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ROS文件系统与工作空间

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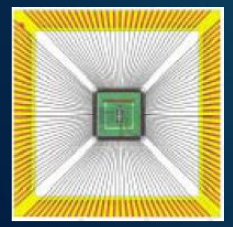
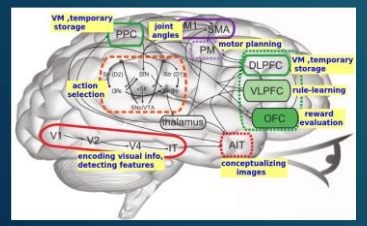
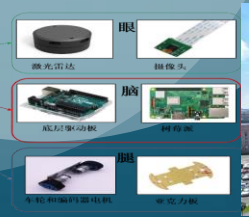
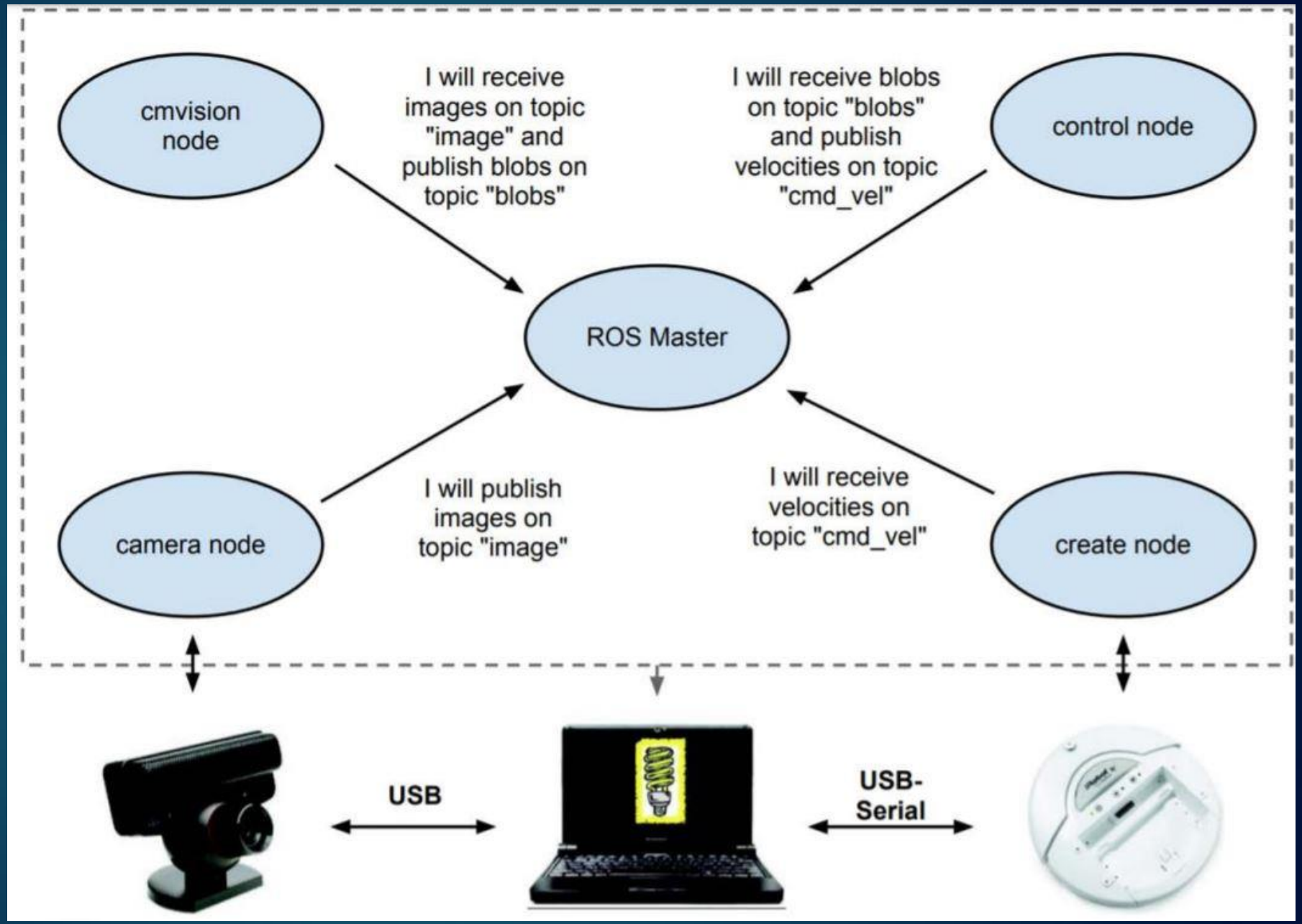






ROS如何工作？



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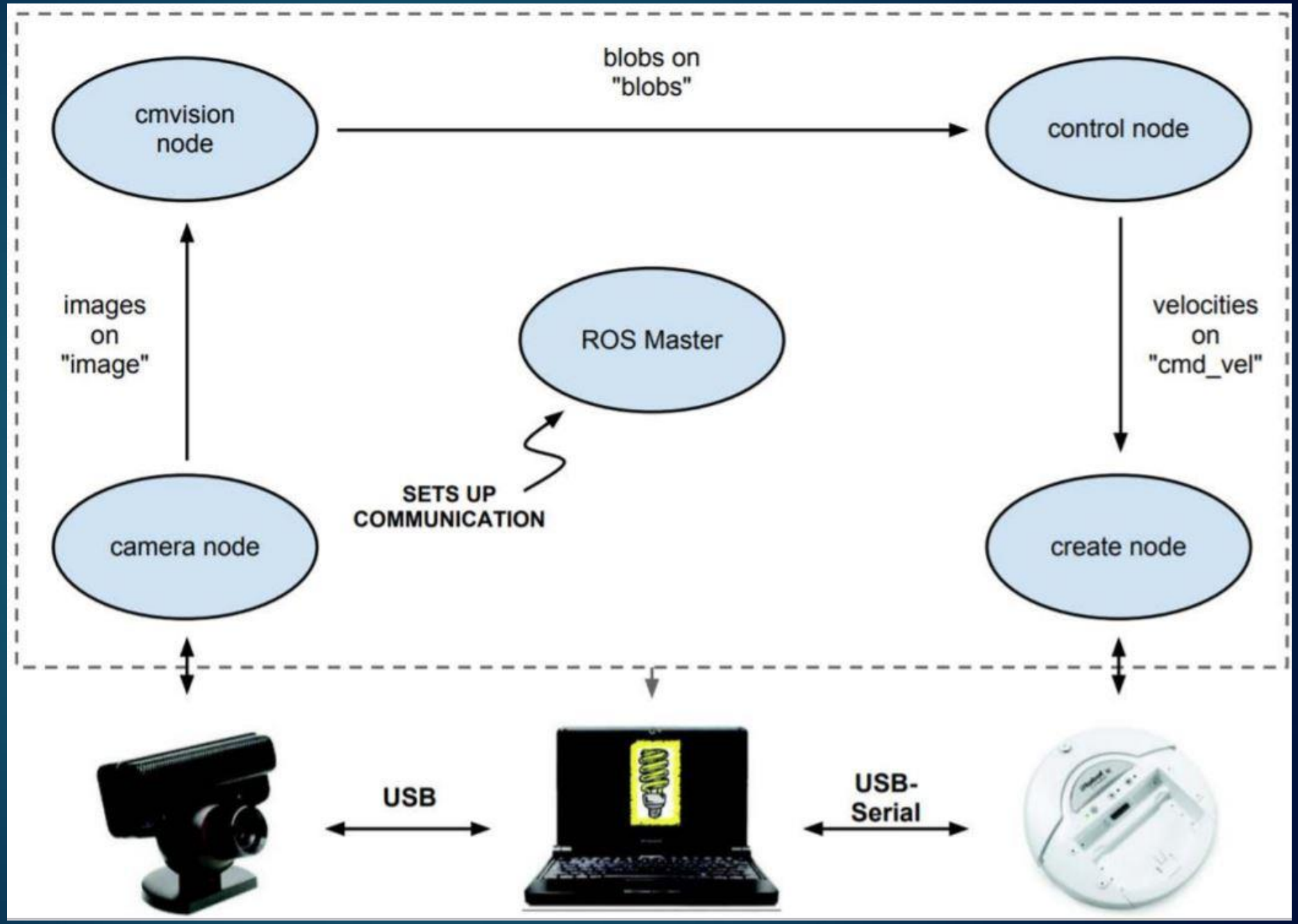
ROS如何工作？


cmvision node
blobs on "blobs"
control node
images on "image"
ROS Master
velocities on "cmd_vel"
SETS UP COMMUNICATION
camera node
create node
USB
USB-Serial

ROS 节点 （Nodes）

- 为了实现某一个任务为目的，可执行的程序
- 独立编译、执行和维护
- 以功能包 (packages)的形式存在

启动ROS 服务器

```
> roscore
```

运行某个节点

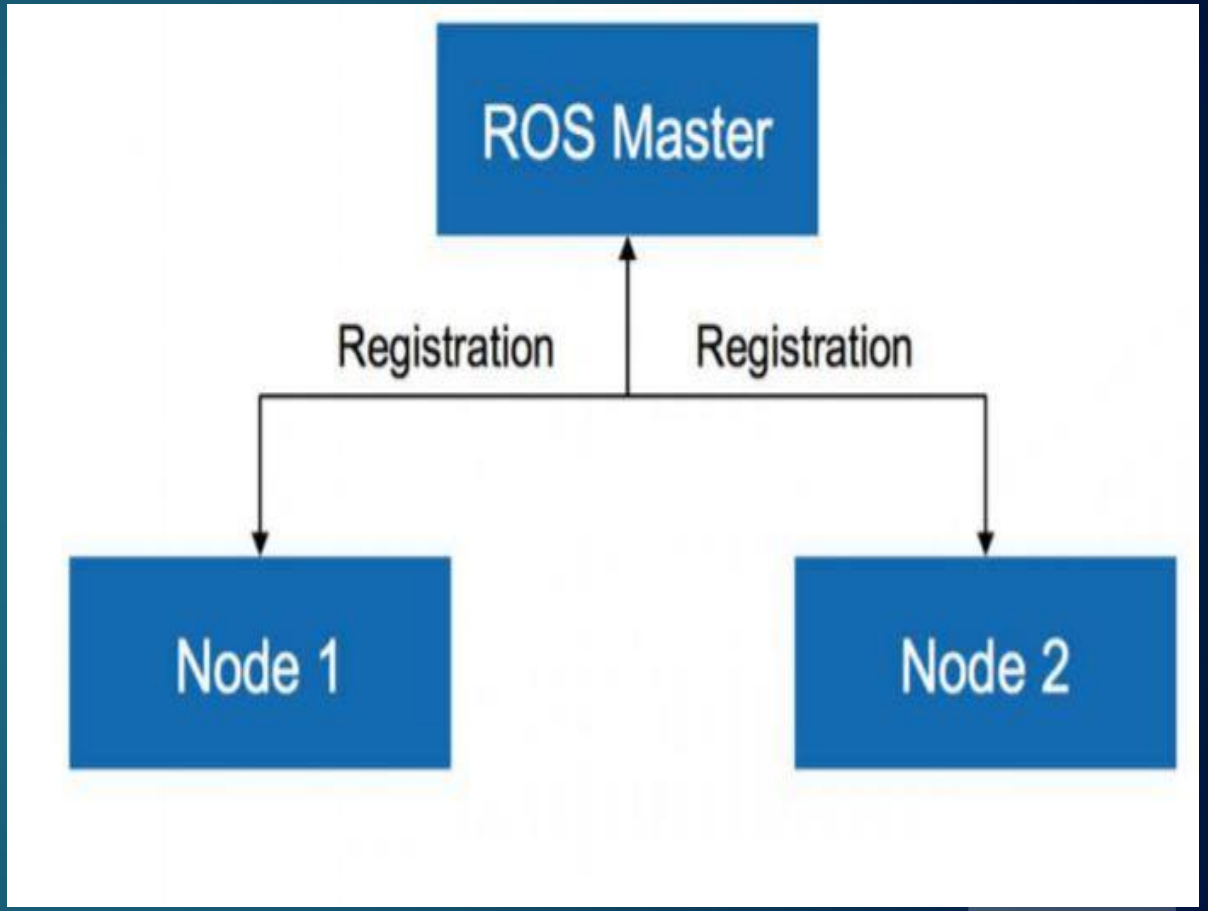
```
> rosrun package_name node_name
```

观察当前活动节点

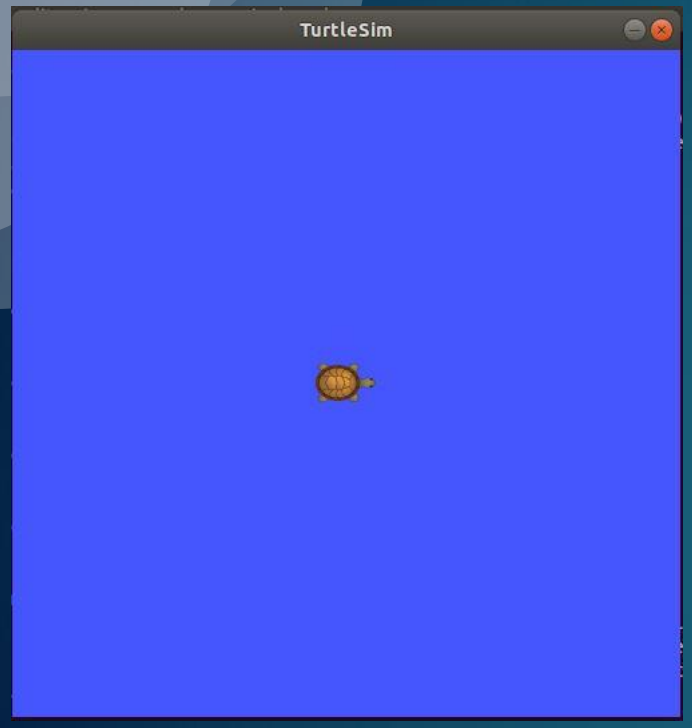
```
> rosnode list
```

获取节点信息

```
> rosnode info node_name
```



rosnode info turtlesim




```
tutor@ubuntu: ~
File  Edit  View  Search  Terminal  Help
tutor@ubuntu:~$ rosnode list
/rosout
/turtlesim
tutor@ubuntu:~$ rosnode info turtlesim
--------------------------------------------------------------------------------
Node [/turtlesim]
Publications:
 * /rosout [rosgraph_msgs/Log]
 * /turtle1/color_sensor [turtlesim/Color]
 * /turtle1/pose [turtlesim/Pose]

Subscriptions:
 * /turtle1/cmd_vel [unknown type]

Services:
 * /clear
 * /kill
 * /reset
 * /spawn
 * /turtle1/set_pen
 * /turtle1/teleport_absolute
 * /turtle1/teleport_relative
 * /turtlesim/get_loggers
 * /turtlesim/set_logger_level


contacting node http://ubuntu:33145/ ...
Pid: 4079
Connections:
 * topic: /rosout
    * to: /rosout
    * direction: outbound (49659 - 127.0.0.1:50426) [23]
    * transport: TCPROS

tutor@ubuntu:~$
```

