**Independent Study Goals/Objectives**

The goal for this independent study is to get a more in-depth view on how the transport layer works, specifically the Transmission Control Protocol (TCP). A great way to do this would be to build my own implementation of TCP. It would require me to research, design, program and test my library which would allow me to gain the knowledge of how reliable data transfer works in the back end. Once this is done, I will go one step further and create my own hypothesis pertaining to TCP and experiment with my library. Then I will make my final conclusions to wrap up what I have learned from the experiment. By following the schedule below, I will learn a great deal about TCP and the transport layer over the course of the semester.

**Schedule**

1. Start by setting up the environment to use for development and install any virtual machines needed for testing. Then research tools that will help with development and pick the best language for the project. Review properties of TCP before implementing any code.
2. Begin implementing the library by adding the ability of sending raw packets between two clients.
3. Deliverable: Program an interface to write packet headers for creating a UDP packet. Then send those packets between two clients.
4. Implement TCP packet headers. Create TCP packets to send between two clients.
5. Implement ability to establish and terminate a connection between two peers.
6. Deliverable: Implement reliable transfer protocol by making sure the packets arrive in order and that no packets are lost. Start by sending packets in a Stop and Wait fashion and then add in the ability to send them in parallel.
7. Add in error detection of packets by examining the checksum of each received packet.
8. Add Flow Control to the library - to avoid having the sender send data too fast for the TCP receiver to receive.
9. Deliverable: Implement Congestion Control – this includes implementing the Slow-Start, Congestion Avoidance, and Fast Recovery algorithms. Begin testing against another implementation of TCP.
10. Deliverable: Make a hypothesis about TCP and what would happen if some property changed. Then experiment by making the appropriate change to the library. Test and analyze the result to make a conclusion about the hypothesis.