National University of Computer & Emerging Sciences

CS 3001 - COMPUTER NETWORKS

Lecture 01

Introduction

21st January, 2025

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Office Hours: 11:30 am till 01:00 pm (Every Tuesday & Thursday)

About the Instructor

Education

- FSc (Government College, Lahore)
- BS EE (University of Engineering & Technology, Lahore - Session '94)
- MS EE (University of Southern California, Los Angeles, USA – Class of '01)

Work Experience

- Senior Manager, Engineering Core Networks, Mobilink, Islamabad (9 Years)
- Regional Service Delivery Manager, Ericsson Region Middle East & Africa (6 Years)
- Adjunct Assistant Professor, FAST – Lahore (Spring 2020 till Date)

Course Administration

- **Course Prerequisites:**
  - Passion and dedication to the course
  - Basic knowledge of Digital Logic, Signals and Systems, Computer Organization
  - Programming Skills (C/C++)
  - CS 218 – Data Structures

Course Administration

- **Attendance Policy:**
  - As per the University Policy & Guidelines
- **Dishonesty, Cheating, Plagiarism:**
  - As per the University Policy & Guidelines
- **Important Points:**
  - Course outline may change 10%-20% as we proceed in the semester
  - No retakes of exams or quizzes
  - Submission deadlines will strictly be enforced. (Homework, Assignments, Project etc.)
  - 2 lectures of 1.5 hours per week + lab per week

