TCP/IP model

Module #1 - Basics networking

Pavlovsky Anton

System engineer at EPAM
Certificates: CCNA Enterprise, CCNP Enterprise, CCNP Service Provider

Agenda

- TCP/IP model layers
- OSI vs TCP/IP model
- Five-layer TCP/IP model
- Examples

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History

The **TCP/IP** is the conceptual model and set of communications protocols used in the Internet and computer networks.

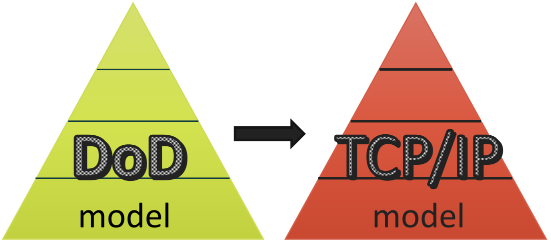
Foundational protocols in TCP/IP are the Transmission Control Protocol (TCP) and the Internet Protocol (IP)

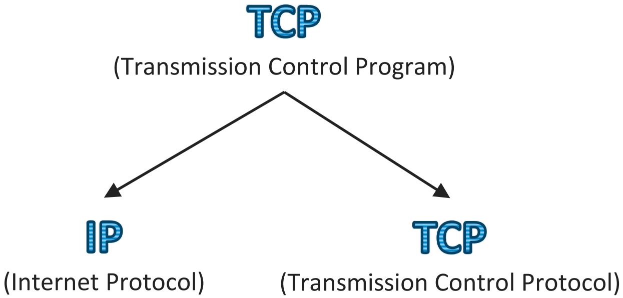
History

Department of Defense (DoD) model preceded of TCP/IP model

In 1974, Vint Cerf and Robert Kahn published a paper "A Protocol for Packet Network Interconnection" which describes the TCP/IP Model.

The technical standards underlying the TCP/IP stack protocols maintained by the Internet Engineering Task Force (IETF)




TCP

(Transmission Control Program)

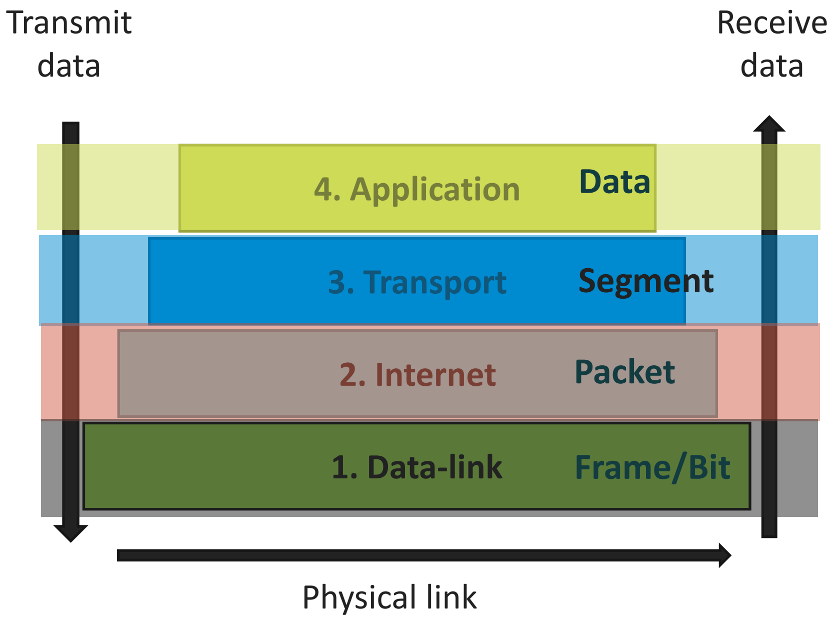
IP

(Internet Protocol)

TCP

(Transmission Control Protocol)

