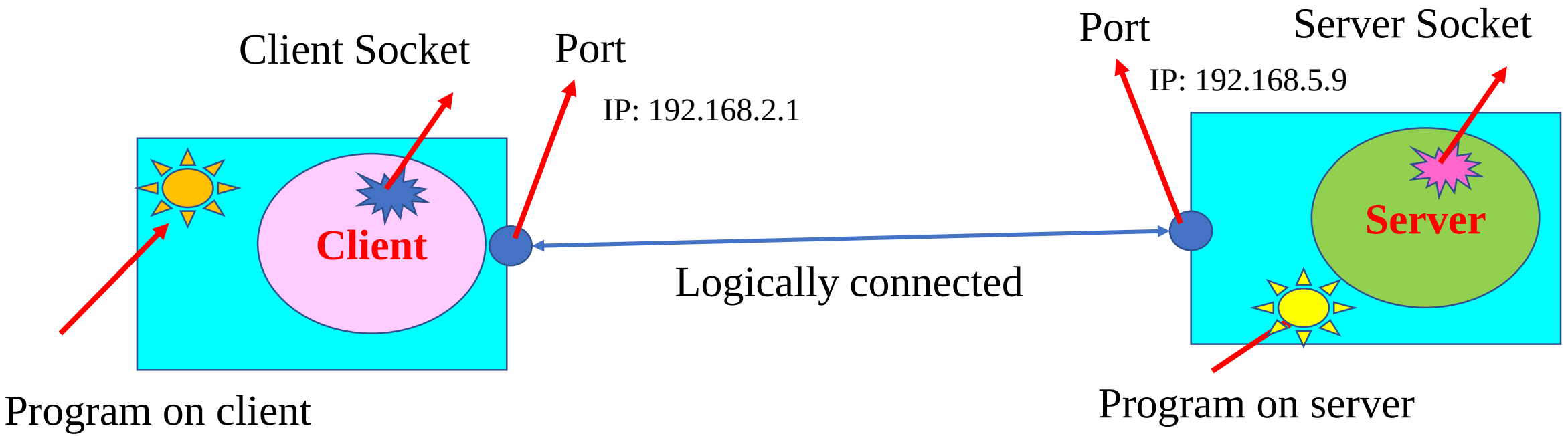
Socket programming

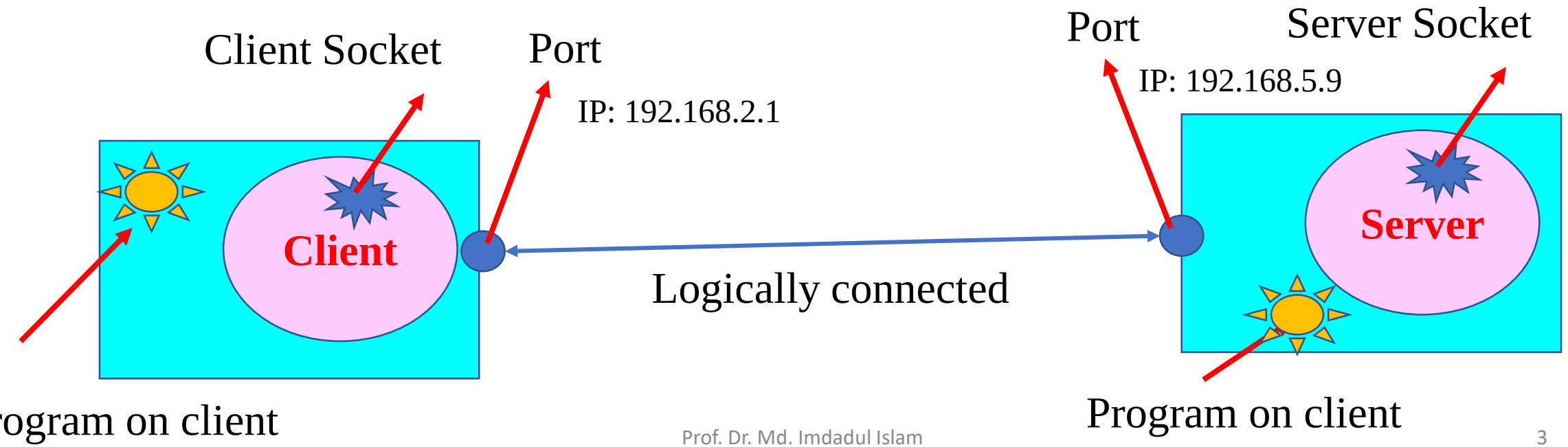
Socket programming establishes connection between two nodes of a network.

