

# Better ROS Builds with Nix

ROSCon 2022 | Kyoto, Japan



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DevOps Staff

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Navigation Manager

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4.5 times faster with  
10% of the resources!

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1. ROS packaging
2. Nix terms & primer
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# How Do You Package ROS?

## **bloom + ros\_buildfarm**

- incremental builds / upgrades
- tagging required for binaries
- no full-system versioning
- no rollback story

## **snapshot / bundles / containers**

- version clarity, rollbacks possible
- high build, storage, transfer cost
- custom tooling, especially around delta builds

# How Do You Package ROS?

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# How Do You Package ROS?

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- incremental builds / upgrades
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## snapshot / bundles / containers

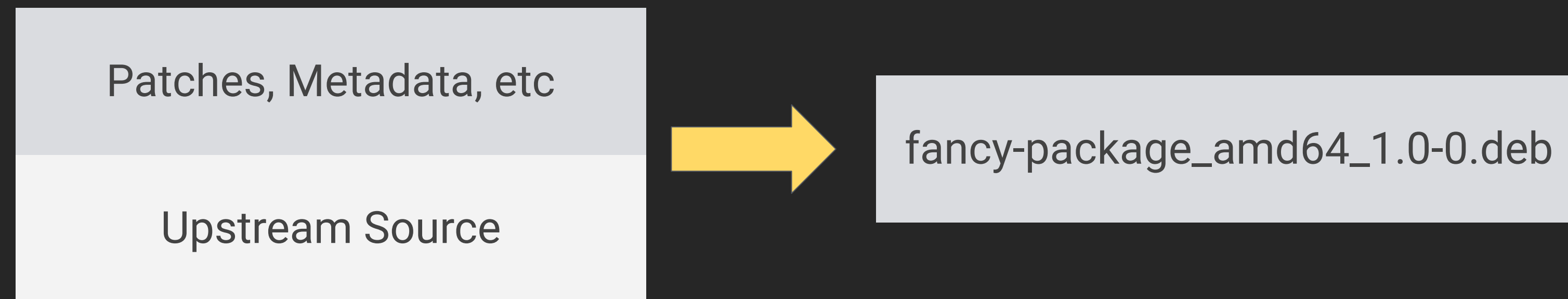
- version clarity, rollbacks possible
- ✗ high build, storage, transfer cost
- ✗ custom tooling, especially around delta builds



# What is Nix?

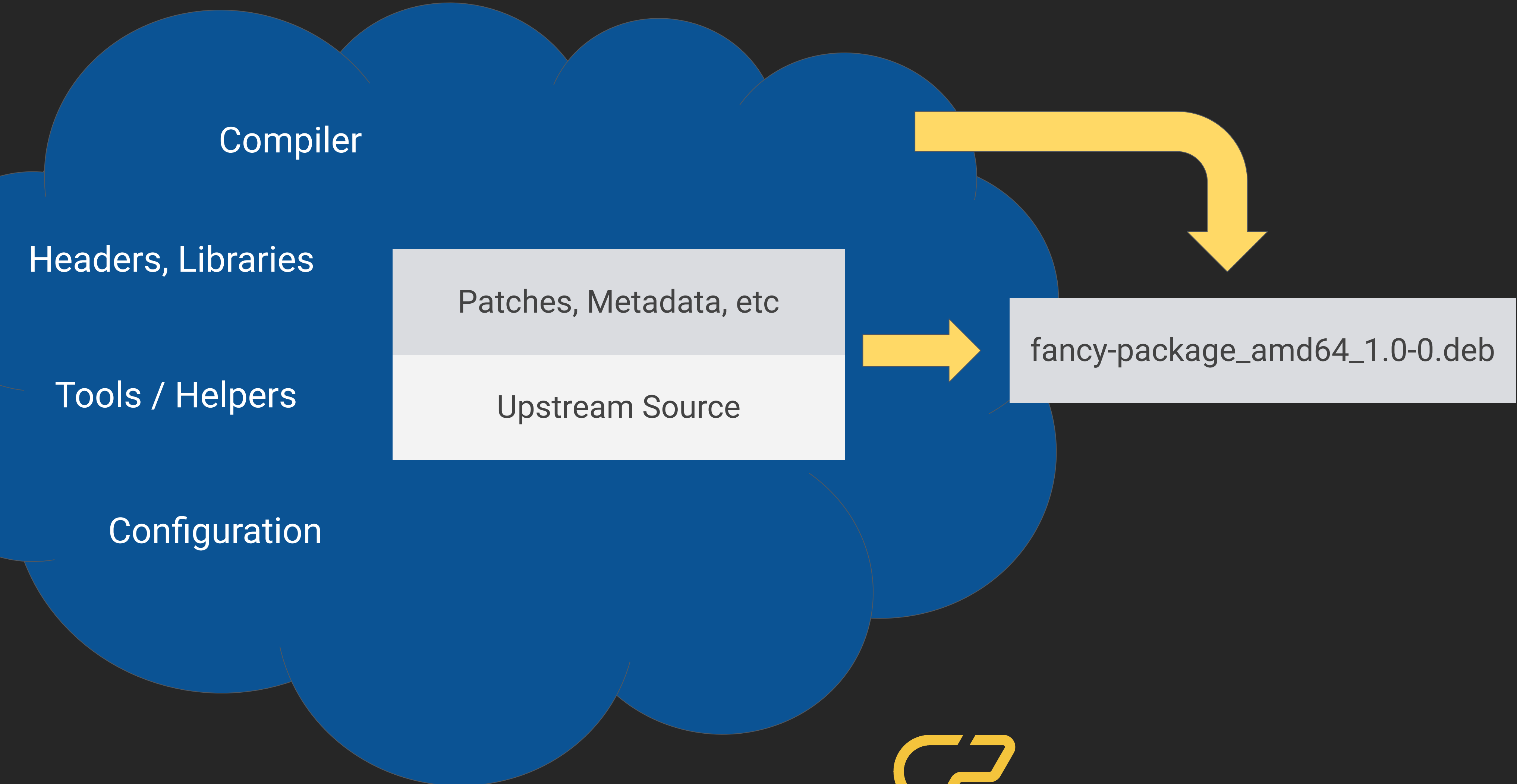
- A DSL for describing packages -> nix
- A package manager / builder -> Nix
- A repository of packages -> nixpkgs
- An declarative operating system -> NixOS

