CSM 152: NETWORKING AND INTERNET

LESSON 2

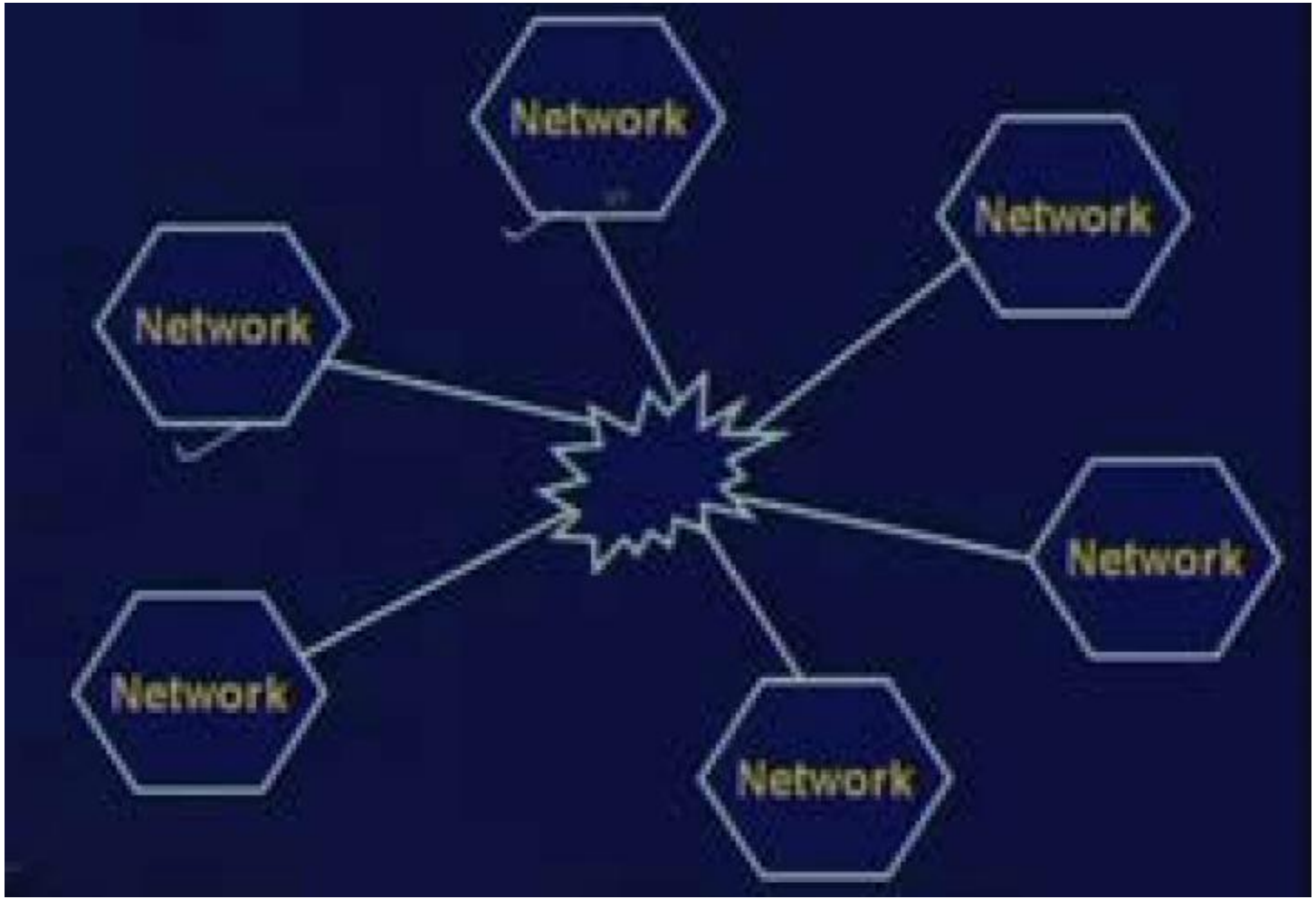
Dr. Gaddafi Abdul-Salaam
Department of Computer Science
Faculty of Physical Sciences
College of Science

Introduction to Internet

What is Internet?

The network formed by the co-operative interconnection of a large number of computer networks.

- Network of networks
- No one owns the Internet
  - Every person who makes a connection owns a slice of the network
- There is no central administration to the Internet.


Network
Network
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Network

So what is it actually?

- A community of people
  - Who use and develop the networks.
- A collection of resources
  - That can be reached from those resources
- A setup to facilitate collaboration
  - Among members of the research and educational communities, world–wide.
- The connected network use the TCP/IP protocol.

Key milestones in evolution

1950s –

- ARPA (Advanced Research Projects Agency).

1970-

- ARPANET creates precursor to Transmission Control Protocols(TCP)

1971-

- universities added to the network
- Telnet and FTP are available

1972-

- First electronic mail message sent

Contd.

1973–

ARPANET connected to England and Norway

1974-

TCP starts being used for communicating across a system of networks

1982-

- US DoD starts building defense data networks based on ARPANET technology

1983-

- ARPANET splits into ARPANET and MILNET

Contd.

1983–

- Internet now in place
- TCP/IP standard

1986-

National Science Foundation (NSF) implements NSFNET; a system of regional network of routers connected over a backbone network.

1991-

- Archie and Gopher released

Contd.

1992–

- Internet links more than 17,000 networks in 33 countries; 3 million hosts.

