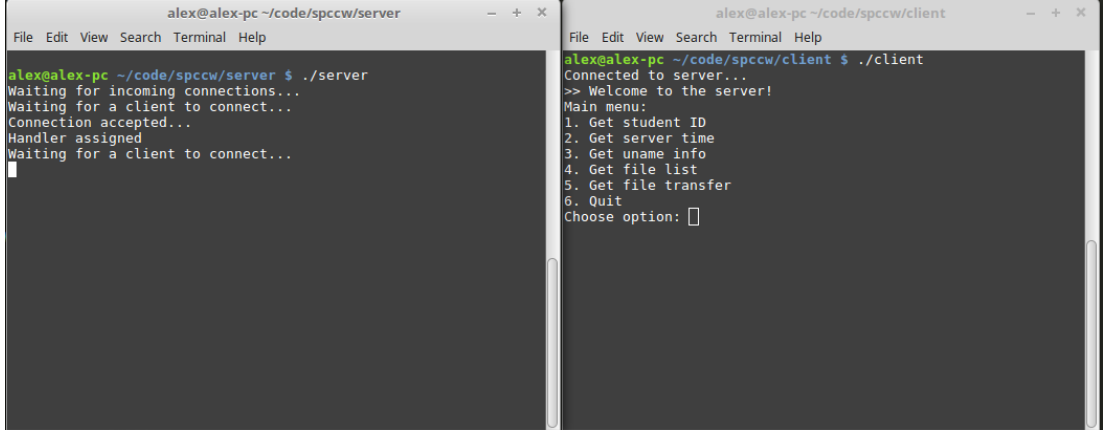
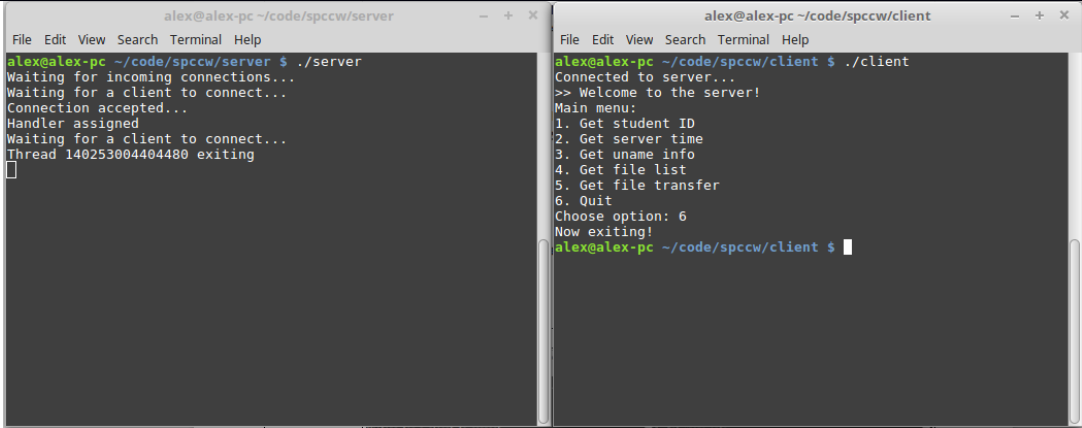
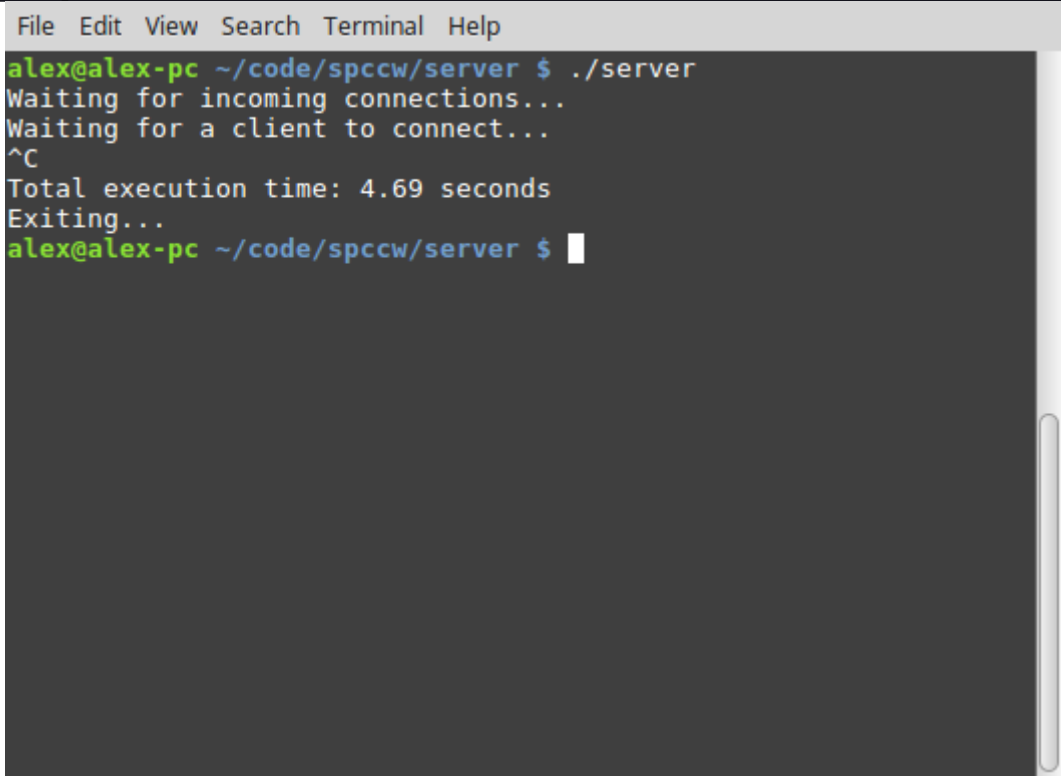
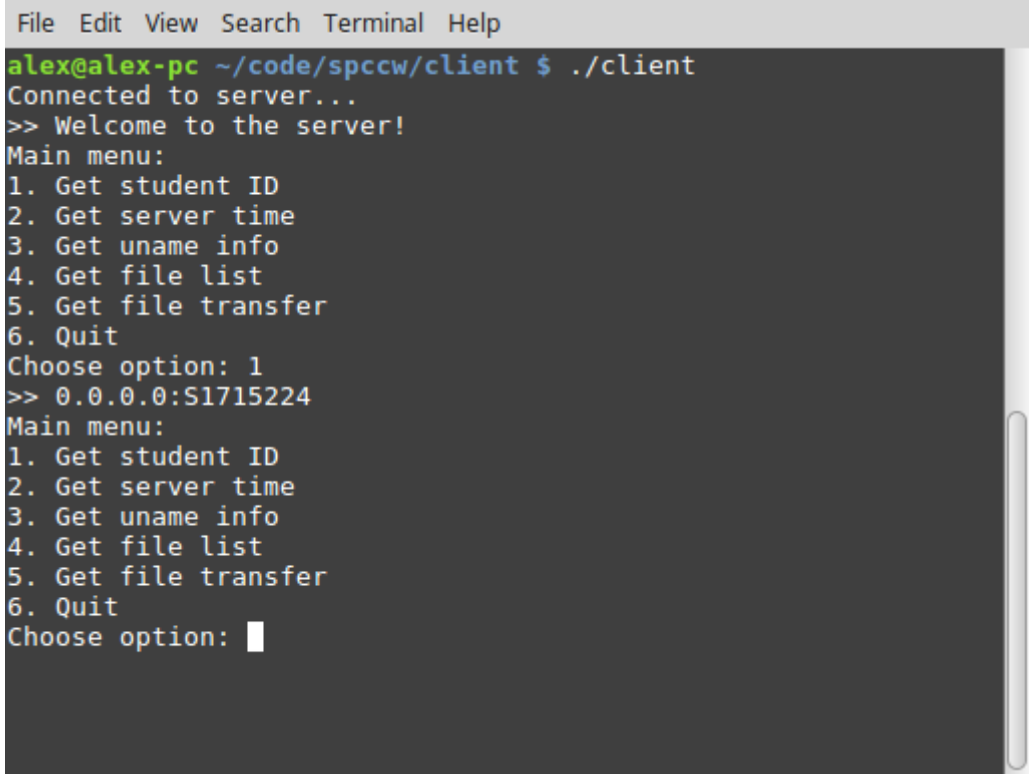


