PROTOCOL ANALYZER USER MANUAL

C++ WIN32 asynchronous TCP and UDP connections

Purpose, Description, Design and Testing information for a TCP and UDP protocol analyzer tool.

Contents

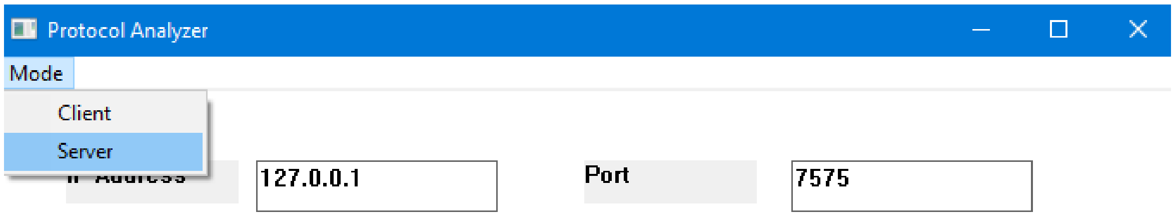
Purpose

To test and compare the difference in performance between TCP and UDP protocols asynchronously utilizing WIN32’s Winsock and WSAAsyncSelect.

Usage

Run the program by double clicking on the exe file.

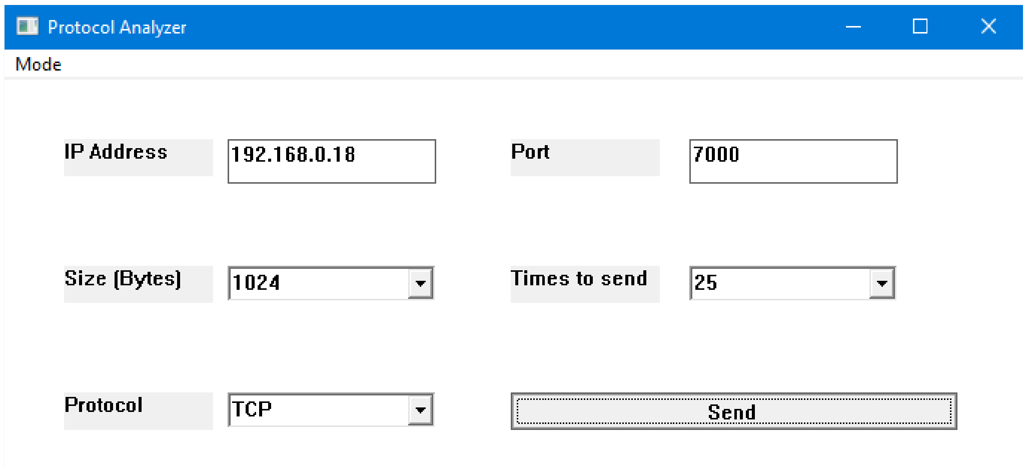
By default, the application runs in client mode. To switch to server mode, click on the word "Mode" at the top left and change to Server. Follow the same process to switch back to Client when needed.



IP Address: 127.0.0.1

Port: 7575

As a client, specify the type of data to be generated and the location (IP and port) to send it to. The specific types of data include using the TCP or UDP, specifying the packet size and the amount of packets to send. Once you have entered the correct information, click the Send button.



IP Address: 192.168.0.18

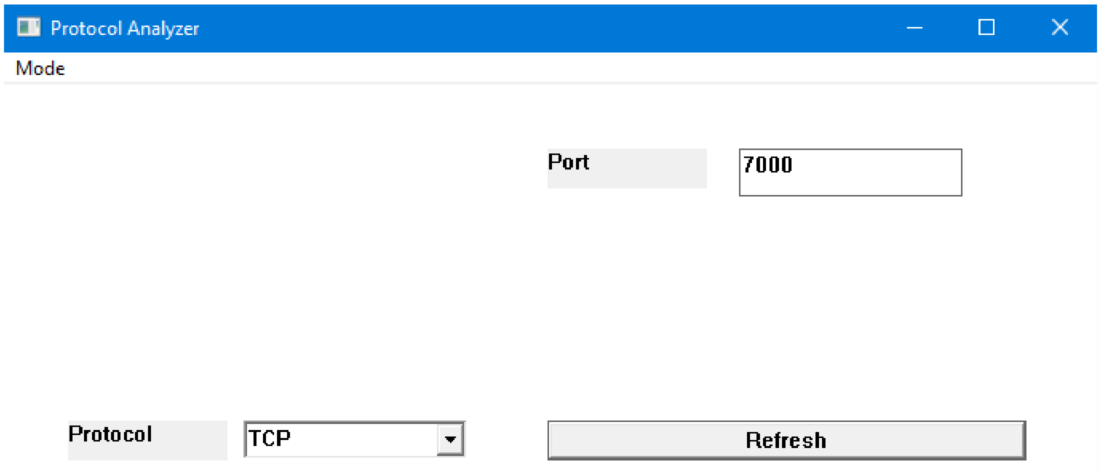
Port: 7000

Size (Bytes): 1024

Times to send: 25

Protocol: TCP

As a server, select the port you wish to connect to and for either TCP or UDP connections. Once you make a change to these values, click the Refresh button to restart the server connection.



Port: 7000

Protocol: TCP

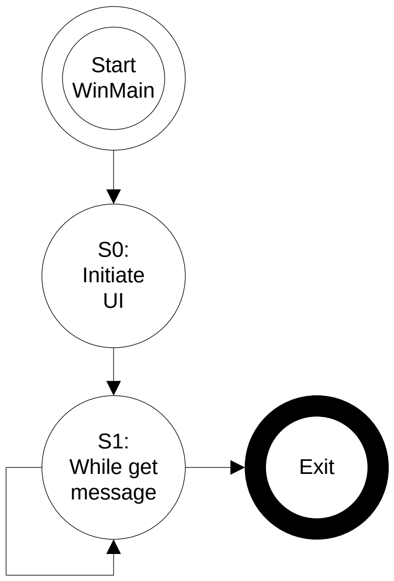
Design

Design Choice Notes

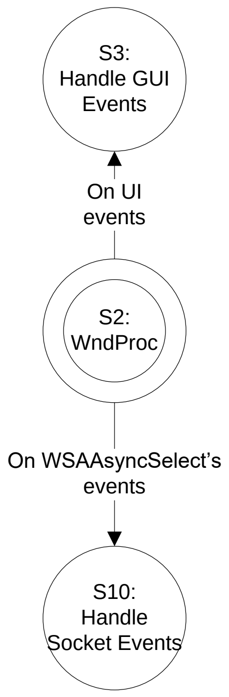
- The program is to be written in C++ using Win32 API
- Both TCP and UDP will be asynchronous
- They will both utilize Winsock2.h and WSAAsyncSelect calls to accomplish the above

