Lab 5

CS-335a

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Computer Science Department

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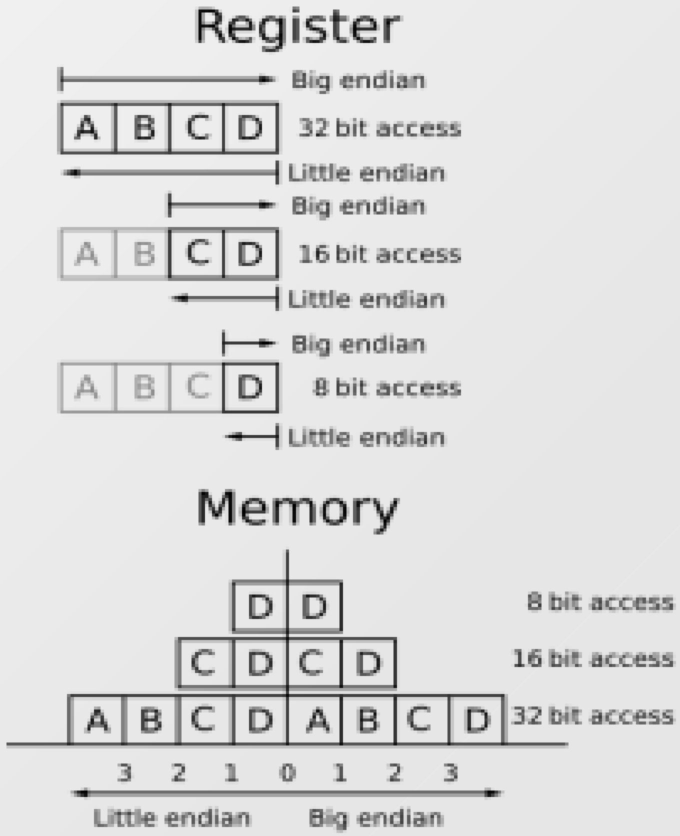
Summary

- Endianess – Network Byte Order
- Create UDP sockets
- Send and receive data from a UDP socket

Endianess and Network Byte Order

- A big-endian machine stores the most significant byte
- A little-endian machine stores the least significant byte first



Endianess and Network Byte Order

- Why do we care about Endianess?
- Internet is an heterogenous network with different types of machines
- The architecture of the host at the other side, is not known
- A lazy programmer sais: '*Ok I am sure that the other host is Little-endian, so I do not care about endianness*'
- **WRONG!** The standard network byte order is big endian and many Socket API functions follow that convension

Endianess and Network Byte Order

- To convert 16 and 32 bits numbers from host byte order (little or big endian) to network byte order you can use:
  - htons()
  - htonl()

- For the inverse operation, you can use:
  - ntohs()
  - ntohls()

- Note that you have to care about endianess when you send entities with size greater than one byte, like shorts, integers etc

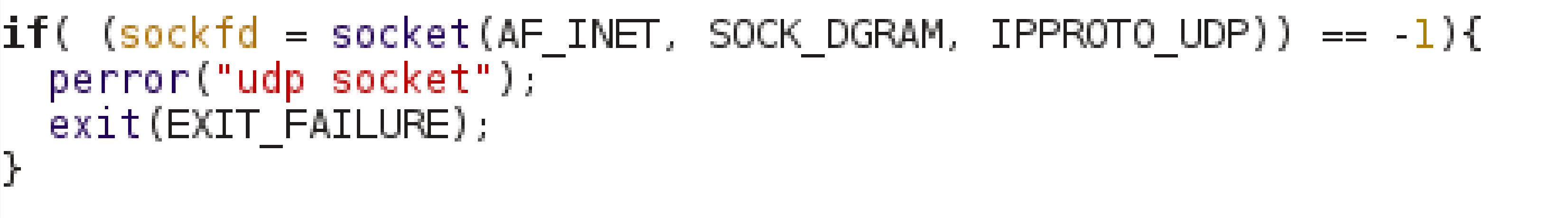
- Sending characters for example is not a problem

Create UDP sockets - Server Side

- Since UDP is connection-less, it has a little bit different procedure to create a UDP socket

- However, it follows the client-server approach like TCP

- To create an IPv4 UDP socket takes the following code:



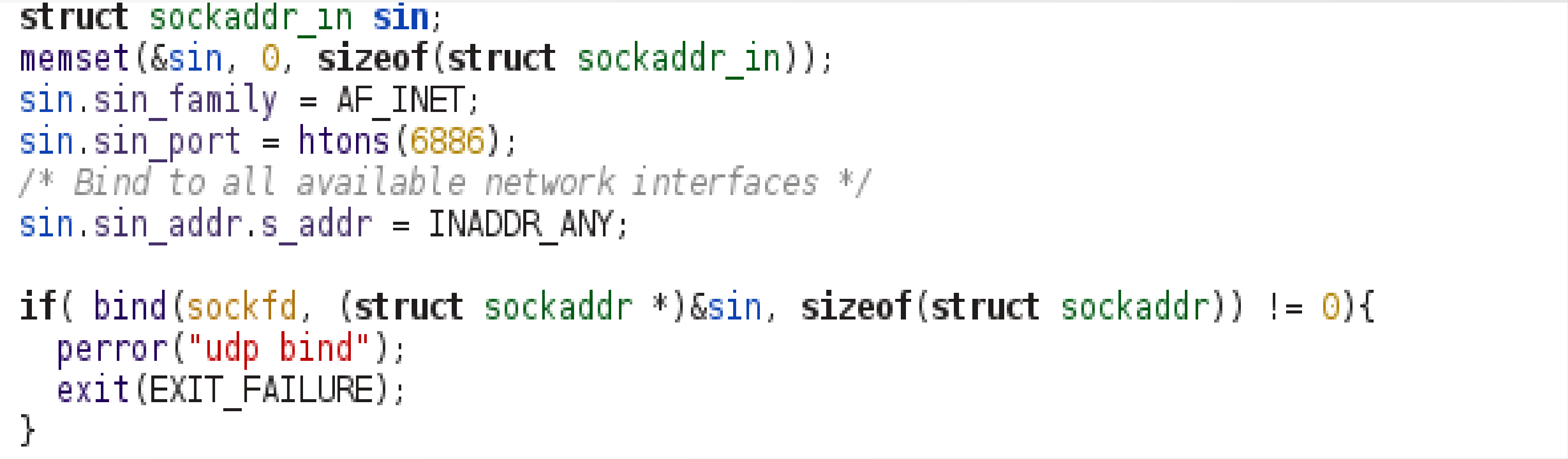
```
if( (sockfd = socket(AF_INET, SOCK_DGRAM, IPPROTO_UDP)) == -1){
  perror("udp socket");
  exit(EXIT_FAILURE);
}
```

