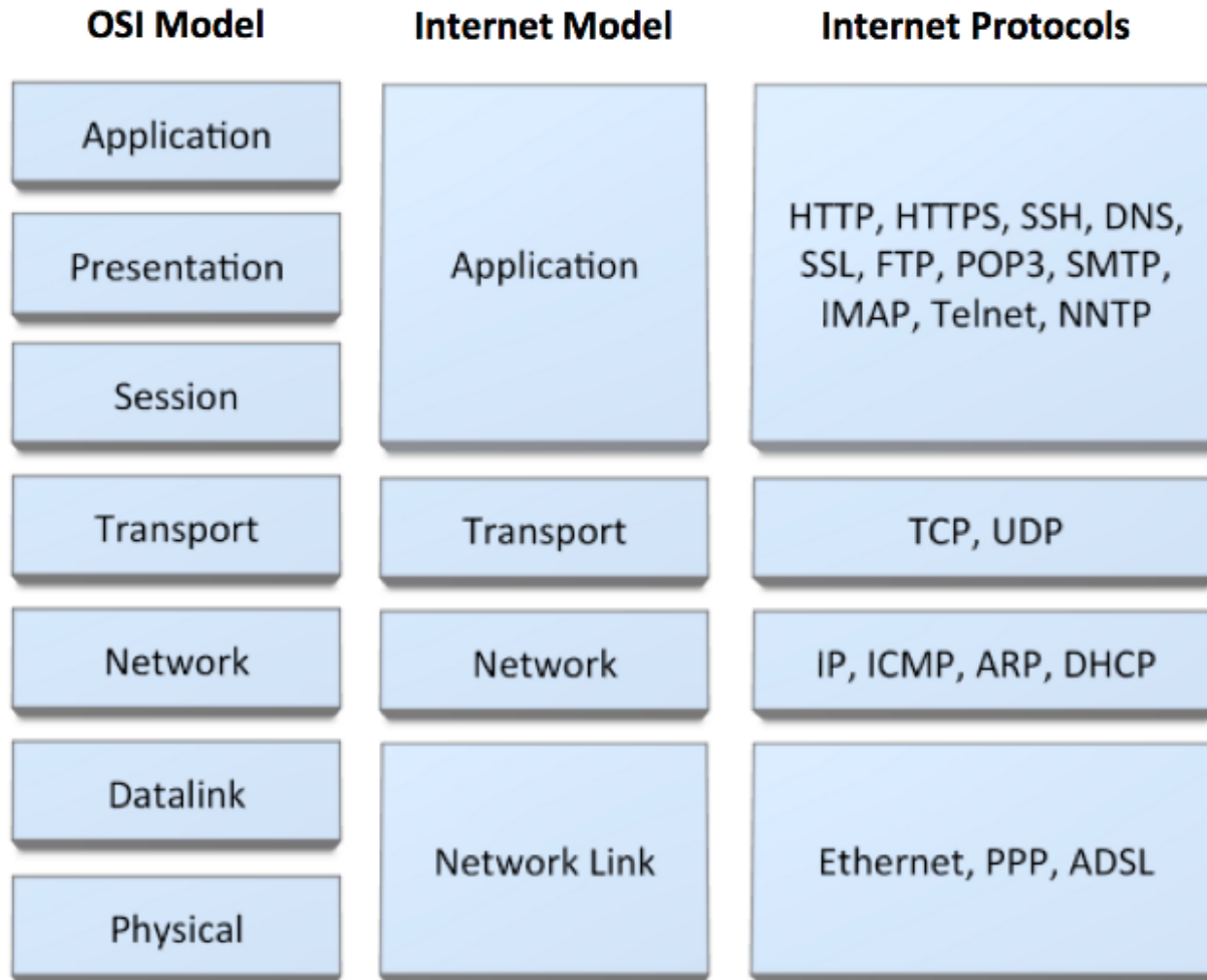


CSE 461 Lab :  
Transmission Control Protocol

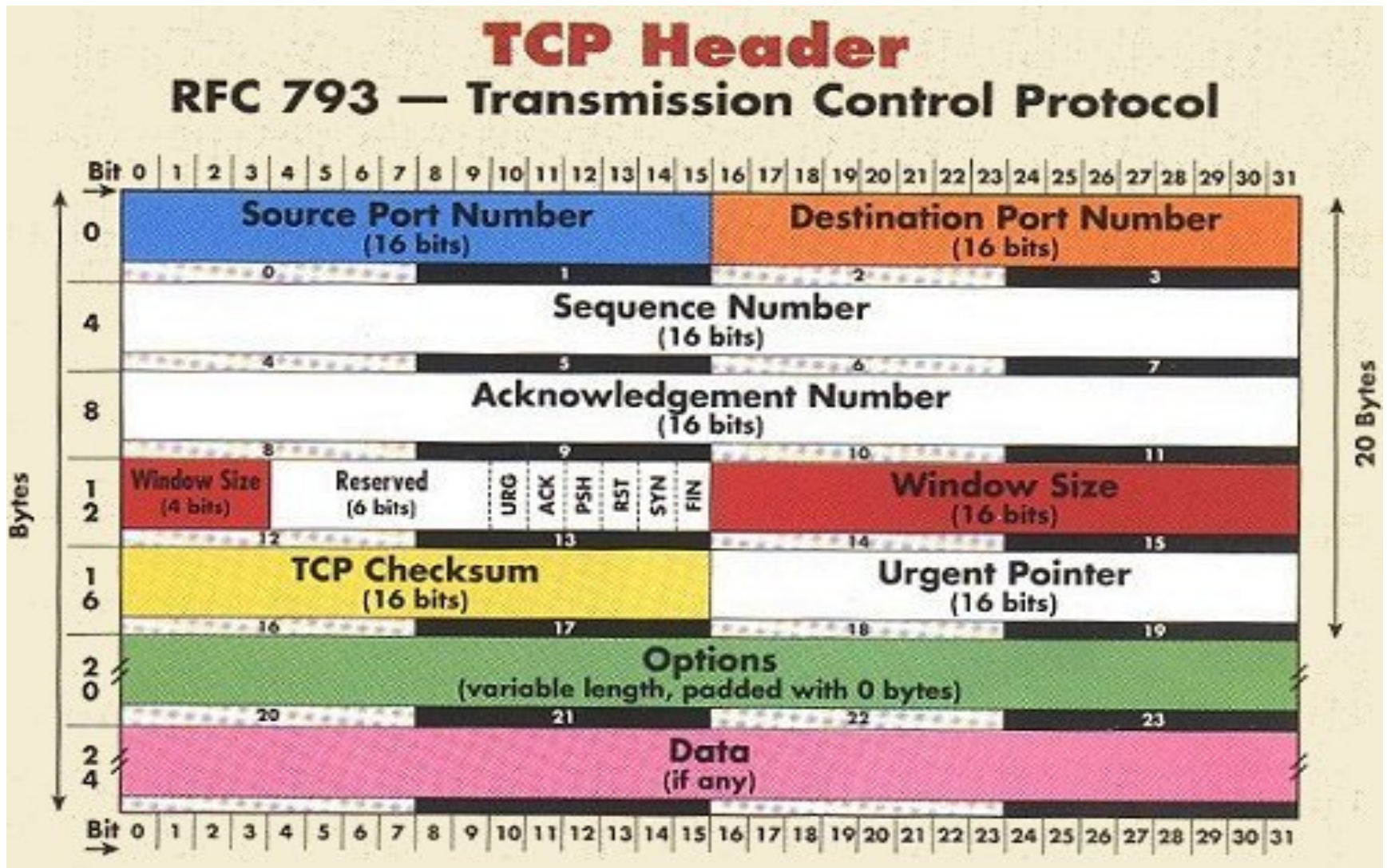
# Layers of Internet



# Transport Layer – TCP vs UDP

<b>TCP</b>	<b>UDP</b>
<b>Reliable</b>	<b>Unreliable</b>
<b>Connection-oriented</b>	<b>Connectionless</b>
<b>Segment retransmission and flow control through windowing</b>	<b>No windowing or retransmission</b>
<b>Segment sequencing</b>	<b>No sequencing</b>
<b>Acknowledge segments</b>	<b>No acknowledgement</b>

# TCP Stream (Packet config)



# Sequence number and ACK number

- **Sequence number:** byte-stream number of the first byte of the segment
- **ACK number:** the sequence number of the next byte the server is expecting.

