Version : **2024.01**

Dernière mise-à-jour : 2024/09/27 10:35

RH12409 - Gestion de l'Archivage et de la Compression

Contenu du Module

Types de Sauvegardes

Sauvegarde complète

Dans ce cas on sauvegarde tous les fichiers et dossiers, toute la partition ou tout le disque :

La restauration nécessite :

- La dernière sauvegarde complète.

Avantage :

- Restauration plus rapide et plus simple que les restaurations à partir de sauvegardes différentielles et incrémentales.

Inconvénient :

- Nécessite plus d'espace de stockage que les sauvegardes différentielles et incrémentales.

Sauvegarde différentielle

Dans ce cas on sauvegarde des données modifiées ou nouvellement ajoutées sur la base de la **dernière sauvegarde complète** :

La restauration nécessite :

- La dernière sauvegarde complète,
- La dernière sauvegarde différentielle.

Avantage :

- Restauration plus rapide que la restauration à partir d'une sauvegarde incrémentale.

Inconvénient :

- Nécessite plus d'espace de stockage que la sauvegarde incrémentale.

Sauvegarde incrémentale

Dans ce cas, on ne sauvegarde que ce qui a changé depuis la dernière sauvegarde quelle qu'elle soit (complète, différentielle ou incrémentale) :

La restauration nécessite :

- La dernière sauvegarde complète,
- Toutes les sauvegardes incrémentales effectuées depuis, et dans l'ordre.

Avantage :

- Sauvegarde plus rapide que la sauvegarde complète ou différentielle,
- Nécessite moins d'espace de stockage que la sauvegarde différentielle.

Inconvénient :

- Plus longue à restaurer.

Sauvegarde décrémentale

Dans ce cas on sauvegarde tous les fichiers puis on produit une sauvegarde de ce qui a changé depuis la dernière sauvegarde complète. Cette sauvegarde est appelée une sauvegarde décrémentale :

La restauration nécessite :

- La dernière sauvegarde complète.

La restauration de J-1 nécessite :

- La dernière sauvegarde complète,
- La sauvegarde décrémentale J.

Par exemple pour obtenir un état du système J1 quand on est à J2, il convient de restaurer la sauvegarde complète de J2 qui est en réalité J2+J1 puis la sauvegarde décrémentale -J2. De cette façon et d'une manière mathématique on obtient : J2 + J1 -J2 = J1.

Avantage :

- Restauration plus rapide et plus simple que les restaurations à partir de sauvegardes différentielles et incrémentales.

Inconvénient :

- Nécessite plus de manipulation de données à chaque sauvegarde.

Outils classiques de sauvegarde

Préparation

Afin de poursuivre, il convient de créer une arborescence à sauvegarder :

```
[root@redhat9 ~]# mkdir -p /test/repY; mkdir /test/repZ
[root@redhat9 ~]# cd /test/repY; touch Y1 Y2 Y3
[root@redhat9 repY]# cd /test/repZ; touch Z1 Z2
[root@redhat9 repZ]# ls -lR /test
/test:
total 0
drwxr-xr-x. 2 root root 36 Sep 27 07:51 repY
drwxr-xr-x. 2 root root 26 Sep 27 07:51 repZ

/test/repY:
total 0
-rw-r--r--. 1 root root 0 Sep 27 07:51 Y1
```

```
-rw-r--r--. 1 root root 0 Sep 27 07:51 Y2
-rw-r--r--. 1 root root 0 Sep 27 07:51 Y3

/test/repZ:
total 0
-rw-r--r--. 1 root root 0 Sep 27 07:51 Z1
-rw-r--r--. 1 root root 0 Sep 27 07:51 Z2
```

La Commande tar

Présentation

Le programme **tar** a été originellement prévu pour sauvegarder sur des bandes magnétiques, d'où son nom issu de **tape archiver**.

La commande **tar** peut sauvegarder vers :

- un fichier spécial, par exemple le nom d'un lecteur de bande,
- un fichier ordinaire sur disque,
- la sortie standard pour être utilisé dans un pipe.

Options de la Commande

Les options de la commande tar sont :

```
[root@redhat9 repZ]# tar --help
Usage: tar [OPTION...] [FILE]...
GNU 'tar' saves many files together into a single tape or disk archive, and can
restore individual files from the archive.

Examples:
  tar -cf archive.tar foo bar  # Create archive.tar from files foo and bar.
```

```
 tar -tvf archive.tar         # List all files in archive.tar verbosely.
 tar -xf archive.tar          # Extract all files from archive.tar.

Main operation mode:
 -A, --catenate, --concatenate   append tar files to an archive
 -c, --create               create a new archive
     --delete               delete from the archive (not on mag tapes!)
 -d, --diff, --compare      find differences between archive and file system
 -r, --append               append files to the end of an archive
     --test-label           test the archive volume label and exit
 -t, --list                 list the contents of an archive
 -u, --update               only append files newer than copy in archive
 -x, --extract, --get       extract files from an archive

Operation modifiers:

     --check-device         check device numbers when creating incremental
                            archives (default)
 -g, --listed-incremental=FILE   handle new GNU-format incremental backup
 -G, --incremental          handle old GNU-format incremental backup
     --hole-detection=TYPE  technique to detect holes
     --ignore-failed-read   do not exit with nonzero on unreadable files
     --level=NUMBER         dump level for created listed-incremental archive
     --no-check-device      do not check device numbers when creating
                            incremental archives
     --no-seek              archive is not seekable
 -n, --seek                 archive is seekable
     --occurrence[=NUMBER]  process only the NUMBERth occurrence of each file
                            in the archive; this option is valid only in
                            conjunction with one of the subcommands --delete,
                            --diff, --extract or --list and when a list of
                            files is given either on the command line or via
                            the -T option; NUMBER defaults to 1
     --sparse-version=MAJOR[.MINOR]
```

```
                           set version of the sparse format to use (implies
                           --sparse)
 -S, --sparse              handle sparse files efficiently

Local file name selection:
     --add-file=FILE       add given FILE to the archive (useful if its name
                           starts with a dash)
 -C, --directory=DIR       change to directory DIR
     --exclude=PATTERN     exclude files, given as a PATTERN
     --exclude-backups     exclude backup and lock files
     --exclude-caches      exclude contents of directories containing
                           CACHEDIR.TAG, except for the tag file itself
     --exclude-caches-all  exclude directories containing CACHEDIR.TAG
     --exclude-caches-under exclude everything under directories containing
                           CACHEDIR.TAG
     --exclude-ignore=FILE  read exclude patterns for each directory from
                           FILE, if it exists
     --exclude-ignore-recursive=FILE
                           read exclude patterns for each directory and its
                           subdirectories from FILE, if it exists
     --exclude-tag=FILE    exclude contents of directories containing FILE,
                           except for FILE itself
     --exclude-tag-all=FILE exclude directories containing FILE
     --exclude-tag-under=FILE   exclude everything under directories
                           containing FILE
     --exclude-vcs         exclude version control system directories
     --exclude-vcs-ignores  read exclude patterns from the VCS ignore files
     --no-null             disable the effect of the previous --null option
     --no-recursion        avoid descending automatically in directories
     --no-unquote          do not unquote input file or member names
     --no-verbatim-files-from   -T treats file names starting with dash as
                           options (default)
     --null                -T reads null-terminated names; implies
                           --verbatim-files-from
```

```
      --recursion             recurse into directories (default)
  -T, --files-from=FILE       get names to extract or create from FILE
      --unquote               unquote input file or member names (default)
      --verbatim-files-from   -T reads file names verbatim (no escape or option
                              handling)
  -X, --exclude-from=FILE     exclude patterns listed in FILE

File name matching options (affect both exclude and include patterns):

      --anchored              patterns match file name start
      --ignore-case           ignore case
      --no-anchored           patterns match after any '/' (default for
                              exclusion)
      --no-ignore-case        case sensitive matching (default)
      --no-wildcards          verbatim string matching
      --no-wildcards-match-slash   wildcards do not match '/'
      --wildcards             use wildcards (default for exclusion)
      --wildcards-match-slash   wildcards match '/' (default)

Overwrite control:

      --keep-directory-symlink   preserve existing symlinks to directories when
                              extracting
      --keep-newer-files      don't replace existing files that are newer than
                              their archive copies
  -k, --keep-old-files        don't replace existing files when extracting,
                              treat them as errors
      --no-overwrite-dir      preserve metadata of existing directories
      --one-top-level[=DIR]   create a subdirectory to avoid having loose files
                              extracted
      --overwrite             overwrite existing files when extracting
      --overwrite-dir         overwrite metadata of existing directories when
                              extracting (default)
      --recursive-unlink      empty hierarchies prior to extracting directory
```

```
      --remove-files         remove files after adding them to the archive
      --skip-old-files       don't replace existing files when extracting,
                             silently skip over them
  -U, --unlink-first         remove each file prior to extracting over it
  -W, --verify               attempt to verify the archive after writing it

Select output stream:

      --ignore-command-error ignore exit codes of children
      --no-ignore-command-error   treat non-zero exit codes of children as
                             error
  -O, --to-stdout            extract files to standard output
      --to-command=COMMAND   pipe extracted files to another program

Handling of file attributes:

      --atime-preserve[=METHOD]   preserve access times on dumped files, either
                             by restoring the times after reading
                             (METHOD='replace'; default) or by not setting the
                             times in the first place (METHOD='system')
      --clamp-mtime          only set time when the file is more recent than
                             what was given with --mtime
      --delay-directory-restore   delay setting modification times and
                             permissions of extracted directories until the end
                             of extraction
      --group=NAME           force NAME as group for added files
      --group-map=FILE       use FILE to map file owner GIDs and names
      --mode=CHANGES         force (symbolic) mode CHANGES for added files
      --mtime=DATE-OR-FILE   set mtime for added files from DATE-OR-FILE
  -m, --touch                don't extract file modified time
      --no-delay-directory-restore
                             cancel the effect of --delay-directory-restore
                             option
      --no-same-owner        extract files as yourself (default for ordinary
```

```
                            users)
     --no-same-permissions  apply the user's umask when extracting permissions
                            from the archive (default for ordinary users)
     --numeric-owner        always use numbers for user/group names
     --owner=NAME           force NAME as owner for added files
     --owner-map=FILE       use FILE to map file owner UIDs and names
 -p, --preserve-permissions, --same-permissions
                            extract information about file permissions
                            (default for superuser)
     --same-owner           try extracting files with the same ownership as
                            exists in the archive (default for superuser)
     --sort=ORDER           directory sorting order: none (default), name or
                            inode
 -s, --preserve-order, --same-order
                            member arguments are listed in the same order as
                            the files in the archive

Handling of extended file attributes:

     --acls                 Enable the POSIX ACLs support
     --no-acls              Disable the POSIX ACLs support
     --no-selinux           Disable the SELinux context support
     --no-xattrs            Disable extended attributes support
     --selinux              Enable the SELinux context support
     --xattrs               Enable extended attributes support
     --xattrs-exclude=MASK  specify the exclude pattern for xattr keys
     --xattrs-include=MASK  specify the include pattern for xattr keys

Device selection and switching:

     --force-local          archive file is local even if it has a colon
 -f, --file=ARCHIVE         use archive file or device ARCHIVE
 -F, --info-script=NAME, --new-volume-script=NAME
                            run script at end of each tape (implies -M)
```

```
 -L, --tape-length=NUMBER   change tape after writing NUMBER x 1024 bytes
 -M, --multi-volume         create/list/extract multi-volume archive
     --rmt-command=COMMAND  use given rmt COMMAND instead of rmt
     --rsh-command=COMMAND  use remote COMMAND instead of rsh
     --volno-file=FILE      use/update the volume number in FILE

Device blocking:

 -b, --blocking-factor=BLOCKS   BLOCKS x 512 bytes per record
 -B, --read-full-records    reblock as we read (for 4.2BSD pipes)
 -i, --ignore-zeros         ignore zeroed blocks in archive (means EOF)
     --record-size=NUMBER   NUMBER of bytes per record, multiple of 512

Archive format selection:

 -H, --format=FORMAT        create archive of the given format

FORMAT is one of the following:
   gnu                      GNU tar 1.13.x format
   oldgnu                   GNU format as per tar <= 1.12
   pax                      POSIX 1003.1-2001 (pax) format
   posix                    same as pax
   ustar                    POSIX 1003.1-1988 (ustar) format
   v7                       old V7 tar format

     --old-archive, --portability
                            same as --format=v7
     --pax-option=keyword[[:]=value][,keyword[[:]=value]]...
                            control pax keywords
     --posix                same as --format=posix
 -V, --label=TEXT           create archive with volume name TEXT; at
                            list/extract time, use TEXT as a globbing pattern
                            for volume name
```

```
Compression options:

 -a, --auto-compress        use archive suffix to determine the compression
                            program
 -I, --use-compress-program=PROG
                            filter through PROG (must accept -d)
 -j, --bzip2                filter the archive through bzip2
 -J, --xz                   filter the archive through xz
     --lzip                 filter the archive through lzip
     --lzma                 filter the archive through xz --format=lzma
     --lzop                 filter the archive through lzop
     --no-auto-compress     do not use archive suffix to determine the
                            compression program
     --zstd                 filter the archive through zstd
 -z, --gzip, --gunzip, --ungzip   filter the archive through gzip
 -Z, --compress, --uncompress   filter the archive through compress

Local file selection:

     --backup[=CONTROL]     backup before removal, choose version CONTROL
     --hard-dereference     follow hard links; archive and dump the files they
                            refer to
 -h, --dereference          follow symlinks; archive and dump the files they
                            point to
 -K, --starting-file=MEMBER-NAME
                            begin at member MEMBER-NAME when reading the
                            archive
     --newer-mtime=DATE     compare date and time when data changed only
 -N, --newer=DATE-OR-FILE, --after-date=DATE-OR-FILE
                            only store files newer than DATE-OR-FILE
     --one-file-system      stay in local file system when creating archive
 -P, --absolute-names       don't strip leading '/'s from file names
     --suffix=STRING        backup before removal, override usual suffix ('~'
                            unless overridden by environment variable
```

```
                            SIMPLE_BACKUP_SUFFIX)

File name transformations:

     --strip-components=NUMBER   strip NUMBER leading components from file
                            names on extraction
     --transform=EXPRESSION, --xform=EXPRESSION
                            use sed replace EXPRESSION to transform file
                            names

Informative output:

     --checkpoint[=NUMBER]  display progress messages every NUMBERth record
                            (default 10)
     --checkpoint-action=ACTION   execute ACTION on each checkpoint
     --full-time            print file time to its full resolution
     --index-file=FILE      send verbose output to FILE
 -l, --check-links          print a message if not all links are dumped
     --no-quote-chars=STRING   disable quoting for characters from STRING
     --quote-chars=STRING   additionally quote characters from STRING
     --quoting-style=STYLE  set name quoting style; see below for valid STYLE
                            values
 -R, --block-number         show block number within archive with each message
     --show-defaults        show tar defaults
     --show-omitted-dirs    when listing or extracting, list each directory
                            that does not match search criteria
     --show-snapshot-field-ranges
                            show valid ranges for snapshot-file fields
     --show-transformed-names, --show-stored-names
                            show file or archive names after transformation
     --totals[=SIGNAL]      print total bytes after processing the archive;
                            with an argument - print total bytes when this
                            SIGNAL is delivered; Allowed signals are: SIGHUP,
                            SIGQUIT, SIGINT, SIGUSR1 and SIGUSR2; the names
```

```
                             without SIG prefix are also accepted
      --utc                  print file modification times in UTC
  -v, --verbose              verbosely list files processed
      --warning=KEYWORD      warning control
  -w, --interactive, --confirmation
                             ask for confirmation for every action

 Compatibility options:

  -o                         when creating, same as --old-archive; when
                             extracting, same as --no-same-owner

 Other options:

  -?, --help                 give this help list
      --restrict             disable use of some potentially harmful options
      --usage                give a short usage message
      --version              print program version

Mandatory or optional arguments to long options are also mandatory or optional
for any corresponding short options.

The backup suffix is '~', unless set with --suffix or SIMPLE_BACKUP_SUFFIX.
The version control may be set with --backup or VERSION_CONTROL, values are:

  none, off       never make backups
  t, numbered     make numbered backups
  nil, existing   numbered if numbered backups exist, simple otherwise
  never, simple   always make simple backups

Valid arguments for the --quoting-style option are:

  literal
  shell
```

```
  shell-always
  shell-escape
  shell-escape-always
  c
  c-maybe
  escape
  locale
  clocale

*This* tar defaults to:
--format=gnu -f- -b20 --quoting-style=escape --rmt-command=/etc/rmt
--rsh-command=/usr/bin/ssh
```

LAB #1 - Travailler avec la Commande tar

Vous allez maintenant sauvegarder votre dossier **test** ainsi que son contenu vers un fichier :

```
[root@redhat9 repZ]# tar cvf /tmp/test.tar /test
tar: Removing leading `/' from member names
/test/
/test/repY/
/test/repY/Y1
/test/repY/Y2
/test/repY/Y3
/test/repZ/
/test/repZ/Z1
/test/repZ/Z2
```

Pour visualiser la **table of contents** de votre sauvegarde, utilisez la commande suivante :

```
[root@redhat9 repZ]# tar tvf /tmp/test.tar
drwxr-xr-x root/root         0 2024-09-27 07:51 test/
```

```
drwxr-xr-x root/root         0 2024-09-27 07:51 test/repY/
-rw-r--r-- root/root         0 2024-09-27 07:51 test/repY/Y1
-rw-r--r-- root/root         0 2024-09-27 07:51 test/repY/Y2
-rw-r--r-- root/root         0 2024-09-27 07:51 test/repY/Y3
drwxr-xr-x root/root         0 2024-09-27 07:51 test/repZ/
-rw-r--r-- root/root         0 2024-09-27 07:51 test/repZ/Z1
-rw-r--r-- root/root         0 2024-09-27 07:51 test/repZ/Z2
```

Afin de créer une sauvegarde incrémentale, vous avez besoin de créer un fichier qui servira de référence de date :

```
[root@redhat9 repZ]# touch /tmp/dateref
```

Modifiez maintenant deux des fichiers de votre arborescence **test** :

```
[root@redhat9 repZ]# echo "CentOS est super \!" > /test/repY/Y1

[root@redhat9 repZ]# echo "RHEL is wonderful \!" > /test/repZ/Z1
```

Pour procéder à votre sauvegarde incrémentale, vous devez sauvegarder uniquement les fichiers modifiés ou créés depuis la création de votre fichier **/tmp/dateref**.

Saisissez donc la commande suivante :

```
[root@redhat9 repZ]# tar -cvf /tmp/incremental.tar -N /tmp/dateref /test
tar: Removing leading `/' from member names
/test/
/test/repY/
/test/repY/Y1
tar: /test/repY/Y2: file is unchanged; not dumped
tar: /test/repY/Y3: file is unchanged; not dumped
/test/repZ/
/test/repZ/Z1
tar: /test/repZ/Z2: file is unchanged; not dumped
```

Important - Notez l'utilisation de l'option **-N** avec l'argument **/tmp/dateref** qui permet d'identifier les fichiers modifiés ou créés depuis la création de **/tmp/dateref**.

Contrôlez maintenant le contenu de l'archive **/tmp/incremental.tar** :

```
[root@redhat9 repZ]# tar tvf /tmp/incremental.tar
drwxr-xr-x root/root         0 2024-09-27 07:51 test/
drwxr-xr-x root/root         0 2024-09-27 07:51 test/repY/
-rw-r--r-- root/root        20 2024-09-27 07:58 test/repY/Y1
drwxr-xr-x root/root         0 2024-09-27 07:51 test/repZ/
-rw-r--r-- root/root        21 2024-09-27 07:58 test/repZ/Z1
```

Supprimez maintenant le contenu du répertoire **test** :

```
[root@redhat9 ~]# rm -rf /test/*
```

Important - Notez que le système vous permet de supprimer le répertoire **/test/repZ**, or vous vous situez dans ce même répertoire !

Afin de pouvoir restaurer les fichiers de votre première sauvegarde, placez-vous à la racine de votre système et restaurez le contenu de votre répertoire **test** en saisissant la commande tar suivante :

```
[root@redhat9 ~]# cd /
[root@redhat9 /]# tar xvf /tmp/test.tar
test/
test/repY/
test/repY/Y1
test/repY/Y2
```

```
test/repY/Y3
test/repZ/
test/repZ/Z1
test/repZ/Z2
```

Constatez maintenant que l'opération s'est bien déroulée :

```
root@redhat9 /]# ls -lR /test
/test:
total 0
drwxr-xr-x. 2 root root 36 Sep 27 07:51 repY
drwxr-xr-x. 2 root root 26 Sep 27 07:51 repZ

/test/repY:
total 0
-rw-r--r--. 1 root root 0 Sep 27 07:51 Y1
-rw-r--r--. 1 root root 0 Sep 27 07:51 Y2
-rw-r--r--. 1 root root 0 Sep 27 07:51 Y3

/test/repZ:
total 0
-rw-r--r--. 1 root root 0 Sep 27 07:51 Z1
-rw-r--r--. 1 root root 0 Sep 27 07:51 Z2
```

Important - Notez qu'à ce stade les fichiers **/test/repY/Y1** et **/test/repZ/Z1** sont vides.

Restaurez maintenant votre archive incrémentale :

```
[root@redhat9 /]# tar xvf /tmp/incremental.tar
test/
test/repY/
```

```
test/repY/Y1
test/repZ/
test/repZ/Z1
```

Constatez maintenant que l'opération s'est bien déroulée :

```
[root@redhat9 /]# ls -lR /test
/test:
total 0
drwxr-xr-x. 2 root root 36 Sep 27 07:51 repY
drwxr-xr-x. 2 root root 26 Sep 27 07:51 repZ

/test/repY:
total 4
-rw-r--r--. 1 root root 20 Sep 27 07:58 Y1
-rw-r--r--. 1 root root  0 Sep 27 07:51 Y2
-rw-r--r--. 1 root root  0 Sep 27 07:51 Y3

/test/repZ:
total 4
-rw-r--r--. 1 root root 21 Sep 27 07:58 Z1
-rw-r--r--. 1 root root  0 Sep 27 07:51 Z2
```

Important - Notez que les fichiers **/test/repY/Y1** et **/test/repZ/Z1** sont maintenant non-vides.

La Commande GPL tar et la Compression

Dernièrement, la commande tar peut archiver en utilisant des algorithmes de compression :

Algorythme	Option de la commande tar
gzip	z
bzip2	j
lzma	J

La Commande cpio

Présentation

La commande **cpio** (Copy Input To Output). cpio peut gérer les archives au format **tar**. La différence majeure entre tar et cpio est que ce dernier stocke les chemins d'accès aux fichiers sauvgardés en même temps que les fichiers eux-mêmes. Ceci implique que dans le cas où le chemin absolu a été spécifié lors de la sauvegarde, il est impossible de restaurer un fichier à un autre emplacement que son emplacement d'origine.

Vous allez utiliser maintenant le logiciel **cpio** pour effectuer les sauvegardes et restaurations.

Options de la Commande

Les options de la commande **cpio** sont :

```
[root@redhat9 /]# cpio --help
Usage: cpio [OPTION...] [destination-directory]
GNU `cpio' copies files to and from archives

Examples:
  # Copy files named in name-list to the archive
  cpio -o < name-list [> archive]
  # Extract files from the archive
  cpio -i [< archive]
  # Copy files named in name-list to destination-directory
  cpio -p destination-directory < name-list
```

```
Main operation mode:
 -i, --extract              Extract files from an archive (run in copy-in
                            mode)
 -o, --create               Create the archive (run in copy-out mode)
 -p, --pass-through         Run in copy-pass mode
 -t, --list                 Print a table of contents of the input

Operation modifiers valid in any mode:

     --block-size=BLOCK-SIZE   Set the I/O block size to BLOCK-SIZE * 512
                            bytes
 -B                         Set the I/O block size to 5120 bytes
 -c                         Identical to "-H newc", use the new (SVR4)
                            portable format. If you wish the old portable
                            (ASCII) archive format, use "-H odc" instead.
 -C, --io-size=NUMBER       Set the I/O block size to the given NUMBER of
                            bytes
 -D, --directory=DIR        Change to directory DIR
     --force-local          Archive file is local, even if its name contains
                            colons
 -H, --format=FORMAT        Use given archive FORMAT
     --quiet                Do not print the number of blocks copied
 -R, --owner=[USER][:.][GROUP]   Set the ownership of all files created to the
                            specified USER and/or GROUP
 -v, --verbose              Verbosely list the files processed
 -V, --dot                  Print a "." for each file processed
 -W, --warning=FLAG         Control warning display. Currently FLAG is one of
                            'none', 'truncate', 'all'. Multiple options
                            accumulate.

Operation modifiers valid in copy-in and copy-out modes

 -F, --file=[[USER@]HOST:]FILE-NAME
                            Use this FILE-NAME instead of standard input or
```

```
                            output. Optional USER and HOST specify the user
                            and host names in case of a remote archive
 -M, --message=STRING       Print STRING when the end of a volume of the
                            backup media is reached
     --rsh-command=COMMAND  Use COMMAND instead of rsh

Operation modifiers valid only in copy-in mode:

 -b, --swap                 Swap both halfwords of words and bytes of
                            halfwords in the data. Equivalent to -sS
 -f, --nonmatching          Only copy files that do not match any of the given
                            patterns
 -I [[USER@]HOST:]FILE-NAME Archive filename to use instead of standard input.
                            Optional USER and HOST specify the user and host
                            names in case of a remote archive
 -n, --numeric-uid-gid      In the verbose table of contents listing, show
                            numeric UID and GID
 -r, --rename               Interactively rename files
 -s, --swap-bytes           Swap the bytes of each halfword in the files
 -S, --swap-halfwords       Swap the halfwords of each word (4 bytes) in the
                            files
     --to-stdout            Extract files to standard output

 -E, --pattern-file=FILE    Read additional patterns specifying filenames to
                            extract or list from FILE
     --only-verify-crc      When reading a CRC format archive, only verify the
                            checksum of each file in the archive, don't
                            actually extract the files

Operation modifiers valid only in copy-out mode:

 -A, --append               Append to an existing archive.
     --device-independent, --reproducible
                            Create device-independent (reproducible) archives
```

```
     --ignore-devno         Don't store device numbers
 -O [[USER@]HOST:]FILE-NAME Archive filename to use instead of standard
                            output. Optional USER and HOST specify the user
                            and host names in case of a remote archive
     --renumber-inodes      Renumber inodes

Operation modifiers valid only in copy-pass mode:

 -l, --link                 Link files instead of copying them, when
                            possible

Operation modifiers valid in copy-in and copy-out modes:

     --absolute-filenames   Do not strip file system prefix components from
                            the file names
     --no-absolute-filenames   Create all files relative to the current
                            directory

Operation modifiers valid in copy-out and copy-pass modes:

 -0, --null                 Filenames in the list are delimited by null
                            characters instead of newlines
 -a, --reset-access-time    Reset the access times of files after reading
                            them
 -L, --dereference          Dereference  symbolic  links  (copy  the files
                            that they point to instead of copying the links).

Operation modifiers valid in copy-in and copy-pass modes:

 -d, --make-directories     Create leading directories where needed
 -m, --preserve-modification-time
                            Retain previous file modification times when
                            creating files
     --no-preserve-owner    Do not change the ownership of the files
```

```
      --sparse               Write files with large blocks of zeros as sparse
                             files
  -u, --unconditional        Replace all files unconditionally

  -?, --help                 give this help list
      --usage                give a short usage message
      --version              print program version

Mandatory or optional arguments to long options are also mandatory or optional
for any corresponding short options.

Report bugs to <bug-cpio@gnu.org>.
```

LAB #2 - Travailler avec la Commande cpio

Dans un premier temps, vous devez utiliser la commande **find** pour construire une liste de fichiers à sauvegarder :

```
[root@redhat9 /]# find /test > /tmp/cpio.list
[root@redhat9 /]# cat /tmp/cpio.list
/test
/test/repY
/test/repY/Y2
/test/repY/Y3
/test/repY/Y1
/test/repZ
/test/repZ/Z2
/test/repZ/Z1
```

Sauvegardez maintenant les fichiers et répertoires référencés par le fichier **/tmp/cpio.list** :

```
[root@redhat9 /]# cpio -ov < /tmp/cpio.list > /tmp/test.cpio
/test
```

```
/test/repY
/test/repY/Y2
/test/repY/Y3
/test/repY/Y1
/test/repZ
/test/repZ/Z2
/test/repZ/Z1
1 block
```

Consultez maintenant la **table of contents** de votre sauvegarde :

```
[root@redhat9 /]# cpio -it < /tmp/test.cpio
/test
/test/repY
/test/repY/Y2
/test/repY/Y3
/test/repY/Y1
/test/repZ
/test/repZ/Z2
/test/repZ/Z1
1 block
```

Supprimez maintenant le répertoire **/test/repY** et son contenu :

```
[root@redhat9 /]# rm -rf /test/repY
```

Contrôlez le bon déroulement de la suppression :

```
[root@redhat9 /]# ls -lR /test
/test:
total 0
drwxr-xr-x. 2 root root 26 Sep 27 07:51 repZ

/test/repZ:
```

```
total 4
-rw-r--r--. 1 root root 21 Sep 27 07:58 Z1
-rw-r--r--. 1 root root  0 Sep 27 07:51 Z2
```

Restaurez les fichiers supprimés :

```
[root@redhat9 /]# cpio -ivdum "/test/repY/*" < /tmp/test.cpio
/test/repY/Y2
/test/repY/Y3
/test/repY/Y1
1 block
```

Important - Notez l'utilisation de la chaîne **“/test/repY/*”** qui permet de rechercher uniquement le répertoire **repY** ainsi que les fichiers **Y1**, **Y2** et **Y3** dans l'archive test.cpio.

