

# Setting Up a FreeRADIUS Server

## WHAT?

FreeRADIUS is the open source RADIUS server implementation for AAA (Authentication, Authorization, and Accounting).

## WHY?

This article provides a complete overview of the FreeRADIUS server setup and basic FreeRADIUS configuration for testing.

## EFFORT

It takes 15 minutes to install and configure FreeRADIUS. You need up to an hour to fully understand the FreeRADIUS architecture and functionality.

## GOAL

Basic understanding of setting up and testing a FreeRADIUS server.

## REQUIREMENTS

- A virtual machine or instance to install FreeRADIUS.
- Another virtual machine on your network to test client functions.

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# 1 The FreeRADIUS concept

The RADIUS (Remote Authentication Dial-In User Service) protocol is a standard service for managing network access. FreeRADIUS is the open source RADIUS server implementation and the most widely used RADIUS server.

FreeRADIUS verifies users and clients and manages network access and operations. FreeRADIUS ensures secure communication between network devices and user authentication servers.

FreeRADIUS performs authentication, authorization and accounting (AAA) for very large businesses such as Internet service providers and cellular network providers, and is also popular for small networks. It authenticates users and devices, authorizes those users and devices for certain network services, and tracks the use of services for billing and auditing. You do not have to use all three of the AAA protocols, use only the ones you need.

RADIUS operates over a distributed architecture and runs separately from the Network Access Server (NAS). User access data is stored on a central RADIUS server that is available to multiple NAS devices. The NAS provides physical access to the network, such as a managed Ethernet switch or a wireless access point. FreeRADIUS verifies and manages network access and operations. FreeRADIUS ensures secure communication between network devices and user authentication servers. To set up a FreeRADIUS server, you must install, configure and define user accounts, and define and determine authentication and authorization for FreeRADIUS. After installing FreeRADIUS, you must test the function by integrating FreeRADIUS with the devices to be managed.

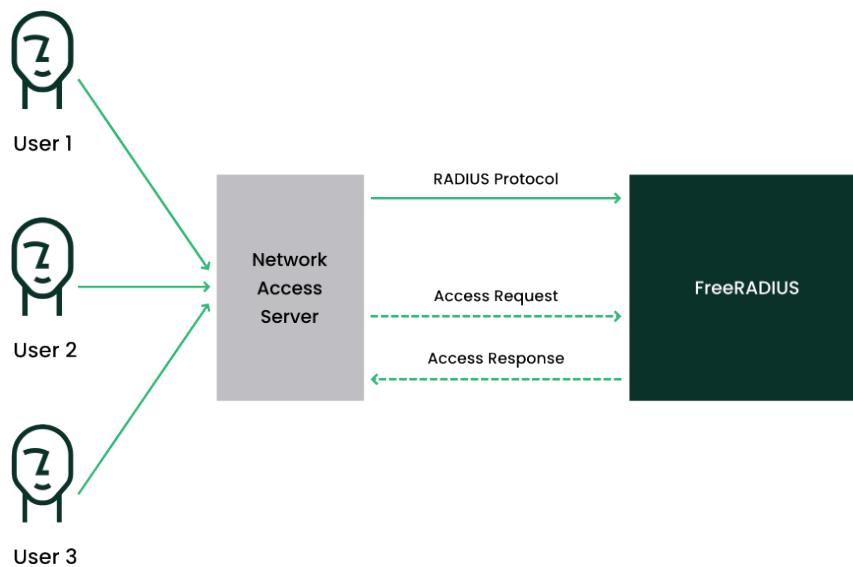


FIGURE 1: FREERADIUS ARCHITECTURE

This article includes an example that shows installing FreeRADIUS, creating a set of test certificates, starting the server, adding client server and user, testing authentication, and testing multiple clients.

## 2 Installing the FreeRADIUS server

The following example shows how to install a FreeRADIUS server. Ensure that you install the `freeradius-server` and `freeradius-server-utils` packages on a separate machine from your Network Access Server (NAS).

Install `freeradius-server` and `freeradius-server-utils`.

```
> sudo zypper install freeradius-server and freeradius-server-utils
```

## 3 Creating test certificates on the server

Certificates enable secure communication between the FreeRADIUS clients and the FreeRADIUS server.

To allow access to the server, certificate authentication is required. To test the authentication using FreeRADIUS, you can create test certificates. The following example shows how to create test certificates to test FreeRADIUS. Ensure that you remove the test certificates and use the correct certificates after testing FreeRADIUS.



### Note

The test certificates created are not suitable for production use.

Create a set of test certificates in `/etc/raddb/certs`.

```
> cd /etc/raddb/certs
./bootstrap
```

When you are satisfied with your testing and ready to create a production configuration, remove all the test certificates in `/etc/raddb/certs` and replace them with your own certificates.

## 4 Starting FreeRADIUS on the server

You must start FreeRADIUS on the server after installation.

### PROCEDURE 1: STARTING FREERADIUS

After the bootstrap is complete, start the server in debugging mode as a root user.

- To do this, run the following command:



#### Note

Start the FreeRADIUS server in debugging mode only for testing. Other than for testing, use **sudo systemctl start freeradius**

```
> sudo radiusd -X
[...]
Listening on auth address * port 1812 bound to server default
Listening on acct address * port 1813 bound to server default
Listening on auth address :: port 1812 bound to server default
Listening on acct address :: port 1813 bound to server default
Listening on auth address 127.0.0.1 port 18120 bound to server inner-tunnel
Listening on proxy address * port 54435
Listening on proxy address :: port 58415
Ready to process requests
```

The Listening and Ready to process requests appear when the server starts correctly.