State Diagrams

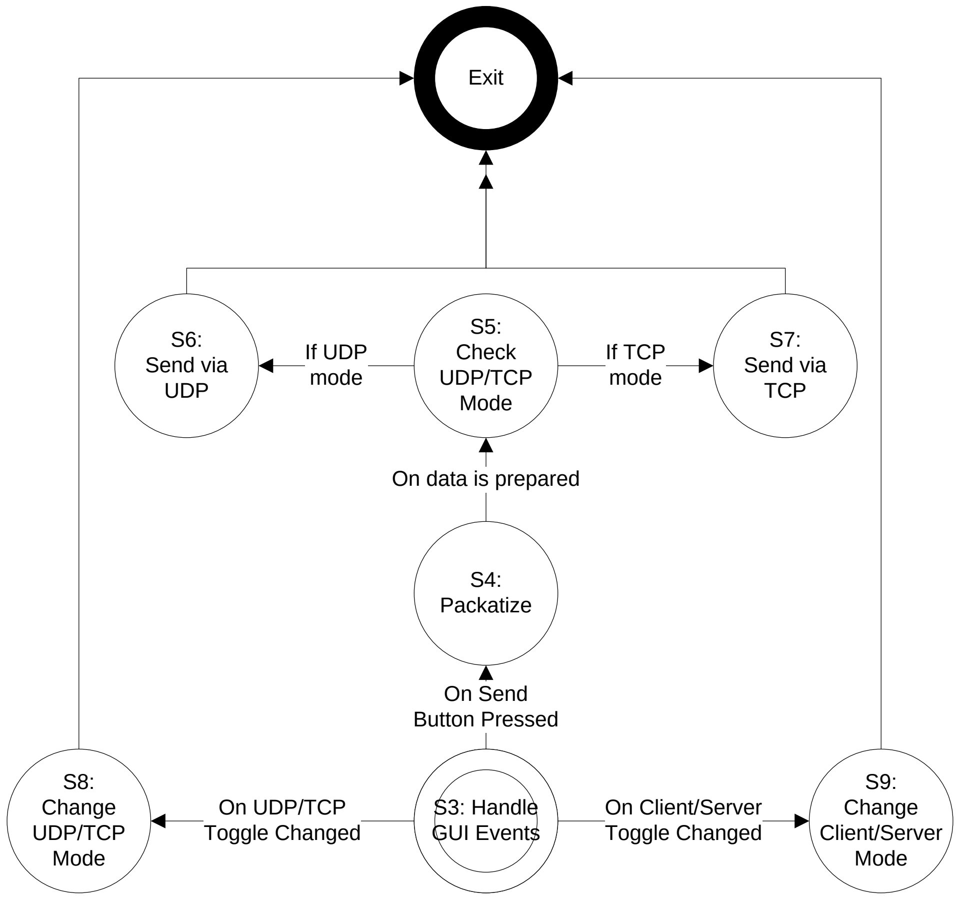
WinMain



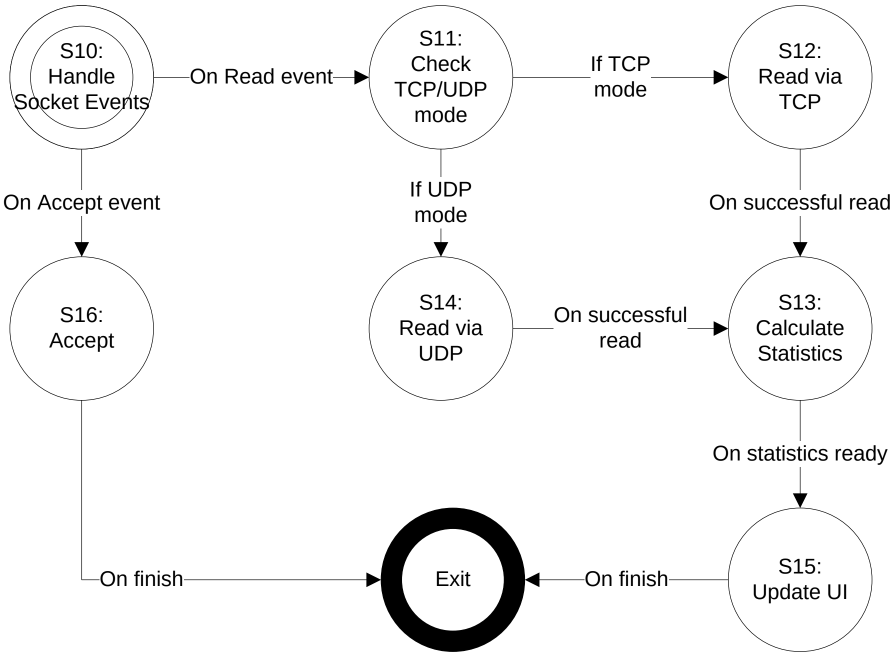
WndProc - Start



WndProc – UI Events



WndProc – Socket Events



Pseudocode

WinMain

S0: Instantiate UI

```
Create Window and store its handle
Get handles for all UI elements on Window
Set default data for all UI elements
GOTO S1:
```

S1: While get message

```
//Mandatory WinMain loop
while GetMessage() is true
    TranslateMessage()
    DispatchMessage()
Exit()
```

WndProc

S2: WndProc

```
switch case event message
    case any UI event
        GOTO S3
    case WSAAsyncSelect's socket events
        GOTO S10
```

S3: Handle GUI Events

```
switch case event message
    case UDP/TCP toggle changed
        GOTO S8
    case Send button pressed
        GOTO S4
    case Client/Server toggle changed
        GOTO S9
```

S4: Packatize

```
Check if GUI is set to read from file
if yes
    packatize packets based on GUI settings from file
else
    packatize packets based on randomly generated data
GOTO S5
```

S5: Check UDP/TCP Mode

```
if mode == UDP
    GOTO S6
else
    GOTO S7
```

S6: Send via UDP

```
Call WSAStartup to setup the enviroment
Call WSASocket to create a datagram socket
foreach packet created
    WSASendTo with socket
Exit()
```

S7: Send via TCP

```
Call WSAStartup to setup the enviroment
Call WSASocket to create a stream socket
foreach packet created
    WSASend with socket
Exit()
```

S8: Change UDP/TCP Mode

```
if wndproc event invoked was to UDP
    ProtocolMode = UDP
else
    ProtocolMode = TCP
if ClientServerMode == Server
```

```
        if ProtocolMode == UDP
            WSAAsyncSelect to invoke WndProc under socket needing to be read
        else
            WSAAsyncSelect to invoke WndProc under socket needing to be read or
accepted
    Exit()
```

S9: Change Client/Server Mode

```
    if wndproc event invoked was Client
        Update UI for client-related elements to be displayed
        Close any open server sockets
    else
        Update UI for server-related elements to be displayed
```

S10: Handle Socket Events

```
    switch case socket event messages
        case Read
            GOTO S11
        case Accepting
            GOTO S16
```

S11: Check TCP/UDP Mode

```
    if ProtocolMode == TCP
        GOTO S12
    else
        GOTO S14
```

S12: Read via TCP

```
    start timer
    while there is more data on the socket
        read data
    end timer
    GOTO S13
```

S13: Calculate Statistics

```
    User timer form S12/S14 & data read to determine statistics
    Such as reading efficiency for each packet size & amount that came in.
    GOTO S15
```

S14: Read via UDP

```
    start timer
    while there is incoming data on the socket
        read data
```

```
end timer
GOTO S13
```

S15: Update GUI

```
Draw statistics onto GUI
Exit()
```

Testing Document

Summary

Screenshots and more information on the tests can be found below.

Section #	Description	Test	Expected Output	Success
1	Program runs without crashing	Run the program	The program does not crash upon starting	Passed
2	UI are functional	Repeat Test #1 and type in a field or click a drop down combo box.	The UI is responsive	Passed
3	Client/Server mode switching changes the UI	Repeat Test #1 and click on the Mode button in the menu. Switch back and forth between Server and Client	The UI will update itself to signify the change in mode. Non-relevant fields in server side will be removed.	Passed
4	A packet can be sent between a client and server instance of this application via TCP	Run two instances of the program on separate computers.	The server UI will state a packet was received	Passed
5	Multiple packets can be sent between a client and a server instance of this application via TCP	Repeat Test #4, however raise the amount of packets to be sent to 10.	The server UI will state data was read equivalent to ten times the packet size.	Passed
6	100 packets can be sent between a client and a server at 1024 byte packets	Repeat Test #5, however raise the amount of packets to 10 and specify a size of 1024	The server UI will state 102400 bytes were read.	Passed
7	Large packets can be sent via TCP. 32768 bytes.	Repeat Test #4, however raise the size of the packet to 32768 bytes.	The server UI will state 32768 bytes were read.	Passed
8	A packet can be sent between a client and server instance of this application via UDP	Run two instances of the program on separate computers.	The server UI will state a packet was received	Passed
9	Multiple packets can be sent between a client and a server instance of this application via UDP	Repeat Test #8, however raise the amount of packets to be sent to 10.	The server UI will state data was read equivalent to ten times the packet size.	Passed
10	100 packets can be sent between a client and a server at 1024	Repeat Test #8, however raise the amount of packets to	The server UI will state 102400 bytes were read.	Passed

	byte packets	10 and specify a size of 1024		
11	Large packets can be sent via UDP. 32768 bytes.	Repeat Test #8, however raise the size of the packet to 32768 bytes.	The server UI will state 32768 bytes were read.	Passed
12	TCP can send 500 packets all size 8192	Repeat Test #5, but make it send 500 packets of size 8192	All data should be sent and the UI display that the data is received.	Passed

