Socket Programming

Socket Programming

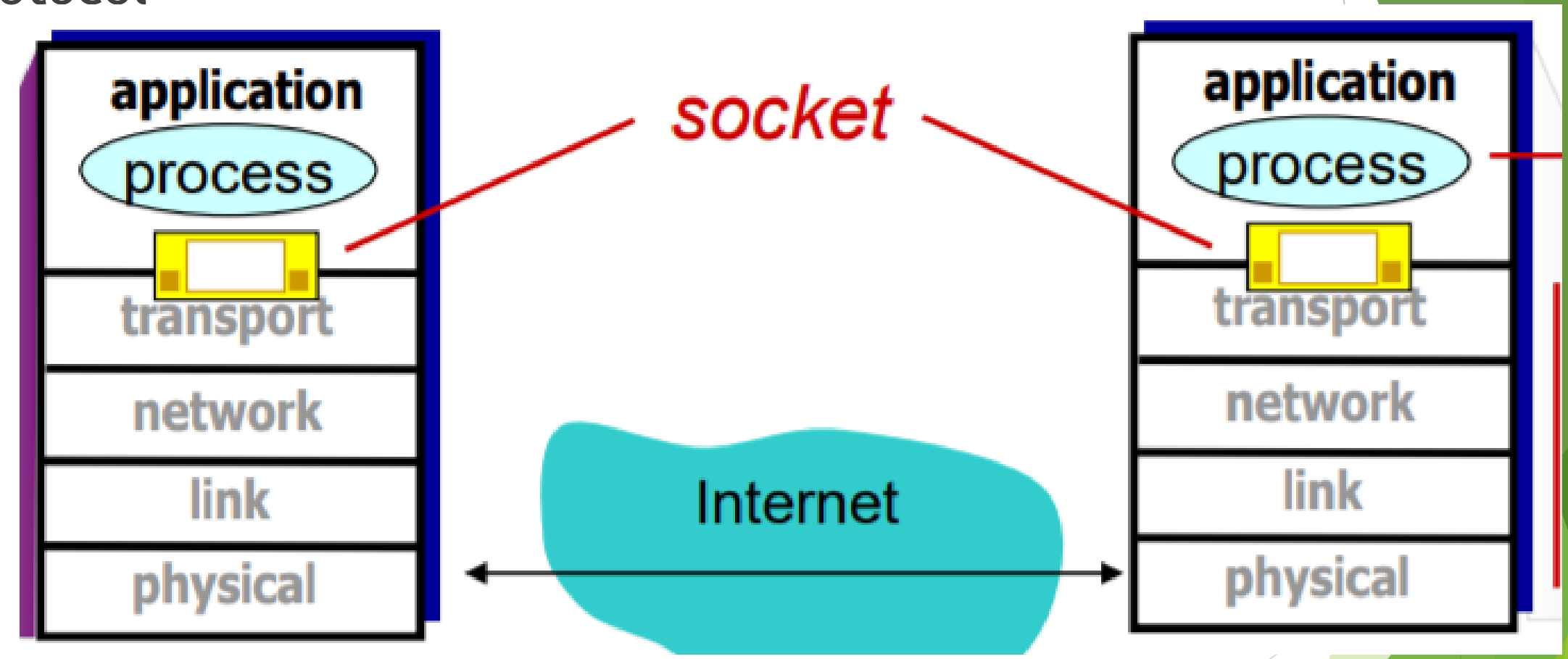
- **Socket programming is a way of connecting two nodes on a network to communicate with each other. One socket(node) listens on a particular port at an IP, while other socket reaches out to the other to form a connection. Server forms the listener socket while client reaches out to the server.**

Socket Programming

- **End to end programming (chatting, file transfer, calculation , data processing etc.)**
- **process sends/receives messages to/from its socket**
- **A socket can be uniquely identified by**
  - **An Internet Address**
  - **An End to End Protocol (TCP or UDP)**
  - **A Port Number**

