



Chapter 3: Network Protocols and Communications



Network Basics

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Chapter 3: Objectives

After completing this chapter, you will be able to:

- Explain the role protocols and standards organizations in facilitating interoperability in network communications.
- Explain how standards are established using the Request for Comments (RFC) process.
- Explain how devices on a LAN access resources in a small-to-medium-sized business network.



Chapter 3

- 3.1 Network Protocols and Standards
- 3.2 Using Requests for Comments
- 3.3 Moving Data in the Network
- 3.4 Summary



3.1 Network Protocols and Standards

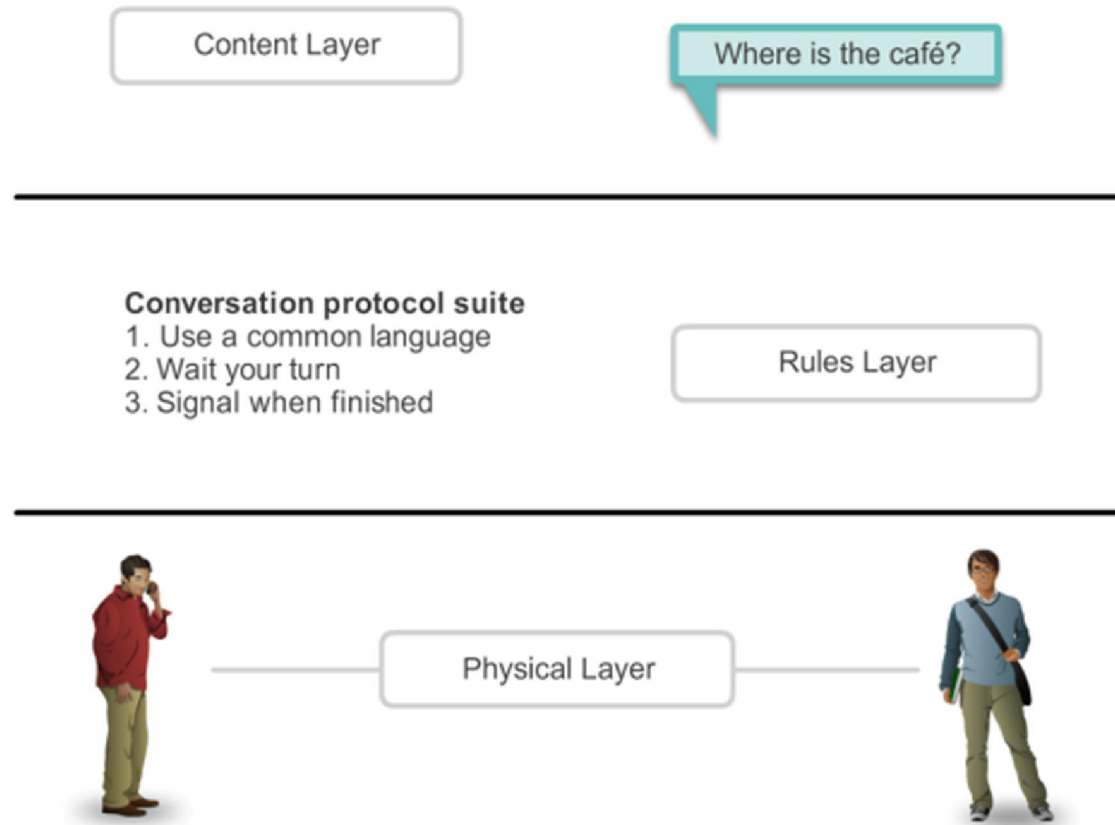


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Protocols

Rules that Govern Communications



Protocol suites are sets of rules that work together to help solve a problem.



Protocols

Network Protocols

- How the message is formatted or structured
- The process by which networking devices share information about pathways with other networks
- How and when error and system messages are passed between devices
- The setup and termination of data transfer sessions



Protocols

Interaction of Protocols

- Application Protocol – Hypertext Transfer Protocol (HTTP)
- Transport Protocol – Transmission Control Protocol (TCP)
- Internet Protocol – Internet Protocol (IP)
- Network Access Protocols – data link and physical layers



Protocol Suites

Protocol Suites and Industry Standards

Protocol Suites and Industry Standards

TCP/IP	ISO	AppleTalk	Novell Netware
HTTP DNS DHCP FTP	ACSE ROSE TRSE SESE	AFP	NDS
TCP UDP	TP0 TP1 TP2 TP3 TP4	ATP AEP NBP RTMP	SPX
IPv4 IPv6 ICMPv4 ICMPv6	CONP/CMNS CLNP/CLNS	AARP	IPX
Ethernet PPP Frame Relay ATM WLAN			



Protocol Suites

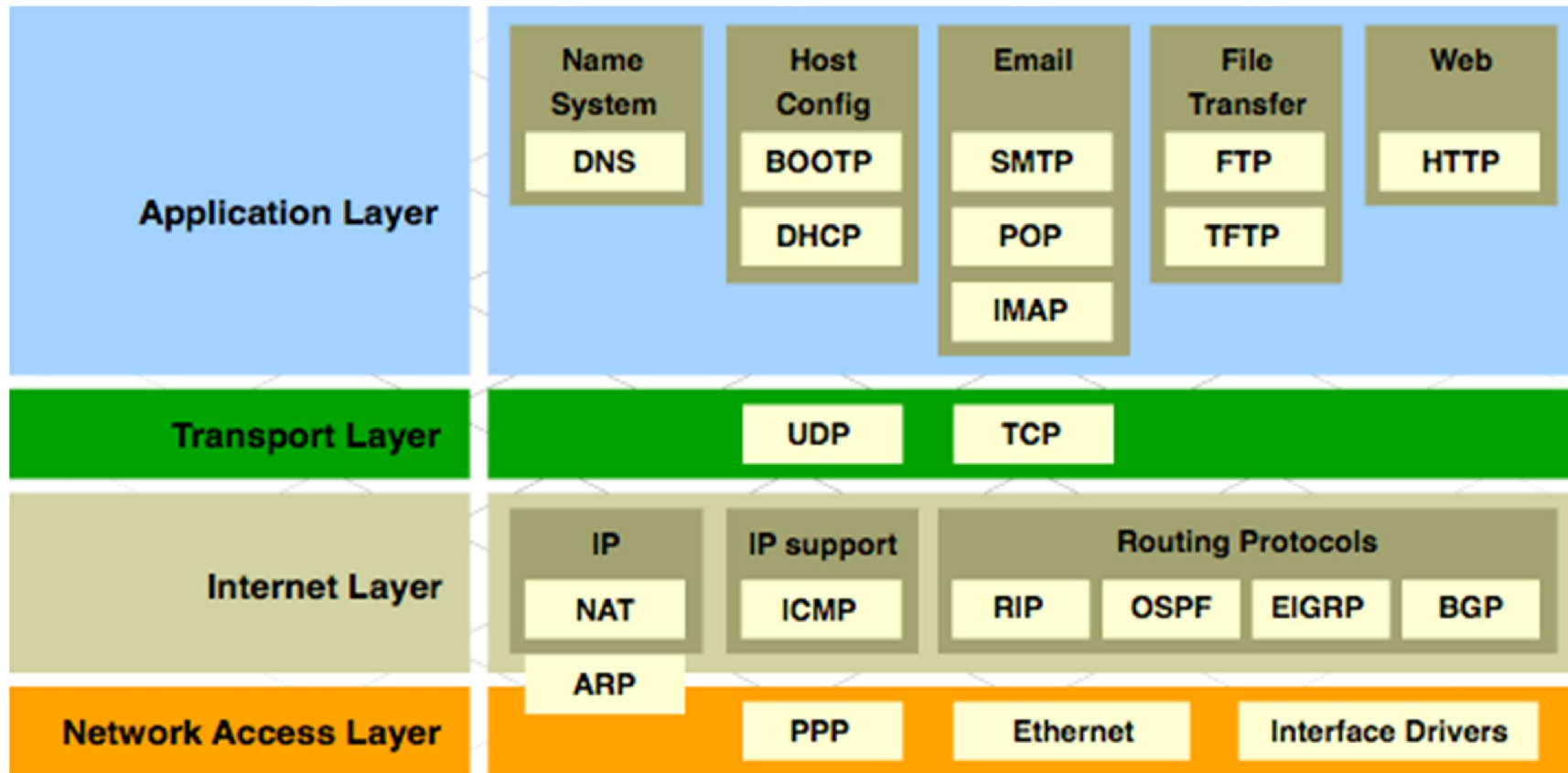
Creation of Internet – TCP/IP Development

- The first packet switching network and predecessor to today's Internet was the Advanced Research Projects Agency Network (ARPANET), which came to life in 1969 by connecting mainframe computers at four locations.
- ARPANET was funded by the U.S. Department of Defense for use by universities and research laboratories. Bolt, Beranek and Newman (BBN) was the contractor that did much of the initial development of the ARPANET, including creating the first router known as an Interface Message Processor (IMP).
- In 1973, Robert Kahn and Vinton Cerf began work on TCP to develop the next generation of the ARPANET. TCP was designed to replace ARPANET's current Network Control Program (NCP).
- In 1978, TCP was divided into two protocols: TCP and IP. Later, other protocols were added to the TCP/IP suite of protocols including Telnet, FTP, DNS, and many others.



Protocol Suites

TCP/IP Protocol Suite and Communication





Standards Organizations

Open Standards

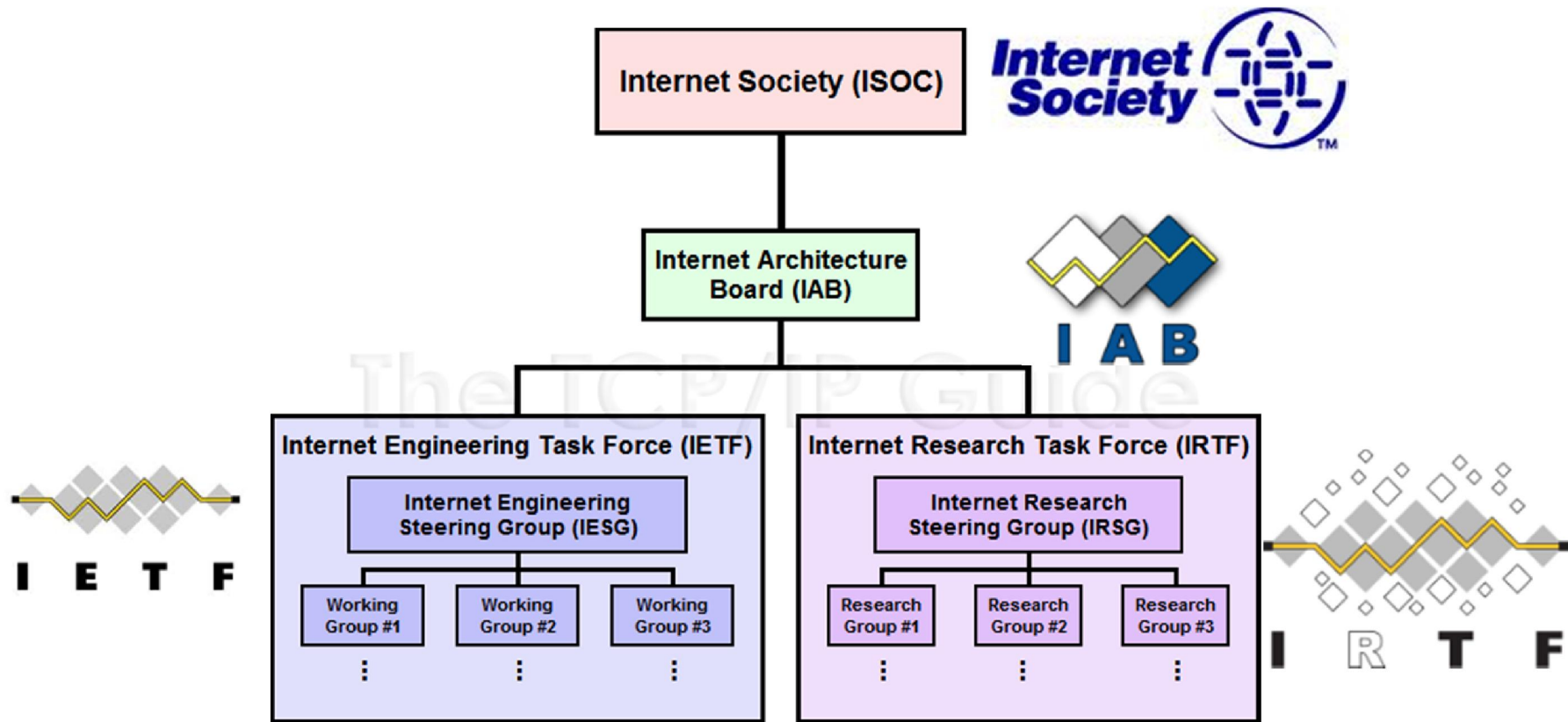
- The Internet Society (ISOC)
- The Internet Architecture Board (IAB)
- The Internet Engineering Task Force (IETF)
- Institute of Electrical and Electronics Engineers (IEEE)
- The International Organization for Standards (ISO)





Standards Organizations

ISOC, IAB, IETF and IRTF





Standards Organizations

IEEE

- 38 societies
- 130 journals
- 1,300 conferences each year
- 1,300 standards and projects
- 400,000 members
- 160 countries
- IEEE 802.3
- IEEE 802.11

IEEE 802 Working Groups and Study Groups

- 802.1 Higher Layer LAN Protocols Working Group
- 802.3 Ethernet Working Group
- 802.11 Wireless LAN Working Group
- 802.15 Wireless Personal Area Network (WPAN) Working Group
- 802.16 Broadband Wireless Access Working Group
- 802.18 Radio Regulatory TAG
- 802.19 Wireless Coexistence Working Group
- 802.21 Media Independent Handover Services Working Group
- 802.22 Wireless Regional Area Networks
- 802.24 Smart Grid TAG



Standards Organizations

ISO Reference Model





Standards Organizations

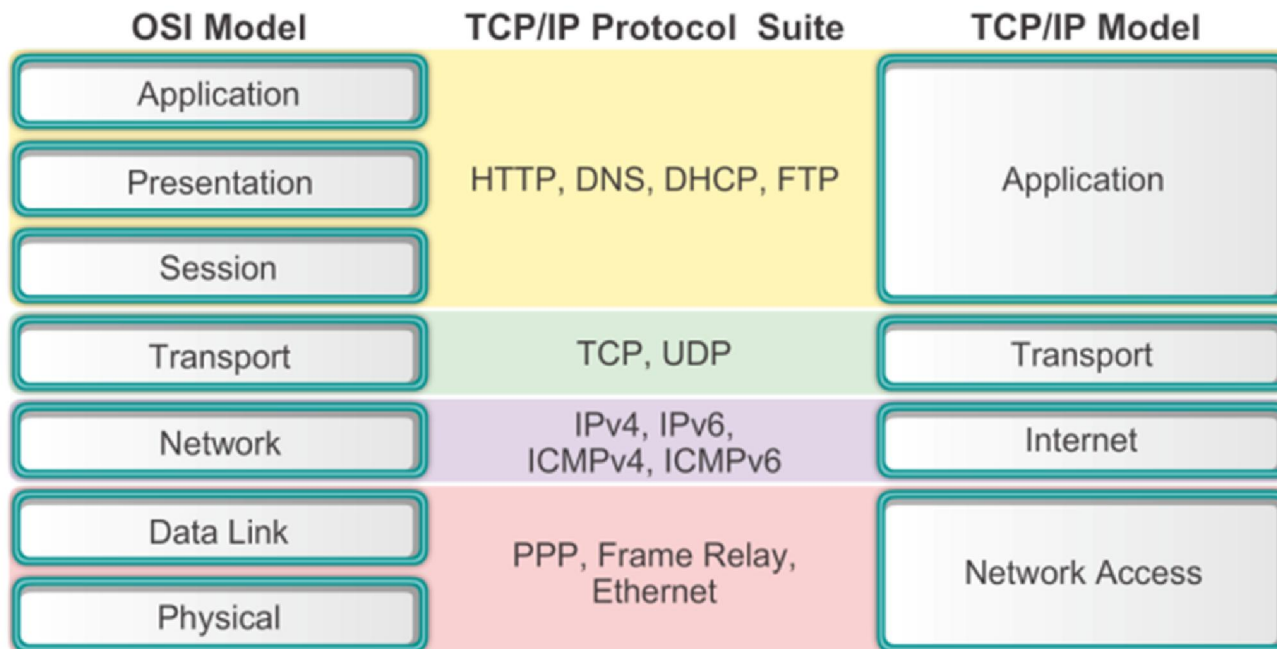
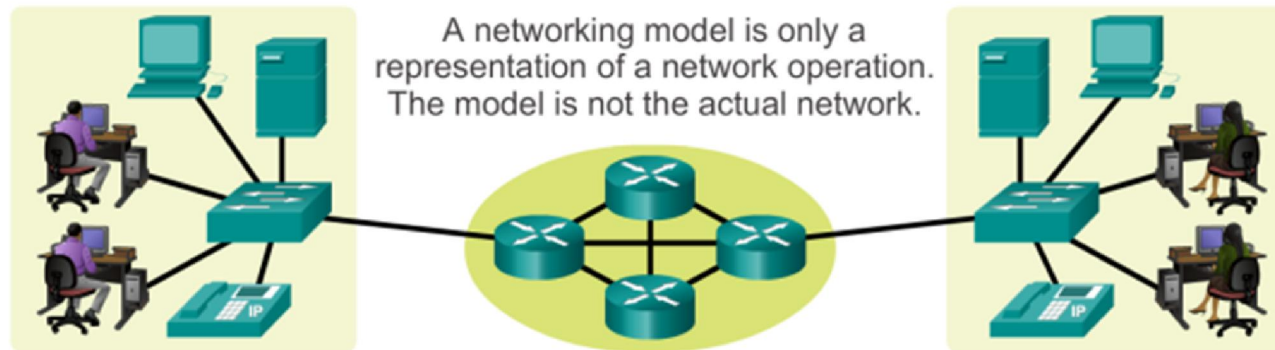
Other Standards Organization

- The Electronic Industries Alliance (EIA)
- The Telecommunications Industry Association (TIA)
- The International Telecommunications Union – Telecommunications Standardization Sector (ITU-T)
- The Internet Corporation for Assigned Names and Numbers (ICANN)
- The Internet Assigned Numbers Authority (IANA)



Reference Models

Benefits of Using a Layered Model





Reference Models

OSI Reference Model

OSI Model

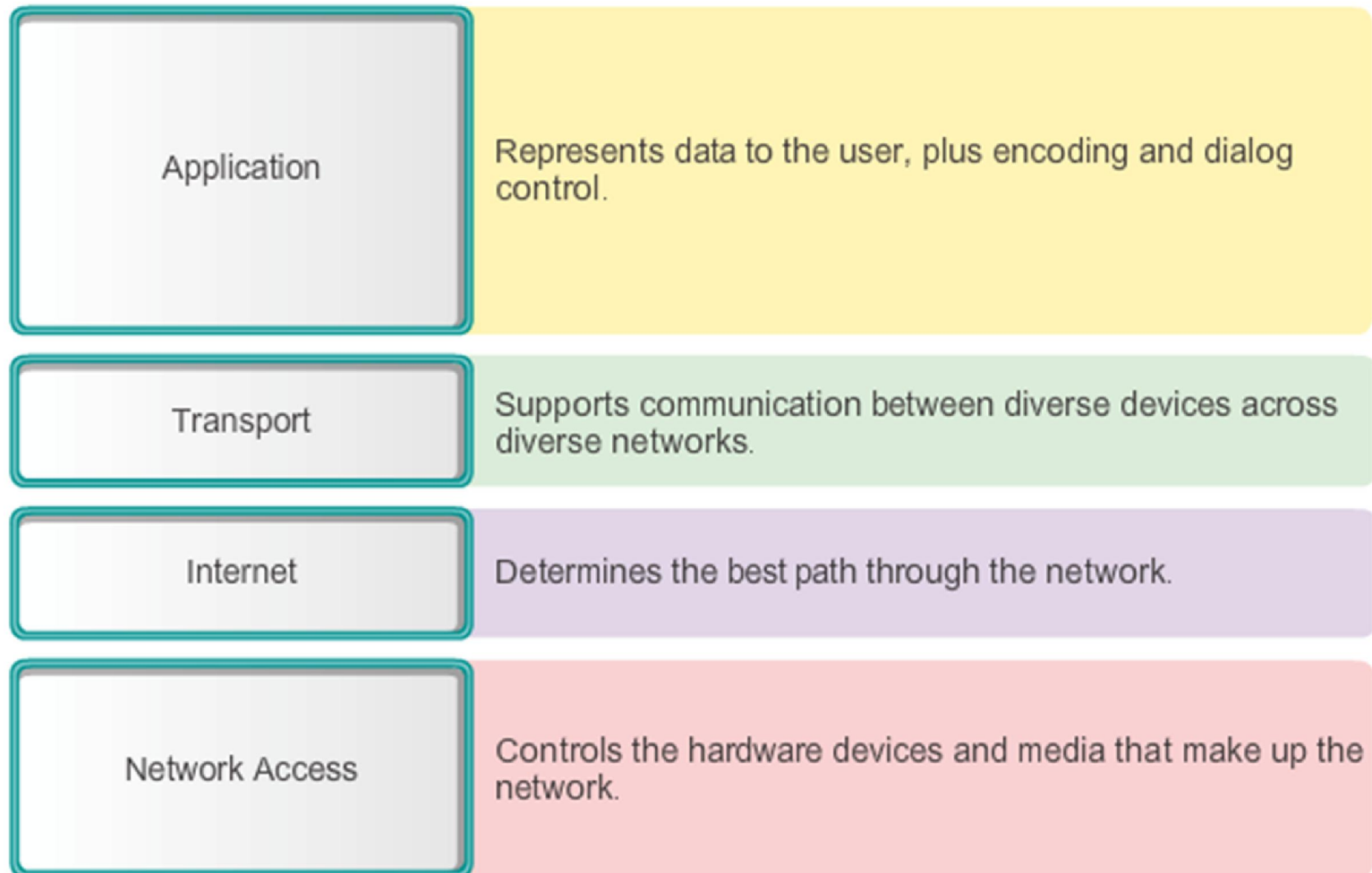




Reference Models

TCP/IP Reference Model

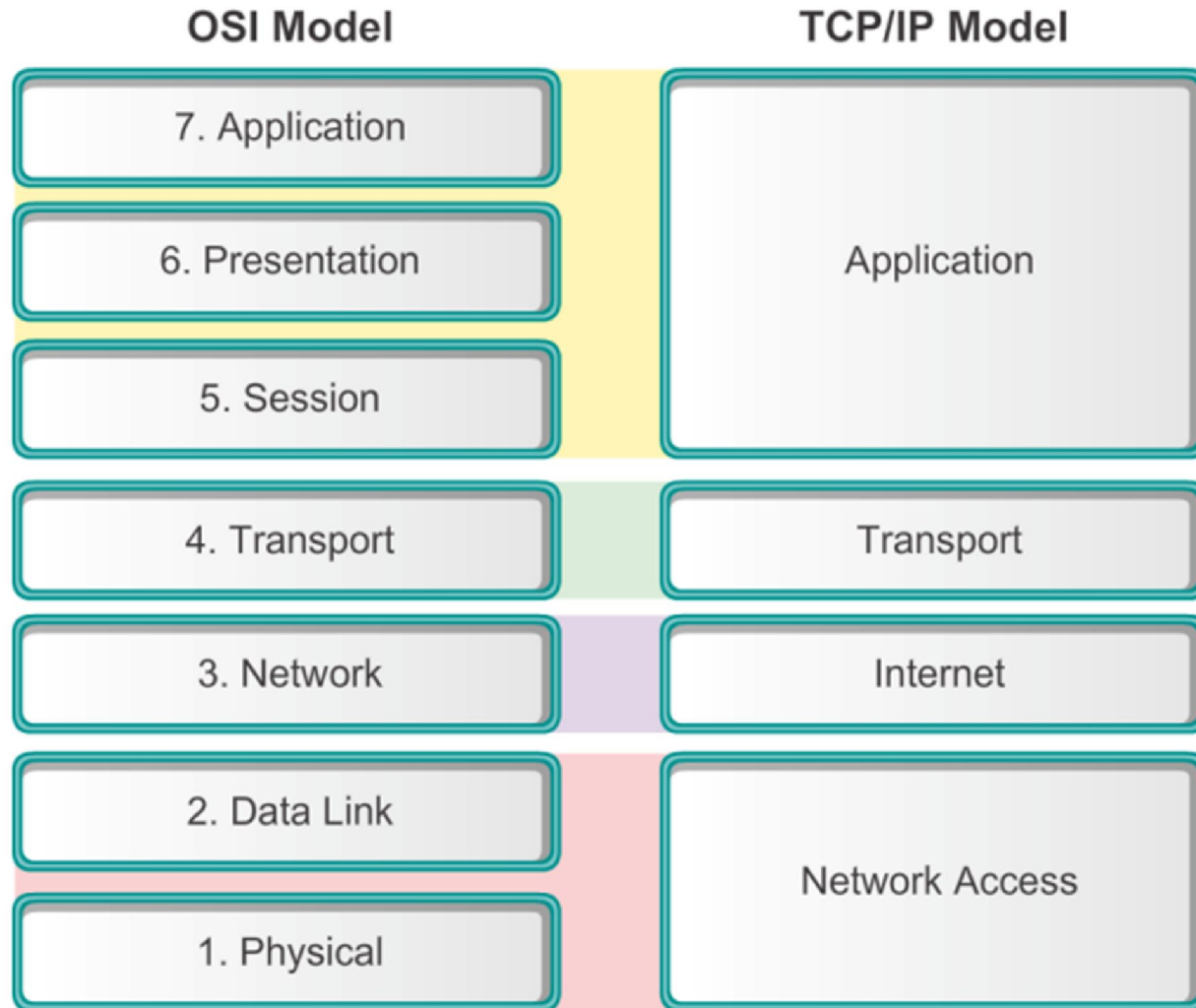
TCP/IP Model





Reference Models

Comparing the OSI and TCP/IP Models





3.2 Using Requests for Comments



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Why RFCs

Request for Comments

These are some of the current RFCs for common TCP/IP protocols:

- HTTP – RFC 2616
- DHCP – RFC 2131
- IPv4 – RFC 791
- IPv6 – RFC 2460



Why RFCs

History of RFCs



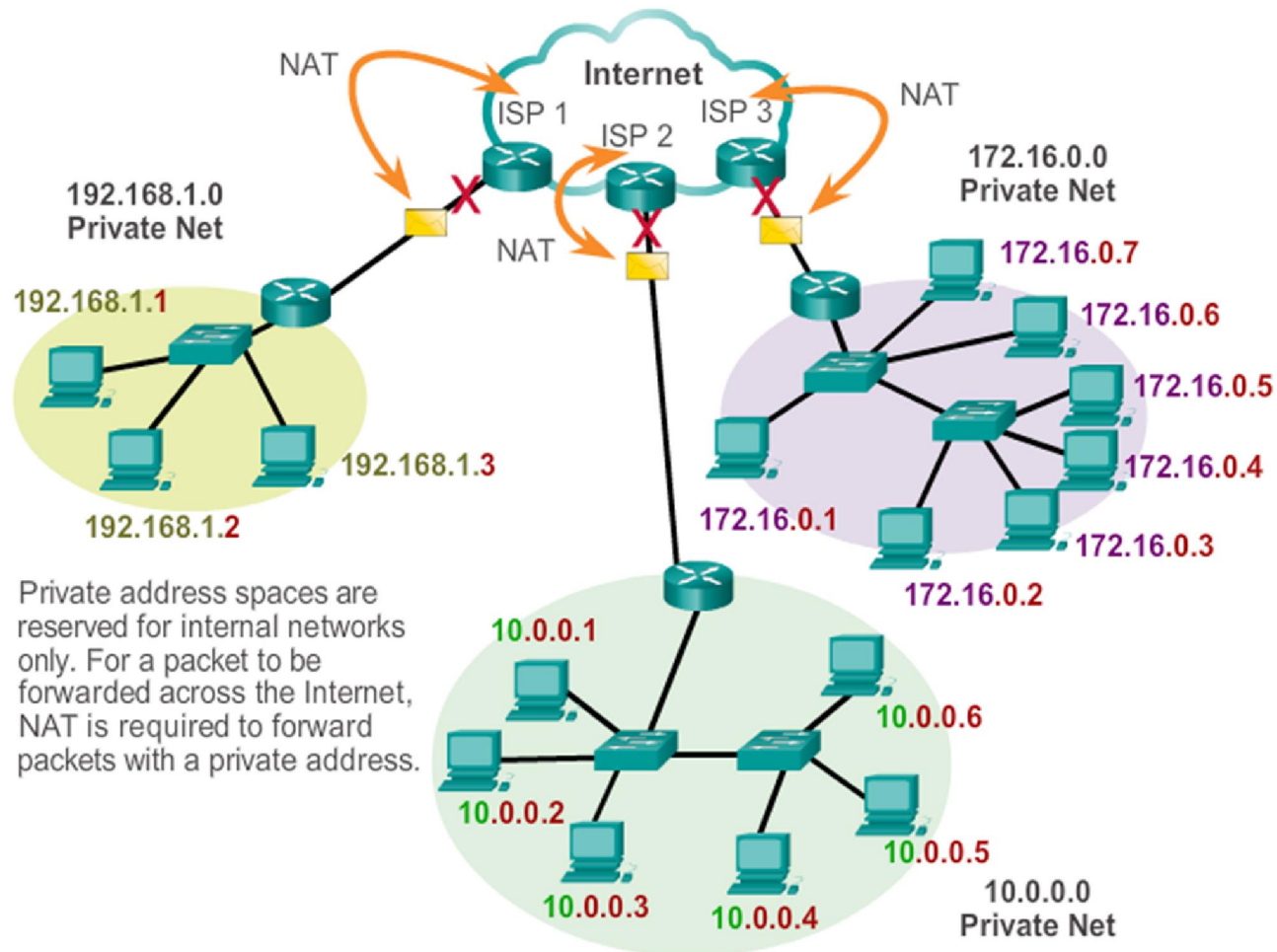
October 29, 1969 ARPANET sent first message



Why RFCs

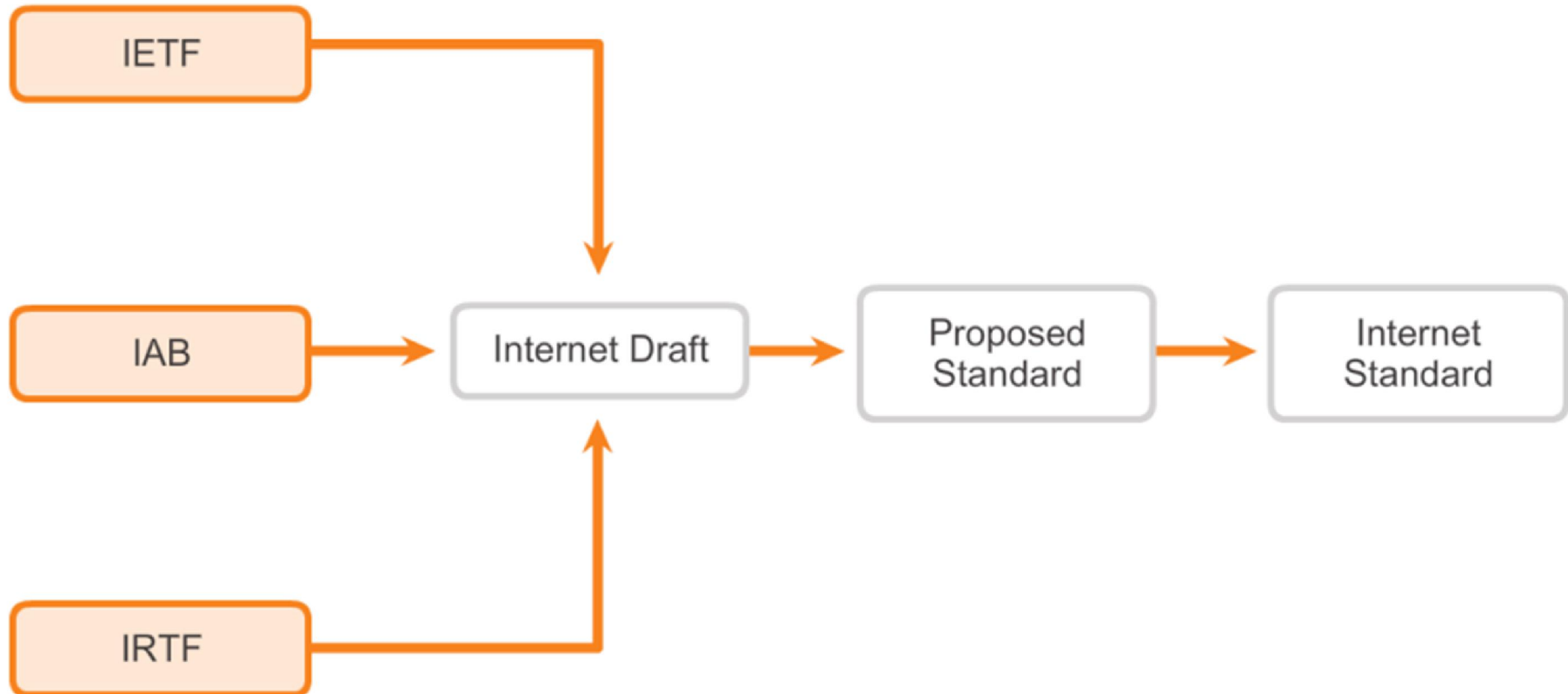
Sample RFC

RFC 1918 Private Address Space





CU – Using Requests for Comments RFC Processes

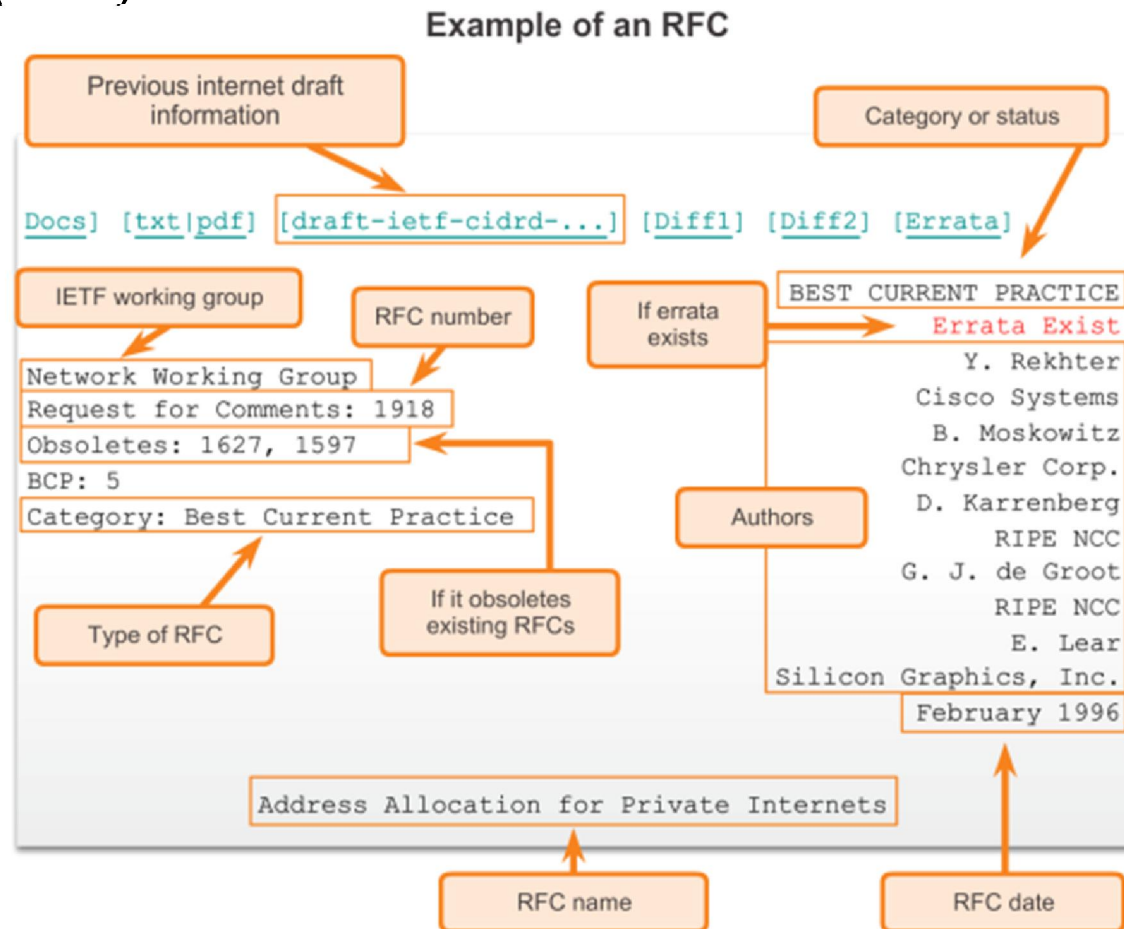




RFC Processes

RFC Types

- Internet Standard
- Best Current Practice (BCP)
- Informational
- Experimental
- Historic





3.3 Moving Data in the Network

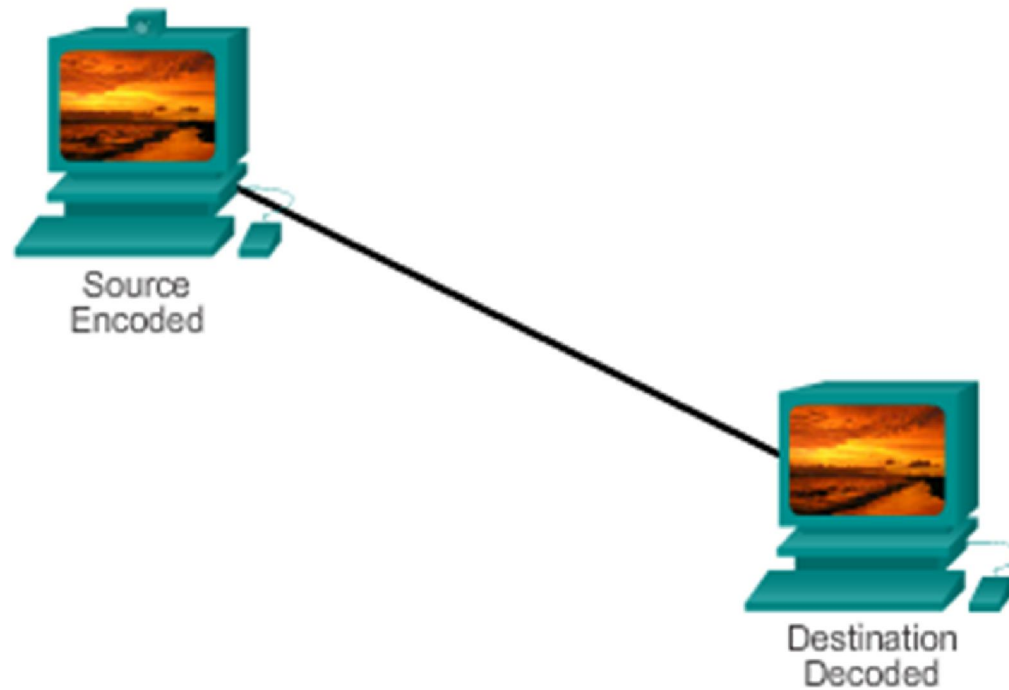


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Data Encapsulation

Elements of Communication

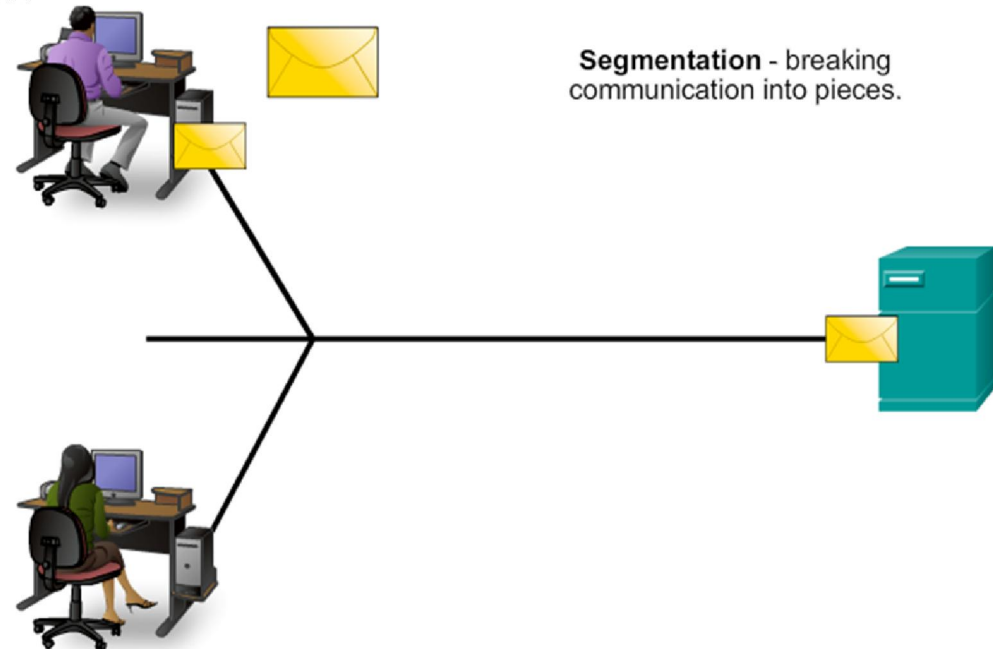




Data Encapsulation

Communicating the Messages

- Segmenting message benefits
 - Different conversations can be interleaved
 - Increased reliability of network communications
- Segmenting message disadvantage
 - Increased level of complexity

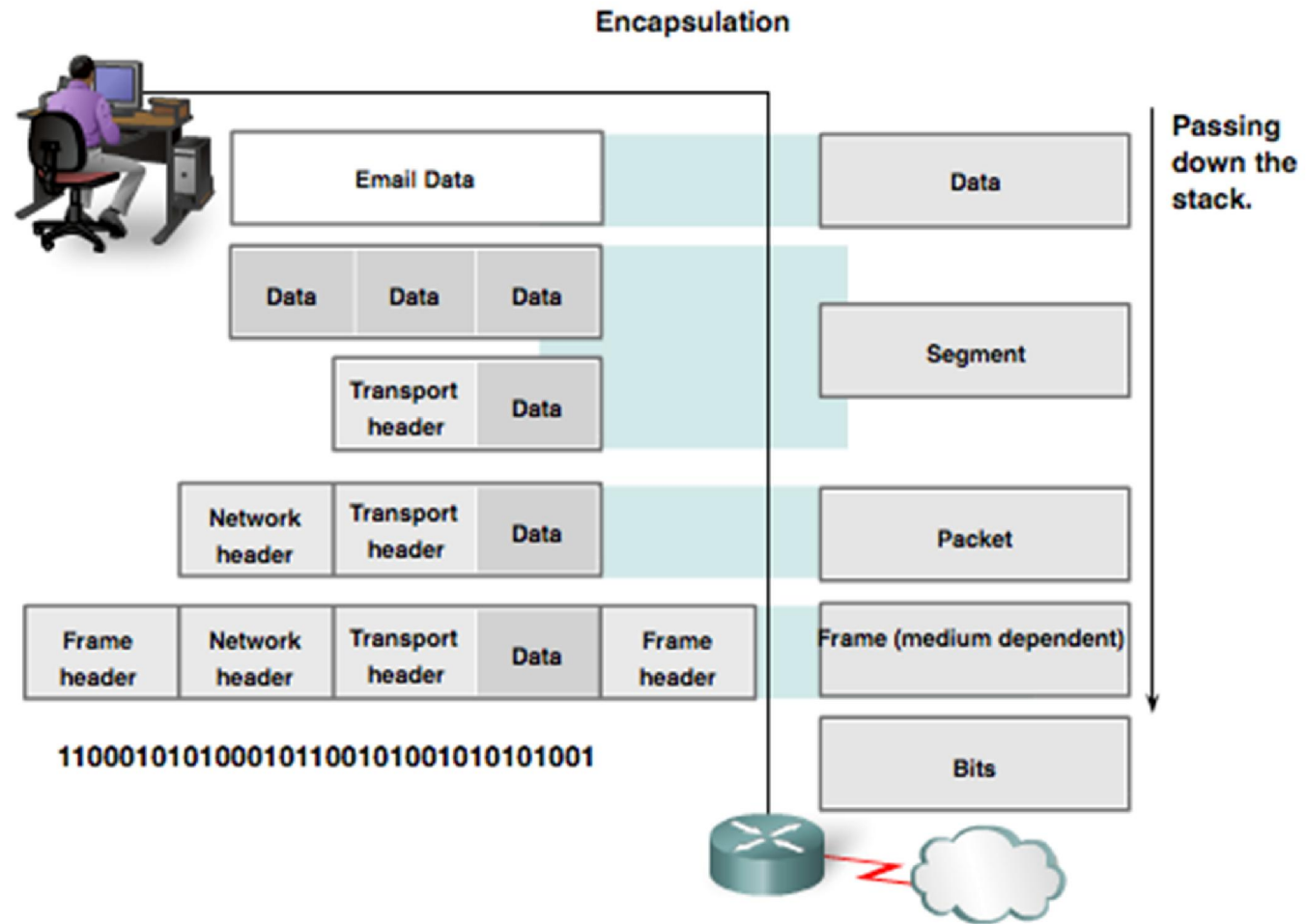




Data Encapsulation

Protocol Data Units

- Data
- Segment
- Packet
- Frame
- Bits

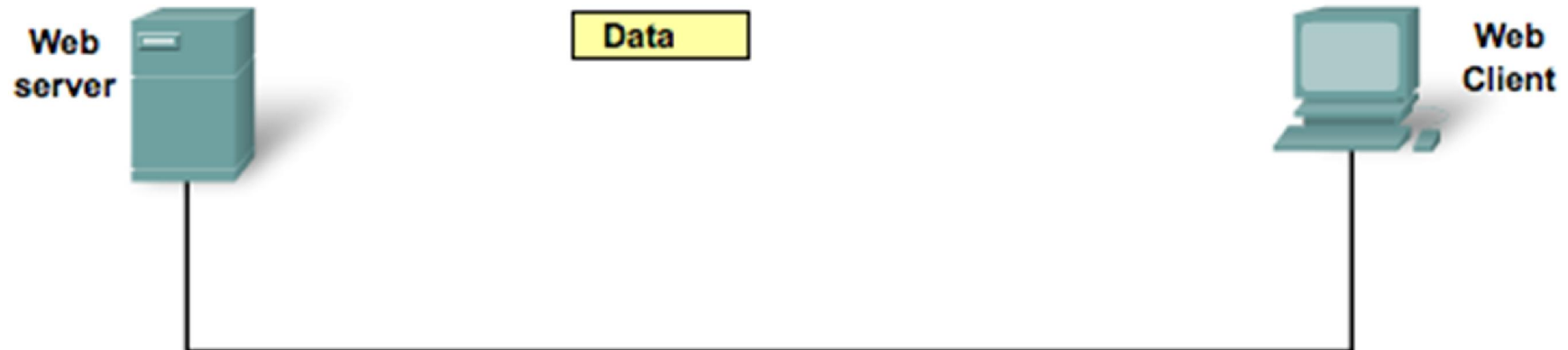
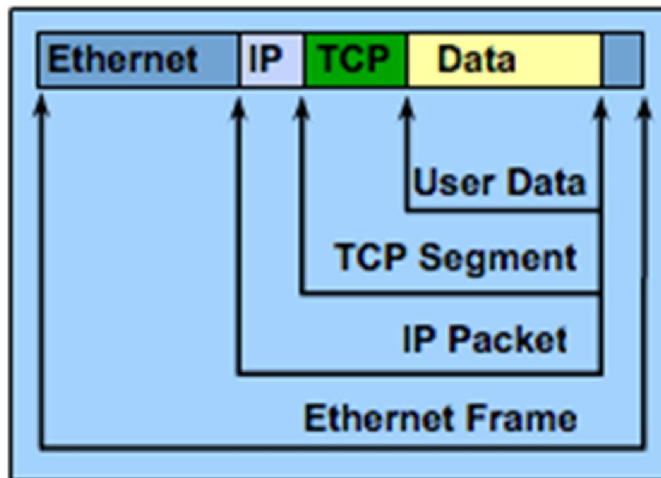




Data Encapsulation

Encapsulation

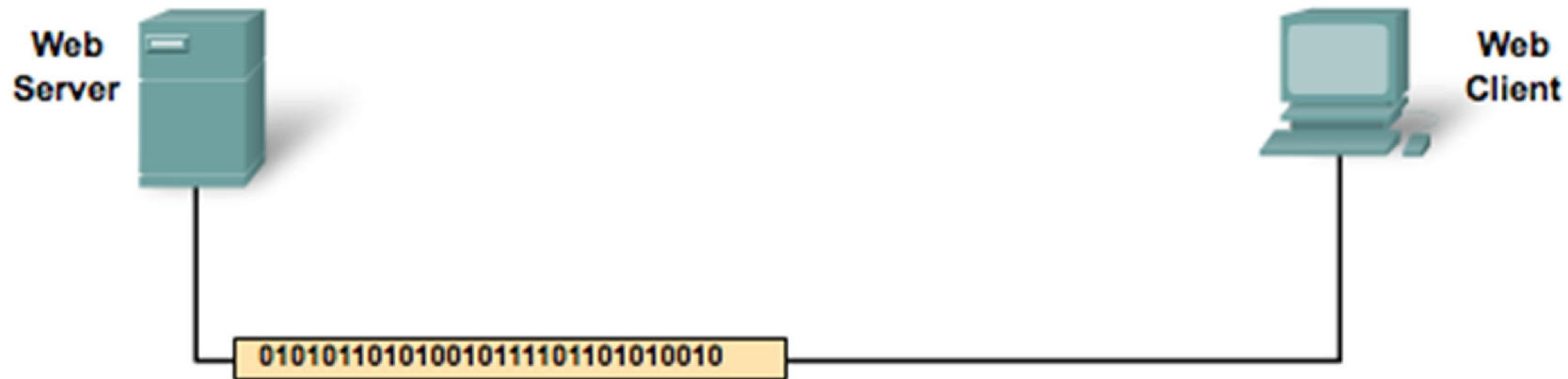
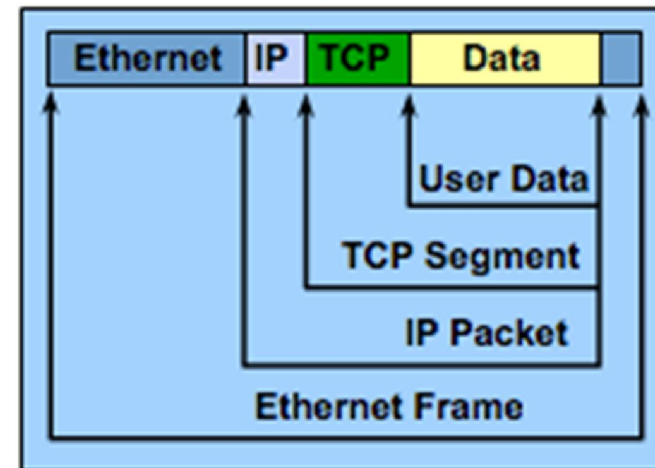
Protocol Encapsulation Terms





Data Encapsulation De-Encapsulation

Protocol Encapsulation Terms

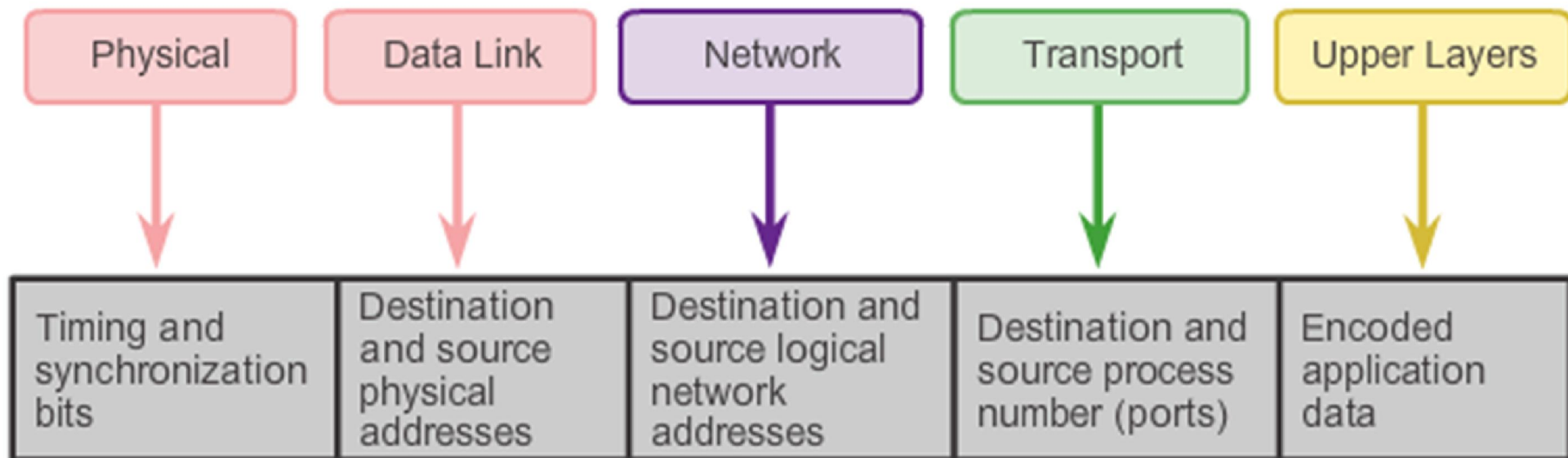




Moving Data in the Network

Network Address and Data Link Addresses

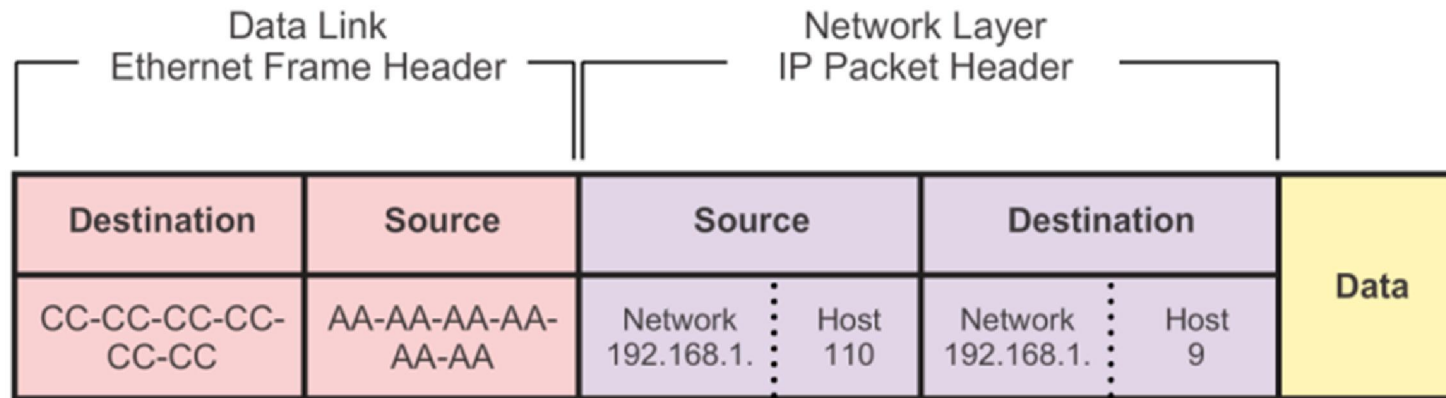
Network Addresses and Data Link Addresses



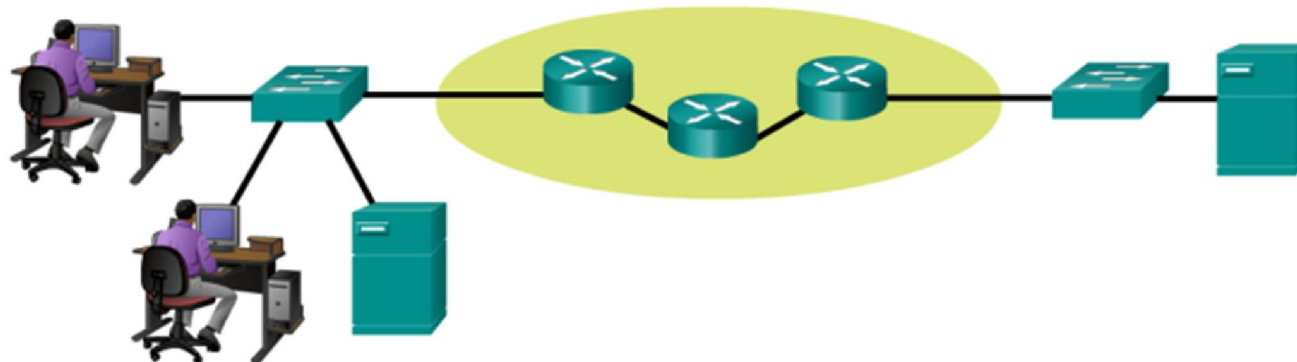


Accessing Local Resources

Communicating with Device/Same Network



PC1
192.168.1.110
AA-AA-AA-AA-AA-AA



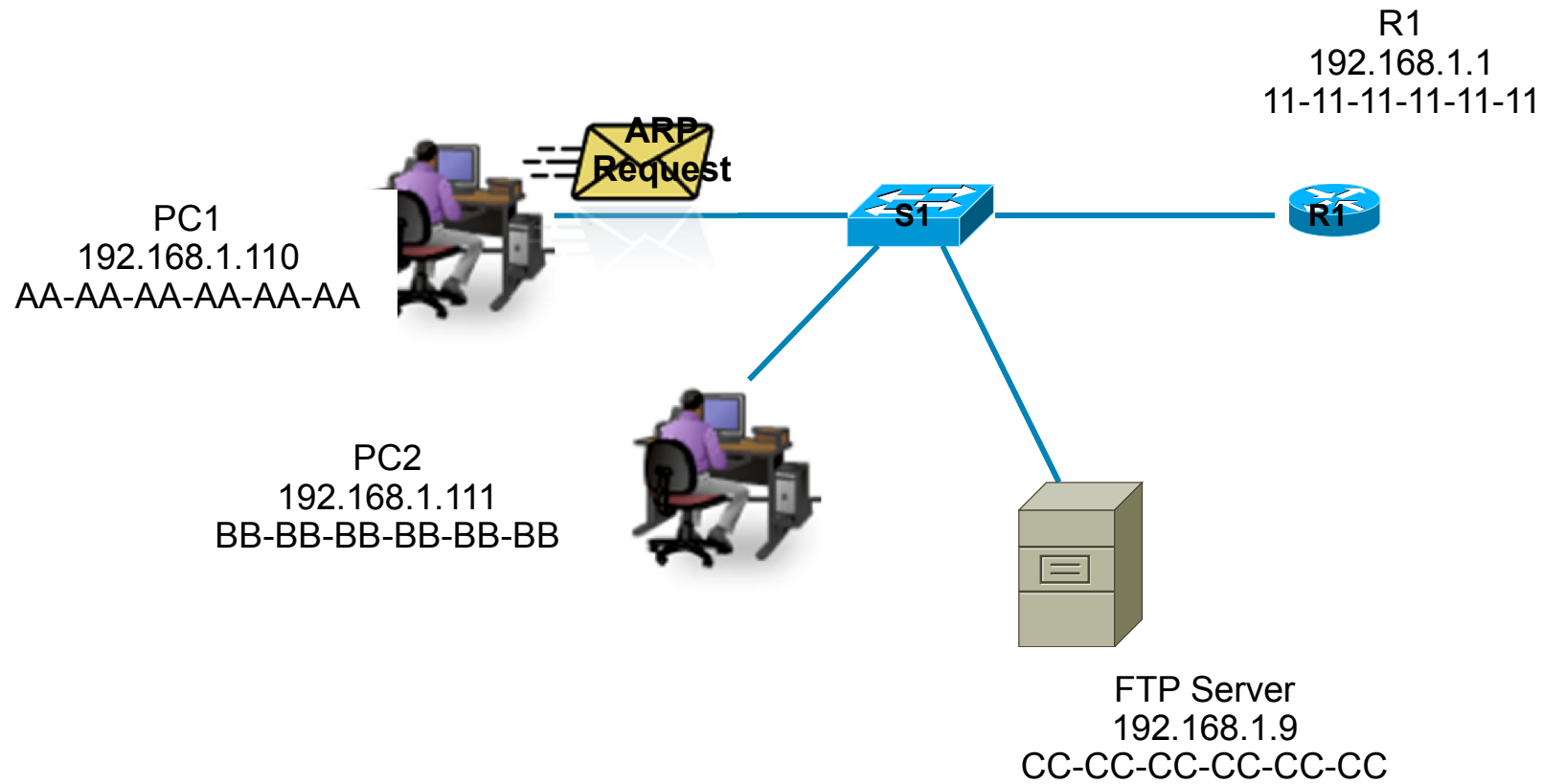
FTP Server
192.168.1.9
CC-CC-CC-CC-CC-CC



Accessing Local Resources

MAC and IP Addresses

Address Resolution Protocol



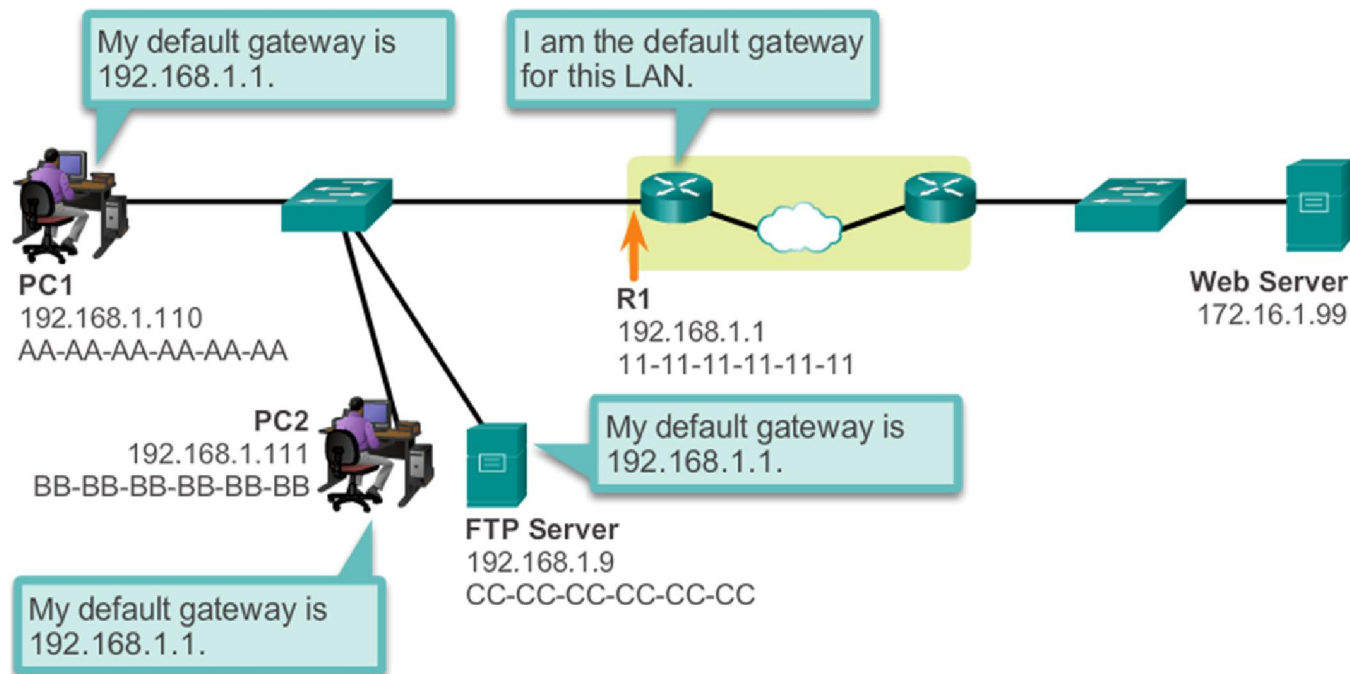


Accessing Remote Resources

Default Gateway

Getting the Pieces to the Correct Network

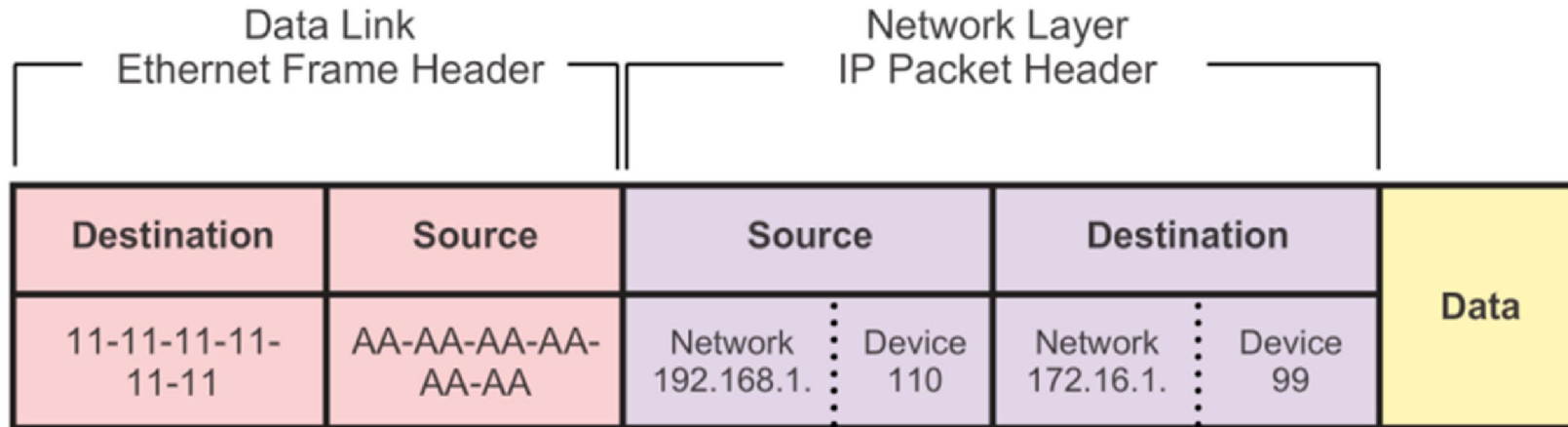
Protocol Data Unit (PDU)				
Source		Destination		Data
Network 192.168.1	Device 110	Network 172.16.1	Device 99	



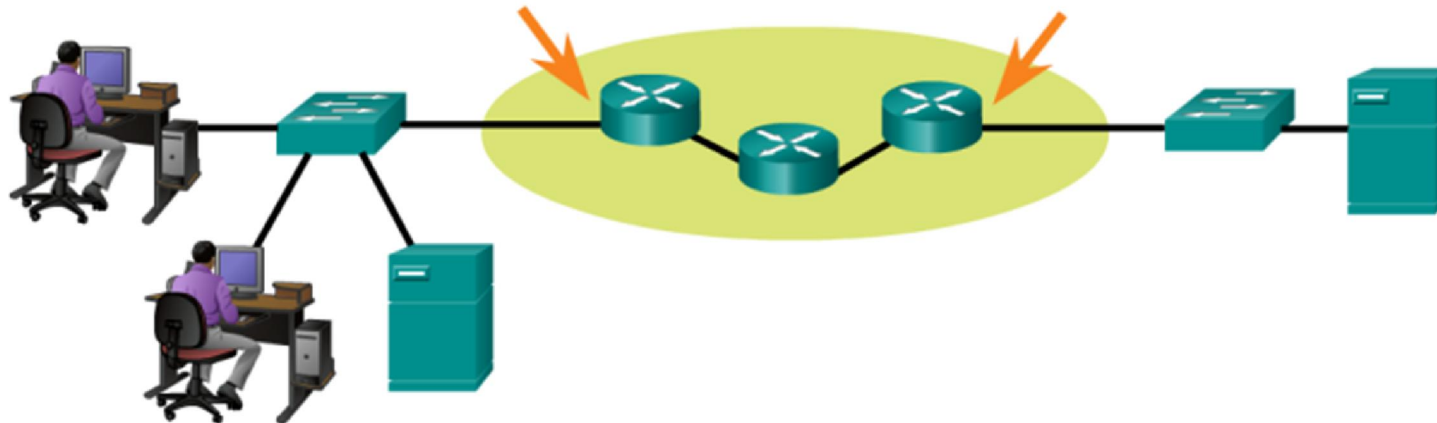


Accessing Remote Resources

Communicating Device/Remote Network



PC1 192.168.1.110 AA-AA-AA-AA-AA-AA	R1 192.168.1.1 11-11-11-11-11-11	R2 172.16.1.99 22-22-22-22-22-22	Web Server 172.16.1.99 AB-CD-EF-12-34-56
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Network Protocols and Communications Summary

In this chapter, you learned:

- Data networks are systems of end devices, intermediary devices, and the media connecting the devices. For communication to occur, these devices must know how to communicate.
- These devices must comply with communication rules and protocols. TCP/IP is an example of a protocol suite.
- Most protocols are created by a standards organization, such as IETF or IEEE.
- The most widely-used networking models are OSI and TCP/IP.
- Data that passes down the stack of the OSI model is segmented into pieces and encapsulated with addresses and other labels. The process is reversed as the pieces are de-encapsulated and passed up the destination protocol stack.



Network Protocols and Communications Summary (cont.)

In this chapter, you learned:

- The OSI model describes the processes of encoding, formatting, segmenting, and encapsulating data for transmission over the network.
- The TCP/IP protocol suite is an open standard protocol that has been endorsed by the networking industry and ratified, or approved, by a standards organization.
- The Internet Protocol Suite is a suite of protocols required for transmitting and receiving information using the Internet.
- PDUs are named according to the protocols of the TCP/IP suite: data, segment, packet, frame, and bits.
- Applying models allows individuals, companies, and trade associations to analyze current networks and plan the networks of the future.

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