



# UNIVERSITY OF CAGLIARI

DIEE - Department of Electrical and Electronic Engineering

## Infrastrutture ed Applicazioni Avanzate nell'Internet

Background



# Preliminary questions

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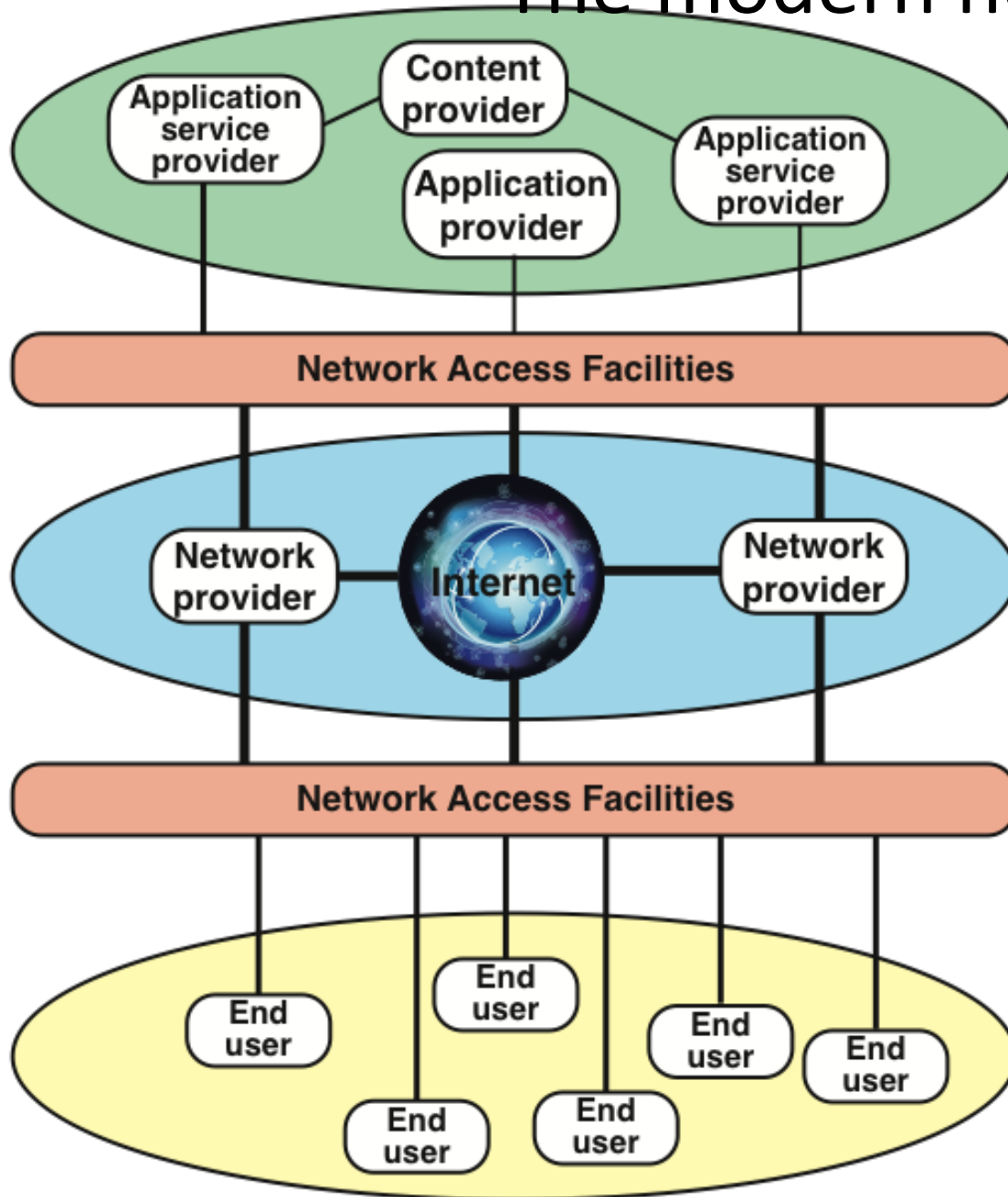
- What is the role of a router?
- Do you know the difference between OTTs (Over The Top service providers) and ISPs (Internet Service Providers)?
- What is the most important protocol in the Internet?
- Which are the major characteristics of the current Internet?

# Preliminary questions

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- What are the major issues of the current Internet?
  - 1 ...
  - 2 ...

# The modern network ecosystem



OTT – Over the top service providers

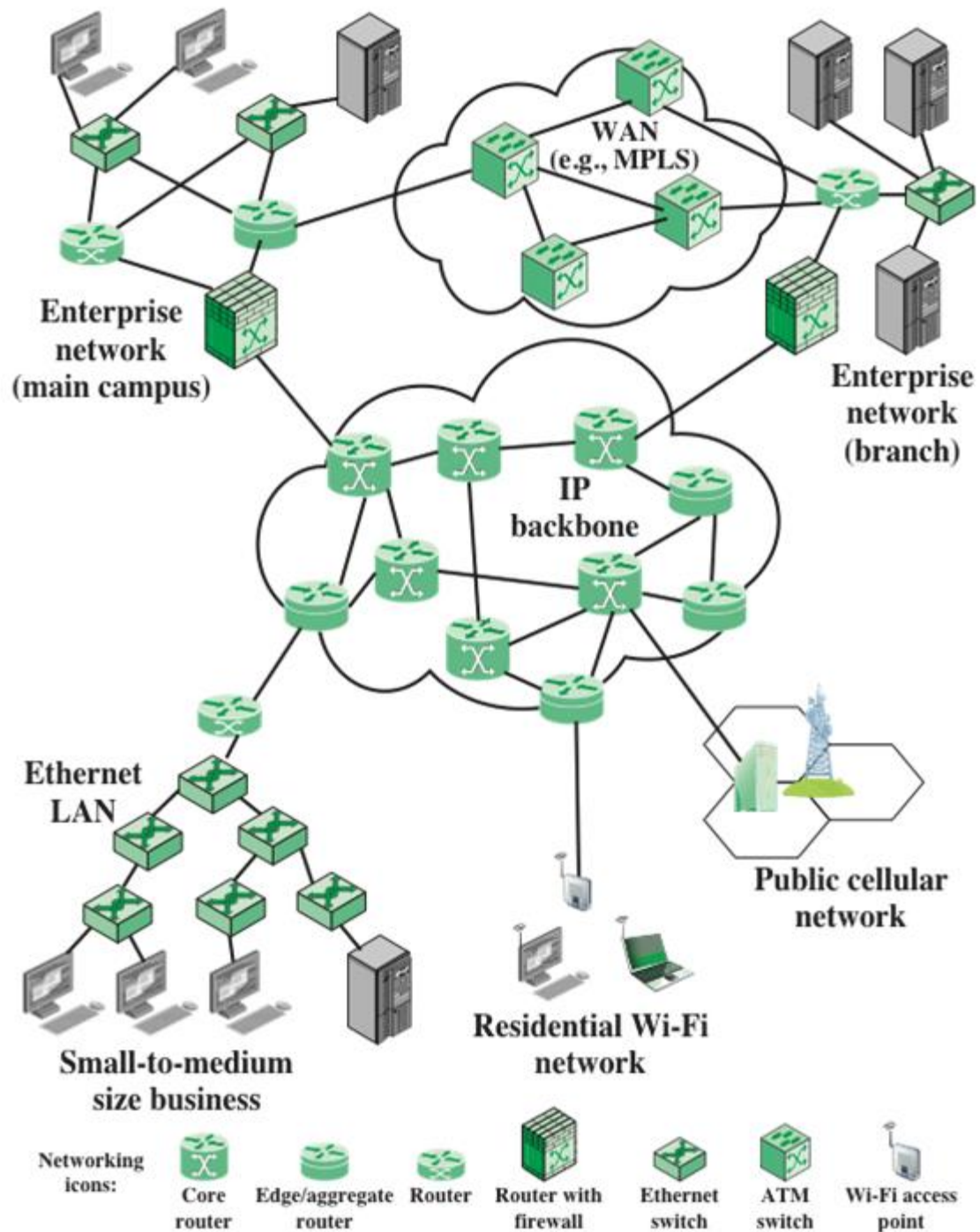
ISP – Internet service providers

New trends:  
- data center networking (80% of traffic is internal)  
- IoT and fog networking