TCP/IP model



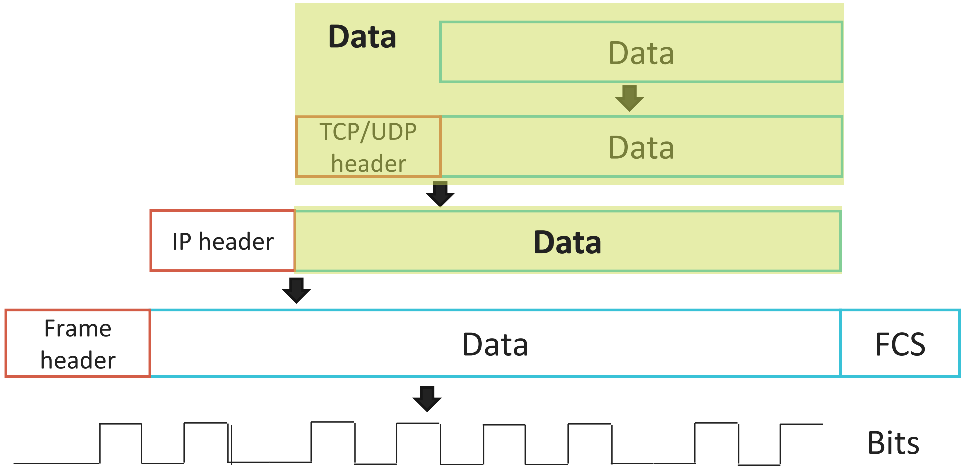
The **TCP/IP model** is the conceptual model and set of communications protocols used in the Internet and computer networks.

TCP/IP model describes communication between two points using TCP/IP protocols

Encapsulation

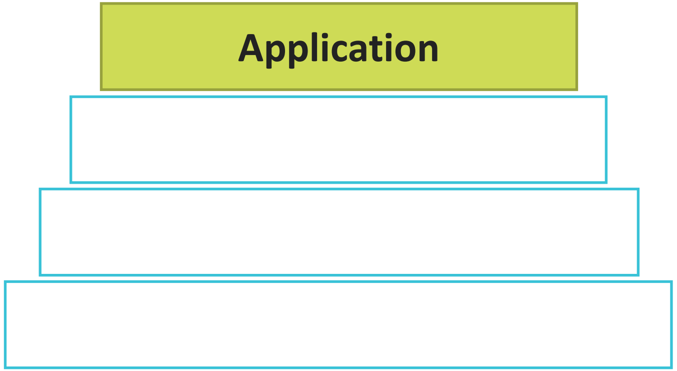
Data **Encapsulation** is adding a bit of additional information to the user data packet and preparing the information for being delivered in the network.

Each layer adds its own information to data and passes the result to the next layer.



Encapsulation on TCP/IP layers

TCP/IP model

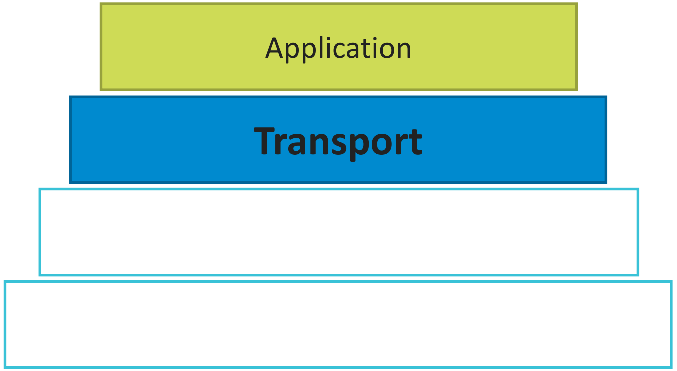


The **Application layer** includes the protocols used by most applications for providing user services or exchanging application data over the network connections established by the lower level protocols.

The application layer in the TCP/IP model is often compared as equivalent to a combination of the Session, Presentation, and Application layers of the OSI model.

Protocols:
HTTP, HTTPS, FTP, DHCP, DNS and etc

TCP/IP model

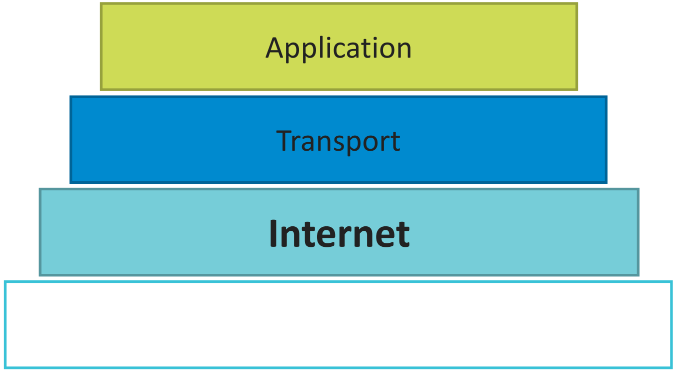


The **Transport layer** is analogous to the transport layer of the OSI model. It is responsible for end-to-end communication and error-free delivery of data.

Important functions:
- Division into segments and numbers them to make a sequence.
- Delivery to the correct process on the destination machine.
- Arrival without any error.

Protocols:
TCP, UDP

TCP/IP model

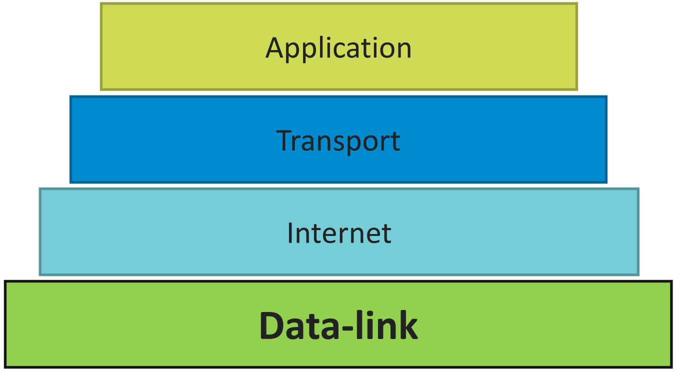


The **Internet layer** has the responsibility of sending packets across potentially multiple networks.
Internetworking requires sending data from the source network to the destination network.

Important functions:
- Host addressing and identification.
- Packet routing.

Protocols:
IP, ARP, ICMP, IGMP

TCP/IP model

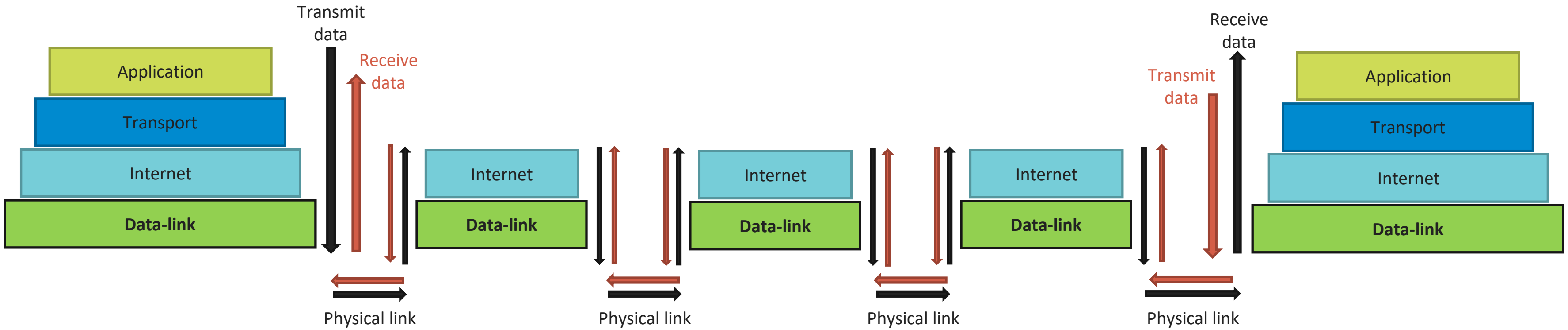


Data-link layer defines how the data should be sent physically through the network. This layer is also called a network access layer.

