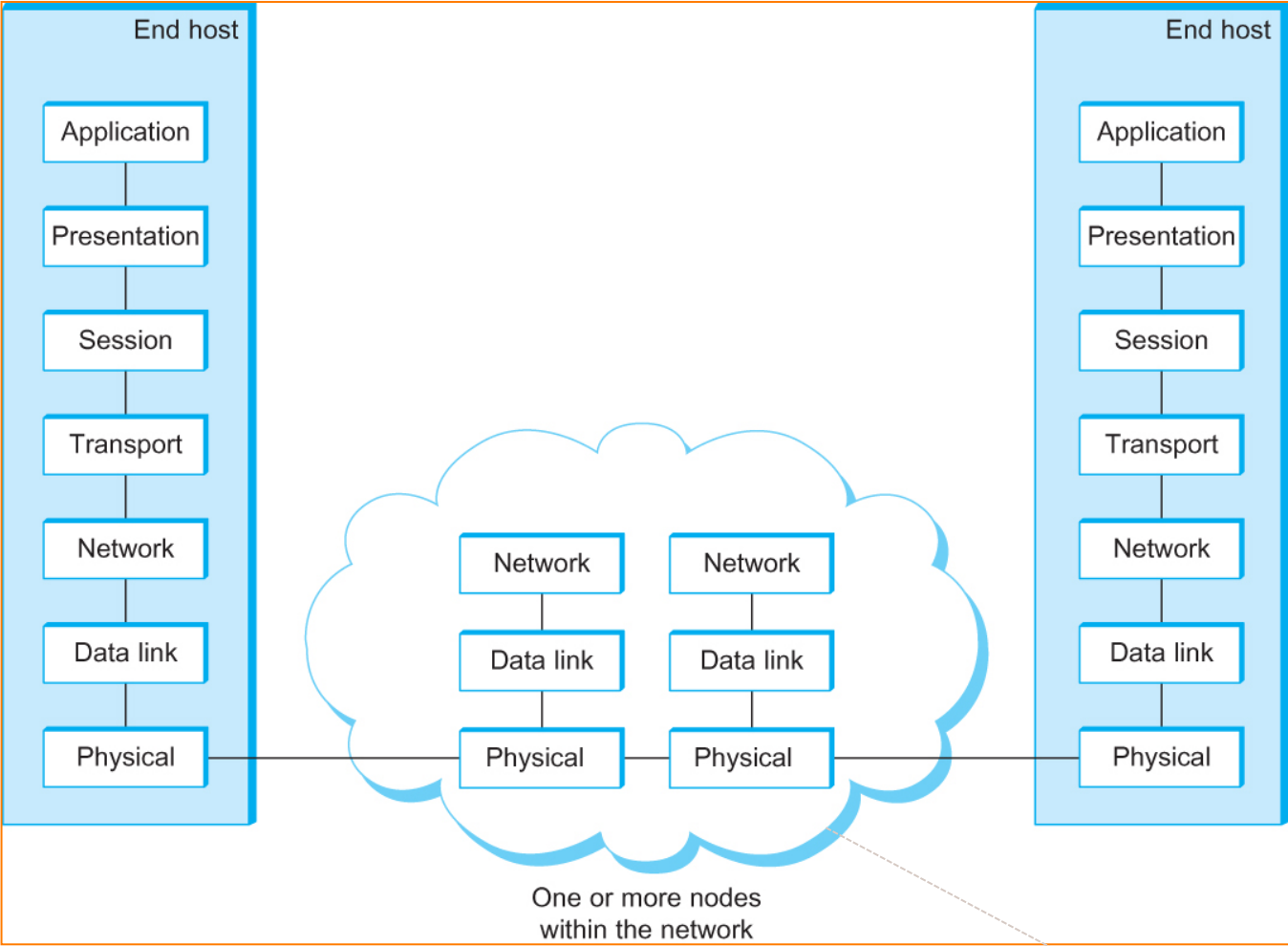


OSI Architecture



The OSI 7-layer Model

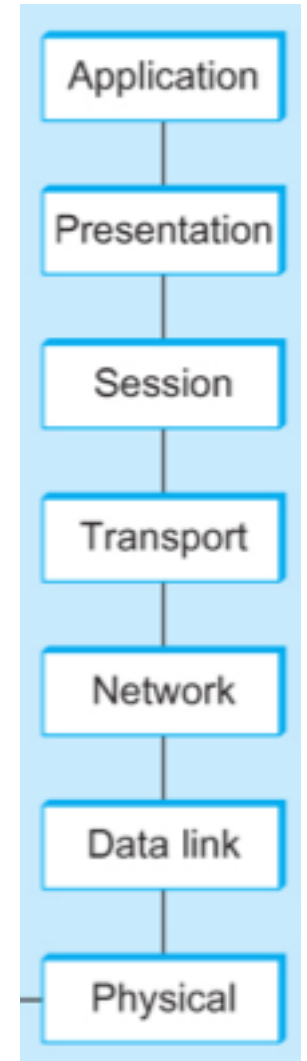
OSI – Open Systems Interconnection

internetwork

Description of Layers

- **Physical Layer**
 - ▣ Handles the transmission of raw bits over a communication link
- **Data Link Layer**
 - ▣ Collects a stream of bits into a larger aggregate called a *frame*
 - ▣ Network adaptor along with device driver in OS implement the protocol in this layer
 - ▣ Frames are actually delivered to hosts
- **Network Layer**
 - ▣ Handles routing among nodes within a packet-switched network
 - ▣ Unit of data exchanged between nodes in this layer is called a *packet*

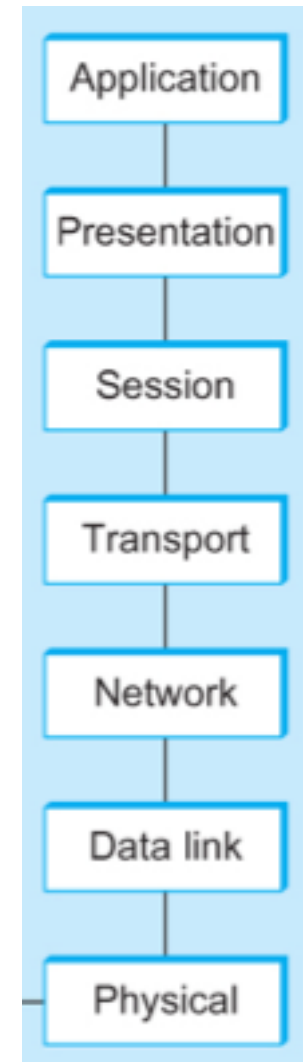
The lower three layers are implemented **on all network nodes**



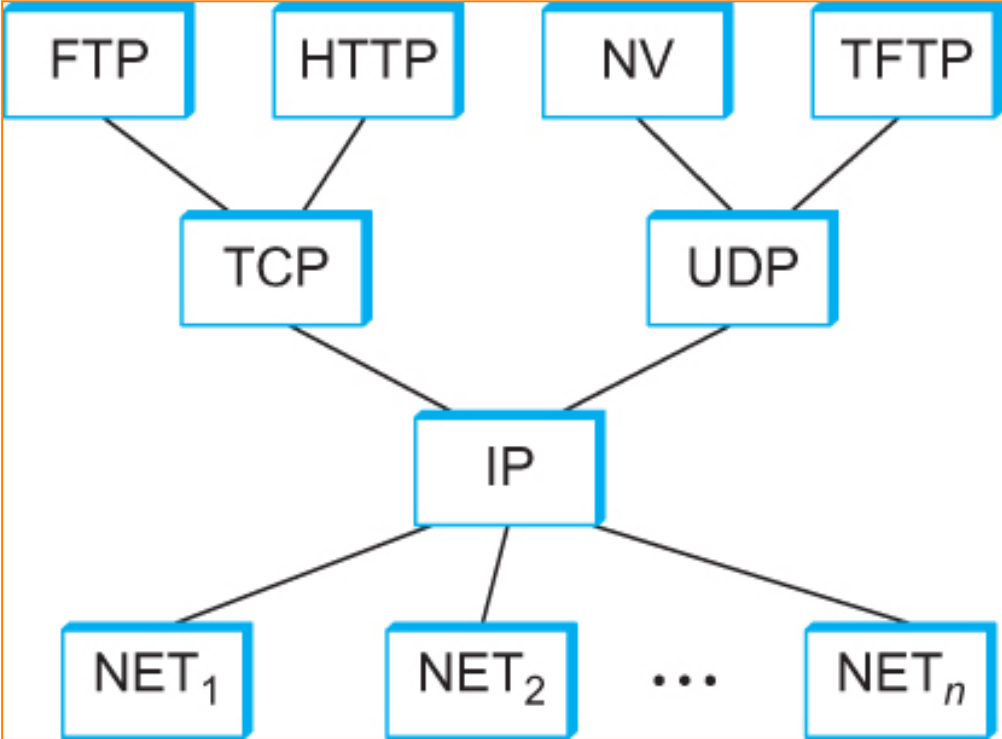
Description of Layers

- **Transport Layer**
 - ▣ Implements a process-to-process channel
 - ▣ Unit of data exchanges in this layer is called a *message*
- **Session Layer**
 - ▣ Provides a name space that is used to tie together the potentially different transport streams that are part of a single application
- **Presentation Layer**
 - ▣ Concerned about the format of data exchanged between peers
- **Application Layer**
 - ▣ Standardize common type of exchanges

The transport layer and the higher layers typically run only **on end-hosts** and not on the intermediate switches and routers

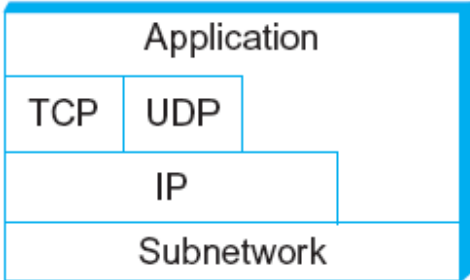


Internet Architecture



Example of an Internet Protocol Graph

TCP/IP architecture!



Alternative view of the Internet architecture. The “Network” layer shown here is sometimes referred to as the “sub-network” or “link” layer.

Internet Architecture

- Defined by IETF (Internet Engineering Task Force)
- Three main features
 - ▣ Does not imply strict layering. The application is free to bypass the defined transport layers and to directly use IP or other underlying networks
 - ▣ An hour-glass shape – wide at the top, narrow in the middle and wide at the bottom. IP serves as the focal point for the architecture
 - ▣ In order for a new protocol to be officially included in the architecture, there needs to be both a protocol specification and at least one (and preferably two) representative implementations of the specification

Application Programming Interface



- Interface exported by the network
- This is the interface that the OS provides to its networking subsystem
- The interface is called the network Application Programming Interface (API)

Application Programming Interface (Sockets)

- **Socket Interface** was originally provided by the **Berkeley** distribution of Unix
 - Now supported in virtually all operating systems and on the Java Virtual Machine: **Java Sockets**

- Each protocol provides a certain set of *services* via the Service Interface and the API provides a syntax by which that service interface can be invoked

Socket

- What is a socket?
 - ▣ The point where a local application process attaches to the network
 - ▣ An interface between an application and the network
 - ▣ An application creates the socket
- The interface defines operations for
 - ▣ Creating a socket
 - ▣ Attaching a socket to the network
 - ▣ Sending and receiving messages through the socket
 - ▣ Closing the socket

Berkeley Sockets in C language

- Socket Family
 - ▣ PF_INET denotes the Internet family
 - ▣ PF_UNIX denotes the Unix pipe facility
 - ▣ PF_PACKET denotes direct access to the network interface (i.e., it bypasses the TCP/IP protocol stack)

- Socket Type
 - ▣ SOCK_STREAM is used to denote a byte stream (TCP)
 - ▣ SOCK_DGRAM is an alternative that denotes a message oriented service (UDP)