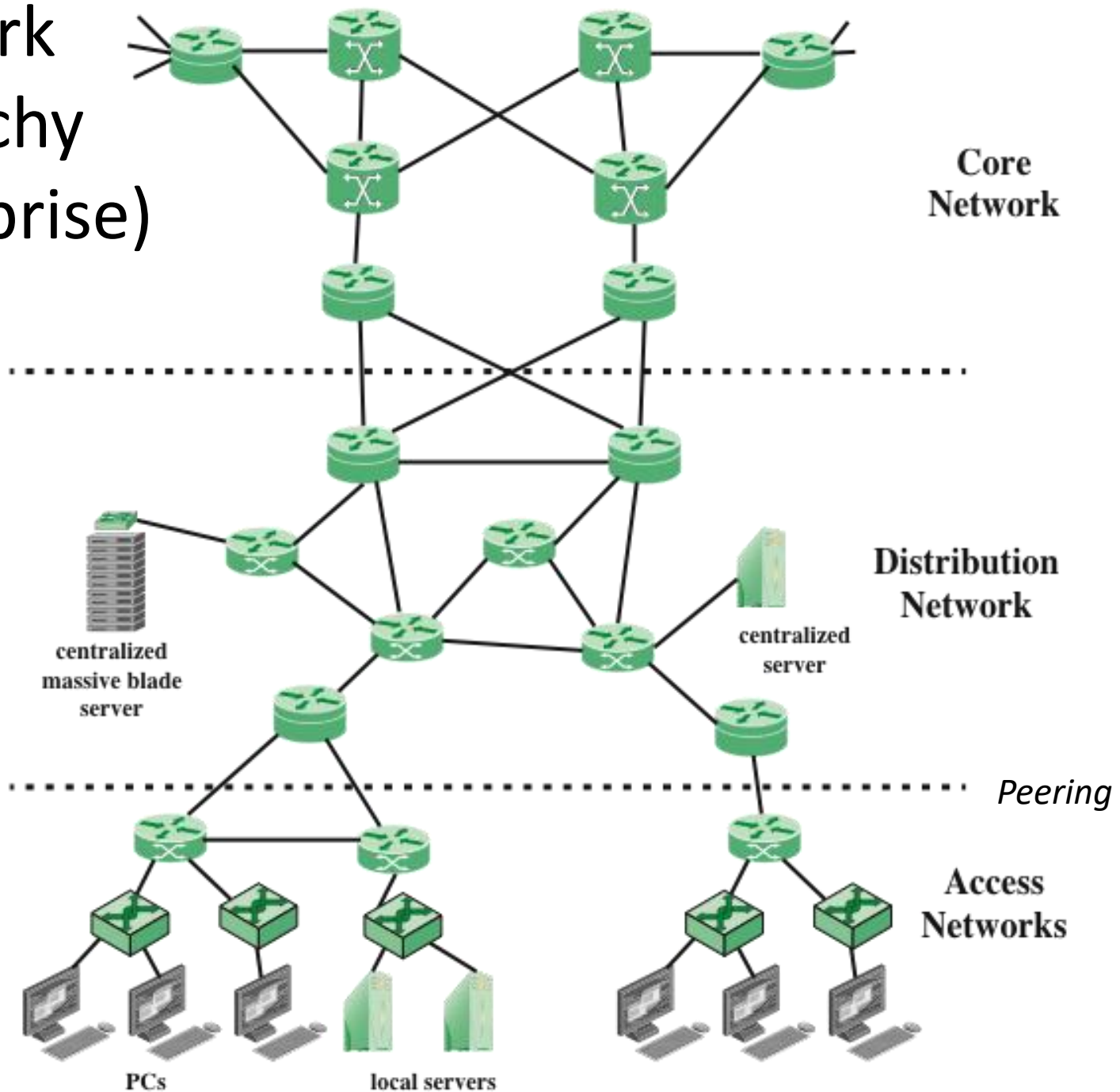
# A global architecture

Access links:  
200-400 Gbps

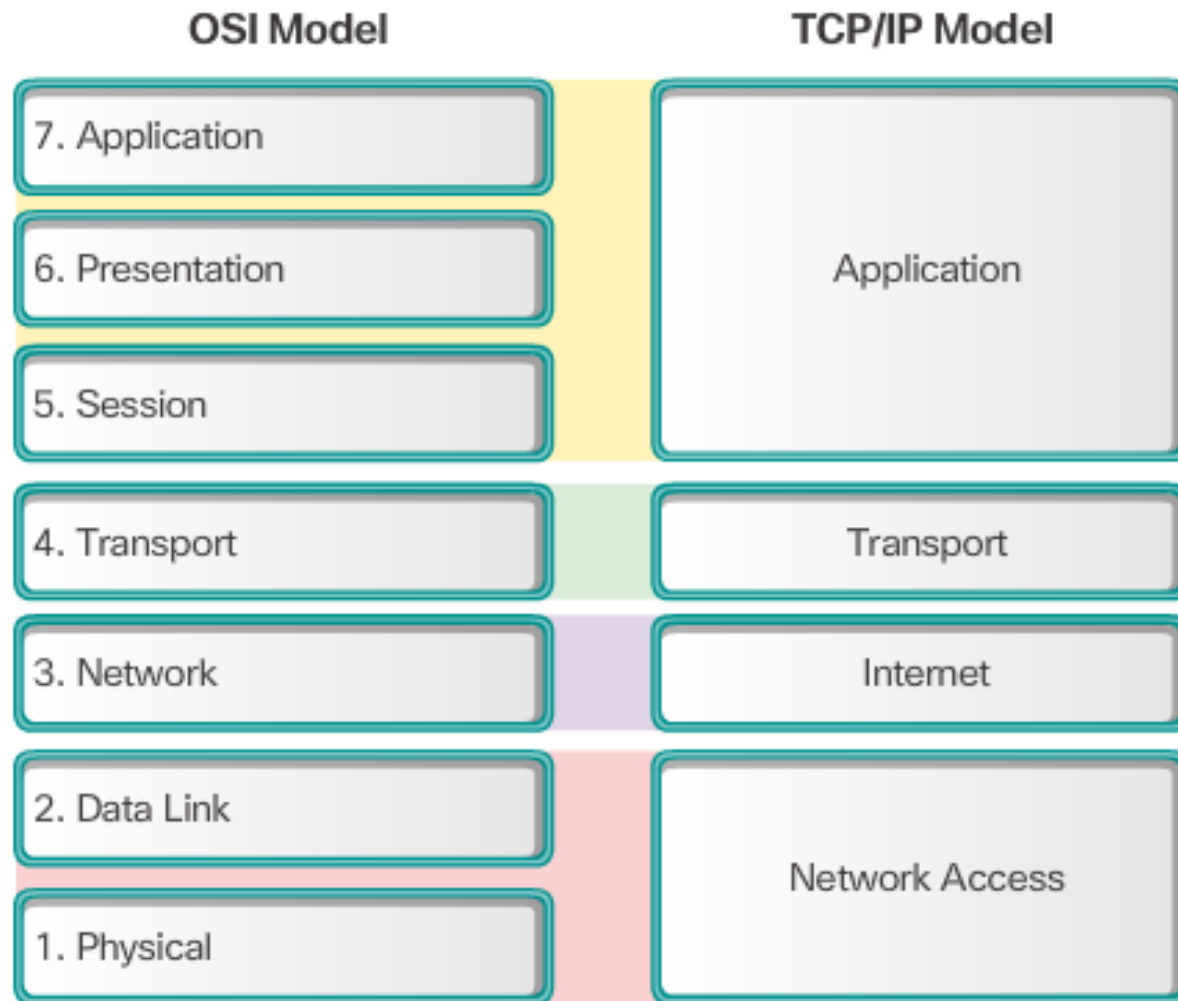
Backbone links:  
400-1000 Gbps



# Network Hierarchy (enterprise)

