Install NixOS with Flake configuration on Git

This tutorial will walk you through the steps necessary to install NixOS, enable flakes while tracking the resulting system configuration in a Git repository.

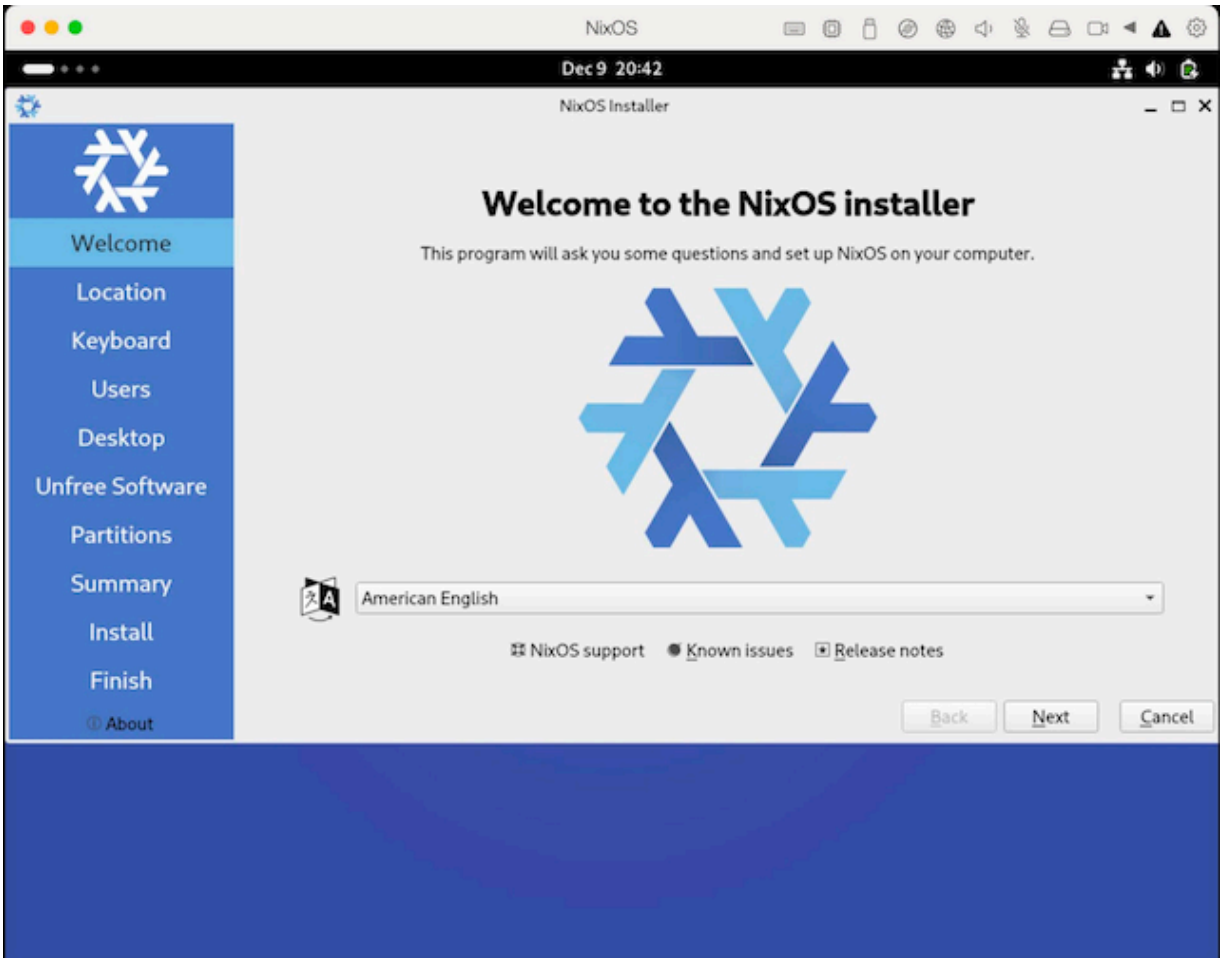
Welcome to the tutorial series on NixOS

This page is the first in a planned series of tutorials aimed towards onboarding Linux/macOS users into comfortably using NixOS as their primary operating system.

Prepare to install NixOS

- Download the latest NixOS ISO from here. Choose the GNOME (or Plasma) graphical ISO image for the appropriate CPU architecture.
- Create a bootable USB flash drive (instructions here) and boot the computer from it.

NixOS will boot into a graphical environment with the installer already running.



