Nix & NixOS

pour la robotique

2024-05-23

Guilhem Saurel

This presentation

Available at

`https://homepages.laas.fr/gsaurel/ nix-rob.pdf`

`https://gitlab.laas.fr/gsaurel/talks : nix-rob.md`

Under License

Introduction

Résumé des épisodes précédents

- robotpkg

LAAS CNRS

Résumé des épisodes précédents

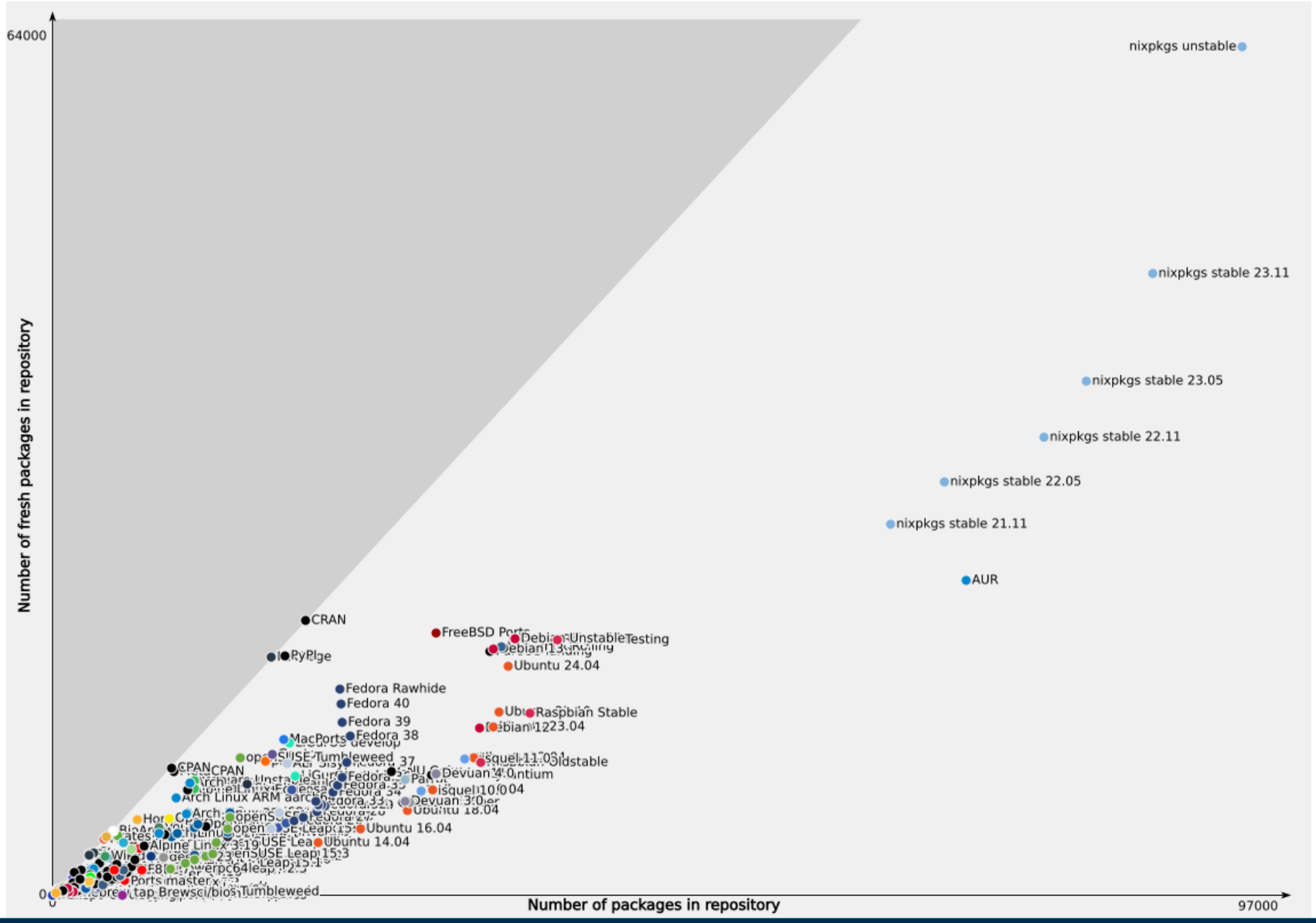
- robotpkg
- cmake-wheel

LAAS CNRS

Résumé des épisodes précédents

- robotpkg
- cmake-wheel
- PID

Repology


64000
Number of fresh packages in repository
0
Number of packages in repository
97000
nixpkgs unstable
nixpkgs stable 23.11
nixpkgs stable 23.05
nixpkgs stable 22.11
nixpkgs stable 22.05
nixpkgs stable 21.11
AUR
CRAN
FreeBSD Ports
Debian Unstable
Testing
Ubuntu 24.04
Fedora Rawhide
Fedora 40
Fedora 39
Fedora 38
Raspbian Stable
MacPorts
SUSE Tumbleweed
CPAN
Devuan 4.0
Ubuntu 18.04
Ubuntu 16.04
Ubuntu 14.04
openSUSE Leap 15.3
Alpine Linux 3.19
Arch Linux ARM aarch64
Ports master x
tap Brewsci/bio
Tumbleweed

Cahier des charges

LAAS CNRS

Installer des paquets

- source
- binaires

LAAS CNRS

Installer des paquets

- source
- binaires
- cache

Reproducibilité des paquets

Mêmes sources + recette => mêmes résultats

Reproducibilité des paquets

Mêmes sources + recette => mêmes résultats

- OS (eg. macos / linux)
- CPU (eg. x86_64 / arm64)
- Compilateur (eg. gcc / clang)
- Environnement
- Options automatiques

=> Isolation

Dépendences

L'Enfer.

Dépendences

L'Enfer.

- versions
- ld
- python
