

The ROS Ecosystem: Impact, Insights, and Improvements

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Outline

Motivation

Tools

Metrics

Visualization

Introduction

The ROS Ecosystem

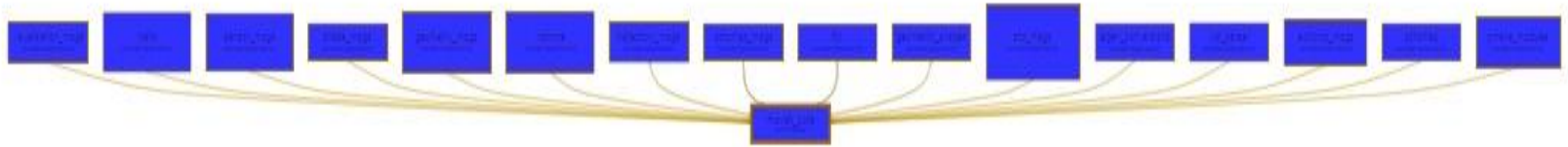
Packages

Nodes

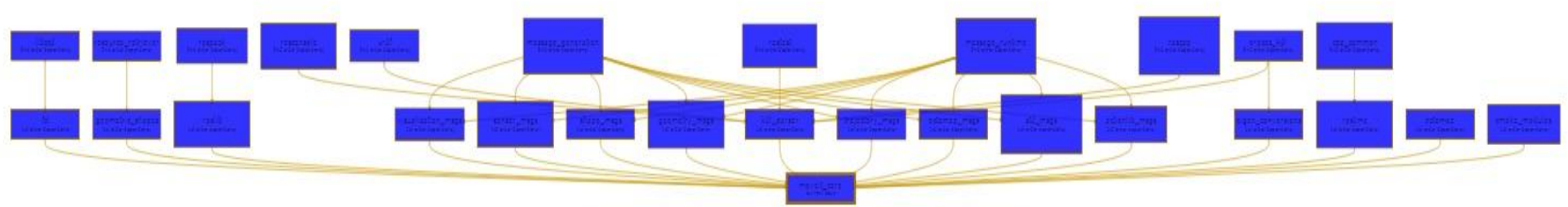
People

Highly interconnected and dependent

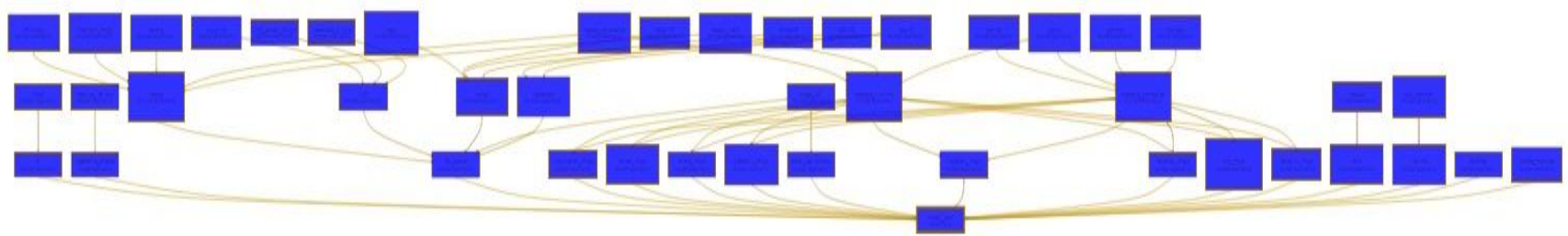
Node Dependencies 1 DoS



Node Dependencies 2 DoS



Node Dependencies 3 DoS



Motivation

“People think that computer science is the art of geniuses but the actual reality is the opposite, just many people doing things that build on each other, like a wall of mini stones.”

— Donald Knuth



©Steve Kropp





← Daniel

Maintainer Ratio

Packages: 1500

Top 10 maintainers

1/3 of packages

Daniel Stonier, 124

Dirk Thomas, 84

Shadow Robot software team, 53

Vincent Rabaud, 51

Johannes Meyer, 51

Ioan Sucan, 42

Jihoon Lee, 36

Michael Ferguson, 34

Jack O'Quin, 32

Focus

Challenge: Where do we focus the effort?

Solution: Develop a picture.

Combine **live usage statistics**, **static analysis** and a slick **visualization**.

