

**COMPSCI 3SH3 Winter, 2021**  
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# **Assignment #2**

## **Socket Programming**

**NOTE:**

Test Cases For Python Socket Programming Assignment.

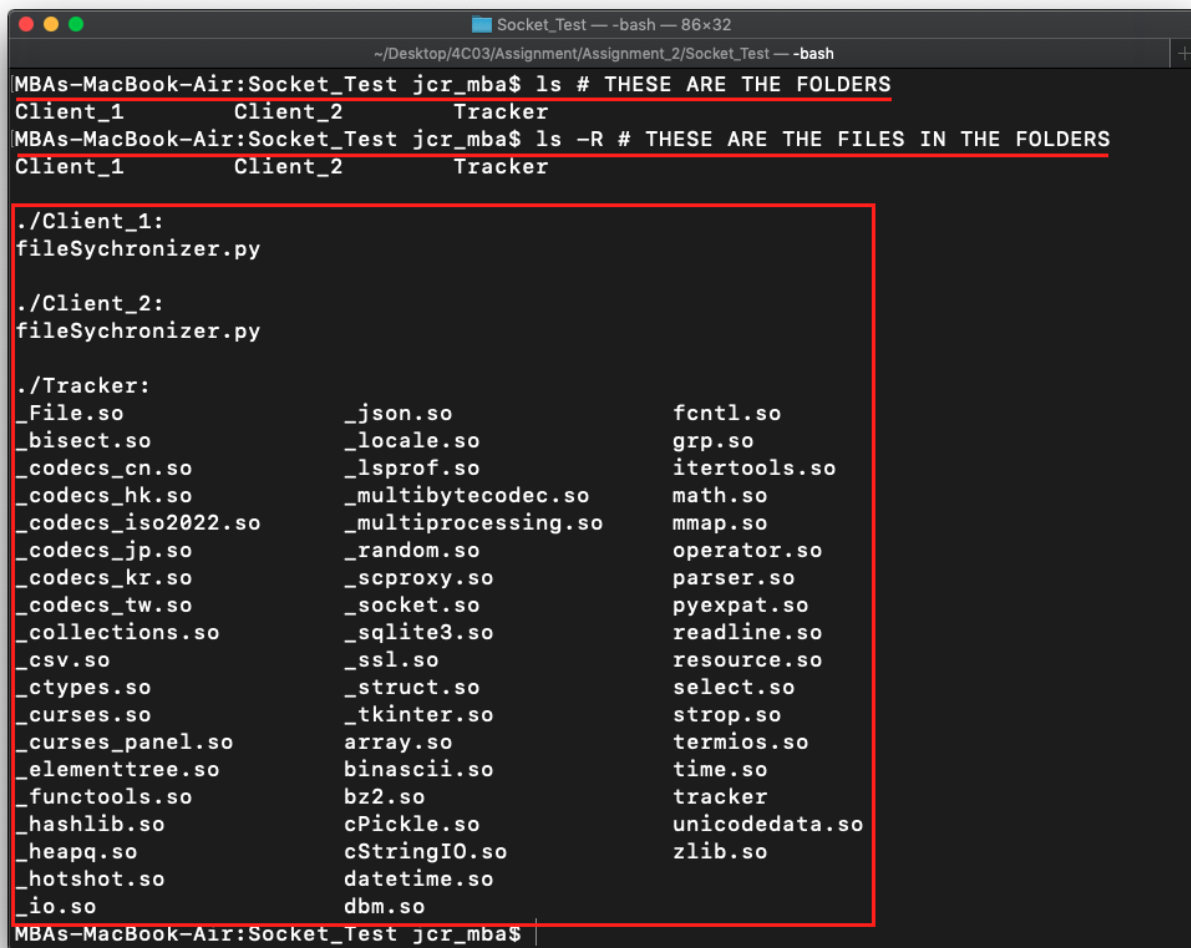
The following is done on macOS 10.14.6.

The left-terminal is *Client 1*, and the right-terminal is *Client 2*.

Knowledge of the *tracker* executable is assumed. Please reference *instructions.pdf* in the *A2.zip*.

All errors in the terminal window are keyboard interrupts. This is done to stop the program.

