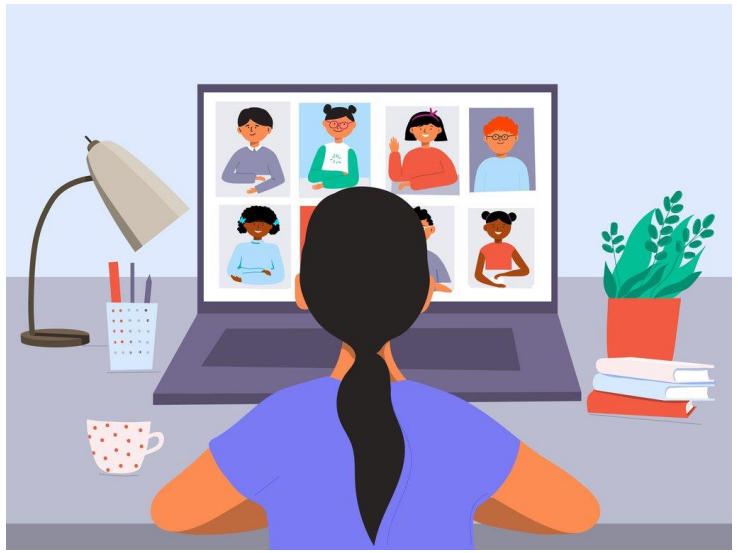
Computer Networks
COL 334/672

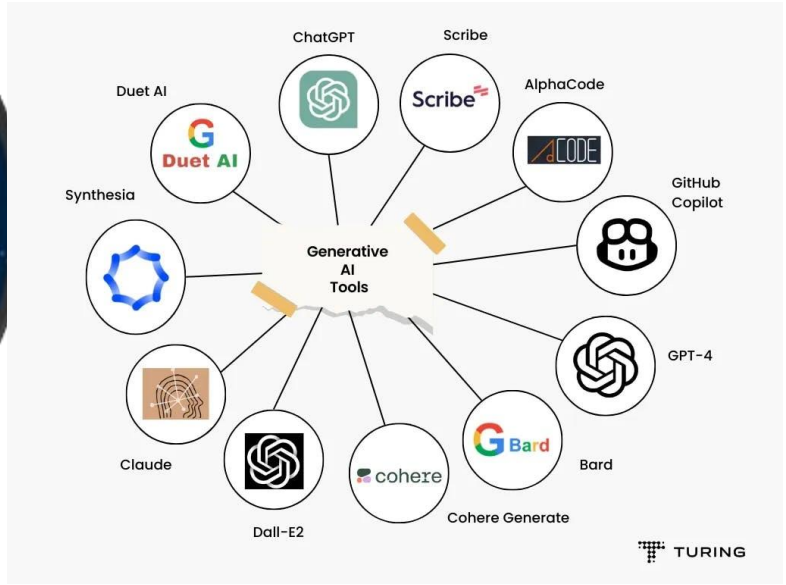
Why computer networks and administrivia

Tarun Mangla

Sem 1, 2025-26

Internet: Mankind's Largest Engineered System





“Fun” Internet-connected devices

Amazon Echo

Internet refrigerator

IP picture frame

Pacemaker & Monitor

Tweet-a-watt: monitor energy use

bikes

cars

scooters

Security Camera

Slingbox: remote control cable TV

Web-enabled toaster + weather forecaster

AR devices

Fitbit

Internet phones

Gaming devices

sensorized, bed mattress

diapers

Others?