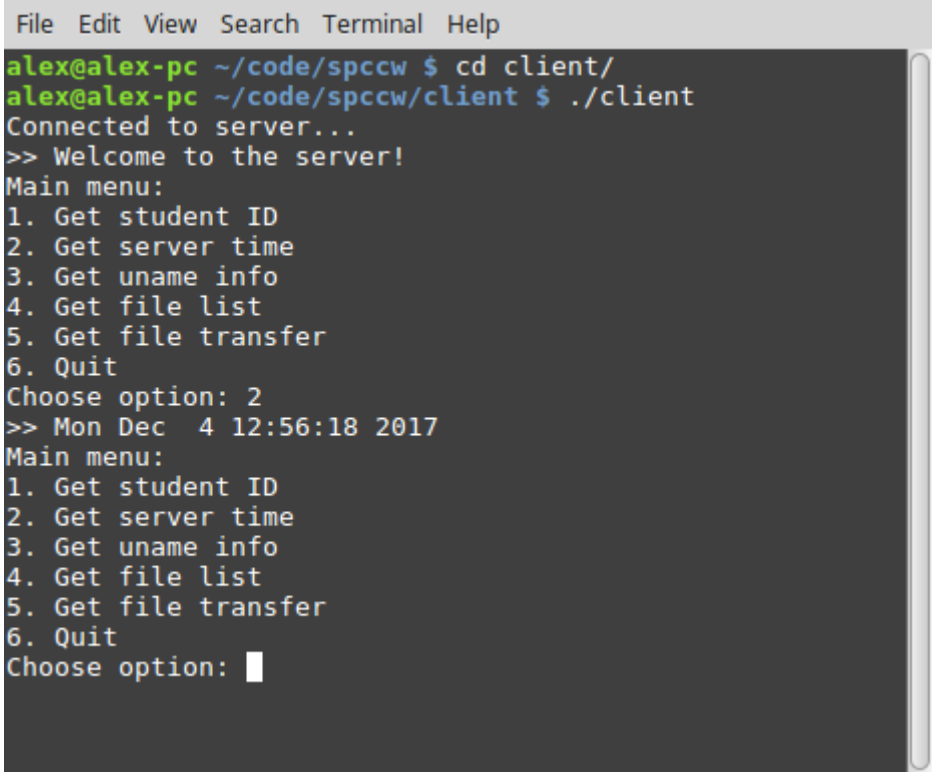
| | |
|----------------------|---|
| System | Client/Server (C coursework) |
| Author | Alex McBride |
| Student ID | S1715224 |
| Student Email | AMCBRI206@caledonian.ac.uk |
| Date | 04/12/2017 |
| Before | It's required to run both server and client in different terminal windows, so you can see the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

