User's Manual



R-Studio for Linux



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I Introduction to R-Studio for Linux

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 <u>Ext2/3/4FS</u> and XFS (Linux), FAT12/16/32, exFAT, NTFS (created or updated by Windows 2000/XP/2003/? Vista/2008/7/8/8.1/70), HFSHFS+ and APFS (Macintosh), Little and Big Endian variants of UFS1/UFS2 (FreeBSD/? OpenBSD/NetBSD/Solaris) 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 for Linux Features

System Requirements

Contact Information and Technical Support

Data Recovery Using R-Studio for Linux

Basic File Recovery

Advanced Data Recovery

Mass File Recovery

Volume Sets and RAIDs

Data Recovery over Network

R-Studio Technician/T80+

Text/Bexadecimal editor

Technical Information and Troubleshooting

Working with the Third-Party Hardware

R-Studio Emergency

R-Studio Agent Emergency

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1.1 R-Studio for Linux Features

R-Studio is a family of file restoring utilities. It recovers files both on local disks and on disks on remote computers over network, even if their <u>partition</u> structures are damaged. A unique *IntelligentScan* technology and flexible parameter settings give you real control over the fastest data recovery ever seen.

R-Studio for Linux features:

- Host OS: Linux, kernel 2.6 and above.
- Automatic check for updates.
- Remotely recovers data over network. Data can be recovered on network computers running Windows,
 Mac, and Linux and some other UNIX OS.
- Supported file systems:

Windows: FAT12/16/32, exFAT, NTFS, NTFS5, ReFS/ReFS2+ file (Resilient File System); ReFS for Windows Server 2019 (including deduplication).

macOS: HFS, HFS+, HFSX, APFS, FAT/exFAT;

Linux and UNIX: Ext2/3/4FS and XFS (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/T80+).

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 for Linux** is able to read existing files from HFS, HFS+, and HFSX disks.

- Support for known file types. R-Studio for Linux 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.
- <u>Scan process</u> visualization. While scanning an object, **R-Studio for Linux** 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 for Linux**, manually edited, and then loaded back. Files from such lists will be automatically marked for recovery.
- APM, Basic and GPT support. R-Studio for Linux supports all three partition schemes used to define the low-level organization of data on disks formatted for use with Macintosh computers.
- Support for Linux mdadm Volumes
- Support for Linux LVM/LVM2
- 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 <u>Windows Storage Spaces</u>, created by Windows 8/8.1 and Windows 10/Threshold 2/Anniversary/Fall Creators updates.
- Support for <u>Apple software RAIDs</u>
- Support for <u>Apple CoreStorage/FileVault/Fusion Drive Volumes</u>
- Support for Intel Software RAID.
- Hardware RAID, volume set, and stripe set support.
- RAID consistency check (check for valid data parity values).
- Automatic RAID parameter recognition.
- Creates image files for an entire drive, logical disk, or its part. Such image files can be processed like regular drives. In addition to simple exact object copies (Plain images) and R-Drive Image compatible images. It can create other disk image and virtual disk formats, together with opening several file formats "read-only". You may read more about those formats and their properties on the Supported Virtual Disk and Disk Image Formats page. Images may be saved either on the local or remote computer. Image creation can be stopped and then resumed. R-Studio for Linux can scan objects while creating their images. R-Studio Technician/T80+ supports multi-pass and runtime imaging. Images can be mounted in the operating system as devices which makes their content accessible to any program including any other data recovery software.
- 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, including Windows Server 2022.
- 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, XFS, and UFS file systems.
- Support for compressed files on the HFS+ file system.
- Recognizes localized names.
- Recovered files can be saved on any (including network) disks visible to the host operating system.
- A hexadecimal disk and file viewer/editor supporting NTFS file non-resident attribute editing. Data alteration is available on the **Technician/T80+** and **Corporate** versions only..
- Patterns (or templates) in the hexadecimal editor allowing for parsing the data according to specific data structure. Such patterns may be custom-created.
- File preview. Most of the file types can be previewed to estimate recovery chances.
- Enhanced remote host scanning procedure. In the new **R-Studio for Linux** 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.
- Support for <u>S.M.A.R.T.</u> (Self-Monitoring, Analysis and Reporting Technology) attribute monitoring.
- **R-Studio Emergency***. The **R-Studio for Linux Emergency** version starts from a floppy or compact disk when it is necessary to recover data on a computer, on which OS cannot start up because its system files are corrupted or deleted.

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

R-Studio features available only in the Technician/T80+ versions:

- Magnetic tape devices file system: UStar/Tar/CPIO/Pax.
- <u>USB Activation</u> (Technician only)
- Show Files (Advanced) to process problematic hard drives with minimum disk access.
- Multitasking. Several data recovery tasks can be run simultaneously.
- Additional Recovery Options
- <u>Hidden Devices</u>. Some unnecessary devices can be hidden in the Main panel.
- Extended File Information
- Symbolic Link Recovery Options
- <u>Drive Copy Wizard</u> to copy any object in the Drives panel to any other object. In addition to byte to byte copy of any object visible in the Drives panel, smart copy of partitions and drives is available.
- File Maps
- I/O Monitor and Sector Map files.
- Multi-pass and Runtime imaging
- Reverse RAIDs: A technique that decomposes real drive 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 devices.

- Support for third-party hardware.
- Forensic mode.
- File recovery over Internet.

R-Studio for Linux recovers files:

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

R-Studio for Linux 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

- An Intel-compatible x86 or 64-bit platform with 256 MB RAM, a mouse, and enough disk space for recovered files, image files, etc.
- Linux: Fedora 12+, Ubuntu/Kubuntu 10.4+, Debian 4.0+ or any kernel 2.6+ Linux distribution capable of installing .rpm or .deb packages.
- Any Window manager.
- X.Org X server 1.7.6+ installed.
- Root privileges to install and run the program.
- A network connection for data recovering over network.

1.3 Contact Information and Technical Support

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

Product Site: 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 for Linux 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

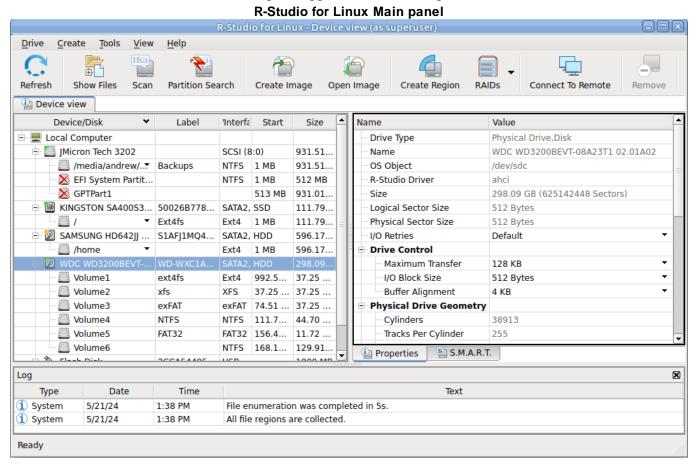
Send your support request to: http://www.r-tt.com/SupportRequest.shtml

File Recovery FAQ: http://www.r-tt.com/File_Recovery_FAQ.shtml

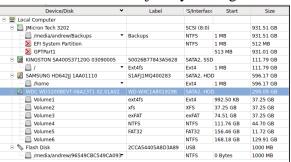
R-TT Forum: http://forum.r-tt.com

1.4 R-Studio for Linux Main Panel

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



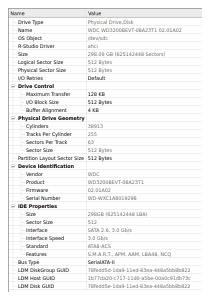
Drives panel:
You can select an object by clicking on it.



Properties tab:

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

Depending on the selected object, information on this Properties tab may vary.



The Properties tab names and values are described in detail on the <u>Properties tab</u> topic.

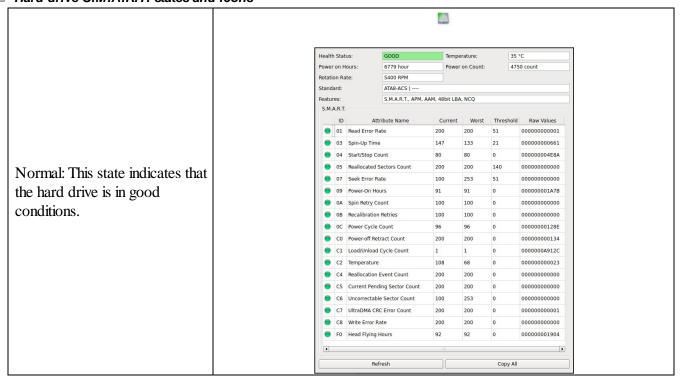
Log panel



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

R-Studio for Linux shows hard drive **S.M.A.R.T.** states using their icons. You may copy all S.M.A.R.T. attributes and paste them into a text editor.

■ Hard drive S.M.A.R.T. states and icons



Health Status: Temperature: Power on Hours: 2135 hour Power on Count: 2384 count Rotation Rate: UNKNOWN Standard: ATA/ATAPI-7 | ATA8-ACS version 3b S.M.A.R.T., APM, AAM, 48bit LBA, NCQ Features: S.M.A.R.T. ID Attribute Name Current Worst Threshold Raw Values 51 0 4 Start/Stop Count 98 98 0
0 5 Reallocated Sectors Count 99 99 10
0 7 Seek Error Rate 100 100 51
0 8 Seek Time Performance 100 100 15 A86000000008A Warning: This state indicates 000000000011 000000000000 that some small problems with 000000000000 the disk are possible in the O9 Power-On Hours
OA Spin Retry Count 100 100 0 100 100 51 000000000000 future, you may work with it but OB Recalibration Retries 100 100 000000000000 with cautions and regular check OC Power Cycle Count 98 98 0
 OD Soft Read Error Rate stab 100 100 0 000000000950 000000000000 of these parameters. Disk B8 End-to-End Error
 B8
 End-to-End Error
 100
 100

 BB
 Reported Uncorrectable Errors
 100
 100
 imaging is strongly 99 000000000000 000000000000 recommended. 100 100 BC Command Timeout 000000000000 BE Airflow Temperature 73 59 000018180018 C2 Temperature 100 100 0 C3 Hardware ECC recovered 000000005077 C4 Reallocation Event Count 000000000000 C5 Current Pending Sector Count 100 100 000000000000 C6 Uncorrectable Sector Count 100 100 0000000000000 C8 Write Error Rate 100 99 0 00000000000F O Soft Read Error Rate 000000000000 Copy All Health Status: BA Temperature: 32 °C Power on Count: 107 count Power on Hours: 2 hour Rotation Rate: 5400 RPM Standard: ATA8-ACS | ATA8-ACS version 4 S.M.A.R.T., APM, 48bit LBA, NCO Critical: This state indicates that S.M.A.R.T. | ID | Attribute Name | Current | Worst | Threshold | Raw Values | the hard drive conditions are ● 01 Read Error Rate 83 68 6 ● 03 Spin-Up Time 99 99 0 O3 Spin-Up Time critical and chances of O4 Start/Stop Count 100 100 20 0000000002D3 05 Seallocated Sectors Count 100 100 20

05 Reallocated Sectors Count 35 35 36

07 Seek Fror Rate 75 60 30

09 Power-On Hours 100 97 0 hardware failure are great. The 000000000547 0000020EE607 best recommendation for this 000000000000 100 97 case is to stop working with the OA Spin Retry Count 000000000000 disk and bring it to professional BB Reported Uncorrectable Errors 1 data recovery specialists. You 000000003F10 BC Command Timeout 1 0006000600BF may though continue to work 100 100 68 59 BD High Fly Writes 000000000000 BE Airflow Temperature 0000201F0020 with the disk at your own risk, but disk imaging is very strongly O Power-off Retract Count 100 100 0 000000000097 recommended. C2 Temperature 000700000020 C3 Hardware ECC recovered 00000997EB10 100 O C5 Current Pending Sector Count 100 C6 Uncorrectable Sector Count 100 000000000233 C7 UltraDMA CRC Error Count 200 200 0 000000000000 FE Free Fall Protection 000000000000 100 100 Refresh Copy All

When a hard drive is selected on the **R-Studio for Linux** 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.

<u>S.M.A.R.T.</u> (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 for Linux** 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.

■ To enable/disable:

Toolbar	Select/clear Toolbar on the View menu
Status bar	Select/clear Status bar on the View menu
Drive pane	Select/clear Device View on the View menu
Properties pane	Select/clear Properties View on the View menu
Log panel	Select/clear Event Log on the View menu
If you have several tabs in the right pane, you may easily switch to any of the tab by selecting on the View	
menu	
Properties Tab	to view the Properties tab
Scan Information Tab	to view the Scan Information Tab tab
Parents Tab	to view the Parents tab
Properties	Select data types in which the data will be represented



Connect

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.



Partition Search

Click this button to start <u>fast searching for lost and deleted</u> partitonsi.



Show 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.



Remove

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

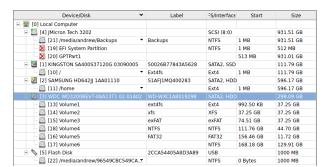
The button may change its appearance and title depending on the context.

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:

Show Physical Drives Indexes
Show All Objects Indexes

to display the indexes only for hard drives to display the indexes for all objects on the Drives panel



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 for Linux** 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 <u>Settings</u> dialog box.

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

R-Studio for Linux has two operation modes:

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

In this mode, **R-Studio for Linux** analyzes MFTs on NTFS partitions, FATs on <u>FAT</u> partitions, and SuperBlocks on Ext2/3/4FS 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 <u>file masks</u> and <u>regular expressions</u>. Multiple files in different folders can be found and recovered in one recover session.

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

File content may be previewed before recovery.

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

Disk scan, searching for partitions.

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

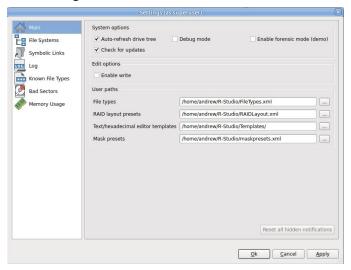
A disk can be scanned through several successive scans, each with its own parameters. **R-Studio for Linux** accumulates the information from successive scans and keeps track of changes in the information obtained from different scans. The information obtained from the disc scan can be stored in a file.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

1.5 R-Studio for Linux Settings

You may specify some global setting for **R-Studio for Linux** on the Settings dialog box. You may reach it by selecting **Settings** on the **Tools** menu.

Main

Main dialog box



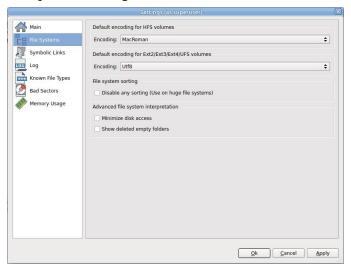
■ Main settings

System Options		
Auto-refresh Drive Tree	If this box is selected, R-Studio for Linux automatically refreshes the list of connected drives. You may disable it if R-Studio for Linux experiences problems with connected devices.	
Debug Mode	If this check box is selected, R-Studio for Linux displays an additional command Create FS Snapshot on the shortcut menu for an object with a <u>file system</u> . 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 for Linux technical support to identify the problem. This option greatly slows R-Studio for Linux .	
Enable forensic mode (demo)	If this check box is selected, R-Studio for Linux turns on the <u>Forensic mode</u> in demo mode.	
Check for update	If this box is selected, R-Studio for Linux will automatically check for updates.	
Use dark mode	If this box is selected, R-Studio for Linux will change to its dark mode.	
Edit options		
Enable Write	If this check box is selected, R-Studio Technician/T80 + enables you to write any changes made in the <u>Text/Rexadecimal editor</u> . It enables <u>wiping objects</u> in R-Studio and R-Studio Corporate .	
Max changes buffer size	Maximum amount of data stored for the Undo command in the <u>Text/?</u> hexadecimal editor . R-Studio Technician(/T80+)	
User paths		
File types	Specifies a file name and path to the file where the descriptions of user's known file types are stored. You need to re-start R-Studio for	

	Linux or click the Reload User's File Types button on the Known File Types tab for the new file to take effect.
RAID layout presets	Specifies a file name and path to the file where the descriptions of user's RAID layouts are stored
Text/Mexadecimal editor templates	Specifies the path for <u>pattern description files</u> for <u>Text/Bexadecimal</u> <u>editor</u> .
Mask presets	Specifies a file name and path to the file with file mask presets.
Reset all hidden notifications	This button enables all previously disabled notification and warning messages.

File Systems

File Systems dialog box



■ File Systems

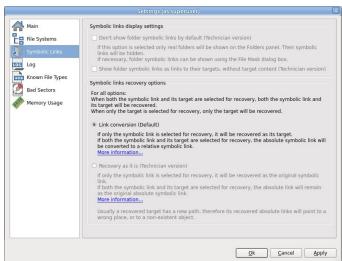
Default encoding for HFS volumes	
Encoding	Select the national encoding for the HFS partitions.
Default encoding for Ext2/Ext3/? Ext4/ <u>DFS</u> volumes	
Encoding	Select the national encoding for the Ext2, Ext3, Ext4, and UFS partitions.
File system sorting	
Disable any sorting	Select this option if the number of files on the drive is so large that R-Studio sorts files in selected folders for too long time.
Advanced file system interpretation	ו
Minimize drive access	Select this option if a lot of <u>bad sectors</u> are on the drive. R-Studio will reduce access to internal files in the file system to speed up the interpretation of file system data.
Show deleted empty folders	Select this option if you want to view empty deleted folders.

Symbolic Links

All settings are available in the Technician/T80+ 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 dialog box



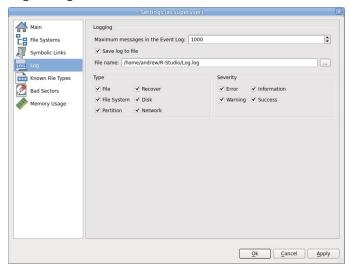
Symbolic Links

Link conversion (Default)	
Both an object and its symbolic link are selected for recovery:	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 C:\ProgramData\Documents is a symbolic link to C:\Users\Public\Documents, it will be converted to a symbolic link to\Users\Public\Documents. Therefore, the symbolic link will point to its object regardless of the place to which the object has been recovered.
Only an object is selected for recovery:	Only the selected object will be recovered.
Only a symbolic link is selected for recovery:	The selected symbolic link will be recovered as a real object.

Log

Log dialog box



■ Log options

Eug options	
Logging	
Maximum messages in the Event Log	Specifies the maximum number of messages R-Studio for Linux will keep in the event log
Save log to file	If this check box is selected, R-Studio for Linux writes its log into a log file specified in the File name field.
File name	Specifies the file name in which the log will be saved.
Туре	
File	If this check box is selected, R-Studio for Linux logs all events with recovered files.
File System	If this check box is selected, R-Studio for Linux logs all events with the file system.
Partition	If this check box selected, R-Studio for Linux logs all events with partitions.
Recover	If this check box is selected, R-Studio for Linux logs all events with the recovering processes.
Disk	If this check box is selected, R-Studio for Linux logs all events with disks.
Network	If this check box is selected, R-Studio for Linux logs all events with network operation.

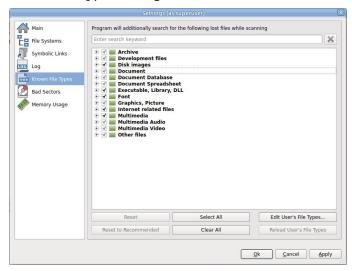
Severity	
Error	If this check box is selected, R-Studio for Linux adds error messages into its log.
Warning	If this check box is selected, R-Studio for Linux adds warning messages into its log.
Information	If this check box is selected, R-Studio for Linux adds information messages into its
	log.
Success	If this check box is selected, R-Studio for Linux adds success messages into its log.

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

Note: If in the <u>Recover</u> dialog box the Condense successful restoration events check box is selected, the Log will display only Error, Warning, and Information event messages.

Known File Types

Known File Types dialog box



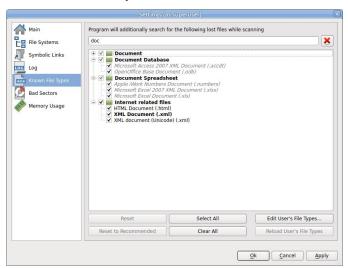
You may specify which **Known File Types** will be enabled/disabled by default. You may also specify know file types to search for during a **specific scan** session on the **Scan** dialog box.

■ Known File Types

Reset	Click this button to reset the settings to the previous state. Active until the Apply button is clicked.
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.
Reload User's File Types	Click this button to apply new file types after the user's file types file has been changes from the Main tab.
Edit User's File Types	Click this button to add a new customer's Known File Type, or to edit already existing ones. See the <u>Customizing File Types</u> help page for more details.
Reset to Recommended	Click this button to reset the settings to the default (Recommended) file set.

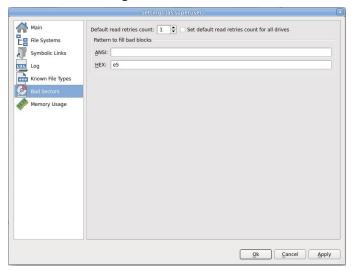
■ You may search for required file types if necessary

Search for the doc pattern



Bad Sectors

Bad Sectors dialog box



■ Bad Sectors settings

Default read retries count

Specifies a default value for I/O Tries, or how many times **R-Studio for Linux** will try to read a bad sector. You may specify this parameter for each drive separately on the <u>Properties</u> tab.

R-Studio treats bad sectors in the following way:

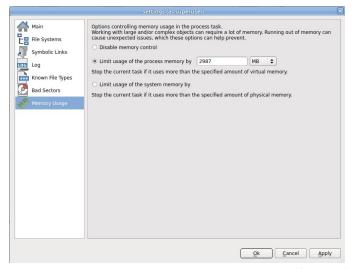
It reads a certain part of drive (predefined by Windows) and

- 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 for Linux reads again that part sector by sector, repeating the attempts the specified number of times. If R-Studio for Linux 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 drive read process. For example, if you set Default read retries count to 1, a bad sector will be read 2 times.
Set default read retries count for all drives	Select this option to set Default read retries count for all drives to this value.
Pattern to fill bad blocks	Specifies a default pattern R-Studio for Linux will use to fill bad sectors in files to recover, in <u>images</u> , or when showing data in the <u>Text/Rexadecimal viewer/editor</u> . You may specify the pattern either in the ANSI or Hex data format. Note: R-Studio for Linux will never ever try to write anything on the drive from which data is to recover or an image is to create.

Memory Usage

Memory Usage dialog box



These settings control how much memory **R-Studio for Linux** uses for its work. They help preventing **R-Studio for Linux** 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

Disable memory control	If this option is selected, the memory control is disabled.	
Limit usage of the process memory by	If this option is selected, R-Studio for Linux will automatically stop performing the task when the amount of used virtual memory reaches the specified value.	
Limit usage of the process memory by	If this option is selected, R-Studio for Linux will automatically stop performing the task when the amount of used physical memory reaches the specified value.	

You may see how much memory **R-Studio for Linux** actually uses on the <u>Memory Usage</u> dialog box.

II Data Recovery Using R-Studio for Linux

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 formatted partition

If the file system on such <u>logical disk</u> is damaged, the operating system sees that logical disk as a <u>partition</u> without a valid <u>file system</u>. Such partition should be previously <u>scanned</u>. Also, it should be scanned if you want to recover data on a previously deleted or re-<u>formatted</u> partition.

When the partition is scanned, a number of recognized partitions will appear. **R-Studio for Linux** shows them in different colors depending on which elements of the partition have been found.

	The state of the s	
Partition5	An existing logical disk or partition	
Recognized5	An existing logical disk or partition after disk scan	
Recognized7	A recognized partition. Both boot records and file entries are found for this partition	
Recognized6	A recognized partition. Only file entries are found for this partition	
Recognized16	A recognized partition. Only boot records are found for this partition	
Recognized5	A fast found partition	
≥ DeletedPart1	A deleted partition	
Empty Space17	Empty space on the object	
Raw Files	Files that have been found using scan for known file types.	

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

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 <u>preview</u> a couple of files from the recognized partition. If the files are seen correctly, this is the right partition.

- 3. Data recovery from a damaged system disk. The computer does not start up.
 - If this computer is on a network, create an **R-Studio Agent Emergency** startup disk for the computer, install **R-Studio for Linux** on another computer on the network, and recover data over network.
 - If this computer is stand-alone, create an **R-Studio Emergency** startup disk and use it to start up the computer and recover data. You may use external USB hard disks to store recovered files.

R-Studio for Linux Features

Contact Information and Technical Support

Basic File Recovery

Advanced Data Recovery

Mass File Recovery

Volume Sets and RAIDs

Data Recovery over Network

Text/Rexadecimal 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 <u>partition</u> visible to the operating system. In all other cases, <u>Advanced Data Recovery</u> is required.

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

- 1 Double-click a logical disk on the R-Studio for Linux's Drives panel to enumerate files on the disk
 - Other ways to enumerate files
 - Select the disk and click the Open Drive Files button,

or

• Right-click the selected disk and select Open Drive Files on the context menu,

or

• Select Open Drive Files on the Drive menu

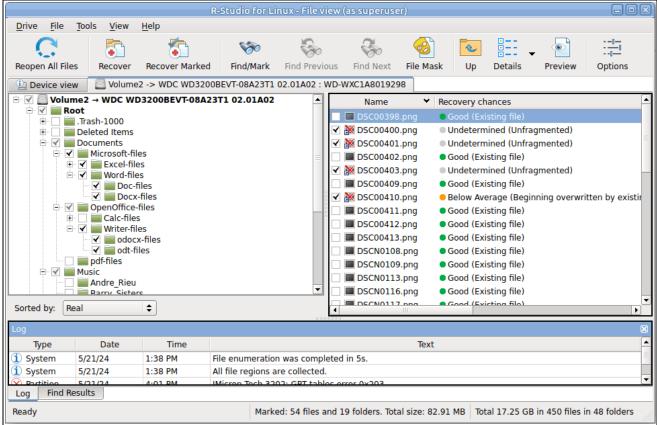
If you try to enumerate files on a hard drive or another object without a valid file system on it, a Double-click a logical disk... message will appear. Select a <u>logical disk</u> on the object or <u>scan</u> the object.

> R-Studio for Linux will change its panel showing the disk's folders/files structure

R-Studio for Linux analyzes data on the object and displays all files for which records have been found in the analyzed tables. If files have not been found, that means that their records have been deleted. To find such files, <u>Advanced Data Recovery</u> is required.

Please note that **R-Studio for Linux** shows only those files/folders that match a specified file mask.





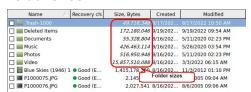
Panel view options

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

The Toolbar	Select/clear Toolbar on the View menu
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

R-Studio for Linux shows folder sizes in the right pane.

Folder sizes



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

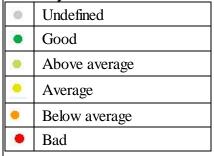
Files shown as icons/tiles



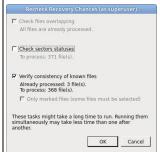
Recovery chances

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

Recovery chances



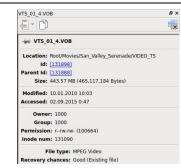
When **R-Studio** has enumerated files, those estimates may not be accurate and aren't available for most files. You may improved them by right-clicking any folder on the Content pane and selecting **Recheck Recovery Chances** on the context menu.



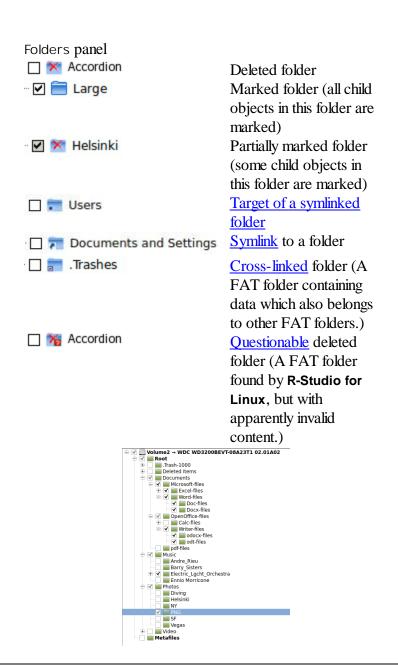
The best estimations are though after scanning the disk/partition.

File Information

You may view some information about a file. Right-click the file and select **Get Info** on the context menu. **File Information**

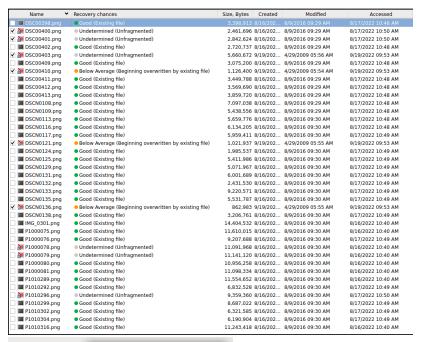


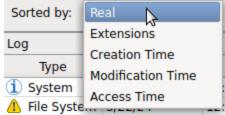
R-Studio Technician shows much more information about a file. See the <u>Information about a File</u> topic for more details.





Deleted file:
Marked deleted file
Selected deleted file
Target of a hard link
Hard link to a file





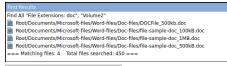
Sorted by:

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

Log				
Туре	Date	Time	Text	
i) System	5/21/24	1:38 PM	File enumeration was completed in 5s.	
i) System	5/21/24	1:38 PM	All file regions are collected.	
Partition	5/21/24	4:01 PM	JMicron Tech 3202: GPT tables error 0x203	
i) System	5/21/24	4:15 PM	File enumeration was completed in 1s.	
i) System	5/21/24	4:15 PM	All file regions are collected.	
i) System	5/21/24	4:16 PM	File enumeration was completed in 1s.	
i) System	5/21/24	4:16 PM	All file regions are collected.	
System	5/21/24	4:21 PM	No specified files found.	
i System	5/21/24	4:21 PM	Search has been finished.	

Find Results panel





Reopen All Files

Click this button to list files again.



Recover

Click this button to recover selected folders/files.



Recover Marked

Click this button to recover marked folders/files.



Find

Click this button to find or/and mark a particular file/folder.



Find Next

Click this button to find the next object specified in the Find/Mark dialog box



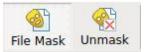
Find Previous

Click this button to find the previous object specified in the Find/Mark dialog box.



File Mask

Click this button to specify a file mask.



The **Unmask** button appears when a mask is applied.

Click this button to remove the applied mask.



Up

Click this button to move highlighting one folder up.



Options

Click this button to change Recovery Options.



Details

A button selecting how the files will be shown: Details, Small, Medium, Large Icons

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 <u>log filter</u>.

Note: Metafiles are the file system's internal files invisible to any user, or file system data, which **R-Studio for Linux** 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 temporally 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 for Linux** 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	To copy the file's Name, Size, Created, etc., depending on which column is	
Name):	selected	
Click Copy Path:	To copy the file path.	
Click Copy Selected	To copy all the columns of the selected file.	
Text:		

2 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 context 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 context menu. To unmark an object, click the box left to the object once more or select Unmark on the context menu. You may unmark all objects in the folder by selecting Unmark All on the Tools or context menu.

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

R-Studio for Linux can search for a particular file. Go to the <u>Searching for a File</u> topic for details. If you need to find and mark many files, go to the <u>Find and Mark Multiple Files</u> 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 for Linux** 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 <u>Searching for a File</u> 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 <u>Advanced Data Recovery</u> to find them.

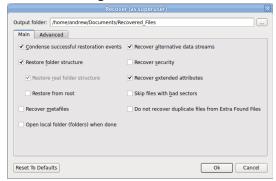
3 Click the Recover or Recover Marked button

■ Other ways to recover selected files

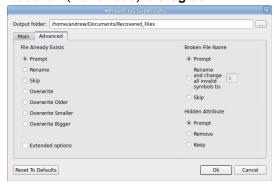
- Right-click the selected file/folder and select **Recover** or **Recover Marked** on the context menu, or
- Select Recover or Recover Marked on the File menu.

4 Specify recover options and output folder on the Recover dialog box and click the OK button

Recover dialog box



Recover (Advanced) dialog box



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

■ Recover options

Condense successful restoration events	If this check box is selected, R-Studio for Linux will display only error and warning messages in its Log
Restore folder structure	If this check box is selected, R-Studio for Linux recovers the entire path to the selected object.
Restore from root	If this check box is selected, R-Studio for Linux recovers the entire path to the selected object starting from the root folder of the disk.
Recover metafiles	If this check box is selected, R-Studio for Linux recovers disk metafiles. Metafiles are the file system's internal files invisible to any user, or file system data, which R-Studio for Linux represents as files. These files do not contain user data directly. Unless you want to scrutinize a disk file system, do not restore them.
Recover alternative data streams	If this check box is selected, R-Studio for Linux recovers alternative data streams for file systems that support them. Has no effect on <u>FAT</u> files. See <u>Extended Information Recovery</u> for the NTFS file system, and <u>Data Recovery on HFS/HFS+ File</u> <u>System</u> for the Mac computers.

Recover security	If this check box is selected, R-Studio for Linux recovers security attributes for NTFS files. Has no effect on FAT files. See Extended Information Recovery for details.
Recover extended attributes	If this check box is selected, R-Studio for Linux recovers extended (HPFS) file attributes.
Remove hidden attributes	If this check box is selected, R-Studio for Linux removes the Hidden and System attributes from recovered files enabling the user to see them in the Windows Explorer.
Recover real folders structure	Enabled when the files are sorted by their extensions or date. See Find and Mark Multiple Files for details. If this check box is selected, R-Studio for Linux recovers the real folders/files structure on the disk rather than that of sorted files.
Skip files with <u>bad sectors</u>	If this check box is selected, R-Studio for Linux 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 separately decide later what to do with those files. See Bad sectors for details. If this check box is cleared, R-Studio for Linux tries to read those sectors several times (specified on the Settings/Bad Sectors 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 Log.
Do not recover duplicate files from Extra Found Files	If this check box is selected, R-Studio for Linux does not recover files from Extra Found Files (raw files) that coincide with files recovered from the file system.
Ignore file mask	If this check box is selected, R-Studio for Linux recovers all content of a selected folder, ignoring a specified File Mask .
Open local folder (folders) when done	If this check box is selected, the folder with recovered files will be opened upon recovery completion.
Advanced	Specifies options for mass file recovery

If you want to recover multiple files at once, go to the Recover Multiple Files for more information

R-Studio Technician/T80+

It has additional Recovery options.

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 properties

File name	Shows the current incorrect file name.
New name	Field for a new file name.

Edit broken symbols only	If this check box is selected, only invalid symbols may be corrected
Change all invalid symbols to	If this check box is selected, all invalid symbols will be changed to the specified symbol
Buttons	
Rename	Click to resume file recovery
Rename All	Click to resume file recovery. All other files will be renamed according to the specified rule.
Skip	Click to skip this file
Skip All	Click to skip all files and stop file recovery

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.

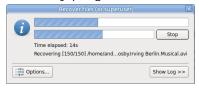
There is not enough space on the disk dialog box



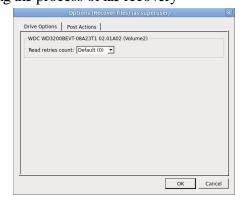
> R-Studio for Linux will recover the selected/marked files/folders to the specified folder and show the results in the Log pane

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

Recovery progress indicator



You may change some options during the process of file recovery in real time You may change some options during the process of file recovery



Only in the Technician version

Note: R-Studio for Linux recovers files from Ext2/3/4FS partitions, but can write them to any local or network disks. . **R-Studio for Linux** successfully recovers files from Ext2FS partitions except its security attributes. **R-Studio for Linux** recovers <u>symlinks</u> as files containing the path to files which <u>symlinks</u> point to.

See <u>Data Recovery on HFS/HFS+ file system</u> for details on recovering data from disks with the HFS/HFS+ file system

Opening several disk/partitions in one tab

Searching for a File

Finding Previous File Versions

Previewing Files

File Masks

Regular Expressions

Event Log

2.1.1 Opening several partitions in one tab

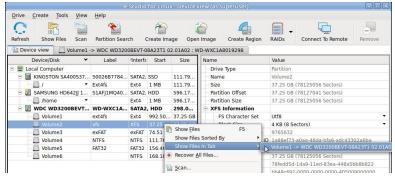
You may open several <u>partitions</u> in one tab. Then you may search for files and recover them from several disks/<u>partitions</u> at once. This is especially useful if files are to be recovered from several recognized partitions found on one real partition or a drive.

To open several partitions in one tab,

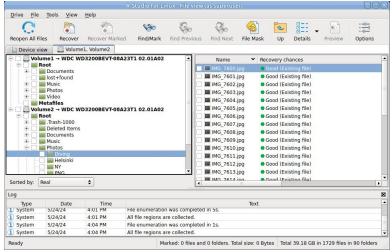
- 1 Open one partition in a usual way (double-click a logical disk, for example).
- 2 Right-click the next partition, select Show Files In Tab, and select the tab you want the partition appear in, or

drag the disk/partition from the Device view to the required tab.

Several partitions in one tab



> R-Studio for Linux will show files from several partitions in one tab Several partitions in one tab

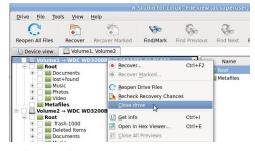


Now files may be searched for, marked for recovery, and recovered.

To remove a partition from the tab,

1 Right-click the required partition in the tab and select Close drive in the context menu.

Several partitions in one tab



> R-Studio for Linux remove the selected partition from the tab

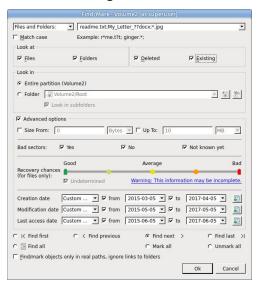
2.1.2 Searching for a File

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

To search for a file,

- 1 Click the Find button
 - Other ways to search for the file
 - Right-click a folder and select Find on the context menu,
 - 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 for Linux stores previously		
entered search str	rings.		
All Files and Folders	If this option is selected, R-Studio for Linux applies Advanced Options to all files.		
File Extensions	If this option is selected, R-Studio for Linux treats specified strings as file extensions		
Files and Folders	If this option is selected, R-Studio for Linux treats specified strings as file names. Use ? for one unspecified character and * for an unlimited number of them to specify file masks.		
Regular Expressions	If this option is selected, R-Studio for Linux treats specified strings as regular expressions		
File Id	Specifies File Id that R-Studio for Linux assigns to a file.		
Match case	If this check box is selected, R-Studio for Linux makes a case-sensitive search		
Look at			
Files	If this check box is selected, R-Studio for Linux includes files into a search.		
Folders	If this check box is selected, R-Studio for Linux includes folders into a search. Disables when the Mark/Unmark All option is selected.		
Deleted files	If this check box is selected, R-Studio for Linux makes a search among deleted files/? folders.		
Existing files	If this check box is selected, R-Studio for Linux makes a search among existing files/? folders.		
Look in	Specifies where R-Studio searches for, and marks, files. It can look for them on the Entire partition, or in/from a certain folder. If several <u>partitions</u> are opened in one tab, the places will be: All opened partitions, Selected partition, or in/from a certain folder. You may specify the starting folder for the search.		

	Recognized0 🔻
	Recognized0
	Recognized0/Root/Files to Recover
	The cognized of Novignies to Necover
	identifies current opened folder.
	identifies current starting folder for the search.
	sets starting folder to the current opened folder.
	sets back current starting folder.
Advanced options	If this check box is selected, R-Studio for Linux will use the advanced options.
Size from/up to	Specifies file size limits. See the Data Formats and Multipliers topic for more details on data formats.
Bad sectors	
<u>Dau Sectors</u>	Specifies whether there are bad sectors in the files. Not known: it's unclear if there are bad sectors in the files.
Runtime image	Specifies whether the files have already been included into the runtime <u>image</u> .
Recovery Chances	Specifies files with certain recovery chances.
Date	Specifies file date boundaries. Dates for Modified, Created, and Last Accessed timestamps may be set separately.
	The Set for all button sets the specified data for all fields.
Find/Mark options	Specify what R-Studio for Linux does with the found files.
	The Find first/previous/next/last options. R-Studio for Linux stops at the
	first/previous/next/last file that matches the specified search criteria.
	Find all files. R-Studio for Linux searches for all files that matches the specified search
	criteria The search results appear in the Find Results panel.
	Mark/Unmark All. R-Studio for Linux 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 for
	Linux does not takes into consideration the previous marked/finmarked 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	If this check box is selected, <u>links to folders</u> will be treated as real folders: they will
objects only in	appear among search results or marked objects.
real paths, ignore links to folders	
III IV2 TO TOIGEL2	

> R-Studio for Linux 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
 - Right-click a folder and select **Find Next** or **Find Previous** on the context 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 for Linux will show the found files on the Find Results panel

You may do the following actions on the found files:

Recover, Mark, Preview

by right-clicking the found file and selecting the appropriate item in the context menu.

2.1.3 Finding Previous File Versions

R-Studio for Linux 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:

Conditions	Legend
File name	N
File extension	E
Recognized file type	T

To search for previous file versions,

- 1 Right-click the file and select Find Previous Versions of the File on the context menu
- * R-Studio for Linux will show the files in the list:

File versions



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

2.1.4 Previewing Files

R-Studio for Linux has a built-in file previewer that allows you to preview both existing and deleted files. You may use this feature to estimate chances for successful file recovery or to find a file to recover.

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

Previewer buttons



Locate file, Mark for recovery, Previous file, Next file, Recover, Zoom In. Zoom Out, Actual Size, Rotate Counterclockwise, Rotate Clockwise, Fit in Window, Full Screen

To preview a file

- 1 Right-click a file to preview on the Files panel and select Preview on the context menu
 - Other ways to preview the file
 - Select the file on the Files panel and click the **Preview** button, or
 - Select the file on the Files panel and select Preview on the File menu
- > R-Studio for Linux 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.

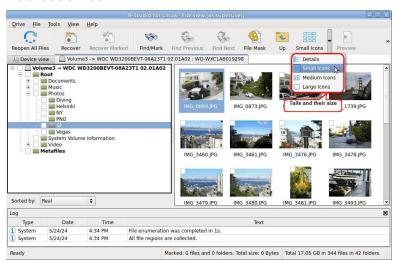
File Previewer for Pictures:

Pictures can be previewed either as tiles within the main window of **R-Studio for Linux** or in an external previewer.

Within the main window as tiles:

Tile size can be changed...

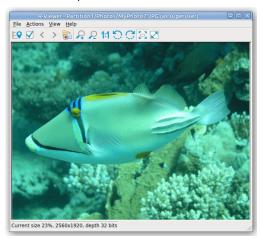
Pictures as tiles



In the external viewer:

Picture files can be zoomed in/out and rotated.

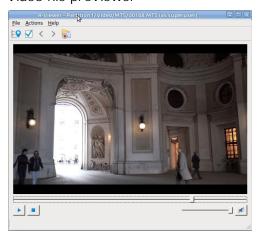
Picture file previewer



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

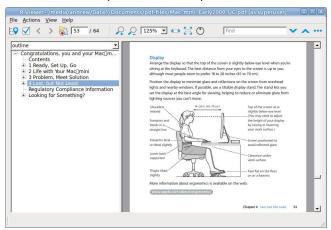


File Previewer for Adobe Acrobat PDF Files:

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:

■ Documents:

MS Office and Open/Libre Office files, even without the programs installed:

- Word/Writer documents: docx;
- Excel/Calc spreadsheets: xlsx;
- PowerPoint presentation: pptx.

Office 97-2003, without the program installed:

- Word documents: doc;
- Excel spreadsheets xls;
- PowerPoint presentation ppt.

Adobe Acrobat document: pdf.

■ Multimedia Files

Video formats:

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.

