

# COMP476 Networked Computer Systems

## Protocol Layers

## 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

## International Standards Organization Open System Interface

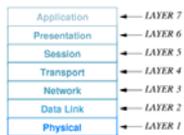
- A standard and network architecture model.
  - Not very often followed as a standard.
  - OSI networks are more popular in Europe.
  - Popular and important model for network architectures.
  - Similar to the Internet Protocol model but not the same.

## 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.

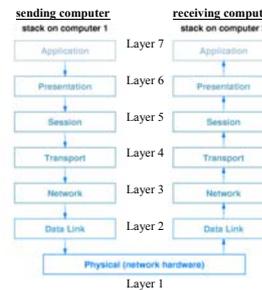


## OSI Flow Chart

### • 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



## OSI (an 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

layer	purpose	example
1. Application	Provides network services.	X.400 email, HTTP, FTP
2. Presentation	Converts the data to the representation used by the local computer.	
3. Session	Establishes sessions.	
4. 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)
5. Network	Finds a route for packets to take through the network.	Internet Protocol (IP)
6. Data link - logical data link	Detects and corrects any errors on the link. Provides flow control.	
- media access control	Provides network services.	Ethernet, Token Ring
7. Physical	Defines the characteristics of the physical connections. This is the only layer that actually sends bits to another computer.	SONET, RS-232C

## Internet Protocol Stack

- The Internet Protocol uses a similar, but slightly different model than OSI.
- The Internet Protocol does not define the lower levels.

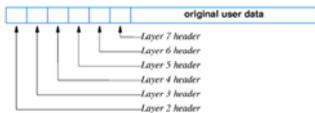
layer	purpose	OSI equivalent	example
1. Application	Provides network services.	Application, Session and Presentation	HTTP, FTP, Telnet
2. Transport	Multiplexes data streams from different applications. May also provide error correction.	Transport	TCP, UDP
3. Internet	Routing.	Network	IP
5. Network Interface	Provides access to the Data Link and lower protocols. The IP stack does not define the lower levels.	Data Link	Ethernet

## Protocol Stacks in Use

Vendor	Stack
Novell Corporation	Netware
Banyan System Corporation	VINES
Apple Computer Corporation	AppleTalk
Digital Equipment Corporation	DECNET
IBM	SNA
(many vendors)	TCP/IP

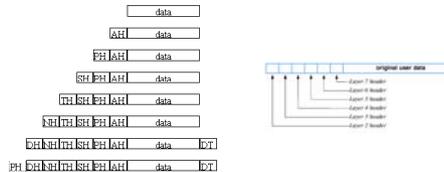
- Although the stacks share many general concepts, the details differ, making them incompatible.

## Nested Protocol Headers



The nested protocol headers that appear in a frame as the frame travels across a network. Each layer of protocol software adds a header to an outgoing frame.

## 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.