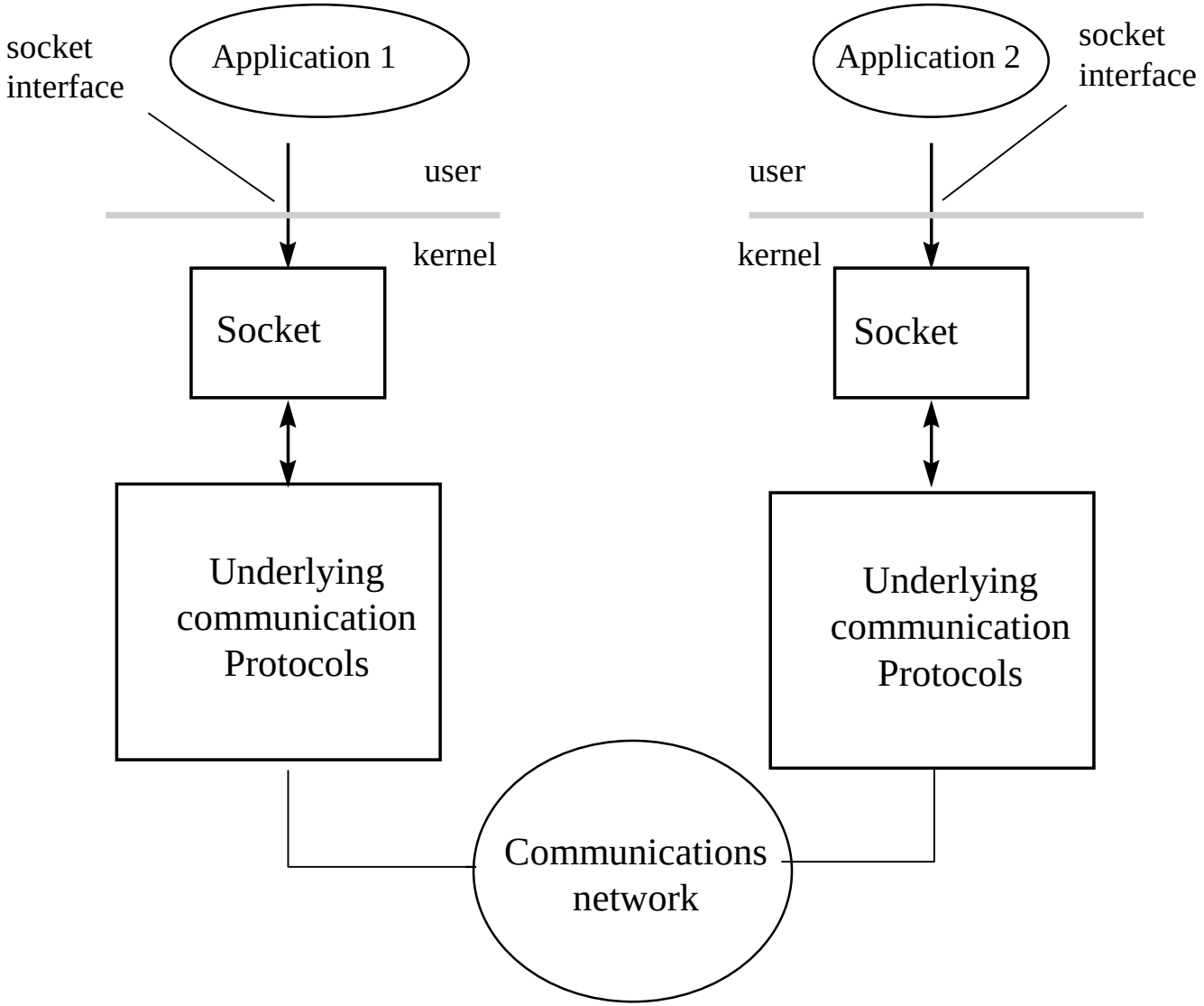
Elementary TCP Sockets

Chapter 4

UNIX Network Programming

Vol. 1, Second Ed. Stevens



TCP socket calls

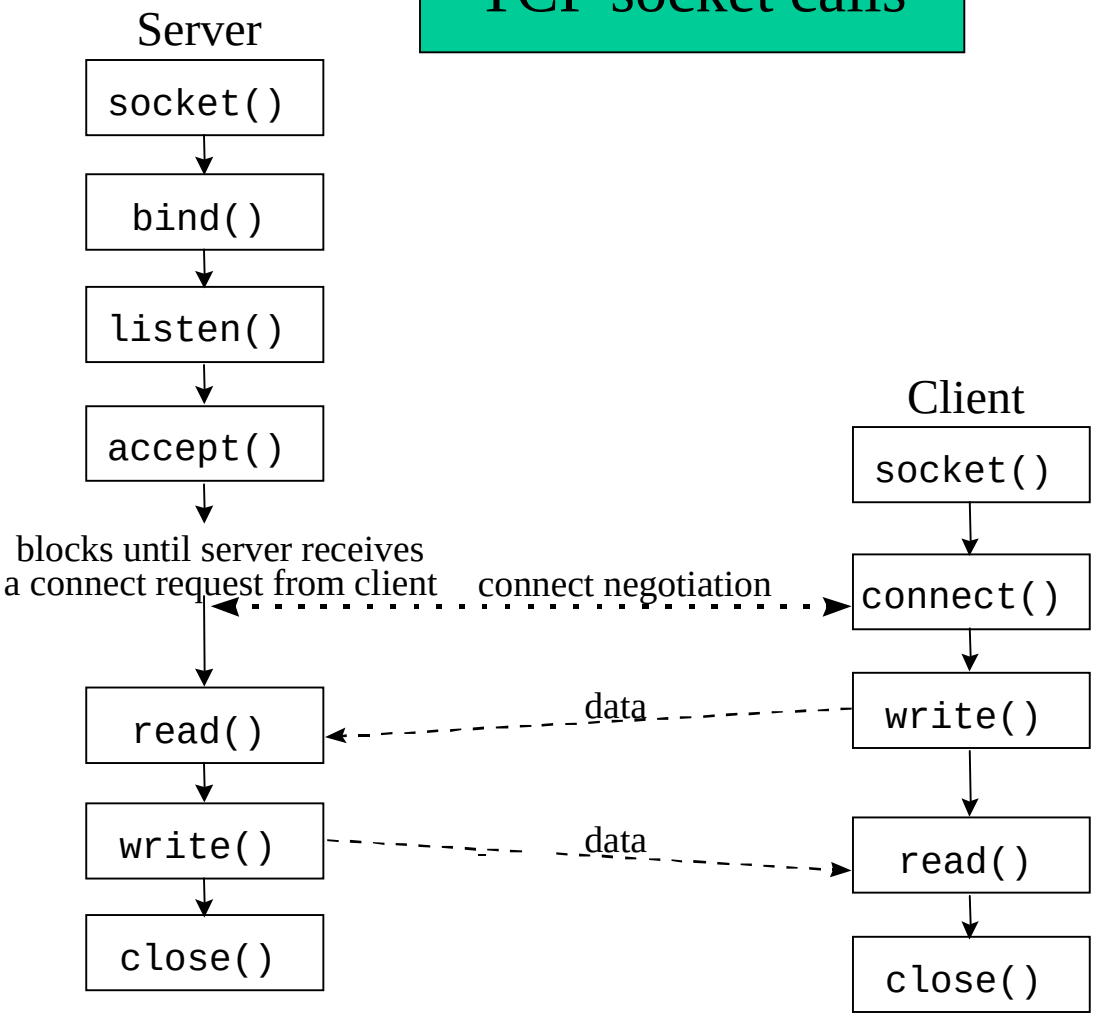
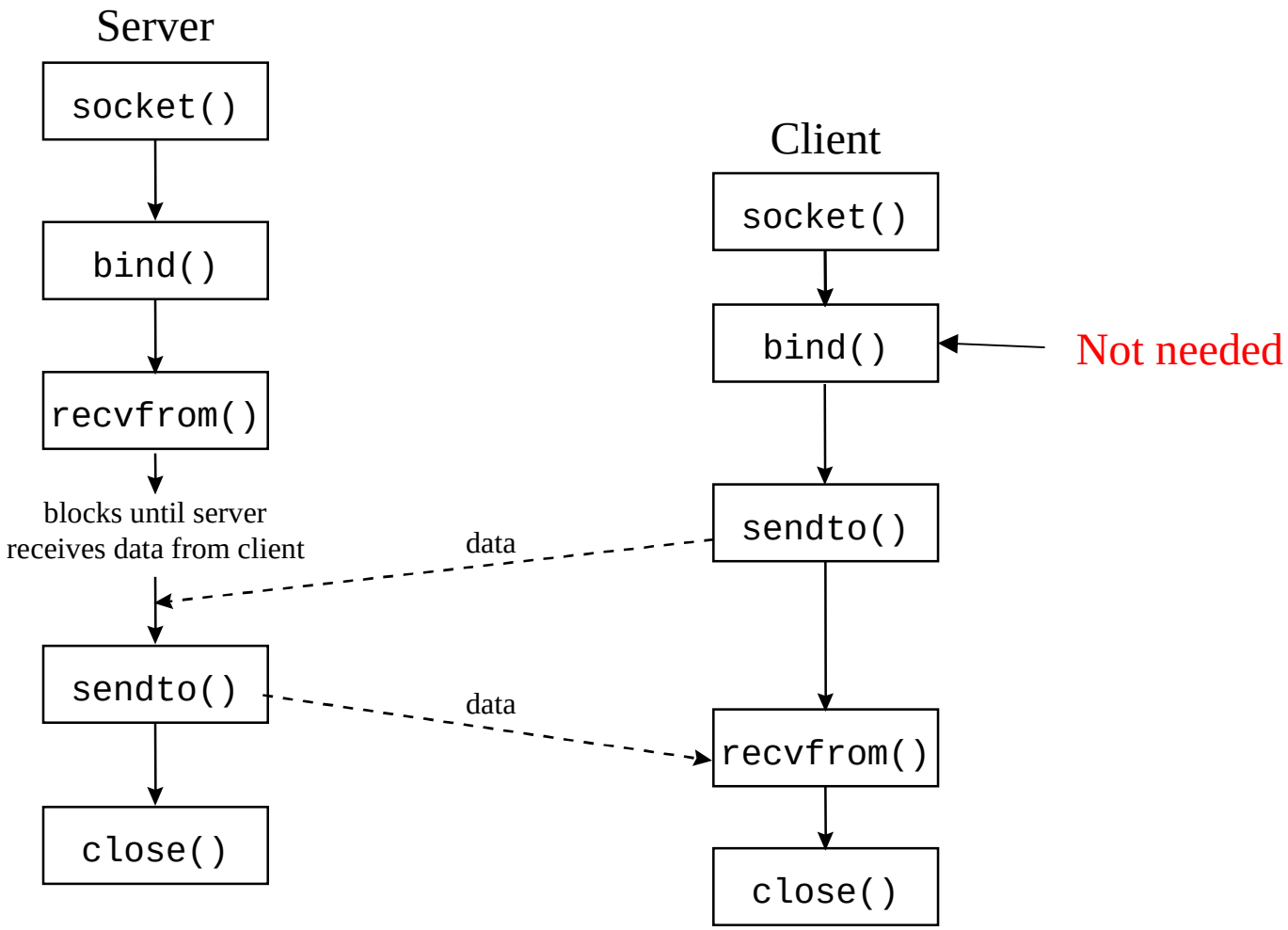


