

Quantum Computing on OpenShift

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Agenda

Quantum Computing on OpenShift

Future of computing

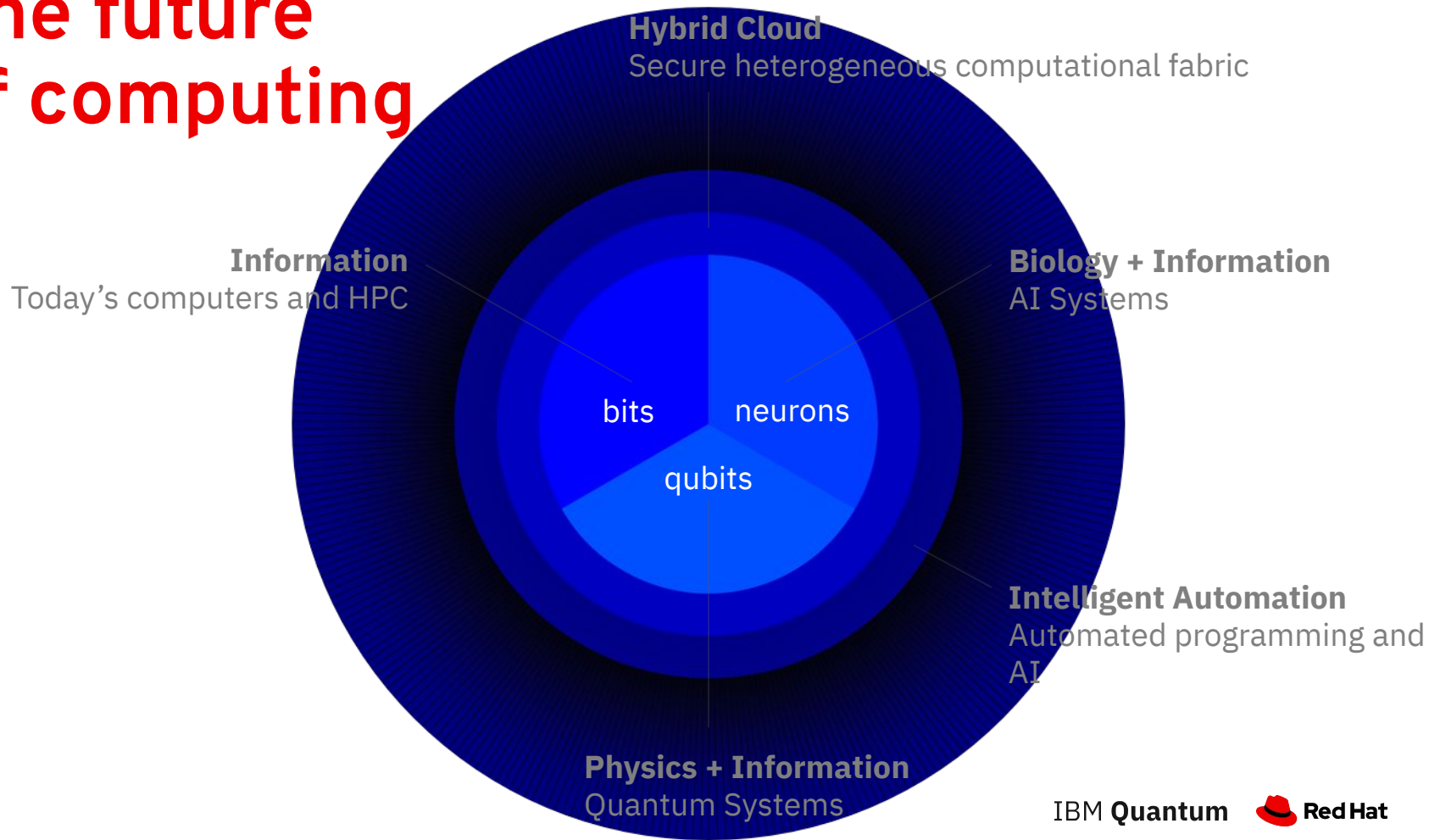
OpenShift Qiskit Operator

Demo how to launch a development env for implementing quantum algorithm using Qiskit & OpenShift