Audio formats:

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 Digitial), 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

■ Graphic files (with file extensions)

3DS Max thumbnail (max), AAA logo (bpr), ACE texture (ace), ADEX (img, rle), AIM Grey Scale (ima, im), AIPD image (aipd), ARF (arf), AT&T Group 4 (att), AT&T multigen (icn), AVHRR Image (sst), AVT RAW (raw), AWD (awd), Ability Photopaint Image (apx), Access (g4, acc), Aces 200 (ace), Acorn Sprite (acorn), AdTech perfectfax (adt), Adobe Illustrator (ai), Adobe PhotoParade(images) (php), Adobe Photoshop (psd), Advanced Art Studio (ocp., art, pic), AirNav (anv), Album bébé (frm), 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 (hdru, hdr, gn), ArcInfo Binary (hdr), Art Director (art), Artisan (art), 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, bfli, fli, flp, afl), BIAS 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, brt), Brother Fax (uni), Buttonz & Tilez texture (til), CALS Raster (cal, cals, gp4, mil), CDU Paint (cdu), CGM (cgm), CImage (dsi), CMU Window Manager (cmu), CP8 256 Gray Scale (cp8), CSV (csv), Calamus (cpi, crg), Camera RAW (raw), Canon EOS-1D Mark II RAW (cr2), Canon Navigator Fax (can), Canon PowerShot (crw), Cartes Michelin (big), Casio QV-10/100 Camera (cam), Casio RAW (bay, raw), Chinon ES-1000 digital camera (cmt), Cisco IP Phone (cip), Cloe Ray-Tracer (clo, cloe), ColoRIX (rix, sci, scx, sc?), CompW (wlm), CompuServe GIF (gif, giff), Computer Eyes, Digital Vision (ce), Computer Eyes Raw (ce1, ce2), Contax RAW (bay, raw),

Core IDC (idc), 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) (nct), 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 (pi1, pc1, pi2, pc2, pi3, pc3, pi4, pi5, pi6), Deluxe Paint, Electronic Arts (lbm, ilbm), 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 (trp), Electric Image (ei, eidi), Embroidery (bmc), Encapsulated Postscript (ps, eps), Encapsulated Postscript (Preview) (eps), Enhance Simplex (esm), Enhanced Compressed Wavelet (ecw), Epson RAW (erf), Eroiica (eif), Everex Everfax (efx, ef3), Explore(TDI) & Maya (iff, tdi), FIF(Iterated System) (fif), FIT (fit), Face Painter (fpt), Fast Piecewise-constant (pwc), Fax Group 3 (g3, fax), Fax man (fmf), Faxable PCX (fcx), 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 (fts, fits, fit), Foculus RAW (bay, raw), Fontasy Grafik (bsg), Fremont Fax96 (f96), Fugawi Map (fx3), Fuji S2 RAW (raf), Fun Painter II (fp2, fun), Fun Photor (fpr), Fuzzy bitmap (fbm, cbm), GRS16 (g16), Gamma Fax (gmf), GeoPaint (geo), Gfa Raytrace (sul), GigaPaint Hi-res (gih), GigaPaint Multi (gig), Gimp Bitmap (xcf), Gimp Brush (gbr), Gimp Icon (ico), Gimp Pattern (pat), GoDot (4bt, 4bit, clp), GunPaint (gun, ifl), HD Photo (wdp, hdp), HDRI (hdr, hdri), HF (hf), HP-48/49 GROB (gro, grb), HP-49 OpenFire (gro2, gro4), HPGL-2 (hp, hpg, hgl, plt, hpgl, hpgl2, gl2, prn, prt, spl), HRU (hru), HSI Raw (raw), Half-Life Model (mdl), Hasselblad RAW (3fr), Hayes JTFax (jtf), Hemera Photo Image (hpi), Hemera Thumbs (hta), Heretic II MipMap (m8), Hi-Eddi (hed), Hires C64 (hir, hbm), Homeworld Texture (lif), IBM Kips (kps), IBM Printer Page Segment (pse), IM5(Visilog) (im5), IMNET Image (imt), IOCA (ica, ioca, mod), IPLab (ipl), IPod thumb (ithmb), ISS (iss), IcoFX (ifx), Icon Library (icl), Imacon/Hasselblad RAW (fff), Image Capture Board (icb), Image Magick file (mif, miff), Image Speeder (ish), Image System(Hires) (ish), Image System(Multicolor) (ism), Image Systems RLC2 Graphic (rlc), 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 Format (itg, cit, rle), Interleaf (iimg), Iris CT (ct), Iris Graphics (iris), J Wavelet Image Codec (wic), JBIG (jbg, bie, jbig), JBIG-2 (jb2), JFIF based file (jb2), JPEG/IFIF (jpg, jpeg, jif, jfif, J, jpe), JPEG 8BIM header(Mac) (jpg, jpeg, jif, jfif, J, jpe), JPEG XR (jxr), JPEG-2000 Code Stream (jpc), JPEG-2000 JP2 File Format (jp2, j2k, jpx, jpf), JPEG-LS (jls), Jeff's Image Format (jif), Jigsaw (jig), Jovian VI (vi), Jpeg Network Graphics (jng), JustButtons animated bitmap (btn), KONTRON (img), Khoros Visualization Image file (vif, viff, xv), KinuPix Skin (thb), Kiss Cel (cel), Koala Paint (koa, kla), Koala Paint(Compressed) (gg), Kodak Cineon (cin), Kodak DC120 Digital Camera (kdc), Kodak DC25 Camera (k25), Kodak Photo CD (pcd), Kodak Pro Digital RAW (dcr), Kofax Group 4 (kfx), Kolor Raw Format (kro), Konica Camera File (kgp), LSS16 (lss, 16), LView Pro (lvp), LaserData (lda), Leaf RAW (mos), Leica RAW (bay, raw), Light Work Image (lwi), LucasFilm Format (lff), Lumena CEL (cel), LuraDocument Format (ldf), LuraDocument.jpm Format (jpm), LuraWave Format (lwf), LuraWave JPEG-2000 Code Stream (jpc), LuraWave JPEG-2000 Format (jp2, j2k, jpx, jpf), MAKIchan Graphics (mag), MGI Photosuite Project(images) (pzp), MGR bitmap (mgr), MRC(Medical Research Council) (mrc), MTV Ray-Tracer (mtv), Mac Paint (mac, mpnt, macp, pntg, pnt, paint), Mac icon (icns), Macintosh Quickdraw/Pict (pic, pict, pict2, pct), Mac OSX Resource (rsc, rsrc), Maggi Hairstyles & Cosmetics (fff),

Male MRI (pd, t1, t2), Male Normal CT (fre), Mamiya RAW (mef), Marks Russel File (mrf), Mavica (411), Maw-Ware Textures (mtx), Mayura Draw (pdx), MegaPaint (bld), Megalux Frame (frm), Micro Dynamics MARS (pbt), Micro Illustrator Uncompressed (mil), Micrografx Picture Publisher 4.0 (pp4), Micrografx Picture Publisher 5.0 (pp5), Micron RAW (bay, raw), Microsoft Image Composer (mic), Microsoft Paint (msp), Microtek Eyestar (img), Mindjongg Format (ipg), Minolta DiMAGE RAW (mrw), Mobile FAX (rfa), MonkeyCard (pdb), MonkeyLogo (pdb), MonkeyPhoto (mph), MrSid (sid), Msx 2 Screen (sc2), Multiple Network Graphics (mng), NCR Image (ncr), NIST ihdr (pct), National Imagery Transmission F. (ntf, nitf), NeoBook Cartoon (car), Neochrome(ST & TT) (neo), Neopaint Mask (npm), Neopaint Stamp (stw), NewsRoom (nsr, ph, bn), Nifti (img), Nikon RAW (nef), Nokia Group Graphics (ngg), Nokia Logo File (nlm), Nokia OTA bitmap (otb), Nokia Operator Logo (nol), OAZ Fax (oaz, xfx), OS/2 Bitmap (bmp, bga), Olicom Fax (ofx), Olympus RAW (orf), Open Image Library Format (oil), OpenEXR (exr), Optigraphics (ctf), Optigraphics Tiled (ttf), Optocat (abs), Oric Hires (hir), Oric TAP (tap), Os/2 Warp (bga), PABX background (pix), PAX (pax), PC Paint/Pictor Page (pic, clp), PCO (b16), PM (pm), Page Control Language (pcl), Paint Magic (pmg), PaintShopPro Browser Cache File (jbf), PaintShopPro Brush (pspbrush), PaintShopPro Brush (jbr), PaintShopPro Frame (pfr, pspframe), PaintShopPro Image (psp, pspimage), PaintShopPro Mask (pspmask), PaintShopPro Mask (msk), PaintShopPro Pattern (pat), PaintShopPro Picture Tube (tub, psptube), PaintShopPro Texture (tex), Palm Pilot (pdb), Panasonic DMC-LC1 RAW (srf), Panasonic LX3 RAW (rw2), Panasonic RAW (bay, raw), Pegs (pxs, pxa), Pentax *ist D (pef), Pfs Art Publisher (art), Photo Deluxe (pdd, pdb), Photo Filtre Studio (pfi), PhotoFantasy Image (fsy), PhotoFrame (frm), PhotoStudio File (psf), PhotoStudio Stamp (stm), Photomatrix (cat), Pic2 (p2), Picasso 64 (p64), Picture Gear Pocket (prc), Picture It! (mix), Pixar picture file (pic, pxr, picio, pixar), Pixel Power Collage (ib7, i17, i18, if9), Pixia (pxa), Pixibox (pxb), Planetary Data System (pds, img), Playback Bitmap Sequence (bms), Pocket PC Bitmap (2bp), Pocket PC Themes(images) (tsk), Polychrome Recursive Format (prf), Portable Bitmap (pbm, rpbm, ppma), Portable Document Format (pdf), Portable Greyscale (pgm, rpgm), Portable Image (pnm, rpnm, pbm, rpbm, pgm, rpgm, ppm, rppm), Portable Network Graphics (png, apng), Portable Pixmap (ppm, rppm), Portfolio Graphics (pgf), Portfolio Graphics Compressed (pgc), Portrait (cvp), Poser Bump (bum), Postscript (ps, ps1, ps2, ps3, eps, prn), PowerCard maker (crd), PowerPoint(images) (pps), PowerPoint Presentation(images) (ppt), Print Master (pm), Print Shop (psa, psb), Printfox/Pagefox (bs, pg, gb), Prism (cpa), Prisms (pri), Psion Series 3 Bitmap (pic), Psion Series 5 Bitmap (mbm), Punk Productions Picture (ppp), Puzzle (pzl), Q0 (q0, rgb), Qdv(Random Dot Software) (qdv), Qrt Ray-Tracer (qrt), Quake Texture (wal), Quantel VPB (vpb), QuickTime Image Format (qtif, qti), RAW DVR (raw), RIPTerm Image (icn), Radiance (rad, img, pic), Rainbow Painter (rp), Raw (raw, gry, grey), Rawzor (rwz), Rayshade (pic), Red Storm File Format (rsb), Ricoh Digital Camera (j6i), Ricoh Fax (001, ric), Ricoh IS30 (pig), Rm2K XYZ (xyz), Rollei RAW (rdc, ia), RoverShot RAW (bay, raw), RunPaint(Multicolor) (rpm), Saracen Paint (sar), SBIG CCD camera ST-4 (st4), SBIG CCD camera ST-X (stx, st4, st5, st6, st7, st8), SciFax (sci), SciTex Continuous Tone (sct, ct, ch), Seattle Film Works (sfw), Seattle Film Works multiimage (pwp, sfw), SecretPhotos puzzle (xp0), Sega SJ-1 DIGIO (sj1), Sharp GPB (img), Siemens Mobile (bmx), SIF MICHEL-Soft (sif), Sigma RAW (x3f), Silicon Graphics RGB (rgb, rgba, bw, iris, sgi, int, inta), Sinar RAW (cs1, sti), Skantek (skn), Slow Scan Television (hrz), SmartDraw 6 template (sdt), SmartFax (1), SmoothMove Pan Viewer (pan), Softimage (pic, si), Solitaire Image Recorder (sir), Sony DSC-F1 Cyber-shot (pmp), Sony DSC-F828 RAW (srf), Sony PS2 TIM (tm2), Sony Playstation TIM (tim), Sony RAW (sr2, arw), Spectrum 512 (spu), Spectrum 512(Compressed) (spc), Spectrum 512(Smooshed) (sps), SPOT (dat), SriSun (ssi), Stad (pic, pac, seq), Star Office Gallery (sdg), Starbase (img), Stardent AVS X (x, avs, mbfs, mbfavs), Starlight Xpress SX (RAW), Stereo Image (jps), ST Micro RAW (bay,

raw), Structured Fax Format (sff), Sun Icon/Cursor (icon, cursor, ico, pr), Sun Rasterfile (ras, rast, sun, sr, scr, rs), Sun TAAC file (iff, vff, suniff, taac), Syberia texture (syj), Synthetic Universe (syn, synu), SVG (svg), TG4 (tg4), TI Bitmap (92i, 73i, 82i, 83i, 85i, 86i, 89i), TIFF Revision 6 (tif, tim, tiff), TMSat image (imi), TRS 80 (hr), TealPaint (pdb), Teli Fax (mh), Thumbnail (tnl), TilePic (tjp), Tiny (tny, tn1, tn2, tn3), TopDesign Thumbnail (b3d, b2d), Total Annihilation (gaf), Truevision Targa (tga, targa, pix, bpx, ivb), Ulead Pattern (pst), Ulead PhotoImpact (upi), Ulead Texture(images) (pe4), Usenix FaceServer (fac, face), Utah raster image (rle, urt), VIPS Image (v), VITec (vit), VRML2 (wrl), Venta Fax (vfx), Verity (vif), Vicar (vic, vicar, img), Vidcom 64 (vid), Video Display Adapter (vda), Vista (vst), Vivid Ray-Tracer (img), Vort (pix), Vue d'esprit (vob), WAD(Half life) (wad), WSQ (wsq), WaveL (iwc), Wavefront Raster file (rla, rlb, rpf), WebShots(images) (wb1, wbc, wbp, wbz), Weekly Puzzle (jig), WebP (webp, wep), Whypic (ypc), WinFAX (fxs, fxo, wfx, fxr, fxd, fxm), WinMIPS (pic), Windows & Aldus Metafile (wmf), Windows Animated Cursor (ani), Windows Bitmap (bmp, rle, vga, rl4, rl8, sys), Windows Clipboard (clp), Windows Comp. Enhanced Metafile (emz), Windows Compressed Metafile (wmz), Windows Cursor (cur), Windows DIB (dib), Windows Enhanced Metafile (emf), Windows Icon (ico), Winzle Puzzle (wzl), Wireless Bitmap(level 0) (wbmp, wbm, wap), Word Perfect Graphics(images) (wpg), Worldport Fax (wfx), X Windows System dump (xwd, x11), X11 Bitmap (xbm, bm), X11 Pixmap (xpm, pm), XV Visual Schnauzer (p7), Xara(images) (xar), Xerox DIFF (xif), Ximage (xim), Xionics SMP (smp), YUV 16Bits (yuv, qtl, uyvy), YUV 16Bits Interleaved (yuv, qtl, uyvy), YUV 4:1:1 (yuv, qtl), YUV 4:2:2 (yuv, qtl), YUV 4:4:4 (yuv, qtl), ZX Spectrum Hobetta (\$s, \$c, !s), ZX Spectrum Snapshot(sna), ZX Spectrum standard (screen scr), ZZ Rough (rgh), Zeiss BIVAS (dta), Zeiss LSM (lsm), Zoner Callisto Metafile(zmf), Zoner Zebra Metafile (zbr), Zsoft Multi-page Paintbrush (dcx), Zsoft Publisher's Paintbrush (pcx, pcc, dcx), byLight (bif)

2.1.5 File Masks

R-Studio for Linux 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
 - Right-click a folder and select **File Mask** on the context menu or
 - Select the folder and select File Mask on the Tools menu
- 2 Specify the file mask on the File mask dialog box and click the OK button

Mask (Main) dialog box



■ File mask options

You may specify opt	tions for All Files, File Extensions, Files, and Regular Expressions		
Match case	If this check box is selected, R-Studio for Linux makes a case-sensitive search.		
Show empty folders	If this check box is selected, R-Studio for Linux will show folders with no files in them.		
Deleted files	If this check box is selected, R-Studio for Linux makes a search among deleted files/folders.		
Existing files	If this check box is selected, R-Studio for Linux makes a search among existing files/folders.		
Hide symbolic links	If this check box is selected, R-Studio for Linux hides all <u>symbolic links</u> . It may be selected by default if the Don't show symbolic links by default option is selected on the <u>Settings</u> dialog box.		
Use advanced options	If this check box is selected, R-Studio for Linux will use the advanced options, even when they are hidden.		
Advanced Options			
Size from/up to	Specifies file size limits. See the Data Formats and Multipliers topic for more details on data formats.		
Bad sectors	Specifies whether there are bad sectors in the files. Not known: it's unclear if there are bad sectors in the files.		
Runtime image	Specifies whether the files have already been included into the runtime <u>image</u> .		
Date	Specifies file date boundaries. Dates for Modified, Created, and Last Accessed timestamps may be set separately.		
	The Set for all button sets the specified data for all fields.		

> R-Studio for Linux 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.

2.1.6 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.

	Wildcard: any character
*	Repeat: zero or more occurrences of previous character or class
^	Line position: beginning of line
\$	Line position: end of line
[class]	Character class: any character in the set
[^class]	Inverse class: any character not in the set
[x-y]	Range: any characters within the specified range

\x	Escape: literal use of metacharacter x
\ <xyz< th=""><th>Word position: beginning of the word</th></xyz<>	Word position: beginning of the word
xyz\>	Word position: end of the word

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

2.1.7 Event Log

R-Studio for Linux 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 <u>Settings</u> dialog box.

You may clear or save the log

To clear the log,

* Right-click the Log panel and select Clear Log on the context menu.

To save the log to a file,

* Right-click the Log panel and select Save Log to File on the context menu.

2.2 Advanced Data Recovery

This chapter explains how to perform advanced data recovery operations.

- Disk Scan
- 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.

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

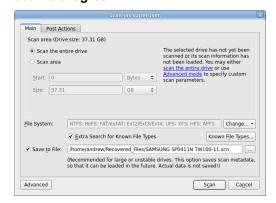
NEVER TRY TO SAVE SCAN INFORMATION TO THE OBJECT BEING SCANNED!!! Or you may obtain unpredictable results and lose all of your data.

To scan an object

- 1 Select an object on the R-Studio for Linux's Drives panel
- 2 Click the Scan button
 - Other ways to start scan
 - Right-click the selected disk and select **Scan** on the context menu,

or

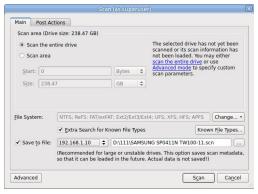
- Select **Scan** on the **Drive** menu
- 3 Specify the required parameters on the Scan dialog box and click the Scan button Scan dialog box



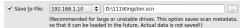
■ Scan options

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 da	ata formats.		
File Systems:	Specifies the file systems which objects are to be searched for. Current version supports: FAT, NTFS, exFAT, ReFS, Ext2/3/4FS, XFS, HFS, APFS, and UFS file systems. The Technician version supports also the ISO9660 file system. 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. See Data Recovery on HFS/HFS+ file system for details.		
Extra search for Known File Types	Enables search for Known File Types.		
Save scan Info to File:	If this checkbox is selected, R-Studio for Linux 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. R-Studio for Linux shows path to this file during disk scan.		
Buttons			
Scan	Starts scanning		
Advanced	Activates advanced scan options		
Known File Types	Selects file types that R-Studio for Linux will recognize during the disk scan.		
Cancel	Closes the dialog box		
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 the Scan dialog box will have a different look.



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 for Linux can recognize the data's particular file type. Using such information, R-Studio for Linux can obtain more information about data/file structure on the object being scanned. By default, R-Studio for Linux 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 <u>Settings</u> panel.
Reset to	Click this button to revert to factory-preset default settings.
Recommended	
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

List of known file types Document			
AbiWord	Adobe InDesign	Adobe PDF	Apple iWork Keynote
Document: .abw	File: . indd	document: .pdf	document: . key
Apple iWork Pages	Apple iWork document	Capella document: .cap	Final Draft
document: .pages	Apple IWOIK document	Capella document cap	Document: .fdr
FrameMaker	GNU Info	Commin Man Source	Lotus AMI Pro
Document: .fm	Document: .info	Garmin MapSource data: .mps	Document: .sam
	Lotus Word Pro	_	Microsoft OneNote
Lotus Organizer: .or5	Document: .1wp	Microsoft Office Open XML Document	section file: .one
Microsoft Doctrot Ctucata			
Microsoft Pocket Streets	Microsoft PowerPoint 2007 XML	Microsoft PowerPoint	Microsoft Visio document: .vsd
Map File: .mps	Document: .pptx	Document: .ppt	documentvsa
Microsoft Word 2007	Microsoft Word	Word for Macintosh	Microsoft Word2
XML Document: .docx	Document: .doc	Document: .mcw	Document: .doc
Microsoft Works			
	OLE Storage	OpenOffice Writer document: .odt	OpenOffice document: .ods
document: .wps	Do at Covint		
PageMaker Document: .p65	PostScript document:.ps	QuarkXPress file: .qxd	QuarkXpress
	_	Tout do ourreaute	project: .qxp
Rich Text	TEX document: .tex	Text document: .txt	Unicode
Document: .rtf			document: .txt
WordPerfect			
Document: .doc			
Document: E-book	EDITO D 1	TD2 D 1	MODY D. I
Chaoxing SSReader	EPUB eBook: .epub	FB2 eBook: .fb2	MOBI eBook: .mobi
eBook: .pdg			Microsoft Money
1. C.D. 1	NC 0.D 1		Data: .mny
Microsoft Reader	Microsoft Reader		
eBook:.lit	eBook		
D	annotations: .ebo		
Document: Spreadsheet		1 2 2 2	1 2 2 2
Apple iWork Numbers	Lotus 1-2-3 v1	Lotus 1-2-3 v2	Lotus 1-2-3 v3
document: .numbers	worksheet: .wk3	workshee: .wk1, .fmt	worksheet: .wk3, .fm
Lotus 1-2-3 v4	Lotus 1-2-3	Microsoft Excel 2/3/4	Microsoft Excel 2007
worksheet: .wk4	workbook: .123	worksheet: .xls	XML
			Document: .xlsx
Microsoft Excel 4	Microsoft Excel	Quattro Pro	
Spreadsheet: .xls	Spreadsheet: .xls	Spreadsheet: .wq1	
Document: Database			
Cathy database: .caf	Data Interchange	GDSII database: .gds	Microsoft Access 2007
•	Format file: .dif		XML

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.qdf
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Comer (CD2) DAW	Carra (CDW) DAW	C-1-DIV I	Camarata a Carata
Canon (CR2) RAW	Canon (CRW) RAW	ColoRIX Image: .rix	Computer Graphics
graphics file: .cr2	graphics file: .crw	G 155	Metafile image: .cg
ComputerEyes Raw	Continous Edge Graphic	Corel Texture	CorelDraw CMX
Image:.cel, .cel	Image: .ceg	Image: .tex	Image: .cmx
CorelDraw Image: .cdr	Cubicomp Picture	DICOM medical	Digital Negative
	Maker Image	image: .dcm	image: .dbg
Du Holo molette.	.r8, .g8, .b8	Engan DAW	Engan Ctribia
Dr. Halo palette: .pal	Enhanced MetaFile	Epson RAW	Epson Stylus
E 1 I ANI/OIG	Image: .emf	image: .erf	Image: .prn
Erdas LAN/GIS	Fractal Image	Freehand (MX)	Fuji RAW image: .raf
Image: .lan, .gis	Format: .fif	Database: .fh10	G
GEM Raster	GEM VDI Image: .gdi	CompuServe GIF	Garmin Mapsource
Image:.img		Image:.gif	image:.img
Graphics Workshop for	Gridded Binary	HP Command Language	HP Raster Image: .rtl
Windows	Image: .grb	Image: .pcl	
Thumbnail: .thn			
HSI JPEG Image: .hsi	Hemera Photo-Object	Hitachi Raster	Hotspot Image: .shg
	Image: .hpi	Image: .hrf	
IBM Picture Maker	JPEG 2000: . jp2	JPEG Digital	JPEG Image: . jpg
Image: .pic		Camera: . jpg	
Jovian Logic Image: .vi	Kodak PhotoCD	Kodak RAW	LBM/IFF Image: .1bm
	Image: .pcd	image: .dng	
Leica RAW image: .dng	Lightwave Object: .1wo	Lotus PIC Image: .pic	Macintosh PICT
			Image:.pct, .pic
Macintosh Paint	Mamiya RAW	McIDAS Satellite	Microsoft Paint
Image: .mac	image: .mef	Image: .goe	Image: .msp
Minolta RAW	Nikon RAW	OS/2 Icon: .ico	Olympus RAW
image: .mrw	image: .nef		image: .orf
PBM Image: .pbm	PGM Image: .pgm	PIX Image: .pix	PM Image: .pm
PNG Image: .png	PPM Image: .ppm	PaintShop Pro	Panasonic RAW
		Image: .psp	image: .rw2
PaperPort Image: .max	Pentax RAW	Pictor PC Paint	Print Shop Image: .pds
	image:.pef	Image: .pic	
Quick Link II fax	QuickDraw 3D	RAW Digital Camera	RenderMan
Image: .qfx	Metafile: .3dmf	image: .dng	Image: .rib
Ricoh RAW image: .dng	SGI Image: .sgi	STAD Image: .pac	Samsung RAW
	6		image: .dng
Seattle FilmWorks/?	Sigma RAW	Sketch Image: .sk	SmartDraw file: .sdr
PhotoWorks	image: .x3f		Z-MI IZ IV. IIIV. IV.
image: .pwm	.6		
Sony RAW image: .arw	Sun Raster Image: .sun	SymbianOS	TI Image: .92i
and any and a second se	2 22 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Image: .mbm	
	1		

Tagged Image Format	TargetExpress	Utah Raster Toolkit	VITec Image: .vit	
File: .tif	image:.mte	Image:.rle		
Webshots Image: .wb1	Weresc CADE	Windows Animated	Windows Bitmap	
	drawing: .dtc	cursor: .ani	Image: .bmp	
Windows Color	Windows Fax Cover	Windows MetaFile	Windows cursor: .cur	
Palette: .pal	Image: .cpe	Image: .wmf		
Windows icon: .ico	WordPerfect Graphics	X PixMap Image: .xpm	X Window Dump	
	Image: .wpg		Image: .xwd	
Xara Drawing: .xar	ZSoft PCX Image: .pcx	iPhoto Image: .attr		
Multimedia: Audio Files	1			
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	Creative voice file: .voc	DiamondWare	
	Binary: .cf1		sound: .dwd	
Digital Speech File: .dss	Digital voice file: .dvf	EA ASF/MUS audio	Extended M3U	
		file: .asf	playlist: .m3u	
FLAC audio	KaraBox sound: .mkf	La Lossless audio	Liquid Audio File: .1a1	
file:.fla, .flac		file:.la		
MIDI Instrument	MIDI music: .mid	MIDI stream: .mds	MPEG Layer I audio	
definition: .idf			file: .mpg	
MPEG Layer II audio	MPEG Layer III audio	MUS music: .mus	Monkeys audio	
file: .mp2	file: .mp3		file: .ape	
Musepack audio	Next/Sun uLaw	Nitro Composer	Nord Modular G2	
file: .mpc	sound: .au	sound: .minincs	Patch: .pch2	
Ogg Vorbis audio	OptimFROG audio	Portable Sound	RIFF MIDI	
file: .ogg	file: .ofr	Format: .psf	music: .rmi	
RK Audio sound: .rka	Sierra AUD	Sony OpenMG audio	Super NES audio	
	sound: .aud	file: .oma	file: .spc	
TTA audio file: .tta	VQF sound: .vqf	WavPack audio file: .wv	Westwood AUD	
			sound: .aud	
Windows Media Audio	Windows WAVE	X-MIDI music: .xmi	ZyXEL sound: . zyx	
File: .wma	sound: .wav			
aPac audio file: .apc				
Multimedia: Video Files				
3GPP multimedia	3GPP2 multimedia	4X Movie Video: . 4xm	Adobe Filmstrip	
audio/video: .3gp	audio/video: .3g2		Animation: .fsf	
AMV Video: .amv	ARMovie video: .rpl	Adobe Filmstrip	Autodesk	
		animation: .fsf	Animator: .fli	

BINK Video: .bik	BluffTitler video: .bt	DVM video: .dvm	DeluxePaint animation: .anm
Director video: .dcr	DriveCam video: .dce	Eyemail video: .eye	Flash Video: .flv
Intel DVI Video: .dvi	Intel Indeo Video File: .ivf	Interplay MVE Video: .mve	LZA animation: .lza
LZA Animation: .lza	Lotus ScreenCam video: .scm	MPEG Transport Stream video: .mts	MPEG video: .mpg
MPEG-2 Transport Stream video: .m2ts	Matroska video: .mkv	MythTV video: .nuv	NEOchrome animation: .ani
Nancy Codec video: .noa	Nullsoft Video: .nsv	QV-10 video: .cam	QuickTime video: .mov
SGI movie format: .mv	SMJPEG Video: .mjpg	Sega FILM/CPK video: . cpk	Shockwave video: .swf
Smacker video: . smk	Sony Movie Player video: .mqv	VOB video files: .vob	VP6 encoded Video: .vp6
VideoCD video: .vcd	Vivo streaming video: .viv	Windows AVI Video: .avi	Windows Media Video: .wmv
Multimedia Files			
MP4 file: .mp4	Material Exchange File: .mxf	RIFF Multimedia File	Real Networks audio/video: .rm
Archive Files			
7-Zip archive: .7z	ACE archive: .ace	AIN archive: .ain	ARJ archive: .arj
ARX archive: .arx	Android Package: .apk	BAG archive: .bag	BIX archive: .bix
BOA archive: .b58, .boa	BZip2 archive: .bz2	BlackHole archive: .bh	Blink archive: .bli
CPIO archive: .cpio	ChArc archive: .chz	Compress archive: . z	Crush archive: .cru
DEB archive: .deb	FOXSQZ archive: .sqz	GZip archive: .gz	HA archive: .ha
HAP archive: .hap	HPack archive: . hpk	Hyper archive: .hyp	InstallShield CAB archive: .cab
InstallShield Z archive: . z	InstallShield compressed file	JAR archive: . jar	JRC archive: . jrc
LHA/LZARK archive: .lzh	LZA archive: .1za, .1zz	LZOParchive: .1zo, .	LZX archive: .1zx
LIMIT archive: .lim	Microsoft Cabinet archive: . cab	Microsoft Compress compressed file	PAKLEO archive: .pll
QFC archive: .qfc	Quantum archive: .q, .pak	Quark archive: .ark	RAR archive: .rar
RPM archive: .rpm	ReSOF archive: .sof	SAR archive: .sar	SBC archive: .sbc
SQZ archive: .sqz	SZip archive	StuffIt archive: .sit	TAR archive: .tar

UFA archive: .ufa	UHArc archive: .uha	UltraCompressor 2 archive: .uc2	WRAptor archive: .wra
WinImm analiza	Windows Installer	Windows Installer	indows Installer
WinImp archive: .imp	Merge Module: .msm	Package: .msi	Patch: .msp
Windows Installer Patch	Windows Installer	YAC archive: .yc	YBS archive: .ybs
Creation File: .pcp	Validation	The alcinveye	1 DS archive yds
erement not the	Module: .cub		
ZIP archive: .zip	ZOO archive: . zoo	ZZip archive: .zz	iOS Package: .ipa
xz archive: .xz			
Executable/Library/DLI	L		
DOS Style	ELF Executable (UNIX)	ELF Library (UNIX)	ELF Module (UNIX)
Executable: .exe			
Java Bytecode: .class	KolibriOS Executable	NetWare Loadable Module: .nlm	Shell Script
UEFI Executable	Windows DLL: .dll	Windows	Windows 9x Device
.efi	Windows DEE all	Executable: .exe	Driver: .vxd
Windows Device	Windows OCX		
Driver: .sys	File: .ocx		
Development files		l	
ACUCOBOL object	Borland Delphi	Borland Turbo Pascal	C/C++ Source
	Compiled Unit: .dcu	compiled Unit: .tpu	Code: .c
COM Type	GUI Design Studio	LUA Script: . lua	Library: .lib
Library: .tlb	project: .gui		
Microsoft .NET XML	Microsoft ClassWizard	Microsoft Linker	Microsoft Precompiled
Resource	file: .clw	database .ilk	header: .pch
template: .resx			
Microsoft Program	Microsoft Visual C++	Microsoft Visual Studio	Microsoft Visual Studio
database: .pdb	project: .mdp	Solution: .sln	project: .dsp
Microsoft Visual Studio	OMF Object	PolySpace results: .chk	RDOFF Object
workspace: .dsw	library: .lib		File: .rdf
Resource Compiler	Visual Studio Solution	Visual Studio Widget	Visual Studio
Script File: .rc	User Options: . suo	File: .wid	Workspace Options
VisualBasic	WinDev Window: .wdw	Windows Compiled	file: .opt XPCOM Type
Project: .vbp	WIIDEV WIIIOWWaw	resource (32bit): .res	Library: .xpt
Xcode		10000000 (0200) 1 es	indiaryxpc
Project: .pbxproj			
Disk images	<u>I</u>	<u> </u>	ı
Hyper-V virtual	JAM compressed	Norton Ghost disk	QEMU virtual
disk: .vhdx	disk: . jam	image: .ghs	disk: .qcow2
<u> </u>		<u>, , , , , , , , , , , , , , , , , , , </u>	*

R-Drive Image disk	VMware virtual	Virtual PC virtual	VirtualBox virtual
image: .rdr disk: .vmdk		disk: .vhd	disk: .vdi
Other file types			
ABBYY Lingvo	AIX Backup File: .bff	ArtMoney Table	CrystalMaker Data
dictionary: .1sd		file: .amt	File: .cmdf, .cmmf
Dwarf Fortress save	EasyCrypto	Fallout 3 save	Java Applet cache
data: .dat	file: .encrypted	game: .fos	index: .idx
Kaspersky Anti-Virus	Kaspersky Anti-Virus	Kaspersky Anti-Virus	Magic 3D Easy View
data base: .avc	report: .rpt	signature bas: .kdc	object: .x
Microsoft Security	NHTSA UDS-1992	NOD32 Antivirus	ORTIMZeit
Catalog: .cat	crash test result: .uds	Update file: .nup	project: .ozv
OziExplorer Map	PRO100 project: .sto	PlayStation 3	RegEdit file: .reg
data: .map		Theme: .p3t	
RegEdit file	Source Game Engine	Unreal Package	Valve Texture
(UNICODE): .reg	Compiled AI		File: .vtf
	Nodegraph: .ain		
WinHelp: .hlp	WinHelp	WinXP Prefetch file: .pf	Windows Backup
	Contents: .cnt		File: .bkf
Windows Clipboard	Windows Color	Windows	Windows National
file: .clp	Profile: .icm	Minidump: .dmp, .mdm	locale: .nls
		р	
Windows Password	Windows Registry	Windows Thumbnail	Windows User
file: .pwl	hive:.dat, .hiv	cache: .db	Interface Module: .wim
Windows shortcut: .lnk	X-Plane Scenery: .dsf	XNA Game Data: .xnb	

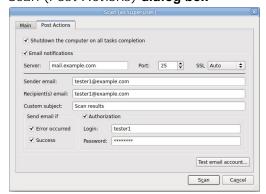
Note: Using scan for Known File Types, **R-Studio for Linux** can successfully recover only un-fragmented files.

You may also specify your own file types for scanning. See <u>Customizing File Types</u> 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 for Linux Settings**.

R-Studio Technician/T80+

Scan (Post Actions) dialog box



■ Post Actions Options

Shutdown the computer on task completion	If this check box is selected, R-Studio for Linux 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 for Linux will inform you about the outcome of the operation via email.

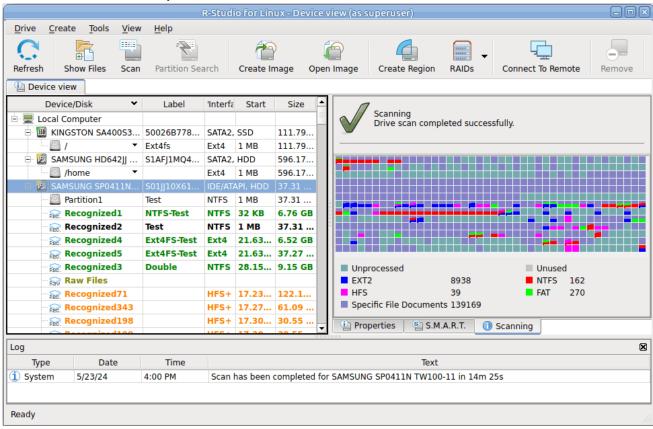
> R-Studio starts scanning the object, and its panel will show information about new found objects:



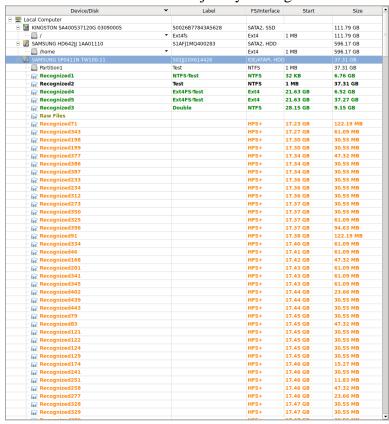
shows path

The Log pane will show scan progress. Scan may be stopped by clicking the **Stop** button on the tab. 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.

■ R-Studio for Linux Main panel

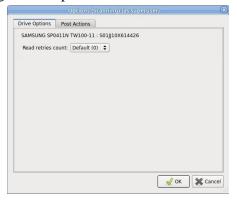


Drives panel after scanning: You can select an object by clicking on it





You may change some options during the scan process

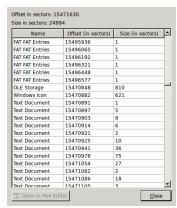


Options (Scanning) (assuperuser) Drive Options Post Actions I shutdown the computer on all tasks completion I small example.com Server: mail.example.com Port: 25 \$ SSL Auto \$ Sender email: tester1@example.com Recipient(s) email: tester2@example.com Custom subject: Scan results Send email if Authorization I server: Authorization V Error occurred I success Test email account... Test email account...

Only in the Technician version

You may see which file object(s) is/are on a particular disk part. Click the corresponding rectangle on the Scan Information pane and view the information on the Scan Information dialog box.

Scan Information dialog box



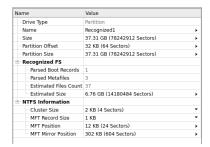
Double-click an object to view/edit the file object in the **Text/Rexadecimal editor**.

When an object is scanned, a number of Recognized partitions will appear. **R-Studio for Linux** shows them in different colors depending on which elements of the <u>partition</u> have been found.

Partition5	An existing logical disk or partition	
Recognized5	An existing logical disk or partition after disk scan	
Recognized 7 A recognized partition. Both boot records and file entries are found to partition		
Recognized6	A recognized partition. Only file entries are found for this partition	
Recognized16	A recognized partition. Only boot records are found for this partition	
Recognized5 A fast found partition		
DeletedPart1	A deleted partition	
 Empty Space17 	Empty space on the object	
Raw Files	Files that have been found using scan for known file types.	

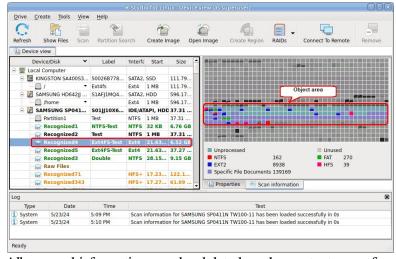
Although such recognized partitions are virtual objects, files can be searched for and recovered from recognized partitions as from real <u>logical disks</u> using <u>Basic File Recovery</u>.

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 Recognized1 on the Partition5:



When an object in a scanned drive is selected, **R-Studio** shows the scanned area of the object.

Object's scanned area



All scanned information may be deleted on the context 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 context 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



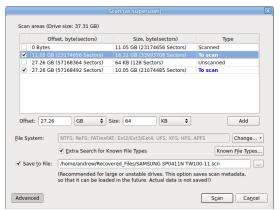
You may rescan the entire disk, scan unscanned areas, or scan an explicitly specified area.

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 AII**, and **Merge Selected**. You may also select/unselect unscanned areas.

Advanced Scan dialog box



R-Studio for Linux 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 for Linux Drives panel
- 2 Select Save Scan Information on the Drive or context menu and save the scan information in a file The default file extension is *.scn.

To load scan information

- 1 Select an object on the R-Studio for Linux Drives panel
- 2 Select Open Scan Information on the Drive or context menu and select the required file with the scan information

The default file extension is *.scn.

> The scan information will appear in the Drives panel

To remove scan information

- 1 Select an object on the R-Studio for Linux Drives panel
- 2 Select Remove Scan Information on the Drive or context menu
- > The scan information will disappear from the Drives panel

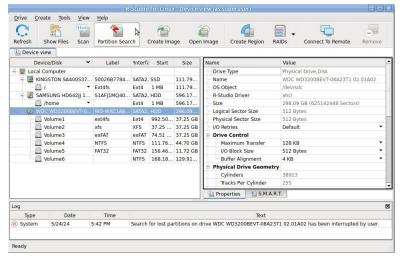
NEVER TRY TO SAVE SCAN INFORMATION ON THE OBJECT BEING SCANNED!!! Or you may obtain unpredictable results and lose all your data.

2.2.2 Fast Search for Lost Partitions

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

To perform fast search for lost partitions,

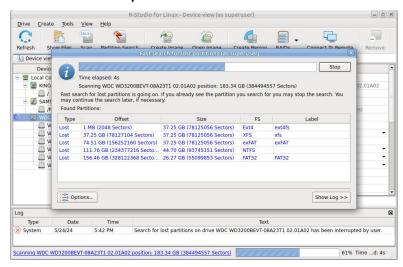
1 Select an object on the R-Studio for Linux's Drives panel
Fast search for lost partitions



2 Click the Fast Partition Search button

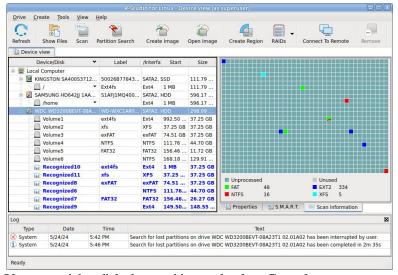
R-Studio for Linux will start searching for lost partitions showing its progress.

Fast search for lost partitions



> **R-Studio for Linux** will show fast found partitions in blue.

Fast search for lost partitions



You may right-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.

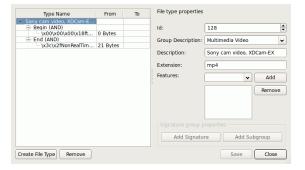
You can do that either by using the **R-Studio for Linux's** graphic interface or by direct editing the known file description file specified on the **R-Studio for Linux** Main settings dialog box.

Creating a Known File Types using a Graphic User's Interface

The easiest way to add your own is to use the **R-Studio for Linux's** graphic interface.

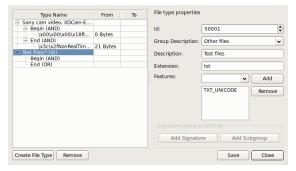
To create a Known File Type,

- 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 Edit User's File Types dialog box



2 Click the Create File Types button and specify File type properties

Edit User's File Types dialog box

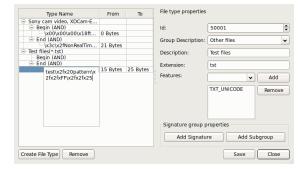


■ File Types properties

■ File Types	s properties		
id	digit	Required	Digital file type identifier. Should be unique for each custom file type.
group	string	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.
descrip tion	string	Optional	Brief file description
feature s	NO_SCAN TXT_ANS I TXT_UNI CODE	Optional	Additional properties of the file type. If you want to specify several properties, they should be separated by a space. NO_SCAN: Not to be scanned for. If this flag is used, R-Studio for Linux will not search for such file type. Such files will be shown when sorting files by their extensions. TXT_ANSI: 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. TXT_UNICODE: 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.
extensi	<string< td=""><td>Optional</td><td>File extension.</td></string<>	Optional	File extension.
on	>	1	

3 Click the Add Signature button, specify the signature parameters, and click the Save button

Edit User's File Types dialog box



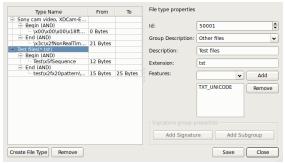
■ File signature properties

Begin End	Specifies from where the signature begins. 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.
AND OR	Shows the order of the logical operation (union or intersection)
From	A decimal number specifying the leftmost possible offset for the file signature.
То	A decimal number specifying the rightmost possible offset for the file signature.

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 <u>Customizing File Types-II</u> help page.

> The newly specified file type will appear on the Edit User's File Types dialog box and the <u>File Types</u> 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 the file specified on the **R-Studio for Linux** Main settings dialog box.

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

Signature file example

File structure

File header

The file starts with a standard XML header

```
<?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:

id	<u32></u32>	Required	Digital file type identifier. Should be unique for each file type.	
group	<string></string>	Optional	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
description	<string></string>	Optional	Brief file description	Default: null (no description)
features	NO_SCAN TXT_ANSI TXT_UNICODE	Optional	Additional properties of the file type. If you want to specify several properties, they should be separated by a space.	Default: 0
extension	<string></string>	Optional	File extension.	Default: null (no extension)

File type properties flags

NO_SCAN	Not to be scanned for. If this flag is used, R-Studio for Linux will not search for such file type. Such files will be shown when sorting files by their extensions.
TXT_ANSI	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.
TXT_UNICOD E	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 Text/Bexadecimal editor .

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

Element Signature

Attributes:

offset	<u16></u16>	Optional	Decimal offset for the signature	Default: 0
count	<u16></u16>	Optional	Decimal number specifying the	Default: 1
			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.	

		I		
			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 "1",	
			and size should be equal to the	
			length (the number of bytes) of the	
			signature.	
size	<u16></u16>	Optional	Decimal number specifying the	Default: the number
			number of bytes in the signature.	of bytes written in
				the element.
from	begin	Optional	Specifies from where the offset is	Default: begin
	end		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.	

Comments

<!-- Comment string -->

An XML standard string for a comment.

2.2.5 Customizing File Types-II

Currently **R-Studio for Linux** 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 version="1.0" encoding="utf-8"?>

Section FileTypeList

<FileTypeList>

Attributes:

Ī	version	1.0	Optional	Version of file type description	Default: 1.0
---	---------	-----	----------	----------------------------------	--------------

It requires a closing element </FileTypeList>.

Comments

<!-- Comment string -->

An XML-standard string for a comment.

Version 1 of file type description

Signature file example

Section FileType

This is a description of each file signature.

Attributes:

id	<u32></u32>	Required	Digital file type identifier. Should be unique for each file type.	
group	<string></string>	Optional	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.	Default: unknown
description	<string></string>	Optional	Brief file description	Default: null (no description)
features	NO_SCAN TXT_ANSI TXT_UNICODE	Optional	Additional properties of the file type. If you want to specify several properties, they should be separated by a space.	Default: 0
extension	<string></string>	Optional	File extension.	Default: null (no extension)

File type properties flags

NO_SCAN	Not to be scanned for. If this flag is used, R-Studio for Linux will not search for such file type. Such files will be shown when sorting files by their extensions.			
TXT_ANSI	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/Rexadecimal editor.			
TXT_UNICODE	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/Rexadecimal editor.			

List of predefined file type groups

Group	Name on the File Types dialog box.		
archive	Archive Files		
graphics	Graphics/Picture		
internet	Internet-related files		

multimedia	Multimedia Files		
audio	Multimedia: Audio Files		
video	Multimedia: Video Files		
font	Font		
document	Document		
doc_database	Document: Database		
doc_sheet	Document: Spreadsheet		
exe	Executable/Library/DLL		
unknown	Other file types		

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 \xspace hh format, where hh is a hexadecimal byte code. If that is not a hexadecimal number after \xspace x, \xspace x are treated as a part of the string section of the signature

Attributes:

offset	<u16></u16>	Optional	Decimal offset for the signature	Default: 0
count	<u16></u16>	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 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.	Default: 1
size	<u16></u16>	Optional	Decimal number specifying the number of bytes in the signature.	Default: the number of bytes written in the element.
from	begin end	Optional	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

Version 2 of file type description

Signature file example

```
<?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

Sections Begin and End

Specify the positions of file type signatures in the file.