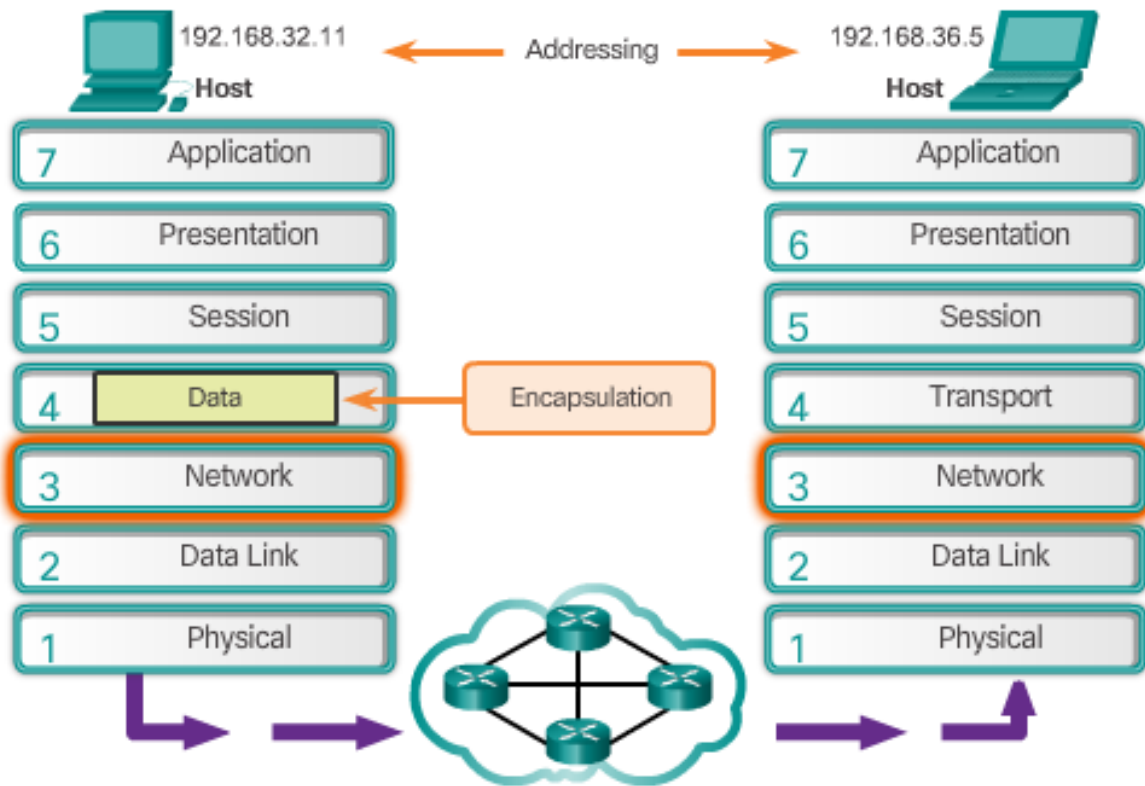


# The layered architecture is still valid



# The network layer is still central

The Exchange of Data



Network layer protocols forward transport layer PDUs between hosts.

