“Quality is more important than quantity. One home run is much better than two doubles.”
- *Steve Jobs*
HOW DOES ROS CARE ABOUT QUALITY?

A preliminary study of ROS Quality Assurance (QA) practices and the nature of ROS bugs
Preliminary Study

Objectives:
- Understand the As Is
  - What are the current quality assurance (QA) and quality control practices?
  - What are the current quality assurance challenges?
  - What are the characteristics of ROS bugs?

Methods:
- Intensive interviews conducted with community members
- Analysis of ROS Wiki and online documentations
- The analysis of 177 reported bugs representative collection of ROS code repositories
This is what we learned from the community

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It’s a role-based environment:
(1) Core Development,
(2) Driver and Reusable Packages Development,
(3) Application Development

ROS cares about quality: some industry established practices have been implemented but experiencing some challenges.

Quality Assurance Challenges

- **Core Development**
  - Lack of overview for new contributors
  - Heterogeneous quality criteria
  - Maintenance effort
  - Lack of maintainers
  - Unmaintained packages
  - Late detection of errors

- **Driver and Reusable Packages Development**
  - Connection to hardware
  - Quality of architectural design
  - Lack of established processes

- **Application Development**
  - Complexity
  - Selecting the right module
  - Interdisciplinary domain
  - User Interfaces
This is what we learned about ROS bugs

**ROS Bugs Longevity**

- Percentage of bugs fixed against days elapsed.
This is what we learned about ROS bugs

- **ROS Bugs Classification (i.e. types)**
  - FUNCTIONAL ERRORS 50%
  - DEPENDENCY ERRORS 33%
  - COMPILER ERRORS 10%
  - CONCURRENCY ERRORS 3%
  - MISCELLANEOUS ERRORS 4%

- **ROS Bugs Detection Phase**
  - Runtime-operation 53%
  - Runtime-initialization 16%
  - Compile-time 11%
  - Build-time 12%
  - Deployment-time 8%
  - Build-time 12%
  - Compile-time 11%
  - Runtime-operation 53%

- Finding the functional errors is likely to take a wide collection of different techniques and tools. It appears to be worthwhile to add a wide collection of different code scanners to the continuous integration service.
- One out of seven bugs is reported by users.
How does ROS care for quality?

- ROS cares about quality:
  - Established QA practices are in place
  - However:
    - The execution and implementation of these practices is experiencing some challenges.
    - It seems that these practices are not ingrained in the community, lacks of consistency in the application of QA practices.
    - Tools and methods in practice need to be expanded (i.e. code scanning techniques) and further analysis required to identify the right fits.

- Next:
  - Work closely and collaboratively with the community:
    - To address the current challenges
    - Implement the recommendations (i.e. CI, code scanning techniques, etc.)
    - Extend this study to more participants to understand further the current challenges
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Poster session for questions, feedback and discussion

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