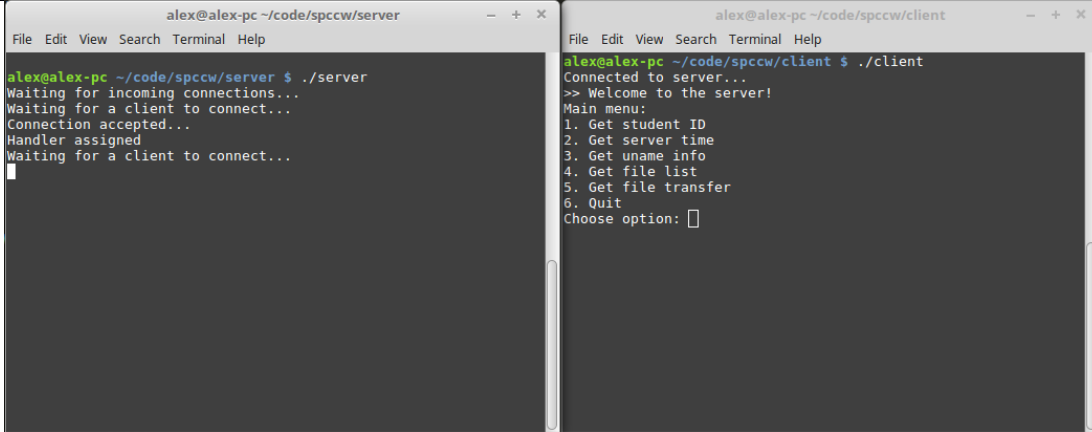
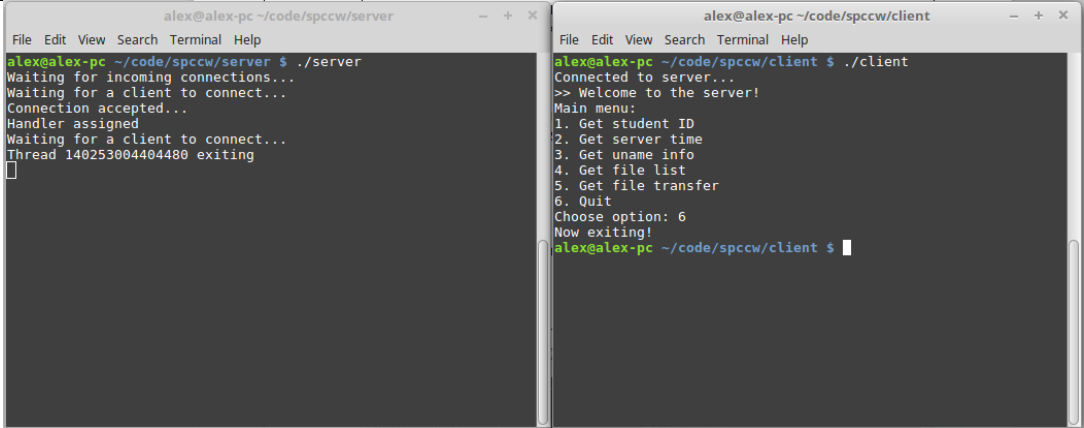
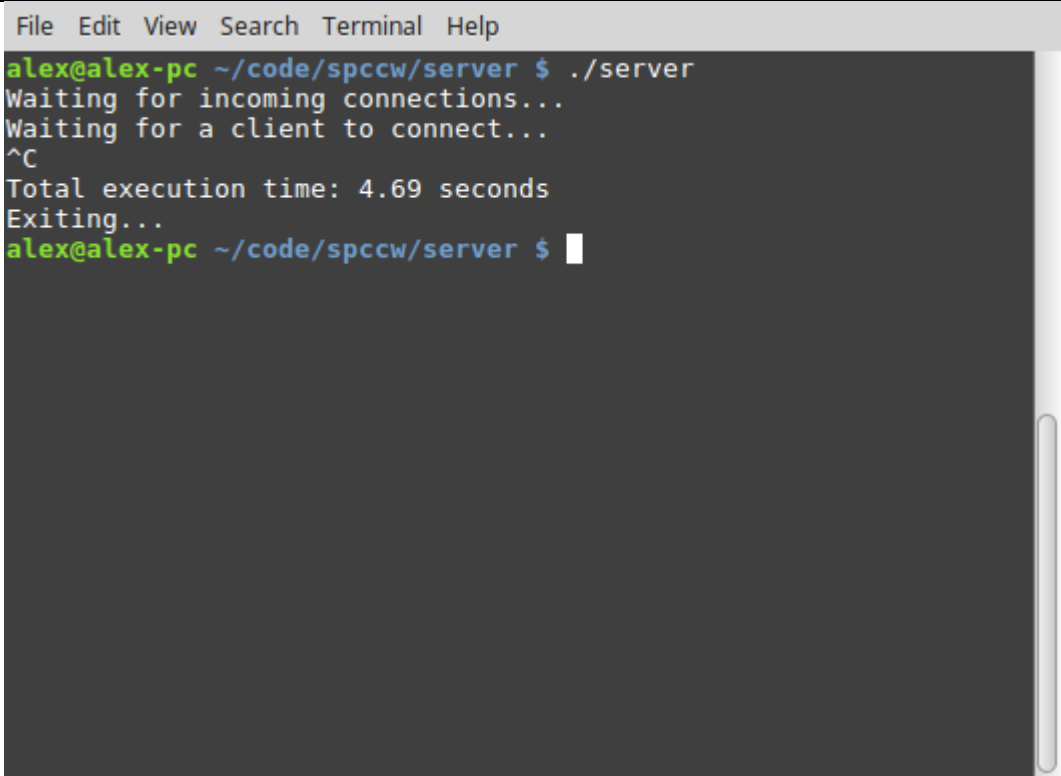
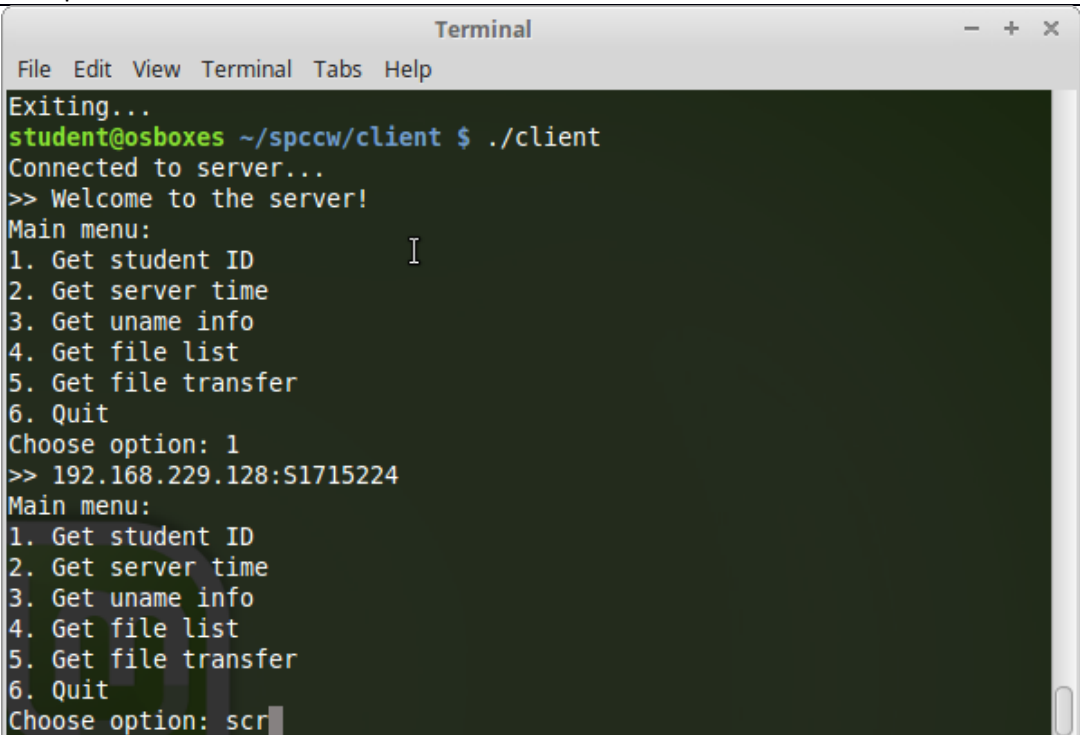