Live Usage Statistics

By using **live usage statistics** we would like to answer:

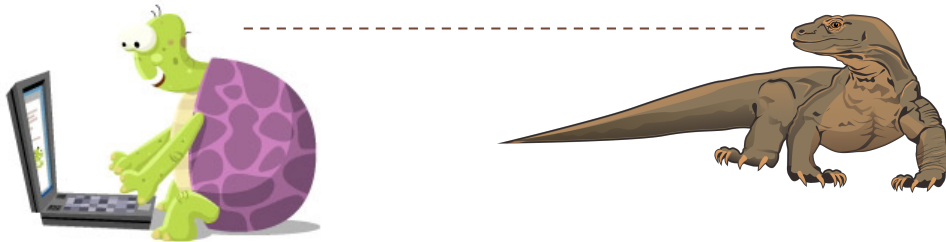
“How many people use ROS in the US?”

“How many people run the nav stack under hydro?”

ROS Komodo

Accumulates/Monitors live usage statistics on nodes, packages, and communications

Lightweight, transparent, **opt-in** and **non-invasive**




ROS Komodo

Accumulates live usage statistics on nodes, packages, and communications

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```
#!/-  
ROS Core Stack definition  
  
Before making any modifications to this file, please read:  
http://ros.org/wiki/roscore  
-->  
<launch>  
  <group ns="/">  
    <param name="rosversion" command="rosversion roslaunch" />  
    <param name="rostdistro" command="rosversion -d" />  
    <node pkg="roskomodo" type="main.py" name="roskomodo" />  
    <node pkg="rosout" type="rosout" name="rosout" respawn="true" />  
  </group>  
</launch>  
~  
~
```



ROS Komodo

Two Parts

Intercepting Logging - rosmaster

Built on top of rosmaster to intercept launch logging.

Wrap logging information into roskomodo message.

Compiling usage metrics - roskomodo

Store roskomodo messages and compute metrics

Write metrics to the cloud or local xml on shutdown.

ROS Komodo

Current live statistics:

Messages:

Message Name

Message Type

Topic Type

Node Name

Duration

Nodes:

Package Name

Node Name

Operating System

Master URI

ROS Distro

MAC/IP Addr

Duration

ROS Komodo

Extendable

Opt-In

Offline functionality

<https://github.com/OSUrobotics/roskomodo>

Aggregation

Repositories

Packages

People

Authors, Maintainers, GitHub Users

Process

ROS distribution file
GitHub repositories
Package manifests



branch: master | [rosdistro](#) / [hydro](#) / [distribution.yaml](#)

tfoote 14 hours ago Merge pull request #5523 from dirk-thomas/bloom-rospack-1

139 contributors

7903 lines (7902 sloc) 216.464 kb

Raw Blame History

```
1 XYAML 1.1
2 # ROS distribution file
3 # see REP 141: http://ros.org/reps/rep-0141.html
4 ---
5 release_platforms:
6   fedora:
7     - heisenbug
8   ubuntu:
9     - precise
10    - quantal
11    - raring
12 repositories:
13   abb:
14     doc:
15       type: git
16       url: https://github.com/ros-industrial/abb.git
17       version: hydro
```

```
<?xml version="1.0"?>
<package format="2">
  <name>catkin</name>
  <version>0.6.9</version>
  <description>Low-level build system macros and infrastructure for ROS.</description>
  <maintainer email="dthomas@osrfoundation.org">Dirk Thomas</maintainer>
  <license>BSD</license>

  <url type="website">http://www.ros.org/wiki/catkin</url>
  <url type="bugtracker">https://github.com/ros/catkin/issues</url>
  <url type="repository">https://github.com/ros/catkin</url>

  <author>Troy Straszheim</author>
  <author>Morten Kjaergaard</author>
  <author>Brian Gerkey</author>
  <author>Dirk Thomas</author>

  <buildtool_depend>cmake</buildtool_depend>
  <buildtool_export_depend>cmake</buildtool_export_depend>

  <depend>python-argparse</depend>
  <depend version_gte="0.2.2">python-catkin-pkg</depend>

  <build_depend>python-empy</build_depend>

  <build_export_depend>gtest</build_export_depend>
  <build_export_depend>python-empy</build_export_depend>
  <build_export_depend>python-nose</build_export_depend>

  <test_depend>python-mock</test_depend>
  <test_depend>python-nose</test_depend>

  <export>
    <rostdoc config="rostdoc.yaml"/>
    <architecture_independent/>
  </export>
</package>
```

Metrics

Impact

name	impact
catkin	1
std_msgs	0.488538
roscpp	0.486213
message_generation	0.444518
message_runtime	0.439037
rospy	0.35515
geometry_msgs	0.322093
rostime	0.304817
roscpp_serialization	0.292691
cpp_common	0.29186
rosgraph_msgs	0.28505
sensor_msgs	0.284884
roscconsole	0.284385
roslib	0.280565
roscpp_traits	0.278405
genpy	0.257475
rostest	0.244851
xmlrpcpp	0.224585
roslang	0.217608
genmsg	0.207143

Health

name	health
rqt_service_caller	1
vision_visp	0.998093
serial_utils	0.998001
rqt_web	0.998001
filters	0.997265
diagnostic_updater	0.996688
pcl_msgs	0.996389
moveit_msgs	0.996193
nmea_comms	0.996162
ecto_image_pipeline	0.995989
test_bond	0.995951
cob_base_velocity_smoother	0.995951
rqt_robot_monitor	0.99593
hector_imu_attitude_to_tf	0.995898
rocon_service_pair_msgs	0.995887
move_slow_and_clear	0.995883
slime_wrapper	0.995863
test_roslaunch	0.995835
ecl_navigation	0.99581
depthimage_to_laserscan	0.995786

Activity

username	activity
ipa-fxm	1
jihoonl	0.896423
ugocupcic	0.774052
stonier	0.717608
dirk-thomas	0.615085
toliver	0.475888
ipa-fmw	0.46137
shadowmanos	0.426941
adolfo-rt	0.37933
mikepurvis	0.37465
davetcoleman	0.346664
bit-pirate	0.338185
vooon	0.282759
TSC21	0.243293
k-okada	0.228299
ipa-nhg	0.223965
keulYSMB	0.209246
hsu	0.198333
skohlbr	0.195073
ayrton04	0.190307

Benefits

Pools information together

Answers questions about ROS

For this distribution, what is the sum of all ROS repositories in kilobytes?	2630469
How many of the packages have a BSD license?	837
How many different GitHub users have opened an issue on a ROS repo?	930
What is the average days since a eco_Repository was updated?	99.1739
Which packages is most commonly listed as a run dependency?	roscpp
How many packages are there per maintainer?	8.4065

Reveals changes over time

Community

Provide feedback

Evaluate initiatives

Direct efforts efficiently

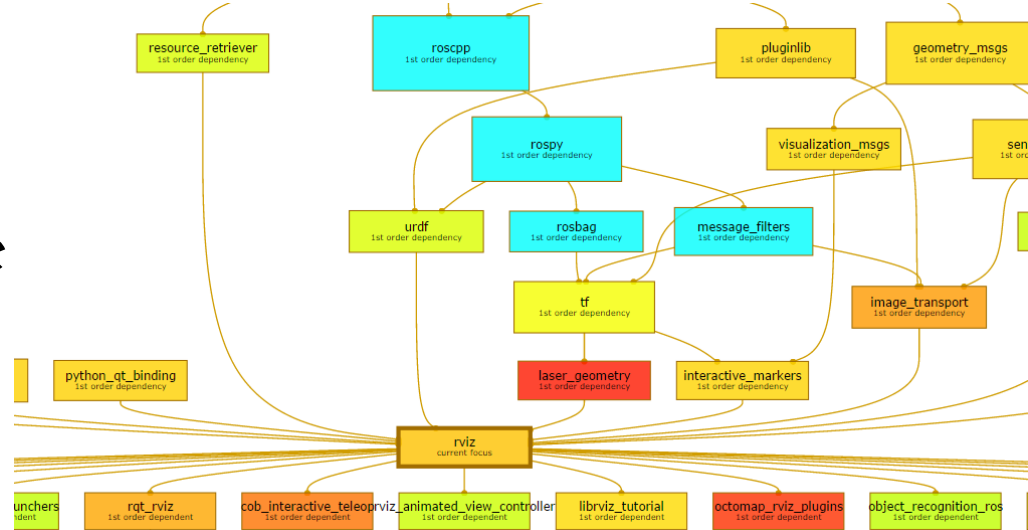
How many total open Issues are there on ROS repos?	1496
How many open Issues are unassigned?	1314
Which Repository has the most open Issues?	ros/ros_comm
Which package has the lowest health with a substantial impact?	scheduler_msgs

Visualization

Directed graph linked by dependencies

Demonstration!

Credit to Jonathan Mace



Questions?

<https://github.com/OSUrobotics/roskomodo>

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