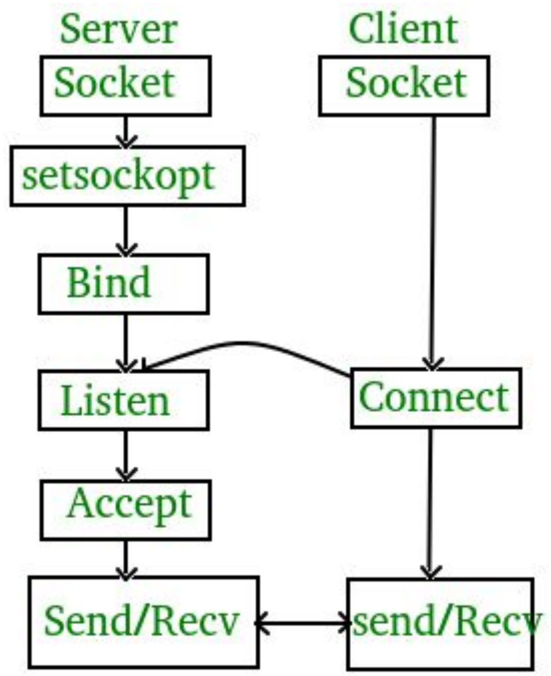
TCP/IP Client Server Communication

Lab Program - 3

TCP/IP Client Server Communication



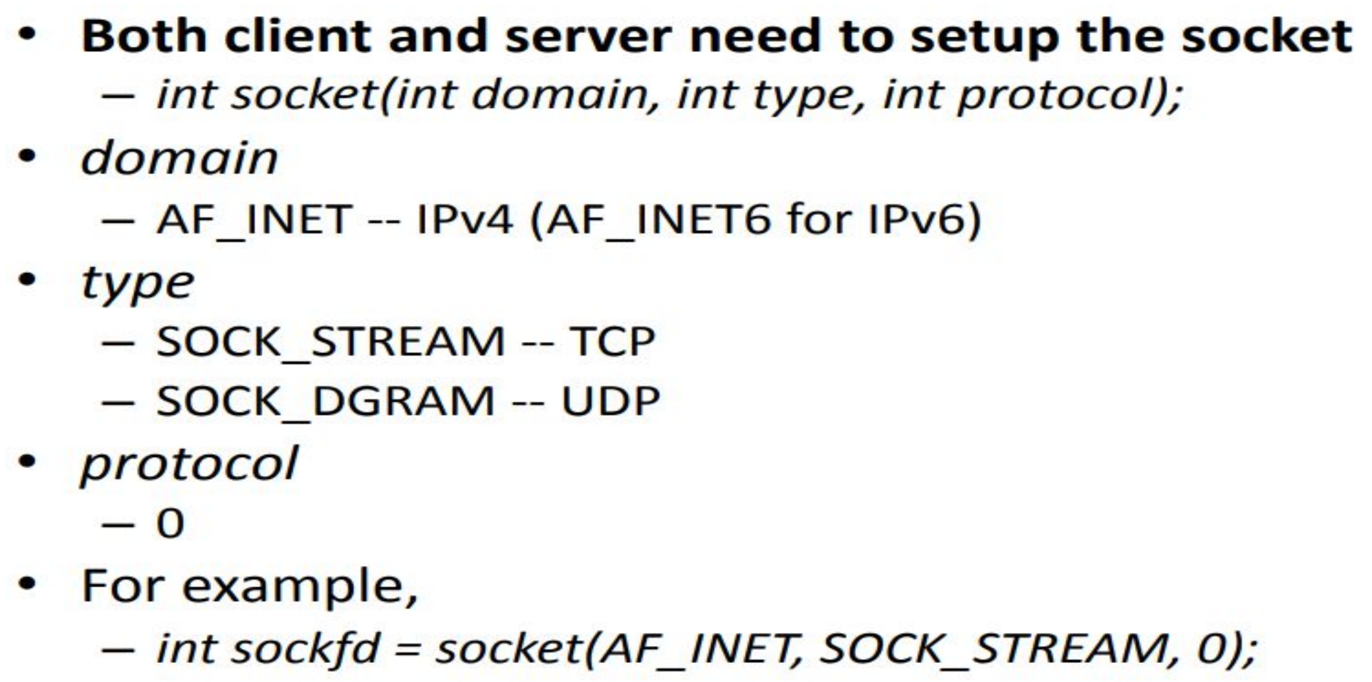
TCP Server

- ✔ Create() - Create TCP socket.
- ✔ Bind() - Bind the socket to server address.
- ✔ Listen() - put the server socket in a passive mode, where it waits for the client to approach the server to make a connection
- ✔ Accept() - At this point, connection is established between client and server, and they are ready to transfer data.
- ✔ Go back to Step 3.

TCP Client

- ✔ Create TCP socket.
- ✔ Connect newly created client socket to server.

Setup Socket



- **Both client and server need to setup the socket**
  - *int socket(int domain, int type, int protocol);*
- *domain*
  - AF_INET -- IPv4 (AF_INET6 for IPv6)
- *type*
  - SOCK_STREAM -- TCP
  - SOCK_DGRAM -- UDP
- *protocol*
  - 0
- For example,
  - *int sockfd = socket(AF_INET, SOCK_STREAM, 0);*

Sock_stream - Provides sequenced, reliable, two-way, connection- based byte streams.

Scok_Dgram - Supports datagrams (connectionless, unreliable messages of a fixed maximum length).

Socket address structure

- **servaddr.sin_family=AF_INET**

AF_INET is an address family that is used to designate the type of addresses that your socket can communicate with (in this case, Internet Protocol v4 addresses).

- **servaddr.sin_addr.s_addr=htonl(INADDR_ANY)**

INADDR_ANY is used when you don't need to bind a socket to a specific IP. When you use this value as the address when calling bind() , the socket accepts connections to all the IPs of the machine.

The htonl() function converts the unsigned integer hostlong from host byte order to network byte order.