# What is Nix?





# What is Nix?



# What is Nix?



# Package Identification

- Packages are described as functions in the Nix language

```
stdenv.mkDerivation {
  pname = "canfestival";
  version = "3.0.4";

  src = fetchFromClearpathGitLab {
    owner = "forks";
    repo = "canfestival-3";
    rev = "605fc6a2adf250d50dd22ac4f1d527e3a21a58a3";
    hash = "sha256-os3qbS1Dbg2ya5McU1o0W8xcz8mealwgr90eZeErQzM=";
  };

  propagatedNativeBuildInputs = [ python3 ];

  configurePhase = ''
    bash configure --prefix=$out --can=socket --wx=0
  '';
}
```

# Package Identification

- Packages are described as functions in the Nix language
- Nix evaluates this into a derivation structure which captures the entire input for the package build.

```
$ nix show-derivation clearpath#canfestival
{
  "/nix/store/4pwklyajqgx61yqs0dl3q9xwfy3692y0-canfestival-3.0.4.drv": {
    "outputs": {
      "out": {
        "path": "/nix/store/rn9asxp3fjxyj9xwgdv36b92x1n8w33b-canfestival-3.0.4"
      }
    },
    "inputSrcs": [
      "/nix/store/9krlzvny65gdc8s7kpb6lkx8cd02c25b-default-builder.sh"
    ],
    "inputDrvs": {
      "/nix/store/9nl7galmmj9n61jw6dkfv7w3zcqcf1j5-source.drv": [
        "out"
      ],
      "/nix/store/bqfy8ydlxs0xhzqmy7rc3zjw60vwab6j-stdenv-linux.drv": [
        "out"
      ]
    }
  },

```

# Package Identification

- Packages are described as functions in the Nix language
- Nix evaluates this into a derivation structure which captures the entire input for the package build.
- Nix stores the result of the build in a path based on the hash of this structure.

```
$ nix path-info clearpath#canfestival
/nix/store/rn9asxp3fjxyj9xwgdv36b92x1n8w33b-canfestival-3.0.4

$ ll /nix/store/rn9asxp3fjxyj9xwgdv36b92x1n8w33b-canfestival-3.0.4/lib
total 96
-r--r--r-- 1 root root 65380 Jan  1  1970 libcanfestival.a
-r-xr-xr-x 1 root root 18200 Jan  1  1970 libcanfestival_can_socket.so
-r--r--r-- 1 root root 12142 Jan  1  1970 libcanfestival_unix.a
```

# Package Identification

- Packages are described as functions in the Nix language
- Nix evaluates this into a derivation structure which captures the entire inputs for the package build.
- Nix stores the result of the build in a path based on the hash of this structure.

```
$ nix path-info clearpath#canfestival
/nix/store/rn9asxp3fjxyj9xwgdv36b92x1n8w33b-canfestival-3.0.4

$ ll /nix/store/rn9asxp3fjxyj9xwgdv36b92x1n8w33b-canfestival-3.0.4/lib
total 96
-r--r--r-- 1 root root 65380 Jan  1  1970 libcanfestival.a
-r-xr-xr-x 1 root root 18200 Jan  1  1970 libcanfestival_can_socket.so
-r--r--r-- 1 root root 12142 Jan  1  1970 libcanfestival_unix.a
```

If anything captured by the derivation changes, the hash changes and from Nix's perspective, it becomes a completely different package.