**Precursor Step – Create the following hierarchy:**



The image shows a terminal window titled "Socket\_Test" with a window size of 86x32. The terminal is running a bash shell. The user has executed the following commands:

```
MBAs-MacBook-Air:Socket_Test jcr_mba$ ls # THESE ARE THE FOLDERS
Client_1      Client_2      Tracker
MBAs-MacBook-Air:Socket_Test jcr_mba$ ls -R # THESE ARE THE FILES IN THE FOLDERS
Client_1      Client_2      Tracker
```

The output of the `ls -R` command is displayed in a red-bordered box:

```
./Client_1:
fileSynchronizer.py

./Client_2:
fileSynchronizer.py

./Tracker:
_File.so          _json.so         fcntl.so
_bisect.so        _locale.so       grp.so
_codecs_cn.so     _lsprof.so       itertools.so
_codecs_hk.so     _multibytecodec.so math.so
_codecs_iso2022.so _multiprocessing.so mmap.so
_codecs_jp.so     _random.so       operator.so
_codecs_kr.so     _scproxy.so      parser.so
_codecs_tw.so     _socket.so       pyexpat.so
_collections.so   _sqlite3.so      readline.so
_csv.so           _ssl.so          resource.so
_ctypes.so        _struct.so       select.so
_curses.so        _tkinter.so      strop.so
_curses_panel.so  array.so         termios.so
_elementtree.so   binascii.so      time.so
_funcertools.so   bz2.so           tracker
_hashlib.so       cPickle.so       unicodedata.so
_heapq.so         cStringIO.so     zlib.so
_hotshot.so       datetime.so
_io.so            dbm.so
```

A) Create a folder called *Socket\_Test*. Inside that folder create 3 new folders: *Client\_1*, *Client\_2*, & *Tracker*.

B) Inside the *Tracker* folder, paste all the binary files pertaining to the *tracker* file. These are the files in the *BIN* folder.

C) Inside the *Client\_1* and *Client\_2* folders, you need to paste the *fileSynchronizer.py* python file.

## Test Case 1: 1 Unique File In *Client\_1*, and Nothing In *Client\_2*

```
Client_1 — -bash — 80x36
~/Desktop/4C03/Assignment/Assignment_2/Socket_Test/Client_1 — -bash

MBAs-MacBook-Air:Client_1 jcr_mba$ ls
fileSynchronizer.py  uniqueFile.txt
MBAs-MacBook-Air:Client_1 jcr_mba$ python3.9 fileSynchronizer.py 127.0.0.1 8899
Waiting for connections on port 8900
('connect to: 127.0.0.1', 8899)
received from tracker: b'{"fileSynchronizer.py": {"ip": "127.0.0.1", "port": 8900
, "mtime": 1613354300}, "uniqueFile.txt": {"ip": "127.0.0.1", "port": 8900, "mti
me": 1613355204}, ".DS_Store": {"ip": "127.0.0.1", "port": 8900, "mtime": 161335
4787}}'
HeartBeat Message: {"port": 8900}
('connect to: 127.0.0.1', 8899)
received from tracker: b'{"fileSynchronizer.py": {"ip": "127.0.0.1", "port": 8900
