Synchronization and backup programs

This page lists and compares applications that synchronize data between two or more locations, and those that build on top of such functionality to make incremental copies of important data for backup purposes. Because of their relationship, the two groups share several traits that justify describing them in the same article.

Related articles

- System backup
- Disk cloning
- List of applications/Internet#File sharing
- System maintenance#Backup
- Dotfiles
- File recovery

1 Important considerations

In order to choose the best program for one's own needs, the following aspects should be considered:

- The type of backup medium that is going to store the data, e.g. CD, DVD, remote server, external hard drive, etc.
- The planned frequency of backups, e.g. daily, weekly, monthly, etc.
- The features expected from the backup solution, e.g. compression, encryption, handles renames, etc.
- The planned method to restore backups if needed.

2 Data synchronization

These applications simply keep directories synchronized between multiple locations/machines, in a "mirror" fashion. Nonetheless, most of them still allow storing and reverting to old revisions of modified or deleted files.

See also:

- List of applications/Utilities#File synchronization and backup
- List of applications/Internet#Cloud synchronization clients
- Wikipedia:Comparison of file synchronization software

2.1 Legend

Name
: The application name, linking to the ArchWiki article or the official website.

Package
: A link to the package.

Implementation
: The programming language, library, or utility that the application is based on.

Delta transfer
: Only the modified *parts* of files are transferred.

Encrypted transfer
: Data is encrypted by default when transferred over the network.

FS metadata
: File system permissions and attributes are synchronized.

Resumable
: The synchronization can be resumed if interrupted.

Handles renames
: Moved/renamed files are detected and not stored or transferred twice. It typically means that a checksum of files or its chunks is computed. Applications missing this functionality can be supplemented by combining with `hsync (https://aur.archlinux.org/packages/hsync/)`[AUR], which *only* synchronizes renames.

Version control
: The old version of files are backed up (*reverse incremental backup*).

Change propagation
: Specifies in how many directions changes can be propagated.

  - *unidirectional* means one-way synchronization of two locations,
  - *bidirectional* means two-way synchronization of two locations and
  - *multidirectional* means full synchronization of more than two locations.

Conflict resolution
: The application handles file conflicts, either automatically or interactively, i.e. it does not silently discard conflicting files. This attribute does not apply to applications that only propagate changes in one direction.

FS monitoring
: The application listens to file system events to trigger the synchronization.

CLI
: The application provides a command-line interface.

Other interfaces
: The application has the specified user interfaces, e.g. GUI, TUI, or web-based.

License
: The license of the server and client applications.

Other platforms
: Supported operating systems other than Linux.

Maintained
: The project is maintained.

Specificity
: Brief notes about special features that notably set the application apart from the others.