# Requirements

- A frozen rosdistro distribution.yaml (all version attributes changed hashes)
- The package.xml data from all packages (for dependency info)
- The content hash of the source of every package (for nix purity)



# A single package

```
canfestival_ros:  
  source:  
    type: git  
    url: git@gitlab.clearpathrobotics.com:software/canfestival_ros.git  
    version: 24db50db6626a0cac958590148347b66244a59d2  
    status_description: 'Branch: devel'  
canopen_service:  
  source:  
    type: git  
    url: git@gitlab.clearpathrobotics.com:clearpath-os/canopen_service.git  
    version: 6f410b7b35526cf087187c3ca36fb5fc327e34cd  
    status_description: 'Branch: devel'
```





# A single package

```
canfestival_ros:  
  source:  
    type: git  
    url: git@gitlab.clearpathrobotics.com:software/canfestival_ros.git  
    version: 24db50db6626a0cac958590148347b66244a59d2  
    status_description: 'Branch: devel'  
canopen_service:  
  source:  
    type: git  
    url: git@gitlab.clearpathrobotics.com:software/canopen_service.git  
    version: 6f410b7b3552  
    status_description: 'Branch: devel'
```

```
{ pkgSrc, fetchFromClearpathGitLab }:  
let  
  pkg = pkgSrc (fetchFromClearpathGitLab {  
    owner = "software";  
    repo = "canfestival_ros";  
    rev = "24db50db6626a0cac958590148347b66244a59d2";  
    hash = "sha256-nnzpYHjgZuqFBVI3Jx3FycJptpF48HgA3ReILM+a1L4=";  
    name = "software-canfestival_ros-24db50db6626a0cac958590148347b66244a59d2";  
  });  
in  
{  
  canfestival_ros = pkg "sha256-nnzpYHjgZuqFBVI3Jx3FycJptpF48HgA3ReILM+a1L4="  
  ".";  
}
```



# A single package

```
canfestival_ros:
  source:
    type: git
    url: git@gitlab.clearpathrobotics.com:software/canfestival_ros.git
    version: 24db50db6626a0cac958590148347b66244a59d2
  status_description: 'Branch: devel'
canopen_service:
  source:
    type: git
    url: git@gitlab.clearp
    version: 6f410b7b35526
  status_description: 'Bra
  <?xml version="1.0"?>
  <package format="2">
    <name>canfestival_ros</name>
    <version>0.9.2</version>
    <description>CANfestival library wrapper for ROS</description>
    <maintainer email="<>@clearpath.ai">Jeffrey G</maintainer>
    <license>Proprietary</license>
    <buildtool_depend>catkin</buildtool_depend>
    <build_depend>boost</build_depend>
    <depend>roscpp</depend>
    <depend>canfestival-devel</depend>
    <depend>canfestival-socket</depend>
    <exec_depend>canfestival-objdictedit</exec_depend>
    <test_depend>roslint</test_depend>
  </package>
```

