Towards a Robot App Store

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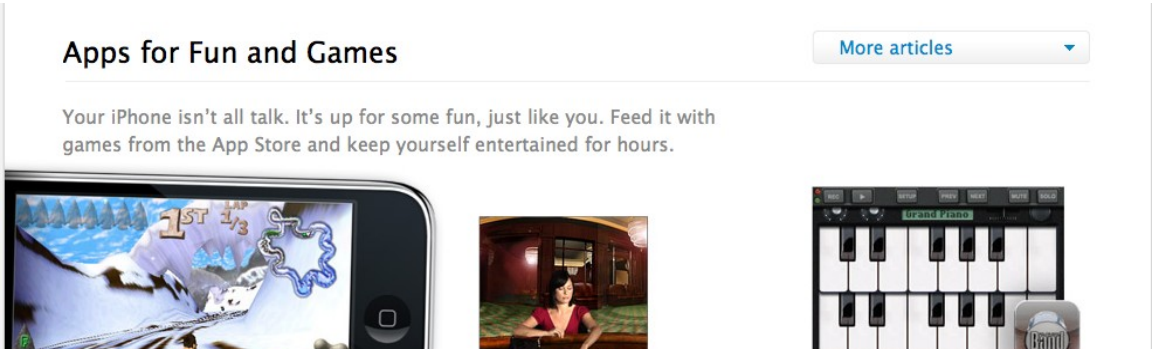
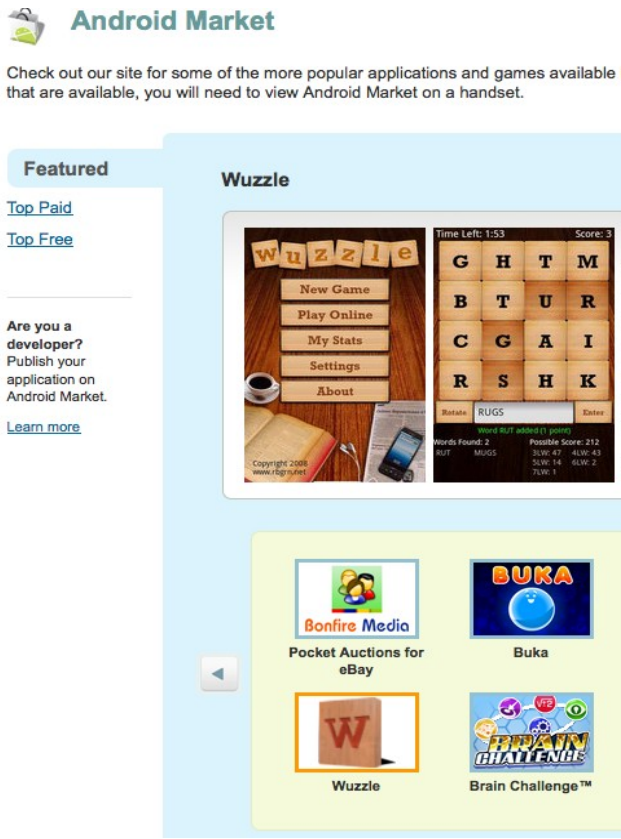
Willow Garage

The power of apps

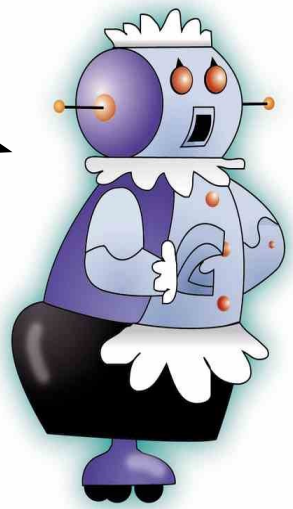
- Shared platform provides system services, distribution & installation mechanism
- Creative users develop and publish novel applications
- Platform functionality explodes (and some people even make money)





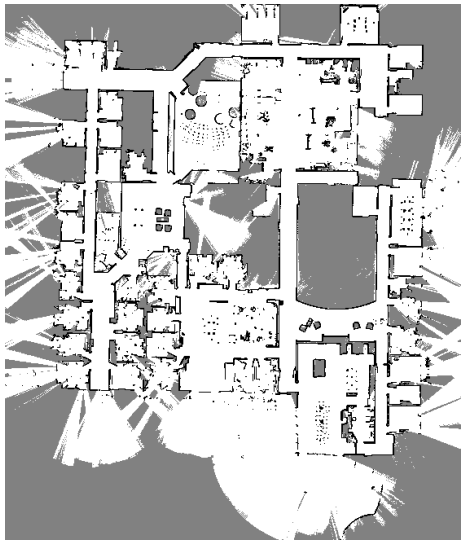
What's a robot app?