- **servaddr.sin_port=htons(1999)**

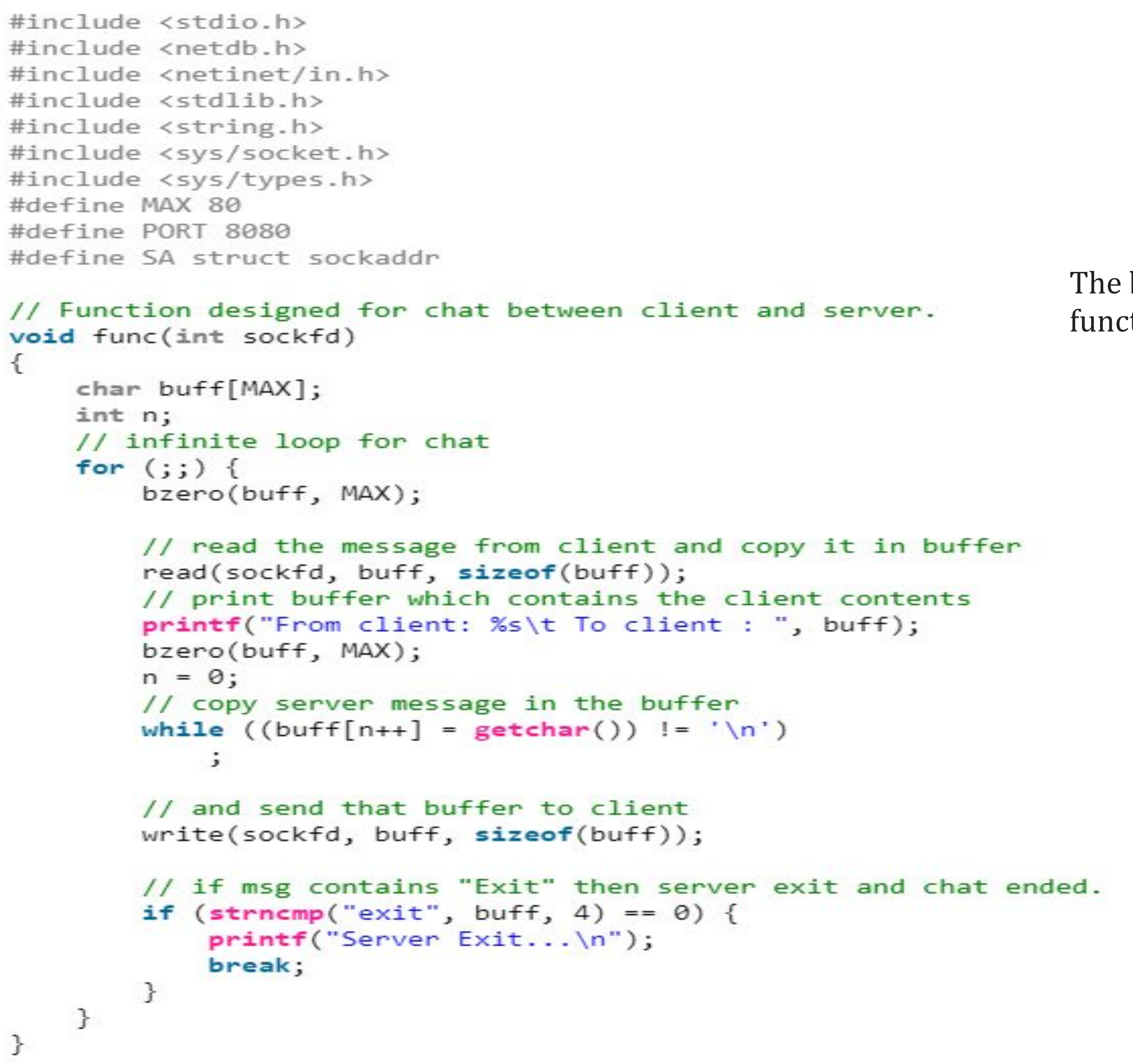
The htons() function converts the unsigned short integer hostshort from host byte order to network byte order.

What is htonl(),htons()?

- Byte ordering
  - Network order is big-endian
  - Host order can be big- or little-endian
    - x86 is little-endian
    - SPARC is big-endian
- Conversion
  - *htons(), htonl()*: host to network short/long
  - *ntohs(), ntohl()*: network order to host short/long
- What need to be converted?
  - Addresses
  - Port
  - etc.

