

Basic Concepts (I)

Basic Terms

- **Protocol**
 - An agreement on how a communication is to proceed
- **Packet** (message, segment, datagram, frame, ...)
 - Term used to refer the message transmitted in networks
 - Has different names depending on the layer a packet is at
 - Application layer — message, transport layer — segment, network layer — datagram, data link layer — frame
 - composed of header (for control information), data (aka payload), trailer (for error checking, not all packets have trailer, ethernet frame has)



- ***-cast**
 - unicast, one -to-one
 - multicast, one-to-group
 - broadcast, one-to-all
 - anycast, one-to-anyone in a group
 - ...
- **Single hop** vs. **multi-hop** ([traceroute](#) kili from glogin; [traceroute](#) [google.com](#))

Network Characteristics

- **Point to point**
 - Transmissions are between two participants
 - Three transmission modes: simplex, half-duplex, and full-duplex, defining the direction of the signal flow between two connected devices.
 - Simplex operation
 - One direction communication mode. “one-way street”.
 - E.g., keyboard, mouse, and monitor.
 - Half-duplex operation
 - A node cannot send and receive at the same time.
 - IEEE-1284 allows printers to send messages to the computer. The printer cannot send the messages to the computer while the computer is sending data to the printer. But when the computer stops sending, the printer can send messages back.
 - Full-duplex operation
 - The nodes at both ends of a link can transmit packets at the same time (e.g., telephone line).
 - Provide the potential greatest performance

- Ref
 - <http://www.iec-usa.com/Browse05/DTHFDUP.html>
 - http://www.tcpipguide.com/free/t_SimplexFullDuplexandHalfDuplexOperation.htm
- **Broadcast and select**
 - multiple nodes attached to as a shared medium
 - everyone hears every transmission (*broadcast*)
 - addresses needed to *select* transmission intended for a node

OSI 7-Layer Model

- OSI (Open System Interconnection) model defines a networking framework to implement protocols in seven layers.
 - L7 - Application
 - Support network applications: FTP, SMTP, HTTP
 - L6 - Presentation
 - Translate data of application to network format, and vice versa: encryption (ASCII, JPEG, and etc.)
 - L5 - Session
 - Establish, manage and terminate connections between applications
 - L4 - Transport
 - Provide complete data transfer between end hosts (may provide end-to-end error recovery and flow control): TCP, UDP
 - L3 - Network
 - Route datagrams from source to destination: IP, routing protocols
 - L2 - Link
 - Transfer data between neighboring network elements: Ethernet, 802.11 (WiFi)
 - L1 - Physical
 - bits “one the wire”
- In the OSI model, control is passed from one layer to the next, starting at the application layer at one station, and proceeding to the bottom layer, over the channel to the next station and back up the hierarchy.
- Ref: http://www.webopedia.com/quick_ref/OSI_Layers.asp

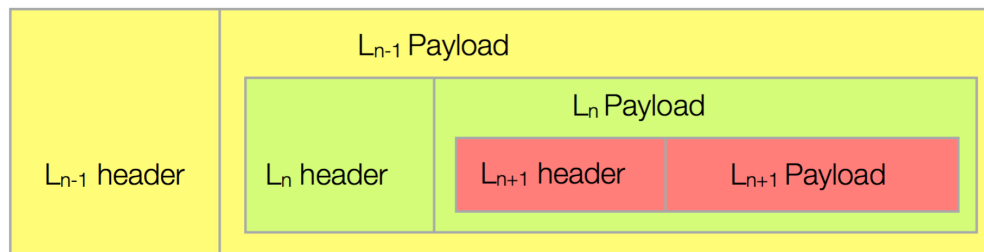
Internet Layers

L7 - Application	Application
L6 - Presentation	
L5 - Session	Transport
L4 - Transport	

L3 - Network	Network
L2 - Link	Link
L1 - Physical	Physical

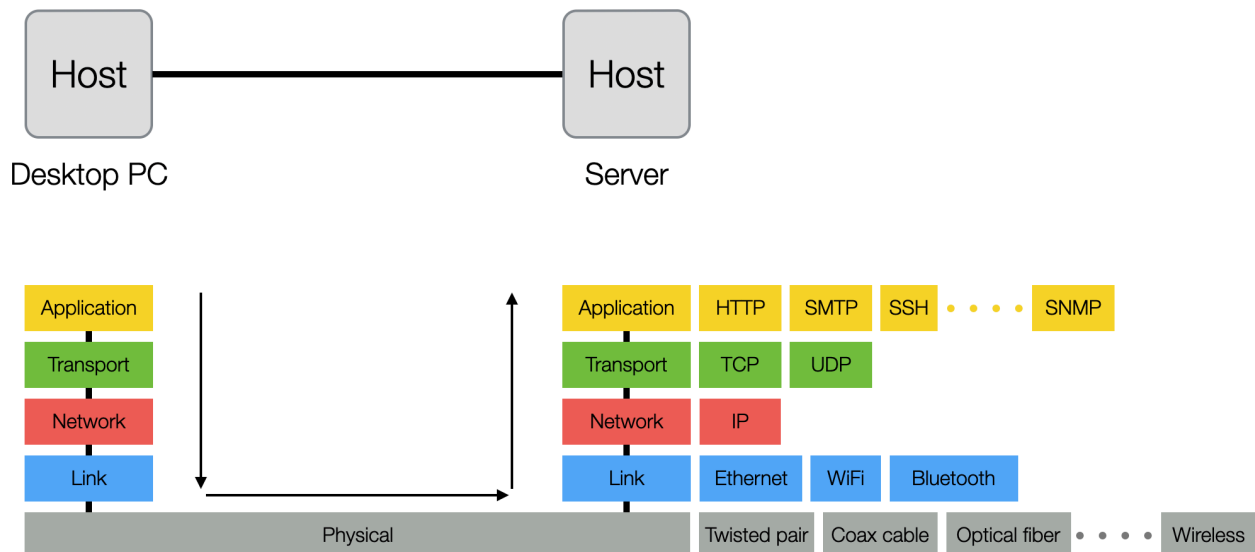
Protocol Hierarchy in a Packet

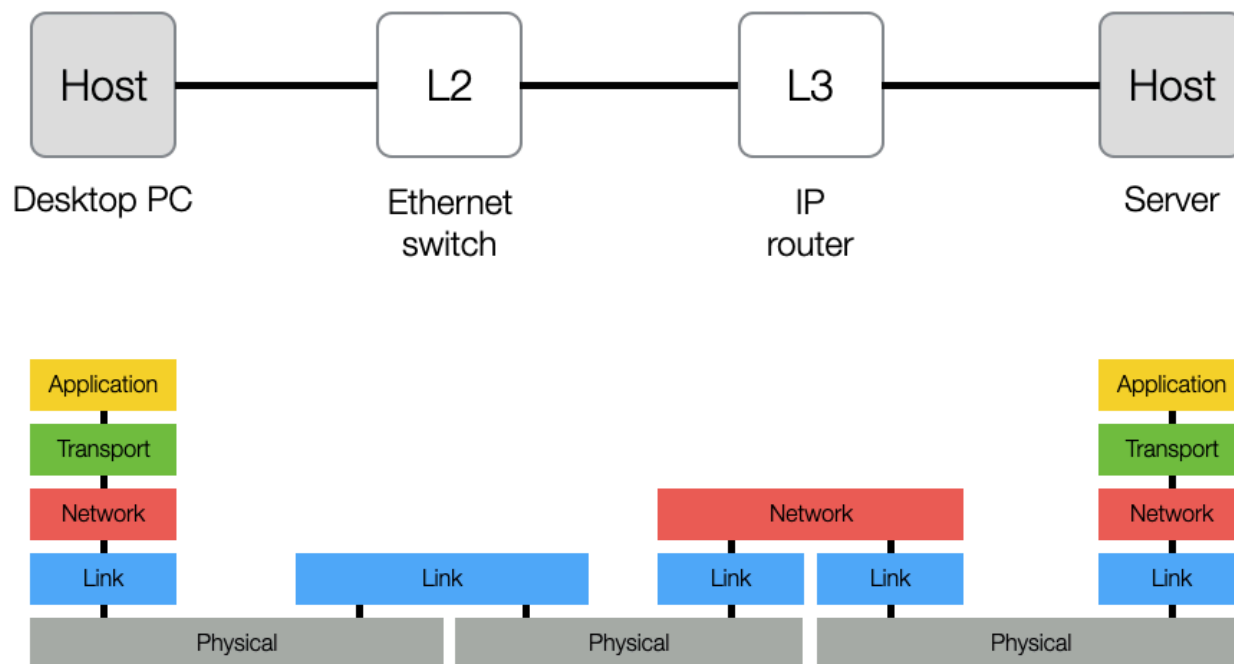
- Conceptual view



- The packet from the above layer is the payload of the packet at the current layer. E.g., the packet of application layer is encapsulated in the payload of the transport layer packet.

A Layer Example





- Use Wireshark to examine the protocol hierarchy of a packet
 - Open Wireshark and sniff on an active interface
 - ping cs.colby.edu
 - nslookup cs.colby.edu
 - ip.addr == 137.146.213.6 && icmp

Disclaimer: Notes adapted from the textbook and online resources.