- In the near future
- Eventually
- For now:
  - demonstrations
  - experiments
  - challenge entries (!)



MapIt!

Autonomous exploration and mapping for any indoor environment.



Click to Buy ($49.99)

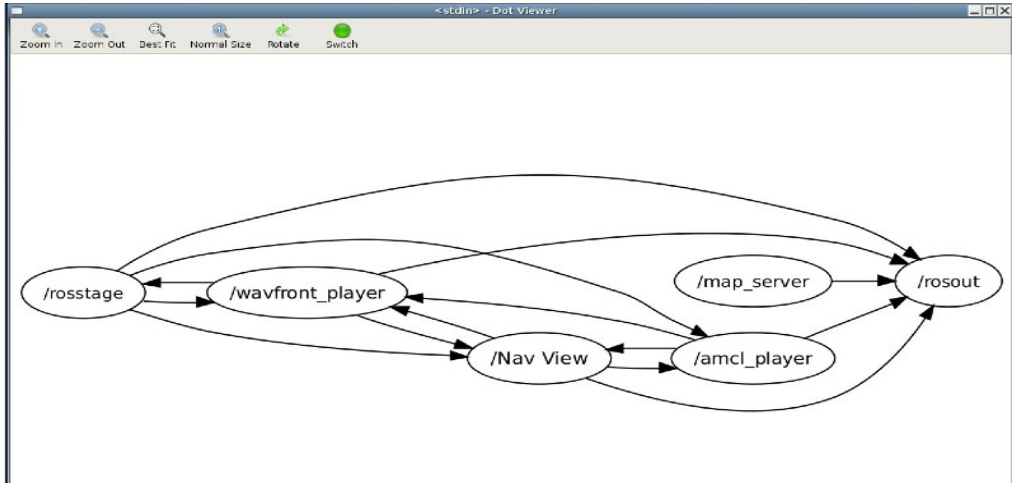
Outline

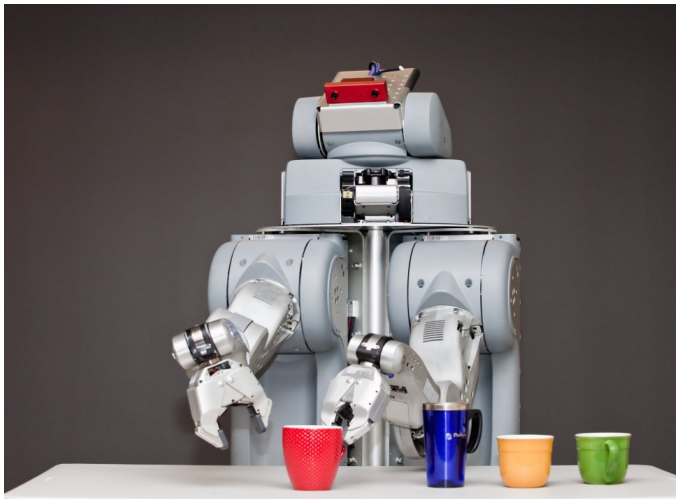
- ROS

- Open Source
- Licensing
- Libraries
- Modularity
- Federated development

ROS (http://ros.sf.net)

- What is ROS?
  - Meta operating system for robotics
  - System for obtaining, building, writing and running code across multiple computers
  - Designed around mobile manipulation systems





ROS (http://ros.sf.net)

Example: opening doors and plugging in

http://pr.willowgarage.com/ wiki/Milestone2/Resul ts_2009-05-29_I ntegrated_(Trial_Procedure)

Open Source

- Core components should be Open
  - much research to be done, and researchers need to see (and change) how things work
  - core system not perfect; users' patches are efficient fixes
- Example core components:
  - build [cmake, pkg-config | rospack, rosbuild]
  - launch [bash | roslaunch]
  - communication [glibc | roscpp, rospy]
  - analysis [top, netstat | rostopic, rxgraph]
  - debugging [gdb | roswtf]

Open Source

- Code used to make claims in papers should be Open
  - key part of experimental design
  - necessary to replicate, refute, or extend results
- How? (*)
  - include versioned download details in the paper
    - SVN URL + revision; Git ref + hash
  - can't share physical state?
    - share configuration info for a well-known simulator

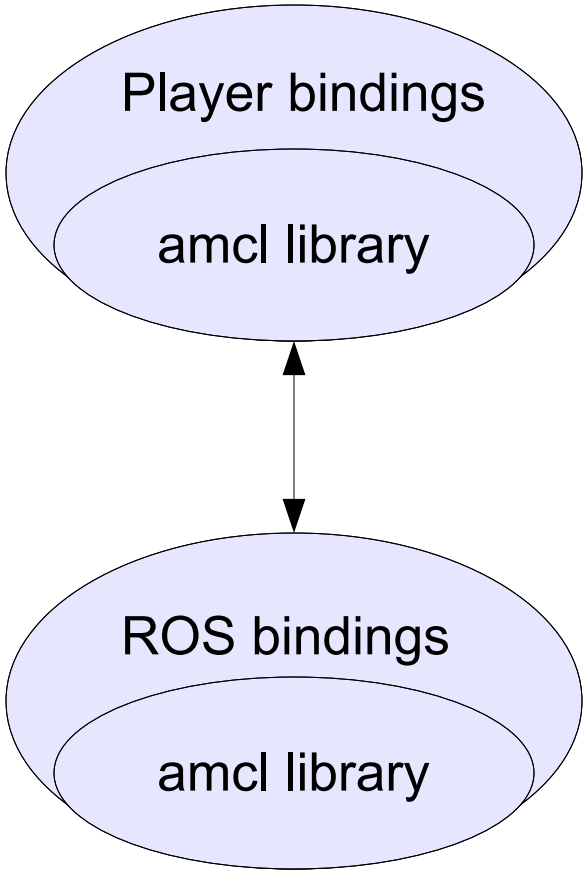
[*] See Wawerla & Vaughan, RSS 2009 workshop on experimental practice

Licensing

- Core components should support commercial use, without license constraints on applications
  - glibc: LGPL
  - ROS core: BSD
- Mid-level components will be more widely used if they follow suit
  - more people will improve upon them, too
  - most ROS packages: BSD or Apache
- Applications: license as appropriate

Libraries

- Implement useful functionality as a library, independent of any robot framework
  - imagine the developer who likes your functionality but doesn't like your framework
- Bind your library into the framework(s) you use
  - bindings should be thin



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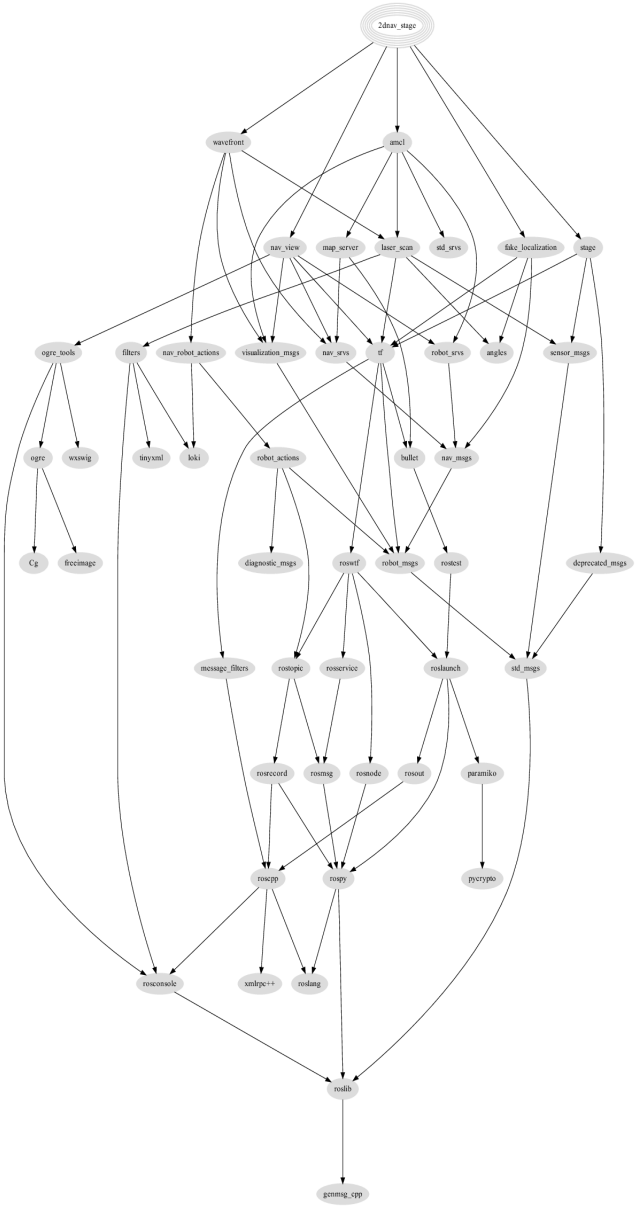
Libraries

- Issues
  - dependencies
  - data structures
  - control loops / state machines
  - version hell

Modularity

- Break functionality up into small pieces
- Plan for reuse of each piece
  - expose a well-defined interface
- Modules provide natural license boundaries
- Issues:
  - maintenance, QA, release burden, dependency hell



