Better ROS Builds with Nix

ROSCon 2022 | Kyoto, Japan

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4.5 times faster with 10% of the resources!
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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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Nix
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?

Patches, Metadata, etc

Upstream Source

fancy-package_amd64_1.0-0.deb
What is Nix?

Compiler

Headers, Libraries

Tools / Helpers

Configuration

Patches, Metadata, etc

Upstream Source

fancy-package_amd64_1.0-0.deb
What is Nix?

- Compiler
- Headers, Libraries
- Tools / Helpers
- Configuration
- Human-readable name and version
- Patches
- Source

/nix/store/mczz86ndimpcw9vwaqh9lks170acl0fa
Package Identification

- Packages are described as functions in the Nix language.

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

  src = fetchFromClearpathGitLab {
    owner = "forks";
    repo = "canfestival-3";
    rev = "605fc6a2adf250d50dd22ac4f1d527e3a21a58a3";
    hash = "sha256-os3qbS1Dbg2ya5McUlo0W8xcz8mealwgr90eZeErQzM=";
  };

  propagatedNativeBuildInputs = [ python3 ];

  configurePhase = ''
    bash configure --prefix=$out --can=socket --wx=0
  '';
}
```
• 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/4pwklyajqqx61yqs0dl3q9xwfy3692y0-cfnestival-3.0.4.drv": {  
    "outputs": {  
        "out": {  
            "path": "/nix/store/rn9asxp3fjxyj9xwgdv36b92x1n8w33b-cfnestival-3.0.4"
        }
    },  
    "inputSrcs": [  
        "/nix/store/9krlzvny65gdc8s7kpb61kx8cd02c25b-default-builder.sh"
    ],  
    "inputDrvs": {  
        "/nix/store/9nl7galmmj9n6ljw6dkfv7w3zcqcf1j5-source.drv": [  
            "out"
        ],  
        "/nix/store/bqfy8ydlxs0xhzqmy7rc3jw60vwab6j-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.

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

$ ls /nix/store/rn9asxp3fjxyj9xwgdv36b92x1n8w33b-ccanfestival-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 clearch#canfestival
/nix/store/rn9asxp3fjxyj9xwgdv36b92x1n8w33b-ccanfestival-3.0.4

$ ll /nix/store/rn9asxp3fjxyj9xwgdv36b92x1n8w33b-ccanfestival-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:clearpath-os/canopen_service.git
        version: 6f410b7b35526cf087187c3ca36fb5fc327e34cd
        status_description: 'Branch: devel'

let pkgSrc, fetchFromClearpathGitLab =
    let
default packages
    pkg = pkgSrc (fetchFromClearpathGitLab {
        owner = "software";
        repo = "canfestival_ros";
        rev = "24db50db6626a0cac958590148347b66244a59d2";
        hash = "sha256-nnzpYHjgZuqFBVI3Jx3FycJptpF48HgA3ReILM+alL4=";
        name = "software-canfestival_ros-24db50db6626a0cac958590148347b66244a59d2"; 
    })
    in
    {
        canfestival_ros = pkg "sha256-nnzpYHjgZuqFBVI3Jx3FycJptpF48HgA3ReILM+alL4=" ";
    }
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'

<?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 = "24db50db6626a0cac958590148347b66244a59d2";
    hash = "sha256-nnzpYHjgZuqFBVI3Jx3FycJptpF";
    name = "software-canfestival_ros-24db50db6";
  });
in
  canfestival_ros = pkg "sha256-nnzpYHjgZuqFBVI3Jx3FycJptpF" .

{ 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 ];
}
```
Architecture

Freeze distribution

rosdistro repo
- distribution.yaml
- snapshots

Nix file generation

nix support repo
- buildColconPackage
- buildColconWorkspace
- overrides
- other tooling