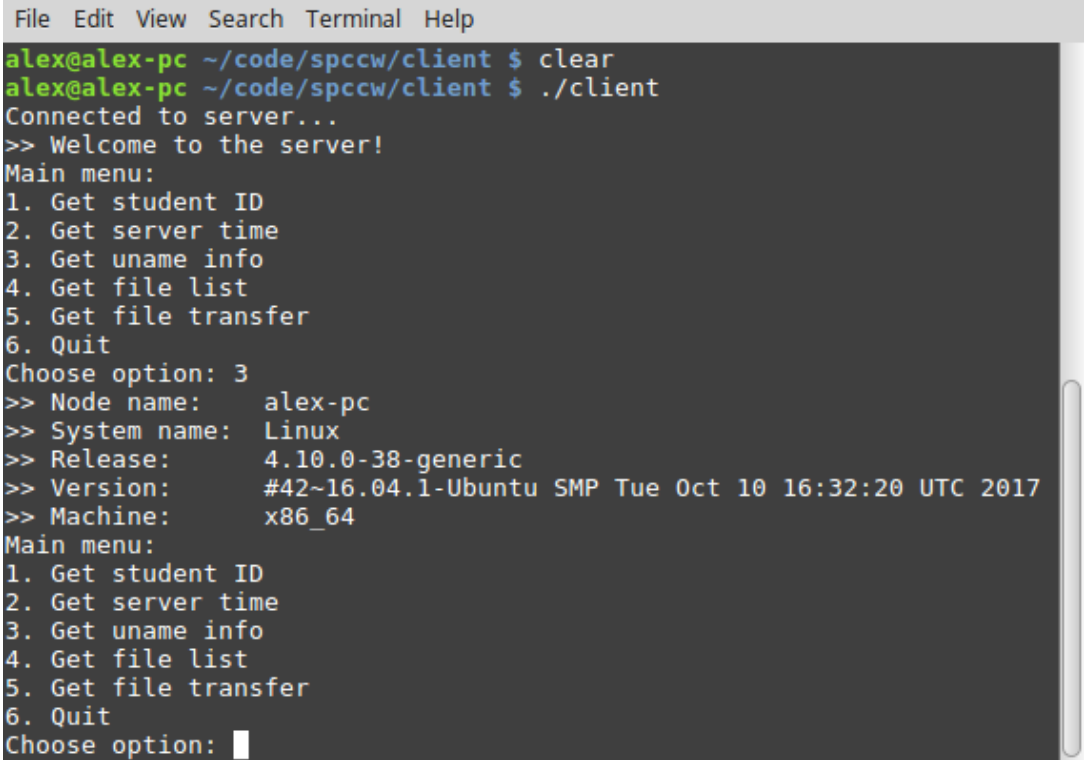
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| Test | 001 |
| Description | Client connects to server |
| Input | <p>In first terminal start the server: <code>./server</code></p> <p>In the second terminal start the client: <code>./client</code></p> |
| Expected | <p>The server should display 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 |  <p>The screenshot shows two terminal windows. The left window, titled 'alex@alex-pc ~/code/spccw/server', shows the output of running './server'. The output is: 'Waiting for incoming connections...', 'Waiting for a client to connect...', 'Connection accepted...', 'Handler assigned', and 'Waiting for a client to connect...'. The right window, titled 'alex@alex-pc ~/code/spccw/client', shows the output of running './client'. The output is: '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: ' followed by a cursor.</p> |

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| 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 |  |

