Creating a ROS Package

For a package to be considered a catkin package it must meet a few requirements:

* The package must contain a [catkin compliant package.xml](http://wiki.ros.org/catkin/package.xml) file.
  + That package.xml file provides meta information about the package.
* The package must contain a [CMakeLists.txt which uses catkin](http://wiki.ros.org/catkin/CMakeLists.txt).
  + If it is a [catkin metapackage](http://wiki.ros.org/catkin/package.xml#Metapackages) it must have the relevant boilerplate CMakeLists.txt file.
* Each package must have its own folder
  + This means no nested packages nor multiple packages sharing the same directory.

The simplest possible package might have a structure which looks like this:

* my\_package/
* CMakeLists.txt
* package.xml

## **Packages in a catkin Workspace**

The recommended method of working with catkin packages is using a [catkin workspace](http://wiki.ros.org/catkin/workspaces), but you can also build catkin packages standalone. A trivial workspace might look like this:

* workspace\_folder/ -- WORKSPACE
* src/ -- SOURCE SPACE
* CMakeLists.txt -- 'Toplevel' CMake file, provided by catkin
* package\_1/
* CMakeLists.txt -- CMakeLists.txt file for package\_1
* package.xml -- Package manifest for package\_1
* ...
* package\_n/
* CMakeLists.txt -- CMakeLists.txt file for package\_n
* package.xml -- Package manifest for package\_n

## **Creating a catkin Package**

This tutorial will demonstrate how to use the [catkin\_create\_pkg](http://wiki.ros.org/catkin/commands/catkin_create_pkg) script to create a new catkin package, and what you can do with it after it has been created.

First change to the source space directory of the catkin workspace you created in the [Creating a Workspace for catkin tutorial](http://wiki.ros.org/catkin/Tutorials/create_a_workspace):

# You should have created this in the Creating a Workspace Tutorial

$ cd ~/catkin\_ws/src

Now use the catkin\_create\_pkg script to create a new package called 'beginner\_tutorials' which depends on std\_msgs, roscpp, and rospy:

$ catkin\_create\_pkg beginner\_tutorials std\_msgs rospy roscpp

This will create a beginner\_tutorials folder which contains a [package.xml](http://wiki.ros.org/catkin/package.xml) and a [CMakeLists.txt](http://wiki.ros.org/catkin/CMakeLists.txt), which have been partially filled out with the information you gave catkin\_create\_pkg.

catkin\_create\_pkg requires that you give it a package\_name and optionally a list of dependencies on which that package depends:

# This is an example, do not try to run this

# catkin\_create\_pkg <package\_name> [depend1] [depend2] [depend3]

catkin\_create\_pkg also has more advanced functionalities which are described in [catkin/commands/catkin\_create\_pkg](http://wiki.ros.org/catkin/commands/catkin_create_pkg).

## **Building a catkin workspace and sourcing the setup file**

Now you need to build the packages in the catkin workspace:

$ cd ~/catkin\_ws

$ catkin\_make

After the workspace has been built it has created a similar structure in the devel subfolder as you usually find under /opt/ros/$ROSDISTRO\_NAME.

To add the workspace to your ROS environment you need to source the generated setup file:

$ . ~/catkin\_ws/devel/setup.bash

## **package dependencies**

### **First-order dependencies**

When using [catkin\_create\_pkg](http://wiki.ros.org/catkin/commands/catkin_create_pkg) earlier, a few package dependencies were provided.  These **first-order** dependencies can now be reviewed with the rospack tool.

$ rospack depends1 beginner\_tutorials

* roscpp
* rospy
* std\_msgs

As you can see, rospack lists the same dependencies that were used as arguments when running catkin\_create\_pkg. These dependencies for a package are stored in the **package.xml** file:

$ roscd beginner\_tutorials

$ cat package.xml

* <package format="2">
* ...
* <buildtool\_depend>catkin</buildtool\_depend>
* <build\_depend>roscpp</build\_depend>
* <build\_depend>rospy</build\_depend>
* <build\_depend>std\_msgs</build\_depend>
* ...
* </package>

### **Indirect dependencies**

In many cases, a dependency will also have its own dependencies. For instance, rospy has other dependencies.