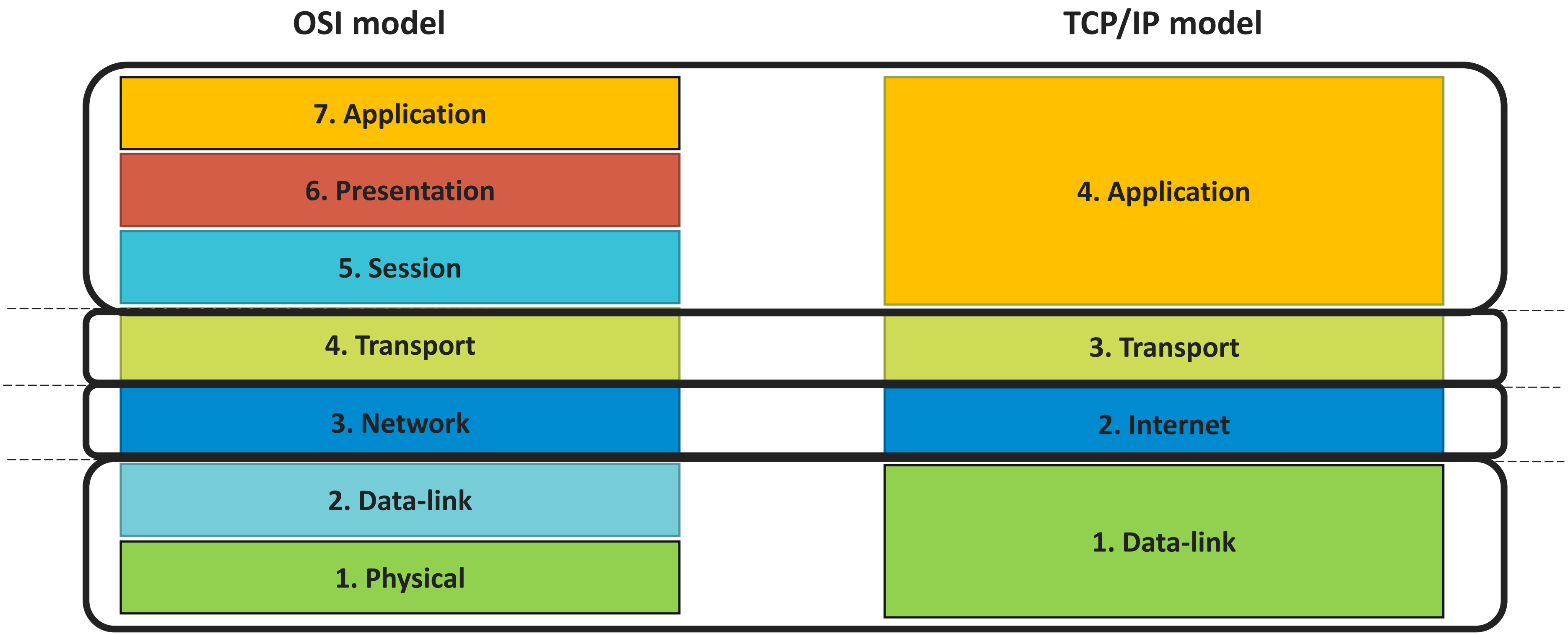
Important functions:
- Physical addressing
- Framing packets
- Preparing packets for transmission
- Transmit the frames to the physical layer and over a transmission medium

Protocols:
Ethernet, Wi-Fi, xDSL

TCP/IP model: traffic flow



Difference between OSI and TCP/IP models



Difference between OSI and TCP/IP models

TCP/IP	OSI
TCP refers to Transmission Control Protocol.	OSI refers to Open Systems Interconnection.
TCP/IP has 4 layers.	OSI has 7 layers.
TCP/IP follow a horizontal approach.	OSI follows a vertical approach.
TCP/IP uses both session and presentation layer in the application layer itself.	OSI uses different session and presentation layers.
TCP/IP developed protocols then model.	OSI developed model then protocol.

Five-layer TCP/IP model

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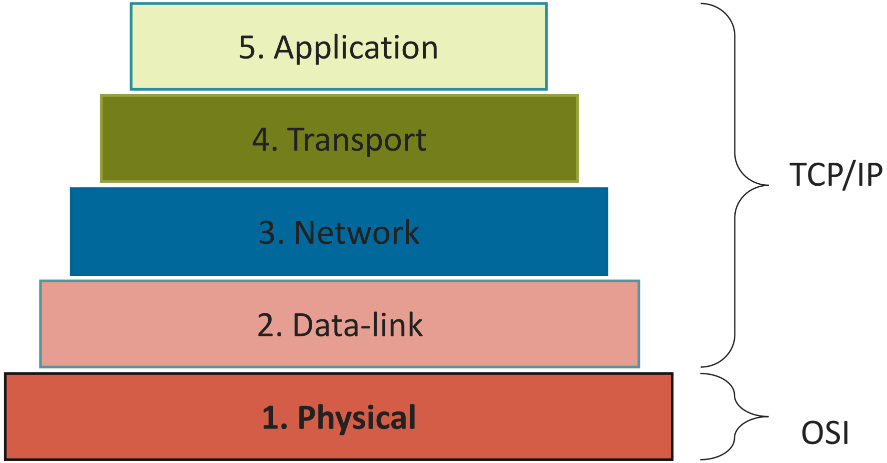
OSI + TCP/IP model