Socket Programming

- socket: door between application process and end-end- transport protocol



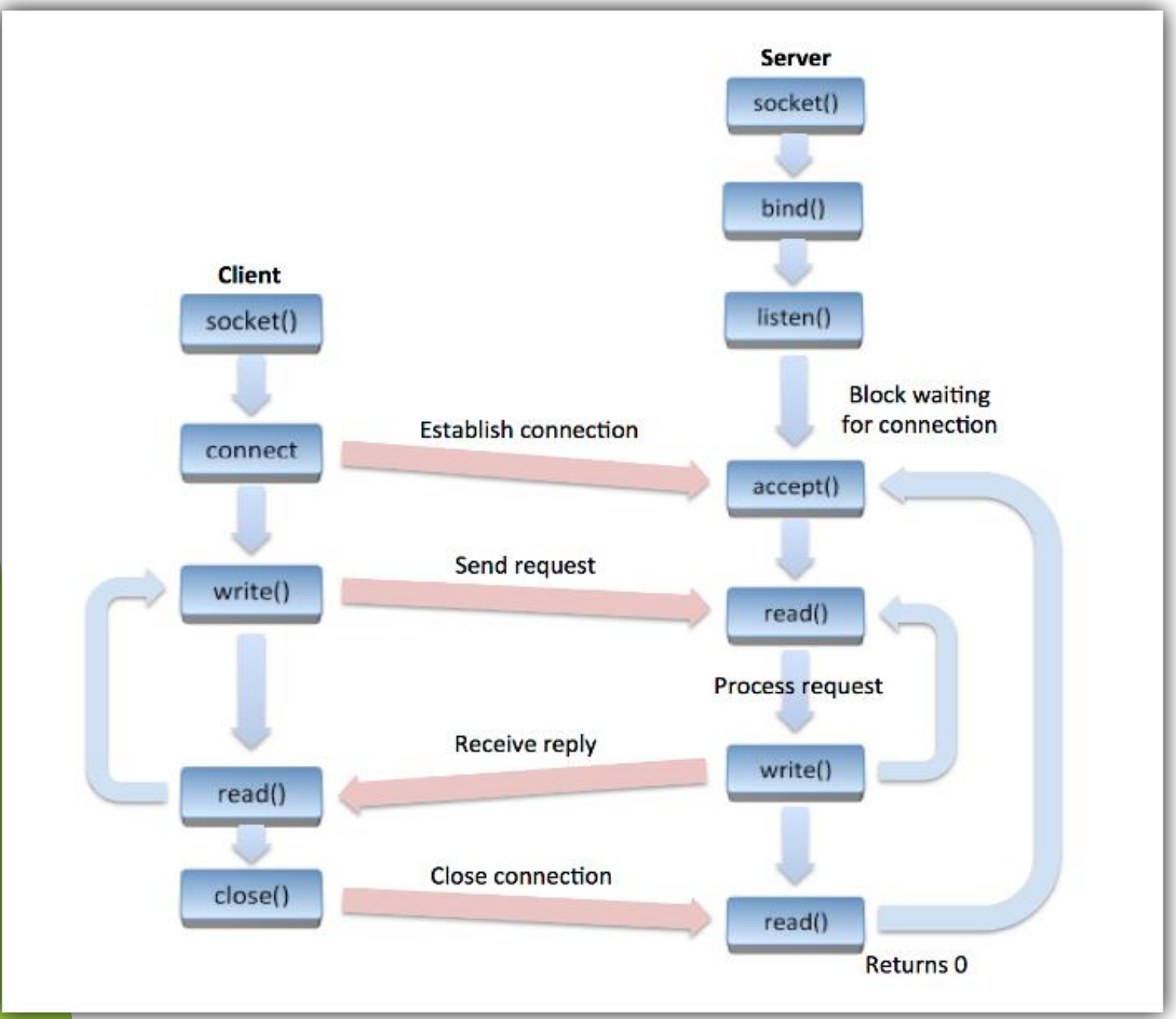
Socket Programming

- Two types of (TCP/IP) sockets
  - Stream sockets (e.g. uses TCP)
  - provide reliable byte-stream service
- Datagram sockets (e.g. uses UDP)
  - provide best-effort datagram service
  - messages up to 65,500 bytes

