



Computer Networks

CS3611

Course Overview

Haiming Jin

Course Logistics

Welcome to CS3611

- **Timing:** Monday, 12:55-15:40, week 1-16
- **Location:** 上院115
- **Instructor:** Haiming Jin
- **Office Hours:** By appointment
- **Email:** jinhaiming@sjtu.edu.cn
- **Course URL** (to distribute slides, homework questions, lab instructions, etc.):
 - <http://cs.sjtu.edu.cn/~jinhaiming/cs3611sp23/>
- **Canvas** (to submit homework & labs, make announcements, Q&A, etc.):
 - <https://oc.sjtu.edu.cn/courses/53043>

Welcome to CS3611



Aug 2021-Present

Associate Professor

June 2018-Aug 2021

Assistant Professor

SJTU

June 2017-June 2018

Post-doctoral Research Associate

CSL@UIUC

Research Interests

Wireless Sensing
Reinforcement Learning

Personal Webpage

<http://cs.sjtu.edu.cn/~jinhaiming/>

Aug. 2012-May 2017

Ph.D.

CS@UIUC

Advisor: Prof. Klara Nahrstedt



Sep. 2008-July 2012

B.S.

EE@SJTU

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- TAs:

- Rong Ding (dingrong@sjtu.edu.cn)
- Xiaocheng Wang (curryjam_cg@sjtu.edu.cn)

- TA office hours: Wednesday, 7:00-8:00 PM, at Software Building No. 1, Room 1319.

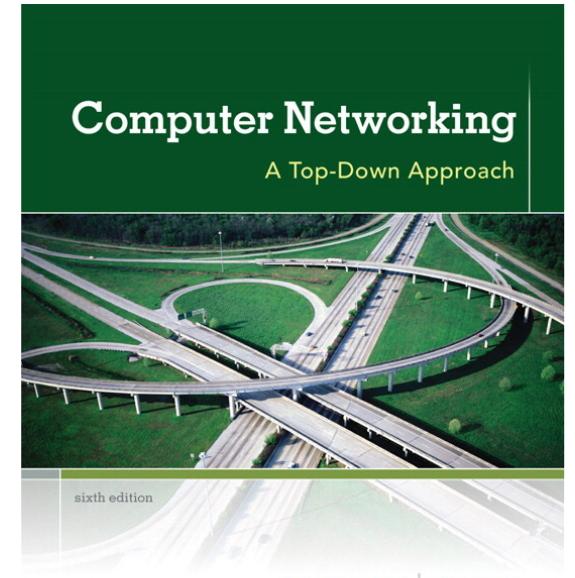
- Prerequisites:

- Basic concepts and principles of data communication will be helpful.
- Basic concepts about how computer works with binary data.
- Comfortable with C/C++ programming.
- Probability.
- Basic concepts of operating systems.

Welcome to CS3611

■ Primary Textbook:

- **Computer Networking: A Top-Down Approach, Jim Kurose & Keith Ross, PEARSON**



■ Other references:

- **Computer Networks, Andrew S. Tanenbaum, PRENTICE HALL**
- **Computer Networks: A Systems Approach, Peterson and Davie, MORGAN-KAUFMAN**
- **Computer Networks and Internets, Douglas E. Comer, PRENTICE HALL**
- **Data and Computer Communication, William Stallings, PRENTICE HALL**

Welcome to CS3611

■ Grading (tentative):

- Homework & quizzes: 40%
- Labs assignments : 30%
- Final exam: 30%

■ Policies:

- Quizzes will happen randomly during the semester without announcements beforehand.
- Please do all the assignments by yourself.
- Late submission will not be accepted.
- Any form of cheating will be reported to and subjected to the university policy.

Course Summary (Very Briefly)

What is this course about?

- *Introductory* (first) course in computer networking
 - For undergrads

- learn **principles** of computer networking
- learn **practice** of computer networking
- Internet architecture/protocols as case study
- Glimpses into the future of networking
- learn via hands-on experiments

Course information

- By the time you are finished ...
 - You understand variety of factoids and concepts
 - Propagation delay, transmit time, queueing, ...
 - Internet layered architecture, HTTP, DNS, P2P, ...
 - Sockets, Ports, ...
 - Congestion Control, Flow Control, TCP, ...
 - Routing, Basic Graphs, Djikstra's Algorithm, IP, BGP, OSPF, ...
 - DSL Vs Cable, Aloha, CSMA, TDMA, Token, ...
 - Cellular Network architecture, handoff, roaming, Mobile IP, ...
 - Wireless Networks (WiFi)
 - Security, RSA, Digital certificates, MIM attacks, ...
 - ...