- etc.

Portée

- Paquets système
- Environnements de travail

Portée

- Paquets système
- Environnements de travail

droits

Hacking

- Et si on changeait l'implémentation de BLAS ?
- Et si on utilisait on recompilait tout avec LLVM ?
- Et si on passait à `-march=native` ?
- Et si on désactivait les mitigations downfall ?
- Et si on modifiait un flag du noyau ?

L'intégration continue & l'outillage

Ref. Own your CI with Nix. FOSDEM, Hufschmitt (2024)

La solution

Eelco Dolstra PhD

Ref. The purely functional software deployment model. PhD, Dolstra (2006)

Domain-Specific Language

```
stdenv.mkDerivation rec {
 pname = "hello";
 version = "2.12.1";

 src = fetchurl {
  url = "mirror://gnu/hello/hello-${version}.tar.gz"
  hash = "sha256-jZkUKv2SV28wsM18tCqNxoCZmLxdYH2…=";
 };

 doCheck = true;
})
```

Dérivations

```
nix-repl> pkgs.hello
«derivation /nix/store/img71klf2wzx867q5ldhf0zqc3wl0m
hello-2.12.1.drv»

nix-repl> "${pkgs.hello}"
"/nix/store/bw9z0jxp5qcm7jfp4vr6ci9qynjyaaip-
hello-2.12.1"
```

Paquets

```
$ tree  /nix/store/bw9…-hello-2.12.1
bw9…-hello-2.12.1/
├── bin/
│   └── hello*
└── share/
    ├── info/
    │   └── hello.info
    ├── locale/
    │   └── […]
    └── man/
        └── man1/
            └── hello.1.gz
```

Liens dynamiques

```
$ ldd /nix/store/bw9…-hello-2.12.1/bin/hello
linux-vdso.so.1 (0x00007fab657f1000)
libc.so.6 => /nix/store/35p…-glibc-2.39-5/lib/libc.so
/nix/store/35p…-glibc-2.39-5/lib/ld-linux-x86-64.so.2
```

