Computer Networks and Internets

《计算机网络与因特网》课件

林坤辉

PART IV Internetworking

Chapter 21 IP: Internet Protocol addresses

IP：互联网协议地址

21.2 Addresses for the Virtual Internet 虚拟互联网地址

- **The goal of internetworking is to provide a seamless(无缝) communication system.**

- **Internet protocol software must hide the details of physical networks and offer the facilities of a large virtual network.**

- **An internet is merely an abstraction imagined by its designers and created entirely by software.**

- **To give the appearance of a single,uniform system,all host computers must use a uniform addressing scheme,and each address must be unique.**

- **To guarantee uniform addressing for all hosts,protocol software defines an addressing scheme that is independent of the underlying physical addresses.**

- **Users, application programs, and higher layers of protocol software use the abstract protocol addresses to communication.**

- **The designers are free to choose addresses, packet formats, and delivery techniques independent of the details of the physical hardware.**

21.3   The IP Addressing Scheme
IP编址方案

- **In the TCP/IP protocol stack, addressing is specified by the Internet Protocol(IP) .**

- **Each host is assigned a unique 32-bit number known as the host's Internet Protocol address(or IP address).**

- **To transmit information across a TCP/IP internet, a computer must know the IP address of the remote computer to which the information is being sent.**

21.4 The IP Address Hierarchy
IP地址层次

- **Each 32-bit IP address is divided into two parts: a prefix and suffix.**

- **The address prefix identifies the physical network to which the computer is attached.**

- **The suffix identifies an individual computer on that network.**

- Each physical network in an internet is assigned a unique value known as a network number.

- Network number assignments must be coordinated globally.

- Each computer on a given physical network is assigned a unique address suffix .

- suffixes can be assigned locally without global coordination.

21.5 Original Classes of IP Addresses IP地址分类

21.6 Computing The Class of An Address 地址类别的计算

- **Whenever it handles a packet, IP software needs to separate the destination address into a prefix and suffix .**

- **Classful IP addresses were called self identifying(自标识的)**

First Four Bits Of Address	Table Index (in decimal)	Class of Address
0000	0	A
0001	1	A
0010	2	A
0011	3	A
0100	4	A
0101	5	A
0110	6	A
0111	7	A
1000	8	B
1001	9	B
1010	10	B
1011	11	B
1100	12	C
1101	13	C
1110	14	D
1111	15	E

21.7 Classes and Dotted Decimal Notation 类别和点分十进制表示法

32-bit Binary Number	Equivalent Dotted Decimal
10000001 00110100 00000110 00000000	129 . 52 . 6 . 0
11000000 00000101 00110000 00000011	192 . 5 . 48 . 3
00001010 00000010 00000000 00100101	10 . 2 . 0 . 37
10000000 00001010 00000010 00000011	128 . 10 . 2 . 3
10000000 10000000 11111111 00000000	128 . 128 . 255 . 0

Class	Range of Values
A	0 through 127
B	128 through 191
C	192 through 223
D	224 through 239
E	240 through 255

21.9 Division of the Address Space
地址空间的划分

Address Class	Bits In Prefix	Maximum Number of Networks	Bits In Suffix	Maximum Number Of Hosts Per Network
A	7	128	24	16777216
B	14	16384	16	65536
C	21	2097152	8	256
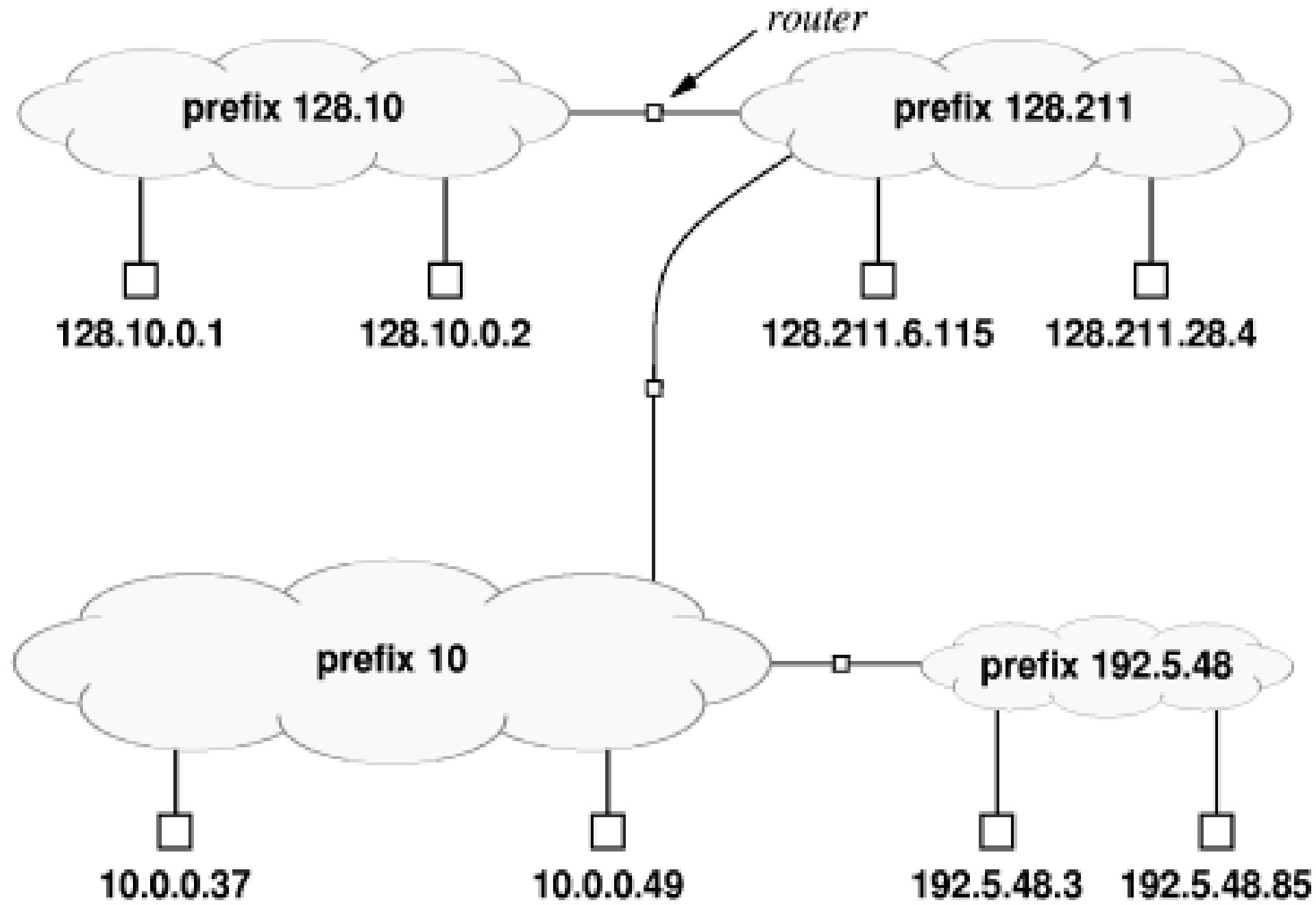
21.12 Subnet and Classless Addressing

- Address mask or subnet mask specify the boundary the network prefix and the suffix.

- A==(D & M);

  D: IP address;

  M: subnet mask

- CIDR notation: 128.10.0.0/16

21.16 CIDR Host Addresses

Network Prefix 128.211.0.16 / 28

0   28   31

| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Address Mask 255.255.255.240