Go through the installation wizard; it is fairly similar to other distros. Once NixOS install is complete, reboot into your new system. You will be greeted with a login screen.

- Login as the user you created with the password you set during installation.
- Then open the “Console” application from the “Activities” menu.

Your first `configuration.nix` change

Your systems configuration includes everything from partition layout to kernel version to packages to services. It is defined in `/etc/nixos/configuration.nix`. The `/etc/nixos` directory looks like this:

```
$ ls -l /etc/nixos
-rw-r--r-- 1 root root 4001 Dec  9 16:03 configuration.nix
-rw-r--r-- 1 root root 1317 Dec  9 15:43 hardware-configuration.nix
```

What is `hardware-configuration.nix`?

Hardware specific configuration (eg: disk partitions to mount) are defined in `/etc/nixos/hardware-configuration.nix` which is `import`ed, as a

module, by `configuration.nix`.

All system changes require a change to this `configuration.nix`. For example, in order to "install" or "uninstall" a package, we would edit this `configuration.nix` and activate it. Let's do this now to install the neovim text editor. NixOS includes the nano editor by default:

```
sudo nano /etc/nixos/configuration.nix
```

Nix language

These `*.nix` files are written in the Nix language.

In the text editor, make the following changes:

- Add `neovim` under `environment.systemPackages`
- [Optional] uncomment `services.openssh.enable = true;` to enable the SSH server

Press Ctrl+X to exit nano.

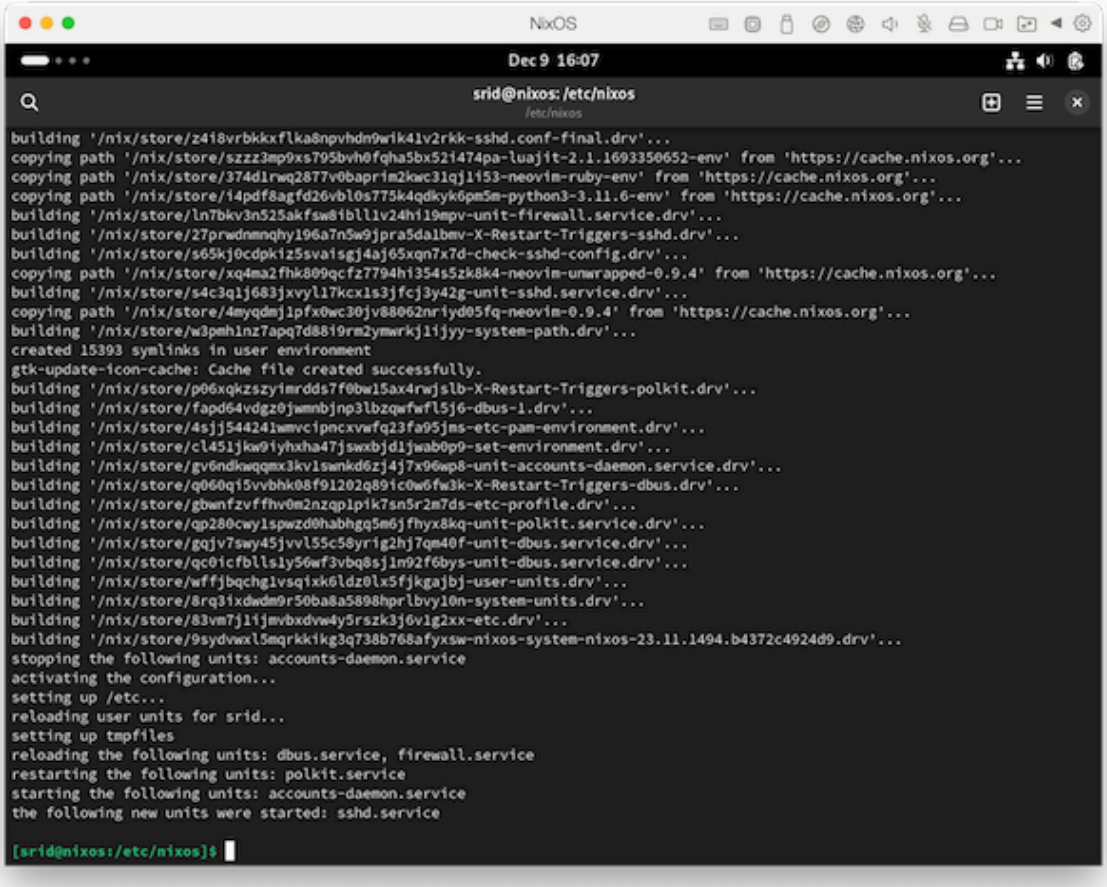
Your `configuration.nix` should now look like:

```
# /etc/nixos/configuration.nix
{
  ...
  environment.systemPackages = with pkgs; [
    neovim
  ];
  ...
  services.openssh.enable = true;
  ...
}
```