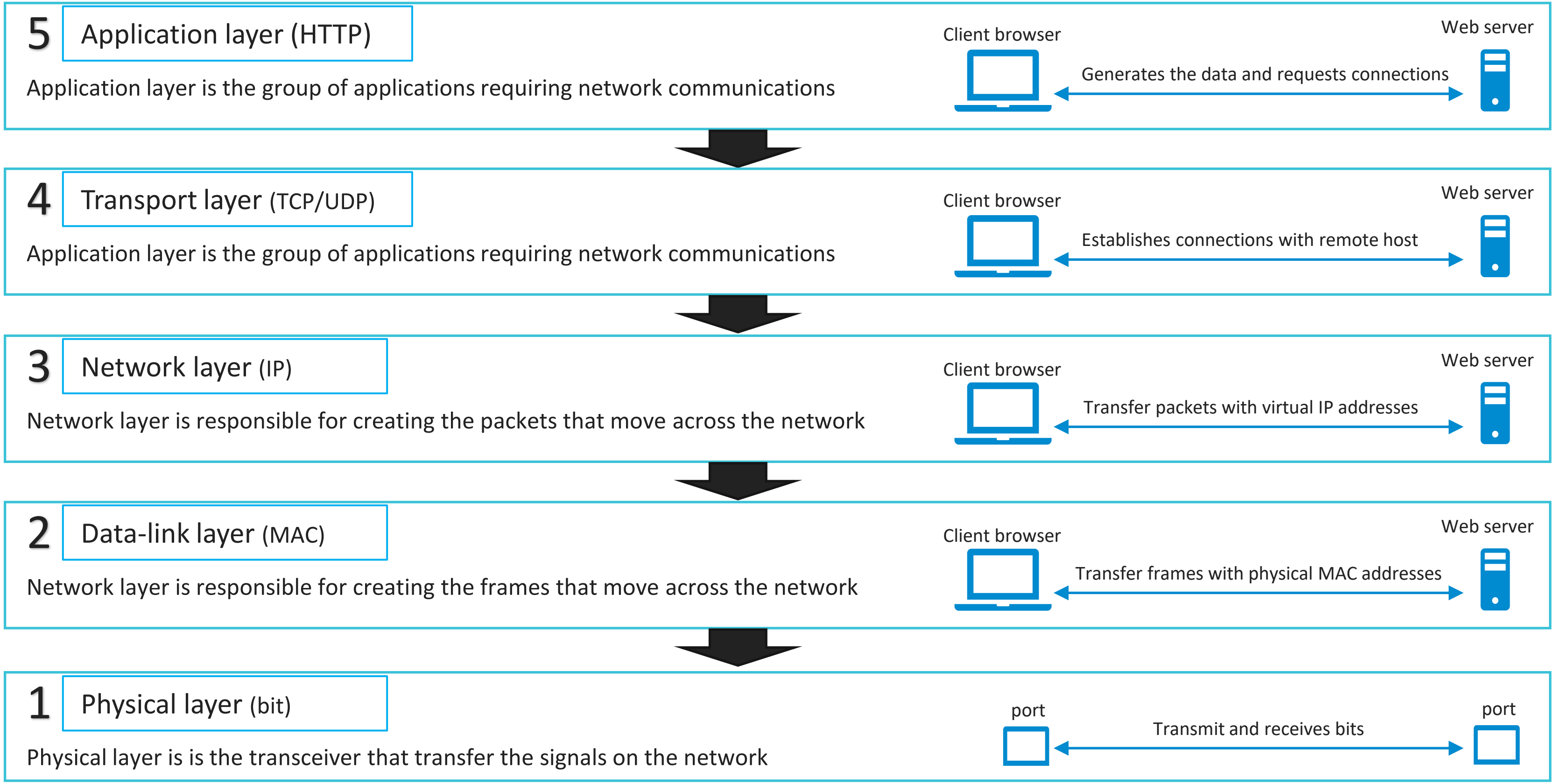


Five-level TCP/IP model is the network communication model between two points

Five-level TCP/IP model concatenates layers from OSI and TCP/IP models.

