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How to Set Up a Firewall with UFW on Ubuntu

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Firewall Ubuntu

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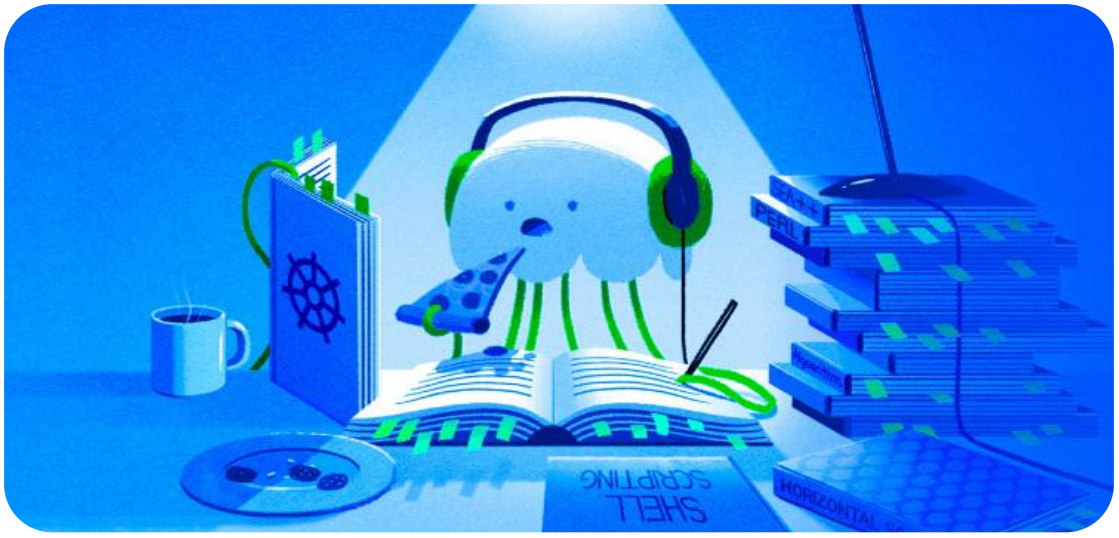

Introduction

UFW, or Uncomplicated Firewall, is an interface to `iptables` that is geared towards simplifying the process of configuring a firewall. While `iptables` is a solid and flexible tool, it can be difficult for beginners to learn how to use it to properly configure a firewall. If you're looking to get started securing your network, and you're not sure which tool to use, UFW may be the right choice for you.

This tutorial will show you how to set up a firewall with UFW on Ubuntu v18.04 and above.

Prerequisites

If you are using Ubuntu version 16.04 or below, we recommend you upgrade to a more latest version since Ubuntu no longer provides support for these versions. This collection of guides will help you in upgrading your Ubuntu version.

To follow this tutorial, you will need:

- A server running Ubuntu, along with a non-root user with `sudo` privileges. For guidance on how to set these up, please choose your distribution from this list and follow our Initial Server Setup Guide.
- UFW is installed by default on Ubuntu. If it has been uninstalled for some reason, you can install it with `sudo apt install ufw`.

Setup Ubuntu firewall with UFW

Step 1 – Making Sure IPv6 is Enabled

In recent versions of Ubuntu, IPv6 is enabled by default. In practice that means most firewall rules added to the server will include both an IPv4 and an IPv6 version, the latter identified by `v6` within the output of UFW's status command. To make sure IPv6 is enabled, you can check your UFW configuration file at `/etc/default/ufw`. Open this file using `nano` or your favorite command line editor:

Copy

```
$ sudo nano /etc/default/ufw
```

Th sure the value of `IPV6` is set to `yes`. It should look like this:

/etc/default/ufw excerpt

```
$ IPV6= yes
```

Save and close the file. If you're using `nano`, you can do that by typing `CTRL+X`, then `Y` and `ENTER` to confirm.

When UFW is enabled in a later step of this guide, it will be configured to write both IPv4 and IPv6 firewall rules.

Step 2 – Setting Up Default Policies

If you're just getting started with UFW, a good first step is to check your default firewall policies. These rules control how to handle traffic that does not explicitly match any other rules.

By default, UFW is set to deny all incoming connections and allow all outgoing connections. This means anyone trying to reach your server would not be able to connect, while any application within the server would be able to reach the outside world. Additional rules to allow specific services and ports are included as exceptions to this general policy.

To make sure you'll be able to follow along with the rest of this tutorial, you'll now set up your UFW default policies for incoming and outgoing traffic.

To set the default UFW incoming policy to `deny`, run:

Copy

```
$ sudo ufw default deny incoming
```

```
Output
incoming policy changed to 'deny'
 to update your rules accordingly)
```

To set the default UFW outgoing policy to `allow`, run:

Copy

```
$ sudo ufw default allow outgoing
```

```
Output
Default outgoing policy changed to 'allow'
(be sure to update your rules accordingly)
```

These commands set the defaults to deny incoming and allow outgoing connections. These firewall defaults alone might suffice for a personal computer, but servers typically need to respond to incoming requests from outside users. We'll look into that next.

Step 3 – Allowing SSH Connections

If you were to enable your UFW firewall now, it would deny all incoming connections. This means that you'll need to create rules that explicitly allow legitimate incoming connections — SSH or HTTP connections, for example — if you want your server to respond to those types of requests. If you're using a cloud server, you will probably want to allow incoming SSH connections so you can connect to and manage your server.

Allowing the OpenSSH UFW Application Profile

Upon installation, most applications that rely on network connections will register an application profile within UFW, which enables users to quickly allow or deny external access to a service. You can check which profiles are currently registered in UFW with:

Copy

```
ufw app list
```

```
Output
Available applications:
  OpenSSH
```

To enable the OpenSSH application profile, run:

Copy

```
$ sudo ufw allow OpenSSH
```

```
Output
Rule added
Rule added (v6)
```

This will create firewall rules to allow all connections on port `22`, which is the port that the SSH daemon listens on by default.

Allowing SSH by Service Name

Another way to configure UFW to allow incoming SSH connections is by referencing its service name: `ssh`.

Copy

```
$ sudo ufw allow ssh
```

```
Output
Rule added
Rule added (v6)
```

UFW knows which ports and protocols a service uses based on the `/etc/services` file.

Allowing SSH by Port Number

Alternatively, you can write the equivalent rule by specifying the port instead of the application profile or service name. For example, this command works the same as the previous examples:

Copy

```
$ sudo ufw allow 22
```

```
Output
Rule added
Rule added (v6)
```

If you configured your SSH daemon to use a different port, you will have to specify the appropriate port. For example, if your SSH server is listening on port `2222`, you can use this command to allow connections on that port:

Copy

```
$ sudo ufw allow  2222
```

```
Output
Rule added
Rule added (v6)
```

Now that your firewall is configured to allow incoming SSH connections, you can enable it.

S – Enabling UFW

Your firewall should now be configured to allow SSH connections. To

verify which rules were added so far, even when the firewall is still disabled, you can use:

Copy

```
$ sudo ufw show added
```

```
Output
Added user rules (see 'ufw status' for running firewall):
ufw allow OpenSSH
```

After confirming your have a rule to allow incoming SSH connections, you can enable the firewall with:

Copy

```
$ sudo ufw enable
```

```
Output
Command may disrupt existing ssh connections. Proceed with opera
Firewall is active and enabled on system startup
```

You will receive a warning that says the command may disrupt existing SSH connections. You already set up a firewall rule that allows SSH connections, so it should be fine to continue. Respond to the prompt with `y` and hit `ENTER`.

The firewall is now active. Run the `sudo ufw status verbose` command to see the rules that are set. The rest of this tutorial covers how to use UFW in more detail, like allowing or denying different kinds of co[illegible]s.

