# Math 279
# Data Communication and the Internet

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# What is the course about?

Introductory (first) course for computer Internet

- learn applications of Internet
- learn components of Internet *
- learn practice of World Wide Web

Goals:

- learn a lot (applications, concepts, practice)
- have fun (well, it should be interesting, at least)

# Course Information

- Course materials:
  - text: ***New Perspectives on HTML and CSS***, 6th Edition, Comprehensive Course Technology, 2011. (ISBN: 978-1111526443)
  - Class notes
- Class meeting time:
  - T, R, 8:30 – 9:45pm
- Office hours:
  - NB/6.63.32
  - Or By appointments

# Course Information (more)

- Class WWW site:

  http://web.cs.gc.cuny.edu/~jchu/math279/

  - everything will be posted on this site
    - syllabus
    - class notes (pdf version)
    - assignments
- me

# Course Information (more)

- Workload and grading:

| Course work | number | approx % |
|---|---|---|
| projects | 3 | 45% |
| In-class exams | 3 | 30% |
| Final project or final exam | 1 | 25% |

- Late policy
- Attendance

# Course Overview

## Part 1: Introduction of Internet

- What is the Internet?
  - Physical view
    - network edge, network core, network access
  - Functional view
    - services (web, email, file transfer, database, remote control)
  - Operational view
    - what is a network protocol?
  - A brief history of Internet

# Course overview

## Part 2: HTML

- HTML basics
  - standards and specifications
  - HTML elements and markup tags
  - basic structure of an HTML file
  - work with block-level elements
  - create lists, inline elements
  - use div and span
  - add attributes
- Working with hyperlinks, images
  - Concept of URL, work with servers

# Course overview

## Part 3: HTML web page design

- Cascading style sheets (CSS)
  - work with CSS selectors
  - create styles for lists
  - create a rollover effect
  - manage page layout with CSS
  - work with overflow and clipping styles
- HTML tables
  - create headings and cells in a table
  - cells span, create row and column groups

# Course overview

## Part 4: forms and frames

- HTML forms
  - create form elements
  - field sets and legends
  - create input boxes, form labels, option buttons, selection lists, check boxes, etc. …
- HTML frames
  - create a frameset consisting of rows and columns of frames, create links targeted in/out frames
  - format the color and size of frame borders
  - using inline frame

# Course overview

## Part 5: Javascript and XHTML

- Javascript
  - understand basic JavaScript syntax
  - JavaScript data types
  - declare and work with variables, create and call a JavaScript function
  - access an external JavaScript file
- XHTML
  - Introduction to XHTML fundamentals

# Questions, Comments, …??

# Part I: Introduction

## Our goal:

- get context, overview, "feel" of Internet

## Overview:

- what's the Internet
  - Physical, services, operational views
- a closer look
  - network edge
  - network core
  - access Internet
- protocol layers
- history

# How is the Internet Organized

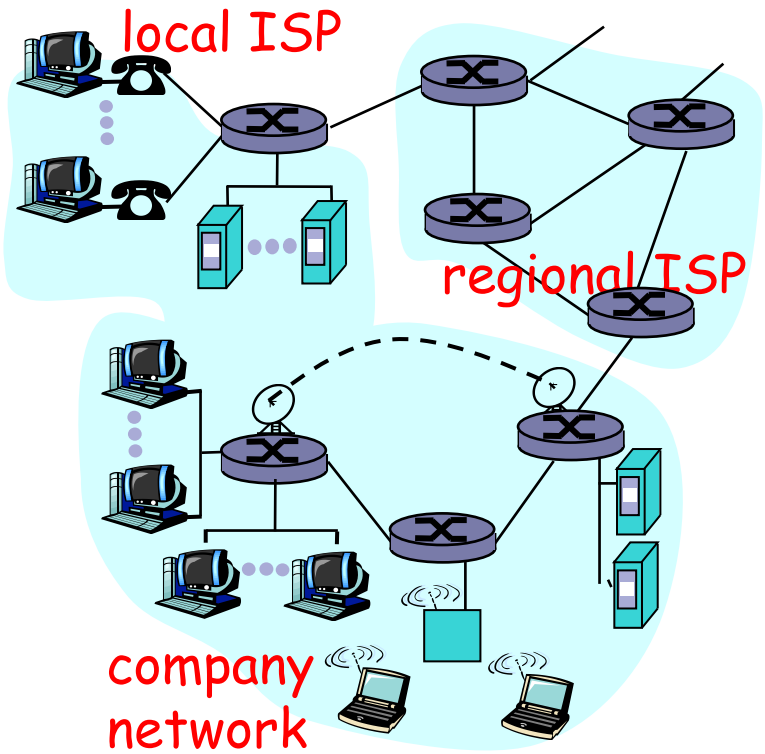
- A hierarchical structure.
- hosts combine to form a Local Area Network (LAN).
- LANs combine to form an Autonomous System (AS)
- Autonomous Systems combine to form the Internet.

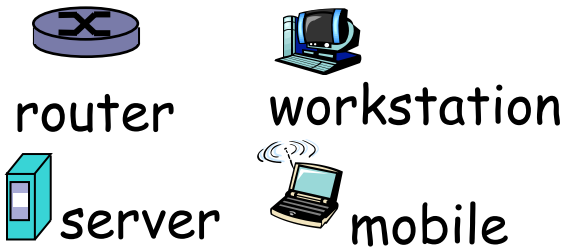
**Inter**networked **net**works - Internet !

# What's the Internet: "nuts and bolts" view

- millions of connected computing devices: *hosts, end-systems*
  - pc's workstations, servers
  - PDA's, smart phones

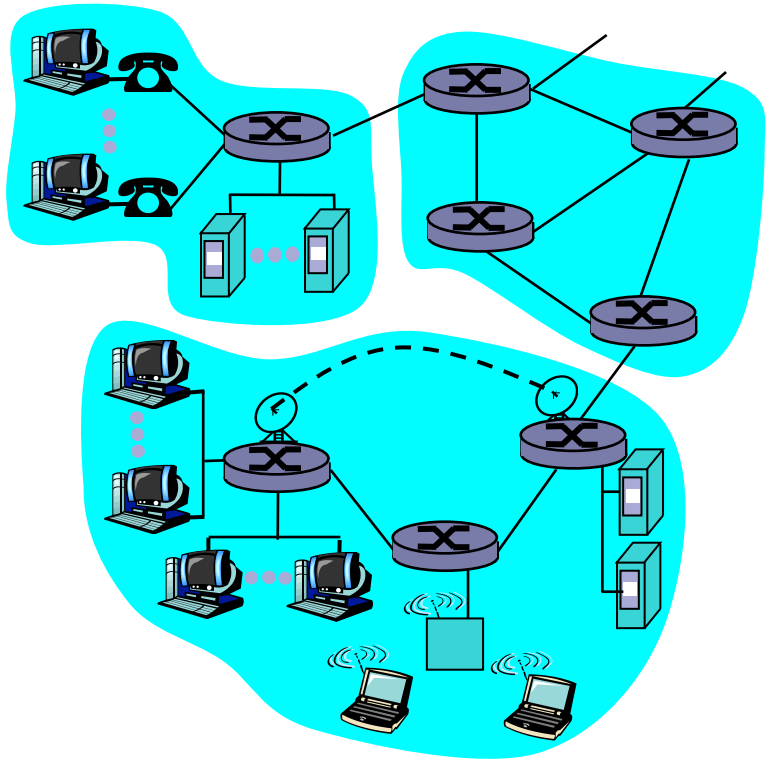
  running *network applications*
- *communication links*
  - fiber, copper, radio, satellite
- *routers:* forward *packets* (chunks) of data thru network



# What's the Internet: a service view

- communication *infrastructure* enables distributed applications:
  - WWW, email, games, e-commerce, database, voting
- communication services provided:
  - connectionless
  - connection-oriented



# What's the Internet: an operational view

human protocols:

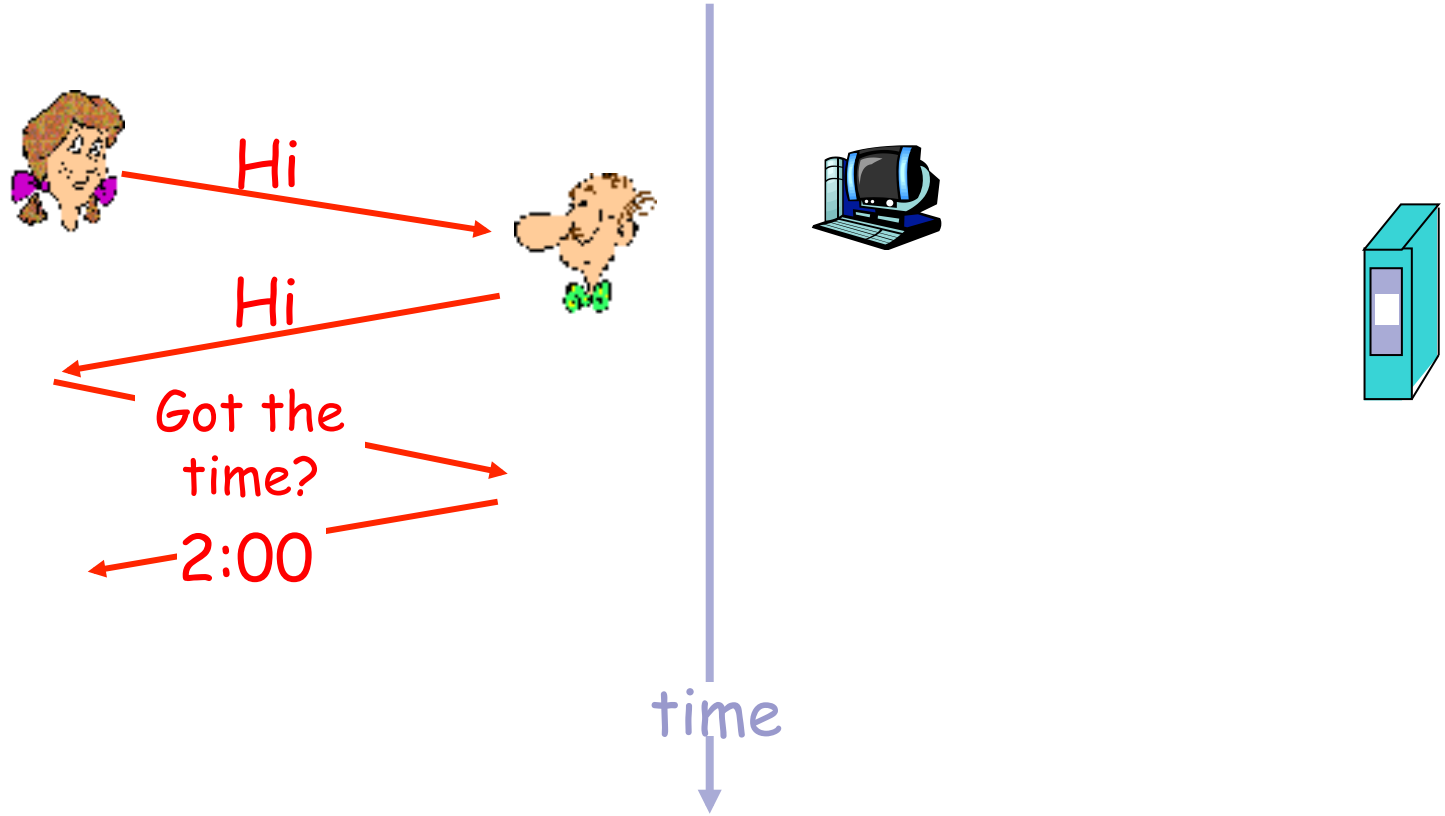
- "what's the time?"
- "I have a question"
- introductions

… specific msgs sent

… specific actions taken when msgs received, or other events

# What's a protocol?

a human protocol and a computer network protocol:




Q: Other human protocol?

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- all communication activity in Internet governed by protocols

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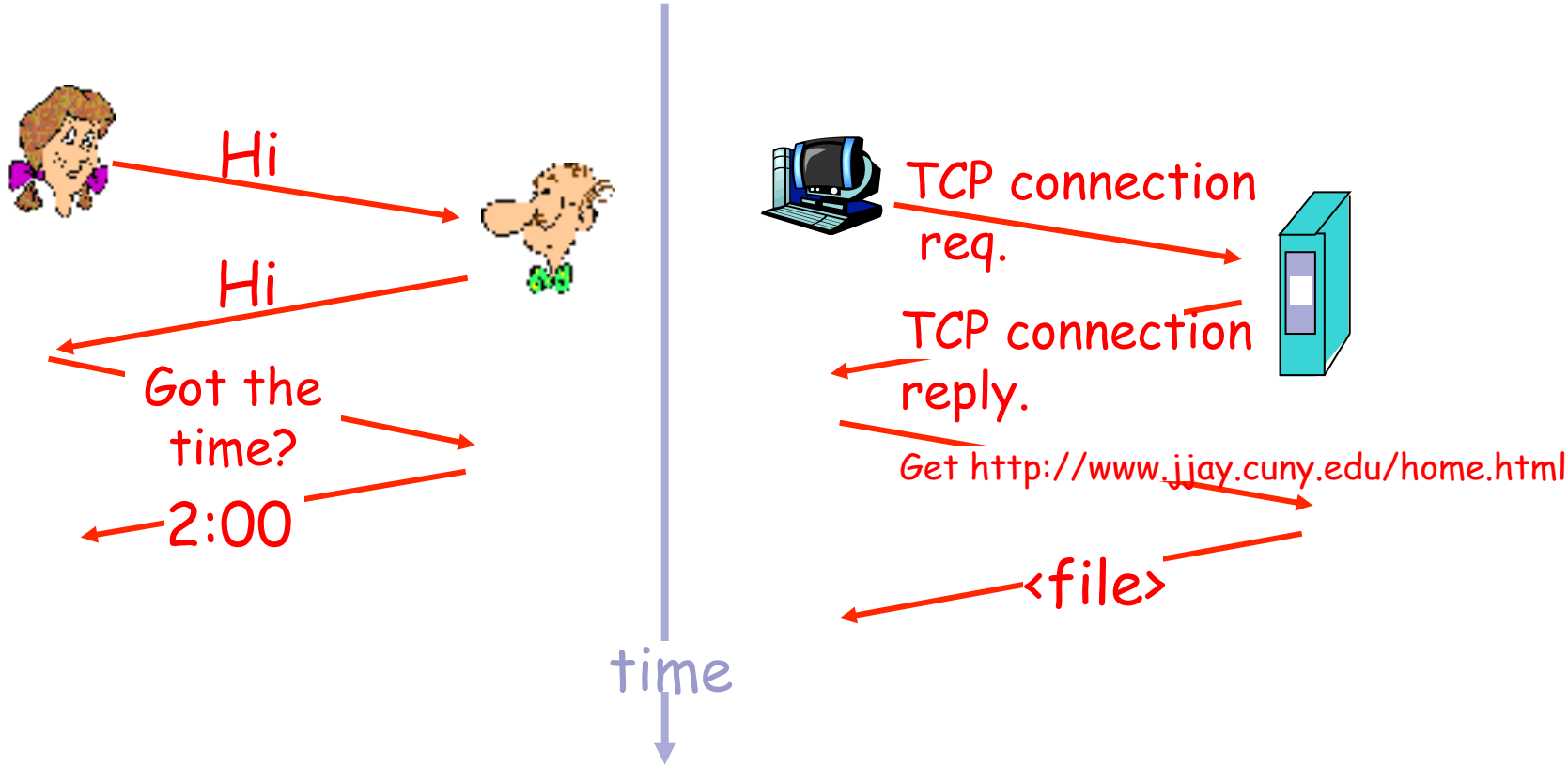


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# What's the Internet: an operational view

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network protocols:

- machines rather than humans
- all communication activity in Internet governed by protocols

*protocols define format, order of msgs sent and received among network entities, and actions taken on msg transmission, receipt*

# Take home messages

- What are the three most important physical components of Internet?
- Name four Internet applications?
- What does an Internet protocol do?

# A closer look at the Internet structure!

# Network edge: hosts

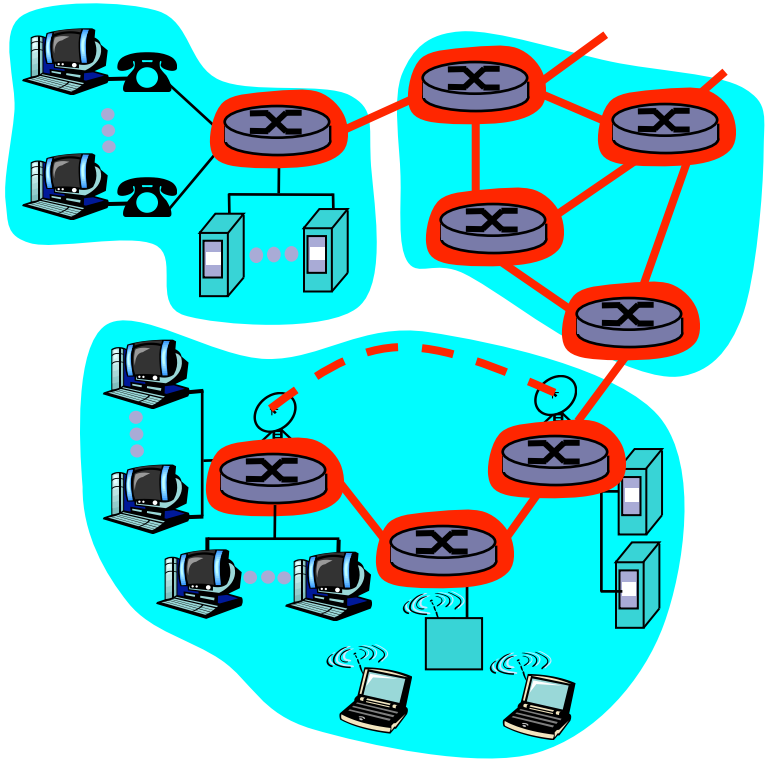
- Each host has two addresses
  - IP address, number address,
    - e.g. 128.119.240.41
  - DNS (Domain Name Server) address, literal address
    - e.g. web.jjay.cuny.edu
    - host name + domain Name
      - host name - web
      - domain name - jjay.cuny.edu
- Top Level Domain (TLD) name :

  ex - .com .edu .org .mil .gov, etc. indicating organization

  or - .au , .fr , .uk, etc. indicating country

# The Network Core

- mesh of interconnected *routers*
- *the* fundamental question: how is data transferred through net?
  - circuit switching: dedicated circuit per call: telephone net
  - packet-switching: data sent thru net in discrete "chunks"



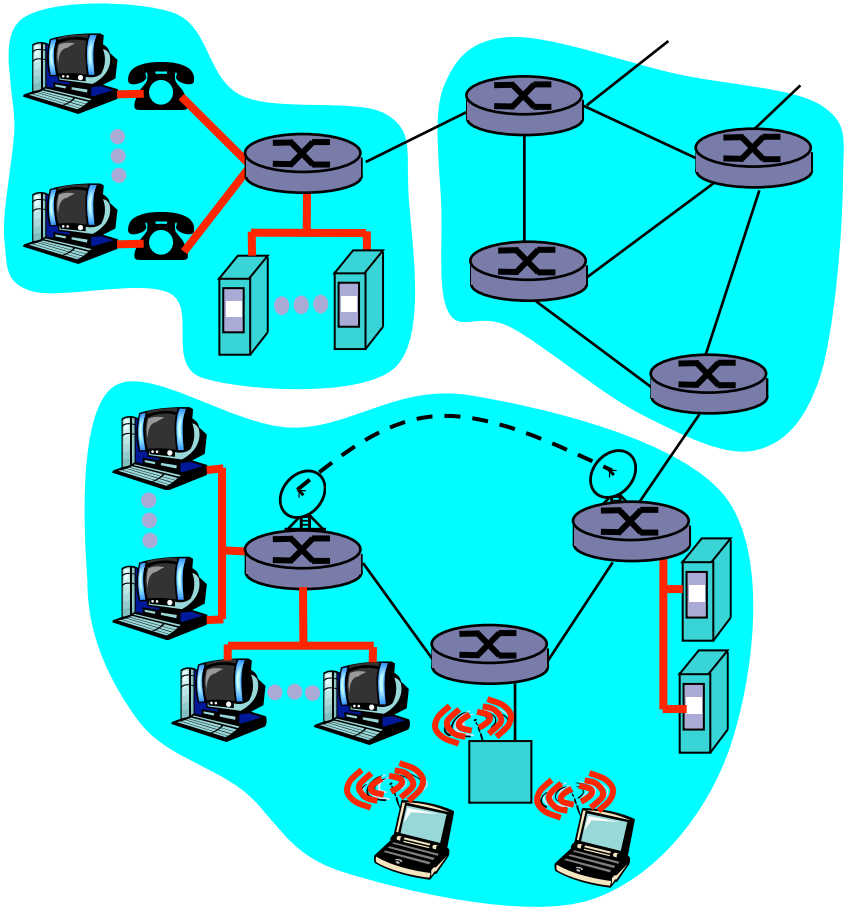
# Access networks and physical media

*Q: How to connect end systems to edge router?*

- residential access nets
- institutional access networks (school, company)
- mobile access networks

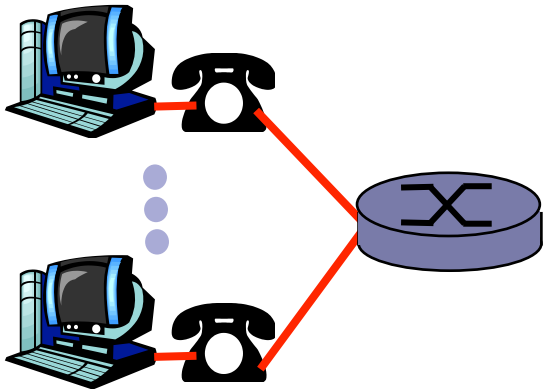
*Keep in mind:*

- bandwidth (bits per second) of access network?
- 1 bit is a memory unit that can hold a binary 0 or 1



# Residential access: point to point access

- Dialup via modem
  - up to 56Kbps direct access to router (conceptually)
- ISDN: integrated services digital network: 128Kbps all-digital connect to router
- ADSL: asymmetric digital subscriber line
  - up to 1 Mbps home-to-router
  - up to 8 Mbps router-to-home

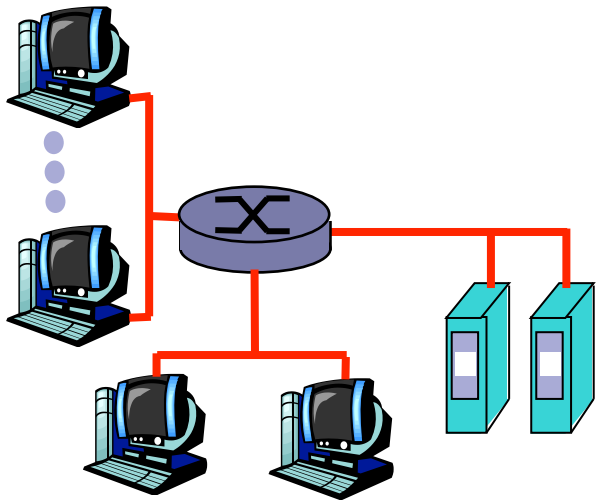


# Residential access: cable modems

- HFC: hybrid fiber coax
  - asymmetric: up to 10Mbps upstream, 1 Mbps downstream
- network of cable and fiber attaches homes to ISP router
  - shared access to router among home
  - issues: congestion
- deployment: available via cable companies, e.g., Comcast, CableVision

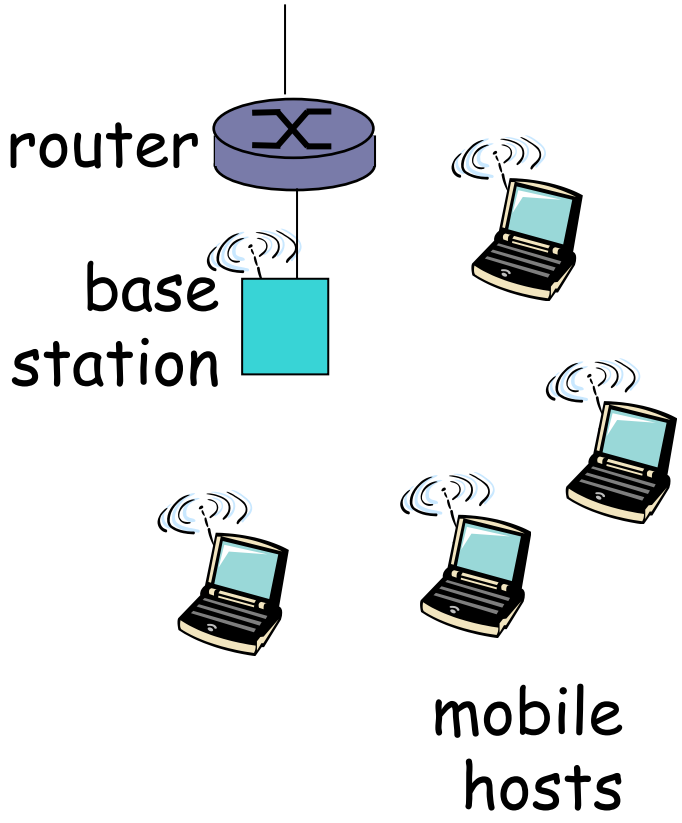
# Institutional access: local area networks

- company/univ local area network (LAN) connects end system to edge router
- Ethernet:
  - shared or dedicated cable connects end system and router
  - 10 Mbps, 100Mbps, Gigabit Ethernet
- deployment: institutions, home LANs happening now



# Wireless access networks

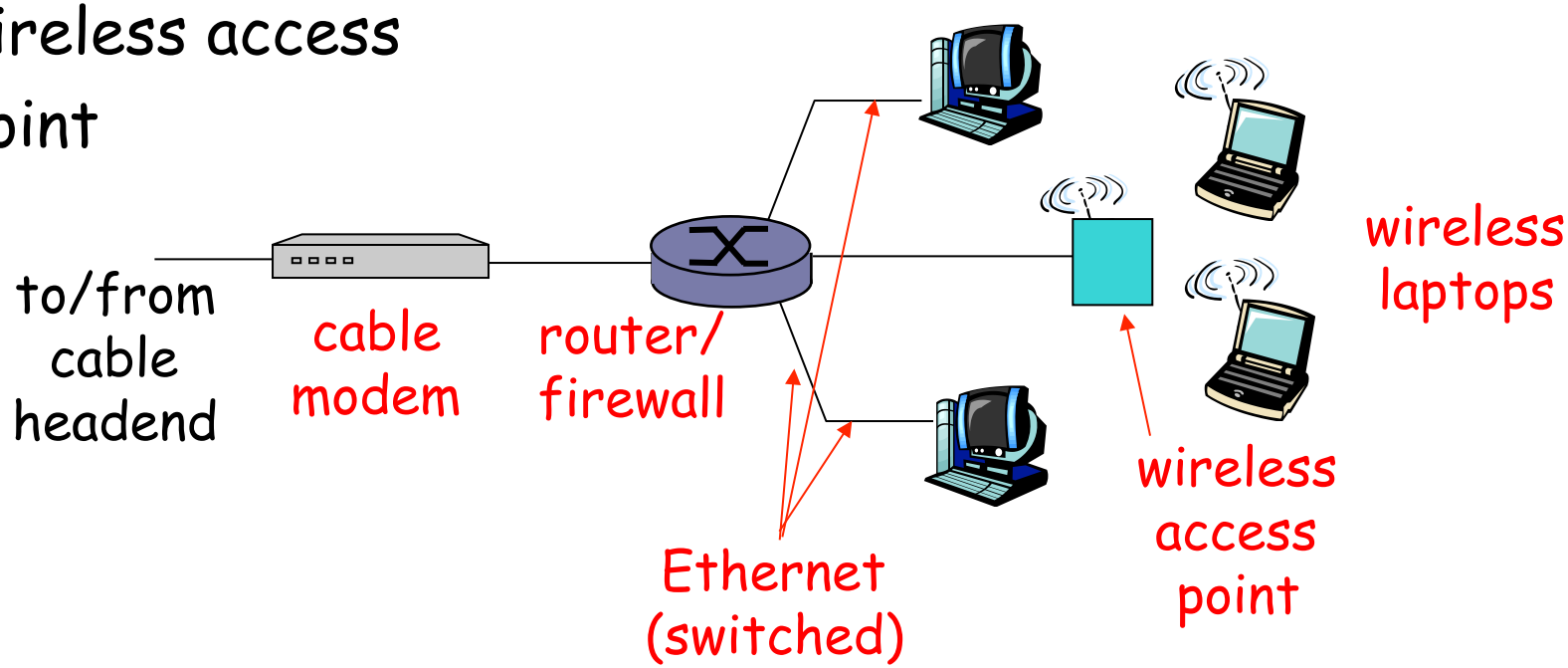
- shared *wireless* access network connects end system to router
- wireless LANs:
  - radio spectrum replaces wire
  - e.g., 802.11n up to 600 Mbps
- wider-area wireless access
  - Wireless access to ISP router via cellular network



# Home networks

Typical home network components:

- ADSL or cable modem
- router/firewall
- Ethernet
- wireless access point



# Internet Protocol Layers

# Protocol "Layers"

Networks are complex!

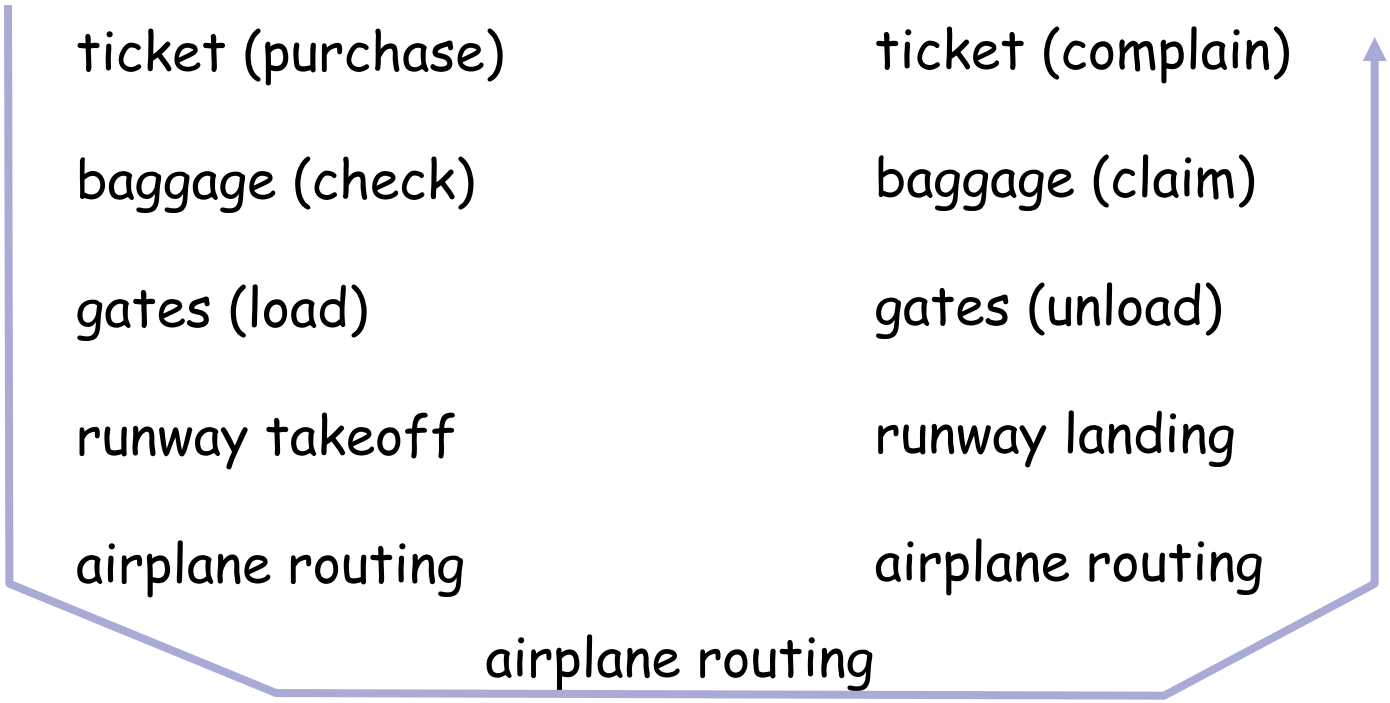
- many "pieces":
  - hosts
  - routers
  - links of various media
  - applications
  - protocols
  - hardware, software

**Question:**

Is there any hope of *organizing* structure of network?