- ✓ Socket is considered as the endpoint (like an object at the communication device) of a 2-way communication.
- ✓ Socket on each endpoint is associated with program called socket programming.



- ✓ Sock address is the combination of IP address and port number (process ID) i.e. a socket binds IP and port together.

- ✓ Port number is associated with process hence provides process to process communication.
- ✓ Socket program on each side sends/receives message.
- ✓ Message is first received by a port, then sent to socket and finally sent to the socket program.
- ✓ Socket program executed at transport layer since transport layer deals with process to process communication.



BIND - attach a socket to a specific local IP address and port number.

LISTEN- indicate that the socket can accept new connections.

ACCEPT-begin a network connection following an incoming connection request.

CONNECT- attempt to establish a connection

SEND- transmit data over the connection.

RECEIVE- receive data over the connection.

CLOSE- release the connection.

Create a socket or node named **s**, where **s** is also called socket object

```
# An example script to connect to Google using socket
# programming in Python
import socket
s = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
print ('Socket successfully created')
# default port for socket
port=80
host_ip = socket.gethostbyname('www.google.com')
# connecting to the server
s.connect((host_ip, port))
print ('IP of www.google.com',host_ip)
```

socket.SOCK_STREAM represents TCP

.AF_INET represents IPv4

www.juniv.edu

```
C:\Users\HP>tracert www.google.com

Tracing route to www.google.com [142.250.192.228]
over a maximum of 30 hops:

  1    <1 ms    <1 ms    <1 ms  172.16.48.1
  2    <1 ms    <1 ms    <1 ms  172.16.251.33
  3    <1 ms    <1 ms    <1 ms  172.16.251.9
  4    <1 ms    <1 ms    <1 ms  163.47.36.9
  5     3 ms     3 ms     3 ms  100.100.4.22
  6     3 ms     3 ms     3 ms  10.100.240.57
  7     *        *        *     Request timed out.
  8     3 ms     3 ms     3 ms  100.100.0.57
  9    12 ms    10 ms    11 ms  123.49.8.146
 10    40 ms    40 ms    40 ms  123.49.13.0
 11    40 ms    40 ms    40 ms  108.170.253.122
 12    59 ms    54 ms    54 ms  72.14.239.10
 13    55 ms    55 ms    55 ms  74.125.243.97
 14    55 ms    55 ms    54 ms  142.251.54.65
 15    54 ms    54 ms    54 ms  del11s13-in-f4.1e100.net [142.250.192.228]

Trace complete.

C:\Users\HP>_
```

We got the same IP from *tracert* and *socket* programming.

Access google using http://142.250.192.228

Socket successfully created

IP of www.google.com 142.250.192.228

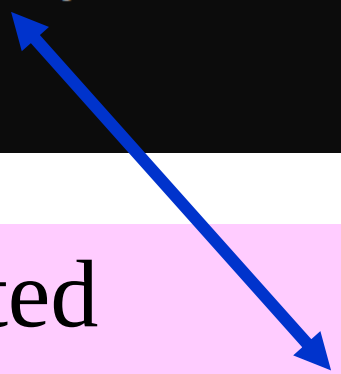
```
C:\Users\HP>tracert www.juniv.edu

Tracing route to juniv.edu [72.249.68.156]
over a maximum of 30 hops:

  1    <1 ms    <1 ms    <1 ms  172.16.48.1
  2    <1 ms    <1 ms    <1 ms  172.16.251.33
  3    <1 ms    <1 ms    <1 ms  172.16.251.9
  4    <1 ms    <1 ms    <1 ms  163.47.36.9
  5     3 ms     3 ms     5 ms  100.100.4.22
  6     3 ms     3 ms     3 ms  10.100.240.57
  7     *        *        *     Request timed out.
  8     3 ms     3 ms     3 ms  100.100.0.57
  9    63 ms    62 ms    62 ms  203.208.191.141
 10    62 ms    61 ms    60 ms  203.208.182.249
 11   243 ms   236 ms   236 ms  203.208.158.46
 12   238 ms   238 ms   238 ms  203.208.172.234
 13   243 ms   242 ms   242 ms  64.125.35.189
 14   278 ms   278 ms   277 ms  ae6.cs2.sjc2.us.eth.zayo.com [64.125.25.100]
 15     *      278 ms     *     ae2.cs2.lax112.us.eth.zayo.com [64.125.28.197]
 16     *      267 ms     *     ae12.cs2.dfw2.us.zip.zayo.com [64.125.26.182]
 17   280 ms   280 ms   280 ms  ae24.er2.dfw2.us.zip.zayo.com [64.125.27.105]
 18   283 ms   283 ms   283 ms  64.124.196.226.t00876-01.above.net [64.124.196.226]
 19   282 ms   278 ms   291 ms  ae3.jvalue1.dal.tierpoint.net [206.123.64.17]
 20   267 ms   267 ms   267 ms  ae0.jvalue3.dal.tierpoint.net [207.210.229.6]
 21   278 ms   278 ms   278 ms  207.210.228.50
 22   292 ms   278 ms   278 ms  vps.juniv.edu [72.249.68.156]

Trace complete.

C:\Users\HP>
```



Socket successfully created

IP of www.juniv.edu 72.249.68.156

Client Server Communications

Server side

Import the python **socket** module, this is a built-in module

IP address 127.0.0.1

We pick a random high TCP port to listen on

```
import socket
LOCALHOST = "127.0.0.1"
PORT = 8080
server = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
server.bind((LOCALHOST, PORT))
server.listen(1)
print("Server started")
print("Waiting for client request..")
```

BIND - attach a socket to a specific local IP address and port number. For a local server, we might choose to bind to the IP address 127.0.0.1 with the TCP port number 8080.

It indicates that server has the capability of listening.

```
clientConnection, clientAddress = server.accept()
print("Connected client :" , clientAddress)
msg = ‘’
while True:
    in_data = clientConnection.recv(1024)
    msg = in_data.decode()
    if msg=='bye':
        break
    print("From Client :" , msg)
    out_data = input()
    clientConnection.send(bytes(out_data,'UTF-8'))
print("Client disconnected....")
clientConnection.close()
```

Incoming connections will be accepted and provide a new socket to communicate with a given client (clientConnection) and the address of the client (clientAddress) is stored at the server

After a connection is established, the server prints out the client address and then waits for data.

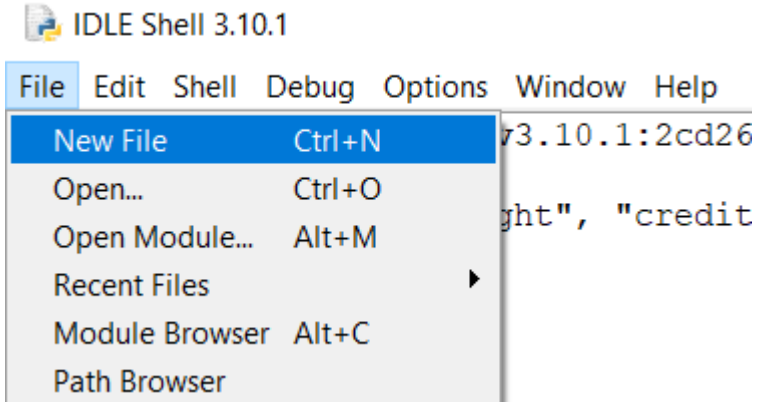
Byte code (UNICODE) to original text converter for received data

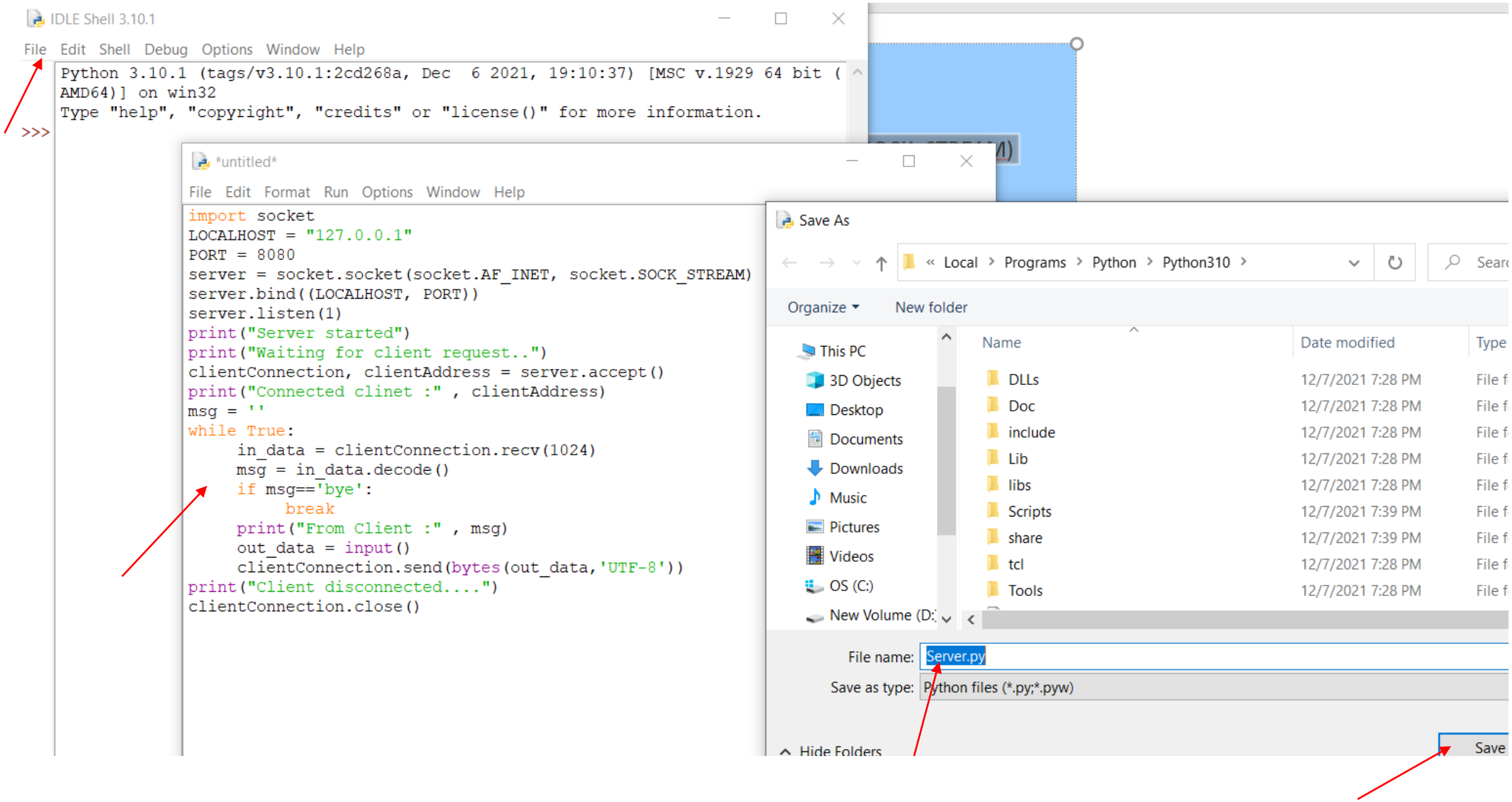
Received data from client in byte format where buffer size of 1024 bytes at a time.

