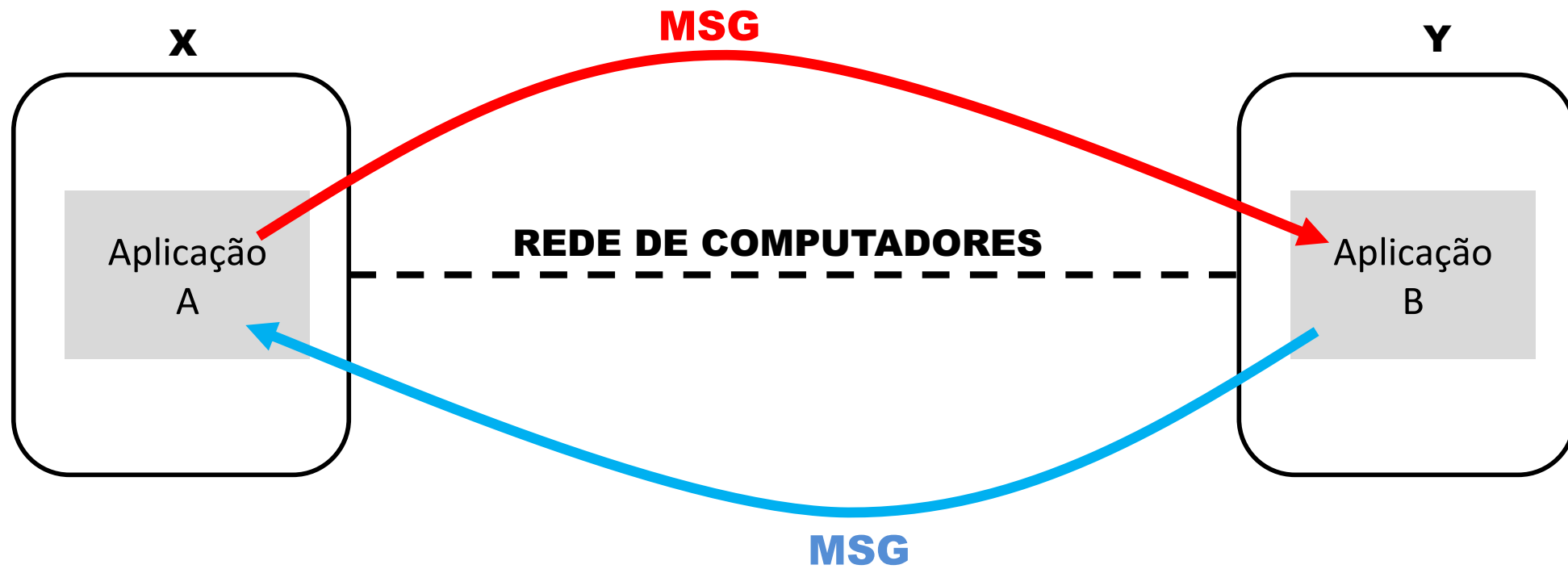


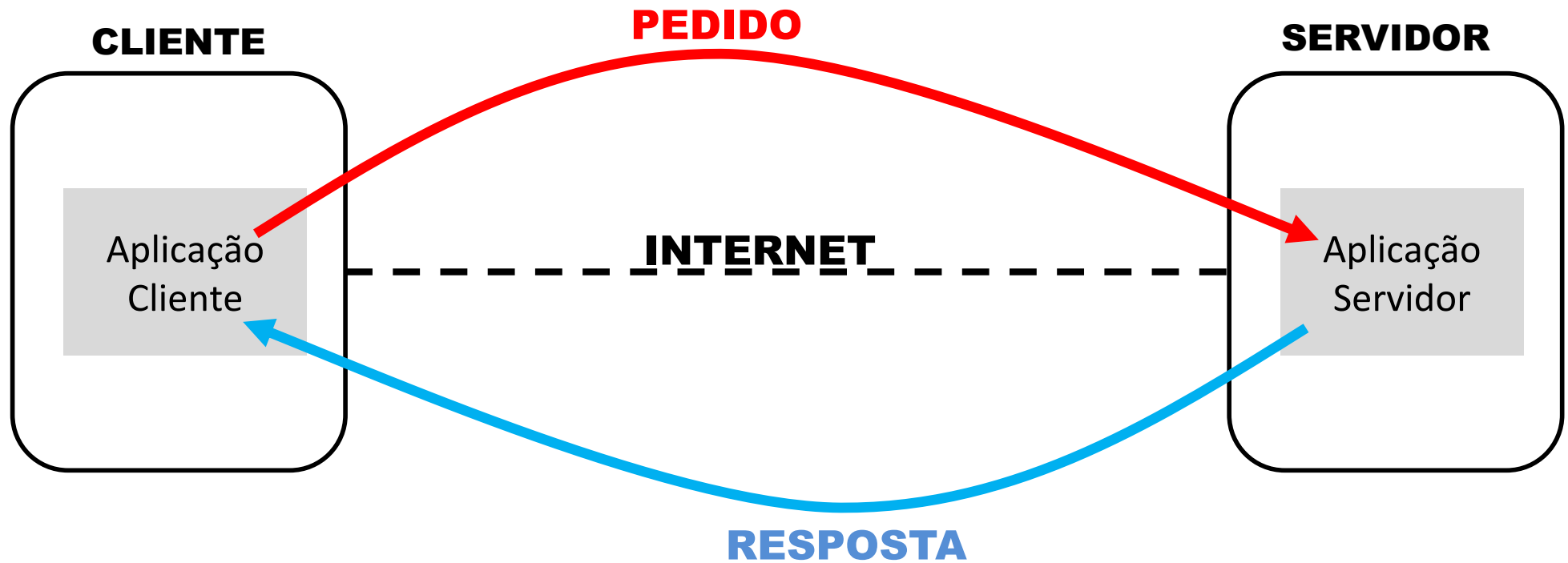
REDES DE COMPUTADORES

Mário Antunes

mario.antunes@ipleiria.pt

Setembro de 2018





CLIENTE/SERVIDOR – [CLIENT/SERVER]

PEDIDO/RESPOSTA – [REQUEST/REPLY]

Modelo TCP/IP

APLICAÇÃO

TRANSPORTE

REDE

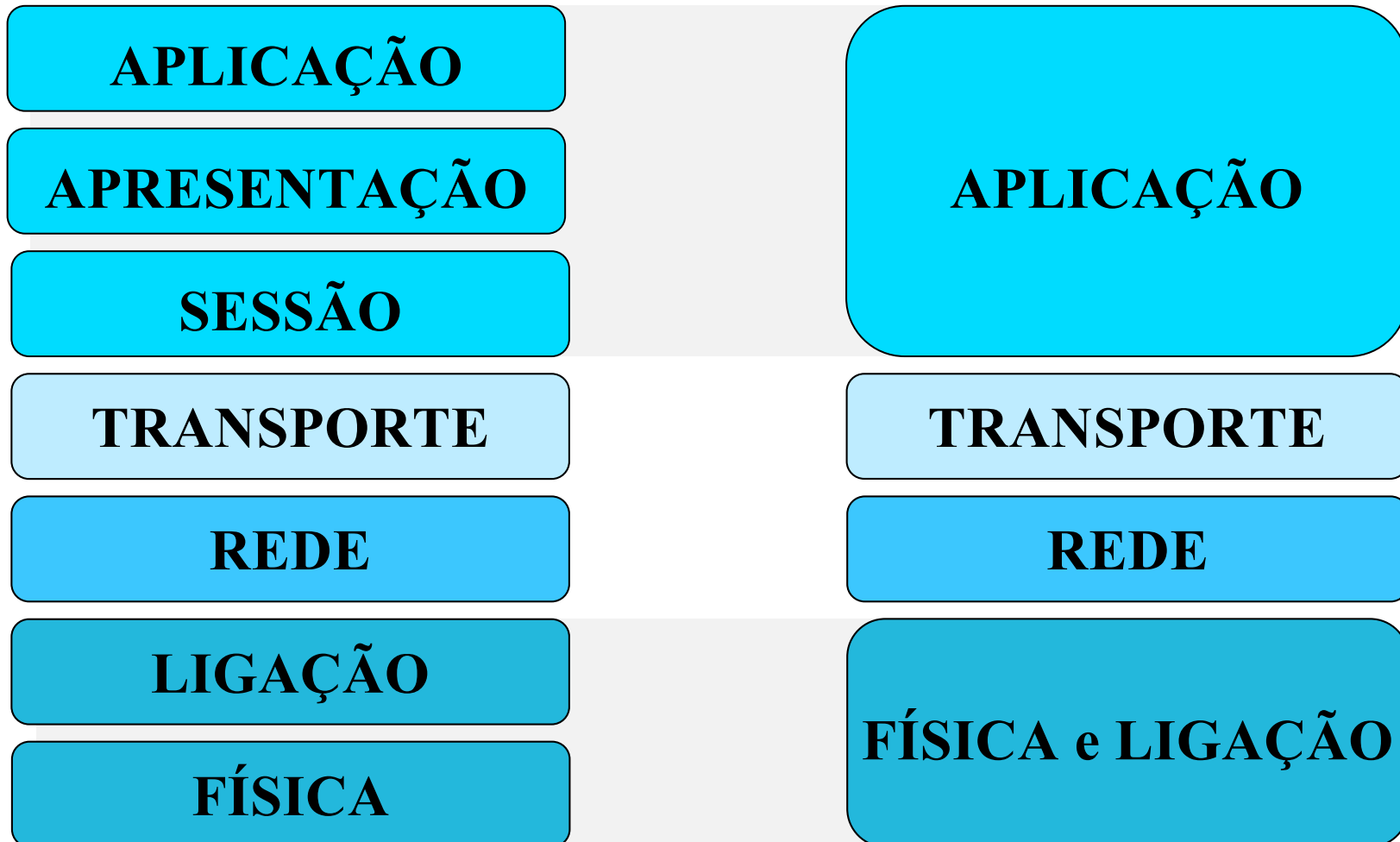
FÍSICA e LIGAÇÃO

Sistema operativo
(Windows, Linux, etc)



Modelo OSI

[Open Systems Interconnection]



Benefícios de um modelo estruturado em camadas (*layered*)

Regras de comunicação:

- Codificação
- Formatação e encapsulamento
- Tamanho
- *Timing*
- Distribuição



The Rules

Message Encoding



Human Communication





The Rules

Message Formatting and Encapsulation

Example: Personal letter contains the following elements:

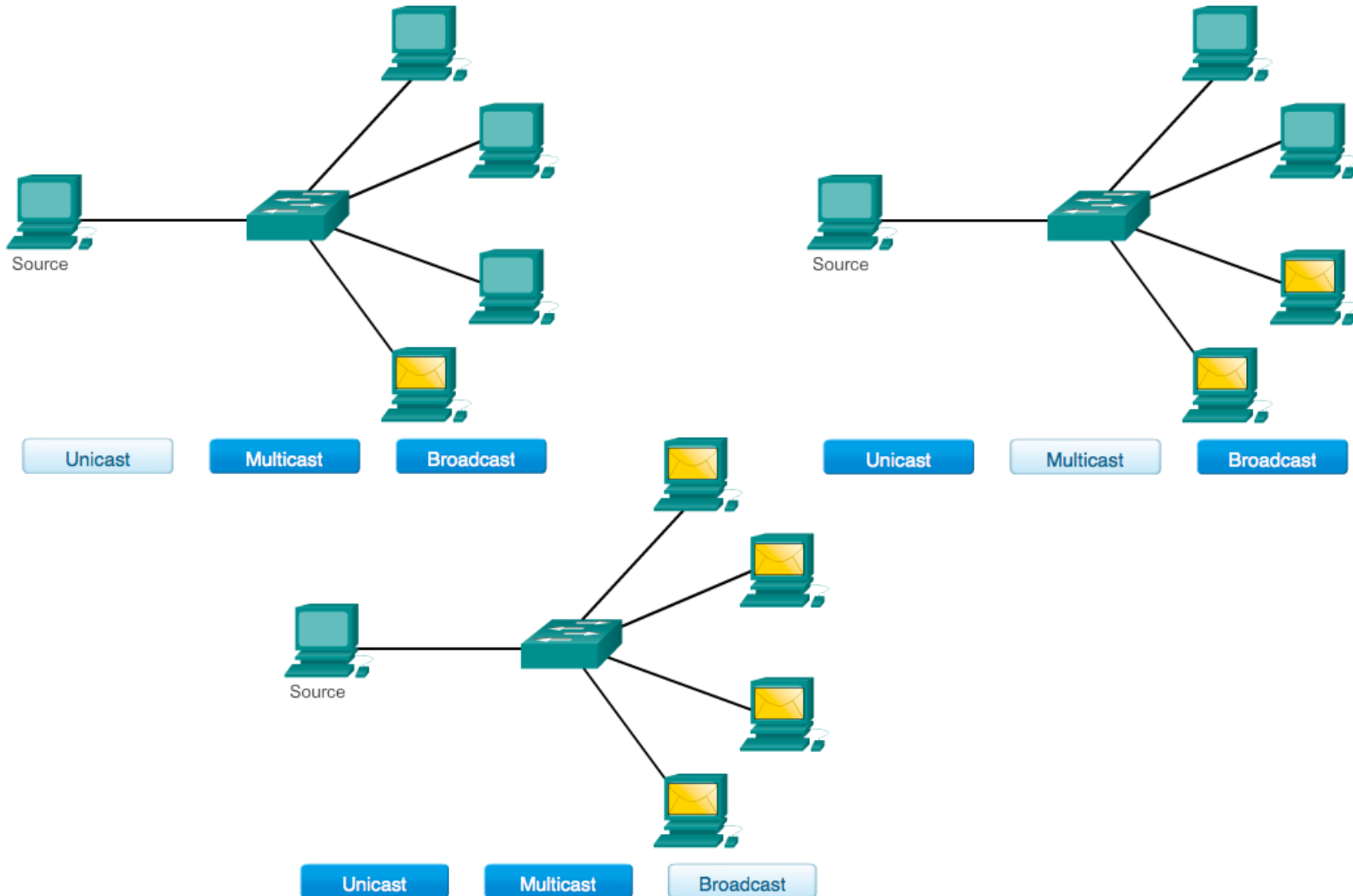
- Identifier of the recipient's location
- Identifier of the sender's location
- Salutation or greeting
- Recipient identifier
- The message content
- Source identifier
- End of message indicator





The Rules

Message Delivery Options



Protocolos de rede

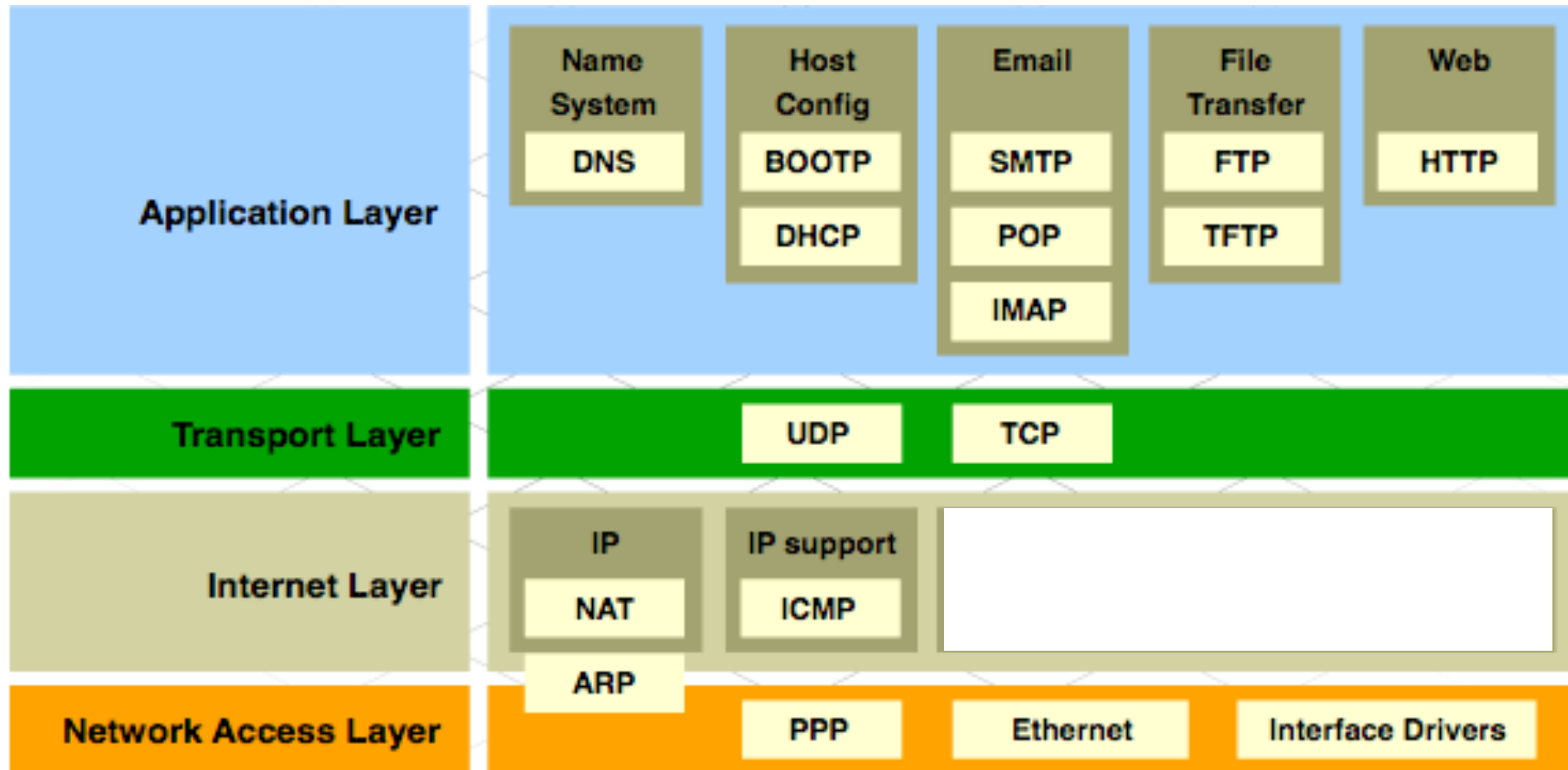
REGRAS:

- Formatação e estrutura das mensagens trocadas entre as aplicações
- Processo de partilha de informação entre dispositivos/aplicações
- Detecção e tratamento de erros nas mensagens trocadas
- Sinalização do estabelecimento e término da transferência de dados

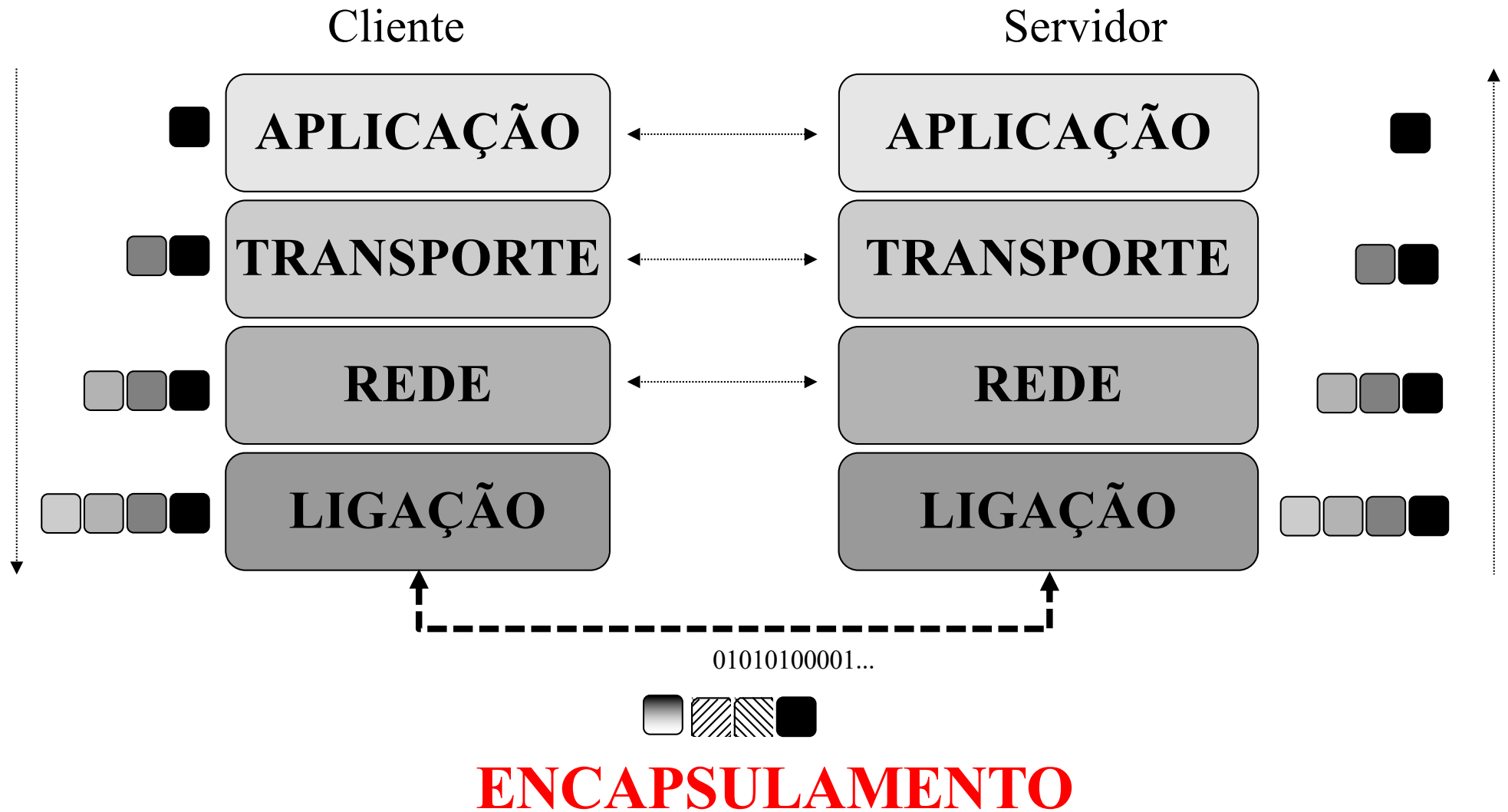


Protocol Suites

TCP/IP Protocol Suite and Communication



Modelo de comunicação TCP/IP

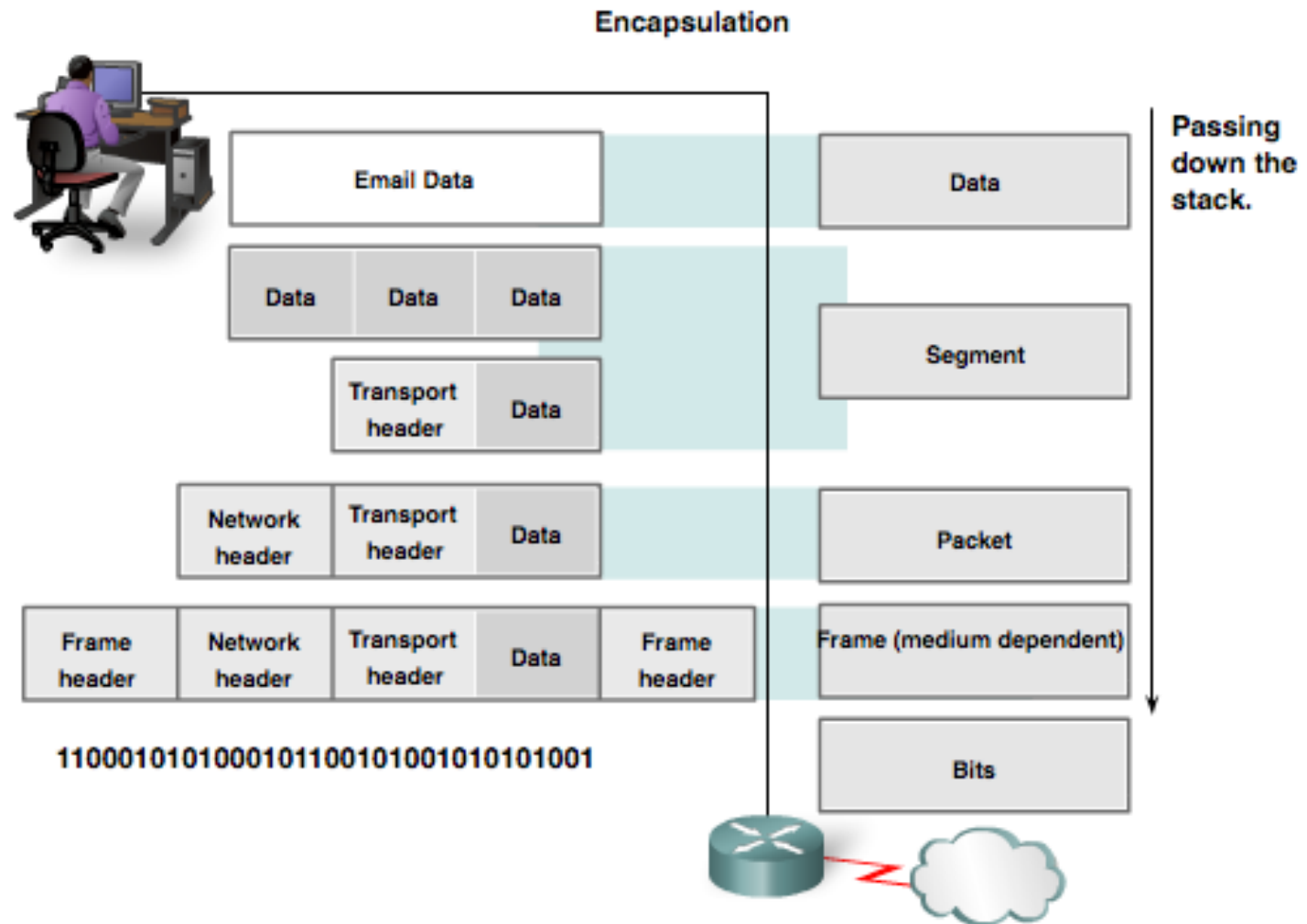




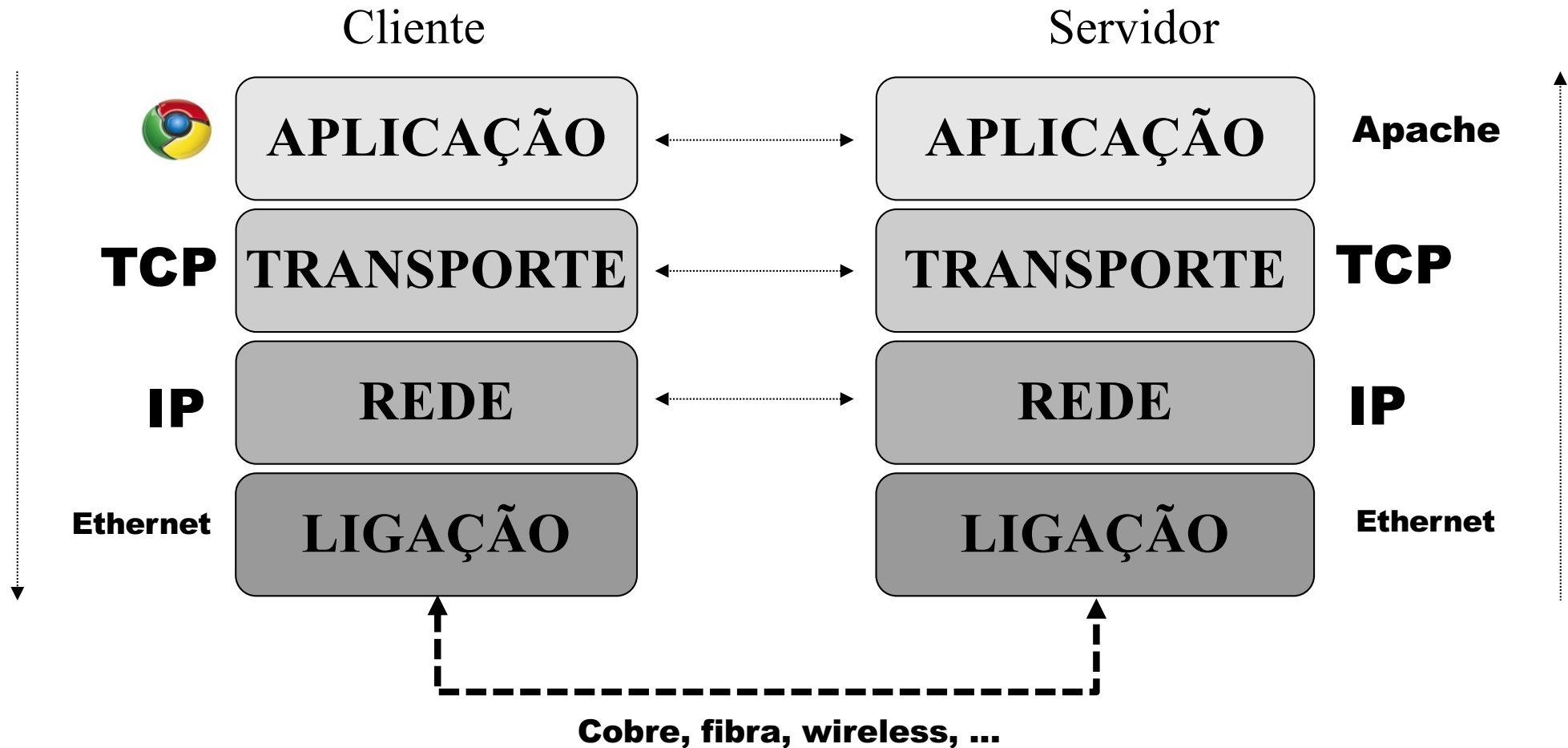
Data Encapsulation

Protocol Data Units (PDUs)

- Data
- Segment
- Packet
- Frame
- Bits



Modelo de comunicação TCP/IP



Modelo de comunicação TCP/IP

Exemplos de encapsulamentos comuns:



telnet, HTTP



NTP, DNS



ICMP

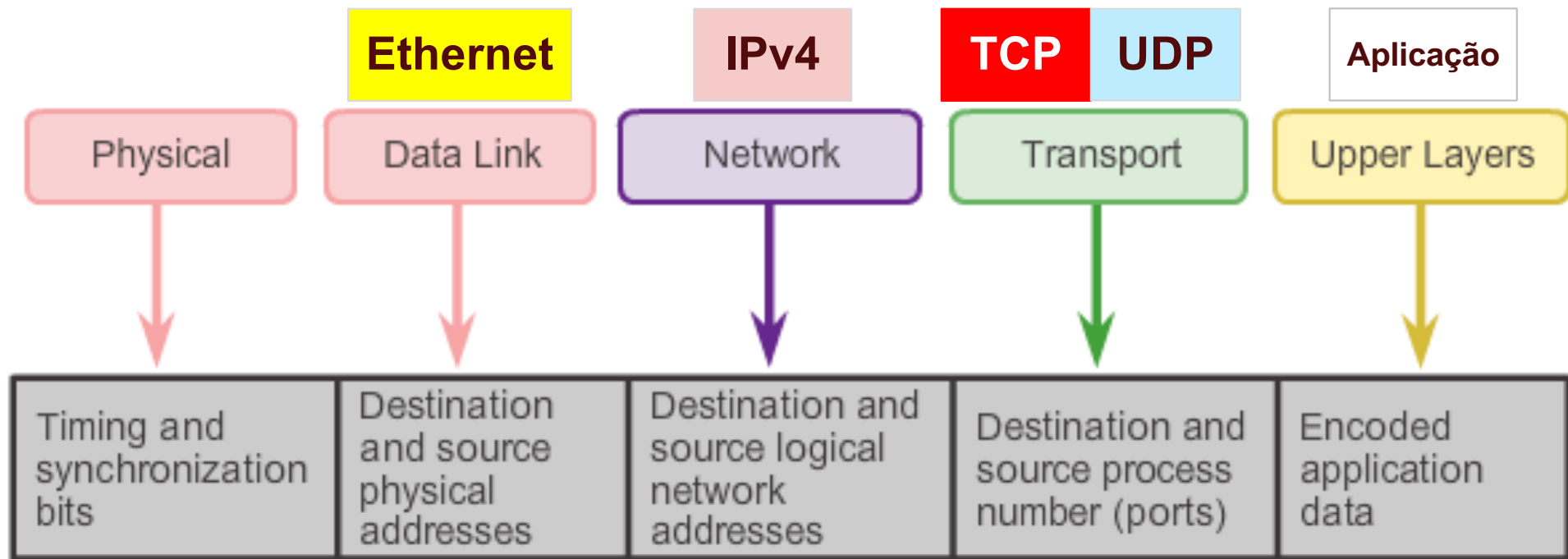


ARP



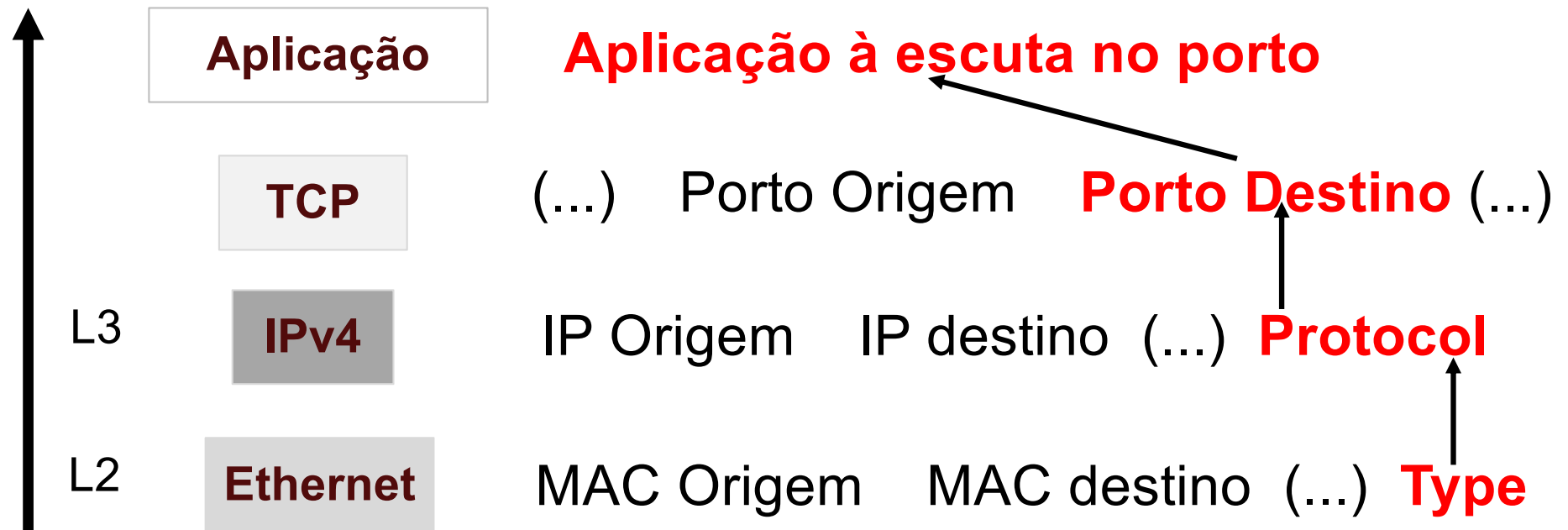


Identificação e acesso a recursos na rede



Modelo de comunicação TCP/IP

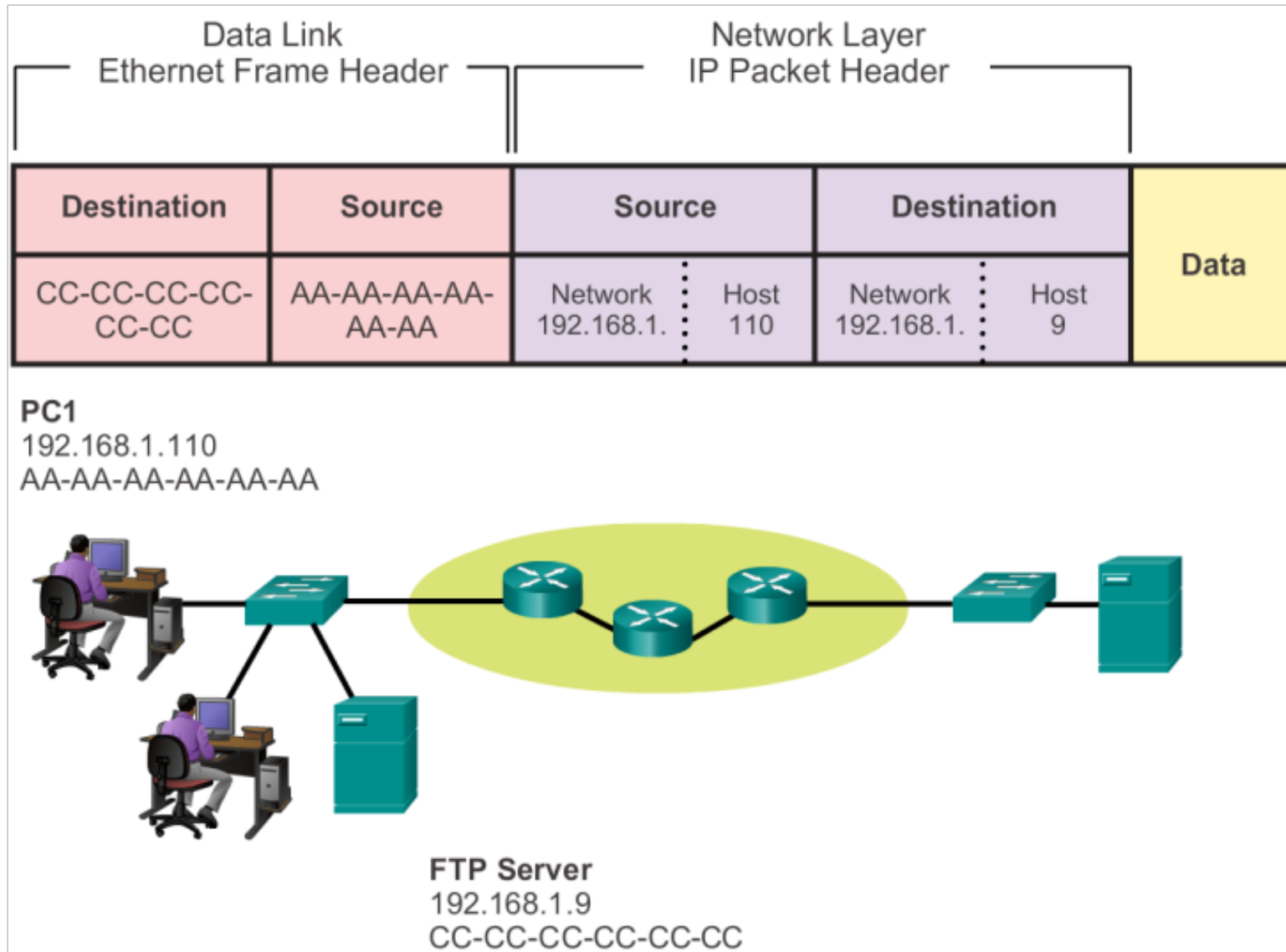
- Interligação vertical entre as camadas
- Protocolo da camada $n-1$ “liga” ao protocolo da camada n





Accessing Local Resources

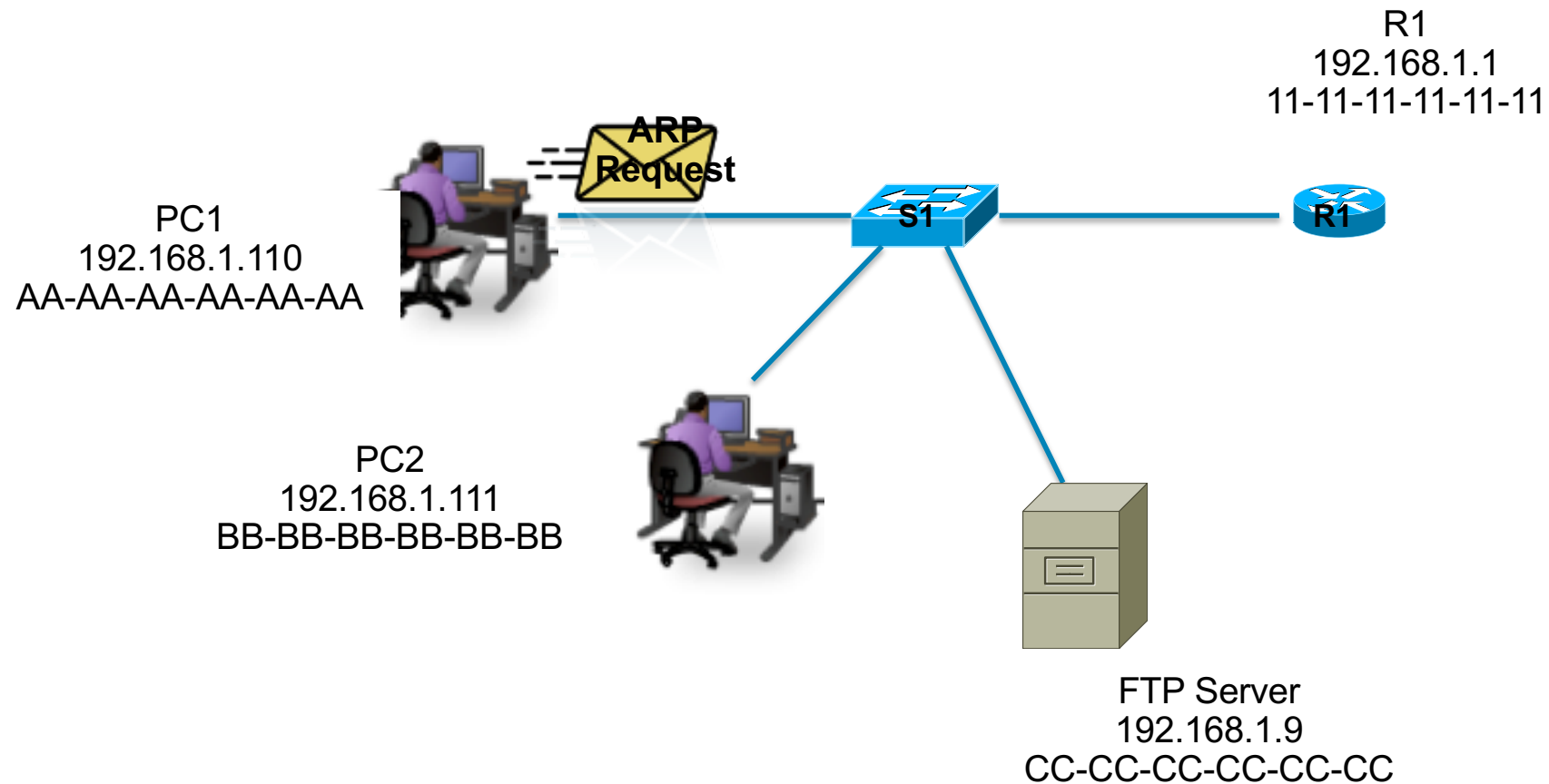
Communicating with Device / Same Network





Accessing Local Resources

MAC and IP Addresses



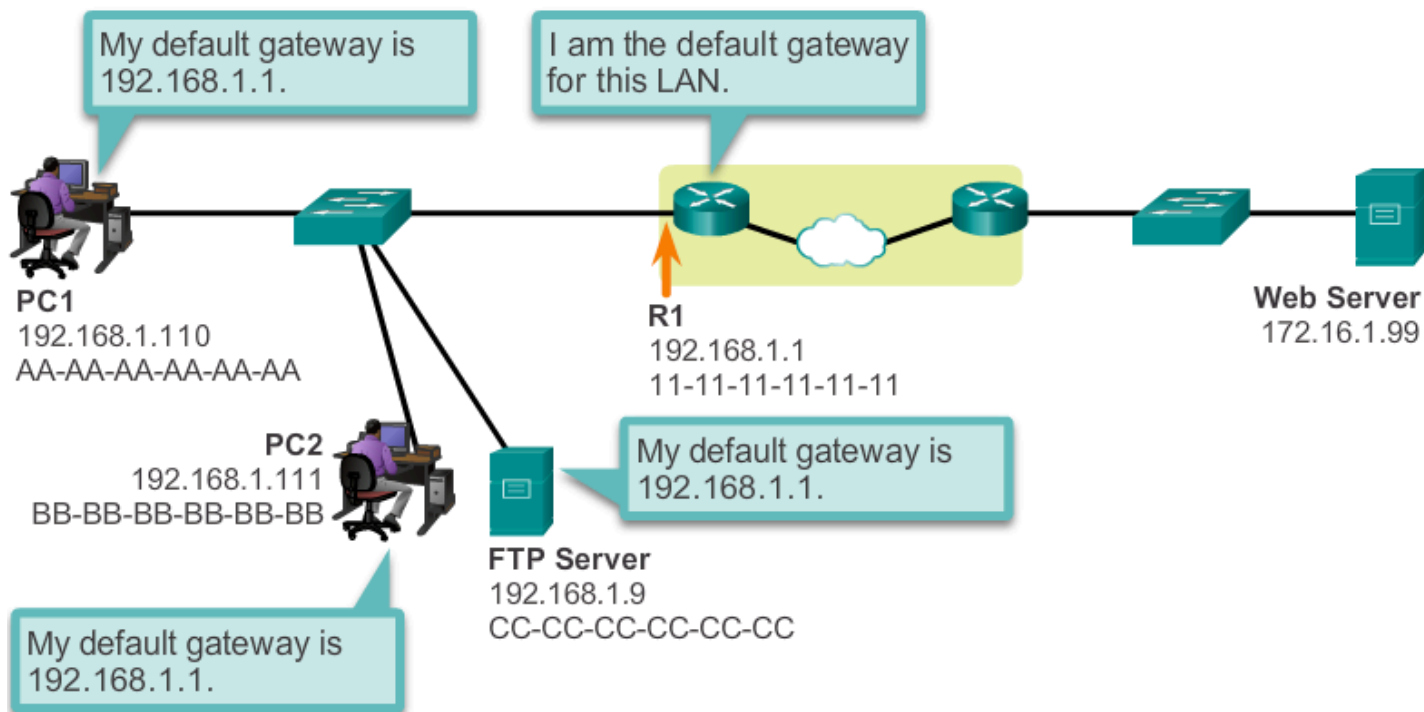


Accessing Remote Resources

Default Gateway

Getting the Pieces to the Correct Network

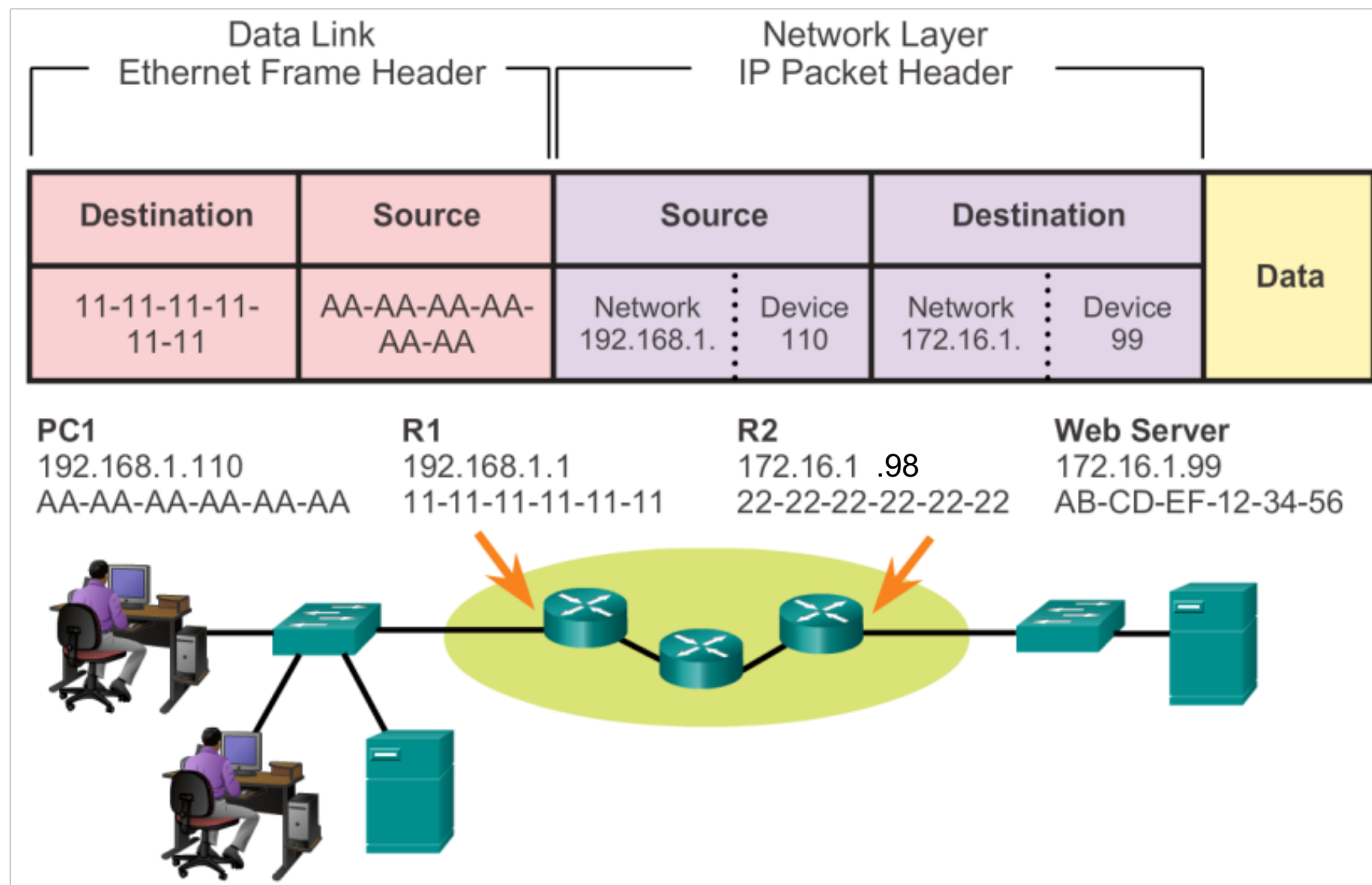
Protocol Data Unit (PDU)				
Source		Destination		Data
Network 192.168.1	Device 110	Network 172.16.1	Device 99	





Accessing Remote Resources

Communicating Device / Remote Network



Cablagem estruturada

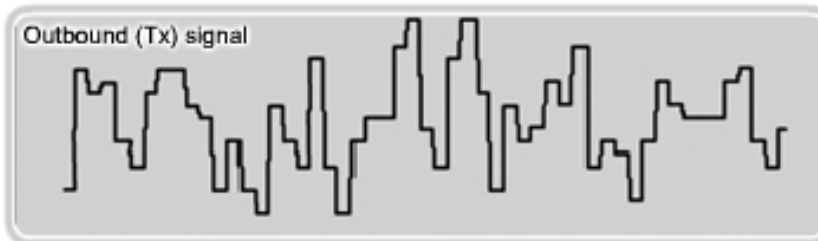
Meio físico

Topologias de rede



Purpose of the Physical Layer

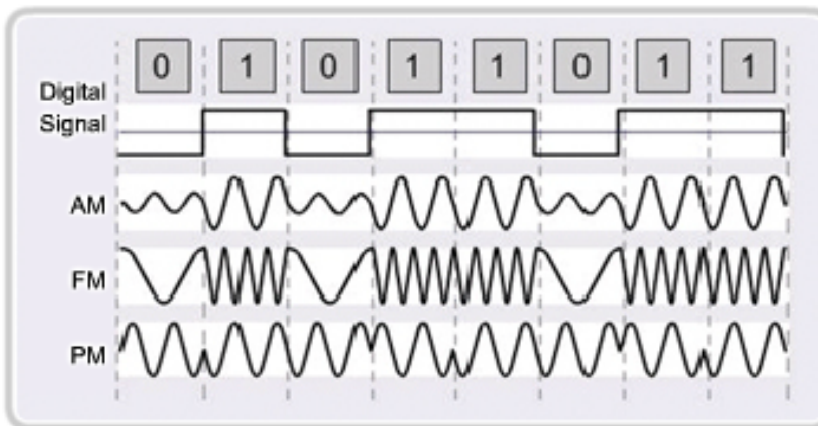
Physical Layer Media



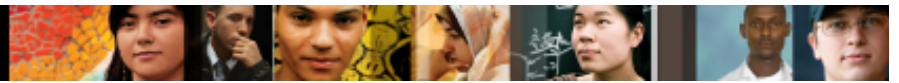
Sample electrical signals
transmitted on copper cable



Representative light pulse fiber
signals

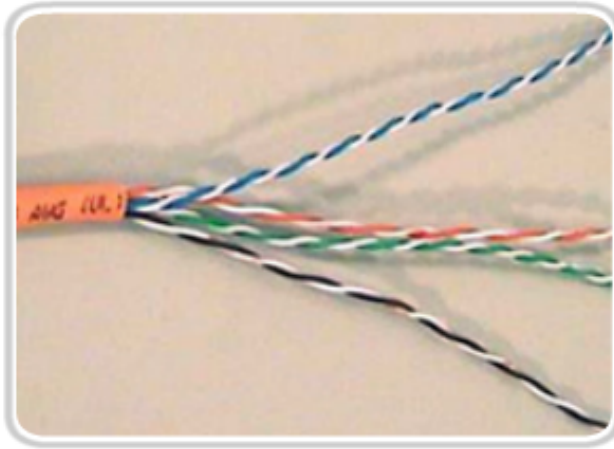


Microwave (wireless) signals

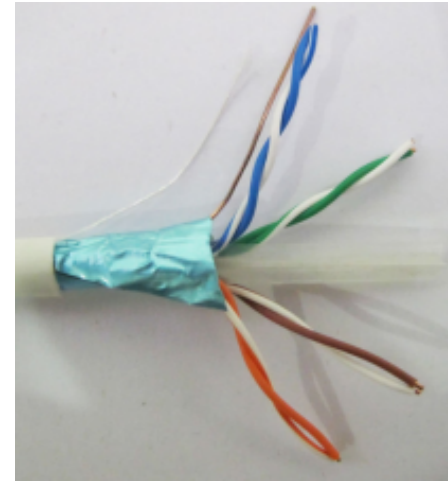


Copper Cabling

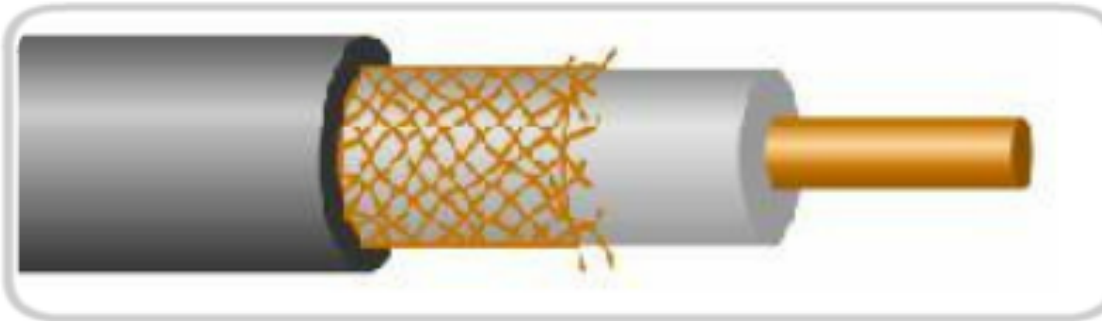
Copper Media



Unshielded Twisted Pair (UTP) cable



Shielded Twisted Pair (STP) cable

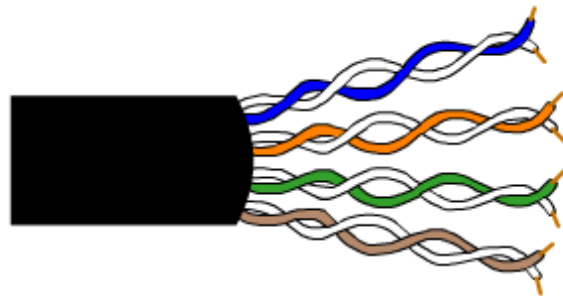


Coaxial cable

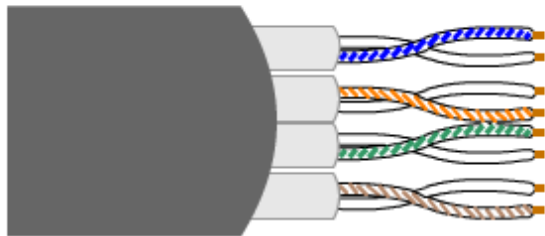


UTP Cabling

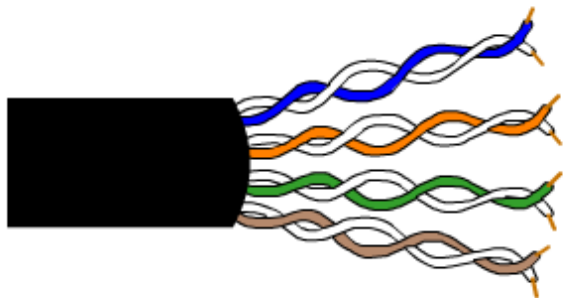
UTP Cabling Standards



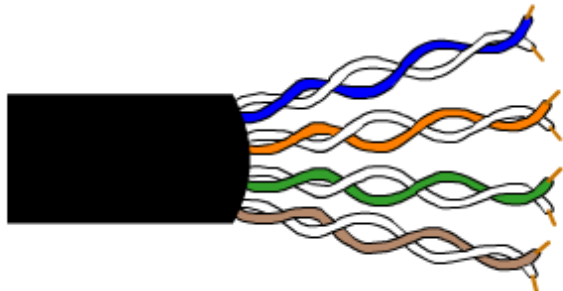
Category 3 Cable
(UTP)



Category 7 Cable
(ScTP)



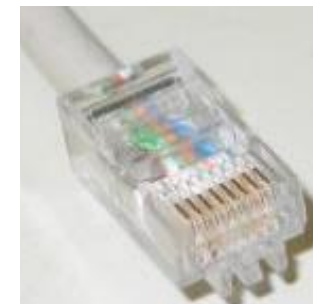
Category 6 Cable
(UTP)



Category 5 and 5e
Cable (UTP)

Category 5 and 5e Cable (UTP)

- Used for Data transmission
- Cat 5 supports 100 Mbps and can support 1000 Mbps but it is not recommended
- Cat 5e supports 1000 Mbps



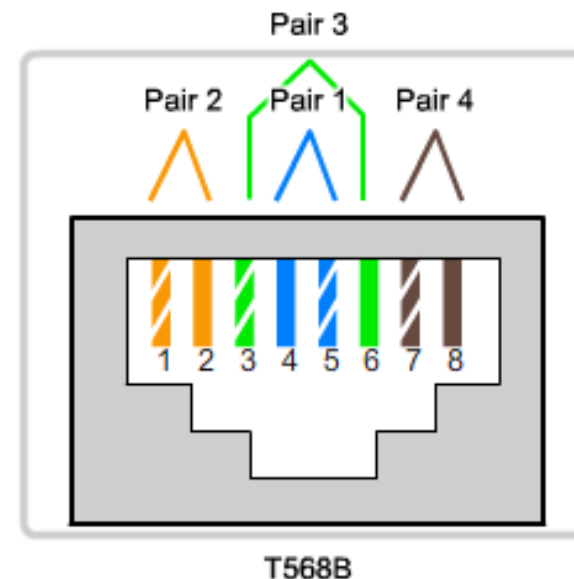
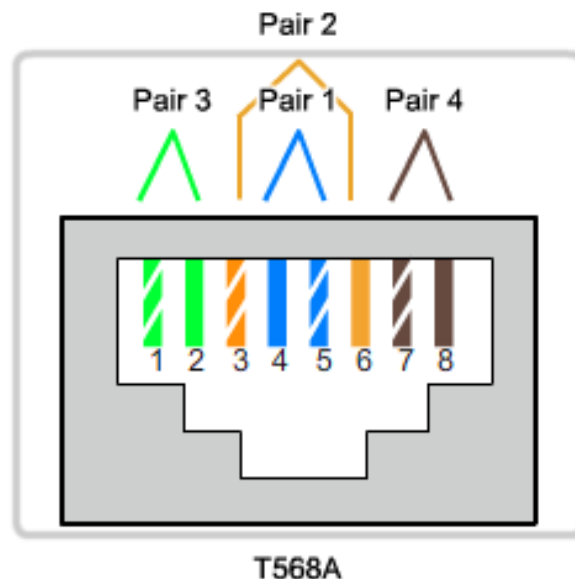
UTP Connectors



UTP Cabling

Types of UTP Cable

Cable Type	Standard	Application
Ethernet Straight-through	Both ends T568A or both ends T568B	Connecting a network host to a network device such as a switch or hub.
Ethernet Crossover	One end T568A, other end T568B	Connecting two network hosts. Connecting two network intermediary devices (switch to switch, or router to router).
Rollover	Cisco proprietary	Connect a workstation serial port to a router console port, using an adapter.





UTP Cabling

Testing UTP Cables

ISO/IEC 11801



International
Organization for
Standardization



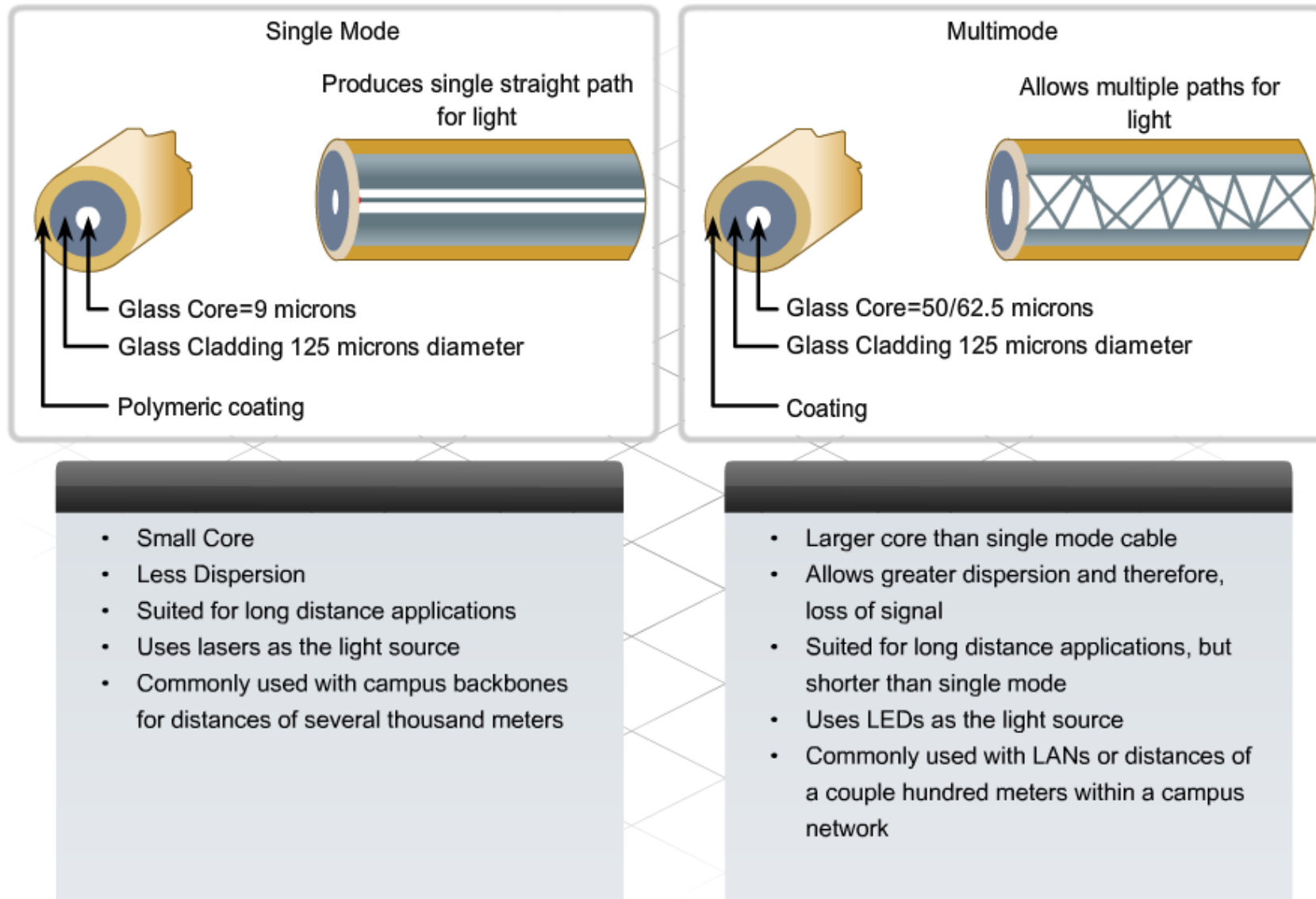
INTERNATIONAL
ELECTROTECHNICAL
COMMISSION





Fiber Optic Cabling

Types of Fiber Media





Fiber Optic Cabling

Network Fiber Connectors



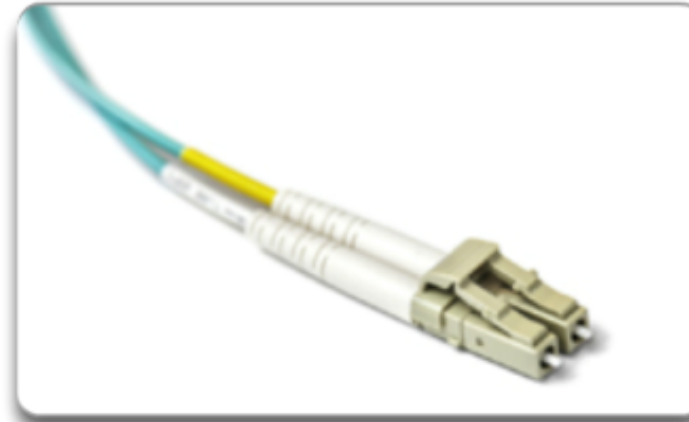
ST Connectors



SC Connectors



LC Connector



Duplex Multimode LC Connectors



Fiber Optic Cabling

Testing Fiber Cables






Optical Time Domain Reflectometer (OTDR)



Wireless Media

Types of Wireless Media

	<ul style="list-style-type: none"> • IEEE 802.11 standards • Commonly referred to as Wi-Fi. • Uses CSMA/CA • Variations include: <ul style="list-style-type: none"> • 802.11a: 54 Mbps, 5 GHz • 802.11b: 11 Mbps, 2.4 GHz • 802.11g: 54 Mbps, 2.4 GHz • 802.11n: 600 Mbps, 2.4 and 5 GHz • 802.11ac: 1 Gbps, 5 GHz • 802.11ad: 7 Gbps, 2.4 GHz, 5 GHz, and 60 GHz
	<ul style="list-style-type: none"> • IEEE 802.15 standard • Supports speeds up to 3 Mbps • Provides device pairing over distances from 1 to 100 meters.
	<ul style="list-style-type: none"> • IEEE 802.16 standard • Provides speeds up to 1 Gbps • Uses a point-to-multipoint topology to provide wireless broadband access.



