山东大学__计算机科学与技术__学院

课程实验报告

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实验题目：机器人操作系统 ROS，编写 ROS 的第一个程序 hello__world		
实验学时：2	实验日期：20210510	
实验目的：学习编写 ROS 程序 hello_world ，学习工作空间的常见和功能包的创建，功能包的源代码编写，功能包的编译配置，功能包的编译，功能包的启动运行等功能。		
实验环境：Ubuntu１６　ＲＯＳ		

实验二：编写 ROS 的第一个程序 hello__world

工作空间的创建

mkdir catkin_ws 创建工作空间文件夹

在 catkin_ws 文件夹下面创建 src 文件，初始化 src 目录，生成 CMakeList.txt 文件。

```
liuxinyue@ubuntu:~$ mkdir catkin_ws
liuxinyue@ubuntu:~$ ls
catkin_ws  Documents  examples.desktop  Pictures  Templates
Desktop    Downloads  Music             Public    Videos
liuxinyue@ubuntu:~$ cd catkin_ws
liuxinyue@ubuntu:~/catkin_ws$ mkdir src
liuxinyue@ubuntu:~/catkin_ws$ ls
src
liuxinyue@ubuntu:~/catkin_ws$ cd src
liuxinyue@ubuntu:~/catkin_ws/src$ catkin_init_workspace
Creating symlink "/home/liuxinyue/catkin_ws/src/CMakeLists.txt" pointing to "
/opt/ros/kinetic/share/catkin/cmake/toplevel.cmake"
liuxinyue@ubuntu:~/catkin_ws/src$ ls
CMakeLists.txt
```

然后对文件进行编译，catkin_make

```
liuxinyue@ubuntu:~/catkin_ws/src$ cd ..
liuxinyue@ubuntu:~/catkin_ws$ catkin_make
Base path: /home/liuxinyue/catkin_ws
Source space: /home/liuxinyue/catkin_ws/src
Build space: /home/liuxinyue/catkin_ws/build
Devel space: /home/liuxinyue/catkin_ws/devel
Install space: /home/liuxinyue/catkin_ws/install
####
#### Running command: "cmake /home/liuxinyue/catkin_ws/src -DCATKIN_DEVEL_PRE
FIX=/home/liuxinyue/catkin_ws/devel -DCMAKE_INSTALL_PREFIX=/home/liuxinyue/ca
tkin_ws/install -G Unix Makefiles" in "/home/liuxinyue/catkin_ws/build"
####
-- The C compiler identification is GNU 5.4.0
-- The CXX compiler identification is GNU 5.4.0
-- Check for working C compiler: /usr/bin/cc
-- Check for working C compiler: /usr/bin/cc -- works
-- Detecting C compiler ABI info
-- Detecting C compiler ABI info - done
-- Detecting C compile features
-- Detecting C compile features - done
-- Check for working CXX compiler: /usr/bin/c++
-- Check for working CXX compiler: /usr/bin/c++ -- works
-- Detecting CXX compiler ABI info
-- Detecting CXX compiler ABI info - done
-- Detecting CXX compile features
-- Detecting CXX compile features - done
-- Using CATKIN_DEVEL_PREFIX: /home/liuxinyue/catkin_ws/devel
-- Using CMAKE_PREFIX_PATH: /opt/ros/kinetic
-- This workspace overlays: /opt/ros/kinetic
-- Found PythonInterp: /usr/bin/python2 (found suitable version "2.7.12", min
imum required is "2")
-- Using PYTHON_EXECUTABLE: /usr/bin/python2
-- Using Debian Python package layout
-- Using empy: /usr/bin/empy
```

```
-- Using CATKIN_ENABLE_TESTING: ON
-- Call enable_testing()
-- Using CATKIN_TEST_RESULTS_DIR: /home/liuxinyue/catkin_ws/build/test_res
s
-- Found gtest sources under '/usr/src/gmock': gtests will be built
-- Found gmock sources under '/usr/src/gmock': gmock will be built
-- Found PythonInterp: /usr/bin/python2 (found version "2.7.12")
-- Looking for pthread.h
-- Looking for pthread.h - found
-- Looking for pthread_create
-- Looking for pthread_create - not found
-- Looking for pthread_create in pthreads
-- Looking for pthread_create in pthreads - not found
-- Looking for pthread_create in pthread
-- Looking for pthread_create in pthread - found
-- Found Threads: TRUE
-- Using Python nosetests: /usr/bin/nosetests-2.7
-- catkin 0.7.29
-- BUILD_SHARED_LIBS is on
-- BUILD_SHARED_LIBS is on
-- Configuring done
-- Generating done
-- Build files have been written to: /home/liuxinyue/catkin_ws/build
####
#### Running command: "make -j2 -l2" in "/home/liuxinyue/catkin_ws/build"
####
```