Client-Server Communication

- Server
  - passively waits for and responds to clients
  - passive socket
- Client
  - initiates the communication
  - must know the address and the port of the server
  - active socket

Socket Programming TCP

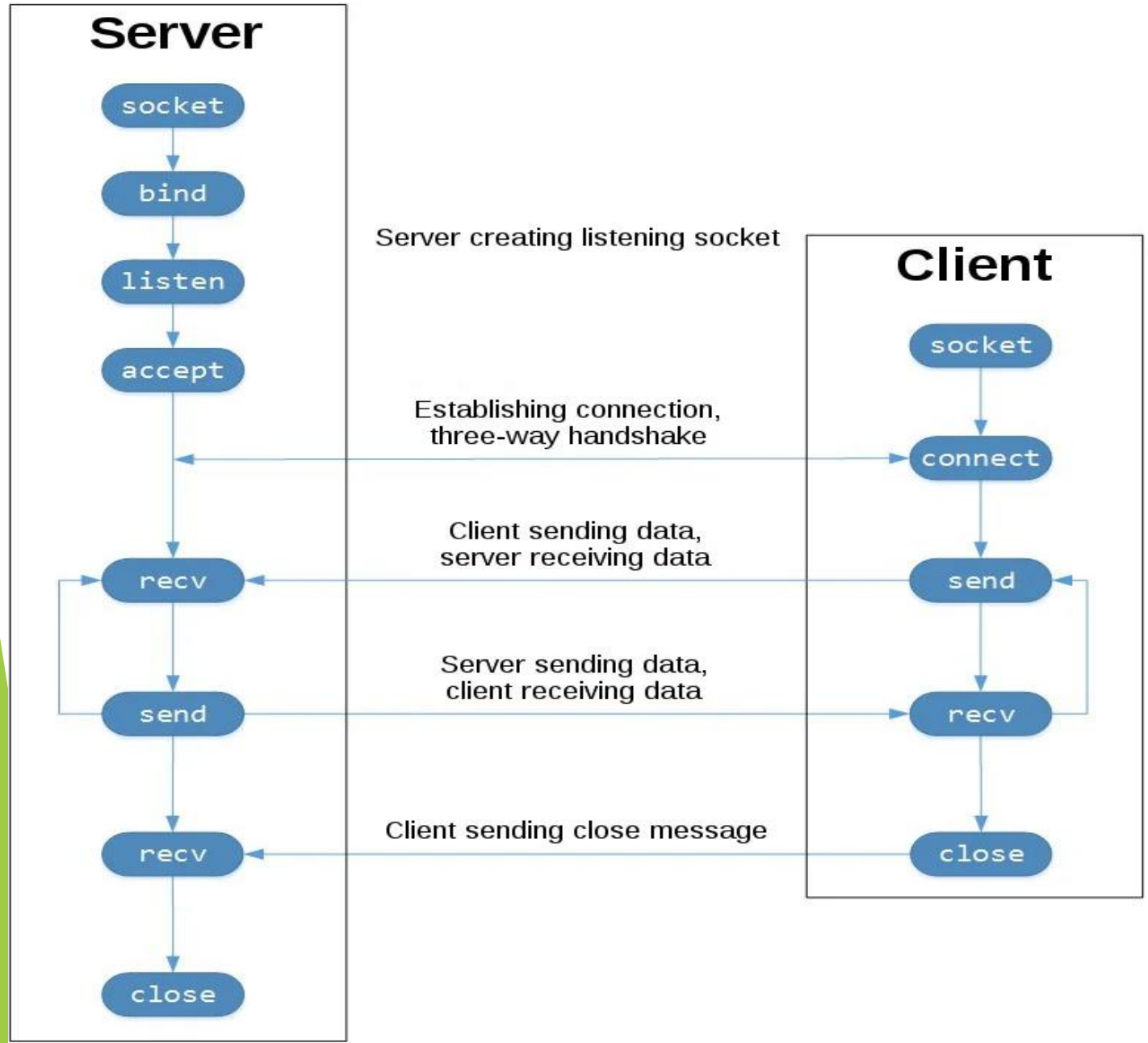


- abc

Socket Programming TCP

- **client must contact server**
  - server process must first be running
  - server must have created socket (door) that welcomes client's contact
- **client contacts server by:**
  - Creating TCP socket, specifying IP address, port number of server process.
- **when client creates socket**: client TCP establishes connection to server TCP
- when contacted by client, server TCP creates new socket for server process to communicate with that particular client
  - allows server to talk with multiple clients
  - source port numbers used to distinguish clients

Socket Programming TCP



Socket Programming TCP

Socket: Create a new communication endpoint

Bind: Attach a local address to a socket

Listen: Announce willingness to accept connections

Accept: Block caller until a connection request arrives

Connect: Actively attempt to establish a connection

Send: Send some data over the connection

Receive: Receive some data over the connection

Read/write

Close: Release the connection

Socket Programming TCP

Clients and servers communicate with each other by reading from and writing to socket descriptors.

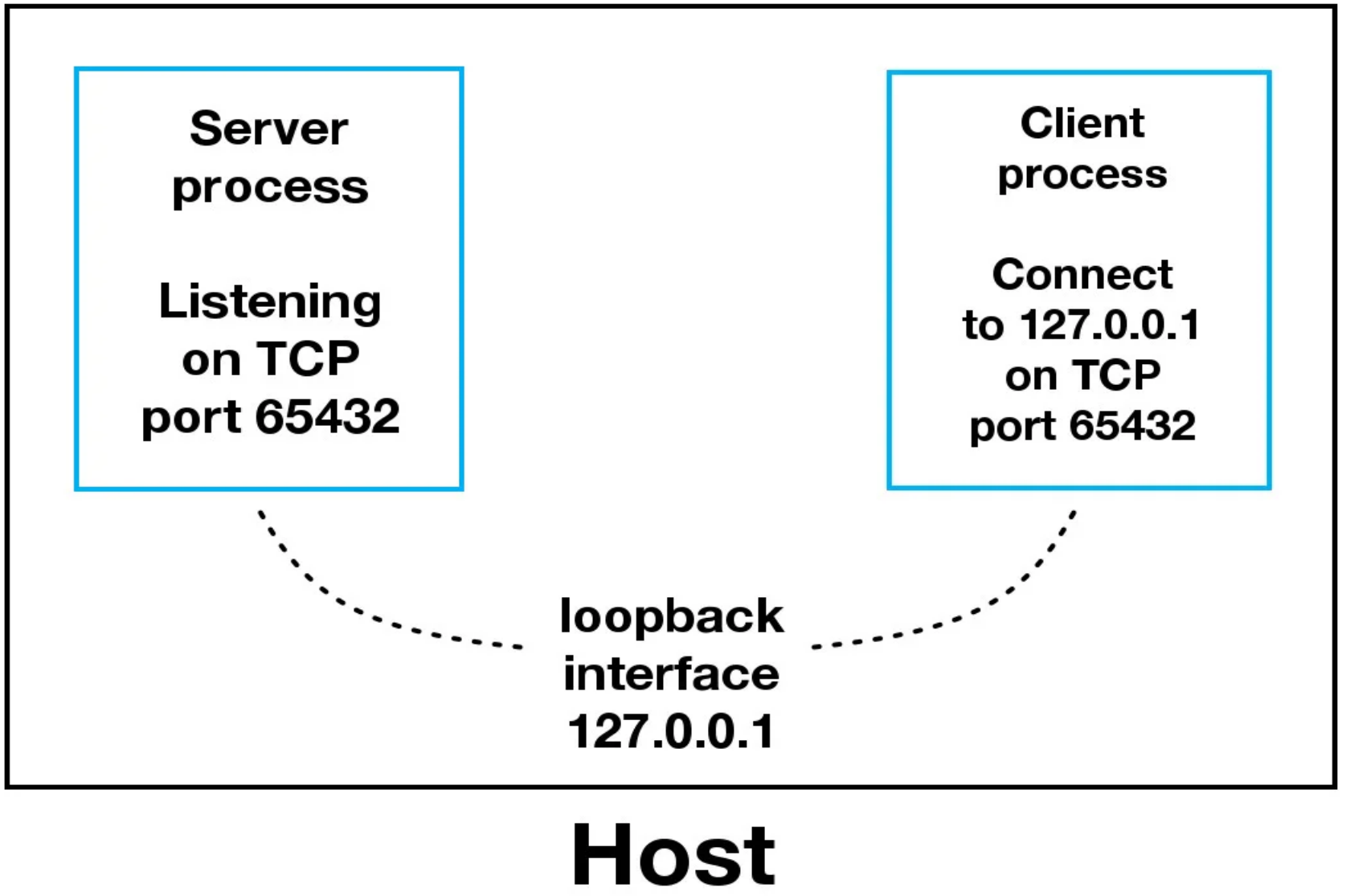
Server creates a socket and binds address/port

- Server creates a socket, just like the client does
- Server associates the socket with the port number

Create a socket –

```
int socket(int domain, int type, int protocol )
```

Socket Programming TCP



Socket Programming TCP

/usr/include/netinet/in.h	Defines Internet constants and structures.
/usr/include/arpa/nameser.h	Contains Internet name server information.
/usr/include/netdb.h	Contains data definitions for socket subroutines.
/usr/include/resolv.h	Contains resolver global definitions and variables.
/usr/include/sys/socket.h	Contains data definitions and socket structures.
/usr/include/sys/types.h	Contains data type definitions.

Socket Programming TCP

- Int sockfd #socket Descriptor
- Int newsockfd #after successful connection we will assign it as socket fd so that a server can handle multiple client.
- ip "127.0.0.1"/ gethostbyname(argv[1]); {character pointer}
- Port "<1024" / atoi(argv[2]); {int}

- struct
  - sockaddr_in, **: Socket /server binding**
  - **serv_addr, : address specifications :**
  - cli_addr; after succesfull connections client address will be linked with it.

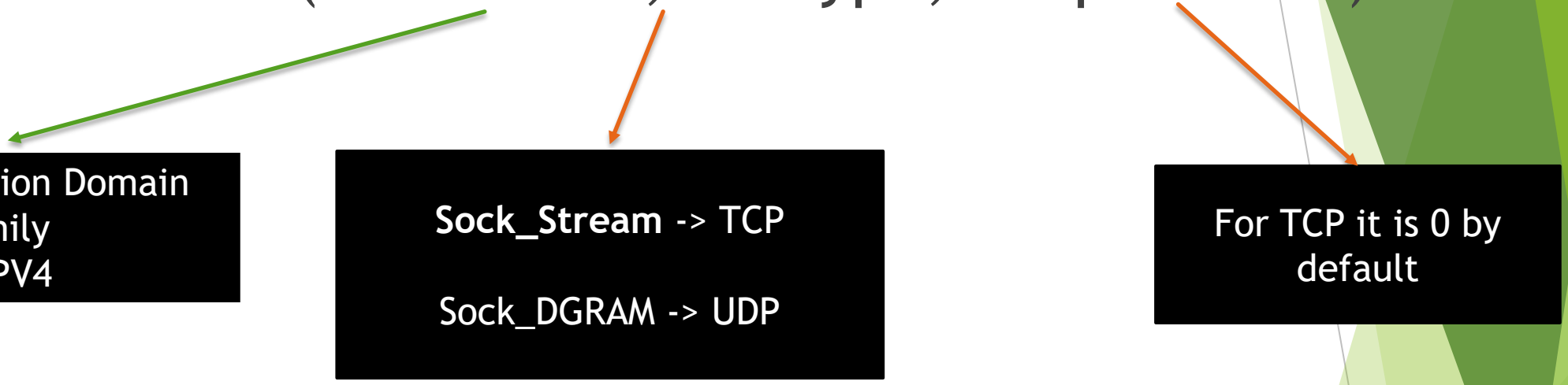
The <*netinet/in.h*> header shall define the **sockaddr_in** structure that includes at least the following members:

```
sa_family_t     sin_family   AF_INET.
in_port_t       sin_port     Port number.
struct in_addr  sin_addr     IP address.
```