1993-

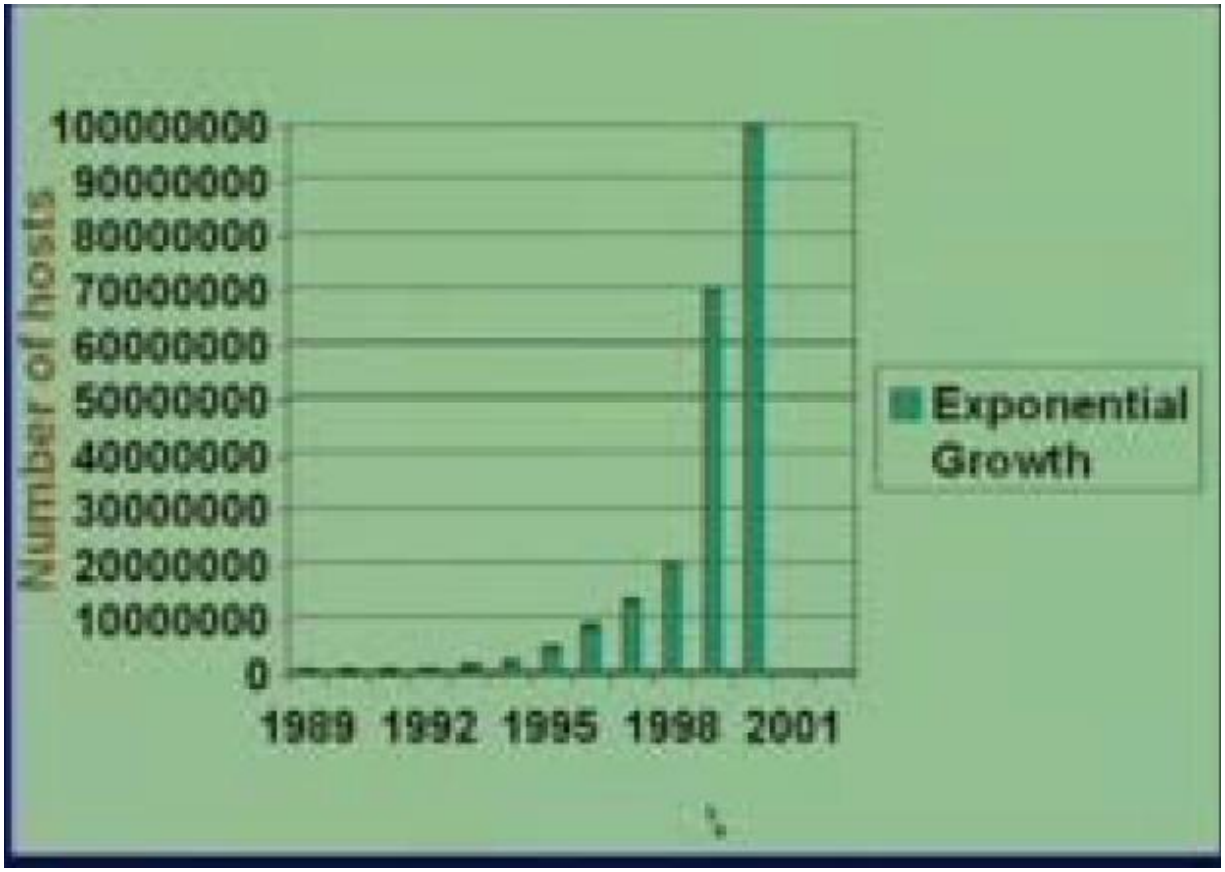
- World Wide Web is launched

1995-

- Interconnected network providers starts offering service

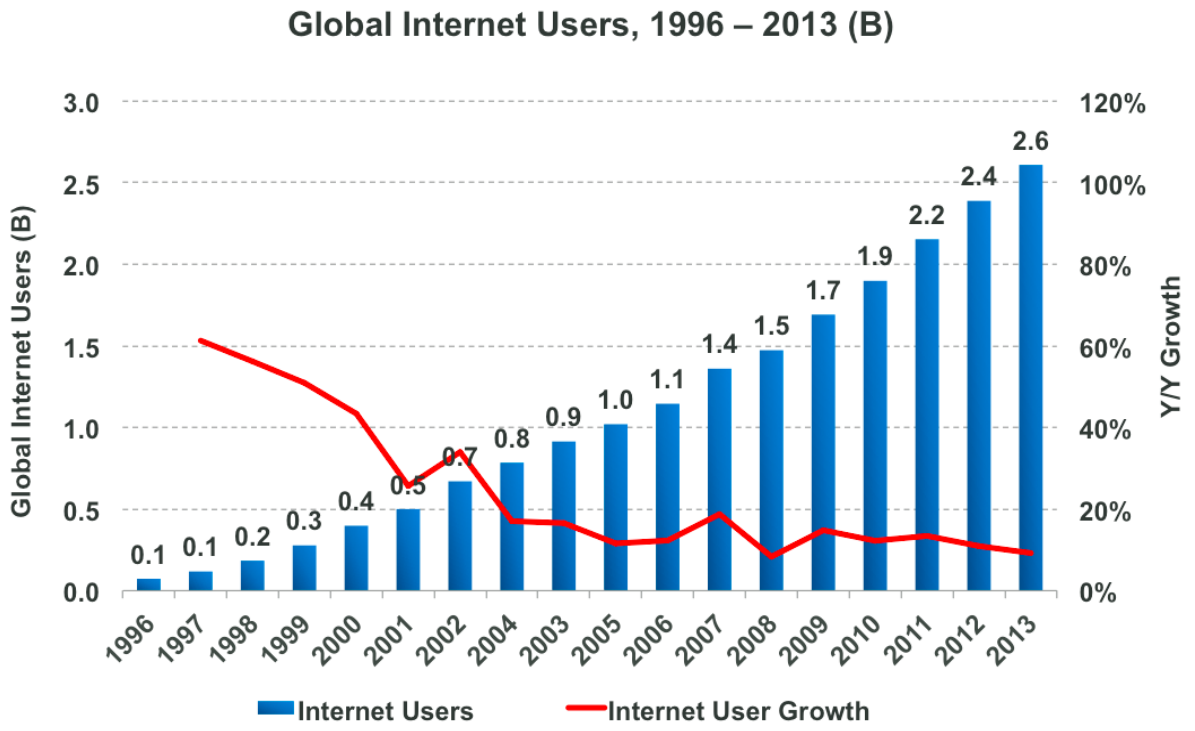
1995-

- About 30 million users


100000000
90000000
80000000
70000000
60000000
50000000
40000000
30000000
20000000
10000000
0
Number of hosts
1989
1992
1995
1998
2001
Exponential Growth

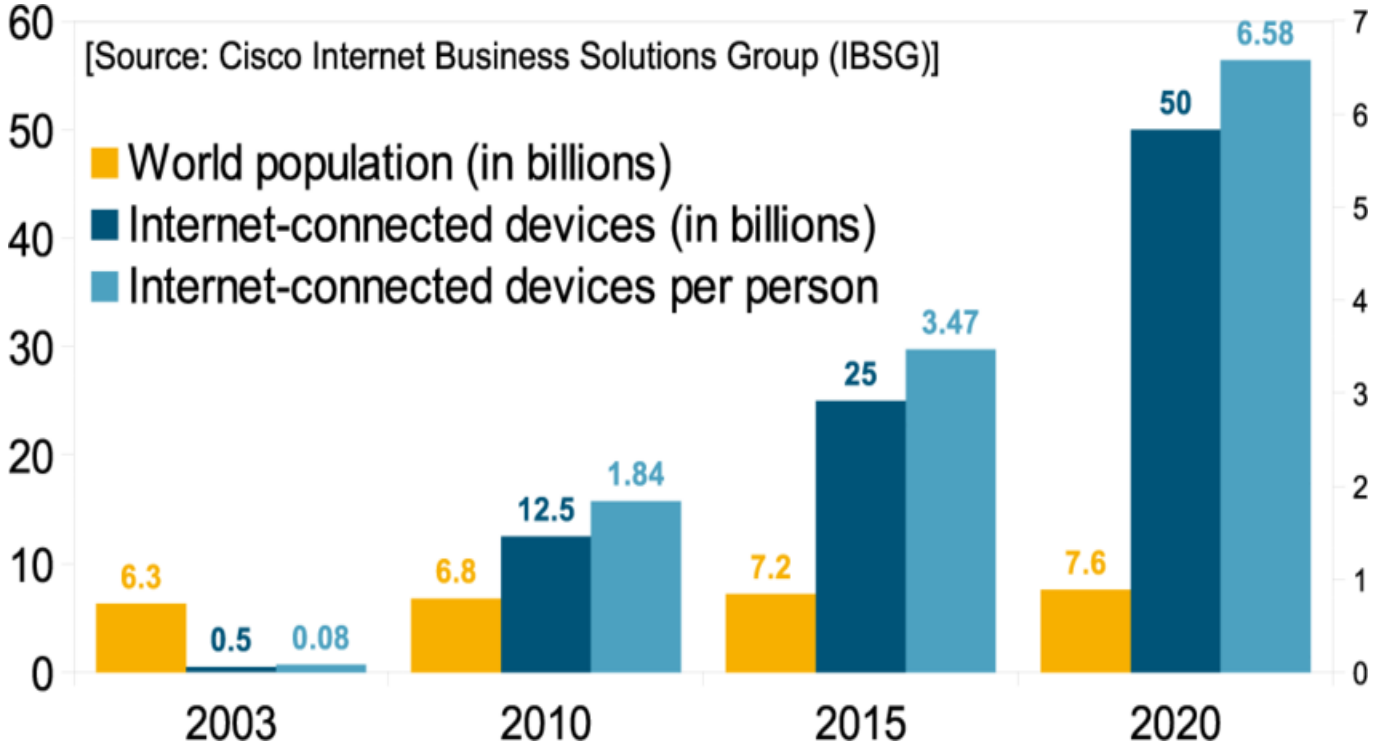
Growth of Internet

Internet User Growth =
+9% in 2013 vs. +11% in 2012 = Solid, But Slowing



@KPCB Source: United Nations / International Telecommunications Union, US Census Bureau, Euromonitor International.

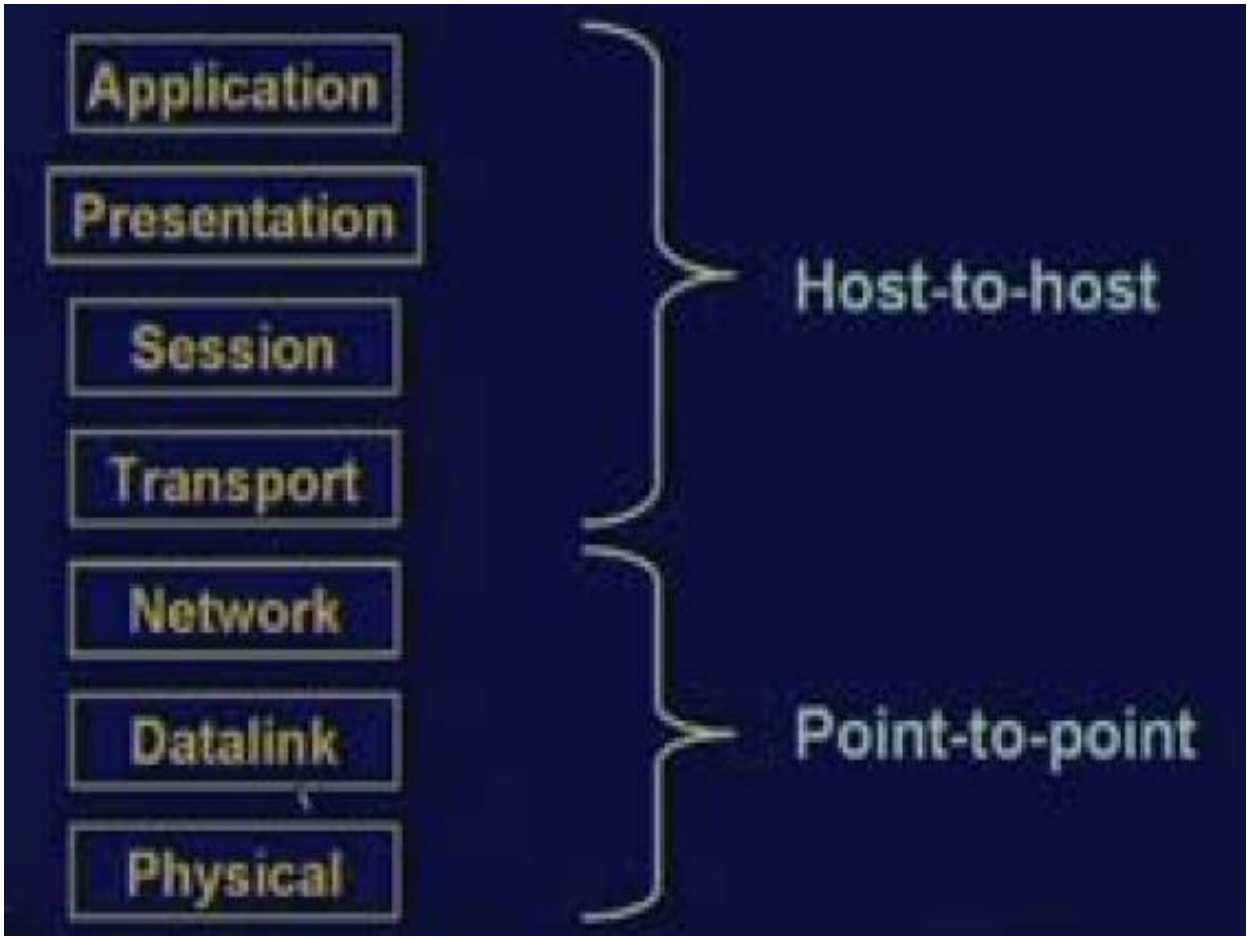
Growth of Internet



Layered Network Architecture

- Open systems Interconnection (OSI) reference model.
  - Seven layered model
  - Communication functions are partitioned into a hierarchical set of layers.
- Objective:
  - Systematic approach to design.
  - Changes in one layer should not require changes in other layers.

The 7-layer OSI model



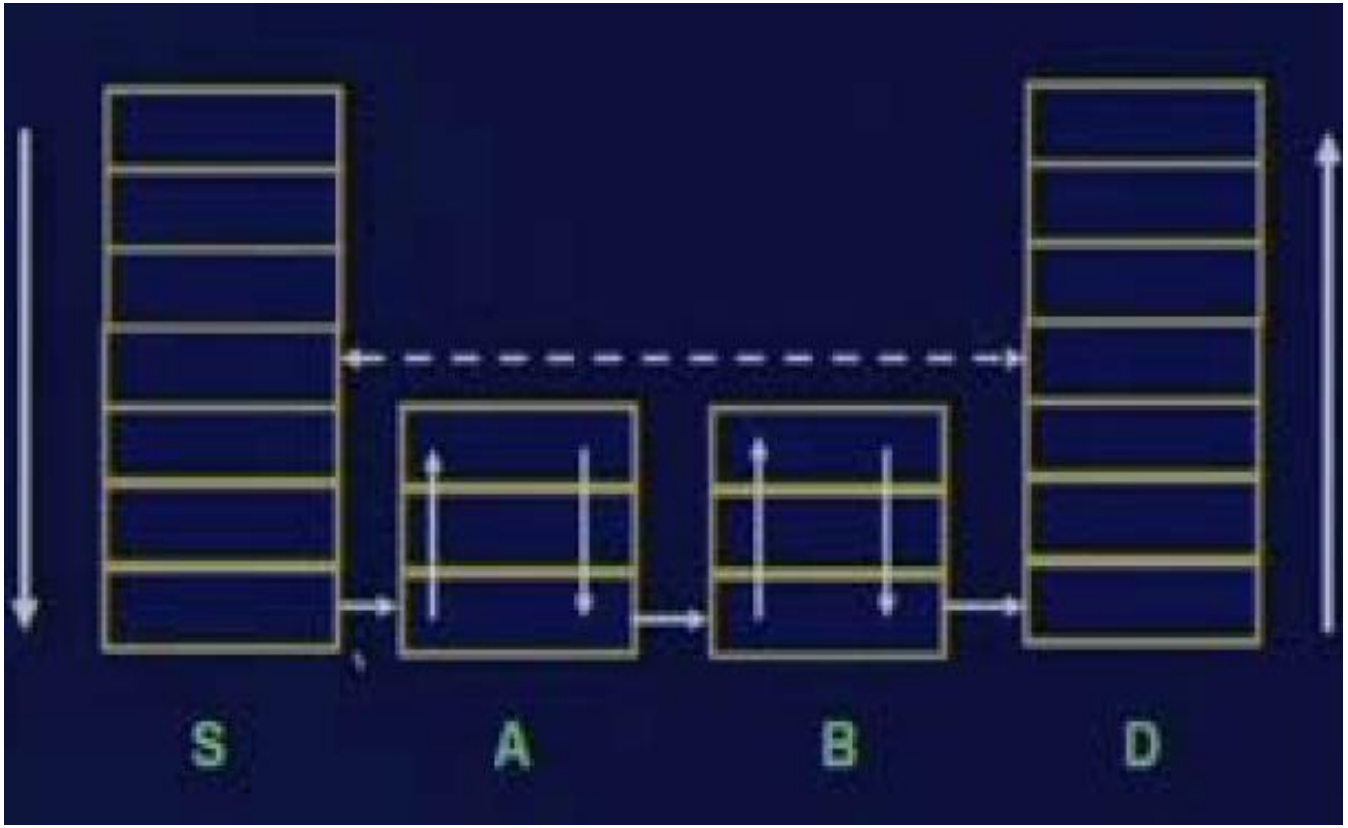
Layer functions

- Physical
  - Transmit raw bit stream over a physical medium.
- Data Link
  - Reliable transfer of frames over a point-to-point link (flow control, error control).
- Network
  - Establishing, maintaining and terminating connections.
  - Routes packets through point-to-point links.

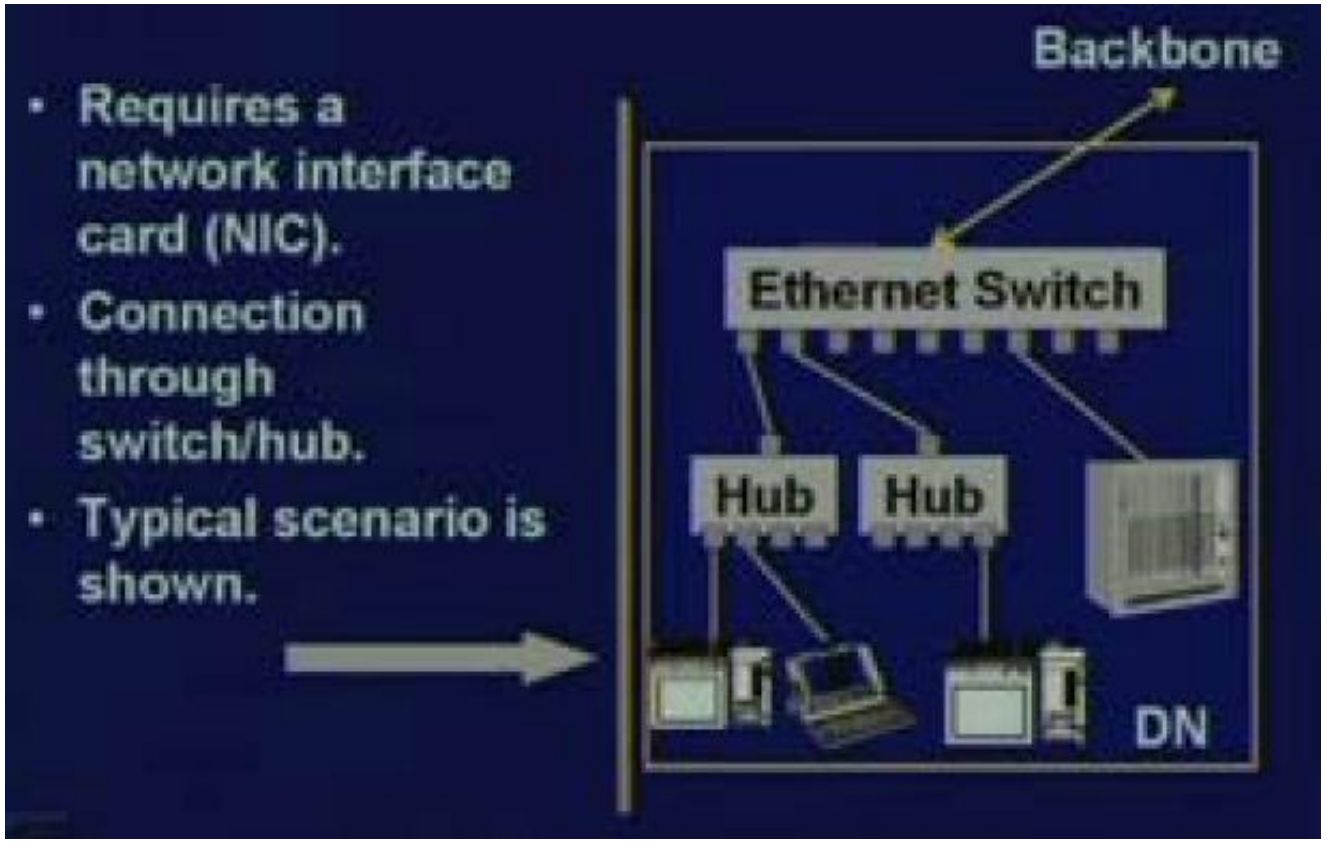
Layer function (contd.)

- Transport
  - End-to-end reliable data transfer, with error recovery and flow control.
- Session
  - Manages sessions.
- Presentation
  - Provides data independence.
- Application
  - Interface point for user applications.

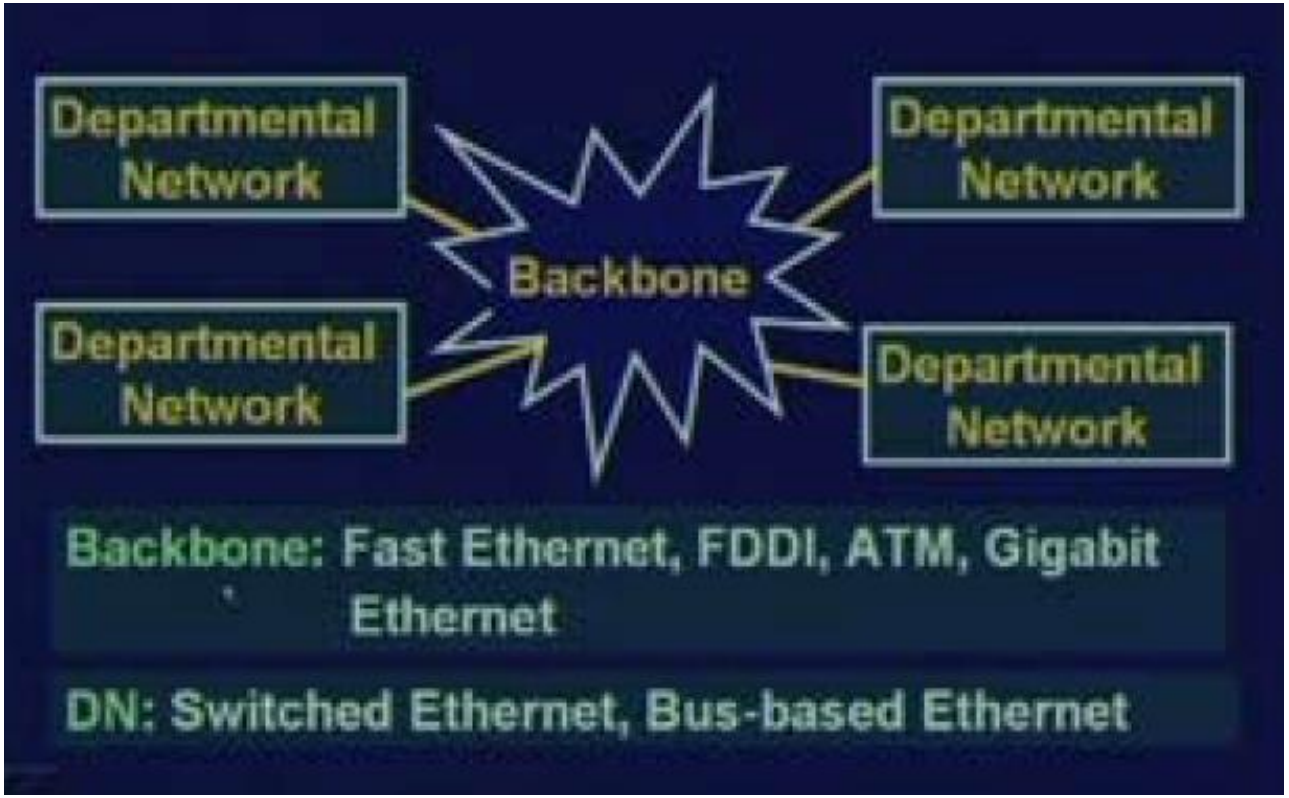
How Data Flows



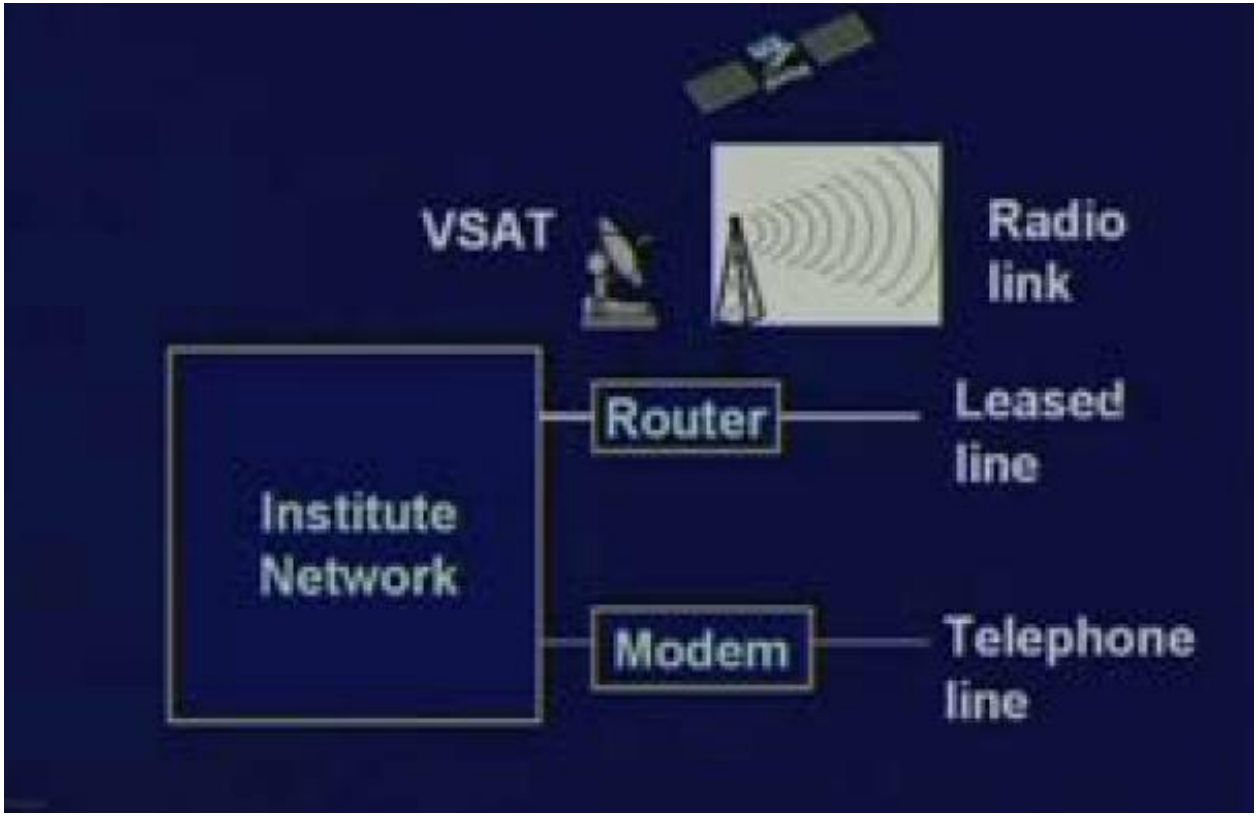
Connecting a computer to DN



Campus Network Schematic



Connecting to Outside World



Important Internet Applications

- TELNET
- File Transfer Protocol (FTP)
- Electronic Mail (Email)
- Gopher
- Internet Relay Chart (IRC)
- Usenet News
- World Wide Web

Request For Comments (RFC)

Internet Standards and RFC

- Internet Societies
  - Internet Architecture Board (IAB)
  - Internet Engineering Task Force (IETF)
  - Internet Engineering Steering Group (IESG)
- Request For Comments (RFC) publications
  - The actual development of new standards is carried out by working groups charted by the IETF
  - Membership is voluntary

- The process involved:
  - The working group makes a draft version of the document.
  - Places it in the “Internet draft” online directory.
  - Kept there for six months, and review and comments on the draft obtained.

