EE/ CprE/ SE 491 - sddec23-17

Simulated Design of Quantum Networks

Week 6 Report

Mar 6 - Mar 12

Client: Dr. Durga Paudyal

Faculty Advisor: Dr. Durga Paudyal

Team Members:

Benjamin Amick - Network security engineer

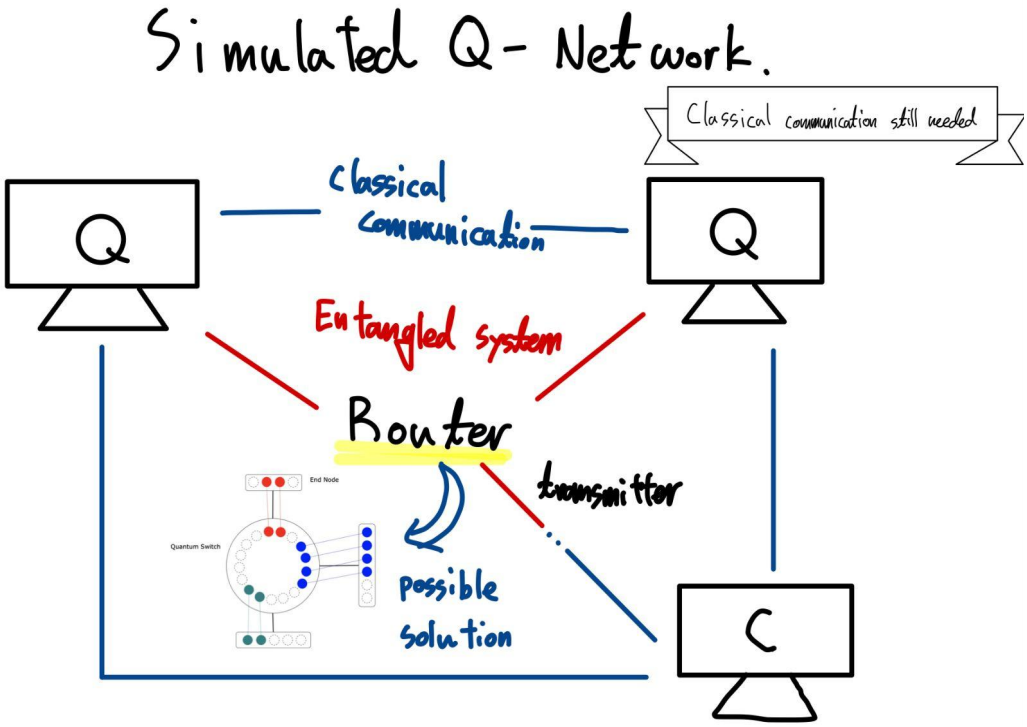
Derrick Wright - System integration engineer

Ohik Kwon- System component designer

Steven Tompary- Network engineer

Past Week Accomplishments

- Since we have a better understanding and clearer image of how our project will be conducted, we tried to figure out what components we might need and what specs are required for running our quantum networks. Even though we have better understanding, we still need to have more clarification of our network's requirements from our clients. Thus, while we acquire more information about quantum information, we will try to keep in contact with our advisor/ client to modulate specific requirements of our network.



[figure 1. More sophisticated network diagram. We referenced quantum switch router concept from https://arxiv.org/pdf/2110.04116.pdf]

- **Ben** - Quantum network router research
  - Read through the paper, "Entanglement Swapping in Quantum Switches: Protocol Design and Stability Analysis," and suggest possible quantum network routers that might be used in our quantum network.

- **Derrick** - Researching about Qiskit document

    - Studied Qiskit toolkit and researched the accessibility of quantum computers that we can use for our simulated network.
    - Keep reading quantum information book

- **Ohik** - Researching about quantum information
    - Reviewed basic quantum gates and trying to figure out how quantum information materials can be used in our project
    - Studied quantum computing algorithm such as fourier transform and quantum search

- **Steven** - Researching about quantum network
    - Researched how entanglement photons are transmitted via optical fiber.
    - Understood how timing is important in quantum networks between classical and quantum computers.

Resources

Slides we used during a meeting

https://drive.google.com/drive/folders/1oB1vU_TI8meRKHKZJX3AA8_SiYVcq_JE?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

- Github Qiskit Community Tutorials
- Ytterbium ion trap quantum computing : The current state of the art
- Entanglement Swapping in Quantum Switches: Protocol Design and Stability Analysis
- (why error correction is required in computing) https://www.youtube.com/watch?v=izG7qT0EpBw

Pending Issues

- We still need more specification about our project such as how many q bits our clients want us to run in our simulated quantum network etc. We should organize questions regarding network performance specifically and ask our client.
- As our project moves from a research phase to building phase, we need to set a work environment to collaborate with different two sections(network and system sections).

Individual Contributions

Team Member	Contribution	Weekly Hours	Total Hours
Benjamin Amick	Researched about QKD	4.5	20.5
Derrick Wright	Researched Quantum Information	4.5	20.5
Ohik Kwon	Research quantum gates	4.5	20.5
Steven Tompary	Researched quantum networks	4.5	20.5

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
- Keep studying about quantum information and computation. Learn more about network to assist building network rather than building quantum system - ohik
- Keep working on quantum network router, communication protocol to be used in our project. Try to have a meeting with computer architecture professor in Iowa State University for discussing communication timing between quantum-classical computers - Ben and Steven
- Move on to the Qiskit platform and try to prepare to build our network on Qiskit. Preparing system integration works- Derrick