



ABAQUS

Automated Benchmarking of Algorithms for Quantum Systems

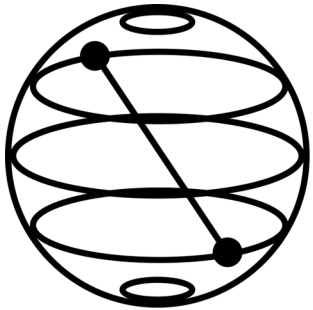
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The Quantum Hype

- Quantum Computers are machines that use quantum mechanical phenomena for computations. Consider them magical!
- A lot of **real** quantum computers and **simulators** exist in the wild now!



rigetti



Cirq



PENNYLANE

STRAWBERRY
FIELDS

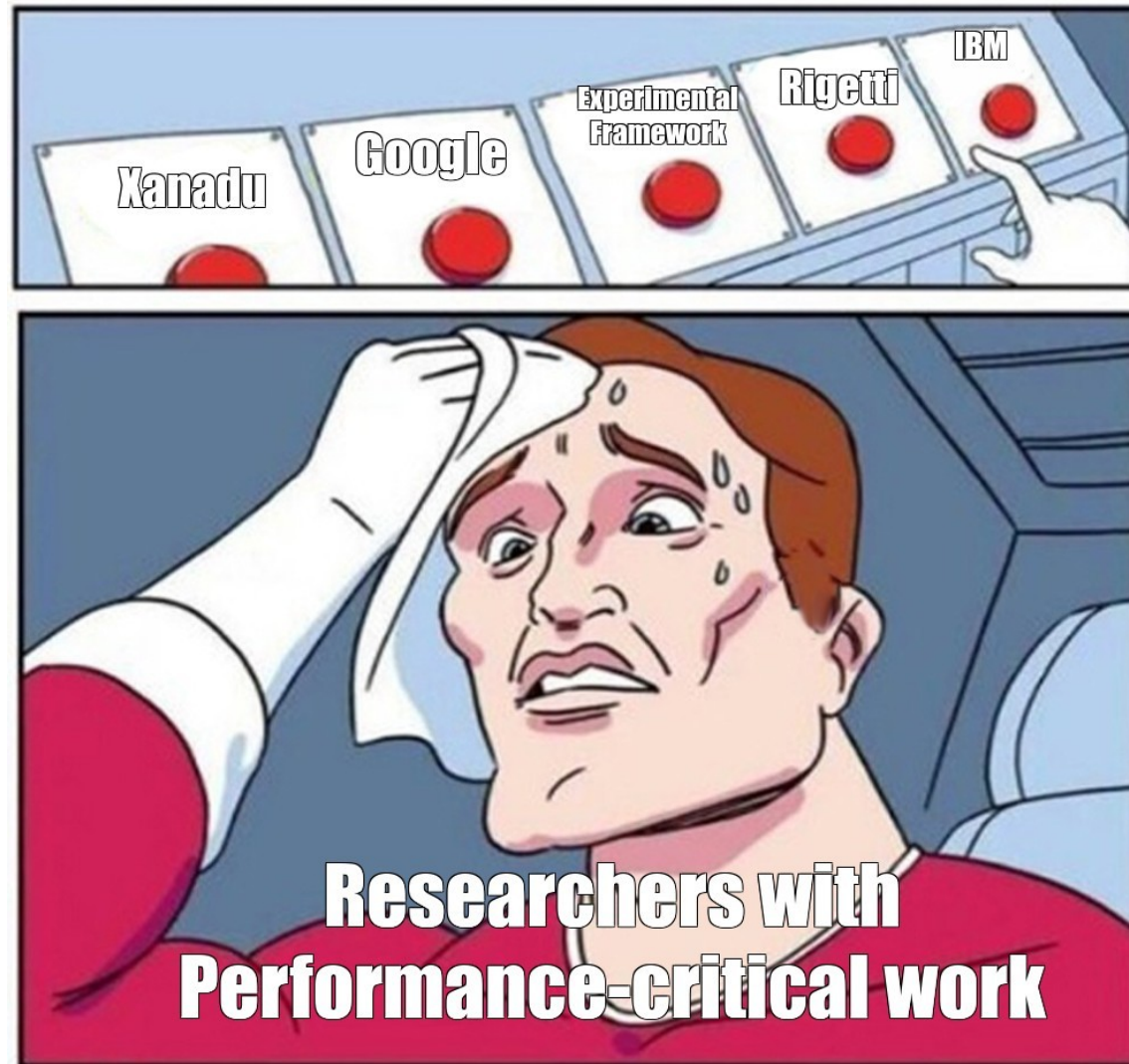


QUANTINUUM



Orchestra®

The result...



Enter ABAQUS

- Main Goal: Create an open-source extensible, **scalable** platform for running benchmarks on quantum devices.

- Allow easy contributions from the community.

- Enable researchers/companies to fully customize it in-house.

- Utilize compute resources more effectively.

- Facilitate deployment on clusters.

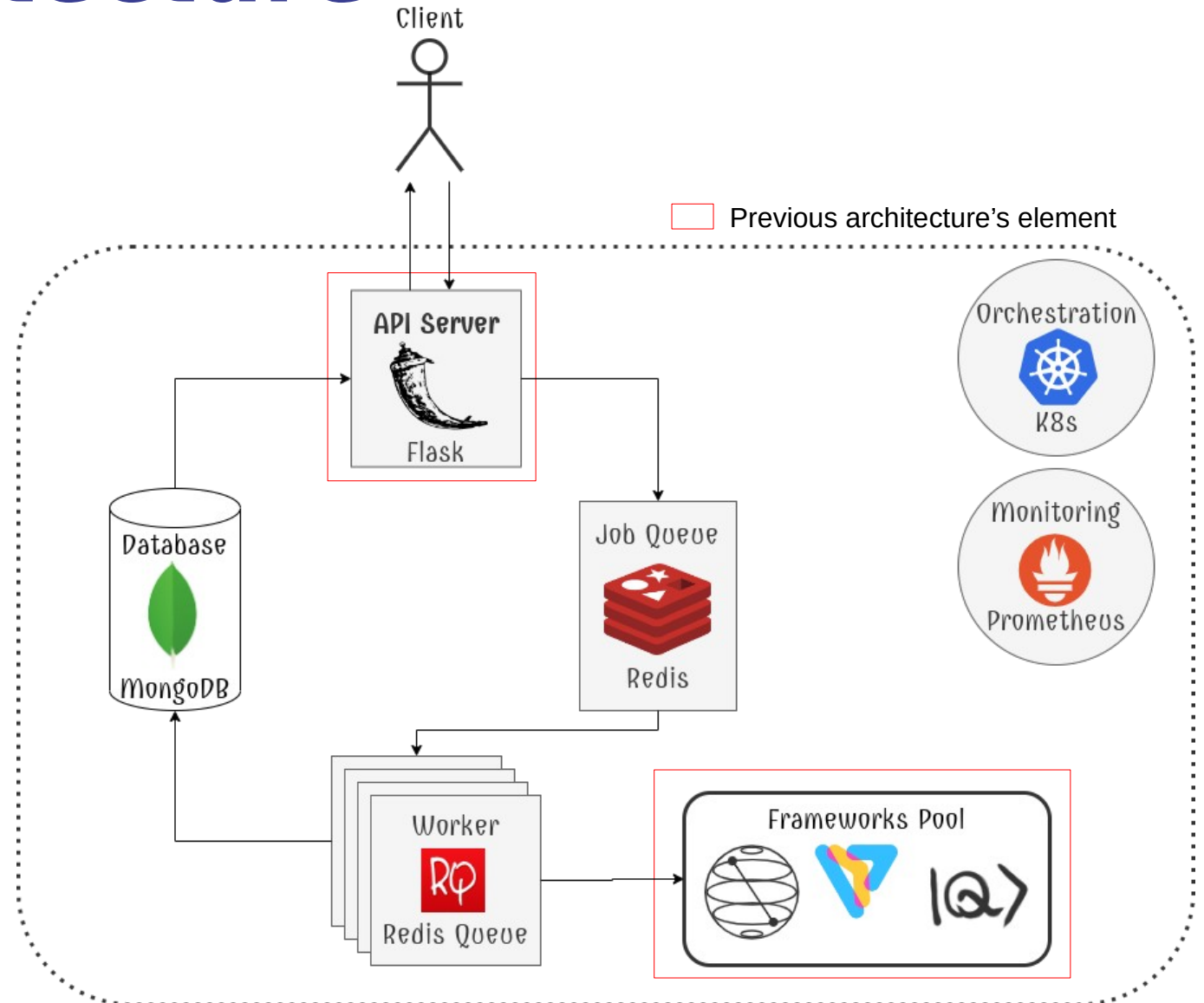
- Proof-of-concept already implemented during last year's cohort, but without the scalability desiderata. → Need to rethink the architecture!

The New Architecture

- Highly based on containers



- How the system works:
 - 1) User submits desired benchmarks to server.
 - 2) Server adds them to a queue of jobs to run.
 - 3) Workers serve the queue, executing the jobs.
 - 4) Workers store result in database.
 - 5) Server returns results to User when they request them later.



Ways to Use ABAQUS

Least Control over Resources

Highest Control

Using the worker code to manually benchmark jobs, bypassing the whole architecture

```
$ pip install .
```

Activation of the platform using Docker Compose or a similar tool

```
$ docker compose build && docker compose up
```

Using a container orchestration tool to configure the system on the lowest level

```
$ bash _deploy.sh
```

Simplest

Most Sophisticated

Sample UI

In [2]: `import ui_logic`

Framework: Backend: Required Output: Use GPU?

Choosing quantum backends

Benchmarking Operation: # of Qubits:
Quantum Operation: Applied on Qubit:

Choosing benchmarking tasks

Backends: Operations:

Summary Section

The Future

- What can be done now:
 - Add more built-in benchmarking tasks. (Variational Algorithms?)
 - Benchmark real quantum hardware. (Only simulators supported now)
 - Retrieve some results and compare to literature/public data.



QUESTIONS?

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