环境变量配置，创建新的 catkin_ws 工作空间可用 source devel/setup.bash

```
liuxinyue@ubuntu:~/catkin_ws$ cd build
liuxinyue@ubuntu:~/catkin_ws/build$ ls
atomic_configure  catkin_make.cache    CTestConfiguration.ini  Makefile
catkin            CMakeCache.txt       CTestCustom.cmake       test_results
catkin_generated  CMakeFiles           CTestTestfile.cmake
CATKIN_IGNORE     cmake_install.cmake  gtest
liuxinyue@ubuntu:~/catkin_ws/build$ cd ..
liuxinyue@ubuntu:~/catkin_ws$ cd devel
liuxinyue@ubuntu:~/catkin_ws/devel$ ls
cmake.lock  lib              local_setup.sh   setup.bash  _setup_util.py
env.sh      local_setup.bash  local_setup.zsh  setup.sh    setup.zsh
```

```
liuxinyue@ubuntu:~/catkin_ws/devel$ cd ..
liuxinyue@ubuntu:~/catkin_ws$ source devel/setup.bash
liuxinyue@ubuntu:~/catkin_ws$
```

（2）创建功能包

在 catkin_ws/src 下面创建名为 hello-world 的功能包

catkin_create_pkg hello_world roscpp rospy

```
liuxinyue@ubuntu:~/catkin_ws$ cd src
liuxinyue@ubuntu:~/catkin_ws/src$ catkin_create_pkg hello_world roscpp rospy
Created file hello_world/package.xml
Created file hello_world/CMakeLists.txt
Created folder hello_world/include/hello_world
Created folder hello_world/src
Successfully created files in /home/liuxinyue/catkin_ws/src/hello_world. Plea
se adjust the values in package.xml.
liuxinyue@ubuntu:~/catkin_ws/src$ ls
CMakeLists.txt  hello_world
```

编写 c++源程序，编写并且保存代码，该段代码初始化 ros 节点并且指明节点的名称，该节点为 hello_node，一旦程序运行后就可以在 ros 的计算图中出现该节点

```
#include"ros/ros.h"
int main(int argc,char**argv)
{
ros::init(argc,argv,"hello_node");
ros::NodeHandle nh;
ROS_INFO_STREAM("hello world!!!");
}
~
```

C++功能包的编译配置文件修改。

然后在 CMakeFile 文件中加入

add_executabel(my_hello_world_nodesrc/my_hello_world_node

.cpp)

target_link_libraries(my_hello_world_node

${catkin_LIBRARIES})

编译结果：采用 catkin_make 的方式来编译编写好的程序

```
s
-- Found gtest sources under '/usr/src/gmock': gtests will be built
-- Found gmock sources under '/usr/src/gmock': gmock will be built
-- Found PythonInterp: /usr/bin/python2 (found version "2.7.12")
-- Using Python nosetests: /usr/bin/nosetests-2.7
-- catkin 0.7.29
-- BUILD_SHARED_LIBS is on
-- BUILD_SHARED_LIBS is on
-- ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
-- ~~  traversing 1 packages in topological order:
-- ~~  - hello_world
-- ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
-- +++ processing catkin package: 'hello_world'
-- ==> add_subdirectory(hello_world)
-- Configuring done
-- Generating done
-- Build files have been written to: /home/liuxinyue/catkin_ws/build
####
#### Running command: "make -j2 -l2" in "/home/liuxinyue/catkin_ws/build"
####
Scanning dependencies of target my_hello_world_node
[ 50%] Building CXX object hello_world/CMakeFiles/my_hello_world_node.dir/src
/my_hello_world_node.cpp.o
[100%] Linking CXX executable /home/liuxinyue/catkin_ws/devel/lib/hello_world
/my_hello_world_node
[100%] Built target my_hello_world_node
liuxinyue@ubuntu:~/catkin_ws$
```