Internet Supports Critical Infrastructure

2015 Ukraine power grid hack

6 languages

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From Wikipedia, the free encyclopedia

On December 23, 2015, the power grid in two western oblasts of Ukraine was hacked, which resulted in power outages for roughly 230,000 consumers in Ukraine for 1-6 hours. The attack took place during the ongoing Russo-Ukrainian War (2014-present) and is attributed to a Russian advanced persistent threat group known as "Sandworm".[1] It is the first publicly acknowledged successful cyberattack on a power grid.[2]

...k place due to improper network segmentation: Govt in RS

By Aashish Aryan, ETtech • Last Updated: Feb 10, 2023, 08:08:00 PM IST

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Major global Microsoft outage grounds planes and locks people out of bank accounts

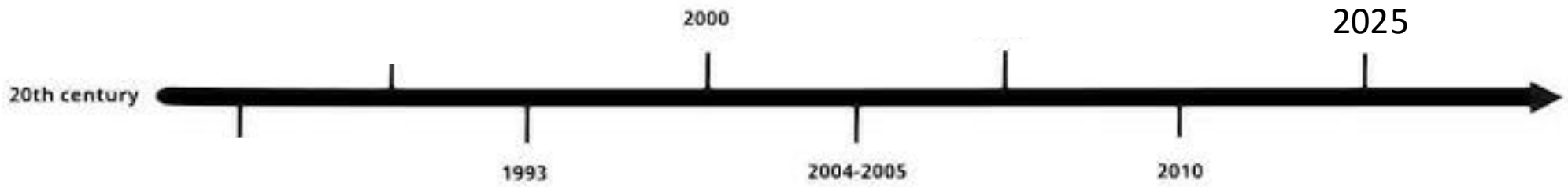
Microsoft's Azure cloud computing service has been severely disrupted, with airlines and banks among those affected

NEWS By Jordan Coussins

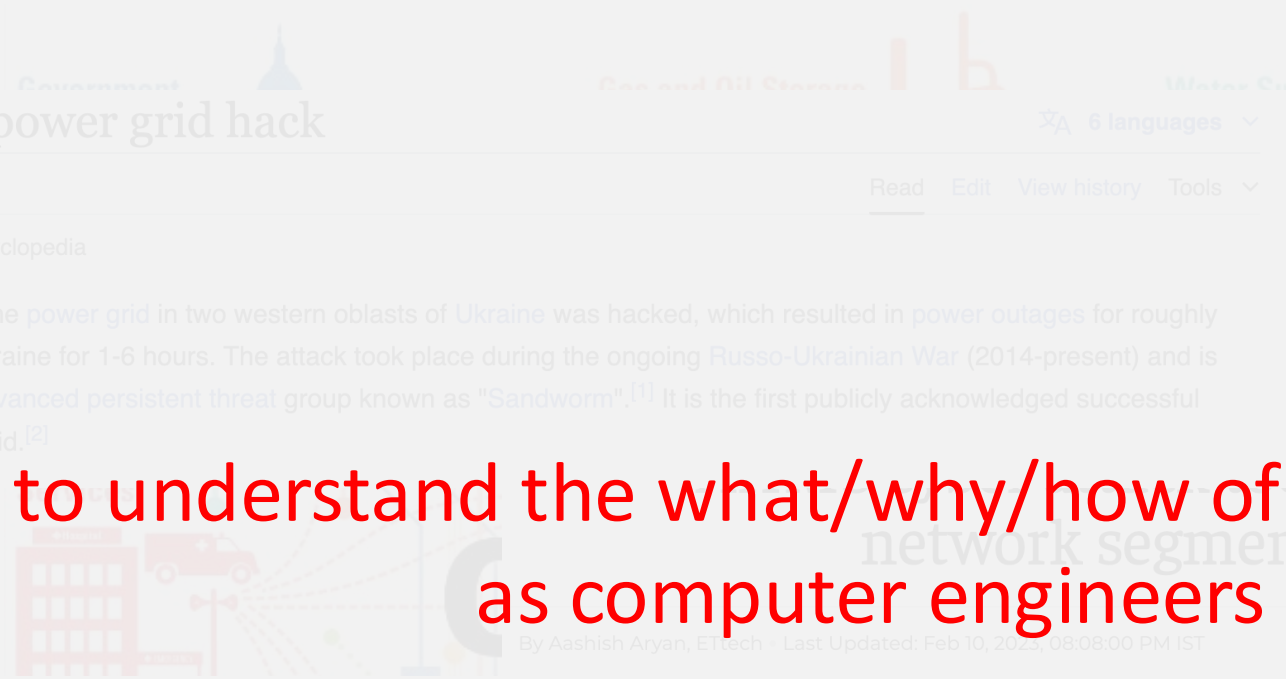
07:57, 19 JUL 2024

Bookmark

How did it all start?

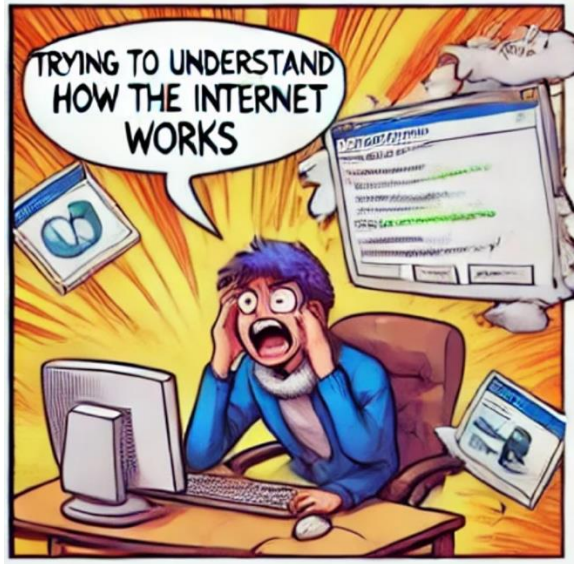


Internet Supports Critical Infrastructure



Important to understand the what/why/how of the Internet, especially as computer engineers

This Course..



How does my browser know where to go when I type google.com?

How is WiFi bandwidth shared between me and my roommate?

How does data traverse across the Internet?

What are these terms: TCP, IP, LAN, VPN..?

Course Learning Objectives

- Learn the principles of **resource management**, **robustness**, **security**, and **efficiency** in **large-scale, federated, and shared systems**

Or understand:

- What is *under the hood* of the Internet
- Why the Internet was designed this way
- How to develop custom network protocols and applications

Administrivia

- TAs
- Evaluation
- Coordination
- Course overview
- Reading material

Teaching Assistants

- Abhiya Jose
- Manan Sharma
- Mayank Shukla
- Phaneesh R Katti
- Satyam Kumar
- Thode Snithik
- Yogesh

Course Prerequisites

- Data Structure and Algorithms, COL106
- Computer Architecture, COL216
- Enthusiasm to learn!

Evaluation

Exams (50%)

- Minor (25%)
- Major (25%)

Assignments (40%)

- There will be 4 assignments
- **Late policy**
  - No extensions will be given
  - You have a balance of 96 late hours allowed
  - Once balance expires, half credit for any submission within a week after the deadline

Quiz (10%)

- Surprise quiz will be conducted either in the beginning or end of the class
- Best of 90% will be considered for the final grade
- Easy if you keep up with the lectures

Class participation (Bonus, 4%)

- Asking questions in class, on piazza

Evaluation

- **Audit Policy**
  - Minimum B- is required to pass the course
  - All assignments should be attempted with a minimum of 50% across assignments
  - Attempt at least 50% of quizzes

- **Pass Criteria**: Minimum 30% needed for a D grade

- **Attendance Policy**
  - Not mandatory but regular attendance will make the course much easier
  - Attendance will be taken either using a sheet or through photograph
  - Any misconduct will result in severe penalty

Coordination

- Assignments and Quiz: Moodle
- Discussion: Piazza and in-class

Contact

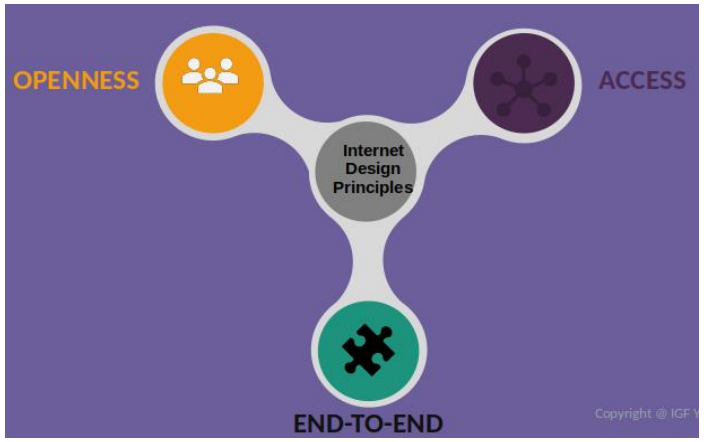
- Office hours: Wednesdays, 2-3p, Bharti 423
- Non-urgent emails will be ignored, use Piazza!
- For urgent emails, use [COL334] in the subject

Course Conduct

- Adherence to the IIT Delhi Honor Code
  - Strict compliance: Cheating will result in severe penalty
- Permitted activities
  - Discussions encouraged among peers
  - Ask questions on Piazza
  - Cite discussions with peers or over Piazza in your submissions
- Use of AI Tools
  - Strongly discouraged
  - If used, you **must** cite the prompt and response in your submission

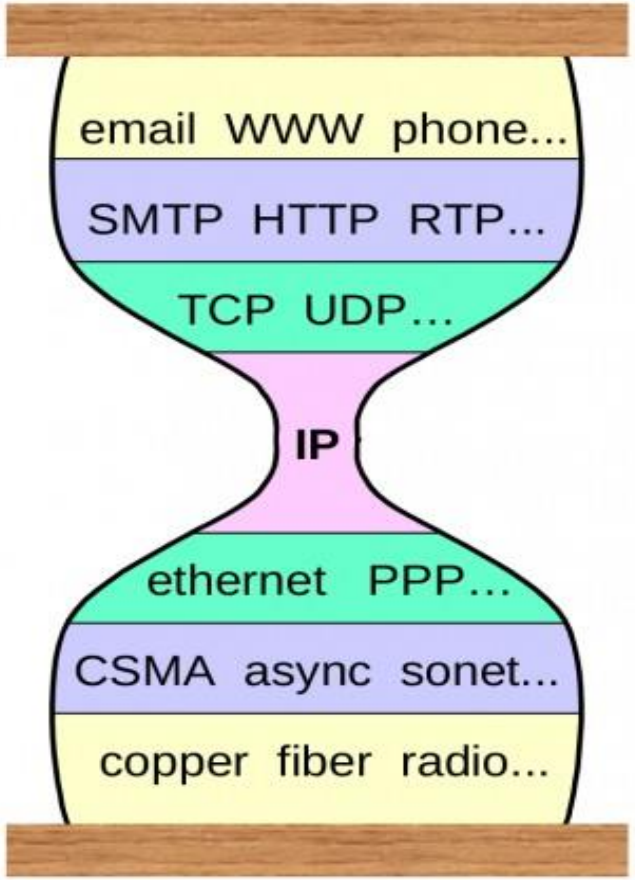
Course Plan (Tentative)

Topic	Sub-topics
Introduction	Internet overview, design decisions
Internet design philosophy	Packet vs circuit switching, protocol layers and service models, 5-layer model



Course Plan

Topic	Sub-topics
Link layer	MAC protocol, switching, error detection/correction
Network layer	Forwarding and routing, data plane, control plane
Transport layer	Multiplexing, UDP, TCP, flow and congestion control
Application layer	Distributed application paradigm, DNS, HTTP, Email, CDN, video streaming and conferencing



Internet hourglass structure

Course Plan

Topic	Sub-topics
Wireless and mobile networks	Wireless link characteristics, WiFi, mobility management, cellular network
Network security	Network-specific attacks and threats, countermeasures
Emerging topics	New networks, virtual network, middleboxes, quantum networking

Reading Material

Recommended Textbooks

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

Lecture Slides

- Will be shared on Moodle after the class

Papers (encouraged)

- Pointers to papers will be shared throughout the lectures

Precap

Build a computer network from first principles

- What are the required design decisions?
- What were the decisions taken by the Internet?