convert a region into an exclusive one
* Control-click the Region on the R-Studio Drives panel and select Exclude area on the shortcut menu

To remove a region
* Select a Region on the R-Studio's Drives panel and click the Remove button, or
  Control-click the selected region and select Remove Region on the contextual menu.

2.2.7  Exclusive Regions

Exclusive regions are areas on any object visible on the R-Studio’s Drives panel that are excluded from disk operations. R-Studio never tries to read/write data from/to such area. Exclusive regions are necessary when, for example, there are areas with bad sectors on a hard drive, and it is necessary to avoid any disk operations with such areas to not inflict further damage to such drive and to speed work with it.

Note: R-Studio does not create anything real on the disk. Exclusive regions are virtual objects that do not affect actual data on the disk.

To create an exclusive region

1  Control-click an object on the R-Studio's Drives panel and select Create Exclusive Region on the contextual menu, or

Select the object and select Create Exclusive Region on the Create menu

2  Specify required parameters on the Create Exclusive Region dialog box and click the Add button

Create exclusive region dialog box

Exclusive Region options

| Offset: | Start point of the exclusive region |
| Size: | Size of the exclusive region. Cannot be larger than Disk size. |
Numbers in these fields can be in bytes or sectors. See the Data Formats and Multipliers topic for more details on data formats.

> An Exclusive Region object will appear on the Drives panel.

Its properties can be seen on the Excluded Areas tab.

To delete an exclusive region

* Select an Exclusive Region on the R-Studio Drives panel and click the Delete button, or Control-click the selected region and select Remove Region on the contextual menu.

To change the size of an exclusive region

* Control-click an Exclusive Region on the R-Studio Drives panel, select Edit on the contextual menu, and add/delete excluded areas on the Edit Exclusive Region dialog box.

You may delete an excluded area by control-clicking it and selecting Remove on the contextual menu.

2.2.8 Images

An image is an exact, byte by byte, copy of any object on the Drives panel. When created, images can be processed like their original objects.

Images are very useful if there is a risk of total data loss due to hardware malfunction. If bad blocks are constantly appearing on a hard drive, you must immediately create an image of this drive. All data search, scan and restoring can be done from this image.

While creating images, R-Studio can simultaneously perform disk scan and save scan information to lessen time necessary to process the disk.

The image can be saved on the remote computer if it is created via network. R-Studio can also load and process images created with the DeepSpar Disk Imager™.

To create an image,

1. Select an object on the R-Studio’s Drives panel and click the Create Image button

   - Other ways to create the image
     * Select the object and select Create Image on the Drive menu
     * Control-click the selected object and select Create Image File on the contextual menu

2. Specify image options, a file name, and destination for the image on the Drive Image Wizard

Note: To store an image file, you need a free space equal to at least the object size.
Create Image (Main) dialog box

Image file name
- Specifies the name and path for the image file

Byte to byte image
- If this option is selected, R-Studio will create a simple exact copy of the object. This image format is compatible with the previous versions of R-Studio.

Compressed image (R-Drive Image compatible)
- If this option is selected, R-Studio will create an image file which can be compressed, split into several parts, and password-protected. This image file is fully compatible with the images created by R-Drive Image, but incompatible with the previous versions of R-Studio.

Compression ratio
- You may compress the data in the image to save space. Active only if the Compressed image (R-Drive Image compatible) is selected.

Estimated size
- Shows the estimated size of the image file. An actual image size depends on how much empty space is on the selected partition and what file types are there. Active only if the Compressed image (R-Drive Image compatible) is selected.

Image split size
- You may set this option to Automatic and let the computer decide how to split the image file. This mostly depends on the file system on the destination disk. You may also either explicitly specify the split size, or choose a preset for various devices with removable storage. Select Fixed size for that. Active only if the Compressed image (R-Drive Image compatible) is selected.

Image password
- You may protect your image file with a password. Note: This feature provides a relatively moderate protection against conventional unauthorized access. Active only if the Compressed image (R-Drive Image compatible) is selected.

If a remote computer is connected for Data Recovery over Network, the Save Image File dialog box will appear when you select a place to store the image. You may save it to the local or remote computer.
Create Image (Scan Information) dialog box
### Image Options (Scan Information)

| Create scan information file | If this option is selected, **R-Studio** will perform disk scan simultaneously with image creation. See the [Disk Scan](#) help page to learn scan options. |

### Create Image (Advanced) dialog box

![Create Image (Advanced) dialog box](image)

### Image Options (Advanced)

| Read attempts | Specifies how many times **R-Studio** will try to read a bad sector. **R-Studio** treats bad sectors in the following way:
|               | It reads a certain part of disk (predefined by Windows) and
|               | - If Default read attempts is set to 0, the entire part with bad sectors will be filled with the specified pattern.
|               | - If Default read attempts is set to a non-zero value, **R-Studio** reads again that part sector by sector, repeating the attempts the specified number of times. If **R-Studio** still cannot read a bad sector, it fills the sectors with the specified pattern. In this case only the bad sectors will be filled with the pattern, but that extremely slows the disk read process.
|               | For example, if you set Default read attempts to 1, a bad sector will be read 2 times. |
| Pattern to fill bad blocks | Specifies a pattern **R-Studio** will use to fill bad sectors in images. [Hexadecimal Editor](#). You may specify the pattern either in the ANSI or Hex data format. **Note:** **R-Studio** will never ever try to write anything on the disk from which data is to recover or an image is to create. This pattern fills bad sectors only in the image. |
**R-Studio Technician**

**Create Image (Additional output folders) dialog box**

Additional output folders

Additional output folders where image files will be stored when **R-Studio** runs out of space.

**Create Image (Post Actions) dialog box**

**Post Actions Options**

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shutdown the computer on task completion</td>
<td>If this check box is selected, <strong>R-Studio</strong> will shut down your computer when image creation has been completed.</td>
</tr>
<tr>
<td>E-Mail notifications</td>
<td>If this check box is selected, <strong>R-Studio</strong> will inform you about the outcome of the operation via email.</td>
</tr>
</tbody>
</table>

> **R-Studio** will start creating the image, the **Progress** message showing the progress.

**To process an already created Image**, the image file should be opened.

**To open an image**

1. Click the Open Image button, or
2. Select **Open Image File** on the **Drive** menu
If a remote computer is connected for **Data Recovery over Network**, the **Open Image File** dialog box will appear when you select a place to load the image file from. You may load it from the local or remote computer.

2. Select the required image file
   
   > **An Image** object will appear on the **Drives** panel
   
   You may perform all data search, scan, and recovery from this image as it were a regular drive/disk object.

   Compressed (**R-Drive Image** compatible) images
   
   Byte-to-byte images
   
   A disk (or disks) containing in an image can be connected to the operating system as a device which makes its content accessible to any program including any other data recovery software.

   **To connect a disk in an image**
   
   1. Control-click the disk in the image on the **Drives** panel and select Mount on the contextual menu
   
   > **A Virtual disk** object will appear on the **Drives** panel
To disconnect a virtual disk from the system

1. Right-click the virtual disk in the image on the Drives panel and select Unmount on the shortcut menu.

### 2.2.9 Object Copy

You may copy any object in the Drives panel to any other object, if there is enough space on the target one. Before Copy object to... becomes enabled on the Create menu, you need to enable writing.

**To enable writing,**

1. On the R-Studio main panel, select the R-Studio menu, then Preferences, and select Enable Write on the Settings dialog box.

> The Copy object to... will be enabled on the Create menu.

Now objects can be copied.

Depending on the objects to copy and your tasks, you may do:

**Binary (byte to byte copy)**

An exact copy of the source object (or a part thereof) to the destination device (from its beginning or a specified offset). Any object may be copied to any object this way.

**To perform a binary copy of an object,**

1. Select Copy object to... on the Create menu.
2 Select a source and destination objects on the Drives Copy Wizard panel and click the Continue button.

Drives Copy Wizard

3 Select Binary (byte to byte) copy on the Copy Options dialog box, specify copy options, and click the Continue button.

Copy options dialog box

Copy options

Source
Copy whole object
Select this option if you want to copy the entire source object to the destination one.

Copy range
Select this option if you want to copy a part of the source object.

Offset
Specify the offset from which the source object data will be copied to the destination object.

Size
Specify the size of the source object data which will be copied to the destination object.

Destination
Offset
Specify the offset on the destination object to which the source object data will be copied.
3 View the copy task settings on the Drives Copy Wizard and click the Done button

**Drives Copy Wizard**

![Drives Copy Wizard](image)

or click the Go Back button to edit the copy parameters

- **R-Studio** will start copying data from the source object to the destination one.
  You may close the wizard by pressing the Esc key.

**Smart partition copy**

Only partitions can be copied with this option to other partitions or empty spaces. You may change some parameters of the copied partition(s) on the destination drive.

To perform a smart partition copy of a partition,

1 Select Copy object to... on the Create menu

2 Select source and destination partitions on the Drives Copy Wizard panel and click the Continue button

**Drives Copy Wizard**

![Drives Copy Wizard](image)
3 Select **Smart partition copy** on the **Copy Options** panel, specify copy options, and click the **Continue** button

**Copy options dialog box**

<table>
<thead>
<tr>
<th>Copy options dialog box</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Source</strong></td>
</tr>
<tr>
<td><strong>Destination</strong></td>
</tr>
<tr>
<td><strong>Copy without stretching</strong></td>
</tr>
<tr>
<td><strong>Copy to</strong></td>
</tr>
<tr>
<td><strong>Partition size</strong></td>
</tr>
<tr>
<td><strong>Partition type</strong></td>
</tr>
</tbody>
</table>

**View the copy task settings on the Drives Copy Wizard and click the Done button**

**Drives Copy Wizard**

or click the **Go Back** button to edit the copy parameters
R-Studio will start copying data from the source partition to the destination place. You may close the wizard by pressing the Esc key.

**Smart drive copy**

Only whole drives can be copied with this option to other drives. You may change some parameters of the copied drives.

1. Select Copy object to... on the Create menu
2. Select source and destination hard drives on the Drives Copy Wizard panel and click the Continue button

Drives Copy Wizard

3. Select Smart drive copy on the Copy Options panel, specify copy options, and click the Next button

Copy options dialog box

**Copy options**

**Copying mode**

- Copy all partitions onto original places
- Select this option if you want to copy all partitions to their original places.
One partition after another

Select this option if you want to copy the partitions one after another preserving their space. If there is empty space between the partitions, it will be omitted. Otherwise it is similar to Copy all partitions onto original places.
If Fixed active partition is selected, the original offset/size of the active partition will be preserved (in case the loader has links to it).

Expand/Shrink partition to whole disk

Specify this option if you want to proportionally expand/shrink the selected partitions to occupy the entire target drive.
If Fixed active partition is selected, the original offset/size of the active partition will be preserved (in case the loader has links to it).

3 View the copy task settings on the Drives Copy Wizard and click the Finish button

Drives Copy Wizard

Smart drive copy

or click the <Back button to edit the copy parameters

> R-Studio will start copying data from the source hard drive to the destination one
You may close the wizard by pressing the Esc key.

2.3 Mass File Recovery

Recovery of multiple files
If you need to recover multiple files you may do it through the following steps:

1 Find and mark all the necessary files
   Go to the Find and Mark Multiple Files topic for more information

2 Recover all marked files in a single file recovery step
   Go to the Recover Multiple Files for more information

3 Create file recovery lists to manually edit the list of files to recovery
   Go to the File Recovery Lists topic for more information
Memory considerations

R-Studio stores information about found files in computer memory. If there are too many files, R-Studio may run out of it. To avoid this, you have two options:

Recover all files

If you want to recover data from an entire file system object (a logical disk, partition, partition image, etc.), you may use the Recover All Files command from the Drive or contextual menu. Right click the object in the Drives panel to access the contextual menu. A Recover dialog box will appear. Select required restore settings, including file mask. This command restores unlimited number of files without memory restrictions.

View file information in steps

As soon as R-Studio nearly runs out of memory, a Too many files... message appears. You may temporally stop file listing and browse through found files. Then you can resume file listing. You also may skip this file section and continue file listing.

In all cases, R-Studio keeps information about the entire file structure.

- Find and Mark Multiple Files
- Recover Multiple Files

2.3.1 Find and Mark Multiple Files

If you need to find and mark many files at once, you may do that in the following ways:

By sorting them by their extensions or creation/modification/accessed time

To sort files by their extensions or creation/modification/accessed time,

* On the Folders panel select the tab
  Real File structure
  Extensions to sort the files by their extensions
  Creation Time to sort the files by their creation time
  Modification Time to sort the files by their modification time
  Accessed Time to sort the files by their accessed time

Other ways to sort files by their extensions or creation/modification/accessed time

- Select the disk on Drives panel, select Open Drive Files Sorted By on the Drive menu, and select the respective option,
  or
- On the Folders panel, control-click the disk letter and select Show Files Sorted By on the contextual menu and select the respective option,

> R-Studio will show the sorted files in the Folders and Content panels, showing the path to each file: Folders panel for files sorted by their extensions
To return to the conventional view,

* On the Drives panel, control-click the logical disk, select Open Drive Files Sorted By on the contextual menu, and select Real File System Structure,

or

* On the Folders panel, select Show Files Sorted By on the Drive menu and select Real File System Structure

or

* Click the Real tab

**By finding and marking multiple files using the Find/Mark dialog box**

You may find and mark all the files on the entire disk by using Mark matched files in the Find/Mark mode option. You may specify all the necessary search options and mark all the found files. Please note that each find and mark/unmark operation is independent from previous ones. That is, if a file matches the search criteria, it will be marked/unmarked regardless of its previous marked/unmarked state.

For example, if you first mark all doc files, and then all txt files, all doc files remain marked, too. If you then decide to unmark all files smaller than 2 kB, all doc and txt files will stay marked except those that less than 2 kB.

### 2.3.2 Recover Multiple Files

If R-Studio while recovering files encounters either an already existing file or file with a broken name, normally it will stop working and ask you what to do with the file. If you recover multiple files, that may require you answer a lot of the same questions. You may use Mass File Recovery Options on the **Recover** dialog box to instruct R-Studio what to do in those cases for all files.
## Mass File Recovery Options

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>File Already Exists</strong></td>
<td>These options instruct R-Studio what to do if there already exists a file with the same name.</td>
</tr>
<tr>
<td><strong>Extended options</strong></td>
<td>If this option is selected, more advanced options become accessible to process multiple duplicates of the file.</td>
</tr>
<tr>
<td><strong>Prompt</strong></td>
<td>If this option is selected, R-Studio asks the user what to do for each such file. It stops file recovery until it receives the answer.</td>
</tr>
<tr>
<td><strong>Rename</strong></td>
<td>If this option is selected, R-Studio adds a File ID to the file name. If a file already exists with the same name and that file ID, a number will be added to the file name and file ID.</td>
</tr>
<tr>
<td><strong>Skip</strong></td>
<td>If this option is selected, R-Studio skips all new files with the same name.</td>
</tr>
<tr>
<td><strong>Overwrite</strong></td>
<td>If this option is selected, R-Studio overwrites the existing file with the new one.</td>
</tr>
<tr>
<td><strong>Overwrite Older</strong></td>
<td>If this option is selected, R-Studio overwrites the existing file with the new one if the existing file is older than the new file. The time stamp used is Modified.</td>
</tr>
<tr>
<td><strong>Overwrite Smaller</strong></td>
<td>If this option is selected, R-Studio overwrites the existing file with the new one if the existing file is smaller than the new file. The time stamp used is Modified.</td>
</tr>
<tr>
<td><strong>Overwrite Bigger</strong></td>
<td>If this option is selected, R-Studio overwrites the existing file with the new one if the existing file is bigger than the new file. The time stamp used is Modified.</td>
</tr>
<tr>
<td><strong>Broken File Name</strong></td>
<td>These options instruct R-Studio what to do if a file to be recovered appears to have an invalid name.</td>
</tr>
<tr>
<td><strong>Prompt</strong></td>
<td>If this option is selected, R-Studio shows the standard Broken File Name dialog box for each file with a broken file name. It stops file recovery until it receives the answer.</td>
</tr>
<tr>
<td><strong>Rename and change all invalid symbols to:</strong></td>
<td>If this option is selected, R-Studio changes all invalid characters to the character specified.</td>
</tr>
</tbody>
</table>
Skip  
If this option is selected, **R-Studio** skips all files with broken file names.

**Hidden Attribute**  
These options instruct **R-Studio** what to do if a file to be recovered appears to have the Hidden attribute.

**Prompt**  
If this option is selected, **R-Studio** asks the user what to do with the attribute. It stops file recovery until it receives the answer.

**Remove**  
If this option is selected, **R-Studio** removes the Hidden attribute from all files.

**Keep**  
If this option is selected, **R-Studio** keeps the Hidden attribute for all files.

**Extended options**  
These options give you more flexible ways to process multiple files with the same name. You may compare files by time (Modified) and size, and decide what **R-Studio** should do with those duplicates. If any of the files has an invalid time, the comparison by time is skipped. In this case, if comparison by size is not active, **R-Studio** goes to the default action.

**Recover (Advanced - Extended options) dialog box**

**Extended advanced file recovery options**

<table>
<thead>
<tr>
<th>First compare time</th>
<th>These options instruct <strong>R-Studio</strong> which condition to use first, file time or size.</th>
</tr>
</thead>
<tbody>
<tr>
<td>First compare size</td>
<td>These options instruct <strong>R-Studio</strong> to enable comparison by time and size.</td>
</tr>
</tbody>
</table>

**Actions**  
These selectable actions instruct **R-Studio** what to do if the condition is met.

| Empty field | If this option is selected, **R-Studio** skips the condition. |
| Prompt | If this option is selected, **R-Studio** asks the user what to do for each such file. It stops file recovery until it receives the answer. |
| Rename | If this option is selected, **R-Studio** adds a File ID to the file name. If a file already exists with the same name and that file ID, a number will be added to the file name and file ID. |
| Skip | If this option is selected, **R-Studio** skips all new files with the same name. |
| Overwrite | If this option is selected, **R-Studio** overwrites the existing file with the new one. |
If the Modified time stamp is invalid, **R-Studio** will skip the comparison.

<table>
<thead>
<tr>
<th>Time conditions</th>
<th>Equal time</th>
<th>Two time stamps are the same.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Older</td>
<td>The existing file is older than the new one.</td>
</tr>
<tr>
<td></td>
<td>Newer</td>
<td>The existing file is newer than the new one.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Size conditions</th>
<th>Equal size</th>
<th>Two files have the same size.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Smaller</td>
<td>The existing file is smaller than the new one.</td>
</tr>
<tr>
<td></td>
<td>Bigger</td>
<td>The existing file is bigger than the new one.</td>
</tr>
</tbody>
</table>

**By default**

- The action **R-Studio** takes when none of the comparison conditions have been met. That may happen when the comparison by size is not enabled.

### 2.3.3 File Recovery Lists

You may create a file containing a list of files and folder found on a disk/partition. Then such file may be manually edited to specify files to recover and then loaded back into **R-Studio**. **R-Studio** will automatically mark the files in this list for recovery. Such file lists recovery are very useful, for example, when it is necessary to have such file lists approved for recovery by someone else who is far away from the computer where **R-Studio** is running.

You may create file recovery lists for the entire disk or for specific folders. Moreover, you may create a file recovery list for all files within the disk/folder, or for marked files/folders only.

**Creating a file recovery list**

To create a file recovery list

1. **For an entire disk**, select **Save File Names to File** on the File menu, or
   - Control-click the uppermost folder (higher than **Root**, usually the letter or the name of the disk) and select **Save File Names to File** on the contextual menu.
   - **For a specific folder**, control-click the folder and select **Save File Names to File** on the contextual menu.

2. **Specify the place to save the file recovery list and other necessary options on the Save File Names dialog box**

   - **File name**: Specifies file name of the file recovery list.
Save only marked files/folders from... | If this option is selected, only marked files will be included into the file recovery list.
---|---
Save sub folders | If this option is selected, sub folders and their files will also be included into the file recovery list.
File format: | Specifies the file format in which localized file/folder names will be saved. You may select either the UTF-8 or UTF-16 codepage. Also you may write a special BOM header to the file which helps some text editors to understand which codepage is used.
Advanced options | Technician version: Specifies information to include into the file.

**Structure of a file recovery list file created by R-Studio**

*An example of such a file (Technician version):*

```bash
sort: by real
#: PathDelim = \\
Docs\\
  :! Id: 4587531
  :! Flags: directory
  :! MFT number: 70
  :! Parent MFT number: 5
  :! Regions (sector size=512B): sector 2433976 (offset: 50 )
    :! size: 2 Bytes / resident sector 2433976 (offset: 80 )
    :! size: 72 Bytes / resident sector 2433976 (offset: 176 )
    :! size: 74 Bytes / resident sector 2433976 (offset: 288 )
    :! size: 222 Bytes / resident sector 2433977
    :! size: 136 Bytes / resident

Docs\MyDoc1.odt
  :! Id: 4653067
  :! Flags: valid first data offset
  :! Modified: 2011-03-01T17:41:14
  :! File type: OpenOffice Writer Document
  :! Recovery chances: Good (Existing file)
  :! MFT number: 71
  :! Parent MFT number: 70
  :! Regions (sector size=512B): sector 2268
    :! size: 24 KB (24,576 Bytes) / first data sector 2433978 (offset: 80 )
    :! size: 72 Bytes / resident sector 2433978 (offset: 176 )
    :! size: 86 Bytes / resident

Docs\MyDoc2.odt
  :! Id: 4718603
  :! Flags: valid first data offset
  :! Modified: 2011-02-28T23:31:02
```

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Data Recovery Using R-Studio

File type: OpenOffice Writer Document
Recovery chances: Good (Existing file)
MFT number: 72
Parent MFT number: 70
Regions (sector size=512B): sector 2316
  size: 24 KB (24,576 Bytes) / first dataset 2433980 (offset: 80)
  size: 72 Bytes / resident sector 2433980 (offset: 176)
  size: 86 Bytes / resident

Docs\MyDoc3.odt
Id: 4784139
Flags: valid first data offset
Modified: 2011-02-28T23:31:10
File type: OpenOffice Writer Document
Recovery chances: Good (Existing file)
MFT number: 73
Parent MFT number: 70
Regions (sector size=512B): sector 2020080
  size: 177.38 MB (185,991,168 Bytes) / first dataset 2433982 (offset: 80)
  size: 72 Bytes / resident sector 2433982 (offset: 176)
  size: 86 Bytes / resident

# PathDelim = \ is a parameter specifying a character for path delimitation. You may also specify a Unix-style delimiter /.
# PathDelim = \n# PathDelim = /

In addition, the files from the virtual folders Metafiles, ExtraFoundFiles, etc..., have the following designations:

| Metafiles: | ///m/[localized_name_for_Metafiles]/ |
| Extra Found Files: | ///e/[localized_name_for_ExtraFoundFiles]/ |
| Other Virtual Folders: | ///v/[localized_name_for_OtherVirtualFolders]/ |

For the English language, that will look like:
///m/Metafiles\n///m/Metafiles\$BOOT\n///m/Metafiles\$FAT\n///m/Metafiles\$FAT0\n///m/Metafiles\$FAT1

Editing the file recovery list file

All files included into a file recovery list will be marked when the file will be loaded into R-Studio. So, if you have some files in the file recovery list that doesn't need to be recovered, just delete them from the list. In addition, you may use the following marks to specify some options

+: Mark all files and subfolders within the folder.
*: Mark only files within the folder.
:- Unmark the file or all files and subfolders within the folder.
:= Unmark the file or only files within the folder.

processes records in the file consequently. That is, if there are the following lines in the file,
:+Files to Delete\  
:-Files to Delete\File_2.pst 
the file File_2.pst won't be marked for recovery, while for the lines  
:-Files to Delete\File_2.pst 
:+Files to Delete\ 
file File_2.pst will be.

Please note that records for folders without any marks don't affect the file marking. Thus, for the lines  
:-Files to Delete\File_2.pst 
Files to Delete\ 
file File_2.pst will not be marked.

**Loading the file recovery list**

To load a file recovery list into R-Studio,

* Select Load File Names from File and Mark on the File menu and select the file.

> R-Studio will load the file and mark the files accordingly.

### 2.4 Volume Sets and RAIDs

R-Studio detects and processes valid hardware volume sets and RAIDs like regular drives/volumes.

R-Studio can analyze and recover data from software volume sets and RAIDs. If a software volume set or RAID is present in your system, R-Studio detects it, and a **Volume sets and RAIDs** object appears on the Drives panel. This object can be searched for files, scanned, and files found on it can be recovered the same way as from normal drives/volumes.

If, due to hardware failure, a hardware volume set or RAID cannot be accessed, or due to data loss your system does not recognize a software volume set or RAID, and you know what hard drives were in it, you may create a **Virtual volume set** or **RAID** and process it like a real software volume set or RAID or hardware volume set or RAID.

You may find more information on RAID data structure in Wikipedia.

- **Volume Sets, Stripe Sets, and Mirrors**
- **Basic RAID 4 and RAID 5 Operations**
- **Working with RAID 6 Presets**
- **Working with RAID6 (Double Xor)**
- **Working with RAIDs with Parity Delays**
- **Working with Advanced RAID Layouts**
- **Nested and Non-Standard RAID Levels**
- **Finding RAID Parameters**
- **Checking RAID Consistency**
- **Syntax of a Description File for RAID Configurations**
- **Description Files for RAID Configurations**
- **Reverse RAIDs**
- **Various Disk and Volume Managers**

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• **Connecting Virtual Objects to the System**

**Creating and saving your own RAID configuration**
You may create and save your own RAID configurations for non-standard RAIDs. You may specify Offset, Block order/size and Row count. See [Working with Advanced RAID Layouts](#) for details.

**To save your own RAID configuration**
1. Select <New> in the Blocks order drop-down list
2. Specify the name for the configuration on the Preset name dialog box.
   - Preset name dialog box

   ![Preset name dialog box](image)

   > The new RAID configuration will be saved

   The configurations are stored in the user's RAID layout file. The path and name for this file is specified on the R-Studio Settings dialog box. If no file is specified, R-Studio will ask you to enter the name.

**Loading your RAID configuration**
If there're objects in the Parents tab, the preset will be applied to them. If the Parents tab is empty, R-Studio will search the disks listed in the Drives tab for the parents in the user's RAID layout file. If the search fails, R-Studio will show the Reference Parents not found message.

**To load your RAID configuration**
* Select your configuration in the Blocks order drop-down list

> The new RAID configuration will be loaded

**To edit your own RAID configuration**
1. Select <Edit> in the Blocks order drop-down list
2. Select the required configuration on the Edit Block RAID Layout Presets dialog box.
   - Edit Block RAID Layout Presets dialog box

   ![Edit Block RAID Layout Presets dialog box](image)

3. Edit the parameters of the configuration and save it

   > The new configuration parameters will be saved.

**Turning Disks On-Line and Off-Line on-the-fly**
You may turn the objects in the virtual RAID or volume set on-line and off-line by selecting/clearing the checkbox on the Parents tab. It may be useful, for example, if you need to see which disk is non-actual in a RAID5.
Actually, when you turn an object off-line, **R-Studio** substitutes it with a *Missing Disk* or *Empty Space* object.

### Missing Disks

If one partition from a hardware volume set or RAID or software volume set or RAID is absent, due to hardware failure, for example, you need to add a virtual missing disk in order to correctly re-construct the hardware volume set or RAID or software volume set or RAID structure. The missing disk should be placed in the same place as the missing partition.

**Note:** **R-Studio** does not write anything real on the disk. Missing disks are virtual objects that do not affect actual data on the drive.

#### To add an *Missing disk* object

1. Select a *Volume sets and RAIDs* object on the R-Studio's Drives panel
2. Control-click in the *Parents* tab in the right pane and select *Add Missing Disk* on the contextual menu or select *Add Missing Disk* in the Create menu

> A *Missing Disk* object will appear in the *Parents* tab

### 2.4.1 Volume Sets, Stripe Sets, and Mirrors

#### To create a Volume set object

1. Click the Create Virtual RAID button and select *Create Virtual Volume set* or select the *Create Virtual Volume set* on the Create menu

> A Virtual Volume set object will appear on the Drives panel

2. Drag the required partitions from the Drives panel to the Parents tab

#### Other ways to add objects

- Control-click the *Parents* tab and select the required partition from the contextual menu, or
- Control-click the partition on the Drives panel, select *Add to RAID* on the contextual menu, and select the RAID object you want to add the partition to.

**Note:** Objects should be placed in the same order as they were in the original volume set. If this order is incorrect, you must change it by dragging the parents to place them in the correct order.

> The *Virtual volume set or RAIDs* object can now be processed like regular drives/volumes

If **R-Studio** detects a valid file system on the newly created RAID object, a partition object will appear on the Drives panel.
To create a Stripe set object (RAID 0)

1. Click the Create Virtual RAID button and select Create Virtual Block RAID or select the Create Virtual Block RAID on the Create menu

> A Virtual Block RAID object will appear on the Drives panel

2. Select RAID 0 (Stripe set) on the RAID type

3. Drag the required partitions from the Drives panel to the Parents tab

Other ways to add objects

- Control-click the Parents tab and select the required partition from the contextual menu, or
- Control-click the partition on the Drives panel, select Add to RAID on the contextual menu, and select the RAID object you want to add the partition to.

You may either make R-Studio to process your changes immediately or wait until you finish editing the RAID layout. Select or clear the Apply changes immediately checkbox on the Parents tab. Click the Apply button to apply the changes when are you through.

Note: Objects should be placed in the same order as they were in the original volume set. If this order is incorrect, you must change it by dragging the parents to place them in the correct order.

Object control buttons

<table>
<thead>
<tr>
<th>Button</th>
<th>Description and Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locate</td>
<td>Click this button to locate the selected object in the Drives panel.</td>
</tr>
<tr>
<td>Add Empty Space/Add Missing Disk</td>
<td>Click this button to add an empty space or missing disk object to the RAID</td>
</tr>
<tr>
<td>Remove</td>
<td>Click this button to remove the selected object from the RAID</td>
</tr>
<tr>
<td>Move Up</td>
<td>Click this button to move up the selected object in the RAID</td>
</tr>
<tr>
<td>Move Down</td>
<td>Click this button to move down the selected object in the RAID</td>
</tr>
<tr>
<td>Synchronize Offsets</td>
<td>Click this button to make the offsets the same for all objects in the RAID</td>
</tr>
<tr>
<td>Reset changes</td>
<td>Click this button to return the configuration to the initial state (after clicking the Apply button or immediately after loading)</td>
</tr>
</tbody>
</table>

The Block size and Offset (in sectors) parameters must be set the same as for the original volume set.

You also need to specify Block order. You may select it on the Block order drop-down or contextual menu.

If the those parameters are not correct, data on the parents will not be damaged, but they cannot be recovered.
> The Virtual Block RAID object can now be processed like regular drives/volumes.

If R-Studio detects a valid file system on the newly created RAID object, a partition object will appear on the Drives panel.

The Description Files for RAID Configurations topic shows the RAID description file for this RAID configuration.

You also may check the RAID consistency, if necessary. See the Checking RAID Consistency help page for details.

To create a Mirror set object (RAID 1)

1. Click the Create Virtual RAID button and select Create Virtual Mirror or select the Create Virtual Mirror on the Create menu.

> A Virtual Mirror object will appear on the Drives panel.

2. Drag the required partitions from the Drives panel to the Parents tab.

- Other ways to add objects
  - Control-click the Parents tab and select the required partition from the contextual menu, or
  - Control-click the partition on the Drives panel, select Add to RAID on the contextual menu, and select the RAID object you want to add the partition to.

Note: Objects should be placed in the same order as they were in the original volume set. If this order is incorrect, you must change it by dragging the parents to place them in the correct order.
> The Virtual Mirror object can now be processed like regular drives/volumes

If R-Studio detects a valid file system on the newly created RAID object, a partition object will appear on the Drives panel.

2.4.2 Basic RAID 4 and RAID 5 Operations

RAID 4 and RAID 5 are much similar. You may create and edit a RAID 4 object the same way as a RAID 5 one.

To create a RAID 5 object

1. Click the Create Virtual RAID button and select Create Virtual Block RAID
   or select the Create Virtual Block RAID on the Create menu

   > A Virtual Block RAID object will appear on the Drives panel

2. Select RAID 5 on the RAID type

3. Drag the required partitions from the Drives panel to the Parents tab

   Other ways to add objects
   - Control-click the Parents tab and select the required partition from the contextual menu, or
   - Control-click the partition on the Drives panel, select Add to RAID on the contextual menu, and select the RAID object you want to add the partition to.

You may either make R-Studio to process your changes immediately or wait until you finish editing the RAID layout. Select or clear the Apply changes immediately checkbox on the Parents tab. Click the Apply button to apply the changes when you are through.

Note: Objects should be placed in the same order as they were in the original RAID 5. If this order is incorrect, you must change it by dragging the parents to place them in the correct order.

Object control buttons

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locate</td>
<td>Click this button to locate the selected object in the Drives panel.</td>
</tr>
<tr>
<td>Add Empty Space/Add Missing Disk</td>
<td>Click this button to add an empty space or missing disk object to the RAID</td>
</tr>
<tr>
<td>Remove</td>
<td>Click this button to remove the selected object from the RAID</td>
</tr>
<tr>
<td>Move Up</td>
<td>Click this button to move up the selected object in the RAID</td>
</tr>
<tr>
<td>Move Down</td>
<td>Click this button to move down the selected object in the RAID</td>
</tr>
<tr>
<td>Synchronize Offsets</td>
<td>Click this button to make the offsets the same for all objects in the RAID</td>
</tr>
</tbody>
</table>
The RAID block size and Offset (in sectors) parameters must be set the same as for the original RAID 5. You also need to specify Block order for virtual RAID 5. You may select it on the Block order drop-down or contextual menu.

If the those parameters are not correct, data on the parents will not be damaged, but files from the RAID 5 cannot be recovered.

**Note:** You may check how correctly you have reconstructed the original RAID 5. Find a file and preview it. If the file appears correct, you have created a correct RAID 5 layout.

If your RAID 5 has an unusual configuration, you may create them manually. See [Working with Advanced RAID Layouts](#) for details.

> The **RAID 5 object can now be processed like regular drives/volumes**

If **R-Studio** detects a valid file system on the newly created RAID object, a partition object will appear on the **Drives** panel.

The [Description Files for RAID Configurations](#) topic shows the RAID description file for this RAID configuration.

You also may check the RAID consistency, if necessary. See the [Checking RAID Consistency](#) help page for details.
Creating and saving your own RAID 5 configuration
You may create and save your own RAID configurations for non-standard RAIDs. You may specify Offset, Block order/size and Row count. See Working with Advanced RAID Layouts for details.

2.4.3 Working with RAID 6 Presets

R-Studio allows you to create and process RAID 6 layouts. You may use either presets for several RAID 6 layouts, or use your own custom ones.

R-Studio provides presets for the following RAID 6 layouts:

- **Reed-Solomon**
  - Left Synchronous
  - Left Asynchronous
  - Right Synchronous
  - Right Asynchronous

In addition you may create your own RAID 6 configurations.

Creating a RAID 6 object from a preset:
We will use the Reed-Solomon (Left Synchronous (standard)) preset as an example.

To create a RAID 6 object:

1. Click the Create Virtual RAID button and select Create Virtual Block RAID
   or select the Create Virtual Block RAID on the Create menu

A Virtual Block RAID object will appear on the Drives panel

2. Select RAID 6/Reed-Solomon on the RAID type

3. Drag the required partitions from the Drives panel to the Parents tab

Other ways to add objects
- Control-click the Parents tab and select the required partition from the contextual menu, or
- Control-click the partition on the Drives panel, select Add to RAID on the contextual menu, and select the RAID object you want to add the partition to.

You may either make R-Studio to process your changes immediately or wait until you finish editing the RAID layout. Select or clear the Apply changes immediately checkbox on the Parents tab. Click the Apply button to apply the changes when are you through.

Parents tab
Note: Objects should be placed in the same order as they were in the original volume set. If this order is incorrect, you must change it by dragging the parents to place them in the correct order.