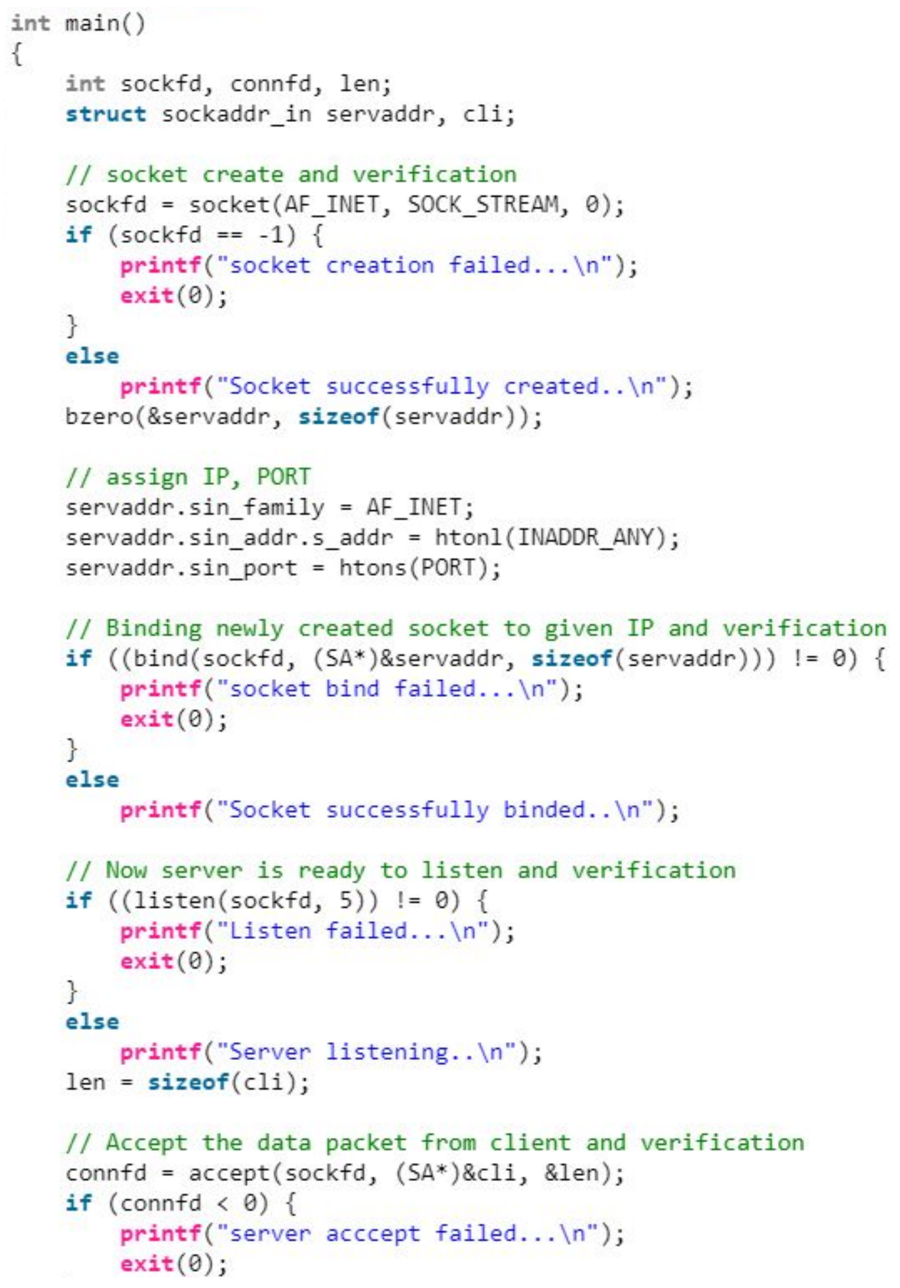
- The **sockfd** argument is a file descriptor that refers to a socket of type SOCK_STREAM or SOCK_SEQPACKET.
- backlog – number of pending connections to queue

Server Side

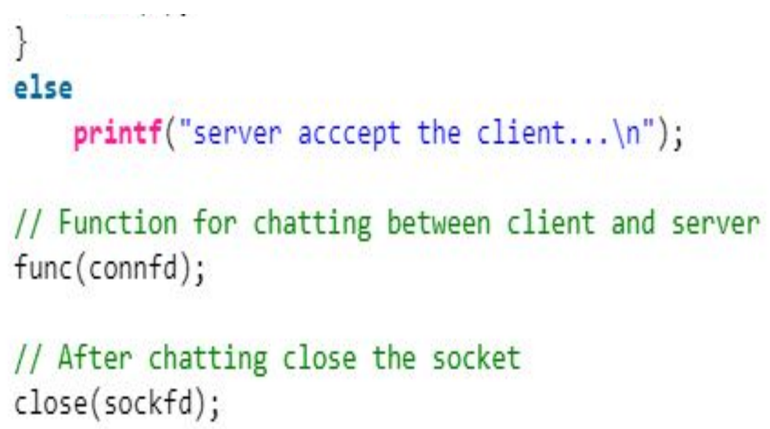


```
#include <stdio.h>
#include <netdb.h>
#include <netinet/in.h>
#include <stdlib.h>
#include <string.h>
#include <sys/socket.h>
#include <sys/types.h>
#define MAX 80
#define PORT 8080
#define SA struct sockaddr

// Function designed for chat between client and server.
void func(int sockfd)
{
    char buff[MAX];
    int n;
    // infinite loop for chat
    for (;;) {
        bzero(buff, MAX);

        // read the message from client and copy it in buffer
        read(sockfd, buff, sizeof(buff));
        // print buffer which contains the client contents
        printf("From client: %s\t To client : ", buff);
        bzero(buff, MAX);
        n = 0;
        // copy server message in the buffer
        while ((buff[n++] = getchar()) != '\n')
            ;

        // and send that buffer to client
        write(sockfd, buff, sizeof(buff));

        // if msg contains "Exit" then server exit and chat ended.
        if (strncmp("exit", buff, 4) == 0) {
            printf("Server Exit...\n");
            break;
        }
    }
}
```