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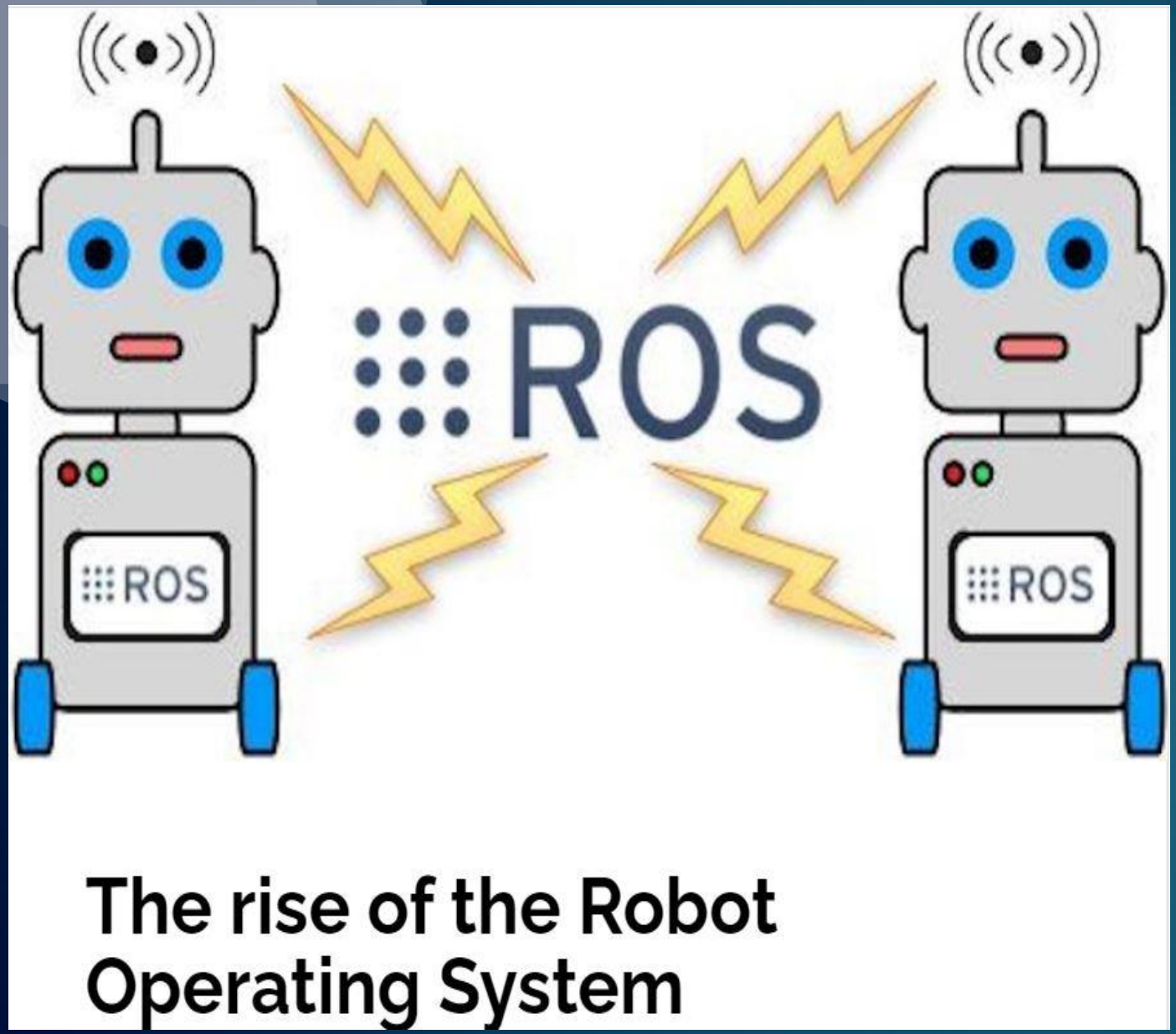
Rostopic

- 给出话题的信息，并可以在命令行将消息发布到话题上。

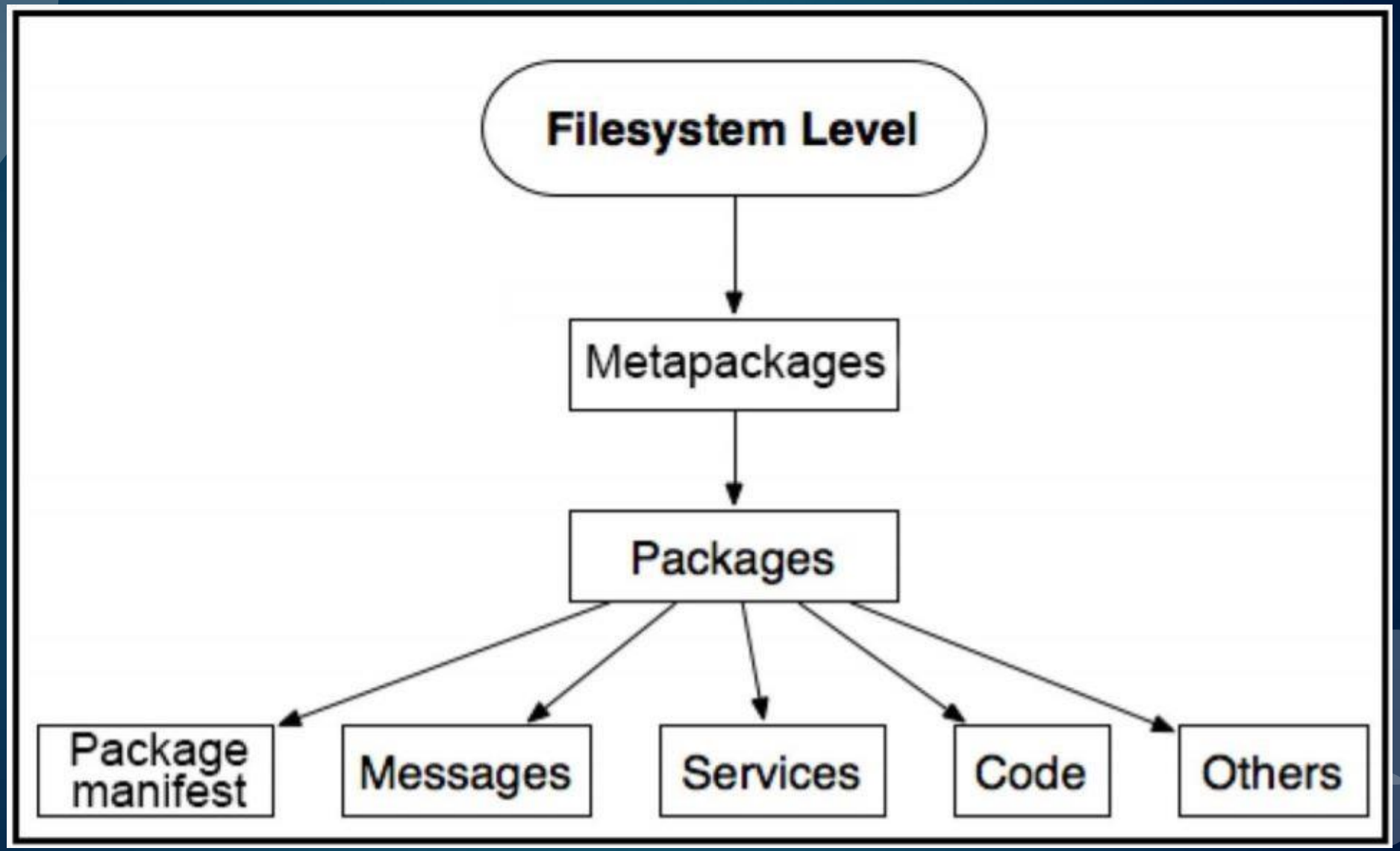
Command	
$rostopic list	List active topics
$rosnode echo /topic	Prints messages of the topic to the screen
$rostopic info /topic	Print information about a topic
$rostopic type /topic	Prints the type of messages the topic publishes
$rostopic pub /topic type args	Publishes data to a topic

rostopic pub -r 10 /turtle1/cmd_vel geometry_msgs/Twist '[1, 0, 0]' ‘[0,0,1]'



- 在ROS中编译程序（功能包、节点）
- ROS 工作空间
- ROS 功能包

ROS文档结构



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ROS 编译系统

- ROS 采用catkin 作为编译工具，实际为cmake
- Catkin 编译后的ROS 工作空间包含：

包含需要编译的功能包的源代码，是你的工作区

Build区域是Cmake编译源代码时产生的中间文档与缓存信息存放区

Devel区域存放了已编译完成的目标文档

- Catkin 空间是存放ROS 代码的 目录
- 用户可拥有多个Catkin 空间，但任何时候，只应有一个catkin空间被使用

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ROS空间中功能包的组织结构

```
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
```

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生成一个catkin 空间

```
% mkdir –p ~/catkin_ws/src
% cd ~/catkin_ws/src
% catkin_init_workspace
```

