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Sybex CCNA 640-802
Chapter 2: Introduction to TCP/IP

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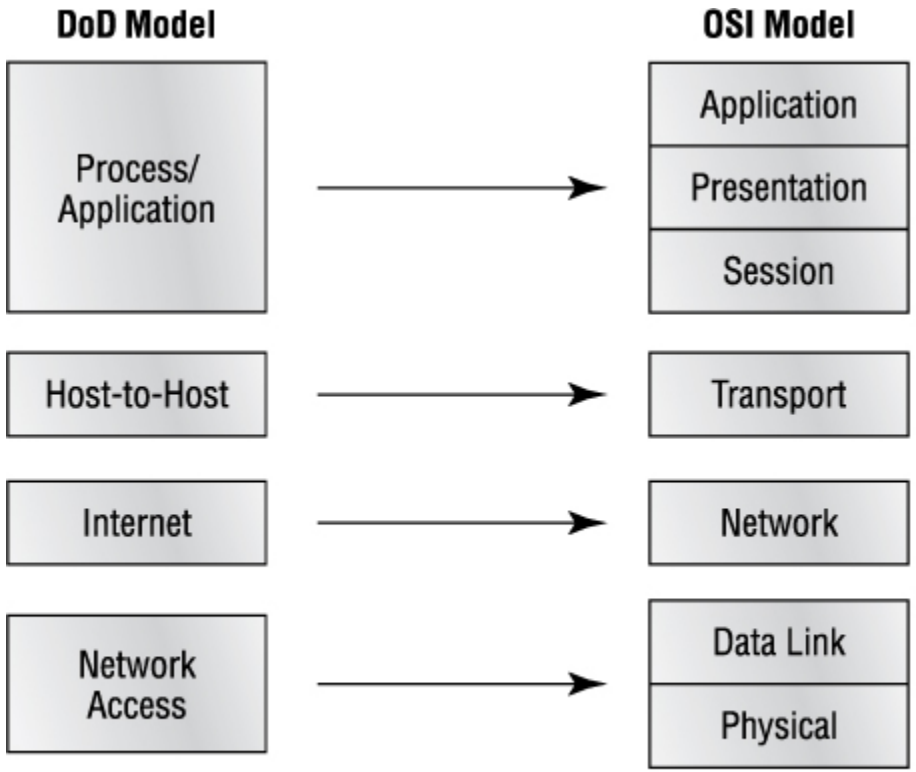
Chapter 2 Objectives

- The CCNA Topics Covered in this chapter include:
- TCP/IP and the DoD Model
  - Process/Application Layer
  - Host-to-Host Layer
  - Internet Layer
  - Network Access
- IP Addressing
  - Class A
  - Class B
  - Class C
  - Private Addressing

TCP/IP and the DoD Model

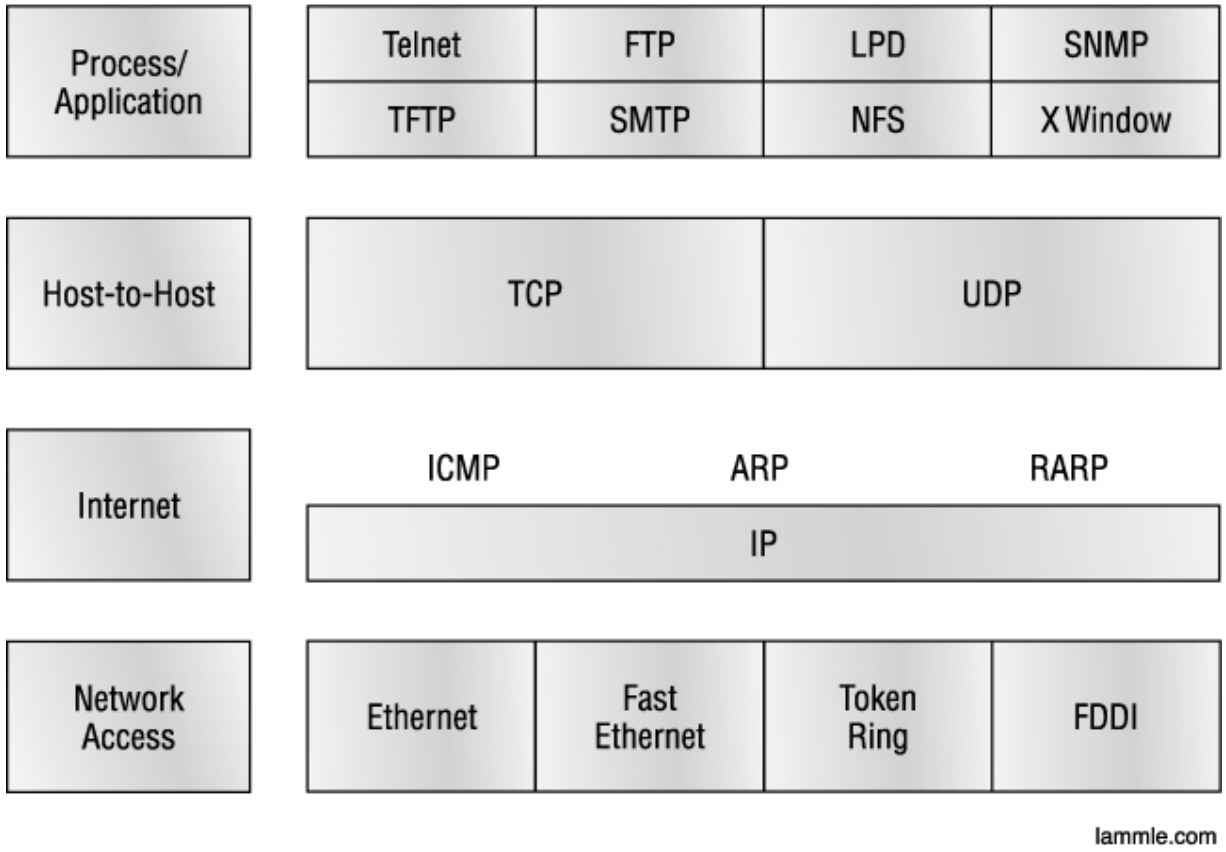
The figure shows a comparison of the DoD model and the OSI reference model. As you can see, the two are similar in concept, but each has a different number of layers with different names.



The TCP/IP Protocol Suite

The DoD and OSI models are alike in design and concept and have similar functions in similar layers.

DoD Model



Process/Application Layer

This section describes different applications and services typically used in IP networks. The following protocols and applications are discussed:

- Telnet
- FTP
- TFTP
- NFS
- SMTP
- LPD
- X Window
- SNMP
- DNS
- DHCP/BootP

Host to Host Layer

The main purpose of the Host-to-Host layer is to shield the upper-layer applications from the complexities of the network.

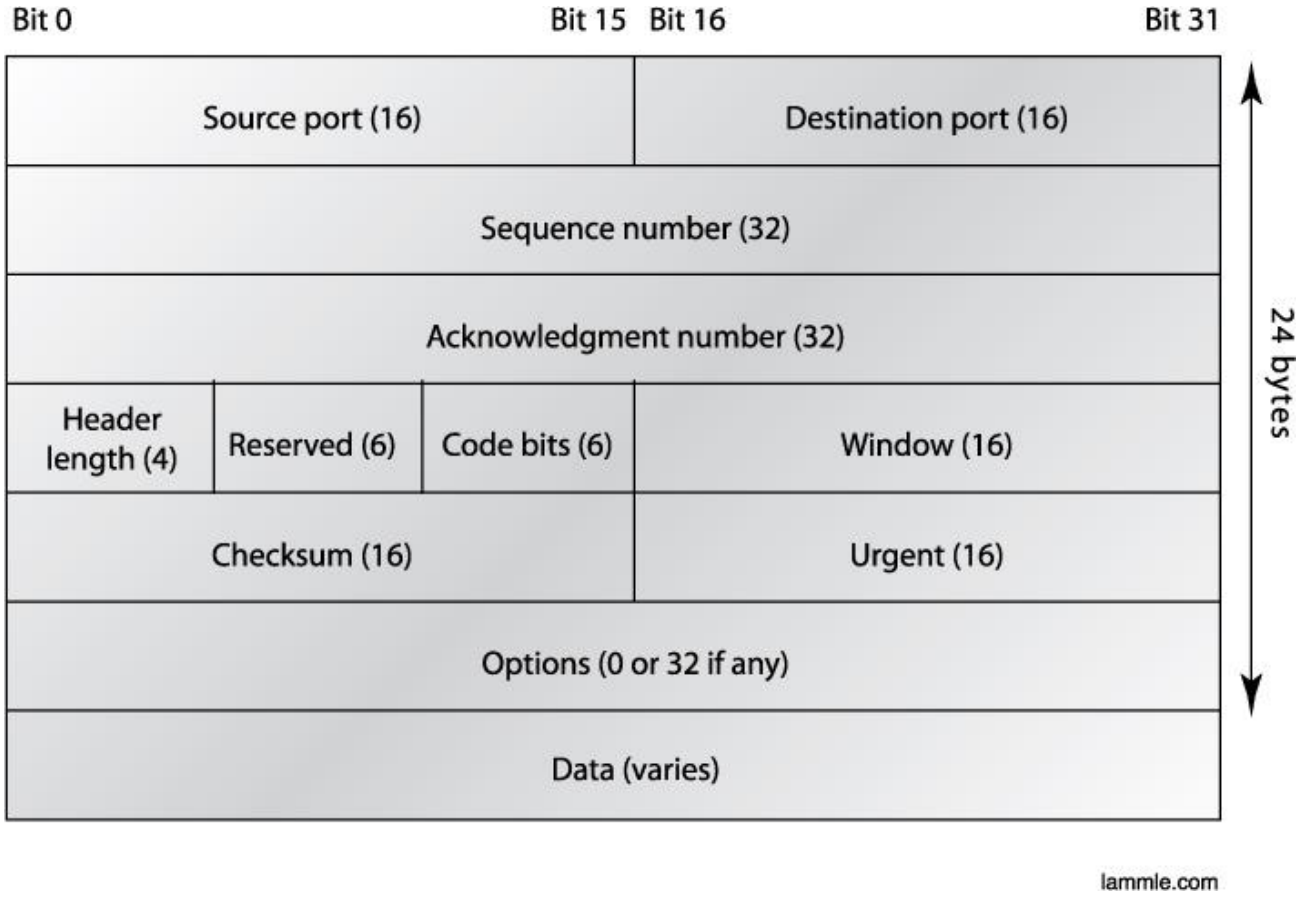
This layer says to the upper layer, “Just give me your data stream, with any instructions, and I’ll begin the process of getting your information ready to send.”

The following sections describe the two protocols at this layer:

- **Transmission Control Protocol (TCP)**
- **User Datagram Protocol (UDP)**

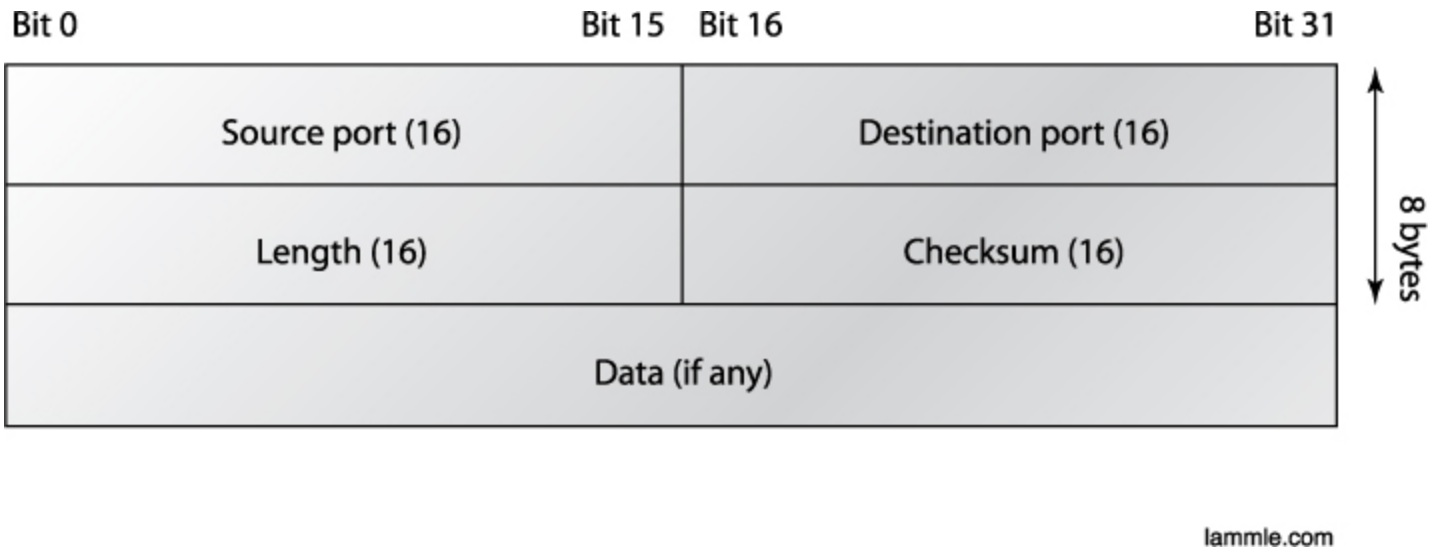
TCP

The figure shows the different fields within the TCP header.



UDP

This figure clearly illustrates UDP's markedly low overhead as compared to TCP's hungry usage.

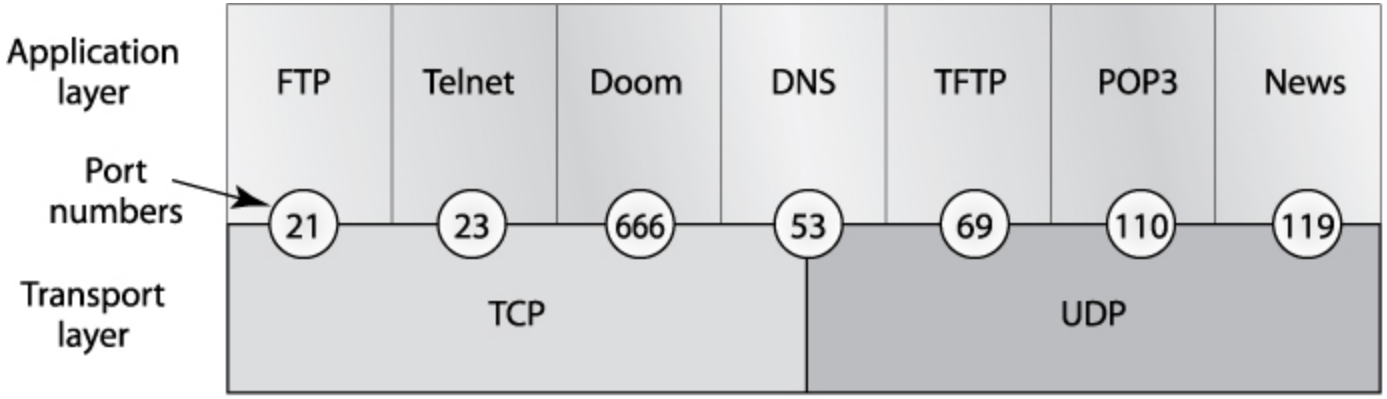


Key concepts of Host to Host Protocols

TCP	UDP
Sequenced	Unsequenced
Reliable	Unreliable
Connection-oriented	Connectionless
Virtual circuit	Low overhead
Acknowledgments	No acknowledgment
Windowing flow control	No windowing or flow control

Port Numbers

Port number examples for TCP and UDP



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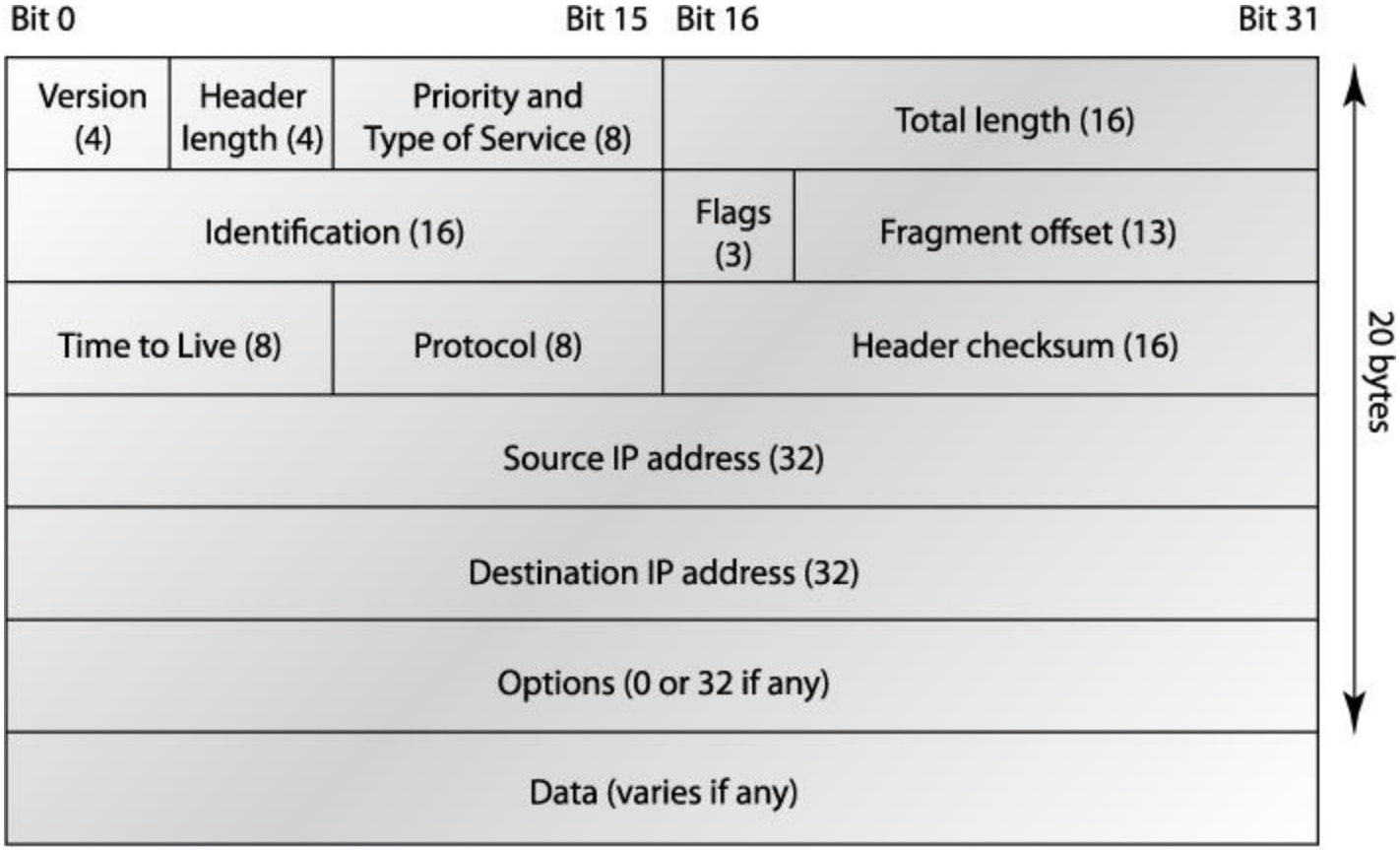
Key Protocols and Port Numbers

TCP		UDP	
Telnet	23	SNMP	161
SMTP	25	TFTP	69
HTTP	80	DNS	53
FTP	21		
DNS	53		
HTTPS	443		

Internet Layer

IP Header



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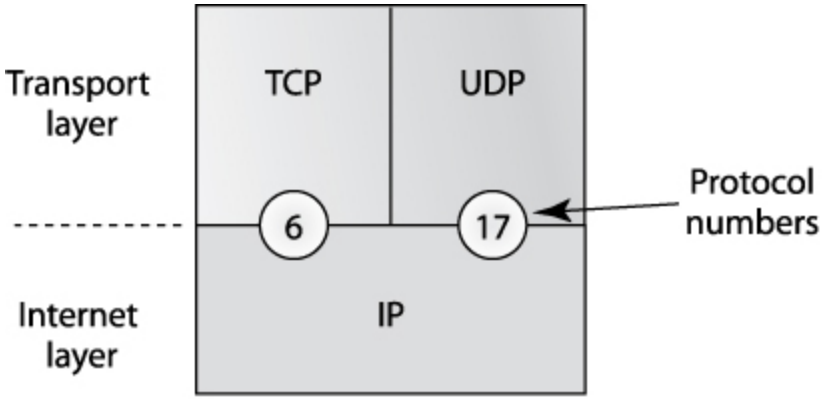
Internet Layer

Protocol Field in IP Header



Internet Layer

Protocol Field in IP Header

Protocol	Protocol Number
ICMP	1
IP in IP (tunneling)	4
IGRP	9
EIGRP	88
OSPF	89
IPv6	41
GRE	47
Layer 2 tunnel (L2TP)	115

Internet Layer

ICMP

Internet Control Message Protocol (ICMP) works at the Network layer and is used by IP for many different services.

- ICMP is a management protocol and messaging service provider for IP.
- Its messages are carried as IP datagrams.

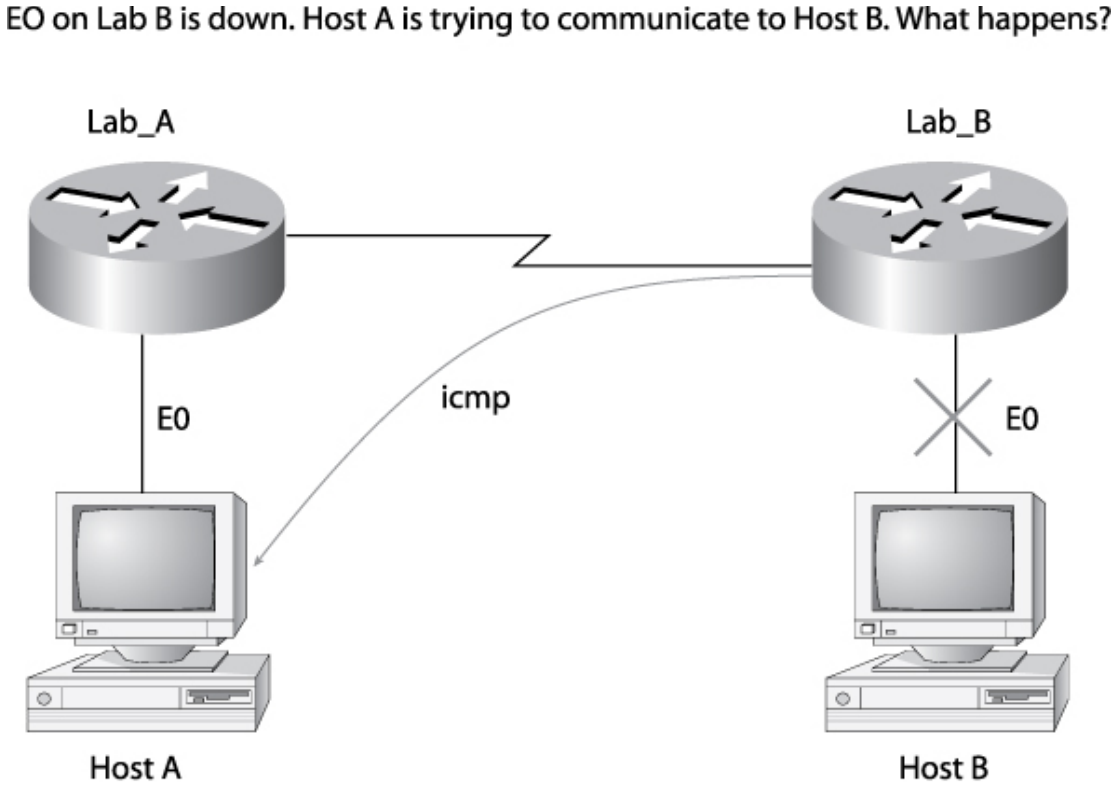
ICMP packets have the following characteristics:

- They can provide hosts with information about network problems.
- They are encapsulated within IP datagrams.

Internet Layer

ICMP

E0 of LAB_B goes down. What happens?



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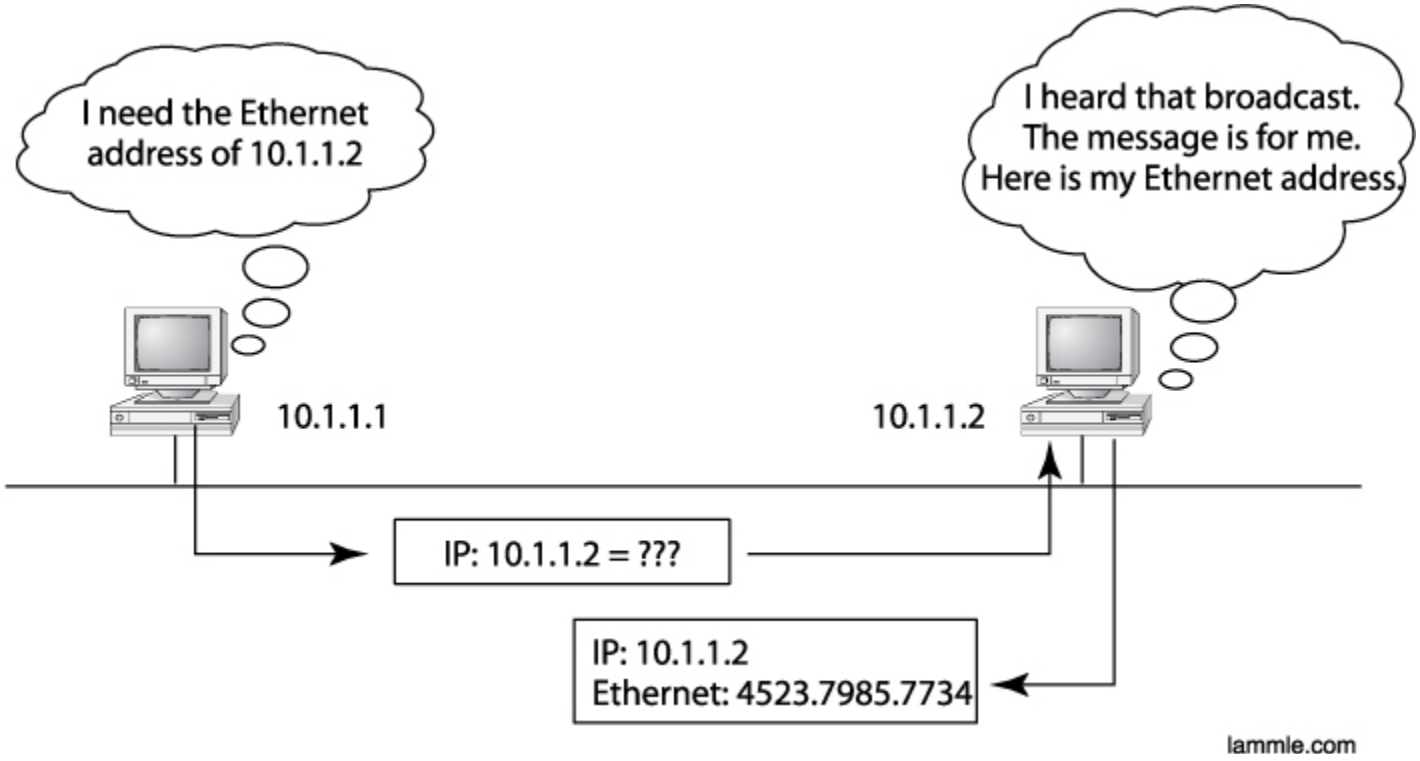
Internet Layer

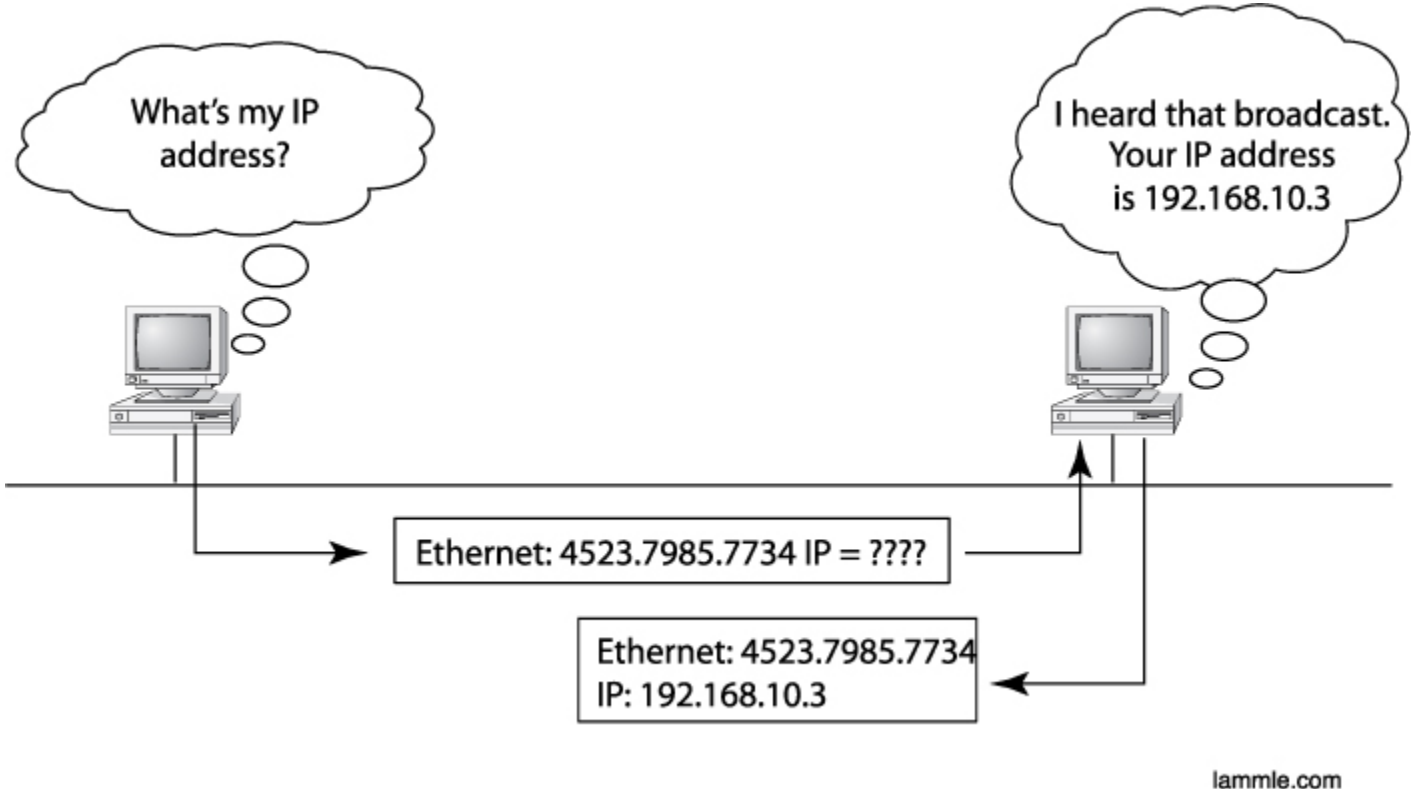
ARP

ARP resolves IP addresses to Ethernet (MAC) addresses.



Internet Layer

RARP



IP Addressing

An IP address is a numeric identifier assigned to each machine on an IP network.

It designates the specific location of a device on the network.

IP addressing was designed to allow hosts on one network to communicate with a host on a different network regardless of the type of LANs the hosts are participating in.

IP Terminology

BIT: A bit is one digit, either a 1 or a 0.

BYTE: A byte is 7 or 8 bits, depending on whether parity is used. For the rest of this chapter, always assume a byte is 8 bits.

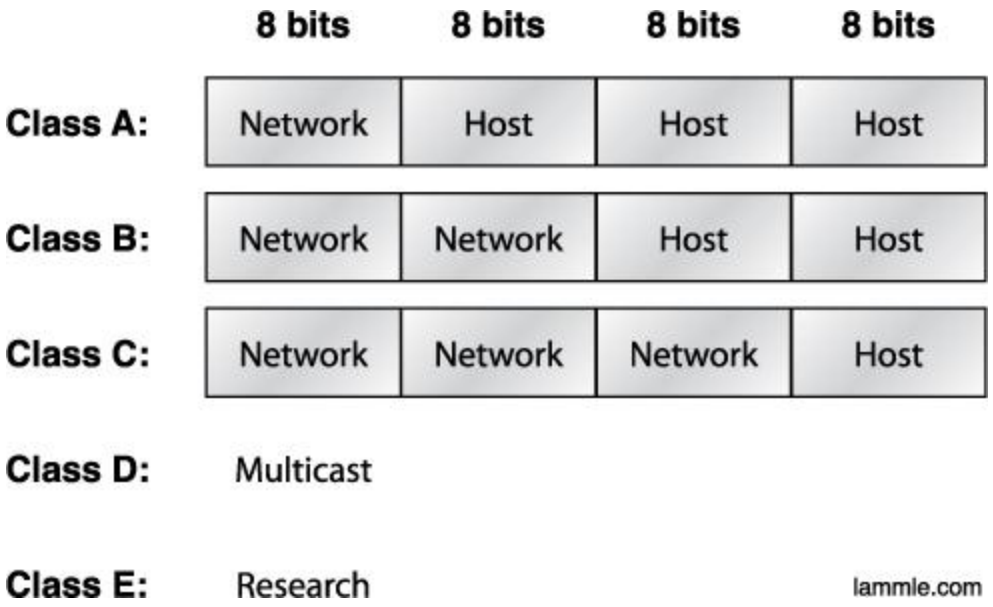
OCTET: An octet, made up of 8 bits, is just an ordinary 8-bit binary number. In this chapter, the terms byte and octet are completely interchangeable.

Network address: This is the designation used in routing to send packets to a remote network—for example, 10.0.0.0, 172.16.0.0, and 192.168.10.0.

Broadcast address: The address used by applications and hosts to send information to all nodes on a network is called the broadcast address.

Network Addressing

Subdividing an IP address into a network and node address is determined by the class designation of one's network. This figure summarizes the three classes of networks



0-127

128 - 191

192-223

224 - 239

240 - 225

Reserved Addressing

Address	Function
Network address of all 0s	Interpreted to mean “this network or segment.”
Network address of all 1s	Interpreted to mean “all networks.”
Network 127.0.0.1	Reserved for loopback tests.
Node address of all 0s	Interpreted to mean “network address” or any host on specified network.
Node address of all 1s	Interpreted to mean “all nodes” on the specified network
Entire IP address set to all 0s	Used by Cisco routers to designate the default route. Could also mean “any network.”
Entire IP address set to all 1s	(same as Broadcast to all nodes on the current network; 255.255.255.255) sometimes called an “all 1s broadcast” or limited broadcast

Private Addressing

Address Class	Reserved Address Space
Class A	10.0.0.0 through 10.255.255.255
Class B	172.16.0.0 through 172.31.255.255
Class C	192.168.0.0 through 192.168.255.255

Written Labs and Review Questions

- Open your books and go through all the written labs and the review questions.
- Review the answers in class.