# Transport Layer – TCP vs UDP

## TCP Client

```
s = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
s.connect((TCP_IP, TCP_PORT))
s.send(MESSAGE)
```

## UDP Client

```
sock = socket.socket(socket.AF_INET, socket.SOCK_DGRAM)
sock.sendto(MESSAGE, (UDP_IP, UDP_PORT))
```

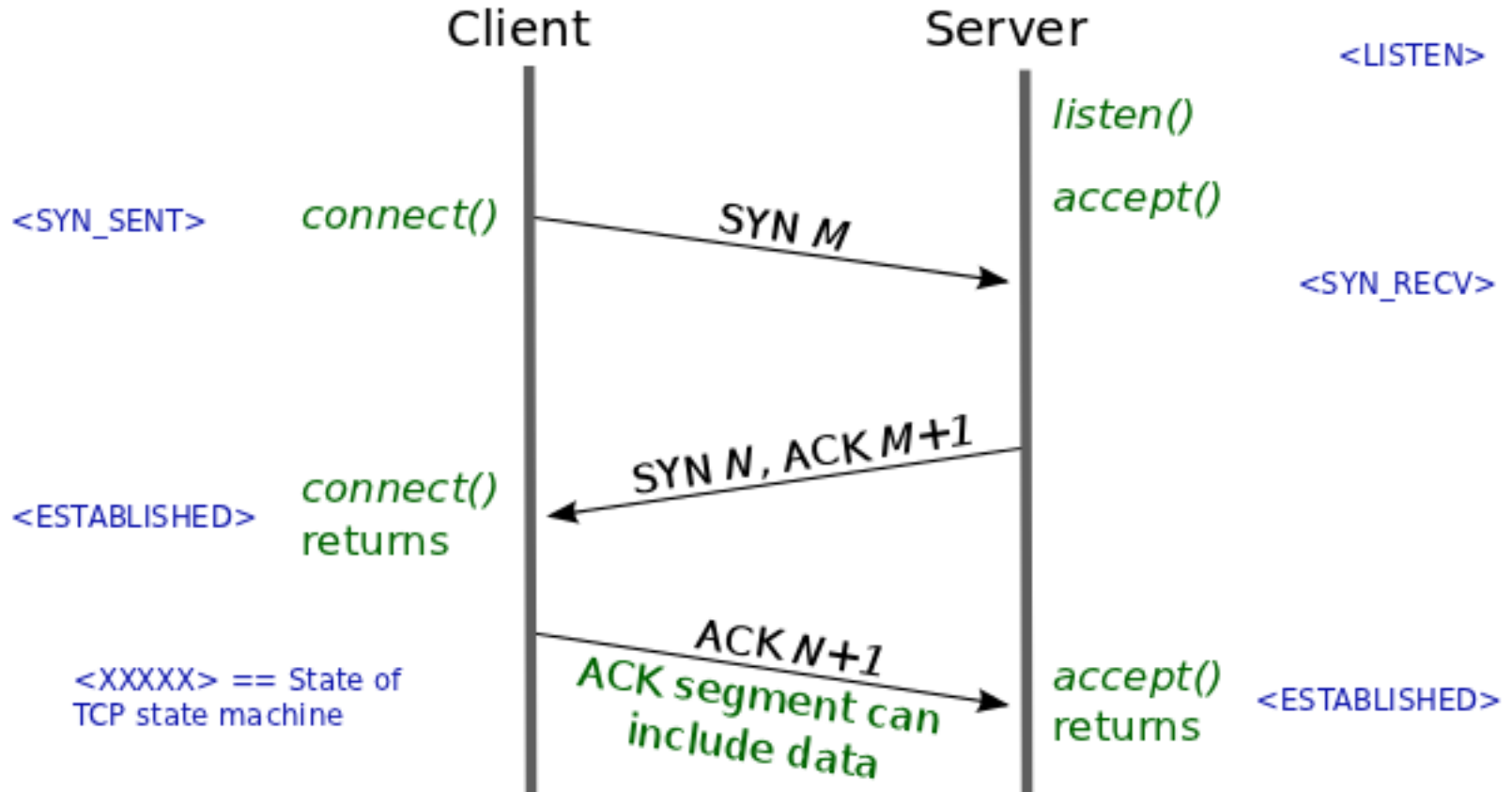
## TCP Server

```
s = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
s.bind((TCP_IP, TCP_PORT))
s.listen(1)
conn, addr = s.accept()
data = conn.recv(BUFFER_SIZE)
```

## UDP Server

```
sock = socket.socket(socket.AF_INET, socket.SOCK_DGRAM) # UDP
sock.bind((UDP_IP, UDP_PORT))
data, addr = sock.recvfrom(1024)
```

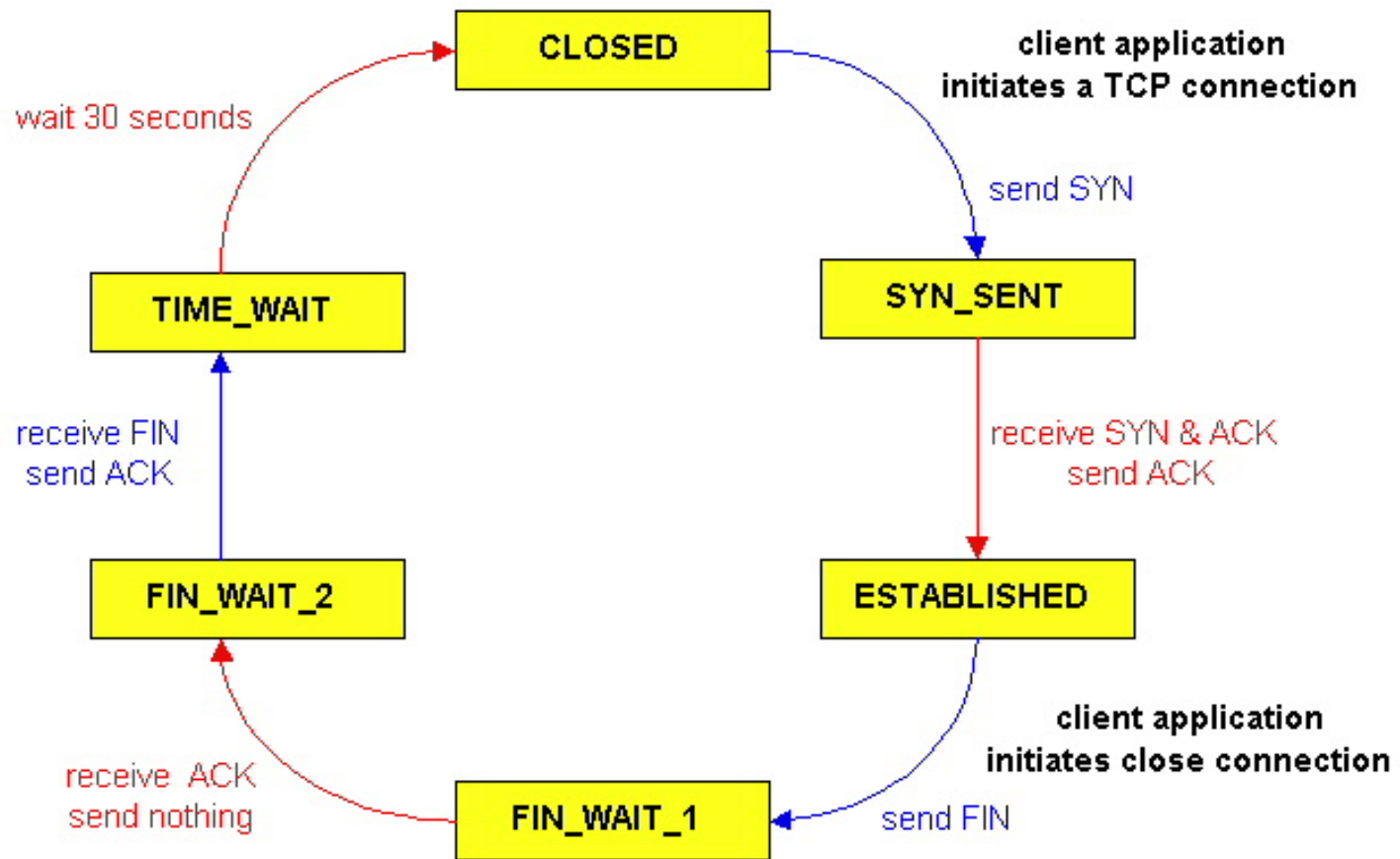
# Three Way Handshake



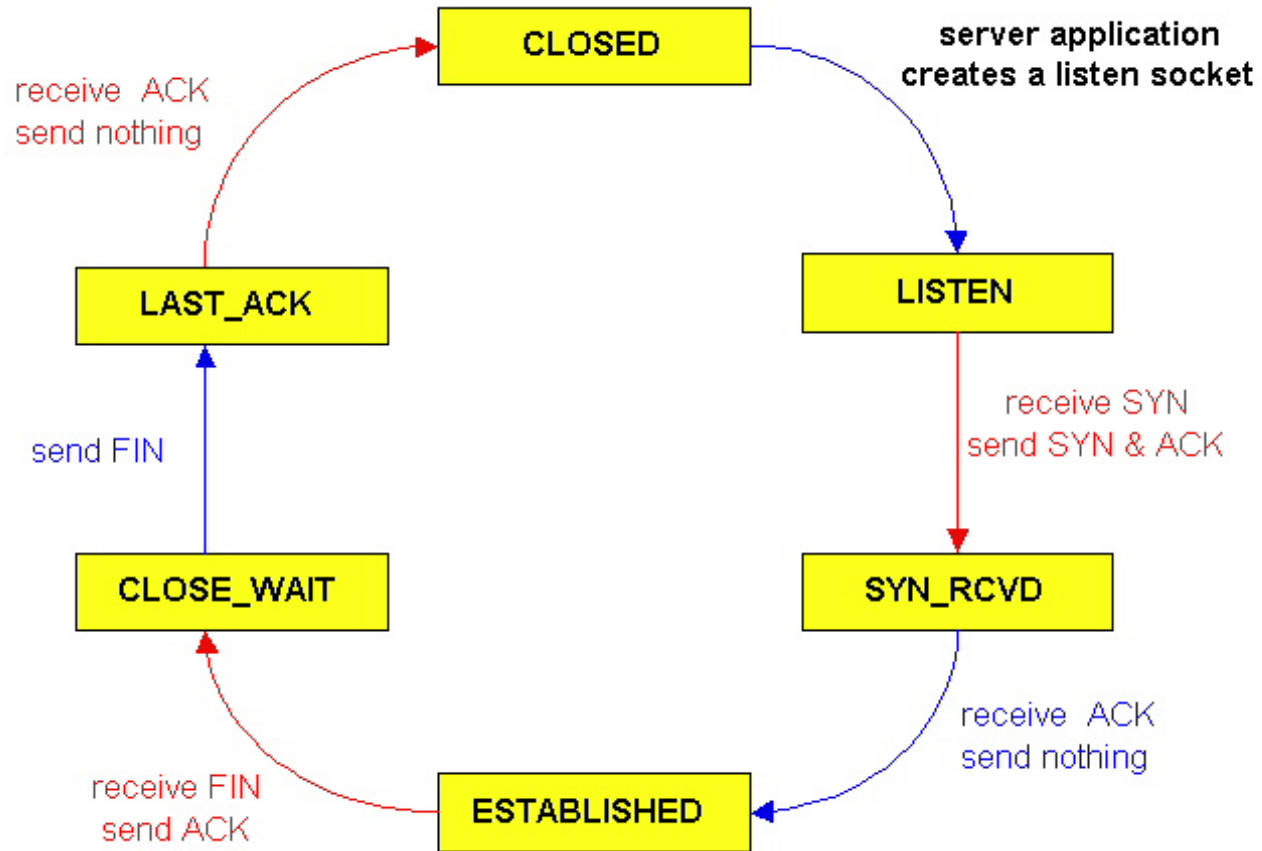




# TCP States



# TCP States



# TCP Socket Options

SO\_TIMEOUT : sets a timeout value

SO\_LINGER : sets a timeout to gracefully close the connection. (max is 65535)

SO\_KEEPALIVE: detect if the peer host crashes

SO\_REUSEPORT: allows two process to bind to the same port

SO\_REUSEADDR: allows reuse of local address while it is not active

# Questions

- Why do we need any connection protocol at all? Why isn't a TCP segment with sequence number 0 enough to start a connection?
- Given that we're going to do the 3-way handshake, why isn't always starting at initial sequence number 0 a good idea?
- Why randomize initial sequence numbers?
- Why the timeout state in the connection close portion of the protocol?
- Why not reuse sockets/port numbers until after a delay, by default?