Contrôlez le bon déroulement de la restauration :

```
[root@redhat9 /]# ls -lR /test
/test:
total 0
drwxr-xr-x. 2 root root 36 Sep 27 08:10 repY
drwxr-xr-x. 2 root root 26 Sep 27 07:51 repZ

/test/repY:
total 4
-rw-r--r--. 1 root root 20 Sep 27 07:58 Y1
-rw-r--r--. 1 root root  0 Sep 27 07:51 Y2
-rw-r--r--. 1 root root  0 Sep 27 07:51 Y3

/test/repZ:
total 4
```

```
-rw-r--r--. 1 root root 21 Sep 27 07:58 Z1
-rw-r--r--. 1 root root  0 Sep 27 07:51 Z2
```

La Commande dd

Présentation

La commande **dd** n'est pas réellement une commande de sauvegarde.

La commande **dd** copie le fichier passé en entrée dans le fichier de sortie en limitant le nombre d'octets copiés par l'utilisation de deux options :

- **count**
  - le nombre
- **bs**
  - la taille du bloc à copier

Options de la Commande

Les options de la commande **dd** sont :

```
[root@redhat9 /]# dd --help
Usage: dd [OPERAND]...
  or:  dd OPTION
Copy a file, converting and formatting according to the operands.

  bs=BYTES        read and write up to BYTES bytes at a time (default: 512);
                  overrides ibs and obs
  cbs=BYTES       convert BYTES bytes at a time
  conv=CONVS      convert the file as per the comma separated symbol list
  count=N         copy only N input blocks
  ibs=BYTES       read up to BYTES bytes at a time (default: 512)
```

```
  if=FILE         read from FILE instead of stdin
  iflag=FLAGS     read as per the comma separated symbol list
  obs=BYTES       write BYTES bytes at a time (default: 512)
  of=FILE         write to FILE instead of stdout
  oflag=FLAGS     write as per the comma separated symbol list
  seek=N          skip N obs-sized blocks at start of output
  skip=N          skip N ibs-sized blocks at start of input
  status=LEVEL    The LEVEL of information to print to stderr;
                  'none' suppresses everything but error messages,
                  'noxfer' suppresses the final transfer statistics,
                  'progress' shows periodic transfer statistics

N and BYTES may be followed by the following multiplicative suffixes:
c=1, w=2, b=512, kB=1000, K=1024, MB=1000*1000, M=1024*1024, xM=M,
GB=1000*1000*1000, G=1024*1024*1024, and so on for T, P, E, Z, Y.
Binary prefixes can be used, too: KiB=K, MiB=M, and so on.

Each CONV symbol may be:

  ascii     from EBCDIC to ASCII
  ebcdic    from ASCII to EBCDIC
  ibm       from ASCII to alternate EBCDIC
  block     pad newline-terminated records with spaces to cbs-size
  unblock   replace trailing spaces in cbs-size records with newline
  lcase     change upper case to lower case
  ucase     change lower case to upper case
  sparse    try to seek rather than write all-NUL output blocks
  swab      swap every pair of input bytes
  sync      pad every input block with NULs to ibs-size; when used
            with block or unblock, pad with spaces rather than NULs
  excl      fail if the output file already exists
  nocreat   do not create the output file
  notrunc   do not truncate the output file
  noerror   continue after read errors
```

```
  fdatasync  physically write output file data before finishing
  fsync      likewise, but also write metadata

Each FLAG symbol may be:

  append    append mode (makes sense only for output; conv=notrunc suggested)
  direct    use direct I/O for data
  directory  fail unless a directory
  dsync     use synchronized I/O for data
  sync      likewise, but also for metadata
  fullblock  accumulate full blocks of input (iflag only)
  nonblock  use non-blocking I/O
  noatime   do not update access time
  nocache   Request to drop cache.  See also oflag=sync
  noctty    do not assign controlling terminal from file
  nofollow  do not follow symlinks
  count_bytes  treat 'count=N' as a byte count (iflag only)
  skip_bytes  treat 'skip=N' as a byte count (iflag only)
  seek_bytes  treat 'seek=N' as a byte count (oflag only)

Sending a USR1 signal to a running 'dd' process makes it
print I/O statistics to standard error and then resume copying.

Options are:

      --help     display this help and exit
      --version  output version information and exit

GNU coreutils online help: <https://www.gnu.org/software/coreutils/>
Full documentation <https://www.gnu.org/software/coreutils/dd>
or available locally via: info '(coreutils) dd invocation'
```

LAB #3 - Travailler avec la Commande dd

Vous allez utiliser maintenant le logiciel **dd** pour effectuer une sauvegarde de votre MBR et de la table des partitions.

Effectuez une sauvegarde de votre MBR qui se trouve dans les premiers 446 octets de votre disque **/dev/sda** :

```
[root@redhat9 /]# dd if=/dev/sda of=/tmp/mbr.save bs=1 count=446
446+0 records in
446+0 records out
446 bytes copied, 0.00114645 s, 389 kB/s
```

Effectuez maintenant une sauvegarde de votre table des partitions qui se trouve dans les 64 octets après les 446 précédemment sauvegardés :

```
[root@redhat9 /]# dd if=/dev/sda of=/tmp/tblpart.save bs=1 count=64 skip=446
64+0 records in
64+0 records out
64 bytes copied, 0.000282251 s, 227 kB/s
```

> **Important** - Notez l'utilisation de l'option **skip** qui permet de positionner le début de la sauvegarde au 447ième octet.

Les Commandes dump et restore

Présentation

Les commandes **dump** et **restore** se basent sur le format d'enregistrement des données (ext3). Pour cette raison il n'est pas possible de sauvegarder des répertoires à l'intérieur d'un système de fichiers mais uniquement des systèmes de fichiers complets.

Il est important de noter que le système de fichier ne doit pas être utilisé pendant le processus de dump. Pour cette raison il est normalement conseillé

de démonter le système de fichiers.

Il existe 10 niveaux de dump possibles de **0** à **9**. Lors d'un dump le niveau est spécifié. Chaque fois qu'un dump est effectué, cette information est sauvegardée dans le fichier /etc/dumpdates.

Par définition un dump de niveau **0** est une sauvegarde complète tandis que le dump de niveau 1 est une sauvegarde incrémentale.

Notez que les fichiers sont sauvegardés avec des nom relatifs. Ceci implique que vous devez vous positionner dans le système de fichiers lors de la restauration avec la commande **restore**.

Outils Avancés de Sauvegarde

Outils de Sauvegarde Unidirectionnelle

Ces outils sauvegardent des fichiers vers un répertoire local ou distant dans un seul sens.

Ce premier tableau compare les outils par rapport aux caractéristiques et aux capacités des opérations de sauvegarde :

Outil	Backend	Sauvegarde différentielle	Sauvegarde incrémentale	Sauvegarde décrémentale	Planification incorporée	Restauration incorporée	Chiffrement	Compression	Site
AMANDA	tar, gzip	✗	✗	✗	✗	✗	✗	✗	**AMANDA**
Areca Backup	Aucun	✗	✗	✗	✗	✗	✗	✗	**Areca Backup**
bacula (Bareos)	MySQL	✗	✗	✗	✗	✗	✗	✗	**bacula**
BackInTime	rsync, diff, meld	✗	✗	✗	✗	✗	✗	✗	**BackInTime**
BackupPC	rsync, samba, tar	✗	✗	✗	✗	✗	✗	✗	**BackupPC**
Dar	Aucun	✗	✗	✗	✗	✗	✗	✗	**Dar**
Déjà Dup	duplicity	✗	✗	✗	✗	✗	✗	✗	**Duplicity**
Grsync	rsync	✗	✗	✗	✗	✗	✗	✗	**Grsync**

Outil	Backend	Sauvegarde différentielle	Sauvegarde incrémentale	Sauvegarde décrémentale	Planification incorporée	Restauration incorporée	Chiffrement	Compression	Site
luckyBackup	rsync	✗	✗	✗	✗	✗	✗	✗	luckyBackup
SBackup	Aucun	✗	✗	✗	✗	✗	✗	✗	SBackup

A Faire - Consultez la page **List of backup software** sur Wikipedia pour plus d'informations.

Ce deuxième tableau compare les outils triés par la date de dernière version connue :

Outil	Ecrit en	Licence	Dernière Version	Date Version	Linux	Windows	Mac	Site Web
Dar	C++	GPL	2.6.2	09/02/2019	✗	✗	✗	Dar
Bacula (Bareos)	C, C++	GNU Affero General Public License v3.0	9.4.2	04/02/2019	✗	✗	✗	bacula
BackupPC	Perl	GPL v3.0	4.3.0	25/11/2018	✗	✗	✗	BackupPC
luckyBackup	C++	GPL v3.0	0.5.0	18/11/2018	✗	✗	✗	luckyBackup
Déjà Dup (Duplicity)	Python	GPL	0.7.18.2	17/11/2018	✗	✗	✗	Duplicity
AMANDA	C, Perl	GPL, LGPL, Apache, Amanda License	3.5.1	01/12/2017	✗	✗	✗	AMANDA
BackInTime	Python3	GPL	1.1.24	07/11/2017	✗	✗	✗	BackInTime
Grsync	GTK	GPL	1.2.6	15/03/2016	✗	✗	✗	Grsync
Areca Backup	Java	GPLv2	7.5	26/08/2015	✗	✗	✗	Areca Backup
SBackup	GTK	GPLv2	0.11.6	24/02/2014	✗	✗	✗	SBackup

Outils de Sauvegarde Multidirectionnelle

Ces outils synchronisent les fichiers entre deux serveurs.

Ce premier tableau compare les outils par rapport aux caractéristiques et aux capacités des opérations de sauvegarde :

Outil	Backend	Sauvegarde différentielle	Sauvegarde incrémentale	Sauvegarde décrémentale	Planification incorporée	Restauration incorporée	Chiffrement	Compression

Outil	Backend	Sauvegarde différentielle	Sauvegarde incrémentale	Sauvegarde décrémentale	Planification incorporée	Restauration incorporée	Chiffrement	Compression
FullSync	smb, ftp, sftp	✗	✗	✗	✗	S/O	✗	✗
FreeFileSync	Aucun	✗	✗	✗	✗	S/O	✗	✗
unison	SSH, RSH	✗	✗	✗	✗	S/O	✗	✗
Synkron	Aucun	✗	✗	✗	✗	✗	✗	✗

A Faire - Consultez la page **Comparison of file synchronization software** sur Wikipedia pour plus d'informations..

Ce deuxième tableau compare les outils triés par la date de dernière version connue :

Outil	Ecrit en	Licence	Dernière Version	Date Version	Linux	Windows	Mac	Site Web
FreeFileSync	Divers	GPL v3.0	10.8	05/01/2019	✗	✗	✗	**FreeFileSync**
unison	OCaml	GPL v3.0	2.51.2	27/01/2018	✗	✗	✗	**unison**
FullSync	Java	GPLv2	0.10.4	05/04/2016	✗	✗	✗	**FullSync**
Synkron	C++	GPL v2	1.6.2	25/01/2011	✗	✗	✗	**Synkron**

Outils de Sauvegarde des Partitions

Ce premier tableau compare les outils par rapport aux caractéristiques et aux capacités des opérations de sauvegarde :

Outil	Backend	Sauvegarde différentielle	Sauvegarde incrémentale	Sauvegarde décrémentale	Planification incorporée	Restauration incorporée	Chiffrement	Compression
CloneZilla	SSH, samba, NFS	✗	✗	✗	✗	✗	✗	✗
Partclone	Aucun	✗	✗	✗	✗	✗	✗	✗
partimage	Aucun	✗	✗	✗	✗	✗	✗	✗

A Faire - Consultez la page **Comparison of disk cloning software** sur Wikipedia pour

plus d'informations.

Ce deuxième tableau compare les outils triés par la date de dernière version connue :

Outil	Ecrit en	Licence	Dernière Version	Date Version	Linux	Windows	Mac	Site Web
CloneZilla	Perl, Unix shell	GPL	2.6.0-37	10/01/2019	✗	✗	✗	**CloneZilla**
Partclone	C	GPL	0.2.89	05/07/2016	✗	✗	✗	**Partclone**
partimage	C	GPL	0.6.9	25/07/2010	✗	✗	✗	**Partimage**

LAB #4 - Que Sauvegarder en Priorité ?

Sauvegarde de la Liste des Paquets

Supprimez les fichiers de verrouillage de la base de données RPM :

```
root@redhat9 /]# rm -f /var/lib/rpm/__db*
```

Sauvegardez les bases de données RPM :

```
[root@redhat9 /]# tar czvf $(hostname).rpmdatabase.tar.gz /var/lib/rpm
tar: Removing leading `/' from member names
/var/lib/rpm/
/var/lib/rpm/rpmdb.sqlite
/var/lib/rpm/rpmdb.sqlite-wal
/var/lib/rpm/rpmdb.sqlite-shm
/var/lib/rpm/.rpm.lock
```

Pour sauvegarder la liste des paquets à l'identique en termes de version, utilisez la commande RPM :

```
[root@redhat9 /]# rpm -qa > liste-des-paquets_`hostname`_`date +%Y-%m-%d-%H-%M`
```

Consultez le contenu de ce fichier :

```
[root@redhat9 /]# more liste-des-paquets_redhat9.ittraining.loc_2024-09-27-08-15
fonts-filesystem-2.0.5-7.el9.1.noarch
xkeyboard-config-2.33-2.el9.noarch
abattis-cantarell-fonts-0.301-4.el9.noarch
yelp-xsl-40.2-1.el9.noarch
mozilla-filesystem-1.9-30.el9.x86_64
google-noto-fonts-common-20201206-4.el9.noarch
foomatic-db-filesystem-4.0-72.20210209.el9.noarch
adobe-mappings-cmap-20171205-12.el9.noarch
subscription-manager-rhsm-certificates-20220623-1.el9.noarch
libreport-filesystem-2.15.2-6.el9.noarch
adobe-mappings-cmap-deprecated-20171205-12.el9.noarch
adobe-source-code-pro-fonts-2.030.1.050-12.el9.1.noarch
dejavu-sans-mono-fonts-2.37-18.el9.noarch
dejavu-sans-fonts-2.37-18.el9.noarch
langpacks-core-font-en-3.0-16.el9.noarch
google-droid-sans-fonts-20200215-11.el9.2.noarch
thai-scalable-fonts-common-0.7.2-5.el9.noarch
redhat-indexhtml-9-4.el9_2.noarch
poppler-data-0.4.9-9.el9.noarch
mobile-broadband-provider-info-20210805-2.el9.noarch
man-pages-overrides-9.0.0.0-1.el9.noarch
hunspell-filesystem-1.7.0-11.el9.x86_64
hplip-common-3.21.2-6.el9.x86_64
gawk-all-langpacks-5.1.0-6.el9.x86_64
adwaita-cursor-theme-40.1.1-3.el9.noarch
adobe-mappings-pdf-20180407-10.el9.noarch
vim-filesystem-8.2.2637-20.el9_1.noarch
rhsm-icons-6-1.el9.noarch
filesystem-3.16-2.el9.x86_64
urw-base35-fonts-common-20200910-6.el9.noarch
basesystem-11-13.el9.noarch
```

```
quota-nls-4.06-6.el9.noarch
publicsuffix-list-dafsa-20210518-3.el9.noarch
pkgconf-m4-1.7.3-10.el9.noarch
popt-1.18-8.el9.x86_64
xz-libs-5.2.5-8.el9_0.x86_64
libxcrypt-4.4.18-3.el9.x86_64
bzip2-libs-1.0.8-8.el9.x86_64
libzstd-1.5.1-2.el9.x86_64
libpng-1.6.37-12.el9.x86_64
libcap-ng-0.8.2-7.el9.x86_64
libicu-67.1-9.el9.x86_64
libunistring-0.9.10-15.el9.x86_64
libgpg-error-1.42-5.el9.x86_64
libseccomp-2.5.2-2.el9.x86_64
lcms2-2.12-3.el9.x86_64
readline-8.1-4.el9.x86_64
libwayland-client-1.21.0-1.el9.x86_64
libwayland-server-1.21.0-1.el9.x86_64
jansson-2.14-1.el9.x86_64
libxkbcommon-1.0.3-4.el9.x86_64
libwayland-egl-1.21.0-1.el9.x86_64
keyutils-libs-1.6.3-1.el9.x86_64
libdhash-0.5.0-53.el9.x86_64
libXau-1.0.9-8.el9.x86_64
--More--(4%)
[q]
```

Important - Il convient ensuite de sauvegarder les deux fichiers **liste-des-paquets_*** et **$(hostname).rpmdatabase.tar.gz** sur un support externe.

