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?

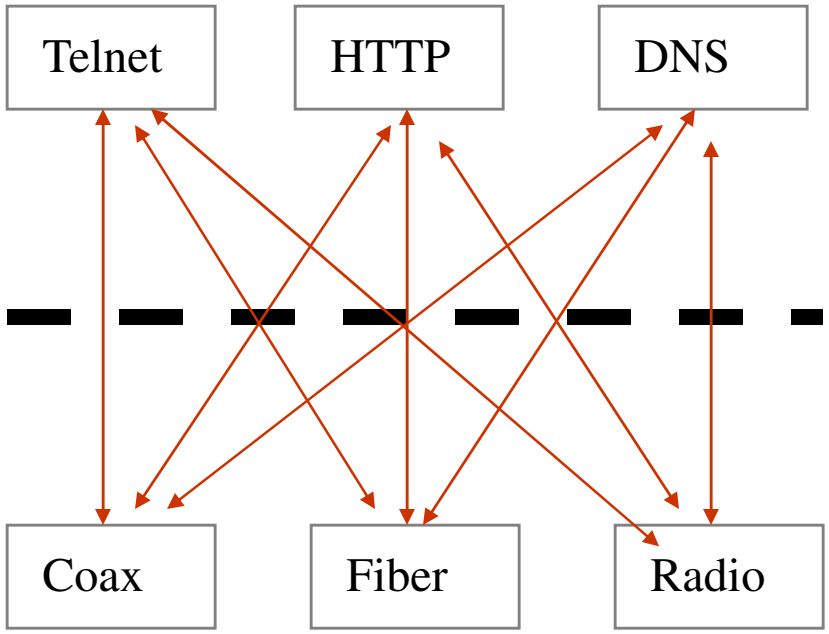
Solving all the problems at once is difficult.

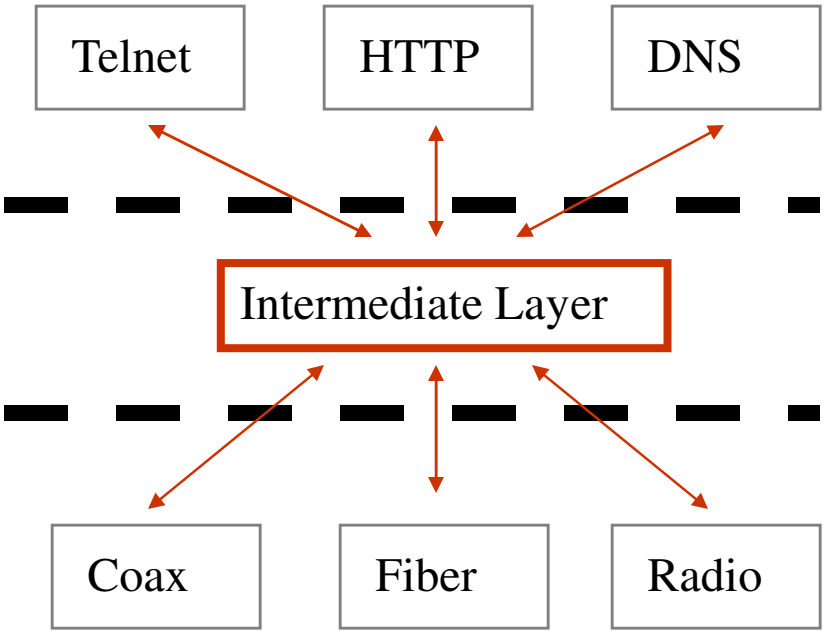
It's a good idea to divide problems or functions into several sets in such a way that:

