Computer Networks
COL 334 / COL 672

Course Instructor: Dr. Abhijnan Chakraborty

Slot E: Tuesday, Wednesday and Friday 10-11 AM

Room: Lecture Hall 111

Introductory course on computer networks

- This course provides an introduction to computer networks, with a special focus on the Internet architecture and protocols.
- The course will cover protocols at the Application, Transport, Network and Data Link layers (won’t go into physical layer).
- We will cover network security and wireless networks.
- Topics include layered network architectures, addressing, naming, forwarding, routing, communication reliability, the client-server model, web and email protocols.
- Besides the theoretical foundations, students will acquire practical experience through the programming assignments.

Textbooks

- Primary: Computer Networking: A Top-Down Approach by Jim Kurose and Keith Ross.
- Computer Networks: A Systems Approach by Larry Peterson and Bruce Davie.

Evaluation

- Minor Exam (35%)
- Major Exam (40%)
- Programming Assignments (25%)

Audit criteria: 40% marks overall AND at least 30% in each of the components

Programming Assignments

- Assignment is to be done and submitted individually.
- Needs to be submitted within the deadline.
- There will be penalties on late submission.
- No marks for mere submission.
- There will be separate evaluations for each of the assignments.

Attendance

- At least 70% to be eligible to sit in the major exam.

No Cheating

- Fine to talk with other students about assignments
  - But only general concepts, not specifics
- General rule: no copying of specifics
  - If you're unsure, then ask.
- Will use similarity detection software
  - Any cheating (in assignments/exams) – Fail (F Grade)
  - Don't come with excuses later

What is this course about?

- Networks
  - Road Network – traffic
  - Telephone Network – traditionally build a circuit
  - Internet is a Packet data network
  - This course is about the Internet

Goals for the Internet

- Ability to connect many different networks
- Ability to scale to the entire world
- Ability to recover from failures
- Basic network technology goals
  - Speed
  - Cost
  - Port-density
  - Reliability
  - Other “features”: quality of service, security, etc..

These are harder and more interesting goals!

(more architectural than engineering)

Architecture vs Engineering

- Architecture:
  - The allocation of functionality and definition of interfaces among elements

- The Internet “architecture” is the decision about *what* tasks get done, and *where*:
  - In the network, or in the hosts
  - Engineering is more about *how* tasks get done

- These architectural decisions play a crucial role in scaling, heterogeneity, robustness, etc…