System	Client/Server (C coursework)
Author	Alex McBride
Student ID	S1715224
Student Email	AMCBRI206@caledonian.ac.uk
Date	04/12/2017
Before	It's required to run both server and client in different terminal windows, so you can see the results side-by-side.

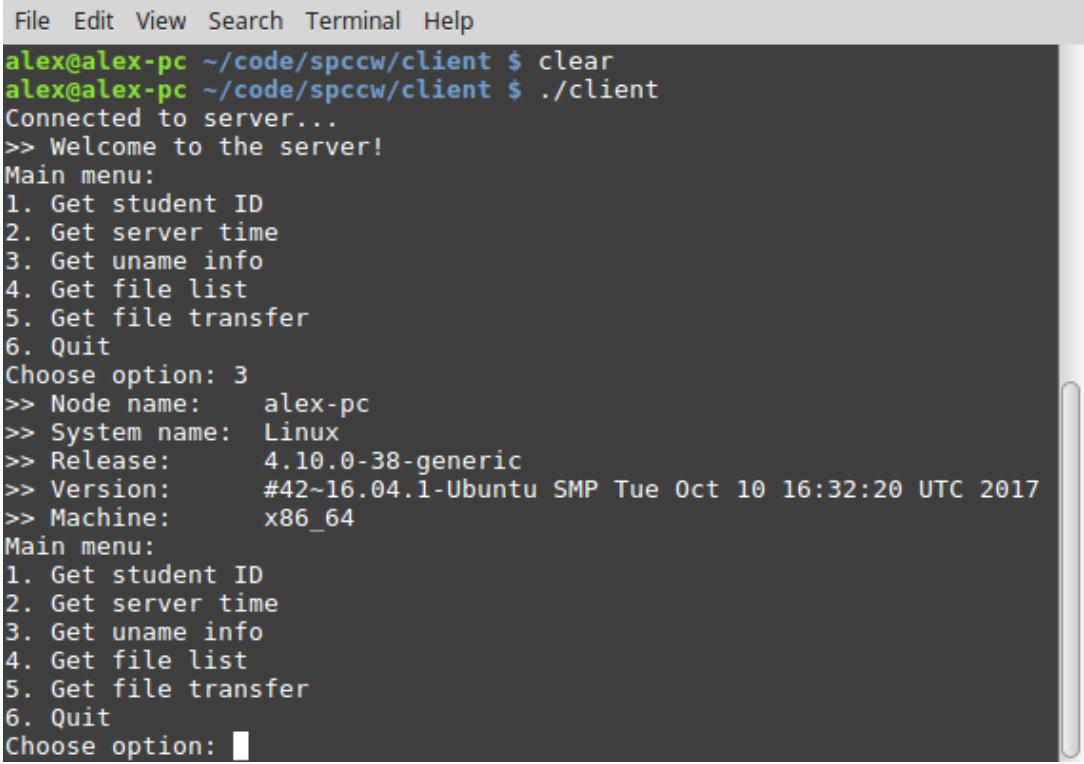
Test	001
Description	Client connects to server
Input	<p>In first terminal start the server: <code>./server</code></p> <p>In the second terminal start the client: <code>./client</code></p>
Expected	<p>The server should display the following:</p> <pre>Waiting for incoming connections... Waiting for a client to connect... Connection accepted... Handler assigned</pre> <p>The client should display:</p> <pre>Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option:</pre>
Actual	As expected
Screen	 The screenshot shows two terminal windows side-by-side. The left window is titled 'alex@alex-pc ~/code/spccw/server' and shows the output of running './server'. It displays: 'Waiting for incoming connections...', 'Waiting for a client to connect...', 'Connection accepted...', 'Handler assigned', and 'Waiting for a client to connect...'. The right window is titled 'alex@alex-pc ~/code/spccw/client' and shows the output of running './client'. It displays: 'Connected to server...', '>> Welcome to the server!', 'Main menu:', a list of 6 options (1. Get student ID, 2. Get server time, 3. Get uname info, 4. Get file list, 5. Get file transfer, 6. Quit), and 'Choose option: ' with a cursor.

