EE/ CprE/ SE 491 - sddec23-17

Simulated Design of Quantum Networks

Week 7 Report

Mar 21 - April 2
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

- We finally set our project more clearly throughout recent ideation processes and meetings concerning which work related to quantum networking we can do as a part of senior design class. Furthermore, we twist our project from just about quantum network to quantum network for cluster commuting which is little different from the previous project. The below image is what we're planning to make.
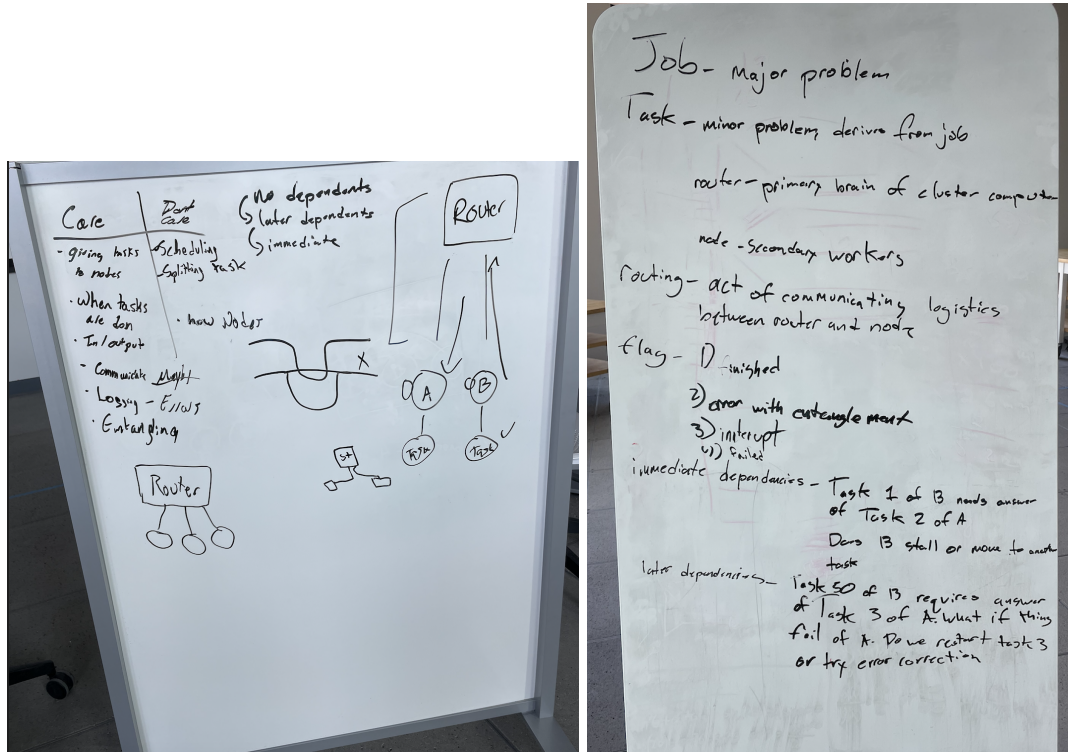
[figure 1. Brainstorming for our design. We describe design terminology more clearly and design schematics of our network]

- **Ben/Steven** - Researching about quantum network
  - Discussed classical networks that we will use for our quantum network.
  - Researched about how the job scheduling in the classical computer is done, and how we can implement this on our project.
  - Discussed about the network packet between classical nodes and quantum nodes.

- **Derrick/Ohik** - Researching about Qiskit document

- Keep reading quantum information books.
- Researched Qiskit documents and several papers regarding how we can make entangled quantum gates which is essential to exchange q-bits in the router.
- Researched and learned more about networking and networking protocols for the router.

Resources

Slides we used during a meeting

https://drive.google.com/drive/folders/1012whGq3kvmEk1mJyfZUpK-D59Vfs_FM?usp=share_link

Books we are reading

- Quantum Computation and Quantum Information, Michael A. Nielson

Articles we found this week and reading

- Github Qiskit Community Tutorials
- https://www.nature.com/articles/s41566-021-00802-1
- https://www.nature.com/articles/s41534-020-00344-4
- Entanglement Swapping in Quantum Switches: Protocol Design and Stability Analysis

Pending Issues

- Now we're moving our project phase from the research to implementation. So we need to care about our project's goal (how many bits we're concerned about, and how many nodes are concerned).
- We need more specification, especially to what degree we can assume a realistic difference to be simple for our simulated quantum network for quantum cluster computing such as "can we totally ignore error correction?" and "what degrees of complexity can be

assumed for a one job?." We will discuss about this with advisor for our next meeting.

Individual Contributions

Team Member	Contribution	Weekly Hours	Total Hours
Benjamin Amick	Researched about QKD	5	25.5
Derrick Wright	Researched Quantum Information	5	25.5
Ohik Kwon	Research quantum gates	5	25.5
Steven Tompary	Researched quantum networks	5	25.5

Plans for Coming Week

- Share individual research about quantum networks - everyone
- Research about interrupt handler of classical network for implementing interrupt handler to our quantum network for cluster computing.-Steven
- Keep studying about quantum information and computation. Learn more about the Qiskit system for implementing Bell state in our simulation. Also learn about the error correction which will be considered for the next semester.- ohik
- Keep communicating with Steven regarding quantum network cluster computing. And write down Pseudocode for our quantum router which we will make for our quantum network. - Ben
- Trying to learn very simple quantum gates in Qiskit before we start to make our own quantum gates more seriously. Research about quantum cluster which other research teams have been used- Derrick