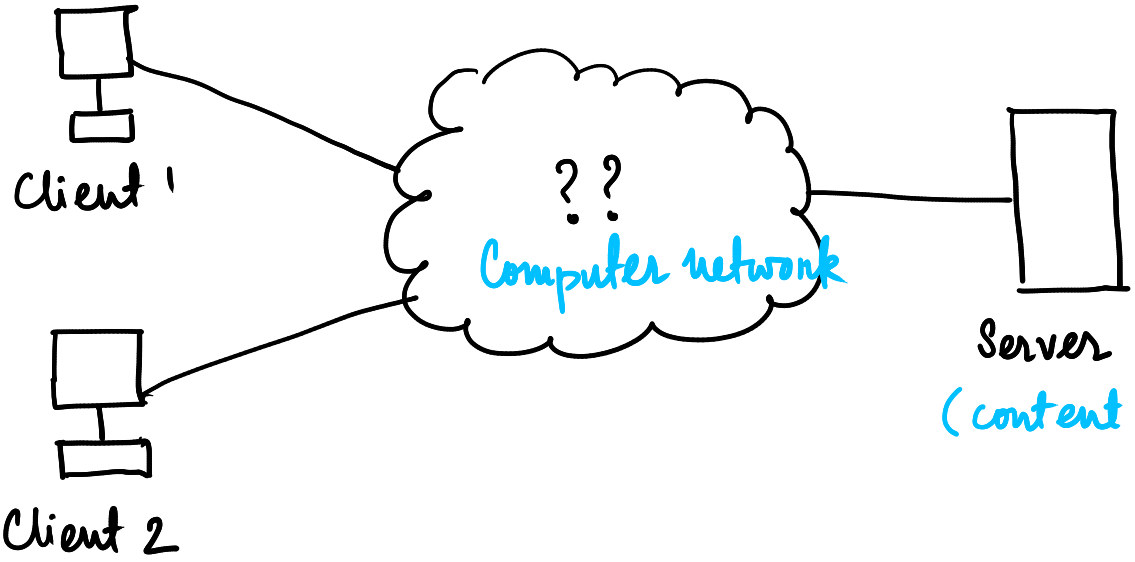
CS425: Computer Networks

A classic engineering course



Focus: To **understand** how the messages and information is passed through this network from source to destination.

Three types of networking topics

1. Distributed systems - applications running on systems
2. Networking - packets/messages that are sent across communication links
3. Communication technologies/links - signals and coding

Our discussion: primarily (2) with some overlap with (1) and (3)

[more informative than deductive]

Applications of Networking

① Business applications

- resources to be bound / connected to make one unified resource
- data need to pass through various resources for an efficient operation.

e.g. ① network printer

② Customer - inventory apps - app is the client that accesses the store (server)

③ advertising

④ crowdsourcing

② Personal applications

- sending emails, instant messages
- voice over internet calls
- browsing the web - on-demand access to information

③ Mobility of information

- users don't need to be stationary to access information it can be accessed remotely as well.

Social issues related to networks (examples)

- Data privacy: how and where data is being shared
- Collection and use of users' personal information - used by social platforms or service providers in lieu of their service

Policies need to be established for networks to ensure guarantees.

Examples:

① Net neutrality

② GDPR – general data protection regulation
- came in effect May 25, 2018 in EU
- safeguards users' data

what happens to your data when you leave a platform or how the service provider can monetize your data from third parties.

Goal of this course

① How the Internet works
- what happens while browsing the web
- what are TCP/IP, DNS, HTTPS, NAT, VPN, 802.11

② Fundamentals of networking in modular fashion
- layerwise abstraction

Evolution of the internet

- ARPANET 1970, 4 node network
- Current internet data size 2.7×10^{21} (till 2017)
  ↑ zettabytes

Why learn networking?

① intellectual interest: the topics we discuss here will be useful for designing any system that communicates with each other.
e.g., our discussions are primarily on wired networks, but applies similarly for wireless / satellite communications.

② design launchpad: knowing the current standards and technologies can help designing / proposing a new / better solution.

③ job prospects

more on intellectual interest

What are the key issues in communication networks?

① reliability:
- failure tolerance
- message corruption

some solutions:
- codes to detect and correct errors in the transmission.
- route through a failed part of the network

② quality of service / delay tolerance:
- certain applications have to be of low delay, e.g., voice communication

③ network growth:
- addressing and naming
- protocol layering

④ allocation of resources:
- multiple access, congestion control

⑤ security against malicious attackers:
- confidentiality of the messages passed

Some technologies that resulted into other innovations

Causes	Effects
Web (WWW)	Content Distribution Networks (CDNs)
Digital media (song/video)	peer to peer file sharing (P2P)
Falling costs/bit	Voice over internet (VoIP)
Expansion of the number of hosts	IPv6
Wireless reliability	mobile devices

Not in this course

- setting up a networking system using IT job skills
  e.g., certifications like CCNA, CCNP, CCIE etc.
  they change very quickly.
  with fundamental principles clear, these can be learned in a short time.