Nixpkgs

- 100k paquets
- 7k contributeurs
- 3k mainteneurs
- 630k commits
- 20 ans

Flakes

- dépôt git + flake.nix
- entrées: autres flakes
- sorties:
  - paquets
  - applications
  - tests
  - dev shells
  - NixOS configurations

Flake example: gsaurel/laas-beamer-theme

```
laas-beamer-theme = pkgs.stdenvNoCC.mkDerivation {
  name = "laas-beamer-theme";
  src = ./.;
  outputs = [ "tex" ];
  installPhase = ''
    path="$tex/tex/latex/laas-beamer-theme"
    mkdir -p "$path"
    cp *.{png,sty} "$path/"
  '';
  meta = {
    description = "My LAAS beamer theme";
    homepage = "https://gitlab.laas.fr/gsaurel/laas-
    license = pkgs.lib.licenses.cc-by-sa-40;
    maintainers = [ pkgs.lib.maintainers.nim65s ];
  };
};
```

Flake example: gsaurel/talks

```
gsaurel-talks = stdenvNoCC.mkDerivation {
  name = "gsaurel-talks";
  src = ./.;
  nativeBuildInputs = [ source-code-pro
    source-sans source-serif ];
  buildInputs = [
    pandoc
    (python3.withPackages (p: [ p.pyyaml ]))
    (texlive.combined.scheme-full.withPackages(
        _: [ laas-beamer-theme ]))
  ];
  installPhase = ''
    mkdir $out
    cp public/*.{pdf,html} $out
  '';
};
```

NixOS

Wishlist

Ref. ROS2 deployment with Docker and BalenaOS. ROSConFr, Chataignon (2023):

Deploying on Robot/embedded device whishlist:

- *Easy updates/rollback*
- *Same code/binary on all devices*
- *No user interaction installation*

Wishlist

Ref. ROS2 deployment with Docker and BalenaOS. ROSConFr, Chataignon (2023):

Deploying on Robot/embedded device whishlist:

- *Easy updates/rollback*
- *Same code/binary on all devices*
- *No user interaction installation*

But **ROS => ubuntu**

Déclaration

```
{
  imports = [ ./hardware-configuration.nix ];
  boot.loader.systemd-boot.enable = true;
  networking.hostName = "loon";
  networking.networkmanager.enable = true;
  time.timeZone = "Europe/Paris";
  console.keyMap = "fr-bepo";
  users.users.gsaurel = {
    shell = pkgs.fish;
    isNormalUser = true;
    description = "Guilhem Saurel";
    extraGroups = [ "networkmanager" "wheel" ];
  };
  environment.systemPackages = [ pkgs.git pkgs.vim ]
  services.openssh.enable = true;
}
```