Figure 2.17

UDP socket calls



System Calls for Elementary TCP Sockets

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

socket Function

int socket (int *family*, int *type*, int *protocol*);

family: specifies the protocol family {AF_INET for TCP/IP}

type: indicates communications semantics

SOCK_STREAM	stream socket	TCP
SOCK_DGRAM	datagram socket	UDP
SOCK_RAW	raw socket	

protocol: set to 0 except for raw sockets

returns on success: socket descriptor {a small nonnegative integer}

on error: -1

Example:

```
If  (( sockfd = socket (AF_INET, SOCK_STREAM, 0)) < 0)
    err_sys ("socket call error");
```

connect Function

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

sockfd: a socket descriptor returned by the socket function

*servaddr: a pointer to a socket address structure

addrlen: the size of the socket address structure

The socket address structure must contain the *IP address* and the *port number* for the connection wanted.

In TCP connect initiates a three-way handshake. connect returns when the connection is established or when an error occurs.

returns on success: 0

on error: -1

Example:

```
if ( connect (sockfd, (struct sockaddr *) &servaddr, sizeof (servaddr)) != 0)
   err_sys("connect call error");
```

bind Function

int **bind** (int *sockfd*, const struct sockaddr **myaddr*, socklen_t *addrlen*);

bind assigns a local protocol address to a socket.

protocol address: a 32 bit IPv4 address + a 16 bit TCP or UDP port number.

sockfd: a socket descriptor returned by the socket function.

*myaddr: a pointer to a protocol-specific address.

addrlen: the size of the socket address structure.

Servers bind their "well-known port" when they start.

returns on success: 0

on error: -1

Example:

```
If (bind (sd, (struct sockaddr *) &servaddr, sizeof (servaddr)) != 0)
   errsys ("bind call error");
```

listen Function

int **listen** (int *sockfd*, int *backlog*);

Listen is called **only** by a TCP server and performs two actions:

1. Converts an unconnected socket into a passive socket.
2. Specifies the maximum number of connections that the kernel should queue for this socket.

returns on success: 0

on error: -1

Example:

```
If (listen (sd, 2) != 0)
   errsys ("listen call error");
```

accept Function

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

accept is called by the TCP server to return the next completed connection from the front of the completed connection queue.

sockfd: this is the same socket descriptor as in listen call.

*cliaddr: used to return the protocol address of the connected peer process (i,e., the client process).

*addrlen: {this is a value-result argument}

before the accept call: we set the integer value pointed to by *addrlen to the size of the socket address structure pointed to by cliaddr;

on return from accept call: this integer value contains the actual number of bytes stored in the socket address structure.

returns on success: a new socket descriptor

on error: -1

accept Function **(cont.)**

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

For accept the first argument sockfd is the listening socket and the returned value is the connected socket.

The server will have one connected socket for each client connection accepted.

When the server is finished with a client, the connected socket must be closed.

Example:

```
sfd = accept (s, NULL, NULL);
if (sfd == -1) err_sys ("accept error");
```

close Function

int **close** (int *sockfd*);

close marks the socket as closed and returns to the process immediately.

sockfd this socket descriptor is no longer useable.

Note – TCP will try to send any data already queued to the other end before the normal connection termination sequence.

Returns on success: 0

on error: -1

Example:

```
close (s);
```