, "mtime": 1613354300}, "uniqueFile.txt": {"ip": "127.0.0.1", "port": 8900, "mti
me": 1613355204}, ".DS_Store": {"ip": "127.0.0.1", "port": 8900, "mtime": 161335
4787}}'
HeartBeat Message: {"port": 8900}
^CException ignored in: <module 'threading' from '/Library/Frameworks/Python.fra
mework/Versions/3.9/lib/python3.9/threading.py'>
Traceback (most recent call last):
  File "/Library/Frameworks/Python.framework/Versions/3.9/lib/python3.9/threadin
g.py", line 1428, in _shutdown
    lock.acquire()
KeyboardInterrupt:
MBAs-MacBook-Air:Client_1 jcr_mba$

Client_2 — -bash — 80x36
~/Desktop/4C03/Assignment/Assignment_2/Socket_Test/Client_2 — -bash

MBAs-MacBook-Air:Client_2 jcr_mba$ ls
fileSynchronizer.py
MBAs-MacBook-Air:Client_2 jcr_mba$ python3.9 fileSynchronizer.py 127.0.0.1 8899
Waiting for connections on port 8901
('connect to: 127.0.0.1', 8899)
received from tracker: b'{"fileSynchronizer.py": {"ip": "127.0.0.1", "port": 8900
, "mtime": 1613354300}, "uniqueFile.txt": {"ip": "127.0.0.1", "port": 8900, "mti
me": 1613355204}, ".DS_Store": {"ip": "127.0.0.1", "port": 8900, "mtime": 161335
4787}}'
HeartBeat Message: {"port": 8901}
('connect to: 127.0.0.1', 8899)
received from tracker: b'{"fileSynchronizer.py": {"ip": "127.0.0.1", "port": 8900
, "mtime": 1613354300}, "uniqueFile.txt": {"ip": "127.0.0.1", "port": 8900, "mti
me": 1613355204}, ".DS_Store": {"ip": "127.0.0.1", "port": 8900, "mtime": 161335
4787}}'
HeartBeat Message: {"port": 8901}
('connect to: 127.0.0.1', 8899)
received from tracker: b'{"fileSynchronizer.py": {"ip": "127.0.0.1", "port": 8900
, "mtime": 1613354300}, "uniqueFile.txt": {"ip": "127.0.0.1", "port": 8900, "mti
me": 1613355204}, ".DS_Store": {"ip": "127.0.0.1", "port": 8900, "mtime": 161335
4787}}'
HeartBeat Message: {"port": 8901}
^CException ignored in: <module 'threading' from '/Library/Frameworks/Python.fra
mework/Versions/3.9/lib/python3.9/threading.py'>
Traceback (most recent call last):
  File "/Library/Frameworks/Python.framework/Versions/3.9/lib/python3.9/threadin
g.py", line 1428, in _shutdown
    lock.acquire()
KeyboardInterrupt:
MBAs-MacBook-Air:Client_2 jcr_mba$ ls
fileSynchronizer.py  uniqueFile.txt
MBAs-MacBook-Air:Client_2 jcr_mba$

Tracker — tracker 127.0.0.1 8899 — 162x11
~/Desktop/4C03/Assignment/Assignment_2/Socket_Test/Tracker — tracker 127.0.0.1 8899

MBAs-MacBook-Air:Tracker jcr_mba$ ./tracker 127.0.0.1 8899
Waiting for connections on port 8899
Client connected with 127.0.0.1:51822
Client connected with 127.0.0.1:51823
client server127.0.0.1:8900
client server127.0.0.1:8901
client server127.0.0.1:8900
client server127.0.0.1:8901
client server127.0.0.1:8901
```