The functions of each layers of the hybrid model are the same as OSI and TCP/IP layers

TCP/IP. Traffic flow



5 Application layer (HTTP)

Application layer is the group of applications requiring network communications

Client browser

Web server

Generates the data and requests connections

4 Transport layer (TCP/UDP)

Application layer is the group of applications requiring network communications

Client browser

Web server

Establishes connections with remote host

3 Network layer (IP)

Network layer is responsible for creating the packets that move across the network

Client browser

Web server

Transfer packets with virtual IP addresses

2 Data-link layer (MAC)

Network layer is responsible for creating the frames that move across the network

Client browser

Web server

Transfer frames with physical MAC addresses

1 Physical layer (bit)

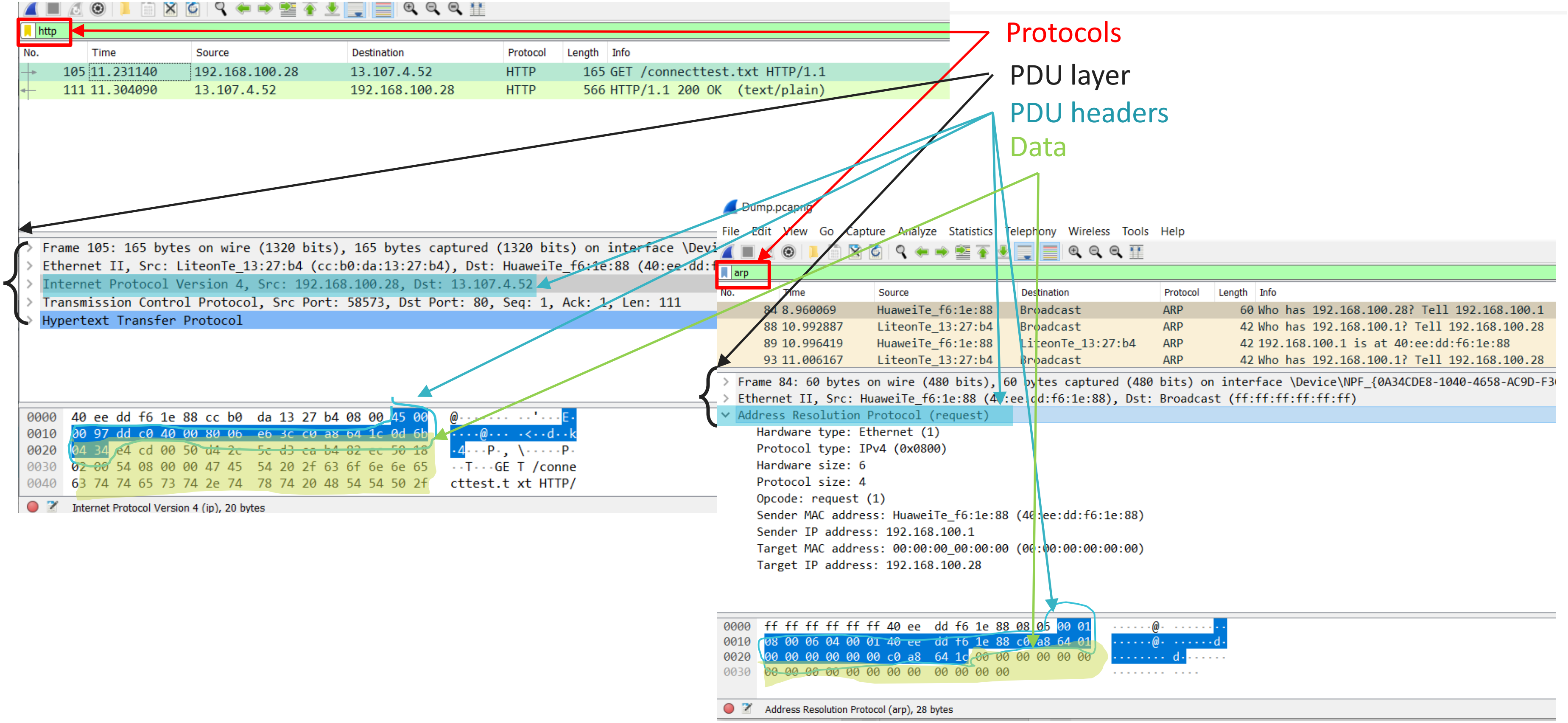
Physical layer is is the transceiver that transfer the signals on the network

