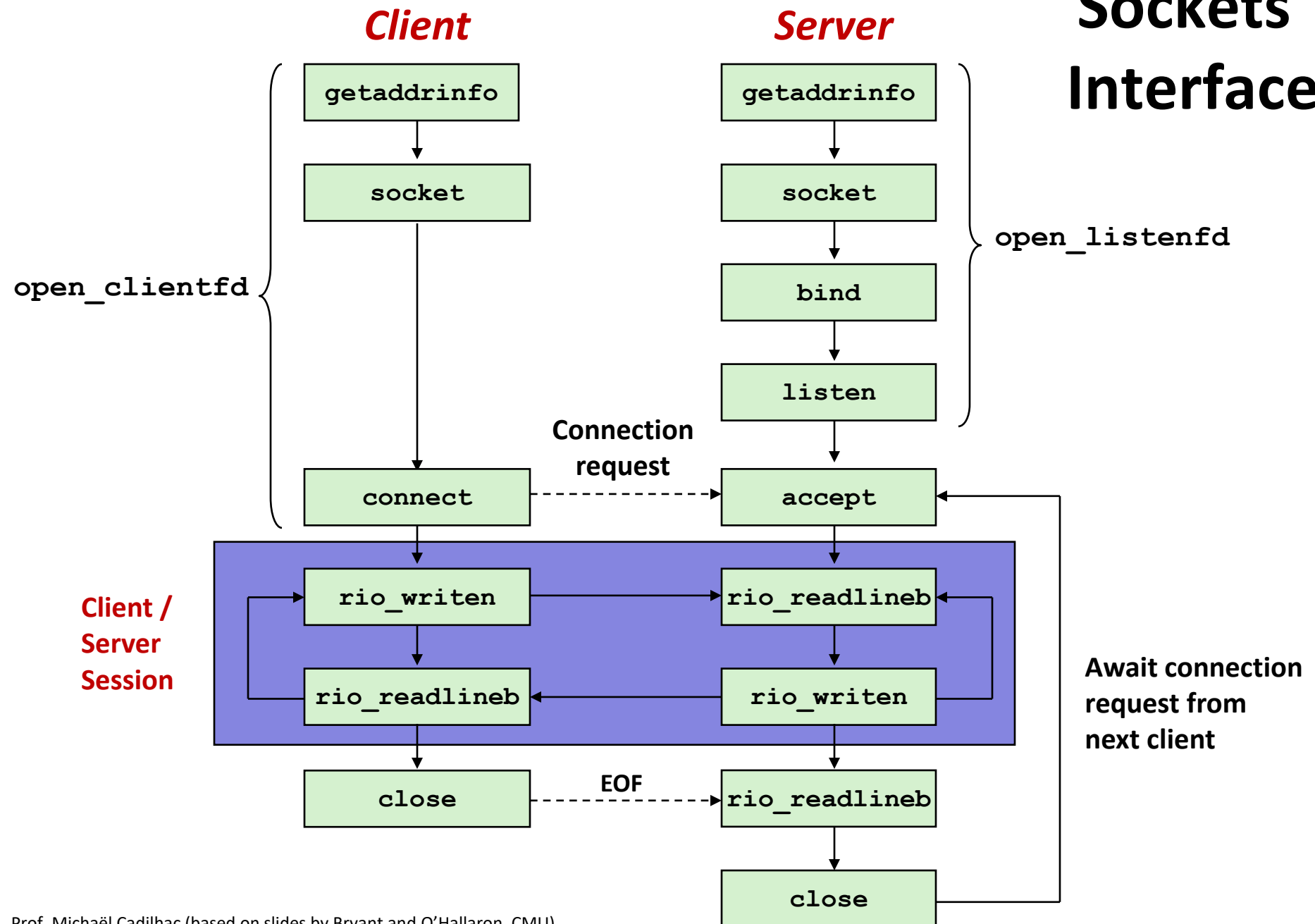


# **Network Programming:**

## ***Basic client/server application:***

### ***4. echo client & server***

# Sockets Interface



# Echo Client: Main Routine

```
#include "csapp.h"

int main(int argc, char **argv)
{
    int clientfd;
    char *host, *port, buf[MAXLINE];
    rio_t rio;

    host = argv[1];
    port = argv[2];

    clientfd = Open_clientfd(host, port);
    Rio_readinitb(&rio, clientfd);

    while (Fgets(buf, MAXLINE, stdin) != NULL) {
        Rio_writen(clientfd, buf, strlen(buf));
        Rio_readlineb(&rio, buf, MAXLINE);
        Fputs(buf, stdout);
    }
    Close(clientfd);
    exit(0);
}
```