Générations

Mise à jour / rollbacks atomiques

Robotique

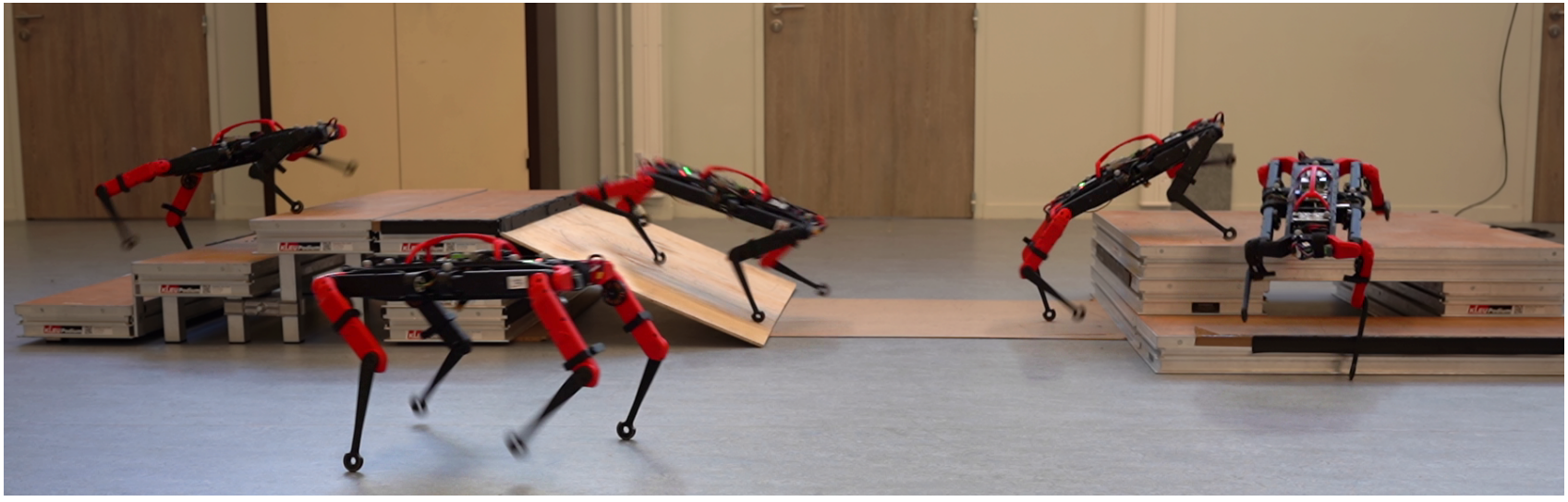


Figure 1: solo

Better ROS Builds with Nix

ROSCon 2022 | Kyoto, Japan

Mike Purvis
DevOps Staff

https://github.com/mikepurvis

Ivor Wanders
Navigation Manager

https://github.com/iwanders

CLEARPATH

https://github.com/lopsided98/nix-ros-overlay

Communauté: projets

Home-Manager

```
home = {
  packages = [ … ];
  home.file = {
    ".config/dfc/dfcrc".source =
        ./.config/dfc/dfcrc;
  };
  sessionVariables.PAGER = "vim -c PAGER -";
  programs.atuin = {
    enable = true;
    flags = [ "--disable-up-arrow" ];
  };
  programs.git = {
      enable = true;
      delta.enable = true;
      lfs.enable = true;
      userName = "Guilhem Saurel";
      userEmail = "guilhem.saurel@laas.fr";
  };
```

disko

```
disko.devices.disk.my-disk = {
  device = "/dev/sda";
  type = "disk";
  content = {
    type = "gpt";
    partitions = {
      ESP = {
        type = "EF00";
        size = "500M";
        content = {
          type = "filesystem";
          format = "vfat";
          mountpoint = "/boot";
        };
      };
```

disko (suite)

```
disko.devices.disk.my-disk = {
  device = "/dev/sda";
  type = "disk";
  content = {
    type = "gpt";
    partitions = {
      ESP = { ... };
      root = {
        size = "100%";
        content = {
          type = "filesystem";
          format = "ext4";
          mountpoint = "/";
        };
      };
    };
```

nixos-anywhere

Installation automatique

sops-nix

Gestion des secrets par utilisateur et par machine

Communauté: entreprises

LAAS CNRS

Principales contributrices

- Determinate Systems
- Flox
- Tweag / Modus Create
- Numtide
- Cachix
- Hercules-CI

Controversées

- Anduril

Communauté: humains

PFH

...

Questions ?

Questions ?

Links

- `https://homepages.laas.fr/gsaurel/home-manager.pdf` (enregistrement)
- `https://homepages.laas.fr/gsaurel/nix-rob.pdf`

References

Chataignon, Alexandre. 2023. *ROS2 Deployment with Docker and Balenaos*. https://indymotion.fr/w/27cfXhaR5qDtSazXN9DaiG.

Dolstra, Eelco. 2006. "The Purely Functional Software Deployment Model." PhD thesis, Utrecht University. https://edolstra.github.io/pubs/phd-thesis.pdf.

Hufschmitt, Théophane. 2024. *Own Your CI with Nix*. https://fosdem.org/2024/schedule/event/fosdem-2024-2282-own-your-ci-with-nix/.