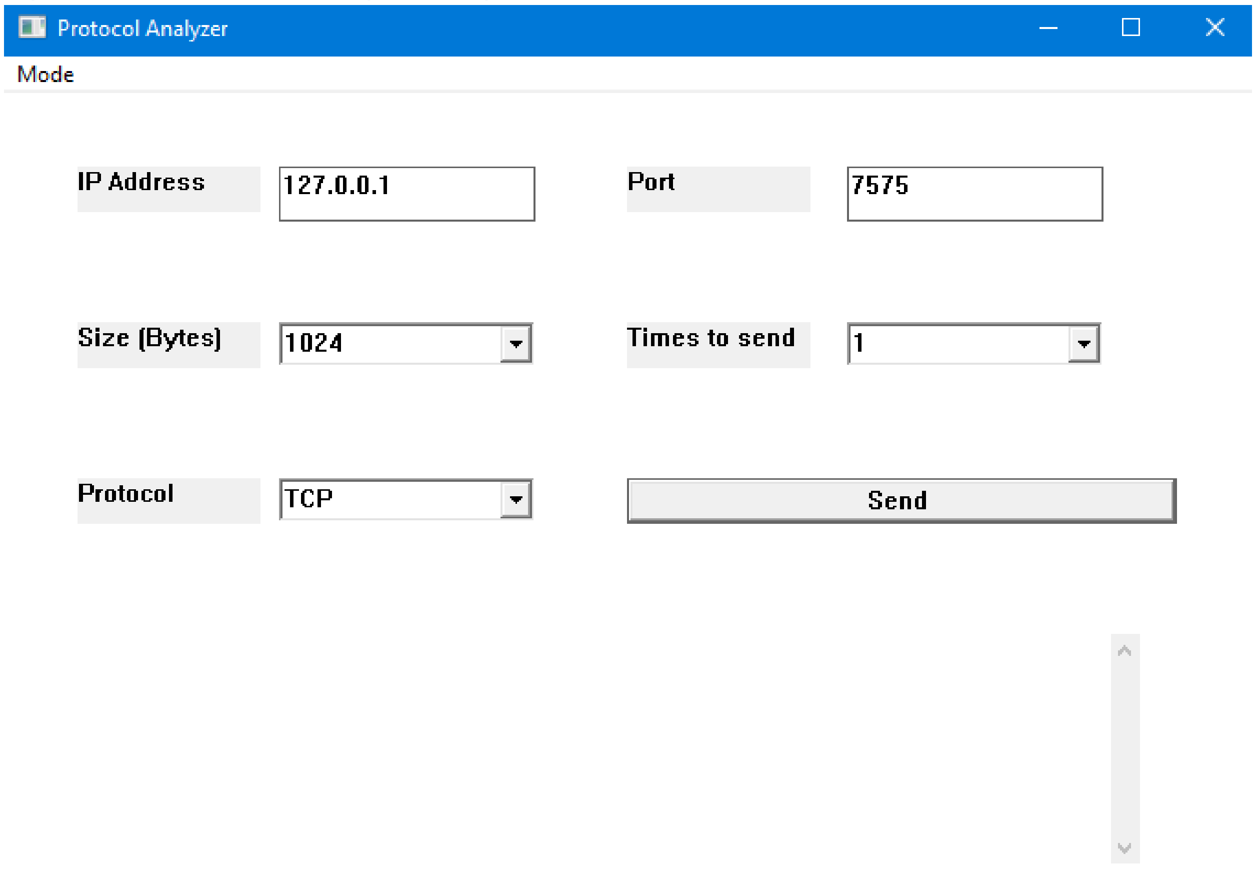
Test 1) Program Runs Without Crashing

Description: The program runs without crashing.

Result: The program will display the UI.

Result: Passed

Figure 1) UI loaded, showing the program does not crash.



Protocol Analyzer

Mode

IP Address: 127.0.0.1

Port: 7575

Size (Bytes): 1024

Times to send: 1

Protocol: TCP

Send

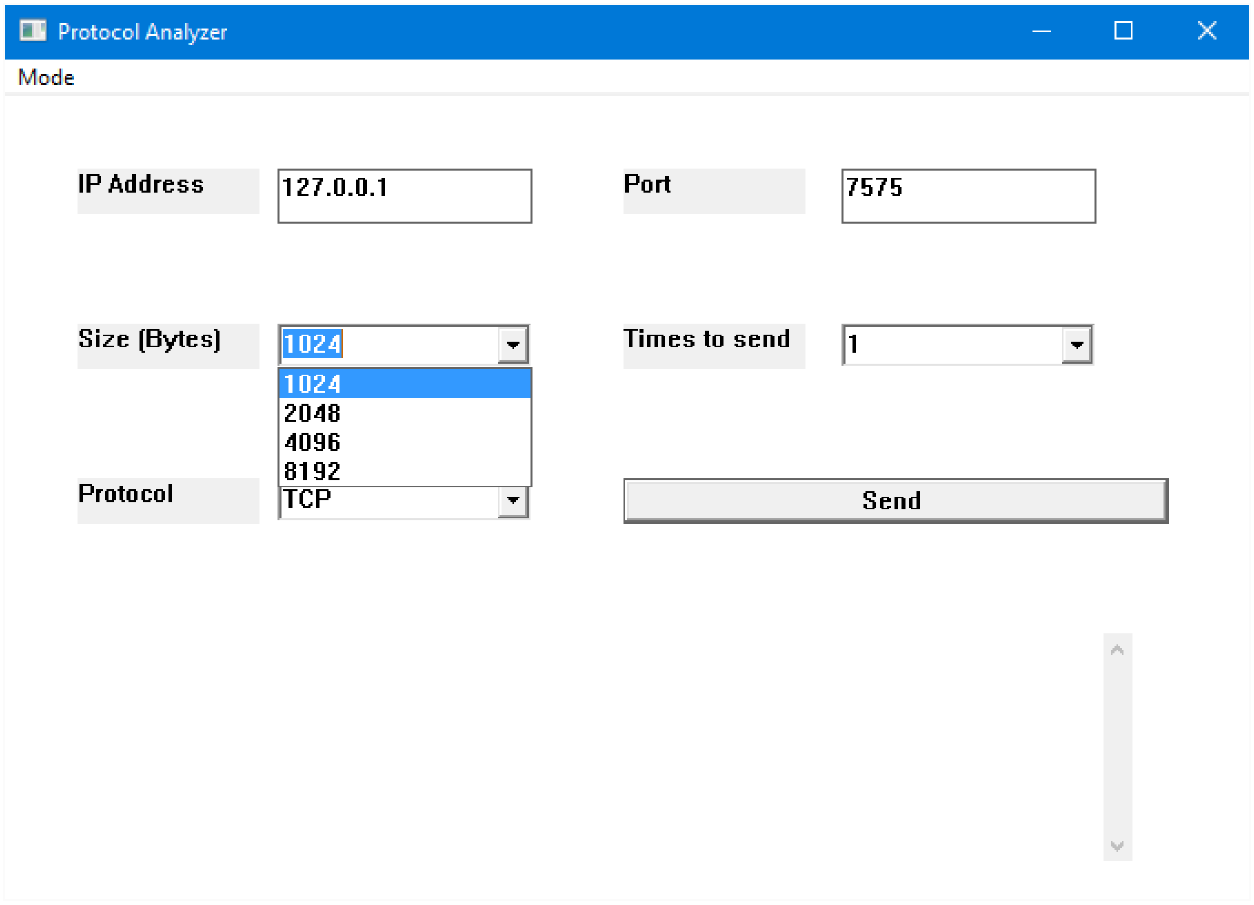
Test 2) UI is functional

Description: The UI is fully functional and can be edited without error.

Result: The UI is functional

Result: Passed

Figure 2) UI loaded, showing the program does not crash.


Protocol Analyzer

Mode

IP Address: 127.0.0.1

Port: 7575

Size (Bytes): 1024

1024
2048
4096
8192

Times to send: 1

Protocol: TCP

Send

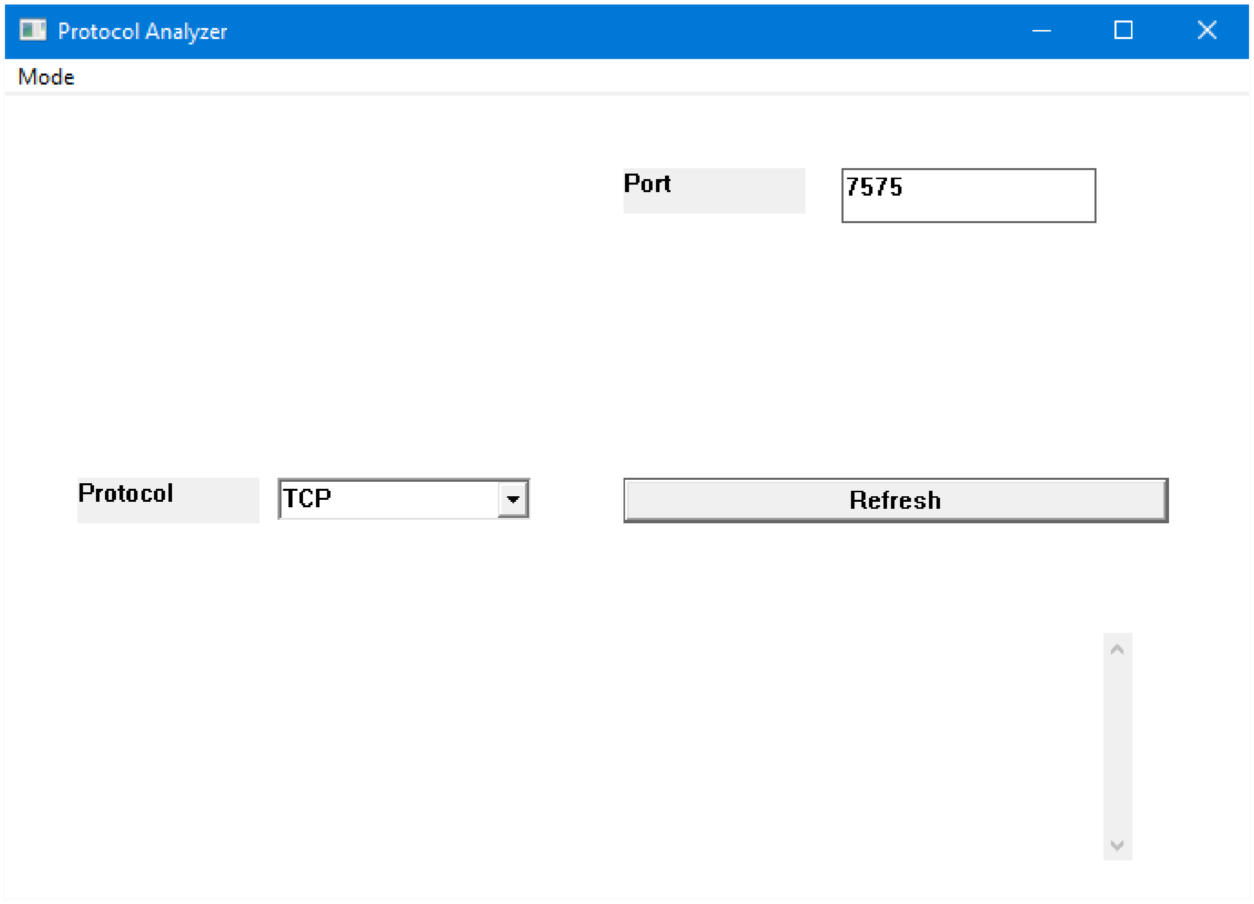
Test 3) Client/Server Mode Changes Modifies UI

Description: When the user changes between client and server mode, the UI will be changed. We do this by clicking the Mode option at the top right and changing over to server or back to client.

Result: The UI will have elements that are irrelevant disappear on server mode, and reappear on client mode.

Result: Passed

Figure 3) UI in server mode.



Port: 7575

Protocol: TCP

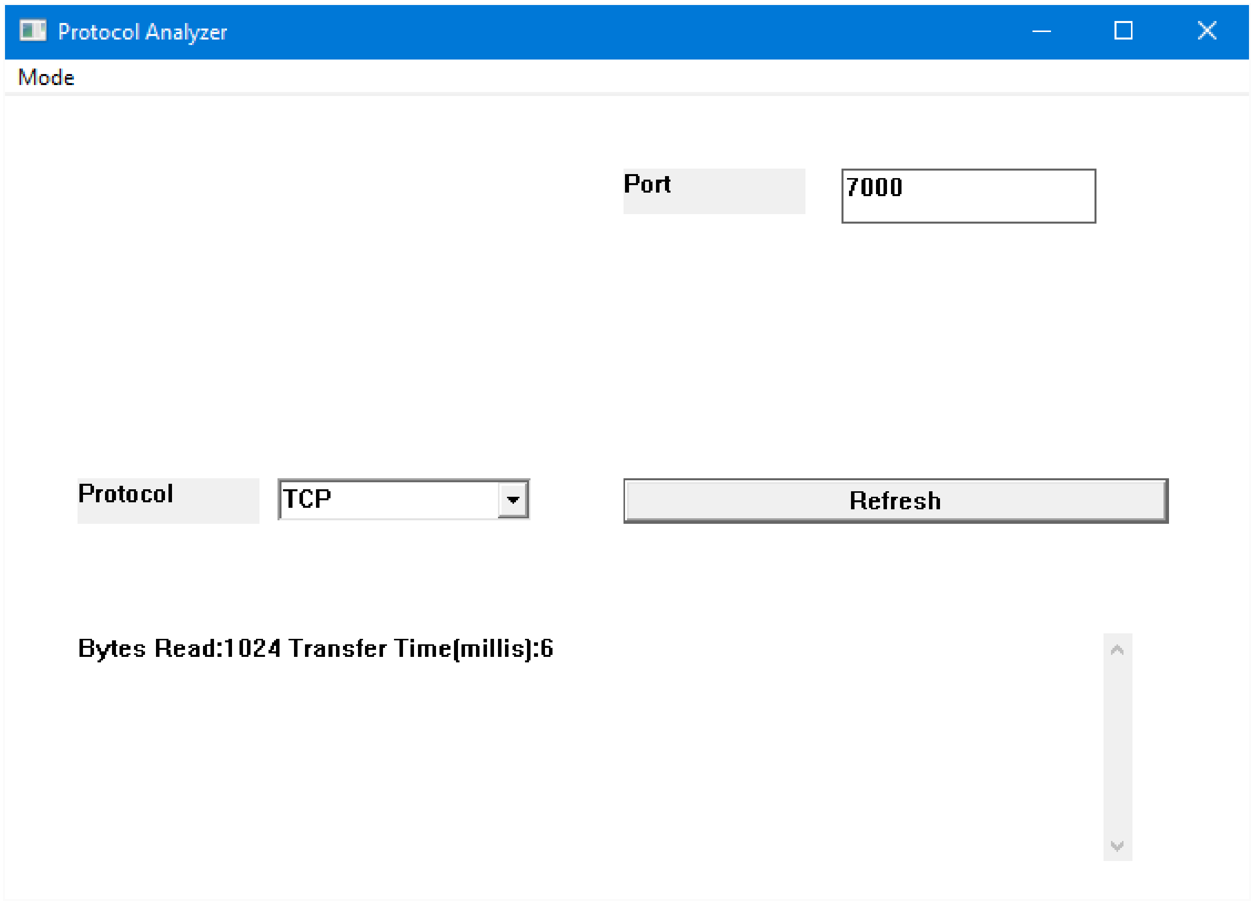
Test 4) Sending a single TCP packet

Description: The TCP client can send a server application a single packet.

Result: The server displays the data for a single packet.

Result: Passed.

Figure 4) Server UI



Port 7000

Protocol TCP

Bytes Read:1024 Transfer Time(millis):6

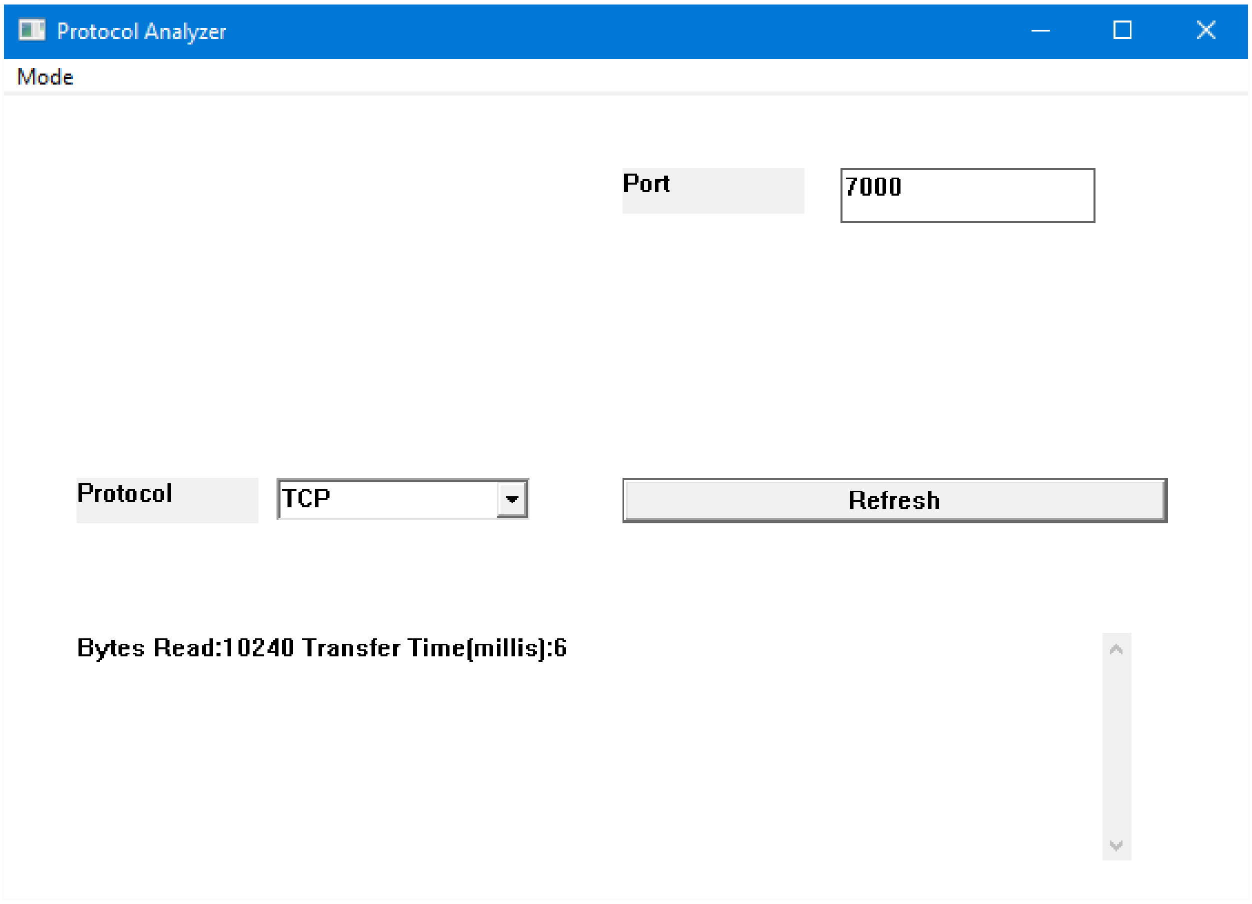
Test 5) Sending multiple TCP packets

Description: The client can send multiple TCP packets to a server instance and the server instance acknowledges them. Send 10 different 1024 packets to test.

Result: The server instance displays 10240 bytes read, AKA 10 different 1024 packets were received.

Result: Passed

Figure 5) Server UI displaying 10240 bytes read



Port 7000

Protocol TCP

Bytes Read:10240 Transfer Time(millis):6

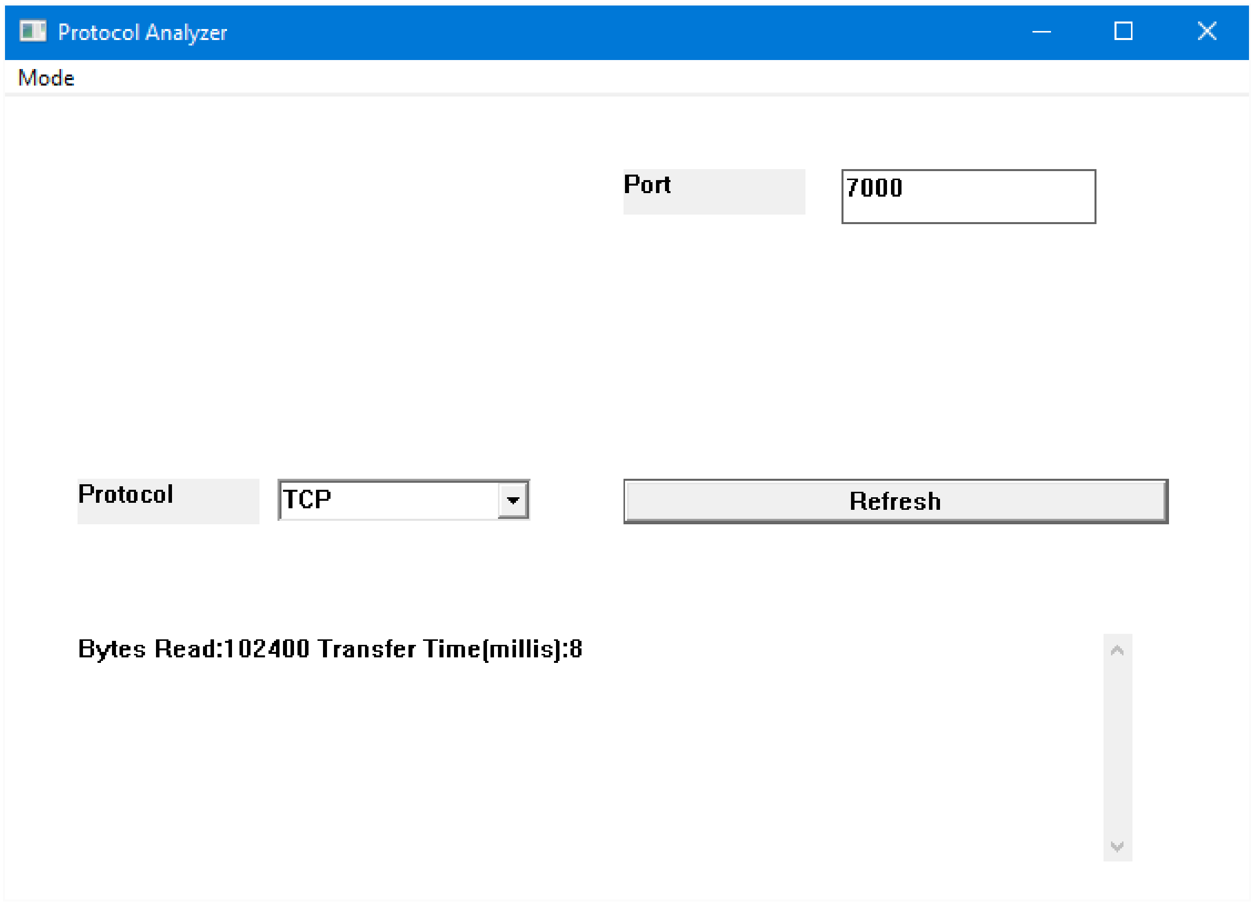
Test 6) Sending 100 packets size 1024 in TCP

Description: A client TCP application can send 100 different packets of size 1024 to the server application.

Result: The server displays 102400 bytes read, AKA 100 different 1024 byte packets read.

Result: Passed

Figure 6) Server UI displaying 102400 bytes read



Port 7000

Protocol TCP

```
Bytes Read:102400 Transfer Time(millis):8
```

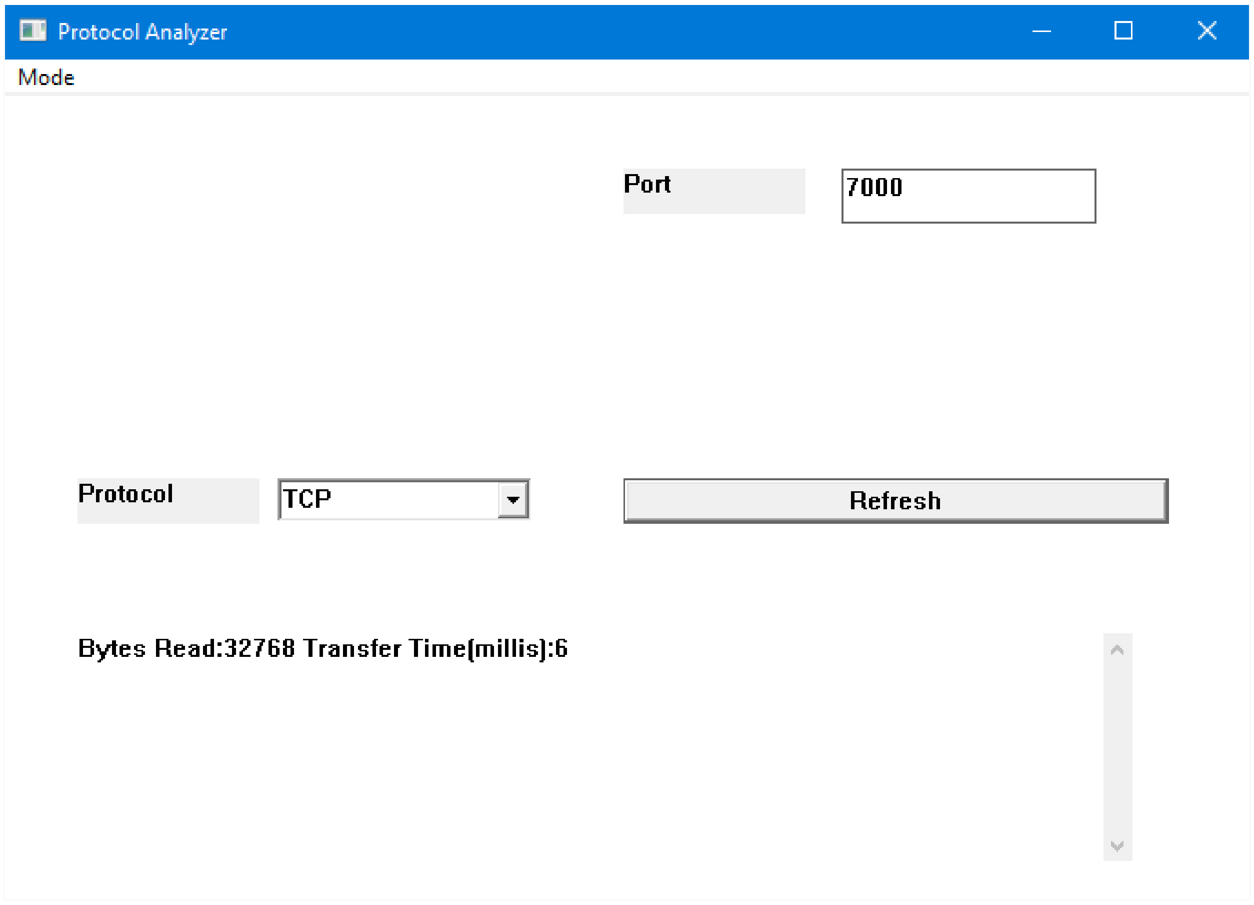
Test 7) Large 32768 byte packets can be sent via TCP

