



Report

Assignment 3 - *TFTP Server*



10 Mar, 2017

Semester: Spring 2017
Course: Computer Networks
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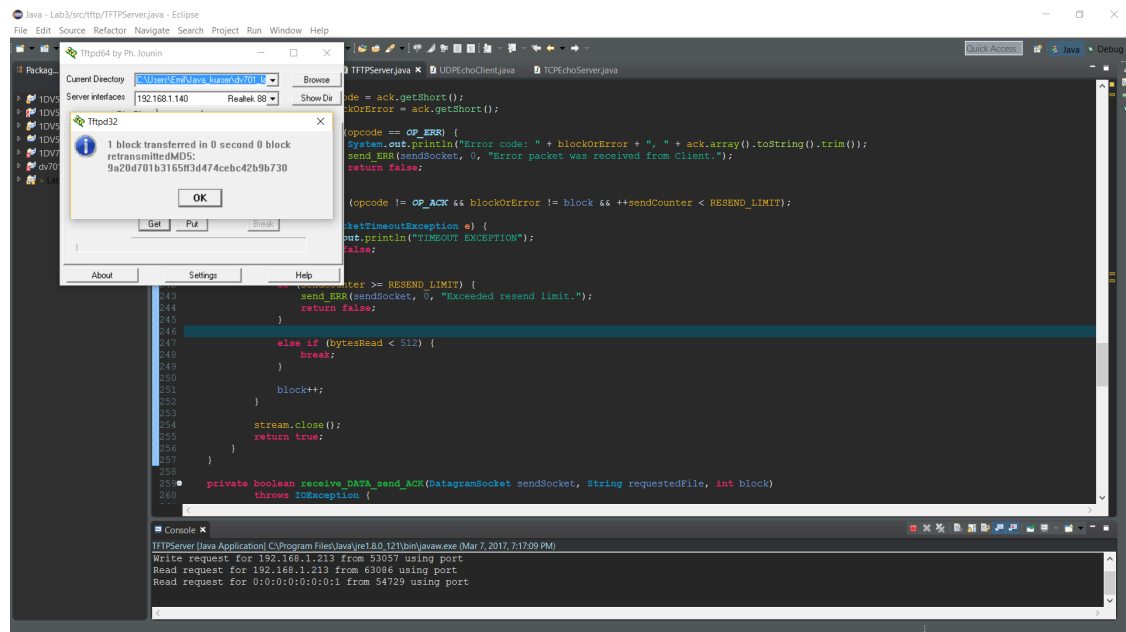
Summary of work done

Work by both

We have done all the work together. We give 50% to each other.

Problem 1

Read request less than 512 bytes



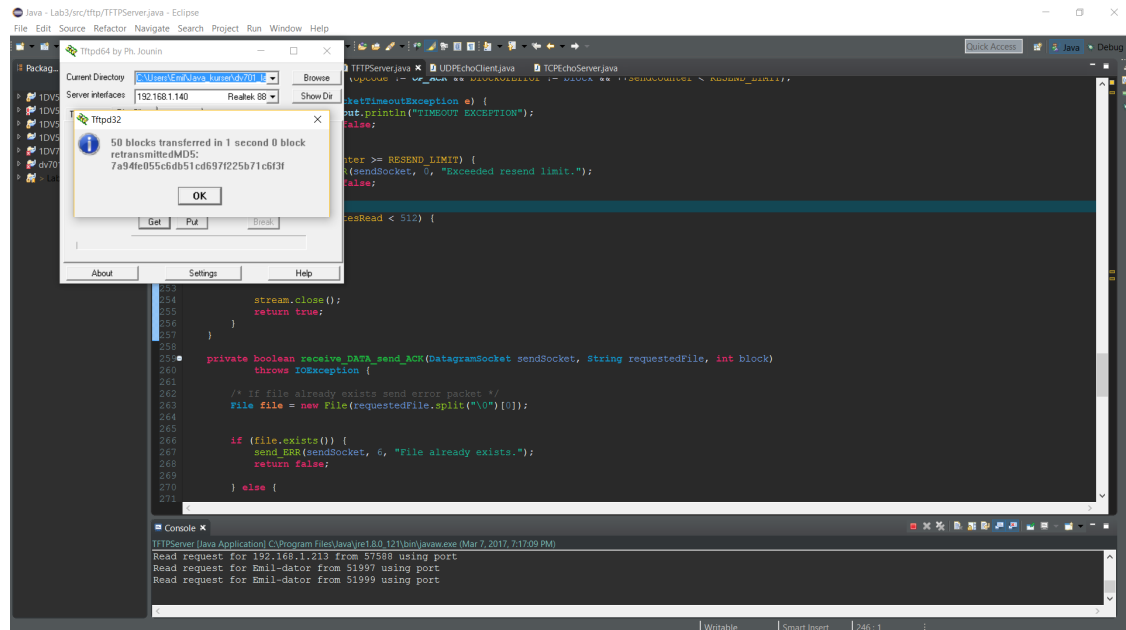
The picture above shows the result of a read request from TFTP Client to the TFTP Server. The requested file was less than 512 bytes.