Afin de restaurer les sauvegardes, récupérez les deux fichiers **liste-des-paquets_*** et **$(hostname).rpmdatabase.tar.gz** du support externe à la

racine du système de fichiers :

```
[root@redhat9 ~]# cp liste-des-paquets_redhat9.ittraining.loc_2024-09-27-08-15
redhat9.ittraining.loc.rpmdatabase.tar.gz /
```

Placez-vous à la racine du système de fichiers et restaurez les bases de données RPM :

```
[root@redhat9 /]# tar xvf redhat9.ittraining.loc.rpmdatabase.tar.gz
var/lib/rpm/
var/lib/rpm/rpmdb.sqlite
var/lib/rpm/rpmdb.sqlite-wal
var/lib/rpm/rpmdb.sqlite-shm
var/lib/rpm/.rpm.lock
```

Utilisez YUM pour restaurer les paquets :

```
[root@redhat9 /]# dnf -y install -y $(cat liste-des-paquets_redhat9.ittraining.loc_2024-09-27-08-15)
```

Sauvegarde d'un Mémo sur la Structure du Disque Dur Système

```
[root@redhat9 /]# cd ~
[root@redhat9 ~]# fdisk -l /dev/sda > structure.list
[root@redhat9 ~]# cat structure.list
Disk /dev/sda: 50 GiB, 53687091200 bytes, 104857600 sectors
Disk model: QEMU HARDDISK
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: dos
Disk identifier: 0xd00dfc8a

Device     Boot   Start       End   Sectors Size Id Type
```

```
/dev/sda1  *       2048   2099199   2097152   1G 83 Linux
/dev/sda2       2099200 104857599 102758400  49G 8e Linux LVM
```

> **Important** - Il convient ensuite de sauvegarder le fichier **structure.list** sur un support externe.

Sauvegarde d'un Mémo sur les Points de Montage du Disque Dur Système

Saisissez la commande suivante :

```
[root@redhat9 ~]# df -h | grep "^/dev/" > montages.list
[root@redhat9 ~]# cat montages.list
/dev/mapper/rhel-root   44G  7.8G   37G  18% /
/dev/sda1             1014M  398M  617M  40% /boot
```

> **Important** - Il convient ensuite de sauvegarder le fichier **montages.list** sur un support externe.

Sauvegarde du Chargeur de Démarrage

GRUB Legacy

```
# cp /boot/grub/menu.lst grubmenu.lst
```

GRUB 2 avec BIOS

Saisissez les commandes suivantes :

```
[root@redhat9 ~]# cp /boot/grub2/grub.cfg grub.cfg
[root@redhat9 ~]# cp /boot/grub2/device.map device.map
```

GRUB 2 avec EFI

```
# cp /boot/efi/EFI/redhat/grub.cfg grub.cfg
# cp /boot/grub2/device.map device.map
```

> **Important** - Il convient ensuite de sauvegarder le fichier **menu.lst** ou **grub.cfg** et le fichier **device.map** sur un support externe.

Sauvegarde des Dossiers Utilisateurs

```
[root@redhat9 ~]# cp -apv /home/ .
'/home/' -> './home'
'/home/trainee' -> './home/trainee'
'/home/trainee/training' -> './home/trainee/training'
'/home/trainee/training/f1' -> './home/trainee/training/f1'
'/home/trainee/training/f2' -> './home/trainee/training/f2'
'/home/trainee/training/f3' -> './home/trainee/training/f3'
'/home/trainee/training/f4' -> './home/trainee/training/f4'
'/home/trainee/training/f5' -> './home/trainee/training/f5'
'/home/trainee/training/f52' -> './home/trainee/training/f52'
'/home/trainee/training/f62' -> './home/trainee/training/f62'
```

```
'/home/trainee/training/a100' -> './home/trainee/training/a100'
'/home/trainee/training/f' -> './home/trainee/training/f'
'/home/trainee/training/f.txt' -> './home/trainee/training/f.txt'
'/home/trainee/training/f123.txt' -> './home/trainee/training/f123.txt'
'/home/trainee/training/f123123.txt' -> './home/trainee/training/f123123.txt'
'/home/trainee/training/f123123123.txt' -> './home/trainee/training/f123123123.txt'
'/home/trainee/training/file' -> './home/trainee/training/file'
'/home/trainee/training/user_check' -> './home/trainee/training/user_check'
'/home/trainee/bin' -> './home/trainee/bin'
'/home/trainee/bin/myscript' -> './home/trainee/bin/myscript'
'/home/trainee/Desktop' -> './home/trainee/Desktop'
'/home/trainee/Documents' -> './home/trainee/Documents'
'/home/trainee/.config' -> './home/trainee/.config'
'/home/trainee/.config/ibus' -> './home/trainee/.config/ibus'
'/home/trainee/.config/ibus/bus' -> './home/trainee/.config/ibus/bus'
'/home/trainee/.config/ibus/bus/5a35a3eb625c45cea1d33535723e791f-unix-wayland-0' ->
'./home/trainee/.config/ibus/bus/5a35a3eb625c45cea1d33535723e791f-unix-wayland-0'
'/home/trainee/.config/user-dirs.dirs' -> './home/trainee/.config/user-dirs.dirs'
'/home/trainee/.config/user-dirs.locale' -> './home/trainee/.config/user-dirs.locale'
'/home/trainee/.config/evolution' -> './home/trainee/.config/evolution'
'/home/trainee/.config/evolution/sources' -> './home/trainee/.config/evolution/sources'
'/home/trainee/.config/evolution/sources/system-proxy.source' ->
'./home/trainee/.config/evolution/sources/system-proxy.source'
'/home/trainee/.config/gtk-3.0' -> './home/trainee/.config/gtk-3.0'
'/home/trainee/.config/gtk-3.0/bookmarks' -> './home/trainee/.config/gtk-3.0/bookmarks'
'/home/trainee/.config/.gsd-keyboard.settings-ported' -> './home/trainee/.config/.gsd-keyboard.settings-ported'
'/home/trainee/.config/gnome-initial-setup-done' -> './home/trainee/.config/gnome-initial-setup-done'
'/home/trainee/.config/goa-1.0' -> './home/trainee/.config/goa-1.0'
'/home/trainee/.config/pulse' -> './home/trainee/.config/pulse'
'/home/trainee/.config/pulse/cookie' -> './home/trainee/.config/pulse/cookie'
'/home/trainee/.config/dconf' -> './home/trainee/.config/dconf'
'/home/trainee/.config/dconf/user' -> './home/trainee/.config/dconf/user'
'/home/trainee/codes' -> './home/trainee/codes'
'/home/trainee/codes/exit.txt' -> './home/trainee/codes/exit.txt'
```

```
'/home/trainee/.local' -> './home/trainee/.local'
'/home/trainee/.local/share' -> './home/trainee/.local/share'
'/home/trainee/.local/share/evolution' -> './home/trainee/.local/share/evolution'
'/home/trainee/.local/share/evolution/addressbook' -> './home/trainee/.local/share/evolution/addressbook'
'/home/trainee/.local/share/evolution/addressbook/system' ->
'./home/trainee/.local/share/evolution/addressbook/system'
'/home/trainee/.local/share/evolution/addressbook/system/contacts.db' ->
'./home/trainee/.local/share/evolution/addressbook/system/contacts.db'
'/home/trainee/.local/share/evolution/addressbook/system/photos' ->
'./home/trainee/.local/share/evolution/addressbook/system/photos'
'/home/trainee/.local/share/evolution/addressbook/trash' ->
'./home/trainee/.local/share/evolution/addressbook/trash'
'/home/trainee/.local/share/evolution/mail' -> './home/trainee/.local/share/evolution/mail'
'/home/trainee/.local/share/evolution/mail/trash' -> './home/trainee/.local/share/evolution/mail/trash'
'/home/trainee/.local/share/evolution/tasks' -> './home/trainee/.local/share/evolution/tasks'
'/home/trainee/.local/share/evolution/tasks/system' -> './home/trainee/.local/share/evolution/tasks/system'
'/home/trainee/.local/share/evolution/tasks/system/tasks.ics' ->
'./home/trainee/.local/share/evolution/tasks/system/tasks.ics'
'/home/trainee/.local/share/evolution/tasks/trash' -> './home/trainee/.local/share/evolution/tasks/trash'
'/home/trainee/.local/share/evolution/calendar' -> './home/trainee/.local/share/evolution/calendar'
'/home/trainee/.local/share/evolution/calendar/trash' -> './home/trainee/.local/share/evolution/calendar/trash'
'/home/trainee/.local/share/evolution/calendar/system' -> './home/trainee/.local/share/evolution/calendar/system'
'/home/trainee/.local/share/evolution/calendar/system/calendar.ics' ->
'./home/trainee/.local/share/evolution/calendar/system/calendar.ics'
'/home/trainee/.local/share/evolution/memos' -> './home/trainee/.local/share/evolution/memos'
'/home/trainee/.local/share/evolution/memos/trash' -> './home/trainee/.local/share/evolution/memos/trash'
'/home/trainee/.local/share/applications' -> './home/trainee/.local/share/applications'
'/home/trainee/.local/share/icc' -> './home/trainee/.local/share/icc'
'/home/trainee/.local/share/icc/edid-bb6ad72dc802b000932c73ad20996ae5.icc' ->
'./home/trainee/.local/share/icc/edid-bb6ad72dc802b000932c73ad20996ae5.icc'
'/home/trainee/.local/share/sounds' -> './home/trainee/.local/share/sounds'
'/home/trainee/.local/share/flatpak' -> './home/trainee/.local/share/flatpak'
'/home/trainee/.local/share/flatpak/repo' -> './home/trainee/.local/share/flatpak/repo'
'/home/trainee/.local/share/flatpak/repo/refs' -> './home/trainee/.local/share/flatpak/repo/refs'
```

```
'/home/trainee/.local/share/flatpak/repo/refs/heads' -> './home/trainee/.local/share/flatpak/repo/refs/heads'
'/home/trainee/.local/share/flatpak/repo/refs/mirrors' -> './home/trainee/.local/share/flatpak/repo/refs/mirrors'
'/home/trainee/.local/share/flatpak/repo/refs/remotes' -> './home/trainee/.local/share/flatpak/repo/refs/remotes'
'/home/trainee/.local/share/flatpak/repo/objects' -> './home/trainee/.local/share/flatpak/repo/objects'
'/home/trainee/.local/share/flatpak/repo/config' -> './home/trainee/.local/share/flatpak/repo/config'
'/home/trainee/.local/share/flatpak/repo/tmp' -> './home/trainee/.local/share/flatpak/repo/tmp'
'/home/trainee/.local/share/flatpak/repo/tmp/cache' -> './home/trainee/.local/share/flatpak/repo/tmp/cache'
'/home/trainee/.local/share/flatpak/repo/extensions' -> './home/trainee/.local/share/flatpak/repo/extensions'
'/home/trainee/.local/share/flatpak/repo/state' -> './home/trainee/.local/share/flatpak/repo/state'
'/home/trainee/.local/share/flatpak/.changed' -> './home/trainee/.local/share/flatpak/.changed'
'/home/trainee/.local/share/flatpak/db' -> './home/trainee/.local/share/flatpak/db'
'/home/trainee/.local/share/pki' -> './home/trainee/.local/share/pki'
'/home/trainee/.local/share/pki/nssdb' -> './home/trainee/.local/share/pki/nssdb'
'/home/trainee/.local/share/keyrings' -> './home/trainee/.local/share/keyrings'
'/home/trainee/.local/share/keyrings/login.keyring' -> './home/trainee/.local/share/keyrings/login.keyring'
'/home/trainee/.local/share/keyrings/user.keystore' -> './home/trainee/.local/share/keyrings/user.keystore'
'/home/trainee/.local/share/gnome-shell' -> './home/trainee/.local/share/gnome-shell'
'/home/trainee/.local/share/gnome-shell/gnome-overrides-migrated' -> './home/trainee/.local/share/gnome-
shell/gnome-overrides-migrated'
'/home/trainee/.local/share/gnome-shell/application_state' -> './home/trainee/.local/share/gnome-
shell/application_state'
'/home/trainee/.local/share/gvfs-metadata' -> './home/trainee/.local/share/gvfs-metadata'
'/home/trainee/.local/share/gvfs-metadata/home' -> './home/trainee/.local/share/gvfs-metadata/home'
'/home/trainee/.local/share/gvfs-metadata/root' -> './home/trainee/.local/share/gvfs-metadata/root'
'/home/trainee/.local/share/gvfs-metadata/home-6f6e2002.log' -> './home/trainee/.local/share/gvfs-
metadata/home-6f6e2002.log'
'/home/trainee/.local/share/gvfs-metadata/root-47507e37.log' -> './home/trainee/.local/share/gvfs-
metadata/root-47507e37.log'
'/home/trainee/.local/share/gnome-settings-daemon' -> './home/trainee/.local/share/gnome-settings-daemon'
'/home/trainee/.local/share/gnome-settings-daemon/input-sources-converted' -> './home/trainee/.local/share/gnome-
settings-daemon/input-sources-converted'
'/home/trainee/.local/state' -> './home/trainee/.local/state'
'/home/trainee/.local/state/wireplumber' -> './home/trainee/.local/state/wireplumber'
'/home/trainee/.local/state/wireplumber/restore-stream' -> './home/trainee/.local/state/wireplumber/restore-
```

```
stream'
'/home/trainee/Downloads' -> './home/trainee/Downloads'
'/home/trainee/Music' -> './home/trainee/Music'
'/home/trainee/.cache' -> './home/trainee/.cache'
'/home/trainee/.cache/event-sound-cache.tdb.5a35a3eb625c45cea1d33535723e791f.x86_64-redhat-linux-gnu' ->
'./home/trainee/.cache/event-sound-cache.tdb.5a35a3eb625c45cea1d33535723e791f.x86_64-redhat-linux-gnu'
'/home/trainee/.cache/gstreamer-1.0' -> './home/trainee/.cache/gstreamer-1.0'
'/home/trainee/.cache/gstreamer-1.0/registry.x86_64.bin' ->
'./home/trainee/.cache/gstreamer-1.0/registry.x86_64.bin'
'/home/trainee/.cache/appstream' -> './home/trainee/.cache/appstream'
'/home/trainee/.cache/mesa_shader_cache' -> './home/trainee/.cache/mesa_shader_cache'
'/home/trainee/.cache/mesa_shader_cache/35' -> './home/trainee/.cache/mesa_shader_cache/35'
'/home/trainee/.cache/mesa_shader_cache/35/fdf1af19fe3030e69e8f1eb8e8b27af5336130' ->
'./home/trainee/.cache/mesa_shader_cache/35/fdf1af19fe3030e69e8f1eb8e8b27af5336130'
'/home/trainee/.cache/mesa_shader_cache/37' -> './home/trainee/.cache/mesa_shader_cache/37'
'/home/trainee/.cache/mesa_shader_cache/37/e5792d1d01536d5334b02004e37fb0e4447734' ->
'./home/trainee/.cache/mesa_shader_cache/37/e5792d1d01536d5334b02004e37fb0e4447734'
'/home/trainee/.cache/mesa_shader_cache/db' -> './home/trainee/.cache/mesa_shader_cache/db'
'/home/trainee/.cache/mesa_shader_cache/db/61eeaba3f7216beef1a6584479498f1a1bcc6e' ->
'./home/trainee/.cache/mesa_shader_cache/db/61eeaba3f7216beef1a6584479498f1a1bcc6e'
'/home/trainee/.cache/mesa_shader_cache/89' -> './home/trainee/.cache/mesa_shader_cache/89'
'/home/trainee/.cache/mesa_shader_cache/89/e5753098f3e9b475aea4ee27559d24e8a477cd' ->
'./home/trainee/.cache/mesa_shader_cache/89/e5753098f3e9b475aea4ee27559d24e8a477cd'
'/home/trainee/.cache/mesa_shader_cache/89/f6154a1a3badafdf80810f15b7fcdcf76055f7' ->
'./home/trainee/.cache/mesa_shader_cache/89/f6154a1a3badafdf80810f15b7fcdcf76055f7'
'/home/trainee/.cache/mesa_shader_cache/29' -> './home/trainee/.cache/mesa_shader_cache/29'
'/home/trainee/.cache/mesa_shader_cache/29/192c9c298ee4c8c9fbf0ec63ef2235bd284281' ->
'./home/trainee/.cache/mesa_shader_cache/29/192c9c298ee4c8c9fbf0ec63ef2235bd284281'
'/home/trainee/.cache/mesa_shader_cache/ba' -> './home/trainee/.cache/mesa_shader_cache/ba'
'/home/trainee/.cache/mesa_shader_cache/ba/c8c6c30bb2fd3a6ad51b81489fba57176bdb63' ->
'./home/trainee/.cache/mesa_shader_cache/ba/c8c6c30bb2fd3a6ad51b81489fba57176bdb63'
'/home/trainee/.cache/mesa_shader_cache/80' -> './home/trainee/.cache/mesa_shader_cache/80'
'/home/trainee/.cache/mesa_shader_cache/80/51554895958b09bfcc357550bff8c7c91d3f13' ->
'./home/trainee/.cache/mesa_shader_cache/80/51554895958b09bfcc357550bff8c7c91d3f13'
```

```
'/home/trainee/.cache/mesa_shader_cache/de' -> './home/trainee/.cache/mesa_shader_cache/de'
'/home/trainee/.cache/mesa_shader_cache/de/594a26def33b0ccfc9b9af4ee0d1f15e01af73' ->
'./home/trainee/.cache/mesa_shader_cache/de/594a26def33b0ccfc9b9af4ee0d1f15e01af73'
'/home/trainee/.cache/mesa_shader_cache/2c' -> './home/trainee/.cache/mesa_shader_cache/2c'
'/home/trainee/.cache/mesa_shader_cache/2c/58c677aeedca2646d85af2feeaa58bcaba11cd' ->
'./home/trainee/.cache/mesa_shader_cache/2c/58c677aeedca2646d85af2feeaa58bcaba11cd'
'/home/trainee/.cache/mesa_shader_cache/66' -> './home/trainee/.cache/mesa_shader_cache/66'
'/home/trainee/.cache/mesa_shader_cache/66/189cc50668aeaf9534cda7798d819feafd56c7' ->
'./home/trainee/.cache/mesa_shader_cache/66/189cc50668aeaf9534cda7798d819feafd56c7'
'/home/trainee/.cache/mesa_shader_cache/6e' -> './home/trainee/.cache/mesa_shader_cache/6e'
'/home/trainee/.cache/mesa_shader_cache/6e/590e396934a1b10561cef716c8f8e4ab789a36' ->
'./home/trainee/.cache/mesa_shader_cache/6e/590e396934a1b10561cef716c8f8e4ab789a36'
'/home/trainee/.cache/mesa_shader_cache/ed' -> './home/trainee/.cache/mesa_shader_cache/ed'
'/home/trainee/.cache/mesa_shader_cache/ed/48dbafa506e7835391085c2b2979ffad8a8940' ->
'./home/trainee/.cache/mesa_shader_cache/ed/48dbafa506e7835391085c2b2979ffad8a8940'
'/home/trainee/.cache/mesa_shader_cache/56' -> './home/trainee/.cache/mesa_shader_cache/56'
'/home/trainee/.cache/mesa_shader_cache/56/520536fab9c4bd7b65662bdcc0099f3d1fd090' ->
'./home/trainee/.cache/mesa_shader_cache/56/520536fab9c4bd7b65662bdcc0099f3d1fd090'
'/home/trainee/.cache/mesa_shader_cache/7b' -> './home/trainee/.cache/mesa_shader_cache/7b'
'/home/trainee/.cache/mesa_shader_cache/7b/b2b9a86dde20d2ffe0c14d344d36dfae760c54' ->
'./home/trainee/.cache/mesa_shader_cache/7b/b2b9a86dde20d2ffe0c14d344d36dfae760c54'
'/home/trainee/.cache/mesa_shader_cache/17' -> './home/trainee/.cache/mesa_shader_cache/17'
'/home/trainee/.cache/mesa_shader_cache/17/7d02a06d53b04eae8fb946e8bff91c951d8dc3' ->
'./home/trainee/.cache/mesa_shader_cache/17/7d02a06d53b04eae8fb946e8bff91c951d8dc3'
'/home/trainee/.cache/mesa_shader_cache/2f' -> './home/trainee/.cache/mesa_shader_cache/2f'
'/home/trainee/.cache/mesa_shader_cache/2f/5b6e06b2728ebe3fa7976bcea3474fed301b2b' ->
'./home/trainee/.cache/mesa_shader_cache/2f/5b6e06b2728ebe3fa7976bcea3474fed301b2b'
'/home/trainee/.cache/mesa_shader_cache/d0' -> './home/trainee/.cache/mesa_shader_cache/d0'
'/home/trainee/.cache/mesa_shader_cache/d0/6fca52ab2f687b8e6f4c135e084e39bcb0c859' ->
'./home/trainee/.cache/mesa_shader_cache/d0/6fca52ab2f687b8e6f4c135e084e39bcb0c859'
'/home/trainee/.cache/mesa_shader_cache/9e' -> './home/trainee/.cache/mesa_shader_cache/9e'
'/home/trainee/.cache/mesa_shader_cache/9e/d50ad4e45ed562c3e7b4570526c4cc8154f214' ->
'./home/trainee/.cache/mesa_shader_cache/9e/d50ad4e45ed562c3e7b4570526c4cc8154f214'
'/home/trainee/.cache/mesa_shader_cache/6c' -> './home/trainee/.cache/mesa_shader_cache/6c'
```

```
'/home/trainee/.cache/mesa_shader_cache/6c/2e2e9047a693755c7cfdc286874dc0e3e30b4e' ->
'./home/trainee/.cache/mesa_shader_cache/6c/2e2e9047a693755c7cfdc286874dc0e3e30b4e'
'/home/trainee/.cache/mesa_shader_cache/6c/3101d0fdf7a12f96507b4ac96b83de38448541' ->
'./home/trainee/.cache/mesa_shader_cache/6c/3101d0fdf7a12f96507b4ac96b83de38448541'
'/home/trainee/.cache/mesa_shader_cache/d3' -> './home/trainee/.cache/mesa_shader_cache/d3'
'/home/trainee/.cache/mesa_shader_cache/d3/075b420db4b80da890c1576f69ba7758421738' ->
'./home/trainee/.cache/mesa_shader_cache/d3/075b420db4b80da890c1576f69ba7758421738'
'/home/trainee/.cache/mesa_shader_cache/e2' -> './home/trainee/.cache/mesa_shader_cache/e2'
'/home/trainee/.cache/mesa_shader_cache/e2/eda2c17a911182ce0675a982c19d7ec332fe48' ->
'./home/trainee/.cache/mesa_shader_cache/e2/eda2c17a911182ce0675a982c19d7ec332fe48'
'/home/trainee/.cache/mesa_shader_cache/3c' -> './home/trainee/.cache/mesa_shader_cache/3c'
'/home/trainee/.cache/mesa_shader_cache/3c/5cfbfcea5eaa35a106d2bad38d8d89c7da4759' ->
'./home/trainee/.cache/mesa_shader_cache/3c/5cfbfcea5eaa35a106d2bad38d8d89c7da4759'
'/home/trainee/.cache/mesa_shader_cache/61' -> './home/trainee/.cache/mesa_shader_cache/61'
'/home/trainee/.cache/mesa_shader_cache/61/d347702600b207e1d67f23f11f089553172512' ->
'./home/trainee/.cache/mesa_shader_cache/61/d347702600b207e1d67f23f11f089553172512'
'/home/trainee/.cache/mesa_shader_cache/03' -> './home/trainee/.cache/mesa_shader_cache/03'
'/home/trainee/.cache/mesa_shader_cache/03/d956db16f83ba111f7e395ca2e6b7b3f83ff46' ->
'./home/trainee/.cache/mesa_shader_cache/03/d956db16f83ba111f7e395ca2e6b7b3f83ff46'
'/home/trainee/.cache/mesa_shader_cache/a4' -> './home/trainee/.cache/mesa_shader_cache/a4'
'/home/trainee/.cache/mesa_shader_cache/a4/a2550d53877cc1471892b1bec5444abc719ef8' ->
'./home/trainee/.cache/mesa_shader_cache/a4/a2550d53877cc1471892b1bec5444abc719ef8'
'/home/trainee/.cache/mesa_shader_cache/ab' -> './home/trainee/.cache/mesa_shader_cache/ab'
'/home/trainee/.cache/mesa_shader_cache/ab/d56ebc4a54bcc4e49aa3dde4fddb884ff797c1' ->
'./home/trainee/.cache/mesa_shader_cache/ab/d56ebc4a54bcc4e49aa3dde4fddb884ff797c1'
'/home/trainee/.cache/mesa_shader_cache/b1' -> './home/trainee/.cache/mesa_shader_cache/b1'
'/home/trainee/.cache/mesa_shader_cache/b1/8414b51e1825350f6af7ba143d082ba6e91338' ->
'./home/trainee/.cache/mesa_shader_cache/b1/8414b51e1825350f6af7ba143d082ba6e91338'
'/home/trainee/.cache/mesa_shader_cache/c8' -> './home/trainee/.cache/mesa_shader_cache/c8'
'/home/trainee/.cache/mesa_shader_cache/c8/d3f9f8d81fa2bafb1e8e03193e8861047adcde' ->
'./home/trainee/.cache/mesa_shader_cache/c8/d3f9f8d81fa2bafb1e8e03193e8861047adcde'
'/home/trainee/.cache/mesa_shader_cache/df' -> './home/trainee/.cache/mesa_shader_cache/df'
'/home/trainee/.cache/mesa_shader_cache/df/ad5863cff76ca47fcea0a47b9f8d81bf57c605' ->
'./home/trainee/.cache/mesa_shader_cache/df/ad5863cff76ca47fcea0a47b9f8d81bf57c605'
```

```
'/home/trainee/.cache/mesa_shader_cache/index' -> './home/trainee/.cache/mesa_shader_cache/index'
'/home/trainee/.cache/mesa_shader_cache/fc' -> './home/trainee/.cache/mesa_shader_cache/fc'
'/home/trainee/.cache/mesa_shader_cache/fc/0a9b98f3ab91773422fdf596d8b90aa3f0319f' ->
'./home/trainee/.cache/mesa_shader_cache/fc/0a9b98f3ab91773422fdf596d8b90aa3f0319f'
'/home/trainee/.cache/mesa_shader_cache/0f' -> './home/trainee/.cache/mesa_shader_cache/0f'
'/home/trainee/.cache/mesa_shader_cache/0f/30c6ae612cca20f942383cf6c3d207a5fa23cc' ->
'./home/trainee/.cache/mesa_shader_cache/0f/30c6ae612cca20f942383cf6c3d207a5fa23cc'
'/home/trainee/.cache/mesa_shader_cache/0f/10bb2c604d0ef8a698a506a297cc7a72885e1f' ->
'./home/trainee/.cache/mesa_shader_cache/0f/10bb2c604d0ef8a698a506a297cc7a72885e1f'
'/home/trainee/.cache/mesa_shader_cache/9a' -> './home/trainee/.cache/mesa_shader_cache/9a'
'/home/trainee/.cache/mesa_shader_cache/9a/32ee45d4531554f10a8184bf639fdf0a072fba' ->
'./home/trainee/.cache/mesa_shader_cache/9a/32ee45d4531554f10a8184bf639fdf0a072fba'
'/home/trainee/.cache/mesa_shader_cache/9a/3061c95eb9135ea46575ef514f2fae7f4711cc' ->
'./home/trainee/.cache/mesa_shader_cache/9a/3061c95eb9135ea46575ef514f2fae7f4711cc'
'/home/trainee/.cache/mesa_shader_cache/06' -> './home/trainee/.cache/mesa_shader_cache/06'
'/home/trainee/.cache/mesa_shader_cache/06/3c901c6133c1b0568bb9b8ff1d4a35af6d8df4' ->
'./home/trainee/.cache/mesa_shader_cache/06/3c901c6133c1b0568bb9b8ff1d4a35af6d8df4'
'/home/trainee/.cache/mesa_shader_cache/7c' -> './home/trainee/.cache/mesa_shader_cache/7c'
'/home/trainee/.cache/mesa_shader_cache/7c/40694e298e691a0e7ac606cb160097a65c5fe9' ->
'./home/trainee/.cache/mesa_shader_cache/7c/40694e298e691a0e7ac606cb160097a65c5fe9'
'/home/trainee/.cache/mesa_shader_cache/77' -> './home/trainee/.cache/mesa_shader_cache/77'
'/home/trainee/.cache/mesa_shader_cache/77/390cf9430a3344e71ec336b898ff0af5362f27' ->
'./home/trainee/.cache/mesa_shader_cache/77/390cf9430a3344e71ec336b898ff0af5362f27'
'/home/trainee/.cache/mesa_shader_cache/57' -> './home/trainee/.cache/mesa_shader_cache/57'
'/home/trainee/.cache/mesa_shader_cache/57/b7f8fa574271b61ecbd67cfdbf0fbfa4e7309f' ->
'./home/trainee/.cache/mesa_shader_cache/57/b7f8fa574271b61ecbd67cfdbf0fbfa4e7309f'
'/home/trainee/.cache/mesa_shader_cache/78' -> './home/trainee/.cache/mesa_shader_cache/78'
'/home/trainee/.cache/mesa_shader_cache/78/37d600b50e8a23efed7bcb298703d700c4bdde' ->
'./home/trainee/.cache/mesa_shader_cache/78/37d600b50e8a23efed7bcb298703d700c4bdde'
'/home/trainee/.cache/mesa_shader_cache/08' -> './home/trainee/.cache/mesa_shader_cache/08'
'/home/trainee/.cache/mesa_shader_cache/08/c25769e6f0d114ee11363b6a006276457ba0fe' ->
'./home/trainee/.cache/mesa_shader_cache/08/c25769e6f0d114ee11363b6a006276457ba0fe'
'/home/trainee/.cache/mesa_shader_cache/52' -> './home/trainee/.cache/mesa_shader_cache/52'
'/home/trainee/.cache/mesa_shader_cache/52/675f8b2f5bf87b675ae31f54f2b3c412721c24' ->
```

```
'./home/trainee/.cache/mesa_shader_cache/52/675f8b2f5bf87b675ae31f54f2b3c412721c24'
'/home/trainee/.cache/mesa_shader_cache/72' -> './home/trainee/.cache/mesa_shader_cache/72'
'/home/trainee/.cache/mesa_shader_cache/72/6f5d4d61d416fbce8e03f0ba6f3be83b7617ef' ->
'./home/trainee/.cache/mesa_shader_cache/72/6f5d4d61d416fbce8e03f0ba6f3be83b7617ef'
'/home/trainee/.cache/mesa_shader_cache/1d' -> './home/trainee/.cache/mesa_shader_cache/1d'
'/home/trainee/.cache/mesa_shader_cache/1d/16707620c6d057cc29f510df219eae84cb9433' ->
'./home/trainee/.cache/mesa_shader_cache/1d/16707620c6d057cc29f510df219eae84cb9433'
'/home/trainee/.cache/mesa_shader_cache/da' -> './home/trainee/.cache/mesa_shader_cache/da'
'/home/trainee/.cache/mesa_shader_cache/da/35509cf05c257db6419f61347e3abcbfb47931' ->
'./home/trainee/.cache/mesa_shader_cache/da/35509cf05c257db6419f61347e3abcbfb47931'
'/home/trainee/.cache/mesa_shader_cache/b2' -> './home/trainee/.cache/mesa_shader_cache/b2'
'/home/trainee/.cache/mesa_shader_cache/b2/cfbf371328300a5b5d686da17d3722ea1ea680' ->
'./home/trainee/.cache/mesa_shader_cache/b2/cfbf371328300a5b5d686da17d3722ea1ea680'
'/home/trainee/.cache/mesa_shader_cache/3d' -> './home/trainee/.cache/mesa_shader_cache/3d'
'/home/trainee/.cache/mesa_shader_cache/3d/e830f90f2d4d3d79bba17a59903ad4aa4736ed' ->
'./home/trainee/.cache/mesa_shader_cache/3d/e830f90f2d4d3d79bba17a59903ad4aa4736ed'
'/home/trainee/.cache/mesa_shader_cache/53' -> './home/trainee/.cache/mesa_shader_cache/53'
'/home/trainee/.cache/mesa_shader_cache/53/5db4be69e145c6708f2d30c70b5a292464c990' ->
'./home/trainee/.cache/mesa_shader_cache/53/5db4be69e145c6708f2d30c70b5a292464c990'
'/home/trainee/.cache/mesa_shader_cache/e7' -> './home/trainee/.cache/mesa_shader_cache/e7'
'/home/trainee/.cache/mesa_shader_cache/e7/b2552c608263fa6b536e5aba787ce66bbb222b' ->
'./home/trainee/.cache/mesa_shader_cache/e7/b2552c608263fa6b536e5aba787ce66bbb222b'
'/home/trainee/.cache/mesa_shader_cache/59' -> './home/trainee/.cache/mesa_shader_cache/59'
'/home/trainee/.cache/mesa_shader_cache/59/87c57c825b5080423c1f92ee06f23998a21164' ->
'./home/trainee/.cache/mesa_shader_cache/59/87c57c825b5080423c1f92ee06f23998a21164'
'/home/trainee/.cache/mesa_shader_cache/04' -> './home/trainee/.cache/mesa_shader_cache/04'
'/home/trainee/.cache/mesa_shader_cache/04/7e399922091e12b6b1038ffd9d65cb8a8d4e52' ->
'./home/trainee/.cache/mesa_shader_cache/04/7e399922091e12b6b1038ffd9d65cb8a8d4e52'
'/home/trainee/.cache/mesa_shader_cache/5e' -> './home/trainee/.cache/mesa_shader_cache/5e'
'/home/trainee/.cache/mesa_shader_cache/5e/c3362db3becd652b156ef7cef7b65a14000175' ->
'./home/trainee/.cache/mesa_shader_cache/5e/c3362db3becd652b156ef7cef7b65a14000175'
'/home/trainee/.cache/mesa_shader_cache/4b' -> './home/trainee/.cache/mesa_shader_cache/4b'
'/home/trainee/.cache/mesa_shader_cache/4b/c7bfac6ba6440df22b676247a760ea33ef00e9' ->
'./home/trainee/.cache/mesa_shader_cache/4b/c7bfac6ba6440df22b676247a760ea33ef00e9'
```

```
'/home/trainee/.cache/mesa_shader_cache/38' -> './home/trainee/.cache/mesa_shader_cache/38'
'/home/trainee/.cache/mesa_shader_cache/38/ab4c0ec5a2678353a62e2adb585cac57621027' ->
'./home/trainee/.cache/mesa_shader_cache/38/ab4c0ec5a2678353a62e2adb585cac57621027'
'/home/trainee/.cache/mesa_shader_cache/f0' -> './home/trainee/.cache/mesa_shader_cache/f0'
'/home/trainee/.cache/mesa_shader_cache/f0/23c0293a789bd41028bbe52116a8050da78300' ->
'./home/trainee/.cache/mesa_shader_cache/f0/23c0293a789bd41028bbe52116a8050da78300'
'/home/trainee/.cache/mesa_shader_cache/f0/fe14587cf5f14504a4d663d50b842ab6708459' ->
'./home/trainee/.cache/mesa_shader_cache/f0/fe14587cf5f14504a4d663d50b842ab6708459'
'/home/trainee/.cache/mesa_shader_cache/0a' -> './home/trainee/.cache/mesa_shader_cache/0a'
'/home/trainee/.cache/mesa_shader_cache/0a/2e07fbab5189565440428bc82a0b3716f1c7f9' ->
'./home/trainee/.cache/mesa_shader_cache/0a/2e07fbab5189565440428bc82a0b3716f1c7f9'
'/home/trainee/.cache/mesa_shader_cache/21' -> './home/trainee/.cache/mesa_shader_cache/21'
'/home/trainee/.cache/mesa_shader_cache/21/f7c9c648eaf6ad5386e464adf635c5fcbda019' ->
'./home/trainee/.cache/mesa_shader_cache/21/f7c9c648eaf6ad5386e464adf635c5fcbda019'
'/home/trainee/.cache/mesa_shader_cache/41' -> './home/trainee/.cache/mesa_shader_cache/41'
'/home/trainee/.cache/mesa_shader_cache/41/c7d27f4328971dfae62cbeeb047f4051f58de2' ->
'./home/trainee/.cache/mesa_shader_cache/41/c7d27f4328971dfae62cbeeb047f4051f58de2'
'/home/trainee/.cache/mesa_shader_cache/2b' -> './home/trainee/.cache/mesa_shader_cache/2b'
'/home/trainee/.cache/mesa_shader_cache/2b/a8165b2be71340b0d73b74a10311320d6c8cf2' ->
'./home/trainee/.cache/mesa_shader_cache/2b/a8165b2be71340b0d73b74a10311320d6c8cf2'
'/home/trainee/.cache/mesa_shader_cache/13' -> './home/trainee/.cache/mesa_shader_cache/13'
'/home/trainee/.cache/mesa_shader_cache/13/b31a6f63cea64dc9bbe84ea28710f135184274' ->
'./home/trainee/.cache/mesa_shader_cache/13/b31a6f63cea64dc9bbe84ea28710f135184274'
'/home/trainee/.cache/mesa_shader_cache/c4' -> './home/trainee/.cache/mesa_shader_cache/c4'
'/home/trainee/.cache/mesa_shader_cache/c4/9bbd97238c5299a3e74ac9606194a6bbe48334' ->
'./home/trainee/.cache/mesa_shader_cache/c4/9bbd97238c5299a3e74ac9606194a6bbe48334'
'/home/trainee/.cache/mesa_shader_cache/63' -> './home/trainee/.cache/mesa_shader_cache/63'
'/home/trainee/.cache/mesa_shader_cache/63/9e6e421d46d0b2e7802b4919b10a7c3cfb5a57' ->
'./home/trainee/.cache/mesa_shader_cache/63/9e6e421d46d0b2e7802b4919b10a7c3cfb5a57'
'/home/trainee/.cache/ibus' -> './home/trainee/.cache/ibus'
'/home/trainee/.cache/flatpak' -> './home/trainee/.cache/flatpak'
'/home/trainee/.cache/flatpak/system-cache' -> './home/trainee/.cache/flatpak/system-cache'
'/home/trainee/.cache/evolution' -> './home/trainee/.cache/evolution'
'/home/trainee/.cache/evolution/addressbook' -> './home/trainee/.cache/evolution/addressbook'
```

```
'/home/trainee/.cache/evolution/addressbook/trash' -> './home/trainee/.cache/evolution/addressbook/trash'
'/home/trainee/.cache/evolution/mail' -> './home/trainee/.cache/evolution/mail'
'/home/trainee/.cache/evolution/mail/trash' -> './home/trainee/.cache/evolution/mail/trash'
'/home/trainee/.cache/evolution/sources' -> './home/trainee/.cache/evolution/sources'
'/home/trainee/.cache/evolution/sources/trash' -> './home/trainee/.cache/evolution/sources/trash'
'/home/trainee/.cache/evolution/calendar' -> './home/trainee/.cache/evolution/calendar'
'/home/trainee/.cache/evolution/calendar/trash' -> './home/trainee/.cache/evolution/calendar/trash'
'/home/trainee/.cache/evolution/memos' -> './home/trainee/.cache/evolution/memos'
'/home/trainee/.cache/evolution/memos/trash' -> './home/trainee/.cache/evolution/memos/trash'
'/home/trainee/.cache/evolution/tasks' -> './home/trainee/.cache/evolution/tasks'
'/home/trainee/.cache/evolution/tasks/trash' -> './home/trainee/.cache/evolution/tasks/trash'
'/home/trainee/.cache/gnome-software' -> './home/trainee/.cache/gnome-software'
'/home/trainee/.cache/gnome-software/appstream' -> './home/trainee/.cache/gnome-software/appstream'
'/home/trainee/.cache/gnome-software/appstream/components.xmlb' -> './home/trainee/.cache/gnome-
software/appstream/components.xmlb'
'/home/trainee/.cache/gnome-software/flatpak-system-default' -> './home/trainee/.cache/gnome-software/flatpak-
system-default'
'/home/trainee/.cache/gnome-software/flatpak-system-default/components.xmlb' -> './home/trainee/.cache/gnome-
software/flatpak-system-default/components.xmlb'
'/home/trainee/.cache/gnome-software/flatpak-user-user' -> './home/trainee/.cache/gnome-software/flatpak-user-
user'
'/home/trainee/.cache/gnome-software/flatpak-user-user/components.xmlb' -> './home/trainee/.cache/gnome-
software/flatpak-user-user/components.xmlb'
'/home/trainee/.cache/gnome-software/odrs' -> './home/trainee/.cache/gnome-software/odrs'
'/home/trainee/.cache/gnome-software/odrs/ratings.json' -> './home/trainee/.cache/gnome-
software/odrs/ratings.json'
'/home/trainee/.bash_logout' -> './home/trainee/.bash_logout'
'/home/trainee/.exrc' -> './home/trainee/.exrc'
'/home/trainee/.viminfo' -> './home/trainee/.viminfo'
'/home/trainee/vitext' -> './home/trainee/vitext'
'/home/trainee/aac' -> './home/trainee/aac'
'/home/trainee/abc' -> './home/trainee/abc'
'/home/trainee/bca' -> './home/trainee/bca'
'/home/trainee/xyz' -> './home/trainee/xyz'
```

```
'/home/trainee/.lesshst' -> './home/trainee/.lesshst'
'/home/trainee/errorlog' -> './home/trainee/errorlog'
'/home/trainee/file' -> './home/trainee/file'
'/home/trainee/file1' -> './home/trainee/file1'
'/home/trainee/file2' -> './home/trainee/file2'
'/home/trainee/list' -> './home/trainee/list'
'/home/trainee/typescript' -> './home/trainee/typescript'
'/home/trainee/Templates' -> './home/trainee/Templates'
'/home/trainee/Pictures' -> './home/trainee/Pictures'
'/home/trainee/.bash_profile' -> './home/trainee/.bash_profile'
'/home/trainee/.bashrc' -> './home/trainee/.bashrc'
'/home/trainee/.bash_history' -> './home/trainee/.bash_history'
'/home/trainee/Public' -> './home/trainee/Public'
'/home/trainee/Videos' -> './home/trainee/Videos'
'/home/trainee/.mozilla' -> './home/trainee/.mozilla'
'/home/trainee/.mozilla/extensions' -> './home/trainee/.mozilla/extensions'
'/home/trainee/.mozilla/plugins' -> './home/trainee/.mozilla/plugins'
```

Important - Il convient ensuite de sauvegarder le dossier **/root/home** sur un support externe.

La Commande Rsync

Présentation

Rsync ou *Remote Sync* est un utilitaire de synchronisation de fichiers qui utilise un algorithme qui minimise la quantité de données copiée en ne copiant que les parties des fichiers qui ont été modifiées.

LAB #5 - Travailler avec la Commande rsync

Créez les répertoires **/test/repA** et mkdir **/test/repB** :

```
[root@redhat9 ~]# mkdir -p /test/repA; mkdir /test/repB
```

Créez maintenant 20 fichiers vides dans le répertoire **/test/repA** :

```
[root@redhat9 ~]# touch /test/repA/file{1..20}
[root@redhat9 ~]# ls -l /test/repA/
total 0
-rw-r--r--. 1 root root 0 Sep 27 11:43 file1
-rw-r--r--. 1 root root 0 Sep 27 11:43 file10
-rw-r--r--. 1 root root 0 Sep 27 11:43 file11
-rw-r--r--. 1 root root 0 Sep 27 11:43 file12
-rw-r--r--. 1 root root 0 Sep 27 11:43 file13
-rw-r--r--. 1 root root 0 Sep 27 11:43 file14
-rw-r--r--. 1 root root 0 Sep 27 11:43 file15
-rw-r--r--. 1 root root 0 Sep 27 11:43 file16
-rw-r--r--. 1 root root 0 Sep 27 11:43 file17
-rw-r--r--. 1 root root 0 Sep 27 11:43 file18
-rw-r--r--. 1 root root 0 Sep 27 11:43 file19
-rw-r--r--. 1 root root 0 Sep 27 11:43 file2
-rw-r--r--. 1 root root 0 Sep 27 11:43 file20
-rw-r--r--. 1 root root 0 Sep 27 11:43 file3
-rw-r--r--. 1 root root 0 Sep 27 11:43 file4
-rw-r--r--. 1 root root 0 Sep 27 11:43 file5
-rw-r--r--. 1 root root 0 Sep 27 11:43 file6
-rw-r--r--. 1 root root 0 Sep 27 11:43 file7
-rw-r--r--. 1 root root 0 Sep 27 11:43 file8
-rw-r--r--. 1 root root 0 Sep 27 11:43 file9
```

Pout synchroniser les fichiers de **/test/repA** vers le répertoire **/test/repB**, utilisez l'option **-r** de la commande rsync :

```
[root@redhat9 ~]# rsync -r /test/repA/ /test/repB
[root@redhat9 ~]# ls -l /test/repB/
total 0
-rw-r--r--. 1 root root 0 Sep 27 11:45 file1
-rw-r--r--. 1 root root 0 Sep 27 11:45 file10
-rw-r--r--. 1 root root 0 Sep 27 11:45 file11
-rw-r--r--. 1 root root 0 Sep 27 11:45 file12
-rw-r--r--. 1 root root 0 Sep 27 11:45 file13
-rw-r--r--. 1 root root 0 Sep 27 11:45 file14
-rw-r--r--. 1 root root 0 Sep 27 11:45 file15
-rw-r--r--. 1 root root 0 Sep 27 11:45 file16
-rw-r--r--. 1 root root 0 Sep 27 11:45 file17
-rw-r--r--. 1 root root 0 Sep 27 11:45 file18
-rw-r--r--. 1 root root 0 Sep 27 11:45 file19
-rw-r--r--. 1 root root 0 Sep 27 11:45 file2
-rw-r--r--. 1 root root 0 Sep 27 11:45 file20
-rw-r--r--. 1 root root 0 Sep 27 11:45 file3
-rw-r--r--. 1 root root 0 Sep 27 11:45 file4
-rw-r--r--. 1 root root 0 Sep 27 11:45 file5
-rw-r--r--. 1 root root 0 Sep 27 11:45 file6
-rw-r--r--. 1 root root 0 Sep 27 11:45 file7
-rw-r--r--. 1 root root 0 Sep 27 11:45 file8
-rw-r--r--. 1 root root 0 Sep 27 11:45 file9
```

Important - Notez que l'horodatage des fichiers synchronisés n'a pas été préservé.

Supprimez les fichiers dans **/test/repB** :

```
[root@redhat9 ~]# rm -rf /test/repB/*
[root@redhat9 ~]# ls -l /test/repB/
total 0
```

Pour synchroniser les fichiers de **/test/repA** vers le répertoire **/test/repB**, utilisez l'option **-a** de la commande rsync :

```
[root@redhat9 ~]# rsync -a /test/repA/ /test/repB
[root@redhat9 ~]# ls -l /test/repB/
total 0
-rw-r--r--. 1 root root 0 Sep 27 11:43 file1
-rw-r--r--. 1 root root 0 Sep 27 11:43 file10
-rw-r--r--. 1 root root 0 Sep 27 11:43 file11
-rw-r--r--. 1 root root 0 Sep 27 11:43 file12
-rw-r--r--. 1 root root 0 Sep 27 11:43 file13
-rw-r--r--. 1 root root 0 Sep 27 11:43 file14
-rw-r--r--. 1 root root 0 Sep 27 11:43 file15
-rw-r--r--. 1 root root 0 Sep 27 11:43 file16
-rw-r--r--. 1 root root 0 Sep 27 11:43 file17
-rw-r--r--. 1 root root 0 Sep 27 11:43 file18
-rw-r--r--. 1 root root 0 Sep 27 11:43 file19
-rw-r--r--. 1 root root 0 Sep 27 11:43 file2
-rw-r--r--. 1 root root 0 Sep 27 11:43 file20
-rw-r--r--. 1 root root 0 Sep 27 11:43 file3
-rw-r--r--. 1 root root 0 Sep 27 11:43 file4
-rw-r--r--. 1 root root 0 Sep 27 11:43 file5
-rw-r--r--. 1 root root 0 Sep 27 11:43 file6
-rw-r--r--. 1 root root 0 Sep 27 11:43 file7
-rw-r--r--. 1 root root 0 Sep 27 11:43 file8
-rw-r--r--. 1 root root 0 Sep 27 11:43 file9
```

Important - Notez que non seulement l'option **-a** de la commande **rsync** synchronise les fichiers d'une manière récursive, toute comme l'option **-r**, mais elle préserve aussi les fichiers spéciaux, les liens symboliques, les permissions, les propriétaires, les groupes ainsi que les dates de modification des fichiers.

De nouveau, supprimez les fichiers dans le répertoire **/test/repB** :

```
[root@redhat9 ~]# rm -rf /test/repB/*
[root@redhat9 ~]# ls -l /test/repB/
total 0
```

Exécutez maintenant le commande suivante et constatez le résultat :

```
[root@redhat9 ~]# rsync -a /test/repA /test/repB
[root@redhat9 ~]# ls -l /test/repB/
total 4
drwxr-xr-x. 2 root root 4096 Sep 27 11:43 repA
[root@redhat9 ~]# ls -l /test/repB/repA/
total 0
-rw-r--r--. 1 root root 0 Sep 27 11:43 file1
-rw-r--r--. 1 root root 0 Sep 27 11:43 file10
-rw-r--r--. 1 root root 0 Sep 27 11:43 file11
-rw-r--r--. 1 root root 0 Sep 27 11:43 file12
-rw-r--r--. 1 root root 0 Sep 27 11:43 file13
-rw-r--r--. 1 root root 0 Sep 27 11:43 file14
-rw-r--r--. 1 root root 0 Sep 27 11:43 file15
-rw-r--r--. 1 root root 0 Sep 27 11:43 file16
-rw-r--r--. 1 root root 0 Sep 27 11:43 file17
-rw-r--r--. 1 root root 0 Sep 27 11:43 file18
-rw-r--r--. 1 root root 0 Sep 27 11:43 file19
-rw-r--r--. 1 root root 0 Sep 27 11:43 file2
-rw-r--r--. 1 root root 0 Sep 27 11:43 file20
-rw-r--r--. 1 root root 0 Sep 27 11:43 file3
-rw-r--r--. 1 root root 0 Sep 27 11:43 file4
-rw-r--r--. 1 root root 0 Sep 27 11:43 file5
-rw-r--r--. 1 root root 0 Sep 27 11:43 file6
-rw-r--r--. 1 root root 0 Sep 27 11:43 file7
-rw-r--r--. 1 root root 0 Sep 27 11:43 file8
```

```
-rw-r--r--. 1 root root 0 Sep 27 11:43 file9
```

> **Important** - Notez que dans ce cas, le caractère **/** est manquant après **repA** dans la commande **rsync -a /test/repA /test/repB**. Le résultat est la synchronisation du **répertoire /test/repA** vers **/test/repB**.

Pour éviter des erreurs, la commande **rsync** vous permet de visualiser le résultat de votre commande sans exécuter la commande grâce à l'utilisation des options **-n** et **-r**.

De nouveau, supprimez les fichiers dans le répertoire **/test/repB** :

```
[root@redhat9 ~]# rm -rf /test/repB/*
[root@redhat9 ~]# ls -l /test/repB/
total 0
```

Exécutez la commande ci-dessous :

```
[root@redhat9 ~]# rsync -anv /test/repA/ /test/repB
sending incremental file list
./
file1
file10
file11
file12
file13
file14
file15
file16
file17
file18
file19
```

```
file2
file20
file3
file4
file5
file6
file7
file8
file9

sent 387 bytes  received 79 bytes  932.00 bytes/sec
total size is 0  speedup is 0.00 (DRY RUN)

[root@redhat9 ~]# ls -l /test/repB/
total 0
```

> **Important** - Notez que dans ce cas, le résultat de la synchronisation est d'envoyer le **contenu** du répertoire **/test/repA** vers **/test/repB**.

Maintenant, exécutez la commande ci-dessous :

```
[root@redhat9 ~]# rsync -anv /test/repA /test/repB
sending incremental file list
repA/
repA/file1
repA/file10
repA/file11
repA/file12
repA/file13
repA/file14
repA/file15
```

```
repA/file16
repA/file17
repA/file18
repA/file19
repA/file2
repA/file20
repA/file3
repA/file4
repA/file5
repA/file6
repA/file7
repA/file8
repA/file9

sent 397 bytes  received 80 bytes  954.00 bytes/sec
total size is 0  speedup is 0.00 (DRY RUN)

[root@redhat9 ~]# ls -l /test/repB/
total 0
```

> **Important** - Notez que dans ce cas, le résultat de la synchronisation est d'envoyer le répertoire **/test/repA** vers **/test/repB**.

