Embedded Systems

Week 11: Interfaces II

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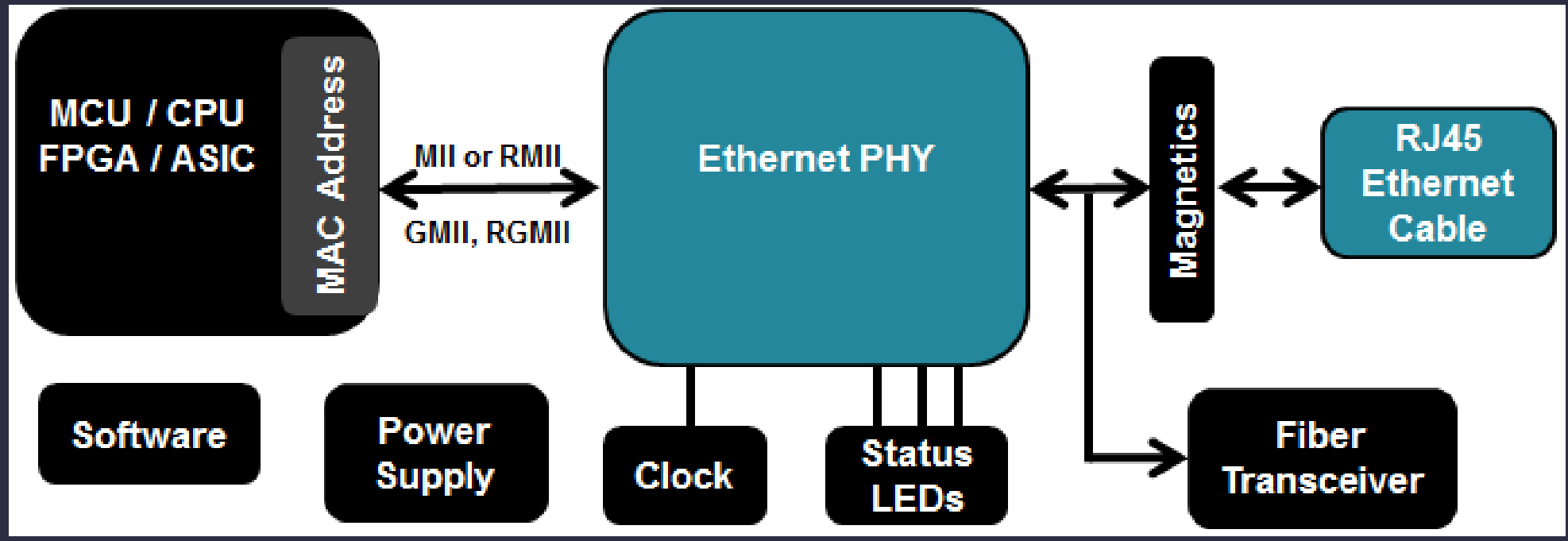
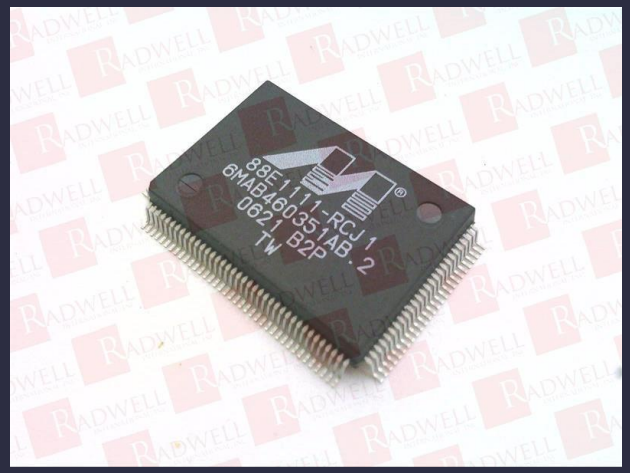
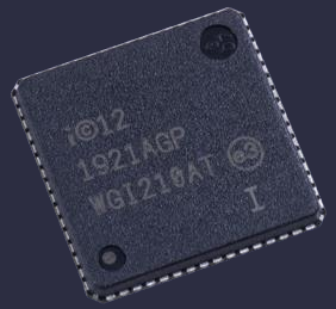
Ethernet