Example circuit

Qiskit developer from IBM will demo how to implement circuits using Qiskit

The future of computing



The world's most powerful “bits + neurons” system

Oak Ridge National Laboratory
US Department of Energy

Summit supercomputer specs

200,000

trillion calculations
per second

9216

IBM Power 9 processors

27,648

NVIDIA GPUs

250 PB

File System

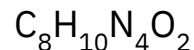
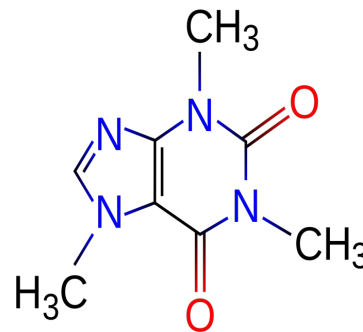
IBM Red Hat Enterprise Linux (RHEL) v 7.4
Operating System



**Are there still
intractable
problems?**

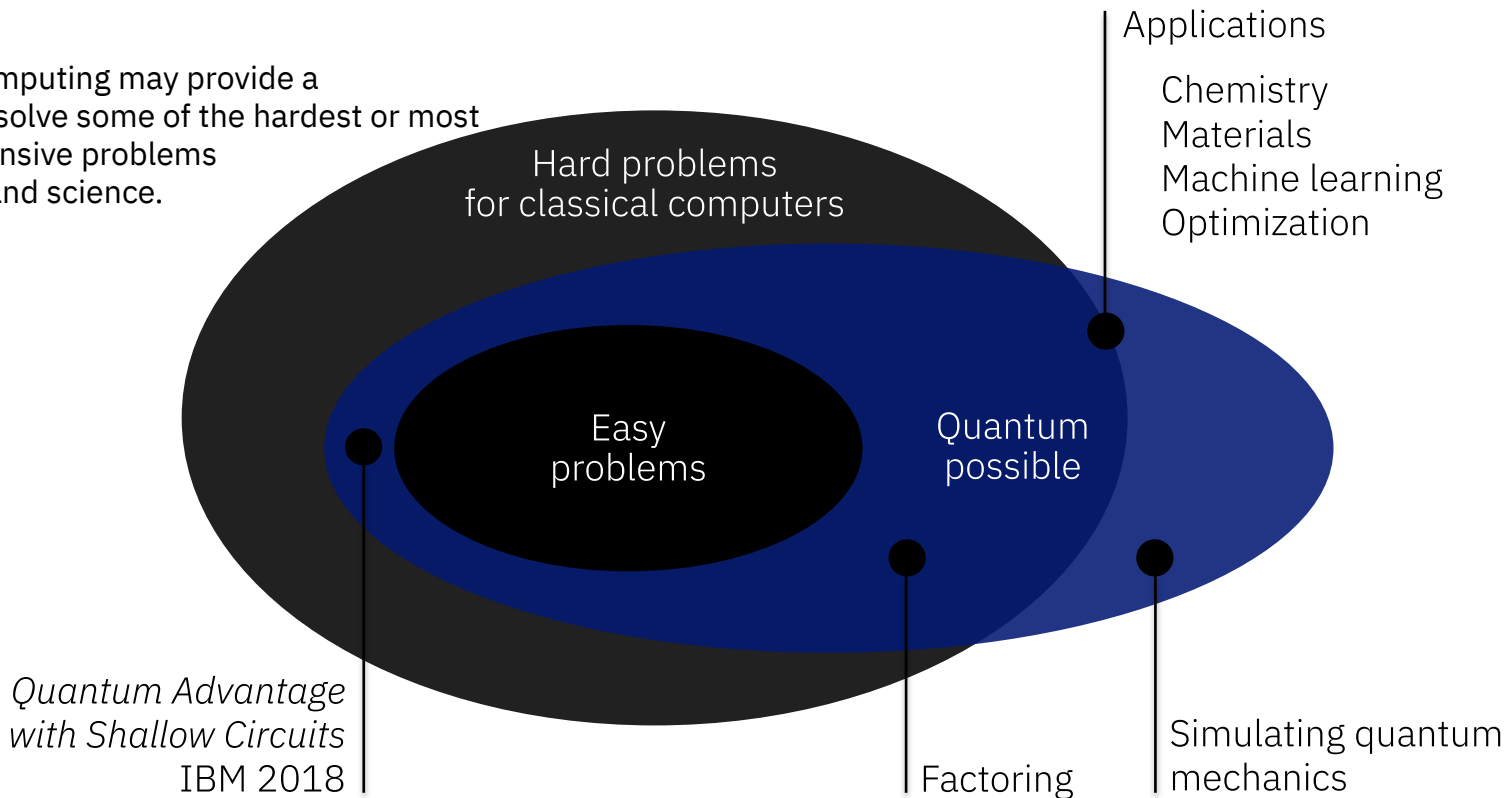
Bits & Qubits