2.2 Table

Name	Package	Implementation	Delta transfer	Encrypted transfer	FS metadata	Resumable	Handles renames	Version control	Change propagation	Conflict resolution	FS monitoring	CLI	Other interfaces	License	Other platforms	Maintained	Specificity
FreeFileSync (https://www.freefilesync.org/)	freefilesync-bin (https://aur.archlinux.org/packages/freefilesync-bin/) AUR	C++	?	SFTP [1] (https://www.freefilesync.org/faq.php#features)	?	?	Yes [2] (https://www.freefilesync.org/faq.php#features)	Yes [3] (https://www.freefilesync.org/manual.php?topic=versioning)	**uni**directional / **multi**directional	Yes	?	No	Yes	GPL	Windows, macOS	Yes	
git-annex (https://git-annex.branchable.com/)	git-annex (https://archlinux.org/packages/?name=git-annex)	Haskell, git	rsync [4] (https://git-annex.branchable.com/transferring_data/)	rsync, others [5] (https://git-annex.branchable.com/transferring_data/)	No, but has custom non-FS metadata [6] (https://git-annex.branchable.com/metadata/)	Yes [7] (https://git-annex.branchable.com/transferring_data/)	Yes, content-addressable storage	Yes	**multi**directional; with git remotes [8] (https://git-annex.branchable.com/sync/)	renames conflicting files [9] (https://git-annex.branchable.com/automatic_conflict_resolution/)	optional, git-annex assistant	Yes	git-annex assistant (https://git-annex.branchable.com/assistant/)	GPLv3	macOS, Android (beta), Windows (beta)	Yes	Manage files with git
osync.sh (http://www.netpower.fr/osync)	osync (https://aur.archlinux.org/packages/osync/) AUR	Bash, based on rsync	rsync	rsync	?	Yes	No	Yes	**bi**directional	keeps multiple versions of a file [10] (http://www.netpower.fr/sites/default/files/soft/html-doc/osync_v1.2.html#toc-Subsubsection-1.3.1)	optional [11] (https://github.com/deajan/osync#daemon-mode)	Yes	No	BSD		Yes	
rclone (https://rclone.org/)	rclone (https://archlinux.org/packages/?name=rclone)	Go	No [12] (https://rclone.org/faq/#why-doesn-t-rclone-support-partial-transfers-binary-diffs-like-rsync)	Yes [13] (https://rclone.org/crypt/)	?	?	?	?	**uni**directional / **bi**directional [14] (https://rclone.org/faq/#can-rclone-do-bi-directional-sync)	?	?	Yes	Web (experimental add-on) (https://rclone.org/gui/)	MIT	*BSD, Plan9, Solaris, Windows, macOS	Yes	Optimized for synchronization with cloud storage, behavior varies with the features supported by the remote location.
rdiff-backup (https://www.nongnu.org/rdiff-backup/)	rdiff-backup (https://aur.archlinux.org/packages/rdiff-backup/) AUR	Python, librsync	rsync	rsync	Yes	?	No	Yes	**uni**directional		No	Yes	No	GPLv2	Win32	Yes	
Resilio Sync	rslsync (https://aur.archlinux.org/packages/rslsync/) AUR	C++	Yes	Yes	?	Yes	?	Yes	**multi**directional	?	?	No	Web	Proprietary freemium	FreeBSD, Windows, macOS, Android, iOS, Windows Phone, Amazon Kindle Fire	Yes	P2P sync
rsync	rsync (https://archlinux.org/packages/?name=rsync)	C	Yes	SSH or native protocol	Yes	Yes	No	▪ `--link-dest` with hard links [15] (https://www.ibm.com/developerworks/aix/library/au-spu	**uni**directional		No	Yes	Rsync#Front-ends	GPLv3	Win32	Yes	Standard tool available on all Linux distributions.

Name	Package	Implementation	Delta transfer	Encrypted transfer	FS metadata	Resumable	Handles renames	Version control	Change propagation	Conflict resolution	FS monitoring	CLI	Other interfaces	License	Other platforms	Maintained	Specificity
								nix_rsync/index.html#backup) • `--backup`									
SparkleShare (https://www.sparkleshare.org/)	sparkleshare (https://aur.archlinux.org/packages/sparkleshare/) AUR	C#, git	Yes	AES-256 [16] (https://github.com/hbons/SparkleShare/wiki/Client-Side-Encryption)	?	?	Yes	Yes	?	?	?	No	Yes	GPLv3	Windows, macOS	Yes	It can sync with any Git server over SSH.
Syncany (https://www.syncany.org/)	syncany (https://aur.archlinux.org/packages/syncany/) AUR	Java	?	?	?	?	?	?	?	?	?	Yes	Yes	GPLv3		No [17] (https://github.com/syncany/syncany/graphs/contributors)	
Syncthing	syncthing (https://archlinux.org/packages/?name=syncthing)	Go	Yes [18] (https://docs.syncthing.net/users/faq.html#is-synchronization-fast)	Yes [19] (https://docs.syncthing.net/users/security.html)	partial [20] (https://docs.syncthing.net/users/faq.html#what-things-are-synced)	Yes	?	Yes [21] (https://docs.syncthing.net/users/versioning.html), previous versions moved to archive folder	**multi**directional	renames one file [22] (https://docs.syncthing.net/users/faq.html#what-if-there-is-a-conflict)	Yes	Yes	Web, GTK	MPL v2	BSD, Windows, macOS, Android, Kindle Paperwhite	Yes	P2P sync
Synkron (https://synkron.sourceforge.net/)	synkron (https://aur.archlinux.org/packages/synkron/) AUR	C++	?	?	?	?	?	?	**multi**directional	?	?	No	Qt	GPLv2	Windows, macOS	No (https://sourceforge.net/projects/synkron/)	
taskd	taskd (https://archlinux.org/packages/?name=taskd)	C++, Python	Yes	Yes	?	Yes	?	?	**multi**directional	?	No	Yes	No	MIT	Android	Yes	
Unison	unison (https://archlinux.org/packages/?name=unison)	OCaml	Yes	Yes	partial [23] (https://github.com/bcpierce00/unison/blob/master/doc/unison-manual.tex#L2050) (Subsection "perms")	optional [24] (https://github.com/bcpierce00/unison/blob/master/doc/unison-manual.tex#L2266) (Subsection "speeding")	No - "Unison sees the rename as a delete and a separate create" [25] (https://github.com/bcpierce00/unison/blob/master/doc/unison-manual.tex#L11130) (Subsection "caveats")	Yes [26] (https://github.com/bcpierce00/unison/blob/master/doc/unison-manual.tex#L1515) (Subsection "backups")	**bi**directional	interactive	Yes, built-in for Linux and Windows since before version 2.48: [27] (https://github.com/bcpierce00/unison/blob/master/NEWS.md#changes-in-248) For macOS see "unison-fsmonitor": [28] (https://github.com/autozimu/unison-fsmonitor)	Yes	GTK2	GPL	FreeBSD, Windows, macOS, Android	Yes [29] (https://github.com/bcpierce00/unison/blob/master/NEWS.md)	
yarsync (https://github.com/ynikitenko/yarsync)	yarsync (https://aur.archlinux.org/packages/yarsync/) AUR	Python, based on rsync	rsync	rsync	Yes	Yes	Yes	Yes, for repository snapshots (each file has a single version)	**uni**directional / **multi**directional	renames one file	No	Yes	No	GPLv3		Yes	UNIX-like systems or backup drives, CLI like *git*.