*Client\_1* contains *uniqueFile.txt*, but *Client\_2* does not contain it. After running the *fileSynchronizer.py* program, the file is copied to *Client\_2*. This is evident in the second *ls* command. The output of the *tracker* executable is shown below, on the left.

## Test Case 2: 1 Unique File In *Client\_1*, and 1 Unique File In *Client\_2*

```
Client_1 -bash 80x36
~/Desktop/4C03/Assignment/Assignment_2/Socket_Test/Client_1 -bash
MBAs-MacBook-Air:Client_1 jcr_mba$ ls
fileSynchronizer.py  uniqueFile.txt
MBAs-MacBook-Air:Client_1 jcr_mba$ python3.9 fileSynchronizer.py 127.0.0.1 8899
Waiting for connections on port 8900
('connect to: 127.0.0.1', 8899)
received from tracker: b'{"fileSynchronizer.py": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613354300}, "uniqueFile.txt": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613355204}, ".DS_Store": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613354787}}'
HeartBeat Message: {"port": 8900}
('connect to: 127.0.0.1', 8899)
received from tracker: b'{"fileSynchronizer.py": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613354300}, "uniqueFile.txt": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613355204}, "otherFile.txt": {"ip": "127.0.0.1", "port": 8901, "mtime": 1613355540}, ".DS_Store": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613354787}}'
HeartBeat Message: {"port": 8900}
^CException ignored in: <module 'threading' from '/Library/Frameworks/Python.framework/Versions/3.9/lib/python3.9/threading.py'>
Traceback (most recent call last):
  File "/Library/Frameworks/Python.framework/Versions/3.9/lib/python3.9/threading.py", line 1428, in _shutdown
    lock.acquire()
KeyboardInterrupt:
MBAs-MacBook-Air:Client_1 jcr_mba$ ls -la
total 40
drwxr-xr-x  6 jcr_mba  staff   192 14 Feb 21:19 .
drwxr-xr-x  6 jcr_mba  staff   192 14 Feb 20:40 ..
-rw-r--r--@ 1 jcr_mba  staff  6148 14 Feb 21:06 .DS_Store
-rw-r--r--@ 1 jcr_mba  staff 10519 14 Feb 20:58 fileSynchronizer.py
-rw-r--r--  1 jcr_mba  staff    0 14 Feb 21:19 otherFile.txt
-rw-r--r--@ 1 jcr_mba  staff    0 14 Feb 21:13 uniqueFile.txt
MBAs-MacBook-Air:Client_1 jcr_mba$

Client_2 -bash 80x36
~/Desktop/4C03/Assignment/Assignment_2/Socket_Test/Client_2 -bash
MBAs-MacBook-Air:Client_2 jcr_mba$ ls
fileSynchronizer.py  otherFile.txt
MBAs-MacBook-Air:Client_2 jcr_mba$ python3.9 fileSynchronizer.py 127.0.0.1 8899
Waiting for connections on port 8901
('connect to: 127.0.0.1', 8899)
received from tracker: b'{"fileSynchronizer.py": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613354300}, "uniqueFile.txt": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613355204}, "otherFile.txt": {"ip": "127.0.0.1", "port": 8901, "mtime": 1613355540}, ".DS_Store": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613354787}}'
HeartBeat Message: {"port": 8901}
('connect to: 127.0.0.1', 8899)
received from tracker: b'{"fileSynchronizer.py": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613354300}, "uniqueFile.txt": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613355204}, "otherFile.txt": {"ip": "127.0.0.1", "port": 8901, "mtime": 1613355540}, ".DS_Store": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613354787}}'
HeartBeat Message: {"port": 8901}
^CException ignored in: <module 'threading' from '/Library/Frameworks/Python.framework/Versions/3.9/lib/python3.9/threading.py'>
Traceback (most recent call last):
  File "/Library/Frameworks/Python.framework/Versions/3.9/lib/python3.9/threading.py", line 1428, in _shutdown
    lock.acquire()
KeyboardInterrupt:
MBAs-MacBook-Air:Client_2 jcr_mba$ ls -la
total 40
drwxr-xr-x  6 jcr_mba  staff   192 14 Feb 21:19 .
drwxr-xr-x  6 jcr_mba  staff   192 14 Feb 20:40 ..
-rw-r--r--@ 1 jcr_mba  staff  6148 14 Feb 21:06 .DS_Store
-rw-r--r--@ 1 jcr_mba  staff 10519 14 Feb 20:58 fileSynchronizer.py
-rw-r--r--  1 jcr_mba  staff    0 14 Feb 21:19 otherFile.txt
-rw-r--r--  1 jcr_mba  staff    0 14 Feb 21:19 uniqueFile.txt
MBAs-MacBook-Air:Client_2 jcr_mba$

Tracker - tracker 127.0.0.1 8899 - 162x11
~/Desktop/4C03/Assignment/Assignment_2/Socket_Test/Tracker - tracker 127.0.0.1 8899
MBAs-MacBook-Air:Tracker jcr_mba$ ./tracker 127.0.0.1 8899
Waiting for connections on port 8899
Client connected with 127.0.0.1:51825
client server127.0.0.1:8900
Client connected with 127.0.0.1:51826
client server127.0.0.1:8901
client server127.0.0.1:8900
client server127.0.0.1:8901
```

*Client\_1* only contains *uniqueFile.txt*, while *Client\_2* only contains *otherFile.txt*. This is shown in the first *ls* command for both clients. Each client contains one unique file. After running the *fileSynchronizer.py* program, each client gets a copy of each other's file. Now, both *Client\_1* and *Client\_2* contain *uniqueFile.txt* and *otherFile.txt*. This is demonstrated in the second *ls -la*. The output of the *tracker* executable is shown below, on the left.

