2.4 Layered Network Models

What is Layering?

A technique to organize a network system into a succession of logically distinct entities, such that the service provided by one entity is solely based on the services provided by the previous (lower level) entity.

Why Layering?

Solving all the problems at once is difficult.

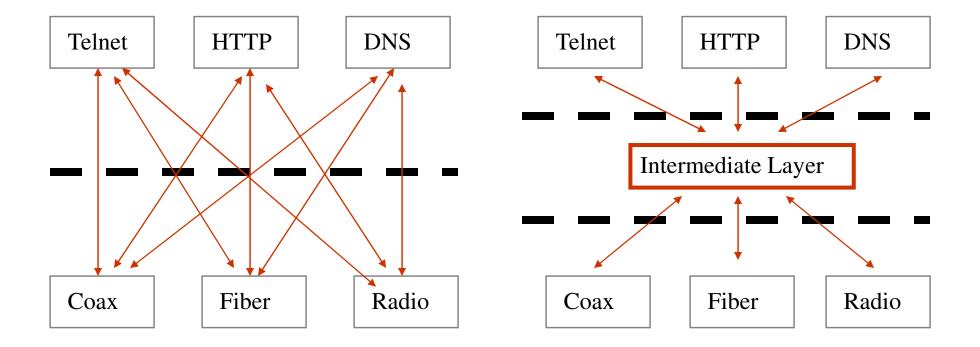
It's a good idea to divide problems or functions into several sets in such a way that:

- problems or functions in a same set are tightly coupled
- the inter-dependence between problems or functions in different sets is minimized

Address the problem sets separately.



Layered Network Architecture







Advantages of Layering

A smaller number of problems need to be addressed at a time
Modularity – protocols easier to manage and maintain
A layer or its functionality can be altered without affecting the functionality of the layer above it.
Facilitate standardization process
Reuse – upper layers can reuse the functionality provided by lower layers
Many different solutions for different problem sets can be combined in many different ways to form a complete solution.
Good for teaching and learning





2.4.1 OSI Reference Model

- □ The International Standards Organization (ISO) proposal for the *standardization* of the various protocols used in computer networks (specifically those networks used to connect *open systems*) is called the *Open Systems Interconnection Reference Model*, or simply the OSI model.
- □ In 1970's the ISO undertook to develop this standard and the *first* standard of the *7 layer* architecture came in 1974.
- □ Although the OSI model is just a model (*not a specification*), it is generally regarded as the most complete model (*popular network protocol* suites in use today were developed before the OSI model was defined APANET 1969 & TCP/IP 1974).
- □ Detailed standards for the various layers were developed separately by ISO.
- ☐ Goal : A general open standard
 - allow vendors to enter the market by using their own implementation and protocols.



OSI Model

OSI:
Open Systems
Interconnection
Reference Model

Application

Provides access to the OSI environment for users and also provides distributed information services.

Presentation

Provides independence to the application processes from differences in data representation (syntax).

Session

Provides the control structure for communication between applications; establishes, manages, and terminates connections (sessions) between cooperating applications.

Transport

Provides reliable, transparent transfer of data between end points; provides end-to-end error recovery and flow control.

Network

Provides upper layers with independence from the data transmission and switching technologies used to connect systems; responsible for establishing, maintaining, and terminating connections.

Data Link

Provides for the reliable transfer of information across the physical link; sends blocks (frames) with the necessary synchronization, error control, and flow control.

Physical

Concerned with transmission of unstructured bit stream over physical medium; deals with the mechanical, electrical, functional, and procedural characteristics to access the physical medium.