Network layer End to End Transport processes

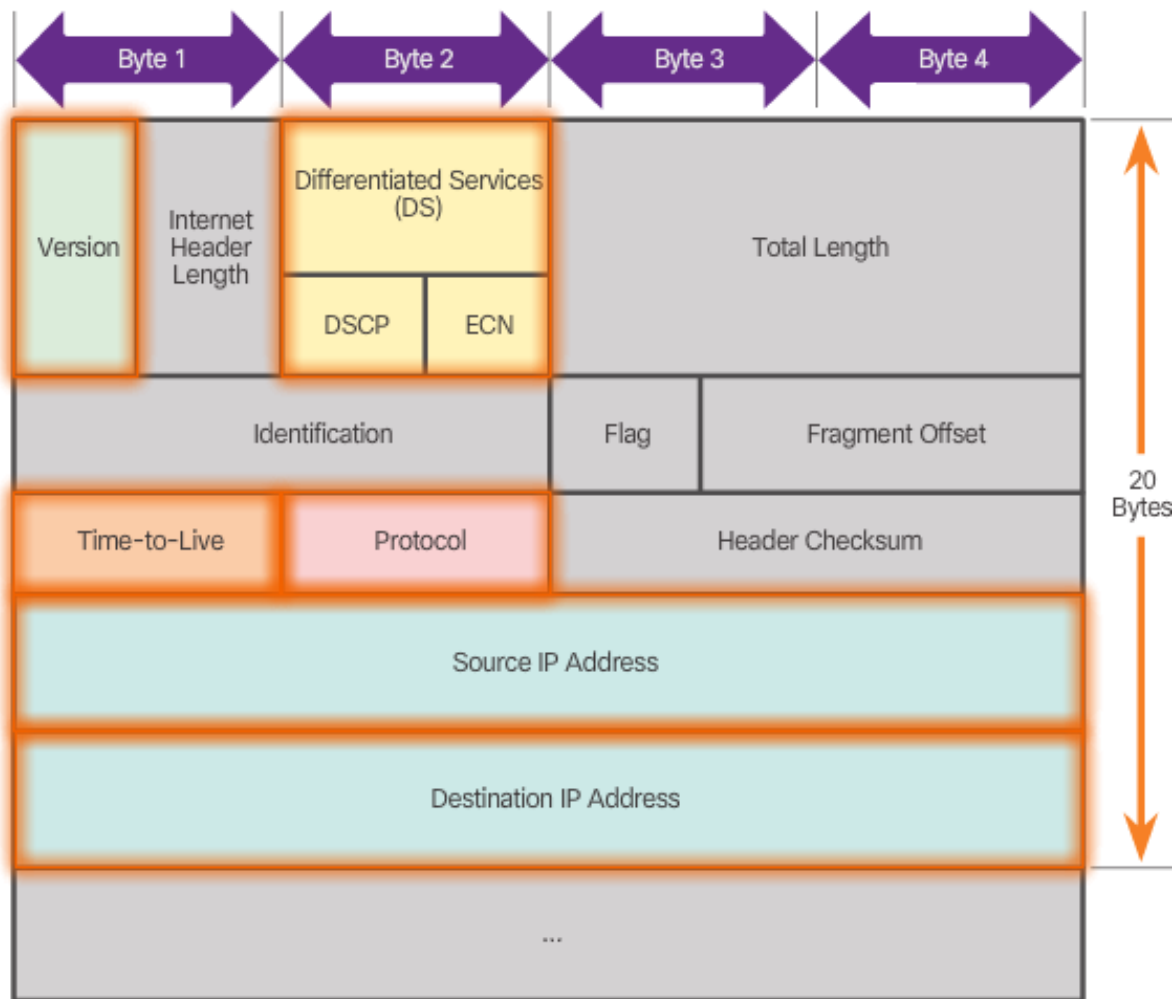
- Addressing end devices
- Encapsulation
- Routing
- De-encapsulating

# The major IP protocol features

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# You need to remember the major IP fields