Description: Client can send a large packet in TCP to server instance. Size for test is 32768.

Result: 32768 bytes read by server displayed on screen.

Result: Passed

Figure 7) Server UI



Port 7000

Protocol TCP

```
Bytes Read:32768 Transfer Time(millis):6
```

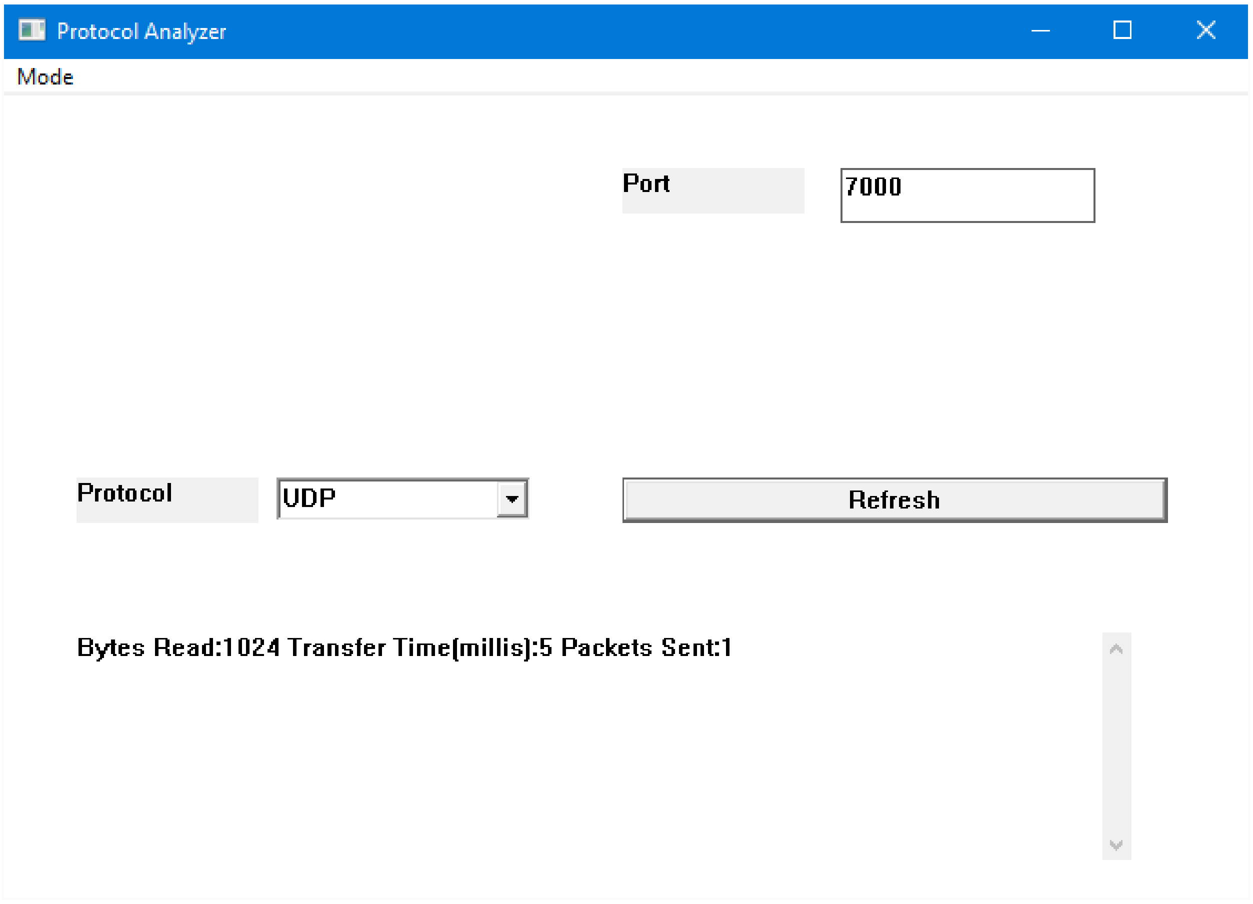
Test 8) Sending a single UDP packet

Description: The UDP client can send a server application a single packet.

Result: The server displays the data for a single packet.

Result: Passed.

Figure 8) Server UI



Port: 7000

Protocol: UDP

```
Bytes Read:1024 Transfer Time(millis):5 Packets Sent:1
```

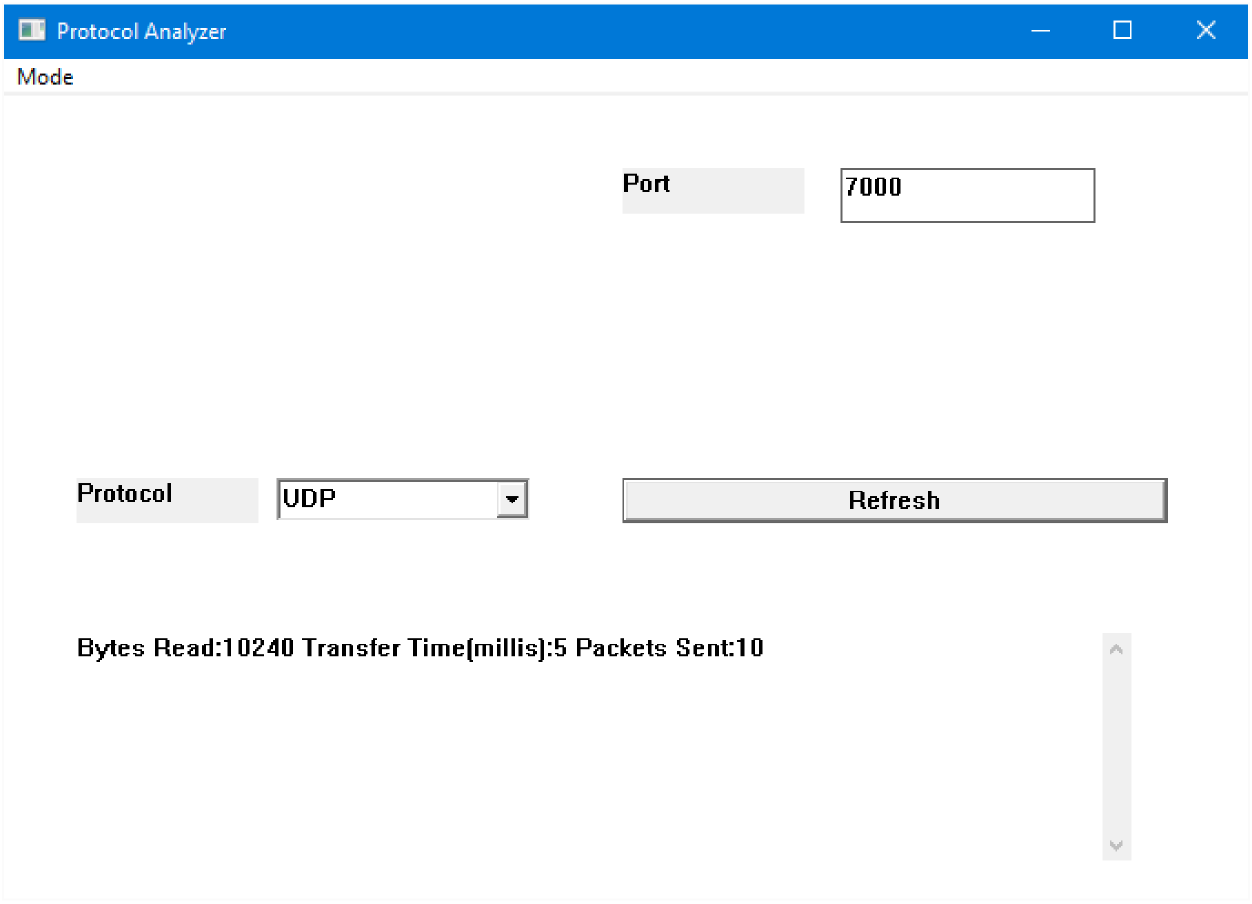
Test 9) Sending multiple UDP packets

Description: The client can send multiple UDP packets to a server instance and the server instance acknowledges them. Send 10 different 1024 packets to test.