Object control buttons

<table>
<thead>
<tr>
<th>Action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locate</td>
<td>Click this button to locate the selected object in the Drives panel.</td>
</tr>
<tr>
<td>Add Empty Space/Add Missing Disk</td>
<td>Click this button to add an empty space or missing disk object to the RAID</td>
</tr>
<tr>
<td>Remove</td>
<td>Click this button to remove the selected object from the RAID</td>
</tr>
<tr>
<td>Move Up</td>
<td>Click this button to move up the selected object in the RAID</td>
</tr>
<tr>
<td>Move Down</td>
<td>Click this button to move down the selected object in the RAID</td>
</tr>
<tr>
<td>Synchronize Offsets</td>
<td>Click this button to make the offsets the same for all objects in the RAID</td>
</tr>
<tr>
<td>Reset changes</td>
<td>Click this button to return the configuration to the initial state (after clicking the Apply button or immediately after loading)</td>
</tr>
</tbody>
</table>

The RAID block size and Offset (in sectors) parameters must be set the same as for the original volume set. You also need to specify Blocks order (Left Synchronous (standard) for our case) for virtual RAID 6. You may select it on the Blocks order drop-down or contextual menu.

If those parameters are not correct, data on the parents will not be damaged, but it cannot be recovered. Note: You may check how correctly you have reconstructed the original volume set or RAID. Find a file and preview it. If the file appears correct, you have created a correct RAID layout.

> The Virtual Block RAID object can now be processed like regular drives/volumes

If R-Studio detects a valid file system on the newly created RAID object, a partition object will appear on the Drives panel.

The Description Files for RAID Configurations topic shows the RAID description file for this RAID configuration.
You also may check the RAID consistency, if necessary. See the Checking RAID Consistency help page for details.

### 2.4.4 Working with RAID6 (Double Xor) Presets

R-Studio allows you to create and process RAID 6 Double Xor layouts with the following presets:

- **EVENODD**
- **RAID DP**
- **X-Code(2)**
- **Adaptec 3805**

In addition you may create your own RAID 6 configurations.

**Creating a RAID 6 (Double Xor) object from a preset:**

We will use the EVENODD preset as an example.

**To create a RAID 6 (Double Xor) object**

1. Click the Create Virtual RAID button and select Create Virtual Block RAID or select the Create Virtual Block RAID on the Create menu

> A Virtual Block RAID object will appear on the Drives panel

2. Select RAID 6 / Double Xor on the RAID type

3. Drag the required partitions from the Drives panel to the Parents tab

   **Other ways to add objects**
   - Control-click the Parents tab and select the required partition from the contextual menu, or
   - Control-click the partition on the Drives panel, select Add to RAID on the contextual menu, and select the RAID object you want to add the partition to.

You may either make R-Studio to process your changes immediately or wait until you finish editing the RAID layout. Select or clear the Apply changes immediately checkbox on the Parents tab. Click the Apply button to apply the changes when are you through.
Parents tab

Note: Objects should be placed in the same order as they were in the original volume set. If this order is incorrect, you must change it by dragging the parents to place them in the correct order.

Object control buttons

<table>
<thead>
<tr>
<th>Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locate</td>
<td>Click this button to locate the selected object in the Drives panel.</td>
</tr>
<tr>
<td>Add Empty Space/Add Missing Disk</td>
<td>Click this button to add an empty space or missing disk object to the RAID</td>
</tr>
<tr>
<td>Remove</td>
<td>Click this button to remove the selected object from the RAID</td>
</tr>
<tr>
<td>Move Up</td>
<td>Click this button to move up the selected object in the RAID</td>
</tr>
<tr>
<td>Move Down</td>
<td>Click this button to move down the selected object in the RAID</td>
</tr>
<tr>
<td>Synchronize Offsets</td>
<td>Click this button to make the offsets the same for all objects in the RAID</td>
</tr>
<tr>
<td>Reset changes</td>
<td>Click this button to return the configuration to the initial state (after clicking the Apply button or immediately after loading)</td>
</tr>
</tbody>
</table>

The RAID block size and Offset (in sectors) parameters must be set the same as for the original volume set. You also need to specify Blocks order (EVENODD for our case) for virtual RAID 6 (Double Xor). You may select it on the Blocks order drop-down or contextual menu.

If the those parameters are not correct, data on the parents will not be damaged, but they cannot be recovered.

Note: You may check how correctly you have reconstructed the original volume set or RAID. Find a file and preview it. If the file appears correct, you have created a correct RAID layout.

> The Virtual Block RAID object can now be processed like regular drives/volumes

If R-Studio detects a valid file system on the newly created RAID object, a partition object will appear on the Drives panel. The Description Files for RAID Configurations topic shows the RAID description file for this RAID configuration.
You also may check the RAID consistency, if necessary. See the Checking RAID Consistency help page for details.

2.4.5 Working with RAIDs with Parity Delays

**R-Studio** allows you to create RAIDs with parity delays (any level that allows that). For example, let us create a RAID 5 the parity delays with the following layout:

- Three disks,
- Delay=16
- Block size: 16 KB
- Offset: 1088 sectors (544 KB)
- Block order: Left Asynchronous (Continuous)

```
<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
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</thead>
<tbody>
<tr>
<td>1</td>
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<td>2</td>
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<td>4</td>
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<td>6</td>
<td>PD</td>
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<tr>
<td>19</td>
<td>37</td>
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<td>38</td>
</tr>
<tr>
<td>20</td>
<td>39</td>
<td>PD</td>
<td>40</td>
</tr>
</tbody>
</table>
```

Delay=16
To create such RAID 5,

1. Click the Create virtual volume sets or RAIDs button and select Create Virtual Block RAID & Autodetect or select Create Virtual Block RAID & Autodetect on the Create menu. Check that the Apply changes immediately check box is clear on the Parents tab. This will prevent R-Studio from trying to start processing the RAID configuration until you specify it completely.

2. Drag the required objects from the Drives pane to the Parents tab and select RAID 5 on the RAID type.

**Other ways to add objects**

- Control-click the Parents tab and select the required partition from the contextual menu, or
- Control-click the partition on the Drives panel, select Add to RAID on the contextual menu, and select the RAID object you want to add the partition to.
These objects may be hard drives, logical disks, or images. Check that the objects are correctly placed.

**Note:** Objects should be placed in the same order as they were in the original RAID 5. If this order is incorrect, you must change it by dragging the parents to place them in the correct order.

**Object control buttons**

<table>
<thead>
<tr>
<th>Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locate</td>
<td>Click this button to locate the selected object in the Drives panel.</td>
</tr>
<tr>
<td>Add Empty Space/Add Missing Disk</td>
<td>Click this button to add an empty space or missing disk object to the RAID.</td>
</tr>
<tr>
<td>Remove</td>
<td>Click this button to remove the selected object from the RAID.</td>
</tr>
<tr>
<td>Move Up</td>
<td>Click this button to move up the selected object in the RAID.</td>
</tr>
<tr>
<td>Move Down</td>
<td>Click this button to move down the selected object in the RAID.</td>
</tr>
<tr>
<td>Synchronize Offsets</td>
<td>Click this button to make the offsets the same for all objects in the RAID.</td>
</tr>
<tr>
<td>Reset changes</td>
<td>Click this button to return the configuration to the initial state (after clicking the Apply button or immediately after loading)</td>
</tr>
</tbody>
</table>

3. **Specify the Block size and Offset parameters on the Parents tab**
   Disregard the Block order field.

4. **Specify the parity delay number in the Parity delay control on the Parents tab.**
   The number of rows will change to 48.
   - If necessary, adjust the First parity parameter
     By default, this parameter is set equal to Parity delay. By changing it, you may "shift" the block order table.
     For example, when the First parity parameter is set as 1 for the RAID 5 of 3 disks with Parity delay of 3,
     the block order table will be the following:

   ![Block order table example](image)
5 Select Left Asynchronous (Continuous) on the Block Order Field and click the Apply button on the Parents tab.

> The created Virtual Block RAID 1 object can now be processed like regular drives/volumes. If R-Studio detects a valid file system on this RAID object, a partition object will appear on the Drives panel.

The Description Files for RAID Configurations topic shows the RAID description file for this RAID configuration.

You also may check the RAID consistency, if necessary. See the Checking RAID Consistency help page for details.

2.4.6 Working with Advanced RAID Layouts

R-Studio allows you to create and process very complex custom RAID layouts.

Advanced RAID 5

For example, let us create a RAID 5 with the following layout:

- Three disks,
- Block size: 4 KB
- Offset: 32768 sectors (64 KB)
- Block order:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PD</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>PD</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
To create such RAID 5,

1. Click the Create virtual volume sets or RAIDs button and select Create Virtual Block RAID or select Create Virtual Block RAID on the Create menu. Check that the Apply changes immediately check box is clear on the Parents tab. This will prevent R-Studio from trying to start processing the RAID configuration until you specify it completely.

2. Drag the required objects from the Drives pane to the Parents tab and select RAID 5 on the RAID type.

   Other ways to add objects
   - Control-click the Parents tab and select the required partition from the contextual menu, or
   - Control-click the partition on the Drives panel, select Add to RAID on the contextual menu, and select the RAID object you want to add the partition to. These objects may be hard drives, logical disks, or images. Check that the objects are correctly placed.

Object control buttons

<table>
<thead>
<tr>
<th>Locate</th>
<th>Click this button to locate the selected object in the Drives panel.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add Empty Space/Add Missing Disk</td>
<td>Click this button to add an empty space or missing disk object to the RAID.</td>
</tr>
<tr>
<td>Remove</td>
<td>Click this button to remove the selected object from the RAID.</td>
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<td>Move Up</td>
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<tr>
<td>Synchronize Offsets</td>
<td>Click this button to make the offsets the same for all objects in the RAID.</td>
</tr>
<tr>
<td>Reset changes</td>
<td>Click this button to return the configuration to the initial state (after clicking the Apply button or immediately after loading).</td>
</tr>
</tbody>
</table>

3. Specify the Block size and Offset parameters on the Parents tab. Disregard the Block order field.
4 Manually enter 9 to Number of rows on the Parents tab

5 Enter the block order in the table on the Parents tab
   Use the RAID sequence window to move from one row to another.
   **Using the keyboard**: arrow keys to navigate, digit and p keys to enter the block order.
   **Using the mouse**: control-click the cell and select the number or parity from the contextual menu. If the block table is too large, you better use the keyboard to enter the digits.

**Corrections**: R-Studio will tell you if some digits are not correct. Navigate to the required cell and enter the correct value. Use the **Delete** key to clear a cell.

6 When you finishes entering the information, click the **Apply** button on the Parents tab
The created Virtual Block RAID 1 object can now be processed like regular drives/volumes. If R-Studio detects a valid file system on this RAID object, a partition object will appear on the Drives panel.

The Description Files for RAID Configurations topic shows the RAID description file for this RAID configuration.

You also may check the RAID consistency, if necessary. See the Checking RAID Consistency help page for details.

Advanced RAID 5

Another example is a RAID with the following layout, similar to that used in Mac Pro internal RAID cards with 4 hard drives.

- Four disks,
- Block size: 512 KB (1024 sectors)
- Offset: 32768 sectors (64 KB)
- Block order:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
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<th>D</th>
</tr>
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</tr>
<tr>
<td>PD</td>
<td>5</td>
<td>6</td>
<td>PD</td>
<td>8</td>
</tr>
<tr>
<td>7</td>
<td>PD</td>
<td>9</td>
<td>PD</td>
<td>10</td>
</tr>
<tr>
<td>11</td>
<td>PD</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>16</td>
<td>PD</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td></td>
<td>18</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As you see, this layout cannot be fit directly into a standard 2D block order table. Still, it's possible to create such RAID layout using the RAID Sequence window.
To create such RAID,

1. Click the Create virtual volume sets or RAIDs button and select Create Virtual Block RAID & Autodetect or select Create Virtual Block RAID & Autodetect on the Create menu.

   Check that the Apply changes immediately check box is clear on the Parents tab. This will prevent R-Studio from trying to start processing the RAID configuration until you specify it completely.

2. Drag the required objects from the Drives pane to the Parents tab and select RAID 5 on the RAID type.

   These objects may be hard drives, logical disks, or images. Check that the objects are correctly placed.

   **Object control buttons**

<table>
<thead>
<tr>
<th>Locate</th>
<th>Click this button to locate the selected object in the Drives panel.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add Empty Space/Add Missing Disk</td>
<td>Click this button to add an empty space or missing disk object to the RAID.</td>
</tr>
<tr>
<td>Remove</td>
<td>Click this button to remove the selected object from the RAID.</td>
</tr>
<tr>
<td>Move Up</td>
<td>Click this button to move up the selected object in the RAID.</td>
</tr>
<tr>
<td>Move Down</td>
<td>Click this button to move down the selected object in the RAID.</td>
</tr>
<tr>
<td>Synchronize Offsets</td>
<td>Click this button to make the offsets the same for all objects in the RAID.</td>
</tr>
<tr>
<td>Reset changes</td>
<td>Click this button to return the configuration to the initial state (after clicking the Apply button or immediately after loading).</td>
</tr>
</tbody>
</table>

3. Specify the Block size and Offset parameters on the Parents tab.

   Disregard the Block order field.

4. Manually enter 3 to Number of rows on the Parents tab and change Block order to Custom.

5. Control-click the RAID Sequence window and select Remove All. Manually enter 3 to Number of rows on the Parents tab and change Block order to Custom.

6. Control-click Cell 1 in the block order table and select Create New Sequence.

7. Control-click Cell 2 in the block order table and select Add to Sequence, do that for Cell 3, too.

8. Control-click Cell 4 in the block order table and select Create New Sequence.

9. Control-click Cell 5 in the block order table and select Add to Sequence, do that for Cell 6, too.

   Continue those steps for the rest of the table until the RAID Sequence window will have 4 sequences of 3 disks:
10 Select the first line in the RAID Sequence window, control-click Cell 1 in the block order table, and select Parity of Data.
If any unnecessary sequences appear, control-click them in the RAID Sequence window, and select Remove.

11 Control-click Cell 2 in the block order table and select 1, do that for Cell 3 selecting 2.
If any unnecessary sequences appear, control-click them in the RAID Sequence window, and select Remove.

12 Move to the next sequence in the RAID Sequence window and repeat the procedure for cells 4, 5, and 6.
Do that for the rest of the sequences until you fill all cells in the block order table in the Parents tab.

> The created Virtual Block RAID 1 object can now be processed like regular drives/volumes
If R-Studio detects a valid file system on this RAID object, a partition object will appear on the Drives panel.
The Description Files for RAID Configurations topic shows the RAID description file for this RAID configuration.
You also may check the RAID consistency, if necessary. See the Checking RAID Consistency help page for details.

**Advanced RAID 6 Layout**

For example, let us create a RAID 6 with the following layout:

- Five disks,
- Block size: 64 KB
- Offset: 0
- Block order:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RS</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>PD</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>PD</td>
<td>RS</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>9</td>
<td>PD</td>
<td>RS</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>12</td>
<td>PD</td>
<td>RS</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>5</td>
<td>PD</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>PA</td>
<td>PA</td>
<td>PA</td>
<td>PA</td>
<td></td>
</tr>
</tbody>
</table>

where

- PD is parity of data;
- PA is parity of all;
- RS is Reed-Solomon;

Rows from 1 to 5 use two types of error correction: parity of data (xor) and Reed-Solomon. That is, row 1 uses blocks A1 and E1, row 2 uses blocks D2 and E2, and so on.
Row 6 is used for error correction for columns. That is, column A uses block A6, column B uses B6, and so on. Parity of all is used for error correction.

1. **Click the Create virtual volume sets or RAIDs button and select Create Virtual Block RAID** or select Create Virtual Block RAID on the Create menu
   Check that the Apply changes immediately check box is clear on the Parents tab. This will prevent R-Studio from trying to start processing the RAID configuration until you specify it completely.

2. **Drug the required objects from the Drives pane to the Parents tab and select Custom on the RAID type**

   - **Other ways to add objects**
     - Control-click the Parents tab and select the required partition from the contextual menu, or
     - Control-click the partition on the Drives panel, select Add to RAID on the contextual menu, and select the RAID object you want to add the partition to.
   These objects may be hard drives, logical disks, or images. Check that the objects are correctly placed.
### Object control buttons

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locate</td>
<td>Click this button to locate the selected object in the <strong>Drives</strong> panel.</td>
</tr>
<tr>
<td>Add Empty Space/Add Missing Disk</td>
<td>Click this button to add an empty space or missing disk object to the RAID</td>
</tr>
<tr>
<td>Remove</td>
<td>Click this button to remove the selected object from the RAID</td>
</tr>
<tr>
<td>Move Up</td>
<td>Click this button to move up the selected object in the RAID</td>
</tr>
<tr>
<td>Move Down</td>
<td>Click this button to move down the selected object in the RAID</td>
</tr>
<tr>
<td>Synchronize Offsets</td>
<td>Click this button to make the offsets the same for all objects in the RAID</td>
</tr>
<tr>
<td>Reset changes</td>
<td>Click this button to return the configuration to the initial state</td>
</tr>
</tbody>
</table>

3. **Specify the Block size and Offset parameters on the Parents tab**
   - Disregard the Block order parameter.

4. **Manually enter 6 to Number of rows on the Parents tab**

5. **Enter the block order in the table on the Parents tab**
   - You may enter either a block number, or an error correction block of the following types:
     - **PD**: Parity of data
     - **PA**: Parity of all
     - **RS**: Reed-Solomon
     - **U**: Unknown
     - **I**: Ignore

   **Note:** You should specify an error correction block only when the correct sequence is selected on the **RAID Sequences** window.

   **Using the keyboard:** arrow keys to navigate, digit, and rs, pd, pa, u, i keys to enter the block order.

   **Using the mouse:** control-click the cell and select the number or parity from the contextual menu. If the block table is too large, you better use the keyboard to enter the digits.
For the rows:
Select the required row sequence on the RAID Sequences window, select the cell on the RAID table, and enter the required value. R-Studio automatically generates those sequences when you add RAID parents.

For the columns and arbitrary sequences:
You need to create those sequences and add the respective blocks to it manually.
To create a sequence: Click Add empty on the RAID Sequences window or select Create New Sequence on the contextual menu on the Parents tab.
To add a block to a sequence: Control-click the respective cell and select Add To Sequence on the contextual menu on the Parents tab.
To remove a block to a sequence: Control-click the respective cell and select Remove From Sequence on the contextual menu on the Parents tab.

6 When you finishes entering the information, click the Apply button on the Parents tab.

> The created Virtual Block RAID 1 object can now be processed like regular drives/volumes
If R-Studio detects a valid file system on this RAID object, a partition object will appear on the Drives panel.
The **Description Files for RAID Configurations** topic shows the RAID description file for this RAID configuration.

<table>
<thead>
<tr>
<th>Local Computer</th>
<th>Volume</th>
<th>FS</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST3210111AES.AES</td>
<td></td>
<td></td>
<td>111.7 GB</td>
</tr>
<tr>
<td>Partition1</td>
<td>Windows XP</td>
<td>NTFS</td>
<td>111.7 GB</td>
</tr>
<tr>
<td>Partition2</td>
<td>Mac OS</td>
<td>HFS+</td>
<td>29.2 GB</td>
</tr>
<tr>
<td>Partition3</td>
<td></td>
<td>HFS+</td>
<td>22.4 GB</td>
</tr>
<tr>
<td>Partition4</td>
<td></td>
<td></td>
<td>22.4 GB</td>
</tr>
<tr>
<td>ST330459A05</td>
<td></td>
<td></td>
<td>465.7 GB</td>
</tr>
<tr>
<td>Empty Space1</td>
<td>Backup</td>
<td>NTFS</td>
<td>7.08 MB</td>
</tr>
<tr>
<td>Empty Space2</td>
<td></td>
<td></td>
<td>7.08 MB</td>
</tr>
</tbody>
</table>

You also may check the RAID consistency, if necessary. See the **Checking RAID Consistency** help page for details.

### 2.4.7 Nested and Non-Standard RAID Levels

- **RAID10 (1+0)**
- **RAID1E**
- **RAID5E**
- **RAID5EE**
- **RAID6E**

#### 2.4.7.1 RAID10 (1+0)

A RAID 10 (or 1+0) is a stripe of mirrors. Its block order can be represented as:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

To create a RAID 10 object:

1. Click the Create Virtual RAID button and select Create Virtual Block RAID or select the **Create Virtual Block RAID** on the **Create** menu.

   > A Virtual Block RAID object will appear on the **Drives** panel.

2. Drag the required partitions from the **Drives** panel to the **Parents** tab.

   - **Other ways to add objects**
     - Control-click the **Parents** tab and select the required partition from the contextual menu, or
     - Control-click the partition on the **Drives** panel, select **Add to RAID** on the contextual menu, and select the RAID object you want to add the partition to.

3. Select RAID 10 on the RAID type.
You may either make R-Studio to process your changes immediately or wait until you finish editing the RAID layout. Select or clear the Apply changes immediately checkbox on the Parents tab. Click the Apply button to apply the changes when you are through.

**Note:** Objects should be placed in the same order as they were in the original RAID 10. If this order is incorrect, you must change it by dragging the parents to place them in the correct order.

### Object control buttons

<table>
<thead>
<tr>
<th>Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locate</td>
<td>Click this button to locate the selected object in the Drives panel.</td>
</tr>
<tr>
<td>Add Empty Space/Add Missing Disk</td>
<td>Click this button to add an empty space or missing disk object to the RAID.</td>
</tr>
<tr>
<td>Remove</td>
<td>Click this button to remove the selected object from the RAID.</td>
</tr>
<tr>
<td>Move Up</td>
<td>Click this button to move up the selected object in the RAID.</td>
</tr>
<tr>
<td>Move Down</td>
<td>Click this button to move down the selected object in the RAID.</td>
</tr>
<tr>
<td>Synchronize Offsets</td>
<td>Click this button to make the offsets the same for all objects in the RAID.</td>
</tr>
<tr>
<td>Reset changes</td>
<td>Click this button to return the configuration to the initial state (after clicking the Apply button or immediately after loading).</td>
</tr>
</tbody>
</table>

The RAID block size and Offset (in sectors) parameters must be set the same as for the original RAID 10. You also need to specify Block order for virtual RAID 10. You may select it on the Block order drop-down or contextual menu.

If the those parameters are not correct, data on the parents will not be damaged, but files from the RAID 10 cannot be recovered.

**Note:** You may check how correctly you have reconstructed the original RAID 10. Find a file and preview it. If the file appears correct, you have created a correct RAID 10 layout.
The **RAID 10** object can now be processed like regular drives/volumes.

If R-Studio detects a valid file system on the newly created RAID object, a partition object will appear on the **Drives** panel.

The [Description Files for RAID Configurations](#) topic shows the RAID description file for this RAID configuration.

You also may check the RAID consistency, if necessary. See the [Checking RAID Consistency](#) help page for details.

### 2.4.7.2 RAID1E

RAID 1E utilizes both the mirroring and striping: data is striped across all drives, as in RAID 0. Additionally, a copy of each stripe is stored on a different drive, as in RAID 1. Its block order can be represented as:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

**To create a RAID 1E object**

1. Click the Create Virtual RAID button and select Create Virtual Block RAID or select the **Create Virtual Block RAID** on the **Create** menu.

2. Drag the required partitions from the **Drives** panel to the **Parents** tab.

**Other ways to add objects**

- Control-click the **Parents** tab and select the required partition from the contextual menu, or
- Control-click the partition on the **Drives** panel, select **Add to RAID** on the contextual menu, and select...
the RAID object you want to add the partition to.

3 **Select RAID 1E on the RAID type**

You may either make **R-Studio** to process your changes immediately or wait until you finish editing the RAID layout. Select or clear the Apply changes immediately checkbox on the **Parents** tab. Click the **Apply** button to apply the changes when are you through.

**Note:** Objects should be placed in the same order as they were in the original RAID 1E. If this order is incorrect, you must change it by dragging the parents to place them in the correct order.

**Object control buttons**

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locate</td>
<td>Click this button to locate the selected object in the <strong>Drives</strong> panel.</td>
</tr>
<tr>
<td>Add Empty Space/Add Missing Disk</td>
<td>Click this button to add an empty space or missing disk object to the RAID.</td>
</tr>
<tr>
<td>Remove</td>
<td>Click this button to remove the selected object from the RAID.</td>
</tr>
<tr>
<td>Move Up</td>
<td>Click this button to move up the selected object in the RAID.</td>
</tr>
<tr>
<td>Move Down</td>
<td>Click this button to move down the selected object in the RAID.</td>
</tr>
<tr>
<td>Synchronize Offsets</td>
<td>Click this button to make the offsets the same for all objects in the RAID.</td>
</tr>
<tr>
<td>Reset changes</td>
<td>Click this button to return the configuration to the initial state (after clicking the <strong>Apply</strong> button or immediately after loading)</td>
</tr>
</tbody>
</table>

The RAID block size and Offset (in sectors) parameters must be set the same as for the original RAID 1E. You also need to specify Block order for virtual RAID 1E. You may select it on the **Block order** drop-down or contextual menu.

If the those parameters are not correct, data on the parents will not be damaged, but files from the RAID 1E cannot be recovered.

**Note:** You may check how correctly you have reconstructed the original RAID 1E. Find a file and preview it. If the file appears correct, you have created a correct RAID 1E layout.
The **RAID 1E** object can now be processed like regular drives/volumes

If **R-Studio** detects a valid file system on the newly created RAID object, a partition object will appear on the **Drives** panel.

The [Description Files for RAID Configurations](#) topic shows the RAID description file for this RAID configuration.

You also may check the RAID consistency, if necessary. See the [Checking RAID Consistency](#) help page for details.

### 2.4.7.3 RAID5E

RAID 5E (where E stands for Enhanced) is a RAID 5 layout with an integrated hot-spare drive, where the spare drive is an active part of the block rotation scheme. An example of such RAID layout is in the table below:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>PD</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>6</td>
<td>PD</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
<td>PD</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>PD</td>
<td>10</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>5</td>
<td>SP</td>
<td>SP</td>
<td>SP</td>
<td>SP</td>
</tr>
</tbody>
</table>

where PD and SP stand for Parity of Data and Spare Part.

To create a RAID 5E object

1. Click the Create Virtual RAID button and select Create Virtual Block RAID
   or select the Create Virtual Block RAID on the **Create** menu
A Virtual Block RAID object will appear on the Drives panel.

2 Drag the required partitions from the Drives panel to the Parents tab.

- Control-click the Parents tab and select the required partition from the contextual menu, or
- Control-click the partition on the Drives panel, select Add to RAID on the contextual menu, and select the RAID object you want to add the partition to.

3 Select RAID 5E on the RAID type.

You may either make R-Studio to process your changes immediately or wait until you finish editing the RAID layout. Select or clear the Apply changes immediately checkbox on the Parents tab. Click the Apply button to apply the changes when you are through.

**Note:** Objects should be placed in the same order as they were in the original RAID 5E. If this order is incorrect, you must change it by dragging the parents to place them in the correct order.

### Object control buttons

<table>
<thead>
<tr>
<th>Locate</th>
<th>Click this button to locate the selected object in the Drives panel.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add Empty Space/Add Missing Disk</td>
<td>Click this button to add an empty space or missing disk object to the RAID</td>
</tr>
<tr>
<td>Remove</td>
<td>Click this button to remove the selected object from the RAID.</td>
</tr>
<tr>
<td>Move Up</td>
<td>Click this button to move up the selected object in the RAID.</td>
</tr>
<tr>
<td>Move Down</td>
<td>Click this button to move down the selected object in the RAID.</td>
</tr>
<tr>
<td>Synchronize Offsets</td>
<td>Click this button to make the offsets the same for all objects in the RAID</td>
</tr>
<tr>
<td>Reset changes</td>
<td>Click this button to return the configuration to the initial state (after clicking the Apply button or immediately after loading).</td>
</tr>
</tbody>
</table>

The RAID block size and Offset (in sectors) parameters must be set the same as for the original RAID 5E. You also need to specify Block order for virtual RAID 5E. You may select it on the Block order drop-down or contextual menu.

If the those parameters are not correct, data on the parents will not be damaged, but files from the RAID 5E cannot be recovered.

**Note:** You may check how correctly you have reconstructed the original RAID 5E. Find a file and preview it. If the file appears correct, you have created a correct RAID 5E layout.
The RAIDE object can now be processed like regular drives/volumes. If R-Studio detects a valid file system on the newly created RAID object, a partition object will appear on the Drives panel.

The Description Files for RAID Configurations topic shows the RAID description file for this RAID configuration.

You also may check the RAID consistency, if necessary. See the Checking RAID Consistency help page for details.

2.4.7.4 RAID5EE

RAID 5EE (where E stands for Enhanced) is a RAID 5 layout with an integrated hot-spare drive, where the spare drive is an active part of the block rotation scheme. An example of such RAID layout is in the table below:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>2</td>
<td>SP</td>
<td>PD</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>SP</td>
<td>PD</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>SP</td>
<td>PD</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>PD</td>
<td>7</td>
<td>8</td>
<td>SP</td>
</tr>
</tbody>
</table>

where PD and SP stand for Parity of Data and Spare Part.

To create a RAID 5EE object

1. Click the Create Virtual RAID button and select Create Virtual Block RAID or select the Create Virtual Block RAID on the Create menu.
> A Virtual Block RAID object will appear on the Drives panel

2 Drag the required partitions from the Drives panel to the Parents tab

- Other ways to add objects
  - Control-click the Parents tab and select the required partition from the contextual menu, or
  - Control-click the partition on the Drives panel, select Add to RAID on the contextual menu, and select the RAID object you want to add the partition to.

3 Select RAID 5EE on the RAID type

You may either make R-Studio to process your changes immediately or wait until you finish editing the RAID layout. Select or clear the Apply changes immediately checkbox on the Parents tab. Click the Apply button to apply the changes when you are through.

Note: Objects should be placed in the same order as they were in the original RAID 5EE. If this order is incorrect, you must change it by dragging the parents to place them in the correct order.

Object control buttons

| Locate | Click this button to locate the selected object in the Drives panel. |
| Add Empty Space/Add Missing Disk | Click this button to add an empty space or missing disk object to the RAID |
| Remove | Click this button to remove the selected object from the RAID |
| Move Up | Click this button to move up the selected object in the RAID |
| Move Down | Click this button to move down the selected object in the RAID |
| Synchronize Offsets | Click this button to make the offsets the same for all objects in the RAID |
| Reset changes | Click this button to return the configuration to the initial state (after clicking the Apply button or immediately after loading) |

The RAID block size and Offset (in sectors) parameters must be set the same as for the original RAID 5EE. You also need to specify Block order for virtual RAID 5EE. You may select it on the Block order drop-down or contextual menu.

If the those parameters are not correct, data on the parents will not be damaged, but files from the RAID 5EE cannot be recovered.

Note: You may check how correctly you have reconstructed the original RAID 5EE. Find a file and preview it. If the file appears correct, you have created a correct RAID 5EE layout.

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The **RAID 5EE** object can now be processed like regular drives/volumes. If **R-Studio** detects a valid file system on the newly created RAID object, a partition object will appear on the **Drives** panel.

The **Description Files for RAID Configurations** topic shows the RAID description file for this RAID configuration.

You also may check the RAID consistency, if necessary. See the **Checking RAID Consistency** help page for details.

### 2.4.7.5 RAID6E

RAID 6E (where E stands for Enhanced) is a RAID 6 layout with an integrated hot-spare drive, where the spare drive is an active part of the block rotation scheme. An example of such RAID layout is in the table below:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RS</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>PD</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>PD</td>
<td>RS</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>PD</td>
<td>RS</td>
<td>9</td>
</tr>
<tr>
<td>4</td>
<td>15</td>
<td>16</td>
<td>PD</td>
<td>RS</td>
<td>13</td>
<td>14</td>
</tr>
<tr>
<td>5</td>
<td>20</td>
<td>PD</td>
<td>RS</td>
<td>17</td>
<td>18</td>
<td>19</td>
</tr>
<tr>
<td>6</td>
<td>PD</td>
<td>RS</td>
<td>21</td>
<td>22</td>
<td>23</td>
<td>24</td>
</tr>
<tr>
<td>7</td>
<td>SP</td>
<td>SP</td>
<td>SP</td>
<td>SP</td>
<td>SP</td>
<td>SP</td>
</tr>
</tbody>
</table>

where RS, PD and SP stand for Reed-Solomon, Parity of Data, and Spare Part, respectively.
To create a RAID 6E object

1. Click the Create Virtual RAID button and select Create Virtual Block RAID or select the Create Virtual Block RAID on the Create menu.

2. A Virtual Block RAID object will appear on the Drives panel.

3. Drag the required partitions from the Drives panel to the Parents tab.

Other ways to add objects

- Control-click the Parents tab and select the required partition from the contextual menu, or
- Control-click the partition on the Drives panel, select Add to RAID on the contextual menu, and select the RAID object you want to add the partition to.

3. Select RAID 6E on the RAID type.

You may either make R-Studio to process your changes immediately or wait until you finish editing the RAID layout. Select or clear the Apply changes immediately checkbox on the Parents tab. Click the Apply button to apply the changes when you are through.

Note: Objects should be placed in the same order as they were in the original RAID 6E. If this order is incorrect, you must change it by dragging the parents to place them in the correct order.

Object control buttons

<table>
<thead>
<tr>
<th>Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locate</td>
<td>Click this button to locate the selected object in the Drives panel.</td>
</tr>
<tr>
<td>Add Empty Space/Add Missing Disk</td>
<td>Click this button to add an empty space or missing disk object to the RAID</td>
</tr>
<tr>
<td>Remove</td>
<td>Click this button to remove the selected object from the RAID.</td>
</tr>
<tr>
<td>Move Up</td>
<td>Click this button to move up the selected object in the RAID.</td>
</tr>
<tr>
<td>Move Down</td>
<td>Click this button to move down the selected object in the RAID.</td>
</tr>
<tr>
<td>Synchronize Offsets</td>
<td>Click this button to make the offsets the same for all objects in the RAID.</td>
</tr>
<tr>
<td>Reset changes</td>
<td>Click this button to return the configuration to the initial state (after clicking the Apply button or immediately after loading)</td>
</tr>
</tbody>
</table>

The RAID block size and Offset (in sectors) parameters must be set the same as for the original RAID 6E. You also need to specify Block order for virtual RAID 6E. You may select it on the Block order drop-down or contextual menu.

If the those parameters are not correct, data on the parents will not be damaged, but files from the RAID 6E cannot be recovered.
Note: You may check how correctly you have reconstructed the original RAID 6E. Find a file and preview it. If the file appears correct, you have created a correct RAID 6E layout.

The RAID 6E object can now be processed like regular drives/volumes

If R-Studio detects a valid file system on the newly created RAID object, a partition object will appear on the Drives panel.

The Description Files for RAID Configurations topic shows the RAID description file for this RAID configuration.

You also may check the RAID consistency, if necessary. See the Checking RAID Consistency help page for details.

2.4.8 Finding RAID Parameters

R-Studio can find parameters for RAID 5 and 6. RAID parameters can be found automatically or manually.

The number of disks in the RAID should be between 3 and 32. RAID parameters can be found only when all original disks (or their images) are present. Even one substitute object in a RAID (like a missing disk) makes finding RAID parameters impossible.

To find RAID parameters automatically,

1. Click the Auto Detect button on the Parents tab
R-Studio will start searching for the RAID parameters and show the most probable one on the RAID Parameter Detection dialog box.

**RAID Parameter Detection** dialog box

2 Click the Apply button and R-Studio will change the RAID layout to the selected one on the Parents tab.

3 Click the Apply button on the Parents tab

R-Studio will use the found parameters for the RAID.

If necessary, you may return to the RAID Parameter Detection dialog box by clicking the Choose Variants button, and select another RAID layout.

**To find RAID parameters manually,**

1 Click the drop-down Auto Detect list on the Parents tab and select Advanced Detection.

2 Specify the necessary detection parameters on the RAID Parameter Detection dialog box and click the Start detection button

**Raid Parameters Detection** dialog box

You may change the disk order, offset for disk(s), and enable/disable disks.

**Advanced Parameters**

| Max offset: | The area on the disk to find RAID parameters in. |

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Offset search performance
RAID layouts search performance

Cumulative parameters that estimates the probability of certain found RAID parameters. Moving it to the right increases accuracy but slows the process. Moving it to the left reduces the accuracy but makes the process faster.