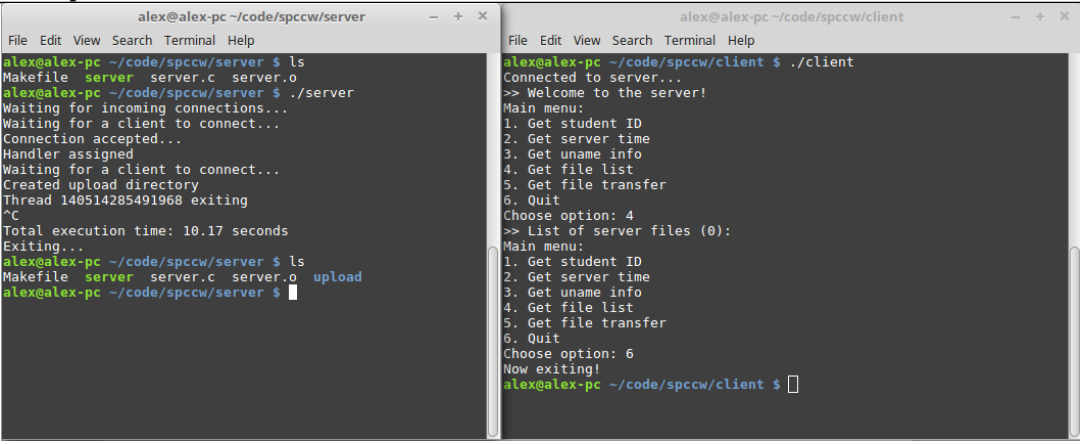
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| Test | 003 |
| Description | Server closes correctly on interrupt |
| Input | <p>In first terminal start the server: <code>./server</code></p> <p>Then press Ctrl+C to send SIGINT to the server process.</p> |
| Expected | <p>The server should display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

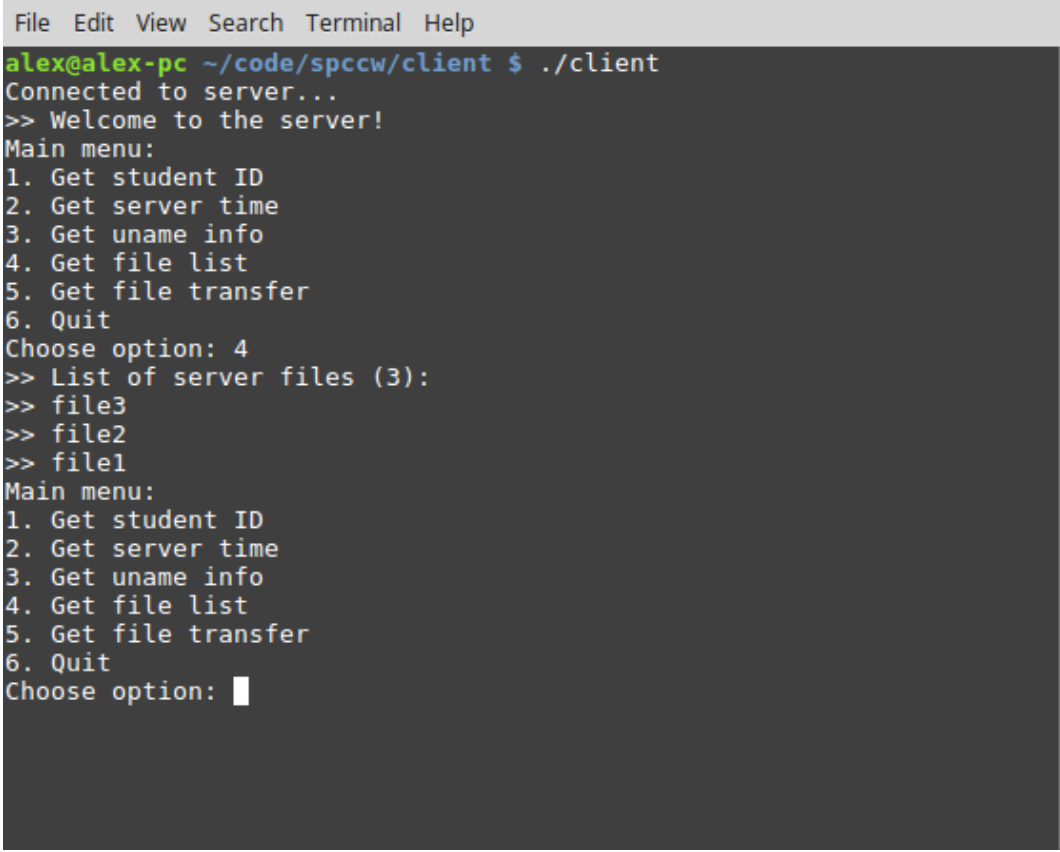
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| Test | 004 |
| Description | Get student ID works correctly |
| Input | <p>In first terminal start the server: <code>./server</code></p> <p>In the second terminal start the client: <code>./client</code></p> <p>Then select option 1 from the client 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 >> 0.0.0.0:S1715224 </pre> <p>Before then displaying the menu again. Note the IP address only works on the lab VM, on this test machine it is returned as 0.0.0.0.</p> |
| 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: 1 >> 0.0.0.0: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: █ </pre> |

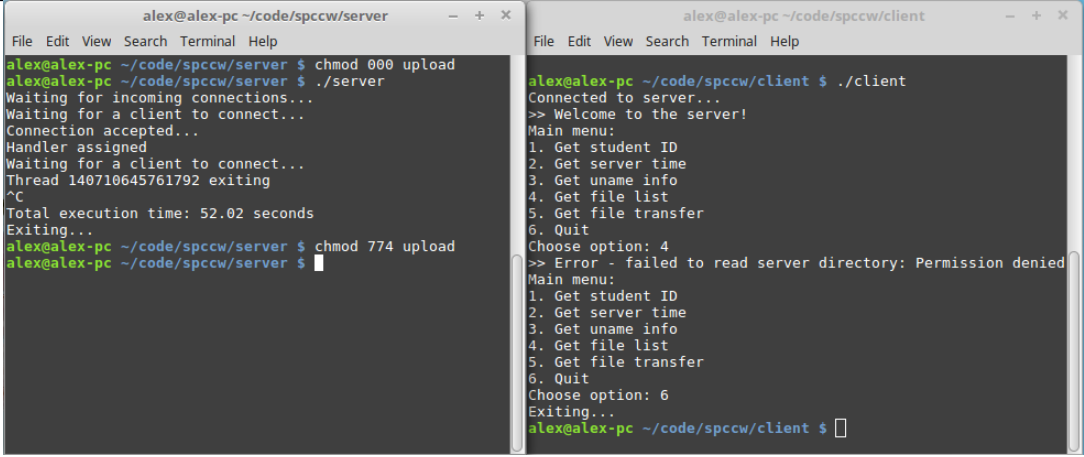
| | |
|--------------------|---|
| Test | 005 |
| Description | Get server time works correctly |
| Input | <p>In first terminal start the server: <code>./server</code></p> <p>In the second terminal start the client: <code>./client</code></p> <p>Then select option 2 from the client menu</p> |
| Expected | <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> |

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| 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> |

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| 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 ls to check that the upload directoy has been created.</p> |
| Expected | <p>The upload directory should now exist in the server directory: <code>ls</code></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 Choose option: 6</pre> |

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| | <p>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', the execution of './server', and the server's operation. It logs 'Waiting for incoming connections...', 'Connection accepted...', 'Handler assigned', and 'Waiting for a client to connect...'. After a client connects, it shows 'Created upload directory' and 'Thread 140514285491968 exiting'. The total execution time is 10.17 seconds. The right window, titled 'alex@alex-pc ~/code/spccw/client', shows the execution of './client', which connects to the server and displays a 'Main menu' with options: 1. Get student ID, 2. Get server time, 3. Get uname info, 4. Get file list, 5. Get file transfer, 6. Quit. The user selects option 4, and the client displays 'List of server files (0):'. The user then selects option 6, and the client displays 'Now exiting!'.</p> |

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| 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: ls > upload/file1</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: ls</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 |  <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: 4 >> List of server files (3): >> file3 >> file2 >> file1 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> |

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| 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: <code>ls</code></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 image 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 <code>alex@alex-pc ~/code/spccw/server \$ chmod 000 upload</code>, then <code>alex@alex-pc ~/code/spccw/server \$./server</code>. The server outputs 'Waiting for incoming connections...', 'Waiting for a client to connect...', 'Connection accepted...', 'Handler assigned', 'Waiting for a client to connect...', 'Thread 140710645761792 exiting', '^C', 'Total execution time: 52.02 seconds', and 'Exiting...'. Then it runs <code>alex@alex-pc ~/code/spccw/server \$ chmod 774 upload</code> and <code>alex@alex-pc ~/code/spccw/server \$</code>. The right window is titled 'alex@alex-pc ~/code/spccw/client' and shows the client's execution. It starts with <code>alex@alex-pc ~/code/spccw/client \$./client</code>. The client outputs 'Connected to server...', '>> Welcome to the server!', 'Main menu:', a list of options (1-6), 'Choose option: 4', '>> Error - failed to read server directory: Permission denied', 'Main menu:', the same list of options, 'Choose option: 6', 'Exiting...', and ends with <code>alex@alex-pc ~/code/spccw/client \$</code>.</p> |

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| 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 alex@alex-pc ~/code/spccw/client \$</pre> <p>Note: the exact contents of the server and client directories may vary.</p> |
| Actual | As expected |