If you understand 75% of these terms, you shouldn't be here

What this Course Does Not Cover

■ Does not cover

- Device drivers, SDNs, cloud computing ...
- Network theory, graph theory, proofs
- Radio hardware, embedded systems, scheduling
- Modulation schemes, transmitter/receiver design

■ Not a “communications” course

■ This is course on

- Understanding, analyzing, and (perhaps) designing protocols and algorithms in networking systems
(with case studies in wired and wireless networks)

What's the difference between

Communications
And
Networking

Hello!
I am CS 3611

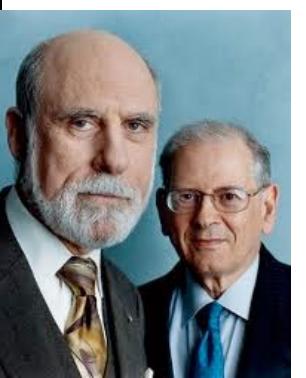
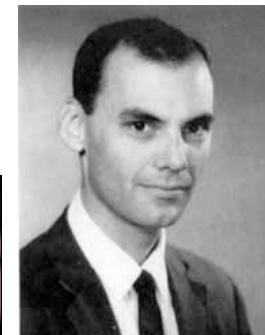


Computer Network Architecture

Past, Present, and Future

On the Shoulders of Giants

- 1961: Leonard Kleinrock published a work on packet switching
- 1962: J. Licklider described a worldwide network of computers called Galactic Network
- 1965: Larry Roberts designed the ARPANET that communicated over long distance links
- 1971: Ray Tomilson invents email at BBN
- 1972: Bob Kahn and Vint Cerf invented TCP for reliable packet transport

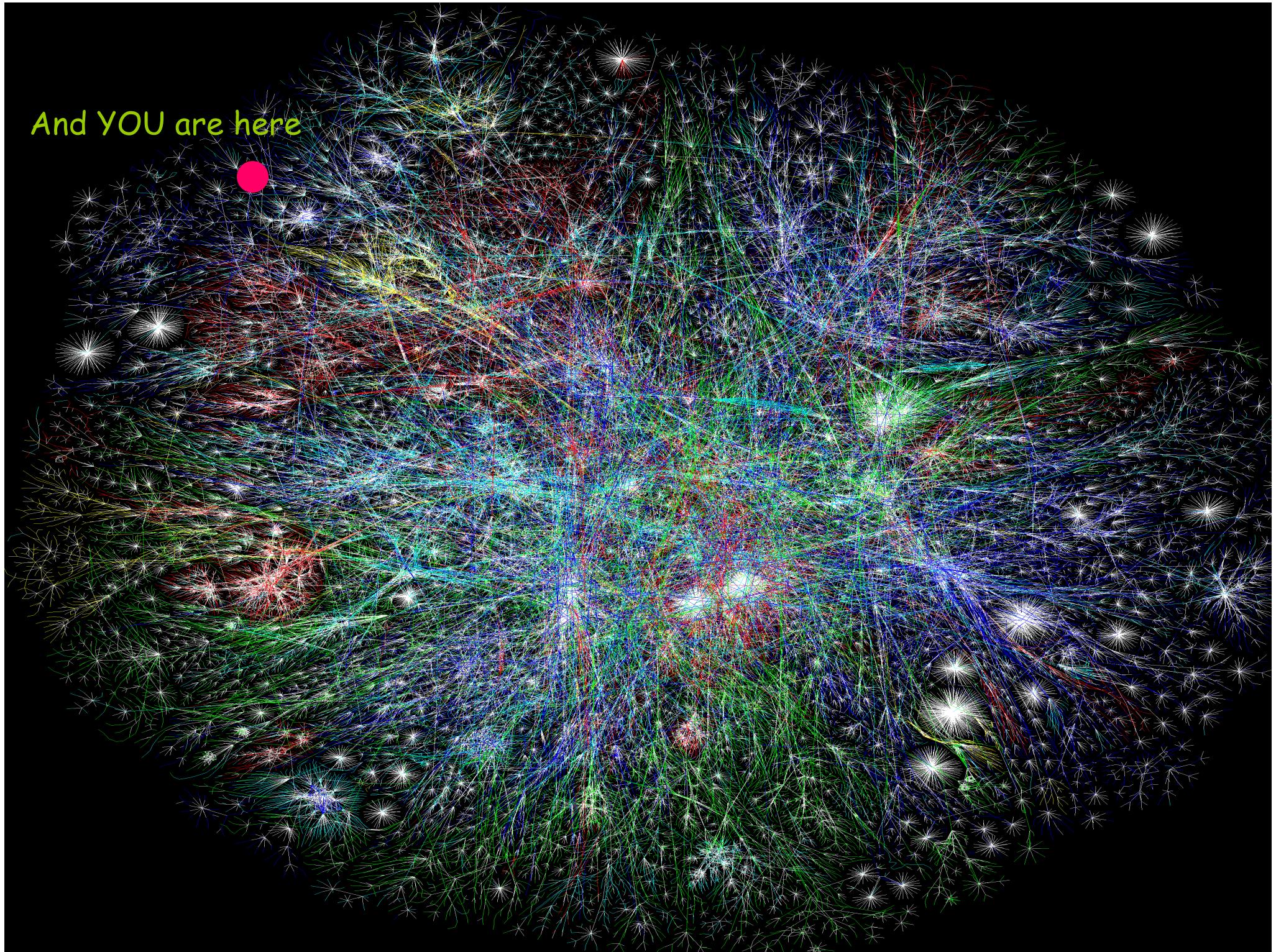


On the Shoulders of Giants ...