It's *impossible* to completely represent the molecular configuration of caffeine on *today's most powerful supercomputers*, but we could represent it using *160 qubits*



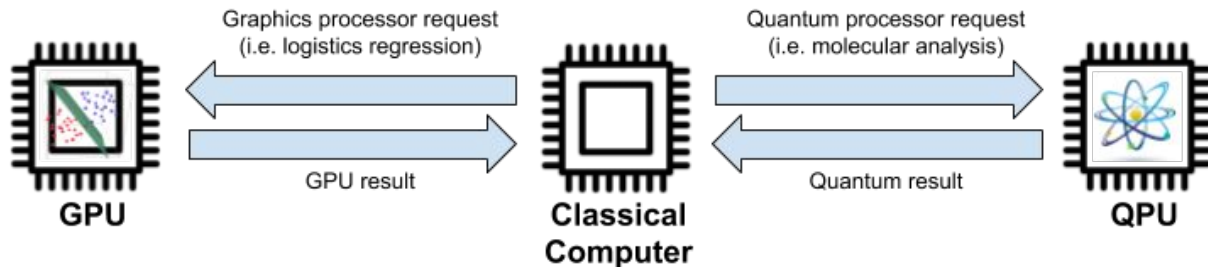
Hard versus easy problems

Quantum computing may provide a new path to solve some of the hardest or most memory intensive problems in business and science.



Quantum Computing on OpenShift

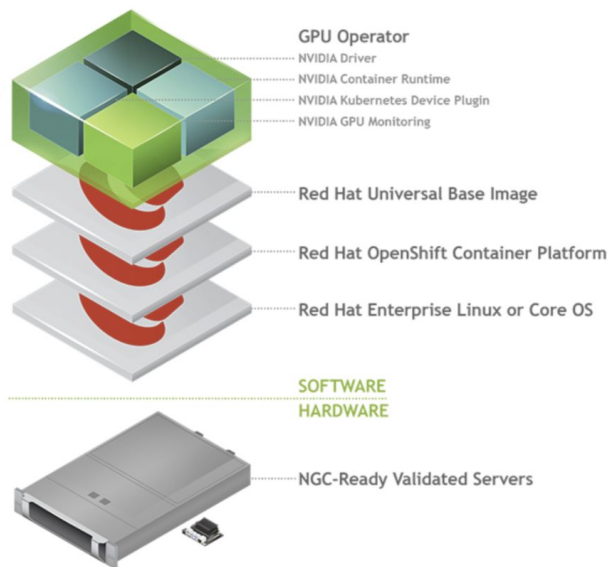
Quantum Computing on OpenShift



Exploring best practices for classical computers to offload work to quantum computers in the cloud in a co-processor model.