S[illegible] – Allowing Other Connections

At this point, you should allow all of the other connections that your server needs to respond to. The connections that you should allow depend on your specific needs. You already know how to write rules that allow connections based on an application profile, a service name, or a port; you already did this for SSH on port `22`. You can also do this for:

- HTTP on port 80, which is what unencrypted web servers use, using `sudo ufw allow http` or `sudo ufw allow 80`
- HTTPS on port 443, which is what encrypted web servers use, using `sudo ufw allow https` or `sudo ufw allow 443`
- Apache with both HTTP and HTTPS, using `sudo ufw allow 'Apache Full'`
- Nginx with both HTTP and HTTPS, using `sudo ufw allow 'Nginx Full'`

Don't forget to check which application profiles are available for your server with `sudo ufw app list`.

There are several other ways to allow connections, aside from specifying a port or known service name. We'll see some of these next.

Specific Port Ranges

You can specify port ranges with UFW. Some applications use multiple ports, instead of a single port.

For example, to allow X11 connections, which use ports `6000-6007`, use these commands:

Copy

```
$ sudo ufw allow 6000:6007/tcp
$ sudo ufw allow 6000:6007/udp
```

W[illegible]ifying port ranges with UFW, you must specify the protocol ([illegible]) that the rules should apply to. We haven't mentioned this be[illegible]use not specifying the protocol automatically allows both protocols, which is OK in most cases.

Specific IP Addresses

When working with UFW, you can also specify IP addresses within your rules. For example, if you want to allow connections from a specific IP address, such as a work or home IP address of `203.0.113.4`, you need to use the `from` parameter, providing then the IP address you want to allow:

Copy

```
$ sudo ufw allow from 203.0.113.4
```

```
Output
Rule added
```

You can also specify a port that the IP address is allowed to connect to by adding `to any port` followed by the port number. For example, If you want to allow `203.0.113.4` to connect to port `22` (SSH), use this command:

Copy

```
$ sudo ufw allow from 203.0.113.4 to any port 22
```

```
Output
Rule added
```

Subnets

If you want to allow a subnet of IP addresses, you can do so using CIDR nc specify a netmask. For example, if you want to allow all of the IP s ranging from `203.0.113.1` to `203.0.113.254` you could use thi nd:

Copy

```
$ sudo ufw allow from 203.0.113.0 / 24
```

```
Output
Rule added
```

Likewise, you may also specify the destination port that the subnet `203.0.113.0/24` is allowed to connect to. Again, we'll use port `22` (SSH) as an example:

Copy

```
$ sudo ufw allow from 203.0.113.0 / 24 to any port 22
```

```
Output
Rule added
```

Connections to a Specific Network Interface

If you want to create a firewall rule that only applies to a specific network interface, you can do so by specifying "allow in on" followed by the name of the network interface.

You may want to look up your network interfaces before continuing. To do so, use this command:

Copy

```
dr
```

```
Output Excerpt
```

```
2:  eth0 : <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfif
. . .
3:  eth1 : <BROADCAST,MULTICAST> mtu 1500 qdisc noop state DOWN
. . .
```

The highlighted output indicates the network interface names. They are typically named something like `eth0` or `enp3s2`.

So, if your server has a public network interface called `eth0`, you could allow HTTP traffic (port `80`) to it with this command:

Copy

```
$ sudo ufw allow in on  eth0  to any port  80
```

```
Output
Rule added
Rule added (v6)
```

Doing so would allow your server to receive HTTP requests from the public internet.

Or, if you want your MySQL database server (port `3306`) to listen for connections on the private network interface `eth1`, for example, you could use this command:

Copy

```
$ sudo ufw allow in on  eth1  to any port  3306
```

```
Output
ed
ed (v6)
```

This would allow other servers on your private network to connect to

your MySQL database.

Step 6 – Denying Connections

If you haven't changed the default policy for incoming connections, UFW is configured to deny all incoming connections. Generally, this simplifies the process of creating a secure firewall policy by requiring you to create rules that explicitly allow specific ports and IP addresses through.