Wireless Media

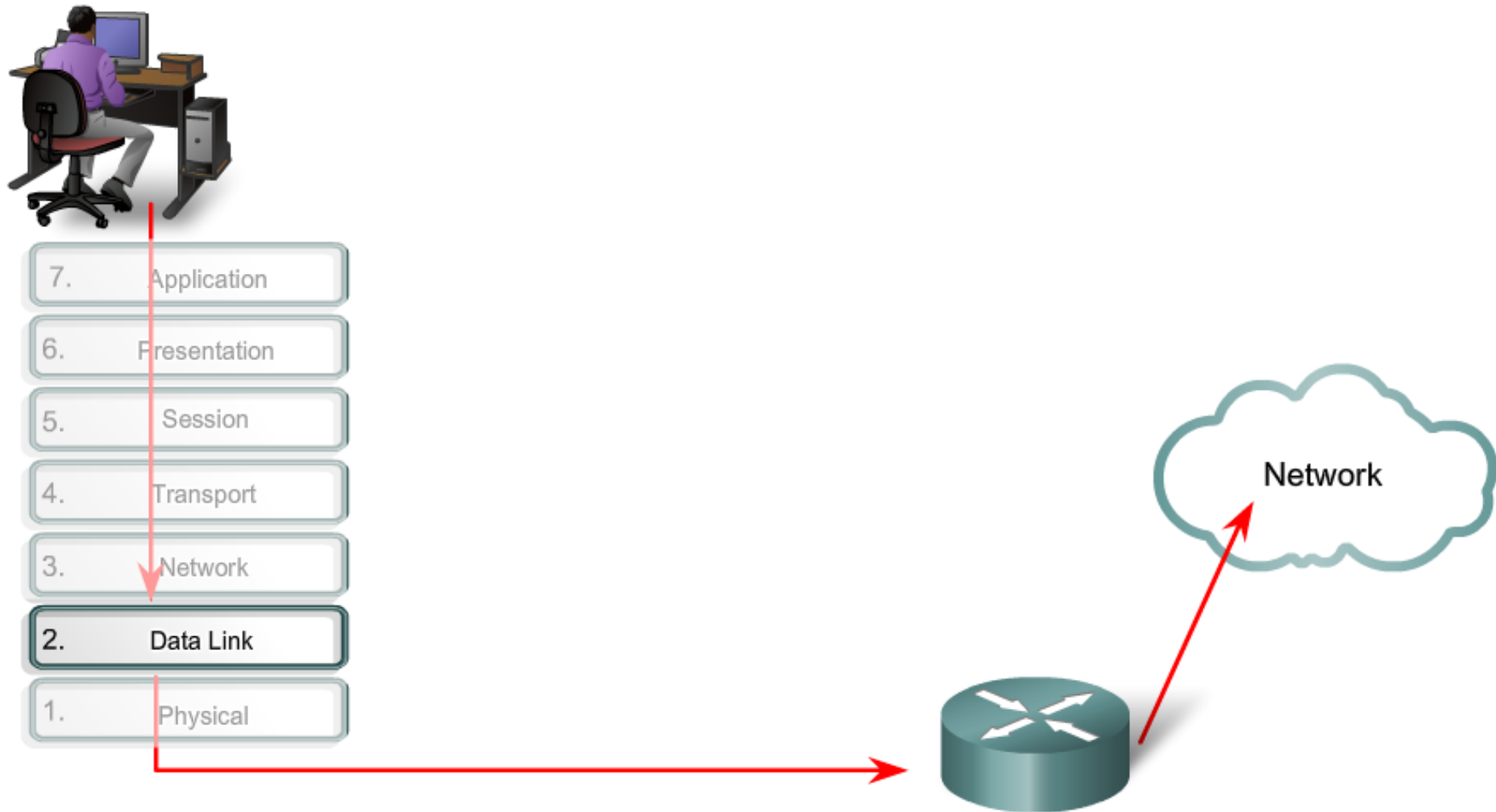
802.11 Wi-Fi Standards

Standard	Maximum Speed	Frequency	Backwards compatible
802.11a	54 Mbps	5 GHz	No
802.11b	11 Mbps	2.4 GHz	No
802.11g	54 Mbps	2.4 GHz	802.11b
802.11n	600 Mbps	2.4 GHz or 5 GHz	802.11b/g
802.11ac	1.3 Gbps (1300 Mbps)	2.4 GHz and 5.5 GHz	802.11b/g/n
802.11ad	7 Gbps (7000 Mbps)	2.4 GHz, 5 GHz and 60 GHz	802.11b/g/n/ac



Purpose of the Data Link Layer

The Data Link Layer



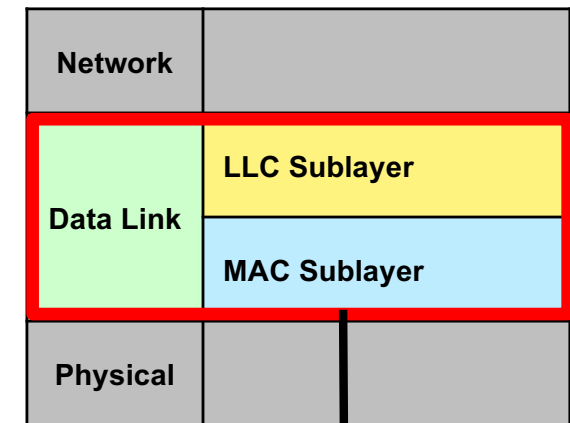
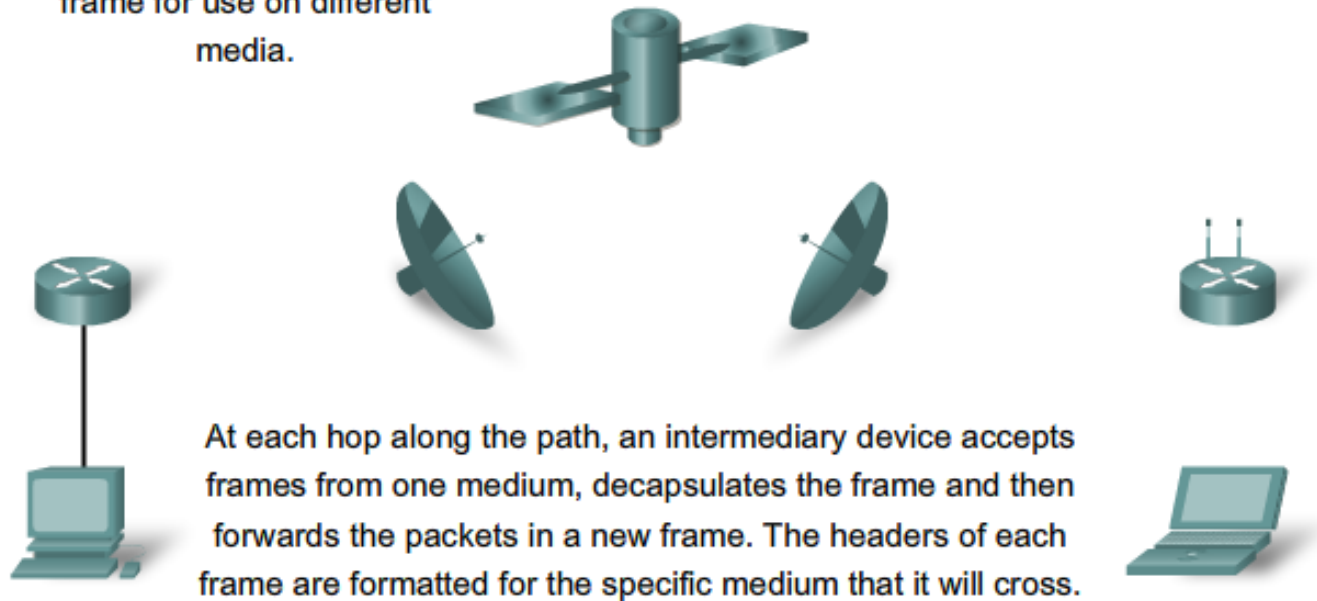


Purpose of the Data Link Layer

Media Access Control

Data link layer protocols govern how to format a frame for use on different media.

Different protocols may be in use for different media.