Options de la Commande

Les options de la commande rsync sont :

```
[root@redhat9 ~]# rsync --help
rsync  version 3.2.3  protocol version 31
Copyright (C) 1996-2020 by Andrew Tridgell, Wayne Davison, and others.
```

```
Web site: https://rsync.samba.org/
Capabilities:
    64-bit files, 64-bit inums, 64-bit timestamps, 64-bit long ints,
    socketpairs, hardlinks, hardlink-specials, symlinks, IPv6, atimes,
    batchfiles, inplace, append, ACLs, xattrs, optional protect-args, iconv,
    symtimes, prealloc, stop-at, no crtimes
Optimizations:
    SIMD, asm, openssl-crypto
Checksum list:
    md5 md4 none
Compress list:
    zstd lz4 zlibx zlib none

rsync comes with ABSOLUTELY NO WARRANTY.  This is free software, and you
are welcome to redistribute it under certain conditions.  See the GNU
General Public Licence for details.

rsync is a file transfer program capable of efficient remote update
via a fast differencing algorithm.

Usage: rsync [OPTION]... SRC [SRC]... DEST
  or   rsync [OPTION]... SRC [SRC]... [USER@]HOST:DEST
  or   rsync [OPTION]... SRC [SRC]... [USER@]HOST::DEST
  or   rsync [OPTION]... SRC [SRC]... rsync://[USER@]HOST[:PORT]/DEST
  or   rsync [OPTION]... [USER@]HOST:SRC [DEST]
  or   rsync [OPTION]... [USER@]HOST::SRC [DEST]
  or   rsync [OPTION]... rsync://[USER@]HOST[:PORT]/SRC [DEST]
The ':' usages connect via remote shell, while '::' & 'rsync://' usages connect
to an rsync daemon, and require SRC or DEST to start with a module name.

Options
--verbose, -v            increase verbosity
--info=FLAGS             fine-grained informational verbosity
--debug=FLAGS            fine-grained debug verbosity
```

```
--stderr=e|a|c          change stderr output mode (default: errors)
--quiet, -q             suppress non-error messages
--no-motd               suppress daemon-mode MOTD
--checksum, -c          skip based on checksum, not mod-time & size
--archive, -a           archive mode; equals -rlptgoD (no -H,-A,-X)
--no-OPTION             turn off an implied OPTION (e.g. --no-D)
--recursive, -r         recurse into directories
--relative, -R          use relative path names
--no-implied-dirs       don't send implied dirs with --relative
--backup, -b            make backups (see --suffix & --backup-dir)
--backup-dir=DIR        make backups into hierarchy based in DIR
--suffix=SUFFIX         backup suffix (default ~ w/o --backup-dir)
--update, -u            skip files that are newer on the receiver
--inplace               update destination files in-place
--append                append data onto shorter files
--append-verify         --append w/old data in file checksum
--dirs, -d              transfer directories without recursing
--mkpath                create the destination's path component
--links, -l             copy symlinks as symlinks
--copy-links, -L        transform symlink into referent file/dir
--copy-unsafe-links     only "unsafe" symlinks are transformed
--safe-links            ignore symlinks that point outside the tree
--munge-links           munge symlinks to make them safe & unusable
--copy-dirlinks, -k     transform symlink to dir into referent dir
--keep-dirlinks, -K     treat symlinked dir on receiver as dir
--hard-links, -H        preserve hard links
--perms, -p             preserve permissions
--executability, -E     preserve executability
--chmod=CHMOD           affect file and/or directory permissions
--acls, -A              preserve ACLs (implies --perms)
--xattrs, -X            preserve extended attributes
--owner, -o             preserve owner (super-user only)
--group, -g             preserve group
--devices               preserve device files (super-user only)
```

```
--copy-devices           copy device contents as regular file
--specials               preserve special files
-D                       same as --devices --specials
--times, -t              preserve modification times
--atimes, -U             preserve access (use) times
--open-noatime           avoid changing the atime on opened files
--crtimes, -N            preserve create times (newness)
--omit-dir-times, -O     omit directories from --times
--omit-link-times, -J    omit symlinks from --times
--super                  receiver attempts super-user activities
--fake-super             store/recover privileged attrs using xattrs
--sparse, -S             turn sequences of nulls into sparse blocks
--preallocate            allocate dest files before writing them
--write-devices          write to devices as files (implies --inplace)
--dry-run, -n            perform a trial run with no changes made
--whole-file, -W         copy files whole (w/o delta-xfer algorithm)
--checksum-choice=STR    choose the checksum algorithm (aka --cc)
--one-file-system, -x    don't cross filesystem boundaries
--block-size=SIZE, -B    force a fixed checksum block-size
--rsh=COMMAND, -e        specify the remote shell to use
--rsync-path=PROGRAM     specify the rsync to run on remote machine
--existing               skip creating new files on receiver
--ignore-existing        skip updating files that exist on receiver
--remove-source-files    sender removes synchronized files (non-dir)
--del                    an alias for --delete-during
--delete                 delete extraneous files from dest dirs
--delete-before          receiver deletes before xfer, not during
--delete-during          receiver deletes during the transfer
--delete-delay           find deletions during, delete after
--delete-after           receiver deletes after transfer, not during
--delete-excluded        also delete excluded files from dest dirs
--ignore-missing-args    ignore missing source args without error
--delete-missing-args    delete missing source args from destination
--ignore-errors          delete even if there are I/O errors
```

```
--force                  force deletion of dirs even if not empty
--max-delete=NUM         don't delete more than NUM files
--max-size=SIZE          don't transfer any file larger than SIZE
--min-size=SIZE          don't transfer any file smaller than SIZE
--max-alloc=SIZE         change a limit relating to memory alloc
--partial                keep partially transferred files
--partial-dir=DIR        put a partially transferred file into DIR
--delay-updates          put all updated files into place at end
--prune-empty-dirs, -m   prune empty directory chains from file-list
--numeric-ids            don't map uid/gid values by user/group name
--usermap=STRING         custom username mapping
--groupmap=STRING        custom groupname mapping
--chown=USER:GROUP       simple username/groupname mapping
--timeout=SECONDS        set I/O timeout in seconds
--contimeout=SECONDS     set daemon connection timeout in seconds
--ignore-times, -I       don't skip files that match size and time
--size-only              skip files that match in size
--modify-window=NUM, -@  set the accuracy for mod-time comparisons
--temp-dir=DIR, -T       create temporary files in directory DIR
--fuzzy, -y              find similar file for basis if no dest file
--compare-dest=DIR       also compare destination files relative to DIR
--copy-dest=DIR          ... and include copies of unchanged files
--link-dest=DIR          hardlink to files in DIR when unchanged
--compress, -z           compress file data during the transfer
--compress-choice=STR    choose the compression algorithm (aka --zc)
--compress-level=NUM     explicitly set compression level (aka --zl)
--skip-compress=LIST     skip compressing files with suffix in LIST
--cvs-exclude, -C        auto-ignore files in the same way CVS does
--filter=RULE, -f        add a file-filtering RULE
-F                       same as --filter='dir-merge /.rsync-filter'
                         repeated: --filter='- .rsync-filter'
--exclude=PATTERN        exclude files matching PATTERN
--exclude-from=FILE      read exclude patterns from FILE
--include=PATTERN        don't exclude files matching PATTERN
```

```
--include-from=FILE      read include patterns from FILE
--files-from=FILE        read list of source-file names from FILE
--from0, -0              all *-from/filter files are delimited by 0s
--protect-args, -s       no space-splitting; wildcard chars only
--copy-as=USER[:GROUP]   specify user & optional group for the copy
--address=ADDRESS        bind address for outgoing socket to daemon
--port=PORT              specify double-colon alternate port number
--sockopts=OPTIONS       specify custom TCP options
--blocking-io            use blocking I/O for the remote shell
--outbuf=N|L|B           set out buffering to None, Line, or Block
--stats                  give some file-transfer stats
--8-bit-output, -8       leave high-bit chars unescaped in output
--human-readable, -h     output numbers in a human-readable format
--progress               show progress during transfer
-P                       same as --partial --progress
--itemize-changes, -i    output a change-summary for all updates
--remote-option=OPT, -M  send OPTION to the remote side only
--out-format=FORMAT      output updates using the specified FORMAT
--log-file=FILE          log what we're doing to the specified FILE
--log-file-format=FMT    log updates using the specified FMT
--password-file=FILE     read daemon-access password from FILE
--early-input=FILE       use FILE for daemon's early exec input
--list-only              list the files instead of copying them
--bwlimit=RATE           limit socket I/O bandwidth
--stop-after=MINS        Stop rsync after MINS minutes have elapsed
--stop-at=y-m-dTh:m      Stop rsync at the specified point in time
--write-batch=FILE       write a batched update to FILE
--only-write-batch=FILE  like --write-batch but w/o updating dest
--read-batch=FILE        read a batched update from FILE
--protocol=NUM           force an older protocol version to be used
--iconv=CONVERT_SPEC     request charset conversion of filenames
--checksum-seed=NUM      set block/file checksum seed (advanced)
--ipv4, -4               prefer IPv4
--ipv6, -6               prefer IPv6
```

```
--version, -V           print the version + other info and exit
--help, -h (*)          show this help (* -h is help only on its own)

Use "rsync --daemon --help" to see the daemon-mode command-line options.
Please see the rsync(1) and rsyncd.conf(5) man pages for full documentation.
See https://rsync.samba.org/ for updates, bug reports, and answers
```

Compression

La Commande gzip

Présentation

La commande **gzip** est un utilitaire de compression sous GNU/Linux. La commande **gunzip** est un utilitaire de décompression sous GNU/Linux.

Options des Commandes

Les options de la commande **gzip** sont :

```
[root@redhat9 ~]# gzip --help
Usage: gzip [OPTION]... [FILE]...
Compress or uncompress FILEs (by default, compress FILES in-place).

Mandatory arguments to long options are mandatory for short options too.

  -c, --stdout      write on standard output, keep original files unchanged
  -d, --decompress  decompress
  -f, --force       force overwrite of output file and compress links
  -h, --help        give this help
```

```
  -k, --keep        keep (don't delete) input files
  -l, --list        list compressed file contents
  -L, --license     display software license
  -n, --no-name     do not save or restore the original name and timestamp
  -N, --name        save or restore the original name and timestamp
  -q, --quiet       suppress all warnings
  -r, --recursive   operate recursively on directories
      --rsyncable   make rsync-friendly archive
  -S, --suffix=SUF  use suffix SUF on compressed files
      --synchronous synchronous output (safer if system crashes, but slower)
  -t, --test        test compressed file integrity
  -v, --verbose     verbose mode
  -V, --version     display version number
  -1, --fast        compress faster
  -9, --best        compress better

With no FILE, or when FILE is -, read standard input.

Report bugs to <bug-gzip@gnu.org>.
```

Les options de la commande **gunzip** sont :

```
[root@redhat9 ~]# gunzip --help
Usage: /usr/bin/gunzip [OPTION]... [FILE]...
Uncompress FILEs (by default, in-place).

Mandatory arguments to long options are mandatory for short options too.

  -c, --stdout      write on standard output, keep original files unchanged
  -f, --force       force overwrite of output file and compress links
  -k, --keep        keep (don't delete) input files
  -l, --list        list compressed file contents
  -n, --no-name     do not save or restore the original name and timestamp
  -N, --name        save or restore the original name and timestamp
```

```
  -q, --quiet       suppress all warnings
  -r, --recursive   operate recursively on directories
  -S, --suffix=SUF  use suffix SUF on compressed files
      --synchronous synchronous output (safer if system crashes, but slower)
  -t, --test        test compressed file integrity
  -v, --verbose     verbose mode
      --help        display this help and exit
      --version     display version information and exit

With no FILE, or when FILE is -, read standard input.

Report bugs to <bug-gzip@gnu.org>.
```

LAB #6 - Travailler avec la Commande gzip

Utilisez **gzip** pour compresser votre fichier tar :

```
[root@redhat9 ~]# gzip /tmp/test.tar
```

Constatez la taille du fichier **test.tar.gz** :

```
[root@redhat9 ~]# ls -l /tmp/test.tar.gz
-rw-r--r--. 1 root root 222 Sep 27 07:57 /tmp/test.tar.gz
```

> **Important** - Notez que le fichier compressé a été créé dans le même répertoire que le fichier source et que le fichier source a disparu.

Décompressez le fichier test.tar.gz :

```
[root@redhat9 ~]# gunzip /tmp/test.tar.gz
```

La Commande bzip2

Présentation

La commande **bzip2** est un utilitaire de compression sous GNU/Linux. La commande **bunzip2** est un utilitaire de décompression sous GNU/Linux.

Options des Commandes

Les options de la commande **bzip2** sont :

```
[root@redhat9 ~]# bzip2 --help
bzip2, a block-sorting file compressor.  Version 1.0.8, 13-Jul-2019.

   usage: bzip2 [flags and input files in any order]

   -h --help           print this message
   -d --decompress     force decompression
   -z --compress       force compression
   -k --keep           keep (don't delete) input files
   -f --force          overwrite existing output files
   -t --test           test compressed file integrity
   -c --stdout         output to standard out
   -q --quiet          suppress noncritical error messages
   -v --verbose        be verbose (a 2nd -v gives more)
   -L --license        display software version & license
   -V --version        display software version & license
   -s --small          use less memory (at most 2500k)
   -1 .. -9            set block size to 100k .. 900k
```

```
   --fast              alias for -1
   --best              alias for -9

   If invoked as `bzip2', default action is to compress.
              as `bunzip2',  default action is to decompress.
              as `bzcat', default action is to decompress to stdout.

   If no file names are given, bzip2 compresses or decompresses
   from standard input to standard output.  You can combine
   short flags, so `-v -4' means the same as -v4 or -4v, &c.
```

Les options de la commande **bunzip2** sont :

```
[root@redhat9 ~]# bunzip2 --help
bzip2, a block-sorting file compressor.  Version 1.0.8, 13-Jul-2019.

   usage: bunzip2 [flags and input files in any order]

   -h --help           print this message
   -d --decompress     force decompression
   -z --compress       force compression
   -k --keep           keep (don't delete) input files
   -f --force          overwrite existing output files
   -t --test           test compressed file integrity
   -c --stdout         output to standard out
   -q --quiet          suppress noncritical error messages
   -v --verbose        be verbose (a 2nd -v gives more)
   -L --license        display software version & license
   -V --version        display software version & license
   -s --small          use less memory (at most 2500k)
   -1 .. -9            set block size to 100k .. 900k
   --fast              alias for -1
   --best              alias for -9
```

```
   If invoked as `bzip2', default action is to compress.
             as `bunzip2',  default action is to decompress.
             as `bzcat', default action is to decompress to stdout.

   If no file names are given, bzip2 compresses or decompresses
   from standard input to standard output.  You can combine
   short flags, so `-v -4' means the same as -v4 or -4v, &c.0
```

LAB #7 - Travailler avec la Commande bzip2

Utilisez **bzip2** pour compresser votre fichier tar :

```
[root@redhat9 ~]# bzip2 /tmp/test.tar
```

Constatez la taille du fichier **tar.bz2** :

```
[root@redhat9 ~]# ls -l /tmp | grep test.tar.bz
-rw-r--r--. 1 root root       207 Sep 27 07:57 test.tar.bz2
```

> **Important** - Notez que le fichier compressé a été créé dans le même répertoire que le fichier source et que le fichier source a disparu.

Décompressez le fichier tar.bz2 :

```
[root@redhat9 ~]# bunzip2 /tmp/test.tar.bz2
```

La Commande xz

Présentation

La commande **xz** est un utilitaire de compression sous GNU/Linux. D'autres commandes sont :

- **unxz** - équivalent à **xz –decompress**.
- **xzcat** - équivalent à **xz –decompress –stdout**.
- **lzma** - équivalent à **xz –format=lzma**.
- **unlzma** - équivalent à **xz –format=lzma –decompress**.
- **lzcat** - équivalent à **xz –format=lzma –decompress –stdout**.

La commande xz ne compressera pas le fichier si :

- le fichier n'est pas de type standard
- le fichier est un lien symbolique
- le fichier est un lien physique
- le fichier possède le sticky bit, le SUID bit ou le SGID bit
- le fichier possède déjà une extension .xz ou .lzma

La commande xz ne décompressera pas le fichier si :

- le fichier ne possède pas d'extension .xz ou .lzma

Options des Commandes

Les options de la commande **xz** sont :

```
[root@redhat9 ~]# xz --help
Usage: xz [OPTION]... [FILE]...
Compress or decompress FILEs in the .xz format.

  -z, --compress      force compression
  -d, --decompress    force decompression
  -t, --test          test compressed file integrity
```

```
  -l, --list          list information about .xz files
  -k, --keep          keep (don't delete) input files
  -f, --force         force overwrite of output file and (de)compress links
  -c, --stdout        write to standard output and don't delete input files
  -0 ... -9           compression preset; default is 6; take compressor *and*
                      decompressor memory usage into account before using 7-9!
  -e, --extreme       try to improve compression ratio by using more CPU time;
                      does not affect decompressor memory requirements
  -T, --threads=NUM   use at most NUM threads; the default is 1; set to 0
                      to use as many threads as there are processor cores
  -q, --quiet         suppress warnings; specify twice to suppress errors too
  -v, --verbose       be verbose; specify twice for even more verbose
  -h, --help          display this short help and exit
  -H, --long-help     display the long help (lists also the advanced options)
  -V, --version       display the version number and exit

With no FILE, or when FILE is -, read standard input.

Report bugs to <lasse.collin@tukaani.org> (in English or Finnish).
XZ Utils home page: <https://tukaani.org/xz/>
```

LAB #8 - Travailler avec la Commande xz

Utilisez **xz** pour compresser votre fichier tar :

```
[root@redhat9 ~]# xz /tmp/test.tar
```

> **Important** - Notez que le fonctionnement par défaut de la commande est identique à celui de l'option **-z**.

Constatez la présence du fichier **test.tar.xz** :

```
[root@redhat9 ~]# ls -l /tmp | grep test.tar.xz
-rw-r--r--. 1 root root       236 Sep 27 07:57 test.tar.xz
```

> **Important** - Notez que le fichier compressé a été créé dans le même répertoire que le fichier source et que le fichier source a disparu. Le fichier source peut être maintenue si l'option **–keep** est spécifiée. Si le fichier test.tar.xz avait déjà existé, la commande aurait échouée avec un message d'erreur. L'extension du fichier est **.xz**, cependant la commande peut aussi gérer l'extension **.lzma**.

Décompressez le fichier test.tar.xz :

```
[root@redhat9 ~]# xz -d /tmp/test.tar.xz
[root@redhat9 ~]# ls -l /tmp | grep test
-rw-r--r--. 1 root root       160 Sep 25 16:05 greptest
-rw-r--r--. 1 root root        49 Sep 25 16:05 greptest1
-rw-r--r--. 1 root root    687556 Sep 25 16:08 sedtest
-rw-r--r--. 1 root root       512 Sep 27 08:08 test.cpio
-rw-r--r--. 1 root root     10240 Sep 27 07:57 test.tar
```

Autres Utilitaires

Il existe d'autres utilitaires pour la compression, chacun produisant un fichier ayant une extension spécifique :

Outil	Extension	Commande de Compression	Commande de Décompression
compress	.Z	compress	uncompress
rar	.rar	rar	unrar
zip	.zip	zip	unzip