Result: The server instance displays “Packets Sent: 10”

Result: Passed

Figure 9) Server UI displaying 10240 bytes read



Port 7000

Protocol UDP

```
Bytes Read:10240 Transfer Time(millis):5 Packets Sent:10
```

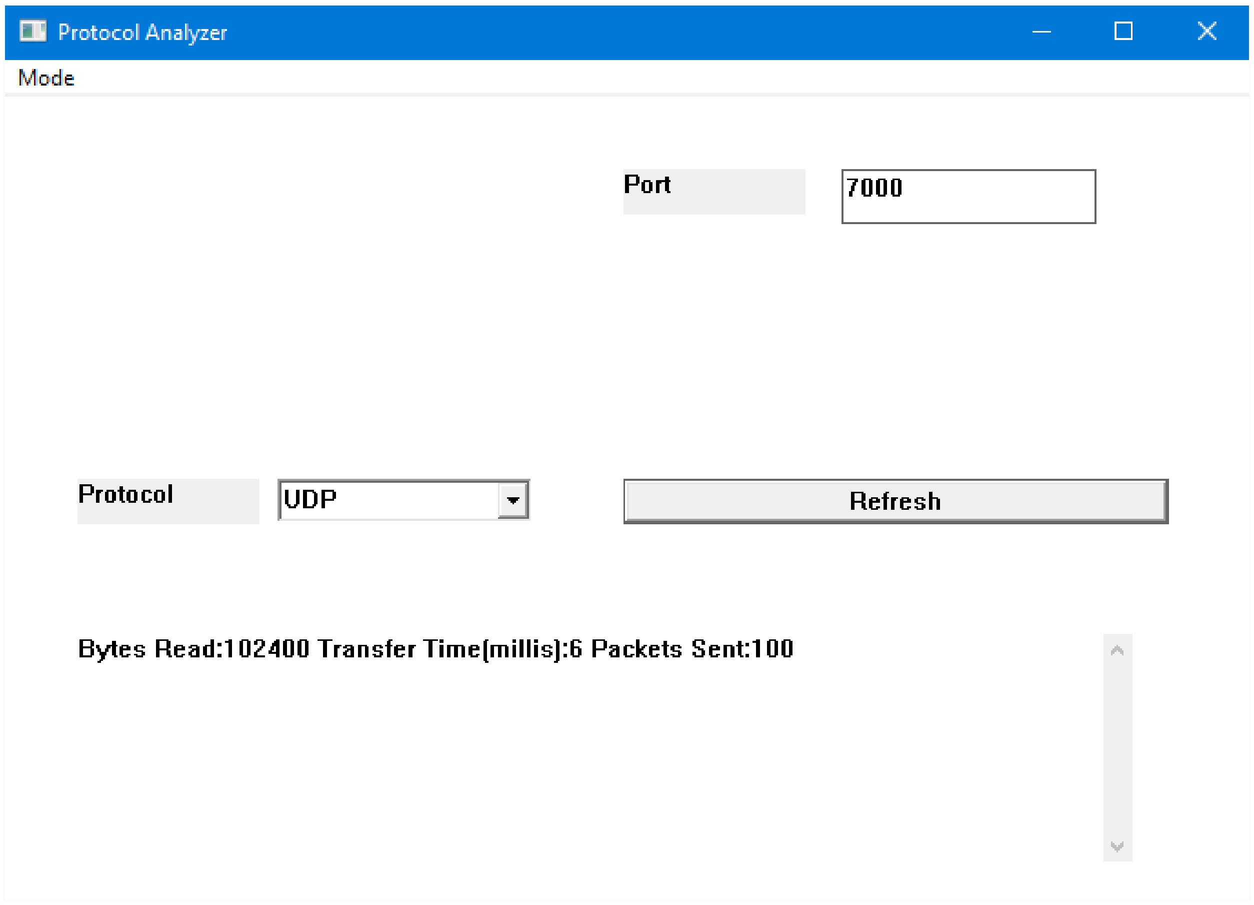
Test 10) Sending 100 packets size 1024 in UDP

Description: A client UDP application can send 100 different packets of size 1024 to the server application.

Result: The server displays “Packets Sent: 100”

Result: Passed

Figure 10) Server UI displaying 100 packets read



Port 7000

Protocol UDP

```
Bytes Read:102400 Transfer Time(millis):6 Packets Sent:100
```

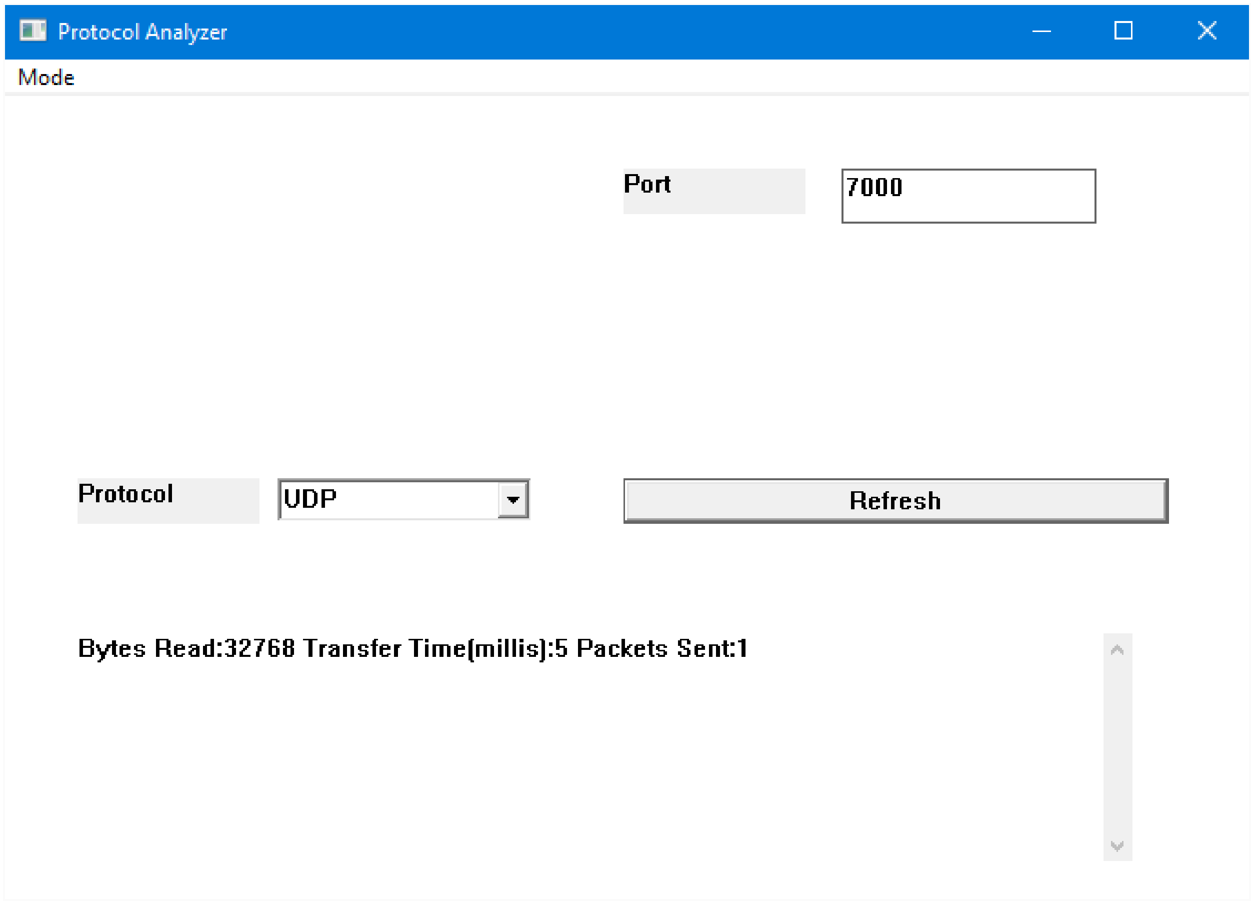
Test 11) Large 32768 byte packets can be sent via UDP

Description: Client can send a large packet in UDP to server instance. Size for test is 32768.

