

Reproducible builds and why NixOS matters

Tired of “works on my machine”?

mmkaram



NixOS Foundation

About me

- Name: Mahdy Karam
- Term: 1B
- Hometown: Seattle, WA, USA
- Interests: Squash, Reading
- Nixos User since Dec 2023
- OpenCV, Prisma



Agenda

- Introduction: Why is NixOS important/how can it be used
- Nix ecosystem
 - Nix language
 - Nixpkgs
 - NixOS
 - Nix shell
 - Home-manager
 - Flakes
- Further reading

Setting the stage

- Congratulations! You got a job at the hottest startup on the block, LooWaterAISoft, as a DevOps engineer!
- You are tasked with deploying the NextJS application that the software team has spent all of Q1 '25 coding up.
- How would you go about setting up this production infrastructure?

Setting the stage: Spec

Management at LooWaterAISoft has given you minimum requirements for your site rollout

- 500,000 users on the waitlist
- 10,000 users expected to be using the site at a time

Setting the stage: Availability



750 RPS



750 RPS



750 RPS

The problem

We need multiple identical nodes to keep up with demand.

The solution?

Docker

Stop using DOCKER

- Docker engine wasn't designed to scale to thousands of instances
- 12 years of containerization and no real world benefits
- Just spin up a VIRTUAL MACHINE
- "The hypervisor is obsolete" - Statements dreamed up by the utterly deranged

"Hello I would like 50 node:20 image instances please"

THEY HAVE PLAYED US FOR ABSOLUTE FOOLS



/node_modules

```
ts ./
lic
./
t
./node_modules
```


The illusion of reproducibility

Issue 1

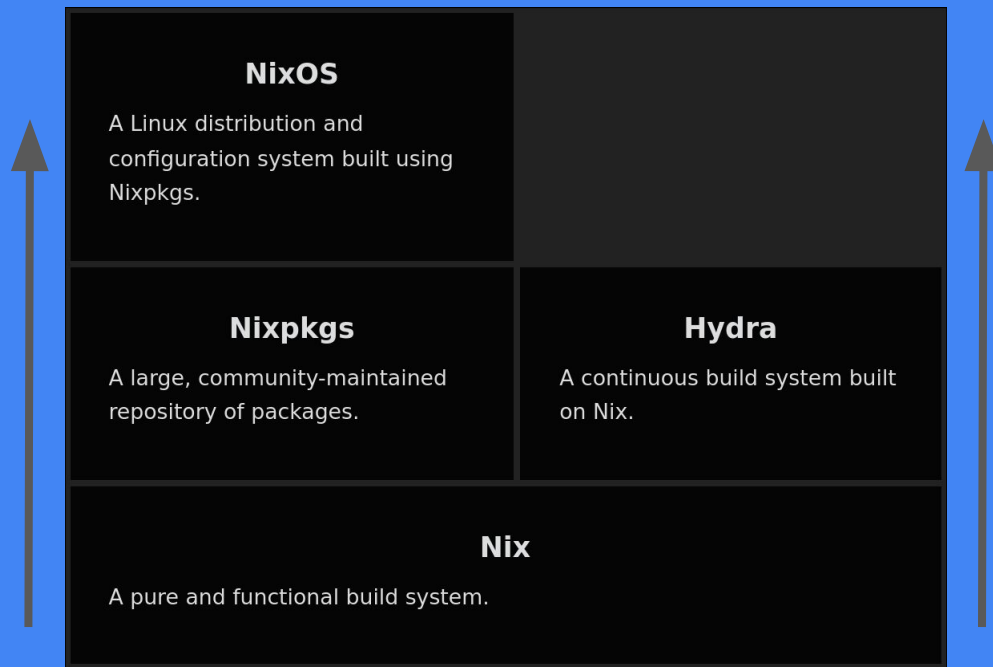
```
FROM node:20-alpine AS deps
```

Issue 2

```
COPY package.json package-lock.json  
RUN npm install
```

The real solution

The NixOS ecosystem stack



Nix

What is Nix?

- A pure and functional programming language

Nix language basics

```
2 + 2
# 4

90.89 - 45.9
# 44.99

true || false
# true

true && false
# false

if true then "this is true" else "this is false"
# "this is true"
```

```
text = ["hello" "alt-tab" "!"]
text
# ["hello" "alt-tab" "!"]

attrSet = {name="Waterloo"; faculty="Math";}
attrSet
# {name="Waterloo"; faculty="Math";}

add = a: b: a + b
add 2 2
# 4

add = {a,b}: a + b
add {a=2; b=2;}
# 4
```

Nix build system/derivations

```
{pkgs ? import <nixpkgs> {} }:
pkgs.stdenv.mkDerivation {
  name = "hello-script";

  src = ./.;

  installPhase = ''
    mkdir -p $out/bin
    cp $src/hello.sh $out/bin/hello
    chmod +x $out/bin/hello
  '';
}
### hello.sh
#!/bin/bash
#echo "Hello AltTab!"
```

nixpkgs

Demo time!

Recap:

- Creating a derivation using Nixpkgs functions
- Built said derivation



NixOS

Another demo!

Recap:

- Adding our Nix derivation to our NixOS configuration

Nix shell (mkShell)

- Don't want your build dependencies to clutter up the rest of your system?

```
{pkgs ? import <nixpkgs> {} }:
pkgs.mkShell {
  buildInputs = [
    pkgs.python311
    pkgs.python311Packages.numpy
  ];
}
```


Home manager

Manage your dotfiles with nix

```
{
  programs.git = {
    enable = true; # allow home manager to mess with git
    userName = "mmkaram";
    userEmail = "mahdykaram@outlook.com";
    extraConfig.init = {
      defaultBranch = "main"; # tell git to name all default branches main instead of master
    };
  };
}
```

Flakes

Pin dependencies to
a specific commit

```
{ "nodes": {  
  "nixpkgs": {  
    "locked": {  
      "lastModified": 1741114848,  
      "narHash": "sha256-8j3yJQGz42o/ty7s1tHbF4LIqGUYaudgsXg/+qSCUyg=",  
      "owner": "nixos",  
      "repo": "nixpkgs",  
      "rev": "7611aea8d5db655461da5ffe0e7373d730b0d5f8",  
      "type": "github"  
    },  
    "original": {  
      "owner": "nixos",  
      "ref": "nixos-unstable-small",  
      "repo": "nixpkgs",  
      "type": "github"  
    }  
  }  
}
```

Further reading

wiki.nixos.org

[Youtube: Vimjoyer](#)

[Github: mmkaram's config](#)

References

“Nix Ecosystem - NixOS Wiki.” Accessed March 23, 2025.
https://wiki.nixos.org/wiki/Nix_ecosystem.

“Server Operating System Market Volume, Share | Analysis, 2032.” Accessed March 21, 2025.
<https://www.fortunebusinessinsights.com/server-operating-system-market-106601>.

Questions?