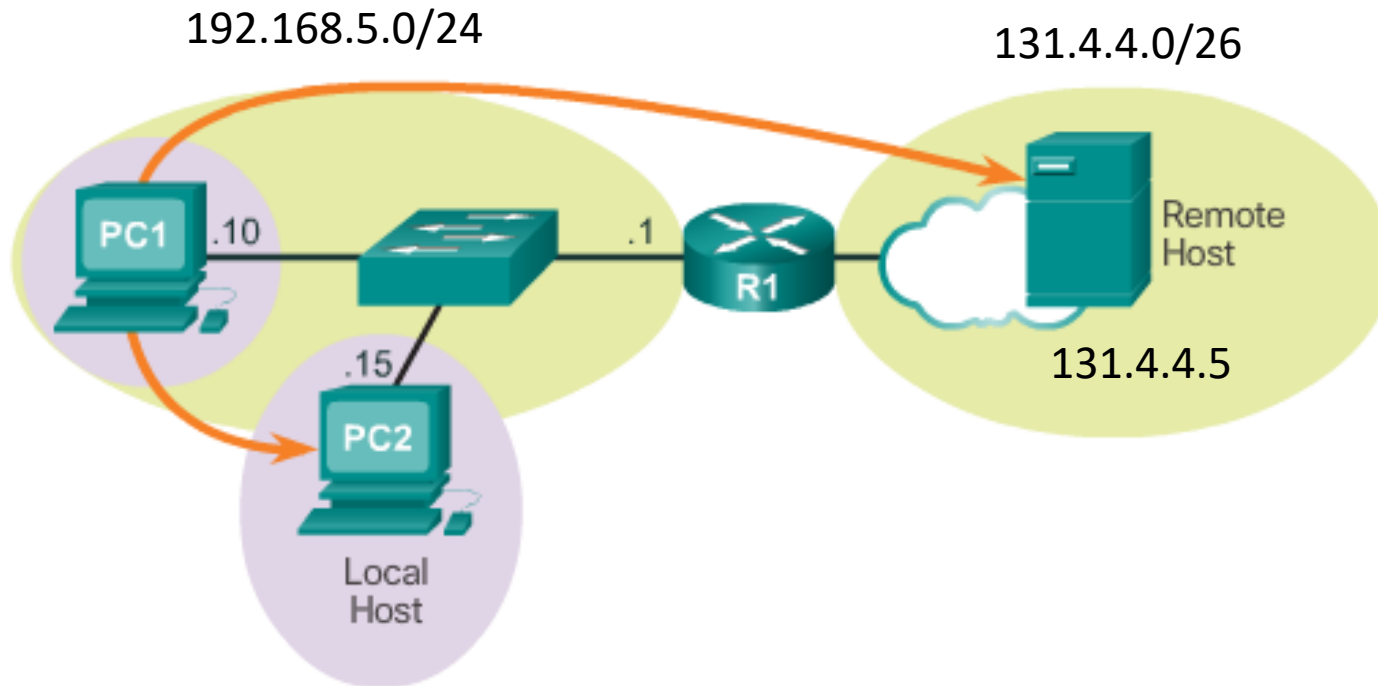


- Version = 0100
- DS = Packet Priority
- TTL = Limits life of Packet
- Protocol = Upper layer protocol such as TCP
- Source IP Address = source of packet
- Destination IP Address = destination of packet

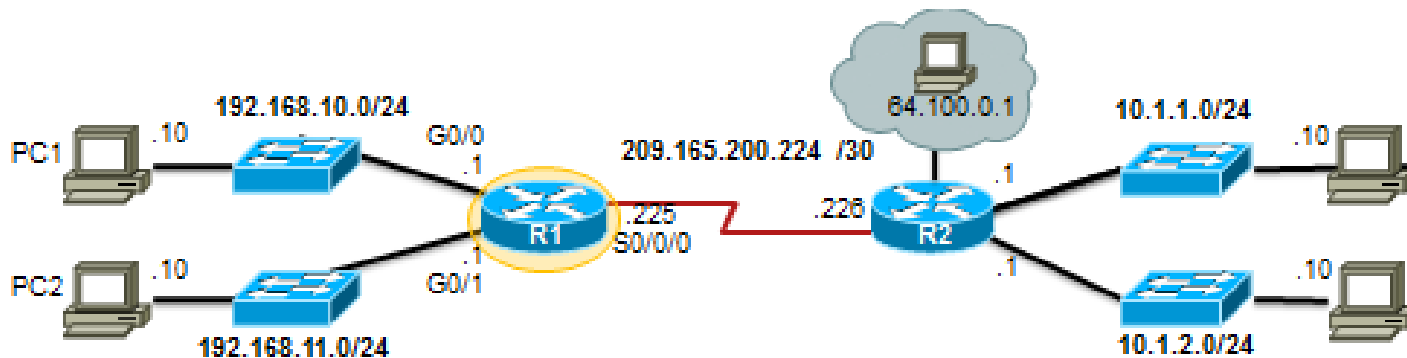
# How each network packet is treated at the source