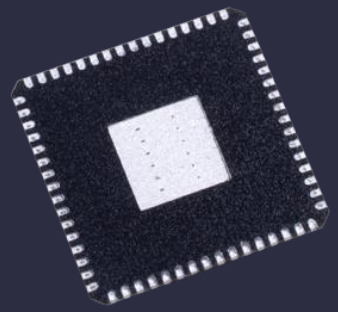


Ethernet PHY – FPGA Connection

Ethernet





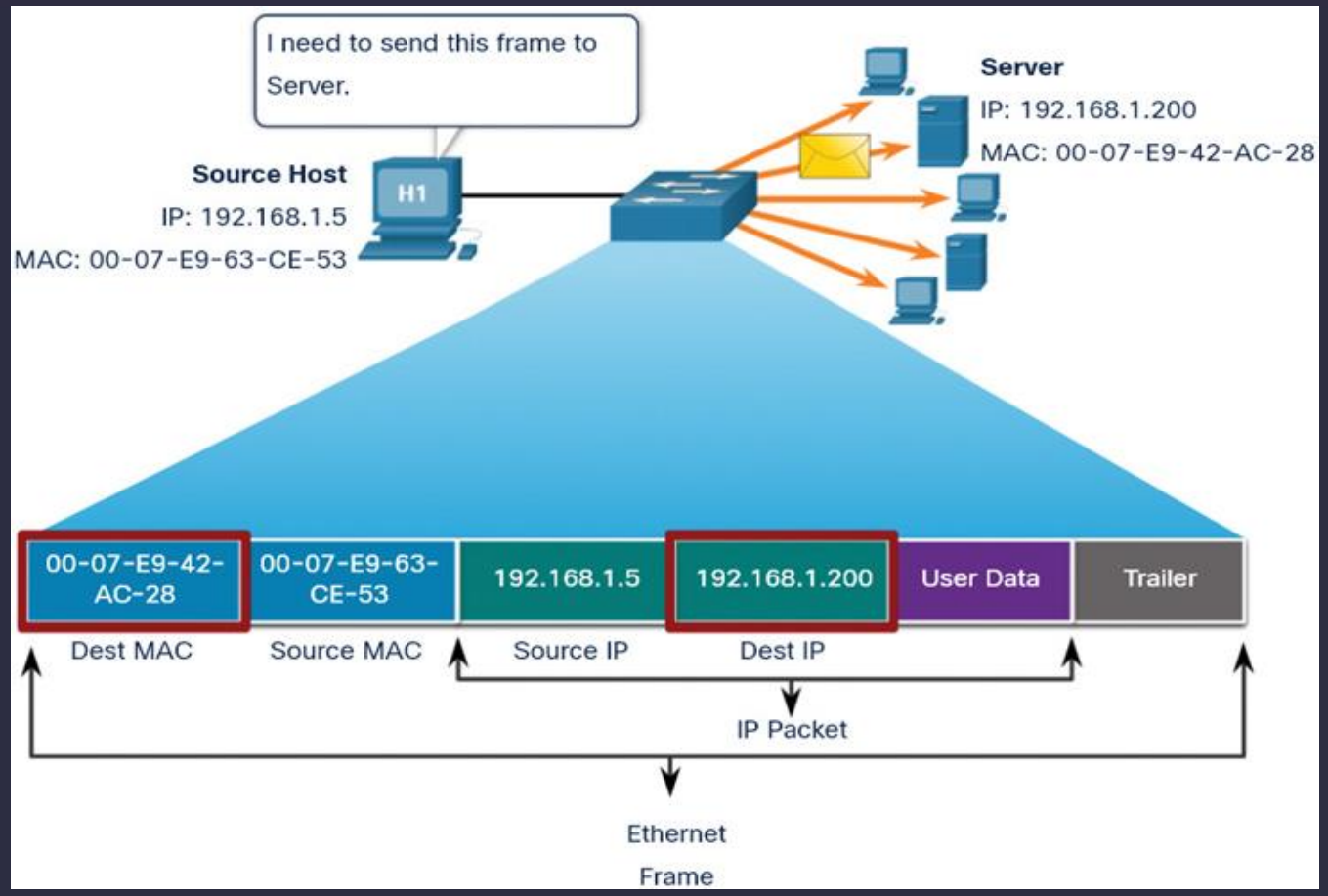


Ethernet PHY ICs

Ethernet

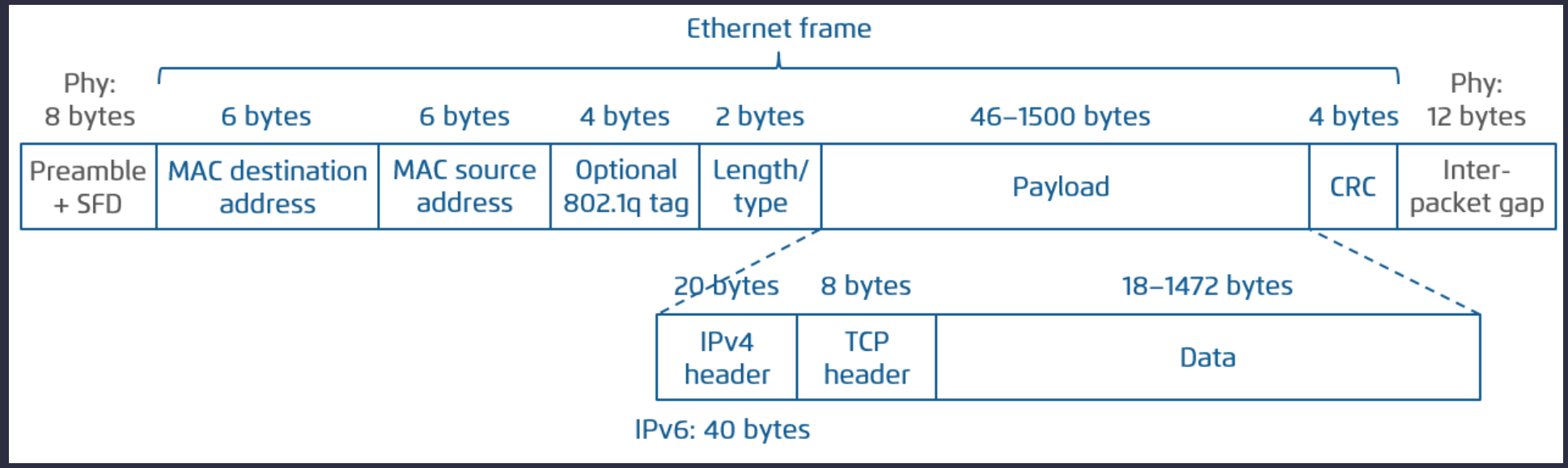
Ethernet Signals

Ethernet



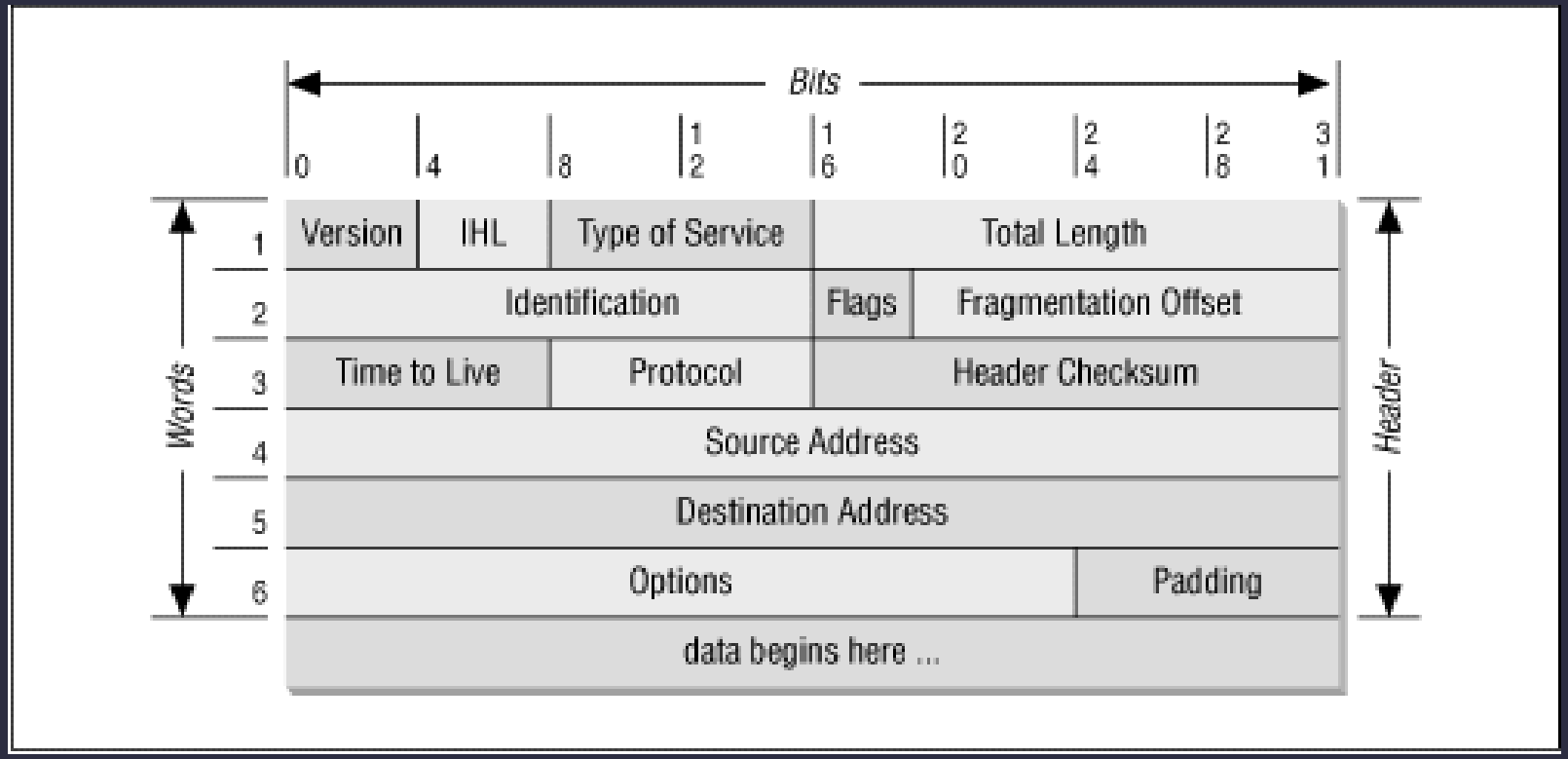
Ethernet MAC Layer Packet

Ethernet



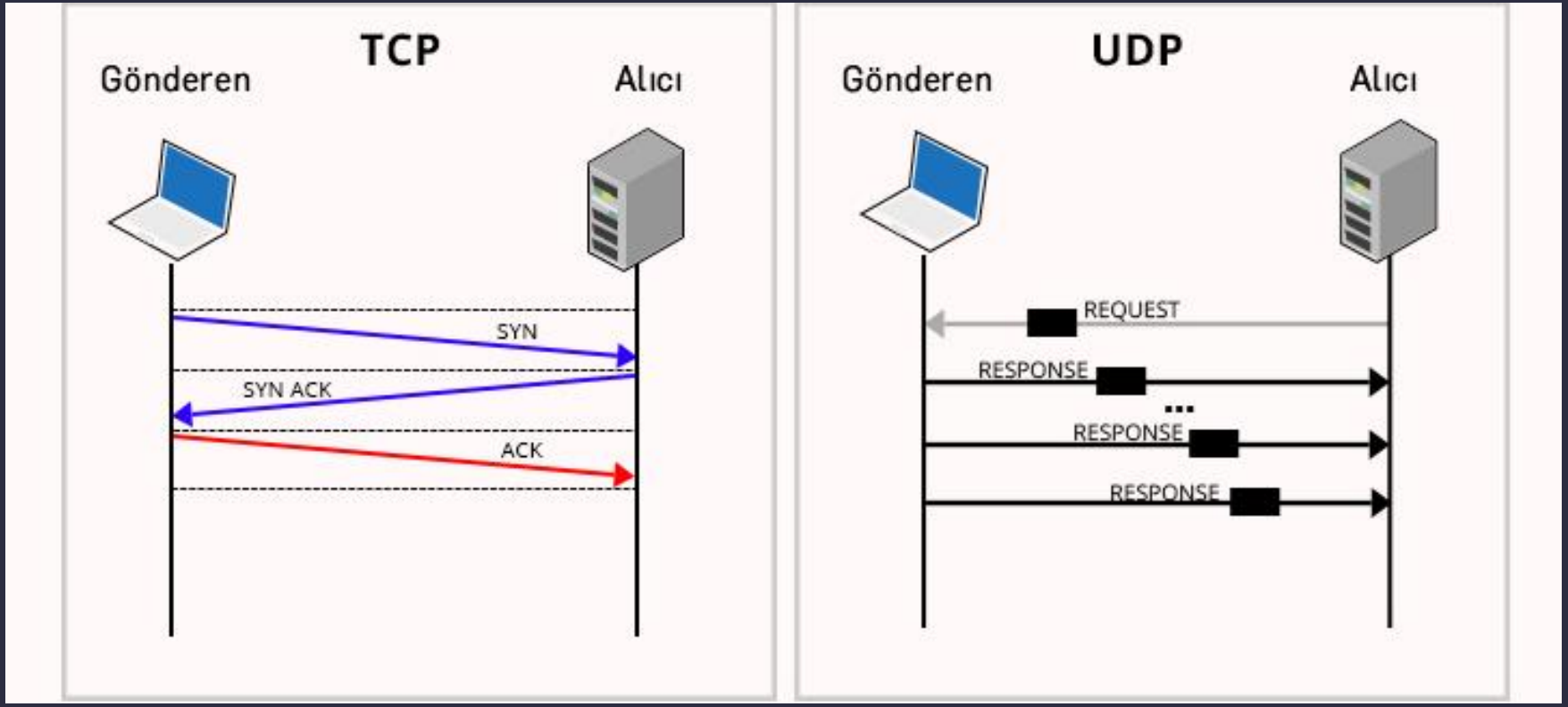
UDP Packet

Ethernet



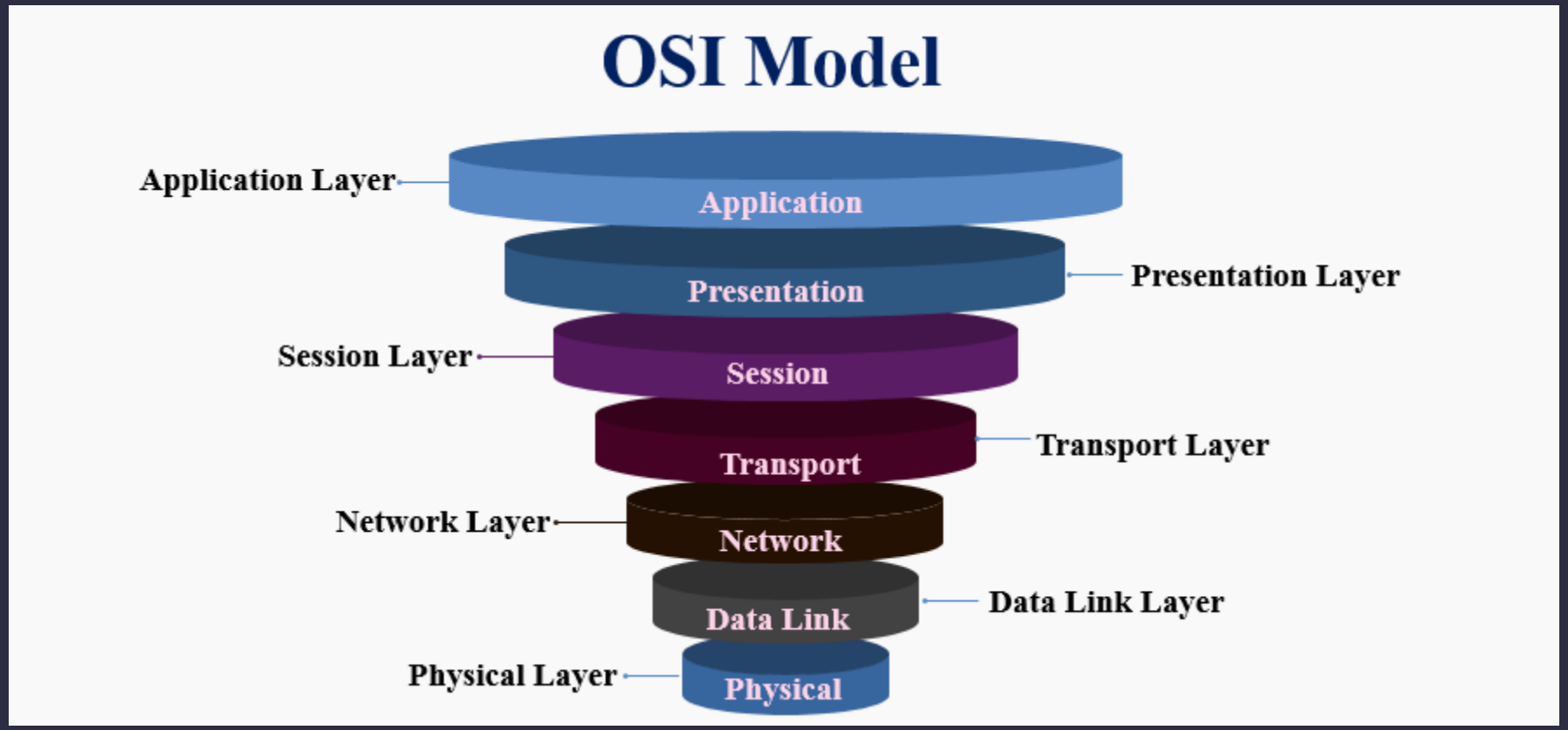
UDP Packet

Ethernet



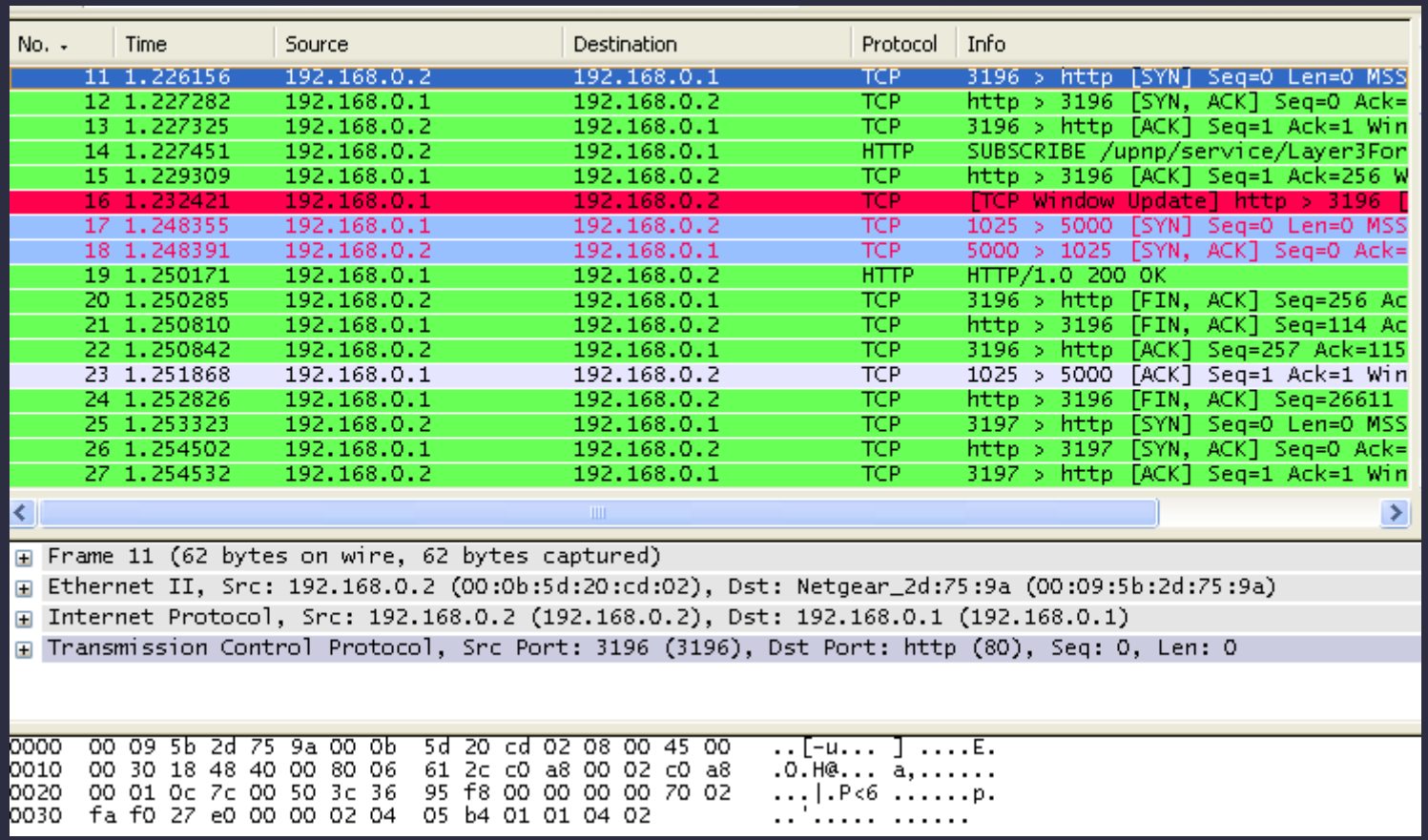
TCP vs UDP

Ethernet



OSI Layers

Ethernet