产生catkin空间的顶层CMakeLists.txt

```
% cd ~/catkin_ws
% catkin_make
```

编译空间以及其中的所有功能包

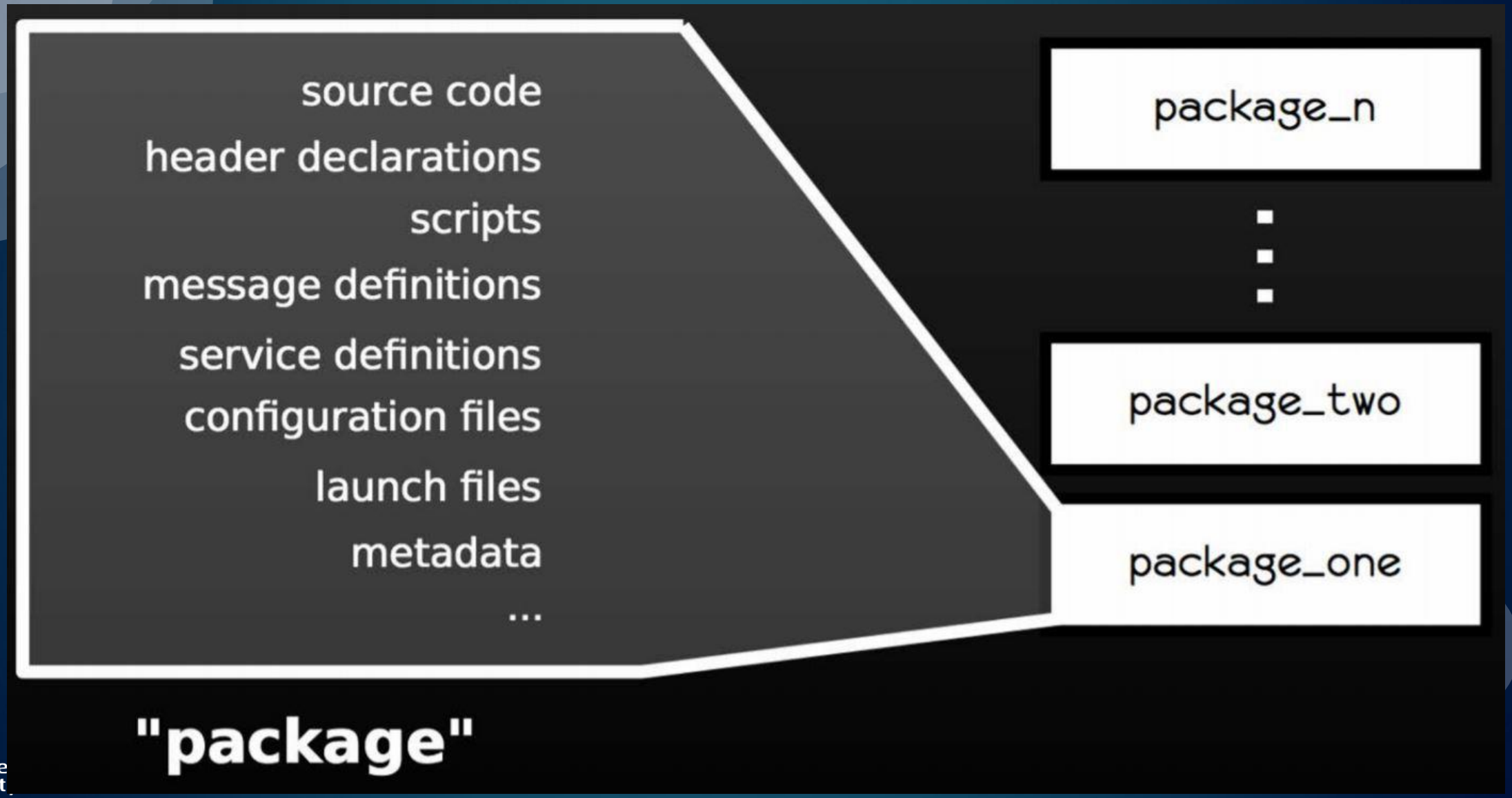
```
% source ~/catkin_ws/devel/setup.bash
```

当编译完成后，不要忘记此source命令，它加载空间的所有环境变量，使得ROS master知道你的编译后的节点位置等信息

ROS 代码具有二级组织架构

- **ROS 功能包(Packages)：** 一组完成一定功能的程序集合，被ROS编译系统认为不可分割的，具有名称的功能单元
- **ROS功能包栈 (Stacks):** 由一组功能包组成的具有名称的集合，主要为方便多组功能包同时分发。