Socket and sendSocket

The reason for having two sockets is that the first socket is to establish a connection and the other socket is for sending the packets between Client and Server.

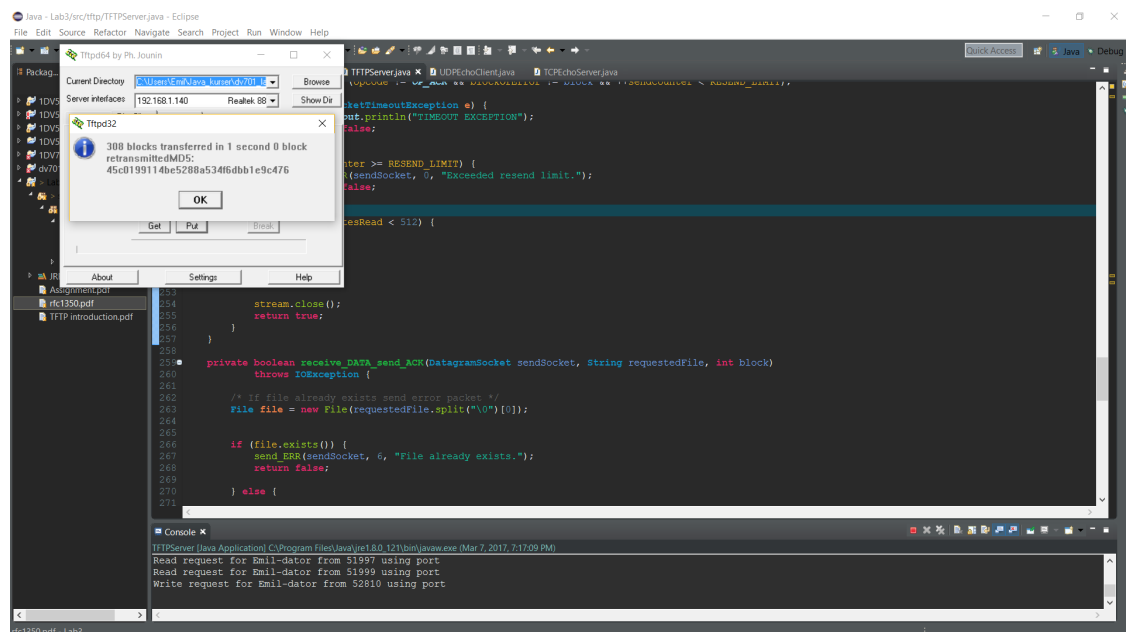
Problem 2

Read request more than 512 bytes



The picture above shows a read request from TFTP Client to the TFTP Server. The requested file was larger than 512 bytes, which can be seen in the TFTP Client because there are more than 1 block of data.

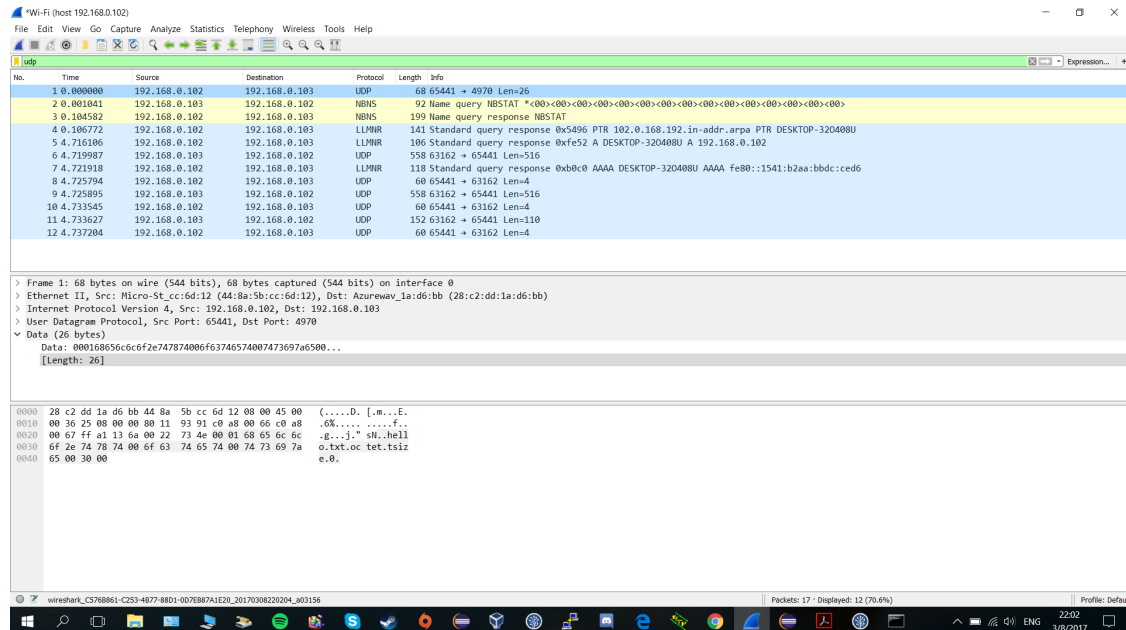
Write request



The screenshot above shows a successful Write request from the TFTP Client to the TFTP Server. Since the image sent was quite large the transfer required 308 blocks of data.

VG Task 1

Wireshark analysis



The screenshot above is showing a Read request from my desktop to our TFTP Server on my laptop. The requested file was hello.txt file and a bit over 1000 bytes large. Since the TFTP protocol is built on top of UDP all the TFTP packets are seen as UDP packets.

Analysis line by line

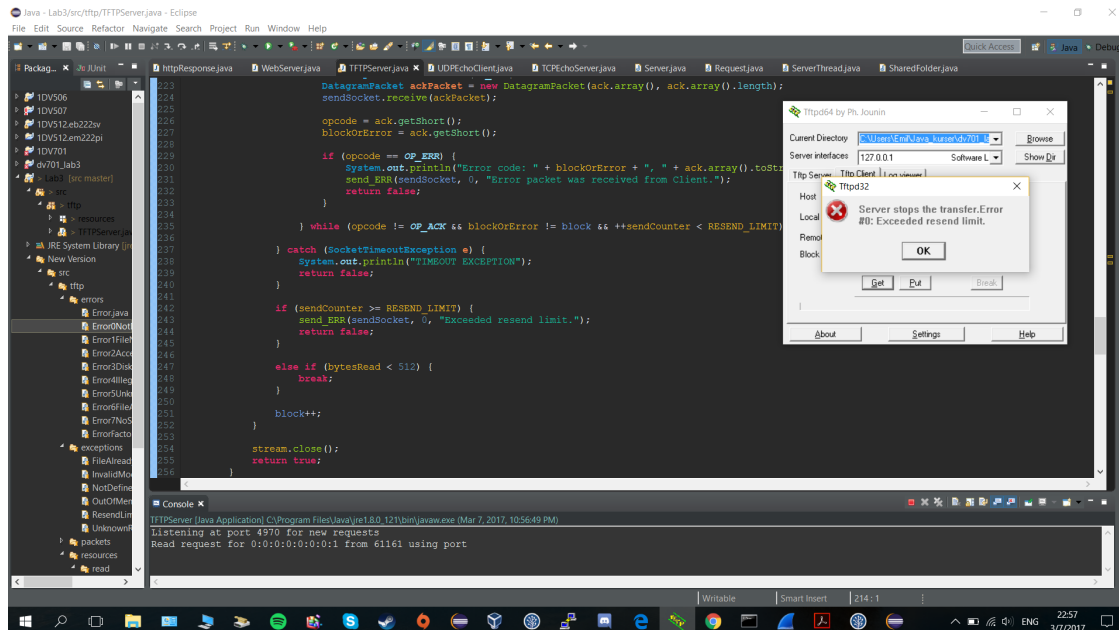
1. First line is the Read request from my desktop to the TFTP Server on my laptop and that it is 26 bytes large. In the data one can see the requested: file "hello.txt" and the mode: octet.
2. The next two lines is the NBNS protocol which is a protocol for translating human-readable names to IP addresses like DNS.
3. The next two lines is LLMNR protocol which is built on top of DNS packet format which allows hosts on the same network to perform name resolution.
4. Here is where the first DATA packet is sent from the TFTP Server to my TFTP Client on my desktop. Although the UDP packet length is 558 the DATA packet is 516 as can be seen in the info. Of these 516 bytes only 512 is the actual data of the requested file, the rest is 2 bytes for opcode and 2 for block number.
5. Another LLMNR protocol.
6. Next is an ACK packet from the desktop to the server for the first DATA packet. Here we can see that the ACK packet has the length 4, 2 for opcode and 2 for the block number.
7. Next is the next data packet of the requested file and since its not the last DATA packet its larger than 515 bytes.
8. ACK packet for the last DATA packet.
9. This is the last DATA packet because it's less than 516 bytes. If the DATA packet is received the TFTP Client will know it's the end of the data of the requested file. If the server don't get an ACK packet after a while it will retransmit the DATA packet a number of times.
10. Here is the last ACK packet for the received DATA packet and now the Client will terminate the connection.

Difference between Read and Write request

Read Request	Write Request
<i>get</i> is the keyword for making this request	<i>put</i> is the keyword for making this request
Its opcode is 1	Its opcode is 2
After accepting it, server creates a DATA packet of requested file and sends it to client	After accepting it, server send ACK packet with same block number to client
After sending the initial packet, server waits for ACK packet from client	After sending the initial packet, server waits for DATA packet from client
Once the packet is received, it only send a new packet (block number will increase by 1) if last sent packet was 512 bytes.	Once the packet is received, server sends ACK packet to client with same block number as received DATA packet have. If last packet received packet was 512 bytes, process repeats again.