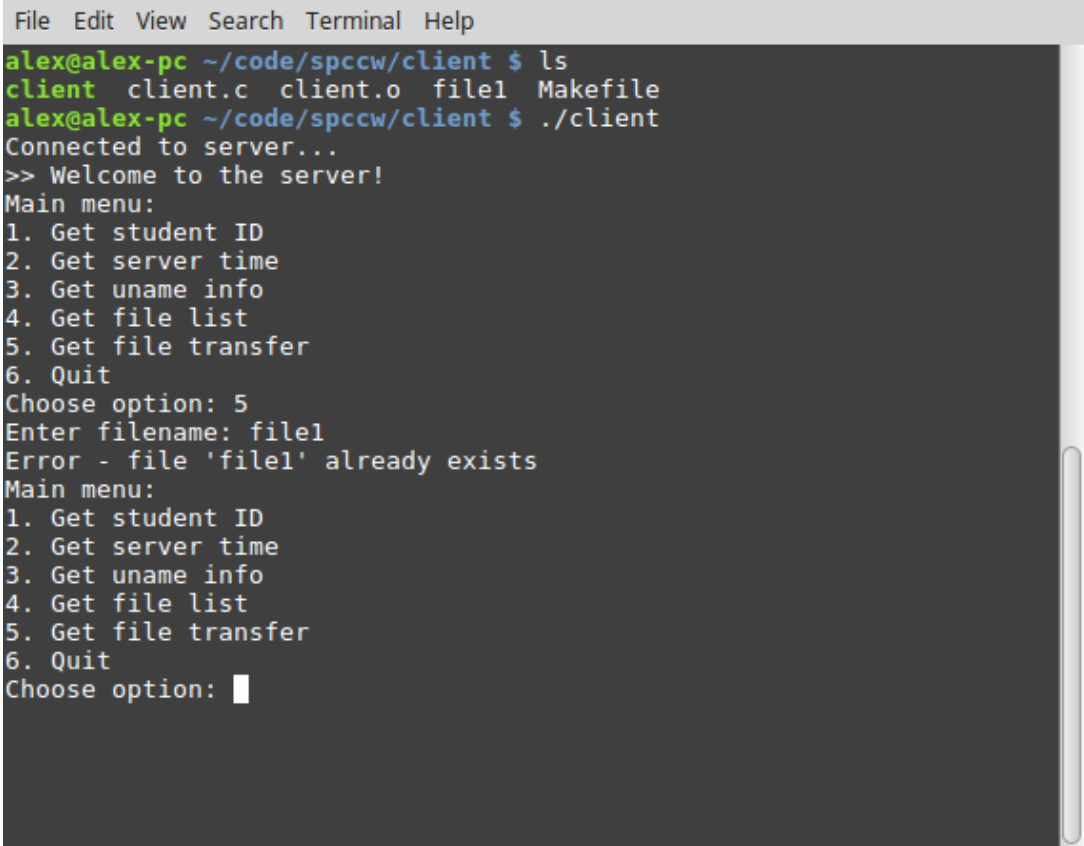
Screen

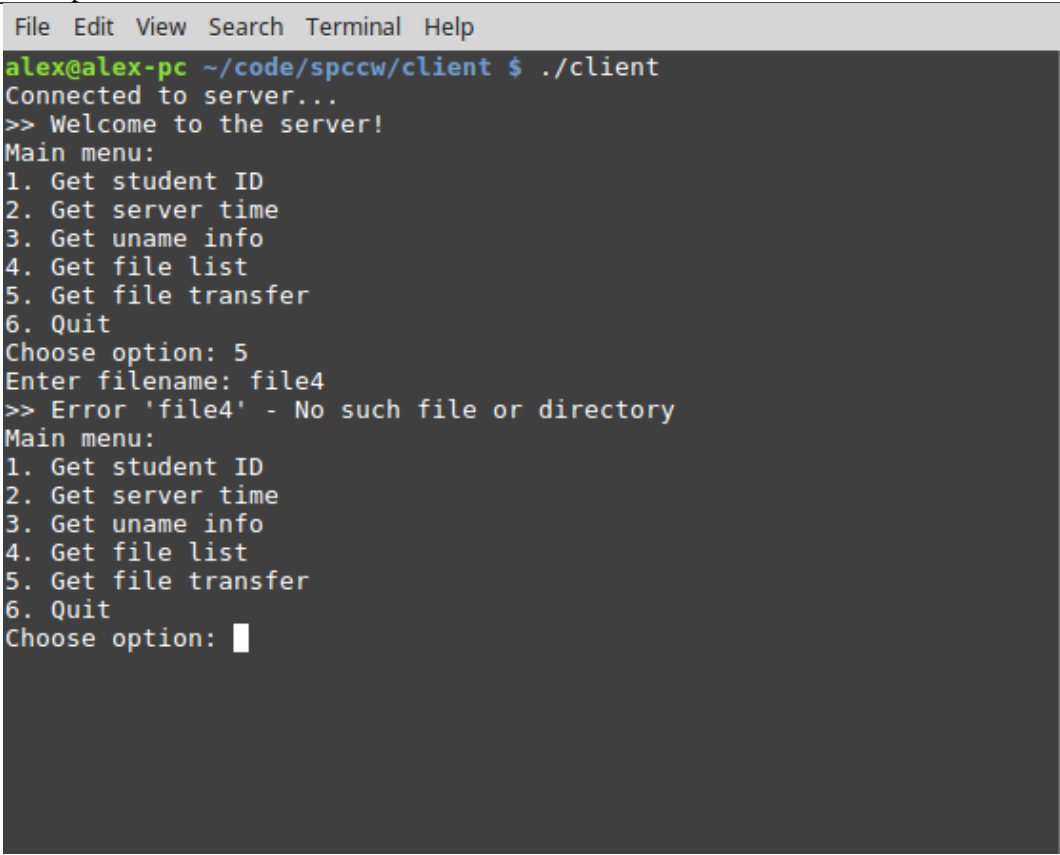
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alex@alex-pc ~/code/spccw/server
File Edit View Search Terminal Help

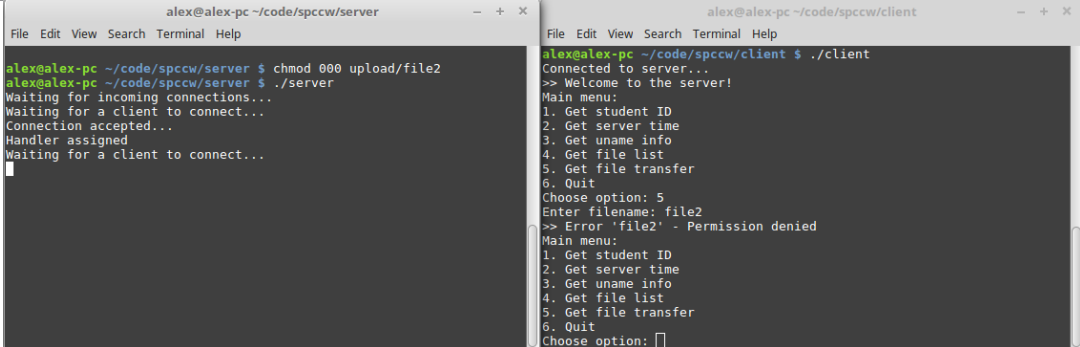
alex@alex-pc ~/code/spccw/server $ ls -l upload
total 12
-rw-rw-r-- 1 alex alex 41 Dec  4 13:21 file1
-rw-rw-r-- 1 alex alex 41 Dec  4 13:21 file2
-rw-rw-r-- 1 alex alex 41 Dec  4 13:21 file3
alex@alex-pc ~/code/spccw/server $ ./server
Waiting for incoming connections...
Waiting for a client to connect...
Connection accepted...
Handler assigned
Waiting for a client to connect...
Thread 139855339710208 exiting
^

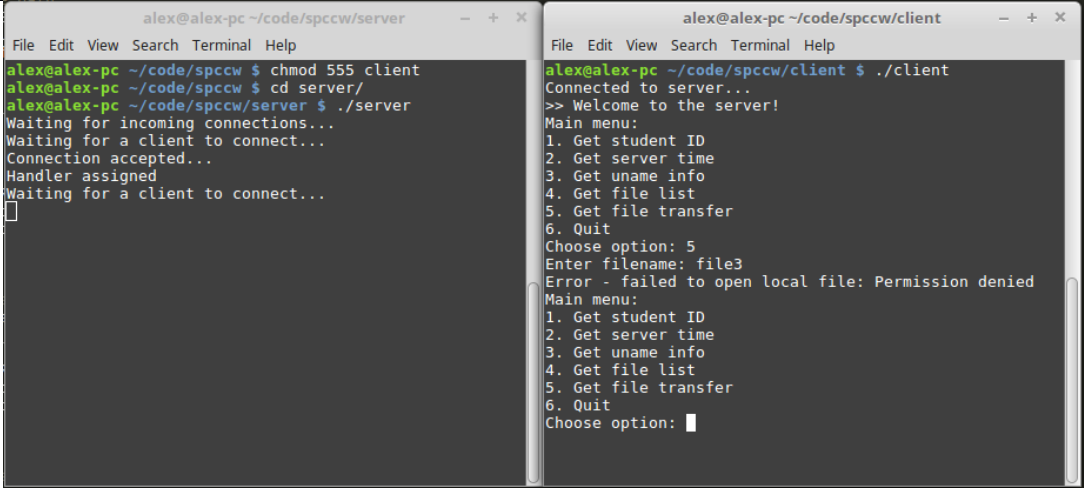
alex@alex-pc ~/code/spccw/client
File Edit View Search Terminal Help

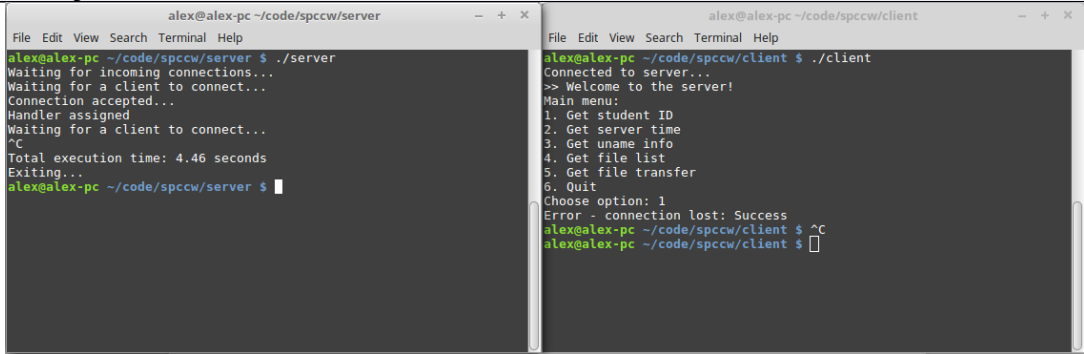
alex@alex-pc ~/code/spccw/client $ ./client
Connected to server...
>> Welcome to the server!
Main menu:
1. Get student ID
2. Get server time
3. Get uname info
4. Get file list
5. Get file transfer
6. Quit
Choose option: 5
Enter filename: file1
>> Transferred 41 of 41 bytes
>> File transfer of 'file1' 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 $
```

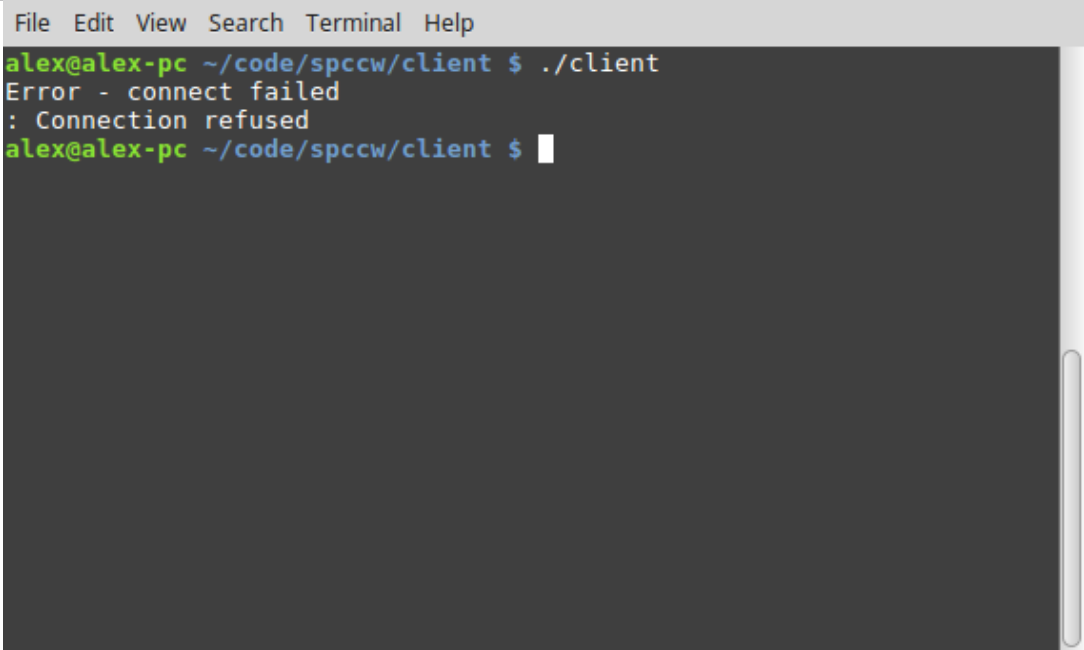
| | |
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| Test | 011 |
| Description | Get file transfer shows file already exists error to transfer file that is already present in client directory |
| Input | <p>In first terminal start the server: <code>./server</code></p> <p>In the second terminal, run 'ls' 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 Before then displaying the menu again. </pre> |
| 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> |

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| 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> |

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| Test | 013 |
| Description | Get file transfer shows permission error when asked to transfer file not in upload directory |
| 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 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 'upload/file2', starting the server with './server', and waiting for a client connection. The right window, titled 'alex@alex-pc ~/code/spccw/client', shows the client's execution: starting the client with './client', connecting to the server, displaying a main menu with six options, selecting option 5, entering 'file2' as the filename, and receiving the error message '>> Error 'file2' - Permission denied'.</p> |

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| 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, navigating to the server directory, and running the server. It shows it is waiting for connections and has accepted one. The right window, titled 'alex@alex-pc ~/code/spccw/client', shows the client's execution: running the client, connecting to the server, displaying the main menu, selecting option 5, entering 'file3', and displaying the error message 'Error - failed to open local file: Permission denied'.</p> |

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| 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 |  |

| | |
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| 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 with a menu bar at the top containing 'File', 'Edit', 'View', 'Search', 'Terminal', and 'Help'. The terminal content shows a prompt 'alex@alex-pc ~/code/spccw/client \$' followed by the command './client'. The output of the command is 'Error - connect failed' followed by a new line and ': Connection refused'. The prompt returns to 'alex@alex-pc ~/code/spccw/client \$' with a cursor. The terminal has a dark background and a scrollbar on the right side. |