No.	Time	Source	Destination	Protocol	Info
11	1.226156	192.168.0.2	192.168.0.1	TCP	3196 > http [SYN] Seq=0 Len=0 MSS
12	1.227282	192.168.0.1	192.168.0.2	TCP	http > 3196 [SYN, ACK] Seq=0 Ack=
13	1.227325	192.168.0.2	192.168.0.1	TCP	3196 > http [ACK] Seq=1 Ack=1 Win
14	1.227451	192.168.0.2	192.168.0.1	HTTP	SUBSCRIBE /upnp/service/Layer3For
15	1.229309	192.168.0.1	192.168.0.2	TCP	http > 3196 [ACK] Seq=1 Ack=256 W
16	1.232421	192.168.0.1	192.168.0.2	TCP	[TCP Window Update] http > 3196 [
17	1.248355	192.168.0.1	192.168.0.2	TCP	1025 > 5000 [SYN] Seq=0 Len=0 MSS
18	1.248391	192.168.0.2	192.168.0.1	TCP	5000 > 1025 [SYN, ACK] Seq=0 Ack=
19	1.250171	192.168.0.1	192.168.0.2	HTTP	HTTP/1.0 200 OK
20	1.250285	192.168.0.2	192.168.0.1	TCP	3196 > http [FIN, ACK] Seq=256 Ac
21	1.250810	192.168.0.1	192.168.0.2	TCP	http > 3196 [FIN, ACK] Seq=114 Ac
22	1.250842	192.168.0.2	192.168.0.1	TCP	3196 > http [ACK] Seq=257 Ack=115
23	1.251868	192.168.0.1	192.168.0.2	TCP	1025 > 5000 [ACK] Seq=1 Ack=1 Win
24	1.252826	192.168.0.1	192.168.0.2	TCP	http > 3196 [FIN, ACK] Seq=26611