Quantum Computing on OpenShift

NVIDIA GPU Example

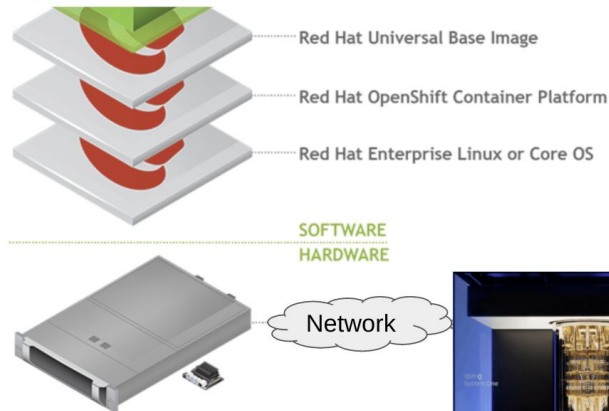


IBM Q Example



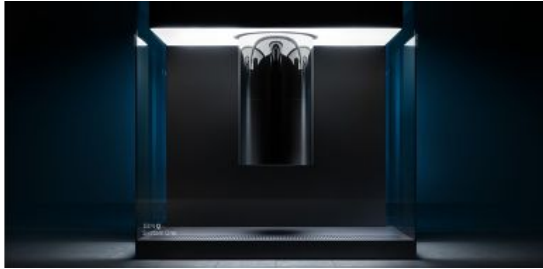
Quantum Operator:

- Qiskit + Jupiter
- Dev API's



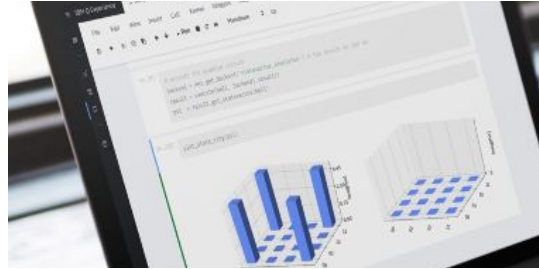
IBM Quantum

Quantum Systems



- Lead the world in application systems (29 Devices)
- Lead the world in quantum research

Quantum Cloud and Software



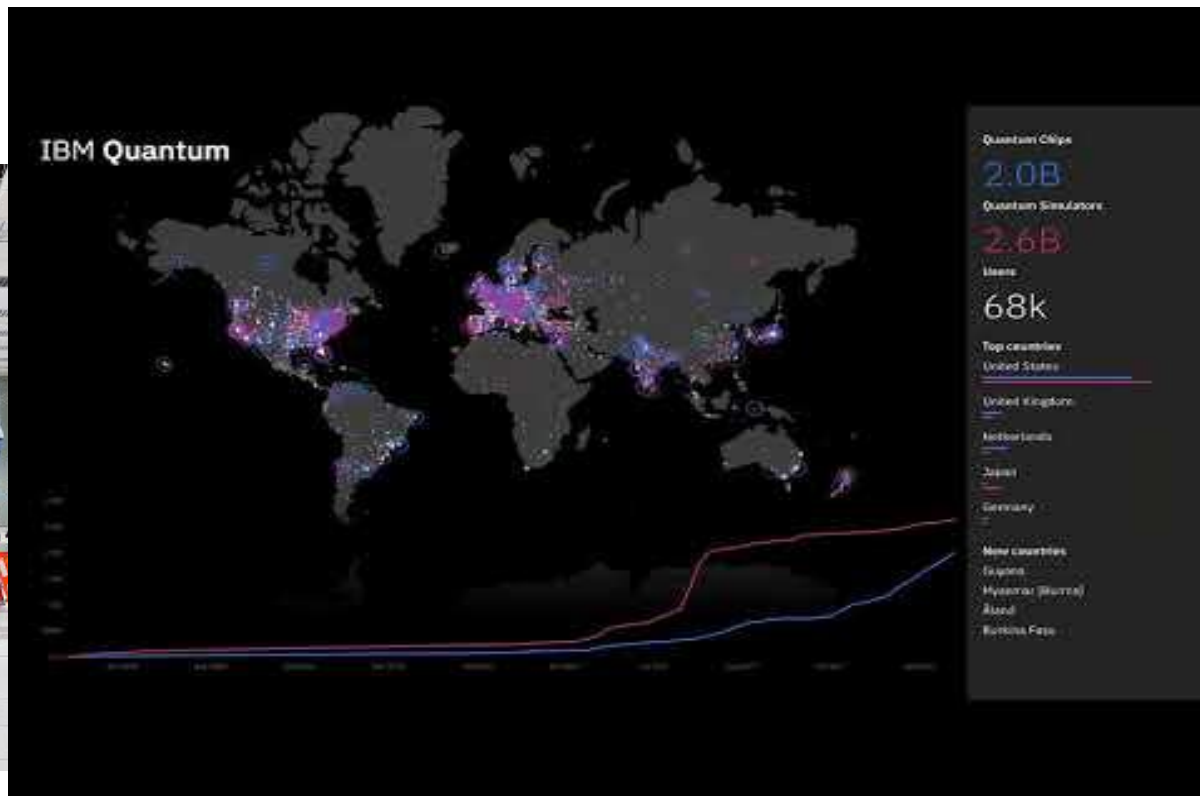
- Open source projects (Qiskit)
- IBM Quantum Services, Quantum Experience, Quantum Lab, Systems access