The **bzero** function places nbyte null bytes in the string s. This function is used to set all the **socket** structures with null values.



```c
int main()
{
    int sockfd, connfd, len;
    struct sockaddr_in servaddr, cli;

    // socket create and verification
    sockfd = socket(AF_INET, SOCK_STREAM, 0);
    if (sockfd == -1) {
        printf("socket creation failed...\n");
        exit(0);
    }
    else
        printf("Socket successfully created..\n");
    bzero(&servaddr, sizeof(servaddr));

    // assign IP, PORT
    servaddr.sin_family = AF_INET;
    servaddr.sin_addr.s_addr = htonl(INADDR_ANY);
    servaddr.sin_port = htons(PORT);

    // Binding newly created socket to given IP and verification
    if ((bind(sockfd, (SA*)&servaddr, sizeof(servaddr))) != 0) {
        printf("socket bind failed...\n");
        exit(0);
    }
    else
        printf("Socket successfully binded..\n");

    // Now server is ready to listen and verification
    if ((listen(sockfd, 5)) != 0) {
        printf("Listen failed...\n");
        exit(0);
    }
    else
        printf("Server listening..\n");
    len = sizeof(cli);

    // Accept the data packet from client and verification
    connfd = accept(sockfd, (SA*)&cli, &len);
    if (connfd < 0) {
        printf("server acccept failed...\n");
        exit(0);
```