# A single package

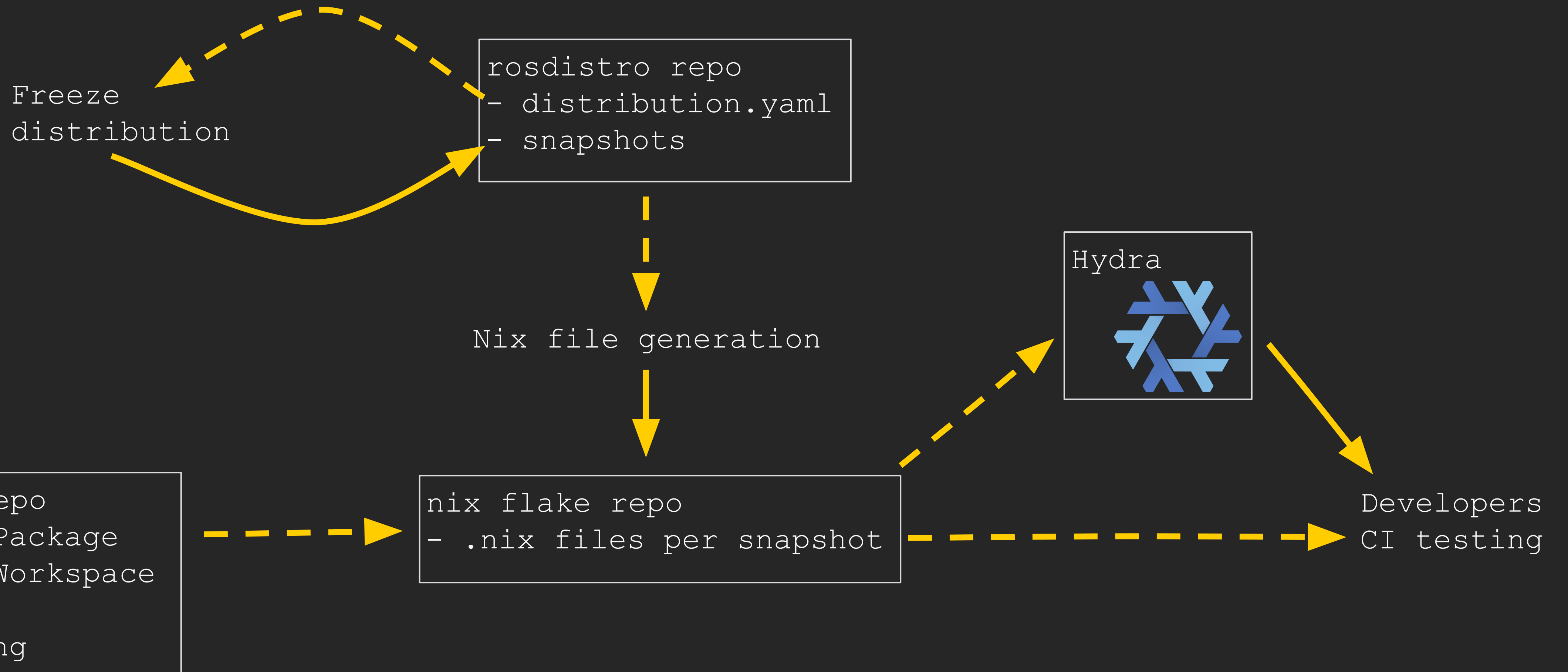
```
{ pkgSrc, fetchFromClearpathGitLab }:  
let  
  pkg = pkgSrc (fetchFromClearpathGitLab {  
    owner = "software";  
    repo = "canfestival_ros";  
    rev = "24db50db6626a0cac958590148347b66244";  
    hash = "sha256-nnzpYHjgZuqFBVI3Jx3FycJptpF";  
    name = "software-canfestival_ros-24db50db6";  
  });  
in  
{  
  canfestival_ros = pkg "sha256-nnzpYHjgZuqFBV";  
}
```

```
{  
  boost, canfestival, catkin, roscpp, roslint,  
  buildColconPackage, final, srcs,  
}:  
buildColconPackage {  
  name = "canfestival_ros";  
  pkgFinal = final.ros.canfestival ros;  
  src = srcs.canfestival_ros.canfestival_ros;  
  colconBuildDepends = [ boost canfestival catkin roscpp ];  
  colconRunDepends = [ canfestival roscpp ];  
  colconTestDepends = [ roslint ];  
}
```

```
<buildtool_depend>catkin</buildtool_depend>  
<build_depend>boost</build_depend>  
<depend>roscpp</depend>  
<depend>canfestival-devel</depend>  
<depend>canfestival-socket</depend>  
<exec_depend>canfestival-objdictedit</exec_depend>  
  
<test_depend>roslint</test_depend>
```



# Architecture



# Consuming Nix built ROS

```
$ nix build clearpath/2.28.0-20220913134929-0#ros.ros_base.ws.contents
```

```
[0/119 built, 1/14/464 copied (141.7/1381.8 MiB), 146.3 MiB DL] fetching linux-headers-5.14 from http://172.17.0.1:5000  
[0/115 built, 1/46/464 copied (229.5/1381.8 MiB), 240.3 MiB DL] fetching glibc-2.33-50-bin from http://172.17.0.1:5000  
[0/103 built, 1/195/464 copied (582.1/1381.8 MiB), 610.4 MiB DL] fetching boost-1.73.0 from http://172.17.0.1:5000  
[0/102 built, 1/198/464 copied (732.3/1381.8 MiB), 763.5 MiB DL] fetching gcc-10.3.0 from http://172.17.0.1:5000  
[0/52 built, 1/391/464 copied (1254.5/1381.8 MiB), 1311.1 MiB DL] fetching cpp_common from http://172.17.0.1:5000  
[0/39 built, 1/410/464 copied (1271.8/1381.8 MiB), 1330.4 MiB DL] fetching nav_msgs from http://172.17.0.1:5000  
[1/2/4 built, 464 copied (1426.5 MiB), 1491.1 MiB DL] building ros_base-merged  
[1/3/4 built, 464 copied (1426.5 MiB), 1491.1 MiB DL] building ros_base-2.28.0-20220913134929-0
```



CLEARPATH

# Consuming Nix built ROS

```
$ nix build clearpath/2.28.0-20220913134929-0#ros.ros_base.ws.contents
```

```
[0/119 built, 1/14/464 copied (141.7/1381.8 MiB), 146.3 MiB DL] fetching linux-headers-5.14 from http://172.17.0.1:5000  
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[1/3/4 built, 464 copied (1426.5 MiB), 1491.1 MiB DL] building ros_base-2.28.0-20220913134929-0
```

```
$ ls -l result
```

```
lrwxrwxrwx 1 root root 76 Sep 22 17:06 result -> /nix/store/xvvrnam0mw724fkavngxs5zxs4cmf84i-ros_base-2.28.0-20220913134929-0
```