- Is almost the same with TCP but with different socket parameters

Create UDP sockets - Server Side

- At the server side, is a good practice to bind the socket with a specific port, in which the client will send its UDP packets

- The procedure for bind is the same with TCP



```
struct sockaddr_in sin;
memset(&sin, 0, sizeof(struct sockaddr_in));
sin.sin_family = AF_INET;
sin.sin_port = htons(6886);
/* Bind to all available network interfaces */
sin.sin_addr.s_addr = INADDR_ANY;

if( bind(sockfd, (struct sockaddr *)&sin, sizeof(struct sockaddr)) != 0){
  perror("udp bind");
  exit(EXIT_FAILURE);
}
```

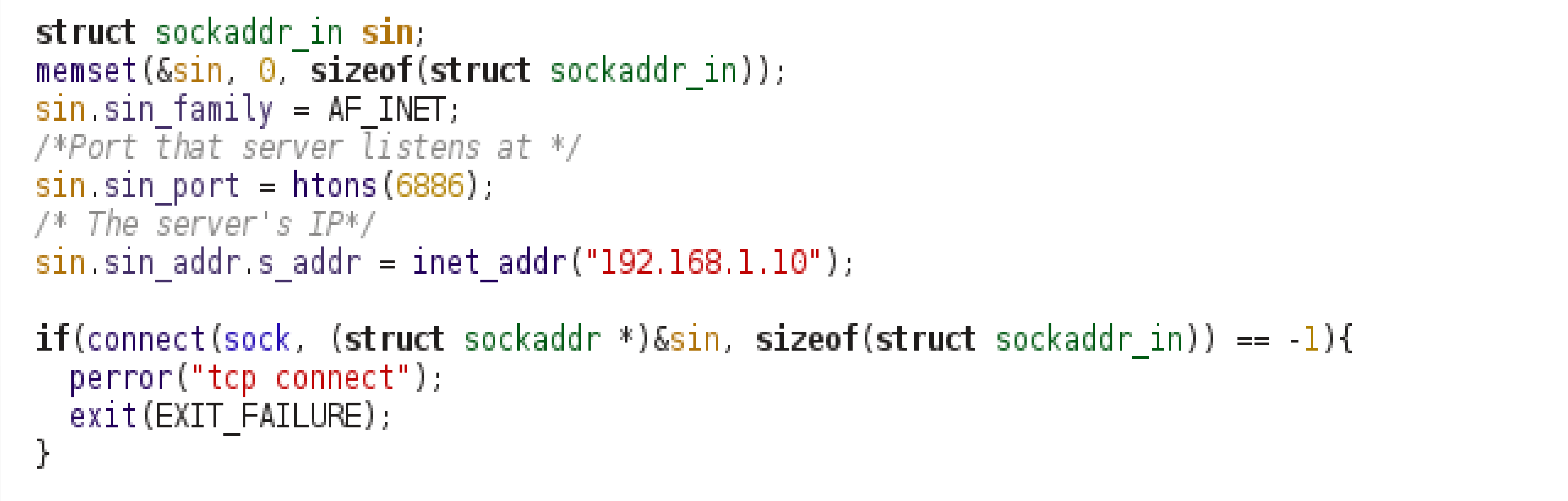
Create UDP sockets – Server Side

- Now your server socket is ready to receive UDP packets
- No need for listen()
- Accept() is useless since UDP is connectionless

Create UDP sockets – Client Side

- At the client side, thinks are also very easy

- After creating a UDP socket, just use connect() in order to be able to send and receive UDP packets from the socket



```
struct sockaddr_in sin;
memset(&sin, 0, sizeof(struct sockaddr_in));
sin.sin_family = AF_INET;
/*Port that server listens at */
sin.sin_port = htons(6886);
/* The server's IP*/
sin.sin_addr.s_addr = inet_addr("192.168.1.10");

if(connect(sock, (struct sockaddr *)&sin, sizeof(struct sockaddr_in)) == -1){
  perror("tcp connect");
  exit(EXIT_FAILURE);
}
```

Sending and receiving data with UDP

- Due to connectionless nature of UDP we can **not** use the send(), recv() system calls
- Use the sendto(), read() instead
- Not that despite TCP in UDP only read() is a blocking operation
- sendto() sends **immediatly** the UDP packet without blocking
- Possible packets lost, due to the unreliable nature of UDP, can not be recovered and is responsibility of the programmer to take care this possibility

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Useful man pages

  - connect(3p)
  - bind(3p)
  - getaddrinfo(3p)
  - setsockopt(3p)
  - sendto(3p)
  - read(3p)
  - inet_ntoa(3p)

- For every man page, take a look at the **SEE ALSO** section. Many other functions that may need are there