Attributes

combine	and	Optional	Shows the order of the logical	Default: and
	or		operation (union or intersection)	

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:

```
<FileTypeList version="2.0">
  <FileType id="2" group="archive" description="ARJ Archive" extension="arj">
    <Begin combine="or">
      <Signature [attributes]> ... </Signature>
     <Signature [attributes]> ... </Signature>
      </AND>
      <OR>
      </OR>
    </Begin>
    <End>
      <0R>
     </OR>
      <Signature [attributes]> ... </Signature>
      <Signature [attributes]> ... </Signature>
    </End>
  </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:

Element Signature

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

Attributes:

offset	<u16></u16>	Optional	Decimal offset for the signature	Default: 0
from	<u16></u16>	Optional	Decimal number specifying the leftmost possible offset for the file signature. Ignored if the offset attribute is specified.	Default: undefined
to	<u16></u16>	Optional	Decimal number specifying the rightmost possible offset for the file signature. Ignored if the offset attribute is specified.	Default: undefined
size	<u16></u16>	Optional	Decimal number specifying the number of bytes in the signature.	Default: the number of bytes written in the element.

Example:

2.2.6 Regions

Scanning large objects may take a long time. Sometimes, only a smaller area of a disk needs to be scanned or searched for files. Such area is called a *region*. A <u>region</u> can be created on any object in the **R-Studio for Linux**'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 for Linux 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 for Linux's Drives panel and click the Create Region button
 - Other ways to create the region
 - Right-click the selected object and select **Create Region** on the context menu or
 - 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



■ 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 remove a region

* Select a Region on the R-Studio for Linux Drives panel and click the Remove button, or Right-click the selected region and select Remove Region on the context menu.

To change the size of a region

* Right-click a Region on the R-Studio for Linux Drives panel, select Edit on the context menu, and enter a new size on the Edit Region dialog box.

To convert a region into an exclusive one

* Right-click the Region on the R-Studio for Linux Drives panel and select Exclude area on the context menu

To remove a region

* Select a Region on the R-Studio for Linux Drives panel and click the Remove button, or Right-click the selected region and select Remove Region on the context menu.

2.2.7 Exclusive Regions

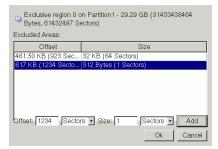
Exclusive regions are areas on any object visible on the **R-Studio for Linux**'s Drives panel that are excluded from disk operations. **R-Studio for Linux** never tries to read/write data from/to such area. Exclusive regions are necessary when, for example, there are areas with <u>bad sectors</u> on 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 for Linux 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 Right-click an object on the R-Studio for Linux's Drives panel and select Create Exclusive Region on the context 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 remove an exclusive region

* Select an Exclusive Region on the R-Studio for Linux Drives panel and click the Remove button, or Right-click the selected region and select Remove Region on the context menu.

To change the size of an exclusive region

* Right-click an Exclusive Region on the R-Studio for Linux Drives panel, select Edit on the context menu, and add/remove excluded areas on the Edite Exclusive Region dialog box.

You may remove an excluded area by right-clicking it and selecting **Remove** on the context menu.

2.2.8 Images

An <u>image</u> 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.

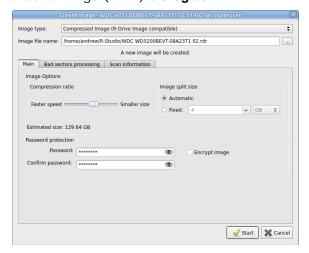
While creating images, **R-Studio for Linux** can simultaneously perform disk scan and save scan information to lessen time necessary to process the disk.

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

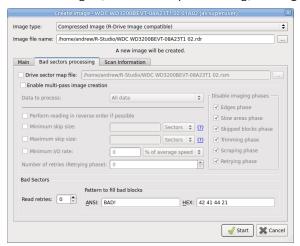
To create an image,

- 1 Select an object on the R-Studio for Linux'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 or
 - Right-click the selected object and select Create Image File on the context menu
- 2 Specify image options, a file name, and destination for the *image* on the Create Image dialog box **Note:** To store an image file, you need a <u>free space</u> equal to at least the object size.

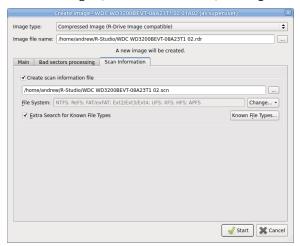
Create Image (Main) dialog box



Create Image (Bad sector processing) dialog box



Create Image (Scan Information) dialog box

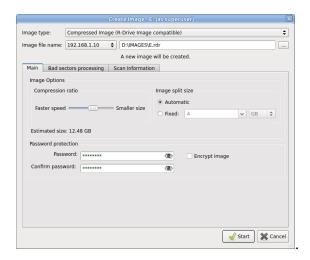


■ Image Options

Image name	Specifies the name and path for the image file
Image type:	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 very old versions of R-Studio .
	Byte by byte image to a file: If this option is selected, R-Studio will create a
	simple exact copy of the object.
	VMDK (ViMware Virtual Machine Disk) image: If this option is selected, R-Studio
	will create an image of the VMware virtual disk type. Available in the Corporate,
	Technician, and T80+ license.
	Byte to byte image to a physical disk: R-Studio will create an exact copy of the
	disk on another hard drive. Data on the target drive will be overwritten. Available
	in the Corporate, Technician, and T80+ license.
	Some other image formats are also available in the Technician, and T80+
	licenses. You may read more about these formats in the Supported Virtual Disk
	and Disk Image Formats page.

Image compression ratio	You may <u>compress</u> 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 <u>partition</u> and what file types are there. Active only if the Compressed image (R-Drive Image compatible) is selected.
lmage split size	You may set this option to Automatic and let the OS 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.
Password Encrypt image	You may protect your image file with a password. Note: If you leave the Encrypt image option clear this feature will provide a relatively moderate protection against conventional unauthorized access. If this option is selected, R-Studio will encrypt the image using the <u>AES-XTS</u> algorithm. Note: Only files in the RDR format can be password protected and encrypted.
Create scan information file	If this option is selected, R-Studio for Linux will perform disk scan simultaneously with image creation. See the Disk Scan help page to learn scan options.
Read retires	 Specifies a value for I/O Tries, or how many times R-Studio for Linux will try to read a bad sector. R-Studio for Linux 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 for Linux reads again that part sector by sector, repeating the attempts the specified number of times. If R-Studio for Linux 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 for Linux will use to fill bad sectors in this image. You may specify the pattern either in the ANSI or Hex data format. Note: R-Studio for Linux 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.
Drive sector map file Enable multi-pass image creation	These options are available only in the Technician/T80 + versions. Read more about these options in the I/O Monitor and Sector Map files and Multi-pass imaging help page.

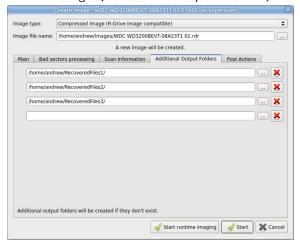
If a remote computer is connected for **Data Recovery over Network**, the Save Image File dialog box will appear when you select a place to store the image. You may save it to the local or remote computer.



R-Studio Technician/T80+

These options are available only in the **Technician/T80**+ versions.

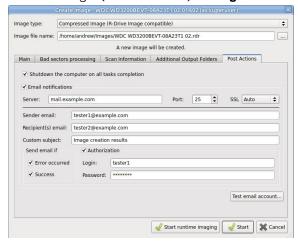
Create Image (Additional output folders) dialog box



Additional output folders

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

Create Image (Post Actions) dialog box

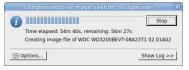


□ Post Actions Options

Shutdown the computer on task completion	If this check box is selected, R-Studio for Linux will shut down your computer when image creation has been completed.
E-Mail notifications	If this check box is selected, R-Studio for Linux will inform you about the outcome of the operation via email.

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

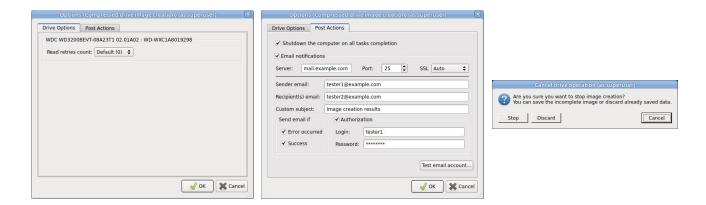
Standalone/Corporate





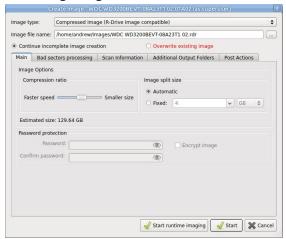
You may change some options during the imaging process. Click the **Options** button and change them as necessary/

You may stop the imaging process and then resume it later on. Click the **Stop** button and the Cancel drive operation dialog box will appear. Select **Stop** if yo want to keep the partially created image or **Discard** if you don't need this image file.



To resume the creation of the image for the same object, select the same file name for the image. You'll be able to create a new image file or continue to create the image for the object.

Resuming image creation



R-Studio for Linux will create a new file for every new start of imaging for the .rdi and .vmdk file types.

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

To open an image

1 Click the Open Image button, or

Select Open Image File on the Drive menu

If a remote computer is connected for <u>Data Recovery over Network</u>, 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

If the image is a multi-volume one, and not all parts are at the same place, the dialog box will appear

Multi-volume image dialog box



Specify paths to other image parts and click the OK button.

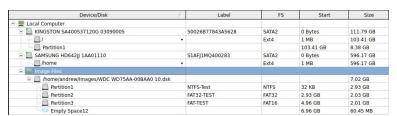
> An Image object will appear on the Drives panel

Depending whether this is a <u>byte-by-byte</u>, compressed (**R-Drive Image** compatible), multi-volume, or VMDK image, its appearance in the Drives panels is different.

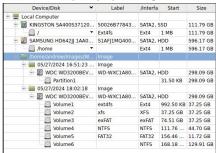
You may perform all data search, scan, and recovery from this image as it were a regular drive/disk object.



A compressed (R-Drive Image compatible) image



A byte by byte image



A multi-volume image

Device/Disk	Label	FS	Start	Size
🖳 Local Computer				
E KINGSTON SA400S37120G 03090005	50026B77843A5628	SATA2	0 Bytes	111.79 GB
	•	Ext4	1 MB	103.41 GB
Partition1			103.41 GB	8.38 GB
E SAMSUNG HD642JJ 1AA01110	S1AFJ1MQ400283	SATA2	0 Bytes	596.17 GB
/home	•	Ext4	1 MB	596.17 GB
🖹 🚃 Image				
Partition1	NTFS-Test	NTFS	32 KB	2.93 GB
Partition2	FAT32-TEST	FAT32	2.93 GB	2.03 GB
Partition3	FAT-TEST	FAT16	4.96 GB	2.01 GB
Empty Space13			6.96 GB	60.46 MB

A VMDK image

To close an image

- Select the image and click the Close Image button,
 - or right-click the image and select Close Image on the shortcut menu
 - or select the image and press the **F8** key.



To close all image

* Select Close All Images on the Tools menu

2.2.9 Wiping Objects

Disk objects can be wiped in order to completely destroy its data.

Supported Wipe Algorithms

File wiping is necessary only for files stored on conventional hard drives. Files stored on new <u>SSD storage</u> <u>devices</u> cannot be effectively wiped out due to the principles of operation of these devices.

Currently **R-Studio** supports 6 wiping algorithms:

Zeroes	The disk object or file is filled with zeroes through 1 pass. The fastest but the least
	secure algorithm. Also it does not conceal the fact that the disk or file has been
	wiped.
Pseudo-random	The disk object or file is filled with pseudo-random numbers through 1 pass. A
numbers	slower but little bit more secure algorithm than the Zeroes algorithm and it also
	conceals to some degree the fact that the disk or file has been wiped.
DoD 5220.22-	The disk object or file is wiped using Department of Defense standard 5220.22-
M(3)	M(3). Provides high-grade data wiping filling the unused space or file with a special
	digital pattern through 3 passes This algorithm is very secure, but slow.
DoD 5200.28-	The disk object or file is wiped using Department of Defense standard 5200.28-
STD(7)	STD(7). Provides high-grade data wiping filling the unused space or file with a
	special digital pattern through 7 passes. This algorithm is very secure, but very
	slow.
Bruce Schneier(7)	The disk object or file is wiped using the Bruce Schneier(7) algorithm. The first
	pass overwrites the drive with the bit pattern "00", the second with "11", and the
	next five with a randomly generated bit pattern. This algorithm is very secure, but
	very slow.
Peter Gutmann	The disk object or file is wiped using the Peter Gutmann's algorithm. Provides high-
(35)	grade data wiping filling the unused space or file with a special digital pattern
	through 35 passes. This algorithm is military-level secure, but horribly slow.

What algorithm is to choose, depends on your specific needs. All of these wiping algorithms make recovery of wiped data with any software-based data recover utility impossible. So if you want to protect your information from a casual snooper, you may safely choose either the **Zeroes** or **Pseudo-random numbers** algorithm. The latter also conceals the fact that you wiped the data.

If you want more security, you need to know the following:

There are some techniques for recovery of wiped data. These techniques are based on the fact that magnetic medium on the hard drive's platters "store" some information about previously written data. Such information cannot be completely removed. Wiped data may be recovered even from mechanically damaged platters. So the

only safe way to completely remove data from a hard drive is to mechanically grind the magnetic medium off the drive platters or dissolve them in special chemical solvents.

But in order to recover the wiped data using one of these techniques, a hard drive must be disassembled, its platters placed in a precise magnetic field measurement system, and the results of such measurement statistically processed. All that is very expensive and requires a very qualified and experienced personnel and a specially developed equipment. Only a very advanced organization such as a law enforcement or intelligence agency of a developed nation, or a special high-tech firm can afford this. Moreover, each successive wiping pass makes such data recovery much and much harder. So, the **DoD 5220.22-M(3)** clearing and sanitizing standard overwriting the data with a special pattern through 3 passes is a rather reliable and safe choice for this case.

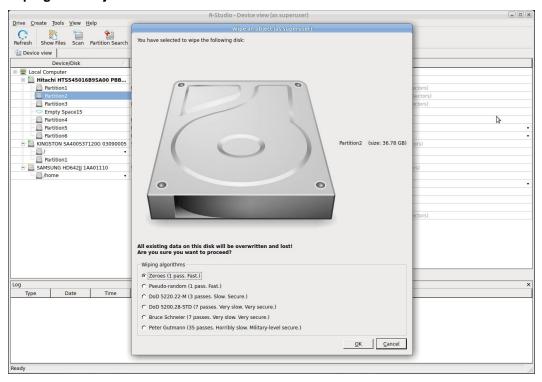
If you need the ultimate security, use the **DoD 5220.22-M(7)** clearing and sanitizing standard, the **Bruce Schneier(7)**, or even the **Peter Gutmann (35)** wiping algorithms. They render data almost unrecoverable, but they are extremely slow.

Wiping Disk Objects:

To wipe a disk object,

- 1 Right-click the disk object in the Device view pane and select Wipe...
- > The Wipe an object dialog box will appear.

Wiping Disk Objects



- 2 Select the desired wiping algorithms and click the OK button.
- > R-Studio for Linux will start wiping the object.

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

Memory considerations

R-Studio for Linux stores information about found files in computer memory. If there are too many files, **R-Studio for Linux** 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 <u>logical disk</u>, <u>partition</u>, partition image, etc.), you may use the **Recover All Files** command from the **Drive** or context menu. Right click the object in the Drives panel to access the context menu. A <u>Recover</u> 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 for Linux** 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 for Linux** 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/Piles panel select the tab

Extensions to sort the files by their extensions

Creation to sort the files by their creation time

Time

Modification to sort the files by their modification time

Time

Accessed to sort the files by their accessed time

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,

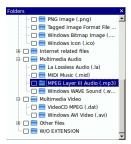
or

• On the Drives panel, right-click the disk and select **Open Drive Files Sorted By** on the context menu and select the respective option,

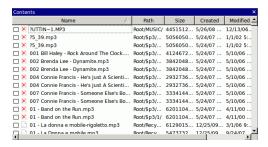
or

- On the Folders panel, right-click the disk letter and select **Show Files Sorted By** on the context menu and select the respective option,
- > R-Studio for Linux 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



Content panel with files/folders sorted by their extensions



To return to the conventional view,

* On the Drives panel, right-click the logical disk, select Open Drive Files Sorted By on the context 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

01

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 for Linux** 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 <u>Recover</u> dialog box to instruct **R-Studio for Linux** what to do in those cases for all files.

Recover (Advanced) dialog box



■Advanced file recovery options

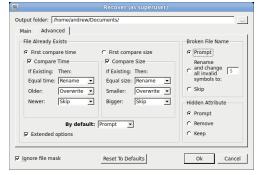
File Already Evists	
File Already Exists	These options instruct R-Studio for Linux what to do if there already exists a
	file with the same name.
Extended options	If this option is selected, <u>more advanced options</u> become accessible to process
	multiple duplicates of the file.
Prompt	If this option is selected, R-Studio for Linux 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 for Linux 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 th file name and file ID.
Skip	If this option is selected, R-Studio for Linux skips all new files with the same
	name.
Overwrite	If this option is selected, R-Studio for Linux overwrites the existing file with
	the new one.
Overwrite Older	If this option is selected, R-Studio for Linux overwrites the existing file with
	the new one if the existing file is older than the new file. The time stamp used is
	Modified.
Overwrite Smaller	If this option is selected, R-Studio for Linux overwrites the existing file with
	the new one if the existing file is smaller than the new file. The time stamp used
	is Modified.
Overwrite Bigger	If this option is selected, R-Studio for Linux overwrites the existing file with
	the new one if the existing file is bigger than the new file. The time stamp used is
	Modified.
Broken File Name	These options instruct R-Studio for Linux what to do if a file to be recovered
	appears to have an invalid name.
Prompt	If this option is selected, R-Studio for Linux shows the standard <u>Broken File</u>
	Name dialog box for each file with a broken file name. It stops file recovery

	until it receives the answer.
Rename and change all invalid symbols to:	If this option is selected, R-Studio for Linux changes all invalid characters to the character specified.
Skip	If this option is selected, R-Studio for Linux skips all files with broken file names.
Hidden Attribute	These options instruct R-Studio for Linux what to do if a file to be recovered appears to have the Hidden attribute.
Prompt	If this option is selected, R-Studio for Linux 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 for Linux removes the Hidden attribute from all files.
Кеер	If this option is selected, R-Studio for Linux 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 for Linux** 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 for Linux** goes to the default action.

Recover (Advanced - Extended options) dialog box



■Extended advanced file recovery options

First compare time First compare size	These options instruct R-Studio for Linux which condition to use first, file time or size.
Compare time Compare size	These options instruct R-Studio for Linux to enable comparison by time and size
Actions	These selectable actions instruct R-Studio for Linux what to do if the condition is met.
Empty field	If this option is selected, R-Studio for Linux skips the condition.
Prompt	If this option is selected, R-Studio for Linux 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 for Linux 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 th file name and file ID.			
Skip	If this option is selected, R-Studio for Linux skips all new files with the same name.			
Overwrite	If this option is selected, R-Studio for Linux overwrites the existing file with the new one.			
Time conditions	If the Modified time stamp is invalid, R-Studio for Linux will skip the comparison.			
Equal time	Two time stamps are the same.			
Older	The existing file is older than the new one.i			
Newer	The existing file is newer than the new one.i			
Size conditions				
Equal size	Two files have the same size.			
Smaller	The existing file is smaller than the new one.i			
Bigger	The existing file is bigger than the new one.i			
By default	The action R-Studio for Linux 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 for Linux**. **R-Studio for Linux** 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 for Linux** 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.

All versions of **R-Studio for Linux** can create recovery lists in the plain text format with basic functionality. **R-Studio Technician/T80+** can create <u>custom recovery lists</u> in other formats with more advanced options

Creating a simple recovery list

To create a recovery list

1 For an entire disk, select Export Recovery List on the File menu, or

Right-click the uppermost folder (higher than **Root**, usually the letter or the name of the disk) and select **Export Recovery List** on the shortcut menu.

For a specific folder, right-click the folder and select Export Recovery List on the shortcut menu.

2 Specify the place to save the recovery list and other necessary options on the Export Recovery List dialog box

Export Recovery List dialog box



Options dialog box



■ Export Recovery List options

Export recovery List options	
Export the entire folder/file tree Export marked file/folder names Export file/folder names	Specifies which file and folder names will be exported.
File format:	A file format for the recovery list. Only text format is available for the standalone and corporate versions. R-Studio Technician/T80 + can create custom recovery lists in other formats with more advanced options The following formats are available for R-Studio Technician/T80 + version: Plain Text HTML XML JSON CSV
File name:	Specifies a file name of the recovery list.

Editing the file recovery list

All files without any marks in the recovery list will be marked when the list is loaded into R-Studio for Linux. So, if you have some files in the recovery list that don't need to be recovered, just delete them from the list. In addition, you may use the following marks to specify some options

- :+ Mark the file, or the folder, all its files, and subfolders within the folder.
- ** Mark the file, or the folder and its files, don't mark subfolders in the folder.
- :- Unmark the file, or the folder, its files, and subfolders in the folder.
- := Unmark the file or the folder and its files, dont unmark subfolders in the folder.
- Provide the information on the file. (**R-Studio Technician/T80**+ only)

R-Studio for Linux processes records in the list consequently. That is, if there are the following lines in the file.

```
:+Files_to_Recover\
:-Files_to_Delete\File_2.jpg
the file File_2.jpg won't be marked for recovery, while for the lines
:-Files_to_Recover\File_2.jpg
:+Files_to_Recover\
file File_2.jpg will be.
```

Loading the edited recovery list

To load a recovery list into R-Studio for Linux,

- * Select Import Recovery List from the File menu and select the file, or
 Right-click the uppermost folder (higher than Root, usually the letter or the name of the disk) and select
 Import Recovery List on the shortcut menu.
- > R-Studio for Linux will load the file and mark the files accordingly.

An example of a simple recovery list

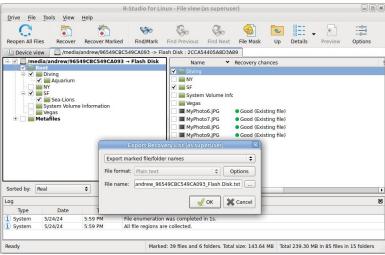
As an example, we'll create a simple recovery list, edit it to mark only those files that are to be recovered, and load it back to mark those files.

To create such recovery list

Mark the necessary folders, right-click the Root folder, and select Export Recovery List on the shortcut menu.

Right-click the uppermost folder (higher than **Root**, usually the letter or the name of the disk) and select **Export Recovery List** on the shortcut menu.

Export Recovery List



Specify the necessary options and click the **OK** button.

R-Studio will save the file.

Structure of a simple recovery list file created by R-Studio for Linux

```
:# Version = 1
:# Sort = by real
:# PathDelim = /
:# CaseSensitive
:# Drive = type: "Volume"; size: "1048576000"; mountpoint: "/media/andrew/ntfs test";
label:"ntfs test"; fs:"NTFS";
:# Parent = type: "Drive"; size: "1048576000"; serial: "2cca54405a8d3a89";
product:"disk"; vendor:"flash";
Diving/
Diving/Aquarium/
Diving/Aquarium/20190822_100644.jpg
Diving/Aquarium/20190822_101620.jpg
Diving/Aguarium/20190822 102526.jpg
Diving/Aguarium/20190822_103830.jpg
Diving/Aquarium/20190822_104333.jpg
SF/
SF/Sea-Lions/
SF/Sea-Lions/IMG_3493.JPG
SF/Sea-Lions/IMG_3535.JPG
SF/Sea-Lions/IMG_3542.JPG
SF/Sea-Lions/IMG_3579.JPG
```

```
SF/Sea-Lions/IMG_3580.JPG
SF/Sea-Lions/IMG_3581.JPG
SF/Sea-Lions/IMG_3589.JPG
SF/IMG_0869.JPG
SF/IMG_0873.JPG
SF/IMG_0890.JPG
SF/IMG_1739.JPG
SF/IMG_3460.JPG
SF/IMG_3461.JPG
SF/IMG_3476.JPG
SF/IMG_3478.JPG
SF/IMG_3479.JPG
SF/IMG_3480.JPG
SF/IMG_3481.JPG
SF/IMG_3493.JPG
SF/IMG_3535.JPG
SF/IMG_3542.JPG
SF/IMG_3579.JPG
SF/IMG_3580.JPG
SF/IMG_3581.JPG
SF/IMG_3589.JPG
SF/IMG_3590.JPG
SF/IMG_3591.JPG
SF/IMG_3592.JPG
SF/IMG_3593.JPG
SF/IMG_3594.JPG
SF/IMG_3595.JPG
SF/IMG_3596.JPG
SF/IMG_3608.JPG
SF/IMG_3627.JPG
MyPhoto6.JPG
MyPhoto7.JPG
MyPhoto8.JPG
MyPhoto9.JPG
```

If such recovery list is created from an entire logical disk/partition, it will contain several virtual folders. For example, they'll have the following structure for an NTFS partition.

```
System Volume Information/
System Volume Information/IndexerVolumeGuid
System Volume Information/WPSettings.dat
Vegas/
MyPhoto6.JPG
MyPhoto7.JPG
MyPhoto8.JPG
MyPhoto9.JPG
///m/$Extend/
///m/$Extend/$Deleted/
///m/$Extend/$RmMetadata/
///m/$Extend/$RmMetadata/$Txf/
///m/$Extend/$RmMetadata/$TxfLog/
///m/$Extend/$RmMetadata/$TxfLog/$Tops
///m/$Extend/$RmMetadata/$TxfLog/$TxfLog.blf
///m/$Extend/$RmMetadata/$TxfLog/$TxfLogContainer0000000000000000001
```

Now we need to edit this file to mark for recovery the following folders/files:

- 1. All files in the root folder;
- 2. Two files MyPhoto1. jpg and MyPhoto3. jpg in the Diving subfolder;
- 3. All files in the Diving/Aquarium/ folder;
- 4. All files in the SF/ folder except the SF/Sea-Lions/ subfolder.

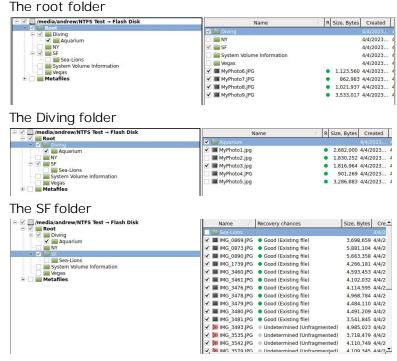
The edited simple recovery list

The final simple recovery list will be the following:

```
:# Version = 1
:# Sort = by real
:# PathDelim = /
:# CaseSensitive
:# Drive = type: "Volume"; size: "1048576000"; mountpoint: "/media/andrew/ntfs test";
label:"ntfs test"; fs:"NTFS";
:# Parent = type: "Drive"; size: "1048576000"; serial: "2cca54405a8d3a89";
product:"disk"; vendor:"flash";
:= Diving/
:+ Diving/Aquarium/
:+ Diving/MyPhoto1.jpg
:+ Diving/MyPhoto3.jpg
:+ SF/
:- SF/Sea-Lions/
MyPhoto6.JPG
MyPhoto7.JPG
MyPhoto8.JPG
MyPhoto9.JPG
```

Loading the edited recovery list

When we load this recovery list into **R-Studio for Linux**, will see the following results;



2.4 Volume Sets and RAIDs

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

R-Studio for Linux 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 for Linux** 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 types in our article What is Hardware RAID.

You may turn numerical indexes for objects to distinguish them better while creating virtual RAIDs.

- 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

Managing your own RAID layouts

To save your own RAID layout in the presets

- 1 Click the More... button on Parents tab and select Save on the context menu.
- 2 Specify the name for the configuration on the Preset name dialog box.

Preset name dialog box



> The new RAID configuration will be saved in the presets

The configurations are stored in the <u>user's RAID layout file</u>. The path and name for this file is specified on the <u>R-Studio for Linux Settings</u> dialog box. If no file is specified, **R-Studio for Linux** 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 for Linux** will search the disks listed in the Drives tab for the parents in the <u>user's RAID layout file</u>. If the search fails, **R-Studio for Linux** will show the Reference Parents not found message.

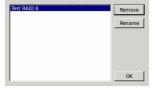
To load your RAID configuration

- 1 Click the More... button on Parents tab and select the preset you want to load
- > The new RAID configuration will be loaded

To edit your own RAID configuration

- 1 Click the More... button on Parents tab and select Edit... on the context menu
- 2 Select the required configuration on the Edit Block RAID Layout Presets dialog box.

Edit Block RAID Layout Presets dialog box



- 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 RAID 5.

Actually, when you turn an object off-line, **R-Studio for Linux** substitutes it with a *Missing Disk* or *Empty Space* object.

Missing Disks and Empty Space

If one <u>partition</u> 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 or empty space in order to correctly re-

construct the hardware volume set or RAID or software volume set or RAID structure. The missing disk/empty space should be placed in the same place as the missing partition.

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

To add a Missing disk/Empty space object

- 1 Select a Volume sets and RAIDs object on the R-Studio for Linux's Drives panel
- Right-click in the Parents tab in the right pane and select Add Missing Disk or Add Empty Space on the context menu or select Add Missing Disk or Add Empty Space on the Create menu. Which object type is necessary, R-Studio for Linux decides automatically.

For the **Empty space** object, Specify its size on the Add Empty Space dialog box.

Add Empty Space dialog box



> A Missing Disk or Empty Space 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
- 3 Drag the required partitions from the Drives panel to the Parents tab
 - Other ways to add objects
 - Right-click the Parents tab and select the required partition from the context menu,
 or
 - Right-click the partition on the Drives panel, select **Add to RAID** on the context menu, and select the RAID object you want to add the partition to.

Or right-click the Parents tab and select the required partition from the context menu.

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.

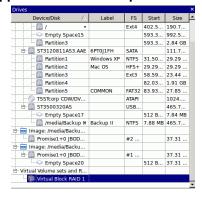


> The *Virtual volume set or RAIDs* object can now be processed like regular drives/volumes

If **R-Studio for Linux** 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

Or right-click the Parents tab and select the required partition from the context menu.

You may either make **R-Studio for Linux** 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.

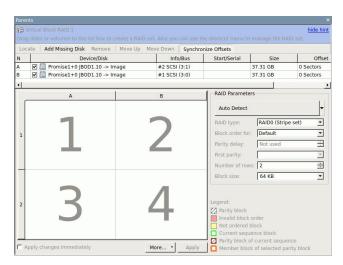
Object control buttons

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 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 Blocks order drop-down or context menu.

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



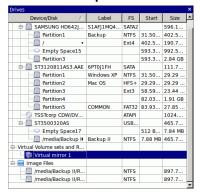
> The Virtual Block RAID object can now be processed like regular drives/volumes

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

The <u>Description Files for RAID Configurations</u> topic shows the RAID description file for this RAID configuration.

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

Or right-click the Parents tab and select the required partition from the context menu.



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

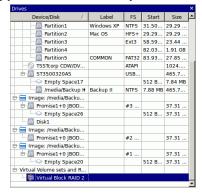
If **R-Studio for Linux** detects a valid file system on the newly created RAID object, a partition object will appear on the Drives panel.

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

You may either make **R-Studio for Linux** 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 5. 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 5.

You also need to specify Block order for virtual RAID 5. You may select it on the Block order drop-down or context menu.

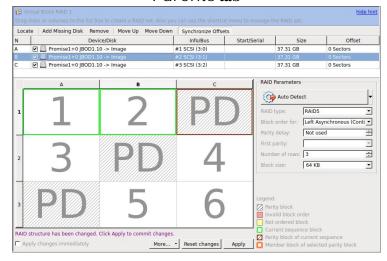
If the those parameters are not correct, data on the parents will not be damaged, but files from the RAID 5 cannot be recovered.

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 5 Layouts** for details.



Parents tab



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

If **R-Studio for Linux** detects a valid file system on the newly created RAID object, a <u>partition</u> object will appear on the Drives panel.

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

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 5 Layouts for details.

2.4.3 Working with RAID 6 Presets

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

Reed-Solomon

(standard), (continuous),

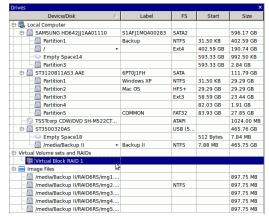
In addition you may create your own RAID 6 configurations.

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

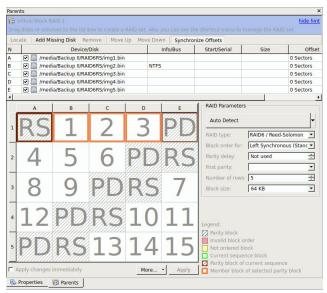
- 1 Click the Create Virtual RAID button and select Create Virtual Block RAID or select the Create Virtual Block RAID on the Create menu
- > A Virtual Block RAID object will appear on the Drives panel



- 2 Select RAID 6/Reed-Solomon on the RAID type
- 3 Drag the required partitions from the Drives panel to the Parents tab
- 3 Drag the required partitions from the Drives panel to the Parents tab
 - Other ways to add objects
 - Right-click the Parents tab and select the required partition from the context menu,
 - Right-click the partition on the Drives panel, select **Add to RAID** on the context menu, and select the RAID object you want to add the partition to.

You may either make **R-Studio for Linux** 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

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 volume set.

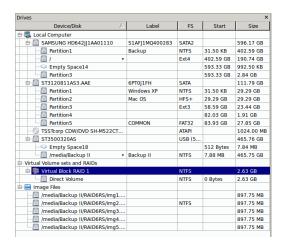
You also need to specify Blocks order (Left Synchronous (standard) for our case) for virtual RAID 6. You may select it on the Blocks order drop-down or context menu.

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 for Linux** detects a valid file system on the newly created RAID object, a <u>partition</u> object will appear on the Drives panel. The <u>Description Files for RAID Configurations</u> topic shows the RAID description file for this RAID configuration.



2.4.4 Working with RAID6 (Double Xor) Presets

R-Studio for Linux allows you to create and process RAID 6 Double Xor layouts with the following presets: EVENODD RAID DP X-Code(2) Adaptec 3805

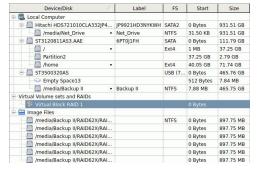
In addition you may create your own RAID 6 configurations.

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 6/2Double Xor on the RAID type
- 3 Drag the required partitions from the Drives panel to the Parents tab
 - Other ways to add objects
 - Right-click the Parents tab and select the required partition from the context menu, or
 - Right-click the partition on the Drives panel, select **Add to RAID** on the context menu, and select the RAID object you want to add the partition to.

You may either make **R-Studio for Linux** 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.

Table Potents | Virtual Block RAID 1 | Side | Sid

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

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 volume set.

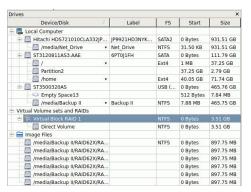
You also need to specify Blocks order (EVENODD for our case) for virtual RAID 6 (Double Xor). You may select it on the Blocks order drop-down or context menu.

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 for Linux** detects a valid file system on the newly created RAID object, a <u>partition</u> object will appear on the Drives panel. The <u>Description Files for RAID Configurations</u> 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 for Linux 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)

■ Block order table:

	Α	В	С	
1	1	2	PD	
2	3	4	PD	
3	5	6	PD	
4	7	8	PD	
5	9	10	PD	
6	11	12	PD	
7	13	14	PD	
8	15	16	PD	Delay=16
9	17	18	PD	
10	19	20	PD	
11	21	22	PD	
12	23	24	PD	
13	25	26	PD	
14	27	28	PD	
15	29	30	PD	
16	31	32	PD	
17	33	PD	34	
18	35	PD	36	Delay=16
19	37	PD	38	

20	39	PD	40	
21	41	PD	42	
22	43	PD	44	
23	45	PD	46	
24	47	PD	48	
25	49	PD	50	
26	51	PD	52	
27	53	PD	54	
28	55	PD	56	
29	57	PD	58	
30	59	PD	60	
31	61	PD	62	
32	63	PD	64	
33	PD	65	66	
34	PD	67	68	
35	PD	69	70	
36	PD	71	72	
37	PD	73	74	
38	PD	75	76	
39	PD	77	78	
40	PD	79	80	Dolov-16
41	PD	81	82	Delay=16
42	PD	83	84	
43	PD	85	86	
44	PD	87	88	
45	PD	89	90	
46	PD	91	92	
47	PD	93	94	
48	PD	95	96	
-	•		•	

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 for Linux** 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 RAID 5 on the RAID type
 - Other ways to add objects
 - Right-click the Parents tab and select the required partition from the context menu, or
 - Right-click the partition on the Drives panel, select Add to RAID on the context menu, and select the

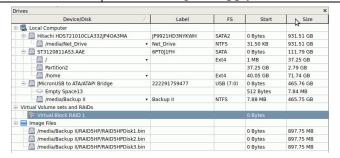
RAID object you want to add the partition to.

These objects may be hard drives, <u>logical disks</u>, or <u>images</u>. 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

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)



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.

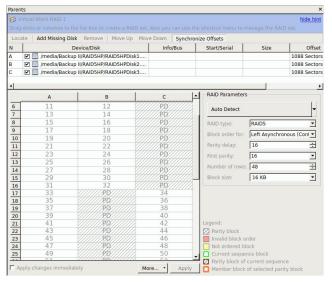
The number of rows will change to 48.

■ If necessary, adjust the First parity parameter

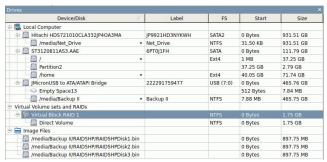
By default, this parameter is set equal to Parity delay. By changing it, you may "shift" the block order table. For example, when the First parity parameter is set as 1 for the RAID 5 of 3 disks with Parity delay of 3., the block order table will be the following:**First parity parameter**

	A	В	С
1	1	2	PD
2	3	PD	4
3	5	PD	6
4	7	PD	8
5	PD	9	10
6	PD	11	12
7	PD	13	14
8	15	16	PD
9	17	18	PD

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 for Linux** detects a valid file system on this RAID object, a <u>partition</u> object will appear on the Drives panel.



The <u>Description Files for RAID Configurations</u> 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 for Linux allows you to create and process very complex custom RAID layouts.

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:

	Α	В	С
1	PD	1	2
2	PD	3	4

3	PD	5	6
4	7	PD	8
5	9	PD	10
6	11	PD	12
7	13	14	PD
8	15	16	PD
9	17	18	PD

To create such RAID 5,

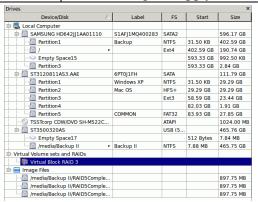
- 1 Click the Create virtual volume sets or RAIDs button and select Create Virtual Block RAID
- 3 Drag the required partitions from the Drives panel to the Parents tab
 - Other ways to add objects
 - Right-click the Parents tab and select the required partition from the context menu, or
 - Right-click the partition on the Drives panel, select **Add to RAID** on the context menu, and select the RAID object you want to add the partition to.

Check that the Apply changes immediately check box is clear on the Parents tab. This will prevent **R-Studio for Linux** 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 These objects may be hard drives, <u>logical disks</u>, or <u>images</u>. Check that the objects are correctly placed.

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)

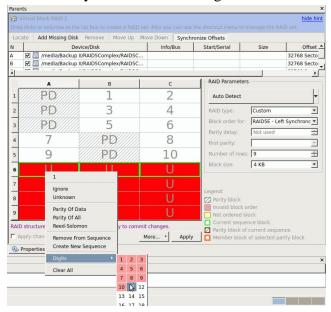


- 3 Specify the Block size and Offset parameters on the Parents tab Disregard the Block order field.
- **4 Manually enter 9 to Number of rows on the** Parents **tab** Block order will change to Custom.
- 5 Enter the block order in the table on the Parents tab

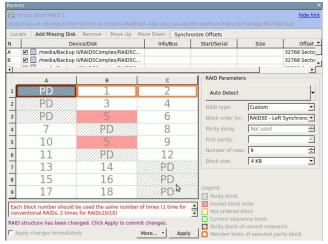
Use the RAID sequence window to move from one row to another.

Using the keyboard: arrow keys to navigate, digit and pd keys to enter the block order.

Using the mouse: right-click the cell and select the number or parity from the context menu. If the block table is too large, you better use the keyboard to enter the digits.

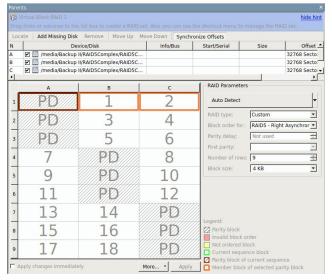


Corrections: R-Studio for Linux will tell you if some digits are not correct. Navigate to the required cell and enter the correct value. Use the **Delete** key to clear a cell.



Clear the table: Right-click the table and select Clear all on the context menu.

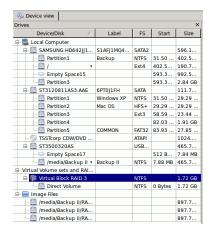
6 When you finishes entering the information, click the Apply button on the Parents tab



> The created Virtual Block RAID 1 object can now be processed like regular drives/volumes

If **R-Studio for Linux** detects a valid file system on this RAID object, a <u>partition</u> object will appear on the Drives panel.

The <u>Description Files for RAID Configurations</u> topic shows the RAID description file for this RAID configuration.



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:

Α	В	С	D	Α	В	С	D	Α	В	С	D
PD	1	2	PD	3	4	PD	5	6	PD	7	8

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 for Linux** 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 RAID 5 on the RAID type

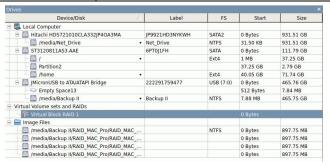
■ Other ways to add objects

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

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

Object control buttons

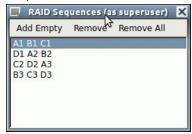
Locate	Click this button to locate the selected object in the Drives panel.
Add Empty Space/Add Missing Disk	Click this button to add an empty space or missing disk object to the RAID
Remove	Click this button to remove the selected object from the RAID
Move Up	Click this button to move up the selected 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)



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

- 7 Right-click Cell 2 in the block order table and select Add to Sequence, do that for Cell 3, too.
- 8 Right-click Cell 4 in the block order table and select Create New Sequence.
- 9 Right-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:

Sequences window



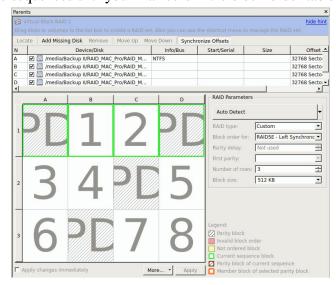
10 Select the first line in the RAID Sequence window, right-click Cell 1 in the block order table, and select Parity of Data.

If any unnecessary sequences appear, right-click them in the RAID Sequence window, and select Remove.

- 11 Right-click Cell 2 in the block order table and select 1, do that for Cell 3 selecting 2.

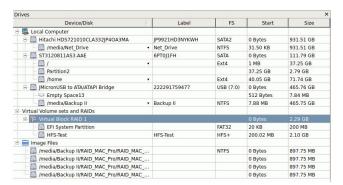
 If any unnecessary sequences appear, right-click them in the RAID Sequence window, and select Remove.
- 12 Move to the next sequence in the RAID Sequence window and repeat the procedure for cells 4, 5, and 6.

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 for Linux** detects a valid file system on this RAID object, a partition object will appear on the Drives panel.

The <u>Description Files for RAID Configurations</u> 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:

	Α	В	С	D	E
1	RS	1	2	3	PD
2	4	5	6	PD	RS
3	8	9	PD	RS	7
4	12	PD	RS	10	11
5	PD	RS	13	14	15
6	PA	PA	PA	PA	PA

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.

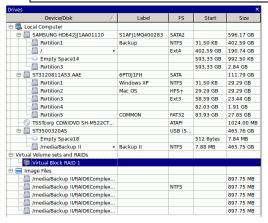
- 1 Click the Create virtual volume sets or RAIDs button and select Create Virtual Block RAID
- 3 Drag the required partitions from the Drives panel to the Parents tab
 - Other ways to add objects
 - Right-click the Parents tab and select the required partition from the context menu,
 or
 - Right-click the partition on the Drives panel, select **Add to RAID** on the context menu, and select the RAID object you want to add the partition to.

Check that the Apply changes immediately check box is clear on the Parents tab. This will prevent **R-Studio for Linux** 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 These objects may be hard drives, logical disks, or <u>images</u>. Check that the objects are correctly placed.

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)



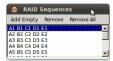
3 Specify the Block size and Offset parameters on the Parents tab Disregard the Block order parameter.

- 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:

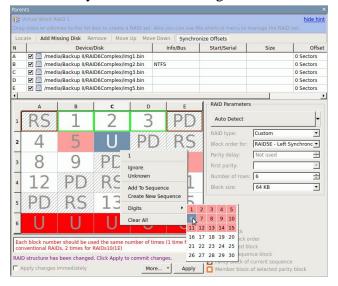
PD	Parity of data
PA	Parity of all
RS	Reed-Solomon
U	Unknown
Ι	Ignore

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: right-click the cell and select the number or parity from the context 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 for Linux** automatically generates those sequences when you add RAID parents.

For the columns and arbitrary sequences:

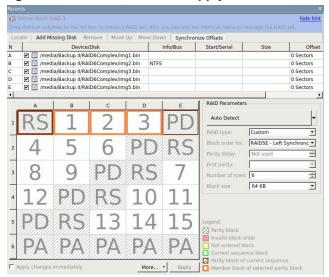
You need to create those sequences and add the respective blocks to it manually.

To create a sequence: Click **Add empty** on the RAID Sequences window or select **Create New Sequence** on the context menu on the Parents tab.

To add a block to a sequence: Right-click the respective cell and select Add To Sequence on the context menu on the Parents tab.

To remove a block to a sequence: Right-click the respective cell and select Remove From Sequence on the context menu on the Parents tab.

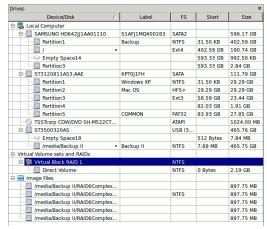
6 When you finishes entering the information, click the Apply button on the Parents tab



> The created Virtual Block RAID 1 object can now be processed like regular drives/volumes

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

The <u>Description Files for RAID Configurations</u> topic shows the RAID description file for this RAID configuration.



2.4.7 Nested and Non-Standard RAID Levels

R-Studio for Linux can work with various <u>nested and non-standard RAID levels</u>. Currently, the following RAID levels are supported:

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

2.4.7.1 RAID10 (1+0)

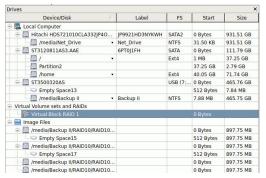
A RAID 10 (or 1+0) is a stripe of mirrors. Its block order can be represented as:

	Α	В	С	D
1	1	1	2	2

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

- Right-click the Parents tab and select the required partition from the context menu,
- Right-click the partition on the Drives panel, select **Add to RAID** on the context 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 for Linux** 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 10. If this order is incorrect, you must change it by dragging the parents to place them in the correct order.

Object control buttons

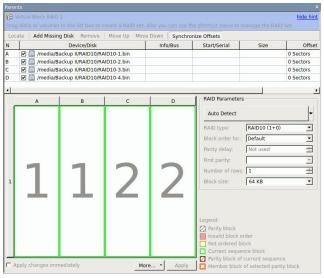
Locate	Click this button to locate the selected object in the Drives panel.
Add Empty Space/Add Missing Disk	Click this button to add an empty space or missing disk object to the RAID
Remove	Click this button to remove the selected object from the RAID
Move Up	Click this button to move up the selected 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 10.

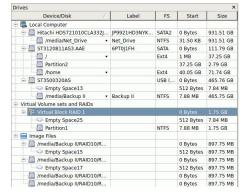
You also need to specify Block order for virtual RAID 10. You may select it on the Block order drop-down or context menu.

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.



Parents tab



> The RAID 10 object can now be processed like regular drives/volumes

If **R-Studio for Linux** detects a valid file system on the newly created RAID object, a <u>partition</u> object will appear on the Drives panel.

The <u>Description Files for RAID Configurations</u> 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

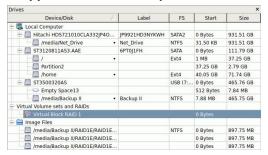
RAID 1E is utilizes both the mirroring and striping: data is striped across all drives, as in RAID 0. Additionally, a copy of each stripe is stored on a different drive, as in RAID 1. Its block order can be represented as:

	Α	В	С
1	1	1	2
2	2	3	3

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

> 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

- Right-click the Parents tab and select the required partition from the context menu,
- Right-click the partition on the Drives panel, select **Add to RAID** on the context 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 for Linux** 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

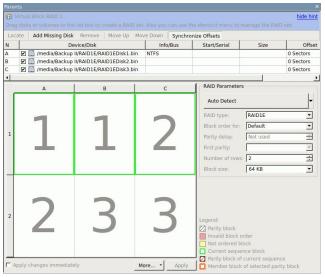
Object control buttons	
Locate	Click this button to locate the selected object in the Drives
	panel.
Add Empty Space/Add Missing Disk	Click this button to add an empty space or missing disk object
	to the RAID
Remove	Click this button to remove the selected object from the RAID
Move Up	Click this button 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 1E.

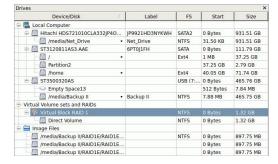
You also need to specify Block order for virtual RAID 1E You may select it on the Block order drop-down or context menu.

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.



Parents tab



> The RAID 1E object can now be processed like regular drives/volumes

If **R-Studio for Linux** detects a valid file system on the newly created RAID object, a <u>partition</u> object will appear on the Drives panel.

The <u>Description Files for RAID Configurations</u> 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

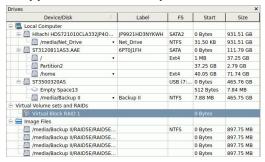
RAID 5E (where E stands for Enhanced) is a RAID 5 layout with an integrated hot-spare drive, where the spare drive is an active part of the block rotation scheme. An example of such RAID layout is in the table below:

	Α	В	С	D
1	1	2	3	PD
2	5	6	PD	4
3	9	PD	7	8
4	PD	10	11	12
5	SP	SP	SP	SP

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

■ Other ways to add objects

- Right-click the Parents tab and select the required partition from the context menu,
- Right-click the partition on the Drives panel, select **Add to RAID** on the context 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 for Linux** 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 5E. If this order is incorrect, you must change it by dragging the parents to place them in the correct order.

Object control buttons

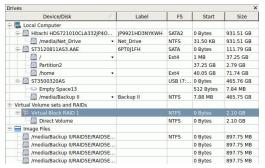
Locate	Click this button to locate the selected object in the Drives panel.
Add Empty Space/Add Missing Disk	Click this button to add an empty space or missing disk object to the RAID
Remove	Click this button to remove the selected object from the RAID
Move Up	Click this button to move up the selected 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 5E.

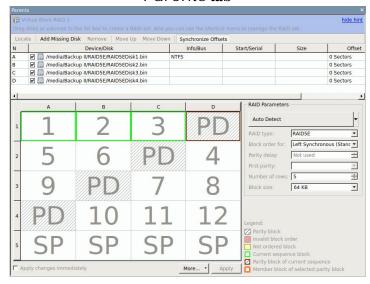
You also need to specify Block order for virtual RAID 5E You may select it on the Block order drop-down or context menu.

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.



Parents tab



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

If **R-Studio for Linux** detects a valid file system on the newly created RAID object, a <u>partition</u> object will appear on the Drives panel.

The <u>Description Files for RAID Configurations</u> 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

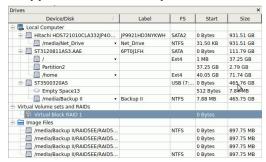
RAID 5EE (where E stands for Enhanced) is a RAID 5 layout with an integrated hot-spare drive, where the spare drive is an active part of the block rotation scheme. An example of such RAID layout is in the table below:

	Α	В	С	D
1	1	2	SP	PD
2	4	SP	PD	3
3	SP	PD	5	6
4	PD	7	8	SP

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
 - Right-click the Parents tab and select the required partition from the context menu, or
 - Right-click the partition on the Drives panel, select **Add to RAID** on the context 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 for Linux** 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 5EE. If this order is incorrect, you must change it by dragging the parents to place them in the correct order.

Object control buttons

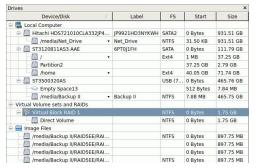
Locate	Click this button to locate the selected object in the Drives
Locate	3
	panel.
Add Empty Space/Add Missing Disk	Click this button to add an empty space or missing disk object
	to the RAID
	to the KAID
Remove	Click this button to remove the selected object from the RAID
Move Up	Click this button 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.

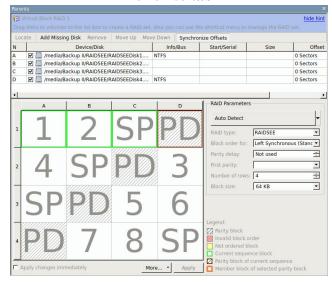
You also need to specify Block order for virtual RAID 5EE You may select it on the Block order drop-down or context menu.

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.



Parents tab



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

If **R-Studio for Linux** detects a valid file system on the newly created RAID object, a <u>partition</u> object will appear on the Drives panel.

The <u>Description Files for RAID Configurations</u> 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:

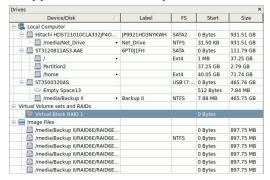
	Α	В	С	D	E	F
1	RS	1	2	3	4	PD
2	5	6	7	8	PD	RS
3	10	11	12	PD	RS	9
4	15	16	PD	RS	13	14

5	20	PD	RS	17	18	19
6	PD	RS	21	22	23	24
7	SP	SP	SP	SP	SP	SP

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
- > 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

- Right-click the Parents tab and select the required partition from the context menu, or
- Right-click the partition on the Drives panel, select **Add to RAID** on the context 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 for Linux** 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 6E. If this order is incorrect, you must change it by dragging the parents to place them in the correct order.

Object control buttons

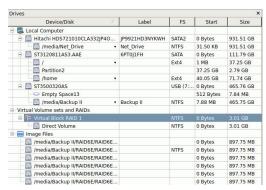
Locate	Click this button to locate the selected object in the Drives panel.
Add Empty Space/Add Missing Disk	Click this button to add an empty space or missing disk object to the RAID
Remove	Click this button to remove the selected object from the RAID
Move Up	Click this button to move up the selected 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 6E.

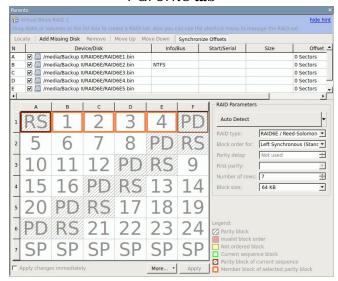
You also need to specify Block order for virtual RAID 6E You may select it on the Block order drop-down or context menu.

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.



Parents tab



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

If **R-Studio for Linux** detects a valid file system on the newly created RAID object, a <u>partition</u> 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.

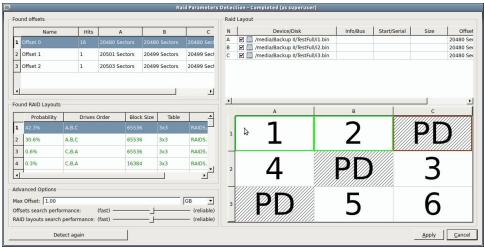
2.4.8 Finding RAID Parameters

R-Studio for Linux 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 <u>images</u>) 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 for Linux 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 for Linux will change the RAID layout to the selected one on the Parents tab.
- 3 Click the Apply button on the Parents tab
- > R-Studio for Linux will use the found parameters for the RAID.

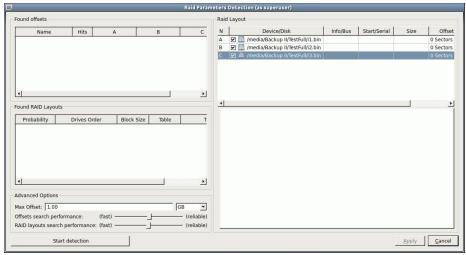
 If necessary, you may return to the RAID Parameter Detection dialog box by clicking the Choose Variants button, and select another RAID layout.

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



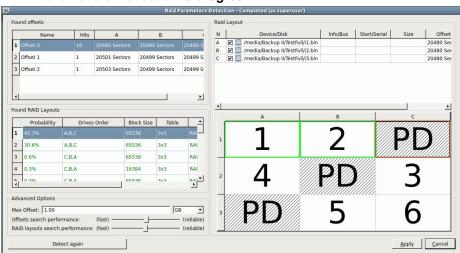
You may change the disk order, offset for disk(s), and enable/@isable disks.

Advanced Parameters

Max offset:	The area on the disk to find RAID parameters in.
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. Right-click empty space on the **Found offsets** pane and select **Add Custom offset** on the context 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 for Linux 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.

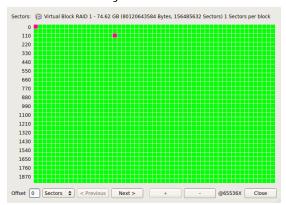
2.4.9 Checking RAID Consistency

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

To check RAID consistency,

- * Right-click the RAID and select Check RAID consistency... on the context menu
- > The RAID consistency check window will appear showing the progress.

RAID consistency check window



When the check is finished, you may inspect the results.

Block	
color	
Green	Data parity values are valid.
Red	Data parity values are not valid.
White	0's

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

Sectors	The number of the first sector in the row.
Offset	Offset in the data. Enter the address you want to jump to and press the Enter key.
Sectors/Bytes/KB	Specifies the dimension of the data in the Offset field.
Previous/Next	Moves to the previous/next part of the data.
+/-	Zooms into/out of, the data.

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 for Linux 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

Custom-created RAID configuration file example

```
<?xml version="1.0" encoding="UTF-8"?>
<RAIDList version="1">
    <RAID blockSize="65536" name="RAID6Complex" rows="6" type="256">
        <Parents>
            <Parent name="imq1.bin" size="941359104" order="1"/>
            <Parent name="imq2.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 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 version="1.0" encoding="utf-8"?>
```

Section RAIDList

<RAIDList>

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

Section structure example:

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

Section RAID

This section describes each RAID layout.

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

</RAIDList>

Attributes:

blocksize	<u32></u32>	Required	The block size of the RAID in bytes
name	<string></string>	Optional	The name of the RAID layout
rows	<u16></u16>	Required	The number of rows in the RAID layout table.
type	<u16></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/'Nertical Xor Encoding
			256: Custom Raid Table
			If the RAID type parameter contradicts to the RAID table,
			the RAID table always prevails.
order	<u16></u16>	Required/Optio	The RAID sub-type. For example, order="2" means Left
		nal	Asynchronous for RAID5 layouts. Any value for the custom
			RAID layouts will be ignored.
parityDela	<u16></u16>	Required	The Parity delay parameter.
У			

Section structure example:

Section Parents

This section describes the RAID parents. It contains the Parent> elements of the RAID.

Section structure example:

Element Parent

The element specifies the parent of the RAID.

Attributes:

comp	<string></string>	Required/O	The file-container with the parent object.
		ptional	
name	<string></string>	Required	The object name of the RAID parent.
offset	<u16></u16>	Required is	The offset value in bytes
		not 0	
size=	<u16></u16>	Required	The object size in bytes
order	<u16></u16>	Required	The order of the RAID object

Section Table

Section structure example:

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:

id	<string></string>	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.	
sequence	<string></string>	Optional	The numerical identifier for non-default sequences.	

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:

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</u16>	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.

```
</Parents>
</RAID>
</RAIDList>
```

Basic RAID 5

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

RAID 5 with parity delays

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

Advanced RAID 5

The RAID layout is described in the Working with Advanced RAID Layouts topic.

```
<Block id="C1">2</Block>
            <Block id="A2">XorOfData</Block>
            <Block id="B2">3</Block>
            <Block id="C2">4</Block>
            <Block id="A3">XorOfData</Block>
            <Block id="B3">5</Block>
            <Block id="C3">6</Block>
            <Block id="A4">7</Block>
            <Block id="B4">XorOfData</Block>
            <Block id="C4">8</Block>
            <Block id="A5">9</Block>
            <Block id="B5">XorOfData</Block>
            <Block id="C5">10</Block>
            <Block id="A6">11</Block>
            <Block id="B6">XorOfData</Block>
            <Block id="C6">12</Block>
            <Block id="A7">13</Block>
            <Block id="B7">14</Block>
            <Block id="C7">XorOfData</Block>
            <Block id="A8">15</Block>
            <Block id="B8">16</Block>
            <Block id="C8">XorOfData</Block>
            <Block id="A9">17</Block>
            <Block id="B9">18</Block>
            <Block id="C9">XorOfData</Block>
        </Table>
    </RAID>
</RAIDList>
```

Advanced RAID 5

The RAID layout is described in the Working with Advanced RAID Layouts topic.

```
<?xml version="1.0" encoding="UTF-8"?>
<RAIDList version="1">
    <RAID blockSize="524288" name="RAID_MacPro" rows="3" type="256">
        <Parents>
            <Parent name="RAID_MAC_ProDisk1.bin" fs="NTFS" offset="16777216"</pre>
size="941359104" order="1"/>
            <Parent name="RAID_MAC_ProDisk2.bin" offset="16777216" size="941359104"</pre>
order="2"/>
            <Parent name="RAID_MAC_ProDisk3.bin" offset="16777216" size="941359104"</pre>
order="3"/>
            <Parent name="RAID_MAC_ProDisk4.bin" offset="16777216" size="941359104"</pre>
order="4"/>
        </Parents>
        <Table>
            <Block id="A1" sequence="1">XorOfData</Block>
            <Block id="B1">1</Block>
            <Block id="C1">2</Block>
            <Block id="D1" sequence="2">XorOfData</Block>
            <Block id="A2">3</Block>
            <Block id="B2">4</Block>
            <Block id="C2" sequence="3">XorOfData</Block>
            <Block id="D2">5</Block>
```

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.

```
<Parent name="imq2.bin" fs="NTFS" size="941359104" order="2"/>
            <Parent name="img3.bin" size="941359104" order="3"/>
            <Parent name="imq4.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 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 id="5">E1 E2 E3 E4 E5 E6</Sequence>
        </Sequences>
    </RAID>
</RAIDList>
RAID10 (1+0)
The RAID layout is described in the RAID 10 (1+0) topic.
```

```
<?xml version="1.0" encoding="UTF-8"?>
<RAIDList version="1">
    <RAID blockSize="65536" name="RAID10" rows="1" type="2" order="7"</pre>
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 version="1.0" encoding="UTF-8"?>
<RAIDList version="1">
    <RAID blockSize="65536" name="RAID1E" rows="2" type="3" order="1"</pre>
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 version="1.0" encoding="UTF-8"?>
<RAIDList version="1">
    <RAID blockSize="65536" name="RAID5E" rows="5" type="6" order="1"</pre>
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 version="1.0" encoding="UTF-8"?>
<RAIDList version="1">
    <RAID blockSize="65536" name="RAID5EE" rows="4" type="7" order="1"</pre>
parityDelay="1">
        <Parents>
            <Parent name="RAID5EEDisk1.bin" fs="NTFS" size="941359104" order="1"/>
            <Parent name="RAID5EEDisk2.bin" size="941359104" order="2"/>
            <Parent name="RAID5EEDisk3.bin" size="941359104" order="3"/>
            <Parent name="RAID5EEDisk4.bin" fs="NTFS" size="941359104" order="4"/>
        </Parents>
    </RATD>
```

</RAIDList>

RAID6E

The RAID layout is described in the **RAID6E** topic.

2.4.12 Various Disk and Volume Managers

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

- BitLocker Drive Encryption
- Windows Dynamic Disks
- Windows Storage Spaces
- Apple RAIDs
- Apple CoreStorage/FileVault/Fusion Drive Volumes
- Linux mdadm RAIDs
- Logical Volume Manager (LVM and LVM2)

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

In addition, **R-Studio** can work with various <u>virtual disk and disk image formats</u>.

2.4.12.1 BitLocker Drive Encryption

BitLocker Drive Encryption, or **BitLocker**, is a data protection feature introduced by Microsoft since Windows Vista. It implements some hard/software measures to encrypt either USB external flash drives or internal system SSD/HDD devices. You may read more about **BitLocker Drive Encryption** on the <u>Microsoft site</u> or <u>Wikipedia</u>.

There are following encryption methods (protectors in the Microsoft terms) that can be utilized in the **BitLocker** protection:

- A <u>TPM/TPM+PIN</u> chip
- A USB key (a flash drive containing a .bek file)
- A user's password (not to confuse with a user's logon password) / recovery key

These methods can be used either individually or as a combination thereof. If they are used as a combination, knowing the decryption information for only one method is enough to unlock the device.

R-Studio can unlock devices encrypted with **BitLocker** provided that all the necessary information is known.

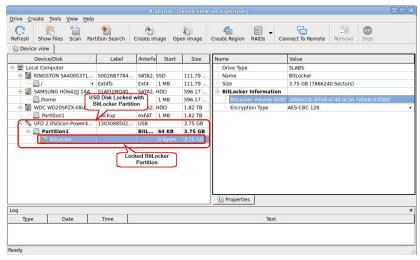
BitLocker ToGo

This is the method used to lock external removable devices. The password or a recovery key is necessary to know to unlock the device. A recovery key may be in the printed form or contained in a file. A name of such a file has the following pattern: BitLocker Recovery Key 600397A9-48AA-4DE4-B775-C71EB130EA1B.txt, where the last characters is the **BitLocker** volume identifier. That file contains the **BitLocker** volume identifier and a recovery key.

To unlock a BitLocker ToGo device,

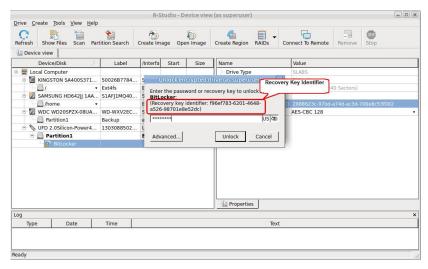
1 Locate the device and double-click the BitLocker partition.

BitLocker ToGo



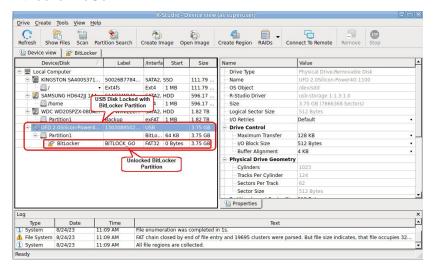
2 Enter the password or recovery key and click the Unlock button.

BitLocker ToGo



> R-Studio will unlock the volume

BitLocker ToGo



BitLocker System Drive Encryption

This is the method used to lock internal system drives.

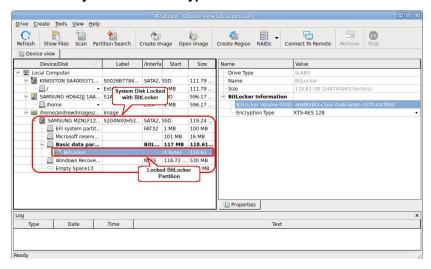
Depending on what methods are used, the following information is necessary to know to unlock the drive.

- A recovery key in the printed form or in a file. A name of such a file has the following pattern: BitLocker Recovery Key FDA7B96C-635E-45AA-BE63-00C3DB3771EE.txt, where the last characters is the **BitLocker** volume identifier. That file contains the **BitLocker** volume identifier and a recovery key.
- A password used to start the preboot process. It shouldn't be confused with the password for the user's logon.
- An external USB flash drive containing its .bek file. Note that Windows sets system and Hidden attributes for such files and Windows doesn't show such files by default.

To unlock a system drive with a BitLocker partition,

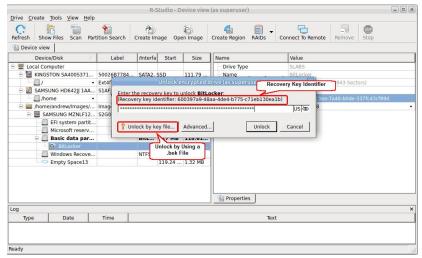
1 Locate the device and double-click the BitLocker partition.

BitLocker System Drive Encryption



2 Enter the password or recovery key and click the Unlock button.

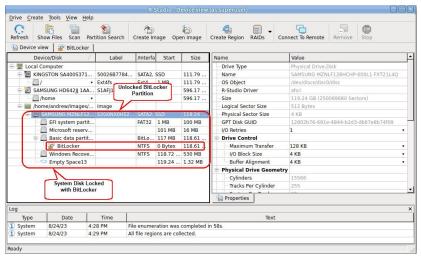
BitLocker System Drive Encryption



If you have the .bec file, click the Unlock by key file button and load the file.

> R-Studio will unlock the volume

BitLocker System Drive Encryption



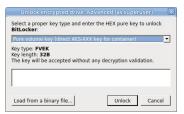
TPM/TPM+PIN modes

Only in registered **R-Studio Technician/T80**+ versions.

If only the TPM/TPM+PIN hardware was used to encrypt the partition, you must have either the FVEK (Full Volume Encryption Key) or VMK (Volume Master Key) data. Obtaining these keys is a very hard task, only quite advanced forensic professionals can do that using specialized hardware. Sometimes it may be possible to extract a FVEK from memory dumps and/or hibernation files, but this is still not a trivial process.

If you have FVEK or VMK data, click the **Advanced** button, select the key type of the data, enter the key or load a file with the key.

BitLocker TPM/TPM+PIN modes



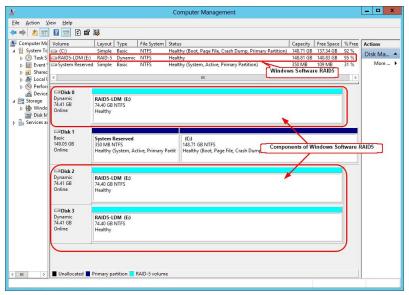
R-Studio for Linux will unlock the volume.

You may also save and load encryption information from a BitLocker Encryption volume.

2.4.12.2 Windows Dynamic Disks

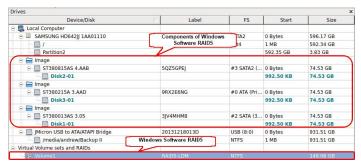
R-Studio for Linux supports <u>dynamic disks</u>, including <u>Windows software RAIDs</u>, mirrors, and spanned volumes. When **R-Studio for Linux** detects components from such dynamic disks, it assembles them accordingly.

Windows dynamic disks (RAID5)



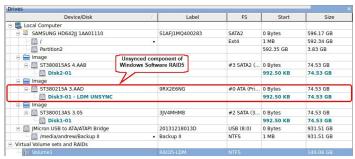
R-Studio for Linux automatically detects components form dynamic disks and creates those dynamic disks automatically. At the same time, **R-Studio for Linux** gives access to the parents of the dynamic disks (hard drives and <u>images</u>).

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



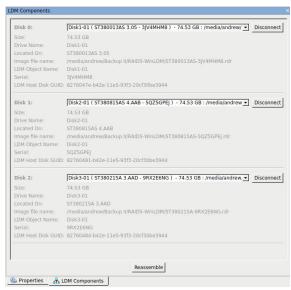
Also, **R-Studio for Linux** automatically detects inconsistent components of dynamic disks and marks them accordingly.

Windows dynamic disks (RAID5) with unsynced parent



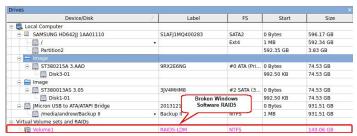
R-Studio for Linux shows the components of the selected dynamic disk on its LDM Components tab.

LDM Components tab



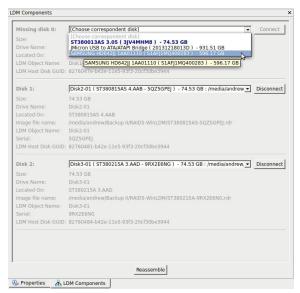
R-Studio for Linux shows broken dynamic disks in pink.

Broken dynamic disks in R-Studio for Linux



The LDM Components tab also allows you to manually disconnect or connect the components, for example, if they are such damaged that **R-Studio for Linux** 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 for Linux** displays the objects it recognizes as the components of the dynamic disk in blue.

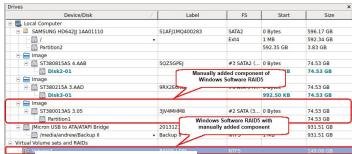
Adding a component manually



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

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

Dynamic disks with added components in R-Studio for Linux



2.4.12.3 Windows Storage Spaces

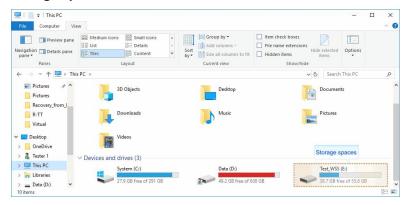
<u>Windows storage spaces</u> is a new storage technology, introduced in Windows 8 and Windows Server 2012, that allows the user to combine various (not always similar) hard drives into a kind of a RAID or compound volume. First, the hard drives are combined into a storage pool, then several storage 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 <u>Storage Spaces: FAQ</u>

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

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

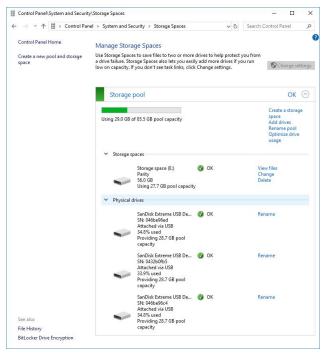
When Windows storage spaces use caching, **R-Studio for Linux** can process both the cache and the storage space itself simultaneously greatly increasing chances for successful recovery of deleted files. For <u>SSD (Solid State Device)</u> media, bypassing the cache may be the only available option to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

Storage spaces in Windows



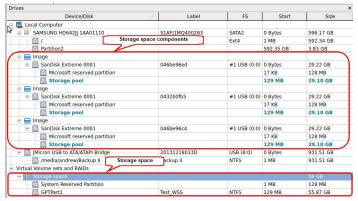
Storage pools and spaces can be managed using the Storage Spaces item in the Windows Control Panel.

Storage spaces in Windows



R-Studio for Linux detects disks (or their <u>images</u>) from storage pools and creates storage pools and spaces automatically. At the same time, **R-Studio for Linux** gives access to the parents of the storage spaces (hard drives and images)

Storage spaces in R-Studio for Linux

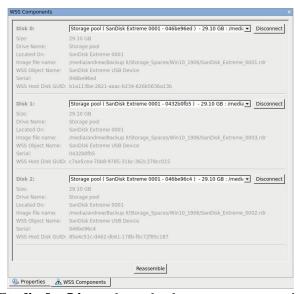


If recognized parents of a storage space, including disk <u>images</u>, are added to **R-Studio for Linux** later, it automatically adds them to their respective storage space.

When an automatically created storage space is selected, **R-Studio for Linux** highlights its components.

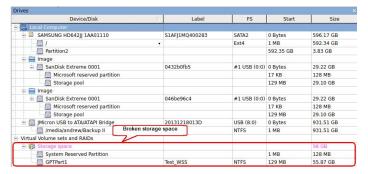
R-Studio for Linux shows the components of the selected storage space on its WSS Components tab.

WSS Components tab



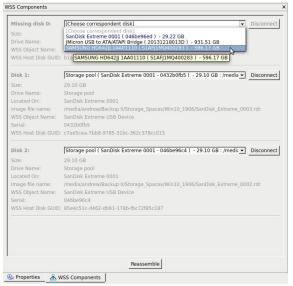
R-Studio for Linux shows broken storage spaces in pink.

Broken storage spaces in R-Studio for Linux



The WSS Components tab also allows you to manually disconnect or connect the components, for example, if they are such damaged that **R-Studio for Linux** 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 for Linux** displays the objects it recognizes as the components of the storage space in blue.

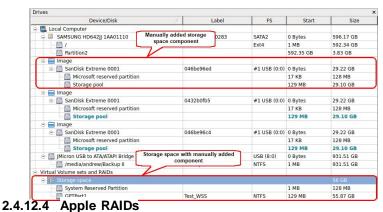
Adding a component manually



You may immediately switch to the storage space configuration that **R-Studio for Linux** believes most probable by clicking the **Reassemble** button.

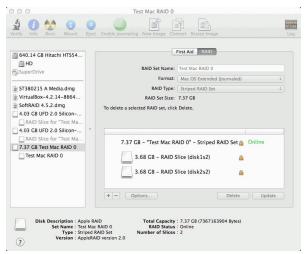
R-Studio for Linux shows such storage spaces in blue:

Storage spaces with added parents in R-Studio for Linux



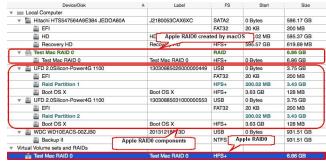
macOS can create several software RAIDs from disks connected to a Mac computer: RAID1 (Mirror set), RAID0 (Stripe set), and Concatenated disk set.

Apple RAID0 example



R-Studio for Linux detects components of Apple RAID sets and creates their virtual RAIDs automatically. At the same time, **R-Studio for Linux** gives access to the individual components of the Apple RAID sets (hard drives and <u>images</u>).

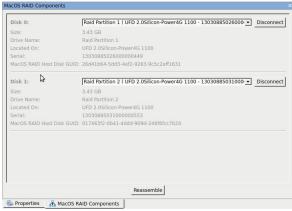
Apple RAIDs in R-Studio for Linux



When an automatically created Apple RAID is selected, **R-Studio for Linux** highlights its components.

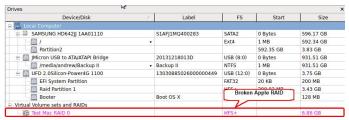
R-Studio for Linux shows the components of the Apple RAID on its MacOS Components tab.

MacOS Components tab



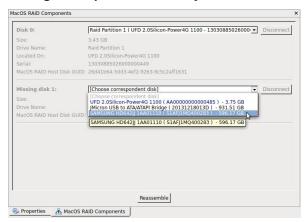
R-Studio for Linux shows broken Apple RAIDs in pink.

Broken Apple RAIDs in R-Studio for Linux



The MacOS Components tab also allows you to manually disconnect or connect the components, for example, if they are such damaged that **R-Studio for Linux** 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 for Linux** displays the objects it recognizes as the components of the Apple RAID in blue.

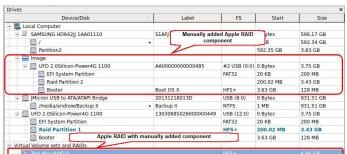
Adding a component manually



You may immediately switch to the Apple RAID configuration that **R-Studio for Linux** believes most probable by clicking the **Reassemble** button.

R-Studio for Linux shows Apple RAIDs with manually added components in blue:

Apple RAIDs with added members in R-Studio for Linux



2.4.12.5 Apple CoreStorage/FileVault/Fusion Drive Volumes

The macOS operating system has the following disk management systems:

FileVault, is a disk encrypted utility;

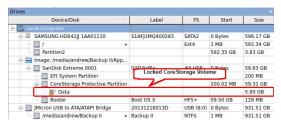
Fusion Drive is an Apple's hybrid drive technology;

CoreStorage is a logical volume management system.

R-Studio for Linux supports all these technologies and can unlock their encrypted volumes (hard drives and <u>images</u>) using either their passwords or recovery keys.

CoreStorage/FileVault

Locked CoreStorage Volume in R-Studio for Linux



To unlock the volume

- 1. Right-click the encrypted volume and select Unlock encrypted drive on the context menu.
- 2. Enter the password/recovery key on the Unlock encrypted drive dialog box



> R-Studio for Linux will unlock the volume

Unlocked CoreStorage Volume in R-Studio for Linux



If the volume is partially encrypted, **R-Studio for Linux** 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



R-Studio Technician/T80+

In addition to the password, it's possible to enter other decryption data. Click the **Advanced**... button and enter available data.

Unlock encrypted drive: Advanced



This data is usually very hard to obtain and only very advanced institutions can recover it from actual hardware.

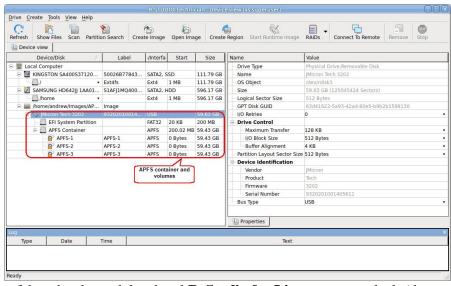
Data recovery from deleted or damaged APFS volumes

Note: this method doesn't always yields positive results.

When macos deletes an APFS volumes, it also wipes out all decryption information from its APFS container. In this case even knowing the password won't help. Still, there's a trick that may help to open a deleted or damaged encrypted volume.

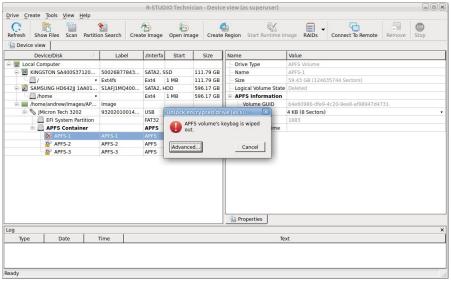
Let's us have a hard drive with an APFS container with 3 APFS volumes:

APFS container and its volumes



One of them has been deleted and **R-Studio for Linux** cannot unlock (decrypt) it:

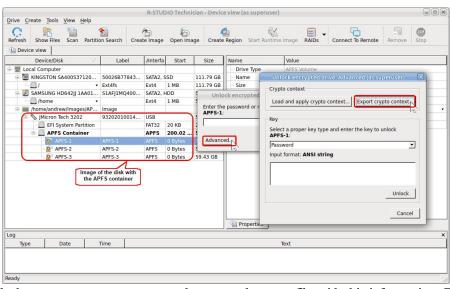
APFS container with a deleted APFS volume



But if we have an image of the disk's previous state, we can extract the necessary encryption information from that image.

Load the image and double-click the existing volume. Click the **Advanced...** button instead of entering its password.

Export of encryption information



Click the **Export crypto context...** button and save a file with this information. Then click the **Close Image** button to unload the image.

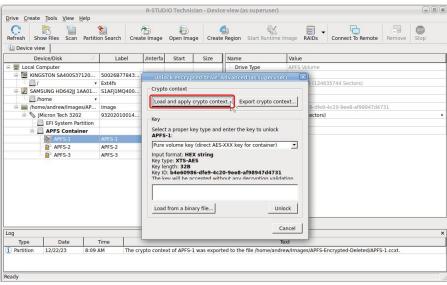
Then double-click the APFS-1 volume and click the Advanced button.

APFS container with a deleted APFS volume



Click the Load and apply crypto context... button

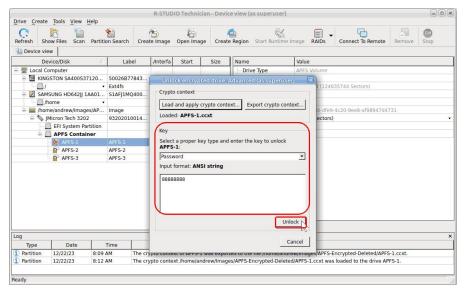
Loading the encryption information



and load the file generated from the image.

Select the required information type (a password for our case), enter the data, and click the Unlock button.

Unlocking the APFS volume



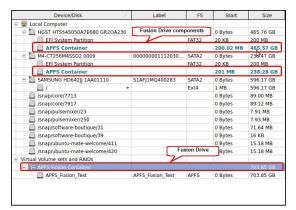
Note that the password will be explicitly shown.

R-Studio for Linux will open files on the volume.

Apple Fusion Drive

R-Studio for Linux detects components of Apple Fusion Drive and creates virtual Fusion Drives automatically. At the same time, **R-Studio for Linux** gives access to the individual components of the Fusion Drives (hard drives and <u>images</u>).

Fusion Drive in R-Studio for Linux



When an automatically created Fusion Drive is selected, **R-Studio for Linux** highlights its components.

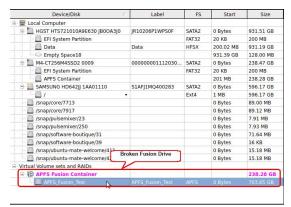
R-Studio for Linux shows the components of the Fusion Drive on its APFS Fusion Components tab.

Fusion Drive Components tab



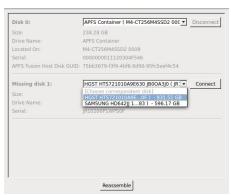
R-Studio for Linux shows broken Fusion Drive s in pink.

Broken Fusion Drive in R-Studio for Linux



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 for Linux** 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 for Linux** displays the objects it recognizes as the components of the Fusion Drive in blue.

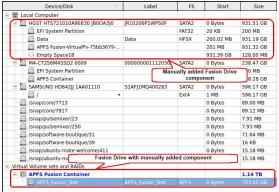
Adding a component manually



You may immediately switch to the Fusion Drive configuration that **R-Studio for Linux** believes most probable by clicking the **Reassemble** button.

R-Studio for Linux shows Fusion Drive with manually added components in blue:

Fusion Drive with added members in R-Studio for Linux



2.4.12.6 Linux mdadm RAIDs

<u>mdadm</u> is a Linux utility used to manage and monitor software RAID devices.

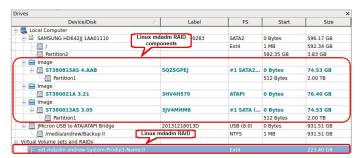
R-Studio for Linux supports such devices and when drives from a mdadm RAID are connected to a Mac computer, it automatically detects them and assembles mdadm RAIDs accordingly.

Linux mdadm RAIDs



R-Studio for Linux detects components from mdadm RAIDs and creates those RAIDs automatically. At the same time, **R-Studio for Linux** gives access to the components of those RAIDs (hard drives and images).

mdadm RAIDs in R-Studio for Linux

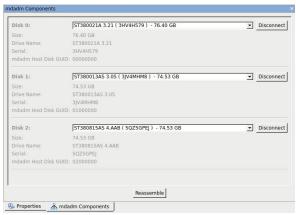


If recognized components of a mdadm RAID, including disk images, are added to **R-Studio for Linux** later, it automatically adds them to their respective mdadm RAID.

When an automatically created mdadm RAID is selected, **R-Studio for Linux** highlights its components. It also highlights the mdadm RAID that Linux may itself create from the same components.

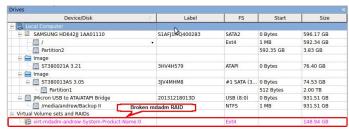
R-Studio for Linux shows the components of the mdadm RAIDs on its mdadm Components tab.

mdadm Components tab



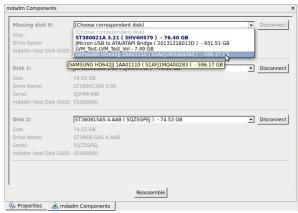
R-Studio for Linux shows broken mdadm RAIDs in pink.

Broken mdamd RAIDs in R-Studio for Linux



The mdadm Components tab also allows you to manually disconnect or connect the components, for example, if they are such damaged that **R-Studio for Linux** 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 for Linux** 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 for Linux** believes most probable by clicking the **Reassemble** button.

R-Studio for Linux shows such mdadm RAIDs in blue:

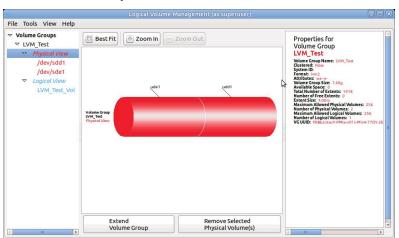
Local Computer SAMSUNG HD642II 1AA01110 596.17 GB S1AFI1MQ400283 SATA2 0 Bytes / Partition2 Fyt4 1 MR 592 34 GR 3.83 GB 592.35 GB Manually added mdadm RAID component inage □ ST380815AS 4.AAB #1 SATA2... 0 Bytes 74.53 GB Partition1 ☐ Image ☐ ST380021A 3.21 3HV4H579 ATAPI 0 Bytes 76.40 GB 0 Bytes 512 Bytes 0 Bytes зју4мнм8 #1 SATA (. 74.53 GB Partition1 20131218013D mdadm RAIDs with manually added c /media/andrew/Backup II 1 MB 931.51 GB Virtual Volume sets and RAIDs

mdadm RAIDs with added components in R-Studio for Linux

2.4.12.7 Linux LVM/LVM2

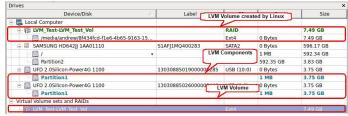
Linux LVM is a logical volume manager for the Linux OS that manages disk drives and other data storage devices. Using it, It is possible to create single logical volumes on several physical disks, add and replace them in a running system, resize logical volumes, create various RAID configuration, and so on. You may read more about Linux LVM in our article: What is Logical Volume Manager (LVM).

LVM volume example



R-Studio for Linux automatically detects disks from LVMs and creates their virtual volumes automatically. At the same time, **R-Studio for Linux** gives access to the components of the virtual LVM volumes (hard drives and images).

LVM Volumes in R-Studio for Linux

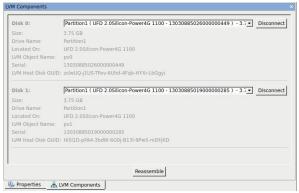


If recognized components of an LVM volume, including disk images, are added to **R-Studio for Linux** later, it automatically adds them to their respective LVM volume.

When an automatically created LVM volume is selected, **R-Studio for Linux** highlights its components. It also highlights the LVM volume that Linux may itself create from the same components.

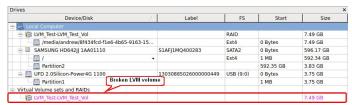
R-Studio for Linux shows the components of the LVM volume on its LVM Components tab.

LVM Components tab



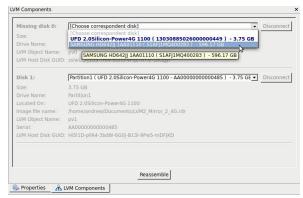
R-Studio for Linux shows broken virtual LVM volumes in pink.

Broken LVM volumes in R-Studio for Linux



The LVM Components tab also allows you to manually disconnect or connect the components, for example, if they are such damaged that **R-Studio for Linux** 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 for Linux** displays the objects it recognizes as the components of the LVM volume in blue.

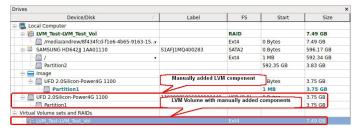
Adding a component manually



You may immediately switch to the LVM volume configuration that **R-Studio for Linux** believes most probable by clicking the **Reassemble** button.

R-Studio for Linux shows such virtual LVM volumes in blue:

LVM volumes with added components in R-Studio for Linux



2.5 Data Recovery over Network

This chapter explains how to perform data recovery operations over network.

R-Studio for Linux has network capabilities that allow the system administrator, using its computer, to recover files on any computers accessible over network.

R-Studio for Linux 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 program gives **R-Studio** for Linux access to local disks on remote computers over network.

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.

Files can be recovered without *R-Studio Agent* if the computer where the files are to be recovered runs Windows NT/2000/XP/2003/Vista/2008/7/8/8.1/10 is accessible from a computer also running Windows NT/2000/XP/2003/Vista/2008/7/8/8.1/10. In this case, the administrator must have administrator privileges on the remote computer.

You should always disable a firewall and/or antivirus software on the both computers. As an alternative, advanced users may tune them to allow **R-Studio for Linux** 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.

In addition, **R-Studio for Linux** can load/save any files like <u>disk images</u>, <u>scan info</u> files, <u>RAID configuration</u> files, from/to the computers to which it has access using *R-Studio Agent*.

- 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 for Linux** 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:

- Linux
- Windows
- Mac OS

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 an Intel-based Mac computer.

Note: You cannot use this program to start Mac computers based on Apple Silicon.

R-Studio for Linux 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 for Linux 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

```
Eile Edit View Terminal Help

roor(BBCK-Ubuntu:-#E od RSA

Corto(BBCK-Ubuntu:-#SAFM../rsagent

Configuring R-Studio Agent 6.0.1020

* Specify password for incoming connections >

### Confirm password for incoming connections >

### Confirm password for incoming connections >

### Confirm password for incoming connections >

### Specify TCP/IP port for Usitening [3174] >

### Running R-Studio Agent

### Running R-Studio Agent

### Nits product is licensed to: UNREGISTERED DEMO VERSION

### System: 2 x Intel(R) Core(TM)2 CPU 6300 @ 1.86GHz, 1862 MHz, 993 MB RAM

### OS: Linux 2.6.32-41-generic-pae #91-Ubuntu SMP Wed Jun 13 12:00:09 UTC 2012

### Running R-Studio Agent

### Running R-Studio Agent is not yet registered, 64KB file size recovery limit is implied until remotelly registered

### R-Studio Agent started and ready to accept connections...

* You may press ENTER to start connection to remote R-Studio ...
```

■ R-Studio Agent for Linux Options

- It buddo rigent i	a R Settlio rigent for Emax 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 for Linux.

You may see the current configuration by starting R-Studio Agent for Linux with the command rsagent -- show_config.

R-Studio Agent for Linux Configuration dialog box