# Consuming Nix built ROS

```
$ nix build clearpath/2.28.0-20220913134929-0#ros.ros_base.ws.contents
```

```
[0/119 built, 1/14/464 copied (141.7/1381.8 MiB), 146.3 MiB DL] fetching linux-headers-5.14 from http://172.17.0.1:5000
[0/115 built, 1/46/464 copied (229.5/1381.8 MiB), 240.3 MiB DL] fetching glibc-2.33-50-bin from http://172.17.0.1:5000
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[0/52 built, 1/391/464 copied (1254.5/1381.8 MiB), 1311.1 MiB DL] fetching cpp_common from http://172.17.0.1:5000
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[1/2/4 built, 464 copied (1426.5 MiB), 1491.1 MiB DL] building ros_base-merged
[1/3/4 built, 464 copied (1426.5 MiB), 1491.1 MiB DL] building ros_base-2.28.0-20220913134929-0
```

```
$ ls -l result
```

```
lrwxrwxrwx 1 root root 76 Sep 22 17:06 result -> /nix/store/xvvrnam0mw724fkavngxs5zxs4cmf84i-ros_base-2.28.0-20220913134929-0
```

```
$ls -lr result/merged/share/ | head
```

```
total 296
```

```
xmlrpcpp -> /nix/store/jg8kgiwv7q3h101kx5ac12gqh0vb50gy-xmlrpcpp/share/xmlrpcpp
```

```
visualization_msgs -> /nix/store/nasbk2s7rzwfq6nzdnddxy4vwrzcr3x-visualization_msgs/share/visualization_msgs
```

```
trajectory_msgs -> /nix/store/8792xra049hlg6zcfwa1gy1a3ynmx3hj-trajectory_msgs/share/trajectory_msgs
```

```
topic_tools -> /nix/store/9f8f9ia6apvd3pv57yjmnpnl0mm0ac3-topic_tools/share/topic_tools
```

```
stereo_msgs -> /nix/store/id9wgzl3bjk2z1f3c2knjnp0hnbvn9v2-stereo_msgs/share/stereo_msgs
```

```
std_srvs -> /nix/store/jb7igsh199zxcz69dlm23xspxc0j60r1-std_srvs/share/std_srvs
```



CLEARPATH

# The environment

```
/demo$ nix develop clearpath/2.28.0-20220913134929-0#ros.ros_base.ws  
2.28.0-20220913134929-0#ros_base:/demo$
```





# The environment

```
/demo$ nix develop clearpath/2.28.0-20220913134929-0#ros.ros_base.ws  
2.28.0-20220913134929-0#ros_base:/demo$
```

```
2.28.0-20220913134929-0#ros_base:/demo$ echo $ROS_PACKAGE_PATH  
/nix/store/wnyiw73mm6arl606wjqxvhi7kzx0sp-ros_base-merged/share
```



# The environment

```
/demo$ nix develop clearpath/2.28.0-20220913134929-0#ros.ros_base.ws  
2.28.0-20220913134929-0#ros_base:/demo$
```

```
2.28.0-20220913134929-0#ros_base:/demo$ echo $ROS_PACKAGE_PATH  
/nix/store/wnyiwm73mm6arl606wjqxvhi7kzx0sp-ros_base-merged/share
```

```
2.28.0-20220913134929-0#ros_base:/demo$ echo $COLCON_HOME  
/nix/store/dnncy2f99bvjz5pm7m19hsvwyybk57c-colcon-home-0.0.1
```



# The environment

```
/demo$ nix develop clearpath/2.28.0-20220913134929-0#ros.ros_base.ws  
2.28.0-20220913134929-0#ros_base:/demo$
```

```
2.28.0-20220913134929-0#ros_base:/demo$ echo $ROS_PACKAGE_PATH  
/nix/store/wnyiw73mm6arl606wjqxvhi7kzx0sp-ros_base-merged/share
```

```
2.28.0-20220913134929-0#ros_base:/demo$ echo $COLCON_HOME  
/nix/store/dnncy2f99bvjz5pm7m19hsvwyybk57c-colcon-home-0.0.1
```

```
2.28.0-20220913134929-0#ros_base:/demo$ which gcc  
/nix/store/s5hkav7whndbfz0szshpb46h4idqdq9a-gcc-wrapper-10.3.0/bin/gcc
```