Socket Programming TCP

Create a socket –

int socket(int domain, int type, int protocol)



sockfd => socket(int domain, int type, int protocol)

is the usual socket file descriptor from the socket() system call

Socket Programming TCP

Bind socket to the local address and port number –

int bind(int sockfd, **struct sockaddr *my_addr**, sizeof(serv_addr)

)

File descriptor

Specify the size in Byte of address structure provided by addr

Assign address specified by my_addr
Which is second parameter

Bind function return 0 for successful binding
-1 for failure

Socket Programming TCP

Listen function:

```
#include <sys/socket.h>
int listen(int sockfd, int queue_size);
```

sockfd => is the usual socket file descriptor from the socket() system call

queue_size =>maximum size of the queue of pending (incomplete) connections

Socket Programming TCP

```
#include <sys/types.h>
#include <sys/socket.h>

int accept(int sockfd, struct sockaddr *addr, socklen_t *addrlen);
```

- addr will usually be a pointer to a local struct sockaddr_in. This is where the information about the incoming connection will go (and with it you can determine which host is calling you from which port).
- addrlen is a local integer variable that should be set to sizeof(struct sockaddr_in) before its address is passed to accept(). Accept will not put more than that many bytes into addr. If it puts fewer in, it'll change the value of addrlen to reflect that.

Socket Programming TCP

```
int connect(int sockfd,
            const struct sockaddr *addr,
            socklen_t addrlen);
```

The connect() system call connects the socket referred to by the file descriptor sockfd to the address specified by addr. Server's address and port is specified in addr.

sizeof(serv_addr)

Socket Programming TCP

The send() call:

```
int send(int sockfd, const void *msg, int len, int flags);
```

msg is a pointer to the data you want to send, and len is the length of that data in bytes.

The recv() call is similar in many respects:

```
int recv(int sockfd, void *buf, int len, unsigned int flags);
```

buf is the buffer to read the information into,

len is the maximum length of the buffer, and flags can again be set to 0.

recv() returns the number of bytes actually read into the buffer, or -1 on error (with errno set, accordingly.)

Wait! recv() can return 0. This can mean only one thing: the remote side has closed the connection.

Socket Programming TCP

The read() call:

int read(int sockfd, string buff, int len);

msg is a pointer to the data you want to send, and len is the length of that data in bytes.

n = read(sockfd,buffer,255);

The write() call is similar in many respects:

int write(int sockfd, string buff, int len);

buf is the buffer to read the information into,

n = write(sockfd,buffer,strlen(buffer));

Socket Programming TCP

write(sockfd, &numbervar, **sizeof**(int));

read(newsockfd, & numbervar, **sizeof**(int));

read(sockfd,buffer,255);

write(sockfd,buffer,strlen(buffer));

int send(int sockfd, const void *msg, int len, int flags);

int recv(int sockfd, void *buf, int len, unsigned int flags);

Socket Programming TCP

close() =>just to close the connection

close(sockfd)

close(newsockfd)

Socket Programming TCP

Server Side:

Create socket > bind() > listen() > accept & newsocket > *(read/write)/(send/receive)* > *fulfill the operation/request/function* > *(read/write)/(send/receive)* > close

Client Side:

Create socket > connect > *(read/write)/(send/receive)* > *fulfill the operation/request/function* > *(read/write)/(send/receive)* > close

Socket Programming TCP

Server Side:

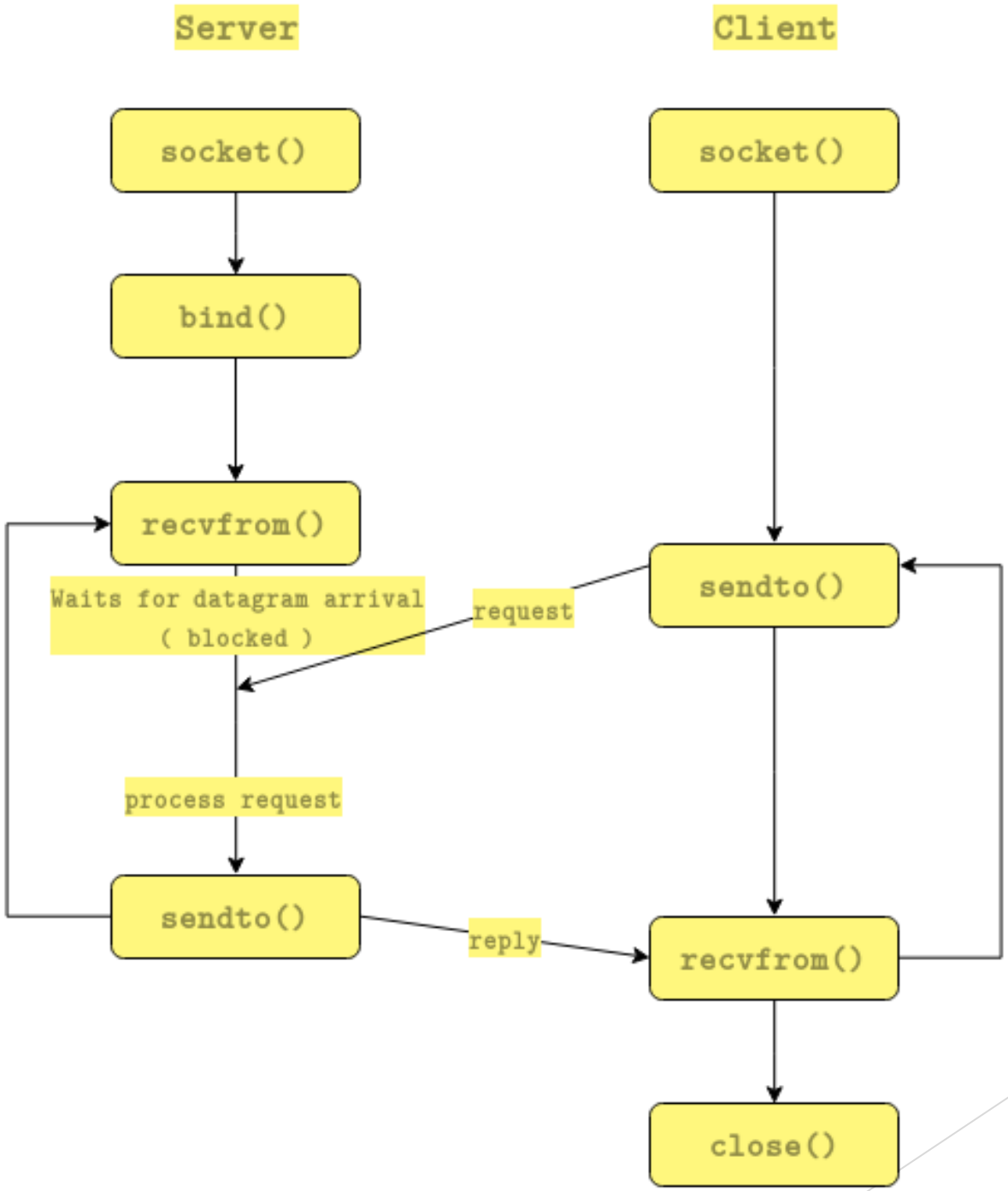
Create socket > bind() > listen() > accept & newsocket > *(read/write)/(send/receive)* > *fulfill the operation/request/function* > *(read/write)/(send/receive)* > close

Client Side:

Create socket > connect > *(read/write)/(send/receive)* > *fulfill the operation/request/function* > *(read/write)/(send/receive)* > close

Thank you !

UDP


Server
Client
socket()
socket()
bind()
recvfrom()
sendto()
Waits for datagram arrival
(blocked)
request
process request
sendto()
reply
recvfrom()
close()

UDP

- sockfd = socket(AF_INET, SOCK_DGRAM, 0);

- DatagramSocket serverSocket = new DatagramSocket(5555);

Evaluation

Even Rollno.

Odd Rollno.

https://meet.google.com/lookup/cvosmsi6sf