- 1973: David Clark, Bob Metcalfe implemented TCP and designed ethernet at Xerox PARC
- 1975: Paul Mockapetris developed DNS system for host lookup
- 1980: Radia Perlman invented spanning tree algorithm for bridging separate networks
- Things snowballed from there on ...

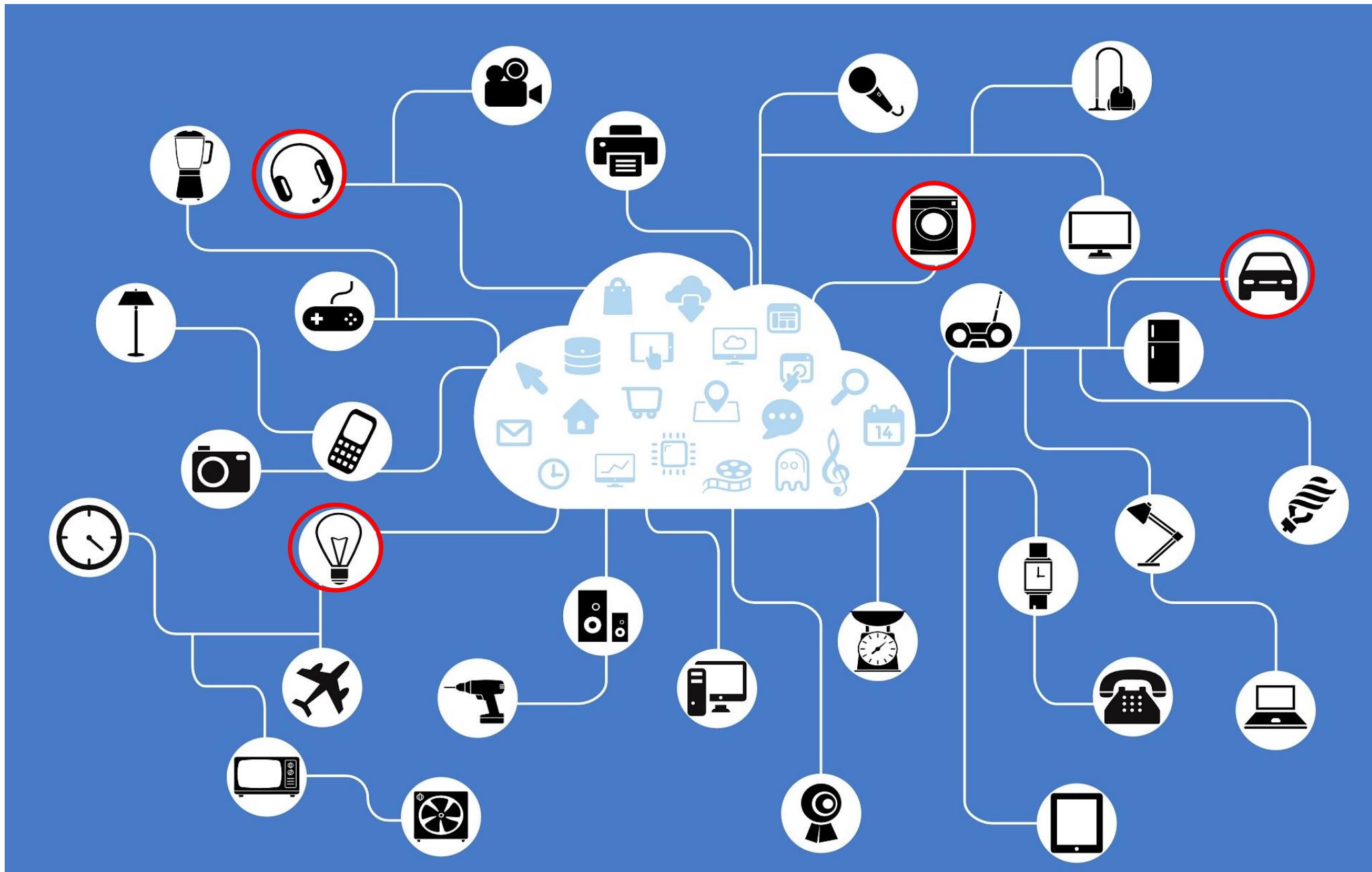
What we have today is beyond any of the inventors' imagination ...

And YOU are here



And by “YOU” I mean ...