port

port

Transmit and receives bits

TCP/IP: Examples



Protocols

PDU layer

PDU headers

Data

```
No.  Time         Source           Destination      Protocol  Length  Info
105  11.231140    192.168.100.28   13.107.4.52      HTTP         165  GET /connecttest.txt HTTP/1.1
111  11.304090    13.107.4.52      192.168.100.28   HTTP         566  HTTP/1.1 200 OK  (text/plain)
```

```
> Frame 105: 165 bytes on wire (1320 bits), 165 bytes captured (1320 bits) on interface \Devi
> Ethernet II, Src: LiteonTe_13:27:b4 (cc:b0:da:13:27:b4), Dst: HuaweiTe_f6:1e:88 (40:ee:dd:f
> Internet Protocol Version 4, Src: 192.168.100.28, Dst: 13.107.4.52
> Transmission Control Protocol, Src Port: 58573, Dst Port: 80, Seq: 1, Ack: 1, Len: 111
> Hypertext Transfer Protocol
```

```
0000  40 ee dd f6 1e 88 cc b0  da 13 27 b4 08 00 45 00   @······· ··'···E·
0010  00 97 dd c0 40 00 80 06  e6 3c c0 a8 64 1c 0d 6b   ····@··· ·<··d··k
0020  04 34 e4 cd 00 50 d4 2c  5c d3 ca b4 82 ec 50 18   ·4···P·, \·····P·
0030  02 00 54 08 00 00 47 45  54 20 2f 63 6f 6e 6e 65   ··T···GE T /conne
0040  63 74 74 65 73 74 2e 74  78 74 20 48 54 54 50 2f   cttest.t xt HTTP/
```

Internet Protocol Version 4 (ip), 20 bytes

```
No.  Time        Source              Destination         Protocol  Length  Info
84   8.960069    HuaweiTe_f6:1e:88   Broadcast           ARP           60  Who has 192.168.100.28? Tell 192.168.100.1
88   10.992887   LiteonTe_13:27:b4   Broadcast           ARP           42  Who has 192.168.100.1? Tell 192.168.100.28
89   10.996419   HuaweiTe_f6:1e:88   LiteonTe_13:27:b4   ARP           42  192.168.100.1 is at 40:ee:dd:f6:1e:88
93   11.006167   LiteonTe_13:27:b4   Broadcast           ARP           42  Who has 192.168.100.1? Tell 192.168.100.28
```

```
> Frame 84: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface \Device\NPF_{0A34CDE8-1040-4658-AC9D-F3
> Ethernet II, Src: HuaweiTe_f6:1e:88 (40:ee:dd:f6:1e:88), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
v Address Resolution Protocol (request)
    Hardware type: Ethernet (1)
    Protocol type: IPv4 (0x0800)
    Hardware size: 6
    Protocol size: 4
    Opcode: request (1)
    Sender MAC address: HuaweiTe_f6:1e:88 (40:ee:dd:f6:1e:88)
    Sender IP address: 192.168.100.1
    Target MAC address: 00:00:00_00:00:00 (00:00:00:00:00:00)
    Target IP address: 192.168.100.28
```

```
0000  ff ff ff ff ff ff 40 ee  dd f6 1e 88 08 06 00 01   ······@· ········
0010  08 00 06 04 00 01 40 ee  dd f6 1e 88 c0 a8 64 01   ······@· ······d·
0020  00 00 00 00 00 00 c0 a8  64 1c 00 00 00 00 00 00   ········ d·······
0030  00 00 00 00 00 00 00 00  00 00 00 00               ········ ····
```

Address Resolution Protocol (arp), 28 bytes

Thank you!