### Test Case 3: One Common File Among *Client\_1* and *Client\_2*, and *Client\_1* Contains An Updated File While *Client\_2* Contains An Outdated File

```
Client_1 — -bash — 80x36
~/Desktop/4C03/Assignment/Assignment_2/Socket_Test/Client_1 — -bash
MBAs-MacBook-Air:Client_1 jcr_mba$ ls
commonFile.txt      fileSynchronizer.py  updatedFile.txt
MBAs-MacBook-Air:Client_1 jcr_mba$ cat updatedFile.txt
This file has been updated.
The new contents in this
file are not contained
in the old file.
MBAs-MacBook-Air:Client_1 jcr_mba$ python3.9 ./fileSynchronizer.py 127.0.0.1 8899
Waiting for connections on port 8900
('connect to: 127.0.0.1', 8899)
received from tracker: b'{"fileSynchronizer.py": {"ip": "127.0.0.1", "port": 8900
, "mtime": 1613354300}, "updatedFile.txt": {"ip": "127.0.0.1", "port": 8900, "mt
ime": 1613374610}, "commonFile.txt": {"ip": "127.0.0.1", "port": 8900, "mtime":
1613358683}, ".DS_Store": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613354787}
}'
HeartBeat Message: {"port": 8900}
('connect to: 127.0.0.1', 8899)
received from tracker: b'{"fileSynchronizer.py": {"ip": "127.0.0.1", "port": 8900
, "mtime": 1613354300}, "updatedFile.txt": {"ip": "127.0.0.1", "port": 8900, "mt
ime": 1613374610}, "commonFile.txt": {"ip": "127.0.0.1", "port": 8900, "mtime":
1613358683}, ".DS_Store": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613354787}
}'
HeartBeat Message: {"port": 8900}
^CException ignored in: <module 'threading' from '/Library/Frameworks/Python.fra
mework/Versions/3.9/lib/python3.9/threading.py'>
Traceback (most recent call last):
  File "/Library/Frameworks/Python.framework/Versions/3.9/lib/python3.9/threadin
g.py", line 1428, in _shutdown
    lock.acquire()
KeyboardInterrupt:
MBAs-MacBook-Air:Client_1 jcr_mba$ ls
commonFile.txt      fileSynchronizer.py  updatedFile.txt
MBAs-MacBook-Air:Client_1 jcr_mba$

Client_2 — -bash — 80x36
~/Desktop/4C03/Assignment/Assignment_2/Socket_Test/Client_2 — -bash
MBAs-MacBook-Air:Client_2 jcr_mba$ ls
commonFile.txt      fileSynchronizer.py  updatedFile.txt
MBAs-MacBook-Air:Client_2 jcr_mba$ cat updatedFile.txt
This file is old.
MBAs-MacBook-Air:Client_2 jcr_mba$ python3.9 ./fileSynchronizer.py 127.0.0.1 8899
Waiting for connections on port 8901
('connect to: 127.0.0.1', 8899)
received from tracker: b'{"fileSynchronizer.py": {"ip": "127.0.0.1", "port": 8900
, "mtime": 1613354300}, "updatedFile.txt": {"ip": "127.0.0.1", "port": 8900, "mt
ime": 1613374610}, "commonFile.txt": {"ip": "127.0.0.1", "port": 8900, "mtime":
1613358683}, ".DS_Store": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613354787}
}'
HeartBeat Message: {"port": 8901}
('connect to: 127.0.0.1', 8899)
received from tracker: b'{"fileSynchronizer.py": {"ip": "127.0.0.1", "port": 8900
, "mtime": 1613354300}, "updatedFile.txt": {"ip": "127.0.0.1", "port": 8900, "mt
ime": 1613374610}, "commonFile.txt": {"ip": "127.0.0.1", "port": 8900, "mtime":
1613358683}, ".DS_Store": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613354787}
}'
HeartBeat Message: {"port": 8901}
^CException ignored in: <module 'threading' from '/Library/Frameworks/Python.fra
mework/Versions/3.9/lib/python3.9/threading.py'>
Traceback (most recent call last):
  File "/Library/Frameworks/Python.framework/Versions/3.9/lib/python3.9/threadin
g.py", line 1428, in _shutdown
    lock.acquire()
KeyboardInterrupt:
MBAs-MacBook-Air:Client_2 jcr_mba$ ls
commonFile.txt      fileSynchronizer.py  updatedFile.txt
MBAs-MacBook-Air:Client_2 jcr_mba$ cat updatedFile.txt
This file has been updated.
The new contents in this
file are not contained
in the old file.

Tracker — tracker 127.0.0.1 8899 — 162x11
~/Desktop/4C03/Assignment/Assignment_2/Socket_Test/Tracker — tracker 127.0.0.1 8899
MBAs-MacBook-Air:Tracker jcr_mba$ ./tracker 127.0.0.1 8899
Waiting for connections on port 8899
Client connected with 127.0.0.1:51871
Client connected with 127.0.0.1:51873
Client server127.0.0.1:8900
Client server127.0.0.1:8901
Client server127.0.0.1:8900
Client server127.0.0.1:8901
```

The first `ls` command shows that both clients contain a `commonFile.txt`, `fileSynchronizer.py`, and an `updatedFile.txt`. However, *Client\_1* contains an updated copy of `updatedFile.txt`; this is evident by the `cat` command used in both terminals. The `cat` command shows the contents of `updatedFile.txt` in *Client\_1*, demonstrating that it is more recent and contains more information/text than the `updatedFile.txt` in *Client\_2*. After running the `fileSynchronizer.py` program, *Client\_2* contains the `updatedFile.txt` from *Client\_1*. This is evident by the second `ls` command and the output of the `cat` command in the terminal window. As you can see, *Client\_2* now has the newer version of `updatedFile.txt`. The output of the `tracker` executable is shown below, on the left.

## Test Case 4: 10 Unique Files In Client\_2, and Nothing In Client\_1

```
Client_1 -- -bash -- 98x53
~/Desktop/4C03/Assignment/Assignment_2/Socket_Test/Client_1 -- -bash

MBAs-MacBook-Air:Client_1 jcr_mba$ ls
fileSynchronizer.py
MBAs-MacBook-Air:Client_1 jcr_mba$ python3.9 ./fileSynchronizer.py 127.0.0.1 8899
Waiting for connections on port 8900
('connect to: 127.0.0.1', 8899)
received from tracker: b'{"fileSynchronizer.py": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613422099}, "fileSynchronizer.py": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613422083}}'
HeartBeat Message: {"port": 8900}
('connect to: 127.0.0.1', 8899)
received from tracker: b'{"fileSynchronizer.py": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613422083}, "file4.txt": {"ip": "127.0.0.1", "port": 8901, "mtime": 1613422357}, "file3.txt": {"ip": "127.0.0.1", "port": 8901, "mtime": 1613422357}, "file5.txt": {"ip": "127.0.0.1", "port": 8901, "mtime": 1613422357}, "file8.txt": {"ip": "127.0.0.1", "port": 8901, "mtime": 1613422357}, "file9.txt": {"ip": "127.0.0.1", "port": 8901, "mtime": 1613422357}, "file0.txt": {"ip": "127.0.0.1", "port": 8901, "mtime": 1613422357}, "file6.txt": {"ip": "127.0.0.1", "port": 8901, "mtime": 1613422357}, "file1.txt": {"ip": "127.0.0.1", "port": 8901, "mtime": 1613422357}, "file2.txt": {"ip": "127.0.0.1", "port": 8901, "mtime": 1613422357}, "file7.txt": {"ip": "127.0.0.1", "port": 8901, "mtime": 1613422357}}'
HeartBeat Message: {"port": 8900}
^CException ignored in: <module 'threading' from '/Library/Frameworks/Python.framework/Versions/3.9/lib/python3.9/threading.py'>
Traceback (most recent call last):
  File "/Library/Frameworks/Python.framework/Versions/3.9/lib/python3.9/threading.py", line 1428, in _shutdown
    lock.acquire()
KeyboardInterrupt:
MBAs-MacBook-Air:Client_1 jcr_mba$ ls
file0.txt      file3.txt      file6.txt      file9.txt
file1.txt      file4.txt      file7.txt      fileSynchronizer.py
file2.txt      file5.txt      file8.txt
MBAs-MacBook-Air:Client_1 jcr_mba$

Client_2 -- -bash -- 96x53
~/Desktop/4C03/Assignment/Assignment_2/Socket_Test/Client_2 -- -bash

MBAs-MacBook-Air:Client_2 jcr_mba$ ls
fileSynchronizer.py
MBAs-MacBook-Air:Client_2 jcr_mba$ touch file1.txt file2.txt file3.txt file4.txt file5.txt file6.txt file7.txt file8.txt file9.txt file0.txt
MBAs-MacBook-Air:Client_2 jcr_mba$ ls
file0.txt      file3.txt      file6.txt      file9.txt
file1.txt      file4.txt      file7.txt      fileSynchronizer.py
file2.txt      file5.txt      file8.txt
MBAs-MacBook-Air:Client_2 jcr_mba$ python3.9 ./fileSynchronizer.py 127.0.0.1 8899
Waiting for connections on port 8901