“Cool” internet appliances



“Cool” internet appliances



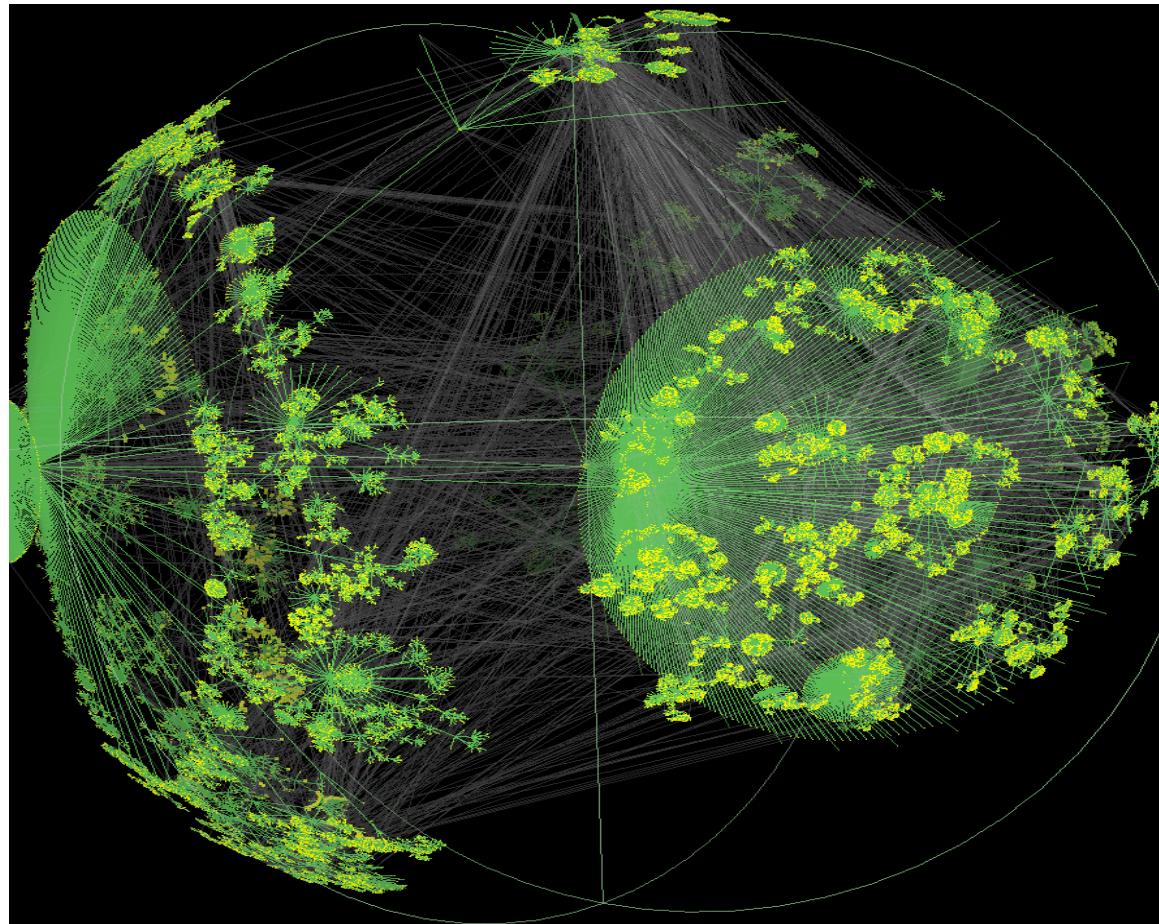
Web-enabled toaster +
weather forecaster

And Of Course people ...