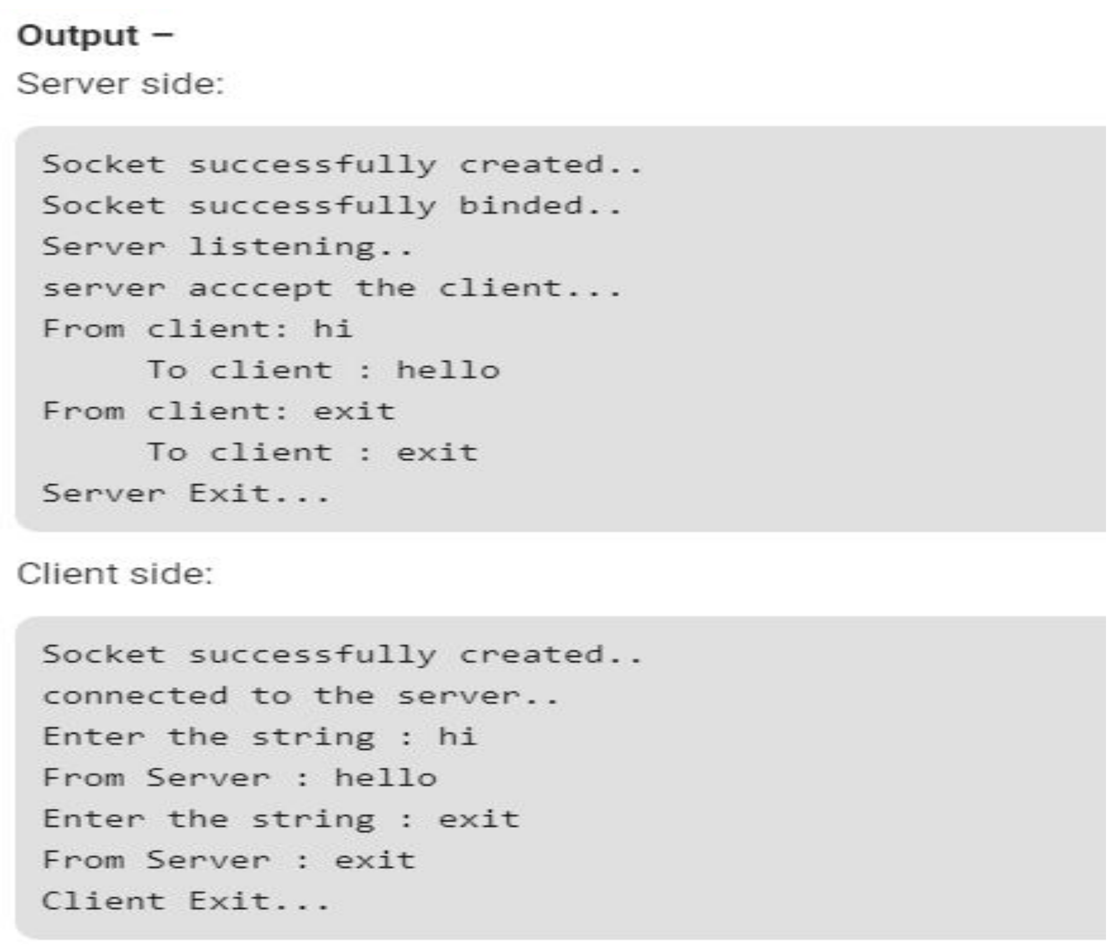


```c
}
else
    printf("server acccept the client...\n");

// Function for chatting between client and server
func(connfd);

// After chatting close the socket
close(sockfd);
```

Client Side

```c
#include <netdb.h>
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <sys/socket.h>
#define MAX 80
#define PORT 8080
#define SA struct sockaddr
void func(int sockfd)
{
    char buff[MAX];
    int n;
    for (;;) {
        bzero(buff, sizeof(buff));
        printf("Enter the string : ");
        n = 0;
        while ((buff[n++] = getchar()) != '\n')
            ;
        write(sockfd, buff, sizeof(buff));
        bzero(buff, sizeof(buff));
        read(sockfd, buff, sizeof(buff));
        printf("From Server : %s", buff);
        if ((strncmp(buff, "exit", 4)) == 0) {
            printf("Client Exit...\n");
            break;
        }
    }
}
```

```c
int main()
{
    int sockfd, connfd;
    struct sockaddr_in servaddr, cli;

    // socket create and varification
    sockfd = socket(AF_INET, SOCK_STREAM, 0);
    if (sockfd == -1) {
        printf("socket creation failed...\n");
        exit(0);
    }
    else
        printf("Socket successfully created..\n");
    bzero(&servaddr, sizeof(servaddr));

    // assign IP, PORT
    servaddr.sin_family = AF_INET;
    servaddr.sin_addr.s_addr = inet_addr("127.0.0.1");
    servaddr.sin_port = htons(PORT);

    // connect the client socket to server socket
    if (connect(sockfd, (SA*)&servaddr, sizeof(servaddr)) != 0) {
        printf("connection with the server failed...\n");
        exit(0);
    }
    else
        printf("connected to the server..\n");

    // function for chat
    func(sockfd);

    // close the socket
    close(sockfd);
}
```



Output –

Server side:

```
Socket successfully created..
Socket successfully binded..
Server listening..
server acccept the client...
From client: hi
     To client : hello
From client: exit
     To client : exit
Server Exit...
```

Client side:

```
Socket successfully created..
connected to the server..
Enter the string : hi
From Server : hello
Enter the string : exit
From Server : exit
Client Exit...
```

Compilation –

Server side:

```
gcc server.c -o server
./server
```

Client side:

```
gcc client.c -o client
./client
```