Test	002
Description	Client disconnects from server
Input	<p>In first terminal start the server: <code>./server</code></p> <p>In the second terminal start the client: <code>./client</code></p> <p>Then press 6 in the client to select the menu option to quit.</p>
Expected	<p>The server should display the following (note the actual thread ID will vary):</p> <pre>Waiting for incoming connections... Waiting for a client to connect... Connection accepted... Handler assigned Waiting for a client to connect... Thread 140253004404480 exiting</pre> <p>The client should display:</p> <pre>Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 6 Now exiting!</pre>
Actual	As expected
Screen	

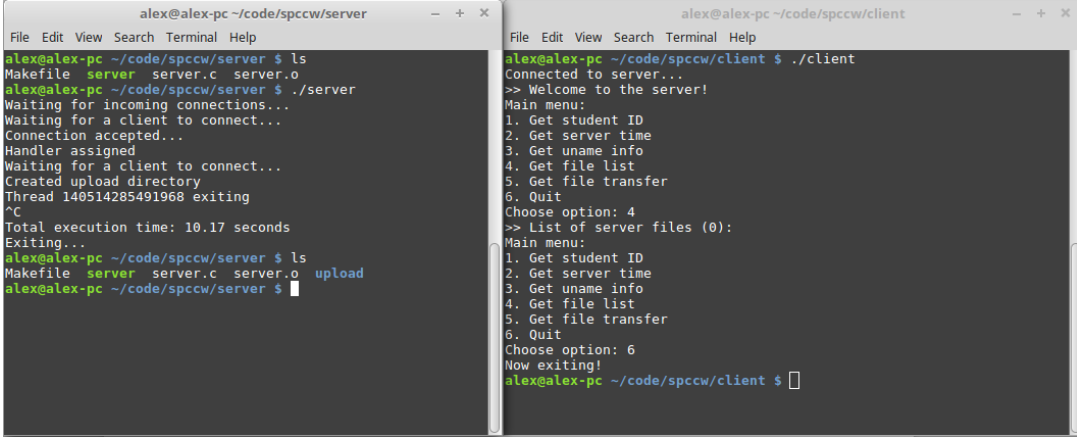
Test	003
Description	Server closes correctly on interrupt
Input	In first terminal start the server: <code>./server</code> Then press Ctrl+C to send SIGINT to the server process.
Expected	The server should display the following (note the actual execution time will vary): Waiting for incoming connections... Waiting for a client to connect... ^C Total execution time: 4.69 seconds Exiting...
Actual	As expected
Screen	 A screenshot of a terminal window with a menu bar (File, Edit, View, Search, Terminal, Help). The prompt is 'alex@alex-pc ~/code/spccw/server \$'. The output shows the server running, waiting for connections, receiving a Ctrl+C interrupt, displaying the execution time (4.69 seconds), and exiting. The prompt returns to 'alex@alex-pc ~/code/spccw/server \$'.

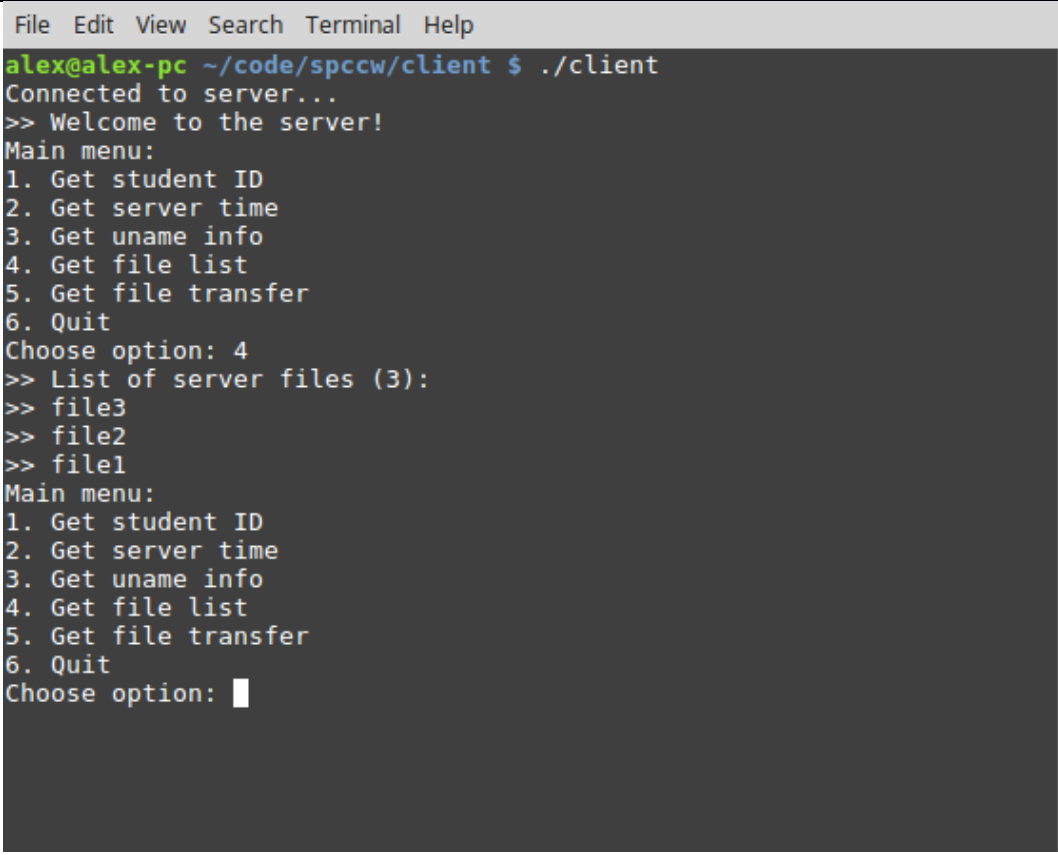
Test	004
Description	Get student ID works correctly
Input	<p>In first terminal start the server: <code>./server</code></p> <p>In the second terminal start the client: <code>./client</code></p> <p>Then select option 1 from the client menu</p>
Expected	<p>The client should display the following:</p> <pre>Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 1 >> 192.168.229.128:S1715224</pre> <p>Before then displaying the menu again.</p>
Actual	As expected
Screen	 A screenshot of a terminal window titled "Terminal" with standard window controls (-, +, x) and a menu bar (File, Edit, View, Terminal, Tabs, Help). The terminal shows the following text: <pre>Exiting... student@osboxes ~/spccw/client \$./client Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 1 >> 192.168.229.128:S1715224 Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: scr</pre>

