Copying Files and Directories with rsync

SUSE Linux Enterprise Server for NVIDIA includes rsync, a utility for transferring and copying files locally or remotely in a single direction. By transmitting only file differences rather than entire contents, rsync minimizes data transfer volume, making it an efficient solution for scheduled backups, server mirroring and transfers over low-bandwidth network connections.

Prerequisites

- Read and write access permissions for the specified source and destination locations
- rsync installed on both source and destination systems with SSH connectivity for remote file transfers

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1 The rsync concept

You can use the `rsync` tool for transferring or copying files locally and remotely. `rsync` is unidirectional. It copies files in a single direction and does not synchronize data. Instead of transmitting all the contents in the file, `rsync` minimizes the amount of data copied by moving only the changes within the file. Hence, this supports the transfer of data over a slow network connection.

For copying large files using `rsync`, detecting changes requires certain computing power. So ensure that machines on both source and destination have enough resources, including RAM.

Use rsync when a large amount of data containing only minor changes needs to be transmitted regularly. This is useful when working with backups. `rsync` can also be useful for mirroring staging servers that store complete directory trees of Web servers to a Web server in a DMZ.

This article includes examples that show the usage of `rsync` to copy files locally and remotely. This document also explains how to configure and use an `rsync` server.

2 Basic rsync usage

You can use `rsync` on any machine where you have access and write permissions.

Copy files from the source location to the destination location as shown in the following example:

```
> rsync [OPTION] SOURCE [SOURCE]... DESTINATION
```

You can have multiple `SOURCE` entries and the `SOURCE` and `DESTINATION` placeholders can be paths, URLs or both.

Listed below are a few use cases of copying files:

- ```
  > rsync -av /directory1/ /destination/
  ```

  In the above example, the trailing slash after the directory denotes the content of the directory and not the directory itself. In this, only the contents of `/directory1` are copied to `/destination`.

- ```
  > rsync -av /directory1 /destination/
  ```

  In the above example, the directory `/directory1` is copied to `/destination` resulting in `/destination/directory1/`.

- ```
  > rsync -av example1.txt example2.txt /destination/directory/
  ```
  ```

The above example shows copying the files `example1.txt` and `example2.txt` to the destination directory.

The commonly used `OPTIONS` are listed below:

- `-V`
  shows verbose output text
- `-a`
  archive mode; copies files recursively and preserves time stamps, user/group ownership, file permissions and symbolic links
- `-z`
  compresses the transmitted data
- `-n` or `--dry-run`
  performs a trial run with no changes made
- `-r`
  recurse into directories
- `--progress`
  shows progress during transfer
- `-b`
  takes a backup during data synchronization
- `-h`
  shows the numbers in the output in a human-readable format
- `-e`
  for remote transfers, instructs rsync to use the SSH protocol
- `-q or --quiet`
  silences the rsync command and option output
- `--version`
  prints the rsync version number and exit

Copy files locally with compression

```
> rsync -avz example1.txt example2.txt /destination/
```

`-a` archive mode

`-v` verbose

`-z` compress data during transfer

Copy a directory with compression

```
> rsync -avz /sourcedirectory/ /destinationdirectory/
```

Transfers `/sourcedirectory/` contents with compression.

Remote file transfer with compression

```
> rsync -avz example1.txt user@remote_host:/remote/destination/
```

Transfers `example1.txt` to a remote machine over SSH while compressing the data.

Remote directory transfer with compression

```
> rsync -avz /sourcedirectory/ user@remote_host:/remote/destination/
```

Transfers `/sourcedirectory/` to a remote machine over SSH while compressing the data.

3 Copying files and directories with rsync locally

You can copy files within the same machine using rsync if you have write permission for the destination location.

To copy the file `backup.tar.xz` to the location `/var/backup/`, use the command **`rsync -avz backup.tar.xz /var/backup/`**.

The file `backup.tar.xz` is copied to `/var/backup/`, and the absolute path is`/var/backup/backup.tar.xz`.

4 Copying files and directories with rsync remotely

You can copy files from one machine to a remote machine using rsync. Ensure that you have rsync in both source and destination machines and that you are connected to the remote machine over SSH.

To copy a single file from one directory on your machine to the `/var/backup` directory on a remote machine, use the following command:

```
> rsync -avz example1.txt user@remote_host:/var/backup/
```



Note: Trailing slash

Ensure that you add the trailing slash after the`/var/backup/` directory. If you do not insert the slash, the file `example1.txt` is copied to `/var/backup` file and not inside the directory `/var/backup/`.

Verify the copied file in the absolute path `/var/backup/example1.txt`.

To copy the directory `source/` and its contents into the directory `/var/backup/`:

```
> rsync -avz /source/ user@remote_host:/var/backup/
```

Verify the copied directory in the absolute path `/var/backup/source/`.

5 Configuring and using an rsync server

An rsync server enables file synchronization, automated backups and centralized storage. You can run rsync as a daemon `rsyncd` listening on default port 873 for incoming connections. This daemon can receive `copying targets`.

PROCEDURE 1: SETTING UP AN RSYNC SERVER

The configuration file for the rsync daemon is separated into a main file and certain modules which hold your backup target. This makes it easier to add additional targets later. You can store global values in `/etc/rsyncd.d/*.inc` files, whereas your modules are placed in `/etc/rsyncd.d/*.conf`.

The following description explains how to create an rsync server with a backup target. This target can be used to store your backups. To create an rsync server, do the following:

1. On your local machine, create a directory `/var/backup` to store all your backup files.

   ```
   > mkdir /var/backup
   ```

2. Specify ownership:
   In this example, the user `tux` in the group `users` owns the directory:

   ```
   > chown tux.users /var/backup
   ```

3. Configure the `rsyncd` daemon:

   a. Create a directory `/etc/rsyncd.d/`

