COMP416: Computer Networks

Project 1 - Part 2 Report

Meryem Karakaş 69074

Since the mentioned APIs allow 50 calls/minute, I set timeout for each client. After accepting a connection, the connection will be closed after 1 minute of inactivity of the client. Then client program will be terminated.

Execution of the program:

- First run the server program (coinNetServer). When the program asks for the port number, enter the port number from the console.

- Then run the client program (coinNetClient). The program first asks for the port number, after entering the port number here, it asks for the host address. After typing "localhost" to this, if the address and port are correct, the connection is established and the connection established information appears on both the client and server sides. At this point, as many client programs can be run as desired.

- After connection is established, client programs ask for API request. If you want to get information from List cryptocurrencies data API, you should write "1". If you want to get information from Search for a cryptocurrency price API, you should write "2". If you want to terminate the client program, you should write "QUIT". If you write anything else other than these 3, the program warns that you entered the wrong input and again asks you to specify the API you want.

- If you type "QUIT", the connection is disconnected and the client program is terminated. If you wrote "1", the server will connect with CoinGeckoAPI after detecting your request and format the list of cryptocurrencies and send it to the client. If you type "2", the client program continues to ask questions to learn the parameters. First, it asks how many currencies you want to know the price of. It then asks you to enter the ids of the currencies in order. Then it combines this data and sends it to the server. The server connects with CoinGeckoAPI and receives the prices of the desired cryptocurrencies and sends this information to the client.

- After the client program receives the information requested from the server, it prints this information on the screen in certain formats. Then the client program asks for the API you want to request information from. If you don't exceed 1 minute, you can send as many API requests to the server as you want.

Protocol Design:

In my project, message protocol is same for packets of each side. Client and server sends their messages enclosed in a packet which is string of size of 65002 chars at most. First I searched for the maximum size for TCP packets. The maximum size of a TCP packet is 64K (65535 bytes). In many cases, String.length() will return the same value as String.getBytes().length but in some cases it's not the same. In Java, String.length() is to return the number of characters in the string, while String.getBytes().length is to return the number of bytes to represent the string with the specified encoding.

In order to decide on the size of the packet carrying the message, I first checked whether there was a message that could exceed the maximum capacity. The longest message in the project is the list of cryptocurrencies. Therefore, I printed the length of this string and the number of bytes required to express this string with the getBytes().length method.

First, I converted the list of currencies to string and concatenated them in my cList string. Then I found the length of this string. The results I got were as follows:

cList.getBytes().length; //gives 311130

cList.length(); //gives 311082

Then I calculated how many bytes are required to represent 65535 length string:

65535*(311130/311082) = 65545

After these processes, I decided to make my packet size a string of maximum 65002 characters.

Structure of the packet:

The first two characters in the package are special characters, the third character is the comma that separates these two special characters from the message if message type is not list request from client. The remaining characters of the string hold the message.

The first character in the String packet determines whether there is a packet after which it should be read or sent again. If the character is '1', this indicates that the message has been split into packets and there are packets to be sent or received after the current packet. If the character is '0', it indicates that there are no packets to be sent or received after the current packet. For example, if the sent packet is "01,zyrro,...", the 0 in the first index indicates that there are no more packets to be sent after this packet. However, if the sent packet is in the form of "11,zyx,...", the initial index indicates that the rest of the message is in another packet or packets, and after this packet is sent, the rest of the message will be sent with other packets.

The second character is the character that specifies the message type. In this case, there can be 4 types of characters.

For client requests:

'1' : The packet with this character in the 2nd character is the packet sent by the client of the message to get the list of cryptocurrencies. (list request from client)

'2': The packet with this character in the 2nd character is the packet sent by the client to learn the price of specific currencies. (price request from client)

For server answer:

'l': The package with this character in the 2nd character is the package containing the list of cryptocurrencies sent by the server to the client. (list answer from server)

'p': The package with this character in the 2nd character is the package containing the price of specific cryptocurrencies sent by the server to the client. (price answer from server)

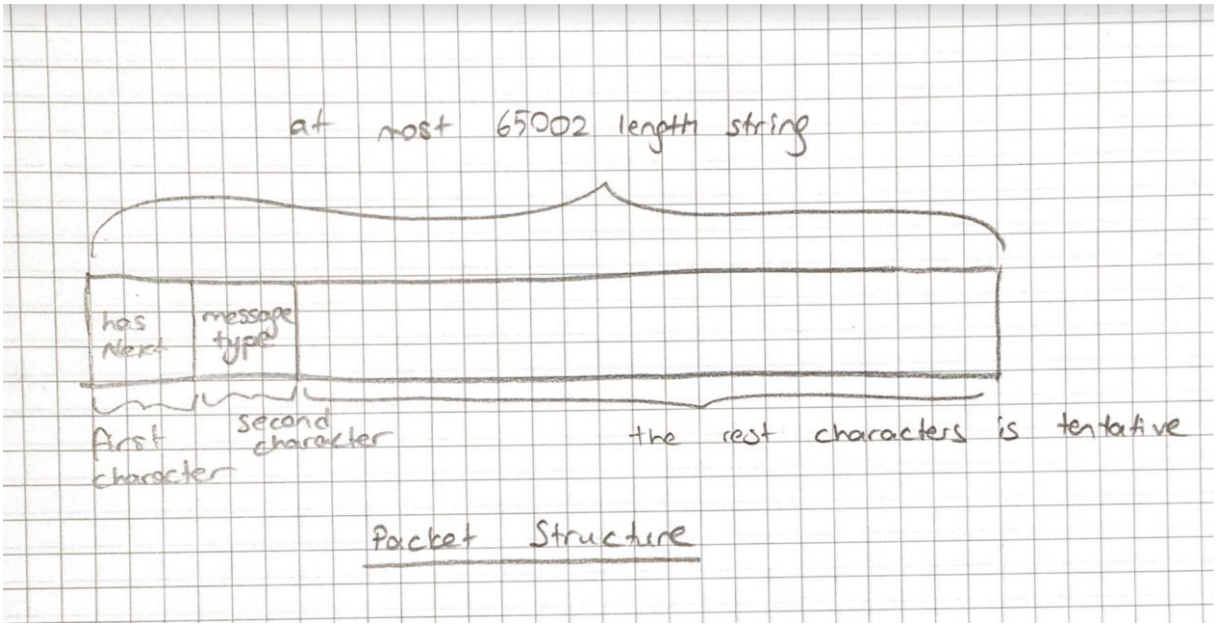
Examples:

“01” : It ıs a packet which indicates list of cyrptocurrencies request

“02,01coin,zyx” : It is a client request which request prices of cyrptocurrencies with ids 01coin and zyx

“1l,…” : It is a server answer which contains list of the cyrptocurrencies. Also, 1 in the first index indicates message divided into parts, and after this packet there will be more packet/s that contains the rest of the message. All 3 dots refer to the part of the message in this package that contains the list.

“0p,…” : It is a server answer which contains prices of the queried cyrptocurrencies. 0 in the first index indicates there will be no more packet after this packet.



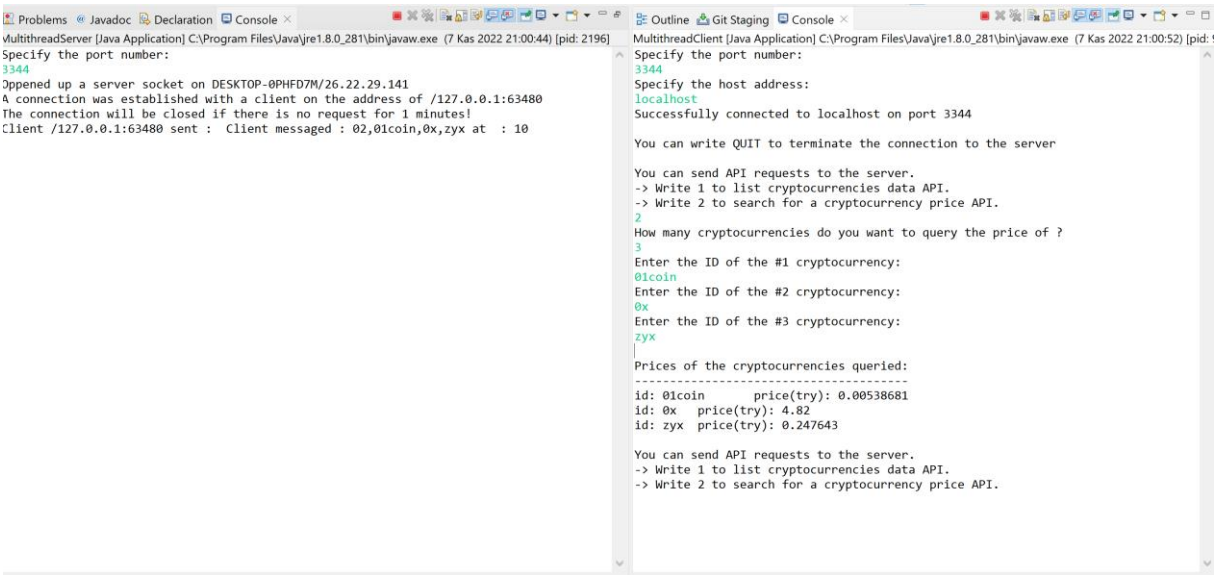
To summarize,

- If the package carries the client-generated list request, it has the content "01".
- If the package is a client-side cryptocurrencies price query, it is in the format "02,..." or "12,...". The 3 dots represent the ids of the currencies whose prices are queried, separated by commas.

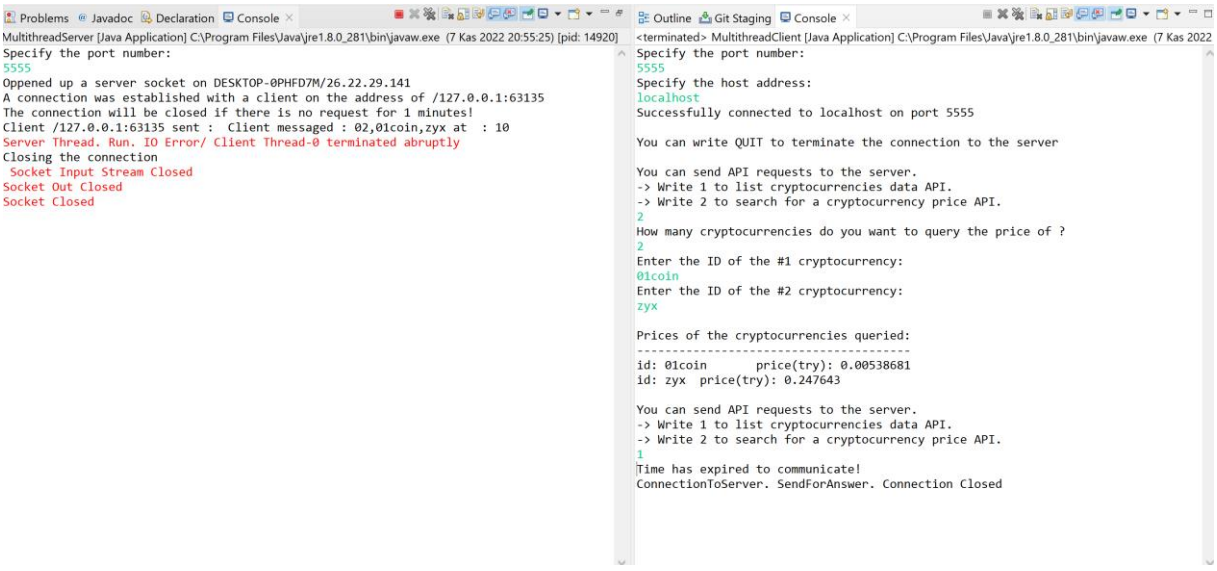
- If the packet contains the server's message containing the list, it is in the format "0l,..." or "1l,..." depending on the size of the list. The 3 dots represent the string message containing the list or part of the message.
- If the packet contains the ids of certain cryptocurrencies and their prices in Turkish lira, the packet is in the format "0p,..." or "1p,..." depending on the size of the message. The 3 dots represent the string containing the ids of the desired currencies and the corresponding prices.

Example Test Scenarios:

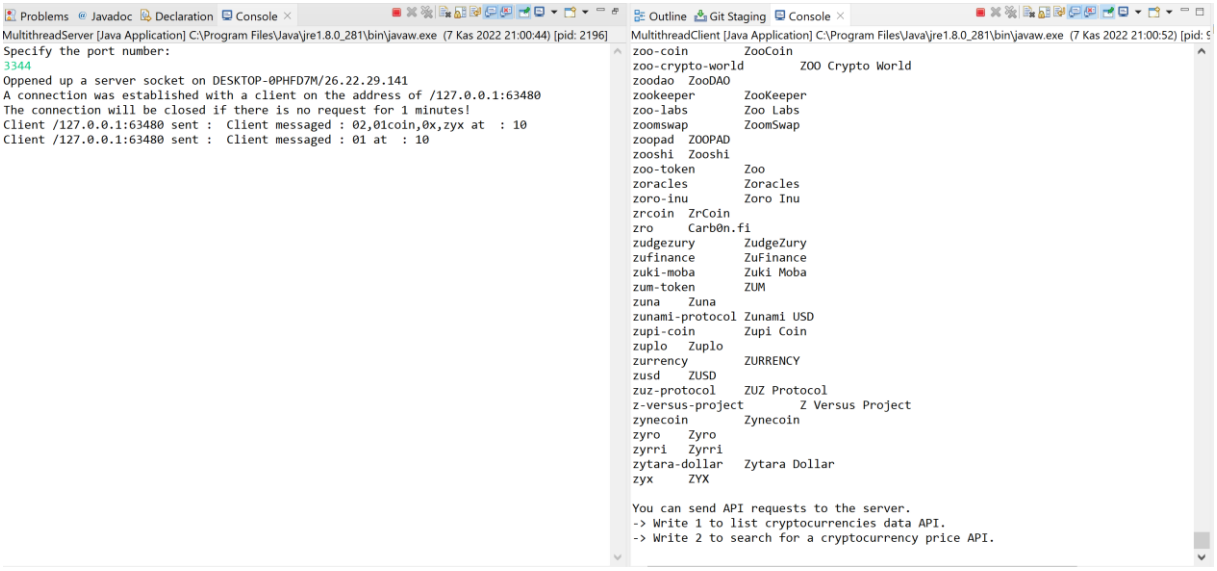
Client request cryptocurrency price:



When request time (1 minute without action) expired:



When client requests cryptocurrency list:

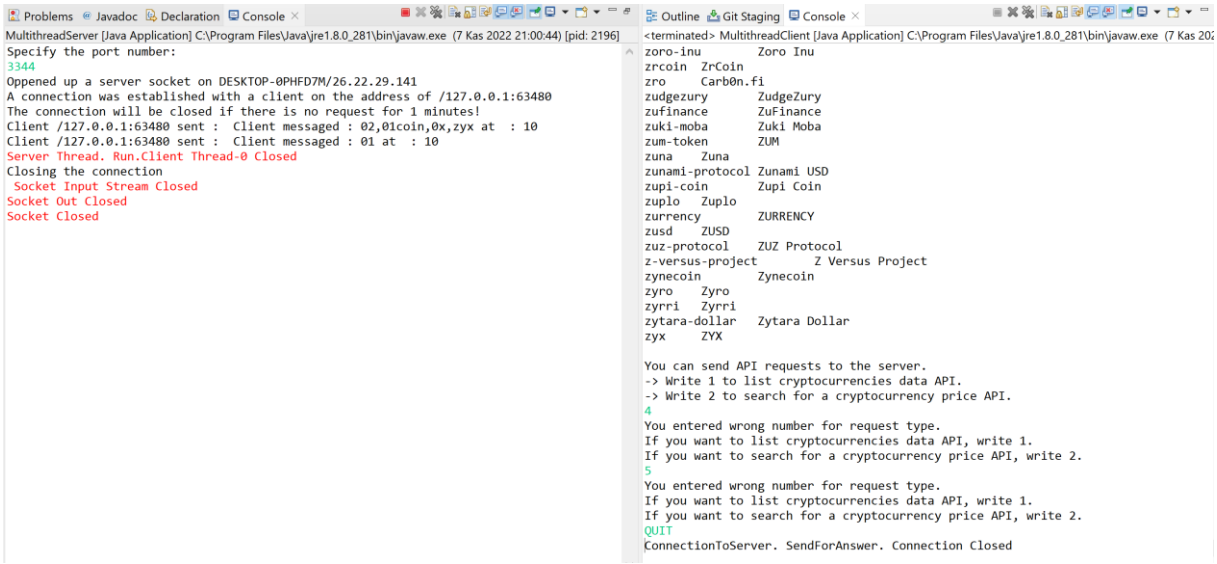


```
Problems  Javadoc  Declaration  Console
MultithreadServer [Java Application] C:\Program Files\Java\jre1.8.0_281\bin\javaw.exe  (7 Kas 2022 21:00:44) [pid: 2196]
Specify the port number:
3344
Oppened up a server socket on DESKTOP-0PHFD7M/26.22.29.141
A connection was established with a client on the address of /127.0.0.1:63480
The connection will be closed if there is no request for 1 minutes!
Client /127.0.0.1:63480 sent :  Client messaged : 02,01coin,0x,zyx at  : 10
Client /127.0.0.1:63480 sent :  Client messaged : 01 at  : 10
```

```
Outline  Git Staging  Console
MultithreadClient [Java Application] C:\Program Files\Java\jre1.8.0_281\bin\javaw.exe  (7 Kas 2022 21:00:52) [pid: 9
zoo-coin        ZooCoin
zoo-crypto-world        ZOO Crypto World
zoodao  ZooDAO
zookeeper       ZooKeeper
zoo-labs        Zoo Labs
zoomswap        ZoomSwap
zoopad  ZOOPAD
zooshi  Zooshi
zoo-token       Zoo
zoracles        Zoracles
zoro-inu        Zoro Inu
zrcoin  ZrCoin
zro     Carb0n.fi
zudgezury       ZudgeZury
zufinance       ZuFinance
zuki-moba       Zuki Moba
zum-token       ZUM
zuna    Zuna
zunami-protocol Zunami USD
zupi-coin       Zupi Coin
zuplo   Zuplo
zurrency        ZURRENCY
zusd    ZUSD
zuz-protocol    ZUZ Protocol
z-versus-project        Z Versus Project
zynecoin        Zynecoin
zyro    Zyro
zyrri   Zyrri
zytara-dollar   Zytara Dollar
zyx     ZYX

You can send API requests to the server.
-> Write 1 to list cryptocurrencies data API.
-> Write 2 to search for a cryptocurrency price API.
```

When client enters invalid message type and termination message (QUIT):



```
Problems  Javadoc  Declaration  Console
MultithreadServer [Java Application] C:\Program Files\Java\jre1.8.0_281\bin\javaw.exe  (7 Kas 2022 21:00:44) [pid: 2196]
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The connection will be closed if there is no request for 1 minutes!
Client /127.0.0.1:63480 sent :  Client messaged : 02,01coin,0x,zyx at  : 10
Client /127.0.0.1:63480 sent :  Client messaged : 01 at  : 10
Server Thread. Run.Client Thread-0 Closed
Closing the connection
 Socket Input Stream Closed
Socket Out Closed
Socket Closed
```

```
Outline  Git Staging  Console
<terminated> MultithreadClient [Java Application] C:\Program Files\Java\jre1.8.0_281\bin\javaw.exe  (7 Kas 202
zoro-inu        Zoro Inu
zrcoin  ZrCoin
zro     Carb0n.fi
zudgezury       ZudgeZury
zufinance       ZuFinance
zuki-moba       Zuki Moba
zum-token       ZUM
zuna    Zuna
zunami-protocol Zunami USD
zupi-coin       Zupi Coin
zuplo   Zuplo
zurrency        ZURRENCY
zusd    ZUSD
zuz-protocol    ZUZ Protocol
z-versus-project        Z Versus Project
zynecoin        Zynecoin
zyro    Zyro
zyrri   Zyrri
zytara-dollar   Zytara Dollar
zyx     ZYX

You can send API requests to the server.
-> Write 1 to list cryptocurrencies data API.
-> Write 2 to search for a cryptocurrency price API.
4
You entered wrong number for request type.
If you want to list cryptocurrencies data API, write 1.
If you want to search for a cryptocurrency price API, write 2.
5
You entered wrong number for request type.
If you want to list cryptocurrencies data API, write 1.
If you want to search for a cryptocurrency price API, write 2.
QUIT
ConnectionToServer. SendForAnswer. Connection Closed
```

Multiple clients running at the same time: