

Chapter 20 and 21 is mostly covered in this document. Read Chapter 22 from book. I don't think slides are enough.

Many repeated exam questions from CIDR, double check that from the book. Subchapter (21.10)

## Chapter 20

### What is internet?

An Internet is a set of networks connected by routers that are configured to pass traffic among any computers attached to networks in the set

Will the Internet be replaced by a single networking technology? Why or why not?

No single networking technology is best for all needs. Because each network technology is designed to fit a specific set of constraints. E.g. LAN technologies are designed to provide communication across short distances, while WAN technologies are for large areas.

### Universal Service

- *A communications system that supplies universal service allows arbitrary pairs of computers to communicate.*
- *Although universal service is highly desirable, incompatibilities among network hardware, frames, and addresses prevent a bridged network from including arbitrary technologies.*
- To provide universal service among all computers on an internet, routers must agree to forward information from a source on one network to a specified destination on another.

What is the chief difficulty in providing universal service?

It is that a computer attached to a given network can only communicate with other computers attached to the same network.

### Internetworking

The resulting system of connected physical networks is known as an *internetwork* or *internet*.

### Physical Network Connection with Routers

- **Router:** The basic hardware component used to connect heterogeneous networks. **Check slide 25 L2**
- *An Internet router is a special-purpose hardware system dedicated to the task of interconnecting networks. A router can interconnect networks that use different technologies, including different media, physical addressing schemes, or frame formats.*

What are the two reasons an organization does not use a single router to connect all its networks?

- Instead of an expensive router that connects all networks, an organization usually buys multiple, small routers and can then upgrade them independently when their capacity is exceeded.
- Using multiple routers improves reliability and avoids a single point of failure.

## Review Of TCP/IP Layering

The five layers of TCP/IP are: Application, transport, internet, network interface, and physical.

Layer 3 (IP) specifies the format of packets sent across the Internet as well as the mechanisms used to forward packets from a computer through one or more routers to a final destination.

Layer 4 (TCP) specifies the messages and procedures that are used to ensure reliable transfer.

## Chapter 21

- Why IPv6? Because of the growth of the internet. The IPv4 was defined when there were only few computer networks. The designers decided to use 32 bits for an IP address.
- Because IP lies at the center of Internet communication, all applications use IP, and IP runs over all underlying network technologies, changing IP requires a change to the entire internet.
- To provide uniform addressing in the Internet, IP defines an abstract addressing scheme that assigns each host a unique protocol address; applications use IP addresses to communicate.
- An Internet address (IP address) is a unique binary number assigned to a host and used for all communication with the host. IPv4 uses **32-bit** addresses, and IPv6 uses **128-bit** addresses.

### The IP Address Hierarchy

Each IP address is divided into two parts: a prefix and a suffix.

- ❖ IP prefix identifies the physical network
- ❖ IP suffix identifies a specific computer on the network

The important point is that the IP address scheme guarantees two properties:

- ❖ Each computer is assigned a unique address
- ❖ Although network number assignments must be coordinated globally, suffixes can be assigned locally without global coordination.

### Original Classes of IPv4 Addresses

#### 2015\_3\_21 problem 1 c

The original scheme, which is known as *classful IP addressing*, divided the IPv4 address space into three primary *classes*, where each class has a different size prefix and suffix.

	bits	0	1	2	3	4	8	16	24	31	
Class A		0	prefix				suffix				
Class B		1	0	prefix				suffix			
Class C		1	1	0	prefix				suffix		
Class D		1	1	1	0	multicast address					
Class E		1	1	1	1	reserved (not assigned)					

**Figure 21.2** The five classes of IPv4 addresses in the original classful scheme.

Although the classful scheme has been superseded, class *D* addresses are still used for multicasting, which allows delivery to a set of computers. multicast address corresponds to a group of computers. *Multicasting is not available across the global Internet.*

## IPv4 Dotted Decimal Notation

### Exam 2018. Problem 1 a

*Dotted decimal notation is a syntactic form that IPv4 software uses to express 32-bit binary values when interacting with humans. Dotted decimal represents each octet in decimal and uses a dot to separate octets.*

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

## IPv4 Subnet and Classless Addressing

### 2015\_3\_21 problem 1

[Subnet addressing](#), and [Classless addressing](#) are two mechanisms to overcome the limitation of IPv4. Instead of having three distinct address classes, **allow the division between prefix and suffix to occur on an arbitrary bit boundary**. [Subnet addressing](#) was initially used within large organizations that attached to the global Internet, and [classless addressing](#) extended the approach to the entire Internet.

Classless addressing allows an ISP to divide class C prefix into four longer prefixes that each accommodate a network of up to 62 hosts.

## Address Masks

Important. Read page 353-356 All. Exam repeated questions.

## 21.18 Routers and The IPv4 Addressing Principle

*An IPv4 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 (e.g., a router) must be assigned one IPv4 address for each connection.*

## 21.21 IPv6 Addressing

### Slide 11 L3

Each IPv6 address is one of the three basic types listed in this Figure

Type	Purpose
unicast	The address corresponds to a single computer. A datagram sent to the address is routed along a shortest path to the computer.
multicast	The address corresponds to a set of computers, and membership in the set can change at any time. IPv6 delivers one copy of the datagram to each member of the set.
anycast	The address corresponds to a set of computers that share a common prefix. A datagram sent to the address is delivered to exactly one of the computers (e.g., the computer closest to the sender).

## 22.3 Virtual Packets

Not in slides. But important to know how the packets are being forwarded.

Chapter 22 is important read it all...