0   28   31

| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |

Lowest Host Address 128.211.0.17

0   28   31

| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |

Highest Host Address 128.211.0.30

0   28   31

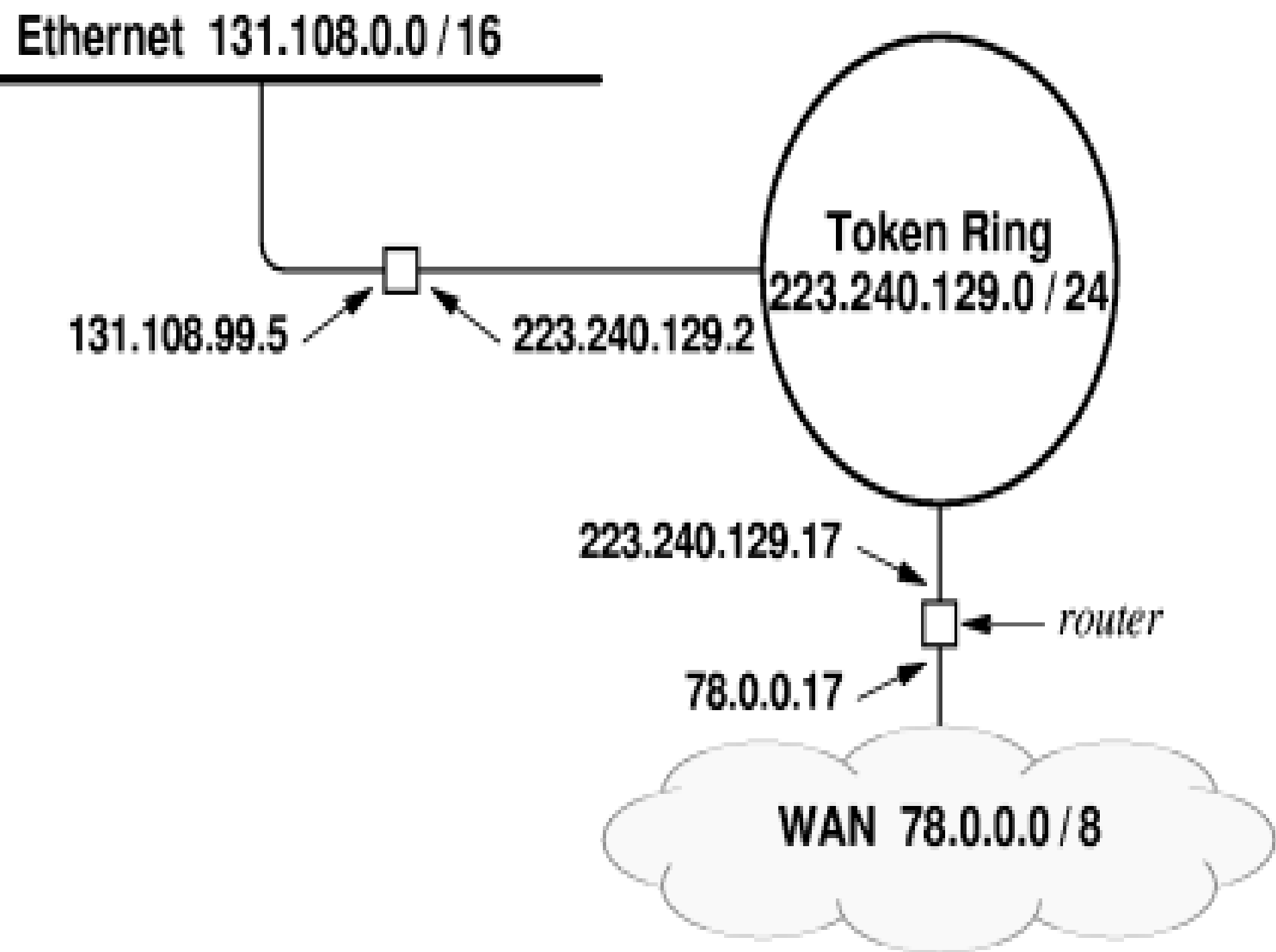| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 |

21.17 Special IP Addresses

- **Network address(网络地址):**
- **Directed Broadcast Address(直接广播地址).**
- **Limited Broadcast Address(有限广播地址).**
- **This Computer address(本机地址).**
- **Loopback address(回送地址).**

21.18 Summary of Special IP Addresses

Prefix	Suffix	Type Of Address	Purpose
all-0s	all-0s	this computer	used during bootstrap
network	all-0s	network	identifies a network
network	all-1s	directed broadcast	broadcast on specified net
all-1s	all-1s	limited broadcast	broadcast on local net
127	any	loopback	testing

21.20 Routers and the IP Addressing principle

- An IP address does not identify a specific computer, Instead, each IP address identifies a connection between a computer and a network.

- A computer with multiple network connections must be assigned one IP address for each connection.

- A router has connections to multiple physical networks

- Each router is assigned two or more IP addresses.

Ethernet 131.108.0.0 / 16

Token Ring
223.240.129.0 / 24

131.108.99.5

223.240.129.2

223.240.129.17

router

78.0.0.17

WAN 78.0.0.0 / 8

作业

- 已知IP地址
  - 218.193.48.48/27
  - 6.23.136.43/16
- 求
  - 地址类型
  - 网络位数、子网位数、主机位数
  - 子网掩码
  - 子网掩码支持的子网数量、一个子网内的主机数量