```
> mkdir /etc/rsyncd.d/
```

b. Create the main configuration file `/etc/rsyncd.conf` and add the following lines:

```
log file = /var/log/rsync.log ❶
pid file = /var/run/rsync.pid ❷
merge /etc/rsyncd.d ❸
include /etc/rsyncd.d ❹
```

❶ `/var/log/rsync.log` is the location where rsync writes the logs.

❷ `/var/run/rsync.pid` is the file that contains the PID of the running rsync daemon instance.

❸ Merges global values from `/etc/rsyncd.d/*.inc` files into the main configuration file.

❹ Loads any modules (or targets) from `/etc/rsyncd.d/*.conf` files. These files must not contain any references to global values.

4. Create your module or your backup target in the file `/etc/rsyncd.d/backup.conf` with the following lines:

```
backup.conf: backup module
  [backup] ❶
     uid = tux ❷
     gid = users ❸
     path = /var/backup ❹
     auth users = tux ❺
     secrets file = /etc/rsyncd.secrets ❻
     comment = Our backup target ❼
```

In the given example:

❶ `[backup]` is the backup target. You can use any name for the backup target. You may use a name according to its purpose and use the same name in your `*.conf` file.

❷ `uid = tux` specifies the user name or group name that is used when the file transfer takes place.

❸ `gid = users` defines the path to store your backups (from Step 1).

❹ `path = /var/backup` defines the path to store your backups (from Step 1).

❺ `auth users = tux` specifies a comma-separated list of allowed users. In its simplest form, it contains the user names that are allowed to connect to this module. In our case, only user tux is allowed.

❻ `secrets file = /etc/rsyncd.secrets` specifies the path of a file that contains lines with user names and plain passwords.

5. Create the `/etc/rsyncd.secrets` file with the following content and replace `PASSPHRASE`:

```
# user:passwd
tux:PASSPHRASE
```

6. Make sure the file is only readable by root:

```
chmod 0600 /etc/rsyncd.secrets
```

7. Start and enable the `rsyncd` daemon with:

```
>  systemctl enable rsyncd
>  systemctl start rsyncd
```

8. On the remote machine, test the access to your `rsync` server:

```
>  rsync jupiter::
```

A response similar to the following appears:

```
backup Our backup target
```

If the above response does not appear, verify your configuration file, firewall and network settings. The above steps create an `rsync` server that you can use to store backups. The example also creates a log file listing all connections. This file is stored in `/var/log/rsyncd`.log. This is useful for debugging your transfers.

9. To list the content of your backup target, use the following command on your local machine:

```
>  rsync -avz jupiter::backup
```

This command lists all files present in the directory `/var/backup` on the server. This request is also logged in the log file `/var/log/rsyncd.log`.

10. To copy the current directory to your `rsync` backup server, provide the source directory. If the source directory is your current directory, use `.`

```
> rsync -avz . jupiter::backup
```

By default, `rsync` does not delete files and directories when it runs. To enable deletion, the additional option `--delete` must be stated. To ensure that no newer files are deleted, the option `--update` can be used instead. Any conflicts that arise must be resolved manually.

6 Deleting and updating files and directories with rsync

You can copy and synchronize files within the same machine using rsync if you have write permission for the destination location. You can also delete files or directories after copying.

To copy files `example1.txt` and `example2.txt` from `/source/directory/` to `/destination/directory/`:

```
> rsync -av --update /source/directory/ /destination/directory/
```

The rsync command updates the files `example1.txt` and `example2.txt` in the `/destination/directory/` if it is older than the source file. If the version in the destination is newer, then the files will not be overwritten. Also, all other new files or directories from `/source/directory/` will be copied to `/destination/`.

To copy an existing file and delete a file that does not exist in the destination directory:

```
> rsync -av --delete /source/directory/ /destination/directory/
```

In this scenario, both the source and destination directories contain `example1.txt` and `example2.txt`. The `/destination/directory` contains an extra file, `example3.txt`.

The rsync command copies or updates the files `example1.txt` and `example2.txt` from `/source/directory/` to `/destination/directory/`. The command also deletes the file `example3.txt` from `/destination/directory/` as it does not exist in the `/source/directory/`. Also, the directory structure in `/destination/directory/` is cleaned up to match the `/source/directory/`.

7 Troubleshooting rsync

File or folder copying may fail due to several reasons. Ensure that you have the required permissions and resources to perform the file copy.

Possible troubleshooting methods are mentioned below:

- Ensure that you have the latest version of rsync. To transfer files or directories remotely, ensure that rsync is installed on both the source and destination machines.
- Ensure that you have the required rsync access permission.
- Ensure that you provide the correct host name to copy files remotely.
- Ensure that the rsync service is running if you are using rsync in daemon mode.

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