3 Select an offset and click the Click here to find RAID Layouts button on the Raid Parameters Detection dialog box

RAID Parameters Detection dialog box

You may add your own RAID offsets. Control-click empty space on the Found offsets pane and select Add Custom offset on the contextual menu and specify the offset individually for every disk.

4 Select a RAID variant on the Found RAID layouts pane and click the Apply button

5 Click the Apply button on the Parents tab

> R-Studio will use the found parameters for the RAID.

If necessary, you may return to the RAID Parameter Detection dialog box by clicking the Choose Variants button, and select another RAID layout.

2.4.9 Checking RAID consistency

You may check RAID consistency (whether the data parity values are valid) for RAID layouts with parity blocks.

To check RAID consistency,

* Control-click the RAID and select Check RAID consistency... on the contextual menu

> The RAID consistency check window will appear showing the progress.
When the check is finished, you may inspect the results.

<table>
<thead>
<tr>
<th>Block color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>Data parity values are valid.</td>
</tr>
<tr>
<td>Red</td>
<td>Data parity values are not valid.</td>
</tr>
<tr>
<td>White</td>
<td>0's</td>
</tr>
</tbody>
</table>

When a mouse pointer hovers over a block, a tooltip will show the sector range within the block and number of consistent and inconsistent sectors. Double-clicking the block moves it to the upper-leftmost corner and zooms in the data by 2.

### RAID consistency check controls

<table>
<thead>
<tr>
<th>Control</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sectors</td>
<td>The number of the first sector in the row.</td>
</tr>
<tr>
<td>Offset</td>
<td>Offset in the data. Enter the address you want to jump to and press the Enter key.</td>
</tr>
<tr>
<td>Sectors/Bytes/KB...</td>
<td>Specifies the dimension of the data in the Offset field.</td>
</tr>
<tr>
<td>Previous/Next</td>
<td>Moves to the previous/next part of the data.</td>
</tr>
<tr>
<td>+/-</td>
<td>Zooms into/out of, the data.</td>
</tr>
</tbody>
</table>

#### 2.4.10 Syntax of a Description File for RAID Configurations

You may create and store your own RAID configurations. The syntax of those files is similar to that of the XML language. They are stored in an .xml file specified on the R-Studio Settings.

A number of file examples are shown on the Description Files for RAID Configurations topic.

There are two types of such description files: for RAID presets and custom-created RAID layouts.

**RAID preset configuration file**

```xml
<?xml version="1.0" encoding="UTF-8"?>
<RAIDList version="1">
    <RAID blockSize="65536" name="RAID5" rows="3" type="5" order="2" parityDelay="1">
        <Parents>
            <Parent comp="RAID5Disk1.dsk" name="Promise1+0 JBOD1.10" size="40060321792" order="1"/>
            <Parent comp="RAID5Disk2.dsk" name="Promise1+0 JBOD1.10" size="40060321792" order="2"/>
            <Parent comp="RAID5Disk3.dsk" name="Promise1+0 JBOD1.10" size="40060321792" order="3"/>
        </Parents>
    </RAID>
</RAIDList>
```
Custom-created RAID configuration file example

```xml
<?xml version="1.0" encoding="UTF-8"?>
<RAIDList version="1">
  <RAID blockSize="65536" name="RAID6Complex" rows="6" type="256">
    <Parents>
      <Parent name="img1.bin" size="941359104" order="1"/>
      <Parent name="img2.bin" fs="NTFS" size="941359104" order="2"/>
      <Parent name="img3.bin" size="941359104" order="3"/>
      <Parent name="img4.bin" size="941359104" order="4"/>
      <Parent name="img5.bin" size="941359104" order="5"/>
    </Parents>
    <Table>
      <Block id="A1">ReedSolomon</Block>
      <Block id="B1">1</Block>
      <Block id="C1">2</Block>
      <Block id="D1">3</Block>
      <Block id="E1">XorOfData</Block>
      <Block id="A2">4</Block>
      <Block id="B2">5</Block>
      <Block id="C2">6</Block>
      <Block id="D2">XorOfData</Block>
      <Block id="E2">ReedSolomon</Block>
      <Block id="A3">8</Block>
      <Block id="B3">9</Block>
      <Block id="C3">XorOfData</Block>
      <Block id="D3">ReedSolomon</Block>
      <Block id="E3">7</Block>
      <Block id="A4">12</Block>
      <Block id="B4">XorOfData</Block>
      <Block id="C4">ReedSolomon</Block>
      <Block id="D4">10</Block>
      <Block id="E4">11</Block>
      <Block id="A5">XorOfData</Block>
      <Block id="B5">ReedSolomon</Block>
      <Block id="C5">13</Block>
      <Block id="D5">14</Block>
      <Block id="E5">15</Block>
      <Block id="A6" sequence="1">XorOfAll</Block>
      <Block id="B6" sequence="2">XorOfAll</Block>
      <Block id="C6" sequence="3">XorOfAll</Block>
      <Block id="D6" sequence="4">XorOfAll</Block>
      <Block id="E6" sequence="5">XorOfAll</Block>
    </Table>
    <Sequences>
      <Sequence id="1">A1 A2 A3 A4 A5 A6</Sequence>
      <Sequence id="2">B1 B2 B3 B4 B5 B6</Sequence>
      <Sequence id="3">C1 C2 C3 C4 C5 C6</Sequence>
      <Sequence id="4">D1 D2 D3 D4 D5 D6</Sequence>
      <Sequence id="5">E1 E2 E3 E4 E5 E6</Sequence>
    </Sequences>
  </RAID>
</RAIDList>
```
**File structure**

**File header**
The file starts with a standard XML header:

```xml
<?xml version="1.0" encoding="utf-8"?>
```

**Section RAIDList**

```xml
<RAIDList>
```

It can contain any number of the `<RAID>` sections and requires a closing element `</FileTypeList>`.

**Section structure example:**

```xml
<RAIDList>
  <RAID [attributes]>
    ...
  </RAID>
  ...
  <RAID [attributes]>
    ...
  </RAID>
</RAIDList>
```

**Section RAID**

This section describes each RAID layout.

It must contain at least one `<Table>` and `<Parents>` sections and can contain one block `<Sequences>`.

```xml
<RAIDList version="1"/>
```

```xml
<RAID blockSize="65536" name="RAID5" rows="3" type="5" order="2" parityDelay="1">
  <Parents>
  </Parents>
  <Table>
  </Table>
  <Sequences>
  </Sequences>
</RAID>
```

**Attributes:**

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Required</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>blockSize</td>
<td>&lt;u32&gt;</td>
<td>Required</td>
<td>The block size of the RAID in bytes</td>
</tr>
<tr>
<td>name</td>
<td>&lt;string&gt;</td>
<td>Optional</td>
<td>The name of the RAID layout</td>
</tr>
<tr>
<td>rows</td>
<td>&lt;u16&gt;</td>
<td>Required</td>
<td>The number of rows in the RAID layout table.</td>
</tr>
</tbody>
</table>
| type    | <u16> | Required | The type of the RAID preset. The following types are supported:  
|         |       |          | 1: RAID0 (Stripe set)  
|         |       |          | 2: RAID10  
|         |       |          | 3: RAID1E  
|         |       |          | 4: RAID4  
|         |       |          | 5: RAID5  
|         |       |          | 6: RAID5E  
|         |       |          | 7: RAID5EE  
|         |       |          | 8: RAID6 / Reed-Solomon Encoding                     |
9: RAID6E / Reed-Solomon Encoding
10: RAID6 / Vertical Xor Encoding
256: Custom Raid Table

If the RAID type parameter contradicts to the RAID table, the RAID table always prevails.

<table>
<thead>
<tr>
<th>order</th>
<th>&lt;u16&gt;</th>
<th>Required/Optional</th>
<th>The RAID sub-type. For example, order=&quot;2&quot; means Left Asynchronous for RAID5 layouts. Any value for the custom RAID layouts will be ignored.</th>
</tr>
</thead>
<tbody>
<tr>
<td>parityDelay</td>
<td>&lt;u16&gt;</td>
<td>Required</td>
<td>The Parity delay parameter.</td>
</tr>
</tbody>
</table>

Section structure example:

```xml
<RAID blockSize="65536" rows="6" type="256">
  <Parents>
  </Parents>
  <Table>
  </Table>
  <Sequences>
  </Sequences>
</RAID>
```

Section Parents
This section describes the RAID parents. It contains the `<Parent>` elements of the RAID.

Section structure example:

```xml
<Parents>
  <Parent comp="RAID5Disk1.dsk" name="Promise1+0 JBOD1.10" size="40060321792" order="1"/>
  <Parent comp="RAID5Disk2.dsk" name="Promise1+0 JBOD1.10" size="40060321792" order="2"/>
  <Parent comp="RAID5Disk3.dsk" name="Promise1+0 JBOD1.10" size="40060321792" order="3"/>
</Parents>
```

Element Parent
The element specifies the parent of the RAID.

Attributes:

<table>
<thead>
<tr>
<th>comp</th>
<th>&lt;string&gt;</th>
<th>Required/Optional</th>
<th>The file-container with the parent object.</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>&lt;string&gt;</td>
<td>Required</td>
<td>The object name of the RAID parent.</td>
</tr>
<tr>
<td>offset</td>
<td>&lt;u16&gt;</td>
<td>Required is not 0</td>
<td>The offset value in bytes</td>
</tr>
<tr>
<td>size=</td>
<td>&lt;u16&gt;</td>
<td>Required</td>
<td>The object size in bytes</td>
</tr>
<tr>
<td>order</td>
<td>&lt;u16&gt;</td>
<td>Required</td>
<td>The order of the RAID object</td>
</tr>
</tbody>
</table>

Section Table
This section describes the RAID layout table. It contains the `<Block>` elements which number is a product of two attributes in the `<RAID>` section: `<parents> x <rows>`.
Section structure example:

```xml
<RAIDList>
  <RAID name="example" parents="2" rows="2" blocksize="16777216">
    <Table>
      <Block [attributes]> ... </Block>
      <Block [attributes]> ... </Block>
      <Block [attributes]> ... </Block>
      <Block [attributes]> ... </Block>
    </Table>
  </RAID>
</RAIDList>
```

**Element Block**

The element specifies the block number in the RAID layout table (a positive integer number) or an error correction block of the following types:

- PD or ParityOfData
- PA or ParityOfAll
- RS or ReedSolomon
- U or Unknown
- I or Ignore

Any other value is treated as Unknown.

**Attributes:**

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>id</td>
<td>Required: The alpha-numerical identifier of the block in the RAID layout table. The element in the 3-rd column of the 2-nd line is designated as C2:AA is used after letter z, and so on.</td>
</tr>
<tr>
<td>sequence</td>
<td>Optional: The numerical identifier for non-default sequences.</td>
</tr>
</tbody>
</table>

**Section Sequences**

This section describes the non-default data checksum sequences used to preserve data integrity. It is not necessary to explicitly list default sequences (the table rows). Sequences can contain any number of the `<Sequence>` elements.

**Section structure example:**

```xml
<RAIDList>
  <RAID name="example" parents="4" rows="4" blocksize="16777216">
    <Parents>
    </Parents>
    <Table>
      ...
    </Table>
    <Sequences>
      <Sequence [attributes]> ... </Sequence>
      ...
      <Sequence [attributes]> ... </Sequence>
    </Sequences>
  </RAID>
</RAIDList>
```
Element Sequence
The element contains the list of the RAID blocks belonging to that sequence. The elements are separated by a space.

Attributes:

| id    | <u16> | Required | The sequence identifier. |

Element example:
See the [RAID configuration file example](#).

Comments
<!-- Comment string -->
An XML standard string for a comment.

2.4.11 Description Files for RAID Configurations
Below are description files for RAID examples described in the Volume Sets and RAIDs chapter. The syntax of them is described in the Syntax of a Description File for RAID Configurations topic.

StripeSet
The stripe set layout is described in the Volume Sets, Stripe Sets, and Mirrors topic.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<RAIDList version="1">
  <RAID blockSize="65536" name="StripeSet" rows="2" type="1" order="7" parityDelay="1">
    <Parents>
      <Parent comp="RAID0Disk1.dsk" name="Promise1+0 JBOD1.10" size="40060321792" order="1"/>
      <Parent comp="RAID0Disk2.dsk" name="Promise1+0 JBOD1.10" size="40060321792" order="2"/>
    </Parents>
  </RAID>
</RAIDList>
```

Basic RAID 5
The RAID layout is described in the Working with Basic RAID 4 and RAID 5 Operations topic.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<RAIDList version="1">
  <RAID blockSize="65536" name="RAID5" rows="3" type="5" order="2" parityDelay="1">
    <Parents>
      <Parent comp="RAID5Disk1.dsk" name="Promise1+0 JBOD1.10" size="40060321792" order="1"/>
      <Parent comp="RAID5Disk2.dsk" name="Promise1+0 JBOD1.10" size="40060321792" order="2"/>
      <Parent comp="RAID5Disk3.dsk" name="Promise1+0 JBOD1.10" size="40060321792" order="3"/>
    </Parents>
  </RAID>
</RAIDList>
```

RAID 5 with parity delays
The RAID layout is described in the RAID5 with Parity Delays Operations topic.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<RAIDList version="1">
  <RAID blockSize="16384" name="RAID5HP" rows="48" type="5" order="2" parityDelay="16" firstParity="16">
    <Parents>
      <Parent name="RAID5HPDisk1.bin" offset="557056" size="941359104" order="1"/>
      <Parent name="RAID5HPDisk2.bin" offset="557056" size="941359104" order="2"/>
    </Parents>
  </RAID>
</RAIDList>
```
Advanced RAID 5
The RAID layout is described in the Working with Advanced RAID Layouts topic.
RAID 6 Reed-Solomon (Left Synchronous (Standard)) Preset
The RAID layout is described in the Working with RAID 6 Presets topic.

RAID6 (Double Xor) Preset
The RAID layout is described in the Working with RAID 6 Presets topic.
Advanced RAID 6

The RAID layout is described in the [Working with Advanced RAID Layouts](#) topic.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<RAIDList version="1">
  <RAID blockSize="65536" name="RAID6Complex" rows="6" type="256">
    <Parents>
      <Parent name="img1.bin" size="941359104" order="1"/>
      <Parent name="img2.bin" fs="NTFS" size="941359104" order="2"/>
      <Parent name="img3.bin" size="941359104" order="3"/>
      <Parent name="img4.bin" size="941359104" order="4"/>
      <Parent name="img5.bin" size="941359104" order="5"/>
    </Parents>
    <Table>
      <Block id="A1">ReedSolomon</Block>
      <Block id="B1">1</Block>
      <Block id="C1">2</Block>
      <Block id="D1">3</Block>
      <Block id="E1">XorOfData</Block>
      <Block id="A2">4</Block>
      <Block id="B2">5</Block>
      <Block id="C2">6</Block>
      <Block id="D2">XorOfData</Block>
      <Block id="E2">ReedSolomon</Block>
      <Block id="A3">8</Block>
      <Block id="B3">9</Block>
      <Block id="C3">XorOfData</Block>
      <Block id="D3">ReedSolomon</Block>
      <Block id="E3">7</Block>
      <Block id="A4">12</Block>
      <Block id="B4">XorOfData</Block>
      <Block id="C4">ReedSolomon</Block>
      <Block id="D4">10</Block>
      <Block id="E4">11</Block>
      <Block id="A5">XorOfData</Block>
      <Block id="B5">ReedSolomon</Block>
      <Block id="C5">13</Block>
      <Block id="D5">14</Block>
      <Block id="E5">15</Block>
      <Block id="A6" sequence="1">XorOfAll</Block>
      <Block id="B6" sequence="2">XorOfAll</Block>
      <Block id="C6" sequence="3">XorOfAll</Block>
      <Block id="D6" sequence="4">XorOfAll</Block>
      <Block id="E6" sequence="5">XorOfAll</Block>
    </Table>
    <Sequences>
      <Sequence id="1">A1 A2 A3 A4 A5 A6</Sequence>
      <Sequence id="2">B1 B2 B3 B4 B5 B6</Sequence>
      <Sequence id="3">C1 C2 C3 C4 C5 C6</Sequence>
      <Sequence id="4">D1 D2 D3 D4 D5 D6</Sequence>
    </Sequences>
  </RAID>
</RAIDList>
```
RAID10 (1+0)
The RAID layout is described in the **RAID10 (1+0)** topic.

```xml
<RAIDList version="1">
  <RAID blockSize="65536" name="RAID10" rows="1" type="2" order="7" parityDelay="1">
    <Parents>
      <Parent name="RAID10-1.bin" size="941359104" order="1"/>
      <Parent name="RAID10-2.bin" size="941359104" order="2"/>
      <Parent name="RAID10-3.bin" size="941359104" order="3"/>
      <Parent name="RAID10-4.bin" size="941359104" order="4"/>
    </Parents>
  </RAID>
</RAIDList>
```

RAID1E
The RAID layout is described in the **RAID1E** topic.

```xml
<RAIDList version="1">
  <RAID blockSize="65536" name="RAID1E" rows="2" type="3" order="1" parityDelay="1">
    <Parents>
      <Parent name="RAID1EDisk1.bin" fs="NTFS" size="941359104" order="1"/>
      <Parent name="RAID1EDisk2.bin" size="941359104" order="2"/>
      <Parent name="RAID1EDisk3.bin" size="941359104" order="3"/>
    </Parents>
  </RAID>
</RAIDList>
```

RAID5E
The RAID layout is described in the **RAID5E** topic.

```xml
<RAIDList version="1">
  <RAID blockSize="65536" name="RAID5E" rows="5" type="6" order="1" parityDelay="1">
    <Parents>
      <Parent name="RAID5EDisk1.bin" fs="NTFS" size="941359104" order="1"/>
      <Parent name="RAID5EDisk2.bin" size="941359104" order="2"/>
      <Parent name="RAID5EDisk3.bin" size="941359104" order="3"/>
      <Parent name="RAID5EDisk4.bin" size="941359104" order="4"/>
    </Parents>
  </RAID>
</RAIDList>
```

RAID5EE
The RAID layout is described in the **RAID5EE** topic.

```xml
<RAIDList version="1">
  <RAID blockSize="65536" name="RAID5EE" rows="4" type="7" order="1" parityDelay="1">
    <Parents>
      <Parent name="RAID5EEDisk1.bin" fs="NTFS" size="941359104" order="1"/>
      <Parent name="RAID5EEDisk2.bin" size="941359104" order="2"/>
    </Parents>
  </RAID>
</RAIDList>
```
Reverse RAIDs is a technique that is reverse to creating virtual RAIDs. When creating a reverse RAID, the data from a real object is decomposed into virtual parents. Then data on those virtual parents can be processed like on real objects. They can be viewed, edited, imaged, copied to physical drives, etc.

- **Reverse RAID of an Object**
  This technique can be used to decompose data on a single volume into virtual parents. Then such virtual parents can be processed like on real objects. They can be viewed, edited, imaged, copied to physical drives, etc.

- **Reverse RAID of a RAID**
  This technique can be used to re-construct data on individual RAID disks when data on physical disks is corrupted, but can be recovered using RAID redundancy. A missing disk is an example of this case. Or if there are bad sectors scattered over the physical disks but the overall RAID integrity remains. Then the data can be copied to physical hard drives to create a healthy RAID.

**Note:** Many controllers write their own metadata to disks to recognize that the disks belong to certain RAIDs. Without that metadata they won't see those RAIDs. You have to write that metadata manually.

### 2.4.12.1 Reverse RAID of an Object

This technique can be used to decompose data on a single object into virtual parents. Then such virtual parents can be processed like on real objects. They can be viewed, edited, imaged, copied to physical drives, etc.

Suppose you have an image of a former RAID 6 (Reed-Solomon) and you want to re-create data on individual disks from that RAID 6. You can do that by creating a reverse RAID of an image.

**Note:** Many controllers write their own metadata to disks to recognize that the disks belong to certain RAIDs. Without that metadata they won't see those RAIDs. You have to write that metadata manually.

**To create a reverse RAID of a disk image (or other disk object),**

1. Control-click the disk object on the Drives panel and select Create Reverse RAID on the contextual menu.
The Reverse parents will appear on the Drives panel.

Initially, the reverse RAID is set to its default values as RAID 5 on the Parents tab.

Adjust RAID parameters on the Parents tab, as necessary.

You need to add one reverse parent, change RAID type, and adjust RAID offset.
Process the appeared reverse parents on the Drives panel as real objects. These parents can be imaged, viewed/edited, etc.

2.4.12.2 Reverse RAID of a RAID

This technique can be used to re-construct data on individual RAID disks when data on physical disks is corrupted, but can be recovered using RAID redundancy.

Suppose you have a RAID 5 with one missing hard drive and you need to reconstruct data on that disk. You can do that by creating a reverse RAID for it and then copy data from that missing disk to a real one, or to an image.

Note: Many controllers write their own metadata to disks to recognize that the disks belong to certains RAIDs. Without that metadata they won’t see those RAIDs. You have to write that metadata manually.

To create a reverse RAID of a RAID with a missing disk,

1. Create a virtual RAID 5 of the existing hard drives or their images
   Add a missing disk to the Parents tab.
If necessary, read the Basic RAID 4 and RAID 5 Operations and Volumes Sets and RAIDs help pages for details.

2 Control-click the Virtual Block Raid on the Drives panel and select Create Reverse RAID on the contextual menu.

> The Reverse parents will appear on the Drives panel

These parents may be processed as real objects, they can be imaged, viewed/edited. For your case the missing disk can be copied to a hard drive in the Drive Copy Wizard.
Note: The reverse parents contain the data that should be on the RAID parents, according to its layout, while RAID parents contain actual data, that may be corrupted.

2.4.13 Various Disk and Volume Managers

R-Studio can work with objects created by various disk and volume managers. Currently, the following managers are supported:

- **Windows Dynamic Disks**
- **Windows Storage Spaces**
- **Apple RAIDs**
- **Apple CoreStorage/File Vault/Fusion Drive Volumes**
- **Linux mdadm RAIDs**
- **Logical Volume Manager (LVM and LVM2)**

R-Studio can automatically recognize and add their physical components, component images, or the user can manually add the components when their data is damaged so severely that R-Studio cannot recognize them.

2.4.13.1 Windows Dynamic Disks

R-Studio supports dynamic disks, including Windows software RAIDs, mirrors, and spanned volumes. When R-Studio detects components from such dynamic disks, it assembles them accordingly.
Windows dynamic disks (RAID5)

R-Studio automatically detects components from dynamic disks and creates those dynamic disks automatically. At the same time, R-Studio gives access to the parents of the dynamic disks (hard drives and images).

Windows dynamic disks (RAID5) in R-Studio for Mac

Also, R-Studio automatically detects inconsistent components of dynamic disks and marks them accordingly.

Windows dynamic disks (RAID5) with unsynced parent

R-Studio shows the components of the selected dynamic disk on its LDM Components tab.
R-Studio shows broken dynamic disks in pink.

### Broken dynamic disks in R-Studio

<table>
<thead>
<tr>
<th>DevicePath</th>
<th>A</th>
<th>Size</th>
<th>Type</th>
<th>Fmt</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>/dev/rdsk/c2t1d0</td>
<td>8E1</td>
<td>74.83 GB</td>
<td>S3</td>
<td>8E1</td>
<td>74.83 GB</td>
</tr>
<tr>
<td>/dev/rdsk/c2t1d1</td>
<td>800</td>
<td>74.83 GB</td>
<td>800</td>
<td>74.83 GB</td>
<td></td>
</tr>
</tbody>
</table>

The **LDM Components** tab also allows you to manually disconnect or connect the components, for example, if they are such damaged that **R-Studio** cannot recognize them as parts of a broken dynamic disk. Select the object from the drop-down box and click the **Connect** button. **R-Studio** displays the objects it recognizes as the components of the dynamic disk in blue.
Adding a component manually

You may immediately switch to the dynamic disk configuration that R-Studio believes most probable by clicking the Reassemble button.

R-Studio shows dynamic disks with manually added components in blue:

### Dynamic disks with added components in R-Studio

![Dynamic disks with added components in R-Studio](image)

2.4.13.2 Windows Storage Spaces

Windows storage spaces is a new storage technology, introduced in Windows 8 and Windows Server 2012, that allows the user to combine various (not always similar) hard drives into a kind of a RAID or compound volume. First, the hard drives are combined into a storage pool, then several storage spaces with striping (similar to RAID0), mirroring (similar to RAID1), and parity (similar to RAID5) can be created in that storage pool. You may read more about storage pools and spaces in the Microsoft's Storage Spaces: FAQ

When drives from a storage pool are connected to a Windows computer, it automatically detects them and assembles storage spaces accordingly.

R-Studio supports Windows Storage Spaces created by Windows 8/8.1 and Windows 10/Threshold 2/Anniversary/Fall Creators updates.

When Windows storage spaces use caching, R-Studio can process both the cache and the storage space itself simultaneously greatly increasing chances for successful recovery of deleted files. For SSD (Solid State Device) media, bypassing the cache may be the only available option to recover lost files.
Storage spaces in Windows

Storage pools and spaces can be managed using the **Storage Spaces** item in the **Windows Control Panel**.

**R-Studio** detects disks (or their images) from storage pools and creates storage pools and spaces automatically. At the same time, **R-Studio** gives access to the parents of the storage spaces (hard drives and images).
Storage spaces in R-Studio

If recognized parents of a storage space, including disk images, are added to R-Studio later, it automatically adds them to their respective storage space.

When an automatically created storage space is selected, R-Studio highlights its components. R-Studio shows the components of the selected storage space on its WSS Components tab.

WSS Components tab

R-Studio shows broken storage spaces in pink.
The **WSS Components** tab also allows you to manually disconnect or connect the components, for example, if they are such damaged that **R-Studio** cannot recognize them as parts of a broken storage space. Select the object from the drop-down box and click the **Connect** button. **R-Studio** displays the objects it recognizes as the components of the storage space in blue.

**Adding a component manually**

You may immediately switch to the storage space configuration that **R-Studio** believes most probable by clicking the **Reassemble** button. **R-Studio** shows such storage spaces in blue:

**Storage spaces with added parents in R-Studio**
2.4.13.3 Apple RAIDs

macOS can create several software RAIDs from disks connected to a Mac computer: RAID1 (Mirror set), RAID0 (Stripe set), and Concatenated disk set.

**Apple RAID0 example**

[R-Studio](https://www.r-studio.com) detects components of Apple RAID sets and creates their virtual RAIDs automatically. At the same time, R-Studio gives access to the individual components of the Apple RAID sets (hard drives and images).

**Apple RAIDs in R-Studio**

When an automatically created Apple RAID is selected, R-Studio highlights its components. It also highlights the Apple RAID that macOS may itself create from the same components.

R-Studio shows the components of the Apple RAID on its MacOS Components tab.
MacOS Components tab

---

**R-Studio shows broken Apple RAIDs in pink.**

### Broken Apple RAIDs in R-Studio

![Image of R-Studio interface showing broken Apple RAID]

The **MacOS Components** tab also allows you to manually disconnect or connect the components, for example, if they are such damaged that **R-Studio** cannot recognize them as parts of a broken Apple RAID. Select the object from the drop-down box and click the **Connect** button. **R-Studio** displays the objects it recognizes as the components of the Apple RAID in blue.

#### Adding a component manually

![Image of R-Studio interface showing adding a component]

You may immediately switch to the Apple RAID configuration that **R-Studio** believes most probable by clicking the **Reassemble** button. **R-Studio** shows Apple RAIDs with manually added components in blue:
Apple RAIDs with added members in R-Studio

<table>
<thead>
<tr>
<th>Device/Drives</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Device/Drives</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Device/Drives</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.4.13.4 Apple CoreStorage/File Vault/Fusion Drive Volumes

The macOS operating system has the following disk management systems:

- **File Vault**, is a disk encrypted utility;
- **Fusion Drive** is an Apple’s hybrid drive technology;
- **CoreStorage** is a logical volume management system.

**R-Studio** supports all these technologies and can unlock their encrypted volumes (hard drives and images).

**File Vault**

Locked CoreStorage Volume in R-Studio

To unlock the volume

1. Control-click the encrypted volume and select Unlock encrypted drive on the contextual menu.
2. Enter the password on the Unlock encrypted drive dialog box

> **R-Studio** will unlock the volume

Unlocked CoreStorage Volume in R-Studio

If the volume is partially encrypted, **R-Studio** can recognize which part is encrypted and which isn't. It will provide a correct access to the unencrypted and encrypted parts of the volume, provided that the correct password is entered.
Partially encrypted volume

![Partially encrypted volume](image)

Apple Fusion Drive (with installed macOS)

R-Studio detects components of Apple Fusion Drive and creates virtual Fusion Drives automatically. At the same time, R-Studio gives access to the individual components of the Fusion Drives (hard drives and images).

Fusion Drive in R-Studio

When an automatically created Fusion Drive is selected, R-Studio highlights its components. R-Studio shows the components of the Fusion Drive on its APFS Fusion Components tab.

Fusion Drive Components tab

![Fusion Drive Components tab](image)

R-Studio shows broken Fusion Drives in pink.

Broken Fusion Drive in R-Studio

![Broken Fusion Drive in R-Studio](image)

The Fusion Drive Components tab also allows you to manually disconnect or connect the components, for example, if they are such damaged that R-Studio cannot recognize them as parts of a broken Fusion Drive.
Select the object from the drop-down box and click the Connect button. R-Studio displays the objects it recognizes as the components of the Fusion Drive in blue.

**Adding a component manually**

![Image of R-Studio interface showing component addition](image1)

You may immediately switch to the Fusion Drive configuration that R-Studio believes most probable by clicking the Reassemble button.

R-Studio shows Fusion Drive with manually added components in blue:

**Fusion Drive with added members in R-Studio**

![Image of R-Studio interface showing added components](image2)

**Apple Fusion Drive (without installed macOS)**

Fusion Drive in R-Studio

![Image of R-Studio interface showing Fusion Drive with macOS](image3)

When an automatically created Fusion Drive is selected, R-Studio highlights its components.

### 2.4.13.5 Linux mdadm RAIDs

mdadm is a Linux utility used to manage and monitor software RAID devices. R-Studio supports such devices and when drives from a mdadm RAID are connected to a Mac computer, it automatically detects them and assembles mdadm RAIDs accordingly.
**Linux mdadm RAIDs**

*R-Studio* detects components from mdadm RAIDs and creates those RAIDs automatically. At the same time, *R-Studio* gives access to the components of those RAIDs (hard drives and images).

### mdadm RAIDs in R-Studio

If recognized components of a mdadm RAID, including disk images, are added to *R-Studio* later, it automatically adds them to their respective mdadm RAID.

When an automatically created mdadm RAID is selected, *R-Studio* highlights its components.

*R-Studio* shows the components of the mdadm RAIDs on its **mdadm Components** tab.

### mdadm Components tab

*R-Studio* shows broken mdadm RAIDs in pink.
Broken mdadm RAIDs in R-Studio

The `mdadm` Components tab also allows you to manually disconnect or connect the components, for example, if they are such damaged that R-Studio cannot recognize them as parts of a broken mdadm RAID. Select the object from the drop-down box and click the Connect button. R-Studio displays the objects it recognizes as the components of the mdadm RAID in blue.

Adding a component manually

You may immediately switch to the mdadm RAID configuration that R-Studio believes most probable by clicking the Reassemble button.

R-Studio shows such mdadm RAIDs in blue:

**mdadm RAIDs with added components in R-Studio**

2.4.13.6 Linux LVM/LVM2

Linux LVM is a logical volume manager for the Linux OS that manages disk drives and other data storage devices. Using it, it is possible to create single logical volumes on several physical disks, add and replace them in a running system, resize logical volumes, create various RAID configuration, and so on. You may read more about Linux LVM on this Wikipedia article: Logical Volume Manager (Linux).

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LVM volume example

R-Studio automatically detects disks from LVMs and creates their virtual volumes automatically. At the same time, R-Studio gives access to the components of the virtual LVM volumes (hard drives and images).

LVM Volumes in R-Studio

If recognized components of an LVM volume, including disk images, are added to R-Studio later, it automatically adds them to their respective LVM volume.

When an automatically created LVM volume is selected, R-Studio highlights its components.

R-Studio shows the components of the LVM volume on its LVM Components tab.

LVM Components tab

R-Studio shows broken virtual LVM volumes in pink.

Broken LVM volumes in R-Studio
The **LVM Components** tab also allows you to manually disconnect or connect the components, for example, if they are such damaged that **R-Studio** cannot recognize them as parts of a broken LVM volume. Select the object from the drop-down box and click the **Connect** button. **R-Studio** displays the objects it recognizes as the components of the LVM volume in blue.

**Adding a component manually**

You may immediately switch to the LVM volume configuration that **R-Studio** believes most probable by clicking the **Reassemble** button. **R-Studio** shows such virtual LVM volumes in blue:

**LVM volumes with added components in R-Studio**

Virtual objects created in the **Device view** pane of **R-Studio** can be connected to the system as read-only virtual drives. Such virtual drives become accessible to the system and to other programs. Moreover, such virtual drives remain connected after **R-Studio** has been closed.
To connect a virtual object as a read-only virtual drive to the system

1. Right-click the virtual object and select Mount on the shortcut menu

> A read-only virtual drive will appear on the Drives panel

And in the system (Disk Utility) as a physical drive

And this virtual disk becomes accessible to the system and other programs.

To disconnect a virtual drive

1. Right-click the virtual drive on the Drives panel and select Unmount on the shortcut menu

2.5 Data Recovery over Network

This chapter explains how to perform data recovery operations over network.

R-Studio has network capabilities that allow the system administrator, using its computer, to recover files on any computers accessible over network.

R-Studio supports the TCP/IP protocol and any protocol supported in Microsoft Network.

R-Studio Agent must be installed on computers where files are to be recovered. This free service program gives R-Studio access to local disks on remote computers over network.
You should always disable a firewall and/or antivirus software on both computers. As an alternative, advanced users may tune them to allow **R-Studio** and **R-Studio Agent** to communicate via network. All data transmitted over network are encrypted with a strong algorithm for data security. Restoring data over network is very much the same as that on a local computer.

- **R-Studio Agent**
- **Data Recovery over Network**
- **Connecting over the Internet**

### 2.5.1 R-Studio Agent

**R-Studio Agent** is a program that provides **R-Studio** with an access to the drives of a network computer. It should be installed and properly registered on the computer which drives are to be accessed. **R-Studio Agent** has versions for the following PC operating systems:

- **Mac OS**
- **Windows**
- **Linux**

and there is **R-Studio Agent Emergency** that can be used to start a computer from which you are going to recover data that cannot start other way due to a file system crash, for example. Please, note that you need to use **R-Studio Emergency** as an emergency agent if you want to start a Mac computer. **R-Studio** can work equally with all versions of **R-Studio Agent** and access computers run under Windows, Mac OS, and Linux.

You must have enough rights on the remote computer to install and run **R-Studio Agent**.

#### 2.5.1.1 R-Studio Agent for Mac

You need to have an administrative account on the Mac computer to start **R-Studio Agent for Mac**. **R-Studio Agent** should be installed on a network computer to enable **R-Studio** access to its drives. **R-Studio Agent** should be registered.

If, due to file system crash, the network computer where you are going to recover your data cannot start, you may use **R-Studio Agent Emergency** to start the computer.

**To start the** **R-Studio Agent for Mac and access its main panel,**

1. Go to the Application folder, double-click **R-Studio Agent for Mac**, and enter the account password

   > The main panel will appear. You may view its log

   ![R-Studio Agent for Mac main panel](image)

   **To configure R-Studio Agent,**

   1. Select Preferences on the R-Studio Agent menu
2 Specify required parameters on the R-Studio Agent Preferences dialog box and click the OK button

R-Studio Agent Preferences dialog box

<table>
<thead>
<tr>
<th>R-Studio Agent Preferences</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Password:</strong> Enter a password to obtain access to this computer from a network.</td>
</tr>
<tr>
<td><strong>Re-Enter:</strong> Re-enter the password.</td>
</tr>
<tr>
<td><strong>Incoming connection preferences</strong></td>
</tr>
<tr>
<td><strong>Enable incoming connections</strong></td>
</tr>
<tr>
<td><strong>Port</strong></td>
</tr>
<tr>
<td><strong>Accepted IP Addresses</strong></td>
</tr>
<tr>
<td><strong>IP Address</strong></td>
</tr>
<tr>
<td><strong>Subnet Mask</strong></td>
</tr>
</tbody>
</table>

R-Studio Agent will now run with the specified parameters

Connecting from R-Studio Agent for Mac to R-Studio.