('connect to: 127.0.0.1', 8899)
received from tracker: b'{"fileSynchronizer.py": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613422083}, "file4.txt": {"ip": "127.0.0.1", "port": 8901, "mtime": 1613422357}, "file3.txt": {"ip": "127.0.0.1", "port": 8901, "mtime": 1613422357}, "file5.txt": {"ip": "127.0.0.1", "port": 8901, "mtime": 1613422357}, "file8.txt": {"ip": "127.0.0.1", "port": 8901, "mtime": 1613422357}, "file9.txt": {"ip": "127.0.0.1", "port": 8901, "mtime": 1613422357}, "file0.txt": {"ip": "127.0.0.1", "port": 8901, "mtime": 1613422357}, "file6.txt": {"ip": "127.0.0.1", "port": 8901, "mtime": 1613422357}, "file1.txt": {"ip": "127.0.0.1", "port": 8901, "mtime": 1613422357}, "file2.txt": {"ip": "127.0.0.1", "port": 8901, "mtime": 1613422357}, "file7.txt": {"ip": "127.0.0.1", "port": 8901, "mtime": 1613422357}}'
HeartBeat Message: {"port": 8901}
('connect to: 127.0.0.1', 8899)
received from tracker: b'{"fileSynchronizer.py": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613422083}, "file4.txt": {"ip": "127.0.0.1", "port": 8901, "mtime": 1613422357}, "file3.txt": {"ip": "127.0.0.1", "port": 8901, "mtime": 1613422357}, "file5.txt": {"ip": "127.0.0.1", "port": 8901, "mtime": 1613422357}, "file8.txt": {"ip": "127.0.0.1", "port": 8901, "mtime": 1613422357}, "file9.txt": {"ip": "127.0.0.1", "port": 8901, "mtime": 1613422357}, "file0.txt": {"ip": "127.0.0.1", "port": 8901, "mtime": 1613422357}, "file6.txt": {"ip": "127.0.0.1", "port": 8901, "mtime": 1613422357}, "file1.txt": {"ip": "127.0.0.1", "port": 8901, "mtime": 1613422357}, "file2.txt": {"ip": "127.0.0.1", "port": 8901, "mtime": 1613422357}, "file7.txt": {"ip": "127.0.0.1", "port": 8901, "mtime": 1613422357}}'
HeartBeat Message: {"port": 8901}
^CException ignored in: <module 'threading' from '/Library/Frameworks/Python.framework/Versions/3.9/lib/python3.9/threading.py'>
Traceback (most recent call last):
  File "/Library/Frameworks/Python.framework/Versions/3.9/lib/python3.9/threading.py", line 1428, in _shutdown
    lock.acquire()
KeyboardInterrupt:
MBAs-MacBook-Air:Client_2 jcr_mba$ ls
file0.txt      file3.txt      file6.txt      file9.txt
file1.txt      file4.txt      file7.txt      fileSynchronizer.py
file2.txt      file5.txt      file8.txt
MBAs-MacBook-Air:Client_2 jcr_mba$

Tracker
~/Desktop/4C03/Assignment/Assignment_2/Socket_Test/Tracker -- -bash

MBAs-MacBook-Air:Tracker jcr_mba$ ./tracker 127.0.0.1 8899
Waiting for connections on port 8899
Client connected with 127.0.0.1:53542
Client connected with 127.0.0.1:53543
client server127.0.0.1:8900
client server127.0.0.1:8901
client server127.0.0.1:8900
client server127.0.0.1:8901
```