```
Elle Edit View Terminal Help
root@EK-Ubuntu:-# cd RSA
root@EK-Ubuntu:-#RSA# ./rsagent --show_config
R-Studio Agent 6.0.1020
Password for incoming connection: present
Accept incoming connection from IP addresses / NetMask: 192.168.1.1 / 255.255.25
5.0
Listening on port: 3174
root@EK-Ubuntu:-/RSA# []
```

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 for Linux.

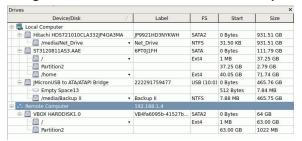
To establish a connection from R-Studio Agent for Linux to R-Studio for Linux,

- 1 Run the R-Studio Agent for Linux and press Enter
- 2 Enter the necessary information

Connect to R-Studio for Linux dialog box



> R-Studio Agent for Linux will connect to the computer where R-Studio for Linux 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.

2.5.1.2 R-Studio Agent for Windows

Attention Windows NT/2000/XP/2003/Vista/2008/7/8/8.1/70 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:

-3	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 for Linux** 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 for Linux will remotely install R-Studio Agent.

Attention Windows NT/2000/XP/2003/Vista/2008/7/8/8.1/70 users: R-Studio Agent may be remotely installed over a network from a computer running Windows NT/2000/XP/2003/Vista/2008/7/8/8.1/70 to another computer running Windows NT/2000/XP/2003/Vista/2008/7/8/8.1/70. To do so, you must have administrator accounts on both computers.

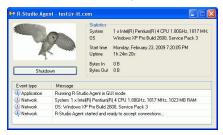
To access the R-Studio Agent main panel,

1 Click its tray icon



> The main panel will appear. You may view its log

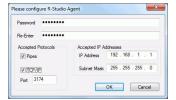
R-Studio Agent main panel



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



■ R-Studio Agent Options

Password:	Enter a password to obtain access to this computer from a network.	
Re-Enter:	Re-enter the password.	
Accepted Protocols		
Pipes	supported by Windows NT/2000/XP/2003/Vista/2008/7/8/8.1/10 only. To improve security, this option should be disabled.	
TCP/IP	supported by any network OS.	
Port	port for incoming connections	
Accepted IP Addresses		
IP Address	specifies addresses from which this computer can be accessed.	
Subnet Mask	specifies a subnet mask of the network from which this computer can be accessed.	

> R-Studio Agent will now run with the specified parameters

2.5.1.3 R-Studio Agent for Mac

You need to have an administrative account on the Mac computer to start R-Studio Agent for Mac.

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



To configure R-Studio Agent for Mac,

- 1 Go to the R-Studio Agent for Mac menu and select Preferences
- 2 Specify required parameters on the Please configure R-Studio Agent dialog box and click the OK button

Please configure R-Studio Agent Mac dialog box



■ R-Studio Agent for Mac Options

Password:	Enter a password to obtain access to this computer from a network.	
Re-Enter:	Re-enter the password.	
Incoming connection preferences		
Enable incoming connections	Select this checkbox if you want to allow incoming connections.	
TCP/IP Port	A TCP/IP port for incoming connections	
Accepted IP Addresses		
IP Address	specifies addresses from which this computer can be accessed.	
Subnet Mask	specifies a subnet mask of the network from which this computer can be accessed.	

> R-Studio Agent for Mac will now run with the specified parameters

Connecting from R-Studio Agent for Mac to R-Studio for Linux.

To establish a connection from R-Studio Agent for Mac to R-Studio for Linux,

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 for Linux dialog box and click the Connect button.

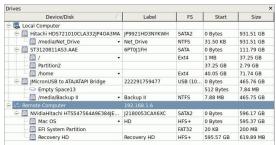
Connect to R-Studio for Linux dialog box



■ Connect to R-Studio settings

Server	Specify the DNS name or IP address of the host where R-Studio for Linux is running.
Port	Specify the port set on the R-Studio for Linux Connect to Remote Computer dialog box.
Password	Specify the password set on the R-Studio for Linux Connect to Remote Computer dialog box.

> R-Studio Agent for Mac will connect to the computer where R-Studio for Linux 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.

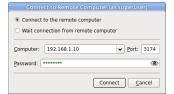
R-Studio Agent should be running on the network computer where data are to be recovered.

Read the Connecting over the Internet topic to learn how to establish connection between R-Studio for Linux 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

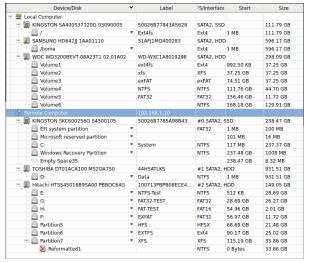


The Port should coincide with the port specified for the **R-Studio Agent**.

The Password: field is for the password of *R-Studio Agent* running on the remote computer. If you want to see the entered password, right-click the field and select **Show password** on the context menu.

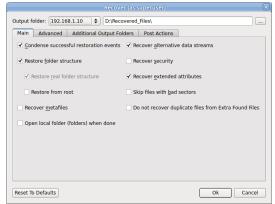
Note: If the remote computer is started with **R-Studio Agent Emergency**, leave this field blank.

R-Studio for Linux 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



It can be processed the same way as that on a local computer.

Recover dialog box



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 for Linux** 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 for Linux** may try to remotely install it. See the **R-Studio Agent** topic for details.

2.5.3 Connecting over the Internet

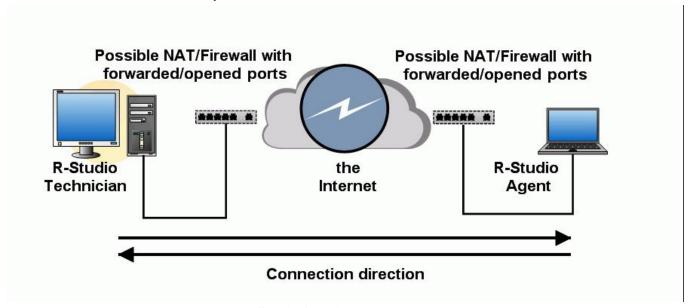
R-Studio for Linux and **R-Studio Agent** can be connected over the Internet. The connection can be made either using IP addresses or DNS names.

If hosts where **R-Studio for Linux** 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 for Linux** or from **R-Studio Agent**.

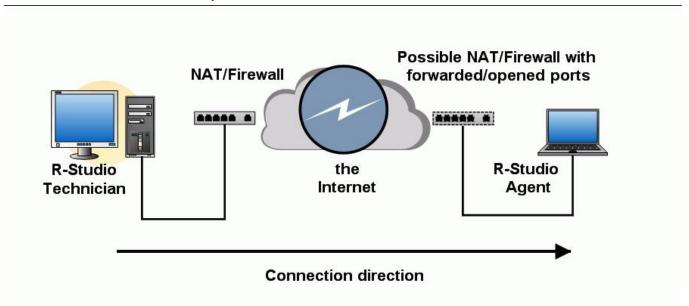
Connection directions

* Both R-Studio for Linux and R-Studio Agent have public IP addresses (no NAT/firewall) or the ports on the NAT/firewall are forwarded/opened.



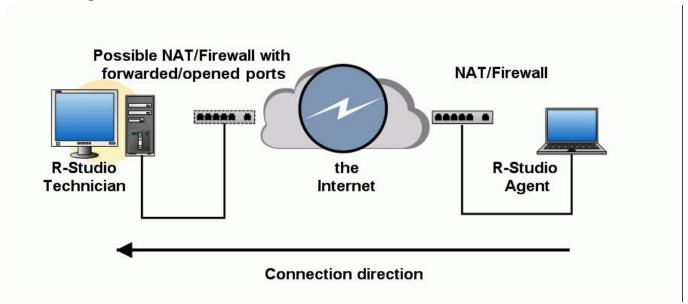
A connection can be made either from **R-Studio for Linux** or from **R-Studio Agent**.

* R-Studio for Linux is behind a NAT and R-Studio Agent has a public IP address or the ports on its NAT/firewall are forwarded/opened.



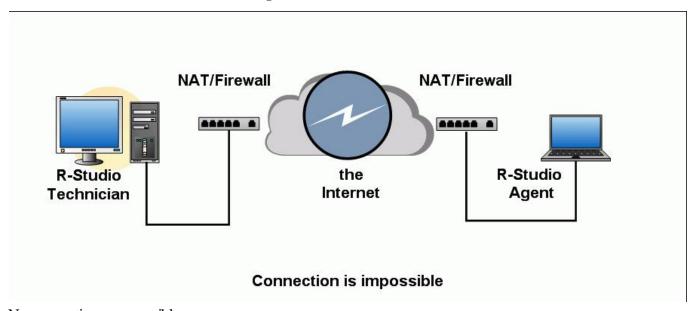
A connection should be made from **R-Studio for Linux**.

* R-Studio for Linux 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 for Linux and R-Studio Agent are behind NATs/firewalls.



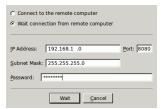
No connections are possible.

Connection from R-Studio Agent to R-Studio for Linux

R-Studio for Linux settings

If a connection is to be made from **R-Studio Agent** to **R-Studio for Linux**, **R-Studio for Linux** should be set to accept connection on the Connect to Remote Computer dialog box.

Connect to Remote Computer dialog box



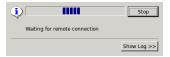
Select Wait connection from remote computer, and specify options for incoming connections.

■ R-Studio Incoming Connection Options

	8 1	
Password:	Enter a password to obtain access to this computer from a network.	
IP Address	specifies addresses from which this computer can be accessed.	
Subnet Mask	specifies subnet mask of the network from which this computer can be accessed.	
Port	port for incoming connections.	

R-Studio for Linux will wait for an incoming connection.

Waiting for remote connection dialog box



Connecting from R-Studio Agent to R-Studio for Linux.

To establish a connection from R-Studio Agent to R-Studio for Linux,

- 1 Right-click the R-Studio Agent tray icon and select Connect
- 2 Enter the necessary information on the Connect to R-Studio for Linux dialog box and click the Connect button.

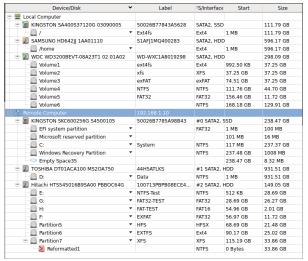
Connect to R-Studio for Linux dialog box



■ Connect to R-Studio settings

Server	Specify the DNS name or IP address of the host where R-Studio for Linux is running.
Port	Specify the port set on the R-Studio for Linux <u>Settings (Server)</u> dialog box.
Password	Specify the password set on the R-Studio for Linux <u>Settings</u> <u>(Server)</u> dialog box.

> R-Studio Agent will connect to the computer where R-Studio for Linux is running and it will show the hard drive and logical disk structure of the remote computer.



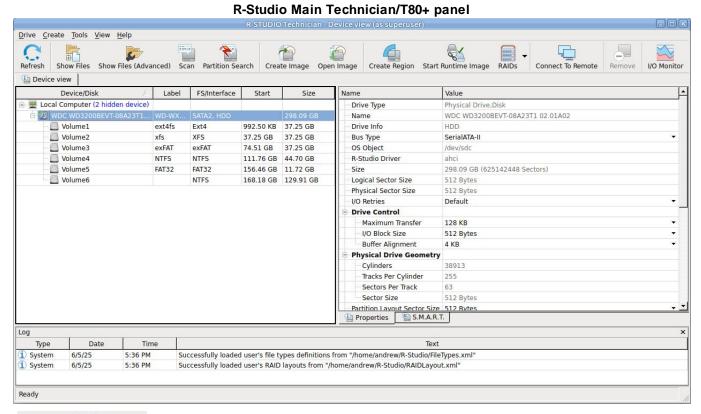
It can be processed the same way as that on a local computer.

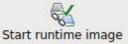
III R-Studio Technician/T80+

R-Studio Technician/T80+ Demo can perform all data recovery actions except saving recovered files greater than 1 MB and multi-pass imaging.

The **R-Studio T80**+ version requires an active internet connection to register and run. You may read more about **R-Studio T80**+ in our article <u>R-Studio T80</u>+ - A <u>Professional Data Recovery and Forensic Solution for Small Business and Individuals Just for US\$1/day.</u>

R-Studio Technician has additional controls on its main panel.





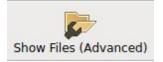
Click this button to start <u>runtime imaging</u> of the selected object.

(**Technician/T80**+ versions only)



I/O Monitor

Click this button to open **I/O Monitor**.



Show Files (Advanced)

Click this button to start <u>enumerating files with minimum disk</u> access.

This chapter covers features that available only in the **R-Studio Technician/T80**+ versions.

- **USB Activation** (Technician only)
- Multitasking
- Show Files (Advanced)
- Additional Recovery Options
- Hidden Devices
- Extended File Information
- Symbolic Link Processing
- Custom Recovery Lists
- Drive Copy Wizard

- File Maps
- I/O Monitor and Sector Map files
- Runtime Imaging
- Multi-pass Imaging
- Reverse RAIDs
- Working with Third-Party Hardware
- Forensic Mode
- Some other information about **R-Studio Technician/T80**+ is shown on the following pages:
- R-Studio Settings
- Drive Scan
- <u>Images</u>
- BitLocker Drive Encryption
- Apple CoreStorage/FileVault/Fusion Drive Volumes
- Connecting over the Internet
- Supported Virtual Disk and Disk Image Formats

3.1 USB Activation

The **R-Studio Technician** license provides the ability to create an activation USB, which allows the licensee to activate/verify the license in a completely offline mode using a supported USB stick selected by the licensee. The article R-Studio Technician: activation using a USB stick explains this process in more detail.

The activation USB can be used not only to verify the license, but also to add **R-Studio Technician Portable** and one of the versions (based on WinPE or Linux) of the bootable **R-Studio Technician Emergency** (Startup version). It means that a technician version licensee can create a universal USB stick and use it to run **R-Studio Technician** on any computer online or offline, running OS or with a damaged OS, at a facility with or without Internet access.

Creating an Activation Stick

To create an activation USB stick you need a working Internet connection.

- 1. Run **R-Studio**, go to the Help, and select Create Activation USB.
- 2. Select one of the supported USB sticks and click the OK button. USB devices that are not supported for creating an activation stick will not be displayed in the list.

R-Studio will display a message about the completion of the operation, and from this moment on, this **R-Studio Technician** license will be automatically activated when you start the software with the USB stick connected to the serviced computer. Internet connection and online activation will no longer be required

Erased, Damaged or Lost Activation Stick

The same activation stick with corrupted data but with working hardware

Quick format doesn't erase the activation information, even if the USB stick been formatted to another file system.

If the data on the activation stick has been completely erased, you can recreate the activation data on the same stick. There are no limitations for the activation stick recreation ON THE SAME USB DEVICE.

The activation stick is lost or damaged.

You can temporally activate the installed **R-Studio Technician** over the Internet and contact <u>R-TT, Inc</u> <u>customer support</u> for assistance.

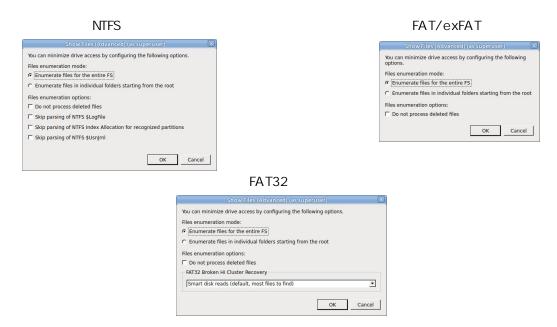
3.2 Show Files (Advanced)

File enumeration may take a very long time if a hard drive has some hardware issues or its file system is severely damaged. Moreover, each access to a problematic drive inflicts additional damage. **R-Studio Technician/T80**+ has a special action to avoid this: **Show Files (Advanced)** that minimizes both parsing the file system and disk access.

There are two types of this action: the first one when the entire file system is processed with some exclusions (default), and the second one when only some individual folders are processed.

Enumerate files for the entire FS

These options depend on the file system type being processed. You should know what your are doing when selecting/clearing them. If you don't know which option to select/clear, select **Do not process deleted files**.



FAT32 Broken Hi Cluster

Windows erases file's hi clusters when deletes files on FAT32 file systems. That makes recovery of such files very difficult. **R-Studio** may collect more information about such files to increase their chances for their successful recovery. Such collection will require additional information which in its turn require additional disk reads. You can control to what extent **R-Studio Technician/T80+** will reduce disk reads.

No additional disk reads (fastest but less files to find)

R-Studio Technician/T80+ will try to recover broken hi clusters without additional disk reads and therefore additional information. Fast but not many files will be successfully recovered.

Smart disk reads (default, most files to find)	Some additional disk reads will be performed to gather more information, and R-Studio Technician/T80+ will use some heuristic methods to recover broken hi clusters. Slower but more files will be successfully recovered.
Exhaustive disk reads (very slow but recovers the largest number of files)	A lot of additional disk reads will be performed to gain most possible information to recover the maximum possible number of files will be successfully recovered.







Enumerate files in individual folders starting from the root

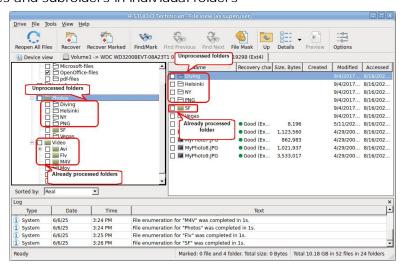
R-Studio Technician/T80+ can enumerate files and subfolders in individual folders rather than in the entire file system. This is especially important when the hard drive has severe hardware damage or file system corruption. This can be done by selecting **Enumerate files in individual folders starting from the root** on the Show Files (Advanced) dialog box.

Files in individual folders



Click the folder where you want to enumerate files.

Files and subfolders in individual folders

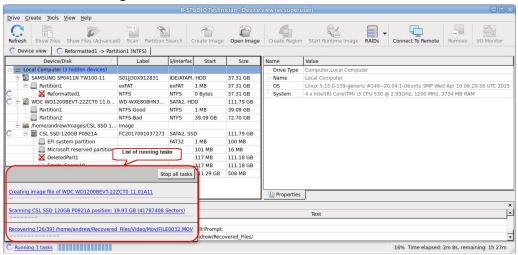


3.3 Multitasking

R-Studio Technician can perform several tasks simultaneously. For example, you can simultaneously recover files from one disk, create an image of another disk, and scan a loaded image. The number of simultaneously running tasks depends on the system performance: CPU power, RAM size, free space on the disks, data transfer speed, and so on.

When, for example, 3 tasks are simultaneously running, **R-Studio Technician** will mark them with a special rotating sign in its Device view pane. In this example, these 3 tasks are file recovery from a logical disk (partition), hard drive image creation, and scanning of an image of a hard drive.

Three tasks running



It also shows a list of running tasks. You may switch to the required task by clicking it. The progress bar at the bottom show the overall progress of all tasks.

Each task runs independently in its own tab, has its own **I/O Monitor**, and can be independently controlled:

File recovery

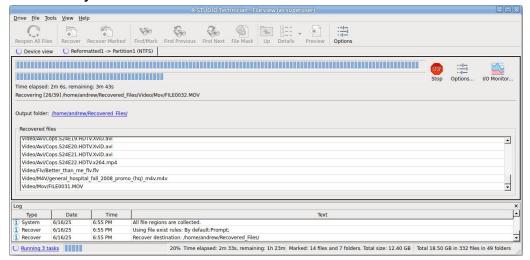


Image creation

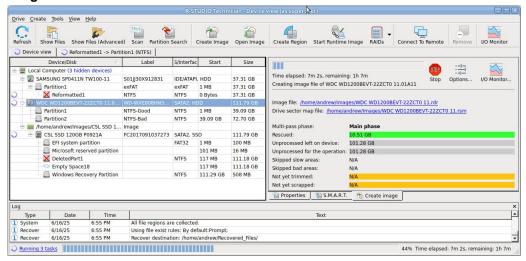
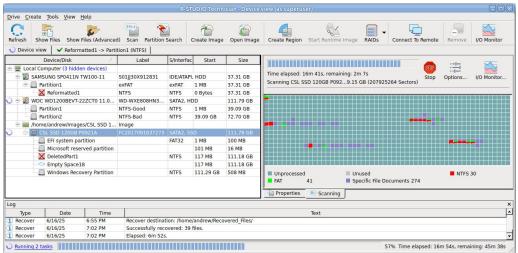
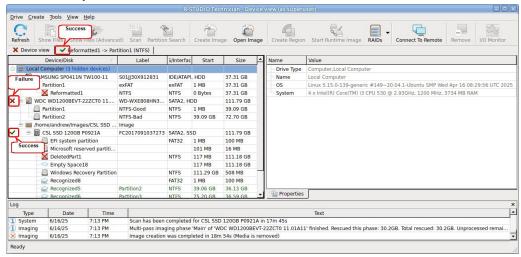


Image scan



When all tasks have been completed, **R-Studio Technician** will show their results with special marks.

All task completed

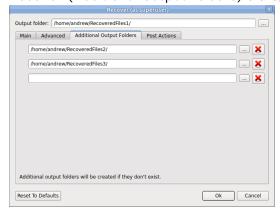


These marks will disappear when the corresponding tabs are opened.

3.4 Additional Recovery Options

R-Studio Technician has additional **Recovery** options.

Recover (Additional Output Folders) dialog box



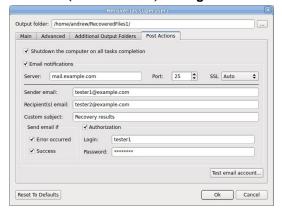
Additional Output Folders

Additional Output Folders	Additional output folders where recovered files will be stored when R-Studio
	Technician/T80+ 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



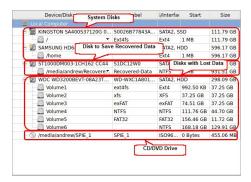
Post Actions Options

Shutdown the computer on task completion	If this check box is selected, R-Studio Technician/T80 + 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 Technician/T80 + will inform you about the outcome of the operation via email.

3.5 Hidden Devices

R-Studio Technician/T80+ can hide unnecessary devices on the Device View pane. Most likely, they may be system drives and drives connected to save recovered data. Hiding those devices doesn't prevent **R-Studio Technician/T80+** from saving recovered and service files on them.

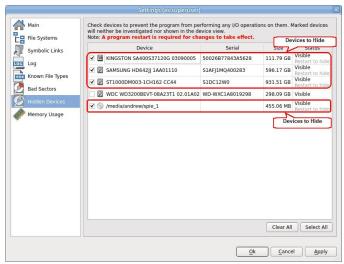
No hidden devices



To hide unnecessary devices,

1 Go to Settings and then to the Hidden Devices tab, mark all devices you want to hide,

Hidden Devices tab



and restart R-Studio Technician/T80+.

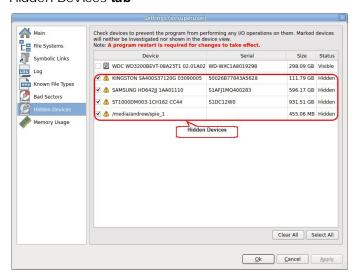
> Only necessary devices will be visible

Necessary devices



You may make hidden devices visible once again on the Hidden Devices tab.

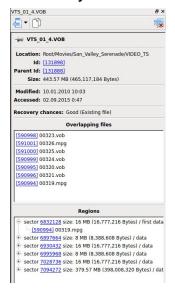
Hidden Devices tab



3.6 Extended File Information

R-Studio Technician/T80+ shows much more information about files than R-Studio for Linux does.

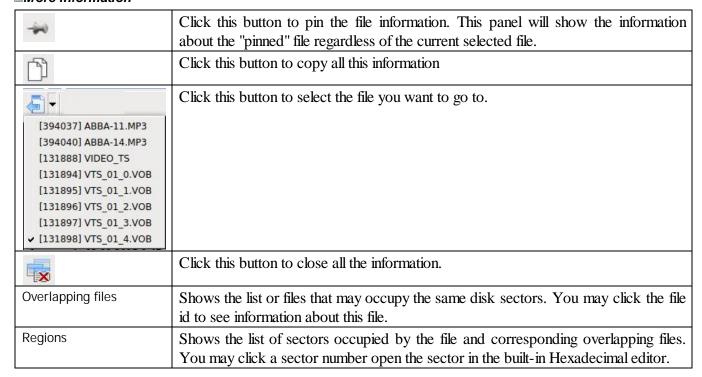
Info about a file with good chances for recovery



Info for a file with below average recovery chances



■More information



Examples of file information on other file systems

File info on an NTFS file system



File info on an APFS file system



Info for a file on an HFS+ file system



Info for a file on an XFS file system

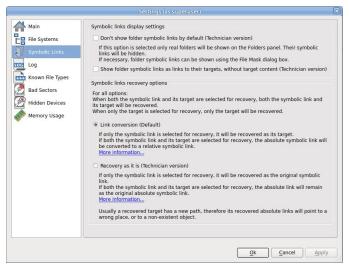


3.7 Symbolic Link Processing

R-Studio Technician/T80+ give its users more control over symbolic links processing.

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 dialog box



■ Symbolic Links

Symbolic links display settings		
Don't show symbolic links by default (Technician version)	If this option is selected, R-Studio Technician/T80+ 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 <u>Mask</u> dialog box.	
Show folder symbolic links as links to their targets, without target content (Technician version)	Only links to their target will be shown in the right pane (Contents). They target content can be reached by clicking those links.	
Symbolic links recovery options		
For all options:	When both the symbolic link and its target are selected for recovery, both the symbolic link and its target will be recoveredl. When only the target is selected fore recovery, only the target will be recovered.	
Link conversion (Default)		
Only a symbolic link is selected for recovery:	The selected symbolic link will be recovered as its target.	
If both a symbolic link and its target are selected for recovery:	If both a symbolic link and its target are selected for recovery, both the target 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 C:\ProgramData\Documents is a symbolic link to C:\Users\Public\Documents, it will be converted to a symbolic link to\Users\Public\Documents. Therefore, the symbolic link will point to its object regardless of the place to which the object has been recovered.	
Recovery as it is (Technician version)		
Only a symbolic link is selected for recovery:	The symbolic link will be recovered as a symbolic link which may contain a path to a nonexistent object.	

If both the symbolic link and its target are selected for recovery, the absolute link will remain as the original absolute symbolic link.	If both the symbolic link and its target are selected for recovery, the file path in that symbolic link will remain unchanged. Example:
	The place to store recovered data: D:\Recovered Files.
	The object to recover: C:\Users\Public\Documents
	The symbolic link: C:\ProgramData\Documents After recovery:
	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. Usually a recovered target has a new path, therefore its recovered absolute links will point to a wrong place, or to a non-existent
	object.

The <u>Data Recovery Topics</u> topic explains processing of symbolic links recovery in more detail.

3.8 Custom Recovery Lists

The **R-Studio Technician/T80**+ versions can create more advanced <u>recovery lists</u>.

■ Export Recovery List options

Export the entire folder/file tree Export marked file/folder names Export file/folder names	Specifies which file and folder names will be exported.
File format:	A file format for the recovery list. Only text format is available for the standalone and corporate versions. R-Studio Technician/T80 + can create custom recovery lists in other formats with more advanced options The following formats are available for R-Studio Technician/T80 + version: Plain Text HTML XML JSON CSV
File name:	Specifies a file name of the recovery list.

Editing the file recovery list

All files without any marks in the recovery list will be marked when the list is loaded into R-Studio for Linux. So, if you have some files in the recovery list that don't need to be recovered, just delete them from the list. In addition, you may use the following marks to specify some options

- Hark the file, or the folder, all its files, and subfolders within the folder.
- :* Mark the file, or the folder and its files, don't mark subfolders in the folder.

- :- Unmark the file, or the folder, its files, and subfolders in the folder.
- := Unmark the file or the folder and its files, dont unmark subfolders in the folder.
- Provide the information on the file. (**R-Studio Technician/T80**+ only)

R-Studio for Linux processes records in the list consequently. That is, if there are the following lines in the file,

```
:+Files_to_Recover\
:-Files_to_Delete\File_2.jpg
the file File_2.jpg won't be marked for recovery, while for the lines
:-Files_to_Recover\File_2.jpg
:+Files_to_Recover\
file File_2.jpg will be.
```

A simple recovery list for reference

```
Structure of a simple recovery list file created by R-Studio for Linux
:# Version = 1
:# Sort = by real
:# PathDelim = /
:# CaseSensitive
:# Drive = type: "Volume"; size: "1048576000"; mountpoint: "/media/andrew/ntfs test";
label:"ntfs test"; fs:"NTFS";
:# Parent = type:"Drive"; size:"1048576000"; serial:"2cca54405a8d3a89";
product:"disk"; vendor:"flash";
Diving/
Diving/Aquarium/
Diving/Aquarium/20190822_100644.jpg
Diving/Aquarium/20190822_101620.jpg
Diving/Aquarium/20190822 102526.jpg
Diving/Aguarium/20190822_103830.jpg
Diving/Aquarium/20190822_104333.jpg
SF/
SF/Sea-Lions/
SF/Sea-Lions/IMG_3493.JPG
SF/Sea-Lions/IMG_3535.JPG
SF/Sea-Lions/IMG_3542.JPG
SF/Sea-Lions/IMG_3579.JPG
SF/Sea-Lions/IMG_3580.JPG
SF/Sea-Lions/IMG_3581.JPG
SF/Sea-Lions/IMG_3589.JPG
SF/IMG_0869.JPG
SF/IMG_0873.JPG
SF/IMG_0890.JPG
SF/IMG_1739.JPG
SF/IMG_3460.JPG
SF/IMG_3461.JPG
SF/IMG 3476.JPG
SF/IMG_3478.JPG
SF/IMG_3479.JPG
SF/IMG_3480.JPG
SF/IMG 3481.JPG
SF/IMG 3493.JPG
SF/IMG_3535.JPG
```

```
SF/IMG 3542.JPG
SF/IMG 3579.JPG
SF/IMG_3580.JPG
SF/IMG_3581.JPG
SF/IMG_3589.JPG
SF/IMG_3590.JPG
SF/IMG_3591.JPG
SF/IMG_3592.JPG
SF/IMG_3593.JPG
SF/IMG_3594.JPG
SF/IMG_3595.JPG
SF/IMG_3596.JPG
SF/IMG 3608.JPG
SF/IMG_3627.JPG
MyPhoto6.JPG
MyPhoto7.JPG
MyPhoto8.JPG
MyPhoto9.JPG
If such recovery list is created from an entire logical disk/partition, it will contain several virtual folders. For
example, they'll have the following structure for an NTFS partition.
System Volume Information/
System Volume Information/IndexerVolumeGuid
System Volume Information/WPSettings.dat
Vegas/
MyPhoto6.JPG
MyPhoto7.JPG
MyPhoto8.JPG
MyPhoto9.JPG
///m/$Extend/
///m/$Extend/$Deleted/
///m/$Extend/$RmMetadata/
///m/$Extend/$RmMetadata/$Txf/
///m/$Extend/$RmMetadata/$TxfLog/
///m/$Extend/$RmMetadata/$TxfLog/$Tops
///m/$Extend/$RmMetadata/$TxfLog/$TxfLog.blf
///m/$Extend/$RmMetadata/$TxfLog/$TxfLogContainer00000000000000000001
///m/$Extend/$RmMetadata/$TxfLog/$TxfLogContainer00000000000000000000
///m/$Extend/$RmMetadata/$Repair
///m/$Extend/$ObjId
///m/$Extend/$Quota
///m/$Extend/$Reparse
///m/$AttrDef
///m/$BadClus
///m/$Bitmap
///m/$Boot
///m/$LogFile
///m/$MFT
///m/$MFTMirr
///m/$Secure
///m/$UpCase
```

///m/\$Volume

HTML format

This is a default format of recovery lists for the **R-Studio Technician/T80+** version. It allows its users to supply their customers with the recovery lists with the easiest way to edit.

Export Recovery List dialog box for the HTML format



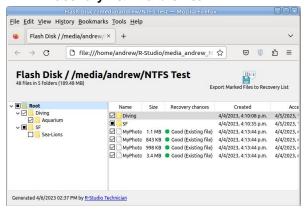
HTML Options dialog box



You may export the default HTML template and edit it to adapt it for your own purposes.

When the customer loads an HTML recovery list in their browser, they can mark files they want to recover, and export their names into the final recovery list in the plain text format.

HTML Recovery list in a browser



You may compare this list with the edited simple recovery list.

An exported recovery list

```
:# Version = 1
:# Sort = by real
:# PathDelim = /
:# CaseSensitive
:# Drive = type:"Volume"; size:"1048576000"; mountpoint:"/media/andrew/ntfs test";
label:"ntfs test"; fs:"NTFS";
:# Parent = type:"Drive"; size:"1048576000"; serial:"2cca54405a8d3a89";
product:"disk"; vendor:"flash";
Diving/Aquarium/20190822_100644.jpg
:! Id=3866625
```

```
Diving/Aquarium/20190822_101620.jpg
:! Id=3932161
Diving/Aquarium/20190822_102526.jpg
:! Id=3997697
Diving/Aquarium/20190822_103830.jpg
:! Id=4063233
Diving/Aquarium/20190822_104333.jpg
:! Id=4128769
Diving/MyPhotol.jpg
:! Id=2883585
Diving/MyPhoto2.jpg
:! Id=2949121
Diving/MyPhoto3.jpg
:! Id=3014657
Diving/MyPhoto4.JPG
:! Id=3080193
Diving/MyPhoto5.jpg
:! Id=3145729
SF/IMG_0869.JPG
:! Id=4915201
SF/IMG_0873.JPG
:! Id=4980737
SF/IMG_0890.JPG
:! Id=5046273
SF/IMG_1739.JPG
:! Id=5111809
SF/IMG_3460.JPG
:! Id=5177345
SF/IMG_3461.JPG
:! Id=5242881
SF/IMG_3476.JPG
:! Id=5308417
SF/IMG_3478.JPG
:! Id=5373953
SF/IMG_3479.JPG
:! Id=5439489
SF/IMG_3480.JPG
:! Id=5505025
SF/IMG_3481.JPG
:! Id=5570561
SF/IMG_3493.JPG
:! Id=5636097
SF/IMG_3535.JPG
:! Id=5701633
SF/IMG_3542.JPG
:! Id=5767169
SF/IMG_3579.JPG
:! Id=5832705
SF/IMG_3580.JPG
:! Id=5898241
SF/IMG_3581.JPG
:! Id=5963777
SF/IMG_3589.JPG
```

```
:! Id=6029313
SF/IMG 3590.JPG
:! Id=6094849
SF/IMG 3591.JPG
:! Id=6160385
SF/IMG 3592.JPG
:! Id=6225921
SF/IMG_3593.JPG
:! Id=6291457
SF/IMG_3594.JPG
:! Id=6356993
SF/IMG 3595.JPG
:! Id=6422529
SF/IMG_3596.JPG
:! Id=6488065
SF/IMG_3608.JPG
:! Id=6553601
SF/IMG_3627.JPG
:! Id=6619137
MyPhoto6.JPG
:! Id=4194305
MyPhoto7.JPG
:! Id=4259841
MyPhoto8.JPG
:! Id=4325377
MyPhoto9.JPG
:! Id=4390913
```

A manually edited plain text recovery list

The edited simple recovery list

The final simple recovery list will be the following:

```
:# Version = 1
:# Sort = by real
:# PathDelim = /
:# CaseSensitive
:# Drive = type: "Volume"; size: "1048576000"; mountpoint: "/media/andrew/ntfs test";
label:"ntfs test"; fs:"NTFS";
:# Parent = type: "Drive"; size: "1048576000"; serial: "2cca54405a8d3a89";
product:"disk"; vendor:"flash";
:= Diving/
:+ Diving/Aquarium/
:+ Diving/MyPhotol.jpg
:+ Diving/MyPhoto3.jpg
:+ SF/
:- SF/Sea-Lions/
MyPhoto6.JPG
MyPhoto7.JPG
MyPhoto8.JPG
MyPhoto9.JPG
```

Plain text format

Custom recovery lists in the text format contains more information about files than simple recovery lists.

Export Recovery List dialog box for the plain text format



You may compare two versions of the same plain text recovery list:

An advanced text recovery list

```
This is an advanced version of the recovery list described on the <u>Recovery List</u> page.
:# Version = 1
:# Sort = by real
:# PathDelim = /
:# CaseSensitive
:# Drive = type: "Volume"; size: "1048576000"; mountpoint: "/media/andrew/ntfs test";
label:"ntfs test"; fs:"NTFS";
:# Parent = type:"Drive"; size:"1048576000"; serial:"2cca54405a8d3a89";
product: "disk"; vendor: "flash";
Diving/
:! Id=4000000260001
:! Flags=directory
:! Created=4/4/2023 04:10 PM
:! Modified=4/4/2023 06:16 PM
:! Accessed=4/5/2023 01:31 PM
:! MFT number=38
:! Parent MFT number=5
Diving/Aquarium/
:! Id=4000000270001
:! Flags=directory
:! Created=4/4/2023 04:10 PM
:! Modified=4/5/2023 01:31 PM
:! Accessed=4/5/2023 01:31 PM
:! MFT number=39
:! Parent MFT number=38
Diving/Aquarium/20190822_100644.jpg
:! Id=3b0001
:! Size=5.49 MB (5,760,305 Bytes)
:! Created=4/5/2023 01:27 PM
:! Modified=8/5/2020 01:34 PM
:! Accessed=4/5/2023 01:27 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Existing file)
:! Regions (sector size=512B):
:! sector 682782 (offset: 80 ) size: 72 Bytes / resident
```

```
:! other files: [24000000410001] MyPhoto7.JPG
:! sector 682782 (offset: 176 ) size: 104 Bytes / resident
    :! other files: [24000000420001] MyPhoto8.JPG
:! sector 1282304 size: 5.49 MB (5,760,305 Bytes) / first data
    :! other files: [24000000410001] MyPhoto7.JPG
:! Bad sectors=No
:! MFT number=59
:! Parent MFT number=39
Diving/Aquarium/20190822_101620.jpg
:! Id=3c0001
:! Size=5.75 MB (6,030,395 Bytes)
:! Created=4/5/2023 01:27 PM
:! Modified=8/5/2020 01:47 PM
:! Accessed=4/5/2023 01:27 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Existing file)
:! Regions (sector size=512B):
:! sector 682784 (offset: 80 ) size: 72 Bytes / resident
    :! other files: [24000000420001] MyPhoto8.JPG
:! sector 682784 (offset: 176 ) size: 104 Bytes / resident
    :! other files: [24000000430001] MyPhoto9.JPG
:! sector 1293560 size: 5.75 MB (6,030,395 Bytes) / first data
   :! other files: [24000000420001] MyPhoto8.JPG
:! Bad sectors=No
:! MFT number=60
:! Parent MFT number=39
Diving/Aquarium/20190822_102526.jpg
:! Id=3d0001
:! Size=4.92 MB (5,163,217 Bytes)
:! Created=4/5/2023 01:27 PM
:! Modified=8/5/2020 09:10 PM
:! Accessed=4/5/2023 01:27 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Existing file)
:! Regions (sector size=512B):
:! sector 682786 (offset: 80 ) size: 72 Bytes / resident
   :! other files: [24000000430001] MyPhoto9.JPG
:! sector 682786 (offset: 176 ) size: 104 Bytes / resident
    :! other files: [24000000440001] IMG_3493.JPG
:! sector 1478800 size: 4.92 MB (5,163,217 Bytes) / first data
   :! other files: [24000000430001] MyPhoto9.JPG
:! Bad sectors=No
:! MFT number=61
:! Parent MFT number=39
Diving/Aquarium/20190822_103830.jpg
:! Id=3e0001
:! Size=5.41 MB (5,674,169 Bytes)
:! Created=4/5/2023 01:27 PM
:! Modified=8/5/2020 09:10 PM
:! Accessed=4/5/2023 01:27 PM
```

```
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Existing file)
:! Regions (sector size=512B):
:! sector 682788 (offset: 80 ) size: 72 Bytes / resident
    :! other files: [24000000440001] IMG_3493.JPG
:! sector 682788 (offset: 176 ) size: 104 Bytes / resident
   :! other files: [24000000450001] IMG_3535.JPG
:! sector 1488888 size: 5.41 MB (5,674,169 Bytes) / first data
    :! other files: [24000000440001] IMG_3493.JPG
:! Bad sectors=No
:! MFT number=62
:! Parent MFT number=39
Diving/Aquarium/20190822_104333.jpg
:! Id=3f0001
:! Size=6.36 MB (6,673,935 Bytes)
:! Created=4/5/2023 01:27 PM
:! Modified=8/5/2020 09:13 PM
:! Accessed=4/5/2023 01:27 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Existing file)
:! Regions (sector size=512B):
:! sector 682790 (offset: 80 ) size: 72 Bytes / resident
    :! other files: [24000000450001] IMG_3535.JPG
:! sector 682790 (offset: 176 ) size: 104 Bytes / resident
    :! other files: [24000000460001] IMG_3542.JPG
:! sector 1642440 size: 6.36 MB (6,673,935 Bytes) / first data
   :! other files: [24000000450001] IMG 3535.JPG
:! Bad sectors=No
:! MFT number=63
:! Parent MFT number=39
Diving/MyPhotol.jpg
:! Id=2c0001
:! Size=2.56 MB (2,682,000 Bytes)
:! Created=4/4/2023 06:16 PM
:! Modified=4/29/2009 05:52 AM
:! Accessed=4/4/2023 06:16 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Existing file)
:! Regions (sector size=512B):
:! sector 682752 (offset: 80 ) size: 72 Bytes / resident
:! sector 682752 (offset: 176 ) size: 90 Bytes / resident
    :! other files: [240000002d0001] MyPhoto2.jpg
:! sector 2036600 size: 2.56 MB (2,682,000 Bytes) / first data
:! Bad sectors=No
:! MFT number=44
:! Parent MFT number=38
Diving/MyPhoto2.jpg
:! Id=2d0001
:! Size=1.75 MB (1,830,252 Bytes)
:! Created=4/4/2023 06:16 PM
```

```
:! Modified=4/29/2009 05:53 AM
:! Accessed=4/4/2023 06:16 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Existing file)
:! Regions (sector size=512B):
:! sector 682754 (offset: 80 ) size: 72 Bytes / resident
   :! other files: [240000002e0001] MyPhoto3.jpg
:! sector 682754 (offset: 176 ) size: 90 Bytes / resident
   :! other files: [240000002e0001] MyPhoto3.jpg
:! sector 2041840 size: 1.75 MB (1,830,252 Bytes) / first data
:! Bad sectors=No
:! MFT number=45
:! Parent MFT number=38
Diving/MyPhoto3.jpg
:! Id=2e0001
:! Size=1.73 MB (1,816,964 Bytes)
:! Created=4/4/2023 06:16 PM
:! Modified=4/29/2009 05:53 AM
:! Accessed=4/4/2023 06:16 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Existing file)
:! Regions (sector size=512B):
:! sector 682756 (offset: 80 ) size: 72 Bytes / resident
   :! other files: [240000002f0001] MyPhoto4.JPG
:! sector 682756 (offset: 176 ) size: 90 Bytes / resident
   :! other files: [24000000300001] MyPhoto5.jpg
:! sector 1683624 size: 1.73 MB (1,816,964 Bytes) / first data
   :! other files: [240000002f0001] MyPhoto4.JPG
:! Bad sectors=No
:! MFT number=46
:! Parent MFT number=38
Diving/MyPhoto4.JPG
:! Id=2f0001
:! Size=880.15 KB (901,269 Bytes)
:! Created=4/4/2023 06:16 PM
:! Modified=4/29/2009 05:54 AM
:! Accessed=4/4/2023 06:16 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Existing file)
:! Regions (sector size=512B):
:! sector 682758 (offset: 80 ) size: 72 Bytes / resident
    :! other files: [24000000310001] IndexerVolumeGuid
:! sector 682758 (offset: 176 ) size: 90 Bytes / resident
   :! other files: [24000000310001] IndexerVolumeGuid
:! sector 2045416 size: 880.15 KB (901,269 Bytes) / first data
    :! other files: [24000000300001] MyPhoto5.jpg
:! Bad sectors=No
:! MFT number=47
:! Parent MFT number=38
Diving/MyPhoto5.jpg
```

```
:! Id=300001
:! Size=3.13 MB (3,286,883 Bytes)
:! Created=4/4/2023 06:16 PM
:! Modified=4/29/2009 06:13 AM
:! Accessed=4/4/2023 06:16 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Existing file)
:! Regions (sector size=512B):
:! sector 682760 (offset: 80 ) size: 72 Bytes / resident
    :! other files: [24000000320001] IMG_0201.JPG
:! sector 682760 (offset: 176 ) size: 90 Bytes / resident
    :! other files: [24000000320001] IMG_0201.JPG
:! sector 1687176 size: 3.13 MB (3,286,883 Bytes) / first data
   :! other files: [24000000310001] IndexerVolumeGuid
:! Bad sectors=No
:! MFT number=48
:! Parent MFT number=38
SF/
:! Id=4000000290001
:! Flags=directory
:! Created=4/4/2023 04:10 PM
:! Modified=4/5/2023 12:36 PM
:! Accessed=4/5/2023 01:27 PM
:! MFT number=41
:! Parent MFT number=5
SF/Sea-Lions/
:! Id=40000002a0001
:! Flags=directory
:! Created=4/4/2023 04:10 PM
:! Modified=4/4/2023 05:03 PM
:! Accessed=4/5/2023 12:36 PM
:! MFT number=42
:! Parent MFT number=41
SF/Sea-Lions/IMG_3493.JPG
:! Id=440001
:! Size=4.75 MB (4,985,023 Bytes)
:! Created=4/4/2023 05:02 PM
:! Modified=6/5/2009 09:50 PM
:! Accessed=4/4/2023 05:02 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Existing file)
:! Regions (sector size=512B):
:! sector 682800 (offset: 80 ) size: 48 Bytes / resident
    :! other files: [240000004c0001] IMG_0873.JPG
:! sector 682800 (offset: 152 ) size: 90 Bytes / resident
   :! other files: [240000004c0001] IMG_0873.JPG
:! sector 682800 (offset: 272 ) size: 80 Bytes / resident
   :! other files: [240000004c0001] IMG_0873.JPG
:! sector 1043832 size: 4.75 MB (4,985,023 Bytes) / first data
    :! other files: [240000004b0001] IMG_0869.JPG
```

```
:! Bad sectors=No
:! MFT number=68
:! Parent MFT number=42
SF/Sea-Lions/IMG_3535.JPG
:! Id=450001
:! Size=3.55 MB (3,718,479 Bytes)
:! Created=4/4/2023 05:02 PM
:! Modified=6/5/2009 09:55 PM
:! Accessed=4/4/2023 05:02 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Existing file)
:! Regions (sector size=512B):
:! sector 682802 (offset: 80 ) size: 48 Bytes / resident
    :! other files: [240000004d0001] IMG_0890.JPG
:! sector 682802 (offset: 152 ) size: 90 Bytes / resident
   :! other files: [240000004d0001] IMG 0890.JPG
:! sector 682802 (offset: 272 ) size: 80 Bytes / resident
    :! other files: [240000004d0001] IMG_0890.JPG
:! sector 1076608 size: 3.55 MB (3,718,479 Bytes) / first data
   :! other files: [240000004c0001] IMG_0873.JPG
:! Bad sectors=No
:! MFT number=69
:! Parent MFT number=42
SF/Sea-Lions/IMG 3542.JPG
:! Id=460001
:! Size=3.92 MB (4,110,749 Bytes)
:! Created=4/4/2023 05:02 PM
:! Modified=6/5/2009 09:57 PM
:! Accessed=4/4/2023 05:02 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Existing file)
:! Regions (sector size=512B):
:! sector 682804 (offset: 80 ) size: 48 Bytes / resident
    :! other files: [2400000004e0001] IMG_1739.JPG
:! sector 682804 (offset: 152 ) size: 90 Bytes / resident
   :! other files: [240000004e0001] IMG_1739.JPG
:! sector 682804 (offset: 272 ) size: 80 Bytes / resident
   :! other files: [240000004f0001] IMG_3460.JPG
:! sector 1109376 size: 3.92 MB (4,110,749 Bytes) / first data
   :! other files: [2400000004e0001] IMG_1739.JPG
:! Bad sectors=No
:! MFT number=70
:! Parent MFT number=42
SF/Sea-Lions/IMG_3579.JPG
:! Id=470001
:! Size=3.92 MB (4,109,345 Bytes)
:! Created=4/4/2023 05:02 PM
:! Modified=6/5/2009 09:59 PM
:! Accessed=4/4/2023 05:02 PM
:! File type=JPEG Digital Camera
```

```
:! Recovery chances=Good (Existing file)
:! Regions (sector size=512B):
:! sector 682806 (offset: 80 ) size: 48 Bytes / resident
    :! other files: [240000004f0001] IMG 3460.JPG
:! sector 682806 (offset: 152 ) size: 90 Bytes / resident
   :! other files: [24000000500001] IMG 3461.JPG
:! sector 682806 (offset: 272 ) size: 80 Bytes / resident
   :! other files: [24000000500001] IMG_3461.JPG
:! sector 1142144 size: 3.92 MB (4,109,345 Bytes) / first data
   :! other files: [240000004f0001] IMG_3460.JPG
:! Bad sectors=No
:! MFT number=71
:! Parent MFT number=42
SF/Sea-Lions/IMG_3580.JPG
:! Id=480001
:! Size=3.35 MB (3,510,477 Bytes)
:! Created=4/4/2023 05:03 PM
:! Modified=6/5/2009 09:59 PM
:! Accessed=4/4/2023 05:03 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Existing file)
:! Regions (sector size=512B):
:! sector 682808 (offset: 80 ) size: 48 Bytes / resident
    :! other files: [24000000510001] IMG_3476.JPG
:! sector 682808 (offset: 152 ) size: 90 Bytes / resident
   :! other files: [24000000510001] IMG_3476.JPG
:! sector 682808 (offset: 272 ) size: 80 Bytes / resident
   :! other files: [24000000510001] IMG_3476.JPG
:! sector 1207680 size: 3.35 MB (3,510,477 Bytes) / first data
   :! other files: [24000000500001] IMG_3461.JPG
:! Bad sectors=No
:! MFT number=72
:! Parent MFT number=42
SF/Sea-Lions/IMG_3581.JPG
:! Id=490001
:! Size=4.09 MB (4,285,353 Bytes)
:! Created=4/4/2023 05:03 PM
:! Modified=6/5/2009 09:59 PM
:! Accessed=4/4/2023 05:03 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Existing file)
:! Regions (sector size=512B):
:! sector 682810 (offset: 80 ) size: 48 Bytes / resident
   :! other files: [24000000520001] IMG_3478.JPG
:! sector 682810 (offset: 152 ) size: 90 Bytes / resident
    :! other files: [24000000520001] IMG_3478.JPG
:! sector 682810 (offset: 272 ) size: 80 Bytes / resident
   :! other files: [24000000530001] IMG_3479.JPG
:! sector 1240448 size: 4.09 MB (4,285,353 Bytes) / first data
   :! other files: [24000000520001] IMG_3478.JPG
:! Bad sectors=No
```

```
:! MFT number=73
:! Parent MFT number=42
SF/Sea-Lions/IMG 3589.JPG
:! Id=4a0001
:! Size=4.44 MB (4,651,043 Bytes)
:! Created=4/4/2023 05:03 PM
:! Modified=6/5/2009 10:00 PM
:! Accessed=4/4/2023 05:03 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Existing file)
:! Regions (sector size=512B):
:! sector 682812 (offset: 80 ) size: 48 Bytes / resident
    :! other files: [24000000530001] IMG_3479.JPG
:! sector 682812 (offset: 152 ) size: 90 Bytes / resident
   :! other files: [24000000540001] IMG_3480.JPG
:! sector 682812 (offset: 272 ) size: 80 Bytes / resident
   :! other files: [24000000540001] IMG_3480.JPG
:! sector 1273216 size: 4.44 MB (4,651,043 Bytes) / first data
    :! other files: [24000000530001] IMG_3479.JPG
:! Bad sectors=No
:! MFT number=74
:! Parent MFT number=42
SF/IMG_0869.JPG
:! Id=4b0001
:! Size=3.53 MB (3,698,659 Bytes)
:! Created=4/4/2023 05:05 PM
:! Modified=5/30/2009 01:13 PM
:! Accessed=4/4/2023 05:05 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Existing file)
:! Regions (sector size=512B):
:! sector 682814 (offset: 80 ) size: 48 Bytes / resident
    :! other files: [24000000550001] IMG_3481.JPG
:! sector 682814 (offset: 152 ) size: 90 Bytes / resident
    :! other files: [24000000550001] IMG_3481.JPG
:! sector 682814 (offset: 272 ) size: 80 Bytes / resident
   :! other files: [24000000550001] IMG 3481.JPG
:! sector 1305984 size: 3.53 MB (3,698,659 Bytes) / first data
    :! other files: [24000000540001] IMG 3480.JPG
:! Bad sectors=No
:! MFT number=75
:! Parent MFT number=41
SF/IMG_0873.JPG
:! Id=4c0001
:! Size=5.61 MB (5,881,104 Bytes)
:! Created=4/4/2023 05:05 PM
:! Modified=5/30/2009 01:15 PM
:! Accessed=4/5/2023 12:35 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Existing file)
```

```
:! Regions (sector size=512B):
:! sector 682816 (offset: 80 ) size: 48 Bytes / resident
    :! other files: [24000000560001] IMG_3493.JPG
:! sector 682816 (offset: 152 ) size: 90 Bytes / resident
   :! other files: [24000000560001] IMG_3493.JPG
:! sector 682816 (offset: 272 ) size: 16 Bytes / resident
   :! other files: [24000000570001] IMG_3535.JPG
:! sector 682816 (offset: 312 ) size: 80 Bytes / resident
   :! other files: [24000000570001] IMG_3535.JPG
:! sector 1338752 size: 5.61 MB (5,881,104 Bytes) / first data
    :! other files: [24000000560001] IMG_3493.JPG
:! Bad sectors=No
:! MFT number=76
:! Parent MFT number=41
SF/IMG_0890.JPG
:! Id=4d0001
:! Size=5.40 MB (5,663,358 Bytes)
:! Created=4/4/2023 05:05 PM
:! Modified=5/30/2009 01:47 PM
:! Accessed=4/4/2023 05:05 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Existing file)
:! Regions (sector size=512B):
:! sector 682818 (offset: 80 ) size: 48 Bytes / resident
    :! other files: [24000000580001] IMG 3542.JPG
:! sector 682818 (offset: 152 ) size: 90 Bytes / resident
   :! other files: [24000000580001] IMG_3542.JPG
:! sector 682818 (offset: 272 ) size: 80 Bytes / resident
   :! other files: [24000000580001] IMG_3542.JPG
:! sector 1371520 size: 5.40 MB (5,663,358 Bytes) / first data
   :! other files: [24000000570001] IMG_3535.JPG
:! Bad sectors=No
:! MFT number=77
:! Parent MFT number=41
SF/IMG 1739.JPG
:! Id=4e0001
:! Size=4.07 MB (4,266,181 Bytes)
:! Created=4/4/2023 05:05 PM
:! Modified=6/3/2009 12:59 PM
:! Accessed=4/4/2023 05:05 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Existing file)
:! Regions (sector size=512B):
:! sector 682820 (offset: 80 ) size: 48 Bytes / resident
    :! other files: [24000000590001] IMG_3579.JPG
:! sector 682820 (offset: 152 ) size: 90 Bytes / resident
   :! other files: [24000000590001] IMG_3579.JPG
:! sector 682820 (offset: 272 ) size: 80 Bytes / resident
   :! other files: [240000005a0001] IMG_3580.JPG
:! sector 1404288 size: 4.07 MB (4,266,181 Bytes) / first data
    :! other files: [24000000590001] IMG_3579.JPG
```

