Docker-based Build Farm for ROS

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Developed by OSRF, sponsored and tested by Bosch.
Custom Build Farm - Motivation

What does it do?

- automatically build .deb files from your packages in order
- continuous integration (unit tests)
- autodocumentation (doxygen, sphinx, epydoc, ...)

OSRF & GitHub are awesome, why would you want your own build farm?

- host your code on your own servers (i.e. you don’t want to or are not allowed to use public github)
- distribute your proprietary ROS packages (only) to customers
- keep specific package versions (e.g. for stability)
Why it is better (than the old build farm)

- perfectly reproducible builds, also in parallel (thanks to Docker)
  - also locally on your dev machine (pre-release jobs)
- allow hosting source code on non-public servers
- scripted deployment & update
  - old build farm installation was not reproducible
- simplify deployment of custom setups, more customization options
- black/white-listing packages
- build non-catkin packages
## Overview - Hardware

<table>
<thead>
<tr>
<th>Jenkins Master</th>
<th>Jenkins Slave (n instances)</th>
<th>Repository/Web Host</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Jenkins" /> Master + Plugins</td>
<td><img src="image" alt="Jenkins" /> Slave</td>
<td><img src="image" alt="Apache" /></td>
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<tr>
<td><img src="image" alt="docker" /></td>
<td><img src="image" alt="docker" /></td>
<td><img src="image" alt="Reprepro" /></td>
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</table>

Deployed from `buildfarm_deployment`
Overview

Configuration Jobs
- configure indigo **release** jobs script
- configure indigo **doc** jobs script
- configure indigo **devel** jobs script

Package specific jobs
- indigo release job
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- indigo doc job
- indigo doc job
- indigo doc job
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- indigo doc job

- indigo devel job
- indigo devel job
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- indigo devel job

Deployed from:
**ros_buildfarm**

local **ros_buildfarm** instance:
generate_config_jobs.py
--indigo ...

Configuration Jobs
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- configure indigo **devel** jobs script

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Deployed from:
**ros_buildfarm**

- .deb
- .html

Apt repo
(building, testing, main)

Web server
Jenkins Jobs

Management jobs:
- rosdistro cache: recreate binary rosdistro cache
- **import_upstream**: call reprepro-updater to fetch upstream .deb packages
- check_slaves: check disk space on jenkins slaves
- release-status-page: create overview page on the repo server
- *-reconfigure/-trigger-jobs: update/run build jobs
- **sync-packages**: move packages from building to testing

Build jobs:
- **devel**: build & run tests
- release: build binary .debs
- source
- doc
Devel Job - Components Interaction
**Initial Setup (Deployment)**

**deployment**: “bootstrap” your build farm environment, only done once (ROS agnostic)

- fork & adapt ros_buildfarm_deployment_config
  - insert information about your servers, ssh keys, jenkins login
- check it out on your servers, run
  - `./install_prerequisites.bash; ./reconfigure.bash master | slave | repo`

**jenkins job configuration:**

- fork & adapt ros_buildfarm_config
  - create your own distribution, e.g. deepfield-indigo
- if you want to build on top of existing packages:
  - fork & adapt rosdistro
  - add your distribution, list of packages (as generated by bloom-release)
About DeepField Robotics

- Corporate Start-Up within Robert Bosch GmbH
- ~ 20 people with robotics and/or agricultural background
Our Use Case

- our agricultural robot BoniRob is fully ROSified
- deliver proprietary ROS packages (& updates) to customers

Until recently:

- `catkin_make install`
- `tar -cf ...`

→ cumbersome, easy to mess up updates

better: `apt-get install ros-indigo-deepfield`
Overview - DF Setup

Setup:

- 3 VMs on a local server: jenkins-master, jenkins-slave, repository
- custom built proprietary drivers added as rosdeps
- external webserver (Google Cloud) where docs, rosdistro, repositories are mirrored
  - accessible via https, one set of credentials per user
- additional jenkins server for testing, static code analysis

Challenges:

- custom rosdep packages
  - i.e. drivers we must not make publicly available
- private repositories on GitHub Enterprise (and Atlassian Tools?)
If your source code builds on standard ROS packages:

- by default, buildfarm builds all packages from source
- so, dependencies in the package.xml can be resolved
- but we don’t have e.g. roscpp source packages & just want to use the pre-built pkgs from OSRF

➡ Use Mike Purvis’ rosdep-generator¹:

- generates rosdep files for OSRF buildfarm pkgs (i.e. map rospack name to debian name)
- e.g.
  
  - actionlib: {fedora: ros-indigo-actionlib, ubuntu: ros-indigo-actionlib}
  - actionlib_msgs: {fedora: ros-indigo-actionlib_msgs, ubuntu: ros-indigo-actionlibmsgs}

- put the resulting rosdep files in your rosdistro repository

¹ https://github.com/mikepurvis/rosdep-generator
Private Repos & GitHub Enterprise

Just replace github.com with your enterprise instance in buildfarm_deployment_config

Still some assumptions wrt. code hosting platform (i.e. public GitHub):

- unauthenticated downloads from raw.github.com: rosdistro, buildfarm_config
  ➔ put buildfarm_config, rosdistro on repo web server

- checkouts from public readable git repositories
  - create OAuth tokens
  - put into checkout url in rosdistro distribution

- open pull requests (bloom-release)
  - adjust rosdistro manually
Caveats

Some steps are not automated & need to be triggered manually:
- trigger import_upstream when new upstream packages are released
- sync packages from testing to main

“docker pull” hangup (v 1.6.2)
- update to 1.8.2 seems to have fixed this

A good overview over the tools involved is (highly) recommended:
- Puppet
- Jenkins & Groovy scripting
- git-buildpackage
- Docker
- bloom
Misc. Questions for Discussion

● when does OSRF switch to the new build farm?
● difference to buildbot-ros (bird-eye view)
   ○ scalability
● users (that we know of):
   ○ Fraunhofer IPA
   ○ Yujin
   ○ Bosch
   ○ Aldebaran
Documentation

Wiki Instructions

- http://wiki.ros.org/buildfarm

Example Jenkins and Repository instances

- http://54.183.65.232/

Mailing List

- https://groups.google.com/forum/#!forum/ros-sig-buildfarm