- The IESG may approve the publication of the draft as an RFC during this period.
  - Or else it is withdrawn from the directory.
- The working group may subsequently publish a revised version of the draft.

Important RFCs

- RFC821: Simple Mail Transfer Protocol
- RFC791: Internet Protocol
- RFC793: Transmission Control Protocol
- RFC2616: Hypertext Transfer Protocol 1.1
- RFC2045: MIME-Multi-Purpose-Internet-Mail-Extensions
- RFC1321: DM5 Message Digest Algorithm
- RFC1866: Hypertext Markup Language
- RFC2437: RSA Crypt Specializations 2.0
- RFC2631: Diffie-Hellman Key Agreement

Where to find the RFCs

- Available in many web sites
- http://www.faqs.org/rfc
- http://www.ietf.org/rfc.html
- http://www.rfcnet.com

TCP/IP

- TCP/IP is the first set of protocols used in Internet.
- Allows computers to communicate / share resources across the network.
- Work on TCP/IP started in the 1970s.
  - Funded by the US Military- ARPA

TCP/IP and the Internet

- The modern internet sits on top of the TCP/IP technology.
  - used as a standard to bridge the gap between non compatible platforms.
  - All computers connected to the internet understand the TCP/IP.

Network layering in TCP/IP

In 1978, International Standards Organizations (ISO) proposed the 7 layer reference model for the network services and protocols.

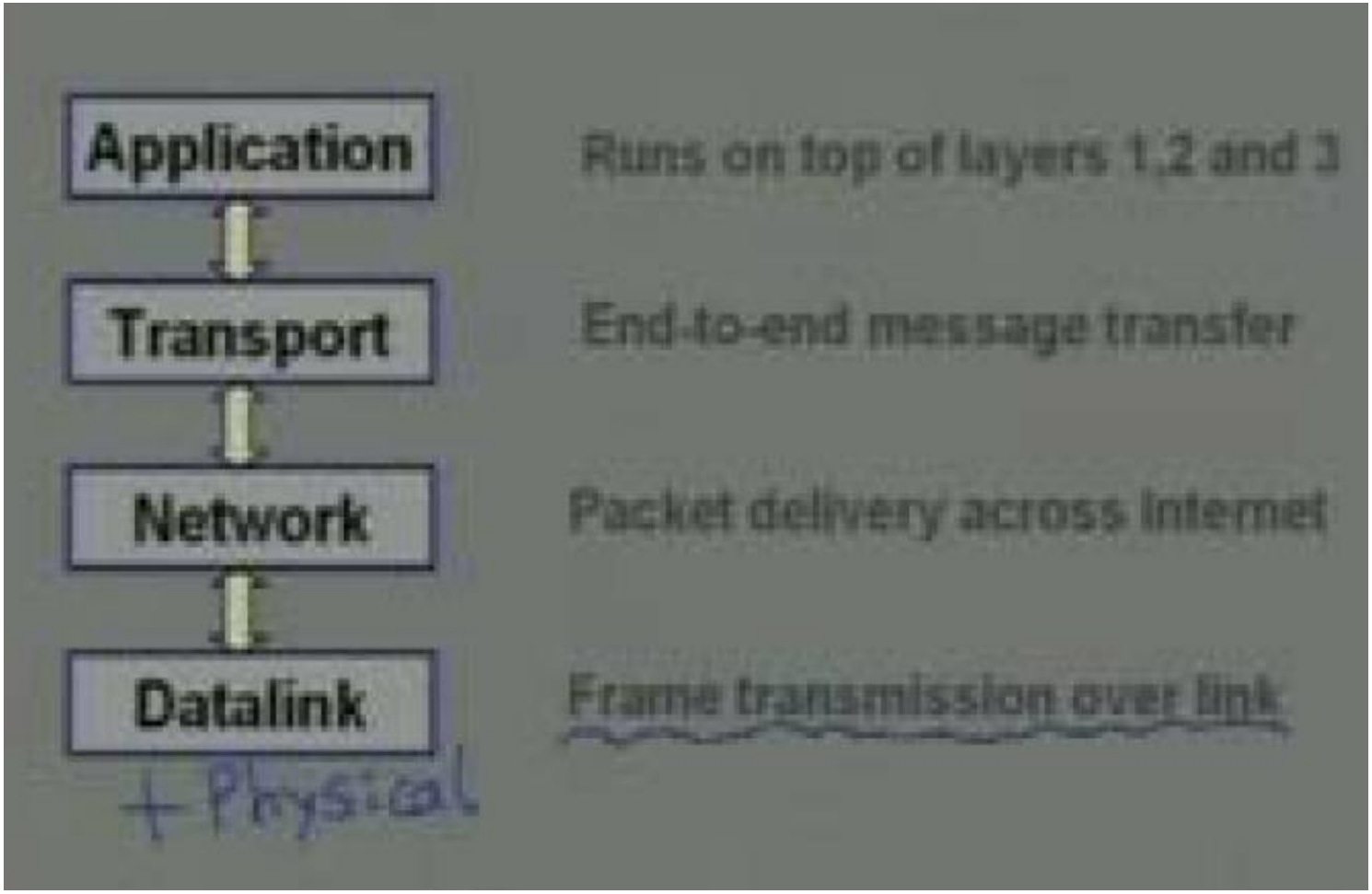
- Known as the OSI model
- TCP/IP does not strictly follow this 7-layer model.
- TCP/IP follows a simplified 4 layer model

Why layering?

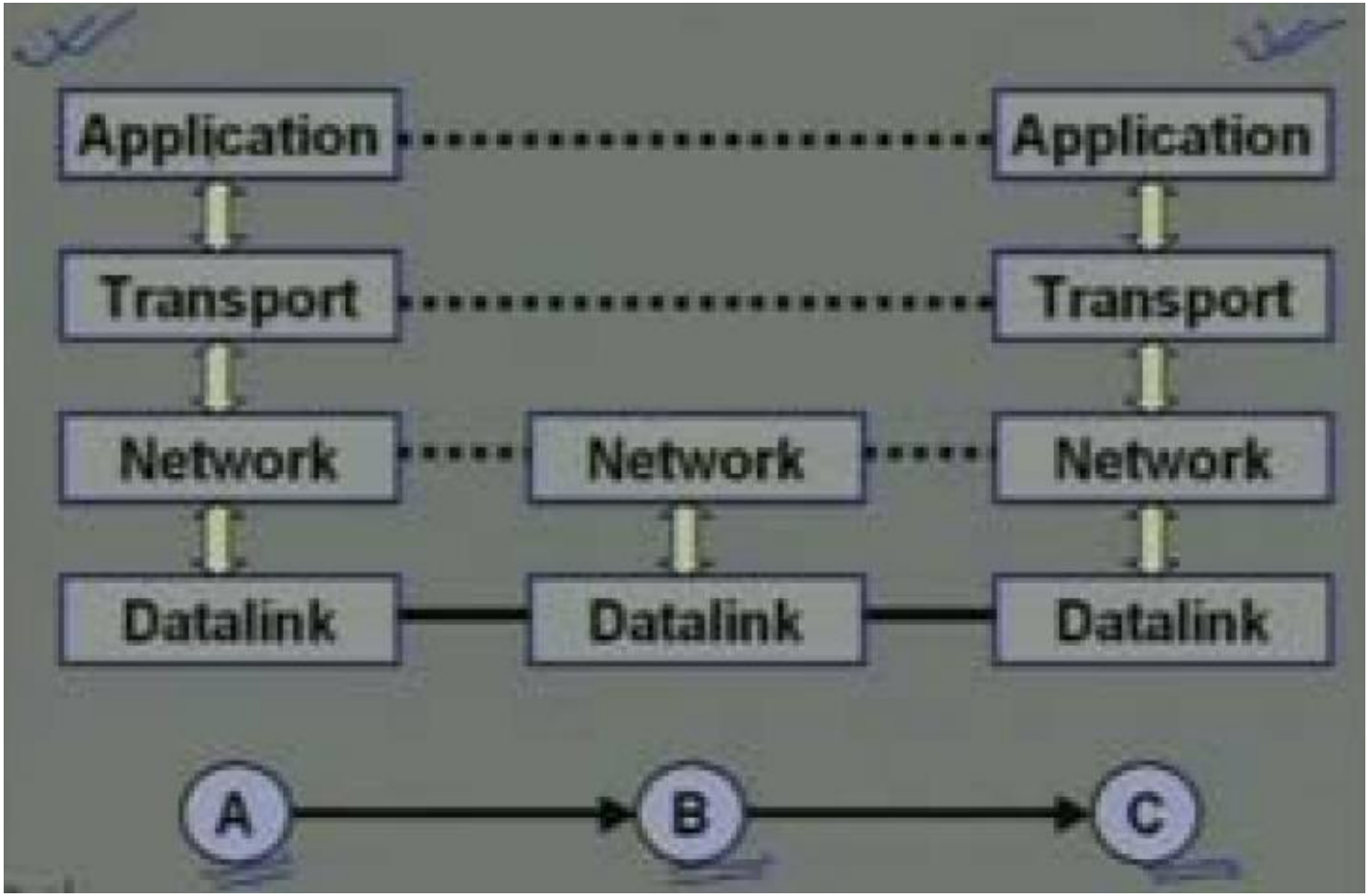
To provide well defined interface between adjacent layers

- A change in one interface does not affect the other.
- Interface must remain the same
- Allows a structured development of network software

The simplified 4-layer protocol



Data Flow in 4-layer Model



TCP/IP Protocol Suite

- Refers to a family of protocols.
- The protocols are built on top of connectionless technology.
  - Data sent from one node to another as a sequence of datagram.
  - Each datagram sent independently
  - The datagrams corresponding to the same message may follow different routes.
    variable delay, arrival order at destination

What does IP do?

- IP transports datagrams (packets) from source node to the destination node.
  - Responsible for routing the packets.
  - Breaks a packet into smaller packets, if required.
  - Unreliable service.
    - A packet may be lost in transit.
    - Packets may arrive out of order
    - Duplicate packets may be generated.

What does TCP do?

- TCP provides a connection-oriented, reliable service for sending messages.
  - Split a message into packets.
  - Reassemble packets at destination.
  - Resend packets that were lost in transit
- Interface with IP
  - Each packet forwarded to IP for delivery.
  - Error control is done by TCP.

What does UDP do?

- UDP provides a connectionless, unreliable service for sending datagrams (packets).
  - Messages small enough to fit in a packet (e.g. DNS query).
  - Simpler and faster than TCP.
  - Never split data into multiple packets.
  - Does not care about error control.
  - The abstract network model.
- Interface with IP:
  - Each UDP packet sent to IP for delivery

Addresses in TCP/IP