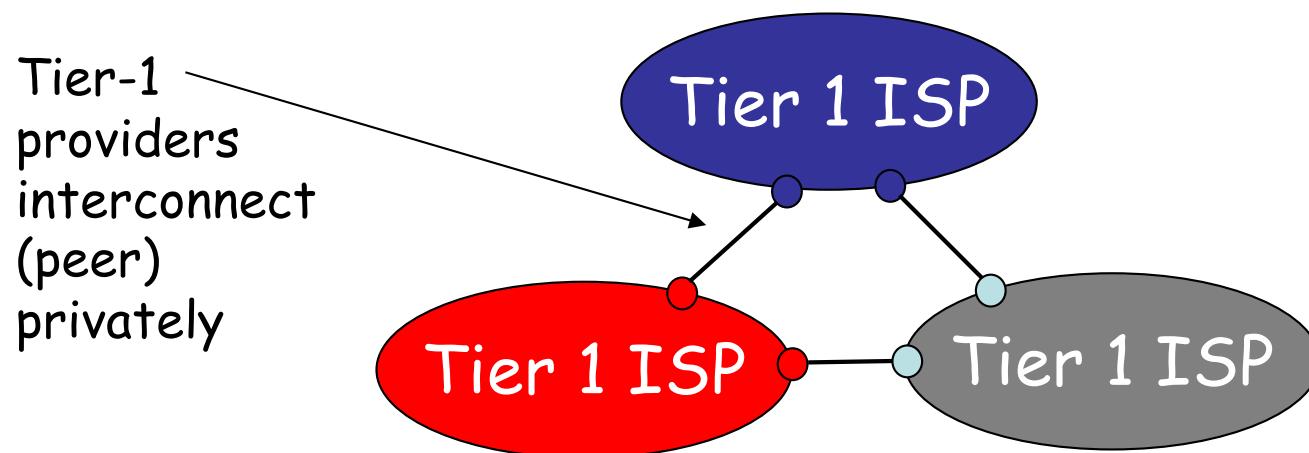
InterNetwork

- Millions of end points (you, me, and toasters) are connected over a network
 - Many end points can be addressed by numbers
 - Many others lie behind a virtual end point
- Many networks form a bigger network
- The overall structure called the Internet
 - With a capital I
 - Defined as the network of networks

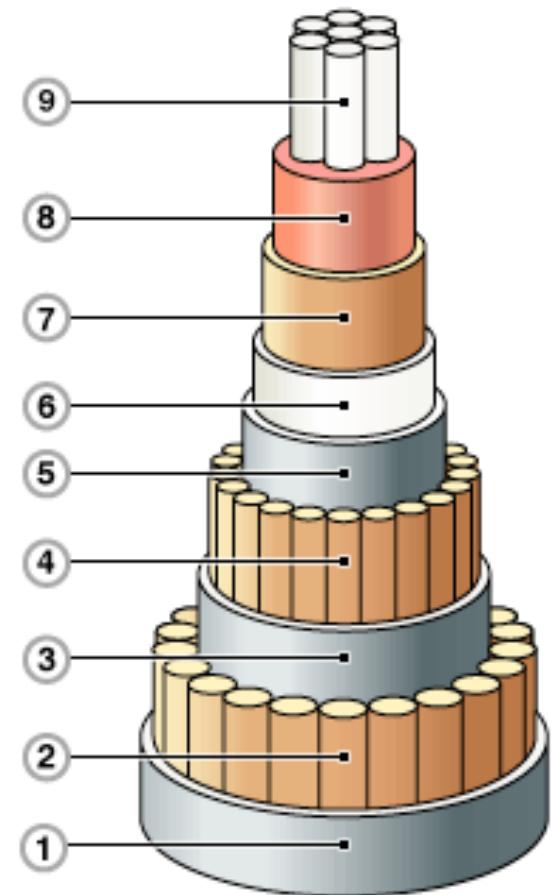


Internet structure: network of networks

- roughly hierarchical
- at center: “tier-1” ISPs (e.g., ChinaNet, CERNET, CSTNET, CHINAGBN, MCI, Sprint, AT&T, Cable and Wireless), national/international coverage
 - treat each other as equals