However, sometimes you will want to deny specific connections based on the source IP address or subnet, perhaps because you know that your server is being attacked from there. Also, if you want to change your default incoming policy to **allow** (which is not recommended), you would need to create **deny** rules for any services or IP addresses that you don't want to allow connections for.

To write **deny** rules, you can use the commands previously described, replacing **allow** with **deny**.

For example, to deny HTTP connections, you could use this command:

Copy

```
$ sudo ufw deny http
```

```
Output
Rule added
Rule added (v6)
```

Or if you want to deny all connections from `203.0.113.4` you could use this command:

Copy

```
ufw deny from 203.0.113.4
```

```
Output
Rule added
```

In some cases, you may also want to block outgoing connections from the server. To deny all users from using a port on the server, such as port `25` for SMTP traffic, you can use `deny out` followed by the port number:

Copy

```
$ sudo ufw deny out  25
```

```
Output
Rule added
Rule added (v6)
```

This will block all outgoing SMTP traffic on the server.

Step 7 – Deleting Rules

Knowing how to delete firewall rules is just as important as knowing how to create them. There are two different ways to specify which rules to delete: by rule number or by its human-readable denomination (similar to how the rules were specified when they were created).

Deleting a UFW Rule By Number

To delete a UFW rule by its number, first you'll want to obtain a numbered list of all your firewall rules. The UFW status command has an option to display numbers next to each rule, as demonstrated here:

Copy

```
$ sudo ufw status numbered
```

```
Numbered Output:
Status: active

     To                         Action      From
     --                         ------      ----
[ 1] 22                         ALLOW IN    15.15.15.0/24
[ 2] 80                         ALLOW IN    Anywhere
```

If you decide that you want to delete rule number **2**, the one that allows port 80 (HTTP) connections, you can specify it in a UFW delete command like this:

Copy

```
$ sudo ufw delete 2
```

```
Output
Deleting:
 allow 80
Proceed with operation (y|n)? y
Rule deleted
```

This will prompt for a confirmation then delete rule 2, which allows HTTP connections. Note that if you have IPv6 enabled, you would want to delete the corresponding IPv6 rule as well.

Deleting a UFW Rule By Name

Instead of using rule numbers, you may also refer to a rule by its human readable denomination, which is based on the type of rule (typically `allow` or `deny`) and the service name or port number that was the target for this rule, or the application profile name in case that was used. For ex you want to delete an `allow` rule for an application profile ca he `Full` that was previously enabled, you can use:

Copy

```
$ sudo ufw delete allow "Apache Full"
```

```
Output
Rule deleted
Rule deleted (v6)
```

The `delete` command works the same way for rules that were created referencing a service by its name or port. For example, if you previously set a rule to allow HTTP connections with `sudo ufw allow http`, this is how you could delete said rule:

Copy

```
$ sudo ufw delete  allow http
```

```
Output
Rule deleted
Rule deleted (v6)
```

Because service names are interchangeable with port numbers when specifying rules, you could also refer to the same rule as `allow 80`, instead of `allow http`:

Copy

```
$ sudo ufw delete  allow 80
```

```
Output
Rule deleted
Rule deleted (v6)
```

When deleting UFW rules by name, both IPv4 and IPv6 rules are deleted if they exist.

Step 8 – Checking UFW Status and Rules

At any time, you can check the status of UFW with this command:

Copy

```
$ sudo ufw status verbose
```

If UFW is disabled, which it is by default, you'll see something like this:

```
Output
Status: inactive
```

If UFW is active, which it should be if you followed Step 3, the output will say that it's active and it will list any rules that are set. For example, if the firewall is set to allow SSH (port `22`) connections from anywhere, the output might look something like this:

```
Output
Status: active
Logging: on (low)
Default: deny (incoming), allow (outgoing), disabled (routed)
New profiles: skip

                     Action      From
                     ------      ----
                     ALLOW IN    Anywhere
```

Use the `status` command if you want to check how UFW has configured the firewall.

Step 9 – Disable or Reset Firewall

If you decide you don't want to use the UFW firewall, you can deactivate it with this command:

Copy

```
$ sudo ufw disable
```

```
Output
Firewall stopped and disabled on system startup
```

Any rules that you created with UFW will no longer be active. You can always run `sudo ufw enable` if you need to activate it later.

If you already have UFW rules configured but you decide that you want to start over, you can use the reset command:

Copy

```
$ sudo ufw reset
```

```
Output
Resetting all rules to installed defaults. This may disrupt exis
connections. Proceed with operation (y|n)? y
Backing up 'user.rules' to '/etc/ufw/user.rules.20210729_170353
Backing up 'before.rules' to '/etc/ufw/before.rules.20210729_17
         up 'after.rules' to '/etc/ufw/after.rules.20210729_1703
         up 'user6.rules' to '/etc/ufw/user6.rules.20210729_1703
         up 'before6.rules' to '/etc/ufw/before6.rules.20210729_
Backing up 'after6.rules' to '/etc/ufw/after6.rules.20210729_17
```

This will disable UFW and delete any rules that were previously defined. This should give you a fresh start with UFW. Keep in mind that the default policies won't change to their original settings, if you modified them at any point.

Conclusion

Your firewall is now configured to allow (at least) SSH connections. Be sure to allow any other incoming connections that your server requires, while limiting any unnecessary connections, so your server will be functional and secure.

To learn about more common UFW configurations, check out the UFW Essentials: Common Firewall Rules and Commands tutorial.

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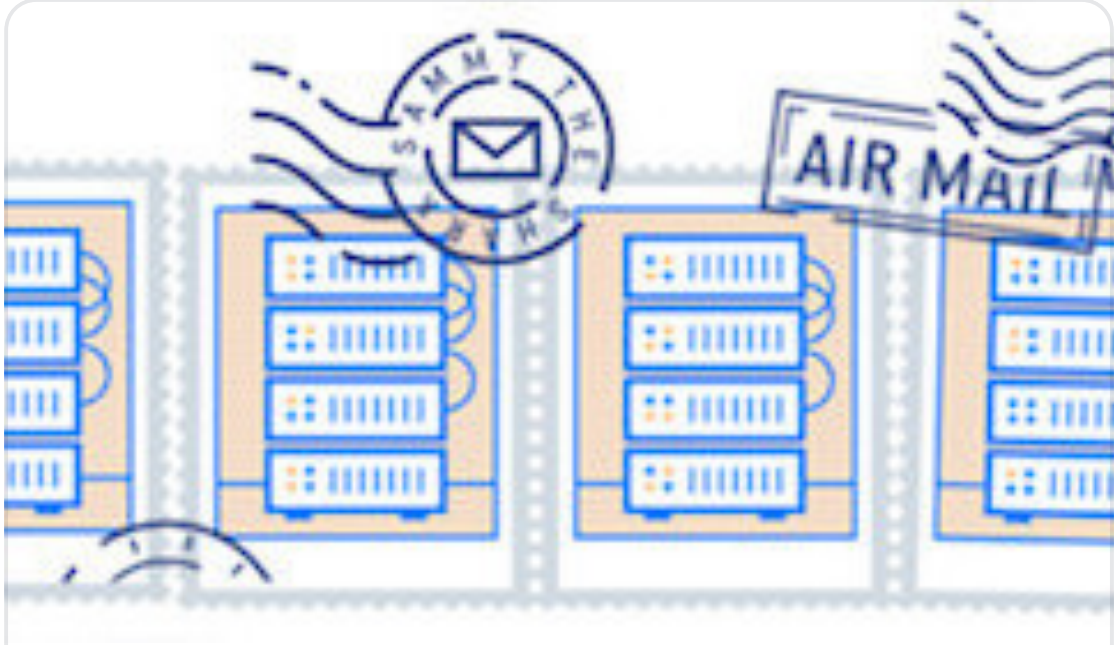

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