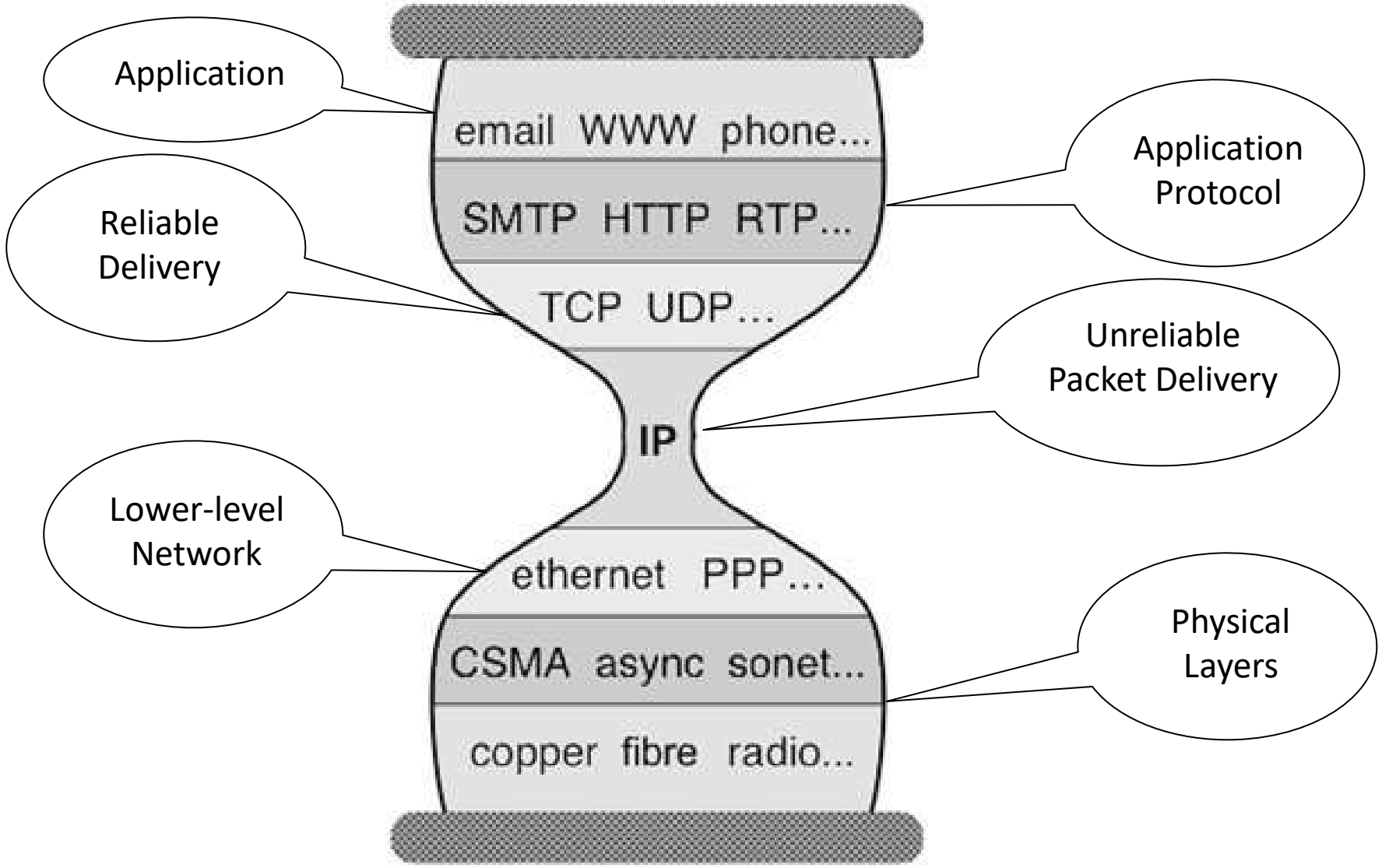
What topics will this course cover?

- The core of the Internet “architecture”:
  - IP, DNS, BGP
- Other technologies crucial to the Internet
  - Higher-level protocols: TCP, HTTP….
  - Crucial lower-level technologies: Ethernet, wireless…
    - These are the two network technologies we will study because they raise interesting questions about shared media
- Won’t cover network topics not crucial to Internet
  - But that doesn’t mean they aren’t interesting
  - E.g., sensornets, low-level encoding, radio technology

Various perspectives on the Internet

- Different levels of abstraction
  - Basic concepts versus actual protocols
- Different geographic scales:
  - LAN vs Enterprise vs WAN vs Interdomain
- Different conceptual approaches:
  - Architecture vs Protocol vs Algorithm
- Different aspects of functionality:
  - Different “layers” focus on different tasks

The Internet: an hourglass *with layers*



Fundamental conceptual questions

- How can you deliver packets from source to destination?
- How do you build reliable transport on top of an unreliable network?
- How can you federate a set of competing ISPs?
- ….

Internet has had tremendous impact

- Internet changed the way we gather information
  - Web, Search engines

- Internet changed the way we relate to each other
  - Email, Facebook, twitter

- **Which one would you choose?**
  - Computers without the Internet (standalone PCs)
  - Internet without modern computers

The Internet introduced new paradigm

- Completely different from the phone network
- Inventors had to overcome strong technical and commercial resistance to realize their dreams
  - Motivation not for personal gain, but societal benefit!
- A true success story of “thinking differently”
  - Their strong vision kept the design on track
  - Brilliant in conception, sometimes weak in execution
- Read internet history: https://www.scienceandmediamuseum.org.uk/objects-and-stories/short-history-internet

Let’s start the journey!