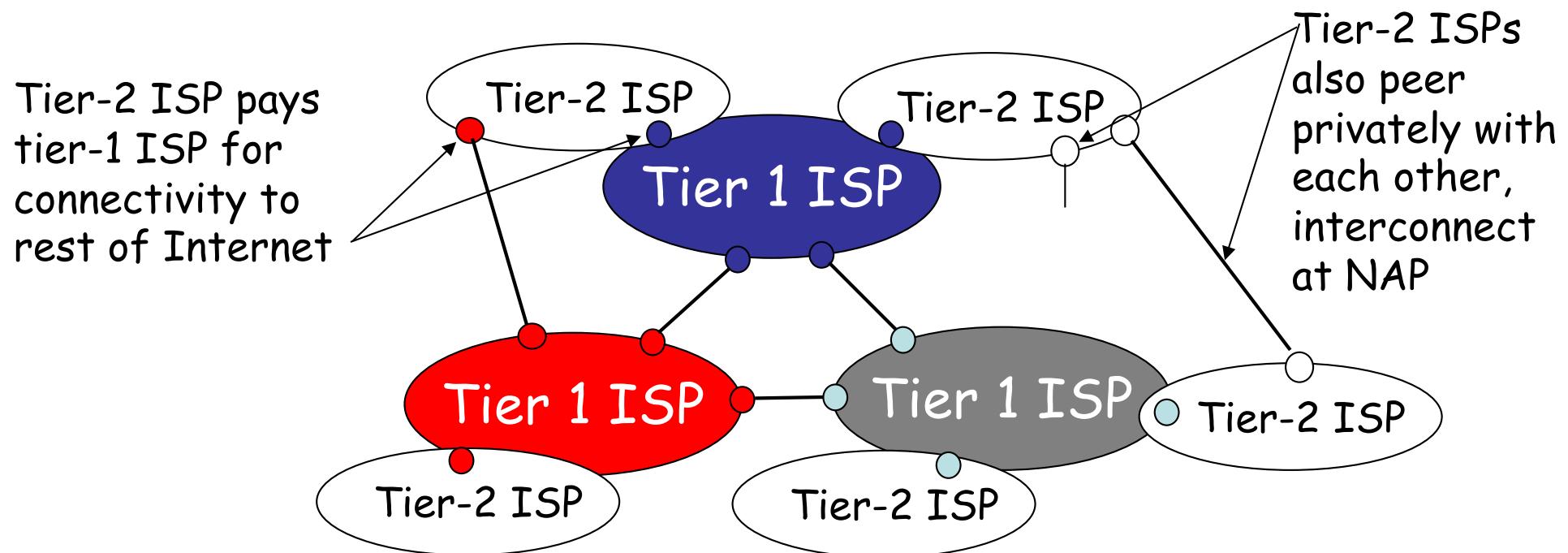
Cables Laid Out in the Oceans



Optical Fiber cross-section

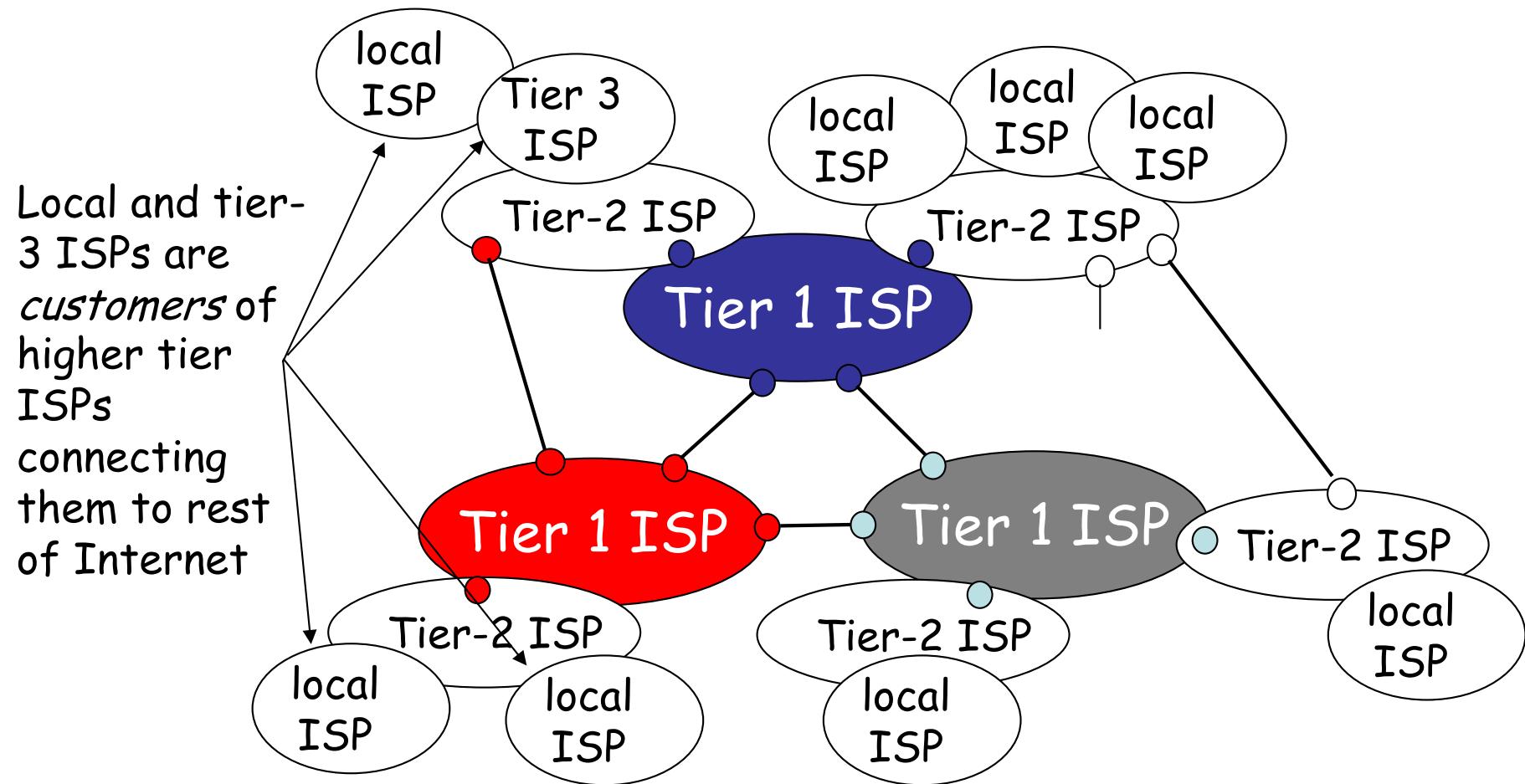
Internet structure: network of networks

- “Tier-2” ISPs: smaller (often regional) ISPs
 - Connect to one or more tier-1 ISPs, possibly other tier-2 ISPs
- France telecome, Tiscali, etc. buys from Sprint



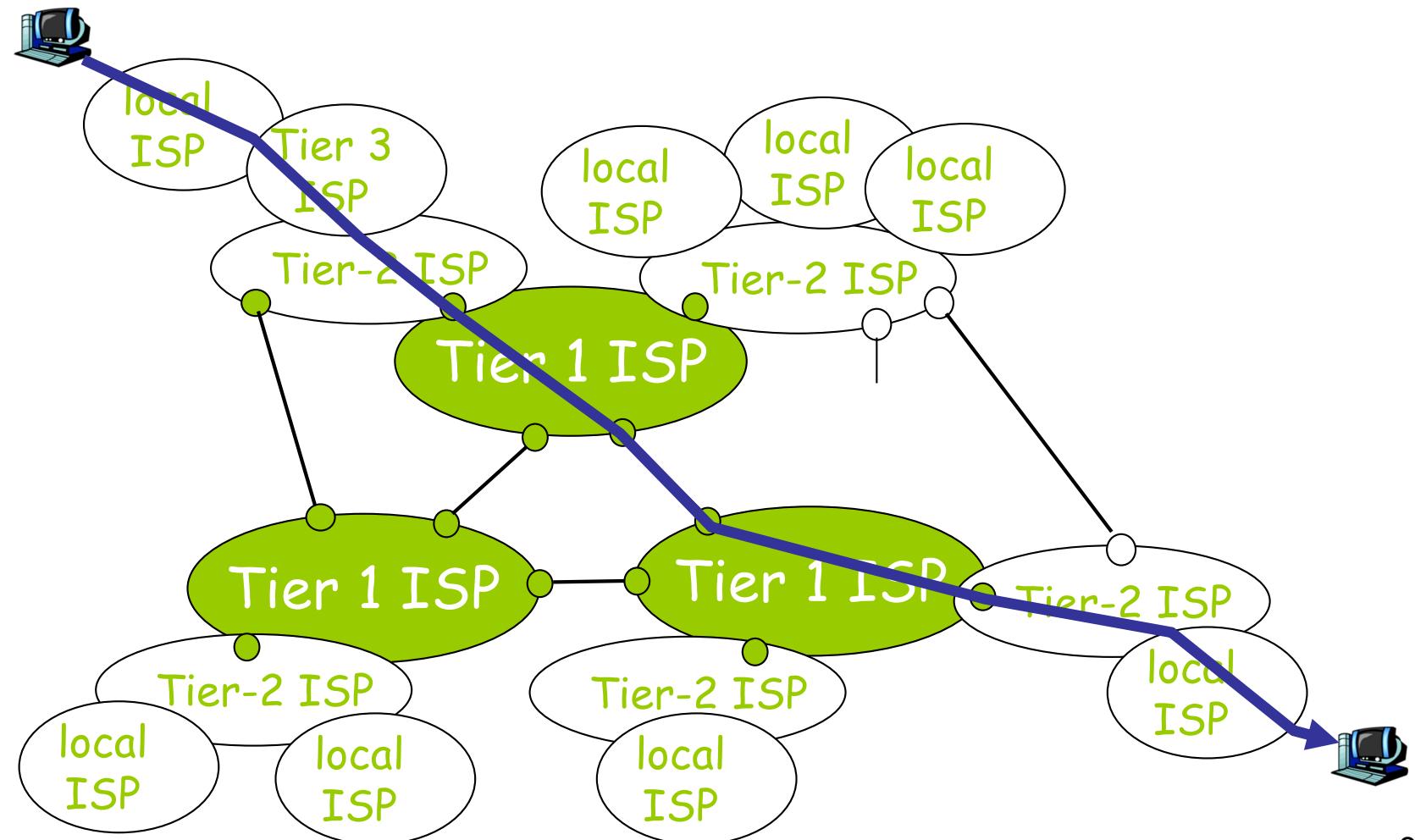
Internet structure: network of networks

- “Tier-3” ISPs and local ISPs (Time Warner, Earthlink, etc.)
 - last hop (“access”) network (closest to end systems)



Internet structure: network of networks

- a packet passes through many networks!



Organizing the giant structure

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?

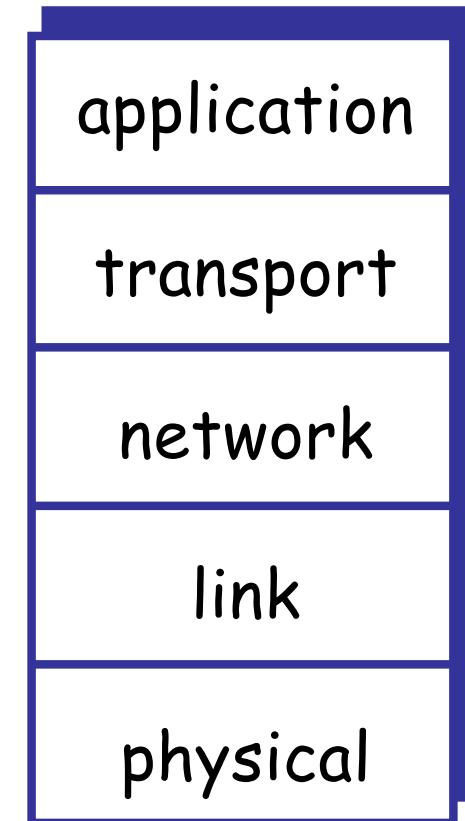
Protocol “Layers”