## Three Types of Destinations

- Itself
- Local Host
- Remote Host



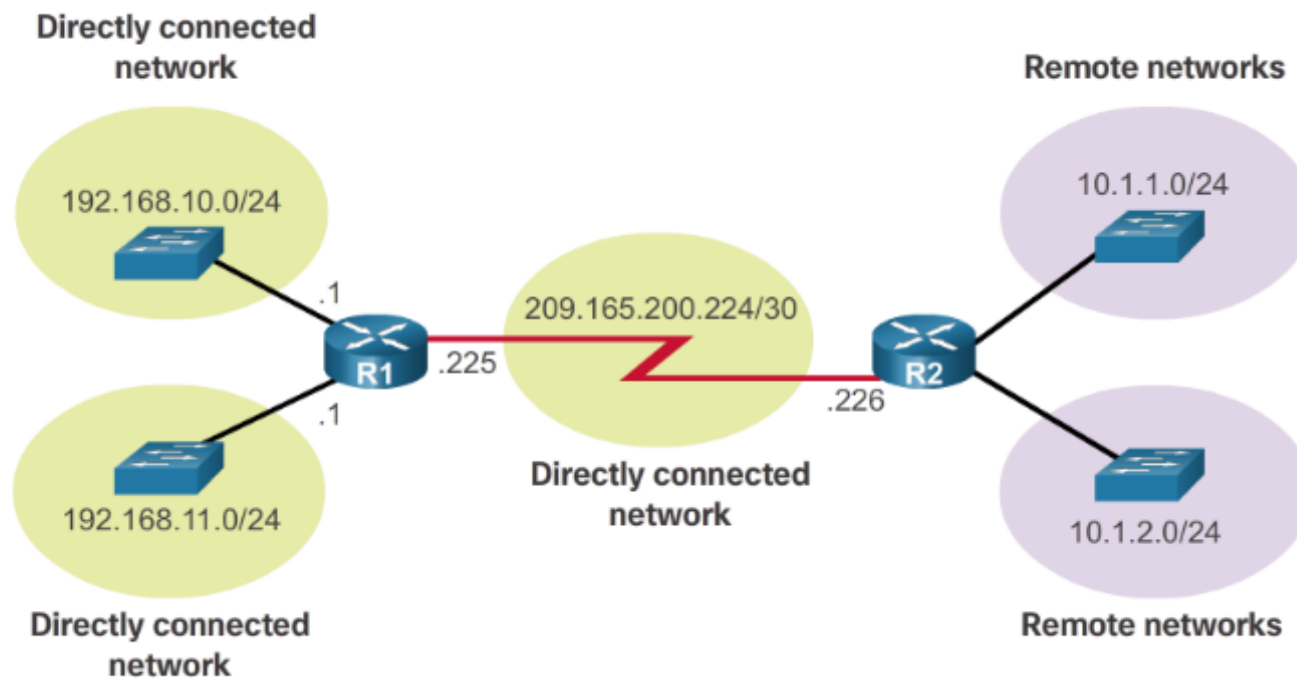
# How each packet is treated by the router: the routing table



<b>D</b>	10.1.1.0/24	[90/2170112]	via 209.165.200.226,	00:00:05,	Serial10/0/0
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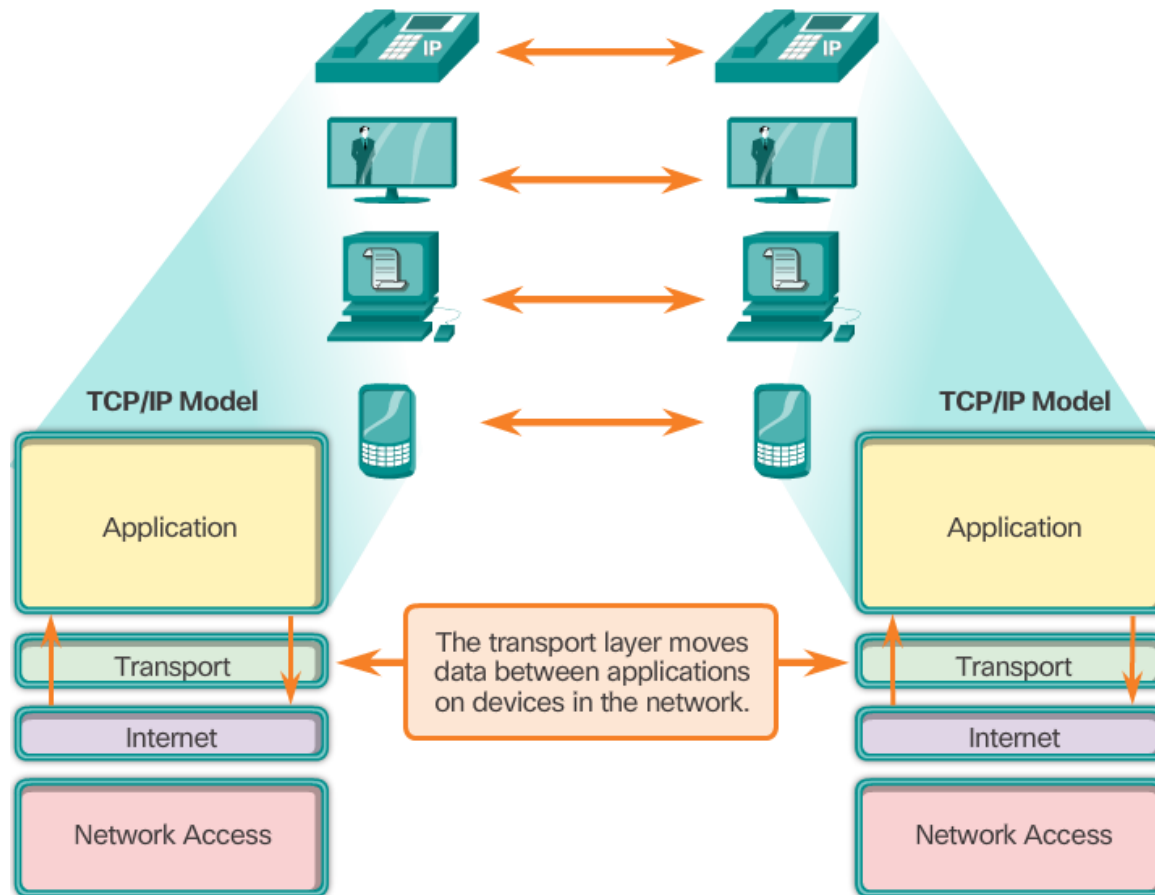
<b>A</b>	Identifies how the network was learned by the router.
<b>B</b>	Identifies the destination network.
<b>C</b>	Identifies the administrative distance (trustworthiness) of the route source.
<b>D</b>	Identifies the metric to reach the remote network.
<b>E</b>	Identifies the next hop IP address to reach the remote network.
<b>F</b>	Identifies the amount of elapsed time since the network was discovered.
<b>G</b>	Identifies the outgoing interface on the router to reach the destination network.