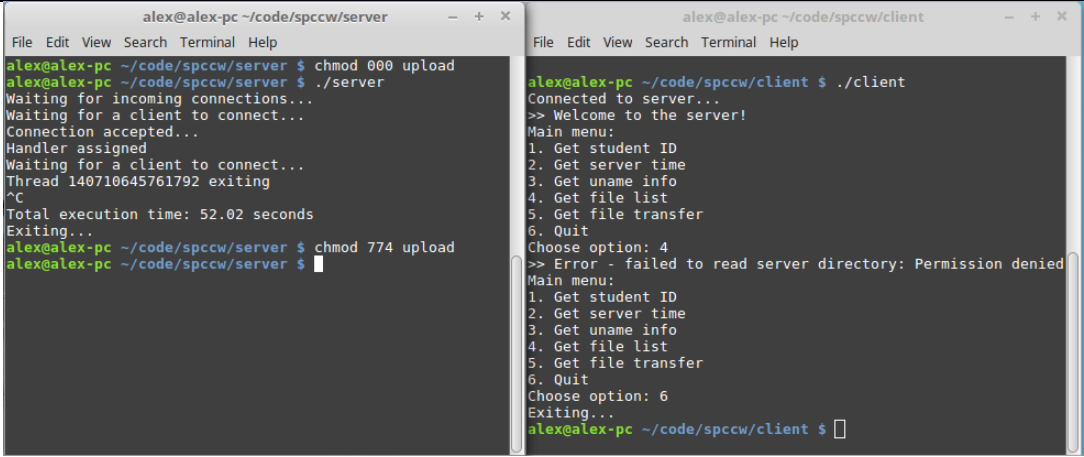
Test	005
Description	Get server time works correctly
Input	<p>In first terminal start the server: <code>./server</code></p> <p>In the second terminal start the client: <code>./client</code></p> <p>Then select option 2 from the client menu</p>
Expected	<p>The client should display the following:</p> <pre> Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 2 >> Mon Dec 4 12:56:18 2017 </pre> <p>Before then displaying the menu again. Note that the current date and time will vary depending on when the test was run.</p>
Actual	As expected
Screen	 <pre> File Edit View Search Terminal Help alex@alex-pc ~/code/spccw \$ cd client/ alex@alex-pc ~/code/spccw/client \$./client Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 2 >> Mon Dec 4 12:56:18 2017 Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: █ </pre>

Test	006
Description	Get uname info works correctly
Input	<p>In first terminal start the server: <code>./server</code></p> <p>In the second terminal start the client: <code>./client</code></p> <p>Then select option 3 from the client menu</p>
Expected	<p>The client should display the following:</p> <pre> Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 3 >> Node name: alex-pc >> System name: Linux >> Release: 4.10.0-38-generic >> Version: #42~16.04.1-Ubuntu SMP Tue Oct 10 16:32:20 UTC 2017 >> Machine: x86_64 </pre> <p>Before then displaying the menu again. Note that the actual uname info provided will vary from machine to machine.</p>
Actual	As expected
Screen	 <pre> File Edit View Search Terminal Help alex@alex-pc ~/code/spccw/client \$ clear alex@alex-pc ~/code/spccw/client \$./client Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 3 >> Node name: alex-pc >> System name: Linux >> Release: 4.10.0-38-generic >> Version: #42~16.04.1-Ubuntu SMP Tue Oct 10 16:32:20 UTC 2017 >> Machine: x86_64 Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: █ </pre>

Test	007
Description	Get file list creates upload directory
Input	<p>Check that the upload directory does not exist for the server: <code>ls</code></p> <p>In first terminal start the server: <code>./server</code></p> <p>In the second terminal start the client: <code>./client</code></p> <p>Then select option 4 from the client menu.</p> <p>Exit from the client by pressing 6 and the server by pressing CTRL+C.</p> <p>Enter <code>ls</code> to check that the upload directory has been created.</p>
Expected	<p>The upload directory should now exist in the server directory.</p> <p>The server should display the following:</p> <pre>alex@alex-pc ~/code/spccw/server \$ ls Makefile server server.c server.o alex@alex-pc ~/code/spccw/server \$./server Waiting for incoming connections... Waiting for a client to connect... Connection accepted... Handler assigned Waiting for a client to connect... Created upload directory Thread 140514285491968 exiting ^C Total execution time: 10.17 seconds Exiting... alex@alex-pc ~/code/spccw/server \$ ls Makefile server server.c server.o upload alex@alex-pc ~/code/spccw/server \$</pre> <p>The client should display:</p> <pre>Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 4 >> List of server files (0): Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit</pre>