ROS 代码具有二级组织架构



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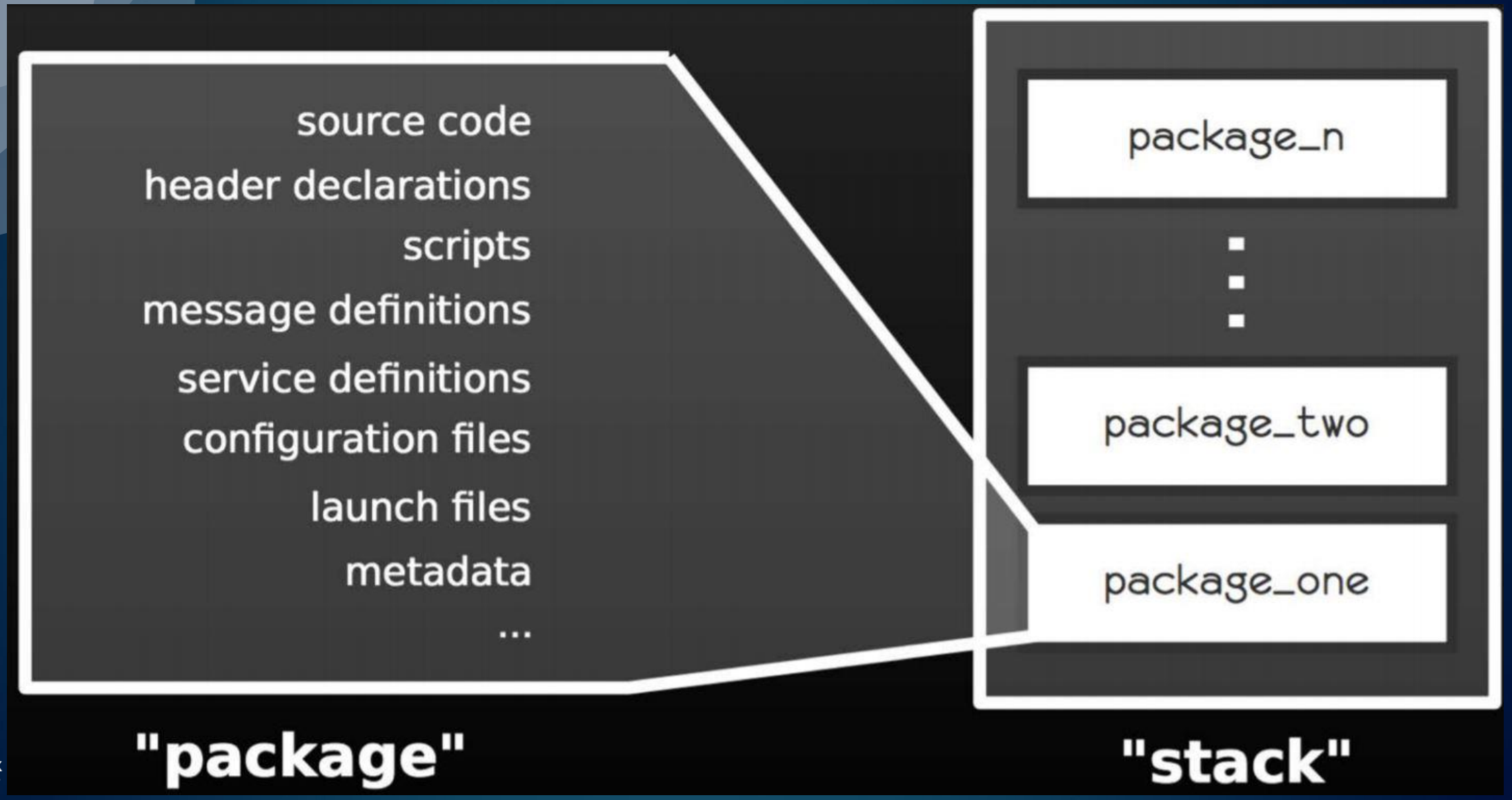

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ROS软件库、源码下载与版本控制

- ROS 某个版本（如 Melodic Morenia)功能包可用命令行查询 (有助于安装dependencies):

  $ apt search ros-melodic-*

- ROS 功能包的安装 (binary)

  $ sudo apt-get install <功能包名>

- ROS 功能包的安装 (from source， in the src subdir of your workspace)

  $ git clone https://github.com/<功能包>
  然后编译

- 或者通过 catkin_create_pkg 命令创建自己的功能包

建议在github.com创建自己的账户，将本课程做的练习上传以备课后复习

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