Quantum Computing (⚛) Technology Ecosystem - Cheatsheet

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In the most simple terms, Quantum computing is area of computing focused on developing computer technology based on the principles of quantum theory, which explains the behavior of energy and material on the atomic and subatomic levels. ***It's not here to replace classic computer but to solve where classic computers are not capable enough to perform required compute.***

Know The Basics (Unlearn and Learn)

Defining Quantum Computing in absolute layman term: Bits, Qubits and much more

QC Core Concepts:
Superposition | Entanglement | Interferences
Q. Circuits | Q. Supremacy | NISQ | Wave Function

QC Algorithms Categories:

- **Quantum Fourier transform (QFT)**: A linear transformation on quantum bits (e.g. Shor's Algorithm)
- **Amplitude Amplification (AA)**: A technique that allows the amplification of a chosen subspace of a quantum state. (e.g. Grover's algorithm)
- **Quantum Walks (QW)**: Based on a probability distribution or a quantum superposition over states (Triangle Finding)
- **Bounded-error quantum polynomial time (BQP)**: A class of decision problems solvable by a quantum computer in polynomial time (e.g. Linear systems of equations)
- **Hybrid**: Mix of all above

Experiment & Hands-on (SDKs & Frameworks to experiment with...)

- D:Wave Ocean SDK
- Microsoft- QDK
- Qiskit (Open Source)
- Google- Cirq
- Amazon- Braket SDK
- 1QBit- 1QBit SDK
- Xanadu- Strawberry Fields

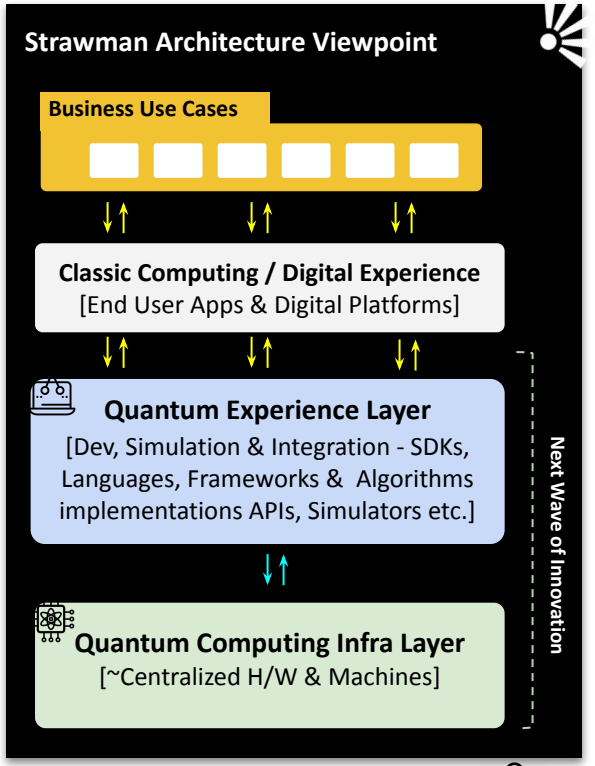
Popular QC Programming Languages:

- Q# & LIQUi by Microsoft
- PyQuil (Quantum Programming in Python)
- QCL (Quantum Computing Language)

Quantum Computing Open Source Foundation (QOSF)

Awesome Quantum Computing Collection & Projects

Strawman Architecture Viewpoint



Cloud/Vendor Offerings

- Amazon Bracket [A fully managed quantum computing service to experiment and Simulate]
- Azure Quantum [An open ecosystem to enable accessing diverse quantum software, hardware, and solutions from Microsoft and our partners ecosystem]
- IBM Quantum Offerings [Covering hardware, software, education and much more]
- Xanadu Quantum Cloud [Fully Managed quantum cloud services, direct access to photonics QPUs]
- Cirq / Google AI - Google Cloud Computing Services
- D:Wave Leap: Build Business Centric Apps on top of QC

Prerequisite for Learning QC

(Maths + Physics + Computer Science)

- Quantum Mechanics & Theory (Basic)
- Linear Algebra
- Group Theory (Basic)
- Probability Theory (Basic)
- Algorithms Fundamentals and Analysis

Potential Market Size

Quantum computing market to reach
$1 trillion by 2035 Source

Industry Use Cases (Potential - Now & Future)

2-5 years

- Financial Portfolio Management
- Financial Transactions Settlements
- Credit/Asset Scoring & Risks Analysis
- Vehicle Routing & Staff Job Scheduling
- Drug Development & Simulations
- Cyber Security & Search Optimization

5+ years & beyond

- Diseases Risk prediction
- Offer Recommendations
- Distribution Supply Chain
- Clinical Trial Enhancements
- Many more...+++++

QC Archetypes (H/W)

- Annealing Based Quantum Computers (More practical use)
- General Purpose / Universal Gate based Quantum Computers (still evolving)

Last updated on 02 Mar, 2021

QC = Quantum Computing

Please note the above cheatsheet does not cover the Quantum AI Ecosystem and that will be covered in another cheatsheet
The above information is based on my recent research to learn and share Quantum Computing Knowledge!