Result: 32768 bytes read by server displayed on screen.

Result: Passed

Figure 11) Server UI



Port: 7000

Protocol: UDP

```
Bytes Read:32768 Transfer Time(millis):5 Packets Sent:1
```

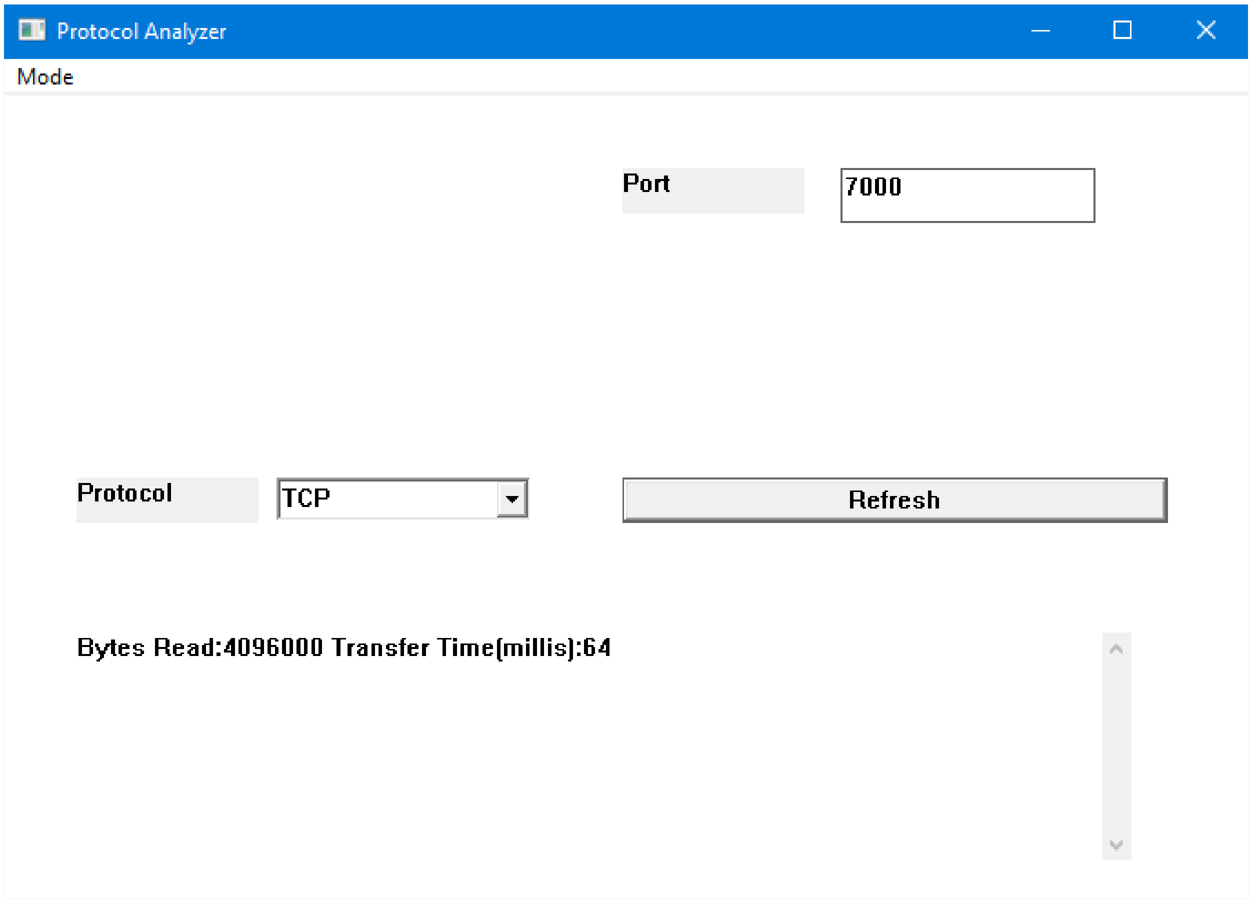
Test 12) TCP can send 500 different packets size 8192

Description: TCP client can send 500 packets all size 8192 to TCP server

Result: 4096000 (500 packets times 8192 bytes per) bytes displayed on screen under Bytes Received

Result: Passed

Figure 12) Server UI



Port: 7000

Protocol: TCP

```
Bytes Read:4096000 Transfer Time(millis):64
```

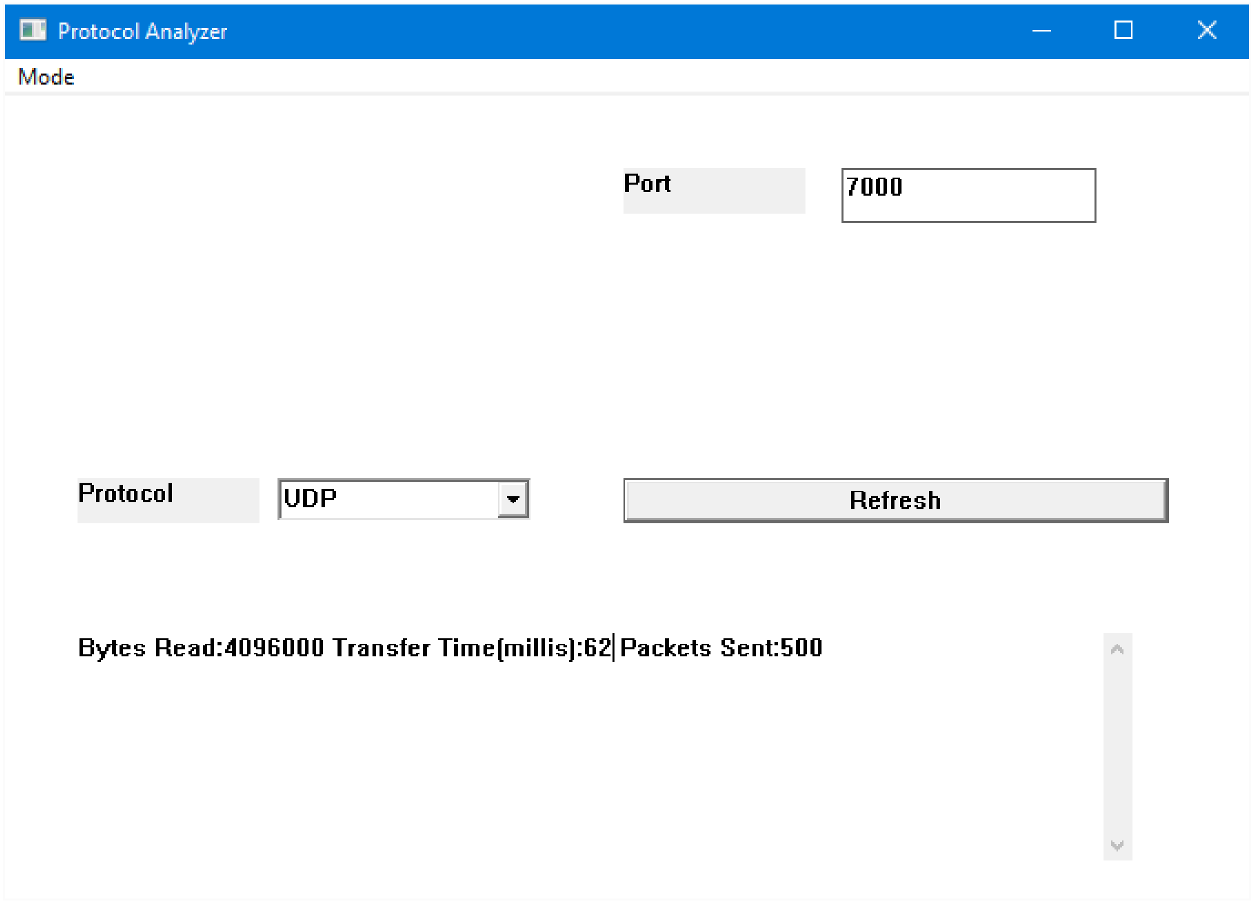
Test 13) UDP can send 500 different packets size 8192

Description: TCP client can send 500 packets all size 8192 to UDP server

Result: Server displays 500 packets read

Result: Passed

Figure 13) Server UI



Port: 7000

Protocol: UDP

```
Bytes Read:4096000 Transfer Time(millis):62 Packets Sent:500
```