The first `ls` command shows that both clients' directory are pretty much empty; with the exception of `fileSynchronizer.py`. For *Client\_2*, 10 text files, from `file0.txt` to `file9.txt` are created using the `touch` command. These files will be transferred over to *Client\_1*. Another `ls` command is run on *Client\_2* to show that 10 text files were successfully created. Next, both clients run the `fileSynchronizer.py` program. Upon execution of this program, the 10 files from *Client\_2* are copied to *Client\_1*. The program is interrupted, by the user, and the output of `fileSynchronizer.py` is observed. The `ls` command is run a final time to show that both clients have 10 text files from `file0.txt` to `file9.txt`. This demonstrates the successful file synchronization and transfer of the two peers, *Client\_1* and *Client\_2*. The output of the `tracker` executable is shown below, on the left.



## Test Case 5: Makefile, C Source File, and Executable Binary File In *Client\_1*, and Nothing In *Client\_2*

```
Client_1 -- -bash -- 80x36
~/Desktop/4C03/Assignment/Assignment_2/Socket_Test/Client_1 -- -bash
MBAs-MacBook-Air:Client_1 jcr_mba$ ls
Makefile      test_case
fileSynchronizer.py  test_case.c
MBAs-MacBook-Air:Client_1 jcr_mba$ ./test_case
TestCase #5 Passed!
MBAs-MacBook-Air:Client_1 jcr_mba$ python3.9 ./fileSynchronizer.py 127.0.0.1 8899
Waiting for connections on port 8900
('connect to: 127.0.0.1', 8899)
received from tracker: b'{"test_case.c": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613376766}, "Makefile": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613376259}, "test_case": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613376943}, ".DS_Store": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613354787}, "fileSynchronizer.py": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613376933}}'
HeartBeat Message: {"port": 8901}
('connect to: 127.0.0.1', 8899)
received from tracker: b'{"test_case.c": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613376766}, "Makefile": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613376259}, "test_case": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613376943}, ".DS_Store": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613354787}, "fileSynchronizer.py": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613376933}}'
HeartBeat Message: {"port": 8901}
^CException ignored in: <module 'threading' from '/Library/Frameworks/Python.framework/Versions/3.9/lib/python3.9/threading.py'>
Traceback (most recent call last):
  File "/Library/Frameworks/Python.framework/Versions/3.9/lib/python3.9/threading.py", line 1428, in _shutdown
    lock.acquire()
KeyboardInterrupt:
MBAs-MacBook-Air:Client_1 jcr_mba$ ls
Makefile      test_case
fileSynchronizer.py  test_case.c
MBAs-MacBook-Air:Client_1 jcr_mba$

Client_2 -- -bash -- 80x36
~/Desktop/4C03/Assignment/Assignment_2/Socket_Test/Client_2 -- -bash
MBAs-MacBook-Air:Client_2 jcr_mba$ ls
fileSynchronizer.py
MBAs-MacBook-Air:Client_2 jcr_mba$ python3.9 ./fileSynchronizer.py 127.0.0.1 8899
Waiting for connections on port 8901
('connect to: 127.0.0.1', 8899)
received from tracker: b'{"test_case.c": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613376766}, "Makefile": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613376259}, "test_case": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613376943}, ".DS_Store": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613354787}, "fileSynchronizer.py": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613376933}}'
HeartBeat Message: {"port": 8901}
('connect to: 127.0.0.1', 8899)
received from tracker: b'{"test_case.c": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613376766}, "Makefile": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613376259}, "test_case": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613376943}, ".DS_Store": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613354787}, "fileSynchronizer.py": {"ip": "127.0.0.1", "port": 8900, "mtime": 1613376933}}'
HeartBeat Message: {"port": 8901}
^CException ignored in: <module 'threading' from '/Library/Frameworks/Python.framework/Versions/3.9/lib/python3.9/threading.py'>
Traceback (most recent call last):
  File "/Library/Frameworks/Python.framework/Versions/3.9/lib/python3.9/threading.py", line 1428, in _shutdown
    lock.acquire()
KeyboardInterrupt:
MBAs-MacBook-Air:Client_2 jcr_mba$ ls
Makefile      test_case
fileSynchronizer.py  test_case.c
MBAs-MacBook-Air:Client_2 jcr_mba$ chmod 777 test_case
MBAs-MacBook-Air:Client_2 jcr_mba$ ./test_case
TestCase #5 Passed!
MBAs-MacBook-Air:Client_2 jcr_mba$

Tracker -- tracker 127.0.0.1 8899 -- 162x11
~/Desktop/4C03/Assignment/Assignment_2/Socket_Test/Tracker -- tracker 127.0.0.1 8899
MBAs-MacBook-Air:Tracker jcr_mba$ ./tracker 127.0.0.1 8899
Waiting for connections on port 8899
Client connected with 127.0.0.1:51893
Client server127.0.0.1:8900
Client connected with 127.0.0.1:51895
Client server127.0.0.1:8901
Client server127.0.0.1:8900
Client server127.0.0.1:8901
```

The first `ls` command shows that *Client\_1* contains a *Makefile*, *test\_case* (binary file), and *test\_case.c* (source file). *Client\_2* does not contain anything except for the *fileSynchronizer.py* file, but it is not included in the purpose of this test case. The *test\_case* file is executed in *Client\_1* to demonstrate that it works flawlessly and does not output errors. After running the *fileSynchronizer.py* program, the *Makefile*, *test\_case*, and *test\_case.c* files are transferred to *Client\_2*; demonstrated by the second `ls`. Finally, the permissions of the *test\_case* file are changed to `rw`x, and it is executed to show that a binary file was transferred over to a different peer without any errors. The output of *test\_case* is identical for both clients, before and after the *fileSynchronizer.py* program was run. This is indicated by the red star on the picture above. The output of the *tracker* executable is shown below, on the left.