$ rospack depends1 rospy

* genpy
* roscpp
* rosgraph
* rosgraph\_msgs
* roslib
* std\_msgs

A package can have quite a few indirect dependencies. Luckily rospack can recursively determine all nested dependencies.

$ rospack depends beginner\_tutorials

cpp\_common

rostime

roscpp\_traits

roscpp\_serialization

catkin

genmsg

genpy

message\_runtime

gencpp

geneus

gennodejs

genlisp

message\_generation

rosbuild

rosconsole

std\_msgs

rosgraph\_msgs

xmlrpcpp

roscpp

rosgraph

ros\_environment

rospack

roslib

rospy

## **Customizing Your Package**

This part of the tutorial will look at each file generated by [catkin\_create\_pkg](http://wiki.ros.org/catkin/commands/catkin_create_pkg) and describe, line by line, each component of those files and how you can customize them for your package.

### **Customizing the package.xml**

The generated [package.xml](http://wiki.ros.org/catkin/package.xml) should be in your new package. Now lets go through the new [package.xml](http://wiki.ros.org/catkin/package.xml) and touch up any elements that need your attention.

#### **description tag**

First update the description tag:

[Toggle line numbers](http://wiki.ros.org/ROS/Tutorials/CreatingPackage)

[5](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-fb97e97d8b791b4f6b911c62d34fe5604a07675c_5) <description>The beginner\_tutorials package</description>

Change the description to anything you like, but by convention the first sentence should be short while covering the scope of the package. If it is hard to describe the package in a single sentence then it might need to be broken up.

#### **maintainer tags**

Next comes the maintainer tag:

[Toggle line numbers](http://wiki.ros.org/ROS/Tutorials/CreatingPackage)

[7](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-2f2f1839d8bd274cd8f99fd961a225fe80fcc1d2_7) <!-- One maintainer tag required, multiple allowed, one person per tag -->

[8](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-2f2f1839d8bd274cd8f99fd961a225fe80fcc1d2_8) <!-- Example: -->

[9](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-2f2f1839d8bd274cd8f99fd961a225fe80fcc1d2_9) <!-- <maintainer email="jane.doe@example.com">Jane Doe</maintainer> -->

[10](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-2f2f1839d8bd274cd8f99fd961a225fe80fcc1d2_10) <maintainer email="user@todo.todo">user</maintainer>

This is a required and important tag for the [package.xml](http://wiki.ros.org/catkin/package.xml) because it lets others know who to contact about the package. At least one maintainer is required, but you can have many if you like. The name of the maintainer goes into the body of the tag, but there is also an email attribute that should be filled out:

[Toggle line numbers](http://wiki.ros.org/ROS/Tutorials/CreatingPackage)

[7](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-30d7f8b2d6d329b74df4869bade8fdfa316bb17c_7) <maintainer email="you@yourdomain.tld">Your Name</maintainer>

#### **license tags**

Next is the license tag, which is also required:

[Toggle line numbers](http://wiki.ros.org/ROS/Tutorials/CreatingPackage)

[12](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-0e6145b2e070238d1afa432d8b9a6a2e65d073cf_12) <!-- One license tag required, multiple allowed, one license per tag -->

[13](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-0e6145b2e070238d1afa432d8b9a6a2e65d073cf_13) <!-- Commonly used license strings: -->

[14](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-0e6145b2e070238d1afa432d8b9a6a2e65d073cf_14) <!-- BSD, MIT, Boost Software License, GPLv2, GPLv3, LGPLv2.1, LGPLv3 -->

[15](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-0e6145b2e070238d1afa432d8b9a6a2e65d073cf_15) <license>TODO</license>