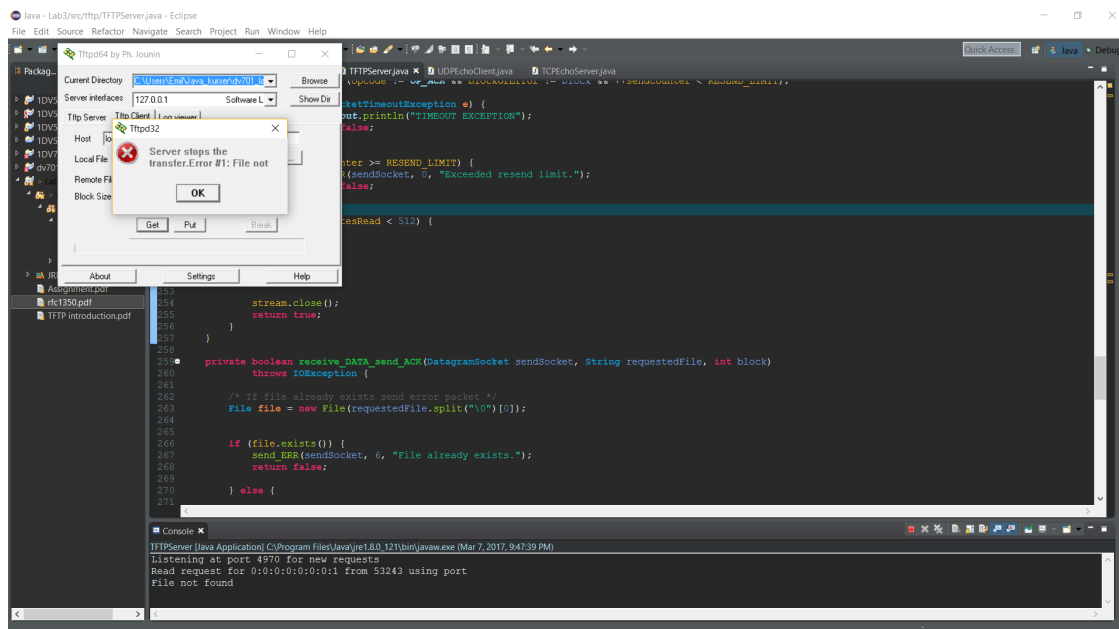
Problem 3

Error code 0 (Not defined, see error message (if any))



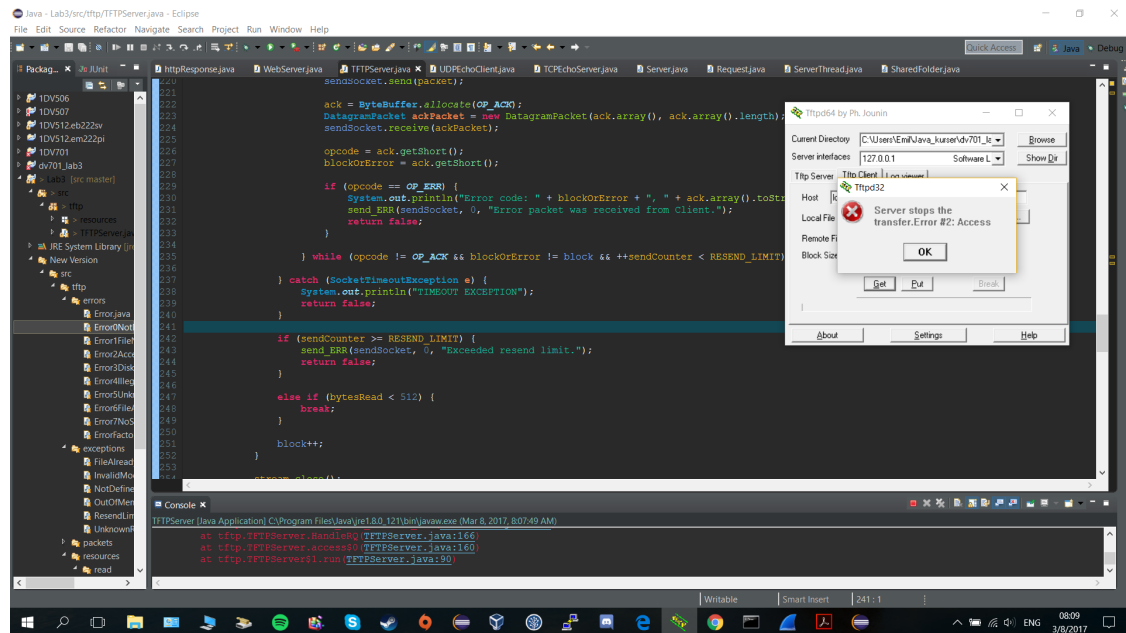
The screenshot above shows an error message from the Server to the Client, the error code received is error #0 "Not defined, see error message". In our case we use it when the Server has retransmitted a DATA packet a number of times.

Error code 1 (File not found)



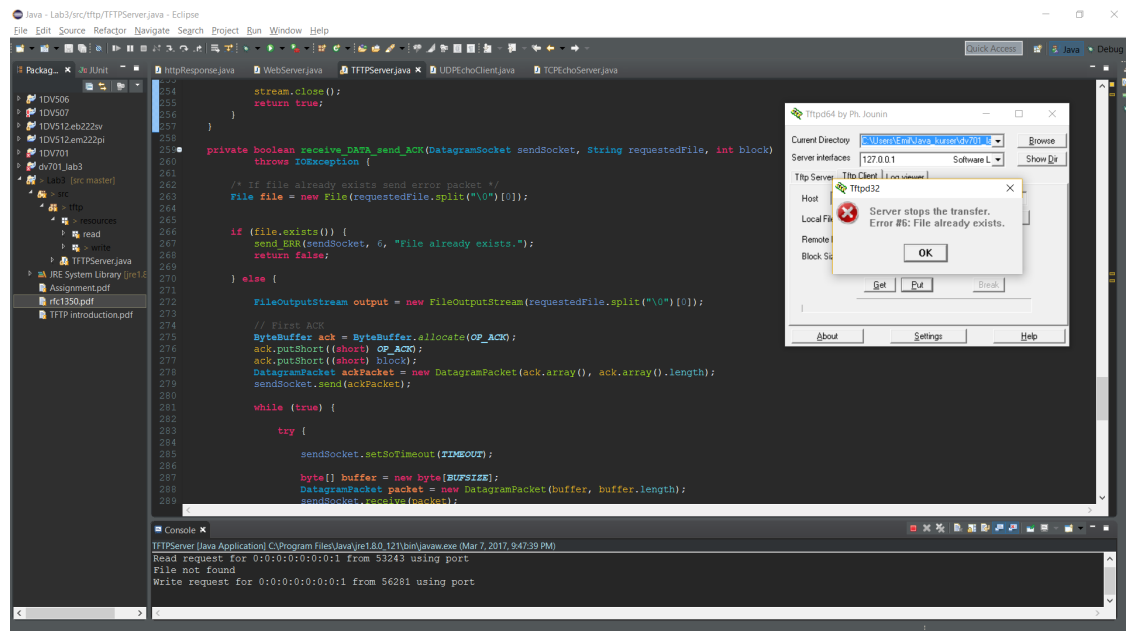
The screenshot above shows when the TFTP Client request a file that doesn't exist. The Client receives an error packet with error code #1: "File not found". Note that for some reason the entire "File not found" sentence can't be seen.

Error code 2 (Access violation)



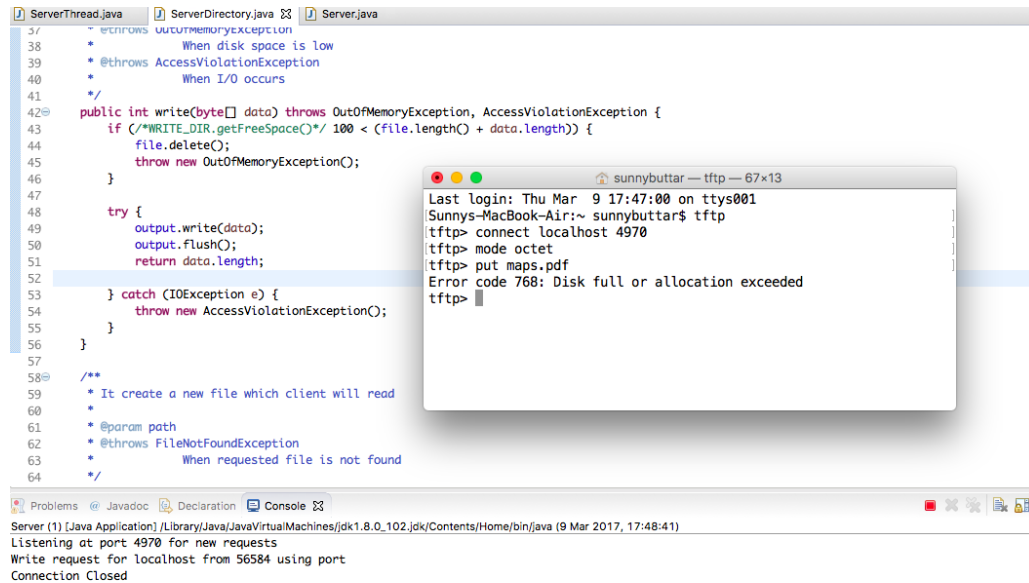
The screenshot above shows that the TFTP Client has received error code #2 "Access violation" from the TFTP Server. We implemented this on my windows laptop, so error code #2 is triggered by a generic IOException.

Error code 6 (File already exists)



The screenshot above shows that the client tried to write a file that already exists on the server and receiving an error packet with error code #6 "File already exists".

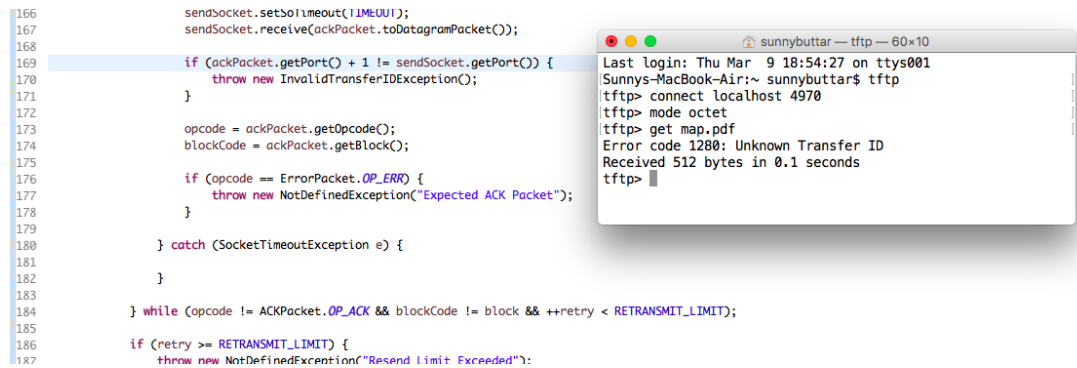
Error code 3 (Disk full or allocation exceeded)



```
ServerThread.java  ServerDirectory.java  Server.java
37  * @throws OutOfMemoryException
38  *       When disk space is low
39  * @throws AccessViolationException
40  *       When I/O occurs
41  */
42  public int write(byte[] data) throws OutOfMemoryException, AccessViolationException {
43      if (/*WRITE_DIR.getFreeSpace()*/ 100 < (file.length() + data.length)) {
44          file.delete();
45          throw new OutOfMemoryException();
46      }
47
48      try {
49          output.write(data);
50          output.flush();
51          return data.length;
52      } catch (IOException e) {
53          throw new AccessViolationException();
54      }
55  }
56
57
58  /**
59   * It create a new file which client will read
60   *
61   * @param path
62   * @throws FileNotFoundException
63   *       When requested file is not found
64   */
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```


Error code 5 (Unknown transfer ID)

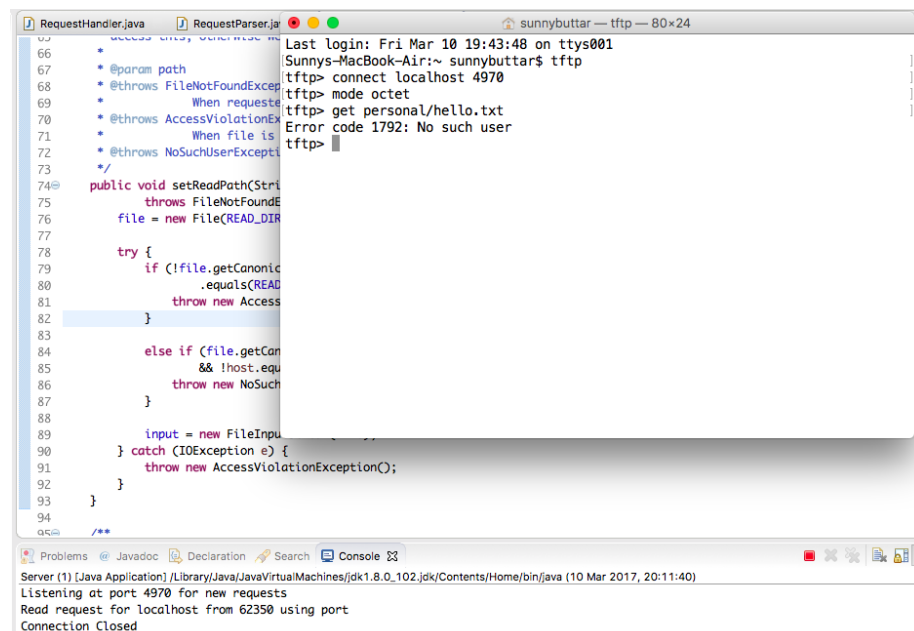


