# Public Questionnaire v1

We propose publishing a questionnaire with a few questions that allow the public to submit their own knowledge and experiences in cloud robotics.

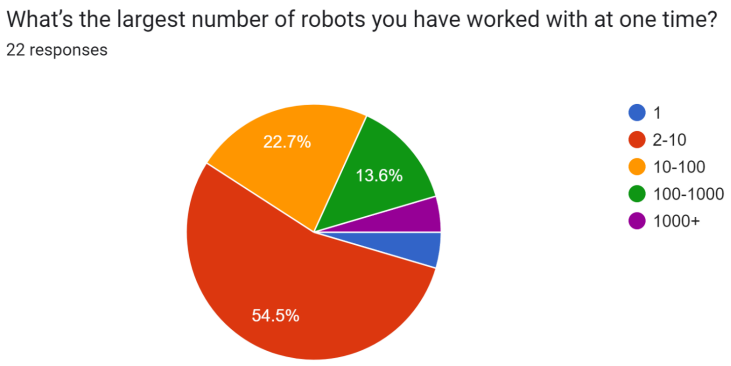
Our proposed questions are as follows:

1. What's the largest number of robots you have worked with at one time? [Select one]
    a. 1
    b. 2-10
    c. 10-100
    d. 100-1000
    e. 1000+
2. What issues did you encounter with your solution that you tried to solve using the cloud? Please specify problem areas e.g. collecting fleet data. [Freeform]
3. In which of the following use cases did you incorporate the cloud? [Select many]
    a. Development
    b. Deployment
    c. Operating a fleet
    d. Collecting fleet data
    e. Cross-device comms
    f. OTA updates
    g. Simulation
    h. Interoperability
    i. Other (please specify): [Freeform]
4. What would help you the most with implementing your cloud solutions? [Select many]
    a. More libraries, frameworks, and other tools
    b. Better integration for tools
    c. Better documentation, tutorials, and examples for tools
    d. Better support or more stability for tools
    e. Recommendations for best practices and successful architectures, e.g. MQTT over DDS for ROS comms
    f. Other (please specify): [Freeform]
5. Please list any cloud robotics technologies or resources that you use and would recommend. [Freeform]
6. What other questions would you like to be included in our next survey of the state of cloud robotics? [Freeform]
7. Do you have any other comments? [Freeform]

# Public Questionnaire v1 Results & Analysis

What avenue to share results?

- Ros discourse
- All in body or pdf?
- Click bait title/sentence - top 5 things / some bar it:
    - You are not alone, other cant connect to their robot either
    - Be reassured you are not the only one struggling with robot connectivity
    - Your robot is not alone, even if you can't connect to it
    - If your robot is not connected to the cloud does it exist?
    - Can you hear me now? Robots struggle to connect robots to the cloud. Do you agree?
    - You are not alone, Others struggle to connect robots to the cloud. Do you agree?
    - Others struggle to connect robots to the cloud. Do you also have this issue?
- Call to action to take the survey
    - Do you agree?
    - Do you struggle as well?
    - What is your biggest cloud robotics problem?
- Picture:
    - Pie chart - remove % but replace with number of robots