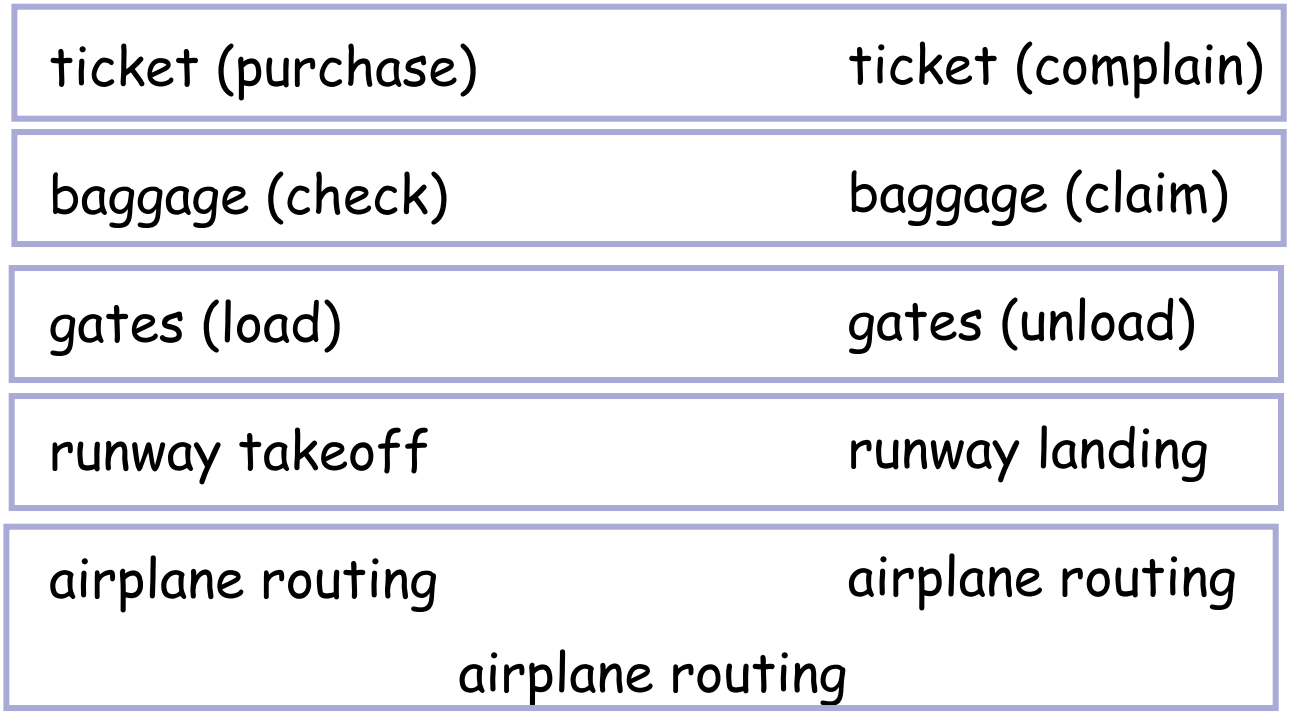
Or at least our discussion of networks?

# Organization of air travel




- a series of steps

# Organization of air travel: a different view




Layers: each layer implements a service

- via its own internal-layer actions
- relying on services provided by layer below

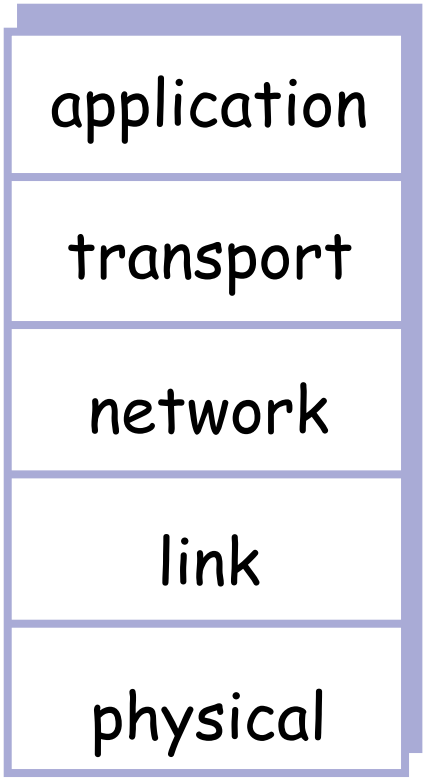
# Why layering?

Dealing with complex systems:

- explicit structure allows identification, relationship of complex system's pieces
  - layered reference model for discussion
- modularization eases maintenance, updating of system
  - change of implementation of layer's service transparent to rest of system
  - e.g., change in gate procedure doesn't affect rest of system

# Internet protocol layers

- application: supporting network applications
  - ftp, smtp, http
- transport: host-host data transfer
  - tcp, udp
- network: routing of datagrams from source to destination
  - ip, routing protocols
- link: data transfer between neighboring network elements
  - ppp, ethernet
- physical: bits "on the wire"



# History of the Internet

- 1968 - The ARPANET Contract was awarded.
- 1969 - The Arpanet was physically establised with 4 computers: SRI - UCLA - UCSB - Univ. of Utah. ( was a 50 Kbps network ).
- Today a dial-up modem is also of 56 Mbps.
- 1973 - Development started on TCP/IP

# History

- 1977 - Email takes off.
- 1982 - TCP/IP becomes standard.
- 1983 - Name Server developed.
- 1991 - Commercialization started. WWW released by CERN
- 1993 - WWW revolution begins.
- 1997 - 19.5 million hosts.

# WWW and URL

- WWW: World Wide Web, the most common internet application
  - Web page - online document generally contains hypertext
    - hypertext - a dynamic variation of traditional text that allows you to view web based documents
  - a Web browser - a piece of software provides web browsing service
- URL - every web page has a unique global address which is called the Uniform Resource Locator or URL
  - Example

    http://www.cnn.com/

# The Client/Server Model

- Client/server model is a basic design for Internet applications
  - server - is the information provider
  - client - is the information consumer
- example
  - web server and a client running web browser
  - a CNN web server simultaneously serves thousands of clients.

- In this class, we will learn how to construct Web pages at the client end!

# Take home messages

- Name three kinds of access to the Internet (e.g., dial-up).
- What are the five Internet protocol layers?
- What is WWW, URL, Server/Client model?