# How each router learns about remote routes



- Directly connected -> once the interfaces are configured
- Remote networks
  - Dynamically with routing protocols
  - Statically configured by the administrator

# Role of the transport layer



# TCP and UDP: the never met brothers

## UDP



IP Telephony



Streaming Live Video

Required protocol properties:

- Fast
- Low overhead
- Does not require acknowledgements
- Does not resend lost data
- Delivers data as it arrives

## TCP



SMTP/POP (Email)



HTTP

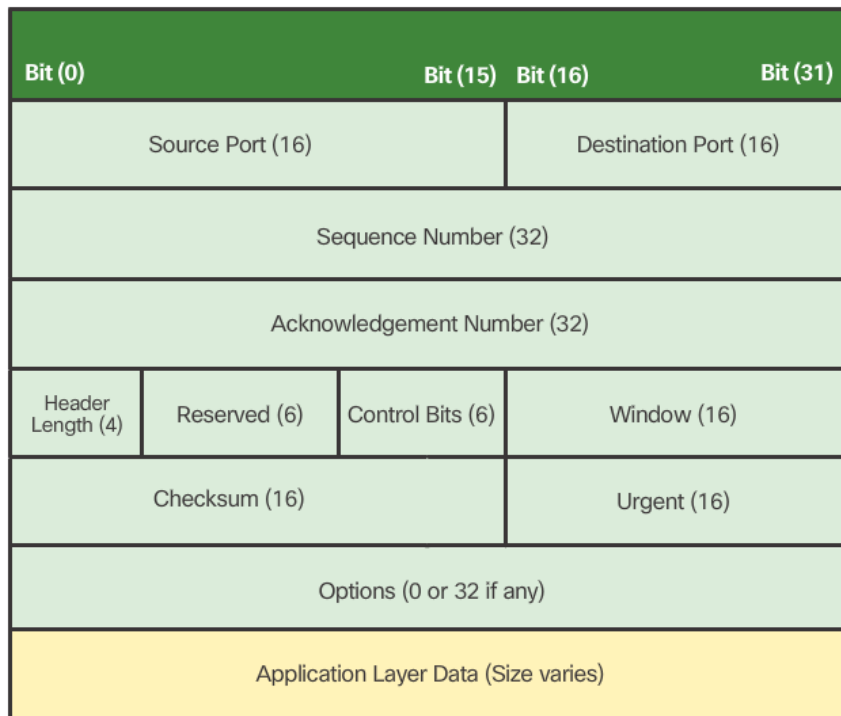
Required protocol properties:

- Reliable
- Acknowledge data
- Resends lost data
- Delivers data in order sent

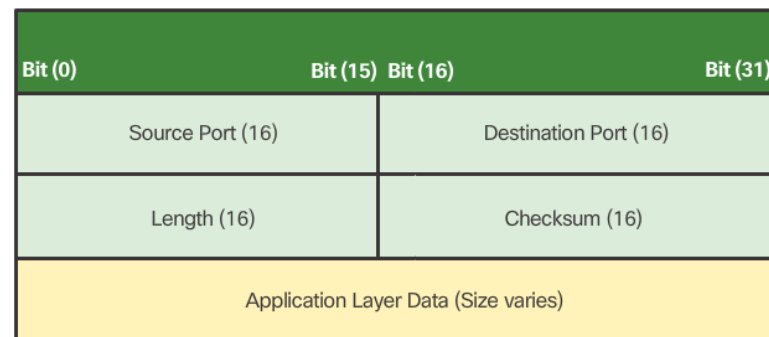
# The two headers

TCP: a stateful protocol

UDP: a stateless protocol



20 Bytes



8 Bytes