Quantum Networking

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Problem Statement

- Dr. Durga and Dr. Smith are researching quantum networks and want to create their own based on physical quantum gates.
- Building a physical quantum network is expensive.
- We aim to develop an inexpensive and scalable simulation.
- The simulation will enable the researchers to conduct their work without high costs.

Requirements and Constraints

- Our simulated network has to be inexpensive and to be expandable
  - Use less Q bits as possible
- Our simulated network has to be easy to implement on current quantum computer simulation tool to make researchers enable to focus on their study.
- Our simulated network has to reflect physical aspects of quantum network
  - Such as Quantum entanglement, error correction between Q gates
  - Our customers want to have simulated network which reflects real world very well

Modularity

- We want to construct a “Plug and Play” system
- New protocolling, similar to the TCP framework
- Needs to convert from quantum to classical

Protocalling

- Going to construct the protocol similar to the TCP
- Figure out the most efficient quark to bit ratio
- Conversion between quantum and classical

Routing

- Can only be single core
- Due to specifications, the quantum computers will only need to communicate every second or more.
- Needs to be as physical as possible

Engineering Standards

IEEE 802.3 Ethernet: Defines physical and data link layers of wired Ethernet networks, which will be critical to set up in conjunction with our quantum network and provide a good baseline network to build off of.

IETF RFC 2544: Describes standards for monitoring and tracking network device performance. We will use these standards to test the speed and reliability of our quantum network to ensure it is a viable option compared to standard internet.

IEEE P7130: Provides standards for describing quantum computing framework functions and terminology. This is important for communicating with our advisor and implementing our design.

IEEE P802.1Q-2021 Amendment 28: Defines the Quantum Key Distribution (QKD) protocol used to secure network traffic over a quantum network. Implementing QKD will be important for ensuring secure traffic on our network.

Intended Users and Uses

- Dr. Durga and Dr. Smith
- Our work might be used to build more used systems