# Building a workspace

```
2.28.0-20220913134929-0#ros_base:/demo/ws$ cd ws/  
2.28.0-20220913134929-0#ros_base:/demo/ws$ colcon build  
[0.2s] [0/0 complete]  
Starting >>> roscpp_tutorials  
[0.3s] [0/1 complete] [roscpp_tutorials:cmake - 0.1s]  
[3.0s] [0/1 complete] [roscpp_tutorials:cmake - 2.8s]  
[3.5s] [0/1 complete] [roscpp_tutorials:build 8% - 3.3s]  
[8.0s] [0/1 complete] [roscpp_tutorials:build 37% - 7.7s]  
[15.5s] [0/1 complete] [roscpp_tutorials:build 97% - 15.2s]  
Finished <<< roscpp_tutorials [17.3s]  
Summary: 1 package finished [17.6s]
```

# Building a workspace

```
2.28.0-20220913134929-0#ros_base:/demo/ws$ cd ws/  
2.28.0-20220913134929-0#ros_base:/demo/ws$ colcon build  
[0.2s] [0/0 complete]  
Starting >>> roscpp_tutorials  
[0.3s] [0/1 complete] [roscpp_tutorials:cmake - 0.1s]  
[3.0s] [0/1 complete] [roscpp_tutorials:cmake - 2.8s]  
[3.5s] [0/1 complete] [roscpp_tutorials:build 8% - 3.3s]  
[8.0s] [0/1 complete] [roscpp_tutorials:build 37% - 7.7s]  
[15.5s] [0/1 complete] [roscpp_tutorials:build 97% - 15.2s]  
Finished <<< roscpp_tutorials [17.3s]  
Summary: 1 package finished [17.6s]
```

```
2.28.0-20220913134929-0#ros_base:/demo/ws$ source install/setup.bash
```

```
2.28.0-20220913134929-0#ros_base:/demo/ws$ echo $ROS_PACKAGE_PATH  
/demo/ws/install/share:/nix/store/wnyiwm73mm6arl606wjqxvhi7kzx0sp-ros_base-merged/share
```

# Building a workspace

```
2.28.0-20220913134929-0#ros_base:/demo/ws$ cd ws/  
2.28.0-20220913134929-0#ros_base:/demo/ws$ colcon build  
[0.2s] [0/0 complete]  
Starting >>> roscpp_tutorials  
[0.3s] [0/1 complete] [roscpp_tutorials:cmake - 0.1s]  
[3.0s] [0/1 complete] [roscpp_tutorials:cmake - 2.8s]  
[3.5s] [0/1 complete] [roscpp_tutorials:build 8% - 3.3s]  
[8.0s] [0/1 complete] [roscpp_tutorials:build 37% - 7.7s]  
[15.5s] [0/1 complete] [roscpp_tutorials:build 97% - 15.2s]  
Finished <<< roscpp_tutorials [17.3s]  
Summary: 1 package finished [17.6s]
```

```
2.28.0-20220913134929-0#ros_base:/demo/ws$ source install/setup.bash
```

```
2.28.0-20220913134929-0#ros_base:/demo/ws$ echo $ROS_PACKAGE_PATH  
/demo/ws/install/share:/nix/store/wnyiwm73mm6arl606wjqxvhi7kzx0sp-ros_base-merged/share
```

```
2.28.0-20220913134929-0#ros_base:/demo/ws$ rosrun roscpp_tutorials talker  
[ INFO] [1663868287.133826774]: hello world 0  
[ INFO] [1663868287.233899760]: hello world 1  
[ INFO] [1663868287.333887589]: hello world 2  
[ INFO] [1663868287.434151743]: hello world 3  
[ INFO] [1663868287.533945368]: hello world 4  
[ INFO] [1663868287.633979542]: hello world 5  
[ INFO] [1663868287.733976728]: hello world 6  
[ INFO] [1663868287.833986026]: hello world 7
```



CLEARPATH

# Versions and environments

```
$ nix develop clearpath/2.28-devel#ros.ros_base.ws  
[0/1 built] querying info about missing paths  
2.28.0-20220922164904-0#ros_base:/demo$  
2.28.0-20220922164904-0#ros_base:/demo$ exit
```

```
$ nix develop clearpath/2.26-devel#ros.ros_base.ws  
[0/1 built] querying info about missing paths  
2.26.2-20220921023444-0#ros_base:/demo$  
2.26.2-20220921023444-0#ros_base:/demo$ exit
```