- Service of each layer encapsulated
- Universally agreed services called
PROTOCOLS

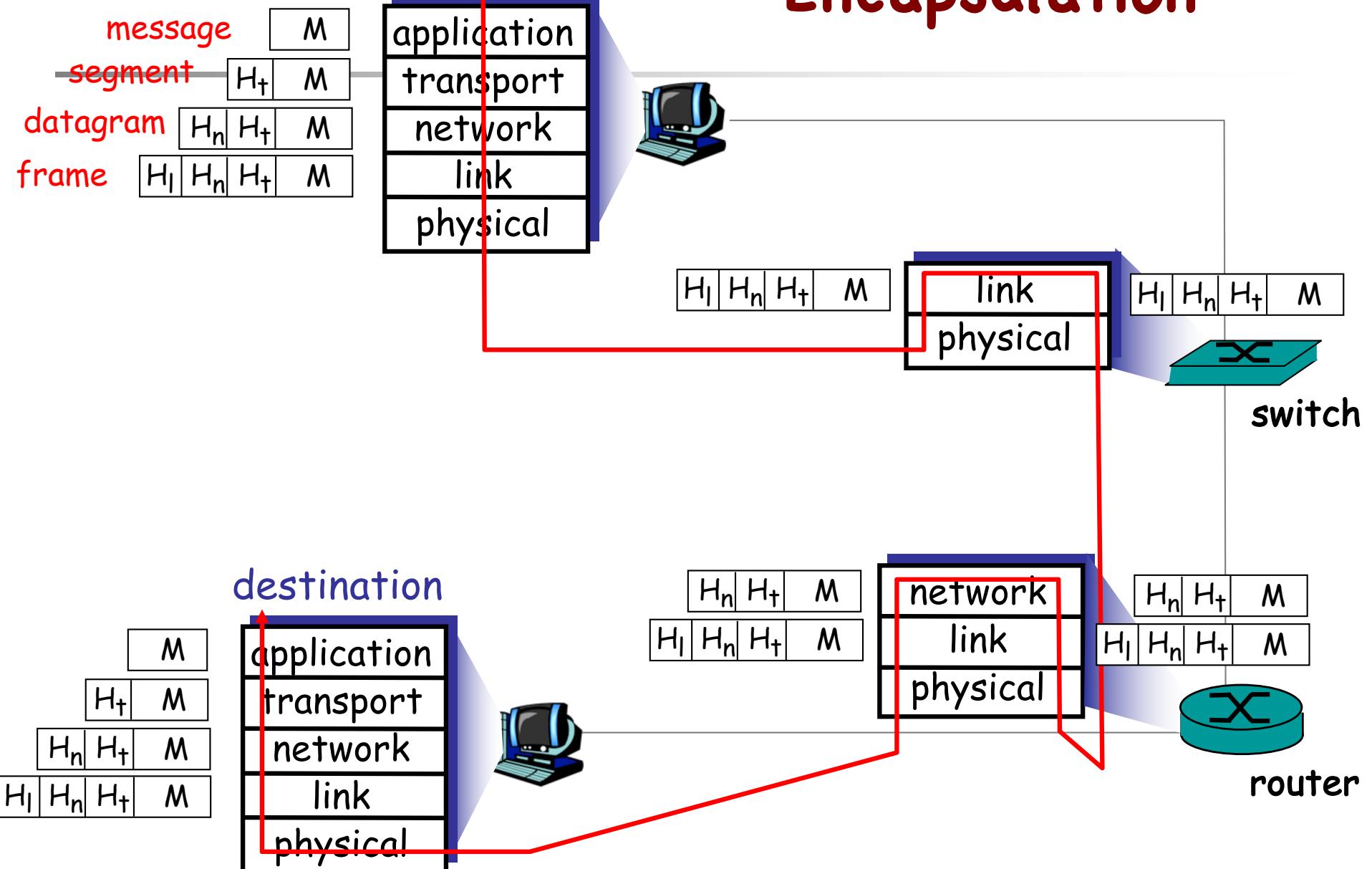
A large part of this course will focus on
understanding protocols for
networking systems

Internet protocol stack

- **application:** supporting network applications
 - FTP, SMTP, HTTP, DNS ...
- **transport:** host-host data transfer
 - TCP, UDP ...
- **network:** routing of datagrams from source to destination
 - IP, BGP, routing protocols ...
- **link:** data transfer between neighboring network elements
 - PPP, Ethernet, WiFi, Bluetooth ...
- **physical:** bits “on the wire”
 - OFDM, DSSS, CDMA, Coding ...



Encapsulation



Questions ?