nix flake repo
- .nix files per snapshot

Hydra

Developers CI testing
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
```
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, 1/418/464 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

$ ls -l result

lrwxrwxrwx 1 root root 76 Sep 22 17:06 result -> /nix/store/xvvrnam0mw724fkavngxs5zx5s4cmf84i-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-2.3.3-50-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
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[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

$ ls -l result

lrwxrwxrwx 1 root root 76 Sep 22 17:06 result -> /nix/store/xvvrnam0mw724fkavngxs5zxds4cmf84i-ros_base-2.28.0-20220913134929-0

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

total 296
xmlrpcpp -> /nix/store/jg8kgiwv7q3h101kx5ac12ggh0vb50gy-xmlrpcpp/share/xmlrpcpp
visualization_msgs -> /nix/store/nasbk2s7rzwfq6nzd6dx4vwrzcr3x-visualization_msgs/share/visualization_msgs
trajectory_msgs -> /nix/store/8792xra049h1g6zcdfwa1gy1a3ynmx3hj-trajectory_msgs/share/trajectory_msgs
topic_tools -> /nix/store/9f8f91a6apvd3pv57yjmmnpnl0mmp0ac3-topic_tools/share/topic_tools
stereo_msgs -> /nix/store/id9wgzl3bjk2z1f3c2knjnp0hnvbn9v2-stereo_msgs/share/stereo_msgs
std_srvs -> /nix/store/jb7igsh199xcz69dlm23xspxc0j60r1-std_srvs/share/std_srvs
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/wnyiwm73mm6ar1606wjqxwvh17kzx0sp-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/wnyiwm73mm6ar16o6wjqwxvhi7kzx0sp-ros_base-merged/share

2.28.0-20220913134929-0#ros_base:/demo$ echo $COLCON_HOME
/nix/store/dnncy2f99bvjfz5pm7m19hsvwyybk57c-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/wnyiwm73mm6arl606wjqxvhi7kzx0sp-ros_base-merged/share

2.28.0-20220913134929-0#ros_base:/demo$ echo $COLCON_HOME
/nix/store/dnncy2f99bvjfz5pm7m19hswwyb57c-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/wnyiwm73mm6ar1606wjqxvh17kzx0sp-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/wnyiwm73mm6ar1606wjxvvh17kzx0sp-ros_base-merged/share

2.28.0-20220913134929-0#ros_base:/demo/ws$ rosrun roscpp_tutorials talker
[ INFO] [1663868287.133826774]: hello world 0
[ INFO] [1663868287.333887589]: hello world 1
[ INFO] [1663868287.434151743]: hello world 2
[ INFO] [1663868287.533945368]: hello world 3
[ INFO] [1663868287.633979542]: hello world 4
[ INFO] [1663868287.733976728]: hello world 5
[ INFO] [1663868287.833986026]: hello world 6
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 lndir-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/s45z7glh9g0qf4appwnahww4lfisrlhj-roscpp-debug-dir/lib/debug/
Tests in Nix

$ nix build clearpth/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/9fia6ynqsqa910mjdfcv5s2jwim09mii-gtest-src': gtests will be built
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/1n1wylana68i3bnw6ggzk0dzy8rgfm4-catkin

svg_draw_tool-testCompile> -- Found gtest sources under '/nix/store/9fia6ynqsva9l0mjdfcv5s2jwim09mii-gtest-src': gtests will be built

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]

svg_draw_tool-test>

1: [==========] Running 1 test from 1 test suite.

1: [ RUN      ] TestSVGDrawTool.test_minimal

1: [  OK   ] TestSVGDrawTool.test_minimal (1 ms)

1: [==========] 1 test from 1 test suite ran. (1 ms total)

1: [  PASSED  ] 1 test.

Finished <<< svg_draw_tool [1.33s]

svg_draw_tool-test>

/nix/store/4zx9ib2yqd5r57d1b44759wvh195kj4z-svg_draw_tool-test/test_results/svg_draw_tool/Testing/20220922-1920/Test.xml: 13 tests, 0 errors, 0 failures, 0 skipped

Summary: 13 tests, 0 errors, 0 failures, 0 skipped
```
 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-mI4gPpoZdGA26ST8YLfeNUWNTNCUoW61f1c5f1BF9U=";
        }),
    ];
});
Closing remarks

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

- True delta builds and downloads.
- 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

- True delta builds and downloads.
- 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-base)
- [https://github.com/clearpathrobotics/nix-ros](https://github.com/clearpathrobotics/nix-ros)
- [https://github.com/clearpathrobotics/rosdistro-snapshots](https://github.com/clearpathrobotics/rosdistro-snapshots)

Tools

- [https://github.com/clearpathrobotics/colcon-distro](https://github.com/clearpathrobotics/colcon-distro)
- [https://github.com/clearpathrobotics/colcon-nix](https://github.com/clearpathrobotics/colcon-nix)