- 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

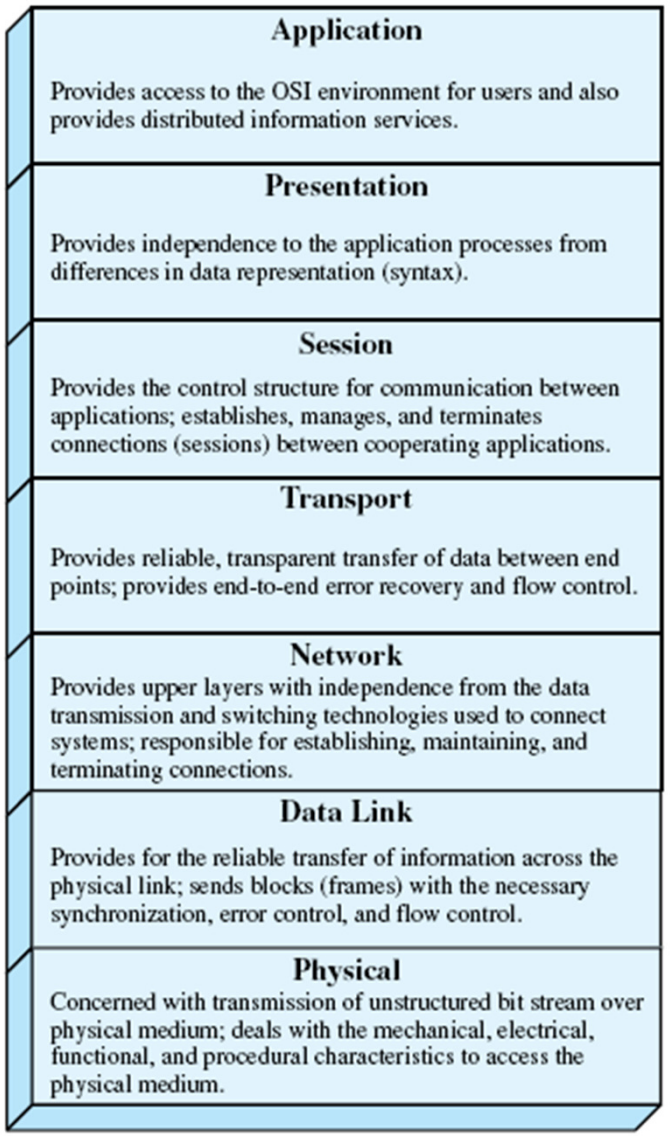
- A smaller number of problems need to be addressed at a time
- Modularity – protocols easier to manage and maintain
- A layer or its functionality can be altered without affecting the functionality of the layer above it.
- Facilitate standardization process
- Reuse – upper layers can reuse the functionality 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.

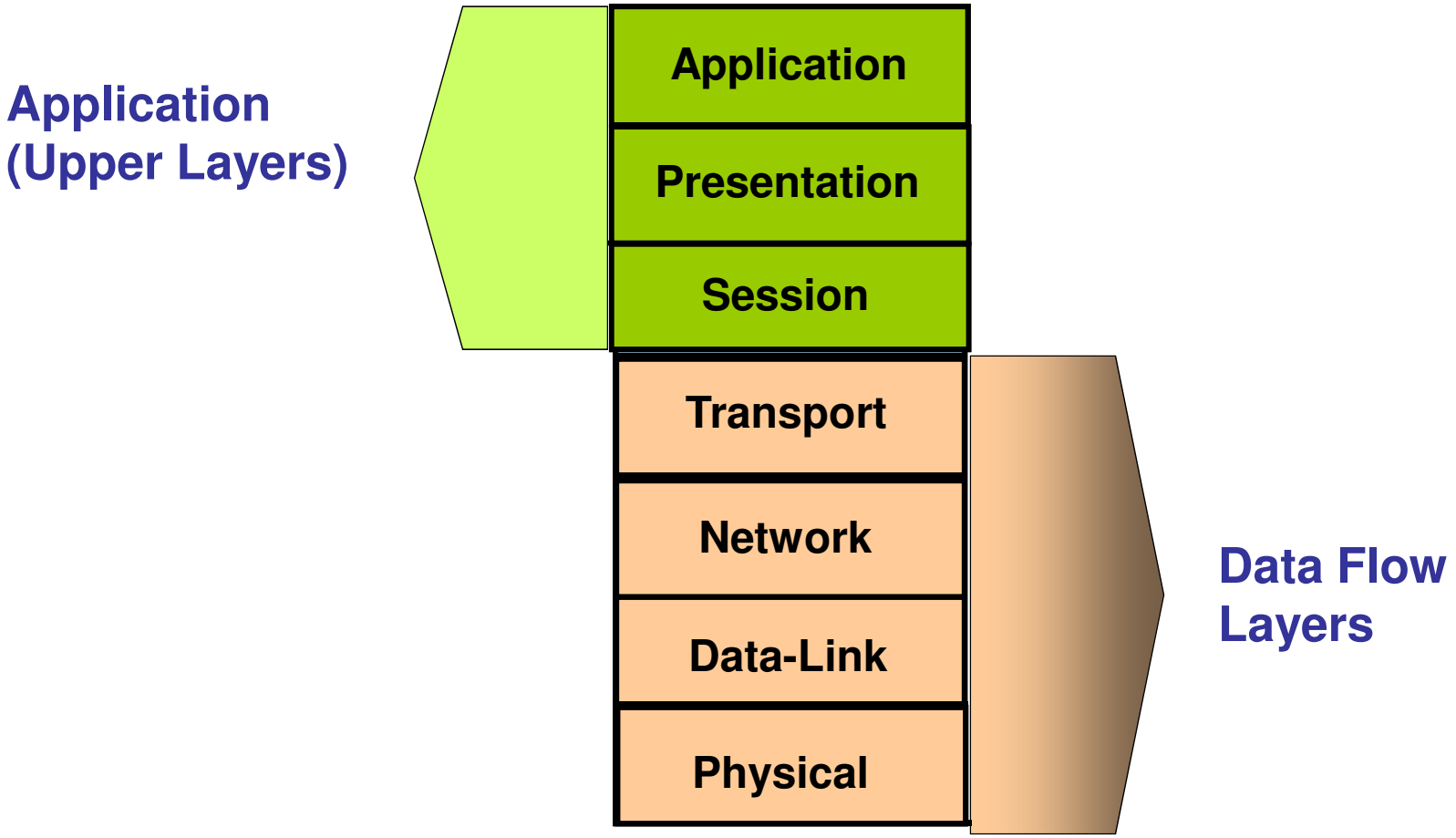
OSI Model

OSI:
Open Systems
Interconnection
Reference Model

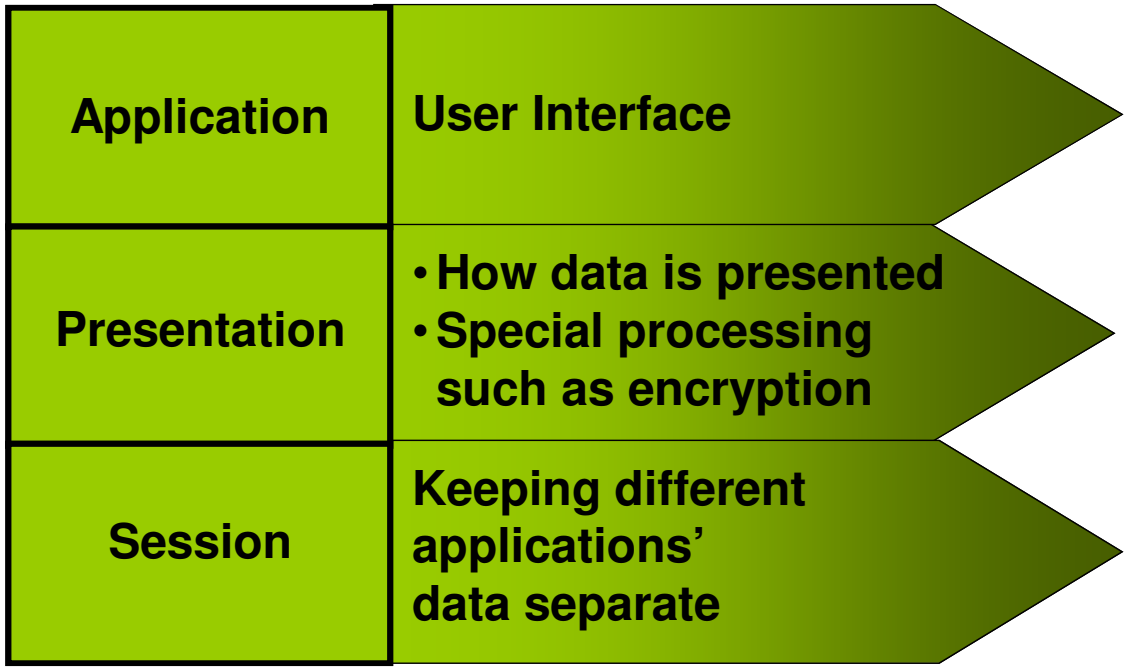


The OSI Layers

OSI Model Overview



Role of Application Layers



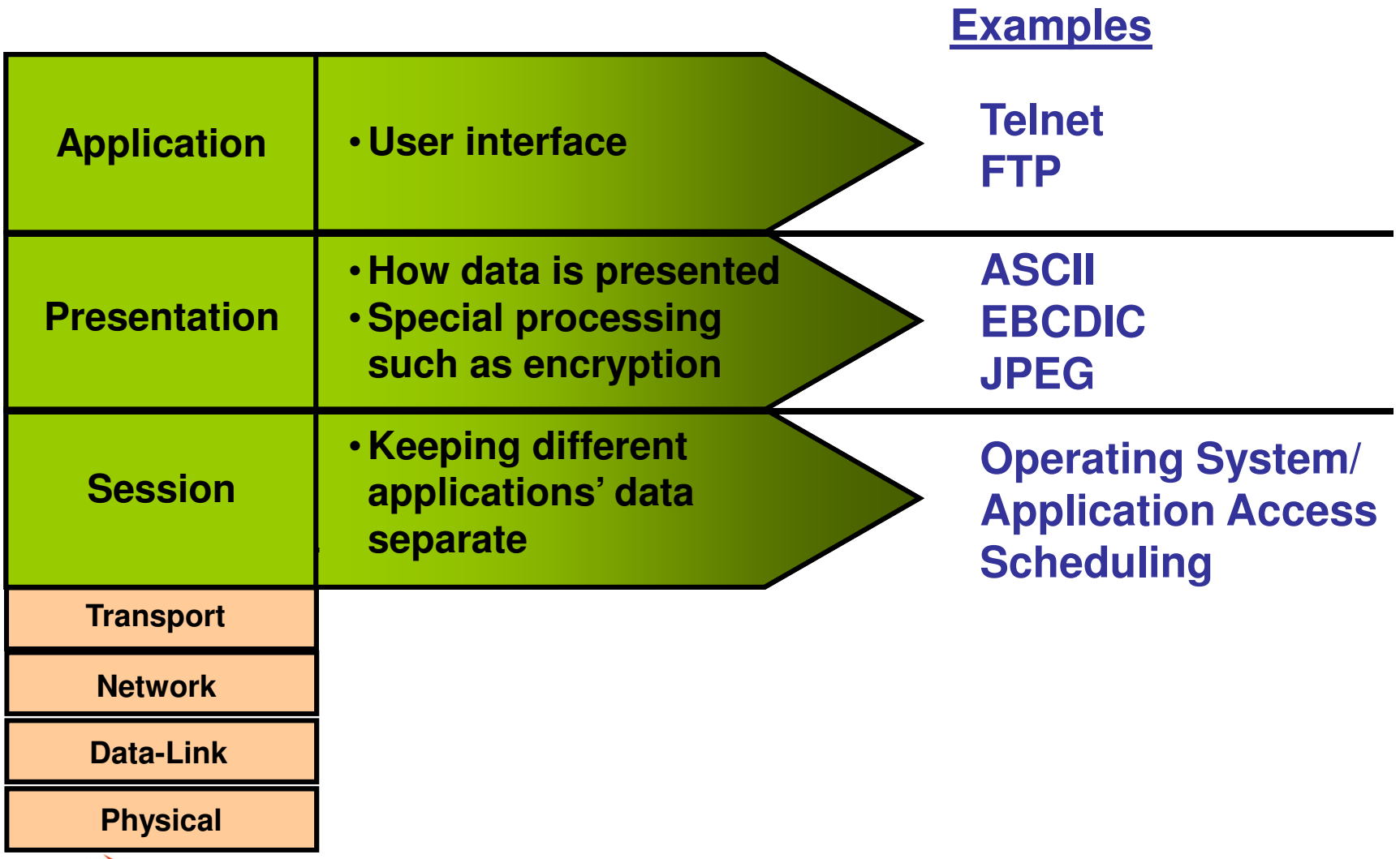
Examples

Telnet
FTP

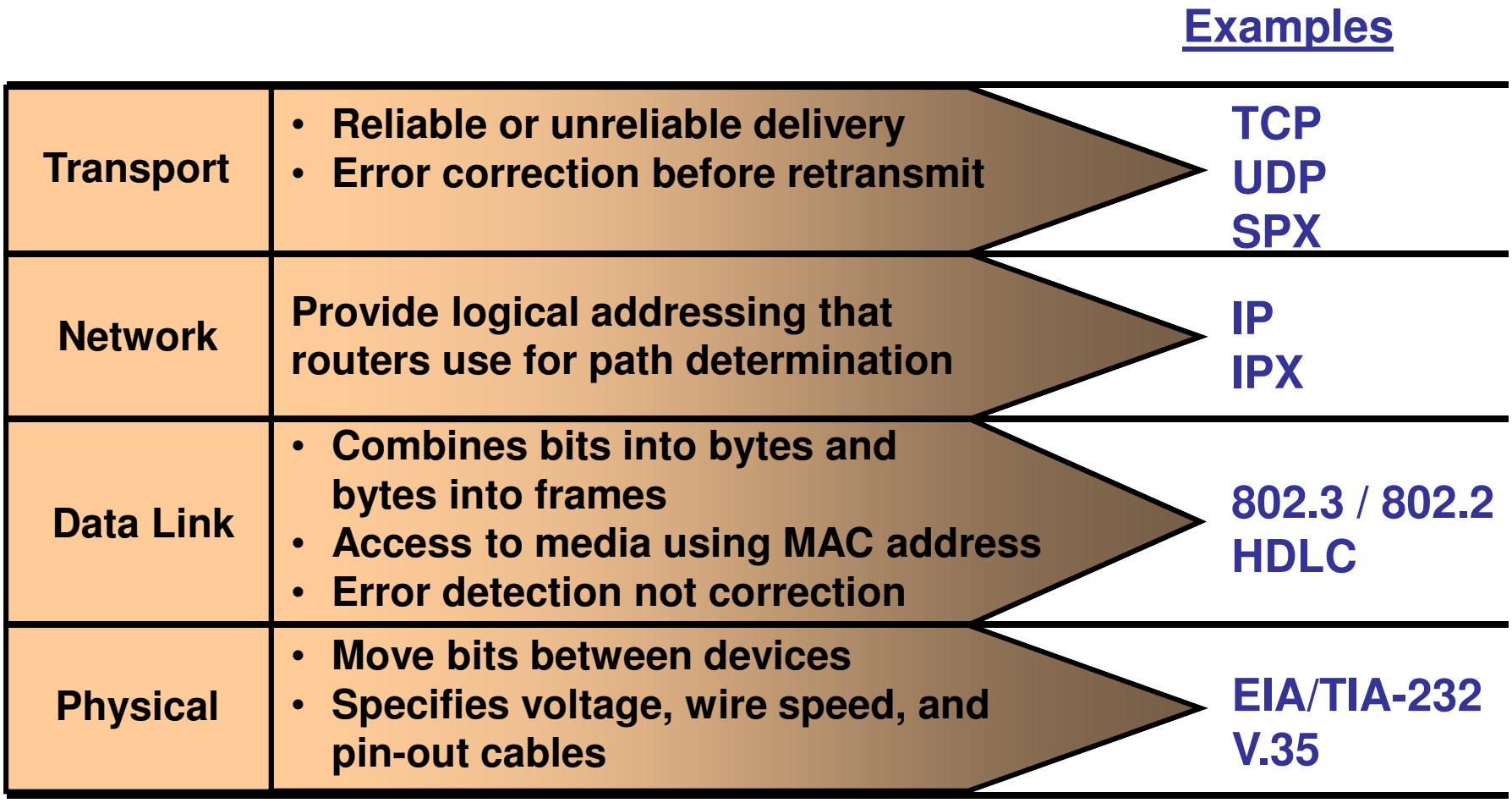
ASCII
EBCDIC
JPEG

Operating System/ Application Access Scheduling

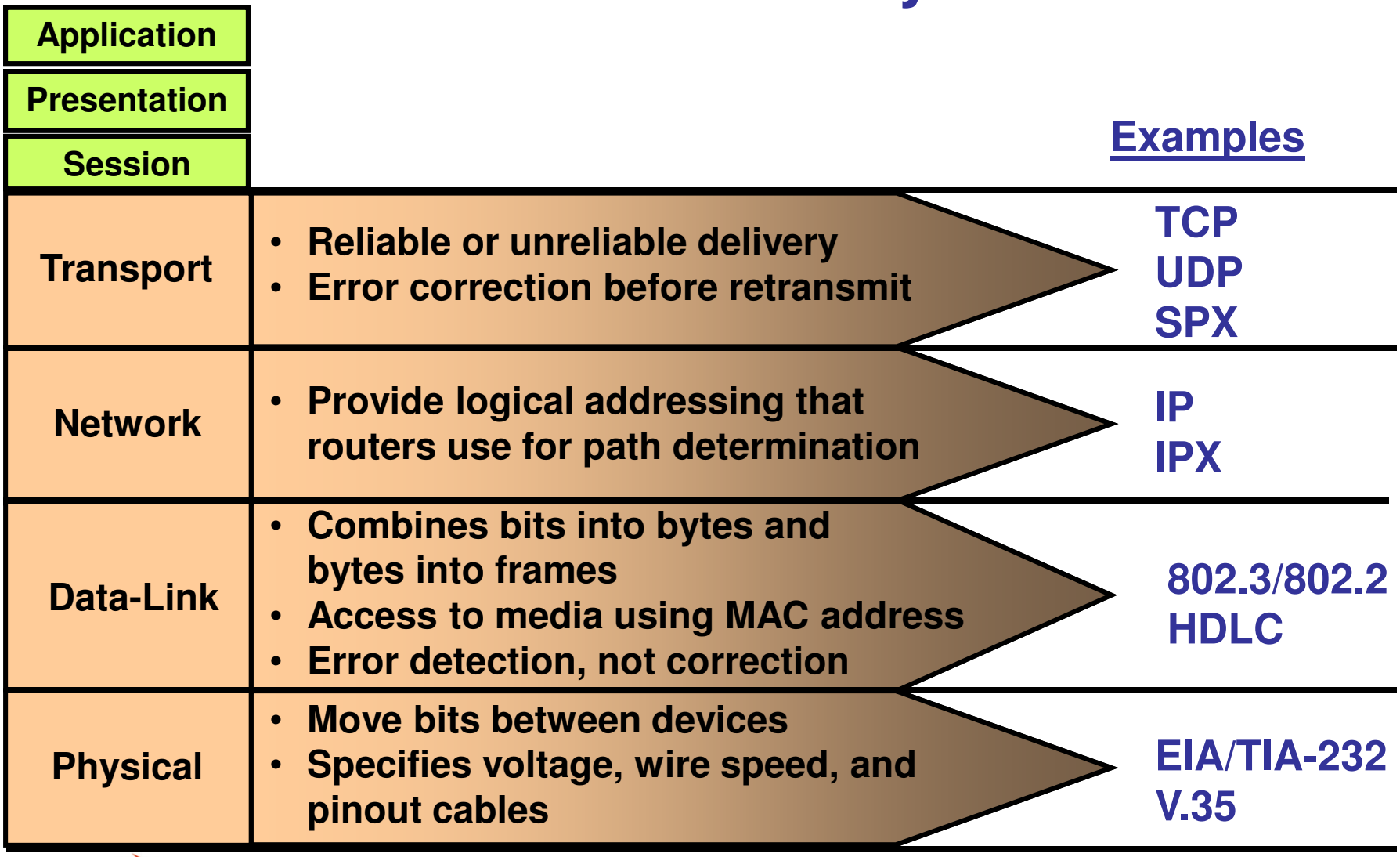
Role of Application Layers



Role of Data Flow Layers



Role of Data Flow Layers



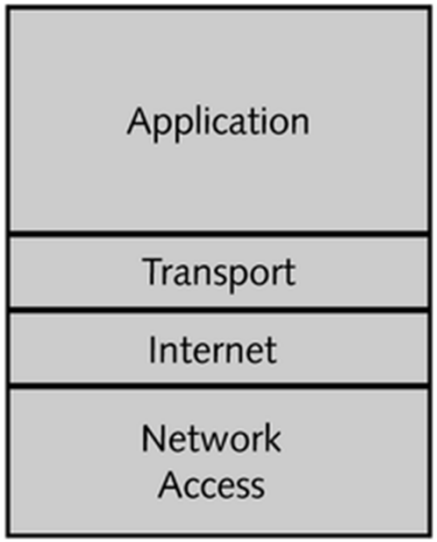
2.4.2 The IP Model

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.

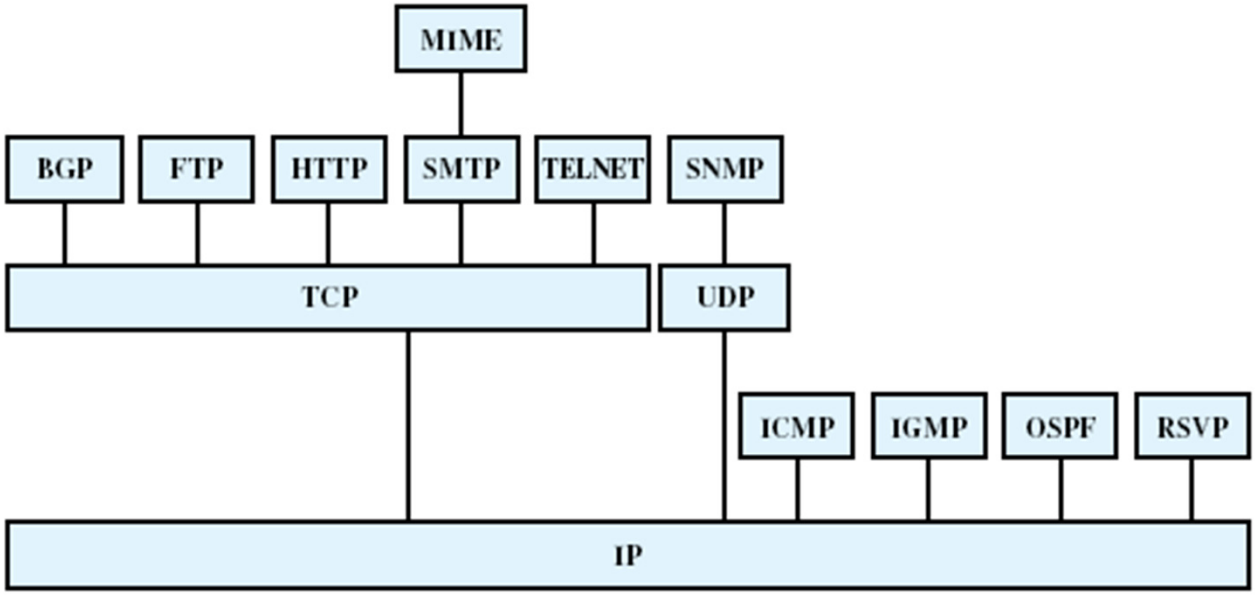
What Is TCP/IP Cont.

- 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

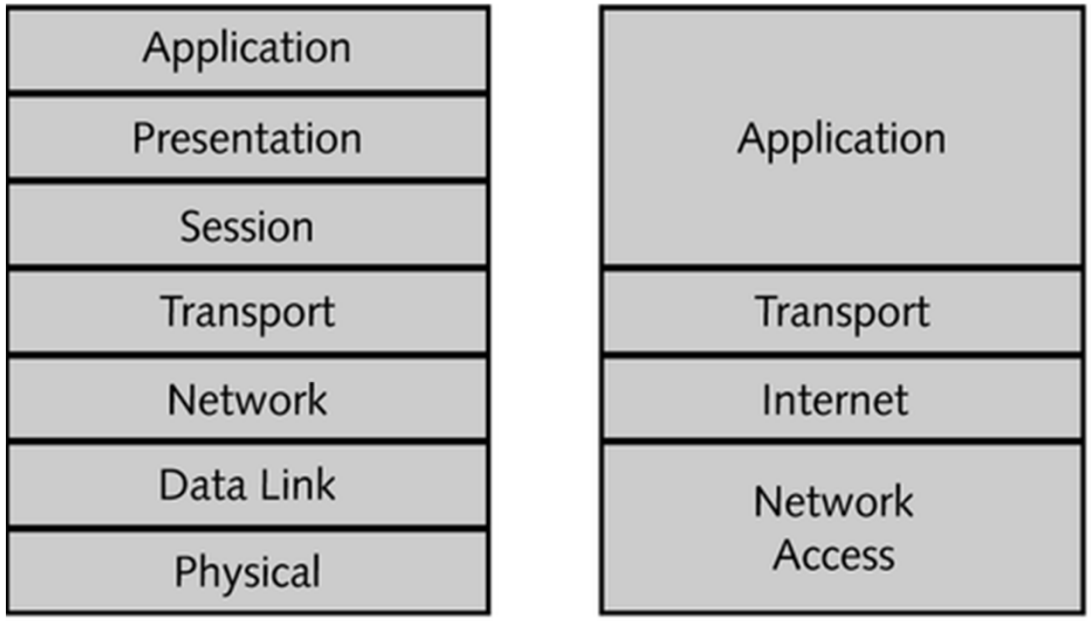
What Is TCP/IP cont.



BGP = Border Gateway Protocol
FTP = File Transfer Protocol
HTTP = Hypertext Transfer Protocol
ICMP = Internet Control Message Protocol
IGMP = Internet Group Management Protocol
IP = Internet Protocol
MIME = Multipurpose Internet Mail Extension
OSPF = Open Shortest Path First
RSVP = Resource ReSerVation Protocol
SMTP = Simple Mail Transfer Protocol
SNMP = Simple Network Management Protocol
TCP = Transmission Control Protocol
UDP = User Datagram Protocol

Some Protocols in the TCP/IP Protocol Suite

OSI Reference Model and TCP/IP Networking Model Layers



End of Chapter.