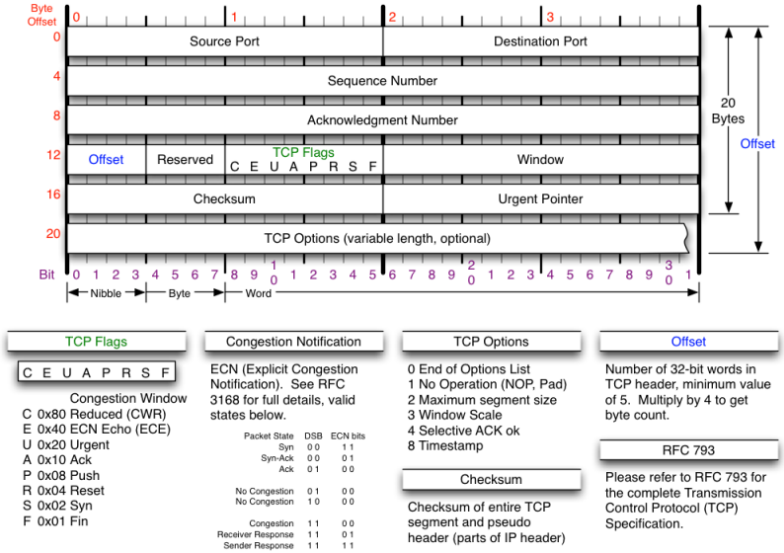
CS241 #36 Protocols

1> Protocol at the TCP level - Handshaking

TCP Packets: What is "SYN. SYN-ACK. ACK" ?

What is the sequence number and what is it used for? What is its initial value & why?

(I see the port number but where is the machine's IP address?)



2> What is a Denial of service?

Syn flood

DDOS

Internet of Things DOS

3> Which TCP client or server call will result in the first "SYN" packet?

4> TCP Handshaking and the speed of light

The moon is 1.3 light seconds distant. The TCP client is on the Earth and a lunar console runs a TCP server. Assume a new TCP connection is required each time.

3.1 How many seconds elapse between wanting to send a REBOOT message and the server receiving the data?

3.2 How many seconds elapse between requesting data from the server and receiving the result?

5> TCP and web performance

HTTP/1.0
If the client-server round trip time is 10 ms. What is the minimum time required to display a page with an image? Assume HTTP/1.0 (and that the image requires a separate request).

6> What is a Denial of service?

Performance improvements in HTTP/1.1

Improvements in HTTP/2.0

Why did Google create QUIC ?

7> Remote Procedure Calls

```
void updateScoreBoard(char*name, int score) {
  char mesg[256];
  sprintf(mesg, "newscore,%100s,%d",name,score);

  write( fd, mesg, strlen(mesg+1));
  // Why did I also send the null byte?
}
// You could also send the message size
// My protocol! So I'll choose bigendian binary format
uint16_t mesglen = htons( strlen(mesg) );
write( fd, & mesglen, sizeof(mesglen) );
write( fd, mesg , strlen(mesg) );
```

8> Heartbeats

Case study: Heartbleed April 2014

```
 /* simplified */
sock_fd = accept(server_fd);
while(1) {
  bytes_read=read( sock_fd, &buffer, bufsize)
  decode(buffer, bytes_read, &mesg);
  switch(mesg->request_type) {
    case (HEARTBEAT):
        write(sock_fd,
          mesg->content,
          mesg->content_length
        );
        break;
    case (...):
        ...
    break;
  }
  free(mesg);
}
```

Change ONE character to fix this program to print
20 dashes.

```
#include <stdio.h>
int main()
{
  int a;
  int b = 20;
  for( a = 0; a < b; a-- )
    putchar('-');
  return 0;
}
```

Actually there are THREE solutions (again,
changing only ONE character). Find all three.

Bonus: Change one character to print 21 dashes.

Heartbleed

Heartbleed is a security bug disclosed in April 2014 in the OpenSSL cryptography library, which is a widely used implementation of the Transport Layer Security (TLS) protocol. Heartbleed may be exploited regardless of whether the party using a vulnerable OpenSSL instance for TLS is a server or a client. It results from improper input validation (due to a missing bounds check) in the implementation of the TLS heartbeat extension, thus the bug's name derives from "heartbeat". The vulnerability is classified as a buffer over-read.

17% of all web servers were vulnerable
In June 2014, 300,000 systems still vulnerable.

HOW THE HEARTBLEED BUG WORKS: