EE/ CprE/ SE 491 - sddec23-17

Simulated Design of Quantum Networks

Week 5 Report

Feb 27 - Mar 5

Client: Dr. Durga Paudyal

Faculty Advisor: Dr. Durga Paudyal

Team Members:

Benjamin Amick - Network security engineer

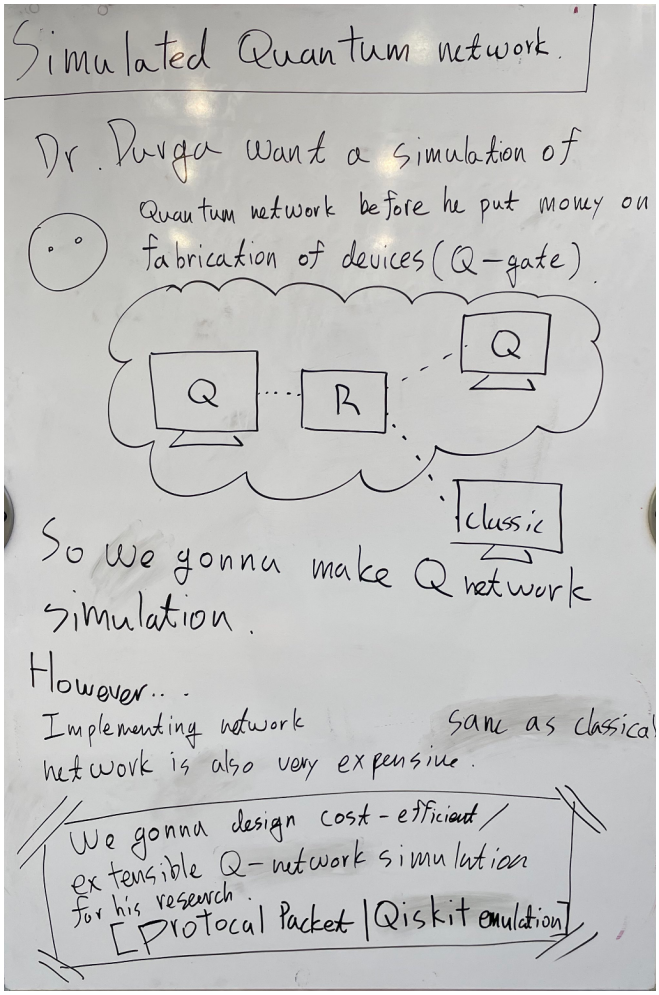
Derrick Wright - System integration engineer

Ohik Kwon- System component designer

Steven Tompary- Network engineer

Past Week Accomplishments

- For this week, we are still studying about quantum physics/technology for our network system, but finally got better images for our design problem. At this stage from our understanding, the problem set and our design subject/plan will be the same as the diagram below.



- **Ben** - Qiskit Research focused on QKD
    - Read through the Qiskit document and run simple Quantum Key Distribution software based on EK91 in python.
    - Kept working on the Quantum Key distribution system on Qiskit platform

- **Derrick** - Researching about quantum gate
    - Read through the book what he has read.

    - Researched about Toffoli gates which are NAND gates in quantum computing systems, and Deutsch's algorithm.

- **Ohik** - Researching about quantum information
    - Reviewed basic linear algebra formulation such as operator matrix, Identity operators.
    - Looked at time complexity in the structure of quantum computing and basic computer science materials.

- **Steven** - Researching about Cluster computing
    - Researched requirements for quantum cluster computing and network.
    - Researched and proposed what we could make in a given resources and time for part of cluster quantum computing.

Resources

Slides we used during a meeting

https://drive.google.com/drive/folders/1hwggT9okAOvb5WOpnUYv1hgNFV69AqFR?usp=sharing

Books we are reading

- Introduction to quantum information, Stephen M. Barnett
- Quantum Computation and Quantum Information, Michael A. Nielson

Articles we found this week and reading

- Perspective on quantum transduction
- Github Qiskit Community Tutorials
- Ytterbium ion trap quantum computing : The current state of the art
- https://en.wikipedia.org/wiki/Kronecker_product
- Large Scale Modular Quantum Computer Architecture with Atomic Memory and Photonic Interconnects

Pending Issues

- Through the past week, we finally got better images for our project. For this week, we will get confirmation from our advisor about our plan which is to build a quantum networking system and design a quantum network protocol for our simulated quantum networking.
- Set individual goals for a month for example, get a better understanding about quantum information and Qiskit platform, or classical TCP/IP protocol for starting to make our own network.

Individual Contributions

Team Member	Contribution	Weekly Hours	Total Hours
Benjamin Amick	Researched about QKD	4	16
Derrick Wright	Researched Quantum Information	4	16
Ohik Kwon	Research quantum gates	4	16
Steven Tompary	Researched quantum networks	4	16

Plans for Coming Week

- Share individual research about quantum networks - everyone
- Get a better view for our project, for example, how many computers we will try to connect our network, how many system components(routers etc.) we will make for this project - everyone
- Investigate more on quantum information system which might be needed to construct our own - ohik
- Discuss our network protocol which will be cost efficient, and open to extendibility to meet our advisor's needs and support his future work. - Ben and Steven
- Move on to the Qiskit platform and try to prepare to build our network on Qiskit. - Derrick