25	1.253323	192.168.0.2	192.168.0.1	TCP	3197 > http [SYN] Seq=0 Len=0 MSS
26	1.254502	192.168.0.1	192.168.0.2	TCP	http > 3197 [SYN, ACK] Seq=0 Ack=
27	1.254532	192.168.0.2	192.168.0.1	TCP	3197 > http [ACK] Seq=1 Ack=1 Win

```
⊞ Frame 11 (62 bytes on wire, 62 bytes captured)
⊞ Ethernet II, Src: 192.168.0.2 (00:0b:5d:20:cd:02), Dst: Netgear_2d:75:9a (00:09:5b:2d:75:9a)
⊞ Internet Protocol, Src: 192.168.0.2 (192.168.0.2), Dst: 192.168.0.1 (192.168.0.1)
⊞ Transmission Control Protocol, Src Port: 3196 (3196), Dst Port: http (80), Seq: 0, Len: 0

0000  00 09 5b 2d 75 9a 00 0b  5d 20 cd 02 08 00 45 00   ..[-u... ] ....E.
0010  00 30 18 48 40 00 80 06  61 2c c0 a8 00 02 c0 a8   .0.H@... a,......
0020  00 01 0c 7c 00 50 3c 36  95 f8 00 00 00 00 70 02   ...|.P<6 ......p.
0030  fa f0 27 e0 00 00 02 04  05 b4 01 01 04 02        ..'..... ......
```

Wireshark for Sniffing

Petalinux

Ethernet

```
#include <stdio.h>
#include <stdlib.h>
#include <unistd.h>
#include <string.h>
#include <sys/types.h>
#include <sys/socket.h>
#include <arpa/inet.h>
#include <netinet/in.h>

#define PORT     8080
#define MAXLINE 1024

// Driver code
int main() {
    int sockfd;
    char buffer[MAXLINE];
    char *hello = "Hello from client";
    struct sockaddr_in     servaddr;

    // Creating socket file descriptor
    if ( (sockfd = socket(AF_INET, SOCK_DGRAM, 0)) < 0 ) {
        perror("socket creation failed");
        exit(EXIT_FAILURE);
    }

    memset(&servaddr, 0, sizeof(servaddr));

    // Filling server information
    servaddr.sin_family = AF_INET;
    servaddr.sin_port = htons(PORT);
    servaddr.sin_addr.s_addr = inet_addr("192.168.2.9");

    int n, len;

    sendto(sockfd, (const char *)hello, strlen(hello),
        MSG_CONFIRM, (const struct sockaddr *) &servaddr,
            sizeof(servaddr));
    printf("Hello message sent.\n");

    n = recvfrom(sockfd, (char *)buffer, MAXLINE,
                MSG_WAITALL, (struct sockaddr *) &servaddr,
                &len);
    buffer[n] = '\0';
    printf("Server : %s\n", buffer);

    close(sockfd);
    return 0;
}
```