The OSI Layers





OSI Model Overview

Application (Upper Layers)

Application Presentation Session Transport Network Data Flow Layers **Data-Link Physical**





Role of Application Layers

		<u>Examples</u>
Application	User Interface	Telnet FTP
Presentation	How data is presentedSpecial processing such as encryption	ASCII EBCDIC JPEG
Session	Keeping different applications' data separate	Operating System/ Application Access Scheduling





Evamples

Role of Application Layers

Examples Telnet Application User interface FTP How data is presented **ASCII Presentation** Special processing **EBCDIC** such as encryption **JPEG** Keeping different **Operating System**/ Session applications' data **Application Access** separate **Scheduling Transport Network** Data-Link **Physical**





Role of Data Flow Layers

Examples

Transport	 Reliable or unreliable delivery Error correction before retransmit 	TCP UDP SPX
Network	Provide logical addressing that routers use for path determination	> IP IPX
Data Link	 Combines bits into bytes and bytes into frames Access to media using MAC address Error detection not correction 	> 802.3 / 802.2 HDLC
Physical	 Move bits between devices Specifies voltage, wire speed, and pin-out cables 	EIA/TIA-232 V.35





Role of Data Flow Layers

Application		
Presentation		Francisco
Session		Examples
Transport	 Reliable or unreliable delivery Error correction before retransmit 	TCP UDP SPX
Network	Provide logical addressing that routers use for path determination	IP IPX
Data-Link	 Combines bits into bytes and bytes into frames Access to media using MAC address Error detection, not correction 	802.3/802.2 HDLC
Physical	 Move bits between devices Specifies voltage, wire speed, and pinout cables 	EIA/TIA-232 V.35



2.4.2 The IP Model

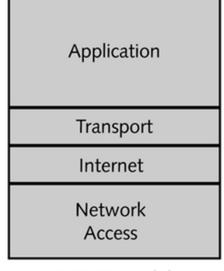
What Is TCP/IP?

- □ The large collection of networking protocols and services called TCP/IP denotes far more than the combination of the two key protocols that gives this collection its name.
- □ These protocols deserve an initial introduction: Transmission Control Protocol, or TCP, handles reliable delivery for messages of arbitrary size, and defines a robust delivery mechanism for all kinds of data across a network.
- ☐ The Internet Protocol, or IP, manages the routing of network transmissions from sender to receiver, along with issues related to network and computer addresses, and much more.



What Is TCP/IP Cont.

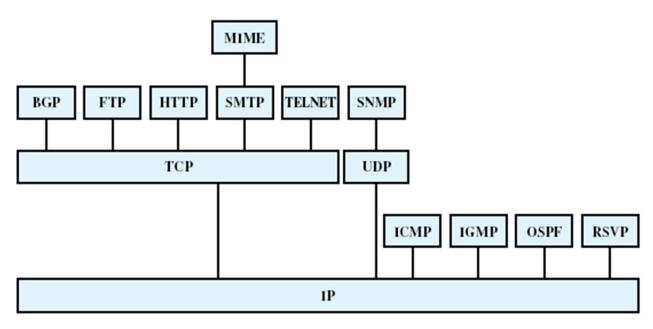
- □ A working understanding of where TCP/IP comes from, and what motivated its original design, can enhance one's understanding of this essential collection of protocols (often called a protocol suite)
- ☐ The standards groups that are involved with TCP/IP are as follows:
 - Internet Society (ISOC)
 - Internet Architecture Board (IAB)
 - Internet Engineering Task Force (IETF)
 - Internet Research Task Force (IRTF)
 - Internet Societal Task Force (ISTF)
 - Internet Corporation for Assigned Names and Numbers (ICANN)



TCP/IP model



What Is TCP/IP cont.



BGP = Border Gateway Protocol OSPF = Open Shortest Path First
FTP = File Transfer Protocol RSVP = Resource ReSerVation Protocol
HTTP = Hypertext Transfer Protocol SMTP = Simple Mail Transfer Protocol

ICMP = Internet Control Message Protocol
IGMP = Internet Group Management Protocol
TCP = Transmission Control Protocol

IP = Internet Group Management Protocol ICP = Transmission Control Protocol

UDP = User Datagram Protocol

MIME = Multipurpose Internet Mail Extension

Some Protocols in the TCP/IP Protocol Suite





OSI Reference Model and TCP/IP Networking Model Layers

Application

Presentation

Session

Transport

Network

Data Link

Physical

OSI model

Application

Transport

Internet

Network Access

TCP/IP model





End of Chapter.