To establish a connection from R-Studio Agent for Mac to R-Studio,

1 Run the R-Studio Agent for Mac and select Connect from the Tools menu
2 Enter the necessary information on the Connect to R-Studio dialog box and click the Connect button.

Connect to R-Studio dialog box
Connect to R-Studio settings

<table>
<thead>
<tr>
<th>Server</th>
<th>Specify the DNS name or IP address of the host where R-Studio is running.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port</td>
<td>Specify the port set on the R-Studio Connect to Remote Computer dialog box.</td>
</tr>
<tr>
<td>Password</td>
<td>Specify the password set on the R-Studio Connect to Remote Computer dialog box.</td>
</tr>
</tbody>
</table>

> R-Studio Agent for Mac will connect to the computer where R-Studio is running and it will show the hard drive and logical disk structure of the remote computer, way as that on a local computer.

2.5.1.2  R-Studio Agent for Windows

Attention Windows NT/2000/XP/Vista/2008/7/8/8.1/10 users: R-Studio Agent should be installed under an administrator account.

When installed, R-Studio Agent starts automatically and runs as a service. To configure it, R-Studio Agent should be started again manually.

The following switches are available:

- `?-` evokes a help screen;
- `-install` installs R-Studio Agent as a service
- `-remove` removes R-Studio Agent services
- `-console` starts R-Studio Agent as a console application

Started without a switch, R-Studio Agent runs as a GUI application and its icon appears on the taskbar tray. In this mode, it can be configured and its log may be viewed.

Simply connect to the remote computer providing a desired password for R-Studio Agent in the Connect to Remote Computer dialog box. R-Studio checks if there is R-Studio Agent running on this computer. If not, a Can’t connect... message will appear.

Click the Yes button, and R-Studio will remotely install R-Studio Agent.


To access the R-Studio Agent main panel,

1. Click its tray icon

> The main panel will appear. You may view its log
To configure *R-Studio Agent*,
1. Right-click its tray icon and select Configure
2. Specify required parameters on the **Please configure R-Studio Agent** dialog box and click the OK button

**Please configure R-Studio Agent** dialog box

<table>
<thead>
<tr>
<th>R-Studio Agent Options</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Password:</strong></td>
</tr>
<tr>
<td><strong>Re-Enter:</strong></td>
</tr>
</tbody>
</table>

**Accepted Protocols**

<table>
<thead>
<tr>
<th>Protocol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipes</td>
<td>supported by Windows NT/2000/XP/2003/Yista/2008/7/8/8.1/10 only. To improve security, this option should be disabled.</td>
</tr>
<tr>
<td>TCP/IP</td>
<td>supported by any network OS.</td>
</tr>
</tbody>
</table>

**Port**

port for incoming connections

**Accepted IP Addresses**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP Address</td>
<td>specifies addresses from which this computer can be accessed.</td>
</tr>
<tr>
<td>Subnet Mask</td>
<td>specifies a subnet mask of the network from which this computer can be accessed.</td>
</tr>
</tbody>
</table>

> R-Studio Agent will now run with the specified parameters

2.5.1.3 R-Studio Agent for Linux

You need to have the root privileges to run R-Studio Agent for Linux.

Unlike R-Studio Agent for Windows and R-Studio Agent for Mac, R-Studio Agent for Linux is a console application and should be run in the Terminal. You also need to mark it as an executable before start.

When it is started for the first time, R-Studio Agent for Linux asks for its configuration.

**R-Studio Agent for Linux Configuration** dialog box

**R-Studio Agent for Linux Options**
Specify password for incoming connection | Enter a password to obtain access to this computer from a network.

Confirm password for incoming connection | Re-enter the password for confirmation.

Specify IP address... | Specifies addresses and a subnet mask from which this computer can be accessed. Enter 0 to allow connections from any address.

Specify TCP/IP Port for listening | A TCP/IP port for incoming connections. Press Enter for the default one [3174].

Don't pay much attention to the warning about "unregistered demo version". If necessary, you'll be able to register **R-Studio Agent for Linux** through **R-Studio**.

You may see the current configuration by starting **R-Studio Agent for Linux** with the command `rsagent --show_config`.

You may change the current configuration by starting **R-Studio Agent for Linux** with the command `rsagent --configure`.

**Connecting from R-Studio Agent for Linux to R-Studio.**

To establish a connection from R-Studio Agent for Linux to R-Studio,

1 Run the **R-Studio Agent for Linux** and press Enter

2 Enter the necessary information

**Connect to R-Studio** dialog box

> **R-Studio Agent for Linux** will connect to the computer where **R-Studio** is running and it will show the hard drive and logical disk structure of the remote computer.
It can be processed the same way as that on a local computer.

2.5.2 Data Recovery over Network

Generally, data restoring over network is very much the same as that on a local computer. **R-Studio Agent** should be running on the network computer where data are to be recovered.

Read the [Connecting over the Internet](#) topic to learn how to establish connection between **R-Studio** and **R-Studio Agent** over the Internet.

To connect to a remote computer

1. Click the Connect to Remote button, or
   Select **Connect To Remote** on the **Drive** menu
2. Specify the name or IP address of the remote computer where data are to be recovered in the **Computer:** field

**Connect to Remote Computer** dialog box

![Image of the Connect to Remote Computer dialog box]

The **Port** should coincide with the port specified for the **R-Studio Agent**.

The **Password:** field is for the password of **R-Studio Agent** running on the remote computer. If you want to see the entered password, control-click the field and select **Show password** on the contextual menu.

**Note:** If the remote computer is started with **R-Studio Agent Emergency**, leave this field blank.

> **R-Studio** will connect to the remote computer and show its hard drive and logical disk structure of the remote computer below the device/disk structure of your local computer

![Image of a connected remote computer]

It can be processed the same way as that on a local computer.

When **R-Studio** connects to the remote computer, it check if **R-Studio Agent** is present and its password. If there is no **R-Studio Agent** installed, **R-Studio** may try to remotely install it. See the **R-Studio Agent** topic for details.
When the Recover dialog box appears, you may select whether you want to save recovered files on the local or remote computer. Saving recovered files on a remote computer may be useful when the remote computer has a healthy disk because you do not have to transfer files over network. It may be an external USB hard drive, for example.

When R-Studio connects to the remote computer, it check if R-Studio Agent is present and its password. If there is no R-Studio Agent installed, R-Studio may try to remotely install it. See the R-Studio Agent topic for details.

### 2.5.3 Connecting over the Internet

R-Studio and R-Studio Agent can be connected over the Internet. The connection can be made either using IP addresses or DNS names.

If hosts where R-Studio and R-Studio Agent are running have public IP addresses the connection can be made the same way as for the local network, except that the IP address or DNS name should be explicitly specified in the Computer filed the Connect to Remote Computer dialog box.

If either (or both) of the hosts are on private networks behind NATs and firewalls and do not have public IP addresses, the corresponding ports should be opened or forwarded. In addition, connection should be made either only from R-Studio or from R-Studio Agent.
Connection directions
* Both R-Studio and R-Studio Agent have public IP addresses (no NAT/firewall) or the ports on the NAT/firewall are forwarded/opened.

A connection can be made either from R-Studio or from R-Studio Agent.
* R-Studio is behind a NAT and R-Studio Agent has a public IP address or the ports on its NAT/firewall are forwarded/opened.

A connection should be made from R-Studio.
* R-Studio has a public IP address or the ports on its NAT/firewall are forwarded/opened and R-Studio Agent is behind a NAT.

A connection should be made from R-Studio Agent.

* Both R-Studio and R-Studio Agent are behind NATs/firewalls.

No connections are possible.

**Connection from R-Studio Agent to R-Studio**

**R-Studio settings**

If a connection is to be made from R-Studio Agent to R-Studio, R-Studio should be set to accept connection on the **Connect to Remote Computer** dialog box.
Connect to Remote Computer dialog box

Select Wait connection from remote computer, and specify options for incoming connections.

R-Studio Incoming Connection Options

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Password</td>
<td>Enter a password to obtain access to this computer from a network.</td>
</tr>
<tr>
<td>IP Address</td>
<td>Specifies addresses from which this computer can be accessed.</td>
</tr>
<tr>
<td>Subnet Mask</td>
<td>Specifies subnet mask of the network from which this computer can be accessed.</td>
</tr>
<tr>
<td>Port</td>
<td>Port for incoming connections.</td>
</tr>
</tbody>
</table>

R-Studio will wait for an incoming connection.

Waiting for remote connection dialog box

Connecting from R-Studio Agent to R-Studio.

(See the R-Studio Agent for Mac or R-Studio Agent for Linux help page to learn how to establish connections from those R-Studio Agent versions).

To establish a connection from R-Studio Agent to R-Studio,

1 Select Connect to on the Tools menu.

2 Enter the necessary information on the Connect to R-Studio dialog box and click the Connect button.

Connect to R-Studio dialog box
Connect to R-Studio settings

<table>
<thead>
<tr>
<th>Server</th>
<th>Specify the DNS name or IP address of the host where R-Studio is running.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port</td>
<td>Specify the port set on the R-Studio Connect to Remote Computer dialog box.</td>
</tr>
<tr>
<td>Password</td>
<td>Specify the password set on the R-Studio Connect to Remote Computer dialog box.</td>
</tr>
</tbody>
</table>

R-Studio Agent will connect to the computer where R-Studio is running and it will show the hard drive and logical disk structure of the remote computer.

It can be processed the same way as that on a local computer.
III  Text/Hexadecimal Editor

Any object visible by R-Studio can be viewed and edited in the Text/Hexadecimal Editor. It is also able to parse the data and represent data according to various data patterns. You may also create your own patterns to parse data.

- Viewing and Editing Objects
- Navigating through an Object
- Data Copy
- Files and Sectors
- Creating Custom Patterns
- Pattern Example I
- Pattern Example II

R-Studio Features
Contact Information and Technical Support
Data Recovery Using R-Studio
Basic File Recovery
Advanced Data Recovery
Mass File Recovery
Volume Sets and RAIDs
Data Recovery over Network
Technical Information and Troubleshooting
R-Studio Emergency
R-Studio Agent Emergency

3.1  Viewing and Editing Objects

YOU MUST BE ABSOLUTELY SURE OF WHAT AND WHERE YOU ARE WRITING!
Or you may completely lose all your data.

Before you can physically write anything on a disk, you need to enable writing.

To enable writing,
1  On the R-Studio main panel, select Enable Write on the Tools menu
>  The Editable: status will change to Yes from Read Only.
Now the object can be edited.

To view/edit an object,
1  Control-click the object and select View/Edit on the contextual menu, or
   Select the object and select View/Edit on the File menu
A Text/hexadecimal Editor panel will appear.

Data Parsed According to the Selected Pattern
**Object Sector Mapping**

<table>
<thead>
<tr>
<th>Sector</th>
<th>Parent Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2000</td>
</tr>
<tr>
<td>2</td>
<td>2000</td>
</tr>
<tr>
<td>3</td>
<td>2000</td>
</tr>
<tr>
<td>4</td>
<td>2000</td>
</tr>
<tr>
<td>5</td>
<td>2000</td>
</tr>
<tr>
<td>6</td>
<td>2000</td>
</tr>
<tr>
<td>7</td>
<td>2000</td>
</tr>
<tr>
<td>8</td>
<td>2000</td>
</tr>
<tr>
<td>9</td>
<td>2000</td>
</tr>
<tr>
<td>10</td>
<td>2000</td>
</tr>
<tr>
<td>11</td>
<td>2000</td>
</tr>
<tr>
<td>12</td>
<td>2000</td>
</tr>
<tr>
<td>13</td>
<td>2000</td>
</tr>
</tbody>
</table>

**Data Shown as Various Digits**

<table>
<thead>
<tr>
<th>Offset</th>
<th>Binary Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0010001001</td>
</tr>
<tr>
<td>1</td>
<td>0010001001</td>
</tr>
<tr>
<td>2</td>
<td>0010001001</td>
</tr>
<tr>
<td>3</td>
<td>0010001001</td>
</tr>
<tr>
<td>4</td>
<td>0010001001</td>
</tr>
<tr>
<td>5</td>
<td>0010001001</td>
</tr>
<tr>
<td>6</td>
<td>0010001001</td>
</tr>
<tr>
<td>7</td>
<td>0010001001</td>
</tr>
<tr>
<td>8</td>
<td>0010001001</td>
</tr>
<tr>
<td>9</td>
<td>0010001001</td>
</tr>
<tr>
<td>10</td>
<td>0010001001</td>
</tr>
<tr>
<td>11</td>
<td>0010001001</td>
</tr>
<tr>
<td>12</td>
<td>0010001001</td>
</tr>
<tr>
<td>13</td>
<td>0010001001</td>
</tr>
</tbody>
</table>

**Binary view**

**Text view**

Find Results
Previous Pattern
Click this button to go to the previous pattern.

Next Pattern
Click this button to go to the next pattern.

Save Changes
Click this button to save changes.

Code pages
Turns supported code pages on/off.

Autoflow
Click this button to turn autoflow on.

Panel view options
You may set which panels and bars to enable/disable.

<table>
<thead>
<tr>
<th>Panel view options</th>
<th>To enable/disable:</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANSI data</td>
<td>Select/clear ANSI on the View menu</td>
</tr>
<tr>
<td>OEM data</td>
<td>Select/clear OEMr on the View menu</td>
</tr>
<tr>
<td>UNICODE data</td>
<td>Select/clear UNICODE on the View menu</td>
</tr>
<tr>
<td>UNICODE+ data</td>
<td>Select/clear UNICODE+ on the View menu</td>
</tr>
<tr>
<td>Toolbar</td>
<td>Select/clear Toolbar on the View menu</td>
</tr>
<tr>
<td>Toolbar Button Text</td>
<td>Select/clear Toolbar Button Text on the View menu</td>
</tr>
<tr>
<td>Properties View</td>
<td>Select/clear Properties View on the View menu</td>
</tr>
<tr>
<td>Sectors View</td>
<td>Select/clear Sectors View on the View menu</td>
</tr>
<tr>
<td>Data Interpreter View</td>
<td>Select/clear Data Interpreter View on the View menu</td>
</tr>
<tr>
<td>Template View</td>
<td>Select/clear Template View on the View menu</td>
</tr>
<tr>
<td>Bookmarks View</td>
<td>Select/clear Bookmarks View on the View menu</td>
</tr>
<tr>
<td>Find Results View</td>
<td>Select/clear Find Results View on the View menu</td>
</tr>
</tbody>
</table>

2 View the information and make necessary changes
Select Enable Write on the Tools menu if you want to save changes.
Viewing
There are up to four tabs showing the data in different representations. Actual number of tabs depends on the object and property being viewed/edited.

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Std</td>
<td>Exact attribute data. If the attribute is compressed, R-Studio decompresses it prior to showing.</td>
</tr>
<tr>
<td>Unlimited</td>
<td>Exact attribute data + free space of last cluster. If the attribute is compressed, R-Studio decompresses it prior to showing.</td>
</tr>
<tr>
<td>Direct</td>
<td>Actual data written on the disk. If the attribute is not compressed, it coincides with the Std representation.</td>
</tr>
<tr>
<td>Allocation</td>
<td>Resident part of the attribute.</td>
</tr>
</tbody>
</table>

You may view data in 4 various code pages: ANSI/OEM/UNICODE/UNICODE+ by switching on/off the respective code pages in the Code pages buttons or select the appropriate code pages on the View menu.

Patterns or Templates
You may select a pattern according to which the data will be parsed and shown in the parsed data pane. The Data Interpreter shows the data selected on the Template pane in various representation.

You may find the next or previous data that matches the pattern signature on the disk. Control-click the right pane of the editor and select either Find Template Signature Next or Find Template Signature Previous on the contextual menu. You may also select these items on the Edit menu.

You may also create your own patterns to parse data from various objects.

Navigating
Text/hexadecimal Editor gives you various ways to navigate through an object. See the Navigating through an Object for more details.

Data Copy
Text/hexadecimal Editor gives you various ways to copy selected data navigate in an object. See the Data Copy for more details.

Filling an area with a pattern
To fill an area with a pattern, select Fill on the Edit menu, and specify the pattern and area on the Fill dialog box.

Fill dialog box

**Fill options**

<table>
<thead>
<tr>
<th>Fill pattern</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEX</td>
<td>Field for the pattern to fill the area in the hexadecimal representation</td>
</tr>
<tr>
<td>ANSI</td>
<td>Field for the pattern to fill the area in the ANSI encoding</td>
</tr>
<tr>
<td>OEM</td>
<td>Field for the pattern to fill the area in the OEM encoding</td>
</tr>
</tbody>
</table>
UNICODE
Field for the pattern to fill the area in the UNICODE encoding

Fill range
From (hex)
Field for the start position of the area to fill with the pattern
To (hex)
Field for the end position of the area to fill with the pattern

3 Click the Save Changes button to save the changes, or
   • Select Save Changes on the Edit menu

> Viewer/Editor will save the changes on the object

YOU MUST BE ABSOLUTELY SURE OF WHAT AND WHERE YOU ARE WRITING!
Or you may completely lose all your data.

Selecting and saving an area in the Viewer/Editor
You may select an area in the Viewer/Editor panel and save it as a file.

To select and save an area in the Viewer/Editor panel,
1 Control-click the beginning of the selection and select Select From on the contextual menu.
2 Control-click the end of the selection and select Select To on the contextual menu

Other ways to select an area
• Select Select... on the Tools menu and specify an area to select on the Select dialog box, or
• Click the start point of the area and drag the mouse cursor to its end.
If you need to select an entire object, select Select All on the Tools menu

Select dialog box

| Select | Save to Binary File... | to save the data in the binary format (default extension is .bin) |
| Select | Save to Hexadecimal File | to save the data in the binary format (default extension is .hex) |

Select an appropriate item in the Tools menu to save the data in a required format and specify its file name
Select:

If you select an existing file, R-Studio will ask you if you want to append or overwrite the file.
If a remote computer is connected for Data Recovery over Network, the Save as... dialog box will appear when you select a place to save the data. You may save it to the local or remote computer.

> Viewer/Editor will save the data in the file

**Loading data from an external file**

You may load a data from a file and overwrite an area of the object opened in the Viewer/Editor panel.

To load binary data from a file and overwrite an area of the object opened in the Viewer/Editor panel,

1. Select an area to overwrite and select Load from File... on the Tools menu

   If a remote computer is connected for Data Recovery over Network, the Open as Binary File dialog box will appear when you select a place to open the data file from. You may open it from the local or remote computer.

2. Select the necessary file and load the data.

   > The area in the Viewer/Editor will be overwritten with the new data.

### 3.2 Navigating through an Object

**Navigating**

You may quickly move to a particular part of the object. To move to a particular part of the object being viewed/edited, enter the required offset in the Go to Offset field between the buttons.

Type an offset to which you want to go. You may select between bytes and sectors. See the Data Formats and Multipliers topic for more details on data formats.

If a file is opened in Text/Hexadecimal Editor, you may select data representation for that file.

You may also use the Go To Offset dialog box to go to a specified place in the object. Click the Offset field on the Status bar. You may also use this dialog box to copy the offset.
Go To Offset options

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>From:</td>
<td>Jump / offset direction. For example, if you need to find the offset from the object end for a selected byte, switch to the End (backward) option.</td>
</tr>
<tr>
<td>HEX / DEC</td>
<td>Switch between the hexadecimal and decimal data representation.</td>
</tr>
<tr>
<td>Range</td>
<td>Range of values that can be entered.</td>
</tr>
<tr>
<td>dec / hex:</td>
<td>Alternative data representation.</td>
</tr>
<tr>
<td>Offset</td>
<td>Flat data offset (without separation between the sector and offset in the sector).</td>
</tr>
<tr>
<td>Sector / offset</td>
<td>Data offset represented as a sector and offset in the sector.</td>
</tr>
<tr>
<td>Go! / OK buttons</td>
<td>The Go! button moves the cursor to the specified positions, but the Go To Offset dialog box remains open. The OK button closes the dialog box after moving the cursor.</td>
</tr>
</tbody>
</table>

Searching

To search for a particular string, click the Find, Find Next, or Find Previous buttons or the same items on the Edit menu, and specify the string on the Search dialog box.

Search dialog box

Search options

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Equal</td>
<td>Search for the place which content is not equal to the string. For example, the first byte not equal to 00 or FF.</td>
</tr>
</tbody>
</table>

Search for

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEX</td>
<td>Field for the string to search for in the hexadecimal representation</td>
</tr>
<tr>
<td>ANSI</td>
<td>Field for the string to search for in the ANSI encoding</td>
</tr>
<tr>
<td>OEM</td>
<td>Field for the string to search for in the OEM encoding</td>
</tr>
<tr>
<td>UNICODE</td>
<td>Field for the string to search for in the UNICODE encoding</td>
</tr>
<tr>
<td>Match case</td>
<td>Select this check box to make the search case-sensitive</td>
</tr>
</tbody>
</table>

Search area

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>From current position</td>
<td>Select this check box to start search from the current position</td>
</tr>
</tbody>
</table>
From start position | Select this check box to start search from the beginning of the object
---|---
From Address | Select this check box and specify the range in which the search is to be carried out
Search position
Exhaustive search | Select this check box to search the entire object
Search at offset | Select this check box and specify the sector offset from which the search will start
Reverse | Select this check box to start the search in the reverse direction
Find all | Select this check box to search for all instances of the string to search. Search results will be shown in the Find Results pane.

**Text/hexadecimal Editor** will show the search progress.

Search results are shown on the Find Results pane. You may easily move to the required found item by clicking the item.

**Features of the Not Equal option**

Suppose we have an object which first 3 consecutive sectors start with:

- Sector1: FILEAAAA
- Sector2: FILEBBBB
- Sector3: NOTAFILE

And the search string is Not Equal FILE.

If the Exhaustive search option is selected, the Text/hexadecimal Editor will stop at the first A character in Sector1.

If the Search at offset=0 option is selected, the Text/hexadecimal Editor will stop at the N character in Sector3.

**Bookmarking**

You may create bookmarks to easily move to those places. Control-click the cursor on the place you want to bookmark and select Toggle Bookmark on the shortcut menu. The list of bookmarks appears in the Bookmark pane. You may easily move to the required bookmark by clicking it in the list.

You may control bookmarks on the Edit menu.

### 3.3 Data Copy

**Text/hexadecimal Editor** gives you various ways to copy selected data navigate in an object.

**Data selected in Text/hexadecimal editor**

© 2021 R-Tools Technology Inc.
Depending on what column you have control-clicked, the following commands are available in the contextual menu:

<table>
<thead>
<tr>
<th>When control-clicking any column</th>
<th>Copy Editor Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>When control-clicking any column</td>
<td>Copy as File Signature</td>
</tr>
<tr>
<td>When control-clicking the Binary data column</td>
<td>Copy as &quot;Binary data&quot;</td>
</tr>
<tr>
<td>When control-clicking the ANSI column</td>
<td>Copy as &quot;ANSI&quot;</td>
</tr>
<tr>
<td>When control-clicking the UNICODE column</td>
<td>Copy as &quot;UNICODE&quot;</td>
</tr>
</tbody>
</table>

3.4 Files and Sectors

You may see which file is written on a particular sector. To do so:

1. Enumerate files on a logical disk on the Drives panel.
2. Go to the tab of that logical disk and select Show Files in HexEditor on the Files menu.
3. Return to the Drives panel and select View/Edit on the shortcut menu.

R-Studio will show a file that belongs to a particular section.
3.5 Creating Custom Patterns

You may create your own patterns yourself. An example of a commented pattern parsing an AVI file.

The syntax of pattern description is similar to that of the XML language. The folder where the files should be placed is specified on the Main tab of the Settings dialog box.

Pattern structure

Pattern header

Each pattern starts with a standard header

```xml
<?xml version="1.0" encoding="utf-8"?>
```

Section template

Each pattern starts with a section giving to the pattern a name that will be shown in the parsed data pane.

Attributes:

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>Specifies the pattern name shown in the parsed data pane</td>
</tr>
</tbody>
</table>

Example:

```xml
<template name="AVI File LIST">
    
</template>
```

Section signature

Attributes:

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>align</td>
<td>Specifies if the data structure address is aligned (i.e., by a sector: 512)</td>
</tr>
</tbody>
</table>

This section contains elements field with hex-codes of the signature. The attribute offset specifies their offset from the start of the record. Field length is equal to the number of hex-codes.

Example:

```xml
<signature align="1">
    <field offset="0">46 49</field>
    <field offset="2">4c 45</field>
</signature>
```

Section section

Such sections contain all expressions and operations needed for the pattern to parse the data. A section name is shown in the parsed data pane. In fact, sections are virtual objects used to group logically connected fields. Sections can be nested. The main section is not shown in the parsed data pane.
Section contain elements field which are actual data objects. field names are shown in the parsed data pane with their values.

Attributes:

| name       | Specifies the pattern name shown in the parsed data pane |

Example:

```xml
<section name="JUNK">
  ....
</section>
```

List of All Objects in Patterns

Data types (in field)

- integer
  - Sub-types:
    - int8
    - int16
    - int32
    - int64
    - uint8
    - uint16
    - uint32
    - uint64
    - uintX
  - Attributes:
    | endian: (be | le) | Optional. Default: system. |
    | as-offset: <expression> | Optional. Specifies that this field is an offset and its value should be evaluated using the expression. A special variable this returns the value of this field. |
    | purpose: (offset | rsector | rcluster) | Optional. Specifies the type of the as-offset expression result. If this attribute is present, the attribute is necessary if the offset value should differ from the value of this field (variable this). rsector and rcluster are offsets relative to the absolute position of the pattern beginning. |
    | assigned-template | Specifies the pattern name linked with this field. Ignored if the as-offset or purpose attributes are not specified. |
    | var: <Name> | Optional. Specifies the name under which the value of this field can be accessed in expressions. |

- binary
  - Attributes:
    | display-encoding: (hex | raw | ... | octal) | Optional. Default: hex. |
    | size: <bytes> | Mandatory. |

- char
Attributes:

<table>
<thead>
<tr>
<th>size: &lt;bytes&gt;</th>
<th>Mandatory.</th>
</tr>
</thead>
<tbody>
<tr>
<td>codepage: (ansi</td>
<td>oem</td>
</tr>
</tbody>
</table>

- **filetime**
  Shows time in the Win32 format (64 bits)

- **unixtime**
  Shows time in the Unix format (seconds from 01/01/1970)

- **filetime**
  Shows time in the DOS format (date: hiword, time: loword)

- **bits**
  Attributes:
<table>
<thead>
<tr>
<th>size: &lt;bytes&gt;</th>
<th>Mandatory.</th>
</tr>
</thead>
</table>

Commands

- **goto**
  Specifies a jump to a specified offset (either absolute or relative one)
  Attributes:
  | address: <expression> | Specifies an absolute address to jump to. |
  | offset: <expression> | Specifies a relative offset to jump by. |
  One and only one of the attributes should always be specified.

- **if**
  Evaluates a condition specified in the test attribute and, if the condition is true, reads fields specified in this tag.
  Attribute:
  | test: <expression> | Sets a condition to test against. |

- **repeat**
  Reads the fields specified in the tag until the exit condition is equal to 0 or specified times
  Attributes:
  | count: <expression> | <expression> is evaluated one time upon entering the block. Internal elements are read the specified number of times. |
  | test: <expression> | <expression> is evaluated upon entering the block. Similar to the C++ construction while(...) {}. |
• **setvar**
  Sets the value of an internal variable. As an example, this command is convenient to store the current offset. The value of the current offset is stored in a predefined variable `offset`.

Attributes:
- `var: <string>` Specifies the name of the variable.
- `expr: <expression>` Specifies an expression which result will be assigned to the variable.

### Expressions

Expressions in the patterns are arithmetic expressions which syntax is similar to that of the C language, including operation preceding.

The following operations are supported:

+ `- ` * / & | > < <= >= != == || &&

### Predefined variables

- **offset**  
  An offset in bytes from the pattern beginning data is currently read at.

- **start_position**  
  An absolute position of the pattern beginning. `offset + start_position = absolute offset`.

- **this**  
  This variable exists only within the context of the `ass-offset` expression evaluation and is the current value of the data field for which that expression is specified.

### 3.6 Pattern Example I

Below is an example of a commented pattern parsing an AVI file.

```xml
<?xml version="1.0" encoding="utf-8"?>
<!-- A pattern section. The pattern name is AVI File. -->
<template name="AVI File">
  <!-- A template signature section. Alignment is 1. -->
  <signature align="1">
    <!-- A 4-byte signature at offset 0x00. -->
    <field offset="0x00">52 49 46 46</field> <!-- ANSI: RIFF -->
    <!-- A 4-byte signature at offset 0x08. -->
    <field offset="0x08">41 56 49 20</field> <!-- ANSI: LIST -->
  </signature>

  <!-- A data section. Its name is AVI File. This is the main data section. It is not shown in the parsing tree as a section (its name is ignored). -->
  <section name="AVI File">
```
<!-- The first 4 bytes are read and shown as an ANSI string. -->
<field type="char" size="4" name="Signature: RIFF" var="signature"/>

<!-- The current position is moved to the beginning of the file. -->
<goto offset="-4"/>

<!-- The first 4 bytes in the file are read and shown as an unsigned integer. The internal variable signature gets the value of the field. -->
<field type="uint32" base="hex" name="Signature RIFF as unsigned integer in hex format" var="signature"/>

<!-- A test against the condition (signature == RIFF) -->
<if test="signature == 0x46464952"> <!-- ANSI: RIFF -->

<!-- The next 4 bytes are read and shown as an unsigned integer. The internal variable dataSize gets the value of the field. -->
<field type="uint32" name="Size of the data in file" var="dataSize"/>

<!-- A new internal variable endOfFile is created and the expr field evaluates its value. -->
<setvar var="endOfFile" expr="offset + dataSize - 8"/>

<!-- The next 4 bytes is read and shown as an ANSI string. -->
<field type="char" size="4" name="File type"/>

<!-- A new section named DATA is created -->
<section name="DATA">
  <!-- A new internal variable chunksOffset is created, the expr filed evaluating its value. This variable gets the absolute value of template offset. -->
  <setvar var="chunksOffset" expr="start_position"/>

  <!-- A loop is created. Its condition is set in the test field (while the endOfFile variable is greater then the current position.) -->
  <repeat test="endOfFile > offset">
    <!-- 4 bytes are read and shown as an ANSI string. -->
    <field type="char" size="4" name="Signature"/>
    <!-- The current position is moved backwards by 4 bytes. -->
    <goto offset="-4"/>
    <!-- The same 4 bytes are read and shown as an unsigned integer. The internal variable signature gets this value. -->
    <field type="uint32" name="Signature as unsigned integer" var="signature"/>
  </repeat>

  <!-- A test against the condition (signature == LIST) -->
  <if test="signature == 1414744396"> <!-- ANSI: LIST -->

    <!-- The section is shown. Its name is LIST -->
    <section name="LIST">

    </section>

  </if>

</section>
<!-- The 4 bytes are read and shown as an unsigned hexadecimal integer. This field has the attributes offset and assigned-template. If the user double-clicks this field, the AVI File LIST pattern will be invoked and the current pattern position will be moved to the address specified in as-offset.-->

<field type="uint32" base="hex" name="Signature LIST as unsigned integer in hex format" as-offset="start_position + offset - 4" assigned-template="AVI File LIST"/>

<!-- The next 4 bytes are read and shown as an unsigned integer. The listSize variable gets its value. -->

<field type="uint32" name="Size of the data in the list" var="listSize"/>

<!-- The 4 bytes are read and shown as an ANSI string. -->
<field type="char" size="4" name="List type"/>

<!-- The current position is moved backward by 4 bytes. -->
<goto offset="-4"/>

<!-- The same 4 bytes are shown as an unsigned hexadecimal integer. The listType variable gets its value.--> 

<field type="uint32" base="hex" name="List type as unsigned integer in hex format" var="listType"/>

<!-- A test against condition (type == movi)--> 
<if test="listType == 0x69766f6d"> <!-- ANSI: movi -->
  <!-- The chunksOffset variable gets the value evaluated in the expr attribute. -->
  <setvar var="chunksOffset" expr="start_position + offset - 4"/>
</if>

<!-- The current position is moved to the address evaluated in the address attribute. -->
<goto address="offset + listSize - 4"/>

</if>

<!-- A test against condition (signature == JUNK)--> 
<if test="signature == 1263424842"> <!-- ANSI: JUNK -->
  <!-- The section is shown with the JUNK name. -->
  <section name="JUNK">
    <!-- The next 4 bytes are read and shown as an unsigned integer. The internal variable junkSize gets its value. -->
    <field type="uint32" name="Size of the data of the junk" var="junkSize"/>
    <!-- The current position is moved by junkSize bytes forward. -->
    <goto offset="junkSize"/>
  </section>
</if>
<!-- A test against condition (signature == idx1) -->
<if test="signature == 829973609"> <!-- ANSI: idx1 -->
<!-- The section is shown with the idx1 name. -->
<section name="idx1">
<!-- The next 4 bytes are read and shown as an unsigned integer. The internal variable idxSize gets its value. -->
   <field type="uint32" name="Size of the data of the idx1" var="idxSize"/>

<!-- The section is shown with the First AVIINDEXENTRY name. -->
<!-- The 4 bytes are read and shown as an ANSI string. -->
<!-- The next 4 bytes are read and shown as an unsigned hexadecimal integer. -->
<!-- The next 4 bytes are read and shown as an unsigned hexadecimal integer. The offset attribute is evaluated for this field as a sum of the chunksOffset variable and valued of this field. -->
   <field type="uint32" base="hex" name="Flags" as-offset="chunksOffset + this"/>
   <field type="uint32" name="Chunk size"/>
</section>
<!-- The next 4 bytes are read and shown as an unsigned integer. -->
<field type="uint32" name="Chunk offset" as-offset="chunksOffset + this"/>
</if>

<!-- A test against the condition. && is a logical AND (&&) -->
<if test="signature != 1414744396 && signature != 1263424842 && signature != 829973609">
   <!-- An empty section is shown. Its name is Unknown signature found -->
   <section name="Unknown signature found">
   </section>
<!-- The current position is moved to the address set in the endOfFile variable. -->
<goto address="endOfFile"/>
</if>
</if>
</section>
</template>
3.7 Pattern Example II

```xml
<?xml version="1.0" encoding="utf-8"?>
<!-- A pattern section. The pattern name is AVI File LIST. -->
<template name="AVI File LIST">
    <!-- A template signature section. Alignment is 1. -->
    <signature align="1">
        <!-- A 4-byte signature at offset 0x00. -->
        <field offset="0x00">4C 49 53 54</field> <!-- ANSI: LIST -->
    </signature>

    <!-- A data section. Its name is AVI File LIST. This is the main data section. It is not shown in the parsing tree as a section (its name is ignored). -->
    <section name="AVI File LIST">
        <!-- The first 4 bytes are read and shown as an ANSI string. -->
        <field type="char" size="4" name="Signature: LIST"/>
        <!-- The current position is moved to the beginning of the file (4 bytes backward). -->
        <goto offset="-4"/>
        <!-- The first 4 bytes in the file are read and shown as an unsigned integer. The internal variable signature gets the value of the field. -->
        <field type="uint32" name="Signature LIST as unsigned integer" var="signature"/>
        <!-- A test against the condition (signature == LIST) -->
        <if test="signature == 1414744396"> <!-- ANSI: LIST -->
            <!-- The next 4 bytes are read and shown as an unsigned integer. The internal variable listSize gets its value. -->
            <field type="uint32" name="Size of the data in the list" var="listSize"/>
            <setvar var="endOfList" expr="offset + listSize"/>
            <!-- A test against condition (listType == movi) -->
            <if test="listType == 0x69766f6d"> <!-- ANSI: movi -->
                <!-- This chunk is not to be parsed. The current position is moved to the end of the chunk. -->
                <goto address="endOfList"/>
            </if>
        </if>
        <setvar var="mediaType" expr="0"/>
        <repeat test="endOfList > offset - 8">
```

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<section name="CHUNK">
    <field type="char" size="4" name="Chunk ID"/>
    <goto offset="-4"/>
    <field type="uint32" name="Chunk ID as unsigned integer" var="chunkId"/>
    <if test="chunkId == 1414744396"> <!-- ANSI: LIST -->
        <goto offset="-4"/>
        <field type="uint32" base="hex" name="LIST chunk ID as unsigned integer in hex format" as-offset="start_position + offset - 4" assigned-template="AVI File LIST"/>
    </if>

    <field type="uint32" name="Size of the data in the chunk" var="chunkSize"/>
    <setvar var="endOfChunk" expr="offset + chunkSize"/>

    <!-- Rounding the value of the variable endOfChunk to a number divisible by 2. -->
    <if test="endOfChunk &amp; 1"/>
        <setvar var="endOfChunk" expr="endOfChunk &amp; 0xFFFFFFFFFE"/>
        <setvar var="endOfChunk" expr="endOfChunk + 2"/>
    </if>

    <if test="chunkId == 1751742049"> <!-- ANSI: avih -->
        <field type="uint32" name="Number of microseconds between frames"/>
        <field type="uint32" name="Approximate maximum data rate of the file"/>
        <field type="uint32" name="Alignment for data, in bytes"/>
            <field type="uint32" name="Bitwise combination of zero or more of the flags"/>
        <field type="uint32" name="Total number of frames of data in the file"/>
        <field type="uint32" name="Initial frame for interleaved files"/>
        <field type="uint32" name="Number of streams in the file"/>
        <field type="uint32" name="Suggested buffer size for reading the file"/>
        <field type="uint32" name="Width of the AVI file in pixels"/>
        <field type="uint32" name="Height of the AVI file in pixels"/>
        <field type="binary" size="16" name="Reserved"/>
    </if>

    <if test="chunkId == 1852994675"> <!-- ANSI: strn -->
        <field type="char" size="chunkSize" name="Stream name"/>
    </if>

    <if test="chunkId == 1752331379"> <!-- ANSI: strh -->
        <field type="char" size="4" name="Type"/>
    </if>
</section>
<field type="uint32" base="hex" name="Type as unsigned integer in hex format" var="type"/>

<setvar var="mediaType" expr="type"/>

<field type="char" size="4" name="Handler (codec)"/>

<field type="uint32" base="hex" name="Flags"/>

<field type="uint32" name="Number of the first block of the stream that is present in the file"/>

<field type="uint32" name="Scale"/>

<field type="uint32" name="Rate"/>

<field type="uint32" name="Start time of stream"/>

<field type="uint32" name="Size of stream in units as defined in Rate and Scale"/>

<field type="uint32" name="Size of buffer necessary to store blocks of that stream"/>

<field type="uint32" name="Quality"/>

<field type="uint32" name="Sample size (number of bytes of one stream atom)"/>

</if>

<if test="chunkId == 1718776947"><!-- ANSI: strf -->

<!-- ANSI: vids -->

<if test="mediaType == 0x73646976"> <!-- ANSI: vids -->

<section name="BITMAPINFOHEADER">

<field type="uint32" name="Number of bytes required by the structure"/>

<field type="int32" name="Width of the bitmap, in pixels"/>

<field type="int32" name="Height of the bitmap, in pixels"/>

<field type="uint16" name="Number of planes for the target device"/>

<field type="uint16" name="Number of bits-per-pixel"/>

<field type="uint32" name="Type of compression for a compressed bottom-up bitmap"/>

<field type="uint32" name="Size, in bytes, of the image"/>

<field type="int32" name="Horizontal resolution, in pixels-per-meter, of the target device for the bitmap"/>

<field type="int32" name="Vertical resolution, in pixels-per-meter, of the target device for the bitmap"/>

<field type="uint32" name="Number of color indexes in the color table that are actually used by the bitmap"/>

<field type="uint32" name="Number of color indexes that are required for displaying the bitmap"/>

</section>

</if>
<if test="mediaType == 0x73647561"> <!-- ANSI: auds -->
  <section name="WAVEFORMATEX">
    <field type="uint16" name="Waveform-audio format type"/>
    <field type="uint16" name="Number of channels in the waveform-audio data"/>
    <field type="uint32" name="Sample rate, in samples per second (hertz)"/>
    <field type="uint32" name="Required average data-transfer rate, in bytes per second, for the format tag"/>
    <field type="uint16" name="Block alignment, in bytes"/>
    <field type="uint16" name="Bits per sample for the Waveform-audio format type"/>
    <field type="uint16" name="Size, in bytes, of extra format information appended to the end of the WAVEFORMATEX structure"/>
  </section>
</if>

<goto address="endOfChunk"/>
</section>
</repeat>

</if>

<if test="signature != 1414744396">
  <section name="Invalid LIST signature found">
  </section>
</if>

</section>
</template>
IV Technical Information and Troubleshooting

This chapter covers various technical issues and troubleshooting.

