CS 348 Computer Networks

Spring 2019

Instructor: Neha Karanjkar

What you will learn through this course:

WHAT: What is the Internet?

- Its Structure
- Design and Principles
- Operation

HOW: How does the Internet work, How to use it effectively

- Protocols
- Tools and Experience

WHY: Why has the internet evolved this way..

- History, trends
- Current flaws and future directions

Logistics

- Timings for **CS 348 (Lectures)**:
  - Tuesdays 10:30-11:25 (LH2)
  - Wednesdays 9:30-10:25 (CL1)
  - Fridays 8:30-9:25 (CL1)

- Timings for **CS 378 LAB**
  - Fridays 3pm to 6pm (Computer Lab, IT Building)

- Course Webpage:
  - **https://nehakaranjkar.github.io/Teaching.html**

Resources

- Textbook:
  - Kurose and Ross, Computer Networks: a Top-down Approach (6th ed)
  - Companion slides (by K&R): http://www-net.cs.umass.edu/kurose-ross-ppt-6e/

- Other References:
  - Tanenbaum and Wetherall, Computer Networks
  - Fall and Stevens, TCP/IP Illustrated, Volume 1

Grading

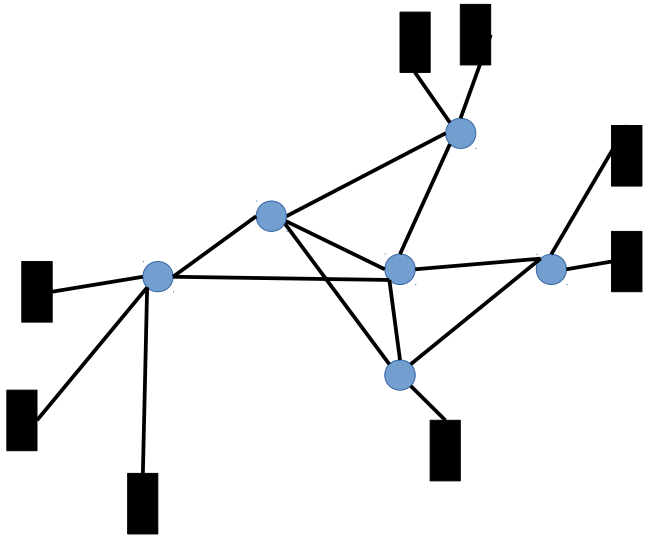
- CS 348 (6 credits)
  - Assignment: 10%
  - Quiz 1: 10%
  - Midsem: 20%
  - Quiz 2: 10%
  - Endsem: 50%

- CS 378 LAB (3 credits)
  - 4 assignments (to be completed individually OR in teams of 2, as specified)
  - Lab exam
- Requisites: C / C++ / Python, Linux environment

Course Overview

Physical Structure of the Internet

- Nodes and Links
  - Nodes: End-systems, Switches, Routers
  - Links: Ethernet, WiFi, DSL, Cellular ....



Physical Structure of the Internet

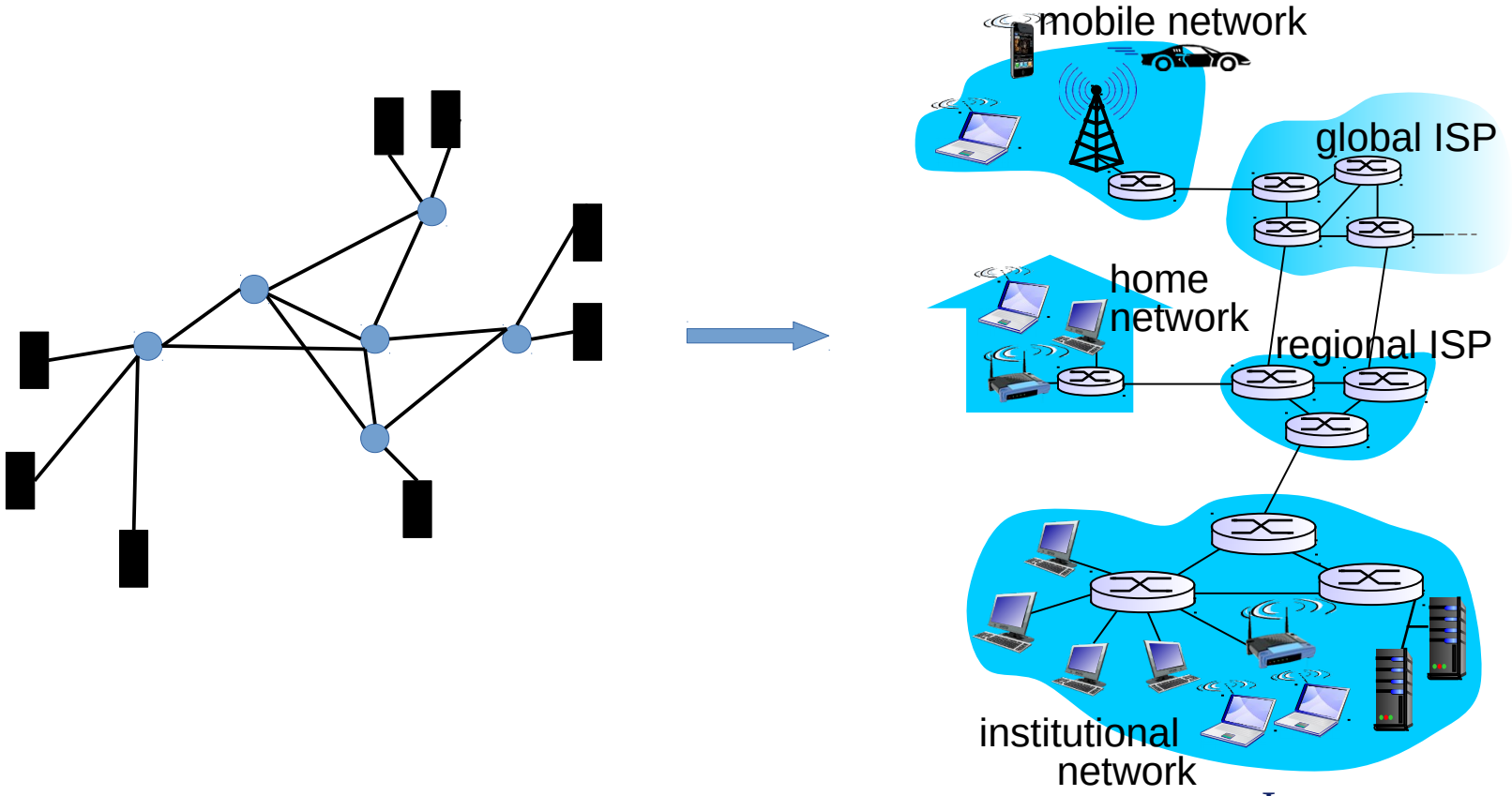
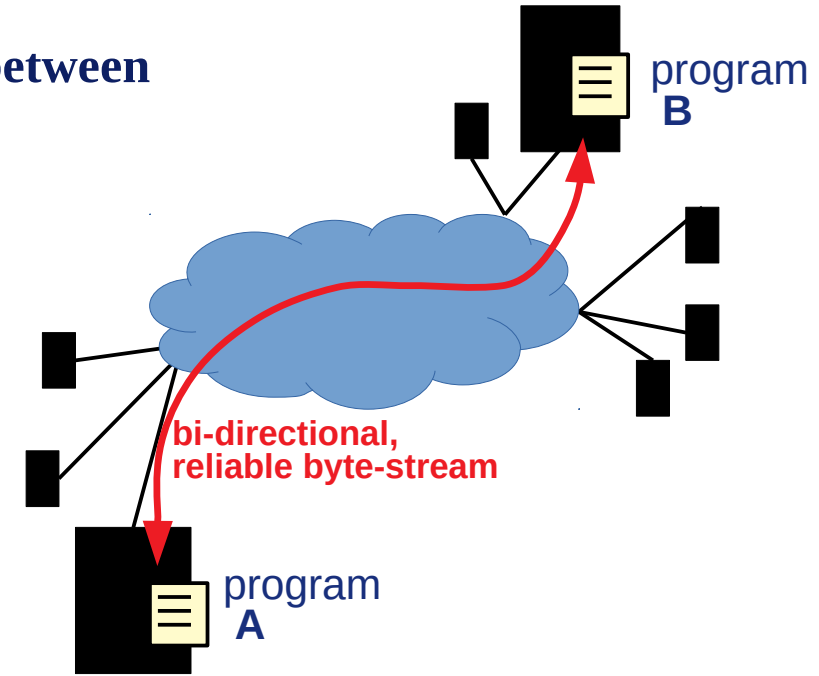


Image source: K&R 6th ed

Abstract view for applications

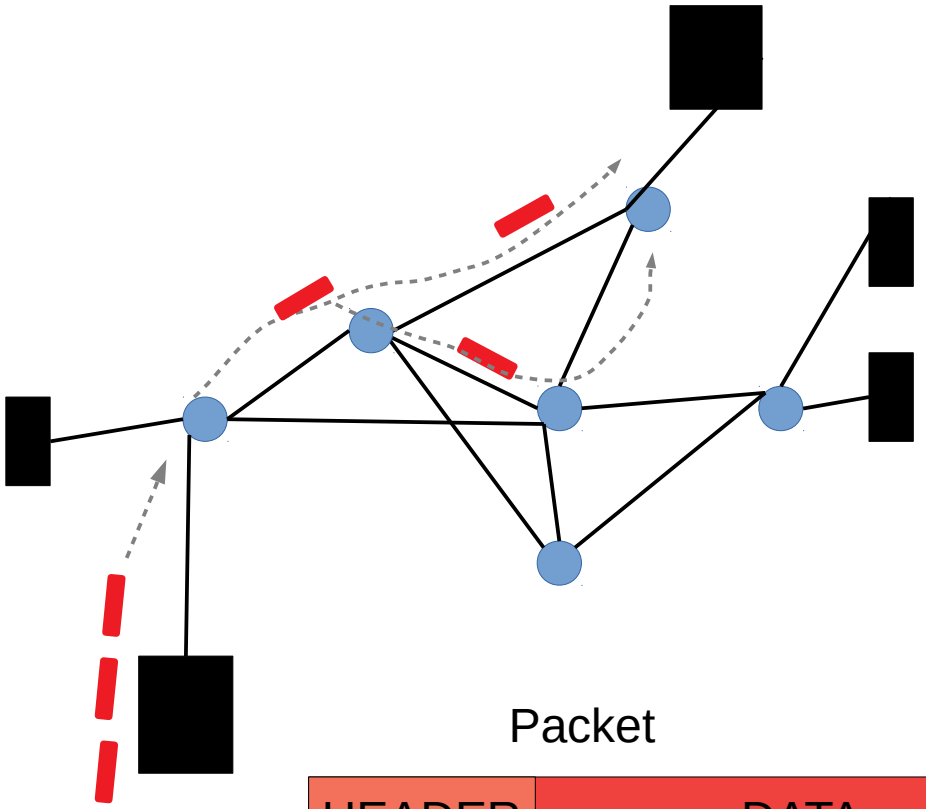
- **A (reliable) bi-directional byte-stream between two programs**
- Examples of applications ...

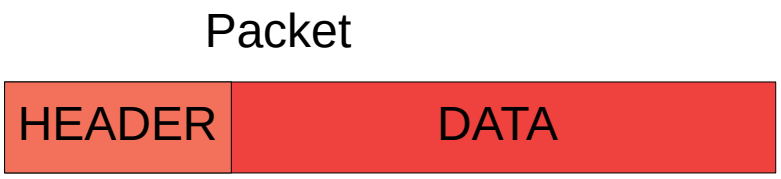


How is this abstraction supported? ...

Design of the Internet: Packet Switching

- Data split into packets. Header contains From/To address, etc
- Routers route each packet independently of others, make local decisions
  - **switches/routers can be SIMPLE and FAST**
- **Better utilization** of the link capacity (compared to circuit switching)
- Store and forward.... there can be queueing delays

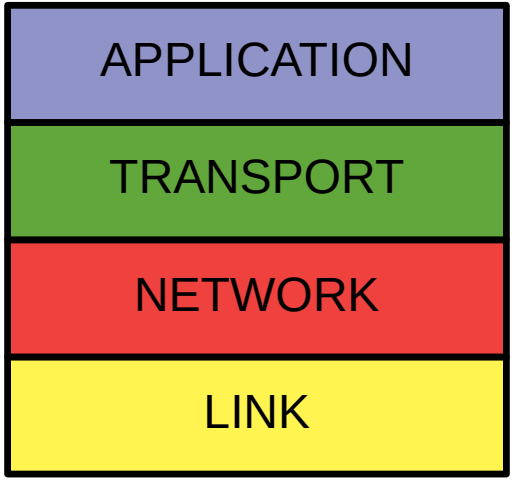




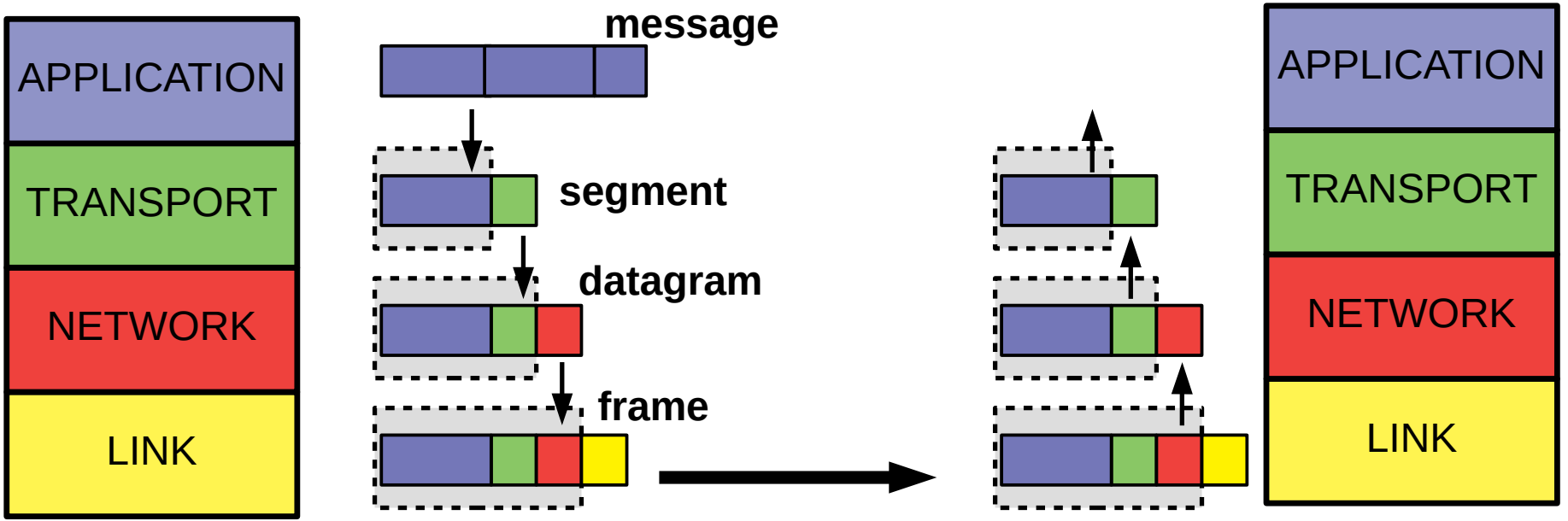
- How are routing decisions made?
- How to achieve reliable, in-order delivery?
- How to handle evolving systems ...
  - addition/removal of nodes and links
  - new link technologies
  - new applications and protocols...

Design of the Internet: Layering

- Separation of concerns
- Modularity, Re-use
- Each layer responsible for a well-defined set of functions
- Each layer has a clear, well-defined interface (API) to the layers above/ below



Design of the Internet: Layering and Encapsulation



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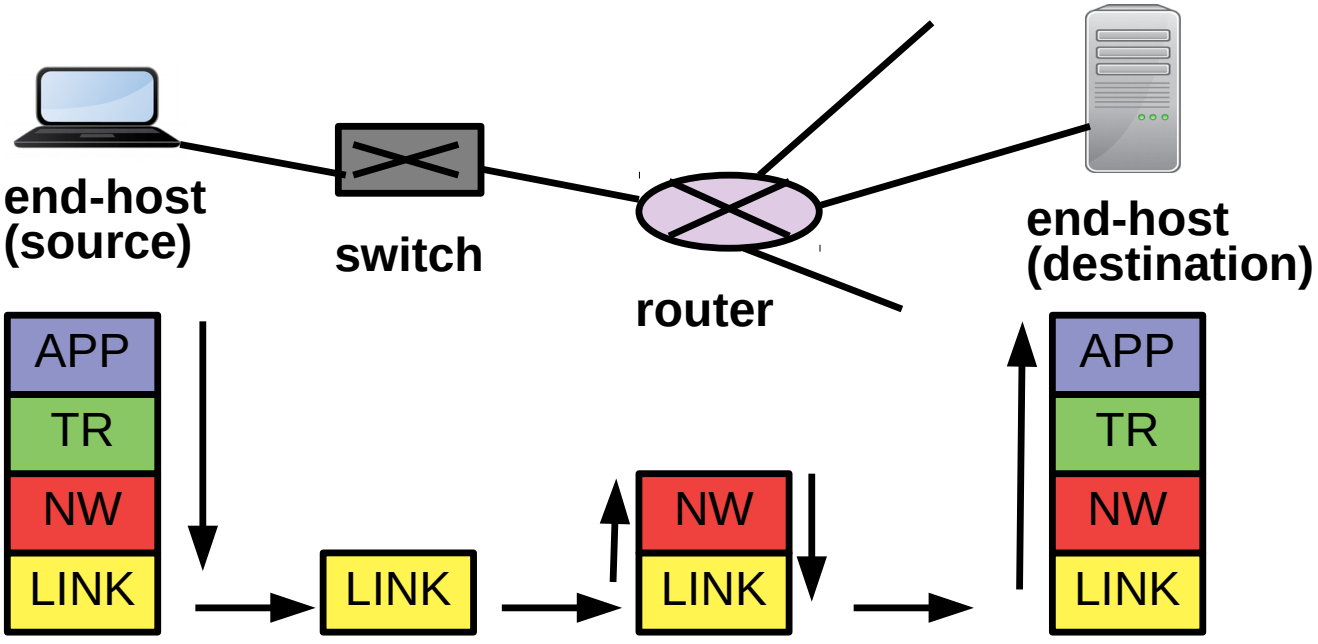
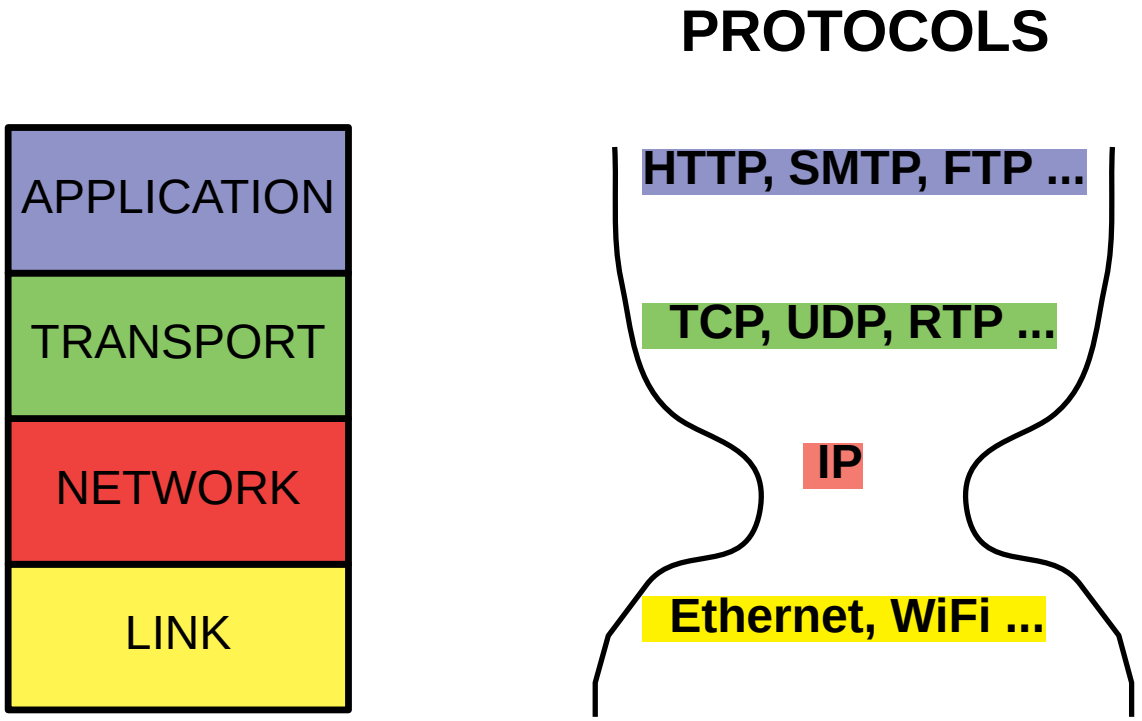
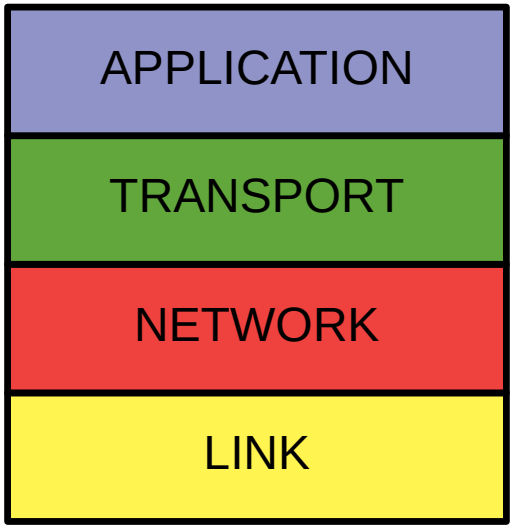


Design of the Internet: Protocols

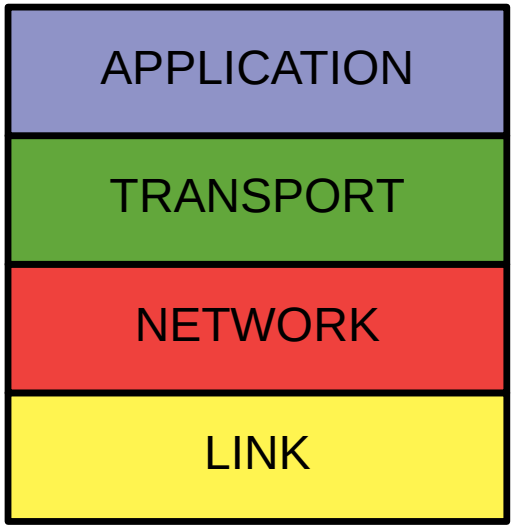


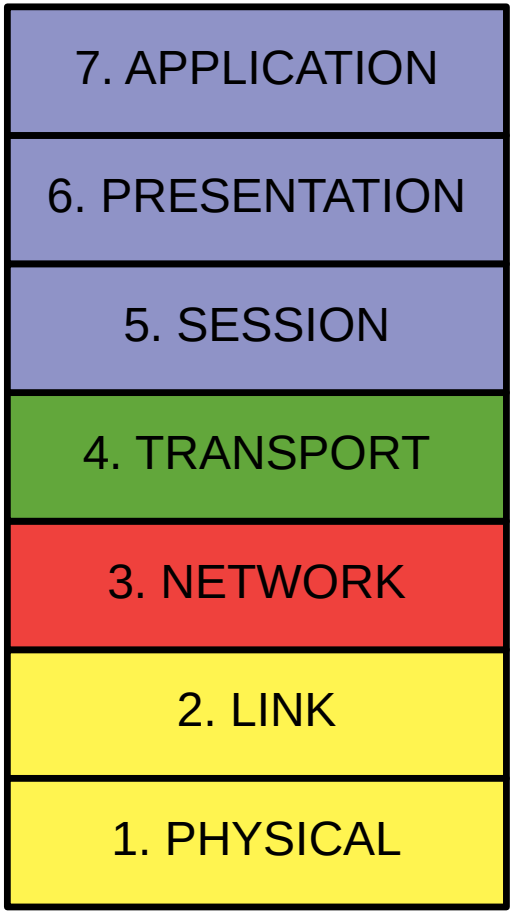
Design of the Internet: Layering

- APPLICATION LAYER: Interpret the byte-stream
- TRANSPORT LAYER: reliable, in-order delivery, congestion control
- NETWORK LAYER: End-to-end delivery of a datagram. Best effort.
- LINK LAYER: Deliver data over a single link



The 7 layer OSI Reference Model





Exercise: Addressing

- Check your laptop/desktop's network settings. What do these fields mean?
  - IP address (IPv4? IPv6?)
  - MAC address
  - Netmask
- What is their format? Are the following valid IP v4 addresses?
  - 107.24.10.4, 10.107.256.10, 1.0.5.12, 192.168.5.4
- What is a Port number?