## 5 Adding a test client with a user on the server

You can add a client and a user to test authentication for the FreeRADIUS server. The client is a client of the RADIUS server, such as a wireless access point or switch. The users are added in the user configuration file and the clients are added in the client configuration file. These configuration files are stored on the server where FreeRADIUS is installed.

The machines that can use the devices of the FreeRADIUS server are defined in the client.conf file.

## PROCEDURE 2: CONFIGURING USERS AND CLIENTS

Add the machines that can use the devices of the FreeRADIUS server and the users by using the following example:

1. Configure users in the authorization file, `/etc/raddb/mods-config/files/authorize`. To do this, open `/etc/raddb/mods-config/files/authorize` and uncomment the following lines:

```
bob   Cleartext-Password := "hello"
      Reply-Message := "Hello, %{User-Name}"

"john" Cleartext-Password := "newpassword"
      Service-Type = New-User,
      Framed-IP-Address = 190.155.2.50
```

2. Add a test client and user to test the authentication in `/etc/raddb/client.conf`.

```
vi /etc/raddb/client.conf
```

A test client, localhost, is provided in `/etc/raddb/client.conf`, with the secret `testing123`.

```
client private-networks {
    ipaddr      = 190.1.0/22
    secret      = testingabc-1
}
client common-network {
    ipaddr      = 191.1.0/27
    secret      = testingxyz
}
```

3. Add clients of the RADIUS server, such as a wireless access point, network switch, or another form of NAS.

Create a client configuration on your server by using the following example.

Uncomment the following entry in `/etc/raddb/client.conf` and use the IP address of your test client machine or access gateway instead of the given IP address.

```
client private-network-1 {
    ipaddr      = 192.0.2.0/24
    secret      = testing123-1
}
```

You must also configure the client to talk to the RADIUS server by using the IP address of the machine running the RADIUS server. The client must use the same secret as configured above in the client section.

4. On the client machine, install **freeradius-server-utils**.

```
> sudo zypper install freeradius-server and freeradius-server-utils
```

You can now add more users and configure databases.

Run one more login test from a different computer on your network.

## 6 Starting the FreeRADIUS daemon on the server

After adding client and user, you must start the FreeRADIUS daemon.

### PROCEDURE 3: STARTING THE FREERADIUS DAEMON

Start the FreeRADIUS daemon to provide authentication, authorization, and accounting (AAA) services in a network environment for network access control and network access management.

1. Start the FreeRADIUS daemon.

```
> sudo systemctl restart freeradius
```

2. Enable auto-start for FreeRADIUS on system boot up.

```
> sudo systemctl enable freeradius
```

## 7 Testing authentication on the client

You can test the authentication for the newly added user in FreeRADIUS.

### PROCEDURE 4: TESTING AUTHENTICATION

Test the authentication for the newly added user using the following example:

- Open a new terminal, and as an unprivileged user, use the **radtest** command to log in as the newly added user **bob**.

```
> radtest bob hello 127.0.0.1 0 testing123
```

```
Sent Access-Request Id 241 from 0.0.0.0:35234 to 127.0.0.1:1812 length 73
  User-Name = "bob"
  User-Password = "hello"
  NAS-IP-Address = 127.0.0.1
  NAS-Port = 0
  Message-Authenticator = 0x00
  Cleartext-Password = "hello"
Received Access-Accept Id 241 from 127.0.0.1:1812 to 0.0.0.0:0 length 20
```

After the authentication is successful, a login message appears in the terminal in which you started FreeRADIUS, as shown below.

```
(3) pap: Login attempt with password
    (3) pap: Comparing with "known good" Cleartext-Password
    (3) pap: User authenticated successfully
    (3)      [pap] = ok
    [...]
    (3) Sent Access-Accept Id 241 from 127.0.0.1:1812 to 127.0.0.1:35234
length 0
    (3) Finished request
    Waking up in 4.9 seconds.
    (3) Cleaning up request packet ID 241 with timestamp +889
```

The access request is successful and the authentication methods PAP, CHAP, MS-CHAPv1, MS-CHAPv2, PEAP, EAP-TTLS, EAP-GTC, EAP-MD5 work for the user bob.

## 8 Troubleshooting FreeRADIUS

There are several test users and test clients provided. Ensure that your server has the correct firewall settings. If your test logins fail, review all the output to understand the issues.

Possible troubleshooting methods are given below:

- Check FreeRADIUS logs in /var/log/freeradius/radius.log or /var/log/radius/radius.log.
- Check if FreeRADIUS is running.

```
systemctl status freeradius
```

If FreeRADIUS is not running, start FreeRADIUS.



```
systemctl start freeradius
```

If a FreeRADIUS server is already running, an error `Address already in use` appears. Stop that server before running the server in debugging mode.

If the server does not start, verify the output. The output includes the details about the errors. You can direct the output to a text file with `tee`:

```
radiusd -X | tee radiusd.text
```

- Check if the ports for FreeRADIUS in the firewall are open for communication.
- Check user authentication.

```
radtest username password localhost 0 testing123
```

- Verify client configuration. Ensure that the secret and IP in the client and the FreeRADIUS server match.
- Update FreeRADIUS software. Ensure that you use the latest stable version of FreeRADIUS.

When you are satisfied with your testing and ready to create a production configuration, remove all the test certificates in `/etc/raddb/certs` and replace them with your own certificates, comment out all the test users and clients, and stop `radiusd` by pressing `Ctrl-C`. Manage the `radiusd.service` with `systemctl`, just like any other service.

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