- **IntelligentScan technology**
- **Data Recovery Issues**
- **Extended Information Recovery**
- **Data Formats and Multipliers**
- **Data Recovery on HFS/HFS+ file system**
- **Bad Sectors**
- **File Information (R-Studio Technician)**
- **Memory Usage**
- **Forensic Mode**
- **R-Studio Switches**
- **Properties Tab**

**R-Studio Features**

**Contact Information and Technical Support**

**Data Recovery Using R-Studio**

**Basic File Recovery**

**Advanced Data Recovery**

**Mass File Recovery**

**Volume Sets and RAIDs**

**Data Recovery over Network**

**Text/Hexadecimal Editor**

**R-Studio Emergency**

**R-Studio Agent Emergency**

### 4.1 IntelligentScan Technology

**R-Studio** uses a unique *IntelligentScan* technology when it tries to recover the data on the area being scanned.

While scanning the selected area, **R-Studio** reads data directly from the disk, analyzes them, and tries to determine a record to which the data belong. The following record types are possible:

- MBR/GPT records
- NTFS Boot Sector, Folder, and MFT records
- FAT/exFAT Boot Sector, folder, and file records
- ReFS Boot sector records and ReFS Meta blocks
- HFS/HFS+ Volume headers and BTree+ nodes
- APFS Super blocks, APFS Volume blocks, and APFS nodes
- Ext2/3/4FS SuperBlocks records
- UFS/FFS SuperBlock records
- Specific file signatures of Known File types for raw file carving
All these record types have different, but known, structure. Knowing valid values of record fields and relations between them for each record type, **R-Studio** determines a record type for the data. If such record type cannot be unambiguously determined, the data are assigned to the most probable record type. The same data can be assigned to several record types, with a certain probability for each assignment. A list of possible files is generated from these records.

**R-Studio** generates a record list for each record type. This list contains references to records assigned to a record type from the list with their assignment probability. The same data can be included into different record lists. Then **R-Studio** analyzes relations between elements in each list and between different lists, and generates a list of found partitions with their parameters, such as partition start point and probable size, file system type, cluster size, and existence probability.

Using the file list and partition list, **R-Studio** reconstructs file systems and files on the found partitions. One file can be attributed to several different partitions.

When the entire disk or its part has been scanned, **R-Studio** shows all found partitions. Then the parameters of the found partitions may be manually corrected, if additional information on them is available.

Using the *IntelligentScan* technology, **R-Studio** can recover files not only on new and existing partitions. It also can find and recover data on partitions that have been deleted or reformatted. If, for example, there was an NTFS partition, which later was reformatted as a FAT partition, **R-Studio** will show two partitions on the same place on the disk, one having the FAT file system, the other the NTFS. Then, found files can be recovered.

The *IntelligentScan* technology makes **R-Studio** a very powerful data recovery tool, but it is not omnipotent. As it uses probabilistic approach to data reconstruction, it cannot guarantee 100% correct results. Moreover, even if **R-Studio** has reconstructed data structure correctly, it is impossible to guarantee that all found files will be completely and correctly recovered, as new data may be already written over the old files. See the [Data Recovery Issues](#) topic for details.

### 4.2 Data Recovery Issues

**NEVER TRY TO SAVE RECOVERED FILES/FOLDERS TO THE SAME LOGICAL DISK WHERE THEY RESIDE!!!**

Or you may obtain unpredictable results and lose all of your data.

**R-Studio** writes directly to a hard drive only when writing recovered data and from its hex editor, if writing is enabled. In all other actions, **R-Studio** only reads data and analyzes them, and never modifies data on the hard drives being analyzed.

Most operating systems use lazy-write. So, there is a time lag between file actions and actual changes on data on a hard drive. **R-Studio** analyzes data on hard drives only. That is why it does not always detect recent changes in data structure.

Most operating systems constantly write their service information on hard drives. Such writing is especially intensive during start-up and shut-down procedures. When an operating system deletes a file/folder, it treats the space where it has resided as empty and may write something in this place. If this happened, the file/folder and its parameters may be detected correctly, but its data may be lost.

Folder names like `$$$Folder58448` on NTFS partitions mean that the folder has not been found on the drive but some references to it have been. For example, folders `My documents`, `Work`, `Photos` have been found and all they have one parent folder, whose description has not actually been found on the disk, so its name is unknown and therefore represented as `$$$Folder58448`. It may happen that the description of such folders was outside of the scan area, so try to enlarge the region or scan the entire hard drive. If that does not help, most likely that the description of the folder has been overwritten.
Folder names like $ROOT58448 on FAT partitions mean that some folders have been found, but they cannot be included into the folder structure for this FAT partition. Sometimes, such folders may contain other folder structures.

If you recover a file, and it appears that the file contains wrong data, try to do the following:

- **Scan:**
  - the logical disk, if the file has been just deleted.
  - the hard drive, if the data structure is damaged more seriously.

- **Search for the file** to be restored on all found partitions and try to recover it from all found partitions.
  - Check each recovered file to ensure that it contains correct data. As soon as you found the partition from which the file is recovered correctly, use this partitions to recover all other deleted files.

If there are several deleted files to be restored, you should use a file larger than 2KB to select the required partition.

**FAT file system:**

**Cross-Linked Folders**

Often **R-Studio** finds several FAT folder records that contain the same data. Such folders are called *cross-linked*. **R-Studio** marks such folders with an arrow mark: 📄 📄 ?Si65611.tmp

**R-Studio** attributes the content of cross-linked folders to one folder called a *target folder*. When recovering, **R-Studio** places the content to the target folder.

To view the list of cross-linked folders,

1. Control-click a cross-linked folder and select Cross Linked Folders on the shortcut menu

   A list of cross-linked folders will appear
   - You may go to any folder in this list by clicking it.

To find a target folder,

* Control-click a cross-linked folder and select Go Target on the shortcut menu, or
  - Select the cross-linked folder and select Goto Target on the File menu

   If Go Target is gray, this folder is already the target folder.

To set the target folder manually,

* Control-click a cross-linked folder and select Set As Default Target on the shortcut menu, or
  - Select the cross-linked folder and select Set As Default Target on the File menu.

   If Set As Default Target is gray, this folder is already the target folder.

**Questionable Folders**

Sometimes, **R-Studio** may find FAT records, which look like folders, but their content is invalid. For example, file names have invalid characters, date, time, and size, or other file attributes may look strange. Please note that **R-Studio** correctly recognizes localized names. **R-Studio** treats such records as folders, but does not analyze their content and structure. You can manually scan such folders, but results may be unpredictable. Usually, such scan reveals garbage.

**R-Studio** marks such folders with a question mark. 📄 📄 ?Si65611.tmp
To re-scan an object,

* Control-click a questionable folder on the R-Studio’s Folders panel and select Rescan on the shortcut menu, or
  Select the questionable folder and select Rescan on the File menu.

**NTFS, APFS, HFS, and ext fs file systems:**

**Symbolic links (symlinks)**

Symbolic links (of symlinks for short) are object that contains references to other files or folders directory in the form of absolute or relative paths and that affect pathname resolution. For example, if a symlink `C:\ProgramData\Documents` points to `D:\Recovered Files\Root\Users\Public\Documents`, entering it will result in entering `D:\Recovered Files\Root\Users\Public\Documents`.

They are present in almost all modern file systems. NTFS, HFS+, APFS, and EXT FS are probably the most popular examples.

R-Studio shows such symlinks and their targets in the following way:

![Symlinks example image]

Symlinks can be marked for recovery^
Only symlinks on the picture above are marked for recovery. They will be recovered as real files and folders.

Only targets (real folders) on the picture above are marked for recovery. They will be recovered as real files and folders.
Both targets (real folders) and symlinks on the picture above are marked for recovery. They will be recovered as real files and folders and symlinks.

The R-Studio Settings topic gives more details about symlink recovery.

**Files:**

**Hard links**

Hard links are file system entries that give file names to files. This term is usually used when files may have several names. R-Studio shows hard links using the following icons:

A hard link: [ ] DSC00001.JPG

The target file: [ ] DSC00001.JPG

You may find a target or hard link for a file. Control-click the file and select **Links** on the shortcut menu.

### 4.3 Extended Information Recovery

R-Studio supports recovery of compressed files, alternative data streams, encrypted files, file security and extended file attributes. If the R-Studio host OS and the file system of the disk you are going to save file to support any particular extended information, it will be saved with the file, too. Otherwise, the extended information will be saved as separate files with the same name as the restored file and extension showing the type of the extended information. Below is a quick reference for the host OS and file system of the target drive.

<table>
<thead>
<tr>
<th>Extended Information</th>
<th>Required target disk FS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encrypted files</td>
<td>NTFS</td>
</tr>
<tr>
<td>Alternative data streams</td>
<td>NTFS</td>
</tr>
<tr>
<td>File security</td>
<td>NTFS</td>
</tr>
<tr>
<td>Extended file attributes</td>
<td>NTFS or FAT</td>
</tr>
</tbody>
</table>

### 4.4 Data Formats and Multipliers

You may enter data in all numerical fields either in sectors or in bytes. If there is no letters are after the number, R-Studio assumes the numbers are in bytes.
Decimal numbers are entered as it is: 2372354
Hexadecimal numbers are entered as 0x23Fa67 or 23Fa67 hex.
The following case-insensitive notation is possible:

<table>
<thead>
<tr>
<th>Letter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>b</td>
<td>1 byte</td>
</tr>
<tr>
<td>kb</td>
<td>1 kb = 2^10=1024 bytes</td>
</tr>
<tr>
<td>mb</td>
<td>1 mb = 2^20=104857 bytes</td>
</tr>
<tr>
<td>gb</td>
<td>1 gb = 2^30=1073741824 bytes</td>
</tr>
<tr>
<td>tb</td>
<td>1 tb = 2^40=1099511627776 bytes</td>
</tr>
<tr>
<td>eb</td>
<td>1 eb = 2^50=1125899906842624 bytes</td>
</tr>
<tr>
<td>hex</td>
<td>A hexadecimal number</td>
</tr>
<tr>
<td>sec (sector)</td>
<td>A number is in sectors</td>
</tr>
</tbody>
</table>

You may also select the multipliers in the drop-down boxes.

Type an offset to which you want to go. You may select between bytes and sectors. See the Data Formats and Multipliers topic for more details on data formats.

If a file is opened in Text/hexadecimal Editor, you may select data representation for that file.

When the multiplier has been changed, the data value will be changed according to the specific contextual commands for that field:
Suppose, the initial value is 1 GB, and the sector size of the object is 512 byte. The results will be the following:

**Command: No recalculate**
- Change from GB to MB: 1
- Change from GB to Sectors: 1

**Command: Always recalculate**
- Change from GB to MB: 1024
- Change from GB to Sectors: 2097152

**Command: Units type recalculate**
- Change from GB to MB: 1
- Change from GB to Sectors: 2097152

### 4.5 Data Recovery on HFS/HFS+ File System

When deleting a file, macOS deletes system BTree+ records describing the file. Therefore, it is hard to recover such file directly. Those records may remain in:

1. The swap file (if the deleted file has been deleted recently).
2. In the journal (if the HFS+ journaling is on, and the deleted file has been CREATED recently)

Actually, if a file has been deleted, chances that the records would be found are small. To greatly increase the chances to recover deleted files successfully, you may actively use scanning with enabled Known Files Types.

**Note:** All above is correct for intentionally deleted files. In case of a corrupted file system, HFS/HFS+ can be recovered quite successfully.
When saving files with HFS+-specific attributes (resource fork, finder info, etc.) to a non-HFS+ disk, R-Studio saves them in the so-called AppleDouble format. When they are copied to an HFS+ disk under macOS, those attributes will be automatically restored.

# 4.6 Bad Sectors

Quite often, drives from which the data are to be recovered have bad sectors, or those sectors that are very hard, even impossible, to read, mostly due to hardware problems. R-Studio tries to read such sectors several times. The number of tries is specified either on the Settings/Bad Sectors dialog box, or on the Properties tab, the Drive Control section, for each drive separately.

When R-Studio encounters such bad sectors while performing various tasks and they appear unreadable, it treats them as follows:

**Object images:**

R-Studio fills the space in the image file where the bad sectors should be with the pattern specified in the Pattern to fill bad blocks field on the Settings/Bad Sectors dialog box. Please note that R-Studio writes the pattern on the image, not on the source drive.

**Files**

If Skip files with bad sectors on the Recovery dialog box is cleared, R-Studio fills bad sectors in the recovered file with the pattern specified on the Settings/Bad Sectors dialog box. Information about such files will appear in the Log.

If Skip files with bad sectors on the Recovery dialog box is selected, R-Studio skips files with bad sectors and displays their list on the Files with bad sectors dialog box when the recovery has been completed. You may select files to immediately recover them or to mark for later recovery. You may also save this list to a text file.

**Files with bad sectors dialog box**

<table>
<thead>
<tr>
<th><strong>Files with bad sectors Buttons</strong></th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select All</td>
<td>Click this button to select all files in the list.</td>
</tr>
<tr>
<td>Clear All</td>
<td>Click this button to unselect all selected files.</td>
</tr>
<tr>
<td>Mark</td>
<td>Click this button to mark all selected files in the list.</td>
</tr>
<tr>
<td>Save to File</td>
<td>Click this button to save the list of files with bad sectors to a text file.</td>
</tr>
<tr>
<td>Recover</td>
<td>Click this button to immediately recover selected files. The bad sectors in the recovered files will be filled with the pattern specified in the Pattern to fill bad blocks field on the Settings/Bad Sectors dialog box.</td>
</tr>
</tbody>
</table>

**Objects edited in the Text/hexadecimal editor/viewer**

Bad sectors in the objects viewed/edited in the Text/hexadecimal editor are shown as filled with the pattern specified in the Pattern to fill bad blocks field on the Settings/Bad Sectors dialog box.
4.7 File Information (R-Studio Technician)

R-Studio Technician shows much more information about files than R-Studio does.

**Info about a file with good chances for recovery**

**Info for a file with below average recovery chances**

**More information**

Click this button to pin the file information. This panel will show the information about the "pinned" file regardless of the current selected file.

Click this button to copy all this information.

Click this button to select the file you want to go to.

Click this button to close all the information.

**Overlapping files**

Shows the list or files that may occupy the same disk sectors. You may click the file id to see information about this file.
Regions

Shows the list of sectors occupied by the file and corresponding overlapping files. You may click a sector number open the sector in the built-in Hexadecimal editor.

Examples of file information on other file systems

File info on an NTFS file system

Info for a file on an Ext file system

4.8 Memory Usage

You may see how much memory R-Studio uses while performing a data recovery task. This is especially useful when scanning large disks on a computer with limited resources. You may specify memory control options on the Memory usage tab in the R-Studio Settings.

To view memory usage,

1. Select Memory usage on the Tools menu

R-Studio will show the total memory in your computer and how much memory it uses

Memory usage dialog box

- **Memory usage**
  - **Process Memory**
    - Shows how much memory R-Studio uses. Limit shows how much memory your system can virtually allocate to R-Studio. Actual memory allocation depends also on the RAM and swap file sizes.
Technical Information and Troubleshooting

<table>
<thead>
<tr>
<th>System Memory</th>
<th>Shows how much RAM is in your system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swap</td>
<td>Shows how much virtual memory is in your system</td>
</tr>
</tbody>
</table>

### 4.9 Forensic Mode

**Note**: This feature is available for the Technician version of **R-Studio** only! When this mode is enabled, **R-Studio** will generate a forensic data collection audit log that can be presented at court hearings. This log includes information about a hardware configuration on which the forensic data collection takes place and MD5 for recovered files.

**Note**: A new log will be generated each time the hardware configuration is changed (a hard drive is connected/disconnected, an external USB device is connected/disconnected, etc)

**To enable this feature,**

* Select **Enable Forensic Mode** on the **Main** tab of the **Settings** dialog box.

Each time you start file recovery, the **Forensic Log Settings** dialog box will appear.

Enter the required information and click the **OK** button to go to the **Recovery** dialog box.

While file recovery, **R-Studio** will create forensic data collection audit log in the specified folder. Below is an example of such log.

```
***********************************************************************
Forensic Data Collection Audit Log
***********************************************************************

R-STUDIO network edition Build 1004/Mar 10 2010

Case Name: Steven  v  Christofor
Case Number: 28-5-0205-CR-85763
```
Operator / Investigator Name: J.F. Lewson

************************** Drives Information **************************

- Drive Number 0 ---------------------------------
  * Drive Type [256 bytes]: Computer, Local Computer
  * Name [30 bytes]: Local Computer
  * OS [32 bytes]: Mac OS X 10.4.5
  * System [10 bytes]: i386

- Drive Number 1 ---------------------------------
  * Drive Type [256 bytes]: Physical Drive, Disk
  * Name [34 bytes]: ST3120811AS3.AAE
  * OS Object [22 bytes]: /dev/disk0
  * Size [8 bytes]: 111 Gb (234441648 sec)
  * Sector Size [4 bytes]: 512 b
  # I/O Tries [4 bytes]: Default
  + Drive Control [4 bytes]:
    # Maximum Transfer [4 bytes]: 32768
    # I/O Unit [4 bytes]: 512
    # Buffer Alignment [4 bytes]: 4096
  + Device Identification [4 bytes]:
    * Product [64 bytes]: ST3120811AS
    * Firmware [16 bytes]: 3.AAE
    * Serial Number [32 bytes]: 6PT0J1FH
  * Bus Type [4 bytes]: SerialATA
  + IDE Properties [4 bytes]:
    * Buffer [10 bytes]: 8 MB
    * ECC Bytes [2 bytes]: 4
    * PIO Modes [16 bytes]: 1, 2, 3, 4
    * DMA Modes [12 bytes]: 0, 1, 2
    * UltraDMA Modes [28 bytes]: 0, 1, 2, 3, 4, 5, 6
    * Current Mode [22 bytes]: UltraDMA 5

- Drive Number 2 ---------------------------------
  * Drive Type [256 bytes]: Partition, Primary
  * Name [22 bytes]: Partition1
  * Size [8 bytes]: 29996 Mb (61432497 sec)
  * Partition Offset [8 bytes]: 32256 b (63 sec)
  * Partition Size [8 bytes]: 29996 Mb (61432497 sec)
  * Partition Type [256 bytes]: NTFS/HPFS
  + NTFS Information [4 bytes]:
    * Cluster Size [4 bytes]: 4096 b (8 sec)
    * MFT Record Size [4 bytes]: 1024 b
    * MFT Position [8 bytes]: 3072 Mb (6291456 sec)
    * MFT Mirror Position [8 bytes]: 14998 Mb (30716248 sec)
    * Index Block Size [4 bytes]: 4096 b
    * Sector Size [4 bytes]: 512 b
    * Volume Size [8 bytes]: 29996 Mb (61432496 sec)

- Drive Number 3 ---------------------------------
  * Drive Type [256 bytes]: Partition, Active
  * Name [22 bytes]: Partition2
* Size [8 bytes]: 29996 Mb (61432560 sec)
* Partition Offset [8 bytes]: 29996 Mb (61432560 sec)
* Partition Size [8 bytes]: 29996 Mb (61432560 sec)
* Partition Type [256 bytes]: Mac OS X HFS+
  + HFS/HFS+ Information [4 bytes]:
    * HFS Type [62 bytes]: HFS+, Journaled, Not unmounted
    * Block Size [4 bytes]: 4096 b (8 sec)
    * HFS Version [4 bytes]: 4
    * Create Time [8 bytes]: 1.5.2007 19:16:12
    * Last Write Time [8 bytes]: 10.3.2010 17:10:55
    * Last Check Time [8 bytes]: 2.5.2007 2:16:12
    * Volume Size [8 bytes]: 29996 Mb (61432560 sec)

- Drive Number 4 ---------------------------------
* Drive Type [256 bytes]: Partition, Primary
* Name [22 bytes]: Partition3
* Size [8 bytes]: 24003 Mb (49158900 sec)
* Partition Offset [8 bytes]: 24003 Mb (49158900 sec)
* Partition Size [8 bytes]: 24003 Mb (49158900 sec)
* Partition Type [256 bytes]: Ext2FS/XIAFS
  + Ext2/Ext3/Ext4 Information [4 bytes]:
    # FS Character Set [4 bytes]: OEM
    * Block Size [4 bytes]: 4096 b (8 sec)
    * First SuperBlock Offset [4 bytes]: 1024 b (2 sec)
    * Blocks Per Volume [4 bytes]: 6144862
    * INodes Per Volume [4 bytes]: 3074176
    * Creator OS [4 bytes]: Linux
    * Major Version [4 bytes]: 1
    * Minor Version [2 bytes]: 0
    * Last Mount Time [8 bytes]: 2.3.2010 15:38:42
    * Last Write Time [8 bytes]: 2.3.2010 16:54:45
    * Last Check Time [8 bytes]: 22.1.2010 15:32:55
    * Volume Size [8 bytes]: 24003 Mb (49158896 sec)

- Drive Number 5 ---------------------------------
* Drive Type [256 bytes]: Partition, Logical
* Name [22 bytes]: Partition4
* Size [8 bytes]: 1953 Mb (4000122 sec)
* Partition Offset [8 bytes]: 1953 Mb (4000122 sec)
* Partition Size [8 bytes]: 1953 Mb (4000122 sec)
* Partition Type [256 bytes]: Linux (swap)

- Drive Number 6 ---------------------------------
* Drive Type [256 bytes]: Partition, Logical
* Name [22 bytes]: Partition5
* Size [8 bytes]: 28521 Mb (58412277 sec)
* Partition Offset [8 bytes]: 28521 Mb (58412277 sec)
* Partition Size [8 bytes]: 28521 Mb (58412277 sec)
* Partition Type [256 bytes]: FAT32
  + FAT Information [4 bytes]:
    * FAT Bits (12,16,32) [4 bytes]: 32
    * Cluster Size [4 bytes]: 16384 b (32 sec)
    * First Cluster Offset [8 bytes]: 14240 Kb (28480 sec)
* Root Directory Cluster [4 bytes]: 2
* First FAT Offset [8 bytes]: 18432 b (36 sec)
* Size of One FAT Table [8 bytes]: 7127 Kb (14254 sec)
* Number of FAT Copies [4 bytes]: 2
  # Active FAT copy [4 bytes]: Auto
* Sector Size [4 bytes]: 512 b
* Major Version [1 bytes]: 0
* Minor Version [1 bytes]: 0
* Volume Size [8 bytes]: 28521 Mb (58412277 sec)

****************************************************************************************************
-------------------------------------------- Session 2 ---------------------------------------------
START Date / Time of Collection: 2010-03-10 20:38:40

<table>
<thead>
<tr>
<th>Source drive:Sector</th>
<th>Modification Date</th>
<th>MD5</th>
<th>File Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:</td>
<td>6333056</td>
<td>2008-02-15 01:07:42</td>
<td>Video</td>
</tr>
<tr>
<td>6:</td>
<td>6333120</td>
<td>2008-01-19 05:47:48</td>
<td>1778568d4a8f7e372e159494a95ed542 Video/</td>
</tr>
<tr>
<td>6:</td>
<td>19130048</td>
<td>2009-04-30 03:47:24</td>
<td>710481dff181558bfc9b1bb222d47c56 Video/</td>
</tr>
<tr>
<td>6:</td>
<td>23097376</td>
<td>2009-12-09 22:15:42</td>
<td>Recovered_Files</td>
</tr>
<tr>
<td>6:</td>
<td>25473216</td>
<td>2009-12-25 21:07:28</td>
<td>Recovered_Files</td>
</tr>
<tr>
<td>6:</td>
<td>4491200</td>
<td>2010-02-03 00:11:08</td>
<td>Recovered_Files</td>
</tr>
<tr>
<td>6:</td>
<td>37777280</td>
<td>2010-02-03 23:45:04</td>
<td>Recovered_Files</td>
</tr>
<tr>
<td>6:</td>
<td>39615936</td>
<td>2010-02-04 00:17:24</td>
<td>Recovered_Files</td>
</tr>
<tr>
<td>6:</td>
<td>4931616</td>
<td>2010-02-19 20:35:48</td>
<td>Recovered_Files</td>
</tr>
<tr>
<td>6:</td>
<td>4950240</td>
<td>2010-02-19 20:38:34</td>
<td>Recovered_Files</td>
</tr>
<tr>
<td>6:</td>
<td>4950304</td>
<td>2010-02-19 20:39:24</td>
<td>Recovered_Files</td>
</tr>
<tr>
<td>6:</td>
<td>4950368</td>
<td>2010-02-19 20:41:00</td>
<td>Recovered_Files</td>
</tr>
<tr>
<td>6:</td>
<td>4950432</td>
<td>2010-02-19 20:42:54</td>
<td>Recovered_Files</td>
</tr>
<tr>
<td>6:</td>
<td>4975136</td>
<td>2010-02-20 19:18:54</td>
<td>Recovered_Files</td>
</tr>
<tr>
<td>6:</td>
<td>4975296</td>
<td>2010-02-20 19:45:24</td>
<td>Recovered_Files</td>
</tr>
</tbody>
</table>

END Date / Time of Collection: 2010-03-10 20:39:50

4.10 R-Studio Command Line Command and Switches

You may start R-Studio from the terminal using the following command:

open a R-Studio [--args -<switch>].

If there are problems in starting R-Studio and while working with it, you may use switches to avoid them.

The following switches are available:

<table>
<thead>
<tr>
<th>Switch</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-all_drives</td>
<td>Forces R-Studio to show all logical disks in the system. Normally R-Studio shows only local disks in the system. Some storage devices may pretend that they are not local disks.</td>
</tr>
<tr>
<td>-debug</td>
<td>Includes additional debug information. When this switch is used, an additional command Create FS Snapshot on the context menu appears for an object with a file system. An FS Snapshot contains system data for the file system only (file descriptions without file contents). If a problem appears, this snapshot can be sent to R-Studio technical support to identify the problem. This switch greatly slows R-Studio. You may also turn this mode on by selecting Debug Mode on the Settings dialog box.</td>
</tr>
<tr>
<td>Switch</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>-flush</td>
<td>Flushes the log file after each write to log operations. This switch is helpful when R-Studio locks and its log file remains in memory cache unwritten to a disk. This switch greatly slows R-Studio.</td>
</tr>
<tr>
<td>-log &lt;filename&gt;</td>
<td>Started with this switch, R-Studio writes its log into the specified file. If R-Studio locks and its log file remains in memory cache unwritten to a disk, use the -flush switch.</td>
</tr>
<tr>
<td>-mem &lt;size in MB&gt;</td>
<td>Sets memory usage limit in MB for R-Studio to reconstruct the file tree. When it exceeds the limit, a Too many files... message appears. You may temporally stop file listing and browse through found files. Then you can resume file listing. You also may skip this file section and continue file listing. Example: -mem 400 - sets the limit to 400 MB.</td>
</tr>
<tr>
<td>-no_ids_ext</td>
<td>Turns off the inquiry about extended information on HDDs in Wind9x/ME. This switch may be helpful if R-Studio returns information about HDDs incorrectly (detects HDD geometry incorrectly).</td>
</tr>
<tr>
<td>-no_int13</td>
<td>Turns off the disc access through Int13 in Wind9x/ME. This switch may be helpful if the system operates incorrectly (detects HDD geometry incorrectly or lock the system).</td>
</tr>
<tr>
<td>-no_ios</td>
<td>Turns off the Wind9x/ME protected-mode I/O system. This switch may be helpful if this system operates incorrectly (detects HDD geometry incorrectly or lock the system).</td>
</tr>
<tr>
<td>-reset</td>
<td>R-Studio resets an HDD controller each time it reads a bad sector. This switch may be helpful if the controller locks after it attempts to read a bad sector, or returns incorrect data.</td>
</tr>
<tr>
<td>-safe</td>
<td>Disables automatic partition search on a hard drive, file system recognition on partitions, and other potentially problematic operations.</td>
</tr>
</tbody>
</table>

If an unrecognized problem appears, start R-Studio with the -debug and -log <filename> switches, and send the log and screenshot of the R-Studio main panel to the R-Studio technical support: R-Studio Technical Support Team is available 24 hours a day, seven days a week, and has an average response time less than 4 hours.

### 4.11 Properties Tab

**Object size units**

You may select the units in which the information on object sizes will be displayed. Some parameters can be edited when the Debug mode is turned on on the Main dialog box of the R-Studio settings.

**To select the units**

1. Select Properties on the View menu
2. Select the units in which you want to see object sizes.
   - You may select
     - Show as Bytes
     - Show as Sectors
     - Show as Bytes and Sectors

### 1. Basic information

This section shows basic information for a disk object.
Drive Type | Device/disk type and subtype. Current **R-Studio** version supports the following types: Disk, WORM, CDROM, Optical, Changer, Floppy, RAM Disk, LDM Partition, LDM Component, LDM Volume and subtypes: Device, OS File, Physical Drive, Mount Point, Partition, Volume Set, Mirror, Stripe Set, RAID5
Name | Device/disk name
Size | Device/disk size
Bus Type | Device/disk bus type. Can be: IDE/ATA, IDE/ATAPI, SCSI, Floppy, USB, 1394, SSA, FibreChannel, RAID, SMART, A/B/S

2. Information on hard drives and logical disks

This section shows available information on hard drives and logical disks. These properties depend on the drive/disk type and appear only when applicable. Under Windows NT/2000/XP/Vista/2008/7/8/8.1/10, an IDE drive/disk may be represented as a SCSI device, that is why the **SCSI Address** section appears under these OSes for those drives/disks.

OS object | Appears for image files. An object name used by OS to access the device/disk.
R-Studio driver | Driver names (both internal and OS) used to access this drive/disk.
Sector Size | Drive/disk sector size
Physical Drive Geometry | This section shows physical geometry for a hard drive. For a logical disk it shows the physical geometry for a hard drive where the logical disk resides
Cylinders
Tracks Per Cylinder
Sectors Per Track
Sector Size
Device Identification | This section shows vendor information for the drive/disk
Vendor
Product
Firmware
Bus
SCSI Address | This section shows SCSI information for the drive/disk
Port Number
Path ID
Target ID
Lun

Windows 9x/ME adds the following properties:
### 3. Properties controlling access to hard drives and logical disks

This section shows properties that control access (read and write) to hard drives and logical disks. They are set to their optimal values and should be altered only if access problems appear.

#### More information...

<table>
<thead>
<tr>
<th><strong>Drive Control</strong></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Maximum transfer</strong></td>
<td>Maximum data size that can be read or written during a single access to the drive. If there are problems with drive access, decrease the value of this property.</td>
</tr>
<tr>
<td><strong>I/O Unit</strong></td>
<td>Data size read or written during a single access to the drive is a multiple value of this property. If there are problems with drive access, decrease the value of this property.</td>
</tr>
<tr>
<td><strong>Buffer Alignment</strong></td>
<td>Drive data transfer buffer is positioned at an address multiple value of this property. If there are problems with drive access, increase the value of this property.</td>
</tr>
</tbody>
</table>

These three properties are set by OS drivers. If the drivers set incorrect values, problems may appear during data transfer operations. You can alter them until data transfer becomes stable.

<table>
<thead>
<tr>
<th><strong>I/O Tries</strong></th>
<th>Description</th>
</tr>
</thead>
</table>
| Number of read/write tries during access to the drive. If there are bad sectors on the drive, increase the value of this property. This may help to successfully read those sectors. Sometimes, if the I/O Tries parameter is set too large and there are some unreadable sectors on the hard drive, the hard drive-controller pair may refuse to perform any successive read/write operations with the entire hard drive when it fails to read/write such sectors. In this case, set this parameter to zero. The default value is specified on the **Settings (Bad Sectors)** panel.