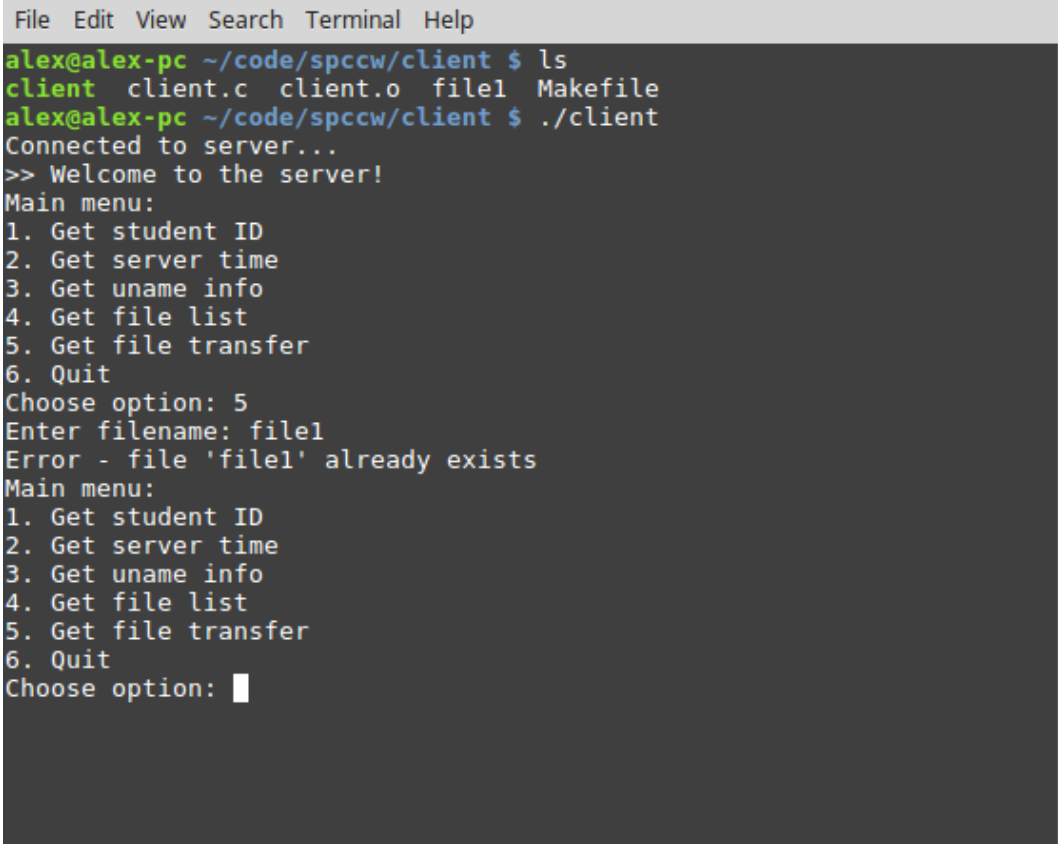
	<p>Choose option: 6 Now exiting!</p> <p>Note: the thread ID and execution times will vary depending on the test.</p>
Actual	As expected
Screen	 <p>The screenshot displays two terminal windows side-by-side. The left window, titled 'alex@alex-pc ~/code/spccw/server', shows the compilation of 'server.c' into 'server.o' and the execution of './server'. The server program outputs messages about waiting for connections, accepting a connection, and then exiting with a total execution time of 10.17 seconds. The right window, titled 'alex@alex-pc ~/code/spccw/client', shows the execution of './client'. The client connects to the server, displays a main menu with options 1-6, chooses option 4 to list server files (which returns an empty list), chooses option 6 to quit, and then exits.</p>

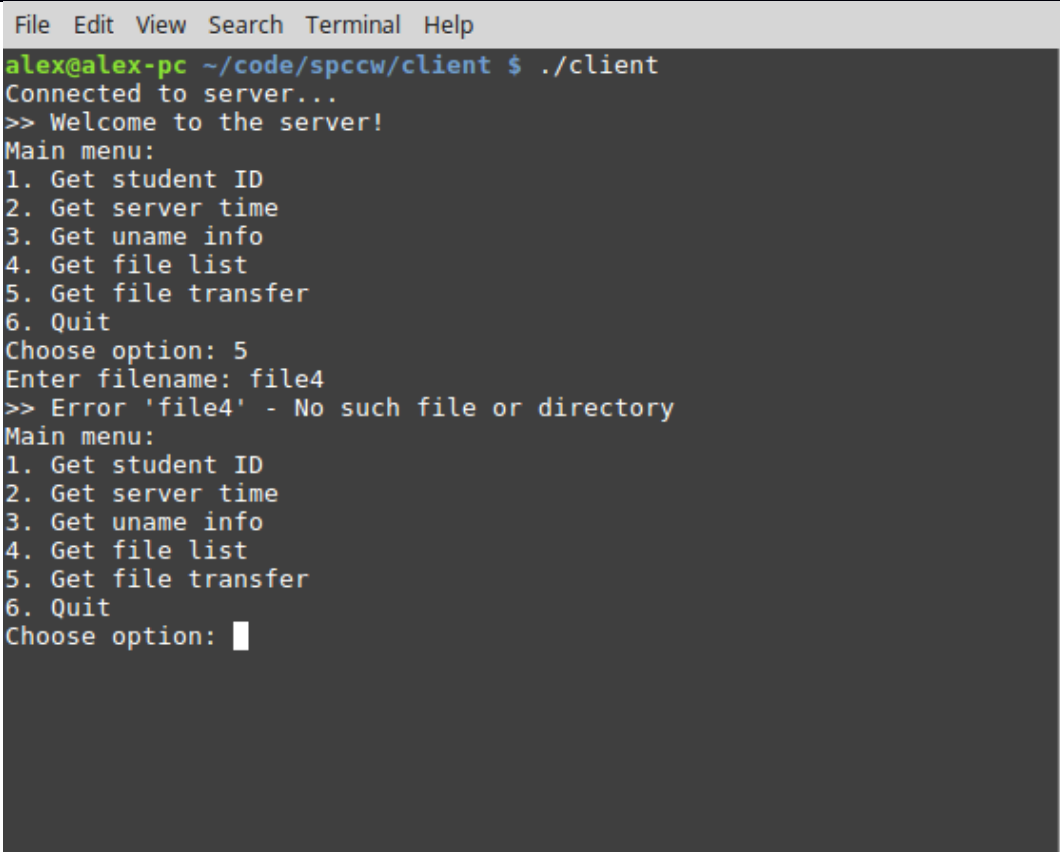
Test	008
Description	Get file list correctly lists files in upload directory
Input	<p>Add some files to the upload directory named file1, file2, and file3: <code>ls > upload/file1</code></p> <p>In first terminal start the server: <code>./server</code></p> <p>In the second terminal start the client: <code>./client</code></p> <p>Then select option 4 from the client menu.</p>
Expected	<p>The upload directory should now exist in the server directory.</p> <p>The client should display the following:</p> <pre> Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 4 >> List of server files (3): >> file3 >> file2 >> file1 </pre>
Actual	As expected
Screen	