Original Text is converted to byte (UNICODE) during transmission

```
import socket
LOCALHOST = "127.0.0.1"
PORT = 8080
server = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
server.bind((LOCALHOST, PORT))
server.listen(1)
print("Server started")
print("Waiting for client request..")
clientConnection, clientAddress = server.accept()
print("Connected clinet :" , clientAddress)
msg = ''
while True:
    in_data = clientConnection.recv(1024)
    msg = in_data.decode()
    if msg=='bye':
        break
    print("From Client :" , msg)
    out_data = input()
    clientConnection.send(bytes(out_data,'UTF-8'))
print("Client disconnected....")
clientConnection.close()
```

Copy it on new file of idle shell and save it as Server.py




IDLE Shell 3.10.1
File Edit Shell Debug Options Window Help
Python 3.10.1 (tags/v3.10.1:2cd268a, Dec 6 2021, 19:10:37) [MSC v.1929 64 bit (
AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
untitled
File Edit Format Run Options Window Help
import socket
LOCALHOST = "127.0.0.1"
PORT = 8080
server = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
server.bind((LOCALHOST, PORT))
server.listen(1)
print("Server started")
print("Waiting for client request..")
clientConnection, clientAddress = server.accept()
print("Connected clinet :" , clientAddress)
msg = ''
while True:
in_data = clientConnection.recv(1024)
msg = in_data.decode()
if msg=='bye':
break
print("From Client :" , msg)
out_data = input()
clientConnection.send(bytes(out_data,'UTF-8'))
print("Client disconnected....")
clientConnection.close()
Save As
Local Programs Python Python310
Organize
New folder
This PC
3D Objects
Desktop
Documents
Downloads
Music
Pictures
Videos
OS (C:)
New Volume (D:)
Name
Date modified
Type
DLLs 12/7/2021 7:28 PM
Doc 12/7/2021 7:28 PM
include 12/7/2021 7:28 PM
Lib 12/7/2021 7:28 PM
libs 12/7/2021 7:28 PM
Scripts 12/7/2021 7:39 PM
share 12/7/2021 7:39 PM
tcl 12/7/2021 7:28 PM
Tools 12/7/2021 7:28 PM
File name: Server.py
Save as type: Python files (*.py;*.pyw)
Hide Folders
Save

Client side

```
import socket
SERVER = "127.0.0.1"
PORT = 8080
client = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
client.connect((SERVER, PORT))
client.sendall(bytes("This is from Client",'UTF-8'))
while True:
  in_data =  client.recv(1024)
  print("From Server :" ,in_data.decode())
  out_data = input()
  client.sendall(bytes(out_data,'UTF-8'))
  if out_data=='bye':
    break
client.close()
```

1.The client also starts by calling SOCKET to create a new socket.

2.Next, the client will attempt to CONNECT to the server. The client doesn't need to be explicitly told to BIND to a specific address - it will pick an appropriate IP and port (usually a random high port).

3.After the server has accepted the connection, the client can SEND and RECEIVE data according to the protocols being used. With HTTP, the client will send GET and POST requests and receive HTTP responses back from the server.

4.Finally, when both client and server issue the CLOSE primitive, the connection will be torn down.

Open a new shell and copy it on new file of idle shell and save it as Cleint.py. Make conversation with the server and client.

Client

```
=== RESTART:
C:\Users\CSEJU\AppData\Local\Programs\Python\Python310\client.py ==
From Server : Hellow
I am client (2)
From Server : Nice to hear
me too (4)
From Server : bye
Bye (5)
```

Server

```
=== RESTART:
C:\Users\CSEJU\AppData\Local\Programs\Python\Python310\Server.py ==
Server started
Waiting for client request..
Connected clinet : ('127.0.0.1', 57676)
From Client : This is from Client
Hellow  (1)
From Client : I am client
Nice to hear (3)
From Client : me too
Bye  (5)
Client disconnected....
```

Repeat the job using command prompt of C: