

# Protocol Layers

COMP476  
Networked Computer Systems

## Network Standards



- The purpose of a network is to allow two computers to communicate.
- Ex: The electrical power network in North America follows a standard to ensure that any electrical device can be used.



Any standard electrical device



110 volts of 60 Hertz providing up to 15 amps

## Internet Protocol Layering Models

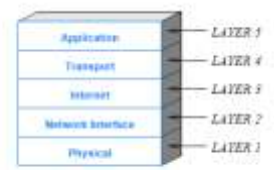
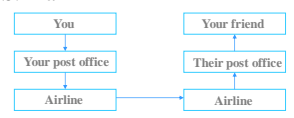


Figure 1.1 The layering model used with the Internet protocols (TCP/IP).

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## OSI Analogy

Ex: U.S. Mail



- You do not have to worry about how to find your friends house in the distant city.
- The post office does not need to know how to fly the airplane.
- Each layer assumes that the layer below it will provide certain functions.
- Each layer provides additional functionality

## Internet Protocol Layers

- Physical Layer (Layer 1)
  - specify details about the underlying transmission medium and hardware
  - all specifications related to electrical properties, radio frequencies, and signals belong in layer 1
- Network Interface Layer (Layer 2)
  - some publications use the term **Data Link**
  - specifications about
    - network **addresses**
    - maximum **packet size** that a network can support
    - protocols used to access the underlying **medium** and hardware addressing

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## Protocol Layers

- Internet Layer (Layer 3)
  - Protocols in the Internet layer form the fundamental basis for the Internet
  - Layer 3 protocols specify communication across the Internet (spanning multiple interconnected networks)
- Transport Layer (Layer 4)
  - Provide for communication from an application program on one computer to an application program on another
  - Includes specifications on
    - controlling the **maximum rate** a receiver can accept data
    - mechanisms to avoid network **congestion**
    - techniques to insure that all data is received in the **correct order**

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## Protocol Layers

- Application Layer (Layer 5)
  - specify how a pair of applications interact when they communicate
  - specify details about
    - the format and the meaning of messages that applications can exchange
    - the procedures to be followed
  - Some examples of network applications in layer 5
    - email exchange
    - file transfer
    - web browsing
    - telephone services
    - and video teleconferencing

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## International Standards Organization Open System Interface

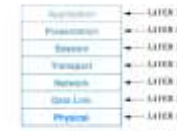
- A standard and network architecture model.
- Not very often followed as a standard.
- Popular and important model for network architectures.
- Similar to the Internet Protocol model but not the same.

## ISO OSI Model

International Standards Organization Open System Interface Model

### OSI Stack

- Divides the many networking functions into seven different layers
- Called a stack because each layer provides functions or services to the layer above it.

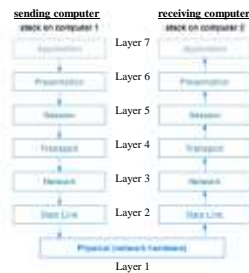


## OSI Flow Chart

### OSI Stack

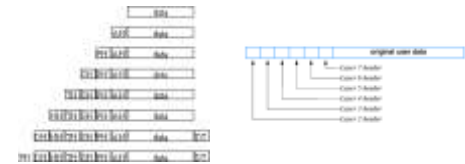
•When a layer wants to send something to its peer layer in another computer, it calls a function in the layer below it to actually send the data.

•Only the lowest layer actually sends bits to another computer



layer	purpose	example
Application	Provides network services.	X.400 email, HTTP, FTP
Presentation	Converts the data to the representation used by the local computer.	
Session	Establishes sessions.	
Transport	Directs packets to the correct user on a computer. This is the first end-to-end layer. May also provide error correction.	TCP UDP
Network	Finds a route for packets to take through the network.	Internet Protocol (IP)
Data link - logical data link	Detects and corrects any errors on the link. Provides flow control.	
- media access control	Determines which node may transmit.	Ethernet, Token Ring
Physical	Defines the characteristics of the physical connections. This is the only layer that actually sends bits to another computer.	SONET, RS-232C

## Nested Protocol Headers



- The data link layer often adds a trailer to the packet that contains a cyclic redundancy check (CRC) to detect errors.
- The physical layer might, or might not, append a header or trailer to the packet.
- It is the bottom frame, with all of the headers, that is actually sent across the network. When it is received at the other end, the headers are stripped off as the packet is passed up the stack to the user application.