# Versions and environments

```
$ nix develop clearpath/2.28-devel#ros.ros_base.ws  
[0/1 built] querying info about missing paths  
2.28.0-20220922164904-0#ros_base:/demo$  
2.28.0-20220922164904-0#ros_base:/demo$ exit
```

```
$ nix develop clearpath/2.26-devel#ros.ros_base.ws  
[0/1 built] querying info about missing paths  
2.26.2-20220921023444-0#ros_base:/demo$  
2.26.2-20220921023444-0#ros_base:/demo$ exit
```

```
$ nix develop clearpath/devel#ros.roscpp.debugEnv  
[0/10 built, 1/1/8 copied (0.0/13.8 MiB), 0.0 MiB DL] fetching cpp_common-debug from http://172.17.0.1:5000  
[0/9 built, 1/2/8 copied (0.1/13.8 MiB), 0.1 MiB DL] fetching Indir-1.0.3 from http://172.17.0.1:5000  
[0/7 built, 1/4/8 copied (1.3/13.8 MiB), 1.4 MiB DL] fetching roscpp-debug from http://172.17.0.1:5000  
[0/7 built, 1/4/8 copied (1.3/13.8 MiB), 1.4 MiB DL] fetching roscpp-debug from http://172.17.0.1:5000  
[0/7 built, 1/4/8 copied (1.3/13.8 MiB), 1.4 MiB DL] fetching roscpp-debug from http://172.17.0.1:5000  
[1/2/3 built, 8 copied (13.3/13.8 MiB), 13.8 MiB DL] building roscpp-debugEnv-env  
2.28.0-20220922164904-0#roscpp-debugEnv:/demo$  
2.28.0-20220922164904-0#roscpp-debugEnv:/demo$ echo $NIX  
$NIX_BUILD_CORES          $NIX_BUNDLE_TAG          $NIX_CFLAGS_COMPILE      $NIX_ENFORCE_NO_NATIVE  $NIX_INDENT_MAKE  
$NIX_LIB64_IN_SELF_RPATH  $NIX_STORE  
$NIX_BUILD_TOP           $NIX_BUNDLE_TYPE        $NIX_DEBUG_INFO_DIRS    $NIX_GCROOT             $NIX_LDFLAGS  
  
2.28.0-20220922164904-0#roscpp-debugEnv:/demo$ echo $NIX_DEBUG_INFO_DIRS  
/nix/store/s45z7glh9g0qf4appwnahww4lfisr1hj-roscpp-debug-dir/lib/debug/
```



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# Tests in Nix

```
$ nix build clearpath/2.28.0-20220913134929-0#ros.svg_draw_tool.test
[1/5 built, 1/11/13 copied (0.3/5.3 MiB), 0.4 MiB DL] fetching svg_draw_tool-build from http://172.17.0.1:5000
[1/1/3 built, 13 copied (5.3/5.3 MiB), 5.5 MiB DL] building svg_draw_tool-testCompile (unpackPhase)
[1/1/3 built, 13 copied (5.3/5.3 MiB), 5.5 MiB DL] building svg_draw_tool-testCompile (patchPhase)
[1/1/3 built, 13 copied (5.3/5.3 MiB), 5.5 MiB DL] building svg_draw_tool-testCompile (buildPhase)
svg_draw_tool-testCompile> -- Using CATKIN_DEVEL_PREFIX: /tmp/nix-build-svg_draw_tool-testCompile.drv-0/build/svg_draw_tool/devel
svg_draw_tool-testCompile> -- This workspace overlays: /nix/store/1n1wylana68i3bnw66ggzk0dzy8rgfm4-catkin
svg_draw_tool-testCompile> -- Found gtest sources under '/nix/store/9fia6ynqsva9l0mjdfcv5s2jwim09mii-gtest-src': gtests will be b
svg_draw_tool-testCompile> [ 1%] Building CXX object gtest/googletest/CMakeFiles/gtest.dir/src/gtest-all.cc.o
svg_draw_tool-testCompile> [ 53%] Building CXX object CMakeFiles/draw_tool_test.dir/test/draw_tool_test.cpp.o
svg_draw_tool-testCompile> [ 84%] Linking CXX executable devel/lib/svg_draw_tool/draw_minimal
svg_draw_tool-testCompile> Finished <<< svg_draw_tool [17.9s]
[1/1/3 built, 13 copied (5.3/5.3 MiB), 5.5 MiB DL] building svg_draw_tool-testCompile (fixupPhase)
[2/3 built, 13 copied (5.3/5.3 MiB), 5.5 MiB DL]
```