功能包的启动运行，使用 roscore 命令来启动 ROS 节点管理器。

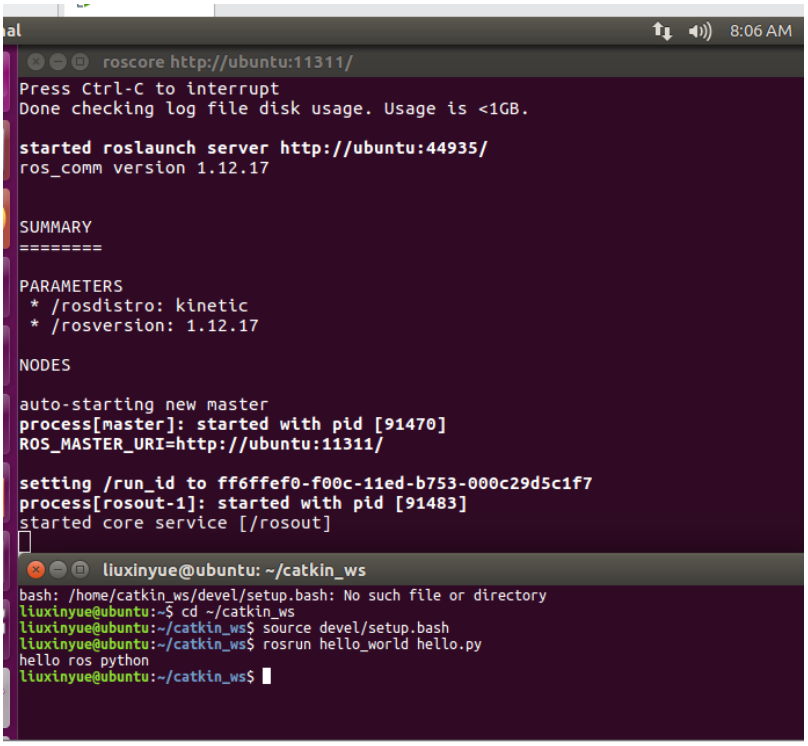
再打开终端输入 source devel/setup.bash

Rosrun hello_world my_hello_world_node

```
roscore http://ubuntu:11311/
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

started roslaunch server http://ubuntu:45933/
ros_comm version 1.12.17


SUMMARY
========

PARAMETERS
 * /rosdistro: kinetic
 * /rosversion: 1.12.17

NODES

auto-starting new master
process[master]: started with pid [41319]
ROS_MASTER_URI=http://ubuntu:11311/

setting /run_id to 1aeaebbc-efff-11ed-b753-000c29d5c1f7
process[rosout-1]: started with pid [41332]
started core service [/rosout]
```

```
liuxinyue@ubuntu:~$ cd ~/catkin_ws
liuxinyue@ubuntu:~/catkin_ws$ source devel/setip.bash
bash: devel/setip.bash: No such file or directory
liuxinyue@ubuntu:~/catkin_ws$ rosrun hello_world my_hello_world_node
[rospack] Error: package 'hello_world' not found
liuxinyue@ubuntu:~/catkin_ws$ source devel/setup.bash
liuxinyue@ubuntu:~/catkin_ws$ rosrun hello_world my_hello_world_node
[ INFO] [1683811524.762943882]: hello world!!!
liuxinyue@ubuntu:~/catkin_ws$
```

Python 源程序的设计，编写 python 程序，修改 python 文件权限，然后直接再终端输入：rosrun hello_world hello.py 执行节点，结果如下所示。


8:06 AM
roscore http://ubuntu:11311/
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.
started roslaunch server http://ubuntu:44935/
ros_comm version 1.12.17
SUMMARY
========
PARAMETERS
* /rosdistro: kinetic
* /rosversion: 1.12.17
NODES
auto-starting new master
process[master]: started with pid [91470]
ROS_MASTER_URI=http://ubuntu:11311/
setting /run_id to ff6ffef0-f00c-11ed-b753-000c29d5c1f7
process[rosout-1]: started with pid [91483]
started core service [/rosout]
liuxinyue@ubuntu: ~/catkin_ws
bash: /home/catkin_ws/devel/setup.bash: No such file or directory
liuxinyue@ubuntu:~$ cd ~/catkin_ws
liuxinyue@ubuntu:~/catkin_ws$ source devel/setup.bash
liuxinyue@ubuntu:~/catkin_ws$ rosrun hello_world hello.py
hello ros python
liuxinyue@ubuntu:~/catkin_ws$