Quantum Community

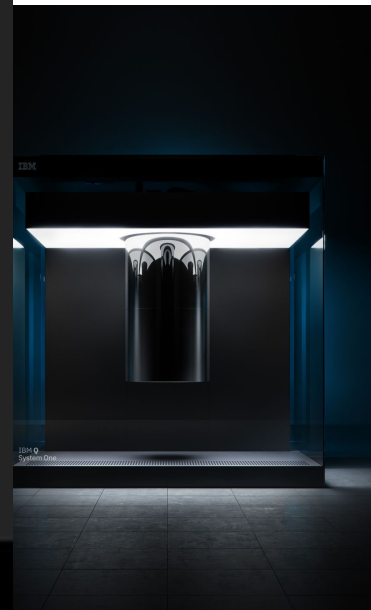


- Education, Researcher, Developers, Business
- Lead quantum software ecosystem development

Research

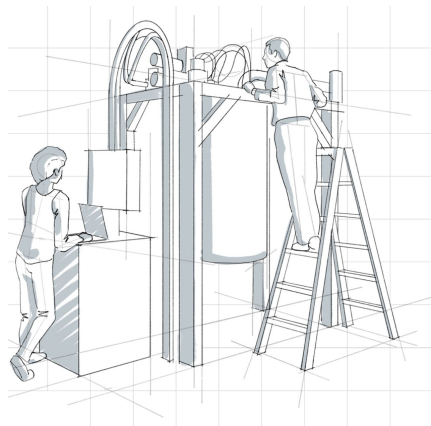


Production



Qiskit

Qiskit [quiss-kit] is an open source SDK for working with quantum computers at the level of pulses, circuits and algorithms.

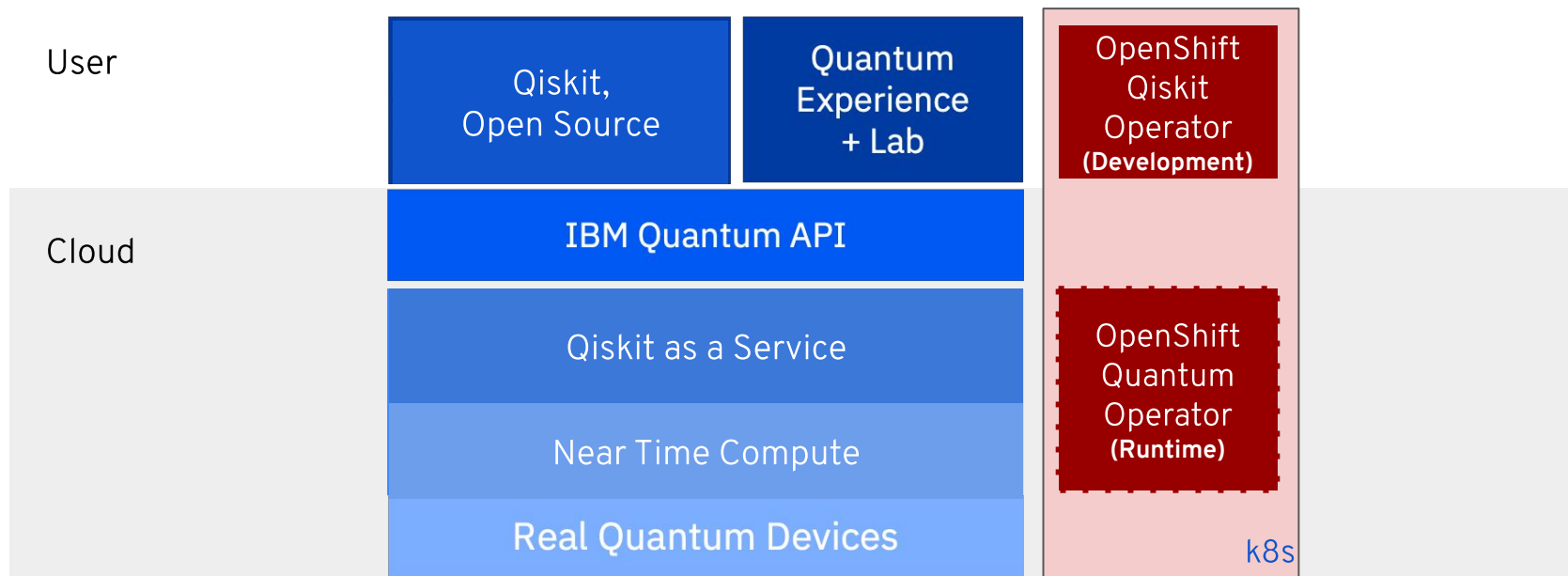


- Application, Programs
- Patterns and Circuits Library
- Transpiler (Analyze, Synthesize, Map, Optimize)
- Experimentalist tools and Pulses tools
- Simulators
- IBMQ Provider

🌐 [Qiskit.org](https://qiskit.org)

🐦 [@qiskit](https://twitter.com/qiskit)

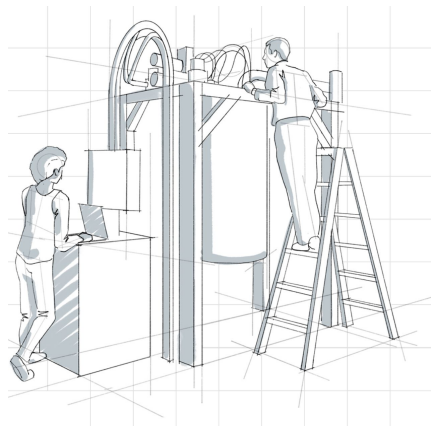
The Software Stack



Key Personas

Key Personas

- **Quantum Algorithm Scientist:**
 - Builds quantum circuits to provide algorithm-level functionality
- **Traditional Application Architect / Developer:**
 - Builds the overall application architecture leveraging combinations of both classical and quantum algorithms.



OpenShift Qiskit operator

Red Hat Quantum Computing Roadmap

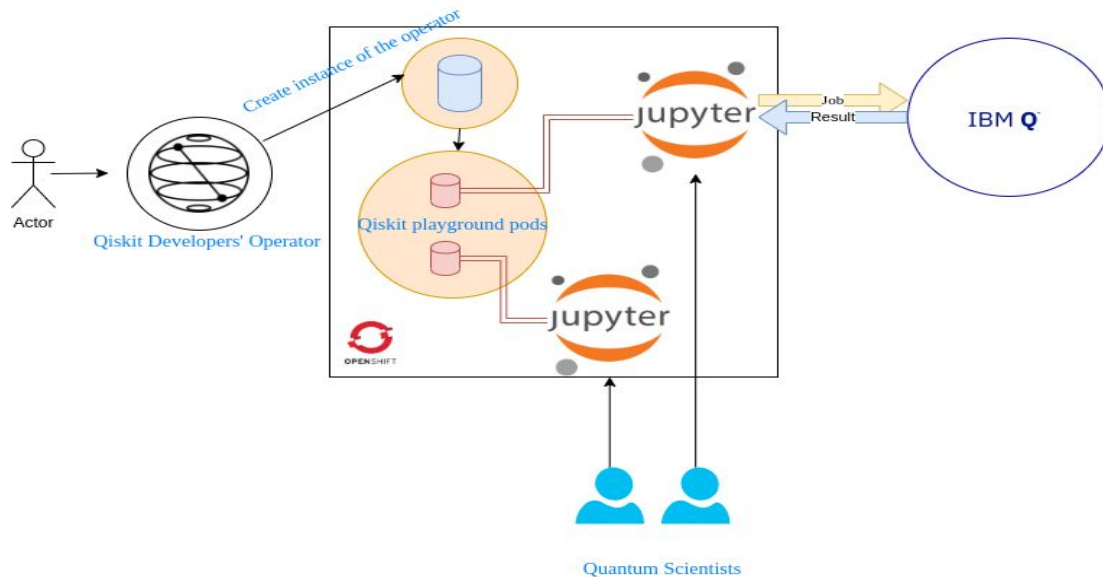


Our general goal

- Define how the **classical and the quantum can be connected together**
- **OpenShift** provides best of classical computing environments
- IBM Research has developed quantum computers based on superconducting qubits

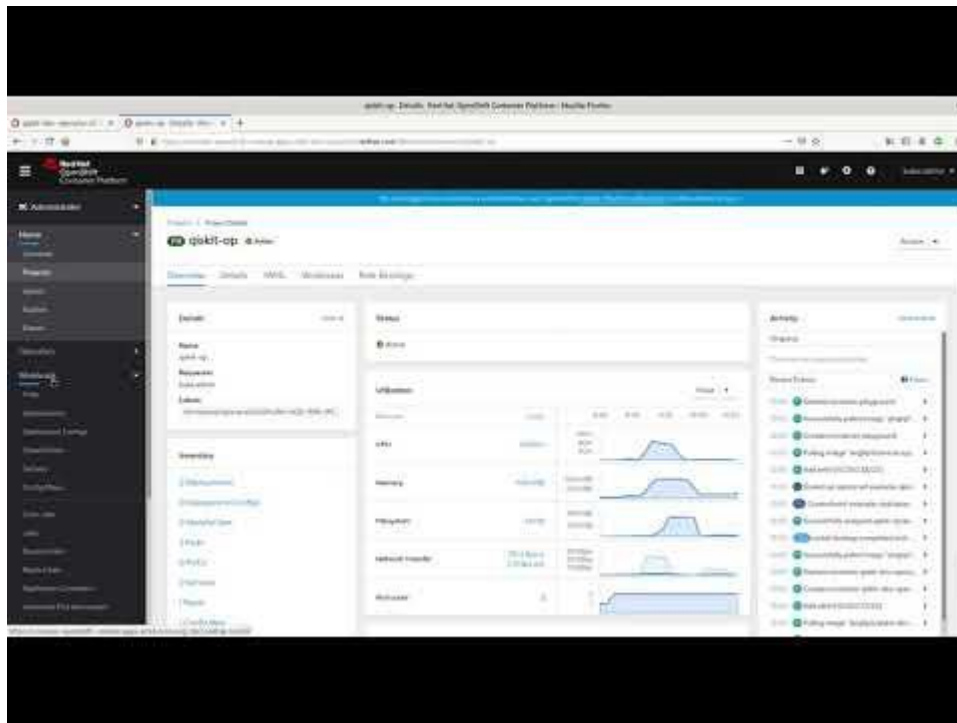
Prototyping to define the best practices for running heterogenous workflows in a co processor model using OpenShift and IBM Quantum Services

OpenShift Qiskit Operator



Operator sets up a development environment with an integrated **Jupyter Notebook** and pre-installed dependencies for running quantum circuits on **IBMQ Account** using **Qiskit**.

OpenShift Qiskit Operator Demo



Qiskit Circuit Demo

Resources

Project Repo : <https://github.com/qiskit-community/openshift-quantum-operators>

OperatorHub: <https://operatorhub.io/operator/ibm-quantum-operator>

IBM Quantum Experience and Account: <https://quantum-computing.ibm.com>

Qiskit: qiskit.org

Presentation and Demo Notebook:

https://github.com/1ucian0/qiskit-presentations/tree/ibmcloudday/2021-01-21_IBM_Cloud_Day

Questions

Thank you