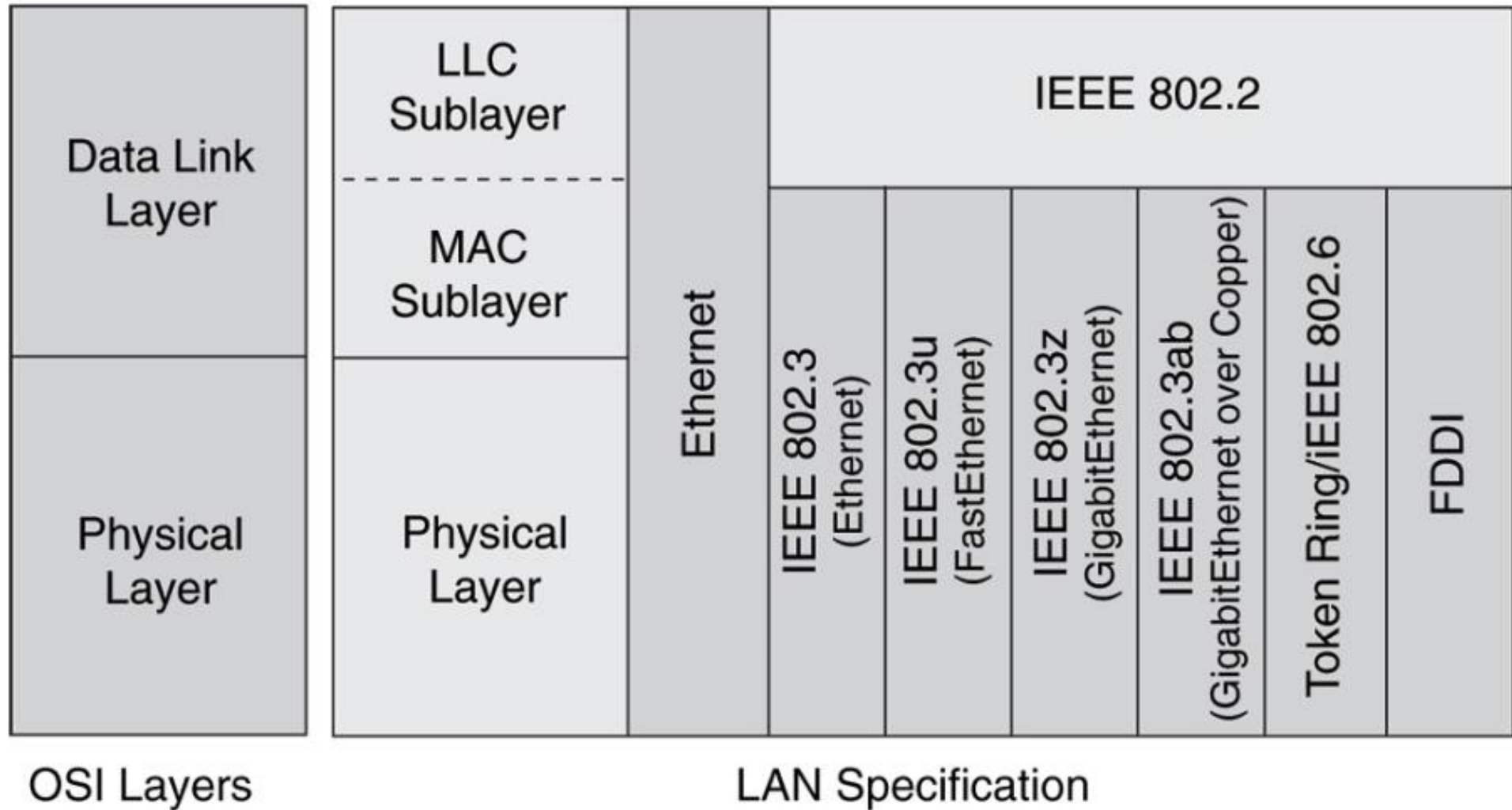


↓
MAC address



Data Link Layer

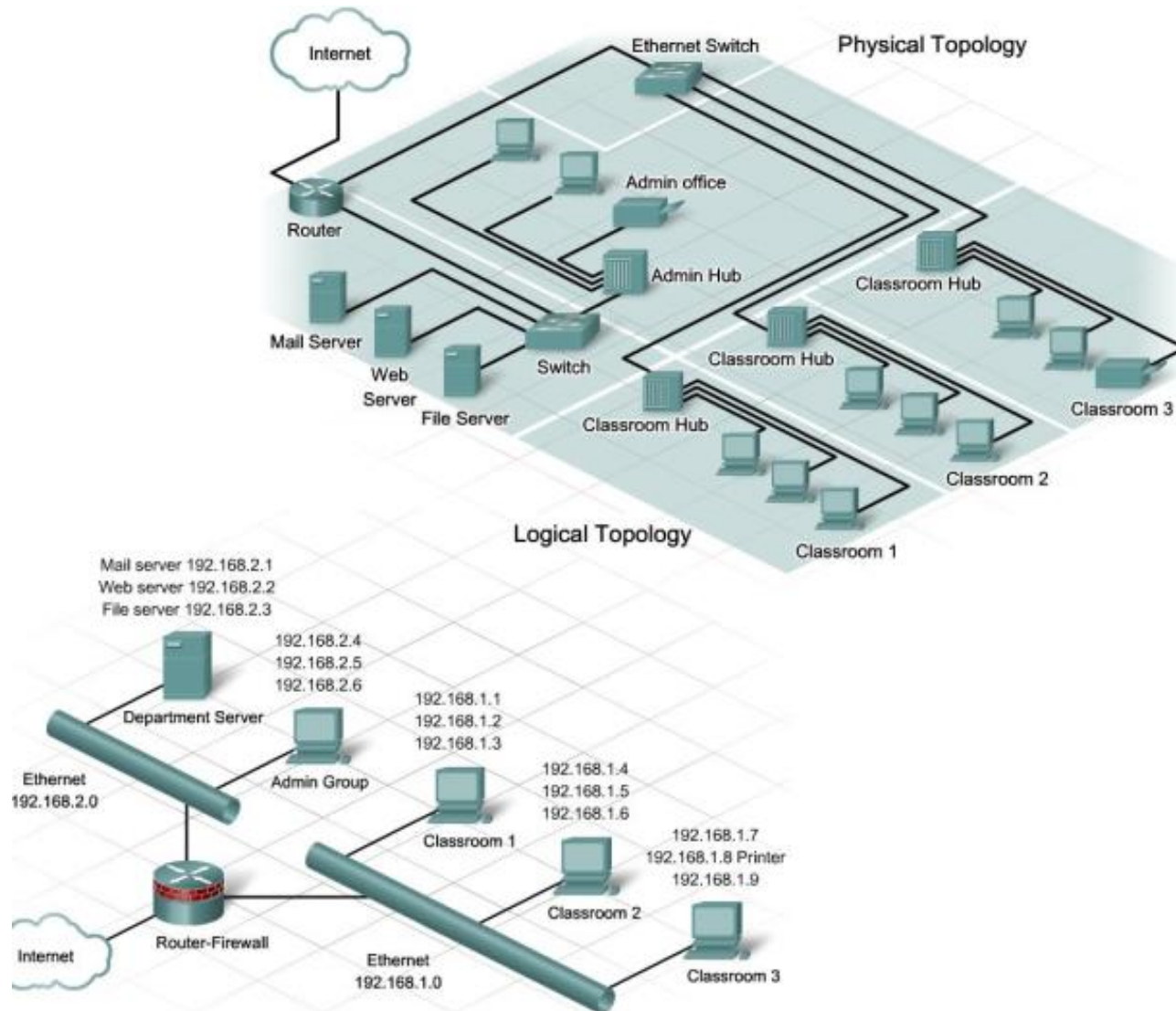
Layer 2 Standards





Topologies

Physical and Logical Topologies





LAN Topologies

Physical LAN Topologies

Physical Topologies



Star topology



Extended star topology



Bus topology

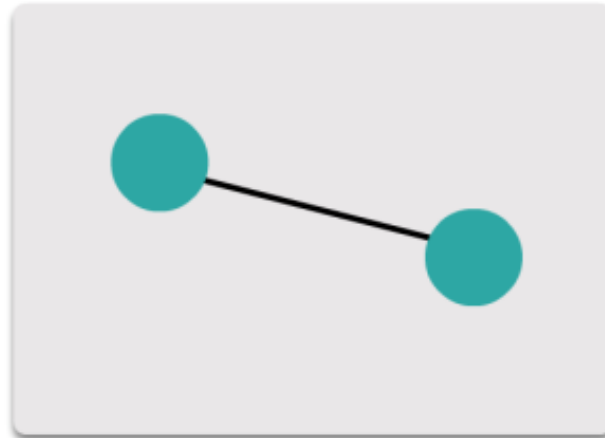


Ring topology

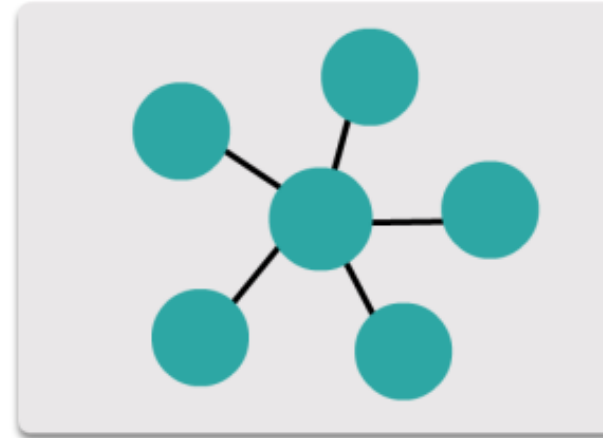


WAN Topologies

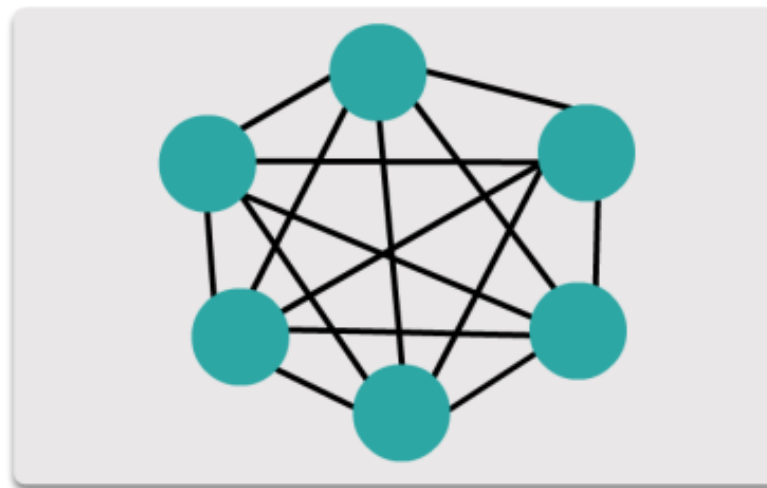
Common Physical WAN Topologies



Point-to-point topology



Hub and spoke topology



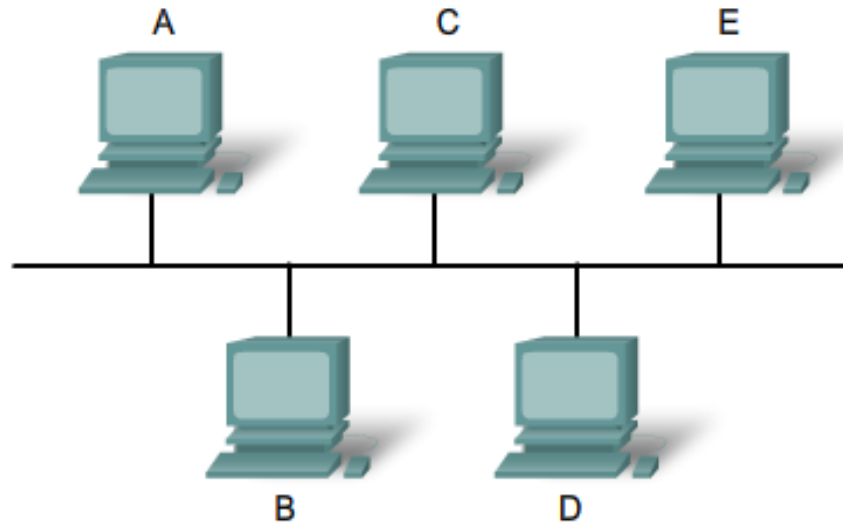
Full mesh topology



LAN Topologies

Multi-Access versus Ring Topologies

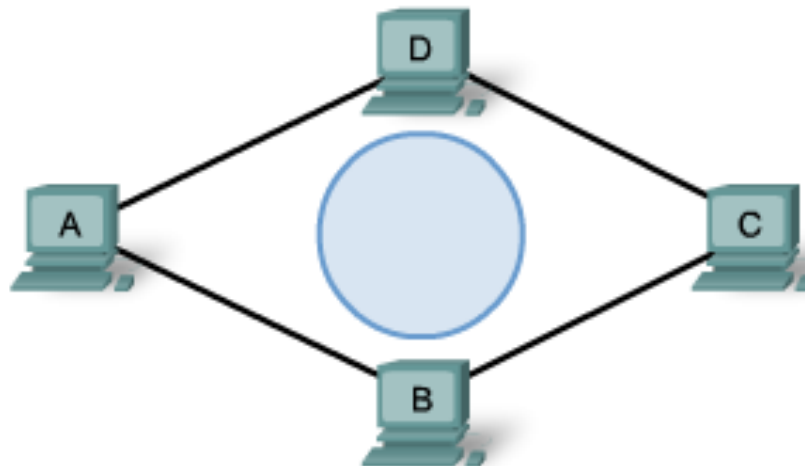
Multi-access



CSMA/CD

CSMA/CA

Ring



Token-Ring

FDDI

ESTUDO AUTÓNOMO

Leituras obrigatórias

CCNA Routing & Switching – Módulo 1

“Chapter 3: Network Protocols and Communications”

“Chapter 4: Network Access”