**R-Studio** treats bad sectors in the following way:

- If Default read attempts is set to 0, the entire part with bad sectors will be filled with the specified pattern.
- If Default read attempts is set to a non-zero value, **R-Studio** reads again that part sector by sector, repeating the attempts the specified number of times. If **R-Studio** still cannot read a bad sector, it fills the sectors with the specified pattern. In this case only the bad sectors will be filled with the pattern, but that extremely slows the disk read process.

For example, if you set Default read attempts to 1, a bad sector will be read 2 times.

---

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4. Partition properties

A partition is a continuous area on a hard drive, characterized by its offset and size. There are partitions on basic disks, dynamic disks, and recognized volumes and partitions. R-Studio treats regions like partitions.

- **More information...**

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partition Offset</td>
<td>Initial offset for the partition.</td>
</tr>
<tr>
<td>Partition Size</td>
<td>Size of the partition.</td>
</tr>
<tr>
<td>Partition Type</td>
<td>File system type for the partition. If the record in the drive partition table is incorrect, this property may differ from the actual file system type for this partition. Still, R-Studio will process this partition correctly, as it does not use this property.</td>
</tr>
<tr>
<td>Partition number</td>
<td>Appears under Windows NT/2000/XP/Vista/2008/7/8/8.1/10 only. Shows the number of the partition on the physical drive. For regions and recognized partitions, Partition Offset and Partition Type properties can be manually corrected.</td>
</tr>
</tbody>
</table>

5. Compound volume properties

A compound volume is a union of several partitions or other disk objects. Each union type has its own rules, unique for each compound volume type. Among compound volumes are: Volume Sets (RAIDs Level 0), Mirrors (RAIDs Level 1), RAIDs5 (RAIDs Level 5), both physical and created by the user (Virtual Volume Sets, Virtual Stripe Sets, Virtual Mirrors, Virtual RAID5).

- **More information...**

Main properties of compound volumes are parents (disk objects from which a compound volume is created) and their order. These properties may be viewed in the Parents tab. For user-created compound volumes these properties may be altered.

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raid Block Size</td>
<td>Data block size for compound volumes of RAID (Level 0-5) types</td>
</tr>
</tbody>
</table>

6. LDM disks and volumes (Dynamic Disks)

LDM disks and volumes are volumes controlled by Logical Disk Manager (LDM). They are represented on a hard drive as a LDM database rather than partition tables. Under Windows 2000/XP/Vista/2008/7/8/8.1/10, LDM disks are also called Dynamic Disks.

- **More information...**

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offset of Logical Disk</td>
<td>Initial offset of a logical disk on a hard drive. For disks, initially formatted by LDM, this value is often 31.5KB, for converted disks, it may be larger.</td>
</tr>
<tr>
<td>Supposed Parents Count</td>
<td>Supposed number of parent partitions for compound LDM volumes. If the LDM database is not damaged, the value of this property must be equal to the number of parent objects in the Parents tab for the disk object.</td>
</tr>
<tr>
<td>LDM Host GUID</td>
<td>Global Unique Identifier of a computer system where this LDM disk group has been created.</td>
</tr>
<tr>
<td>LDM DiskGroup GUID</td>
<td>Global Unique Identifier of the LDM disk group.</td>
</tr>
<tr>
<td>LDM Disk GUID</td>
<td>Global Unique Identifier of the hard drive.</td>
</tr>
<tr>
<td>LDM Volume GUID</td>
<td>Global Unique Identifier of the volume.</td>
</tr>
<tr>
<td>LDM Disk ID</td>
<td>Local hard drive Identifier, unique within this LDM disk group.</td>
</tr>
</tbody>
</table>
LDM Partition ID | Local partition Identifier, unique within this LDM disk group.
LDM Component ID | Local component Identifier, unique within this LDM disk group.
LDM Volume ID | Local volume Identifier, unique within this LDM disk group.
LDM Disk AltName | Additional Alternative Name given by LDM to the hard drive.
LDM Disk DriveHint | Last name of the volume, under which is has been mounted in the system. May be either a letter (C:, D:, etc.), or a mount point under Windows 2000/XP/2003/Vista/? 2008/?7/?8/8.1/?10.

7. File System Volume properties
A File System (FS) volume is a disk object where a certain, supported by R-Studio, file system is present. There are two FS volume types: FS volume on a regular disk object and a recognized volume, found by a scan process. FS volume properties depend on volume’s file system and type.

7.1. NTFS Volume properties
These properties are present for all NTFS volumes and represent their main properties. For recognized volumes, these values can be altered.

<table>
<thead>
<tr>
<th>NTFS Information</th>
<th>Regular volumes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recognized NTFS</td>
<td>Recognized volumes</td>
</tr>
<tr>
<td>Cluster Size</td>
<td>Cluster size for the NTFS volume.</td>
</tr>
<tr>
<td>MFT record size</td>
<td>Size of one MFT record describing one file on the NTFS volume. This is an important property of any NTFS volume. Its common value is 1KB. If this property has incorrect value, many files may be incorrectly recovered.</td>
</tr>
<tr>
<td>Sector Size</td>
<td>Sector size for the physical drive. This property is read from the boot sector of the NTFS volume and does not affect R-Studio operation.</td>
</tr>
<tr>
<td>Index Block Size</td>
<td>Index block size for the NTFS volume. This property determines binary trees used to store NTFS folder structure. It does not affect R-Studio operation.</td>
</tr>
<tr>
<td>MFT position</td>
<td>MFT offset from the start of the NTFS volume.</td>
</tr>
<tr>
<td>MFT Mirror Position</td>
<td>Second MFT copy offset from the start of the NTFS volume.</td>
</tr>
<tr>
<td>Volume size</td>
<td>Size of the NTFS volume. This property does not affect R-Studio operation.</td>
</tr>
</tbody>
</table>

7.2. FAT Volume properties
These properties are present for all FAT volumes and represent their main properties. For recognized volumes, these values can be altered.

<table>
<thead>
<tr>
<th>FAT Information</th>
<th>Regular volumes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recognized FAT</td>
<td>Recognized volumes</td>
</tr>
<tr>
<td>FAT Bits (12, 16, 32)</td>
<td>FAT type. 12 for the FAT12, 16 for the FAT16, 32 for the FAT32.</td>
</tr>
<tr>
<td>Cluster Size</td>
<td>Cluster size for the FAT volume.</td>
</tr>
<tr>
<td>First Cluster Offset</td>
<td>Offset of the first cluster from the start of the FAT volume.</td>
</tr>
</tbody>
</table>
### Boot Directory Cluster

*(For FAT32 only.)* Cluster number where the root directory starts on the FAT volume where the logical disk resides.

### Root Directory Offset

*(For FAT12 and 16 only.)* Root directory offset from the start of the FAT volume.

### Root Directory Length

*(For FAT12 and 16 only.)* Root directory length for the FAT volume.

### First FAT Offset

Offset for the first FAT table on the volume. Together with the *Size of One Fat Table* property, is a most important property for a FAT volume. If this property is incorrect, many files (especially fragmented ones) may be incorrectly recovered.

### Size of One Fat Table

Size of one FAT table on the volume.

### Sector Size

Sector size of the hard drive. This property is read from the boot sector of the FAT volume and does not affect R-Studio operation.

### Number of FAT Copies

Number of FAT copies on the FAT volume.

### Active FAT copy

Active FAT table number for the FAT volume. Can be set to Disabled, Auto, 1, or 2. If it is Disabled, R-Studio processes the volume as there is no FAT table present. This may be useful if the volume has been reformatted and thus a new FAT table is created and the old one is deleted. In this case, it is reasonable to recover files from the previous volume without processing the new and irrelevant FAT table. All files will be recovered as continuous byte chains beginning from their start cluster. Unfragmented files will be recovered successfully. If it is 1 or 2, R-Studio uses the first or second FAT table copy, respectively. If it is Auto, R-Studio uses both FAT table copies and decides, which FAT table copy should be used for a particular FAT table sector. This may be useful when both FAT tables are partially damaged.

### Major version

FAT version.

### Minor version

FAT minor version.

### Volume size

Size of the volume.

### Ext2FS Volume properties

These properties are present for all Ext2FS volumes and represent their main properties. For recognized volumes, these values can be altered.

<table>
<thead>
<tr>
<th>Ext2FS Information</th>
<th>Recognized volumes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Recognized Ext2FS</strong></td>
<td>Recognized volumes</td>
</tr>
<tr>
<td><strong>Block Size</strong></td>
<td>Block size of Ext2FS file system. A block in the Ext2FS file system is similar to a cluster in the FAT file system.</td>
</tr>
<tr>
<td><strong>First SuperBlock Offset</strong></td>
<td>Offset of the first SuperBlock from the start of the Ext2FS volume.</td>
</tr>
<tr>
<td><strong>Blocks Per Volume</strong></td>
<td>Number of blocks in the Ext2FS volume.</td>
</tr>
<tr>
<td><strong>INodes Per Volume</strong></td>
<td>Number of inodes on the Ext2FS volume. An inode is a record describing file's size, attributes, position on an Ext2FS volume - all information about a file, except its name,</td>
</tr>
</tbody>
</table>

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which is stored separately. Therefore, the INodes Per Volume parameter is equal to the maximum number of files on an Ext2FS volume.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creator OS</td>
<td>The OS that created this Ext2FS volume. May be Linux, Hurd, Masix, FreeBSD, Lites.</td>
</tr>
<tr>
<td>Major version</td>
<td>Ext2FS version. Usually 1.</td>
</tr>
<tr>
<td>Minor version</td>
<td>Ext2FS minor version. Usually 0.</td>
</tr>
<tr>
<td>Last Mount Time</td>
<td>Last mount time for this Ext2FS volume.</td>
</tr>
<tr>
<td>Last Write Time</td>
<td>Last write time for this Ext2FS volume.</td>
</tr>
<tr>
<td>Last Check Time</td>
<td>Last check time for this Ext2FS volume.</td>
</tr>
<tr>
<td>Volume size</td>
<td>Size of the volume.</td>
</tr>
</tbody>
</table>

**7.4. Recognized Volume properties**

These properties are present for all recognized volumes, regardless of their file system type. They estimate how reliable those volumes are recognized. This is useful for fast search for, and selection of, optimally recognized volume to recover.

- **More information...**

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parsed File Entries</td>
<td>Number of files proving that this recognized volume existed. May have any non-negative values. The main property characterizing the reliability of volume recognition. The larger it, the higher probability that this recognized volume has file system properties that have been correctly found.</td>
</tr>
<tr>
<td>Parsed Boot Records</td>
<td>Number of boot records proving that this recognized volume existed. May be 0 or 1. This is the second important property characterizing the reliability of volume recognition.</td>
</tr>
<tr>
<td>Estimated Size</td>
<td>Estimated size of the recognized FS partition/volume. This property shows the most probable size of the recognized FS partition/volume. Alternatively, Size and Partition Size are set to the highest possible values in order to recover the maximum number of files.</td>
</tr>
</tbody>
</table>
V Working with the Third-Party Hardware

The Technician version of R-Studio can work together with third-party hardware developed for in-depth data recovery. Currently, the following devices are supported:

- **DeepSpar Disk Imager™**

5.1 DeepSpar Disk Imager™

Currently only the Windows version of R-Studio can work with DeepSpar Disk Imager™ directly. R-Studio versions for Mac and Linux can load and process its images.

DeepSpar Disk Imager™ (DDI) is an HDD imaging device specifically built for data recovery from hard drives with hardware issues. It greatly increases imaging speed, accuracy, and integrity of data retrieved from such drives.

The main features that DDI provides when working with hard drives are the following:

- Direct low-level access to a hard drive bypassing the computers BIOS.
- Disabling specific drive read/write heads.
- Disable SMART subsystem, Bad Sector Reallocation, and Read Look-Ahead
- Read sector timeout controlled by Software/Hardware/PHY drive reset commands
- Bit level analysis of corrupted data to filter out the read-write channel noise
- Fully customizable multi-pass imaging

And many more others an advanced disk imager must have. You may learn more about DDI on its vendor site: DeepSpar Disk Imager™.

**Viewing the drive map**

A drive map shows the conditions for individual disk sectors. You may see which sectors are OK, bad, or unstable.

**To view the drive map,**

* Control-click the required hard drive/partition and select Show drive map... on the contextual menu,

> The drive map will appear in the right tab.

**Drive map controls**

<table>
<thead>
<tr>
<th>Control</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sectors</td>
<td>The number of the first sector in the row.</td>
</tr>
<tr>
<td>Offset</td>
<td>Offset in the data. Enter the address you want to jump to and press the Enter key.</td>
</tr>
<tr>
<td>Sectors/Bytes/KB...</td>
<td>Specifies the dimension of the data in the Offset field.</td>
</tr>
<tr>
<td>Previous/Next</td>
<td>Moves to the previous/next part of the data.</td>
</tr>
<tr>
<td>+/-</td>
<td>Zooms into/out of, the data.</td>
</tr>
</tbody>
</table>

To see more detailed information about a particular sector range, right click the corresponding rectangle and select Information on the contextual menu.

Click the Open in Hex Editor button to open the selected block in the Text/hexadecimal editor.

**Viewing the file map**

A file map shows the conditions for individual file sectors. You may see which sectors are OK, bad, or unstable.
To view the file map,
* Control-click the required file and select Map of file... on the contextual menu,
> The file map will appear in the lower pane.

<table>
<thead>
<tr>
<th>Drive map controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sectors</td>
</tr>
<tr>
<td>Offset</td>
</tr>
<tr>
<td>Sectors/Bytes/KB...</td>
</tr>
<tr>
<td>Previous/Next</td>
</tr>
<tr>
<td>+/-</td>
</tr>
</tbody>
</table>

To see more detailed information about a particular sector range, right click the corresponding rectangle and select Information on the contextual menu.

Click the Open in Hex Editor button to open the selected block in the Text/hexadecimal editor.

VI   R-Studio Emergency

R-Studio Emergency is a tool that allows you to startup a computer with a damaged startup disk and recover data stored on its hard drives. Then restored data can either be saved on its disk or transferred to a working computer via a network.

The R-Studio Emergency version is a part of the R-Studio software package.

You may run this R-Studio Emergency version on a computer for which you have bought an R-Studio license, and you may not transfer the licensed software to another computer.

R-Studio Emergency
- Contact Information and Technical Support
- Installing R-Studio Emergency Startup Media Creator
- Creating Startup Disks

R-Studio Emergency Operation
- Starting a Computer with the R-Studio Emergency Startup Disks
- File Recovery
- Searching for a File
- Disk Scan
- Disk Images

Using R-Studio Emergency as Emergency Agent

Technical Information
- Network Drives
- Properties and Text/Hexadecimal Viewer
- Log
- Devices to Store Recovered Files

Hardware Compatibility List
6.1 Contact Information and Technical Support

To obtain the latest version of R-Studio Emergency, go to:

- Product Site: http://www.r-tt.com
- Sales Department: sales@r-tt.com

R-Studio Technical Support Team is available 24 hours a day, seven days a week, and has an average response time less than 4 hours.

- Tech. Support: support@r-tt.com
- Send your support request to: http://www.r-tt.com/Support_request.html

6.2 Creating Startup Disks

- Installing R-Studio Emergency Startup Media Creator
- Creating Startup Disks Using R-Studio Emergency Startup Media Creator
- Creating Startup Disks for Mac and Linux Computers

6.2.1 Installing R-Studio Emergency Startup Media Creator

Attention Windows NT/2000/XP/2003/Vista/2008/7 users! You must have administrative privileges to install R-Studio Emergency Startup Media Creator.

If you are not sure whether you have such privileges, you almost certainly do not have them. Contact your system administrator for assistance.

1. Run the setup file.
2. Follow the on-screen instructions.

You may create startup disks even before the installation ends.

6.2.2 Creating Startup Disks Using R-Studio Emergency Startup Media Creator

You need to create either

- A startup CD/DVD disc. You may create an ISO image, or write the disc directly from R-Studio Emergency Startup Media Creator, if there is a CD/DVD recorder in your system. You may use this disc to start both UEFI computers (modern Windows/Mac/Linux systems) and old Windows/Mac/Linux machines.

or

- A startup FAT/FAT32 removable device recognized by your system as a bootable one. The total available size of the device should be more than 50 MB. You may use this device to start both UEFI computers (modern Windows/Mac/Linux systems) and old Windows/Mac/Linux machines.

or

- 5 floppy disks. You may use them to start old Windows/Mac/Linux computers

Check the Hardware Compatibility List.

If you have problems with starting you computer up from the R-Studio Emergency startup disks, select Configure startup media troubleshooting options on the Startup media type selection dialog box. Then the Startup Media Troubleshooting Options dialog box will appear. You may configure these options to eliminate those problems.

When R-Studio Emergency Startup Media Creator starts, its Welcome dialog box appears:
Welcome to R-Studio Emergency Startup Media Creator dialog box

Welcome dialog box

![Welcome dialog box](image)

click the **Next** button to see the list of all devices on which startup disks may be created.

Startup media type selection dialog box

![Startup media type selection dialog box](image)

To create a startup CD/DVD disc directly on your CD/DVD writer (if present):

1. Run R-Studio Emergency
2. Select the CD/DVD writer on the **Startup media type selection** dialog box and click the **Next** button
3. Read and accept the License Agreement and enter the registration key on the **R-Studio Emergency Activation** dialog box and click the **Next** button

R-Studio Emergency Activation dialog box

![R-Studio Emergency Activation dialog box](image)
4 Insert a blank CD/DVD disk into the CD/DVD recorder and click the Next button

Insert a CD/ DVD disc dialog box

R-Studio Emergency Startup Media Creator will start creating the startup CD/DVD disc showing the progress on the Creating startup media dialog box

Creating startup media dialog box

When R-Studio Emergency Startup Media Creator finishes creating the startup CD/DVD disc, the R-Studio Emergency Startup Media Creation is Finished message will appear.

You may either exit R-Studio Emergency Startup Media Creator by clicking the Finish button or create another startup media by clicking the Back button.

R-Studio Emergency Startup Media Creation is Finished message

To create an ISO image of a startup CD/DVD disc

1 Run R-Studio Emergency

2 Select ISO Image for a startup CD/DVD on the R-Studio Emergency Startup Media Creator dialog box and click the Next button

3 Read and accept the License Agreement and enter the registration key on the R-Studio Emergency Activation dialog box and click the Next button
4 Select a place and file name for the ISO image of the startup CD/DVD and click the Save button

> When R-Studio Emergency Startup Media Creator finishes writing the file with the ISO image, the R-Studio Emergency Startup Media Creation is Finished message will appear

You may either exit R-Studio Emergency Startup Media Creator by clicking the Finish button or create another startup media by clicking the Next button.

R-Studio Emergency Startup Media Creation is Finished dialog box

5 Create the startup CD/DVD using your favorite CD/DVD creation software

Load the created ISO image into the CD/DVD creation software. Consult documentation for the software for details.

To create a startup FAT/FAT32 removable device

1 Run R-Studio Emergency

2 Select the removable device on the Startup media type selection dialog box and click the Next button

3 Read and accept the License Agreement and enter the registration key on the R-Studio Emergency Activation dialog box and click the Next button

4 Check that the FAT/FAT32-formatted device is ready and click the Next button

Ready to create startup media dialog box

> R-Studio Emergency Startup Media Creator will start creating the startup USB disk showing the progress on the Creating startup media dialog box

When R-Studio Emergency Startup Media Creator finishes creating the startup device, the R-Studio Emergency Startup Media Creation is Finished message will appear

You may either exit R-Studio Emergency Startup Media Creator by clicking the Finish button or create another startup media by clicking the Next button.
R-Studio Emergency Startup Media Creation is Finished dialog box

To create floppy disks:
You will need 5 floppy disks.

1. Run R-Studio Emergency

2. Select Floppy Disk for the startup floppy disks on the R-Studio Emergency Startup Media Creator dialog box and click the Next button

3. Read and accept the License Agreement and enter the registration key on the R-Studio Emergency Activation dialog box and click the Next button

4. Insert the first floppy disk and click the Next button on the Ready to create startup media dialog box

R-Studio Emergency Startup Media Creation- Floppy Disk message

> R-Studio Emergency Startup Media Creator will start creating the first startup floppy disk showing the progress on the Creating startup media dialog box

5. Insert the second floppy disk and click the OK button when the Please insert formatted diskette #2 into drive A: message will appear

> When R-Studio Emergency Startup Media Creator finishes creating the second startup floppy disk, the R-Studio Emergency Startup Media Creation is Finished message will appear

You may either exit R-Studio Emergency Startup Media Creator by clicking the Finish button or create another startup media by clicking the Next button.
R-Studio Emergency Startup Media Creation is Finished message

![R-Studio Emergency Startup Media Creation is Finished message](image)

Startup Media Troubleshooting Options

Those options will help you if you have problems with starting your computer up from the R-Studio startup disks. Please, contact the R-Studio Technical Support Team for more information.

R-Studio Startup Media Troubleshooting Options dialog box

![R-Studio Startup Media Troubleshooting Options dialog box](image)

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display kernel startup messages</td>
<td>If this checkbox is enabled, <strong>R-Studio Emergency</strong> displays all startup messages. That may be useful to locate the source of the problem when your system hangs during <strong>R-Studio Emergency</strong> startup.</td>
</tr>
<tr>
<td>Disables ACPI</td>
<td>Select these checkboxes when your system detects some hardware incorrectly during <strong>R-Studio Emergency</strong> startup and displays messages like: <code>hda: lost interrupt</code></td>
</tr>
<tr>
<td>Disables APIC</td>
<td>Select this checkbox if your system experiences problems during <strong>R-Studio Emergency</strong> startup.</td>
</tr>
<tr>
<td>Disables USB device support</td>
<td>Select this checkbox if your system experiences problems with USB devices during <strong>R-Studio Emergency</strong> startup.</td>
</tr>
<tr>
<td>Disables SCSI device support</td>
<td>Select this checkbox if your system experiences problems with SCSI devices during <strong>R-Studio Emergency</strong> startup.</td>
</tr>
<tr>
<td>Disables PCMCIA device support</td>
<td>Select this checkbox if your system experiences problems with PCMCIA devices during <strong>R-Studio Emergency</strong> startup.</td>
</tr>
<tr>
<td>Disables DMA for all IDE disk drives</td>
<td>Select this checkbox if your system experiences problems with IDE disks during <strong>R-Studio Emergency</strong> startup.</td>
</tr>
<tr>
<td>IRQ polling mode</td>
<td>Select this checkbox to enable the IRQ polling mode to prevent locking the system because a device generates too much interrupts for the system to handle.</td>
</tr>
<tr>
<td>PCI BIOS</td>
<td>Select an appropriate option if your system experiences problems with PCI cards.</td>
</tr>
<tr>
<td>BIOS RAIDS</td>
<td>Select an appropriate option if your system experiences problems with RAIDs built in the system board.</td>
</tr>
</tbody>
</table>
6.2.3 Creating Startup Disks on Mac and Linux Computers

To start a Mac or a Linux computer, you may use the following devices:

1. A USB device created using the R-Studio Emergency Startup Media Creator for Windows. See the Creating Startup Disks Using R-Studio Emergency Startup Media Creator page for more details.
2. A USB device created using a Mac or Linux computer. To create such device, download the ZIP archive of R-Studio Emergency, unzip it, and write files to a FAT32-formatted USB device.

Please note that you cannot use this disk to start non-UEFI computers (old Macs, for example), nor can you just copy those files to a CD/DVD disc to create an R-Studio Emergency startup disc. If you need a CD/DVD disk, burn it using the ISO image.

3. A startup CD/DVD disc. Download the ISO image of that disk and burn it or use the R-Studio Emergency Startup Media Creator for Windows to burn it on a Windows computer.

6.3 R-Studio Emergency Operation

Starting a Computer with the R-Studio Emergency Startup Disks

- File Recovery
- Searching for a File
- Disk Scan
- Disk Images

Using R-Studio Emergency as Emergency Agent

Technical Information
- Properties and Text/Hexadecimal Viewer
- Network Drives
- Log
- Devices to Store Recovered Files

Hardware Compatibility List

R-Studio Emergency
- Contact Information and Technical Support
- Installing R-Studio Emergency Startup Media Creator
- Creating Startup Disks

6.3.1 Starting a Computer with the R-Studio Emergency Startup Disks

We recommended that you print out this help page and have the hardcopy on hand while you are performing this action.

If there is a non-IDE disk controller in your system, or you plan to use network disks or external hardware devices, first check the Hardware Compatibility List.

If you plan to use any external device, turn it on before starting the system.

If the motherboard in your computer supports the Serial ATA (SATA) devices, but IDE disks are also present, only the SATA devices should be set to the Enhanced Mode in BIOS.
To start the computer with the R-Studio Emergency startup CD/DVD disc or any removable device,

1. Make sure that the first startup device in the system BIOS is the CD/DVD drive or the removable device
   Disable "Secure boot" in the system BIOS if your computer is certified to run Windows 8. Refer to your
   system documentation for details.

2. Insert the R-Studio Emergency startup CD/DVD disc and start your computer
   -If you have a Mac computer
   To start a Mac computer with the R-Studio Emergency startup disk,
   1. Insert a CD/DVD disc or connect a USB disk
   2. Switch the Mac on.
   3. While loading, press the Option key on the Mac keyboard (the Alt key if you use a non-Apple keyboard).
   The Options key

4. Select the EFI boot disk and press Enter.

The R-Studio Emergency startup disk

R-Studio Emergency will start loading.
Then a startup screen will appear:
Select the **R-Studio Emergency GUI (Graphic Mode)** to run **R-Studio Emergency** in the graphic mode in which its user interface is similar to the Windows version. If **R-Studio Emergency** cannot run in this mode, restart the system in the Safe VGA mode (only VESA-compliant) which is compatible with most video cards and monitors. If it fails too, select the Text mode in which the **R-Studio Emergency** user interface is shown in the pseudo-graphic mode compatible with all video cards. The help describes this pseudo-graphic mode.

> **R-Studio Emergency** will start and its **Device/Disk** panel will appear

To start the computer with the R-Studio Emergency startup floppy disks,

1. **Make sure that the first startup device in the system BIOS is A (Floppy)**
   Refer to your system documentation for details.

2. **Insert the first startup floppy disk and start your computer**

> The following text will appear on the screen:

   - Loading
   - Uncompressing ... OK, starting the kernel
   - VFS: Insert the second boot disk and press ENTER

3. **Insert the second disk and press ENTER.**

> **R-Studio Emergency** will start and its **Device/Disk** panel will appear

**Secure boot:**

It may be impossible to start a Windows 8 certified computer with the R-Studio Emergency startup disk without some additional actions. This happens because any computer should use a so-called "Secure boot" procedure to comply with Windows 8 hardware certification from Microsoft. In brief, this procedure prevents computer from booting into any operating system that isn't digitally signed with an appropriate digital signature. "Secure boot" is claimed to prevent unauthorized modification of the boot sector by bootkits, viruses, trojans, and other malicious software. To the date, only Windows 8, Windows Server 2012, and selected Linux distributions support this feature. As a side effect, it also prevents most LiveCDs, rescue disks (R-Studio and R-Drive Image included), and other OS from running.

Likely enough, the other requirement of Windows 8 hardware certification is to make it possible for the user to disable the Secure boot procedure. Those settings can be done through the system BIOS under the Boot options. Generally, it's enough to enable Legacy support in those options, but sometimes it may require additional actions. Please, refer to your system documentation to learn more about disabling/enabling Secure boot.

When Secure boot is disabled, it should be possible to start the computer with the R-Studio Emergency startup disk.
Please note that you should enable this feature back after using the startup disks because Windows 8 or Server 2012 may not start properly without the Secure boot feature enabled.

### 6.3.2 File Recovery

To recover files,

1. Select a partition on the **Device/Disk** panel on which the files to recover reside and press the Enter key.
   - R-Studio will change its panel showing the disk's folders/files structure.
2. Select the file to recover on the **Files View** panel. Use the **Tab** key to switch between panes.

   ![Files View panel](image)

3. Press the **F2** key and specify the output folder on the **Recover** dialog box.

   ![Recover dialog box](image)

External USB drives with the NTFS file system: **R-Studio Emergency** can save recovered files on such disks if they are properly disconnected in a Windows system using the **Safely Remove Hardware** icon in the system tray or while shutting Windows down.

**Searching for a File**

**Mapping Network Drives**

**Viewing object properties**

### 6.3.3 Searching for a File

To search for a file,

1. Select **Find** on the **Tools** menu (or press the **Alt+F** key)
2 Specify a file name or mask

**Find dialog box**

- **Look at dialog box**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deleted files:</td>
<td>If it is selected, <strong>R-Studio</strong> makes a search among deleted files/folders.</td>
</tr>
<tr>
<td>Existing files:</td>
<td>If it is selected, <strong>R-Studio</strong> makes a search among existing files/folders.</td>
</tr>
<tr>
<td>Files:</td>
<td>If it is selected, <strong>R-Studio</strong> includes files into a search.</td>
</tr>
<tr>
<td>Folders:</td>
<td>If it is selected, <strong>R-Studio</strong> includes folders into a search.</td>
</tr>
</tbody>
</table>

To find the next file corresponding to the specified file mask,
* Press the Alt+N key

### 6.3.4 Disk Scan

To scan an object
1. Select an object on the **Device/Disk** panel and press the F6 key
2. Specify the required parameters on the **Scan** dialog box and press the Enter key

**Scan dialog box**

- **Scan** dialog box

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start</td>
<td>Sets the start point of the area to be scanned.</td>
</tr>
<tr>
<td>Size</td>
<td>Sets the size of the area to be scanned.</td>
</tr>
</tbody>
</table>

Numbers in these fields can be in bytes or sectors.
If no letters are after the numbers, **R-Studio** assumes the numbers in bytes.
The following case-ignoring notation is possible:
> When an object is scanned, it may be searched for files, and found files may be recovered the same way as for a regular object

**Scan results**

<table>
<thead>
<tr>
<th>Extra Found Files</th>
<th>Entries of known file types have been found</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recognized1</td>
<td>Records and file entries are found for this partition</td>
</tr>
<tr>
<td>Recognized2</td>
<td>Only file entries are found for this partition</td>
</tr>
<tr>
<td>Recognized3</td>
<td>Only boot records are found for this partition</td>
</tr>
</tbody>
</table>

To save scan information
1. Select an object with scan information
2. Press the Alt+D key and select Save Scan Information on the Drive menu
3. Specify the output folder and file name on the **Save Scan Information** dialog box

**Mapping Network Drives**

To open scan information
1. Select an object to which scan information is to be opened
2. Press the Alt+D key and select Open Scan Information on the Drive menu
3. Specify the folder and file name with the scan information on the **Open Scan Information** dialog box

**Mapping Network Drives**

To delete scan information
1. Select an object to which scan information is to be deleted
2. Press the Alt+D key and select Delete Scan Information on the Drive menu

**Disk Images**

To create an image file
1. Select an object on the **Device/Disk** panel
2 Press the Alt+D key and select Create Plain Image File or Create Compressed Image File on the Drive menu

Create Image dialog box

Plain Image
If this option is selected, R-Studio will create a simple exact copy of the object. This image format is compatible with the previous versions of R-Studio.

Compressed Image
If this option is selected, R-Studio will create an image file compatible with the images created by R-Drive Image, but incompatible with the previous versions of R-Studio.

3 Specify the output folder and file name on the Create Image File dialog box

Mapping Network Drives

To load an image file
1 Press the Alt+D key and select Open Image File on the Drive menu
2 Specify the folder and file name with the image on the Open Image File dialog box

Mapping Network Drives

6.4 Using R-Studio Emergency as an Emergency Agent

R-Studio Emergency can be used as an emergency agent for R-Studio. Moreover, if you have a Mac computer, this is the only way to start it with R-Studio Agent Emergency.

To start the computer with the R-Studio Emergency/Agent startup CD/DVD disc or any removable device,

1 Make sure that the first startup device in the system BIOS is the CD/DVD drive or the removable device
   Disable "Secure boot" in the system BIOS if your computer is certified to run Windows 8. Refer to your system documentation for details.

2 Insert the R-Studio Emergency startup CD/DVD disc or the removable device and start your computer
   If you have a Mac computer
   To start a Mac computer with the R-Studio Emergency startup disk,
   1. Insert a CD/DVD disc or connect a USB disk
   2. Switch the Mac on.
   3. While loading, press the Option key on the Mac keyboard (the Alt key if you use a non-Apple keyboard).
The Options key

4. Select the **EFI boot** disk and press **Enter**.

The R-Studio Emergency startup disk

**R-Studio Emergency** will start loading.

Then a startup screen will appear:
Startup Options

1. Select the R-Studio Agent Emergency to run R-Studio Emergency as an emergency agent.

2. R-Studio Agent Emergency will start and its prompt will appear.

R-Studio Emergency as an Emergency Agent

If your network has a DHCP server
The computer running R-Studio Agent Emergency will be assigned an IP address automatically.
A prompt with a computer address will appear. You need to remember it to access the computer via network.

If your network does not have a DHCP server
You need to configure the interfaces and IP addresses manually.

1. Press Enter to start configuring the settings. A prompt to select an interface will appear. Enter the selected interface name and press Enter.
2. A prompt to enter its IP address and optional subnet mask will appear. Enter the IP address and optional subnet mask and press Enter.
Network Setting Configuration

3. A prompt to configure another interface, gateway, or to finish configuring the interfaces will appear. Enter `gw`, enter the IP address of the gateway, and press Enter.

Network Setting Configuration

4. Press Enter to finish configuring the interfaces, or enter the name of the next interface to configure.

- **R-Studio Agent Emergency** will show a prompt that is ready to accept connections

**R-Studio Emergency as an Emergency Agent**

Now the computer may be accessed by **R-Studio** via network.

Secure boot:

It may be impossible to start a Windows 8 certified computer with the R-Studio Emergency startup disk without
some additional actions. This happens because any computer should use a so-called "Secure boot" procedure to comply with Windows 8 hardware certification from Microsoft. In brief, this procedure prevents computer from booting into any operating system that isn't digitally signed with an appropriate digital signature. "Secure boot" is claimed to prevent unauthorized modification of the boot sector by bootkits, viruses, trojans, and other malicious software. To the date, only Windows 8, Windows Server 2012, and selected Linux distributions support this feature. As a side effect, it also prevents most LiveCDs, rescue disks (R-Studio and R-Drive Image included), and other OS from running.

Likely enough, the other requirement of Windows 8 hardware certification is to make it possible for the user to disable the Secure boot procedure. Those settings can be done through the system BIOS under the Boot options. Generally, it's enough to enable Legacy support in those options, but sometimes it may require additional actions. Please, refer to your system documentation to learn more about disabling/enabling Secure boot.

When Secure boot is disabled, it should be possible to start the computer with the R-Studio Emergency startup disk.

Please note that you should enable this feature back after using the startup disks because Windows 8 or Server 2012 may not start properly without the Secure boot feature enabled.

To connect to R-Studio's computer,

1. Press the Enter key and enter the IP address of the computer where R-Studio is running as IPaddress:port.
   
   The default port is 8080, and you don't have to specify it.

2. Enter the password if required, and press the Enter key.

> When the connection is established successfully, R-Studio Agent Emergency will notify you about this.

R-Studio Emergency as an Emergency Agent

6.5 R-Studio Emergency Technical Information

Properties and Text/Hexadecimal Viewer

Network Drives

Log

Devices to Store Recovered Files

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Starting a Computer with the R-Studio Emergency Startup Disks
File Recovery
Searching for a File
Disk Scan
Disk Images

Using R-Studio Emergency as Emergency Agent

Hardware Compatibility List
6.5.1 Properties and Text/Hexadecimal Viewer

To view object properties,
1. Select an object
2. Press the F7 key

To view an object
1. Select an object
2. Press the F3 key
3. Press the F6 key to view and select file attributes
   Press the Esc key to close the viewer.

6.5.2 Network Drives

To map a network drive,
1. On a dialog box with Map Network Drive, press the Alt+M key
   > The Querying DHCP message will appear
   If the network has a DHCP server, the computer will obtain an IP address automatically. A list of adapters
   and their IP addresses will appear on the Network Adapters dialog box.
   If the network does not have a DHCP server, select a network adapter on the Network Adapters dialog
   box and press the F4 key. Enter the IP address and network mask and press the Enter button.
Network Addresses dialog box

2 Select a configured network adapter and press the Enter key
3 Enter the required information on the Map Network Drive message

Map Network dialog box

<table>
<thead>
<tr>
<th>Server IP Address:</th>
<th>IP address of the computer where the network drive is to reside.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Server Share Name:</td>
<td>Name of the shared folder where the network drive is to reside.</td>
</tr>
<tr>
<td>Login:</td>
<td>Username of a user on the computer where the network drive is to reside.</td>
</tr>
<tr>
<td>Password:</td>
<td>User's password on the computer where the network drive is to reside.</td>
</tr>
</tbody>
</table>

For the network drive's path //SERVER/Net_Drive,

- **Server IP address**: The IP address of the SERVER computer (192.168.1.20)
- **Server share name**: Net_Drive.

> The mounted network disk will appear

To disconnect a mounted network drive

1 Select a mounted network drive
2 Switch to the Disconnect button and press the Enter key

6.5.3 Log

To clear log information

* Select Clear Log on the Tools menu
To save log information to a file
*
Select Save Log To File on the Tools menu

6.5.4 Devices to Store Recovered Files

R-Studio Emergency can write recovered files to the following devices:

- FAT devices such as USB sticks, memory cards, and other similar devices. Such devices are inexpensive and easily available, they can be fully accessed by all operating systems, but they have one important drawback: they cannot store files larger that 2GB. So, if you plan to recover large video files, this is not your option.

- exFAT devices such as large USB sticks and memory cards, external hard disks, and other similar devices. They are fully accessed by all operating systems. Unlike FAT devices, they don't have the 2GB file size limit.

- NTFS disks (primarily used in Windows computers).
  Access without any third-party software:
  - Windows computers: full.
  - Mac computers: read.
  - Linux computers: full.

- HFS/HFS+ disks (used in Mac computers).
  Access without any third-party software:
  - Windows computers: no.
  - Mac computers: full. Some access problems may appear for files written by R-Studio Emergency.
  - Linux computers: full. Some access problems may appear for files written by R-Studio Emergency.

- Ext2/3/4 disks (used in Linux computers).
  Access without any third-party software:
  - Windows computers: no.
  - Mac computers: no
  - Linux computers: full.

- XFS disks (used in Linux computers).
  Access without any third-party software:
  - Windows computers: no.
  - Mac computers: no
  - Linux computers: full.

- Network disks. Such disks may be on other network computers or NAS devices. See the Network Drives page for more details.

How to solve file access problems on Macs:
Finder in the OSX system shows such inaccessible folders and files in the following way:
Inaccessible folders in Finder

To get access to such data, do the following:

1. Under an administrator account, right-click the folder and select Get Info on the contextual menu.

Info of an inaccessible folder

Click the Lock icon in the Sharing & Permissions section to unlock the folder properties. The system will ask you for the account password.

2. Click the Privilege column and select Read & Write on the contextual menu.

Setting the access rights for the folder
3. If this is a folder with other folders and files, click the **Properties** icon and select **Apply to enclosed items**.

**Setting access rights for enclosed items in the folder**

Then click the **Lock** icon to lock the properties back.

### 6.6 R-Studio Emergency Hardware Compatibility List

**R-Studio Emergency** supports the following hardware devices:

<table>
<thead>
<tr>
<th><strong>Data Storage Devices</strong></th>
<th><strong>Networking Devices</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Serial ATA and Parallel ATA drivers</strong></td>
<td><strong>Ethernet (10 or 100Mbit)</strong></td>
</tr>
<tr>
<td>ACPI firmware driver for PATA</td>
<td>3c501 <code>EtherLink</code></td>
</tr>
<tr>
<td>AHCI SATA</td>
<td>3c503 <code>EtherLink II</code></td>
</tr>
<tr>
<td>ALi PATA</td>
<td>3c505 <code>EtherLink Plus</code></td>
</tr>
<tr>
<td>AMD/NVidia PATA</td>
<td>3c507 <code>EtherLink 16</code></td>
</tr>
<tr>
<td>ARTOP 6210/6260 PATA</td>
<td>3c509/3c529 (MCA)/3c579 <code>EtherLink III</code></td>
</tr>
<tr>
<td>ARTOP/Acard ATP867X PATA</td>
<td>3c515 ISA <code>Fast EtherLink</code></td>
</tr>
<tr>
<td>ATI PATA</td>
<td>3c590/3c900 series (592/595/597)</td>
</tr>
<tr>
<td>CMD / Silicon Image 680 PATA</td>
<td><code>Vortex/Boomerang</code></td>
</tr>
<tr>
<td>CMD640 PCI PATA</td>
<td>3cr990 series <code>Typhoon</code></td>
</tr>
<tr>
<td>CMD64x PATA</td>
<td>AMD 8111 (new PCI lance)</td>
</tr>
<tr>
<td>CS5510/5520 PATA</td>
<td>AMD LANCE and PCnet (AT1500 and NE2100)</td>
</tr>
<tr>
<td>CS5530 PATA</td>
<td>AMD PCnet32 PCI</td>
</tr>
</tbody>
</table>
CS5535 PATA
CS5536 PATA
Compaq Triflex PATA
Cypress CY82C693 PATA
EFAR SLC90E66
Generic ATA
HPT 343/363 PATA
HPT 366/368 PATA
HPT 370/370A/371/372/374/302 PATA
HPT 372N/302N PATA
IT8211/2 PATA
IT8213 PATA
Initio 162x SATA
Intel ESB, ICH, PIIX3, PIIX4 PATA/SATA
Intel PATA MPIIX
Intel PATA old PIIX
Intel SCH PATA
JMicron PATA
Legacy ISA PATA
Marvell PATA support via legacy mode
Marvell SATA
NETCELL Revolution RAID
NVIDIA SATA
Nat Semi NS87410 PATA
Nat Semi NS87415 PATA
Ninja32/Delkin Cardbus ATA
OPTI FireStar PATA
OPTI621/6215 PATA
Older Promise PATA controller
PCMCIA PATA
Pacific Digital ADMA
Pacific Digital SATA QStor
Platform AHCI SATA
Promise PATA 2027x
Promise SATA SX4
Promise SATA TX2/TX4
QDI VLB PATA
RADISYS 82600 PATA
RDC PATA
SC1200 PATA

AT1700/1720
Adaptec Starfire/DuraLAN
Ansel Communications EISA 3200
Apricot Xen-II on board Ethernet
Atheros L2 Fast Ethernet
Broadcom 440x/47xx ethernet
CS89x0
Cabletron E21xx
DECchip Tulip (dc2114x) PCI
Dave ethernet support (DNET)
Davicom DM910x/DM980x
Early DECchip Tulip (dc2104x) PCI
EtherExpress 16
EtherExpressPro support/EtherExpress 10 (i82595)
Generic DECchip & DIGITAL EtherWORKS
HP 10/100VG PCLAN (ISA, EISA, PCI)
HP PCLAN (27245 and other 27xxx series)
HP PCLAN+ (27247B and 27252A)
ICL EtherTeam 16/32
Intel(R) PRO/100+
LP486E on board Ethernet
Myson MTD-8xx PCI Ethernet
NE2000/NE1000
NI5010
NI5210
NI6510
National Semiconductor DP8381x series PCI
Ethernet
OpenCores 10/100 Mbps Ethernet MAC
PCI NE2000 and clones support (see help)
RDC R6040 Fast Ethernet Adapter
RealTek RTL-8129/8130/8139 PCI Fast Ethernet
Adapter
RealTek RTL-8139 C+ PCI Fast Ethernet Adapter
SEEQ8005
SMC 9194
SMC EtherPower II
SMC Ultra
SMSC LAN9420 PCI ethernet adapter
SiS 900/7016 PCI Fast Ethernet Adapter
SERVERWORKS OSB4/CSB5/CSB6/HT1000 PATA
ServerWorks Frodo / Apple K2 SATA
SiS 964/965/966/180 SATA
SiS PATA
Silicon Image 3124/3132 SATA
Silicon Image SATA
ULi Electronics SATA
VIA PATA
VIA SATA
VITESSE VSC-7174 / INTEL 31244 SATA
Winbond SL82C105 PATA
Winbond W83759A VLB PATA

**SCSI low-level drivers**
- 3ware 5/6/7/8xxx ATA-RAID
- 3ware 97xx SAS/SATA-RAID
- 3ware 9xxx SATA-RAID
- 7000FASST SCSI
- ACARD SCSI
- ARECA (ARC11xx/12xx/13xx/16xx) SATA/SAS RAID Host Adapter
- Adaptec AACRAID
- Adaptec AHA152X/2825
- Adaptec AHA1542
- Adaptec AIC79xx U320
- Adaptec AIC7xxx
- Adaptec AIC7xxx Fast -> U160
- Adaptec AIC94xx SAS/SATA
- Adaptec I2O RAID
- AdvanSys SCSI
- Always IN2000 SCSI
- BusLogic SCSI
- DMX3191D SCSI
- DTC3180/3280 SCSI
- EATA ISA/EISA/PCI (DPT and generic EATA/DMA-compliant boards)
- Emulex LightPulse Fibre Channel Support
- Future Domain 16xx SCSI/AHA-2920A
- Generic NCR5380/53c400 SCSI MMIO
- Generic NCR5380/53c400 SCSI PIO
- HP Smart Array SCSI driver
- Silan SC92031 PCI Fast Ethernet Adapter driver
- Sun Cassini
- Sun GEM
- Sun Happy Meal 10/100baseT
- Sundance Alta
- TI ThunderLAN
- ULI M526x controller
- VIA Rhine
- WD80*3
- Winbond W89c840 Ethernet
- Zenith Z-Note
- nForce Ethernet

**Ethernet (1000 Mbit)**
- Alteon AceNIC/3Com 3C985/NetGear GA620 Gigabit
- Atheros L1C Gigabit Ethernet
- Atheros L1E Gigabit Ethernet
- Atheros/Attansic L1 Gigabit Ethernet
- Broadcom CNIC
- Broadcom NetXtremeII
- Broadcom Tigon3
- DL2000/TC902x-based Gigabit Ethernet
- IP1000 Gigabit Ethernet
- Intel(R) 82575/82576 PCI-Express Gigabit Ethernet
- Intel(R) 82576 Virtual Function Ethernet
- Intel(R) PRO/1000 Gigabit Ethernet
- Intel(R) PRO/1000 PCI-Express Gigabit Ethernet
- JMicron(R) PCI-Express Gigabit Ethernet
- National Semiconductor DP83820
- New SysKonnect GigaEthernet
- Packet Engines Hamachi GNIC-II
- Packet Engines Yellowfin Gigabit-NIC
- QLogic QLA3XXX Network Driver Support
- Realtek 8169 gigabit ethernet
- SiS190/SiS191 gigabit ethernet
- SysKonnect Yukon2
- VIA Velocity

**Ethernet (10000 Mbit)**
- Broadcom NetXtremeII 10Gb
- Chelsio 10Gb Ethernet
HighPoint RocketRAID 3xx/4xxx Controller
IBM Power Linux RAID adapter
IBM ServeRAID
Initio 9100U(W)
Initio INI-A100U2W
Intel/ICP (former GDT SCSI Disk Array) RAID Controller
LSI Logic Legacy MegaRAID Driver
LSI Logic Management Module
LSI Logic MegaRAID Driver
LSI MPT MegaRAID SAS RAID Module
LSI MPT Fusion SAS 2.0 Device Driver
Marvell 88SE64XX/88SE94XX SAS/SATA
NCR53c406a SCSI
PAS16 SCSI
PMC SIERRA Linux MaxRAID adapter
PMC-Sierra SPC 8001 SAS/SATA Based Host Adapter driver
Promise SuperTrak EX Series
QLogic ISP4XXX host adapter family
QLogic QL2XXX Fibre Channel Support
QLogic FAS SCSI
QLogic QLA 1240/1x80/1x160 SCSI
SYM53C8XX Version 2 SCSI
Symbios 53c416 SCSI
Tekram DC390(T) and Am53/79C974 SCSI
Tekram DC395(U/UW/F) and DC315(U) SCSI
Trantor T128/T128F/T228 SCSI
UltraStor 14F/34F
UltraStor SCSI
VMware PVSCSI driver
Workbit NinjaSCSI-32B/UE

USB support
Cypress C67x00 HCD
Datafab Compact Flash Reader
Freecom USB/ATAPI Bridge
ISD-200 USB/ATA Bridge
ISP 1760 HCD
ISP116X HCD
ISP1362 HCD
Chelsio Communications T3 10Gb Ethernet
Chelsio Communications T4 Ethernet
Cisco VIC Ethernet NIC Support
Intel(R) 10GbE PCI Express adapters
Intel(R) PRO/10GbE
Mellanox Technologies 10Gbit Ethernet
Myricom Myri-10G Ethernet
NetXen Multi port (1/10) Gigabit Ethernet NIC
Neterion X3100 Series 10GbE PCIe Server Adapter
QLOGIC QLCNIC 1/10Gb Converged Ethernet NIC Support
QLogic QLGE 10Gb Ethernet Driver Support
S2IO 10Gbe XFrame NIC
ServerEngines’ 10Gbps NIC - BladeEngine
Solarflare Solarstorm SFC4000/SFC9000-family
Sun Neptune 10Gbit Ethernet
Tehuti Networks 10G Ethernet

Token Ring driver support
3Com 3C359 Token Link Velocity XL adapter
Generic TMS380 PCI
Generic TMS380 Token Ring ISA/PCI adapter
IBM Lanstreamer chipset PCI adapter
IBM Olympic chipset PCI adapter
IBM Tropic chipset based adapter
Madge Smart 16/4 PCI Mk2
Proteon ISA
SMC ISA/MCA adapter
SysKonnect TR4/16 ISA

USB Network Adapters
ASIX AX88xxx Based USB 2.0 Ethernet Adapters
CDC EEM
CDC Ethernet support (smart devices such as cable modems)
Davicom DM9601 based USB 1.1 10/100 ethernet devices
GeneSys GL620USB-A based cables
Host for RNDIS and ActiveSync devices
MosChip MCS7830 based Ethernet adapters
NetChip 1080 based cables (Laplink, ...)
Prolific PL-2301/2302 based cables
Lexar Jumpshot Compact Flash Reader
OXU210HP HCD
Olympus MAUSB-10/Fuji DPC-R1
R8A66597 HCD
SL811HS HCD
SanDisk SDDR-09 (and other SmartMedia, including DPCM)
SanDisk SDDR-55 SmartMedia
USB 2.0
USB Mass Storage
USB Monitor
USBAT/USBAT02-based storage
xHCI HCD (USB 3.0)

Block devices
Compaq SMART2
Compaq Smart Array 5xxx
Mylex DAC960/DAC1100 PCI RAID Controller
Normal floppy disk
Promise SATA SX8

IEEE 1394 (FireWire) support
Legacy alternative FireWire driver stack
Storage devices (SBP-2 protocol)

PCMCIA network device support
3Com 3c574 PCMCIA
3Com 3c589 PCMCIA
Asix AX88190 PCMCIA
COM20020 ARCnet PCMCIA
Fujitsu FMV-J18x PCMCIA
NE2000 compatible PCMCIA
New Media PCMCIA
SMC 91Cxx PCMCIA
Xircom 16-bit PCMCIA

Other devices
Microsoft Hyper-V Utilities driver
Microsoft Hyper-V client drivers
Microsoft Hyper-V virtual block driver
Microsoft Hyper-V virtual network driver
Microsoft Hyper-V virtual storage driver
SMSC LAN95XX based USB 2.0 10/100 ethernet devices
Sharp Zaurus (stock ROMs) and compatible
Simple USB Network Links (CDC Ethernet subset)
USB CATC NetMate-based Ethernet device
USB KLSI KL5USB101-based ethernet device
USB Pegasus/Pegasus-II based ethernet device
USB RTL8150 based ethernet device

SMSC LAN95XX based USB 2.0 10/100 ethernet devices
Sharp Zaurus (stock ROMs) and compatible
Simple USB Network Links (CDC Ethernet subset)
USB CATC NetMate-based Ethernet device
USB KLSI KL5USB101-based ethernet device
USB Pegasus/Pegasus-II based ethernet device
USB RTL8150 based ethernet device
VII R-Studio Agent Emergency

R-Studio Agent Emergency is a tool that allows you to start a network computer with a damaged startup disk and recover data stored on its hard drives. Then restored data can be transferred to a working computer via the network.

It works very simple: Just start the computer with the R-Studio Agent Emergency startup disk(s) and, if necessary, manually configure a network interface for R-Studio Agent Emergency. When started, the computer and its hard drives can be accessed by R-Studio installed on another computer on the network.

Contact Information and Technical Support
Installing R-Studio Agent Emergency Startup Media Creator
Creating Startup Disks
Starting a Computer with the R-Studio Agent Emergency Startup Disk

Hardware Compatibility List
Disk Controllers
Network Cards

7.1 Contact Information and Technical Support

To obtain the latest version of R-Studio Agent Emergency, go to:

Product Site: http://www.r-tt.com
Sales Department: sales@r-tt.com

R-Studio Technical Support Team is available 24 hours a day, seven days a week, and has an average response time less than 4 hours.

Tech. Support: support@r-tt.com
Send your support request to: http://www.r-tt.com/Support_request.html

7.2 Installing R-Studio Agent Emergency Startup Media Creator

You must have administrative privileges to install R-Studio Agent Emergency Startup Media Creator.

If you are not sure whether you have such privileges, you almost certainly do not have them. Contact your system administrator for assistance.

1. Run the setup file.
2. Follow the on-screen instructions.
You may create startup disks even before the installation ends.

7.3 Creating Startup Disks

You need to create either

- A startup CD/DVD disc. You may create an ISO image, or write the disc directly from R-Studio Emergency Startup Media Creator, if there is a CD/DVD recorder in your system.
- or
A startup FAT/FAT32 removable device recognized by your system as a bootable one. The total available size of the device should be more than 10 MB.

or

- 4 formatted floppy disks

Check the Hardware Compatibility List.

When R-Studio Agent Emergency Startup Media Creator starts, its Welcome dialog box appears:

**Welcome to R-Studio Agent Emergency Startup Media Creator** dialog box

![Welcome dialog box](image)

Click the Next button to see the list of all devices on which startup disks may be created.

**Startup media type selection** dialog box

![Startup media type selection](image)

To create a startup CD/DVD disc directly on your CD/DVD writer (if present):

1. Run R-Studio Agent Emergency
2. Select the CD/DVD writer on the Startup media type selection dialog box and click the Next button
3. Read and accept the License Agreement and enter the R-Studio Agent registration key on the R-Studio Agent Emergency Activation dialog box and click the Next button

Note: You should enter the registration key of R-Studio Agent, not R-Studio itself.
R-Studio Agent Emergency License Agreement dialog box

R-Studio Agent Emergency Activation dialog box

if you do not enter the registration key, R-Studio Agent Emergency will work in the Demo mode. You may enter the key later when R-Studio Agent Emergency and R-Studio establish a connection.

4 Insert a blank CD/DVD disk into the CD/DVD recorder and click the Next button

Insert media disc dialog box
R-Studio Agent Emergency Startup Media Creator will start creating the startup CD/DVD disc showing the progress on the Creating startup media dialog box

Creating startup media dialog box

When R-Studio Agent Emergency Startup Media Creator finishes creating the startup CD/DVD disc, the R-Studio Agent Emergency Startup Media Creation is Finished message will appear. You may either exit R-Studio Emergency Startup Media Creator by clicking the Finish button or create another startup media by clicking the Back button.

R-Studio Agent Emergency Startup Media Creation is Finished message

To create an ISO image of a startup CD/DVD disc

1 Run R-Studio Agent Emergency

2 Select ISO Image for a startup CD/DVD on the R-Studio Agent Emergency Startup Media Creator dialog box and click the Next button

3 Read and accept the License Agreement and enter the R-Studio Agent registration key on the R-Studio Agent Emergency Activation dialog box and click the Next button

   Note: You should enter the registration key of R-Studio Agent, not R-Studio itself. If you do not enter the registration key, R-Studio Agent Emergency will work in the Demo mode. You may enter the key later when R-Studio Agent Emergency and R-Studio establish a connection.

4 Select a place and file name for the ISO image of the startup CD/DVD and click the Save button

   When R-Studio Bootable Startup Media Creator finishes writing the file with the ISO image, the R-Studio Agent Emergency Startup Media Creation is Finished message will appear. You may either exit R-Studio Bootable Startup Media Creator by clicking the Finish button or create another startup media by clicking the Back button.
5 Create the startup CD/DVD using your favorite CD/DVD creation software
Load the created ISO image into the CD/DVD creation software. Consult documentation for the software for details.

To create a startup FAT/FAT32 removable device
1 Run R-Studio Agent Emergency
2 Select the removable device on the *Startup media type selection* dialog box and click the *Next* button
3 Read and accept the License Agreement and enter the registration key on the *R-Studio Agent Emergency Activation* dialog box and click the *Next* button
4 Check that the correct FAT/FAT32-formatted device is selected and click the *Next* button

**Confirm device selection** dialog box

> *R-Studio Agent Emergency Startup Media Creator* will start creating the startup USB disk showing the progress on the *Creating startup media* dialog box

When *R-Studio Agent Emergency Startup Media Creator* finishes creating the startup device, the *R-Studio Agent Emergency Startup Media Creation is Finished* message will appear
You may either exit *R-Studio Emergency Startup Media Creator* by clicking the *Finish* button or create another startup media by clicking the *Back* button.
R-Studio Agent Emergency Startup Media Creation is Finished dialog box

To create floppy disks:
You will need 4 formatted floppy disks.

1. Run R-Studio Agent Emergency
2. Select Floppy Disk for the startup floppy disk on the R-Studio Agent Emergency Startup Media Creator dialog box and click the Next button
3. Enter the registration information and number on the Registration dialog box and click the Next button
   If you leave all the field blank, R-Studio Agent Emergency will work with the Demo-version limitations
4. Insert the floppy disk and click the Next button on the Insert floppy dialog box
   Insert floppy dialog box

> R-Studio Agent Emergency Startup Media Creator will start creating the startup floppy disk showing the progress on the Creating startup media dialog box

Creating startup media dialog box
5 Insert the second floppy disk and click the OK button when the Please insert formatted diskette #2 into drive A: message will appear.

Do it with the next 2 floppy disks.

> When R-Studio Startup Media Creator finishes creating the startup floppy disk, the R-Studio Agent Emergency Startup Media Creation is Finished message will appear. You may either exit R-Studio Startup Media Creator by clicking the Finish button or create another startup media by clicking the Back button.

R-Studio Agent Emergency Startup Media Creation is Finished dialog box

7.4 Starting a Computer with the R-Studio Agent Emergency Startup Disk

We recommended that you print out this help page and have the hardcopy on hand while you are performing this action.

Before you start the computer you should be aware that your network has a DHCP server or you know the computer's IP address and network mask.

If there is a non-IDE disk controller in your system, or you plan to use network disks or external hardware devices, first check the Hardware Compatibility List.

If you plan to use any external device, turn it on before starting the system.

If the motherboard in your computer supports the Serial ATA (SATA) devices, but IDE disks are also present, only the SATA devices should be set to the Enhanced Mode in BIOS.

To start the computer with the R-Studio Agent Emergency startup disks

1 Make sure that the first startup device in the system BIOS is the device from which you plan to start your computer (a CD/DVD drive or A (Floppy))

   Disable "Secure boot" in the system BIOS if your computer is certified to run Windows 8. Refer to your system documentation for details. Refer to your system documentation for details.

2 Insert the R-Studio Agent Emergency startup CD/DVD disc, a removable device, or the first floppy disk and start your computer

   R-Studio Agent Emergency will start and its prompt will appear

   If you start your computer with floppy disks, you'll see prompts to insert a next floppy disk.

   Booting R-Studio Emergency. Please wait...
Waiting 8 seconds for PCMCIA devices to settle
Booting R-Studio Agent Emergency. Now you may remove floppy.
-----------------------------------------------------------------
Querying DHCP to configure network interfaces...
Press ENTER within 10 seconds to configure them manually.

**If your network has a DHCP server**
The computer running R-Studio Agent Emergency will be assigned an IP address automatically
A prompt with a computer address will appear. You need to remember it to access the computer via network.

**If your network does not have a DHCP server**
You need to configure the interfaces and IP addresses manually.
1. A prompt to select an interface will appear. Enter the selected interface name and press **Enter**.
2. A prompt to enter its IP address and optional subnet mask will appear. Enter the IP address and optional subnet mask and press **Enter**.

<table>
<thead>
<tr>
<th>Name</th>
<th>IP Address</th>
<th>NETMASK</th>
<th>Vendor</th>
</tr>
</thead>
<tbody>
<tr>
<td>re0</td>
<td>Unconfigured</td>
<td></td>
<td>RealTek 8139C+</td>
</tr>
</tbody>
</table>

1. # Enter interface name, 'gw' for default gateway or just press ENTER to finish
   #>re0
2. # Enter IP address and optional NETMASK delimited by space
   #>192.168.0.10 255.255.255.0

3. A prompt to configure another interface, gateway, or to finish configuring the interfaces will appear. Enter **gw**, enter the IP address of the gateway, and press **Enter**.

<table>
<thead>
<tr>
<th>Name</th>
<th>IP Address</th>
<th>NETMASK</th>
<th>Vendor</th>
</tr>
</thead>
<tbody>
<tr>
<td>re0</td>
<td>Unconfigured</td>
<td></td>
<td>RealTek 8139C+</td>
</tr>
</tbody>
</table>

1. # Enter interface name, 'gw' for default gateway or just press ENTER to finish
   #>re0
2. # Enter IP address and optional NETMASK delimited by space
   #>192.168.0.10 255.255.255.0

3. # Enter default gateway IP Address
   #>192.168.0.1
4. Press Enter to finish configuring the interfaces, or enter the name of the next interface to configure.

> R-Studio Agent Emergency will show a prompt that is ready to accept connections

* R-Studio Agent started and ready to accept connections...
* You may press ENTER to start connection to remote R-Studio...

Now the computer may be accessed by **R-Studio** via network.

**Secure boot:**

It may be impossible to start a Windows 8 certified computer with the R-Studio Agent Emergency startup disk without some additional actions. This happens because any computer should use a so-called “Secure boot” procedure to comply with Windows 8 hardware certification from Microsoft. In brief, this procedure prevents computer from booting into any operating system that isn't digitally signed with an appropriate digital signature. “Secure boot” is claimed to prevent unauthorized modification of the boot sector by bootkits, viruses, trojans, and other malicious software. To the date, only Windows 8, Windows Server 2012, and selected Linux distributions support this feature. As a side effect, it also prevents most LiveCDs, rescue disks (R-Studio and R-Drive Image included), and other OS from running.

Likely enough, the other requirement of Windows 8 hardware certification is to make it possible for the user to disable the Secure boot procedure. Those settings can be done through the system BIOS under the Boot options. Generally, it’s enough to enable Legacy support in those options, but sometimes it may require additional actions. Please, refer to your system documentation to learn more about disabling/enabling Secure boot.

When Secure boot is disabled, it should be possible to start the computer with the R-Studio Agent Emergency startup disk.

Please note that you should enable this feature back after using the startup disks because Windows 8 or Server 2012 may not start properly without the Secure boot feature enabled.

**Starting a Connection from R-Studio Agent Emergency**

When you need to connect **R-Studio** and **R-Studio Agent Emergency** over the Internet, it may be necessary to start the connection from the computer where **R-Studio Agent Emergency** is running.

**To connect to R-Studio's computer,**

1. **Press the Enter key and enter the IP address of the computer where R-Studio is running as IPaddress:port.**

   * R-Studio Agent started and ready to accept connections...
   * You may press ENTER to start connection to remote R-Studio...

   The default port is 8080, and you don't have to specify it.

2. **Enter the password if required, and press the Enter key.**

   * R-Studio Agent started and ready to accept connections...
   * You may press ENTER to start connection to remote R-Studio...
   # Enter R-Studio IP address or just press ENTER to cancel> 192.168.0.25:80

   # Enter password or just press ENTER to connect without one>PaSsWoRd1234

   > When the connection is established successfully, R-Studio Agent Emergency will notify you about this.

   * R-Studio Agent started and ready to accept connections...
7.5 R-Studio Agent Emergency Hardware Compatibility List

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R-Studio Agent Emergency

Contact Information and Technical Support

Installing R-Studio Agent Emergency Startup Media Creator

Creating Startup Disks

Starting a Computer with the R-Studio Agent Emergency Startup Disk

7.5.1 Disk Controllers

R-Studio Agent Emergency is based on the FreeBSD 5.3 kernel and supports devices from the list published at http://www.freebsd.org/releases/5.3R/hardware-i386.html.

*: Supported in the floppy version

Disk controllers

IDE/ATA controllers (ata driver) *

The adapters supported by the aic driver include:

Adaptec AHA-1505 (ISA)
Adaptec AHA-1510A, AHA-1510B (ISA)
Adaptec AHA-1520A, AHA-1520B (ISA)
Adaptec AHA-1522A, AHA-1522B (ISA)
Adaptec AHA-1535 (ISA)

Creative Labs SoundBlaster SCSI host adapter (ISA)
Adaptec AHA-1030B, AHA-1030P (PC98)
NEC PC-9801-100 (PC98)

The aha driver supports the following SCSI host adapters:

Adaptec AHA-154xB
Adaptec AHA-154xC
Adaptec AHA-154xCF
Adaptec AHA-154xCP
Adaptec AHA-1640
Adaptec AHA-174x in 154x emulation mode
DTC 3290 SCSI controller in 1542 emulation mode
Tekram SCSI controllers in 154x emulation mode

The ahb driver supports the following SCSI host adapters:

Adaptec AHA-1740
Adaptec AHA-1742
Adaptec AHA-1740A
Adaptec AHA-1742A

The anc driver supports the following SCSI host adapter chips and SCSI controller cards:

Adaptec AIC7770 host adapter chip
Adaptec AIC7850 host adapter chip
Adaptec AIC7860 host adapter chip
Adaptec AIC7870 host adapter chip
Adaptec AIC7880 host adapter chip
Adaptec AIC7890 host adapter chip
Adaptec AIC7891 host adapter chip
Adaptec AIC7892 host adapter chip
Adaptec AIC7895 host adapter chip
Adaptec AIC7896 host adapter chip
Adaptec AIC7897 host adapter chip
Adaptec AIC7899 host adapter chip
Adaptec 274X(W)
Adaptec 274X(T)
Adaptec 284X
Adaptec 2910
Adaptec 2915
Adaptec 2920
Adaptec 2930C
Adaptec 2930U2
Adaptec 2940
Adaptec 2940J
Adaptec 2940N
Adaptec 2940U
Adaptec 2940AU
Adaptec 2940UW
Adaptec 2940UW Dual
Adaptec 2940UW Pro
Adaptec 2940U2W
Adaptec 2940U2B
Adaptec 2950U2W
Adaptec 2950U2B
Adaptec 19160B
Adaptec 29160B
Adaptec 29160N
Adaptec 3940
Adaptec 3940AU
Adaptec 3940U
Adaptec 3940AUW
Adaptec 3940UW
Adaptec 3940AUW
Adaptec 3940U2W
Adaptec 3950U2
Adaptec 3960
Adaptec 39160
Adaptec 3985
Adaptec 4944UW
NEC PC-9821Xt13 (PC-98)
NEC Rvi26 (PC-98)
NEC PC-9821X-B02L/B09 (PC-98)
NEC SV-98/2-B03 (PC-98)
Many motherboards with on-board SCSI support

The **ahd** driver supports the following:

- Adaptec AIC7901 host adapter chip
- Adaptec AIC7901A host adapter chip
- Adaptec AIC7902 host adapter chip
- Adaptec 29320 host adapter
- Adaptec 39320 host adapter
- Many motherboards with on-board SCSI support

Controllers supported by the **aac** driver include:

- Adaptec AAC-364
- Adaptec SCSI RAID 2120S
- Adaptec SCSI RAID 2130S
- Adaptec SCSI RAID 2200S
- Adaptec SCSI RAID 2410SA
- Adaptec SCSI RAID 2810SA
- Adaptec SCSI RAID 5400S
- Dell CERC SATA RAID 2
- Dell PERC 2/Si
- Dell PERC 2/QC
- Dell PERC 3/Si
- Dell PERC 3/Di
- Dell PERC 320/DC
- HP NetRAID 4M

The **adv** driver supports the following **SCSI controllers**:

- AdvanSys ABP510/5150
- AdvanSys ABP5140
- AdvanSys ABP5142
- AdvanSys ABP902/3902
- AdvanSys ABP3905
- AdvanSys ABP915
- AdvanSys ABP920
- AdvanSys ABP3922
- AdvanSys ABP3925
- AdvanSys ABP930, ABP930U, ABP930UA
- AdvanSys ABP960, ABP960U
- AdvanSys ABP542
- AdvanSys ABP742
- AdvanSys ABP842
Advansys ABP940
Advansys ABP940UA/3940UA
Advansys ABP940U
Advansys ABP3960UA
Advansys ABP970, ABP970U
Advansys ABP752
Advansys ABP852
Advansys ABP950
Advansys ABP980, ABP980U
Advansys ABP980UA/3980UA
MELCO IFC-USP (PC-98)
RATOC REX-PCI30 (PC-98)
@Nifty FNECHARD IFC-USUP-TX (PC-98)

The adw driver supports SCSI controllers including:
Advansys ABP940UW/ABP3940UW
Advansys ABP950UW
Advansys ABP970UW
Advansys ABP3940U2W
Advansys ABP950U2W

The bt driver supports the following BusLogic MultiMaster ``W'', ``C'', ``S'', and ``A'' series and compatible SCSI host adapters:
BusLogic BT-445C
BusLogic BT-445S
BusLogic BT-540CF
BusLogic BT-542B
BusLogic BT-542B
BusLogic BT-542D
BusLogic BT-545C
BusLogic BT-545S
BusLogic/BusTek BT-640
BusLogic BT-742A
BusLogic BT-742A
BusLogic BT-747C
BusLogic BT-747D
BusLogic BT-747S
BusLogic BT-757C
BusLogic BT-757CD
BusLogic BT-757D
BusLogic BT-757S
BusLogic BT-946C
BusLogic BT-948
BusLogic BT-956C
BusLogic BT-956CD
BusLogic BT-958
BusLogic BT-958D
Storage Dimensions SDC3211B / SDC3211F
AMI FastDisk Host Adapters that are true BusLogic MultiMaster clones are also supported by the bt driver.

The **dpt** driver provides support for the following RAID adapters:
- DPT Smart Cache Plus
- Smart Cache II (PM2???, PM2022 [EISA], PM2024/PM2124 [PCI]) (Gen2)
- Smart RAID II (PM3?2?, PM3021, PM3222)
- Smart Cache III (PM2???)
- Smart RAID III (PM3?3?, PM3332 [EISA], PM3334UW [PCI]) (Gen3)
- Smart Cache IV (PM2?4?, PM2042 [EISA], PM2044/PM2144 [PCI]) (Gen4)
- Smart RAID IV

The adapters currently supported by the **asr** driver include the following:
- Adaptec SCSI RAID 2100S, 2110S
- Adaptec ATA-100 RAID 2400A
- Adaptec SCSI RAID 3200S, 3210S
- Adaptec SCSI RAID 3400S, 3410S
- Adaptec SmartRAID PM1554
- Adaptec SmartRAID PM1564
- Adaptec SmartRAID PM2554
- Adaptec SmartRAID PM2564
- Adaptec SmartRAID PM2664
- Adaptec SmartRAID PM2754
- Adaptec SmartRAID PM2865
- Adaptec SmartRAID PM3754
- Adaptec SmartRAID PM3755U2B / SmartRAID V Millennium
- Adaptec SmartRAID PM3757
- DEC KZPCC-AC (LVD 1-ch, 4MB or 16MB cache), DEC KZPCC-CE (LVD 3-ch, 64MB cache), DEC KZPCC-XC (LVD 1-ch, 16MB cache), DEC KZPCC-XE (LVD 3-ch, 64MB cache) -- rebadged SmartRAID V Millennium

The **amr** driver supports the following:
- AMI MegaRAID 320-1
- AMI MegaRAID 320-2
- AMI MegaRAID 320-4X
- AMI MegaRAID Series 418
- AMI MegaRAID Enterprise 1200 (Series 428)
- AMI MegaRAID Enterprise 1300 (Series 434)
- AMI MegaRAID Enterprise 1400 (Series 438)
- AMI MegaRAID Enterprise 1500 (Series 467)
- AMI MegaRAID Enterprise 1600 (Series 471)
- AMI MegaRAID Elite 1500 (Series 467)
- AMI MegaRAID Elite 1600 (Series 493)
- AMI MegaRAID Elite 1650 (Series 4xx)
- AMI MegaRAID Express 100 (Series 466WS)
- AMI MegaRAID Express 200 (Series 466)
- AMI MegaRAID Express 300 (Series 490)
AMI MegaRAID Express 500 (Series 475)
Dell PERC
Dell PERC 2/SC
Dell PERC 2/DC
Dell PERC 3/DCL
Dell PERC 3/QC
Dell PERC 4/Di
HP NetRAID-1/Si
HP NetRAID-3/Si (D4943A)
HP Embedded NetRAID

Note: Booting from these controllers is supported. EISA adapters are not supported.

Controllers supported by the mlx driver include:
- Mylex DAC960P
- Mylex DAC960PD / DEC KZPSC (Fast Wide)
- Mylex DAC960PDU
- Mylex DAC960PL
- Mylex DAC960PJ
- Mylex DAC960PG
- Mylex DAC960PU / DEC PZPAC (Ultra Wide)
- Mylex AcceleRAID 150 (DAC960PRL)
- Mylex AcceleRAID 250 (DAC960PTL1)
- Mylex eXtremeRAID 1100 (DAC1164P)
- RAIDarray 230 controllers, aka the Ultra-SCSI DEC KZPAC-AA (1-ch, 4MB cache), KZPAC-CA (3-ch, 4MB), KZPAC-CB (3-ch, 8MB cache)

All major firmware revisions (2.x, 3.x, 4.x and 5.x) are supported, however it is always advisable to upgrade to the most recent firmware available for the controller. Compatible Mylex controllers not listed should work, but have not been verified.

Note: Booting from these controllers is supported. EISA adapters are not supported.

Controllers supported by the mly driver include:
- Mylex AcceleRAID 160
- Mylex AcceleRAID 170
- Mylex AcceleRAID 352
- Mylex eXtremeRAID 2000
- Mylex eXtremeRAID 3000

Compatible Mylex controllers not listed should work, but have not been verified.

The twee driver supports the following ATA RAID controllers:
- AMCC's 3ware 5000 series
- AMCC's 3ware 6000 series
- AMCC's 3ware 7000-2
- AMCC's 3ware 7006-2
- AMCC's 3ware 7500-4LP
- AMCC's 3ware 7500-8
- AMCC's 3ware 7500-12
- AMCC's 3ware 7506-4LP
- AMCC's 3ware 7506-8
AMCC’s 3ware 7506-12
AMCC’s 3ware 8006-2LP
AMCC’s 3ware 8500-4LP
AMCC’s 3ware 8500-8
AMCC’s 3ware 8500-12
AMCC’s 3ware 8506-4LP
AMCC’s 3ware 8506-8
AMCC’s 3ware 8506-8MI
AMCC’s 3ware 8506-12
AMCC’s 3ware 8506-12MI

The **twa** driver supports the following PATA/SATA RAID controllers:
- AMCC’s 3ware 9500S-4LP
- AMCC’s 3ware 9500S-8
- AMCC’s 3ware 9500S-8MI
- AMCC’s 3ware 9500S-12
- AMCC’s 3ware 9500S-12MI

The **ncr** driver provides support for the following NCR/Symbios SCSI controller chips:
- 53C810
- 53C810A
- 53C815
- 53C820
- 53C825A
- 53C860
- 53C875
- 53C875J
- 53C885
- 53C895
- 53C895A
- 53C896
- 53C1510D

The following add-on boards are known to be supported:
- I-O DATA SC-98/PCI (PC-98)
- I-O DATA SC-PCI (PC-98)

The **sym** driver provides support for the following Symbios/LSI Logic PCI SCSI controllers:
- 53C810
- 53C810A
- 53C815
- 53C825
- 53C825A
- 53C860
- 53C875
- 53C876
- 53C895
- 53C895A
The SCSI controllers supported by `sym` can be either embedded on a motherboard, or on one of the following add-on boards:

- ASUS SC-200, SC-896
- Data Technology DTC3130 (all variants)
- Dawicontrol DC2976UW
- Diamond FirePort (all)
- I-O DATA SC-UPCI (PC-98)
- Logitec LHA-521UA (PC-98)
- NCR cards (all)
- Symbios cards (all)
- Tyan S1365

The following devices are currently supported by the `ncv` driver:

- I-O DATA PCSC-DV
- KME KXL002 (TAXAN ICD-400PN, etc.), KXL004, and UJDCD450
- Macnica Miracle SCSI-II mPS110
- Media Intelligent MSC-110, MSC-200
- NEC PC-9801N-J03R
- New Media Corporation BASICS SCSI
- QLogic Fast SCSI
- RATOC REX-9530, REX-5572 (SCSI only)

Controllers supported by the `stg` driver include:

- Adaptec 2920/A
- Future Domain SCSI2GO
- Future Domain TMC-18XX/3260
- IBM SCSI PCMCIA Card
- ICM PSC-2401 SCSI
- MELCO IFC-SC
- RATOC REX-5536, REX-5536AM, REX-5536M, REX-9836A

Note that the Adaptec 2920C is supported by the `ahc` driver.

Cards supported by the `isp` driver include:

- ISP1000
- PTI SBS440
- ISP1020
- ISP1040
- PTI SBS450
- QLogic 1240
- QLogic 1020
Qlogic 1040
Qlogic 1080
Qlogic 1280
Qlogic 12160
Qlogic 2100
Qlogic 2102
Qlogic 2200
Qlogic 2202
Qlogic 2204
Qlogic 2300
Qlogic 2312
PTI SBS470
Antares P-0033

Controllers supported by the **amd** driver include:
- MELCO IFC-DP (PC-98)
- Tekram DC390
- Tekram DC390T

Controllers supported by the **nsb** driver include:
- Alpha-Data AD-PCS201
- I-O DATA CBSC16
- Adaptec AIC-7110 Parallel to SCSI interfaces ( **vpo** driver)

The following controllers are supported by the **ida** driver:
- Compaq SMART Array 221
- Compaq Integrated SMART Array Controller
- Compaq SMART Array 4200
- Compaq SMART Array 4250ES
- Compaq SMART 3200 Controller
- Compaq SMART 3100ES Controller
- Compaq SMART-2/DH Controller
- Compaq SMART-2/SL Controller
- Compaq SMART-2/P Controller
- Compaq SMART-2/E Controller
- Compaq SMART Controller

Controllers supported by the **ciss** driver include:
- Compaq Smart Array 5300
- Compaq Smart Array 532
- Compaq Smart Array 5i
- HP Smart Array 5312
- HP Smart Array 6i
- HP Smart Array 641
- HP Smart Array 642
- HP Smart Array 6400
- HP Smart Array 6400 EM
- HP Smart Array 6422
Controllers supported by the iir driver include:
- Intel RAID Controller SRCMR
- Intel Server RAID Controller U3-1 (SRCU31a)
- Intel Server RAID Controller U3-1L (SRCU31La)
- Intel Server RAID Controller U3-2 (SRCU32)
- All past and future releases of Intel and ICP RAID Controllers.
- Intel RAID Controller SRCU21 (discontinued)
- Intel RAID Controller SRCU31 (older revision, not compatible)
- Intel RAID Controller SRCU31L (older revision, not compatible)
- The SRCU31 and SRCU31L can be updated via a firmware update available from Intel.
- Promise SuperTrak ATA RAID controllers (pst driver)

The hptmv driver supports the HighPoint RocketRAID 182x SATA controllers.

Controllers supported by the ips driver include:
- IBM ServeRAID 3H
- ServeRAID 4L/4M/4H
- ServeRAID Series 5
- ServeRAID 6i/6M

The following controllers are supported by the mpt driver:
- LSI Logic 53c1030 (Dual Ultra320 SCSI)
- LSI Logic FC909 (1Gb/s Fibre Channel)
- LSI Logic FC909A (Dual 1Gb/s Fibre Channel)
- LSI Logic FC919 (2Gb/s Fibre Channel)
- LSI Logic FC929 (Dual 2Gb/s Fibre Channel)
- The SCSI controller chips supported by the mpt driver can be found onboard on many systems including:
  - Dell PowerEdge 1750
  - IBM eServer xSeries 335

SCSI controllers supported by the trm driver include:
- Tekram DC-315 PCI Ultra SCSI adapter without BIOS and internal SCSI connector
- Tekram DC-315U PCI Ultra SCSI adapter without BIOS
- Tekram DC-395F PCI Ultra-Wide SCSI adapter with flash BIOS and 68-pin external SCSI connector
- Tekram DC-395U PCI Ultra SCSI adapter with flash BIOS
- Tekram DC-395UW PCI Ultra-Wide SCSI adapter with flash BIOS
- Tekram DC-395U2W PCI Ultra2-Wide SCSI adapter with flash BIOS
- For the Tekram DC-310/U and DC-390F/U/UW/U2B/U2W/U3W PCI SCSI host adapters, use the sym driver.

The wds driver supports the WD7000 SCSI controller.

7.5.2 Network Cards

R-Studio Agent Emergency is based on the FreeBSD 5.3 kernel and supports devices from the list published at [http://www.freebsd.org/releases/5.3R/hardware-i386.html](http://www.freebsd.org/releases/5.3R/hardware-i386.html).

*: Supported in the floppy version
Ethernet NICs

Adapters supported by the *sf* driver include:
- ANA-62011 64-bit single port 10/100baseTX adapter
- ANA-62022 64-bit dual port 10/100baseTX adapter
- ANA-62044 64-bit quad port 10/100baseTX adapter
- ANA-69011 32-bit single port 10/100baseTX adapter
- ANA-62020 64-bit single port 100baseFX adapter

The *ti* driver supports Gigabit Ethernet adapters based on the Alteon Tigon I and II chips. The *ti* driver has been tested with the following adapters:
- 3Com 3c985-SX Gigabit Ethernet adapter (Tigon 1)
- 3Com 3c985B-SX Gigabit Ethernet adapter (Tigon 2)
- Alteon AceNIC V Gigabit Ethernet adapter (1000baseSX)
- Alteon AceNIC V Gigabit Ethernet adapter (1000baseT)
- Digital EtherWORKS 1000SX PCI Gigabit adapter
- Netgear GA620 Gigabit Ethernet adapter (1000baseSX)
- Netgear GA620T Gigabit Ethernet adapter (1000baseT)

The following adapters should also be supported but have not yet been tested:
- Asante GigaNIX1000T Gigabit Ethernet adapter
- Asante PCI 1000BASE-SX Gigabit Ethernet adapter
- Farallon PN9000SX Gigabit Ethernet adapter
- NEC Gigabit Ethernet
- Silicon Graphics PCI Gigabit Ethernet adapter

The *pcn* driver supports adapters and embedded controllers based on the AMD PCnet/FAST, PCnet/FAST+, PCnet/FAST III, PCnet/PRO and PCnet/Home Fast Ethernet chips:
- AMD Am53C974/Am79C970/Am79C974 PCnet-PCI *
- AMD Am79C970A PCnet-PCI II *
- AMD Am79C971 PCnet-FAST *
- AMD Am79C972 PCnet-FAST+ *
- AMD Am79C973/Am79C975 PCnet-FAST III *
- AMD Am79C976 PCnet-PRO *
- AMD PCnet/Home HomePNA
- Allied-Telesis LA-PCI
- Contec C-NET(98)S (PC-98)
- NEC SV-98/2-B05, B06

The *inc* driver supports the following adapters:
- Novell NE2100 *
- Novell NE32-VL *
- Isolink AT 4141-0 (16 bit)
- Isolink BICC
- Isolink 4110 (8 bit)
- Diamond HomeFree
- Digital DEPCA
- Hewlett Packard Vectra 486/66XM
- Hewlett Packard Vectra XU
Also supported are adapters working with the **pcn** driver. The **Inc** driver runs these in compatibility mode, thus the **pcn** driver should be preferred.

SMC 83c17x (EPIC)-based Ethernet NICs (**tx** driver)

**The ed driver supports the following Ethernet NICs:**

- 3Com 3c503 Etherlink II
- AR-P500 Ethernet
- Accton EN1644 (old model), EN1646 (old model), EN2203 (old model) (110pin) (flags 0xd00000)
- Accton EN2212/EN2216/UE2216
- Allied Telesis CentreCOM LA100-PCM_V2
- Allied Telesis LA-98 (flags 0x000000) (PC-98)
- Allied Telesis SIC-98, SIC-98NOTE (110pin), SIU-98 (flags 0x600000) (PC-98)
- Allied Telesis SIU-98-D (flags 0x610000) (PC-98)
- AmbiCom 10BaseT card
- Bay Networks NETGEAR FA410TXC Fast Ethernet
- CNet BC40 adapter
- Compex Net-A adapter
- Contec C-NET(98), RT-1007(98), C-NET(9N) (110pin) (flags 0xa00000) (PC-98)
- Contec C-NET(98)E-A, C-NET(98)E-L-A, C-NET(98)P (flags 0x300000) (PC-98)
- Corega Ether98-T (flags 0x000000) (PC-98)
- Corega Ether PCC-T/EtherII PCC-T/FEther PCC-TXF/PCC-TXD
- CyQ've ELA-010
- DEC EtherWorks DE305
- Danpex EN-6200P2
- D-Link DE-298, DE-298P (flags 0x500000) (PC-98)
- D-Link DE-650/660
- D-Link IC-CARD/IC-CARD+ Ethernet
- ELECOM LD-98P (flags 0x500000) (PC-98)
- ELECOM LD-BDN, LD-NW801G (flags 0x200000) (PC-98)
- ELECOM Lanced LD-CDL/TX, LD-CDF, LD-CDS, LD-10/100CD, LD-CDWA (DP83902A)
- HP PC Lan+ 27247B and 27252A
- IBM Creditcard Ethernet I/II
- ICM AD-ET2-T, DT-ET-25, DT-ET-T5, IF-2766ET, IF-2771ET, NB-ET-T (110pin) (flags 0x500000) (PC-98)
- I-O DATA LA/T-98, LA/T-98SB, LA2/T-98, ET/T-98 (flags 0x900000) (PC-98)
- I-O DATA ET2/T-PCI
- I-O DATA PCLATE
- Kansai KLA-98C/T (flags 0x900000) (PC-98)
- Kingston KNE-PC2, KNE-PCM/x Ethernet
- Linksys EC2T/PCMC100/PCM100, PCMLM56
- Linksys EtherFast 10/100 PC Card, Combo PCMCIA Ethernet Card (PCMC100 V2)
- Logitec LAN-98T (flags 0xb0000) (PC-98)
- MACNICA Ethernet ME1 for JEIDA
- MACNICA ME98 (flags 0x900000) (PC-98)
- MACNICA NE2098 (flags 0x400000) (PC-98)
- MELCO EGY-98 (flags 0x300000) (PC-98)
C-Bus, ISA, PCI and PC Card devices are supported.

Adapters supported by the rl driver include:

- Accton ``Cheetah'' EN1207D (MPX 5030/5038; ReafTek 8139 clone)
- Allied Telesyn AT2550
- Allied Telesyn AT2500TX
- Belkin F5D5000
- BUFFALO(Meko INC.) LPC-CB-CLX(CardBus)
- Compaq HNE-300
- CompUSA no-name 10/100 PCI Ethernet NIC
- Corega FEther CB-TXD
- Corega FEtherII CB-TXD
- D-Link DFE-530TX+
- D-Link DFE-538TX (same as 530+?)
- D-Link DFE-690TXD
- Edimax EP-4103DL CardBus
Encore ENL832-TX 10/100 M PCI
Farallon NetLINE 10/100 PCI
Genius GF100TXR,
GigaFast Ethernet EE100-AXP
KTX-9130TX 10/100 Fast Ethernet
LevelOne FPC-0106TX
Longshine LCS-8038TX-R
NDC Communications NE100TX-E
Netronix Inc. EA-1210 NetEther 10/100
Nortel Networks 10/100BaseTX
OvisLink LEF-8129TX
OvisLink LEF-8139TX
Peppercon AG ROL-F
Planex FNW-3800-TX
SMC EZ Card 10/100 PCI 1211-TX
SOHO(PRAGMATIC) UE-1211C

The **wb** driver supports Winbond W89C840F based Fast Ethernet adapters and embedded controllers including:

- Trendware TE100-PCIE *

The **vr** driver supports VIA Technologies Rhine I, Rhine II, and Rhine III based Fast Ethernet adapters including:

- D-Link DFE530-TX
- Hawking Technologies PN102TX
- AOpen/Acer ALN-320

The **sis** driver supports Silicon Integrated Systems SiS 900 * and SiS 7016 * based Fast Ethernet adapters and embedded controllers, as well as Fast Ethernet adapters based on the National Semiconductor DP83815 (MacPhyter) chip. Supported adapters include:

- @Nifty FNECHARD IFC USUP-TX
- MELCO LGY-PCI-TXC
- Netgear FA311-TX (DP83815)
- Netgear FA312-TX (DP83815)
- SiS 630, 635, and 735 motherboard chipsets

The **nge** driver supports National Semiconductor DP83820 * and DP83821 based Gigabit Ethernet adapters including:

- SMC EZ Card 1000 (SMC9462TX)
- D-Link DGE-500T
- Asante FriendlyNet GigaNIX 1000TA and 1000TPC
- Addtron AEG320T
- LinkSys EG1032 (32-bit PCI) and EG1064 (64-bit PCI)
- Surecom Technology EP-320G-TX
- Netgear GA622T
- Netgear GA621
- Ark PC SOHO-GA2500T (32-bit PCI) and SOHO-GA2000T (64-bit PCI)
- Trendware TEG-PCITX (32-bit PCI) and TEG-PCITX2 (64-bit PCI)
The **ste** driver supports Sundance Technologies ST201 based Fast Ethernet adapters and embedded controllers including:
- D-Link DFE-530TXS
- D-Link DFE-550TX

**Adapters supported by the sk driver include:**
- 3COM 3C940 single port, 1000baseT adapter
- Belkin F5D5005 single port, 1000baseT adapter
- Linksys EG1032 single port, 1000baseT adapter
- SK-9521 SK-NET GE-T single port, 1000baseT adapter
- SK-9821 SK-NET GE-T single port, 1000baseT adapter *
- SK-9822 SK-NET GE-T dual port, 1000baseT adapter *
- SK-9841 SK-NET GE-LX single port, single mode fiber adapter *
- SK-9842 SK-NET GE-LX dual port, single mode fiber adapter *
- SK-9843 SK-NET GE-SX single port, multimode fiber adapter *
- SK-9844 SK-NET GE-SX dual port, multimode fiber adapter *
- SMC 9452TX single port, 1000baseT adapter

The **tl** driver supports Texas Instruments ThunderLAN based Ethernet and Fast Ethernet adapters including a large number of Compaq PCI Ethernet adapters. Also supported are:
- Olicom OC-2135/2138 10/100 TX UTP adapter
- Olicom OC-2325/OC-2326 10/100 TX UTP adapter
- Racore 8148 10baseT/100baseTX/100baseFX adapter
- Racore 8165 10/100baseTX adapter

The **tl** driver also supports the built-in Ethernet adapters of various Compaq Prosignia servers and Compaq Deskpro desktop machines including:
- Compaq Netelligent 10
- Compaq Netelligent 10 T PCI UTP/Coax
- Compaq Netelligent 10/100
- Compaq Netelligent 10/100 Dual-Port
- Compaq Netelligent 10/100 Proliant
- Compaq Netelligent 10/100 TX Embedded UTP
- Compaq Netelligent 10/100 TX UTP
- Compaq NetFlex 3P
- Compaq NetFlex 3P Integrated
- Compaq NetFlex 3P w/BNC

The **dc** driver provides support for the following chipsets:
- DEC/Intel 21143
- ADMtek AL981 Comet, AN985 Centaur, ADM9511 Centaur II and ADM9513 Centaur II
- ASIX Electronics AX88140A and AX88141
- Conexant LANfinity RS7112 (miniPCI)
- Davicom DM9009, DM9100, DM9102 and DM9102A
- Lite-On 82c168 and 82c169 PNIC
- Lite-On/Macronix 82c115 PNIC II
- Macronix 98713, 98713A, 98715, 98715A, 98715AEC-C, 98725, 98727 and 98732
- Xircom X3201 (cardbus only)
The following NICs are known to work with the dc driver at this time:

3Com OfficeConnect 10/100B (ADMtekJ AN985 Centaur-P)
Abocom FE2500
Accton EN1217 (98715A)
Accton EN2242 MiniPCI
Adico AE310TX (98715A)
Alfa Inc GFC2204 (ASIX AX88140A)
Built in 10Mbps only Ethernet on Compaq Presario 7900 series desktops (21143, non-MII)
Built in DE500-BA on DEC Alpha workstations (21143, non-MII)
Built in Sun DMFE 10/100 Mbps Ethernet on Sun Netra X1 and Sun Fire V100 (DM9102A, MII)
Built in Ethernet on LinkSys EtherFast 10/100 Instant GigaDrive (DM9102, MII)
CNet Pro110B (ASIX AX88140A)
CNet Pro120A (98715A or 98713A) and CNet Pro120B (98715)
Compex RL100-TX (98713 or 98713A)
D-Link DFE-570TX (21143, MII, quad port)
Digital DE500-BA 10/100 (21143, non-MII)
ELECOM Lanced LD-CBL/TXA (ADMtek AN985)
Hawking CB102 CardBus
IBM EtherJet Cardbus Adapter
Intel PRO/100 Mobile Cardbus (versions that use the X3201 chipset)
Jaton XpressNet (Davicom DM9102)
Kingston KNE100TX (21143, MII)
Kingston KNE110TX (PNIC 82c169)
LinkSys LNE100TX (PNIC 82c168, 82c169)
LinkSys LNE100TX v2.0 (PNIC II 82c115)
LinkSys LNE100TX v4.0/4.1 (ADMtek AN985 Centaur-P)
Matrox FastNIC 10/100 (PNIC 82c168, 82c169)
Melco LGY-PCI-TXL
Microsoft MN-120 10/100 CardBus (ADMTek Centaur-C)
Microsoft MN-130 10/100 PCI (ADMTek Centaur-P)
NDC SOHOware SFA110A (98713A)
NDC SOHOware SFA110A Rev B4 (98715AEC-C)
NetGear FA310-TX Rev. D1, D2 or D3 (PNIC 82c169)
Netgear FA511
PlaneX FNW-3602-T (ADMtek AN985)
SMC EZ Card 10/100 1233A-TX (ADMtek AN985)
SVEC PN102-TX (98713)
Xircom Cardbus Realport
Xircom Cardbus Ethernet 10/100
Xircom Cardbus Ethernet II 10/100

Adapters supported by the aue driver include:

Abocom UFE1000, DSB650TX_NA
Accton USB320-EC, SpeedStream
ADMtek AN986, AN8511
Billionton USB100, USB100LP, USB100EL, USBE100

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Corega Ether FEther USB-T, FEther USB-TX, FEther USB-TXS
D-Link DSB-650, DSB-650TX, DSB-650TX-PNA
Elecom LD-USBL/TX
Elsa Microlink USB2Ethernet
HP hn210e
I-O Data USB ETTX
Kingston KNU101TX
LinkSys USB10T adapters that contain the AN986 Pegasus chipset, USB10TA, USB10TX, USB100TX, USB100H1
MELCO LUA-TX, LUA2-TX
Planex UE-200TX
Sandberg USB to Network Link (model number 133-06)
Siemens Speedstream
SmartBridges smartNIC
SMC 2202USB
SOHOware NUB100

The cue driver supports CATC USB-EL1210A based USB Ethernet adapters including:
  Belkin F5U011/F5U111
  CATC Netmate
  CATC Netmate II
  SmartBridges SmartLink

The kue driver supports Kawasaki LSI KL5KLUSB101B based USB Ethernet adapters including:
  3Com 3c19250
  3Com 3c460 HomeConnect Ethernet USB Adapter
  ADS Technologies USB-10BT
  AOX USB101
  ATen UC10T
  Abocom URE 450
  Corega USB-T
  D-Link DSB-650C
  Entrega NET-USB-E45, NET-HUB-3U1E
  I/O Data USB ETT
  Kawasaki DU-H3E
  LinkSys USB10T
  Netgear EA101
  Peracom USB Ethernet Adapter
  SMC 2102USB, 2104USB

The axe driver supports ASIX Electronics AX88172 based USB Ethernet adapters including:
  Buffalo (Melco Inc.) LUA-U2-KTX
  D-Link DUBE100
  LinkSys USB200M
  Netgear FA120
  System TALKS Inc. SGC-X2UL
The **rue** driver supports RealTek RTL8150 based USB Ethernet adapters including:
- Buffalo (Melco Inc.) LUA-KTX
- Green House GH-USB100B
- LinkSys USB100M
- Billionton 10/100 FastEthernet USBKR2

The **udav** driver supports the following adapters:
- Corega FEther USB-TXC

Adapters supported by the **de** driver include:
- Adaptec ANA-6944/TX
- Cogent EM100FX and EM440TX
- Corega FastEther PCI-TX
- D-Link DFE-500TX
- DEC DE435, DE425, DEC DE450, and DEC DE500
- ELECOM LD-PCI12T, LD-PCITS
- I-O DATA LA2/T-PCI
- SMC Etherpower 8432, 9332 and 9334
- ZNYX ZX3xx

Controllers and cards supported by the **fe** driver include:
- Allied Telesis RE1000, RE1000Plus, ME1500 (110-pin)
- CONTEC C-NET(98)P2, C-NET (9N)E (110-pin), C-NET(9N)C (ExtCard)
- CONTEC C-NET(PC)C PCMCIA Ethernet
- Eiger Labs EPX-10BT
- Fujitsu FMV-J182, FMV-J182A
- Fujitsu MB86960A, MB86965A
- Fujitsu MBH10303, MBH10302 Ethernet PCMCIA
- Fujitsu Towa LA501 Ethernet
- HITACHI HT-4840-11
- NextCom J Link NC5310
- RATOCL REX-5588, REX-9822, REX-4886, and REX-R280
- RATOCL REX-9880/9881/9882/9883
- TDK LAC-98012, LAC-98013, LAC-98025, LAC-9N011 (110-pin)
- TDK LAK-CD021, LAK-CD021A, LAK-CD021BX
- Ungermann-Bass Access/PC N98C+(PC85152, PC85142), Access/NOTE N98(PC86132) (110-pin)

Adapters supported by the **fxp** driver include:
- Intel EtherExpress PRO/10
- Intel InBusiness 10/100
- Intel PRO/100B / EtherExpressPRO/100 B PCI Adapter *
- Intel PRO/100+ Management Adapter
- Intel PRO/100 VE Desktop Adapter
- Intel PRO/100 M Desktop Adapter
- Intel PRO/100 S Desktop, Server and Dual-Port Server Adapters
- Contec C-NET(PI)-100TX (PC-98)
- NEC PC-9821Ra20, Rx20, Xv13, Xv20 internal 100Base-TX (PC-98)
- NEC PC-9821X-B06 (PC-98)
Many on-board network interfaces on Intel motherboards

The **ex** driver supports the following Ethernet adapters:
- Intel EtherExpress Pro/10
- Intel EtherExpress Pro/10+
- The Olicom OC2220

The **ie** driver provides supports the following 8 and 16bit ISA Ethernet cards that are based on the Intel i82586 chip:
- 3COM 3C507
- AT&T EN100
- AT&T Starlan 10
- AT&T Starlan Fiber
- Intel EtherExpress 16
- RACAL Interlan N15210

The **ep** driver supports Ethernet adapters based on the 3Com 3C5x9 Etherlink III Parallel Tasking chipset, including:
- 3Com 3C1 CF
- 3Com 3C509-TP, 3C509-BNC, 3C509-Combo, 3C509-TPO, 3C509-TPC ISA
- 3Com 3C509B-TP, 3C509B-BNC, 3C509B-Combo, 3C509B-TPO, 3C509B-TPC ISA
- 3Com 3C529, 3C529-TP MCA
- 3Com 3C562/3C563 PCMCIA
- 3Com 3C569B-J-TPO, 3C569B-J-COMBO CBUS
- 3Com 3C574-TX, 3CCFE574BT, 3CXFE574BT, 3C3FE574BT PCMCIA
- 3Com 3C579-TP, 3C579-BNC EISA
- 3Com 3C589, 3C589B, 3C589C, 3C589D, 3CXE589DT PCMCIA
- 3Com 3CCFEM556B, 3CCFEM556BI PCMCIA
- 3Com 3CXE589EC, 3CCE589EC, 3CXE589ET, 3CCE589ET PCMCIA
- 3Com Megahertz 3CCEM556, 3CXEM556, 3CCEM556B, 3CXEM556B PCMCIA
- 3Com OfficeConnect 3CXSH572BT, 3CCSH572BT PCMCIA
- Farallon EtherMac PCMCIA

The **el** driver supports the 3Com 3c501 8bit ISA Ethernet card.

The **xl** driver supports the following hardware:
- 3Com 3c900-TPO *
- 3Com 3c900-COMBO *
- 3Com 3c905-TX *
- 3Com 3c905-T4 *
- 3Com 3c900B-TPO *
- 3Com 3c900B-TPC *
- 3Com 3c900B-FL *
- 3Com 3c900B-COMBO *
- 3Com 3c905B-T4 *
- 3Com 3c905B-TX *
- 3Com 3c905B-FX *
- 3Com 3c905B-COMBO *
- 3Com 3c905C-TX *
- 3Com 3c980, 3c980B, and 3c980C server adapters
3Com 3cSOHO100-TX OfficeConnect adapters
3Com 3c450 HomeConnect adapters
3Com 3c555, 3c556 and 3c556B mini-PCI adapters
3Com 3C3SH573BT, 3C575TX, 3CCFE575BT, 3CXFE575BT, 3CCFE575CT, 3CXFE575CT, 3CCFEM656, 3CCFEM656B, and 3CCFEM656C, 3CXFEM656, 3CXFEM656B, and 3CXFEM656C
CardBus adapters
3Com 3c905-TX, 3c905B-TX 3c905C-TX, and 3c920B-EMB embedded adapters
Both the 3C656 family of CardBus cards and the 3C556 family of MiniPCI cards have a built-in proprietary modem. Neither the xl driver nor any other driver supports this modem.

The **vx** driver supports the following cards:
- 3Com 3c590 EtherLink III PCI *
- 3Com 3c592 EtherLink III EISA
- 3Com 3c595 Fast EtherLink III PCI in 10 Mbps mode *
- 3Com 3c597 Fast EtherLink III EISA in 10 Mbps mode
Crystal Semiconductor CS89x0-based NICs (cs driver)

The **sn** driver supports SMC9xxx based ISA and PCMCIA cards including:
- 3Com Megahertz X-Jack Ethernet PC-Card CC-10BT

The **xe** driver supports the following cards:
- Xircom CreditCard Ethernet (PS-CE2-10)
- Xircom CreditCard Ethernet + Modem 28 (PS-CEM-28)
- Xircom CreditCard Ethernet + Modem 33 (CEM33)
- Xircom CreditCard 10/100 (CE3, CE3B)
- Xircom CreditCard Ethernet 10/100 + Modem 56 (CEM56)
- Xircom RealPort Ethernet 10 (RE10)
- Xircom RealPort Ethernet 10/100 (RE100)
- Xircom RealPort Ethernet 10/100 + Modem 56 (REM56, REM56G)
- Accton Fast EtherCard-16 (EN2226)
- Compaq Netelligent 10/100 PC Card (CPQ-10/100)
- Intel EtherExpress Pro/100 PC Card Mobile Adapter 16 (Pro/100 M16A)
Other similar devices using the same hardware may also be supported.

Adapters supported by the **lge** driver include:
- SMC TigerCard 1000 (SMC9462SX) *
- D-Link DGE-500SX *

The **txp** driver supports the following cards:
- 3Com 3CR990-TX-95 *
- 3Com 3CR990-TX-97 *
- 3Com 3cR990B-TXM *
- 3Com 3CR990SVR95 *
- 3Com 3CR990SVR97 *
- 3Com 3cR990B-SRV *

The **bge** driver provides support for various NICs based on the Broadcom BCM570x family of Gigabit Ethernet controller chips, including the following:
- 3Com 3c996-T (10/100/1000baseTX) *
- Dell PowerEdge 1750 integrated BCM5704C NIC (10/100/1000baseTX) *
Dell PowerEdge 2550 integrated BCM5700 NIC (10/100/1000baseTX) *
Dell PowerEdge 2650 integrated BCM5703 NIC (10/100/1000baseTX) *
IBM x235 server integrated BCM5703x NIC (10/100/1000baseTX) *
HP ProLiant NC7760 embedded Gigabit NIC (10/100/1000baseTX) *
HP ProLiant NC7770 PCI-X Gigabit NIC (10/100/1000baseTX) *
HP ProLiant NC7781 embedded PCI-X Gigabit NIC (10/100/1000baseTX) *
Netgear GA302T (10/100/1000baseTX) *
SysKonnect SK-9D21 (10/100/1000baseTX) *
SysKonnect SK-9D41 (1000baseSX) *

The **em** driver supports Gigabit Ethernet adapters based on the Intel 82540, 82541PI, 82542, 82543, 82544, 82546, 82546EB and 82547 controller chips:
- Intel PRO/1000 CT Network Connection (82547)
- Intel PRO/1000 F Server Adapter (82543)
- Intel PRO/1000 Gigabit Server Adapter (82542)*
- Intel PRO/1000 GT Desktop Adapter (82541PI)
- Intel PRO/1000 MF Dual Port Server Adapter (82546)
- Intel PRO/1000 MF Server Adapter (82545)
- Intel PRO/1000 MF Server Adapter (LX) (82545)
- Intel PRO/1000 MT Desktop Adapter (82540)
- Intel PRO/1000 MT Desktop Adapter (82541)
- Intel PRO/1000 MT Dual Port Server Adapter (82546)
- Intel PRO/1000 MT Quad Port Server Adapter (82546EB)
- Intel PRO/1000 MT Server Adapter (82545)
- Intel PRO/1000 T Desktop Adapter (82544)
- Intel PRO/1000 T Server Adapter (82543)
- Intel PRO/1000 XF Server Adapter (82544)
- Intel PRO/1000 XT Server Adapter (82544)

The **gx** driver supports Gigabit Ethernet adapters based on the Intel 82542 and 82543 controller chips:
- Intel PRO/1000 Gigabit Server Adapter (82542)
- Intel PRO/1000 F Server Adapter (82543)
- Intel PRO/1000 T Server Adapter (82543)

The **hme** driver supports the on-board Ethernet interfaces of many Sun UltraSPARC workstation and server models. Cards supported by the **hme** driver include:
- Sun PCI SunSwift Adapter
- Sun SBus SunSwift Adapter \``( hme\" and \``SUNW,hme\"")
- Sun PCI Sun100BaseT Adapter 2.0
- Sun SBus Sun100BaseT 2.0
- Sun PCI Quad FastEthernet Controller
- Sun SBus Quad FastEthernet Controller

The **my** driver provides support for various NICs based on the Myson chipset. Supported models include:
- Myson MTD800 PCI Fast Ethernet chip
- Myson MTD803 PCI Fast Ethernet chip
- Myson MTD89X PCI Gigabit Ethernet chip
Broadcom BCM4401 based Fast Ethernet adapters (bfe driver) *

The re driver supports RealTek RTL8139C+, RTL8169, RTL8169S and RTL8110S based Fast Ethernet and Gigabit Ethernet adapters including:

- Alloy Computer Products EtherGOLD 1439E 10/100 (8139C+) *
- Compaq Evo N1015v Integrated Ethernet (8139C+) *
- Corega CG-LAPCIGT Gigabit Ethernet (8169S) *
- Gigabyte 7N400 Pro2 Integrated Gigabit Ethernet (8110S) *
- PLANEX COMMUNICATIONS Inc. GN-1200TC (8169S) *
- Xterasys XN-152 10/100/1000 NIC (8169) *

The ixgb driver supports the following cards:

- Intel PRO/10GbE LR Server Adapter *
- Intel PRO/10GbE SR Server Adapter *
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