```
:! Bad sectors=No
:! MFT number=78
:! Parent MFT number=41
SF/IMG_3460.JPG
:! Id=4f0001
:! Size=4.38 MB (4,593,453 Bytes)
:! Created=4/4/2023 05:05 PM
:! Modified=6/5/2009 07:58 PM
:! Accessed=4/4/2023 05:05 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Existing file)
:! Regions (sector size=512B):
:! sector 682822 (offset: 80 ) size: 48 Bytes / resident
    :! other files: [240000005a0001] IMG_3580.JPG
:! sector 682822 (offset: 152 ) size: 90 Bytes / resident
   :! other files: [240000005b0001] IMG 3581.JPG
:! sector 682822 (offset: 272 ) size: 80 Bytes / resident
    :! other files: [240000005b0001] IMG_3581.JPG
:! sector 1469824 size: 4.38 MB (4,593,453 Bytes) / first data
   :! other files: [240000005a0001] IMG_3580.JPG
:! Bad sectors=No
:! MFT number=79
:! Parent MFT number=41
SF/IMG_3461.JPG
:! Id=500001
:! Size=3.91 MB (4,102,032 Bytes)
:! Created=4/4/2023 05:05 PM
:! Modified=6/5/2009 07:58 PM
:! Accessed=4/4/2023 05:05 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Existing file)
:! Regions (sector size=512B):
:! sector 682824 (offset: 80 ) size: 48 Bytes / resident
    :! other files: [240000005c0001] IMG_3589.JPG
:! sector 682824 (offset: 152 ) size: 90 Bytes / resident
   :! other files: [240000005c0001] IMG_3589.JPG
:! sector 682824 (offset: 272 ) size: 80 Bytes / resident
   :! other files: [240000005c0001] IMG_3589.JPG
:! sector 1502592 size: 3.91 MB (4,102,032 Bytes) / first data
   :! other files: [240000005b0001] IMG_3581.JPG
:! Bad sectors=No
:! MFT number=80
:! Parent MFT number=41
SF/IMG_3476.JPG
:! Id=510001
:! Size=3.92 MB (4,114,595 Bytes)
:! Created=4/4/2023 05:05 PM
:! Modified=6/5/2009 08:02 PM
:! Accessed=4/4/2023 05:05 PM
:! File type=JPEG Digital Camera
```

```
:! Recovery chances=Good (Existing file)
:! Regions (sector size=512B):
:! sector 682826 (offset: 80 ) size: 48 Bytes / resident
    :! other files: [240000005d0001] IMG 3590.JPG
:! sector 682826 (offset: 152 ) size: 90 Bytes / resident
   :! other files: [240000005d0001] IMG 3590.JPG
:! sector 682826 (offset: 272 ) size: 80 Bytes / resident
   :! other files: [240000005e0001] IMG_3591.JPG
:! sector 1535360 size: 3.92 MB (4,114,595 Bytes) / first data
   :! other files: [240000005d0001] IMG_3590.JPG
:! Bad sectors=No
:! MFT number=81
:! Parent MFT number=41
SF/IMG_3478.JPG
:! Id=520001
:! Size=4.74 MB (4,968,784 Bytes)
:! Created=4/4/2023 05:05 PM
:! Modified=6/5/2009 08:03 PM
:! Accessed=4/5/2023 12:35 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Existing file)
:! Regions (sector size=512B):
:! sector 682828 (offset: 80 ) size: 48 Bytes / resident
    :! other files: [240000005e0001] IMG_3591.JPG
:! sector 682828 (offset: 152 ) size: 90 Bytes / resident
   :! other files: [240000005f0001] IMG_3592.JPG
:! sector 682828 (offset: 272 ) size: 80 Bytes / resident
   :! other files: [240000005f0001] IMG_3592.JPG
:! sector 1568128 size: 4.74 MB (4,968,784 Bytes) / first data
   :! other files: [240000005e0001] IMG_3591.JPG
:! Bad sectors=No
:! MFT number=82
:! Parent MFT number=41
SF/IMG_3479.JPG
:! Id=530001
:! Size=4.28 MB (4,484,110 Bytes)
:! Created=4/4/2023 05:05 PM
:! Modified=6/5/2009 08:03 PM
:! Accessed=4/4/2023 05:05 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Existing file)
:! Regions (sector size=512B):
:! sector 682830 (offset: 80 ) size: 48 Bytes / resident
   :! other files: [240000000600001] IMG 3593.JPG
:! sector 682830 (offset: 152 ) size: 90 Bytes / resident
    :! other files: [24000000600001] IMG_3593.JPG
:! sector 682830 (offset: 272 ) size: 80 Bytes / resident
   :! other files: [24000000600001] IMG_3593.JPG
:! sector 1600896 size: 4.28 MB (4,484,110 Bytes) / first data
   :! other files: [240000005f0001] IMG_3592.JPG
:! Bad sectors=No
```

```
:! MFT number=83
:! Parent MFT number=41
SF/IMG_3480.JPG
:! Id=540001
:! Size=4.28 MB (4,491,209 Bytes)
:! Created=4/4/2023 05:05 PM
:! Modified=6/5/2009 08:03 PM
:! Accessed=4/4/2023 05:05 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Existing file)
:! Regions (sector size=512B):
:! sector 682832 (offset: 80 ) size: 48 Bytes / resident
    :! other files: [24000000610001] IMG_3594.JPG
:! sector 682832 (offset: 152 ) size: 90 Bytes / resident
   :! other files: [24000000610001] IMG_3594.JPG
:! sector 682832 (offset: 272 ) size: 80 Bytes / resident
   :! other files: [24000000620001] IMG_3595.JPG
:! sector 1633664 size: 4.28 MB (4,491,209 Bytes) / first data
    :! other files: [24000000610001] IMG_3594.JPG
:! Bad sectors=No
:! MFT number=84
:! Parent MFT number=41
SF/IMG_3481.JPG
:! Id=550001
:! Size=3.38 MB (3,541,845 Bytes)
:! Created=4/4/2023 05:05 PM
:! Modified=6/20/2009 02:00 PM
:! Accessed=4/4/2023 05:05 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Existing file)
:! Regions (sector size=512B):
:! sector 682834 (offset: 80 ) size: 48 Bytes / resident
   :! other files: [24000000620001] IMG_3595.JPG
:! sector 682834 (offset: 152 ) size: 90 Bytes / resident
    :! other files: [24000000630001] IMG_3596.JPG
:! sector 682834 (offset: 272 ) size: 80 Bytes / resident
   :! other files: [24000000630001] IMG 3596.JPG
:! sector 1666432 size: 3.38 MB (3,541,845 Bytes) / first data
    :! other files: [24000000620001] IMG 3595.JPG
:! Bad sectors=No
:! MFT number=85
:! Parent MFT number=41
SF/IMG_3493.JPG
:! Id=560001
:! Size=4.75 MB (4,985,023 Bytes)
:! Flags=deleted
:! Created=4/4/2023 05:05 PM
:! Modified=6/5/2009 09:50 PM
:! Accessed=4/4/2023 05:05 PM
:! File type=JPEG Digital Camera
```

```
:! Recovery chances=Good (Integrity OK, Unfragmented)
:! Regions (sector size=512B):
:! sector 682836 (offset: 80 ) size: 48 Bytes / resident
    :! other files: [24000000640001] IMG 3608.JPG
:! sector 682836 (offset: 152 ) size: 90 Bytes / resident
   :! other files: [24000000640001] IMG 3608.JPG
:! sector 682836 (offset: 272 ) size: 80 Bytes / resident
    :! other files: [24000000640001] IMG_3608.JPG
:! sector 1699200 size: 4.75 MB (4,985,023 Bytes) / first data
   :! other files: [24000000630001] IMG_3596.JPG
:! Bad sectors=No
:! MFT number=86
:! Parent MFT number=41
SF/IMG 3535.JPG
:! Id=570001
:! Size=3.55 MB (3,718,479 Bytes)
:! Flags=deleted
:! Created=4/4/2023 05:05 PM
:! Modified=6/5/2009 09:55 PM
:! Accessed=4/4/2023 05:05 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Integrity OK, Unfragmented)
:! Regions (sector size=512B):
:! sector 682838 (offset: 80 ) size: 48 Bytes / resident
    :! other files: [24000000650001] IMG 3627.JPG
:! sector 682838 (offset: 152 ) size: 90 Bytes / resident
   :! other files: [24000000650001] IMG 3627.JPG
:! sector 682838 (offset: 272 ) size: 80 Bytes / resident
   :! other files: [24000000400001] MyPhoto6.JPG
:! sector 1731968 size: 3.55 MB (3,718,479 Bytes) / first data
   :! other files: [24000000650001] IMG_3627.JPG
:! Bad sectors=No
:! MFT number=87
:! Parent MFT number=41
SF/IMG 3542.JPG
:! Id=580001
:! Size=3.92 MB (4,110,749 Bytes)
:! Flags=deleted
:! Created=4/4/2023 05:05 PM
:! Modified=6/5/2009 09:57 PM
:! Accessed=4/4/2023 05:05 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Integrity OK, Unfragmented)
:! Regions (sector size=512B):
:! sector 682840 (offset: 80 ) size: 48 Bytes / resident
    :! other files: [24000000610001] IMG 3594.JPG
:! sector 682840 (offset: 152 ) size: 90 Bytes / resident
   :! other files: [240000000420001] MyPhoto8.JPG
:! sector 682840 (offset: 272 ) size: 80 Bytes / resident
    :! other files: [24000000430001] MyPhoto9.JPG
:! sector 1764736 size: 3.92 MB (4,110,749 Bytes) / first data
```

```
:! other files: [24000000410001] MyPhoto7.JPG
:! Bad sectors=No
:! MFT number=88
:! Parent MFT number=41
SF/IMG 3579.JPG
:! Id=590001
:! Size=3.92 MB (4,109,345 Bytes)
:! Flags=deleted
:! Created=4/4/2023 05:05 PM
:! Modified=6/5/2009 09:59 PM
:! Accessed=4/4/2023 05:05 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Integrity OK, Unfragmented)
:! Regions (sector size=512B):
:! sector 682842 (offset: 80 ) size: 48 Bytes / resident
   :! other files: [24000000370001] IMG 0390.JPG
:! sector 682842 (offset: 152 ) size: 90 Bytes / resident
    :! other files: [24000000380001] IMG_0391.JPG
:! sector 682842 (offset: 272 ) size: 80 Bytes / resident
   :! other files: [24000000450001] IMG_3535.JPG
:! sector 1797504 size: 3.92 MB (4,109,345 Bytes) / first data
   :! other files: [24000000440001] IMG_3493.JPG
:! Bad sectors=No
:! MFT number=89
:! Parent MFT number=41
SF/IMG 3580.JPG
:! Id=5a0001
:! Size=3.35 MB (3,510,477 Bytes)
:! Flags=deleted
:! Created=4/4/2023 05:05 PM
:! Modified=6/5/2009 09:59 PM
:! Accessed=4/4/2023 05:05 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Integrity OK, Unfragmented)
:! Regions (sector size=512B):
:! sector 682844 (offset: 80 ) size: 48 Bytes / resident
   :! other files: [24000000470001] IMG 3579.JPG
:! sector 682844 (offset: 152 ) size: 90 Bytes / resident
    :! other files: [24000000620001] IMG_3595.JPG
:! sector 682844 (offset: 272 ) size: 80 Bytes / resident
   :! other files: [24000000480001] IMG_3580.JPG
:! sector 1830272 size: 3.35 MB (3,510,477 Bytes) / first data
   :! other files: [24000000460001] IMG_3542.JPG
:! Bad sectors=No
:! MFT number=90
:! Parent MFT number=41
SF/IMG 3581.JPG
:! Id=5b0001
:! Size=4.09 MB (4,285,353 Bytes)
:! Flags=deleted
```

```
:! Created=4/4/2023 05:05 PM
:! Modified=6/5/2009 09:59 PM
:! Accessed=4/4/2023 05:05 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Integrity OK, Unfragmented)
:! Regions (sector size=512B):
:! sector 682846 (offset: 80 ) size: 48 Bytes / resident
    :! other files: [2400000004a0001] IMG_3589.JPG
:! sector 682846 (offset: 152 ) size: 90 Bytes / resident
   :! other files: [2400000003b0001] 20190822_100644.jpg
:! sector 682846 (offset: 272 ) size: 80 Bytes / resident
    :! other files: [2400000003c0001] 20190822_101620.jpg
:! sector 1863040 size: 4.09 MB (4,285,353 Bytes) / first data
   :! other files: [24000000490001] IMG_3581.JPG
:! Bad sectors=No
:! MFT number=91
:! Parent MFT number=41
SF/IMG 3589.JPG
:! Id=5c0001
:! Size=4.44 MB (4,651,043 Bytes)
:! Flags=deleted
:! Created=4/4/2023 05:05 PM
:! Modified=6/5/2009 10:00 PM
:! Accessed=4/4/2023 05:05 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Integrity OK, Unfragmented)
:! Regions (sector size=512B):
:! sector 682848 (offset: 80 ) size: 48 Bytes / resident
    :! other files: [240000004c0001] IMG_0873.JPG
:! sector 682848 (offset: 152 ) size: 90 Bytes / resident
   :! other files: [24000000330001] IMG_0211.JPG
:! sector 682848 (offset: 272 ) size: 80 Bytes / resident
    :! other files: [24000000340001] IMG_0250.JPG
:! sector 1895808 size: 4.44 MB (4,651,043 Bytes) / first data
   :! other files: [2400000004b0001] IMG_0869.JPG
:! Bad sectors=No
:! MFT number=92
:! Parent MFT number=41
SF/IMG_3590.JPG
:! Id=5d0001
:! Size=4.67 MB (4,899,941 Bytes)
:! Flags=deleted
:! Created=4/4/2023 05:05 PM
:! Modified=6/5/2009 10:00 PM
:! Accessed=4/5/2023 12:35 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Integrity OK, Unfragmented)
:! Regions (sector size=512B):
:! sector 682850 (offset: 80 ) size: 48 Bytes / resident
    :! other files: [24000000350001] IMG_0283.JPG
:! sector 682850 (offset: 152 ) size: 90 Bytes / resident
```

```
:! other files: [24000000360001] IMG_0389.JPG
:! sector 682850 (offset: 272 ) size: 80 Bytes / resident
   :! other files: [240000004e0001] IMG_1739.JPG
:! sector 1928576 size: 4.67 MB (4,899,941 Bytes) / first data
   :! other files: [240000004d0001] IMG_0890.JPG
:! Bad sectors=No
:! MFT number=93
:! Parent MFT number=41
SF/IMG_3591.JPG
:! Id=5e0001
:! Size=4.08 MB (4,280,042 Bytes)
:! Flags=deleted
:! Created=4/4/2023 05:05 PM
:! Modified=6/5/2009 10:00 PM
:! Accessed=4/4/2023 05:05 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Integrity OK, Unfragmented)
:! Regions (sector size=512B):
:! sector 682852 (offset: 80 ) size: 48 Bytes / resident
   :! other files: [240000004f0001] IMG_3460.JPG
:! sector 682852 (offset: 152 ) size: 90 Bytes / resident
   :! other files: [240000003d0001] 20190822_102526.jpg
:! sector 682852 (offset: 272 ) size: 80 Bytes / resident
   :! other files: [240000003e0001] 20190822_103830.jpg
:! sector 1961344 size: 4.08 MB (4,280,042 Bytes) / first data
    :! other files: [24000000630001] IMG_3596.JPG
:! Bad sectors=No
:! MFT number=94
:! Parent MFT number=41
SF/IMG_3592.JPG
:! Id=5f0001
:! Size=5.04 MB (5,285,211 Bytes)
:! Flags=deleted
:! Created=4/4/2023 05:05 PM
:! Modified=6/5/2009 10:00 PM
:! Accessed=4/4/2023 05:05 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Integrity OK, Unfragmented)
:! Regions (sector size=512B):
:! sector 682854 (offset: 80 ) size: 48 Bytes / resident
   :! other files: [24000000510001] IMG_3476.JPG
:! sector 682854 (offset: 152 ) size: 90 Bytes / resident
    :! other files: [24000000520001] IMG_3478.JPG
:! sector 682854 (offset: 272 ) size: 80 Bytes / resident
    :! other files: [24000000390001] IMG_3694.JPG
:! sector 1994112 size: 5.04 MB (5,285,211 Bytes) / first data
   :! other files: [24000000500001] IMG_3461.JPG
:! Bad sectors=No
:! MFT number=95
:! Parent MFT number=41
```

```
SF/IMG 3593.JPG
:! Id=600001
:! Size=4.74 MB (4,969,442 Bytes)
:! Flags=deleted
:! Created=4/4/2023 05:05 PM
:! Modified=6/5/2009 10:00 PM
:! Accessed=4/4/2023 05:05 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Integrity OK, Unfragmented)
:! Regions (sector size=512B):
:! sector 682856 (offset: 80 ) size: 48 Bytes / resident
    :! other files: [24000000530001] IMG 3479.JPG
:! sector 682856 (offset: 152 ) size: 90 Bytes / resident
   :! other files: [24000000540001] IMG_3480.JPG
:! sector 682856 (offset: 272 ) size: 80 Bytes / resident
   :! other files: [240000003f0001] 20190822_104333.jpg
:! sector 2026880 size: 4.74 MB (4,969,442 Bytes) / first data
    :! other files: [240000003a0001] IMG_3699.JPG
:! Bad sectors=No
:! MFT number=96
:! Parent MFT number=41
SF/IMG 3594.JPG
:! Id=610001
:! Size=4.69 MB (4,917,237 Bytes)
:! Flags=deleted
:! Created=4/4/2023 05:05 PM
:! Modified=6/5/2009 10:00 PM
:! Accessed=4/4/2023 05:05 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Integrity OK, Unfragmented)
:! Regions (sector size=512B):
:! sector 682858 (offset: 80 ) size: 48 Bytes / resident
    :! other files: [24000000640001] IMG_3608.JPG, [24000000320001]
IMG 0201.JPG
:! sector 682858 (offset: 152 ) size: 90 Bytes / resident
    :! other files: [24000000640001] IMG_3608.JPG, [24000000320001]
IMG_0201.JPG
:! sector 682858 (offset: 272 ) size: 80 Bytes / resident
    :! other files: [240000002e0001] MyPhoto3.jpg
:! sector 973080 size: 4.69 MB (4,917,237 Bytes) / first data
   :! other files: [24000000550001] IMG_3481.JPG
:! Bad sectors=No
:! MFT number=97
:! Parent MFT number=41
SF/IMG_3595.JPG
:! Id=620001
:! Size=5.09 MB (5,338,697 Bytes)
:! Flags=deleted
:! Created=4/4/2023 05:05 PM
:! Modified=6/5/2009 10:00 PM
:! Accessed=4/4/2023 05:05 PM
```

```
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Integrity OK, Unfragmented)
:! Regions (sector size=512B):
:! sector 682860 (offset: 80 ) size: 48 Bytes / resident
    :! other files: [24000000560001] IMG_3493.JPG
:! sector 682860 (offset: 152 ) size: 90 Bytes / resident
   :! other files: [24000000570001] IMG_3535.JPG
:! sector 682860 (offset: 272 ) size: 80 Bytes / resident
   :! other files: [24000000580001] IMG_3542.JPG
:! sector 1174920 size: 5.09 MB (5,338,697 Bytes) / first data
    :! other files: [24000000300001] MyPhoto5.jpg
:! Bad sectors=No
:! MFT number=98
:! Parent MFT number=41
SF/IMG_3596.JPG
:! Id=630001
:! Size=4.93 MB (5,174,072 Bytes)
:! Flags=deleted
:! Created=4/4/2023 05:05 PM
:! Modified=6/5/2009 10:00 PM
:! Accessed=4/4/2023 05:05 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Integrity OK, Unfragmented)
:! Regions (sector size=512B):
:! sector 682862 (offset: 80 ) size: 48 Bytes / resident
    :! other files: [240000005a0001] IMG 3580.JPG
:! sector 682862 (offset: 152 ) size: 90 Bytes / resident
   :! other files: [24000000650001] IMG_3627.JPG
:! sector 682862 (offset: 272 ) size: 80 Bytes / resident
   :! other files: [240000005b0001] IMG_3581.JPG
:! sector 1437064 size: 4.93 MB (5,174,072 Bytes) / first data
    :! other files: [24000000590001] IMG_3579.JPG
:! Bad sectors=No
:! MFT number=99
:! Parent MFT number=41
SF/IMG_3608.JPG
:! Id=640001
:! Size=5.01 MB (5,257,021 Bytes)
:! Flags=deleted
:! Created=4/4/2023 05:05 PM
:! Modified=6/5/2009 10:01 PM
:! Accessed=4/4/2023 05:05 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Below Average (Integrity OK, Beginning overwritten by existing
file)
:! Regions (sector size=512B):
:! sector 682864 (offset: 80 ) size: 48 Bytes / resident
   :! other files: [240000005d0001] IMG 3590.JPG
:! sector 682864 (offset: 152 ) size: 90 Bytes / resident
    :! other files: [240000005e0001] IMG_3591.JPG
:! sector 682864 (offset: 272 ) size: 80 Bytes / resident
```

```
:! other files: [240000005f0001] IMG_3592.JPG
:! sector 1673352 size: 5.01 MB (5,257,021 Bytes) / first data
    :! other files: [240000005c0001] IMG_3589.JPG
:! Overlapping files=[24000000320001] IMG_0201.JPG
:! MFT number=100
:! Parent MFT number=41
SF/IMG_3627.JPG
:! Id=650001
:! Size=3.48 MB (3,651,691 Bytes)
:! Flags=deleted
:! Created=4/4/2023 05:05 PM
:! Modified=6/5/2009 10:02 PM
:! Accessed=4/4/2023 05:05 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Integrity OK, Unfragmented)
:! Regions (sector size=512B):
:! sector 682866 (offset: 80 ) size: 48 Bytes / resident
    :! other files: [240000002c0001] MyPhoto1.jpg
:! sector 682866 (offset: 152 ) size: 90 Bytes / resident
   :! other files: [240000002d0001] MyPhoto2.jpg
:! sector 682866 (offset: 272 ) size: 80 Bytes / resident
   :! other files: [240000002f0001] MyPhoto4.JPG
:! sector 1837136 size: 3.48 MB (3,651,691 Bytes) / first data
    :! other files: [24000000600001] IMG_3593.JPG
:! Bad sectors=No
:! MFT number=101
:! Parent MFT number=41
MyPhoto6.JPG
:! Id=400001
:! Size=1.07 MB (1,123,560 Bytes)
:! Created=4/4/2023 04:13 PM
:! Modified=4/29/2009 05:54 AM
:! Accessed=4/4/2023 04:13 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Existing file)
:! Regions (sector size=512B):
:! sector 682792 (offset: 80 ) size: 48 Bytes / resident
    :! other files: [24000000460001] IMG_3542.JPG
:! sector 682792 (offset: 152 ) size: 90 Bytes / resident
   :! other files: [24000000470001] IMG_3579.JPG
:! sector 682792 (offset: 272 ) size: 80 Bytes / resident
   :! other files: [24000000470001] IMG_3579.JPG
:! sector 938624 size: 1.07 MB (1,123,560 Bytes) / first data
   :! other files: [24000000460001] IMG_3542.JPG
:! Bad sectors=No
:! MFT number=64
:! Parent MFT number=5
MyPhoto7.JPG
:! Id=410001
:! Size=842.76 KB (862,983 Bytes)
```

```
:! Created=4/4/2023 04:13 PM
:! Modified=4/29/2009 05:55 AM
:! Accessed=4/4/2023 04:13 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Existing file)
:! Regions (sector size=512B):
:! sector 682794 (offset: 80 ) size: 48 Bytes / resident
    :! other files: [24000000480001] IMG_3580.JPG
:! sector 682794 (offset: 152 ) size: 90 Bytes / resident
   :! other files: [24000000480001] IMG_3580.JPG
:! sector 682794 (offset: 272 ) size: 80 Bytes / resident
    :! other files: [24000000480001] IMG_3580.JPG
:! sector 971392 size: 842.76 KB (862,983 Bytes) / first data
   :! other files: [24000000470001] IMG_3579.JPG
:! Bad sectors=No
:! MFT number=65
:! Parent MFT number=5
MyPhoto8.JPG
:! Id=420001
:! Size=997.99 KB (1,021,937 Bytes)
:! Created=4/4/2023 04:13 PM
:! Modified=4/29/2009 05:55 AM
:! Accessed=4/4/2023 04:13 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Existing file)
:! Regions (sector size=512B):
:! sector 682796 (offset: 80 ) size: 48 Bytes / resident
    :! other files: [24000000490001] IMG_3581.JPG
:! sector 682796 (offset: 152 ) size: 90 Bytes / resident
   :! other files: [24000000490001] IMG_3581.JPG
:! sector 682796 (offset: 272 ) size: 80 Bytes / resident
    :! other files: [240000004a0001] IMG_3589.JPG
:! sector 1004160 size: 997.99 KB (1,021,937 Bytes) / first data
   :! other files: [24000000490001] IMG 3581.JPG
:! Bad sectors=No
:! MFT number=66
:! Parent MFT number=5
MyPhoto9.JPG
:! Id=430001
:! Size=3.37 MB (3,533,017 Bytes)
:! Created=4/4/2023 04:13 PM
:! Modified=4/29/2009 05:56 AM
:! Accessed=4/4/2023 04:13 PM
:! File type=JPEG Digital Camera
:! Recovery chances=Good (Existing file)
:! Regions (sector size=512B):
:! sector 682798 (offset: 80 ) size: 48 Bytes / resident
   :! other files: [240000004a0001] IMG 3589.JPG
:! sector 682798 (offset: 152 ) size: 90 Bytes / resident
    :! other files: [2400000004b0001] IMG_0869.JPG
:! sector 682798 (offset: 272 ) size: 80 Bytes / resident
```

```
:! other files: [240000004b0001] IMG_0869.JPG

:! sector 1036928 size: 3.37 MB (3,533,017 Bytes) / first data

:! other files: [2400000004a0001] IMG_3589.JPG

:! Bad sectors=No

:! MFT number=67

:! Parent MFT number=5
```

Other recovery list formats

You may export recovery lists in the following formats:

XML format

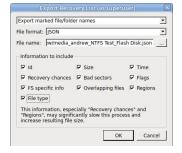
Export Recovery List dialog box for the XML format



JSON format

Custom recovery lists in the text format contains more information about files than simple recovery lists.

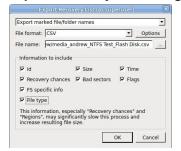
Export Recovery List dialog box for the JSON format



CSV format

Custom recovery lists in the text format contains more information about files than simple recovery lists.

Export Recovery List dialog box for the CSV format



CSV Options dialog box



3.9 Drive Copy Wizard

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.

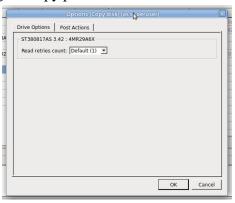
To enable writing,

- 1 On the R-Studio for Linux main panel, select the Tools menu, then Settings, and select Enable Write on the <u>Settings</u> dialog box.
- > The Copy object to... will be enabled on the Create menu. Now objects can be copied.

While the objects are being copied, you may change some parameters and view the <u>I/O monitor</u> on the Object Copy Progress dialog box.



You may change some options during the copy process





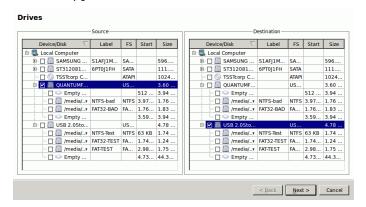
Depending on the objects to copy and your tasks, you may do:

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.

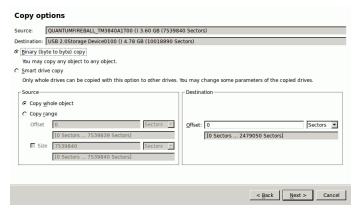
To perform a binary copy of an object,

- 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 Next button Drives Copy Wizard



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

Copy options dialog box

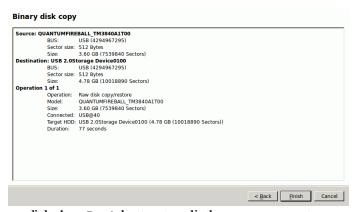


■ Copy options

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 Finish button

Drives Copy Wizard



or click the **<Back** button to edit the copy parameters

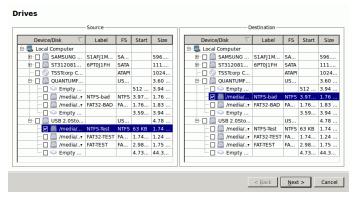
> R-Studio for Linux will start copying data from the source object to the destination one.

Smart partition copy

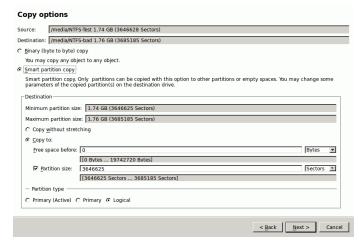
Only <u>partitions</u> can be copied with this option to other partitions or empty spaces. You may change some parameters of the the copied partition(s) on the destination drive.

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 Next button Drives Copy Wizard



3 Select Smart partition copy on the Copy Options panel, specify copy options, and click the Next button Copy options dialog box

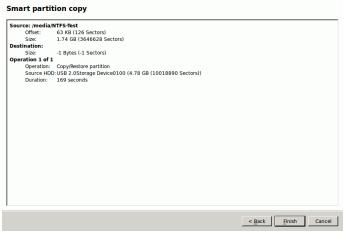


■ Copy options

Destination	
Copy without stretching	Select this option if you want to copy the partition exactly to the destination place
Copy to:	Select this option if you want to change some parameters of the copied partition on the destination place
Free space before	Specify how much space will be left empty before the start of the copied partition
Partition size	Select this option and specify the new size of the copied partition
Partition type Primary (Active)/ Primary/Logical	Specify the type of the partition to be copied. Do not change this setting unless you have serious reasons to do so.

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

Drives Copy Wizard



or click the <Back button to edit the copy parameters

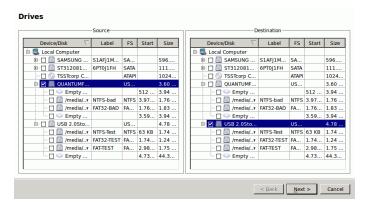
> R-Studio for Linux will start copying data from the source partition to the destination place.

Smart drive copy

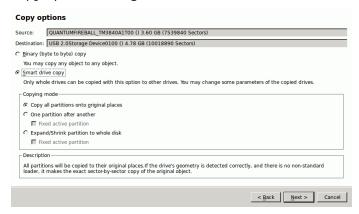
Only whole drives can be copied with this option to other drives. You may change some parameters of the copied drives.

To perform a smart drive copy of a hard drive,

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



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



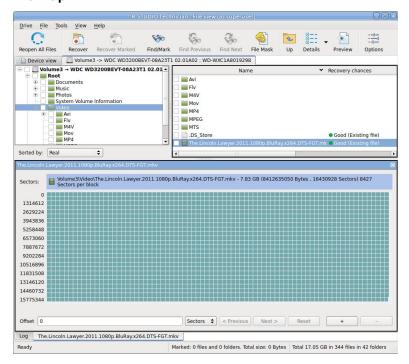
or click the **<Back** button to edit the copy parameters

> R-Studio for Linux will start copying data from the source hard drive to the destination one.

3.10 File Maps

R-Studio for Linux can show file maps. Right-click the file and select Map of file in their shortcut menu.

File Map



3.11 I/O Monitor and Sector Map Files

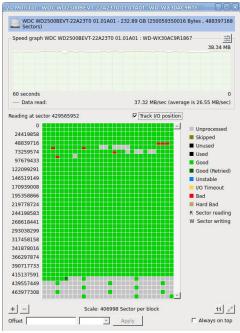
These features greatly improves working with failing drives for **R-Studio for Linux**.

VO Monitor

I/O Monitor allows you to inspect the process of drive input/output operations in real time. When **R-Studio for Linux** performs a disk operation the **I/O Monitor button** becomes active.

Click this button, and the I/O Monitor will appear.

I/O Monitor



You may also start **I/O Monitor** from the context menu and progress dialog boxes during various drive operations.

Sector Map Files

<u>Sector map files</u> are files that contain information about conditions of drive sectors, which may be good, bad, slow, and unstable. **R-Studio for Linux** estimates chances for successful file recovery basing on these files and avoiding unnecessary attempts to read <u>bad sectors</u>. Sector map files are crucial for <u>multi-pass imaging</u>.

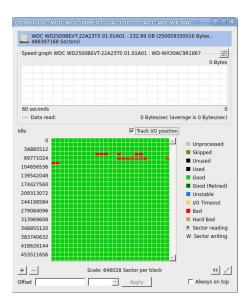
R-Studio for Linux creates its own sector map files or can import such files created from other disk imaging programs. Currently **R-Studio for Linux** supports sector map files from
https://example.com/html/>
html/>
html/>
html/
html

To open, save or clean a sector map file for an object,

* Right-click the object and select Open Sector Map, Save Sector Map, or Clean Sector Map, respectively, on the context menu.

You may look at the graphical representation of the loaded sector map by starting I/O Monitor.

Sector Map



3.12 Runtime Imaging

Runtime imaging is <u>image</u> creation for a drive object performed simultaneously with other data read operations from this drive. When **R-Studio for Linux** reads data from a certain area of the source (a drive, <u>partition</u>, or region), it writes the data to the target which can be either a dedicated drive or an image file. When the data from this area is needed again, **R-Studio for Linux** reads it from the target rather than the source thus reducing access to the source. This is very important for faulty or unstable drives which health may be constantly deteriorating during data recovery operations.

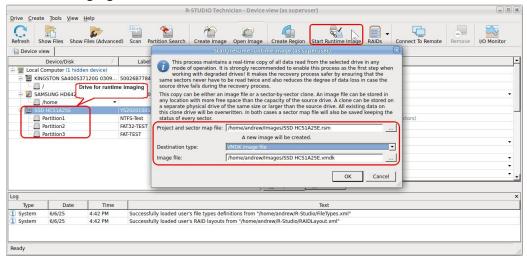


R-Studio for Linux also creates a sector map file during runtime imaging.

To start runtime imaging of an object,

using a plain image file

1 Select a drive object on the R-Studio for Linux's Drives panel and click the Set Runtime Image button, or right-click the object and select Set Runtime Image on the context menu.

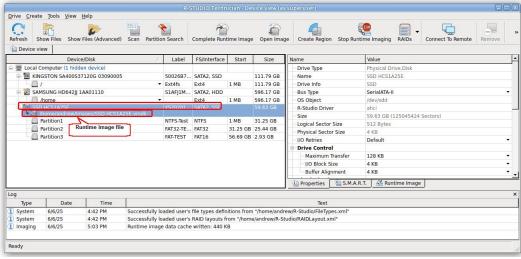


Select Plain or <u>another image type</u> in the Image type field, specify the file name and path for the image and sector map files, and click the **OK** button. Don't select the **VMDK image file** unless you can disable writing to the drive later. Cloning to a physical drive is not recommended because Windows can write some data to the drive corrupting the imaged data when the image has been completed and runtime imaging is over.

Plain image file requires immediate allocation of disk space equal to the object size, whereas VMDK image file is growing gradually upon imaging progress.

> R-Studio for Linux will turn on runtime imaging.

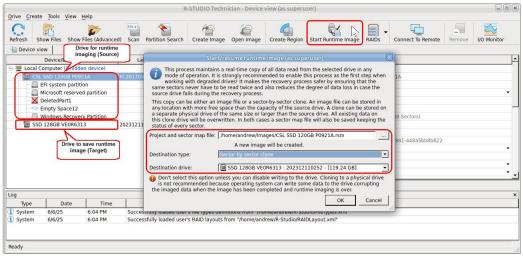
Runtime imaging



Select the object and click the **Stop Runtime Imaging** button or this item in the context menu turn runtime imaging off.

using a physical drive

1 Select a drive object on the R-Studio for Linux's Drives panel and click the Set Runtime Image button, or right-click the object and select Set Runtime Image on the context menu.

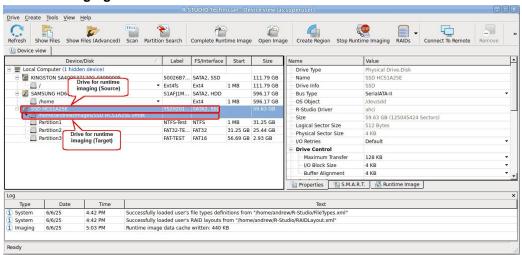


Select **Physical drive** in the **Image type** field, specify the name and path for the sector map file, and click the **OK** button.

Note: all data on the drive will be destroyed.

R-Studio for Linux will turn on runtime imaging.

Runtime imaging



Select the object and click the **Stop Runtime Imaging** button or item in the context o menu turn runtime imaging off.

R-Studio for Linux stores the information about runtime configurations and asks the users whether they want to keep runtime imaging or discard it during its startup.



and this configuration will appear in **R-Studio for Linux**.

Runtime imaging

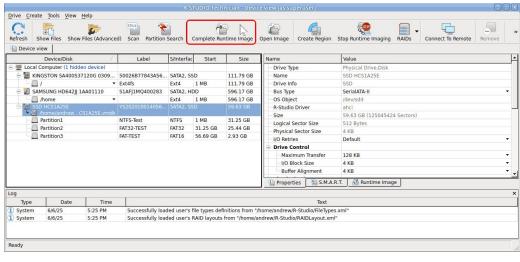


Completing Runtime Image

You may complete the runtime image without browsing through the entire file system on the disk.

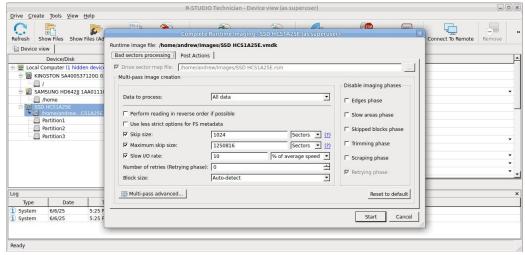
Select the object being imaged and click the Complete Runtime Image button, or right-click the object and select Complete Runtime Image on the shortcut menu.

Runtime imaging



> The Complete Runtime Imaging dialog box will appear.

Runtime imaging



Select the necessary <u>parameters of multi-pass</u> imaging and select the **OK** button.

> R-Studio for Linux will complete the creation of the runtime image.

If the runtime image has not been completed, you may resume it next time you start runtime imaging.

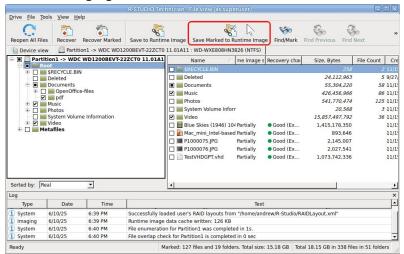
Runtime imaging



Creating runtime image for individual files

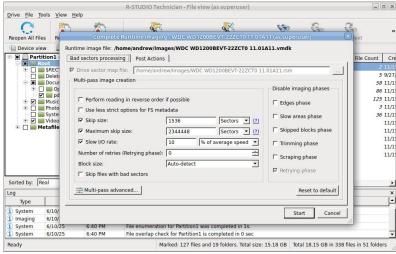
You may create a runtime image containing only individual files rather than all data on the disk.

- 1 Establish a runtime imaging for the disk with the files, open the disk, mark the files, and click the Save marked to runtime image button.
 - or right-click on the right pane, and select Save Marked to Runtime Image on the shortcut menu.



> The Complete Runtime Imaging dialog box will appear.

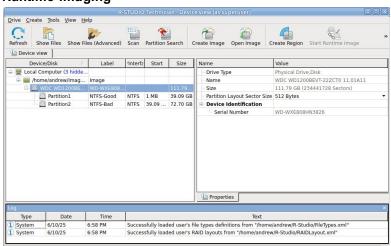
Runtime imaging



Select the necessary <u>parameters of multi-pass</u> imaging and select the **OK** button.

> R-Studio for Linux will complete the creation of the runtime image. You may Skip files with <u>bad sectors</u> if necessary.

You may open such images as regular ones.



Such image contains information about the entire file system, but if a non-imaged file is opened, it'll contain only zeros.

3.13 Multi-pass Imaging

Multi-pass imaging is a process of <u>image</u> creation through several passes (phases). Each phase reads data from different areas of a hard drive, starting from areas with good sectors then going to slow sector areas and finishes with <u>bad sector</u> areas. This approach maximizes the amount of data that can be recovered from a failing drive and reduces it chances to fail during this process.

Phase 1. Copying most good data from the drive

In this phase, **R-Studio** reads data from drive by sector blocks, or groups of consecutive drive sectors read in one go. The phase is performed in several steps.

- **Step 1. R-Studio** reads data from the drive until it runs into a block with bad or slow sector(s). Then it drops that block and jumps to another area until it finds a block with no bad or slow sectors. Then it continues reading data until it runs into another bad or slow block, and the process repeats. When this step is finished, most good data from the hard drive has been read, and **R-Studio** has detected the front blocks (edges) of bad and slow sector areas.
- **Step 2. R-Studio** finds the rear edges of bad sector areas. It reads the skipped area from its rear end backwards until it runs into a block with a bad sector. Then **R-Studio** jumps to another bad sector area and the process is going on until all bad sector areas have been processed. When this step is finished, some good data from the hard drive has been read, and **R-Studio** has detected the rear edges of bad sector areas.
- **Step 3. R-Studio** reads data from slow sector areas. It does that much the same way as for bad sector areas. When this step is finished, good data from slow sectors on the hard drive has been read, and **R-Studio** has detected the rear edges of slow sector areas.
- **Step 4. R-Studio** finds the rear edges of bad sector areas in slow sector areas. When this step is finished, some new good data from slow sectors on the hard drive has been read, and **R-Studio** has detected the rear edges of all bad sectors within slow sector areas.
- **Step 5. R-Studio** tries to read all skipped sector blocks. This is done without skipping bad sector blocks and checking read speed against minimum I/O rate.

When *Phase 1* is completed, **R-Studio** has read most of readable data and detected front and rear edges of all bad sector areas.

R-Studio tries to read the rest of data in the next phases, and does that sector by sector (rather than blocks).

Phase 2. Trimming

R-Studio detects the front and rear sectors of bad sector areas. When this step is finished, some new good data from bad sector areas has been read, and **R-Studio** has detected the front and rear sectors of all bad sector areas.

Phase 3. Scraping

R-Studio tries to read data from bad sector areas sector by sector.

Phase 4. Retrying (mostly optional)

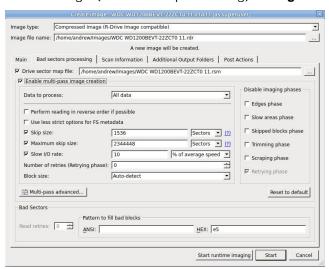
R-Studio tries to read data from bad sectors through several attempts.

You may read more about this process in our article Multi-pass imaging in R-Studio

To create an image through multi-pass imaging,

- 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
 - Right-click the selected object and select Create Image File on the context menu
- 2 Specify image options, a file name, and destination for the image on the Create Image dialog box and click the OK button

Create Image (Bad sector processing) dialog box



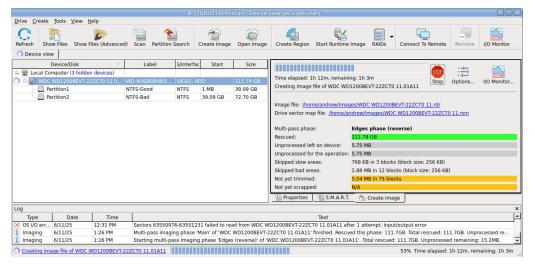
■Bad sectors processing options

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

Image type:	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 . Byte by byte image: If this option is selected, R-Studio will create a simple exact copy of the object. VMDK (ViMware Virtual Machine Disk) image: If this option is selected, R-Studio will create an image of the VMware virtual disk type. Available in the Corporate, Technician, and T80+ license. Some other image formats are also available in the Technician, and T80+ licenses. You may read more about these formats in the Supported Virtual Disk and Disk Image Formats page.
Drive sector map file	A file with the sector map of the object to image. Optional for the RDI image type, mandatory for the byte-by-byte and VMDK image types.
Enable multi-pass image creation	Turns multi-pass imaging on and off.
Data to process	All data: All data on the disk will be imaged. Existing files only (FS bitmap): Only the disk's area where existing files reside will be imaged. Unused clusters only: Only the disk's free space will be imaged. You may image the existing files first and then unused clusters.
Perform reading in reverse order if possible	Switches the direction of all phases/steps to reverse.
Minimum skip size	Minimum size of drive area to skip when a bad sector is encountered.
Maximum skip size	Maximum size of drive area to skip when a bad sector is encountered.
Number of retries (Retrying phase)	The number of read attempts in the Retrying phase.
Disable imaging phases	Multi-imaging phases that can be skipped.

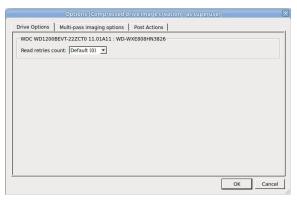
> R-Studio will start creating the image, the Progress message showing the progress.

Multi-pass imaging progress dialog box

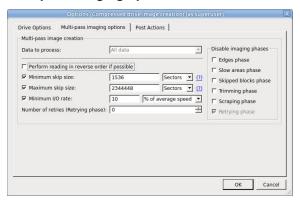


You may change operation parameters during image creation. Click the **Options** button and change them accordingly.

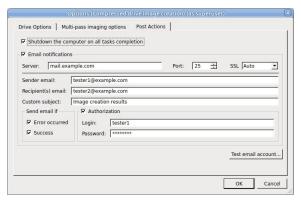
Drive Options tab



Multi-pass imaging options tab



Post Actions tab

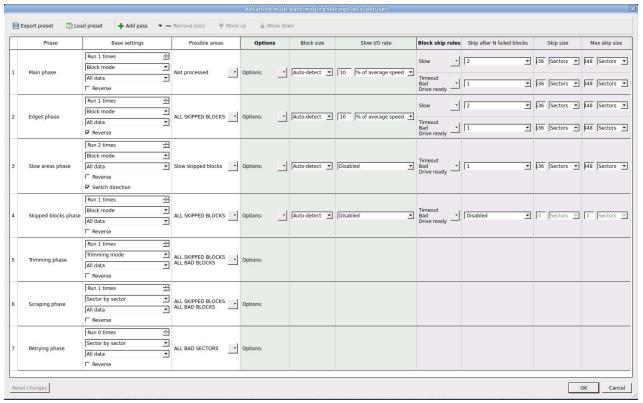


Advanced multi-pass imaging settings window

Note: You should completely understand what you are going to do, or you may severe deteriorate **R-Studio** performance or even damage the hard drive being imaged. When in doubt, confine yourself to parameters on the Multi-pass imaging options tab.

The Bad sector processing dialog box spe cifies options for all stages of multi-pass imaging. You can perform more versatile control of these options on the Advanced multi-pass imaging settings window. You may add or delete individual phases and steps, change their order, and fine-tune each phase and step separately.

Advanced multi-pass imaging settings



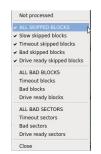
Depending on the phase/step, these options are different. Some of them are described in the <u>Bad sectors</u> <u>processing options</u> tab, some are self-evident, and some are described in the table below.

■Advanced bad sectors processing options

Possible areas	Specifies the areas to which this phase will be applied. Selecting an area in ALL CAPITALS selects all their subareas.
Options	You may specify separate options for sectors where FS metadata resides.
Block skip rules Skip after N failed blocks	Specifies how many times various failed blocks will be encountered to skip them.







All selected subareas



Failed blocks

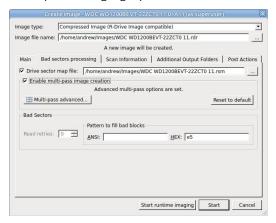


FS metadata options

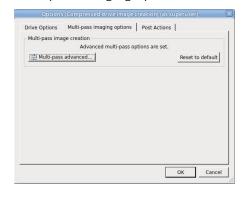
A particular set of these options can be saved as a preset and loaded back when necessary.

The Bad sector processing tabs will look different when the advanced multi-pass imaging settings have been altered.

Multi-pass imaging options tab



Multi-pass imaging options tab



3.14 Reverse RAIDs

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 <u>bad sectors</u> 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 certains RAIDs. Without that metadata they won't see those RAIDs. You have to write that metadata manually.

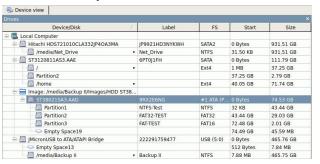
3.14.1 Reverse RAID of an Object

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 <u>image</u> of a former RAID 6 (Reed-Solomon) and you wand to re-create data on individual disks from that RAID 6. You can do that by creating a reverse RAID of an image.

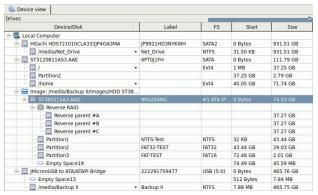
Note: Many controllers write their own metadata to disks to recognize that the disks belong to certains RAIDs. Without that metadata they won't see those RAIDs. You have to write that metadata manually.

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

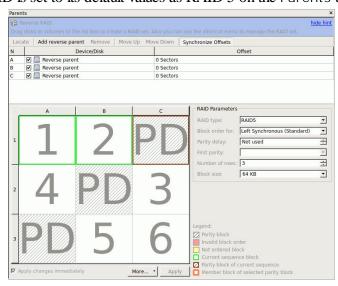
1 Right-click the disk object on the Drives panel and select Create Reverse RAID on the context menu.



> The Reverse parents will appear on the Drives panel

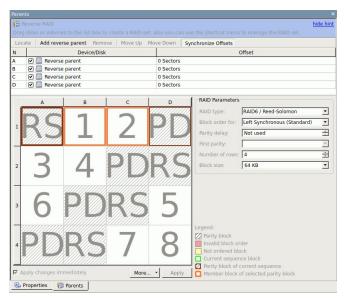


Initially, the reverse RAID is set to its default values as RAID 5 on the Parents tab.

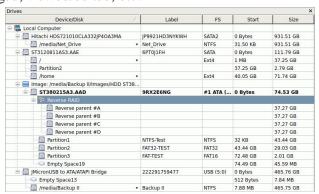


2 Adjust RAID parameters on the Parents tab, as necessary.

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.



3.14.2 Reverse RAID of a RAID

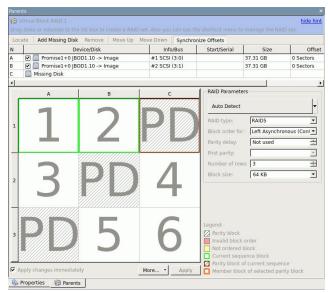
This technique can be used to re-construct data on individual RAID disks when data on physical disks is corrupted, but can be recovered using RAID redundancy.

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 <u>image</u>.

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.

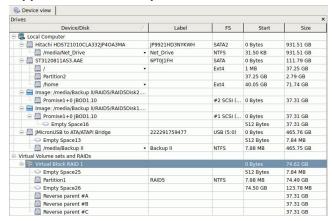
To create a reverse RAID of a RAID with a missing disk,

1 Create a virtual RAID 5 of the existing hard drives or their images Add a missing disk to the Parents tab.

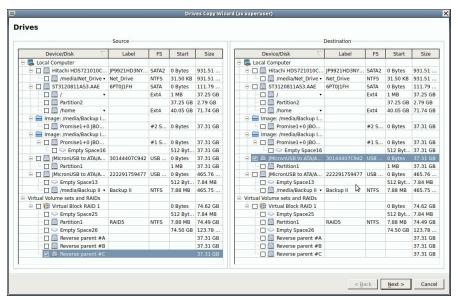


If necessary, read the <u>Basic RAID 4 and RAID 5 Operations</u> and <u>Volumes Sets and RAIDs</u> help pages for details.

- 2 Right-click the Virtual Block Raid on the Drives panel and select Create Reverse RAID on the context 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.

3.15 Working with Third-Party Hardware

The Technician version of **R-Studio for Linux** can work together with third-party hardware developed for indepth data recovery. Currently, the following devices are supported:

- DeepSpar Devices
- HDDSuperClone

3.15.1 DeepSpar Devices

Currently only the Windows version of **R-Studio** can directly work with several **DeepSpar Disk Imager**TM hardware devices for data recovery.

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.

You may learn more about **DDI** on its vendor site: **DeepSpar Disk Imager**TM.

DeepSpar USB StabilizerTM, a device that allows any Windows software to reliably work with unstable/degraded USB storage devices providing a connection between the computer and source device. The storage devices can be hard drives, SSD devices, USB memory sticks, memory cards connected through a special adapter, etc. Windows shows such device as if it was connected directly to the system providing access to it for R-Studio.

You may learn more about USB Stabilizer on its vendor's **USB Stabilizer** or our sites.

The USB Stabilizer 10GbTM: a further development of the USB Stabilizer.

You may learn more about USB Stabilizer 10Gb on its vendor's USB Stabilizer 10Gb site.

RapidSparTM is a specialized data recovery device intended to extract data from problematic drives. Failing (source) and target drives are connected to the device, and it autonomously copies data from the source to the target in a way that maximizes the amount of successfully extracted data and minimizes possible damage to the source drive. The copy parameters can be quickly changed during this process directly on the device. Then the recovery software can read data from the target drive

You may read more about RapidSpar on its web site.

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,

- * Right-click the required hard drive/partition and select Show drive map... on the context menu,
- > The drive map will appear in the right tab.

■ Drive map controls

Sectors	The number of the first sector in the row.
Offset	Offset in the data. Enter the address you want to jump to and press the Enter key.
Sectors/Bytes/KB	Specifies the dimension of the data in the Offset field.
Previous/Next	Moves to the previous/next part of the data.
+/-	Zooms into/out of, the data.

To see more detailed information about a particular sector range, right click the corresponding rectangle and select **Information** on the context 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,

- * Right-click the required file and select Map of file... on the context menu,
- > The file map will appear in the lower pane.

File map controls

Sectors	The number of the first sector in the row.
Offset	Offset in the data. Enter the address you want to jump to and press the Enter key.
Sectors/Bytes/KB	Specifies the dimension of the data in the Offset field.
Previous/Next	Moves to the previous/next part of the data.
+/-	Zooms into/out of, the data.

To see more detailed information about a particular sector range, right click the corresponding rectangle and select **Information** on the context menu.

Click the **Open in Hex Editor** button to open the selected block in the **Text/hexadecimal editor**.

3.15.2 HDDSuperClone

<u>HDDSuperClone</u> from SD Computing Service is a software solution for disk imaging, cloning, and data extraction tasks. It's specifically designed to work with unstable, faulty, or dying hard drives. It uses several advanced techniques to extract data from hard drives with <u>bad sectors</u> and other hardware issues while doing everything possible to avoid inflicting even more damage on the drive being processed.

It has two modes of operations:

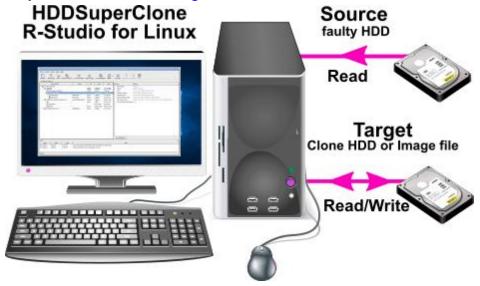
1. The disk cloning/imaging mode: It simply copies data from one disk (the source) to another disk or a file (the target). It also creates a disk map file (the log) that specifies the sectors that cannot be read (the bad sectors).

Such data may be processed by a third-party data recovery program. This mode is available in both free and commercial versions, with some small limitations for the former.

A virtual drive mode (the commercial version only): In this mode, HDDSuperClone installs a special driver
that creates a virtual drive from the disk. This virtual drive becomes accessible to the host OS and other
programs.

To work with the HDDSuperClone in the virtual drive mode,

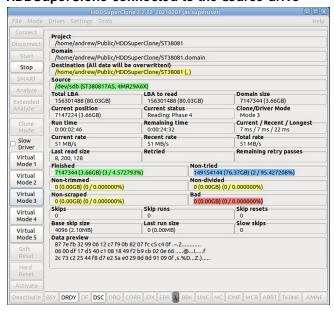
1 Connect the source drive and the target drive if such drive is necessary. If the source drive is small, it's possible to use a disk <u>image</u> file rather than another hard drive.



2 Run HDDSuperClone and create a new project. Next, install the virtual driver before connecting the source and target.

As the source drive is small, the target may be an image file in our case. Select the necessary Virtual Mode and click the Start button.

HDDSuperClone connected to the source drive



You may read more about installing the driver and configuring **HDDSuperClone** in its documentation: HDDSuperClone User Manual.

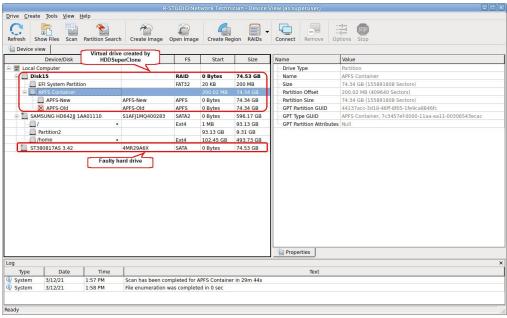
> A virtual drive will appear in the system

Virtual drive created by HDDSuperClone



And in the Main Panel of R-Studio for Linux

Faulty hard drive and its virtual drive created by HDDSuperClone



You may work with this virtual drive as it is a real physical drive.

You may read more about working with HDDSuperClone in our article <u>Joint work of R-Studio and HDDSuperClone</u>.

3.16 Forensic Mode

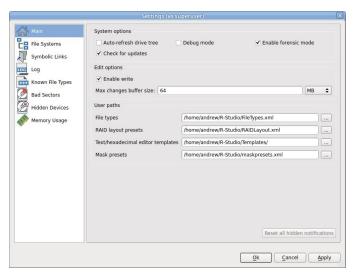
Note: This feature is available for the Technician version of **R-Studio for Linux** only!

When this mode is enabled, **R-Studio for Linux** will generate a <u>forensic</u> 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)

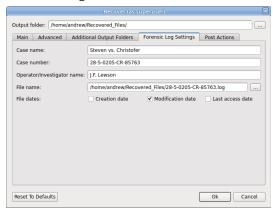
To enable this feature,

* Select Enable Forensic Mode on the Main tab of the <u>Settings</u> dialog box.



The Forensic Log tab will appear on the Recover dialog box.

Forensic Log tab



Enter the required information on this tab and then go to the other tabs of the <u>Recovery</u> 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.