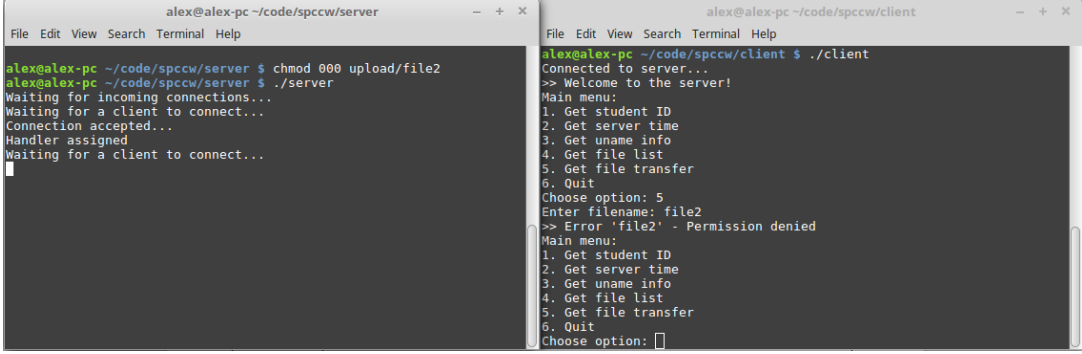
Test	009
Description	Get file list shows error if upload directory permissions not set
Input	<p>Set the upload directory to have restrictive permissions: <code>chmod 000 upload</code></p> <p>In first terminal start the server: <code>./server</code></p> <p>In the second terminal start the client: <code>./client</code></p> <p>Then select option 4 from the client menu. Set the permissions back to something more sensible: <code>chmod 774 upload</code></p>
Expected	<p>The upload directory should now exist in the server directory.</p> <p>The client should display the following:</p> <pre> Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 4 >> Error - failed to read server directory: Permission denied </pre>
Actual	As expected
Screen	 <p>The screenshot shows two terminal windows side-by-side. The left window is titled 'alex@alex-pc ~/code/spccw/server' and shows the server's execution. It starts with setting permissions to 000, then runs './server'. It shows it's waiting for connections, a connection is accepted, and it displays a menu. The right window is titled 'alex@alex-pc ~/code/spccw/client' and shows the client running './client'. It connects to the server, displays the same menu, and selects option 4. The output shows an error: 'Error - failed to read server directory: Permission denied'.</p>

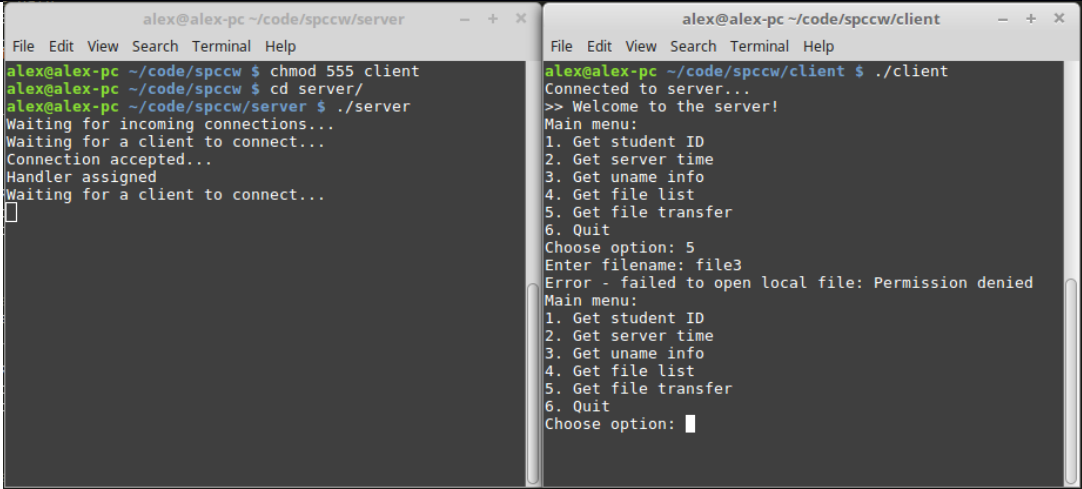
Test	010
Description	Get file transfer works correctly
Input	<p>In first terminal start the server: <code>./server</code></p> <p>In the second terminal get a list of current files to make sure directory does not contain file1, then start the client: <code>./client</code></p> <p>Then select option 5 from the client menu and enter 'file1' and press enter.</p> <p>Exit the menu (option 6) and run ls again to check that 'file1' has been transferred.</p>
Expected	<p>The server should display the following:</p> <pre>Waiting for incoming connections... Waiting for a client to connect... Connection accepted... Handler assigned Waiting for a client to connect... Thread 139786179524352 exiting</pre> <p>Before then displaying the menu again. Note that the actual uname info provided will vary from machine to machine. The client should display:</p> <pre>alex@alex-pc ~/code/spccw/client \$ ls client client.c client.o Makefile alex@alex-pc ~/code/spccw/client \$./client Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 5 Enter filename: file1 >> Transferred 41 of 41 bytes >> File transfer of 'file1' complete! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 6 Now exiting! alex@alex-pc ~/code/spccw/client \$ ls client client.c client.o file1 Makefile</pre> <p>Note: the exact contents of the server and client directories may vary.</p>
Actual	As expected

