The next (big) step for the ROS middleware

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Why "ROS 2.0"?

ROS is great and successful...

... but there is still room for improvement.

- Implemented "everything" from scratch
- Unreliable transport with silent failures
- Non-deterministic start-up behavior
- Separate API for nodes/nodelets
- Limited support for multi-robot
- Limited introspection capability

And much more...

Goals

- Reuse existing libraries / less maintenance
- Modular interfaces / separation of concerns
- Better extensibility
- Enable introspection / debugging / dynamic system response
- Reconnectivity on network changes
- "Verifiable" configuration
- Support demands of "new" domains better:

  - Multi-robot
  - Embedded systems
  - Web interfaces
  - Usable for products

Why "ROS 2.0" instead of 1.X+1?

Why decide between writing a node or nodelet at programming time?

- Should have the same API, decision at start time
- Which one to change (breaking the other)?

  - if possible, provide backward compatible API relaying to new API

Why do we need two wire protocols?

- XMLRPC to talk to master and negotiate with nodes
- TCPROS for all other connections

Why "ROS 2.0" instead of 1.X+1?

Want a deterministic start-up behavior?

- Currently, nodes implementing a custom main function will not comply

Why do we rely on a single master?

- Could it be fully distributed or have multiple masters?

ROS 2.0

ROS 2.0 is a codename describing the numerous efforts.

A lot of these require significant API changes – deploying them iteratively in current ROS would be a significant (if not impossible) overhead.

A separated API will:

- Keep the existing API much more stable
- Enable a cleaner design/development process
- Still allow writing a backward compatibility layer on-top

Approach

- Design abstract protocols and interfaces between layers
- Reuse off-the-shelf libraries; make them pluggable
  - msgpack / protobuf
  - zeromq / amqp
  - zeroconf / avahi
- Breaking API if necessary
  (instead of incremental changes)
  - but communication is possible with "ROS 1.0" ecosystems
  - consider scripts to make a potential upgrade path easier

A lot of affected subsystems

- Modularity points

  - exchangeable msg spec / serialization / transport / compression
- Required capabilities of core systems to support existing concepts

  - topics / services / actions
  - parameters / dynamic reconfigure
  - nodelets
- Network level communication

  - Discovery and negotiation
  - Topology
- Configuration space

  - build time vs. deploy time vs. run time

Up to now

- Bottom-up approach
  - Buildsystem in Groovy was the first step
  - Build infrastructure in Hydro the second
- Prototyping
  - Component-based life cycle, dyn. start/reconfigure/stop of comp.
  - Introspectable components including parameters, callbacks, etc.
    (see DARC - distributed asynchronous reactive components)
- Working on the process to
  - Collect use cases (will be classified:
    must-have, nice-to-have, not-being-implemented, out-of-scope)
  - Extract requirements
  - Derive design decisions

Next Steps

Continue and announce the process and open it to the community to collect more use cases and derive design requirements from them.

Based on that:

Derive high-level system architecture

- Write design documents to make decisions comprehensible
- The design documentation should exhibit *traceability*
    - Users should be able to trace design requirements back to design decisions and back to the use cases which drove those design decisions

Outlook

Stage 1

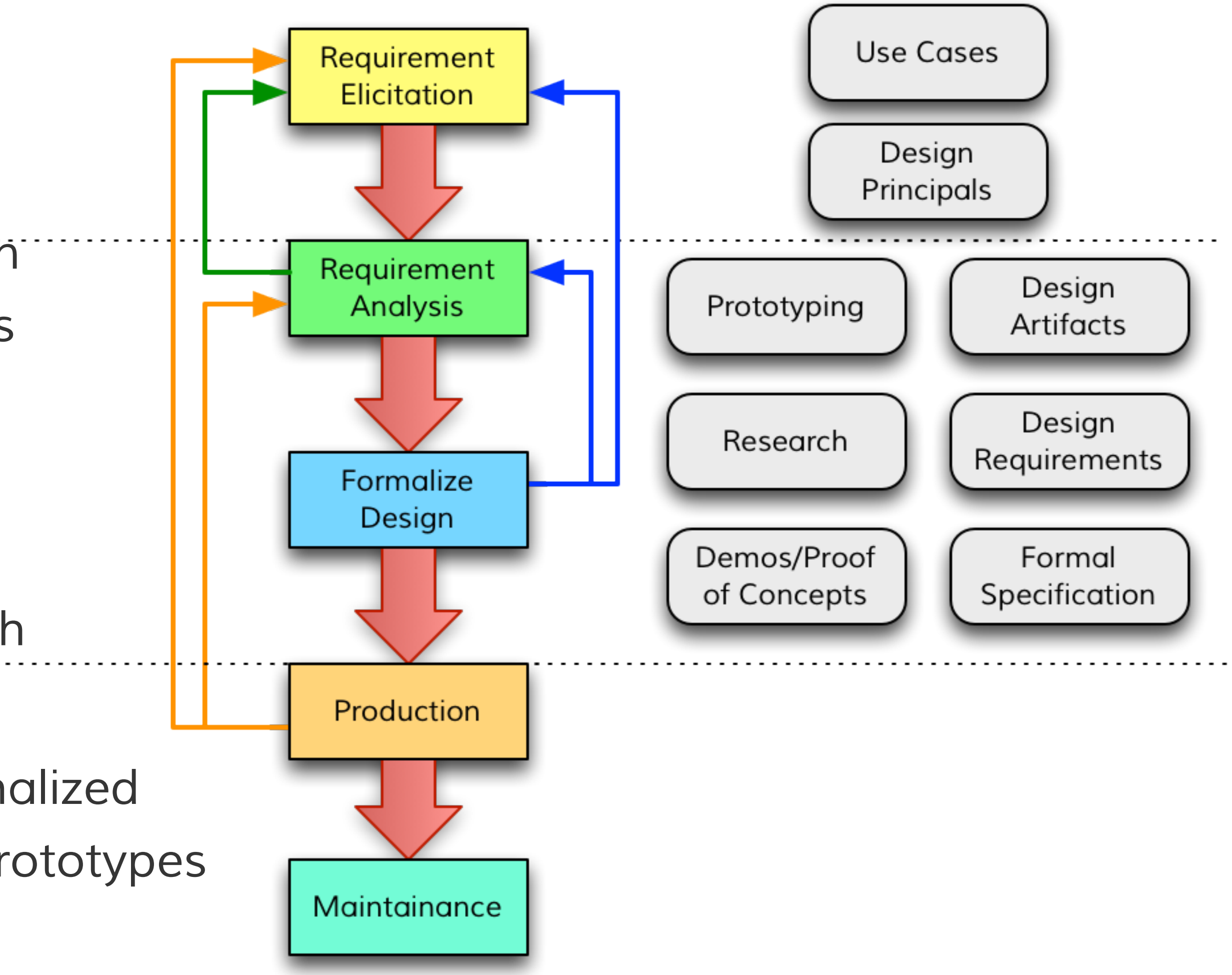
- Use cases Elicitation
- Derive requirements

Stage 2

- Conceptual design
- Whiteboarding
- Technology research

Stage 3

- System design formalized
- Backed by partial prototypes



Alpha release in the first half of 2014.

Stable release in the second half of 2014 (side-by-side with "ROS 1.0").

Questions?
Feedback?

or even better...

Use Cases!

Requirements!