CSC645/745 Computer Networks

Introduction

Professor Hao Yue

Spring 2016

Welcome Back!

Who am I

Hao Yue

Assistant Professor

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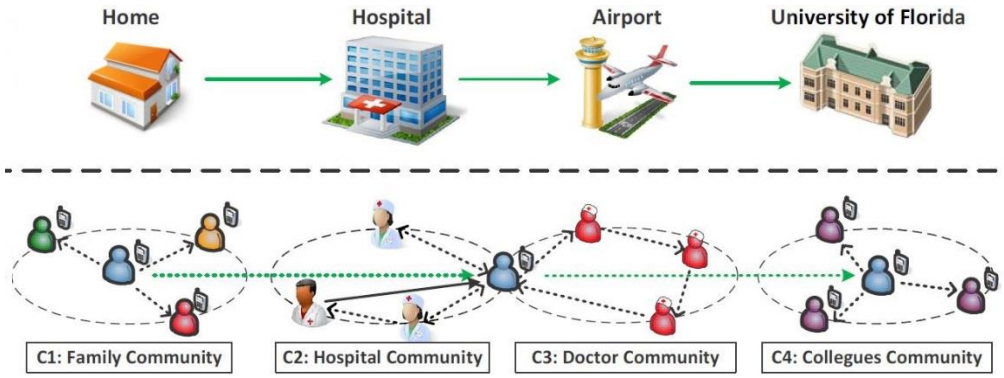
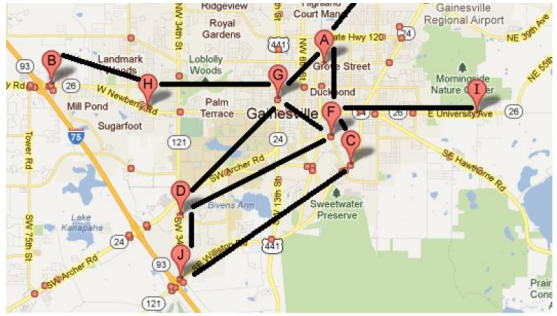
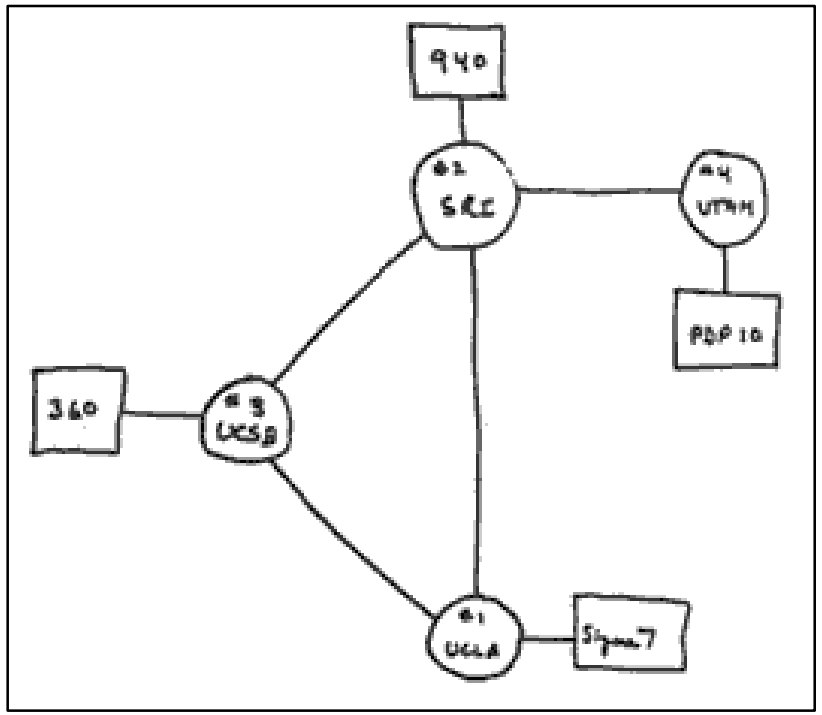


Research Interests:

- Wireless Networks
- Mobile Computing
- Computer and Network Security
- Internet of Things



Past

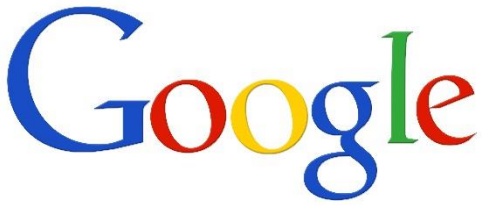


At the UCLA end, they typed in the 'l' and asked SRI if they received it; 'got the l' came the voice reply. UCLA typed in the 'o', asked if they got it, and received 'got the o'. UCLA then typed in the 'g' and the darned system CRASHED! Quite a beginning. On the second attempt, it worked fine!

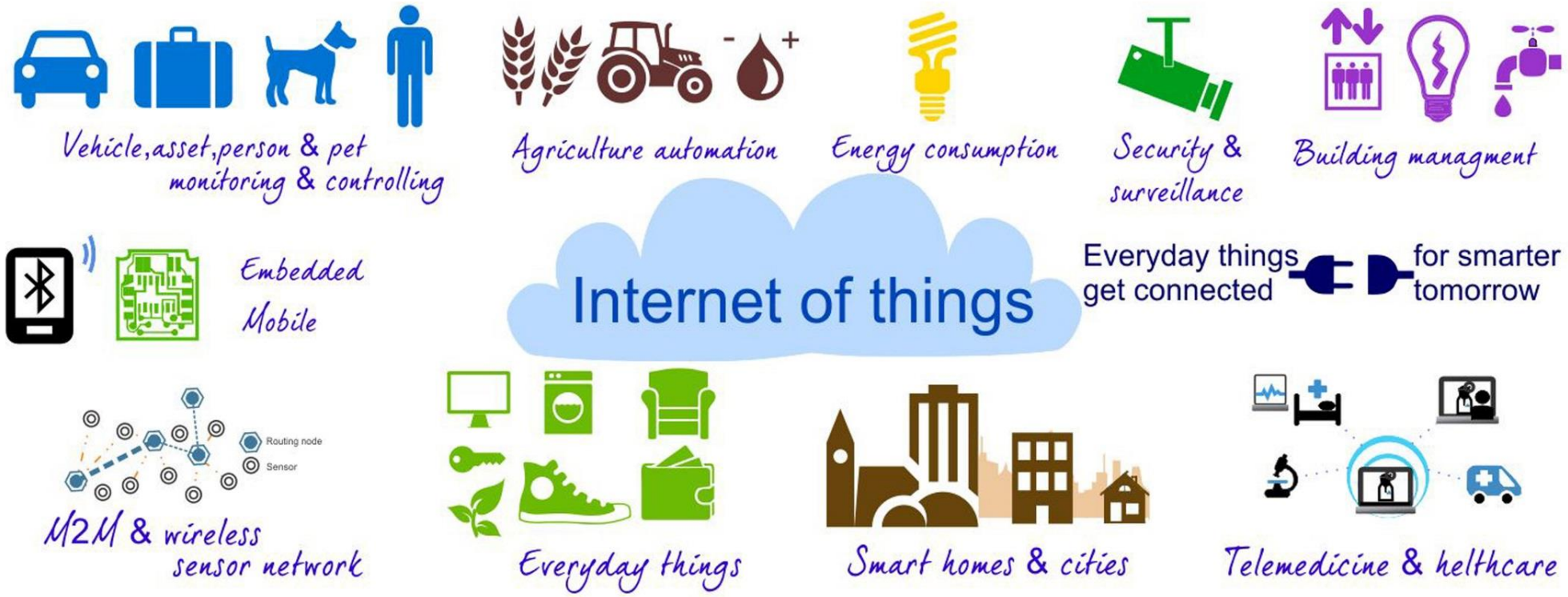
-- Leonard Kleinrock

Now

- The number of internet users worldwide was 3.17 billion in 2015
- Global data traffic over Internet will reach 1.1 zettabytes in 2016 (1 zettabyte = 2^{70} bytes)
- Internet enables millions of high-tech companies



Future



By 2020, the number of Internet-connected things will reach or exceed 50 billion.

Why we offer this course

- Computer Networking is one of the most exciting and important areas in CS
- This course provides background knowledge for studying some other advanced courses
  - Secure Networked Systems, Internet Application Design, *etc.*
- Good job market
  - Cisco, Google, Arista, Qualcomm, …

Course Overview

- This course introduces the fundamental principles and methods on design and implementation of computer networks and network protocols.
- Topics will include TCP/IP Protocol Stack, Packet Switching, Reliable Data Transfer, Congestion Control, Routing, Multiple Access Control, Internet Protocols (HTTP, SMTP, TCP, UDP, IP, RIP, OSPF, BGP), Socket Programming, and other emerging topics (as time permits).

Learning Outcome

- Students successfully completing this course will
  - Have basic knowledge on how to design, analyze, and implement computer networks
  - Gain hands-on experience in network programming and network troubleshooting tools

General Info

- Instructor: Hao Yue
- Class Time/Location: Thursday, 7:00PM – 9:45PM, TH326
- Office: TH930
- Office Hours: Wednesday 11:00AM-12:00PM and 5PM-6PM, or by appointment
- Email: haoyue@sfsu.edu
- TA: TBA

Class Time

- One class is divided into three sessions

  Session 1: 7:00-7:50PM

  Break: 7:50-8:00PM

  Session 2: 8:00-8:50PM

  Break: 8:50-9:00PM

  Session 3: 9:00-9:45PM

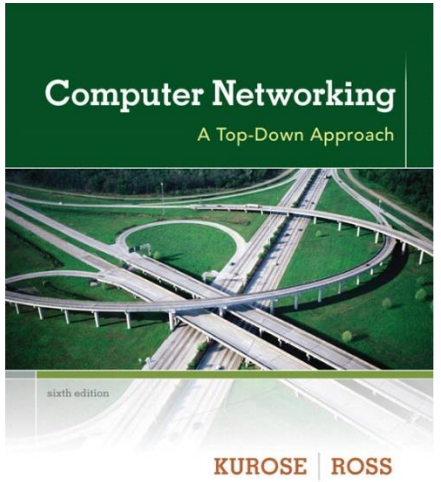
You need to know

- Operating Systems
- C/C++ programming language
- Please contact the instructor if you have questions regarding the material or concerns about whether your background is suitable for the course.

Course Materials

- Textbook
  - Computer Networking: A Top-Down Approach, 6th Edition

    By James F. Kurose and Keith W. Ross
- Course slides, assignments, and other materials will be made available on iLearn.



Grading

- Grading will be distributed as follows:
  - 10% Attendance and Quizzes
  - 15% Homework Assignments
  - 20% Course Projects
  - 25% Midterm Exam
  - 30% Final Exam
- Final scores will be converted to letter grades based on a class curve
- You get the grade that you earn, so be sure that you earn a grade you like.

Grading

- Assignments
  - Three homework assignments. Each counts for 5% of the final grade.
  - Two project assignments. Each counts for 10% of the final grade.
- Exams
  - One midterm and one final exam. Closed-book, closed-note.
- Attendance and Quizzes
  - Five roll-calls. Each counts for 1% of the final grade.
  - Quizzes count for 5% of the final grade in total
- Class Participation
  - Students actively participating in class will receive up to 5 bonus points in the final grade

Lateness

- All assignments are due at the beginning of class
- Late submission within 48 hours of the deadline is allowed, for 75% of the credits
- Students with legitimate reasons should contact the instructor before the deadline to ask for an extension
  - Unless the problem is apocalyptic, don't give me excuses
- ALWAYS start the assignments as early as possible

Academic Integrity

- As scientists and engineers, we must trust each other to make progress
- Academic dishonesty, whether from *cheating, copying, fabricating results* or through *any other dishonest practice* will not be tolerated
- Refer to the link http://cs.sfsu.edu/plagarism.html for the department policy on plagiarism/cheating
- I take this very seriously – you should too.

Chapter 1: introduction

1.1 what *is* the Internet?

