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Programming Assignment 1
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**DESIGN DECISIONS**

I found that most of the code provided for the server could be copied over to the client code. However, there were a few differences. I did not copy over the bind() as it is not necessary for the client side code. Inside the for loop, the order of the recvfrom() and sendto() is the reverse of that of the server code. Furthermore, the address parameter of recvfrom() and sendto() is changed from ‘cliaddr’ to ‘servaddr’ to reflect the fact that the client sends pings to the server and receives responses from the server.

Some additions I made were setsockopt(), and for the timing of the ping-and-response, I used the C++ chrono library. The option parameter of setsockopt() was a timeval variable that was set to exactly 1.0 seconds. This sets the socket to timeout at that specified amount of time.

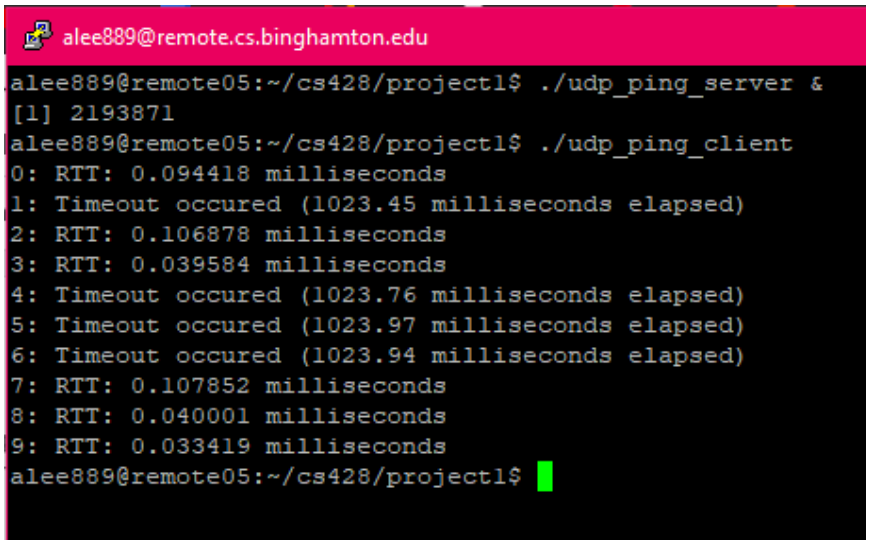
Although I wrote my code in a Windows environment, I wrote for it to run in a Linux environment. As a result, I had to make significant changes to run my code in my Microsoft Visual Studio working environment (rather than in remote). These changes are:

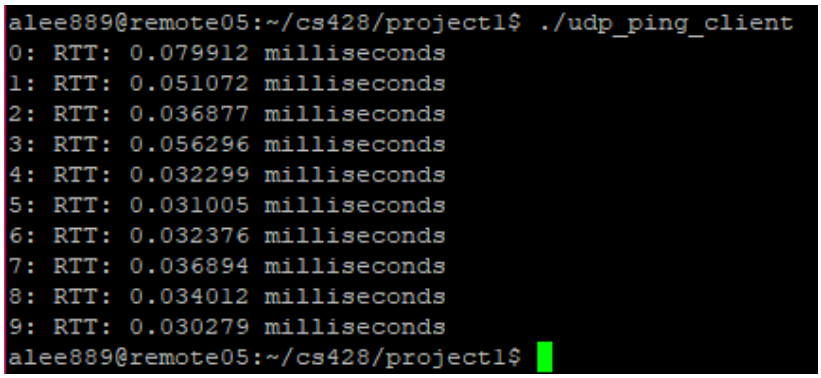
1. Using <ws2tcpip.h> and <winsock2.h> to replace <sys/socket.h>, <arpa/inet.h>, and <netinet/in.h> due to the missing POSIX headers in Visual Studio. I also removed <sys/types.h>.
2. Initialization of winsock with WSAStartup().
3. Making my socket timeout variable a DWORD instead of a timeval
4. Adding -lws2_32 to the Makefile
5. Changing MSG_CONFIRM to 0 in sendto() and recvfrom() in both the server and client files, since there was no Windows-equivalent flag.

Despite the changes I made, I consistently got a RTT of 0 ms for all 10 pings (shown in screenshot), and could not find a way to fix this. My code was fully functional in Linux, however.

In the next page are the screenshots of execution in the remote session, and in Visual Studio’s Command Prompt.

Linux:




Windows:


**ERROR CASES**

The code can run into errors if socket initialization was unsuccessful. In Windows, this error appears as INVALID_SOCKET. Another error can come from unsuccessfully setting the timeout in setsockopt(). This error can be caught through `if( setsockopt(...) < 0)`. As

mentioned, I also got errors with my Windows code, likely due to the many changes I made for the code to be able to run in Windows/Visual Studio.