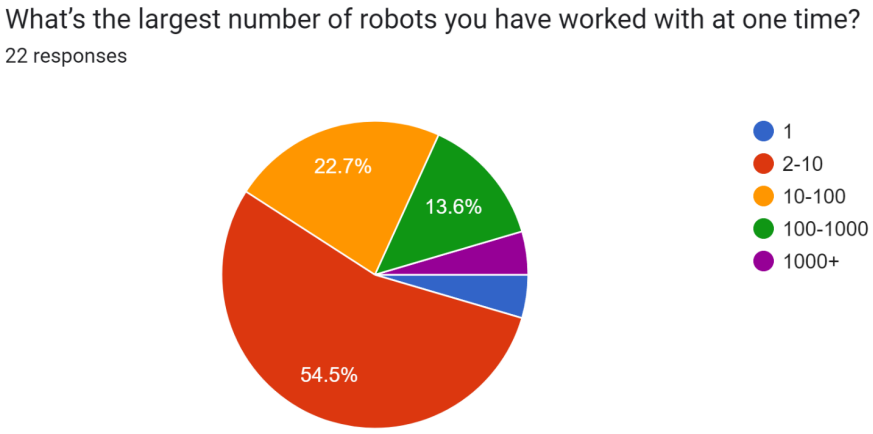



    - Use space well
        - Pie chart on left, question on right
        - Pie chart on left - 3 bullets on right?
- 3 to 5 bullet points with short description:
    - Major issues reported include Networking, Data collection, and Teleoperation
    - Majority of small (2-10) and all large(100+) fleets are using the cloud for Over-The-Air Updates.
    - 70% of respondents are looking for recommendations for best practices or successful architectures
    -

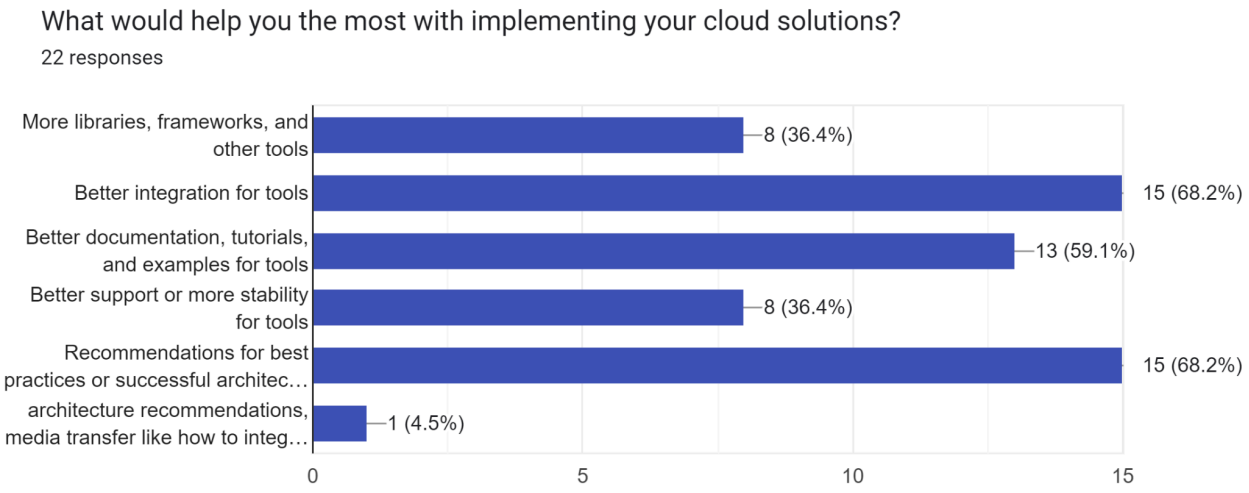
Our overall response (the headlines)
People want more best practices, tutorials & examples
Tools for data collection

Breakdown as follows:

1. What's the largest number of robots you have worked with at one time?




2. Issues did you encounter?
    a. We saw some major categories from freeform responses:
        i. Connectivity/Networking - stability, making the connection through firewalls,
        ii. Data collection
        iii. Teleoperation
3. Use cases