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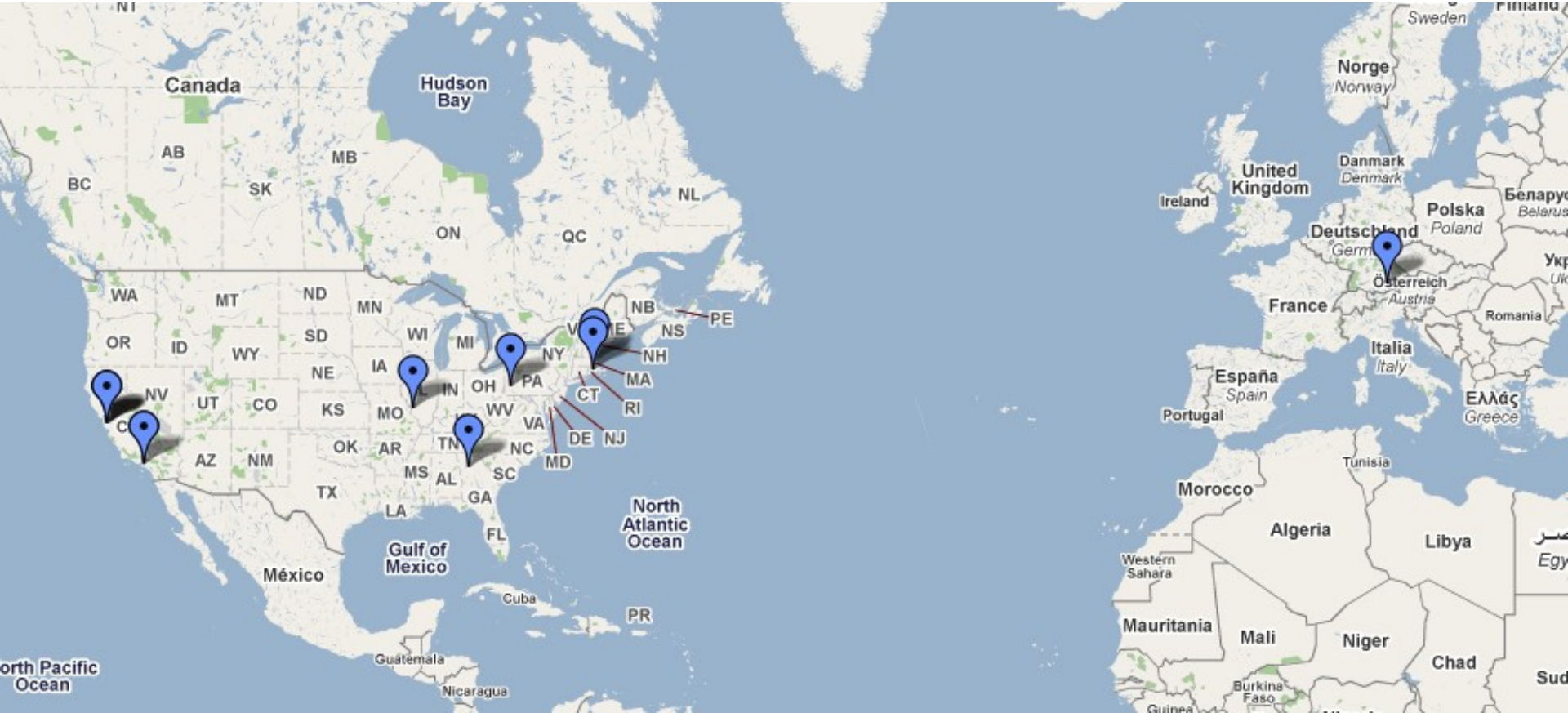
Federated development

- Q: "How do I contribute?"
  - A: Publish your code in a publicly-accessible place (e.g., SourceForge, Google Code)
- Avoid single gateway for (re)distribution of code
  - authors retain control, get credit
  - authors choose licenses, development policies, release schedules
  - scale to worldwide development

Federated development

- Known ROS repositories (12)



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Federated development

- Issues:
  - finding available code
  - avoiding duplication of work
  - working from multiple repositories
  - quality control

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Hypothesis

- Shared, Open infrastructure + modular libraries + commercial-friendly licensing + federated development =
  - shared engineering burden
  - accelerated system development
  - better scientific practice
  - transferable challenge results
  - vibrant business ecosystem
- and, eventually...a Robot App Store.

Acknowledgements

- The ROS team:
  - Lead: Morgan Quigley
  - Josh Faust, Ken Conley, Rob Wheeler,Tully Foote, Jeremy Leibs, Bhaskara Marthi, Rosen Diankov
- The STAIR project: Andrew Ng & Co.
- Everybody at Willow
- The fledgeling ROS community