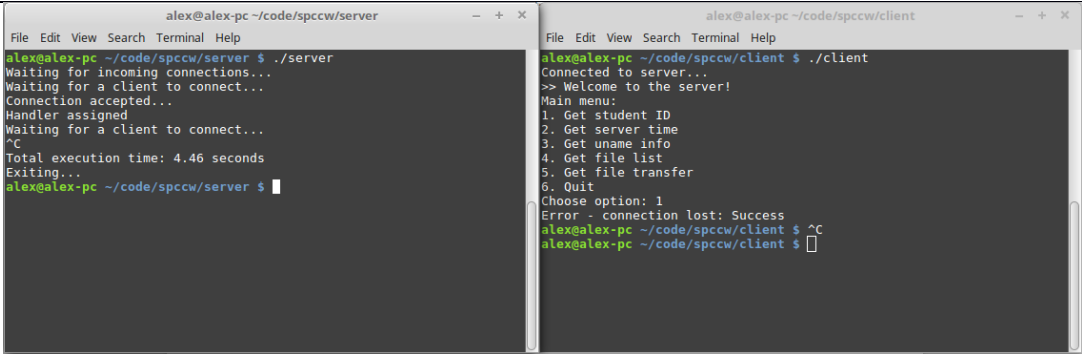
Screen	
<pre>alex@alex-pc ~/code/spccw/server File Edit View Search Terminal Help alex@alex-pc ~/code/spccw/server \$ ls -l upload total 12 -rw-rw-r-- 1 alex alex 41 Dec 4 13:21 file1 -rw-rw-r-- 1 alex alex 41 Dec 4 13:21 file2 -rw-rw-r-- 1 alex alex 41 Dec 4 13:21 file3 alex@alex-pc ~/code/spccw/server \$./server Waiting for incoming connections... Waiting for a client to connect... Connection accepted... Handler assigned Waiting for a client to connect... Thread 139855339710208 exiting </pre>	<pre>alex@alex-pc ~/code/spccw/client File Edit View Search Terminal Help alex@alex-pc ~/code/spccw/client \$./client Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 5 Enter filename: file1 >> Transferred 41 of 41 bytes >> File transfer of 'file1' complete! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 6 Now exiting! alex@alex-pc ~/code/spccw/client \$ ls -l total 64 -rwxrwxr-x 1 alex alex 27184 Dec 4 12:06 client -rw-rw-r-- 1 alex alex 7405 Dec 4 12:06 client.c -rw-rw-r-- 1 alex alex 18320 Dec 4 12:06 client.o -rw-rw-r-- 1 alex alex 41 Dec 4 13:39 file1 -rw-rw-r-- 1 alex alex 410 Dec 4 11:44 Makefile alex@alex-pc ~/code/spccw/client \$ </pre>

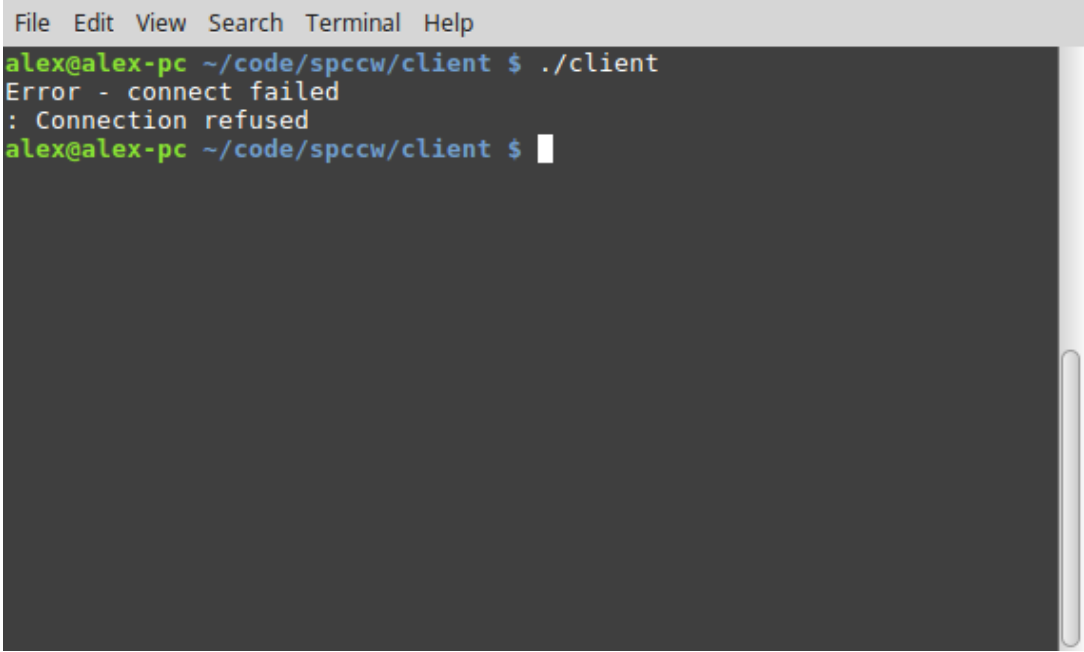
Test	011
Description	Get file transfer shows file already exists error to transfer file that is already present in client directory
Input	<p>In first terminal start the server: <code>./server</code></p> <p>In the second terminal, run <code>ls</code> to check that the file 'file1' exists, then start the client: <code>./client</code></p> <p>Then select option 5 from the client menu, enter 'file1' and press enter.</p>
Expected	<p>The client should display the following:</p> <pre> Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 5 Enter filename: file1 Error - file 'file1' already exists </pre> <p>Before then displaying the menu again.</p>
Actual	As expected
Screen	 <pre> File Edit View Search Terminal Help alex@alex-pc ~/code/spccw/client \$ ls client client.c client.o file1 Makefile alex@alex-pc ~/code/spccw/client \$./client Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 5 Enter filename: file1 Error - file 'file1' already exists Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: █ </pre>

Test	012
Description	Get file transfer shows file not found error when asked to transfer file not in upload directory
Input	<p>In first terminal start the server: <code>./server</code></p> <p>In the second terminal start the client: <code>./client</code></p> <p>Then select option 5 from the client menu, enter 'file4' and press enter.</p>
Expected	<p>The client should display the following:</p> <pre> Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 5 Enter filename: file4 >> Error 'file4' - No such file or directory Before then displaying the menu again. </pre>
Actual	As expected
Screen	 <pre> File Edit View Search Terminal Help alex@alex-pc ~/code/spccw/client \$./client Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 5 Enter filename: file4 >> Error 'file4' - No such file or directory Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: </pre>

Test	013
Description	Get file transfer shows permission error when asked to transfer file with restricted permissions
Input	<p>Set permission on 'file3' in the upload directory to prevent reading: <code>chmod 000 upload/file2</code></p> <p>In first terminal start the server: <code>./server</code></p> <p>In the second terminal start the client: <code>./client</code></p> <p>Then select option 5 from the client menu, enter 'file1' and press enter.</p>
Expected	<p>The client should display the following:</p> <pre> Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 5 Enter filename: file2 >> Error 'file2' - Permission denied </pre>
Actual	As expected
Screen	 <p>The screenshot shows two terminal windows side-by-side. The left window is titled 'alex@alex-pc ~/code/spccw/server' and shows the following commands and output:</p> <pre> alex@alex-pc ~/code/spccw/server \$ chmod 000 upload/file2 alex@alex-pc ~/code/spccw/server \$./server Waiting for incoming connections... Waiting for a client to connect... Connection accepted... Handler assigned Waiting for a client to connect... </pre> <p>The right window is titled 'alex@alex-pc ~/code/spccw/client' and shows the following commands and output:</p> <pre> alex@alex-pc ~/code/spccw/client \$./client Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 5 Enter filename: file2 >> Error 'file2' - Permission denied Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: </pre>

Test	014
Description	Get file transfer shows suitable error if client local directory not writable
Input	<p>Set permission on the 'client' directory to prevent writing: <code>chmod 555 client</code></p> <p>In first terminal start the server: <code>./server</code></p> <p>In the second terminal start the client: <code>./client</code></p> <p>Then select option 5 from the client menu, enter 'file3' and press enter.</p> <p>After test is complete set client folder back to <code>chmod 775 client</code>.</p>
Expected	<p>The client should display the following:</p> <pre> Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 5 Enter filename: file3 Error - failed to open local file: Permission denied </pre>
Actual	As expected
Screen	 <p>The screenshot displays two terminal windows side-by-side. The left window, titled 'alex@alex-pc ~/code/spccw/server', shows the server's execution: setting permissions on the client directory, running the server binary, and waiting for a connection. The right window, titled 'alex@alex-pc ~/code/spccw/client', shows the client's execution: running the client binary, connecting to the server, displaying a menu, selecting option 5, entering 'file3', and receiving the error message 'Error - failed to open local file: Permission denied'.</p>

Test	015
Description	Client deals with losing server connection gracefully
Input	<p>In first terminal start the server: <code>./server</code></p> <p>In the second terminal start the client: <code>./client</code></p> <p>Kill the server with CTRL+C and then select option 1 from client menu.</p>
Expected	<p>The client should display the following:</p> <pre> Connected to server... >> Welcome to the server! Main menu: 1. Get student ID 2. Get server time 3. Get uname info 4. Get file list 5. Get file transfer 6. Quit Choose option: 1 Error - connection lost: Success </pre>
Actual	As expected
Screen	 <p>The image shows two terminal windows side-by-side. The left window is titled 'alex@alex-pc ~/code/spccw/server' and shows the output of running './server'. It displays messages like 'Waiting for incoming connections...', 'Waiting for a client to connect...', 'Connection accepted...', 'Handler assigned', and 'Waiting for a client to connect...'. It then shows a Ctrl+C signal and 'Total execution time: 4.46 seconds' before exiting. The right window is titled 'alex@alex-pc ~/code/spccw/client' and shows the output of running './client'. It displays 'Connected to server...', '>> Welcome to the server!', and a 'Main menu' with options 1 through 6. Option 1 is chosen, and the message 'Error - connection lost: Success' is displayed. The user then presses Ctrl+C to kill the client process.</p>

Test	016
Description	Client deals gracefully with not being able to connect to server
Input	In the second terminal start the client, without the server being active: <code>./client</code>
Expected	The client should display the following: Error - connect failed : Connection refused
Actual	As expected
Screen	 A screenshot of a terminal window. The title bar shows 'File Edit View Search Terminal Help'. The terminal content shows the prompt 'alex@alex-pc ~/code/spccw/client \$' followed by the command './client'. The output is 'Error - connect failed' and ': Connection refused'. The prompt returns to 'alex@alex-pc ~/code/spccw/client \$' with a cursor.