TCP/IP-(18MCA45E)
UNIT-I
‘A Brief History: (TCP/IP)’

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TEXT BOOKS: 1. Behrouz A. Forouzan, “TCP/IP Protocol Suite”, Second edition, Tata Mcgraw – Hill Publishing Company.

REFERENCE BOOKS: 1. W. Richard Stevens, “TCP/IP Illustrated Volume1, The Protocols”, Pearson Education. 2. Comer, “Internetworking with TCP / IP, Vol. 1: Principles, Protocols & Architecture, “Fourth Edition, Pearson Education.

Brief history

- A network is a group of connected, communicating devices such as computers and printers. An internet (note the lowercase i) is two or more networks that cancommunicate with each other.
- The most notable internet is called the Internet (uppercase I), composed of hundreds of thousands of interconnected networks.
- Private individuals as well as various organizations such as government agencies, schools, research facilities, corporations, and libraries in more than 100 countries use the Internet. Millions of people are users. Yet this extraordinary communication system only came into being in 1969.
- ARPANET In the mid-1960s , mainframe computers in research organizations were stand-alone devices. Computers from different manufacturers were unable to communicate with one another.
- The Advanced Research Projects Agency (ARPA) in the Department of Defense (DOD) , thereby reducing costs and eliminating duplication of effort. In 1967, at an Association for Computing Machinery (ACM) meeting, ARPA presented its ideas for ARPANET, a small network of connected computers.

Arpanet

- In the mid-1960s, mainframe computers in research organizations were stand-alone devices.
- Computers from different manufacturers were unable to communicate with one another. The Advanced Research Projects Agency (ARPA) in the Department of Defense (DOD) was interested in finding a way to connect computers together so that the researchers they funded could share their findings, thereby reducing costs and eliminating duplication of effort.
- In 1967, at an Association for Computing Machinery (ACM) meeting, ARPA presented its ideas for ARPANET, a small network of connected computers.
- The idea was that each host computer (not necessarily from the same manufacturer) would be attached to a specialized computer, called an Interface Message Processor (IMP).
- The IMPs, in turn, would be connected to each other. Each IMP had to be able to communicate with other IMPs as well as with its own attached host. By 1969, ARPANET was a reality.
- Four nodes, at the University of California at Los Angeles (UCLA), the University of California at Santa Barbara (UCSB), Stanford Research Institute (SRI), and the University of Utah, were connected via the IMPs to form a network. Software called the Network Control Protocol (NCP) provided com

Transmission Control Protocol/Internetworking Protocol (TCP/IP)

- Cerf and Kahn's landmark 1973 paper outlined the protocols to achieve end-to-end delivery of data.
- This was a new version of NCP. This paper on transmission control protocol (TCP) included concepts such as encapsulation, the datagram, and the functions of a gateway.
- A radical idea was the transfer of responsibility for error correction from the IMP to the host machine. This ARPA Internet now became the focus of the communication effort.
- Around this time responsibility for the ARPANET was handed over to the Defense Communication Agency (DCA).
- In October 1977, an internet consisting of three different networks (ARPANET, packet radio, and packet satellite) was successfully demonstrated.
- Communication between networks was now possible. Shortly thereafter, authorities made a decision to split TCP into two protocols: Transmission Control Protocol (TCP) and Internet Protocol (IP).

MILNET

- In 1983, ARPANET split into two networks: MILNET for military users and ARPANET for nonmilitary users.

CSNET

- Another milestone in Internet history was the creation of CSNET in 1981.
- CSNET was a network sponsored by the National Science Foundation (NSF).
- The network was conceived by universities that were ineligible to join ARPANET due to an absence of defense ties to DARPA.
- CSNET was a less expensive network; there were no redundant links and the transmission rate was slower.
- It featured connections to ARPANET and Telnet, the first commercial packet data service. By the middle 1980s, most U.S. universities with computer science departments were part of CSNET.
- Other institutions and companies were also forming their own networks and using TCP/IP to interconnect. The term Internet, originally associated with government-funded connected networks, now referred to the connected networks using TCP/IP protocols.

NSFNET

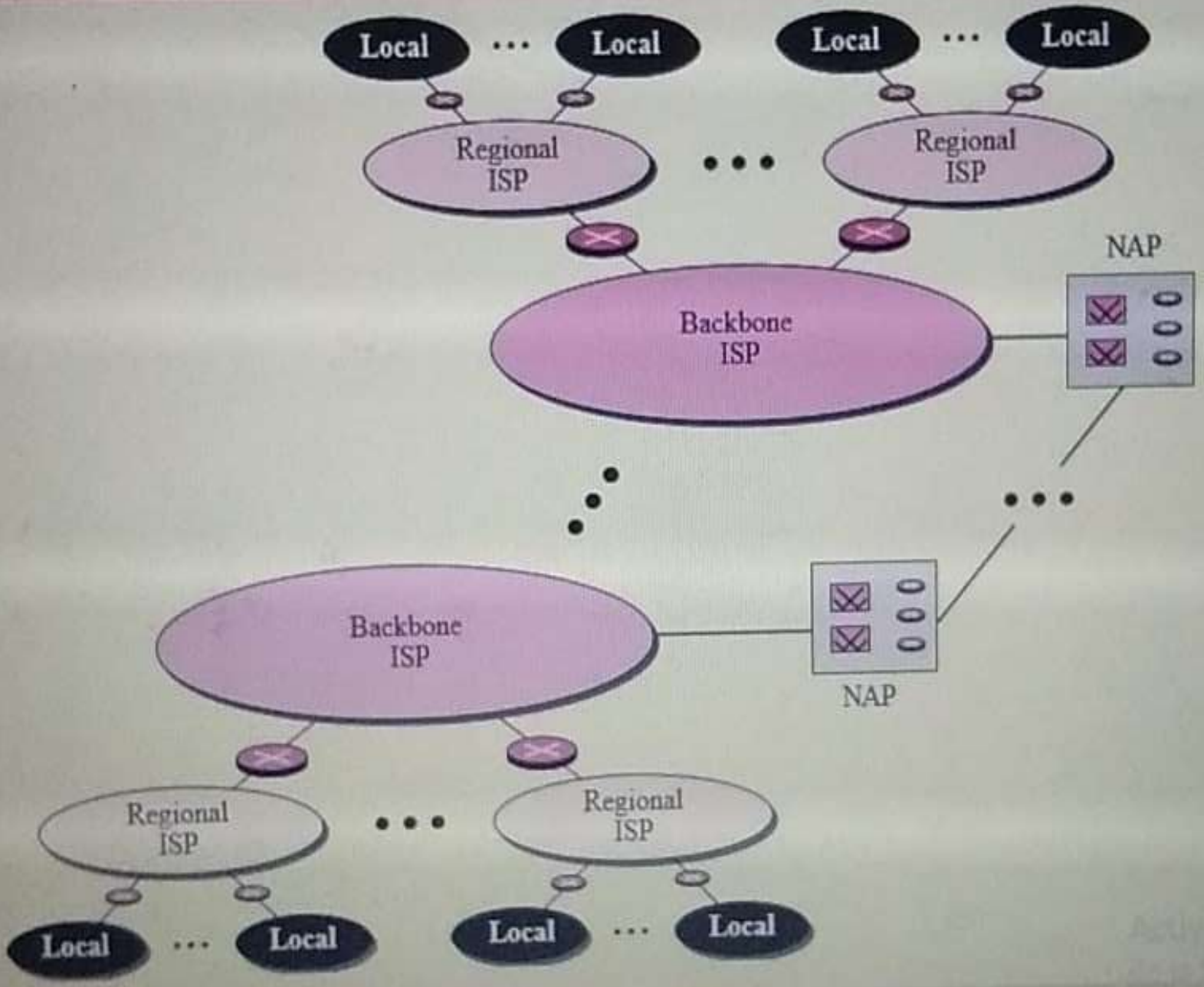
- NSFNET With the success of CSNET, the NSF, in 1986, sponsored NSFNET, a backbone that connected five supercomputer centers located throughout the United States.
- Networks were allowed access to this backbone, a T-1 line with a 1.544-Mbps data rate, thus providing connectivity throughout the United States.
- In 1990, ARPANET was officially retired and replaced by NSFNET.
- In 1995, NSFNET reverted back to its original concept of a research network

ANSNET

- In 1991, the U.S. government decided that NSFNET was not capable of supporting the rapidly increasing Internet traffic.
- Advanced Network and Services (ANS) .

The Internet Today

- The Internet today is not a simple hierarchical structure.
- It is made up of many wide and local area networks joined by connecting devices and switching stations.
- Today most end users who want Internet connection use the services of Internet service providers (ISPs).
- There are international service providers, national service providers, regional service providers, and local service providers


Local
Local
Local
Local
Regional ISP
Regional ISP
NAP
Backbone ISP
Backbone ISP
NAP
Regional ISP
Regional ISP
Local
Local
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Local

Backbone ISPs

- Backbone ISPs are created and maintained by specialized companies.
- There are many backbone ISPs operating in North America; some of the most well-known are Sprint Link, Spinet, UUNet Technology, AGIS, and internet MCI.

Regional ISPs

- Regional ISPs are small ISPs that are connected to one or more backbone ISPs.
- They are at the second level of hierarchy with a lesser data rate.

Local ISPS :-

- Local ISPs provide direct service to the end users. The local ISPs can be connected to regional ISPs or directly to backbone ISPs.

World Wide Web :-

- The 1990s saw the explosion of the Internet applications due to the emergence of the World Wide Web (WWW).
- The web was invented at CERN by Tim Berners-Lee.
- This invention has added the commercial applications to the Internet.

PROTOCOLS AND STANDARDS

- **In this section, we define two widely used terms: protocols and standards. First, we define protocol, which is synonymous with "rule." Then we discuss standards, which are agreed-upon rule.**

Protocols :

- Communication between two people or two devices needs to follow some protocol. A protocol is a set of rules that governs communication.

For example

- in a face-to-face communication between two persons, there is a set of implicit rules in each culture that define how two persons should start the communication, how to continue the communication, and how to end the communication.

Syntax:-

- Syntax refers to the structure or format of the data, meaning the order in which they are presented.

Semantics :-

- Semantics refers to the meaning of each section of bits. How is a particular pattern to be interpreted.

Timing:-

- Timing refers to two characteristics: when data should be sent and how fast it can be sent.

Standards:-

- Standards are essential in creating and maintaining an open and competitive market for equipment manufacturers and also in guaranteeing national and international interoperability of data and telecommunications technology and processes.

Defacto:-

- Standards that have not been approved by an organized body but have been adopted as standards through widespread use are de facto standards.

De jure:-

- De jure standards are those that have been legislated by an officially recognized body.

STANDARDS ORGANIZATIONS

- Standards are developed through the cooperation of standards creation committees, forums, and government regulatory agencies.

Standards Creation Committees:-

- International Standards Organization (ISO).
- International Telecommunications Union–Telecommunications Standards Sector (ITU-T).
- Consultative Committee for International Telegraphy and Telephony (CCITT).
- American National Standards Institute (ANSI).
- Institute of Electrical and Electronics Engineers (IEEE).
- Electronic Industries Association (EIA).
- World Wide Web Consortium (W3C).
- Open Mobile Alliance (OMA).

TCP/IP Protocol Suite

Some of the protocols included in the TCP/IP suite are:

- ARP (Address Resolution Protocol) – used to associate an IP address with a MAC address.
- IP (Internet Protocol) – used to deliver packets from the source host to the destination host based on the IP addresses.
- ICMP (Internet Control Message Protocol) – used to detects and reports network error conditions. Used in ping.
- TCP (Transmission Control Protocol) – a connection-oriented protocol that enables reliable data transfer between two...

TCP/IP Addressing

- Internet Addresses. The Internet Protocol (IP) uses a 32-bit, two-part address field. ...
- Subnet Addresses. Subnet addressing allows an autonomous system made up of multiple networks to share the same Internet address.
- Broadcast Addresses. ...
- Local Loopback Addresses. ...
- Getting an Official Internet Address. ...

Connection Devices

Devices used in each layer of TCP/IP model

- Hubs: Hubs are devices commonly used to connect segments of a LAN. It contains multiple input/output ports. when signal...
- Cables: In Wired network architecture (e.g Ethernet), cables are used to interconnect the devices. some of the types of...
- Repeaters: Repeaters are used in transmission systems to regenerate analog or digital signals distorted by transmission...

Classful addressing

- When the Internet's address structure was originally defined, every uncast IP address had a network portion, to identify the network on which the interface using, Basic IP Address Structure 35
- The IP address was to be found, and a host portion, used to identify the particular host on the network given in the network portion.

Class	Address Range	High Order Bits	use	Fraction of Total	number of Nets	Number of host
A	191.255.	0	Uncast/special	1/2	128	16,777,216
B	191.255.2.5	10	Uncast/special	1/4	1267	16,77
C	191.255.25.255	110	Uncast/special	1/16	456	16,7
D	191.5.25.255	1110	Uncast/special	1/18	N/A	N/A
E	2.55.255.255	11110	Uncast/special	1/18	N/A	N/A

Subnet Addressing

- One of the earliest difficulties encountered when the Internet began to grow was the inconvenience of having to allocate a new network number for any new network segment that was to be attached to the Internet.
- the development and increasing use of local area networks (LANs) in the early 1980s

Supernetting

- Supernetting in Network Layer. Supernetting is the opposite of Subnetting. In subnetting, a single big network is divided into multiple smaller subnetworks. In Supernetting, multiple networks are combined into a bigger network termed as a Supernetwork or Supernet. Supernetting is mainly used in Route Summarization,..

CLASSLESS Addressing

- In each IPv4 sub network, a special address is reserved to be the subnet broadcast address.
- The subnet broadcast address is formed by setting the network/sub network portion of an IPv4 address to the appropriate value and all the bits in the Host field to 1. Consider the left-most subnet from Figure 2-5. Its prefix is 128.32.1.0/24.
- The subnet broadcast address is constructed by inverting the subnet mask (i.e., changing all the 0 bits to 1 and vice versa) and performing a bitwise OR operation with the address of any of the computers on the subnet (or, equivalently, the network/sub network prefix).
- Recall that the result of a bitwise OR operation is 1 if either input bit is 1. Using the IPv4 address 128.32.1.14

Thank you

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