```
* System [132 bytes]: 4 x Intel(R) Core(TM) i3 CPU 530 @ 2.93GHz, 1200 MHz, 3747 MB
RAM
- Drive Number 1 ------
* Drive Type [256 bytes]: Physical Drive, Disk
* Name [62 bytes]: KINGSTON SA400S37120G 03090005
* OS Object [18 bytes]: /dev/sda
* R-Studio Driver [10 bytes]: ahci
* Size [8 bytes]: 111.7GB (234441648 sec)
* Logical Sector Size [4 bytes]: 512B
* Physical Sector Size [4 bytes]: 4KB
# I/O Retries [4 bytes]: Default
+ Drive Control [8 bytes]:
  # Maximum Transfer [4 bytes]: 131072
  # I/O Block Size [4 bytes]: 4096
  # Buffer Alignment [4 bytes]: 4096
+ Physical Drive Geometry [8 bytes]:
  * Cylinders [8 bytes]: 14593
  * Tracks Per Cylinder [4 bytes]: 255
  * Sectors Per Track [4 bytes]: 63
  * Sector Size [4 bytes]: 512B
# Partition Layout Sector Size [4 bytes]: 512B
+ Device Identification [8 bytes]:
  * Vendor [32 bytes]: KINGSTON
  * Product [64 bytes]: SA400S37120G
  * Firmware [16 bytes]: 03090005
  * Serial Number [32 bytes]: 50026B77843A5628
+ IDE Properties [8 bytes]:
  * Size [48 bytes]: 111.7GB (234441648 LBA)
  * Sector Size [8 bytes]: 512
  * Device Type [8 bytes]: SSD
  * Interface [38 bytes]: SATA 3.2, 6.0 Gb/s
  * Interface Speed [18 bytes]: 3.0 Gb/s
  * Standard [12 bytes]: ACS-3
  * Features [70 bytes]: S.M.A.R.T., APM-, LBA48, NCQ, TRIM
* Bus Type [4 bytes]: SerialATA-II
- Drive Number 2 ------
* Drive Type [256 bytes]: Physical Drive, Disk
* Name [50 bytes]: SAMSUNG HD642JJ 1AA01110
* OS Object [18 bytes]: /dev/sdb
* R-Studio Driver [10 bytes]: ahci
* Size [8 bytes]: 596.1GB (1250263728 sec)
* Logical Sector Size [4 bytes]: 512B
* Physical Sector Size [4 bytes]: 512B
# I/O Retries [4 bytes]: Default
+ Drive Control [8 bytes]:
  # Maximum Transfer [4 bytes]: 131072
  # I/O Block Size [4 bytes]: 512
  # Buffer Alignment [4 bytes]: 4096
+ Physical Drive Geometry [8 bytes]:
  * Cylinders [8 bytes]: 77825
```

* Tracks Per Cylinder [4 bytes]: 255

```
* Sectors Per Track [4 bytes]: 63
 * Sector Size [4 bytes]: 512B
# Partition Layout Sector Size [4 bytes]: 512B
+ Device Identification [8 bytes]:
 * Vendor [32 bytes]: SAMSUNG
 * Product [64 bytes]: HD642JJ
 * Firmware [16 bytes]: 1AA01110
 * Serial Number [32 bytes]: S1AFJ1MQ400283
+ IDE Properties [8 bytes]:
 * Size [50 bytes]: 596.1GB (1250263728 LBA)
 * Sector Size [8 bytes]: 512
 * Standard [24 bytes]: ATA/ATAPI-7
 * Features [70 bytes]: S.M.A.R.T., APM-, AAM-, LBA48, NCQ
* Bus Type [4 bytes]: SerialATA-II
- Drive Number 3 -----
* Drive Type [256 bytes]: Physical Drive, Disk
* Name [66 bytes]: Hitachi HTS545016B9SA00 PBBOC64G
* OS Object [18 bytes]: /dev/sdc
* R-Studio Driver [10 bytes]: ahci
* Size [8 bytes]: 149GB (312581808 sec)
* Logical Sector Size [4 bytes]: 512B
* Physical Sector Size [4 bytes]: 512B
# I/O Retries [4 bytes]: Default
+ Drive Control [8 bytes]:
 # Maximum Transfer [4 bytes]: 131072
 # I/O Block Size [4 bytes]: 512
 # Buffer Alignment [4 bytes]: 4096
+ Physical Drive Geometry [8 bytes]:
 * Cylinders [8 bytes]: 19457
 * Tracks Per Cylinder [4 bytes]: 255
 * Sectors Per Track [4 bytes]: 63
 * Sector Size [4 bytes]: 512B
# Partition Layout Sector Size [4 bytes]: 512B
+ Device Identification [8 bytes]:
 * Vendor [32 bytes]: Hitachi
 * Product [64 bytes]: HTS545016B9SA00
 * Firmware [16 bytes]: PBBOC64G
 * Serial Number [32 bytes]: 100713PBPB08ECE4XS0F
+ IDE Properties [8 bytes]:
 * Size [44 bytes]: 149GB (312581808 LBA)
  * Sector Size [8 bytes]: 512
 * Device Type [36 bytes]: HDD 2.5" 5400 RPM
 * Interface [38 bytes]: SATA 2.6, 1.5 Gb/s
 * Standard [18 bytes]: ATA8-ACS
 * Features [66 bytes]: S.M.A.R.T., APM, AAM, LBA48, NCQ
* Bus Type [4 bytes]: SerialATA-II
- Drive Number 4 -----
* Drive Type [256 bytes]: Volume, Disk
* Name [4 bytes]: /
* Mount Points [4 bytes]: /
* OS Object [20 bytes]: /dev/sda2
```

```
* Size [8 bytes]: 103.4GB (216860672 sec)
* Logical Sector Size [4 bytes]: 512B
* Partition Offset [8 bytes]: 1MB (2048 sec)
* Partition Size [8 bytes]: 103.4GB (216860672 sec)
+ Ext2/Ext3/Ext4 Information [8 bytes]:
 # FS Character Set [4 bytes]: Utf8
  * Block Size [4 bytes]: 4KB (8 sec)
  * First SuperBlock Offset [4 bytes]: 1KB (2 sec)
  * Blocks Per Volume [8 bytes]: 27107584
  * INodes Per Volume [4 bytes]: 6782976
  * Creator OS [4 bytes]: Linux
  * Major Version [4 bytes]: 1
  * Minor Version [2 bytes]: 0
  * Last Mount Time [8 bytes]: 5.8.2022 18:54:4
  * Last Write Time [8 bytes]: 5.8.2022 18:54:3
  * Last Check Time [8 bytes]: 12.7.2022 15:43:7
  * Volume Size [8 bytes]: 103.4GB (216860672 sec)
# I/O Retries [4 bytes]: Default
+ Drive Control [8 bytes]:
  # Maximum Transfer [4 bytes]: 131072
  # I/O Block Size [4 bytes]: 512
 # Buffer Alignment [4 bytes]: 4096
+ Physical Drive Geometry [8 bytes]:
  * Cylinders [8 bytes]: 13498
  * Tracks Per Cylinder [4 bytes]: 255
  * Sectors Per Track [4 bytes]: 63
  * Sector Size [4 bytes]: 512B
- Drive Number 5 -----
* Drive Type [256 bytes]: Volume, Disk
* Name [12 bytes]: /home
* Mount Points [12 bytes]: /home
* OS Object [20 bytes]: /dev/sdb1
* Size [8 bytes]: 596.1GB (1250260992 sec)
* Logical Sector Size [4 bytes]: 512B
* Partition Offset [8 bytes]: 1MB (2048 sec)
* Partition Size [8 bytes]: 596.1GB (1250260992 sec)
+ Ext2/Ext3/Ext4 Information [8 bytes]:
 # FS Character Set [4 bytes]: Utf8
  * Block Size [4 bytes]: 4KB (8 sec)
  * First SuperBlock Offset [4 bytes]: 1KB (2 sec)
  * Blocks Per Volume [8 bytes]: 156282624
  * INodes Per Volume [4 bytes]: 39075840
  * Creator OS [4 bytes]: Linux
  * Major Version [4 bytes]: 1
  * Minor Version [2 bytes]: 0
  * Last Mount Time [8 bytes]: 5.8.2022 18:54:14
  * Last Write Time [8 bytes]: 5.8.2022 18:54:14
  * Last Check Time [8 bytes]: 6.2.2022 12:42:58
  * Volume Size [8 bytes]: 596.1GB (1250260992 sec)
# I/O Retries [4 bytes]: Default
+ Drive Control [8 bytes]:
  # Maximum Transfer [4 bytes]: 131072
```

```
# I/O Block Size [4 bytes]: 512
 # Buffer Alignment [4 bytes]: 4096
+ Physical Drive Geometry [8 bytes]:
 * Cylinders [8 bytes]: 77825
 * Tracks Per Cylinder [4 bytes]: 255
 * Sectors Per Track [4 bytes]: 63
 * Sector Size [4 bytes]: 512B
- Drive Number 6 -----
* Drive Type [256 bytes]: Partition, Primary
* Name [22 bytes]: Partition1
* Size [8 bytes]: 8.38GB (17577984 sec)
* Partition Offset [8 bytes]: 103.4GB (216862720 sec)
* Partition Size [8 bytes]: 8.38GB (17577984 sec)
* Partition Type [256 bytes]: Linux (swap) (0x82)
- Drive Number 7 -----
* Drive Type [256 bytes]: Partition, Active
* Name [22 bytes]: Partition2
* Mount Points [4 bytes]: /
* Size [8 bytes]: 103.4GB (216860672 sec)
* Partition Offset [8 bytes]: 1MB (2048 sec)
* Partition Size [8 bytes]: 103.4GB (216860672 sec)
* Partition Type [256 bytes]: Ext2FS/XIAFS (0x83)
+ Ext2/Ext3/Ext4 Information [8 bytes]:
 # FS Character Set [4 bytes]: Utf8
 * Block Size [4 bytes]: 4KB (8 sec)
 * First SuperBlock Offset [4 bytes]: 1KB (2 sec)
 * Blocks Per Volume [8 bytes]: 27107584
 * INodes Per Volume [4 bytes]: 6782976
 * Creator OS [4 bytes]: Linux
 * Major Version [4 bytes]: 1
 * Minor Version [2 bytes]: 0
 * Last Mount Time [8 bytes]: 5.8.2022 18:49:39
 * Last Write Time [8 bytes]: 5.8.2022 18:54:3
 * Last Check Time [8 bytes]: 12.7.2022 15:43:7
 * Volume Size [8 bytes]: 103.4GB (216860672 sec)
- Drive Number 8 -----
* Drive Type [256 bytes]: Partition, Primary
* Name [22 bytes]: Partition1
* Mount Points [12 bytes]: /home
* Size [8 bytes]: 596.1GB (1250260992 sec)
* Partition Offset [8 bytes]: 1MB (2048 sec)
* Partition Size [8 bytes]: 596.1GB (1250260992 sec)
* Partition Type [256 bytes]: Ext2FS/XIAFS (0x83)
+ Ext2/Ext3/Ext4 Information [8 bytes]:
 # FS Character Set [4 bytes]: Utf8
 * Block Size [4 bytes]: 4KB (8 sec)
 * First SuperBlock Offset [4 bytes]: 1KB (2 sec)
 * Blocks Per Volume [8 bytes]: 156282624
 * INodes Per Volume [4 bytes]: 39075840
 * Creator OS [4 bytes]: Linux
```

```
* Major Version [4 bytes]: 1
 * Minor Version [2 bytes]: 0
 * Last Mount Time [8 bytes]: 5.8.2022 18:54:14
 * Last Write Time [8 bytes]: 5.8.2022 18:54:14
  * Last Check Time [8 bytes]: 6.2.2022 12:42:58
 * Volume Size [8 bytes]: 596.1GB (1250260992 sec)
- Drive Number 9 -----
* Drive Type [256 bytes]: Partition, Primary
* Name [22 bytes]: Partition1
* Size [8 bytes]: 52GB (109121536 sec)
* Partition Offset [8 bytes]: 512KB (1024 sec)
* Partition Size [8 bytes]: 52GB (109121536 sec)
* Partition Type [256 bytes]: NTFS/HPFS/exFAT (0x7)
+ NTFS Information [8 bytes]:
 * Cluster Size [4 bytes]: 2KB (4 sec)
 * MFT Record Size [4 bytes]: 1KB
 * MFT Position [8 bytes]: 12KB (24 sec)
 * MFT Mirror Position [8 bytes]: 302KB (604 sec)
  * Index Block Size [4 bytes]: 4KB
 * Sector Size [4 bytes]: 512B
 * Volume Size [8 bytes]: 52GB (109121535 sec)
- Drive Number 10 -----
* Drive Type [256 bytes]: Partition, Primary
* Name [22 bytes]: Partition2
* Size [8 bytes]: 36.7GB (77139794 sec)
* Partition Offset [8 bytes]: 52GB (109126110 sec)
* Partition Size [8 bytes]: 36.7GB (77139794 sec)
* Partition Type [256 bytes]: FAT32 (0xb)
+ FAT Information [8 bytes]:
 * FAT Bits (12,16,32) [4 bytes]: 32
 * Cluster Size [4 bytes]: 4KB (8 sec)
 * First Cluster Offset [8 bytes]: 73.4MB (150392 sec)
 * Root Directory Cluster [4 bytes]: 2
 * First FAT Offset [8 bytes]: 19KB (38 sec)
 * Size of One FAT Table [8 bytes]: 36.7MB (75185 sec)
 * Number of FAT Copies [4 bytes]: 2
 # Active FAT copy [4 bytes]: Auto
 * Sector Size [4 bytes]: 512B
 * Major Version [1 bytes]: 0
  * Minor Version [1 bytes]: 0
 * Volume Size [8 bytes]: 36.7GB (77139794 sec)
- Drive Number 11 -----
* Drive Type [256 bytes]: Partition, Primary
* Name [22 bytes]: Partition3
* Size [8 bytes]: 2GB (4210688 sec)
* Partition Offset [8 bytes]: 88.8GB (186265904 sec)
* Partition Size [8 bytes]: 2GB (4210688 sec)
* Partition Type [256 bytes]: FAT16 (big) (0x6)
+ FAT Information [8 bytes]:
 * FAT Bits (12,16,32) [4 bytes]: 16
```

```
* Cluster Size [4 bytes]: 32KB (64 sec)
 * First Cluster Offset [8 bytes]: 209KB (418 sec)
 * Root Directory Offset [8 bytes]: 263168
 * Root Directory Length [4 bytes]: 16KB
 * First FAT Offset [8 bytes]: 1KB (2 sec)
 * Size of One FAT Table [8 bytes]: 128KB (256 sec)
 * Number of FAT Copies [4 bytes]: 2
 # Active FAT copy [4 bytes]: Auto
 * Sector Size [4 bytes]: 512B
 * Major Version [1 bytes]: 0
  * Minor Version [1 bytes]: 0
 * Volume Size [8 bytes]: 1.99GB (4193698 sec)
- Drive Number 12 -----
* Drive Type [256 bytes]: Partition, Logical
* Name [22 bytes]: Partition4
* Size [8 bytes]: 11.7GB (24576000 sec)
* Partition Offset [8 bytes]: 90.8GB (190480384 sec)
* Partition Size [8 bytes]: 11.7GB (24576000 sec)
* Partition Type [256 bytes]: NTFS/HPFS/exFAT (0x7)
+ FAT Information [8 bytes]:
 * FAT Bits (12,16,32) [4 bytes]: 32
 * Cluster Size [4 bytes]: 8KB (16 sec)
 * First Cluster Offset [8 bytes]: 11.9MB (24544 sec)
 * Root Directory Cluster [4 bytes]: 2
 * First FAT Offset [8 bytes]: 299KB (598 sec)
 * Size of One FAT Table [8 bytes]: 5.85MB (11989 sec)
 * Number of FAT Copies [4 bytes]: 2
 # Active FAT copy [4 bytes]: Auto
 * Sector Size [4 bytes]: 512B
 * Major Version [1 bytes]: 0
 * Minor Version [1 bytes]: 0
 * Volume Size [8 bytes]: 11.7GB (24576000 sec)
- Drive Number 13 -----
* Drive Type [256 bytes]: Partition, Logical
* Name [22 bytes]: Partition5
* Size [8 bytes]: 21.4GB (45056000 sec)
* Partition Offset [8 bytes]: 102.5GB (215058432 sec)
* Partition Size [8 bytes]: 21.4GB (45056000 sec)
* Partition Type [256 bytes]: Mac OS X HFS+ (0xaf)
+ HFS/HFS+ Information [8 bytes]:
 * HFS Type [64 bytes]: HFS+, Case-sensitive, Journaled
 * Block Size [4 bytes]: 4KB (8 sec)
 * HFS Version [4 bytes]: 5
 * Create Time [8 bytes]: 4.3.2022 21:7:1
 * Last Write Time [8 bytes]: 2.5.2022 12:58:2
  * Last Check Time [8 bytes]: 4.3.2022 18:7:1
 * Volume Size [8 bytes]: 21.4GB (45056000 sec)
- Drive Number 14 -----
* Drive Type [256 bytes]: Partition, Logical
* Name [22 bytes]: Partition6
```

```
* Size [8 bytes]: 25GB (52461568 sec)
* Partition Offset [8 bytes]: 124GB (260116480 sec)
* Partition Size [8 bytes]: 25GB (52461568 sec)
* Partition Type [256 bytes]: Ext2FS/XIAFS (0x83)
+ Ext2/Ext3/Ext4 Information [8 bytes]:
 # FS Character Set [4 bytes]: Utf8
 * Block Size [4 bytes]: 4KB (8 sec)
 * First SuperBlock Offset [4 bytes]: 1KB (2 sec)
 * Blocks Per Volume [8 bytes]: 6557696
 * INodes Per Volume [4 bytes]: 1640160
 * Creator OS [4 bytes]: Linux
 * Major Version [4 bytes]: 1
 * Minor Version [2 bytes]: 0
 * Last Mount Time [8 bytes]: 3.5.2022 16:40:24
 * Last Write Time [8 bytes]: 3.5.2022 16:41:17
 * Last Check Time [8 bytes]: 4.3.2022 18:10:17
 * Volume Name [16 bytes]: EXTFS
 * Volume Size [8 bytes]: 25GB (52461568 sec)
- Drive Number 15 -----
* Drive Type [256 bytes]: Empty Space
* Name [28 bytes]: Empty Space15
* Size [8 bytes]: 1.82MB (3729 sec)
* Partition Offset [8 bytes]: 90.8GB (190476592 sec)
* Partition Size [8 bytes]: 1.82MB (3729 sec)
----- Session 1
START Date / Time of Collection: 2022-08-05 15:04:59
Case Name: Steven vs. Christofer
Case Number: 28-5-0205-CR-85763
Operator / Investigator Name: J.F. Lewson
Source drive:Sector
                    Modification Date
     SHA-1
                                            SHA-256
                           File Name
 9
                      2011-04-05 15:42:13
                                            Root/Docs
                      2011-03-01 09:41:14
                                            1b81a7a90fd69e59098737fef990733c
     1c9c6f7f4ba9818a06fb84f19e331c1f20af9f02
710ae48e42cabf8379b55823db8a55737bbd64922c9bfa084bdafb74dd9d83c5
Root/Docs/MyDoc1.odt
   DATA: DATA (Non-Resident)
        2268-2315
                      2011-02-28 15:31:02
                                            1b81a7a90fd69e59098737fef990733c
     1c9c6f7f4ba9818a06fb84f19e331c1f20af9f02
710ae48e42cabf8379b55823db8a55737bbd64922c9bfa084bdafb74dd9d83c5
Root/Docs/MyDoc2.odt
   DATA: DATA (Non-Resident)
        2316-2363
```

```
9
                        2011-02-28 15:31:10
                                                10bb34bb18ca4d30d577bbd7833f6f28
      621b7baacb7ed059e7aec486ba0bcc18e0b2a894
d5f57625ea06ebad876318b42d5a6a9f35dd2974c0639076210a3b377a9d69bc
Root/Docs/MyDoc3.odt
    DATA: DATA (Non-Resident)
         2020080-2383343
                        2022-03-04 13:25:38
                                                Root/Documents
    $130: INDEX ALLOC (Non-Resident)
         2992312-2992319
                        2022-03-04 13:25:38
                                                Root/Documents/OpenOffice-files
    $130: INDEX_ALLOC (Non-Resident)
         2972848-2972855
                        2022-03-04 13:25:37
                                                Root/Documents/OpenOffice-
files/Calc-files
    $130: INDEX_ALLOC (Non-Resident)
         2438980-2438987
                        2022-03-04 13:25:37
                                                Root/Documents/OpenOffice-
files/Calc-files/ods-files
    $130: INDEX ALLOC (Non-Resident)
         2955404-2955411
                        2020-04-06 19:21:52
                                                bleb4cc9101bcb86c0042231f898f0ae
      8e5da7978ebe26604b5f556ec2d20a4ce1176ff1
4d226d7f3c0e1c874f0aaf772f9a5cf9bed2c7d982906a4a0314c206cbc4bb35
Root/Documents/OpenOffice-files/Calc-files/ods-files/.DS Store
   DATA: DATA (Non-Resident)
         2955388-2955403
                        2020-04-06 19:18:30
                                                eab006354c7cf4e1fd3772afd0643672
     bfc7b3368a46a640c3145646b0dfad10bb89f096
4709af13b6dbaf11feab0750bc2a3734eab9a94e184bd7f736805adcb02ac368
Root/Documents/OpenOffice-files/Calc-files/ods-files/file_example_ods_10.ods
   DATA: DATA (Non-Resident)
         2972768-2972795
                        2020-04-06 19:20:50
                                                94790aeb545e806ea9cf161f6ae2697f
      152a13f940c2dfa4530b1b022897cb3dbd0cb45b
edb79e7965f6b61722f1c6427200e4ba44692e573b2f2f8cd210f356aed7f3c9
Root/Documents/OpenOffice-files/Calc-files/ods-files/file example ods 1000.ods
   DATA: DATA (Non-Resident)
         2945868-2945967
  9
                        2020-04-06 19:19:47
                                                000389561d71032e79411613d73f01f5
      3e9fdd1b26eed17f40e98a0f8d13af11decdf951
b668e04c130d51d023531482c8067b5232284decdf54760c6ae431e3718388c3
Root/Documents/OpenOffice-files/Calc-files/ods-files/file_example_ods_50.ods
    DATA: DATA (Non-Resident)
         2972796-2972823
                        2020-04-06 19:21:44
                                                28aa35b07f4a28f4f001e28f277dd1be
      f9dfcafc3e9b6c1c15a949ab9150b8e7d599f1d6
069ad480df6dba6de101188dc126f688127206932d98f02149eb390b6e8f2928
Root/Documents/OpenOffice-files/Calc-files/ods-files/file_example_ods_5000.ods
    DATA: DATA (Non-Resident)
         3047196-3047567
                        2022-03-04 13:25:38
                                                Root/Documents/OpenOffice-
files/Calc-files/oxlsx-files
    $130: INDEX_ALLOC (Non-Resident)
```

```
2972840-2972847
                        2020-04-06 19:31:06
                                                c763a032a1999d42934abebc25fc6a83
      07c1d02aa03ae7768dfb88445bff68e9c32c2264
208fef9240237b668cbb927255a8f204e6ab808a68701ffe72bf3ca85e4d13e1
Root/Documents/OpenOffice-files/Calc-files/oxlsx-files/.DS Store
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  9
                                                53bd8bd63f73df2e647b20ac336b5184
      3847624df92163b5857177e06fccfc01f09655c6
4b5af7cae10bd584f7ffcfd7c6a690a8df6f12bf4a5d54e83fdcec6d44d6ae8d
Root/Video/Mov/FILE0031.MOV
    DATA: DATA (Non-Resident)
         13127944-15791631
  9
                        2015-10-11 10:48:14
                                                4d0737f26d565e7ade41c1eeff0e7cae
      9a11b89381fc546c638eb8cbdfb1a1f4b892348e
0afc907c0ae3aa8f6ee9a35ec2f863650872a30f9dcc3cb72391f856b7124370
Root/Video/Mov/FILE0032.MOV
   DATA: DATA (Non-Resident)
         15791632-18455539
                        2022-03-04 13:28:17
                                                Root/Video/MP4
    $130: INDEX ALLOC (Non-Resident)
         2843112-2843119
  9
                        2010-11-30 13:58:19
                                                3e3661d0dc6f16a5d416791614623e9e
      3d41e5063b1c5b1a4f659c669a2016873578c3c2
553fcee0ff4df6eefc45024c334ff2ddda887031c2d2ce75d64f8a0cc28365f1 Root/Video/MP4/mp4
Haiti_can_succeed,_but_not_without_your_help_(Former_US_president_Bill_Clinton).mp4
    DATA: DATA (Non-Resident)
         18455540-18631839
                        2015-09-18 20:52:23
                                                f9d18db99b4d4f3d5d8f7ecda07a283a
      3f30923a876e075e0c5735d095fafc71798a5a8f
d055ab546e6c24517aeaadc8217b3a56443baf902230c7a41235f6402770e4c0
Root/Video/MP4/VID 20150918 215223.mp4
   DATA: DATA (Non-Resident)
         18631840-18836859
  9
                        2015-09-18 21:00:20
                                                b970ad6b6fc339a639a747d43279fc24
      226dd51746a2765ebfeb7e58a61d5f43ee8cfcf3
0e2d63dc86db96e93cb84e61724699bce08aa1f68ca17216e98355800ead5038
Root/Video/MP4/VID 20150918 220020.mp4
   DATA: DATA (Non-Resident)
         18836860-19173295
                        2015-09-20 11:31:20
                                                050863ea63873886856c1850f89b2872
      15e1a4f4ed00ae657cc4892959e2d161d011b84f
64e86ce37f11c639c102721be53d58f6f42302056fc183a701c7cbd6696a0f38
Root/Video/MP4/VID_20150920_123120.mp4
   DATA: DATA (Non-Resident)
         19173296-19426331
  9
                        2022-03-04 13:28:20
                                                Root/Video/MPEG
                        2016-08-06 14:50:22
                                                8661e7edc04aa49accced6da2520decc
      0b7c023cd7f19445e78f11a5d3d4c2058196e307
63a8045b7ee6345adec7079e0e18fe89656e0cb188eb34712614e9b539f89740
Root/Video/MPEG/Mpeg_Video.mpeg
   DATA: DATA (Non-Resident)
         19426332-19510263
```

```
9
                        2022-03-04 13:28:24
                                                Root/Video/MTS
                                                28264a21f4babe4c26fd9422ecce8066
                        2015-08-05 06:44:42
      ddd8c7b7717e0c0374d50af851a499b9ec11e428
fdaf9826c0bb27005d60b611857f6ac4d81191cfcdd63519343f7d4192208491
Root/Video/MTS/00026.MTS
   DATA: DATA (Non-Resident)
         19510264-19700727
                        2013-03-20 10:16:48
                                                c8813d64f8e33e4e41c773d188ce6f62
      cd6dae3c9a31db7f02d18bfa8fa493d85b64e64b
1cfbb5d3d93c7725f06a388d93490e112427c640db705dfe90036c98c6db4820
Root/Video/MTS/00140.MTS
   DATA: DATA (Non-Resident)
         19700728-19714359
  9
                        2013-03-20 10:16:20
                                                40566a6585ba0440175eed119a32a32a
      95776ef4d52ea51062c472ce744de1ef075bdf2f
34cf55b950cbce275ddc1ecad2e9fc0821e4b664d23eeb3270059b3e6e8d0c4e
Root/Video/MTS/00168.MTS
   DATA: DATA (Non-Resident)
         19714360-19730487
                        2013-03-20 10:15:22
                                                90b17b9d8b04d14b2a72aa1a7ea2c6c8
      19ddc6147e3f8d9c628c83cf33525cc859423c00
fbf55ea6c3b86c666c79caaf5c1386eebede4f02b8b70c7c91610effaf874ddc
Root/Video/MTS/00346.MTS
   DATA: DATA (Non-Resident)
         19730488-19746999
                        2011-02-25 05:07:46
                                                6299534199985cc1c9071f8adcd06685
      33a21bbb8c7ec7d6956dc8eddb0e3944633654af
0e6cc6acb1230bccde6269b6b26ebc47d98226cb34f5bbd331c3352cc1116ae5
Root/Video/MyMovie1.mp4
   DATA: DATA (Non-Resident)
         2383344-2425971
                        2011-02-25 05:07:47
                                                7185b8d6a921ac1d1cdf6c0d7881868f
      8a34c5478b7b8bb58d4fd16999f99bf1ba3d8c63
63342879fc8df632732efca8084f8eed3bbd37fb7fa44068b4175f897b9a0c3d
Root/Video/MyMovie2.mp4
   DATA: DATA (Non-Resident)
         902396-943679
                        2011-02-25 05:07:48
                                                19542a1073bad1b58a0f94ee9fde0772
      2a1383ea3c41d1388deba4e10473c75eb62162bb
c53641c7fc100233bdf929963766abae7807822ce63eb57a925649955e5aa18c
Root/Video/MyMovie3.mp4
   DATA: DATA (Non-Resident)
         2843520-2885903
                        2011-02-25 05:07:49
                                                8d336514bb974726b20d8d358db1dba1
      1fbc1cf51a1a6f4b7b8162267d69bd9be77077e0
48a660f1359f763a77502688c59691fed8aee2b08d59c3bed5af9d45fdea4720
Root/Video/MyMovie4.mp4
   DATA: DATA (Non-Resident)
         1870024-1913723
  9
                        2016-06-05 12:36:07
                                                d6b0ce497e569371b94e19fea48355cd
      37fbacb48c80859f47024f2382d9880be633477b
b08522bb8e9d63c86c290a8c7032f3097fc78db704ea1d54eaaa75934c29de46
Root/Video/The.Lincoln.Lawyer.2011.1080p.BluRay.x264.DTS-FGT.mkv
```

IV Text/hexadecimal Editor

Any object visible to **R-Studio for Linux** can be viewed and edited in the **Text/Rexadecimal 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.

Note: Data alteration is available on the **Technician/T80+** and **Corporate** versions only.

You may turn <u>numerical indexes</u> for objects to distinguish them better.

- Viewing and Editing Objects
- Navigating through an Object
- Data Copy
- Files and Sectors
- Creating Custom Patterns
- Pattern Example I
- Pattern Example II

R-Studio for Linux Features

Contact Information and Technical Support

Data Recovery Using R-Studio for Linux

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

4.1 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.

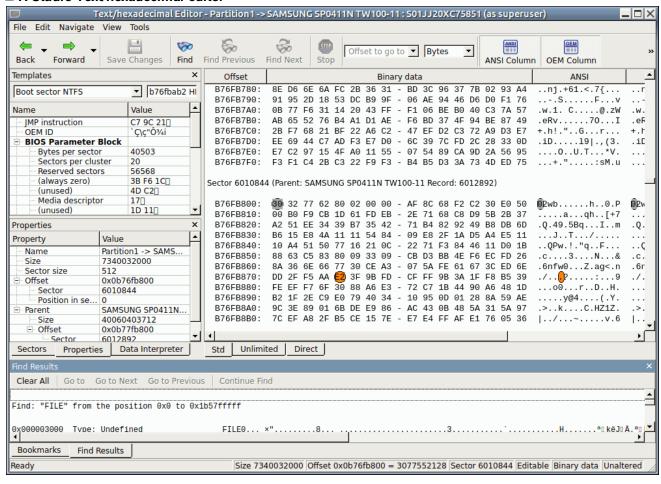
To enable writing,

- 1 On the R-Studio for Linux main panel, select the Tools menu, then Settings, and select Enable Write on the <u>Settings</u> dialog box.
- > The Editable: status will change to Yes from Read Only. Now the object can be edited.

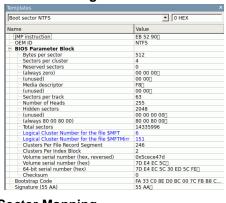
To view/edit an object,

1 Right-click the object and select View/Edit on the context menu, or Select the object and select View/Edit on the File menu

■ R-Studio Text/hexadecimal editor



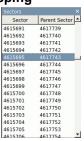
Data Parsed According to the Selected Pattern



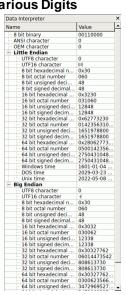
Object Properties



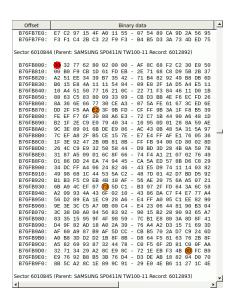
Object Sector Mapping



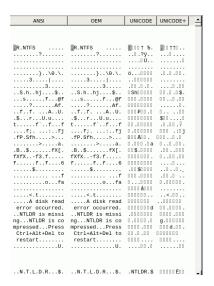
Data Shown as Various Digits



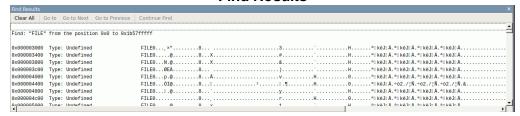
Binary view



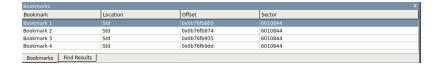
Text view



Find Results



List of Bookmarks



Text/Rexadecimal Editor status

Ready | Size 7340032000 | Offset 0x0b76fb800 = 3077552128 | Sector 6010844 | Editable | Binary data | Unaltered



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.

■ To enable/disable:

ANSI data	Select/clear ANSI on the View menu
OEM data	Select/clear OEMr on the View menu
UNICODE data	Select/clear UNICODE on the View menu
UNICODE+ data	Select/clear UNICODE+ on the View menu
Toolbar	Select/clear Toolbar on the View menu
Properties View	Select/clear Properties View on the View menu
Sectors View	Select/clear Sectors View on the View menu
Data Interpreter View	Select/clear Data Interpreter View on the View menu
Template View	Select/clear Template View on the View menu
Bookmarks View	Select/clear Bookmarks View on the View menu
Find Results View	Select/clear Find Results View on the View menu

2 View the information and make necessary changes

Select **Save Changes** on the **Tools** menu if you want to save changes.

■ Other ways to save changes

• Select Save Changes on the File menu

or

• Press the **Ctrl+S** keys

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.

Std	Exact attribute data. If the attribute is compressed, R-Studio for Linux decompresses it prior
	to showing.
Unlimited	Exact attribute data + <u>free space</u> of last cluster. If the attribute is compressed, R-Studio for
	Linux decompresses it prior to showing.
Direct	Actual data written on the disk. If the attribute is not compressed, it coincides with the Std
	representation.
Allocation	Resident part of the attribute.

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 representations.

You may find the next or previous data that matches the pattern signature on the disk. Right-click the right pane of the editor and select either Find Template Signature Next or Find Template Signature Previous on the context menu. You may also select these items on the Edit menu.

You may also <u>create</u> your own patterns to parse data from various objects.

Navigating.

Text/Bexadecimal Editor gives you various ways to navigate into an object. See the **Navigating through** an **Object** for more details

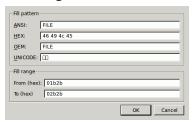
Data Copy

Text/Bexadecimal 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

a i iii opaons	
Fill pattern	
HEX	Field for the pattern to fill the area in the hexadecimal representation
ANSI	Field for the pattern to fill the area in the ANSI encoding
OEM	Field for the pattern to fill the area in the OEM encoding
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
 - **■** Other ways to save the changes made
 - \bullet $\,$ Select Save Changes on the Edit menu $\,$

or

- Press the **F2** key
- > 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,

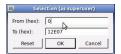
- 1 Right-click the beginning of the selection and select Select From on the context menu
- 2 Right-click the end of the selection and select Select To on the context menu
 - Other ways to select an area
 - Select **Select...** on the **Tools** menu and specify an area to select on the Select dialog 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 or click the Ctrl+A key

Select dialog box



3 Select an appropriate item in the Tools menu to save the data in a required format and specify its file name

Select:

Save to Binary File	to save the data in the binary format (default extension is .bin)
Save to Hexadecimal File	to save the data in the binary format (default extension is .hex)

on the **Tools** menu.

If you select an existing file, **R-Studio for Linux** 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 <u>Data Recovery over Network</u>, 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.

4.2 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.

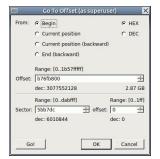
Type an offset to which you want to go. You may select between bytes and sectors. See the **Data**Formats and Multipliers topic for more details on data formats.

If a file is opened in **Text/Rexadecimal 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 dialog box



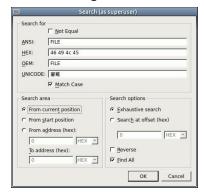
■ Go To Offset options

From:	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.
HEX/?DEC	Switch between the hexadecimal and decimal data representation.
Range	Range of values that can be entered.
dec/?hex:	Alternative data representation.
Offset:	Flat data offset (without separation between the sector and offset in the sector).
Sector/?offset	Data offset represented as a sector and offset in the sector.
Go!/OK buttons	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.

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

Not Equal	Search for the place which content is not equal to the string. For example, the first byte not equal to 00 or FF.
Search for	
HEX	Field for the string to search for in the hexadecimal representation
ANSI	Field for the string to search for in the ANSI encoding
OEM	Field for the string to search for in the OEM encoding
UNICODE	Field for the string to search for in the UNICODE encoding
Match case	Select this check box to make the search case-sensitive
Search area	
From current position	Select this check box to start search from the current position
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/Bexadecimal 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	FILEAAAAA
Sector2	FILEBBBBB
Sector3	NOTAFILE

And the search string is Not Equal FILE.

If the Exhaustive search option is selected, the **Text/Bexadecimal Editor** will stop at the first A character in Sector1.

If the Search at offset=0 option is selected, the **Text/Bexadecimal Editor** will stop at the \mathbb{N} character in Sector3.

Bookmarking

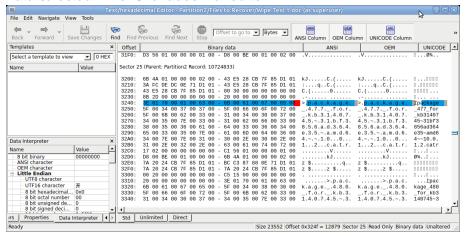
You may create bookmarks to easily move to those places. Right-click the cursor on the place you want to bookmark and select **Toggle Bookmark** on the context menu. The list of bookmarks appears in the Bookmark pane. You may easily move to the required bookmark by clicking it in the list.

You may control bookmarks on the Edit menu.

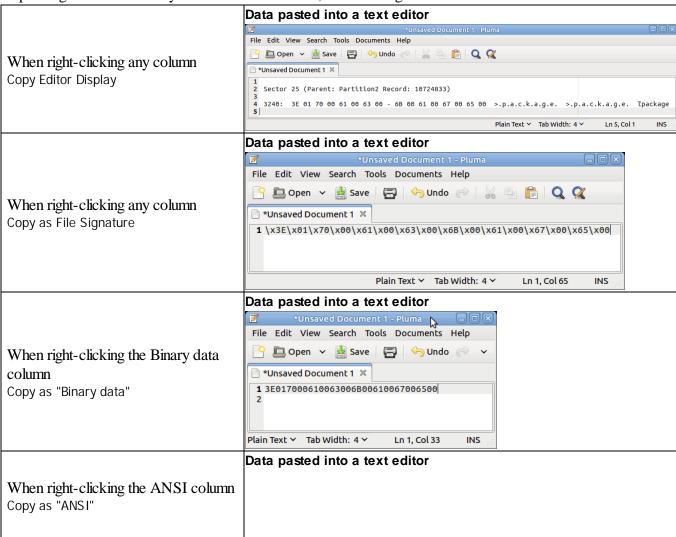
4.3 Data Copy

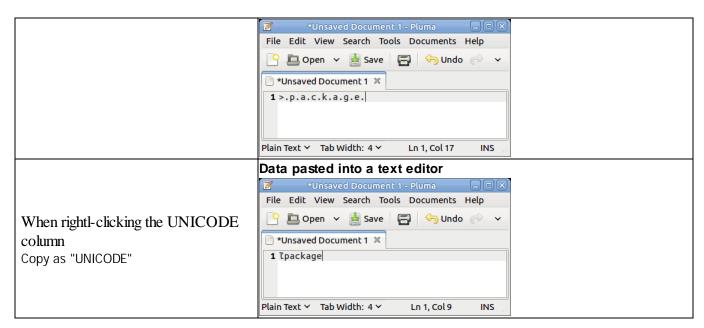
Text/Bexadecimal Editor gives you various ways to copy selected data in an object.

Data selected in Text/Rexadecimal editor



Depending on what column you have control-clicked, the following commands are available in the context menu:



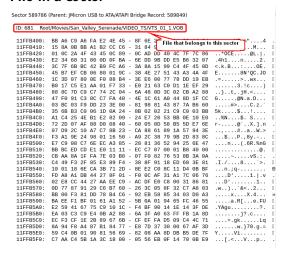


4.4 Files and Sectors

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 context menu.
- > R-Studio for Linux will show a file that belongs to a particular section.

File in a sector



4.5 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 <u>Settings</u> dialog box.

Pattern structure

Pattern header

Each pattern starts with a standard header

```
<?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:

name	Specifies the pattern name shown in the parsed data pane	
TIGHT	speemes the pattern name shown in the purset data pane	

Example:

```
<template name="AVI File LIST">
    .....
</template>
```

Section signature

Attributes:

```
align <positive integer>

Specifies if the data structure address is aligned (i.g., by a sector: 512)
```

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:

```
<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:

```
<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.
system)	
base: (decimal	Optional. Specifies data representation. Default: decimal.
hex octal)	
as-offset:	Optional. Specifies that this field is an offset and its value should be evaluated using
<expression></expression>	the expression. A special variable this returns the value of this field.
<pre>purpose: (offset rsector sector cluster rcluster)</pre>	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: <templatename> var: <name></name></templatename>	Specifies the pattern name linked with this field. Ignored if the as-offset or purpose attributes are not specified. Optional. Specifies the name under which the value of this field can be accessed in expressions.