Once the `configuration.nix` file has been saved to disk, you must activate that new configuration using the nixos-rebuild command:

```
sudo nixos-rebuild switch
```

This will take a few minutes to complete—as it will have to fetch neovim and its dependencies from the official binary cache (`cache.nixos.org`). Once it is done, you should expect to see something like this:



You can confirm that neovim is installed by running `which nvim`:

```
$ which nvim
/run/current-system/sw/bin/nvim
```

Remote access

Now that you have OpenSSH enabled, you may do the rest of the steps from another machine by ssh'ing to this machine.

Flakeify

Convert `configuration.nix` to be a flake

A problem with the default NixOS `configuration.nix` generated by the official installer is that it is not "pure" and thus not reproducible (see here), as it still uses a mutable Nix channel (which is generally discouraged). For this reason (among others), it is recommended to immediately switch to using Flakes for our NixOS configuration. Doing this is pretty simple. Just add a `flake.nix` file in `/etc/nixos`:

```
sudo nvim /etc/nixos/flake.nix
```

Add the following:

```
# /etc/nixos/flake.nix
{
  inputs = {
    # NOTE: Replace "nixos-23.11" with that which is in system.stateVer
    # configuration.nix. You can also use latter versions if you wish t
    # upgrade.
    nixpkgs.url = "github:NixOS/nixpkgs/nixos-23.11";
  };
  outputs = inputs@{ self, nixpkgs, ... }: {
    # NOTE: 'nixos' is the default hostname set by the installer
    nixosConfigurations.nixos = nixpkgs.lib.nixosSystem {
      # NOTE: Change this to aarch64-linux if you are on ARM
      system = "x86_64-linux";
      modules = [ ./configuration.nix ];
    };
  };
}
```

Make sure to change a couple of things in the above snippet:

- Replace `nixos-23.11` with the version from `system.stateVersion` in your `/etc/nixos/configuration.nix`. If you wish to upgrade right away, you can also use latter versions, or use `nixos-unstable` for the bleeding edge.
- `x86_64-linux` should be `aarch64-linux` if you are on ARM

Now, `/etc/nixos` is technically a flake. We can "inspect" this flake using the `nix flake show` command:

```
$ nix flake show /etc/nixos
error: experimental Nix feature 'nix-command' is disabled; use '--extra
```

Oops, what happened here? As flakes is a so-called "experimental" feature, you must manually enable it. We'll *temporarily* enable it for now, and then enable it *permanently* latter. The `--extra-experimental-features` flag can be used to enable experimental features. Let's try again:

```
$ nix --extra-experimental-features 'nix-command flakes' flake show /et
warning: creating lock file '/etc/nixos/flake.lock'
error:
       … while updating the lock file of flake 'path:/etc/nixos?lastMod

       error: opening file '/etc/nixos/flake.lock': Permission denied
```

Progress, but we hit another error—Nix understandably cannot write to root-owned directory (it tries to create the `flake.lock` file). One way to resolve this is to move the whole configuration to our home directory, which would also prepare the ground for storing it in Git. We will do this in the next section.

> **flake.lock**
>
> Nix commands automatically generate a (or update the) `flake.lock` file. This file contains the exacted pinned version of the inputs of the flake, which is important for reproducibility.

Move configuration to user directory

Move the entire `/etc/nixos` directory to your home directory and gain control of it:

```
$ sudo mv /etc/nixos ~/nixos-config && sudo chown -R $USER ~/nixos-conf
```

Your configuration directory should now look like:

```
$ ls -l ~/nixos-config/
total 12
-rw-r--r-- 1 srid root 4001 Dec  9 16:03 configuration.nix
-rw-r--r-- 1 srid root  224 Dec  9 16:12 flake.nix
-rw-r--r-- 1 srid root 1317 Dec  9 15:43 hardware-configuration.nix
```

Now let's try `nix flake show` on it, and this time it should work:

```
$ cd ~/nixos-config
$ nix --extra-experimental-features 'nix-command flakes' flake show
warning: creating lock file '/home/srid/nixos-config/flake.lock'
path:/home/srid/nixos-config?lastModified=1702156518&narHash=sha256-nDt
```

```
└──nixosConfigurations
    └──nixos: NixOS configuration
```

Voila! Incidentally, this flake has a single output, `nixosConfigurations.nixos`, which is the NixOS configuration itself.

More on Flakes

See Rapid Introduction to Nix for more information on flakes.

Once flake-ified, we can use the same command to activate the new configuration but we must additionally pass the `--flake` flag, viz.:

```
# The '.' is the path to the flake, which is current directory.
$ sudo nixos-rebuild switch --flake .
```

If everything went well, you should see something like this:

```
[srid@nixos:~/nixos-config]$ sudo nixos-rebuild switch --flake .
building the system configuration...
stopping the following units: accounts-daemon.service
activating the configuration...
setting up /etc...
reloading user units for srid...
setting up tmpfiles
reloading the following units: dbus.service
restarting the following units: polkit.service
starting the following units: accounts-daemon.service

[srid@nixos:~/nixos-config]$
```

Excellent, now we have a flake-ified NixOS configuration that is pure and reproducible!

Let's store our whole configuration in a Git repository.

Store the configuration in Git

First we need to install Git:

- add `git` to `environment.systemPackages`, and
- activate your new configuration using `sudo nixos-rebuild switch --flake .`.

Then, create a Git repository for your configuration:

```
$ cd ~/nixos-config
$ git config --global user.email "srid@srid.ca"
$ git config --global user.name "Sridhar Ratnakumar"
$ git init && git add . && git commit -m init
```

You may now create a repository on GitHub or your favourite Git host, and push your configuration repo to it.

Benefits of storing configuration on Git

- If you buy a new computer, and would like to reproduce your NixOS setup, all you have to do is clone your configuration repo, adjust your `hardware-configuration.nix` and run `sudo nixos-rebuild switch --flake .`.
- Version controlling configuration changes makes it straightforward to point out problems and/or rollback to previous state.

Enable flakes

As a final step, let's permanently enable Flakes on our system, which is particularly useful if you do a lot of software development. This time, instead of editing `configuration.nix` again, let's do it in a separate module (for no particular reasons other than pedagogic purposes). Remember the `modules` argument to `nixosSystem` function in our `flake.nix`? It is a list of modules, so we can add a second module there:

```
diff --git a/flake.nix b/flake.nix
index cc77fb9..4e84bdf 100644
--- a/flake.nix
+++ b/flake.nix
@@ -8,7 +8,14 @@
     # NOTE: 'nixos' is the default hostname
     nixosConfigurations.nixos = nixpkgs.lib.nixosSystem {
       system = "x86_64-linux";
-      modules = [ ./configuration.nix ];
+      modules = [
+        ./configuration.nix
+        {
+          nix = {
+            settings.experimental-features = [ "nix-command" "flakes" ];
+          };
+        }
+      ];
     };
```

```
  };
}
```

NixOS options

You can see all the available options for NixOS in the NixOS options search engine.

As before, we must activate the new configuration using `sudo nixos-rebuild switch --flake .`. Once that is done, we can verify that flakes is enabled by re-running `nix flake show` but without the `--extra-experimental-features` flag:

```
$ nix flake show
warning: Git tree '/home/srid/nixos-config' is dirty
git+file:///home/srid/nixos-config
└───nixosConfigurations
    └───nixos: NixOS configuration
```

Recap

You have successfully installed NixOS. The entire system configuration is also stored in a Git repo, and can be reproduced at will during either a reinstallation or a new machine purchase. You can make changes to your configuration, commit them to Git, and push it to GitHub. Additionally we enabled Flakes permanently, which means you can now use all the modern `nix` commands, such as running a package directly from nixpkgs (same version pinned in `flake.lock` file):

Up Next

In the next tutorial, we will automate the install process a bit by declaratively specifying our disk partitioning in Nix.

Links to this page

NixOS Tutorial Series

> ☑ Install NixOS with Flake configuration on Git

Install NixOS with `disko` disk partitioning

> In this second tutorial, we will walk you through the process of installing NixOS. Unlike the first installation tutorial, we will use the command line to install NixOS manually, except for using disko to specify disk partitions declaratively in Nix itself. This is the first step toward our next tutorial, where we will automate the entire installation process.

> This tutorial focused mostly on disko, but left some of the things covered in the previous tutorial which you might want to consider:

> [!note] Minimal ISO image This tutorial doesn't use a graphical installer. Instead, it uses the minimal ISO image. This is primarily because we don't want the installer to partion the disk for us. We will use disko to do that.

> Enable flakes

> Store the configuration on Git

Install NixOS directly from a remote flake

> Unlike the previous tutorials (1; 2), the goal here is to near-fully automate our NixOS install using one command (see the next section).