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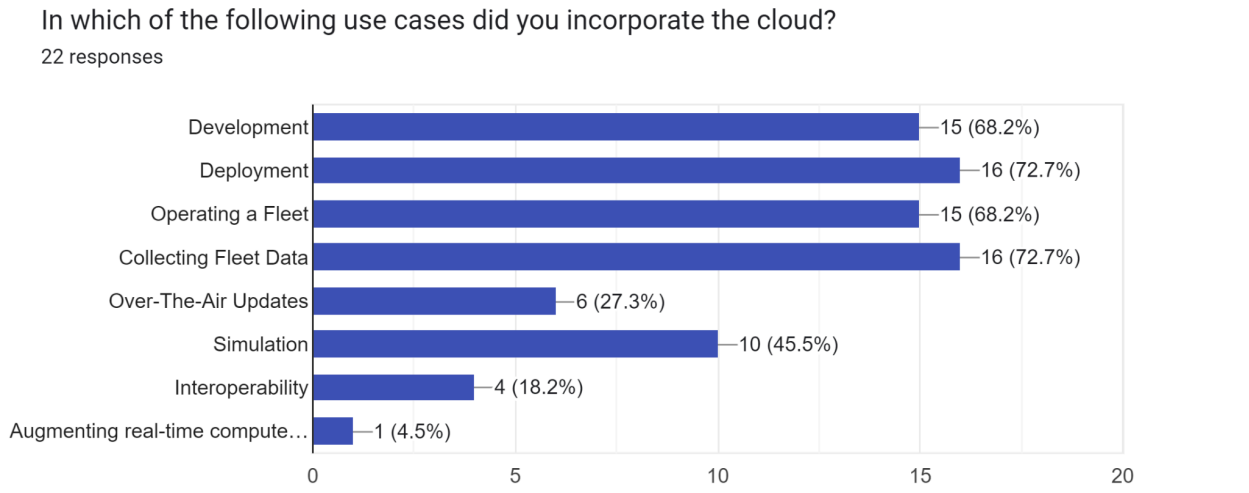


More submissions? Should we try to push this out again?
20+ submissions, some from 1000+, high-level takeaways are…
Sharing even a little could go a long way.

## Next Steps

1. Generate a list of categories that roboticists would appreciate recommendations for
2. List users of larger robot fleets for follow-up contact; divide & conquer
3. Draft a full results post for the survey
4. Begin writing the “state of cloud robotics” page

Note: interested that OTA updates are so low down the list, yet larger cloud frameworks are focused on this feature.

## List of categories for recommendation

Suggestion: Can we recommend ways of linking robotics/ROS2 to https://landscape.cncf.io/ landscape?

Suggestion for formatting: tech on vertical, stack on horizontal

List of issues in order of most frequently mentioned as an issue:

1. [4] Networking - streaming & messaging; latency; teleoperation(?)
2. [1] Cloud application - offloading computation
3.

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| The long tail of issues: autonomy, hardware performance, software performance, config management outliers. |
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| Stale TCP connections from ROS topics forcing me to restart the whole system. |
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| Collect fleet data (Prometheus/Grafana), ingest alerts for robots having issues (PagerDuty), teleop robots that need to be moved |
| fleet orchestration |
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| reinforcement learning<br>autonomous behaviour building<br>training<br>sensor data collection and processing |
| Limited computing power of the robot's control board. We can both physically and logically separate the localization and path planning from the robot which allows more flexible development and faster deployment. |
| Collecting and processing data (ETL, data pipelines), off-loading processing |
| Teleoperation, easy access for non roboticists |
| |
| To make it operable |
| Computational limitations |

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| remote operation, orchestration |
| different software versions on robots, problems with syncing data |
| teleoperation, data collection, blackbox for failure cases, logging, remote ssh access, OTA updates, fleet management |
| data ingestion, storage, and analytics |
| I've been predominantly using swarm algos. Optimizing in a short time frame is an issue. |
| |
| Communication, application deployment |
| Remote teleoperation of robots, collecting fleet data |
| Code deployment, human in the loop intervention, metrics and logging, monitoring and alarms. also, general system integration (integrating w/ upstream and downstream componenets) |
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| Limited processing power |
| matrix issues eg.in MATLAB on importing data angles and orientation data from or to cloud |
| Collective perception and event-based collection of fleet data, mainly for automated vehicles |
| Data storage, information sharing (inter robot communication), ML inference e.g. LLMs, distributed simulation |
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| Health/Telemetry data collection |
| example demo, multi-robot simulation |
| Complex networking |
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