```
166         sendSocket.setSoTimeout(1000);
167         sendSocket.receive(ackPacket.toDatagramPacket());
168
169         if (ackPacket.getPort() + 1 != sendSocket.getPort()) {
170             throw new InvalidTransferIDException();
171         }
172
173         opcode = ackPacket.getOpcode();
174         blockCode = ackPacket.getBlock();
175
176         if (opcode == ErrorPacket.OP_ERR) {
177             throw new NotDefinedException("Expected ACK Packet");
178         }
179
180     } catch (SocketTimeoutException e) {
181     }
182
183 } while (opcode != ACKPacket.OP_ACK && blockCode != block && ++retry < RETRANSMIT_LIMIT);
184
185 if (retry >= RETRANSMIT_LIMIT) {
186     throw new NotDefinedException("Resend limit Exceeded");
187 }
```

```
Last login: Thu Mar 9 18:54:27 on ttys001
Sunnys-MacBook-Air:~ sunnybuttar$ tftp
tftp> connect localhost 4970
tftp> mode octet
tftp> get map.pdf
Error code 1280: Unknown Transfer ID
Received 512 bytes in 0.1 seconds
tftp>
```

The screenshot above shows that received packet is not from same client as expected and therefore server respond with error code 5. We have manually changed the port number in order to produce this error.

Error code 7 (No such user)



```
66 * @param path
67 * @throws FileNotFoundException
68 * @throws AccessViolationException
69 * @throws NoSuchUserException
70 * @throws NoSuchUserException
71 * @throws NoSuchUserException
72 */
73
74 public void setReadPath(String path)
75     throws FileNotFoundException
76     file = new File(READ_DIR + path);
77
78     try {
79         if (!file.getCanonicalPath().equals(READ_DIR))
80             throw new AccessViolationException();
81     }
82
83     else if (file.getCanonicalPath().equals(READ_DIR))
84         throw new NoSuchUserException();
85
86     input = new FileInputStream(file);
87 } catch (IOException e) {
88     throw new AccessViolationException();
89 }
90
91 /**
```

```
Last login: Fri Mar 10 19:43:48 on ttys001
Sunnys-MacBook-Air:~ sunnybuttar$ tftp
tftp> connect localhost 4970
tftp> mode octet
tftp> get personal/hello.txt
Error code 1792: No such user
tftp>
```

```
Server (1) [Java Application] [/Library/Java/JavaVirtualMachines/jdk1.8.0_102.jdk/Contents/Home/bin/java (10 Mar 2017, 20:11:40)]
Listening at port 4970 for new requests
Read request for localhost from 62350 using port
Connection Closed
```

The screenshot above shows that the client tried to access *personal* folder and server respond with error code 7. We show this error if client IP address is not same as we expected for accessing the folder.

NOTE: Error code 2 and 7 follow the windows OS, which means we are catching the generic `IOExceptions` for producing these errors.