• binary

Attributes:

display-encoding:	Optional. Default: hex.
(hex binary)	
size: <bytes></bytes>	Mandatory.

• char

Attributes:

size: <bytes></bytes>	Mandatory.
codepage: (ansi	Optional. Specifies which codepage is used. Default: ansi.
oem utf8 utf16)	

• 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:

size: <bytes></bytes>	Mandatory.
pos: <comma separated list of</comma 	Mandatory. Specifies bit positions in a data block.
bit positions>	

Commands

• goto

Specifies a jump to a specified offset (either absolute or relative one)

Attributes:

address:	Specifies an absolute address to jump to.
<expression></expression>	
offset: <expression></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></expression>	Sets a condition to test against.
CCC CIIFICONICII	200 th College to Cost the Charlest

• repeat

Reads the fields specified in the tag until the exit condition is equal to 0 or specified times

Attributes:

count: <expression></expression>	<pre><expression> is evaluated one time upon entering the block. Internal</expression></pre>
	elements are read the specified number of times.
test: <expression></expression>	<pre><expression> is evaluated upon entering the block. Similar to the C++</expression></pre>
	construction while() {}.
test: <expression></expression>	<pre><expression> is evaluated upon exiting the block. Similar to the C++</expression></pre>
	<pre>construction do {} while().</pre>

• 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></string>	Specifies the name of the variable.
expr: <expression></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

4.6 Pattern Example I

Below is an example of a commented pattern parsing an AVI file.

<!-- 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. -->

<!-- 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. -->
            <qoto 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"</pre>
var="signature"/>
            <!-- A test against the condition (signature == LIST) -->
            <if test="signature == 1414744396"> <!-- ANSI:LIST -->
              <!-- The section is shown. Its name is LIST -->
              <section name="LIST">
                <!-- The current position is moved backward by 4 bytes. -->
                 <goto offset="-4"/>
                 <!-- 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.-->
```

as-offset="start position

in hex format"

template="AVI File LIST"/>

its value. -->

<field type="uint32" base="hex" name="Signature LIST as unsigned</pre>

<!-- The next 4 bytes are read and shown as an unsigned integer. The listSize variable gets

+ offset

```
<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. -->
                <qoto 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"/>
             </section>
            </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. -->
                <section name="First AVIINDEXENTRY">
                  <!-- The 4 bytes are read and shown as an ANSI string. -->
                  <field type="char" size="4" name="Chunck id"/>
                  <!-- The next 4 bytes are read and shown as an unsigned hexadecimal integer. -->
                  <field type="uint32" base="hex" name="Flags"/>
                   <!-- The next 4 bytes are read ans 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="Chunk offset" as-
offset="chunksOffset + this"/>
                  <!-- The next 4 bytes are read and shown as an unsigned integer. -->
                  <field type="uint32" name="Chunk size"/>
                </section>
                <!-- The current position is moved by idxSiz bytes forward. -->
                <goto offset="idxSize"/>
             </section>
           </if>
           <!-- A test against the condition. & amp; & amp; is a logical AND (&&) -->
                 <if test="signature != 1414744396 &amp;&amp; signature != 1263424842</pre>
&& 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>
         </repeat>
       </section>
    </if>
  </section>
</template>
4.7
        Pattern Example II
<?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). -->
    <qoto 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"/>
      <field type="char" size="4" name="List type"/>
      <goto offset="-4"/>
         <field type="uint32" base="hex" name="List type as unsigned integer in hex
format" var="listType"/>
      <!-- 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>
      <setvar var="mediaType" expr="0"/>
       <repeat test="endOfList > offset - 8">
        <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</pre>
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; 0xFFFFFFFE"/>
            <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"/>
            <goto offset="-4"/>
               <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-->
            <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-</pre>
meter, of the target device for the bitmap"/>
                  <field type="int32" name="Vertical resolution, in pixels-per-meter,</pre>
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</pre>
(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>
          </if>
          <goto address="endOfChunk"/>
        </section>
      </repeat>
    </if>
    <if test="signature != 1414744396">
      <section name="Invalid LIST signature found">
      </section>
    </if>
  </section>
</template>
```

V 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
- Supported Virtual Disk and Disk Image Formats
- Bad Sectors
- File Information (R-Studio Technician/T80+)
- Memory Usage
- Forensic Mode
- R-Studio for Linux Switches
- Properties Tab

R-Studio for Linux Features

Contact Information and Technical Support

Data Recovery Using R-Studio for Linux

Basic File Recovery

Advanced Data Recovery

Mass File Recovery

Volume Sets and RAIDs

Data Recovery over Network

Text/Rexadecimal editor

R-Studio Emergency

R-Studio Agent Emergency

5.1 IntelligentScan Technology

R-Studio for Linux uses a unique *IntelligentScan* technology when it tries to recover data on the area being scanned.

While scanning the selected area, **R-Studio for Linux** 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
- <u>UFS/FFS</u> 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 for Linux** 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 for Linux 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 for Linux** analyzes relations between elements in each list and between different lists, and generates a list of found <u>partitions</u> 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 for Linux** 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 for Linux** 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 for Linux** can recover files not only on new and existing partitions. It also can find and recover data on partitions that have been deleted or <u>reformatted</u>. If, for example, there was an NTFS partition, which later was reformatted as a <u>FAT</u> partition, **R-Studio for Linux** 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 for Linux** 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 for Linux** 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.

5.2 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 for Linux 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 for Linux** 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 for Linux** 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 startup and shutdown 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 <u>partitions</u> 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 <u>FAT</u> 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 <u>logical disk</u>, 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 for Linux** finds several FAT folder records that contain the same data. Such folders are called *cross-linked*. **R-Studio for Linux** marks such folders with an arrow mark: \Box **Trashes**

R-Studio for Linux attributes the content of cross-linked folders to one folder called a *target folder*. When recovering, **R-Studio for Linux** places the content to the target folder.

To view the list of cross-linked folders,

- 1 Right-click a cross-linked folder and select Cross Linked Folders on the context 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,

* Right-click a cross-linked folder and select Go Target on the context 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,

* Right-click a cross-linked folder and select Set As Default Target on the context 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 for Linux** 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 for Linux** correctly recognizes localized names. **R-Studio for Linux** 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 for Linux marks such folders with a question mark. \square Marks Such folders with a question mark.

To re-scan an object,

* Right-click a questionable folder on the R-Studio for Linux's Folders panel and select Rescan on the context menu, or

Select the questionable folder and select **Rescan** on the **File** menu.

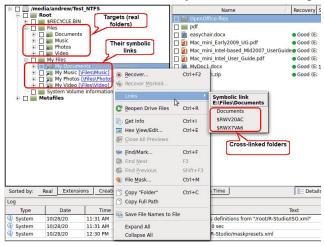
NTFS, APFS, HFS, XFS, and ext fs file systems:

Symbolic links (symlinks)

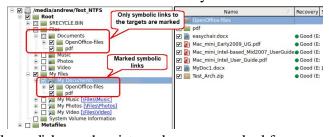
Symbolic links (of symlinks for short) are object that contains references to other files or folders directory in the form of absolute or relative paths and that affect pathname resolution. For example, if a symlink C: \ProgramData\Documents points to D:\Recovered Files\Root\Users\Public\Documents, entering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

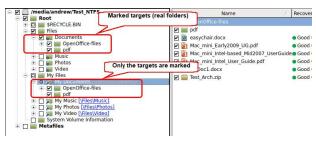
R-Studio for Linux shows such symlinks and their targets in the following way:



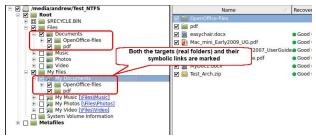
Symlinks can be marked for recovery



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 for Linux Settings topic gives more details about symlink recovery.

Files:

Hard links

<u>Hard links</u> are file system entries that give file names to files. This term is usually used when files may have several names. **R-Studio for Linux** shows hard links using the following icons:

A hard link: 🗆 💦 IMG_3579.JPG

The target file: \(\Bigcap \) IMG_3579.JPG

You may find a target or hard link for a file. Right-click the file and select Links on the context menu.

5.3 Extended Information Recovery

R-Studio for Linux supports recovery of compressed files, <u>alternative data streams</u>, encrypted files, file security and extended file attributes. If the **R-Studio for Linux** 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.

Extended Information	Required host OS	Required target disk FS
Encrypted files	Windows 2000/XP/2003/Yista/?	NTFS
	2008/7/8/8.1/10	
Alternative data streams	Windows NT/2000/XP/2003/?	NTFS
	Vista/2008/7/8/8.1/10	
File security	Windows NT/2000/XP/2003/?	NTFS
	Vista/2008/7/8/8.1/10	

Extended file attributes	Windows NT/2000/XP/2003/?	NTFS or FAT/exFAT
	Vista/2008/7/8/8.1/10	

5.4 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 for Linux** assumes the numbers are in bytes.

Decimal numbers are entered as they are: 2372354

Hexadecimal numbers are entered as 0x23Fa67 or 23Fa67 hex.

The following case-insensitive notation is possible:

b	1 byte
kb	$1 \text{ kb} = 2^10 = 1024 \text{ bytes}$
mb	$1 \text{ mb} = 2^20 = 104857 \text{ bytes}$
gb	$1 \text{ gb} = 2^30 = 1073741824 \text{ bytes}$
tb	1 tb = $2^40 = 1099511627776$ bytes
eb	1 eb = 2^50=1125899906842624 bytes
hex	A hexadecimal number
sec	A number is in sectors
(sector)	

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/Rexadecimal 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 context 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

5.5 Data Recovery on HFS/HFS+ File System

When deleting a file, Mac OS X 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 <u>Known Files Types</u>.

Note: All above is correct for intentionally deleted files. In case of a corrupted file system, HFS/HFS+ can be recovered quite successfully.

When recovering files with HFS+-specific attributes (resource fork, finder info, etc.), **R-Studio for Linux** saves them in the so-called <u>AppleDouble</u> format. When they are copied to an HFS+ disk under Mac OS X, those attributes will be automatically restored.

5.6 Supported Virtual Disk and Disk Image Formats

Along with file formats used for purely disk backup and <u>imaging</u> purposes, there are file formats for virtual disks. Virtual disks are software components that emulates data storage devices in virtual machines. A the same time, virtual disks can be used for disk backup and imaging, too. That is why it's expedient for disk backup and imaging software to support various file formats for virtual disks. This is especially important for system interoperability, when it's necessary to use disk backup/image files on other machines where the disk backup and imaging software isn't installed.

Currently **R-Studio for Linux** supports the following virtual disk and disk image formats:

RDR: A proprietary disk image format developed by **R-Tools Technology, Inc** (**R-TT**). It is the main format in **R-Drive Image**, **R-Studio**, **R-Linux**, and **R-Undelete**. RDR files are interchangeable, that is, any **R-TT** program may load and process, within its capabilities, any rdr file created in another **R-TT** program.

The following image formats can be created only in the **R-Studio Corporate** and **Technician/T80**+ versions:

VHD/VHDX: A virtual disk file format built into Windows. It's a native virtual hard drive for Hyper-V, the Windows virtual machine. You may read more about these file formats in Wikipedia: VHD (file format). **R-Studio** creates a special file with some metadata for the VHD file format, its extension is vhr. The VHDX file format contains this metadata within its main file.

VMDK: A virtual disk file format for the most virtual machines like VMware Workstation, VirtualBox, Parallels Desktop for Mac, etc. You may read more about these file format in our Glossary: What is a VMDK Virtual Disk.

VDI: A virtual disk file format for the VirtualBox virtual machine. **R-Studio** creates a special file with some metadata for the VDI file format, its extension is vdr. You may read more about these file format in Wikipedia: VDI.

R-Studio Standalone can load these image formats.

The main features of these file formats are presented in the table below:

Features	RDR	VHD/VHDX	VMDK	VDI
Several objects in one file	Yes	No	No	No
Compression	Yes	No	Yes	No
Encryption	Yes	No	No	No
Image Split	Yes	No	Yes	No

Native mounting on Windows	No	Yes	No	No
Mounting on Windows using R-Studio	Yes	Yes	Yes	Yes

Additional file formats that can be opened "read-only"

Extensions	Description	Licenses
dmg	Apple Disk Image	All
e01/(ewf)	Expert Witness File Format	Technician/T80+
aff	Advanced Forensic Format	Technician/T80+

5.7 Bad Sectors

Quite often, drives from which the data are to be recovered have <u>bad sectors</u>, or those sectors that are very hard, even impossible, to read, mostly due to hardware problems. **R-Studio for Linux** tries to read such sectors several times. The number of tries is specified either on the <u>Settings/Bad Sectors</u> dialog box, or on the <u>Properties</u> tab, the Drive Control section, for each drive separately.

When **R-Studio for Linux** encounters such bad sectors while performing various tasks and they appear unreadable, it treats them as follows:

Object images:

R-Studio for Linux fills the space in the <u>image</u> file where the bad sectors should be with the pattern specified in the Pattern to fill bad blocks field on the <u>Settings/Bad Sectors</u> dialog box. Please note that **R-Studio for Linux** writes the pattern on the image, not on the source drive.

Files

If Skip files with bad sectors on the <u>Recovery</u> dialog box is cleared, **R-Studio for Linux** fills bad sectors in the recovered file with the pattern specified on the the <u>Settings/Bad Sectors</u> dialog box. Information about such files will appear in the <u>Log</u>.

If Skip files with bad sectors on the <u>Recovery</u> dialog box is selected, **R-Studio for Linux** 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



■Files with bad sectors Buttons

Select All	Click this button to select all files in the list.

Clear All	Click this button to unselect all selected files.
Mark	Click this button to mark all selected files in the list.
Save to File	Click this button to save the list of files with bad sectors to a text file.
Recover	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 <u>Settings/Bad Sectors</u> dialog box.

Objects edited in the Text/Mexadecimal editor/viewer

Bad sectors in the objects viewed/edited in the <u>Text/Rexadecimal editor</u> are shown as filled with the pattern specified in the Pattern to fill bad blocks field on the <u>Settings/Bad Sectors</u> dialog box.

5.8 Memory Usage

You may see how much memory **R-Studio for Linux** 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 for Linux** <u>Settings</u>

To view memory usage,

- 1 Select Memory usage on the Tools menu
- > R-Studio for Linux 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 for Linux uses. Limit shows how much memory your system can virtually allocate to R-Studio for Linux . Actual memory allocation depends also on the RAM and swap file sizes.
System Memory Physical	Shows how much RAM is in your system
System Memory Swap	Shows how much virtual memory is in your system

5.9 R-Studio for Linux Command Line Commands and Switches

You may start **R-Studio for Linux** from the terminal using the following command:

For **R-Studio for Linux**: rstudio.

For **R-Studio for Linux Technician**: rstudio-tech.

Note: You need to elevate your privilegies if you're not the root to start **R-Studio for Linux**.

If there are problems in starting **R-Studio for Linux** and while working with it, you may use switches to avoid them.

The following switches are available:

-all_drives	Forces R-Studio for Linux to show all logical disks in the system. Normally
	R-Studio for Linux shows only local disks in the system. Some storage devices may
	pretend that they are not local disks.

	T
-debug	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 for Linux technical support to identify the problem. This switch greatly
	slows R-Studio for Linux. You may also turn this mode on by selecting Debug Mode
	on the <u>Settings</u> dialog box.
-flush	Flushes the log file after each write to log operations. This switch is helpful when
	R-Studio for Linux locks and its log file remains in memory cache unwritten to a
	disk. This switch greatly slows R-Studio for Linux .
-log <filename></filename>	Started with this switch, R-Studio for Linux writes its log into the specified file. If
	R-Studio for Linux locks and its log file remains in memory cache unwritten to a
	disk, use the -flush switch.
-mem <size in="" mb=""></size>	Sets memory usage limit in MB for R-Studio for Linux 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.
-no_ide_ext	Turns off the inquiry about extended information on HDDs in Wind9x/ME. This
	switch may be helpful if R-Studio for Linux returns information about HDDs
	incorrectly (detects HDD geometry incorrectly).
-no_int13	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).
-no_ios	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).
-reset	R-Studio for Linux 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.
-safe	Disables automatic partition search on a hard drive, file system recognition on
	partitions, and other potentially problematic operations. In this mode, it is necessary
	to use Find partition command from the hard drive context menu to manually find a
	partition.
	

If an unrecognized problem appears, start R-Studio for Linux with the <code>-debug</code> and <code>-log</code> <code><filename></code> switches, and send the log and screenshot of the R-Studio for Linux main panel to the R-Studio for Linux technical support:

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

5.10 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 <u>Main</u> dialog box of the **R-Studio for Linux** 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.

■ More information..

Wore Information	uon
Drive Type	Device/disk type and subtype. Current R-Studio for Linux 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, RAID 4, RAID 5, RAID 6
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, ABIOS

2.Information on hard drives and logical disks

This section shows available information on hard drives and <u>logical disks</u>. These properties depend on the drive/disk type and appear only when applicable. Under Windows NT/2000/XP/2003/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.

■ More information...

OS object	Appears for image files under Windows 9x/ME and NT/2000/XP/2003/Vista/2008/7/? 8/8.1/10, for drives/disks under Windows NT/2000/XP/2003/Vista/2008/7/8/8.1/10 only. An object name used by OS to access the device/disk.
R-Studio for Linux 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 a	adds the following properties:
Int13 Drive Number	128 for the first hard drive accessible through Int13, 129 for the second one, etc. 0128 for drives and other devices accessible through a Windows 9x/ME protected mode driver, if their Int13 device option is disabled. R-Studio for Linux can use Int13 disk access, and for some drive types, like SCSI devices, Int13 access is preferable. You may consider enabling the Int13 device option in the Windows Device Manager for such devices.
Int13 Extension Version	Int13 Extension Version Support for hard drives. Extended Int13 support is necessary for large drives. If this property is zero, Extended Int13 is not supported, otherwise, it shows Extended Int13 standard version, the large, the better.

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...

Drive Control			
Maximum transfer	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		
I/O Unit	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		
Buffer Alignment	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.		
1 1	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.		
I/O Tries	Number of read/write tries during access to the drive. If there are <u>bad sectors</u> 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 for Linux 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 for Linux reads again that part sector by sector, repeating the attempts the specified number of times. If R-Studio for Linux 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.

4. Partition properties

A <u>partition</u> 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 for Linux** treats regions like partitions.

For example, if you set Default read attempts to 1, a bad sector will be read 2 times.

■ More information...

	'
Partition Offset	Initial offset for the partition.
Partition Size	Size of the partition.
Partition Type	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 for Linux will process this partition correctly, as it does not use this property.
Partition number	Appears under Windows NT/2000/XP/2003/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	

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), *RAIDs4/5/6* (RAIDs Level 4/5/6), 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.		
Raid Block Size Data block size for compound volumes of RAID (Level 0-5) types		

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/2003/Vista/2008/7/? 8/8.1/10, LDM disks are also called *Dynamic Disks*.

■ More information...

Offset of Logical Disk	Initial offset of a logical disk on a hard drive. For disks, initially <u>formatted</u> by LDM, this value is often 31.5KB , for converted disks, it may be larger.
Supposed Parents Count	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.
LDM Host GUID	Global Unique Identifier of a computer system where this LDM disk group has been created.
LDM DiskGroup GUID	Global Unique Identifier of the LDM disk group.
LDM Disk GUID	Global Unique Identifier of the hard drive.
LDM Volume GUID	Global Unique Identifier of the volume.
LDM Disk ID	Local hard drive Identifier, unique within this LDM disk group.
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 for Linux**, 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.

■ More information...

NTFS Information	Regular volumes
Recognized NTFS	Recognized volumes
Cluster Size	Cluster size for the NTFS volume.
MFT record size	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.
Sector Size	Sector size for the physical drive. This property is read from the boot sector of the NTFS volume and does not affect R-Studio for Linux operation.
Index Block Size	Index block size for the NTFS volume. This property determines binary trees used to store NTFS folder structure. It does not affect R-Studio for Linux operation.
MFT position	MFT offset from the start of the NTFS volume.
MFT Mirror Position	Second MFT copy offset from the start of the NTFS volume.

Volume size	Size of the NTFS volume. This property does not affect R-Studio for Linux	
	operation.	

7.2.FAT Volume properties

These properties are present for all <u>FAT</u> volumes and represent their main properties. For *recognized volumes*, these values can be altered.

■ More information...

<u> </u>	
FAT Information	Regular volumes
Recognized FAT	Recognized volumes
FAT Bits (12,16,32)	FAT type. 12 for the FAT12, 16 for the FAT16, 32 for the FAT32.
Cluster Size	Cluster size for the FAT volume.
First Cluster Offset	Offset of the first cluster from the start of the FAT volume.
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 for Linux 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 for Linux 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 for Linux uses the first or second FAT table copy, respectively. If it is Auto, R-Studio for Linux 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.

7.3.Ext2/3/4FS Volume properties

These properties are present for all <u>Ext2/3/4FS</u> volumes and represent their main properties. For *recognized volumes*, these values can be altered.

■ More information...

inore iniormation	·
Ext2/3/4FS Information	Regular volumes
Recognized Ext2FS	Recognized volumes
Block Size	Block size of Ext2FS file system. A block in the Ext2FS file system is similar to a
	cluster in the FAT file system.
First SuperBlock Offset	Offset of the first SuperBlock from the start of the Ext2FS volume.
Blocks Per Volume	Number of blocks in the Ext2FS volume.
INodes Per Volume	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,
	which is stored separately. Therefore, the INodes Per Volume parameter is equal to the maximum number of files on an Ext2FS volume.
Creator OS	The OS that created this Ext2FS volume. May be Linux, Hurd, Masix, FreeBSD, Lites.
Major version	Ext2FS version. Usually 1.
Minor version	Ext2FS minor version. Usually 0.
Last Mount Time	Last mount time for this Ext2FS volume.
Last Write Time	Last write time for this Ext2FS volume.
Last Check Time	Last check time for this Ext2FS volume.
Volume size	Size of the volume.

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...

Parsed File Entries	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.
Parsed Boot Records	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.
Estimated Size	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.

VI R-Studio Emergency

Note: You cannot use this program to work with Mac computers based on Apple Silicon.

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-StudioTechnical 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

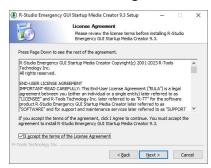
You must have administrative privileges to install R-Studio Emergency Startup Media Creator.

If you are not sure whether you have such privileges, you almost certainly do not have them. Contact your system administrator for assistance.

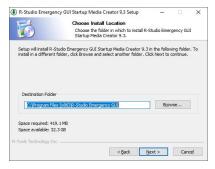
1 Run the setup wizard



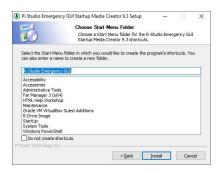
2 Read the License Agreement and accept its conditions.



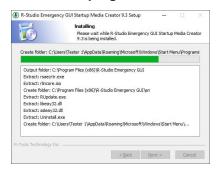
3 Select the installation location



4 Select the Start Menu Folder



5 Wait for the program to install



6 You may start creating R-Studio Emergency immediately upon install completion.



6.2.2 Creating Startup Disks Using R-Studio Emergency Startup Media Creator

You need to create either

- 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.
- 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.
- An ISO image to start up a virtual machine, to create a USB device using other software, or to burn it to a CD/DVD disc using your favorite CD/DVD writing software.

You may create a Linux-based or WinPE based startup disk.

Note: R-Studio Emergency Startup Media Creator supports creating WindowsPE startup disks starting from Windows 8.1. It's possible to create such disk from **R-Studio** Emergency Startup Media Creator on earlier Windows versions if you yourself correctly install a workable copy of WindowsPE Assessment and Deployment

Kit (Windows ADK). Microsoft recommends Windows ADK from Windows 10 version 2004 (20H1) for versions prior to Windows 10.

You may create the **R-Studio Emergency** on a <u>USB Activation Stick</u>.

1 Run R-Studio Emergency

Welcome dialog box



click the **Next** button to select the base for the startup disk.

A Linux-based disk

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 <u>Startup Media Troubleshooting Options</u> dialog box will appear. You may configure these options to eliminate those problems.

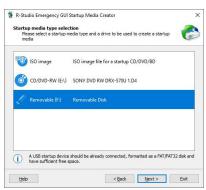
2 Select Linux based on the Startup OS selection and click the Next button.

Startup OS selection dialog box



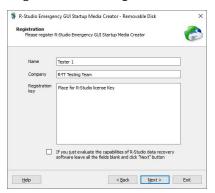
3 Select the device on which you want to create the startup disk.

Startup media type selection dialog box



3 Enter your license key to register your copy of the R-Studio Emergency Startup Media Creator and click the Next button.

Registration dialog box



3 Read and accept the License Agreement and click the Next button.

License Agreement dialog box



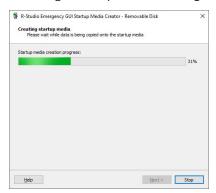
4 Specify the path and name for the ISO file or verify that you've select the correct USB device and click the Next button.

Insert 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

Creating startup media dialog box



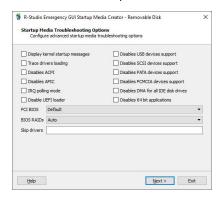
R-Studio Emergency Startup Media Creation is Finished message



Startup Media Troubleshooting Options

Those options will help you if you have problems with starting you computer up from the **R-Studio** startup disks. Please, contact the **R-Studio** Technical Support Team for more information.

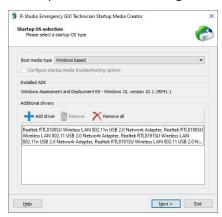
R-Studio Startup Media Troubleshooting Options dialog box



A WindowsPE-based disk

2 Select Windows based on the Startup OS selection and click the Next button.

Startup OS selection dialog box



If you select this option for the first time, you'll need to download and install some extra Windows components. Click the Download button and follow the on-screen instructions. When the process is finished, you'll be able to continue creating the startup disk. You don't have to perform these steps next times.

You may also add hardware drivers at this stage.

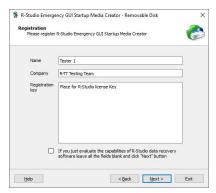
3 Select the device on which you want to create the startup disk.

Startup media type selection dialog box



3 Enter your license key to register your copy of the R-Studio Emergency Startup Media Creator and click the Next button.

Registration dialog box



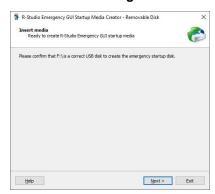
3 Read and accept the License Agreement and click the Next button.

License Agreement dialog box



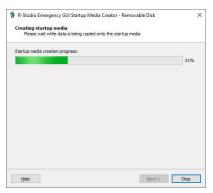
4 Specify the path and name for the ISO file or verify that you've select the correct USB device and click the Next button.

Insert 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

Creating startup media dialog box



R-Studio Emergency Startup Media Creation is Finished message



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 <u>Creating</u> 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

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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 <u>Hardware Compatibility List</u>.

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-Studiowill 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



3 Press the F2 key and specify the output folder on the Recover dialog box

Recover dialog box



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

Deleted files: If it is selected, **R-Studio** makes a search among deleted files/folders.

Existing files:	If it is selected, R-Studio makes a search among existing files/folders.
Files:	If it is selected, R-Studio includes files into a search.
Folders:	If it is selected, R-Studio includes folders into a search.

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

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.		
If no letters are after the numbers, R-Studio assumes the numbers in bytes.		
The following case-ignoring notation is possible:		
b	Bytes	
kb	Kilobytes	
mb	Megabytes	
gb	Gigabytes	
tb	Terabytes	

> 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



Found objects:

1 valid objects:	
Extra Found Files	Entries of known file types have been found
Recognized1	Records and file entries are found for this partition
Recognized2	Only file entries are found for this partition
Recognized3	Only boot records are found for this partition

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

6.3.5 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 Linux version 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



- 2 Select the R-Studio Agent Emergency to run R-Studio Emergency as an emergency agent.
- > R-Studio Agent Emergency will start and its prompt will appear

R-Studio Emergency as an Emergency Agent

```
Loading roctagt...ok
Loading reconfig.bin..ok
Decompressing Linux.. Parsing ELF... No relocation needed... done.
Booting the kernel.

Booting R-Studio Agent Emergency. Please wait...
Maiting B seconds for PCMCIA devices to settle...
Booting R-Studio Agent Emergency. Now you may remove boot media.

Quering DHCP to configure network interfaces...

Quering DHCP to configure network interfaces...

Press EMTER within 10 seconds to configure them manually.

Press EMTER within 10 seconds to configure them manually.

Press EMTER within 12 seconds to configure them manually.

Press EMTER within 12 seconds to configure them manually.

Press EMTER within 12 seconds to configure them manually.

Results as 12 seconds 12 seconds to configure them manually.

Results as 12 seconds 12 se
```

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

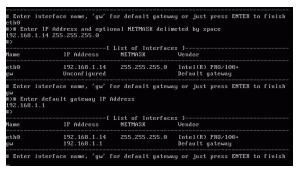
You need to configure the interfaces and IP addresses manually.

- 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

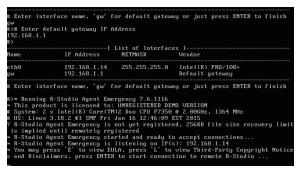
3. A prompt to configure another interface, gateway, or to finish configuring the interfaces will appear. Enter gw, enter the IP address of the gateway, and press **Enter**.

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 <code>IPaddress:port</code>.

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

```
Waiting 8 seconds for PCMCIA devices to settle...

Booting R-Studio Agent Emergency. Now you may remove boot media.

Quering DHCP to configure network interfaces...

Press ENTER within 10 seconds to configure them manually.

IP Address 192.168.1.14 was assigned for interface eth0 using DHCP protocol

Default gateway is 192.168.1.1 now

* Running R-Studio Agent Emergency 7.6.1116

**This product is licensed to: UNREGISTERED DEMO UERSION

**System: 2 × Intel(R) Core-CTM)2 Duo CPU P7350 & 2.09GHz, 1930 MHz

**B OS: Linux 3.18.2 #1 SMP Fri Jan 16 12:46:09 EST 2015

7 R-Studio Agent Emergency is not yet registered, 256KB file size recovery limit is implied until remotely registered

**R-Studio Agent Emergency is istening on IP(s): 192.168.1.14

**You may press 'E' to view EULA, press 'L' to view Third-Party Copyright Notice and Disclaimers, press ENTER to start connection to remote R-Studio ...

#*Enter R-Studio IP address or just press ENTER to cancel > 192.168.1.10:8080

#*Enter password or just press ENTER to connect without one > Connection with 192.168.1.10:8080 is established successfully.

**R-Studio Agent Emergency is listening on IP(s): 192.168.1.10:10:8080

**Connection with 192.168.1.10:8080 is established successfully.

**R-Studio Agent Emergency is listening on IP(s): 192.168.1.14

**You may press 'E' to view EULA, press 'L' to view Third-Party Copyright Notice s and Disclaimers, press ENTER to start connection to remote R-Studio ...
```

6.5 R-Studio Emergency Technical Information

Properties and Text/Hexadecimal Viewer

Network Drives

Log

Devices to Store Recovered Files

R-Studio Emergency

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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 message

Map Network dialog box



Server IP Address:	IP address of the computer where the network drive is to reside.
Server Share Name:	Name of the shared folder where the network drive is to reside.
Login:	Username of a user on the computer where the network drive is to reside.
Password:	User's password on the computer where the network drive is to reside.

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.

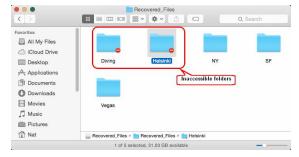
Mac computers: no Linux computers: full.

Network disks. Such disks may be on other network computers or NAS devices. See the <u>Network Drives</u> 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:

Data Storage Devices **Networking Devices** Serial ATA and Parallel ATA drivers Ethernet (10 or 100Mbit) ACPI firmware driver for PATA 3c501 `EtherLink` AHCI SATA 3c503 `EtherLink II` **ALi PATA** 3c505 `EtherLink Plus` AMD/NVidia PATA 3c507 `EtherLink 16` ARTOP 6210/6260 PATA 3c509/3c529 (MCA)/3c579 `EtherLink III` ARTOP/Acard ATP867X PATA 3c515 ISA `Fast EtherLink` 3c590/3c900 ATI PATA series (592/595/597) `Vortex/Boomerang` CMD / Silicon Image 680 PATA CMD640 PCI PATA 3cr990 series `Typhoon` AMD 8111 (new PCI lance) CMD64x PATA AMD LANCE and PCnet (AT1500 and NE2100) CS5510/5520 PATA AMD PCnet32 PCI CS5530 PATA AT1700/1720 CS5535 PATA

CS5536 PATA Adaptec Starfire/DuraLAN

Compaq Triflex PATA Ansel Communications EISA 3200 Cypress CY82C693 PATA Apricot Xen-II on board Ethernet

EFAR SLC90E66 Atheros L2 Fast Ethernet
Generic ATA Broadcom 440x/47xx ethernet

HPT 343/363 PATA CS89x0

HPT 366/368 PATA Cabletron E21xx

HPT 370/370A/371/372/374/302 PATA

DECchip Tulip (dc2114x) PCI
HPT 372N/302N PATA

Davicom DM910x/DM980x

IT8213 PATA Early DECchip Tulip (dc2104x) PCI

Initio 162x SATA EtherExpress 16

Intel ESB, ICH, PIIX3, PIIX4 PATA/SATA EtherExpressPro support/EtherExpress 10 (i82595)
Intel PATA MPIIX Generic DECchip & DIGITAL EtherWORKS

Intel PATA old PIIX PCI/EISA

Intel SCH PATA

JMicron PATA

HP 10/100VG PCLAN (ISA, EISA, PCI)

HP PCLAN (27245 and other 27xxx series)

Legacy ISA PATA

HP PCLAN+ (27247B and 27252A)

Marvell PATA support via legacy mode ICL EtherTeam 16i/32
Marvell SATA Intel(R) PRO/100+

NETCELL Revolution RAID LP486E on board Ethernet
NVIDIA SATA Myson MTD-8xx PCI Ethernet

Nat Semi NS87410 PATA NE2000/NE1000

Nat Semi NS87415 PATANI5010Ninja32/Delkin Cardbus ATANI5210OPTI FireStar PATANI6510

OPTI621/6215 PATA National Semiconductor DP8381x series PCI

Older Promise PATA controller Ethernet

PCMCIA PATA

OpenCores 10/100 Mbps Ethernet MAC
Pacific Digital ADMA

PCI NE2000 and clones support (see help)

Pacific Digital SATA QStor RDC R6040 Fast Ethernet Adapter

Platform AHCI SATA RealTek RTL-8129/8130/8139 PCI Fast Ethernet

Promise PATA 2027x Adapter

Promise SATA SX4 RealTek RTL-8139 C+ PCI Fast Ethernet Adapter

Promise SATA TX2/TX4 SEEQ8005 ODI VLB PATA SMC 9194

RADISYS 82600 PATA SMC EtherPower II

RDC PATA SMC Ultra

SC1200 PATA SMSC LAN9420 PCI ethernet adapter SERVERWORKS OSB4/CSB5/CSB6/HT1000 SiS 900/7016 PCI Fast Ethernet Adapter

PATA Silan SC92031 PCI Fast Ethernet Adapter driver

Sun Cassini ServerWorks Frodo / Apple K2 SATA Sun GEM SiS 964/965/966/180 SATA

SiS PATA Sun Happy Meal 10/100baseT

Silicon Image 3124/3132 SATA Sundance Alta TI ThunderLAN Silicon Image SATA ULi Electronics SATA ULi M526x controller

VIA PATA VIA Rhine WD80*3 VIA SATA

VITESSE VSC-7174 / INTEL 31244 SATA Winbond W89c840 Ethernet

Winbond SL82C105 PATA Zenith Z-Note Winbond W83759A VLB PATA nForce Ethernet

SCSI low-level drivers Ethernet (1000 Mbit)

3ware 5/6/7/8xxx ATA-RAID Alteon AceNIC/3Com 3C985/NetGear GA620

Gigabit 3ware 97xx SAS/SATA-RAID

3ware 9xxx SATA-RAID Atheros L1C Gigabit Ethernet Atheros L1E Gigabit Ethernet 7000FASST SCSI

Atheros/Attansic L1 Gigabit Ethernet ACARD SCSI

Broadcom CNIC ARECA (ARC11xx/12xx/13xx/16xx)

SATA/SAS RAID Host Adapter Broadcom NetXtremeII

Adaptec AACRAID Broadcom Tigon3 DL2000/TC902x-based Gigabit Ethernet Adaptec AHA152X/2825

Adaptec AHA1542 IP1000 Gigabit Ethernet

Intel(R) 82575/82576 PCI-Express Gigabit Ethernet Adaptec AIC79xx U320 Intel(R) 82576 Virtual Function Ethernet

Adaptec AIC7xxx Adaptec AIC7xxx Fast -> U160 Intel(R) PRO/1000 Gigabit Ethernet

Adaptec AIC94xx SAS/SATA Intel(R) PRO/1000 PCI-Express Gigabit Ethernet

Adaptec I2O RAID JMicron(R) PCI-Express Gigabit Ethernet

National Semiconductor DP83820 AdvanSys SCSI Always IN2000 SCSI New SysKonnect GigaEthernet BusLogic SCSI Packet Engines Hamachi GNIC-II DMX3191D SCSI Packet Engines Yellowfin Gigabit-NIC

DTC3180/3280 SCSI QLogic QLA3XXX Network Driver Support

EATA ISA/EISA/PCI (DPT Realtek 8169 gigabit ethernet and generic EATA/DMA-compliant boards) SiS190/SiS191 gigabit ethernet

Emulex LightPulse Fibre Channel Support SysKonnect Yukon2

Future Domain 16xx SCSI/AHA-2920A VIA Velocity

Generic NCR5380/53c400 SCSI MMIO Ethernet (10000 Mbit) Generic NCR5380/53c400 SCSI PIO Broadcom NetXtremeII 10Gb

HP Smart Array SCSI driver Chelsio 10Gb Ethernet

HighPoint RocketRAID 3xxx/4xxx Controller Chelsio Communications T3 10Gb Ethernet 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 Logic 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 QLA2XXX 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-32Bi/UDE

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

Lexar Jumpshot Compact Flash Reader

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

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

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.

Note: You cannot use this program to start Mac computers based on Apple Silicon.

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



click the **Next** button to see the list of all devices on which startup disks may be created.

Startup media type selection dialog box



To create a startup CD/DVD disc directly on your CD/DVD writer (if present):

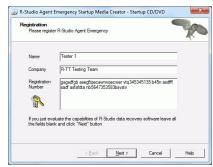
- 1 Run R-Studio Agent Emergency
- 2 Select the CD/DVD writer on the Startup media type selection dialog box and click the Next button
- 3 Read and accept the License Agreement and enter the R-Studio Agent registration key on the R-Studio Agent Emergency Activation dialog box and click the Next button

Note: You should enter the registration key of **R-Studio Agent**, not **R-Studio** itself.

R-Studio Agent Emergency License Agreement dialog box



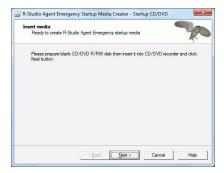
R-Studio Agent Emergency Activation dialog box



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

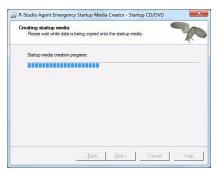
4 Insert a blank CD/DVD disk into the CD/DVD recorder and click the Next button

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

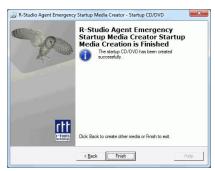


When R-Studio Agent Emergency Startup Media Creator finishes creating the startup CD/DVD disc, the R-Studio Agent Emergency Startup Media Creation is Finished message will appear

You may either exit P-Studio Emergency Startup Media Creator by clicking the Finish button or create

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.

R-Studio Agent 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 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.

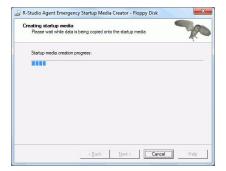
- 1 Run R-Studio Agent Emergency
- 2 Select Floppy Disk for the startup floppy disk on the R-Studio Agent Emergency Startup Media Creator dialog box and click the Next button
- 3 Enter the registration information and number on the Registration dialog box and click the Next button If you leave all the 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



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 <u>Hardware Compatibility List</u>.

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...

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**.

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**.

```
-----[ List of
Interfaces ]-----
     IP Address NETMASK
Name
                                        Vendor
          Unconfigured
                                        RealTek
re0
8139C+
# Enter interface name, 'gw' for default gateway or just press
ENTER to finish
#>re0
# Enter IP address and optional NETMASK delimited by space
#>192.168.0.10 255.255.255.0
   -----[ List of
Interfaces ]-----
     IP Address
                           NETMASK
                                          Vendor
```

```
re0
             192.168.0.10
                                  255.255.255.0
                                                    RealTek
8139C+
qw
             Unconfigured
                                                    Default
gateway
# Enter interface name, 'qw' for default gateway or just press
ENTER to finish
# Enter default gateway IP Address
#>192.168.0.1
 ----- List of
Interfaces |-----
             IP Address
Name
                                 NETMASK
                                                    Vendor
             192.168.0.10
                            255.255.255.0
re0
                                                  RealTek
8139C+
             192.168.0.1
                                                    Default
aw
gateway
# Enter interface name, 'gw' for default gateway or just press
ENTER to finish
```

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 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 <code>IPaddress:port</code>.

```
* 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
```

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...

* 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
Connection with 192.168.0.25:80 is established successfully.
```

7.5 R-Studio Agent Emergency Hardware Compatibility List

Disk Controllers
Network Cards

R-Studio Agent Emergency

Contact Information and Technical Support

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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-1460, AHA-1460B, AHA-1460C, AHA-1460D (PC Card)

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 ahc 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 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 3940U

Adaptec 3940AU

Adaptec 3940UW

Adaptec 3940AUW

Adaptec 3940U2W

Adaptec 3950U2

Adaptec 3960

Adaptec 39160

Adaptec 3985

Adaptec 4944UW

NEC PC-9821Xt13 (PC-98)

NEC RvII26 (PC-98)

NEC PC-9821X-B02L/B09 (PC-98)

NEC SV-98/2-B03 (PC-98)

Many motherboards with on-board SCSI support

The and 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 ABP3950U2W

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?2?, PM2022 [EISA], PM2024/PM2124 [PCI]) (Gen2)

Smart RAID II (PM3?2?, PM3021, PM3222)

Smart Cache III (PM2?3?)

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 Zero-Channel SCSI RAID 2000S, 2005S, 2010S, 2015S

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 twe 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

53C896

53C897

53C1000

53C1000R

53C1010-33

53C1010-66

53C1510D

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)

Tekram DC390W, 390U, 390F, 390U2B, 390U2W, 390U3D, and 390U3W

Tyan S1365

The following devices are currently supported by the ncv driver:

I-O DATA PCSC-DV

KME KXLC002 (TAXAN ICD-400PN, etc.), KXLC004, 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

Ologic 1240

Ologic 1020

Qlogic 1040

Qlogic 1080

Qlogic 1280

Ologic 12160

Qlogic 2100

Qlogic 2102

Ologic 2200

Qlogic 2202

Ologic 2204

Ologic 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 nsp 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:

Compag 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

HP Smart Array V100

HP Modular Smart Array 20 (MSA20)

HP Modular Smart Array 500 (MSA500)

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 supprted 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.

*: 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 *

Isolan AT 4141-0 (16 bit)

Isolan 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 **lnc** 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)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 Laneed 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/PCMPC100/PCM100, PCMLM56

Linksys EtherFast 10/100 PC Card, Combo PCMCIA Ethernet Card (PCMPC100 V2)

Logitec LAN-98T (flags 0xb00000) (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)

MELCO LGH-98, LGY-98, LGY-98-N (110pin), IND-SP, IND-SS (flags 0x400000) (PC-98)

MELCO LGY-PCI-TR

MELCO LPC-T/LPC2-T/LPC2-CLT/LPC2-TX/LPC3-TX/LPC3-CLX

NDC Ethernet Instant-Link

NEC PC-9801-77, PC-9801-78 (flags 0x910000) (PC-98)

NEC PC-9801-107, PC-9801-108 (flags 0x800000) (PC-98)

National Semiconductor InfoMover NE4100

NetGear FA-410TX

NetVin 5000

Network Everywhere Ethernet 10BaseT PC Card

Networld 98X3 (flags 0xd00000) (PC-98)

Networld EC-98X, EP-98X (flags 0xd10000) (PC-98)

Novell NE1000/NE2000/NE2100

PLANEX ENW-8300-T

PLANEX EN-2298-C (flags 0x200000) (PC-98)

PLANEX EN-2298P-T, EN-2298-T (flags 0x500000) (PC-98)

PLANEX FNW-3600-T

RealTek 8029

SMC Elite 16 WD8013

SMC Elite Ultra

SMC EtherEZ98 (flags 0x000000) (PC-98)

SMC WD8003E/WD8003EBT/WD8003S/WD8003SBT/WD8003W/WD8013EBT/WD8013W and

clones

Socket LP-E

Surecom EtherPerfect EP-427

Surecom NE-34

TDK LAK-CD031, Grey Cell GCS2000 Ethernet Card

Telecom Device SuperSocket RE450T

VIA VT86C926

Winbond W89C940

C-Bus, ISA, PCI and PC Card devices are supported.

Adapters supported by the rl driver include:

Accton "Cheetah" EN1207D (MPX 5030/5038; RealTek 8139 clone)

Allied Telesyn AT2550

Allied Telesyn AT2500TX

Belkin F5D5000

BUFFALO(Melco 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 (ADMtek 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 Laneed 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

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 <u>rue</u> 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 <u>uday</u> 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-PCI2T, 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

RATOC REX-5588, REX-9822, REX-4886, and REX-R280

RATOC 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, Rv20, 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 <u>ie</u> 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 NI5210

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, 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 Ige 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 <u>bge</u> 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 <u>em</u> 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">https://mex.pubme.com/html/>https://mex.

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 <u>re</u> 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 <u>ixgb</u> driver supports the following cards:

Intel PRO/10GbE LR Server Adapter *

Intel PRO/10GbE SR Server Adapter *

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