You should choose a license and fill it in here. Some common open source licenses are BSD, MIT, Boost Software License, GPLv2, GPLv3, LGPLv2.1, and LGPLv3. You can read about several of these at the [Open Source Initiative](http://opensource.org/licenses/alphabetical). For this tutorial we'll use the BSD license because the rest of the core ROS components use it already:

[Toggle line numbers](http://wiki.ros.org/ROS/Tutorials/CreatingPackage)

[8](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-c2f485d5ba9efdc616470c2d71df9cf14a55e882_8) <license>BSD</license>

#### **dependencies tags**

The next set of tags describe the dependencies of your package. The dependencies are split into build\_depend, buildtool\_depend, exec\_depend, test\_depend. For a more detailed explanation of these tags see the documentation about [Catkin Dependencies](http://wiki.ros.org/catkin/package.xml#Build.2C_Run.2C_and_Test_Dependencies). Since we passed std\_msgs, roscpp, and rospy as arguments to [catkin\_create\_pkg](http://wiki.ros.org/catkin/commands/catkin_create_pkg), the dependencies will look like this:

[Toggle line numbers](http://wiki.ros.org/ROS/Tutorials/CreatingPackage)

[27](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-004f90df6bf9db2229e4f6943fb865f2dd8e8fc0_27) <!-- The \*\_depend tags are used to specify dependencies -->

[28](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-004f90df6bf9db2229e4f6943fb865f2dd8e8fc0_28) <!-- Dependencies can be catkin packages or system dependencies -->

[29](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-004f90df6bf9db2229e4f6943fb865f2dd8e8fc0_29) <!-- Examples: -->

[30](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-004f90df6bf9db2229e4f6943fb865f2dd8e8fc0_30) <!-- Use build\_depend for packages you need at compile time: -->

[31](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-004f90df6bf9db2229e4f6943fb865f2dd8e8fc0_31) <!-- <build\_depend>genmsg</build\_depend> -->

[32](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-004f90df6bf9db2229e4f6943fb865f2dd8e8fc0_32) <!-- Use buildtool\_depend for build tool packages: -->

[33](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-004f90df6bf9db2229e4f6943fb865f2dd8e8fc0_33) <!-- <buildtool\_depend>catkin</buildtool\_depend> -->

[34](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-004f90df6bf9db2229e4f6943fb865f2dd8e8fc0_34) <!-- Use exec\_depend for packages you need at runtime: -->

[35](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-004f90df6bf9db2229e4f6943fb865f2dd8e8fc0_35) <!-- <exec\_depend>python-yaml</exec\_depend> -->

[36](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-004f90df6bf9db2229e4f6943fb865f2dd8e8fc0_36) <!-- Use test\_depend for packages you need only for testing: -->

[37](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-004f90df6bf9db2229e4f6943fb865f2dd8e8fc0_37) <!-- <test\_depend>gtest</test\_depend> -->

[38](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-004f90df6bf9db2229e4f6943fb865f2dd8e8fc0_38) <buildtool\_depend>catkin</buildtool\_depend>

[39](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-004f90df6bf9db2229e4f6943fb865f2dd8e8fc0_39) <build\_depend>roscpp</build\_depend>

[40](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-004f90df6bf9db2229e4f6943fb865f2dd8e8fc0_40) <build\_depend>rospy</build\_depend>

[41](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-004f90df6bf9db2229e4f6943fb865f2dd8e8fc0_41) <build\_depend>std\_msgs</build\_depend>

All of our listed dependencies have been added as a build\_depend for us, in addition to the default buildtool\_dependon catkin. In this case we want all of our specified dependencies to be available at build and run time, so we'll add a exec\_depend tag for each of them as well:

[Toggle line numbers](http://wiki.ros.org/ROS/Tutorials/CreatingPackage)

[12](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-9ff0b8e163f24ad004671579a176a140ede469f6_12) <buildtool\_depend>catkin</buildtool\_depend>

[13](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-9ff0b8e163f24ad004671579a176a140ede469f6_13)