echoclient.c

# Iterative Echo Server: Main Routine

```
#include "csapp.h"
void echo(int connfd);

int main(int argc, char **argv)
{
    int listenfd, connfd;
    socklen_t clientlen;
    struct sockaddr_storage clientaddr; /* Enough room for any addr */
    char client_hostname[MAXLINE], client_port[MAXLINE];

    listenfd = Open_listenfd(argv[1]);
    while (1) {
        clientlen = sizeof(struct sockaddr_storage); /* Important! */
        connfd = Accept(listenfd, (SA *)&clientaddr, &clientlen);
        Getnameinfo((SA *)&clientaddr, clientlen,
                    client_hostname, MAXLINE, client_port, MAXLINE, 0);
        printf("Connected to (%s, %s)\n", client_hostname, client_port);
        echo(connfd);
        Close(connfd);
    }
    exit(0);
}
```

echoserveri.c

# Echo Server: echo function

- The server uses RIO to read and echo text lines until EOF (end-of-file) condition is encountered.
  - EOF condition caused by client calling `close(clientfd)`

```
void echo(int connfd)
{
    size_t n;
    char buf[MAXLINE];
    rio_t rio;

    Rio_readinitb(&rio, connfd);
    while((n = Rio_readlineb(&rio, buf, MAXLINE)) != 0) {
        printf("server received %d bytes\n", (int)n);
        Rio_writen(connfd, buf, n);
    }
}
```

echo.c

# Testing Servers Using telnet

- The `telnet` program is invaluable for testing servers that transmit ASCII strings over Internet connections
  - Our simple echo server
  - Web servers
  - Mail servers
- Usage:
  - `$ telnet <host> <portnumber>`
  - Creates a connection with a server running on `<host>` and listening on port `<portnumber>`
- Origin: Telnet protocol (RFC 15, 1969), commands start with 0xff, so OK with ASCII.

# Testing the Echo Server With `telnet`



# Testing the Echo Server With telnet

```
$ ./echoserveri 15213
```



# Testing the Echo Server With telnet

```
$ ./echoserveri 15213
```

```
$ telnet localhost 15213
```

# Testing the Echo Server With telnet

```
$ ./echoserveri 15213
```

```
$ telnet localhost 15213
```

```
Trying 127.0.0.1...
```

```
Connected to localhost (127.0.0.1).
```

```
Escape character is '^['.
```

# Testing the Echo Server With telnet

```
$ ./echoserveri 15213  
Connected to (localhost, 50280)
```

```
$ telnet localhost 15213  
Trying 127.0.0.1...  
Connected to localhost (127.0.0.1).  
Escape character is '^['.
```

# Testing the Echo Server With telnet

```
$ ./echoserveri 15213  
Connected to (localhost, 50280)
```

```
$ telnet localhost 15213  
Trying 127.0.0.1...  
Connected to localhost (127.0.0.1).  
Escape character is '^]'.  
Hi there!
```

# Testing the Echo Server With telnet

```
$ ./echoserveri 15213  
Connected to (localhost, 50280)  
server received 11 bytes
```

```
$ telnet localhost 15213  
Trying 127.0.0.1...  
Connected to localhost (127.0.0.1).  
Escape character is '^]'.  
Hi there!
```

# Testing the Echo Server With telnet

```
$ ./echoserveri 15213  
Connected to (localhost, 50280)  
server received 11 bytes
```

```
$ telnet localhost 15213  
Trying 127.0.0.1...  
Connected to localhost (127.0.0.1).  
Escape character is '^]'.  
Hi there!  
Hi there!
```

# Testing the Echo Server With telnet

```
$ ./echoserveri 15213
Connected to (localhost, 50280)
server received 11 bytes

$ telnet localhost 15213
Trying 127.0.0.1...
Connected to localhost (127.0.0.1).
Escape character is '^]'.
Hi there!
Hi there!
Howdy!
```

# Testing the Echo Server With telnet

```
$ ./echoserveri 15213
Connected to (localhost, 50280)
server received 11 bytes
server received 8 bytes

$ telnet localhost 15213
Trying 127.0.0.1...
Connected to localhost (127.0.0.1).
Escape character is '^]'.
Hi there!
Hi there!
Howdy!
```



# Testing the Echo Server With telnet

```
$ ./echoserveri 15213
Connected to (localhost, 50280)
server received 11 bytes
server received 8 bytes

$ telnet localhost 15213
Trying 127.0.0.1...
Connected to localhost (127.0.0.1).
Escape character is '^]'.
Hi there!
Hi there!
Howdy!
Howdy!
```

# Testing the Echo Server With telnet

```
$ ./echoserveri 15213
Connected to (localhost, 50280)
server received 11 bytes
server received 8 bytes

$ telnet localhost 15213
Trying 127.0.0.1...
Connected to localhost (127.0.0.1).
Escape character is '^]'.
Hi there!
Hi there!
Howdy!
Howdy!
^]
```

# Testing the Echo Server With telnet

```
$ ./echoserveri 15213
Connected to (localhost, 50280)
server received 11 bytes
server received 8 bytes

$ telnet localhost 15213
Trying 127.0.0.1...
Connected to localhost (127.0.0.1).
Escape character is '^]'.
Hi there!
Hi there!
Howdy!
Howdy!
^]
telnet> quit
Connection closed.
$
```