Name	Package	Implementation	Delta transfer	Encrypted transfer	FS metadata	Resumable	Handles renames	Version control	Change propagation	Conflict resolution	FS monitoring	CLI	Other interfaces	License	Other platforms	Maintained	Specificity
Zaloha2.sh (https://github.com/Fitus/Zaloha2.sh)		bash	No	SSH+SCP	optional	No	No	No	**bi**directional	interactive	No	Yes	No	MIT	Windows under Cygwin	Yes [30] (https://github.com/Fitus/Zaloha2.sh)	Small and simple

3 Incremental backups

Applications that can do **incremental backups** remember and take into account what data has been backed up during the last run (so-called "diffs") and eliminate the need to have duplicates of unchanged data. Restoring the data to a certain point in time would require locating the last full backup and all the incremental backups from then to the moment when it is supposed to be restored. This sort of backup is useful for those who do it very often.

See also:

- **Wikipedia:List of backup software**
- **Wikipedia:Comparison of backup software**
- **Wikipedia:Comparison of online backup services**

Legend:

- **Name**: the application name, linking to the ArchWiki article or the official website.
- **Package**: a link to the package.
- **Implementation**: the programming language, library, or utility that the application is based on.
- **Compressed storage**: compression is used for storage.
- **Encrypted storage**: encryption is used for storage.
- **Delta transfer**: only the modified *parts* of files are transferred.
- **Encrypted transfer**: data is encrypted by default when transferred over a network.
- **FS metadata**: file system permissions and attributes are backed up.
- **Easy access**: the backup is stored plainly in the file system, or is mountable as such.
- **Resumable**: the backup can be resumed without restarting it if interrupted.
- **Multithreading**: the backup can be done in multiple threads of execution concurrently.
- **Handles renames**: moved/renamed files are detected and not stored or transferred twice; it typically means that a checksum is computed for files or chunks thereof.
- **CLI**: the application is command-line driven, i.e. it is scriptable.
- **Other interfaces**: the application has the specified user interfaces, e.g. GUI, TUI, or web-based.
- **Licence**: the licence of the server and client applications.
- **Other platforms**: supported operating systems other than Linux.
- **Maintained**: whether the project is maintained.
- **Deduplication**: whether the program supports deduplicating saved files
- **Specificity**: brief notes about special features that notably set the application apart from the others.

3.1 Single machine

These applications are aimed at backing up data from the machine they are installed on, although the backup destination can be located on an external machine or storage media.

3.1.1 Chunk-based increments

If a file is modified, these applications store only its changed *parts* at the next snapshot. Compared to **#File-based increments** applications, these are more space-efficient, especially when large files receive small modifications; on the other hand, the archived snapshots have to be opened with the backup application that created them, since the files have to be reconstructed from the stored binary diffs.

Name	Package	Implementation	Compressed storage	Encrypted storage	Delta transfer	Encrypted transfer	FS metadata	Easy access	Resumable	Multithreading	Handles renames	CLI	Other interfaces	Licence	Other platforms	Maintained	Deduplication	Specificity
Areca Backup (http://areca.sourceforge.net/)	areca (https://aur.archlinux.org/packages/areca/) AUR	Java	Zip, Zip64	AES128, AES256	Yes	Yes	Yes	No	Pausing only	No [31] (https://sourceforge.net/p/areca/discussion/587586/thread/cffda80a/)	No	Yes	Yes	GPLv2	Windows	Yes		
Borg backup	borg (https://archlinux.org/packages/?name=borg)	Python, C (Cython)	lz4, zlib, lzma, zstd	AES256	Yes	SSH	Yes [32] (https://borgbackup.readthedocs.org/en/stable/faq.html#which-file-types-attributes-etc-are-preserved)	Yes [33] (https://borgbackup.readthedocs.org/en/stable/usage.html#borg-mount)	Yes [34] (https://borgbackup.readthedocs.org/en/stable/faq.html#if-a-backup-stops-mid-way-does-the-already-backed-up-data-stay-there)	No [35] (https://github.com/borgbackup/borg/issues/37)	Yes	Yes	third party	BSD	*BSD, macOS, Windows (Cygwin / WSL)[36] (https://borgbackup.readthedocs.io/en/stable/#main-features)	Yes	Yes, based on variable length chunks.	Support both local and SSH-based remote backup destination.
bup (https://bup.github.io/)	bup (https://archlinux.org/packages/?name=bup)	C, Python, git	Yes	No	Yes	Yes	Immature	Yes [37] (https://bup.github.io/man/bup-fuse.html) [dead link 2024-10-12 ⓘ]	pick up where you left off [38] (https://github.com/bup/bup/blob/master/README.md#reasons-bup-is-awesome)	No	Yes	Yes	thesafe (https://aur.archlinux.org/packages/thesafe/) AUR	GPLv2	NetBSD, Windows, macOS	Yes	Yes	Same storage format as git.
Duplicacy (https://duplicacy.com/)	duplicacy (https://aur.archlinux.org/packages/duplicacy/) AUR	Go	Yes	Yes	Yes	Yes	Yes	Yes [39] (https://github.com/gilbertchen/duplicacy/wiki/Storage-Backends)	Yes [40] (https://forum.duplicacy.com/t/is-backup-pause-resume-supported/351/3)	Yes [41] (https://github.com/gilbertchen/duplicacy/wiki/backup#-threads-n)	Yes [42] (https://github.com/gilbertchen/duplicacy/wiki/Lock-Free-Deduplication#two-step-fossil-collection)	Yes	duplicacy-web (https://aur.archlinux.org/packages/duplicacy-web/) AUR	Custom (non-free) (https://github.com/gilbertchen/duplicacy/blob/master/LICENSE.md)	FreeBSD, macOS, Windows	Yes	Yes	
Duplicati (https://www.duplicati.com/)	duplicati-canary-bin (https://aur.archlinux.org/packages/duplicati-canary-bin/) AUR	C#	Yes	Yes	Yes	Yes	Yes	No	Pausing only	Yes [43] (https://github.com/duplicati/duplicati/issues/3174#issuecomment-546057181)	No	Yes	Yes	LGPL	Windows, macOS	Yes	Yes	
Duplicity	duplicity (https://archlinux.org/packages/?name=duplicity)	librsync	gzip	gpg	Yes	Yes	?	No	Yes	No	No	Yes	Yes	GPL		Yes		
Kopia (https://kopia.io)	kopia (https://aur.archlinux.org/packages/kopia/) AUR	Go, Javascript front-end	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	APACHE	Windows, macOS, OpenBSD	Yes	Yes	
Kup Backup System (https://a	kup (https://archlinux.org/packages/?na	rsync, bup front-end	Yes	Yes	Yes	Yes	Immature	Yes	No	?	Yes	bup	Qt	GPLv2		Yes		

Name	Package	Implementation	Compressed storage	Encrypted storage	Delta transfer	Encrypted transfer	FS metadata	Easy access	Resumable	Multithreading	Handles renames	CLI	Other interfaces	Licence	Other platforms	Maintained	Deduplication	Specificity
pps.kde.org/kup/)	me=kup)																	
Restic	restic (https://archlinux.org/packages/?name=restic)	Go	Yes	Mandatory (AES-256 (https://github.com/restic/restic/blob/master/doc/design.rst#keys-encryption-and-mac))	Yes	Yes	Yes [44] (https://restic.readthedocs.io/en/latest/manual_rest.html#metadata-handling)	Yes [45] (https://restic.readthedocs.io/en/stable/050_restore.html#restore-using-mount)	Yes [46] (https://github.com/restic/restic/pull/310)	Yes [47] (https://forum.restic.net/t/multithreaded-backup/3062/3)	Yes	Yes	No [48] (https://github.com/restic/restic/issues/60)	BSD	OpenBSD, Windows, macOS	Yes	Yes [49] (https://restic.readthedocs.io/en/v0.3.3/Design/#backups-and-deduplication)	Supports storage on various cloud services natively and through rclone (https://archlinux.org/packages/?name=rclone).
ZBackup (http://zbackup.org/)	zbackup (https://aur.archlinux.org/packages/zbackup/) AUR	C++	LZMA, LZO	AES	Yes	Yes	?	planned [50] (https://github.com/zbackup/zbackup#improvements)	No	?	Kinda through tar	Yes	No	GPLv2		No	Yes	Repository consists of immutable files.

3.1.2 File-based increments

If a file is modified, these applications store its new version entirely at the next snapshot. Compared to #Chunk-based increments applications, these are less space-efficient, especially when large files receive small modifications; on the other hand, often the archived snapshots can be opened without the need to have the backup application installed.

Specific legend:

- **Hard links**: whether unmodified files are stored as hard links to previous versions.

Name	Package	Implementation	Compressed storage	Encrypted storage	Delta transfer	Encrypted transfer	FS metadata	Easy access	Resumable	Handles renames	Hard links	CLI	Other interfaces	Licence	Other platforms	Maintained	Specificity
Back In Time	backintime (https://aur.archlinux.org/packages/backintime/) AUR	Python, rsync, diff	No	Yes	rsync	rsync	rsync	Yes	No	No	Yes [51] (http://backintime.le-web.org/documentation/) [dead link 2023-10-29]	Yes	Qt	GPLv2		Yes	
DAR (http://dar.linux.free.fr/) (Disk ARchive)	dar (https://aur.archlinux.org/packages/dar/) AUR	C++	special archive format	Yes	Yes	Yes	?	?	?	?	No [52] (http://dar.linux.free.fr/doc/Features.html)	Yes	dargui (https://aur.archlinux.org/packages/dargui/) AUR	GPL	FreeBSD, NetBSD, Windows, macOS	Yes	
rdup (https://github.com/miekg/rdup)	rdup (https://aur.archlinux.org/packages/rdup/) AUR	C	tar.gz	gpg, blowfish and others	?	?	?	Yes	?	No	Yes	Yes	No	GPLv3		Yes [53] (https://github.com/miekg/rdup/commits/master)	Set of command-line tools.
rsnapshot	rsnapshot (https://archlinux.org/packages/?name=rsnapshot)	rsync	No	No	Yes	Yes	?	?	?	?	Yes [54] (https://rsnapshot.org/rsnapshot/docs/docbook/rest.html)	Yes	No	GPLv2	Win32	Yes [55] (https://github.com/rsnapshot/rsnapshot/issues/191#issuecomment-562460327)	
timeshift (https://github.com/linuxmint/timeshift)	timeshift (https://archlinux.org/packages/?name=timeshift)	rsync	No	No	rsync	rsync	?	?	?	?	Yes	Yes	GTK	GPLv3	Designed for full-system backups to dedicated devices.	Yes	

3.2 Network oriented

These applications have been designed to centralize the backup of several machines connected to a network, through a server-client model. In general they are more complicated to deploy, compared to #Single machine solutions.

Specific legend:

- **Control direction**: Pull: server logs into client. Push: client initiates backup session.
- **Increment type**: the strategy used to reduce used space by deduplicating data (i.e., besides compression).
  - **file-based**: if a file is modified, the entire new version is stored at each snapshot.
    - **hard-links**: whether unmodified files are stored as hard links to previous versions.
  - **chunk-based**: only the modified *parts* of files are stored at each snapshot.

Name	Package	Implementation	Control direction	Compressed storage	Encrypted storage	Delta transfer	Encrypted transfer	FS metadata	Easy access	Resumable	Handles renames	Increment type	CLI	Other interfaces	Licence	Other platforms	Maintained	Specificity
BackupPC	backuppc (https://archlinux.org/packages/?name=backuppc)	Perl	Pull	Yes	No	Yes	Yes	Yes	No	Yes	?	file-based, hard links [56] (https://backuppc.sourceforge.net/faq/BackupPC.html#Backup-basics)	No	Web	GPLv2	Any (no client needed)	Yes	Identical files across backups of the same or different clients are stored only once.
Bacula (https://www.bacula.org)	bacula* (https://aur.archlinux.org/packages/?K=bacula)	C++	Pull	Yes	Yes	?	Yes	?	?	Yes	?	file-based [57] (https://burp.grke.org/why.html)	Yes	GUI, Web	AGPLv3	Windows, macOS	Yes	
Bareos	bareos* (https://aur.archlinux.org/packages/?K=bareos)	C++ (Bacula fork)	?	?	?	?	?	?	?	?	?	?	?	?	AGPLv3		Yes	
burp (https://burp.grke.org)	burp-backup (https://aur.archlinux.org/packages/burp-backup/) AUR	librsync	Push	Yes	Yes	Yes	Yes	Yes	?	Yes	?	chunk-based [58] (https://burp.grke.org/why.html)	Yes	burp-ui (https://git.ziirish.me/ziirish/burp-ui)	AGPLv3	Windows, macOS	Yes	
SafeKeep (https://safekeep.sourceforge.net/)	safekeep (https://aur.archlinux.org/packages/safekeep/) AUR	rdiff-backup	Pull	No	No	?	Yes	?	?	?	?	chunk-based [59] (https://safekeep.sourceforge.net/safekeep.html)	Yes	Yes	GPL		No	Integrates with LVM and databases to create consistent backups. Bandwidth throttling.
Synbak (https://github.com/ugoviti/synbak)	synbak (https://archlinux.org/packages/?name=synbak)	Multitool wrapper	?	Yes	No	Yes	Yes	Yes	?	?	?	?	No	Web	GPLv3		Yes	Unifies several backup methods.
UrBackup (https://www.urbackup.org)	urbackup* (https://aur.archlinux.org/packages/?K=urbackup)	C++	Pull	No	No	Yes	Internet transfers only	Yes	Yes	Yes	Yes	file-based,hard-links and symlinks[60] (https://blog.urbackup.org/156/symbolically-linking-directories-during-incremental-file-backups)/chunk-based CoW-Snapshots[61] (https://blog.urbackup.org/83/file-backup-storage-with-btrfs-snapshots)	Yes (client)	GUI, Web	AGPLv3+	Windows, macOS	Yes	Identical files across backups of the same or different clients are stored only once. Integrates with LVM, dattobd and btrfs for file system snapshots.

4 Version control systems

While **version control systems** are mostly used for source code, they can track any files in a directory.

See **List of applications/Utilities#Version control systems** and **dotfiles**.

5 See also

- **Backing up Linux and other Unix(-like) systems (https://www.halfgaar.net/backing-up-unix)**
- **Exhaustive list of backup solutions for Linux (https://github.com/restic/others)**
- **Mirroring an Entire Site using Rsync over SSH (https://www.askapache.com/security/mirror-rsync-ssh/)**
- **rsync-snapshots.sh (https://github.com/artur-shaik/rsync-snapshots)** — Local and remote snapshot backup using rsync with hard links