1.2 network edge

- end systems, access networks, links

1.3 network core

- packet switching, circuit switching

1.4 delay, loss, throughput in networks

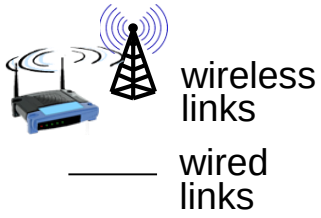
1.5 protocol layers, service models

1.6 networks under attack: security

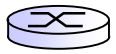
1.7 history

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

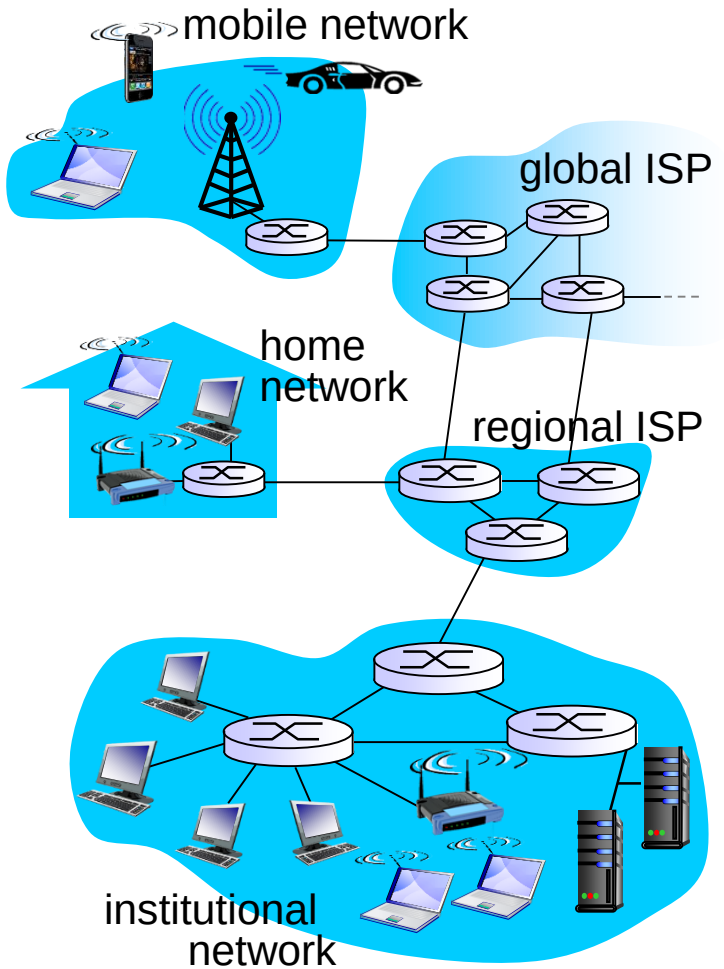
- millions of connected computing devices:
  - *hosts* = *end systems*
  - running *network apps*



- *communication links*
  - fiber, copper, radio, satellite
  - transmission rate: *bandwidth*

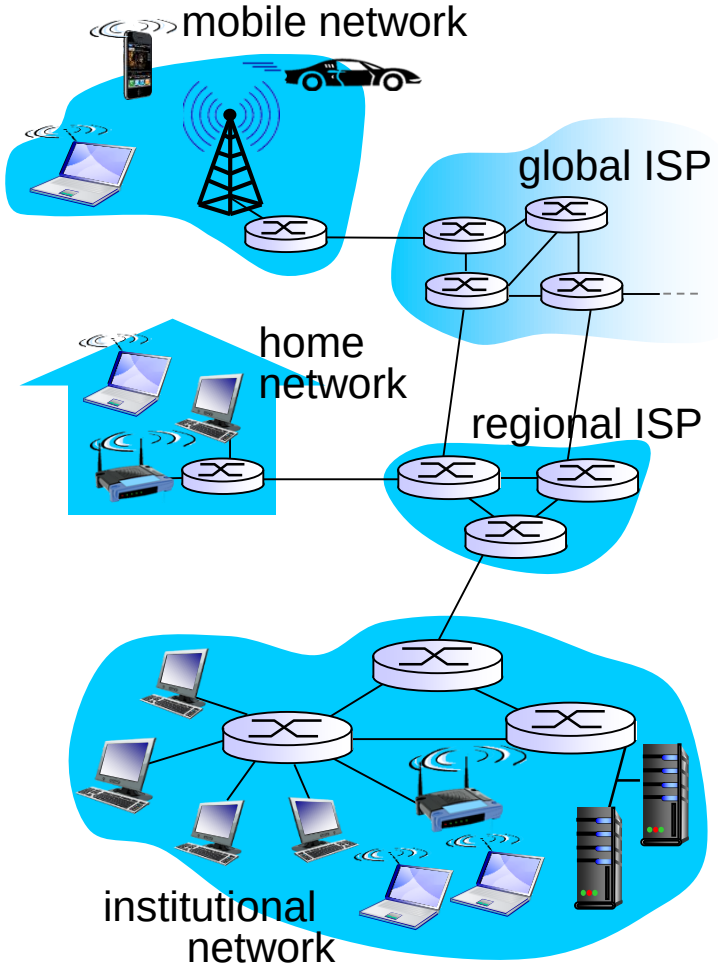


- *Packet switches:* forward packets (chunks of data)
  - *routers* and *switches*



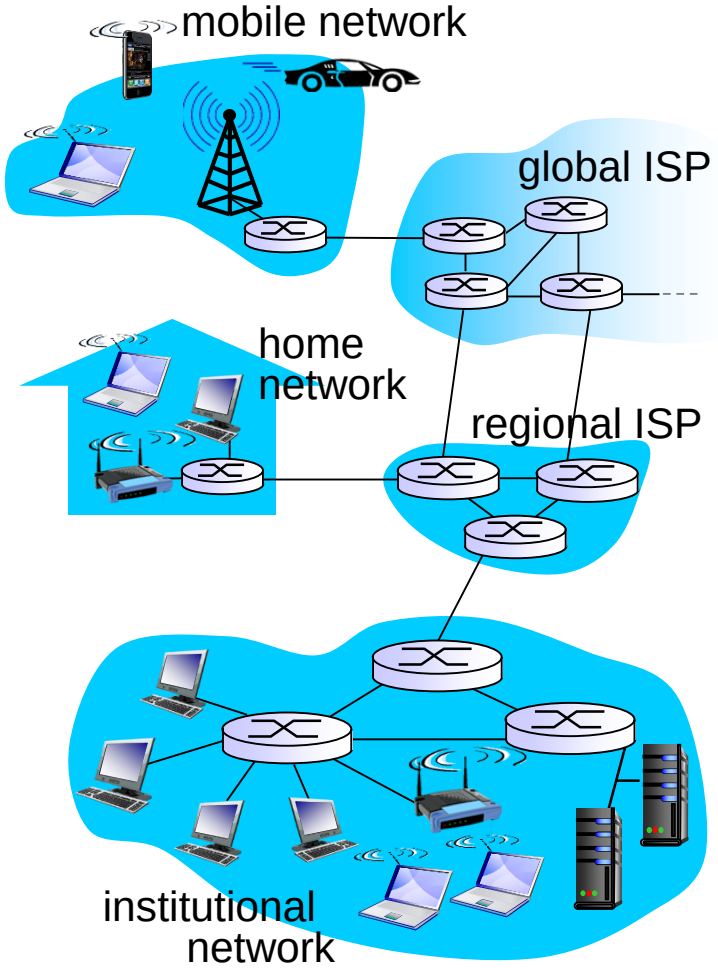
What's the Internet: "nuts and bolts" view

- *Internet:* "network of networks"
  - Interconnected ISPs
- *protocols* control sending, receiving of msgs
  - e.g., TCP, IP, HTTP, Skype, 802.11
- *Internet standards*
  - RFC: Request for comments
  - IETF: Internet Engineering Task Force



What's the Internet: a service view

- *Infrastructure that provides services to applications:*
  - Web, VoIP, email, games, e-commerce, social nets, …
- *End systems provides programming interface to apps*
  - hooks that allow sending and receiving app programs to "connect" to Internet
  - provides service options, analogous to postal service



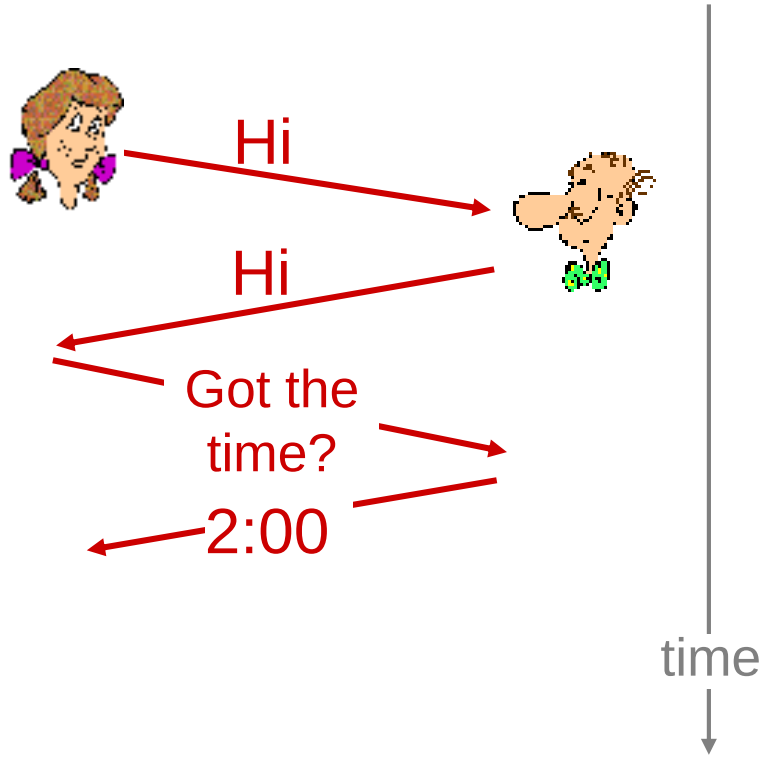
What's a protocol?

human protocols:

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

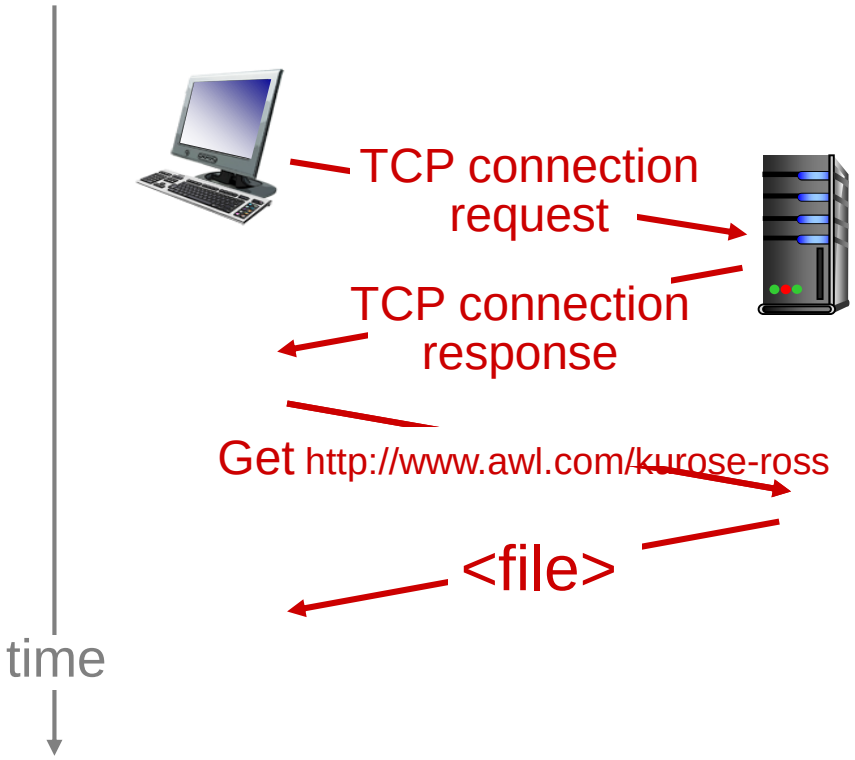
… specific msgs sent

… specific actions taken when msgs received, or other events



Q: other human protocols?

What's a protocol?



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

Chapter 1: roadmap

1.1 what *is* the Internet?

1.2 network edge

- end systems, access networks, links

1.3 network core

- packet switching, circuit switching

1.4 delay, loss, throughput in networks

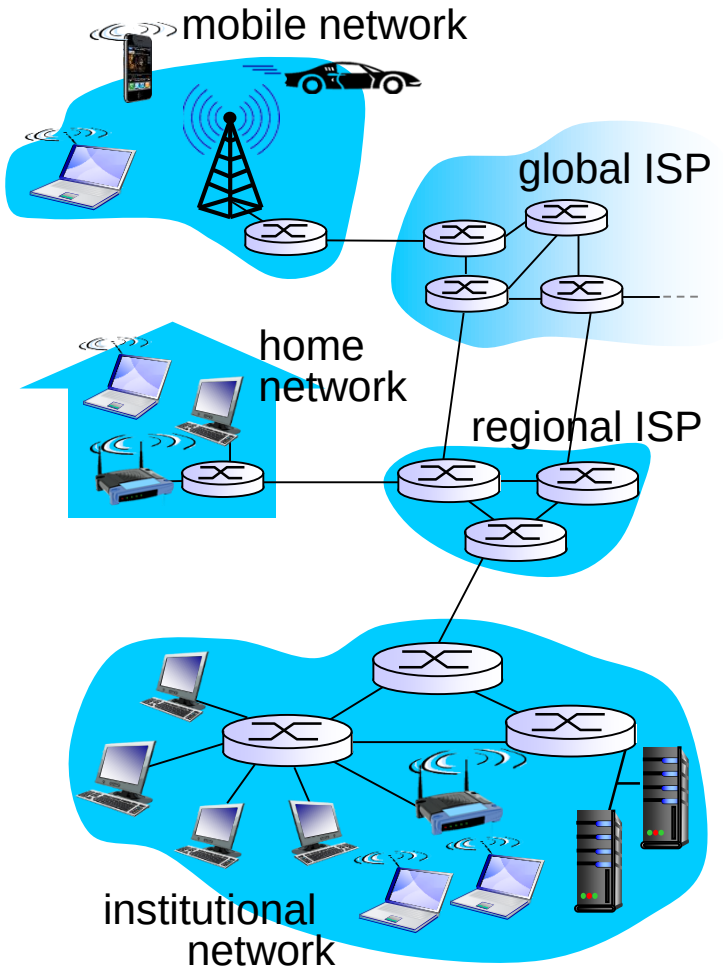
1.5 protocol layers, service models

1.6 networks under attack: security

1.7 history

A closer look at network structure:

- *network edge:*
  - hosts: clients and servers
  - servers often in data centers
- *access networks, physical media:* wired, wireless communication links
- *network core:*
  - interconnected routers
  - network of networks

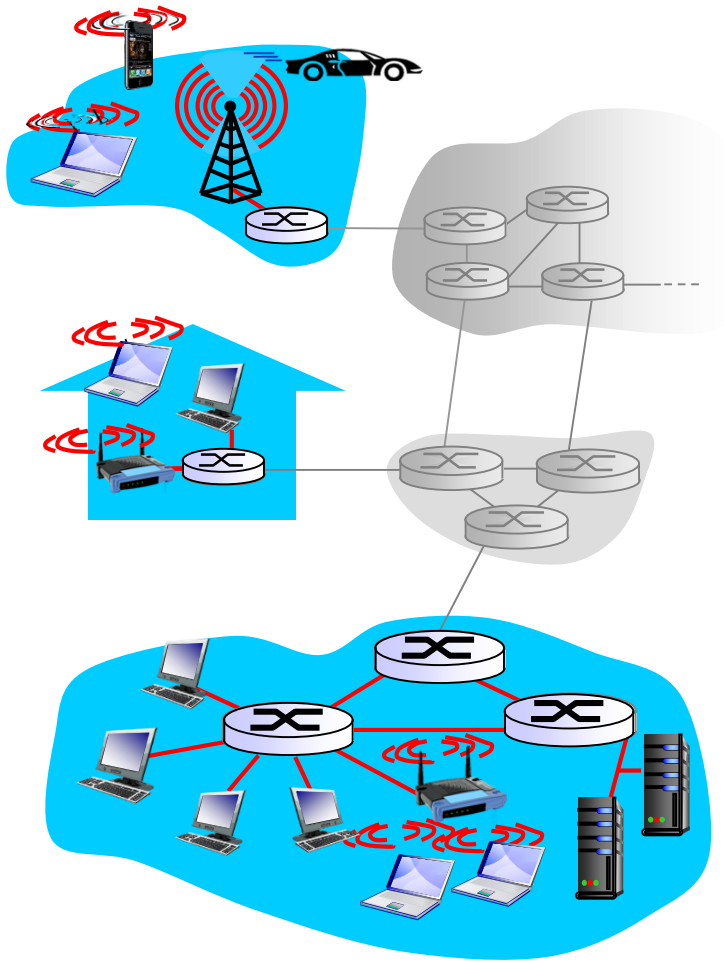


Access networks and physical media

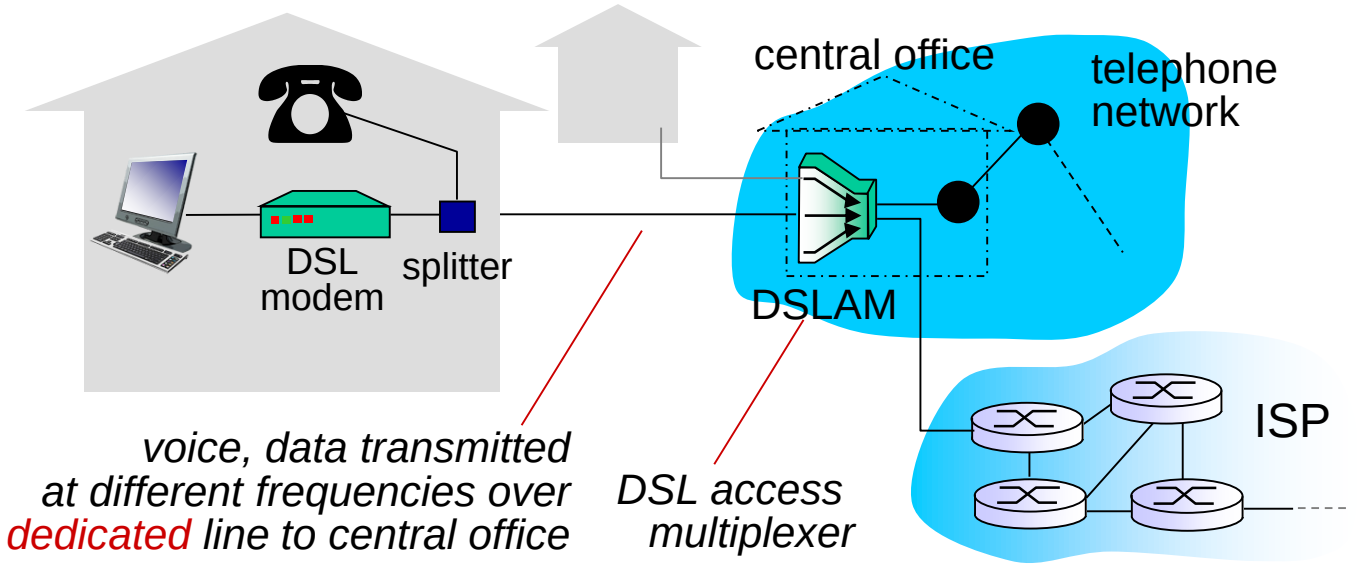
- *Access networks:* the network that physically connects an end system to the first router on a path from the end system to any other distant end system

Q: How to connect end systems to edge router?

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



Access net: digital subscriber line (DSL)



- use *existing* telephone line to central office DSLAM
  - data over DSL phone line goes to Internet
  - voice over DSL phone line goes to telephone net
- < 2.5 Mbps upstream transmission rate (typically < 1 Mbps)
- < 24 Mbps downstream transmission rate (typically < 10 Mbps)