The role of quantum computing simulation

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The final state for quantum computing is one where established hardware technologies, architectures, and programming are made available through standard interfaces to a rich software ecosystem codifying new quantum algorithms and delivering benefits to the enterprise through hybrid classical-quantum applications. A *Quantum Computing System Model* (Figure 1) defines a hardware-software stack designed to bring the benefits of quantum computing technologies through to each enterprise vertical. Standards for implementation of each layer in this model enable industry collaboration and technology interchange to achieve desired end-user outcomes.

A simulation-based approach is key to maturing the form and interfaces within the Quantum Computing System Model when hardware is not readily accessible. This enables us to begin to answer questions such as:

1. What programming languages will be used to build quantum applications?

2. What domain specific languages will be needed to codify hardware control?

3. Can these concepts be merged to create an *embedded language* for quantum programming?

4. Can a quantum computer simulator be used as a hardware surrogate to commence early application development?

5. Are there additional benefits that quantum computer simulation can provide?

Through development of the Quantum Computer Simulation System, QxBranch has gained insights into these and other questions regarding the best software development approach to quantum computing systems.

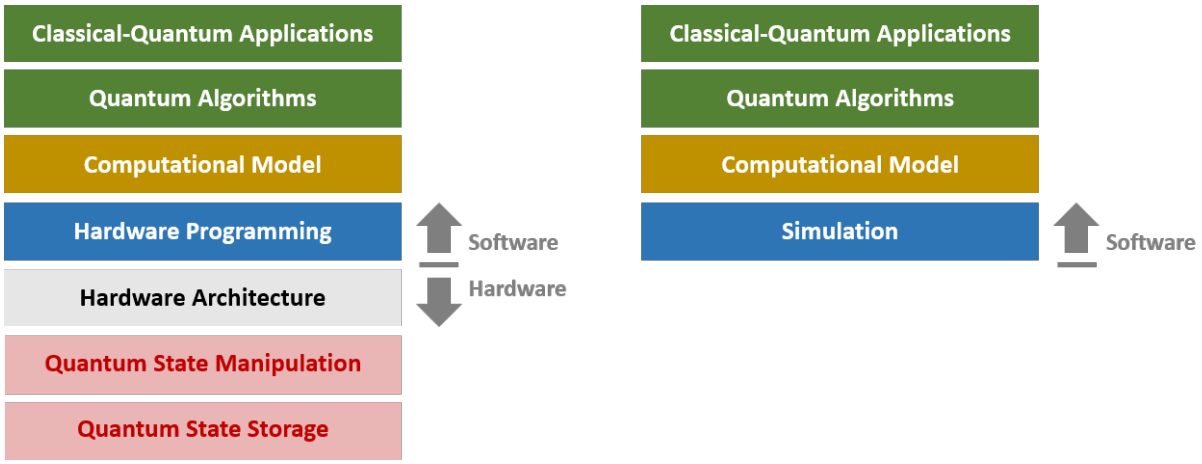

Figure 1: Quantum Computing System Model (left); Simulation-based solution (right).