[14](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-9ff0b8e163f24ad004671579a176a140ede469f6_14) <build\_depend>roscpp</build\_depend>

[15](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-9ff0b8e163f24ad004671579a176a140ede469f6_15) <build\_depend>rospy</build\_depend>

[16](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-9ff0b8e163f24ad004671579a176a140ede469f6_16) <build\_depend>std\_msgs</build\_depend>

[17](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-9ff0b8e163f24ad004671579a176a140ede469f6_17)

[18](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-9ff0b8e163f24ad004671579a176a140ede469f6_18) <exec\_depend>roscpp</exec\_depend>

[19](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-9ff0b8e163f24ad004671579a176a140ede469f6_19) <exec\_depend>rospy</exec\_depend>

[20](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-9ff0b8e163f24ad004671579a176a140ede469f6_20) <exec\_depend>std\_msgs</exec\_depend>

#### **Final package.xml**

As you can see the final [package.xml](http://wiki.ros.org/catkin/package.xml), without comments and unused tags, is much more concise:

[Toggle line numbers](http://wiki.ros.org/ROS/Tutorials/CreatingPackage)

[1](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-503bfcd09daf7b64b4d684d92f02fa06898fc402_1) <?xml version="1.0"?>

[2](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-503bfcd09daf7b64b4d684d92f02fa06898fc402_2) <package format="2">

[3](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-503bfcd09daf7b64b4d684d92f02fa06898fc402_3) <name>beginner\_tutorials</name>

[4](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-503bfcd09daf7b64b4d684d92f02fa06898fc402_4) <version>0.1.0</version>

[5](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-503bfcd09daf7b64b4d684d92f02fa06898fc402_5) <description>The beginner\_tutorials package</description>

[6](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-503bfcd09daf7b64b4d684d92f02fa06898fc402_6)

[7](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-503bfcd09daf7b64b4d684d92f02fa06898fc402_7) <maintainer email="you@yourdomain.tld">Your Name</maintainer>

[8](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-503bfcd09daf7b64b4d684d92f02fa06898fc402_8) <license>BSD</license>

[9](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-503bfcd09daf7b64b4d684d92f02fa06898fc402_9) <url type="website">http://wiki.ros.org/beginner\_tutorials</url>

[10](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-503bfcd09daf7b64b4d684d92f02fa06898fc402_10) <author email="you@yourdomain.tld">Jane Doe</author>

[11](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-503bfcd09daf7b64b4d684d92f02fa06898fc402_11)

[12](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-503bfcd09daf7b64b4d684d92f02fa06898fc402_12) <buildtool\_depend>catkin</buildtool\_depend>

[13](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-503bfcd09daf7b64b4d684d92f02fa06898fc402_13)

[14](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-503bfcd09daf7b64b4d684d92f02fa06898fc402_14) <build\_depend>roscpp</build\_depend>

[15](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-503bfcd09daf7b64b4d684d92f02fa06898fc402_15) <build\_depend>rospy</build\_depend>

[16](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-503bfcd09daf7b64b4d684d92f02fa06898fc402_16) <build\_depend>std\_msgs</build\_depend>

[17](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-503bfcd09daf7b64b4d684d92f02fa06898fc402_17)

[18](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-503bfcd09daf7b64b4d684d92f02fa06898fc402_18) <exec\_depend>roscpp</exec\_depend>

[19](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-503bfcd09daf7b64b4d684d92f02fa06898fc402_19) <exec\_depend>rospy</exec\_depend>

[20](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-503bfcd09daf7b64b4d684d92f02fa06898fc402_20) <exec\_depend>std\_msgs</exec\_depend>

[21](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-503bfcd09daf7b64b4d684d92f02fa06898fc402_21)

[22](http://wiki.ros.org/ROS/Tutorials/CreatingPackage#ROS.2BAC8-Tutorials.2BAC8-catkin.2BAC8-CreatingPackage.CA-503bfcd09daf7b64b4d684d92f02fa06898fc402_22) </package>