# Tests in Nix

```
$ nix build clearpath/2.28.0-20220913134929-0#ros.svg_draw_tool.test
[1/5 built, 1/11/13 copied (0.3/5.3 MiB), 0.4 MiB DL] fetching svg_draw_tool-build from http://172.17.0.1:5000
[1/1/3 built, 13 copied (5.3/5.3 MiB), 5.5 MiB DL] building svg_draw_tool-testCompile (unpackPhase)
[1/1/3 built, 13 copied (5.3/5.3 MiB), 5.5 MiB DL] building svg_draw_tool-testCompile (patchPhase)
[1/1/3 built, 13 copied (5.3/5.3 MiB), 5.5 MiB DL] building svg_draw_tool-testCompile (buildPhase)
svg_draw_tool-testCompile> -- Using CATKIN_DEVEL_PREFIX: /tmp/nix-build-svg_draw_tool-testCompile.drv-0/build/svg_draw_tool/devel
svg_draw_tool-testCompile> -- This workspace overlays: /nix/store/1n1wylana68i3bnw66ggzk0dzy8rgfm4-catkin
svg_draw_tool-testCompile> -- Found gtest sources under '/nix/store/9fia6ynqsva9l0mjdfcv5s2jwim09mii-gtest-src': gtests will be b
svg_draw_tool-testCompile> [ 1%] Building CXX object gtest/googletest/CMakeFiles/gtest.dir/src/gtest-all.cc.o
svg_draw_tool-testCompile> [ 53%] Building CXX object CMakeFiles/draw_tool_test.dir/test/draw_tool_test.cpp.o
svg_draw_tool-testCompile> [ 84%] Linking CXX executable devel/lib/svg_draw_tool/draw_minimal
svg_draw_tool-testCompile> Finished <<< svg_draw_tool [17.9s]
[1/1/3 built, 13 copied (5.3/5.3 MiB), 5.5 MiB DL] building svg_draw_tool-testCompile (fixupPhase)
[2/3 built, 13 copied (5.3/5.3 MiB), 5.5 MiB DL]
[1/2/3 built, 13 copied (5.3/5.3 MiB), 5.5 MiB DL] building svg_draw_tool-test
svg_draw_tool-test> Starting >>> svg_draw_tool
svg_draw_tool-test> 1: [=====] Running 1 test from 1 test suite.
svg_draw_tool-test> 1: [ RUN      ] TestSVGDrawTool.test_minimal
svg_draw_tool-test> 1: [       OK ] TestSVGDrawTool.test_minimal (1 ms)
svg_draw_tool-test> 1: [=====] 1 test from 1 test suite ran. (1 ms total)
svg_draw_tool-test> 1: [  PASSED  ] 1 test.
svg_draw_tool-test> Finished <<< svg_draw_tool [1.33s]
svg_draw_tool-test> /nix/store/4zx9ib2yqd5r57d1b44759wvhi95kj4z-svg_draw_tool-test/test_results/svg_draw_tool/Testing/20220922-19
0 errors, 0 failures, 0 skipped
svg_draw_tool-test> Summary: 13 tests, 0 errors, 0 failures, 0 skipped
```



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# Overrides

```
pcl = (prev.pcl.override {
  boost = final.ros.boost;
  withCuda = true;
}).overrideAttrs(old: {
  propagatedBuildInputs = old.propagatedBuildInputs ++ [ final.xorg.libXt ];
  CXXFLAGS = "${toString final.clearpathCompileFlags} -std=c++11";
  patches = [
    # https://jira.clearpathrobotics.com/browse/CORE-21988
    (final.fetchpatch {
      url = "https://github.com/PointCloudLibrary/pcl/commit/614e19d96bd8415dbfb52d86df0f3774a9f462fe.patch";
      sha256 = "sha256-mI4gPpoZdGA26ST8YLfeNUWTNCUoWeW61f1c5f1BF9U=";
    })
  ];
});
```

# Closing remarks

- True delta builds and downloads.
- All versions locked in and consistent, including the underlying system.
- Uniformity between ros1 and ros2.



# Closing remarks

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- All versions locked in and consistent, including the underlying system.
- Uniformity between ros1 and ros2.
- Nix language can be a barrier.
- Conceptual leap relative to apt.
- Host-Nix interactions can be finicky (eg: CUDA, QT5, glibc modules).



# Closing remarks

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- All versions locked in and consistent, including the underlying system.
- Uniformity between ros1 and ros2.
- Nix language can be a barrier.
- Conceptual leap relative to apt.
- Host-Nix interactions can be finicky (eg: CUDA, QT5, glibc modules).
- Old bundle builds took 144 cores, nix based builds take 12 cores.
- Daily updates are 10s-100s of megabytes vs several gigabytes.
- Pipelines are much faster (20 mins vs 1.5 hours).



# Thanks

- Our colleagues at Clearpath for tolerating all the disruption this change has brought, and being willing to try out a new way of doing things, even when the benefits to the individuals were not immediately obvious.
- The Nix community for the immense work that has gone into Nix and nixpkgs since the project's inception in 2003.
- Ben Wolsieffer for his inspiring work packaging ROS for Nix— check it out on his Github as a supplement to this talk: <https://github.com/lopsided98/nix-ros-overlay>



# Links

## Self-Guided Demonstration

- <https://github.com/clearpathrobotics/nix-ros-base>
- <https://github.com/clearpathrobotics/nix-ros>
- <https://github.com/clearpathrobotics/rosdistro-snapshots>

## Tools

- <https://github.com/clearpathrobotics/colcon-distro>
- <https://github.com/clearpathrobotics/colcon-nix>







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