Stock Market
Pair 20:
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Introduction:

- As our final programing project, we chose to implement a protocol that resembles a real-time functioning stock server.
- Stocks can be bought and sold by clients connected to the server.
- Each client has its own private portfolio, that can only be accessed by him, using a unique username and password.
- New up-to-date offers are sent periodically to all clients.

Functionality:

- **Authentication: (Over TCP)**
  Divided into two steps:

  Step 1 – Registration:
  A new client sends a username, password and amount of money to assign to his portfolio, an Ack message is sent if the username is free to use and X otherwise.

  Step 2 – Login:
  After registration, a client may connect to his portfolio using the username and password he has chosen. After examining the data an Ack ,X or Full message is sent back to the client, if successful the client will receive the server's multicast IP and will be logged in.

- **Display: (Over TCP)**
  A Get message is sent from a client to the server, which sends back a full report on the client's current state including his balance, stock shares and his current profit.
  If successful the client will return a Yes message, else a No.

- **Updates: (Multicast over UDP, State change is done over TCP)**
  An M message is sent from a client to the server, indicating he is currently observing the multicast updates, when the client whishes to exit this state an m message is sent back to the server.

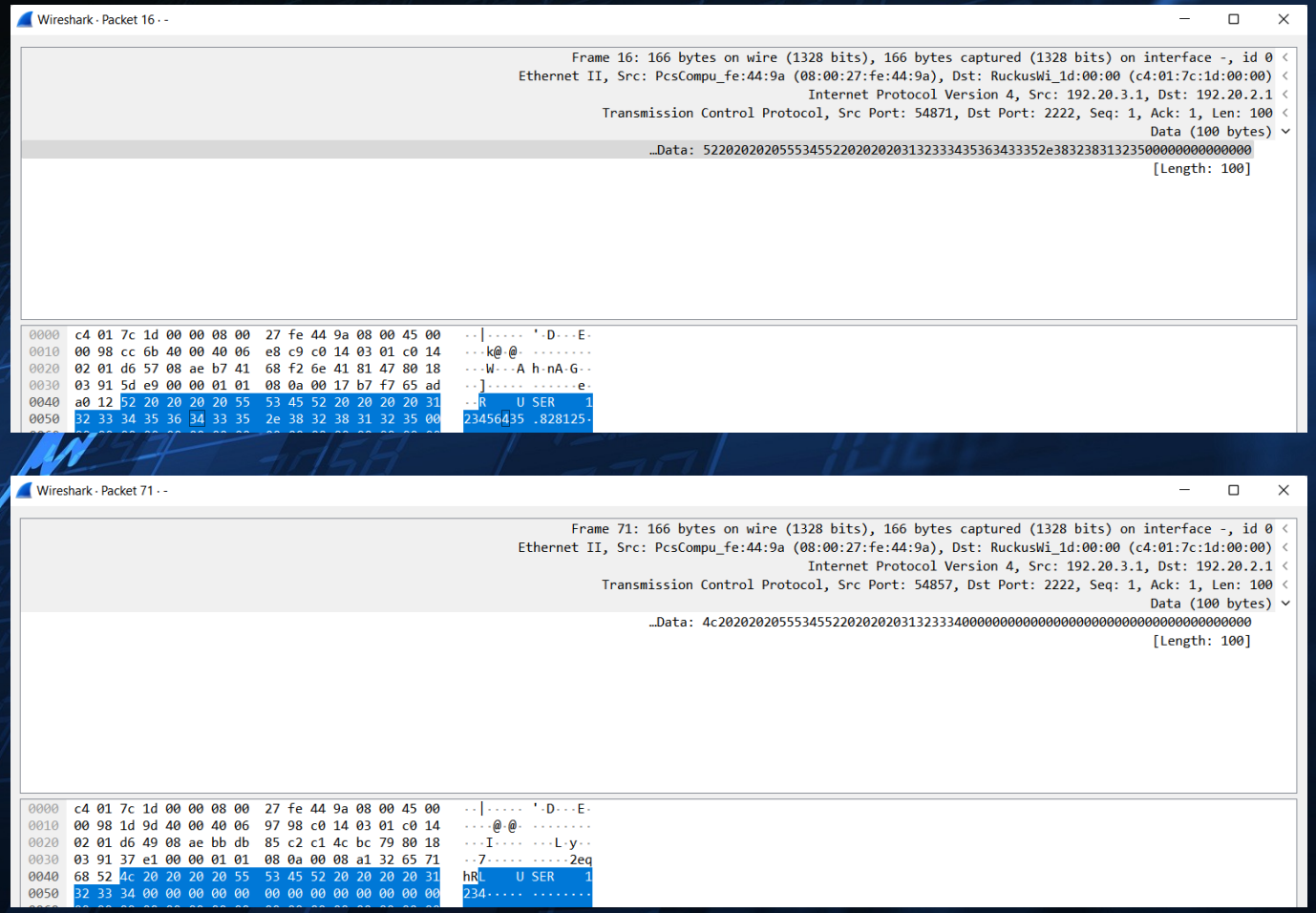
- **Transactions: (Over TCP)**
  A Buy/Sell offer is sent to the server including the stock number, units to buy/sell and price per unit .
  The server will then check if such an offer is valid and will reply with V for a valid offer or an I for an invalid offer, if the offer is valid it is added to the buying/selling offers array.

Networking:

- TCP – A reliable TCP connection is implemented with every client entering the server independently, our server can handle up to 50 clients.
- Multicast – Each client connected to the server joins the multicast group and listens for incoming reports, IP - 239.0.0.1.
- All sockets are handled with care, clients connecting will be assigned a socket and once left the socket will be closed.
- Each Undefined message received by client or server is handled by disconnecting the troublesome client or leaving the server, depends on the receiving end.
- When an old update is received in the multicast (old sequence number), it is discarded by the clients.
- Clients are not allowed to be idle more than 45 seconds disregarding the case of observing upcoming updates, if so, a client will be kicked out.
- Both cases of a server or a client shutting down unexpectedly is handled.
- Both select and threads are used in our implementation.

Screenshots:

```
Welcome to our stock market!
----------------------------
[+] Are you new here? Press 'R' to register and start investing today!
[+] Already have an account? Press 'L' to login
[-] If do you wish to leave, Press 'Q'
R

[+] Enter a username up to 8 characters: USER
[+] Enter a password up to 8 characters: 1234
[+] How much money are you willing to invest? (U.S. Dollars): 56435.83

Registration Successful!
You may now log in your account

[+] Are you new here? Press 'R' to register and start investing today!
[+] Already have an account? Press 'L' to login
[-] If do you wish to leave, Press 'Q'
L

Login Interface:
[+] Username: USER
[+] Password: 1234

Login Successful

Welcome Back, USER.
[+] Your Account Balance is: 56435.83
[-] Your portfolio is empty! Make sure you don't miss good opportunities...

Main Menu:
--------------
[1] Display Full Investment Portfolio & Account Details
[2] Real-Time Stock Prices
[3] Buy/Sell Stocks
[4] Exit
```



Screenshots:

```
Username: USER
Balance:  48027.83

--------------------------------------------------
Portfolio:


 1. Stock-Name: Apple Inc.           | Units:    1

    Current Price Per Unit: 2778.00
    Buying Price Per Unit:  2778.00
    Stock Total Profit:     0.00
--------------------------------------------------
 2. Stock-Name: Bank Of America      | Units:   18

    Current Price Per Unit: 70.00
    Buying Price Per Unit:  59.00
    Stock Total Profit:     198.00
--------------------------------------------------
 3. Stock-Name: Amazon Inc.          | Units:    2

    Current Price Per Unit: 2284.00
    Buying Price Per Unit:  2284.00
    Stock Total Profit:     0.00
--------------------------------------------------
Total Investment Portfolio Profit: 198.00
--------------------------------------------------


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```
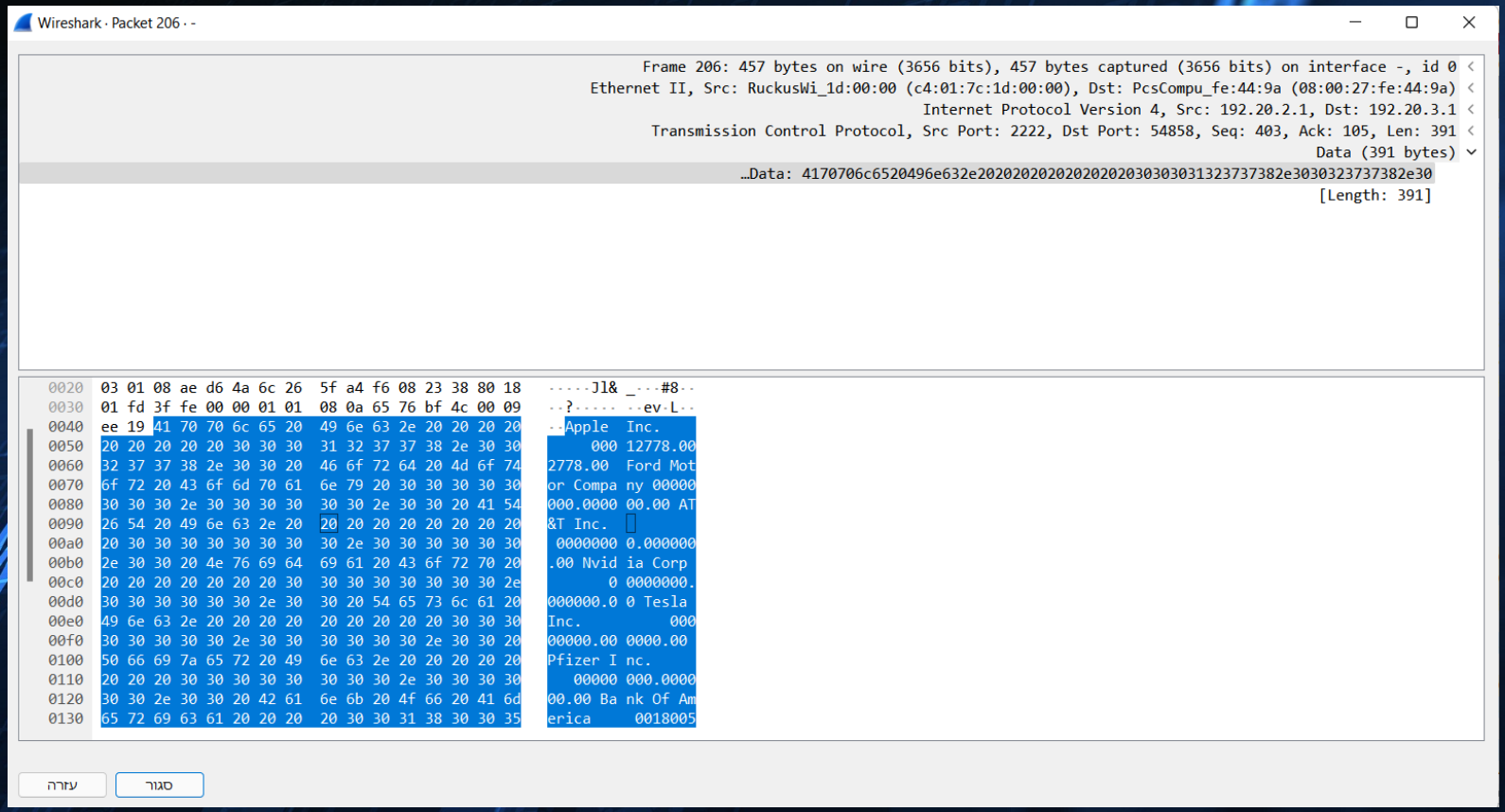
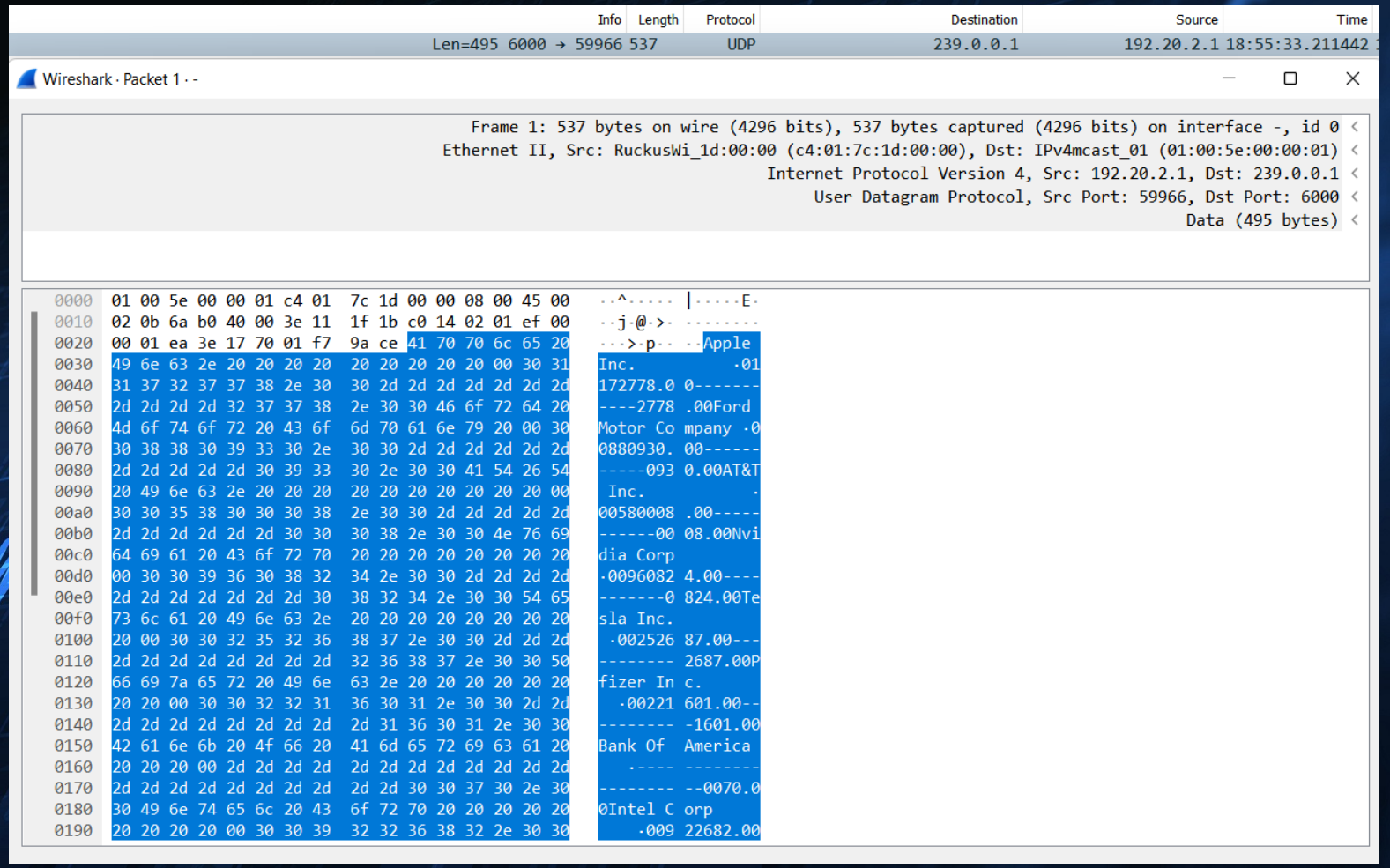



Screenshots:

```
Stock: Tesla Inc.
Current Price: 2687.00
Current Minimum Ask:   25 Units In Price Of 2687.00 Each.
Current Maximum Bid:   -- Currently There Are No Bid Offers --

Stock: Pfizer Inc.
Current Price: 1601.00
Current Minimum Ask:   22 Units In Price Of 1601.00 Each.
Current Maximum Bid:   -- Currently There Are No Bid Offers --

Stock: Bank Of America
Current Price:   70.00
Current Minimum Ask:   -- Currently There Are No Ask Offers --
Current Maximum Bid:   -- Currently There Are No Bid Offers --

Stock: Intel Corp
Current Price: 2682.00
Current Minimum Ask:   92 Units In Price Of 2682.00 Each.
Current Maximum Bid:   -- Currently There Are No Bid Offers --

Stock: Cisco Systems
Current Price: 2415.00
Current Minimum Ask:   53 Units In Price Of 2415.00 Each.
Current Maximum Bid:   21 Units In Price Of   53.00 Each.

Stock: Amazon Inc.
Current Price: 2284.00
Current Minimum Ask:   95 Units In Price Of 2284.00 Each.
Current Maximum Bid:   -- Currently There Are No Bid Offers --

Last update: 18:36:01

** Press 'Enter' To Return To Main Menu **
```



```
Main Menu:
--------------
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3

[+] Would you like to buy or sell? B/S B

[+] Enter Stock to buy/sell: 1
[+] Enter units to buy/sell: 3
[+] Enter price per unit: 77

Good deal! your offer is now online.
```

Wireshark · Packet 73 · -

```
Frame 73: 80 bytes on wire (640 bits), 80 bytes captured (640 bits) on interface -, id 0
Ethernet II, Src: PcsCompu_fe:44:9a (08:00:27:fe:44:9a), Dst: RuckusWi_1d:00:00 (c4:01:7c:1d:00:00)
Internet Protocol Version 4, Src: 192.20.3.1, Dst: 192.20.2.1
Transmission Control Protocol, Src Port: 54872, Dst Port: 2222, Seq: 103, Ack: 403, Len: 14
Data (14 bytes)
Data: 42303030303330303737 2e303000
[Length: 14]
```

```
0000  c4 01 7c 1d 00 00 08 00  27 fe 44 9a 08 00 45 00   ··|····· '·D···E·
0010  00 42 96 df 40 00 40 06  1e ac c0 14 03 01 c0 14   ·B··@·@· ········
0020  02 01 d6 58 08 ae c5 92  a3 38 a3 ec 56 f9 80 18   ···X···· ·8··V···
0030  03 b2 98 6f 00 00 01 01  08 0a 00 18 53 43 65 af   ···o···· ····SCe·
0040  f1 6c 42 30 30 30 30 33  30 30 37 37 2e 30 30 00   ·lB00003 0077.00·
```