Course Administration

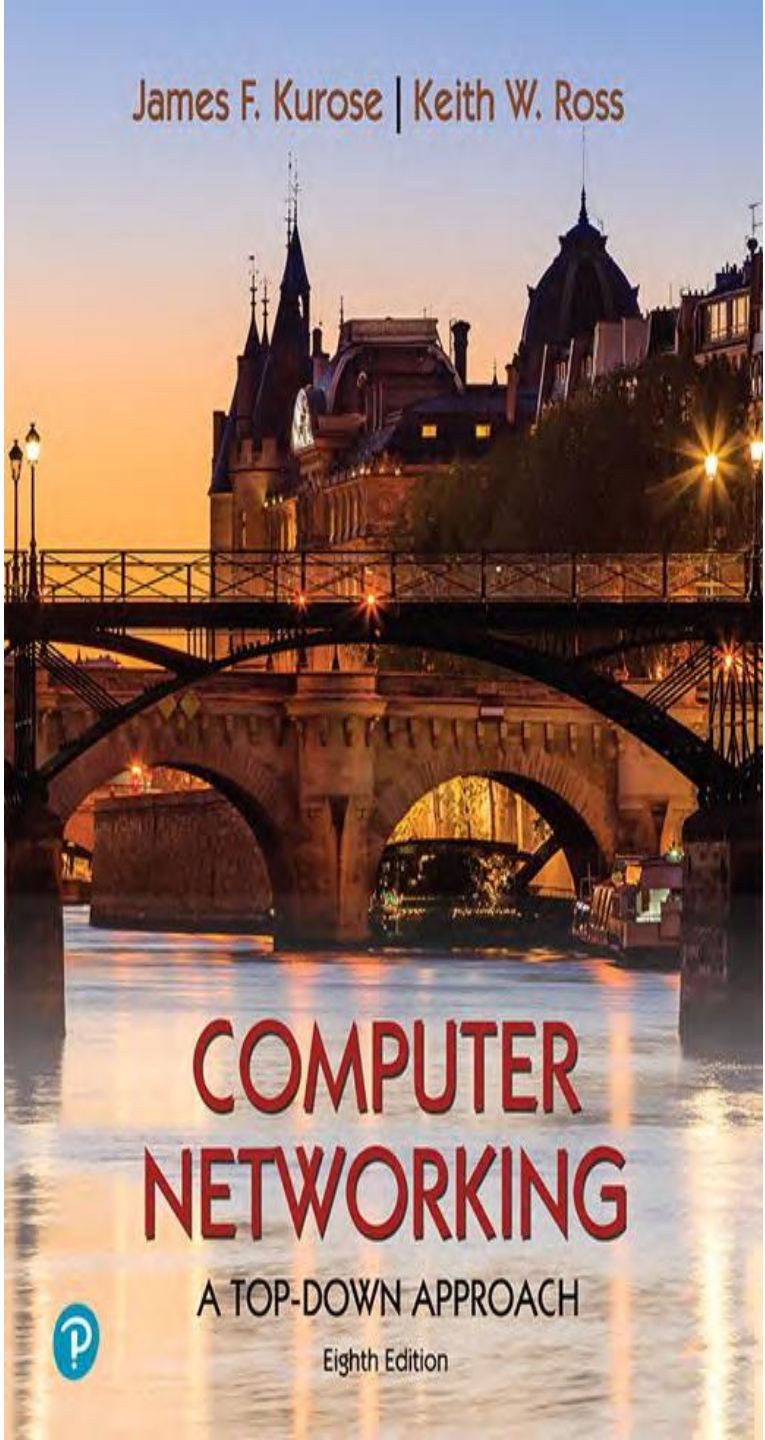
Course Policies

- Course outline may change 10-20% as we proceed in the semester
- Important: It is strived & intended to have uniform & similar weightages of different course components & grade assigning policy across all the sections for this course for the semester, but there may be variations owing to various factors, for example different number / types of assessments like assignments, home works, quizzes and/or projects.
- Assignment deadlines for both class and lab are hard.
- Quizzes might be announced or unannounced.
- There will be **no re-take** of quizzes or exams. Special consideration may be given only for mid or final exam for an emergency on per case basis subject to approval from the department administration & the instructor. In approved circumstances, percentage of mid will be awarded for final or vise versa.
- Integrity in the assignments/quizzes is expected; otherwise result would be an F grade in the course or the case may be forwarded to the Disciplinary Committee.
- The lectures will be of 1.5 hours duration + there will be one 3 hours lab/week.
- (80%) Attendance for the student is a MUST which needs to be ensured according to the University policy to avoid disqualification.
- You may request an appointment according to my schedule by emailing me on the aforementioned email.

Course Administration

- **Course Textbook:**
  - Computer Networking
    A Top-Down Approach
    (8th edition, Kurose & Ross)

- **Reference Textbooks:**
  - Computer Networks
    (5th edition, Tanenbaum)
  - Data Communications and Networking
    (4th Edition, Behrouz A. Forouzan)
  - Other Support & Reading Material
    (Will be posted)



Why study Networking?

- *It's hard to name an area of computer science that has produced more tangible changes for the average person over the last 25 years than networking.*

- *It is the plumbing of computing.*

- *Globally, devices are growing faster than both the population and the internet users. A growing number of M2M applications like video surveillance, health monitoring systems, traffic monitoring systems, smart meters, package or asset tracking are contributing in a major way in this growth.*

What is Networking?

Networking is…

the World-Wide Web

Networking is…

Skype

Networking is…

Facetime

Networking is…

Netflix

Networking is…

YouTube

Networking is…

Napster

Networking is…

BitTorrent

Networking is…

Bitcoin

Networking is…

Fortnite Battle Royale

Networking is…

Gmail

Networking is…

Dropbox

Networking is…

Facebook

Networking is…

Snapchat

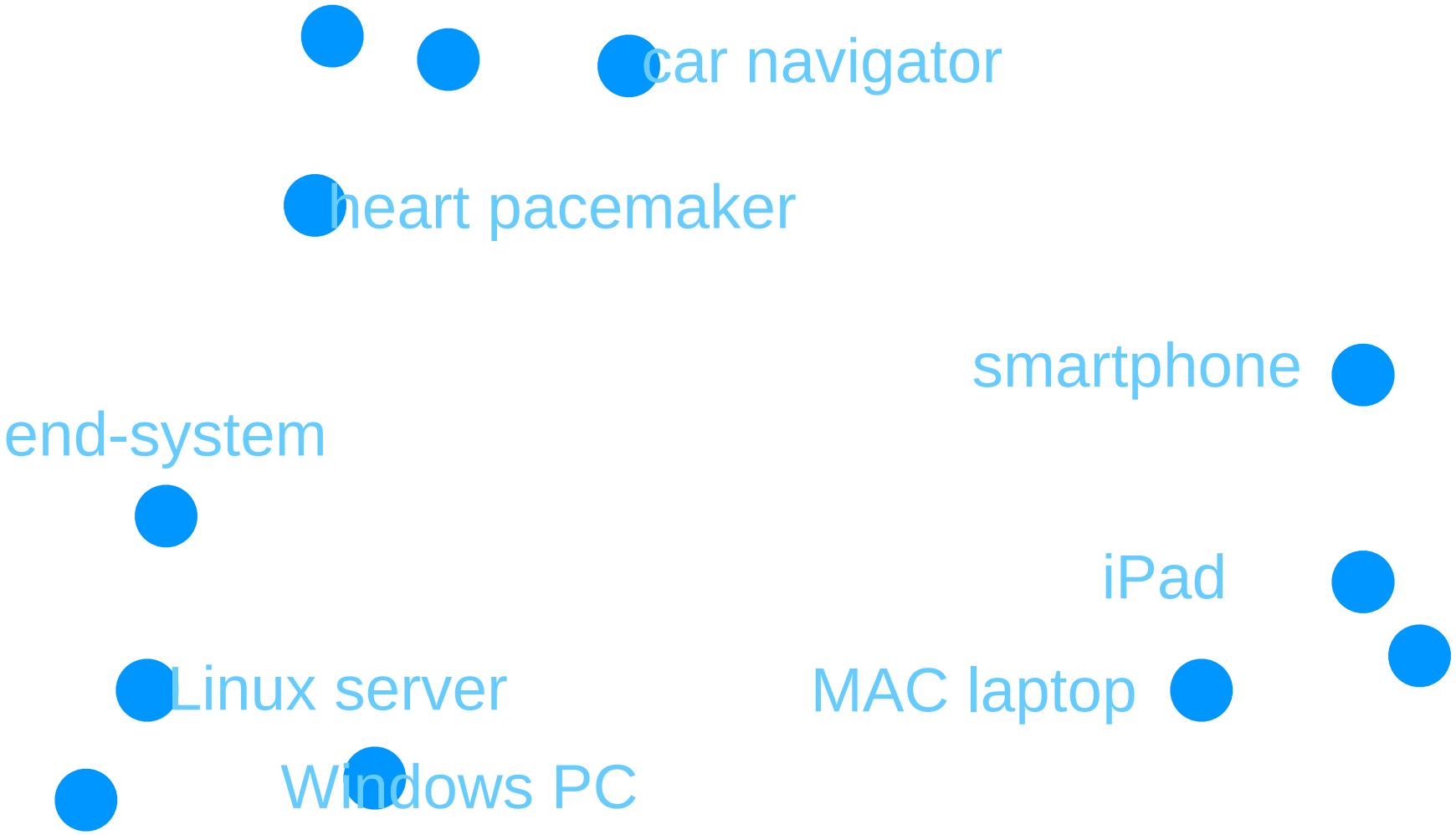
Networking is…

the Internet

Networking is…

Wi-Fi, LTE, SDN, BGP, MIMO,
mesh-networking, full-duplex,
sensor networks, medical devices,
datacenter networks,
undersea, deep space. . .

What is Networking about?


car navigator
heart pacemaker
smartphone
end-system
iPad
Linux server
MAC laptop
Windows PC

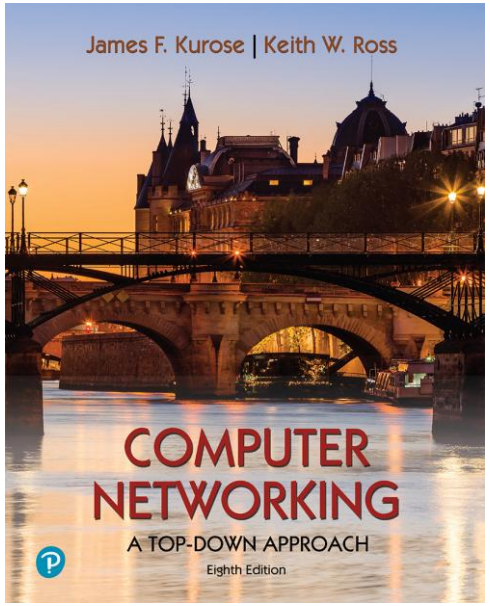
Chapter 1 Introduction

A note on the use of these PowerPoint slides:
We're making these slides freely available to all (faculty, students, readers). They're in PowerPoint form so you see the animations; and can add, modify, and delete slides (including this one) and slide content to suit your needs. They obviously represent a *lot* of work on our part. In return for use, we only ask the following:

- If you use these slides (e.g., in a class) that you mention their source (after all, we'd like people to use our book!)
- If you post any slides on a www site, that you note that they are adapted from (or perhaps identical to) our slides, and note our copyright of this material.

For a revision history, see the slide note for this page.

Thanks and enjoy! JFK/KWR



Computer Networking: A Top-Down Approach
8th edition
Jim Kurose, Keith Ross
Pearson, 2020

Chapter 1: introduction

Chapter goal:

- Get "feel," "big picture," introduction to terminology
  - more depth, detail *later* in course

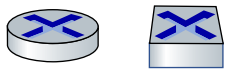
Overview/roadmap:

- What *is* the Internet? What *is* a protocol?
- Network edge: hosts, access network, physical media
- Network core: packet/circuit switching, internet structure
- Performance: loss, delay, throughput
- Protocol layers, service models
- Security
- History

The Internet: a "nuts and bolts" view

Billions of connected computing *devices*:

- *hosts = end systems*
- running *network apps* at Internet's "edge"



Packet switches: forward packets (chunks of data)

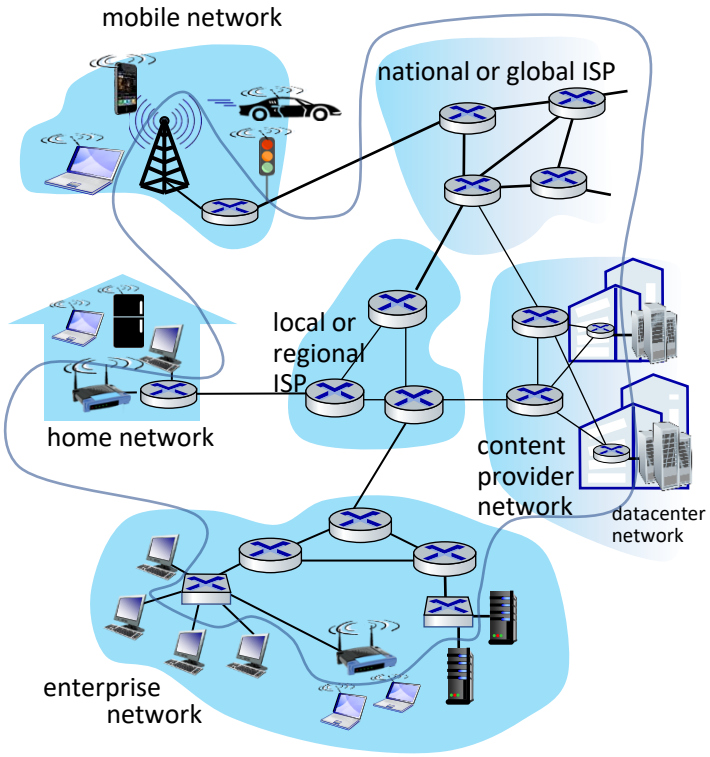
- *routers, switches*

Communication links

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

Networks

- collection of devices, routers, links: managed by an organization



“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

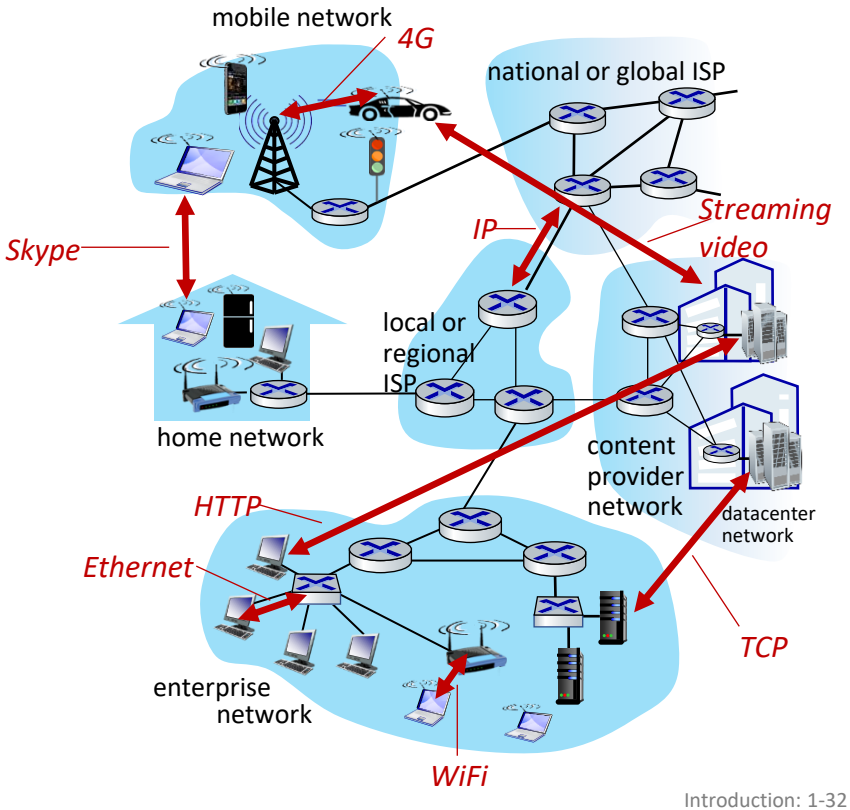
sensorized bed mattress

diapers

Others?

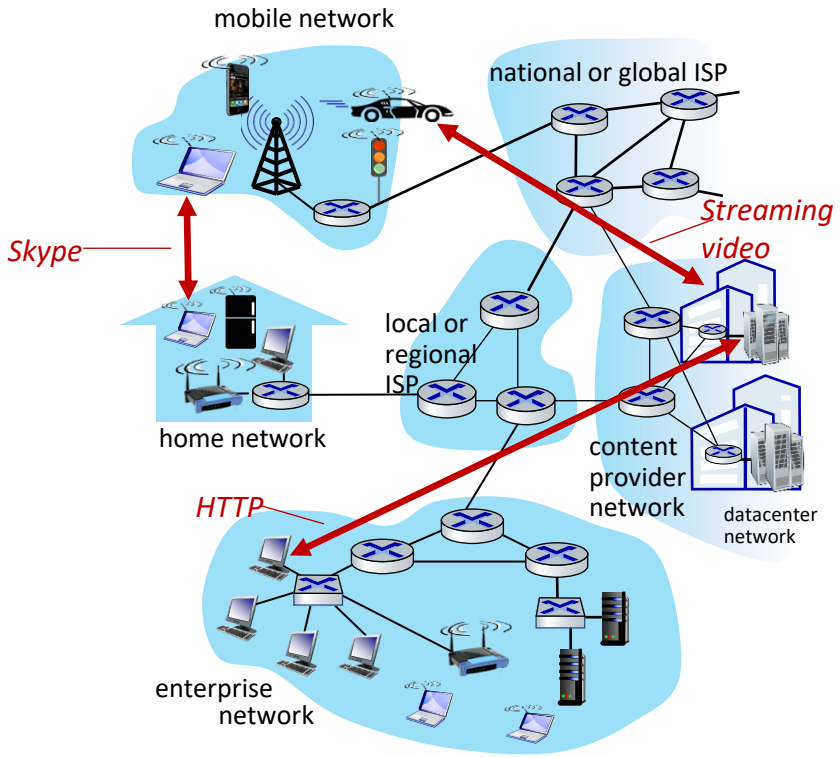
The Internet: a "nuts and bolts" view

- *Internet:* "network of networks"
  - Interconnected ISPs
- *protocols* are *everywhere*
  - control sending, receiving of messages
  - e.g., HTTP (Web), streaming video, Skype, TCP, IP, WiFi, 4/5G, Ethernet
- *Internet standards*
  - RFC: Request for Comments
  - IETF: Internet Engineering Task Force



The Internet: a "services" view

- *Infrastructure* that provides services to applications:
  - Web, streaming video, multimedia teleconferencing, email, games, e-commerce, social media, inter-connected appliances, …
- provides *programming interface* to distributed applications:
  - "hooks" allowing sending/receiving apps to "connect" to, use Internet transport service
  - provides service options, analogous to postal service



What's a protocol?

Human protocols:

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

Rules for:

… specific messages sent

… specific actions taken when message received, or other events

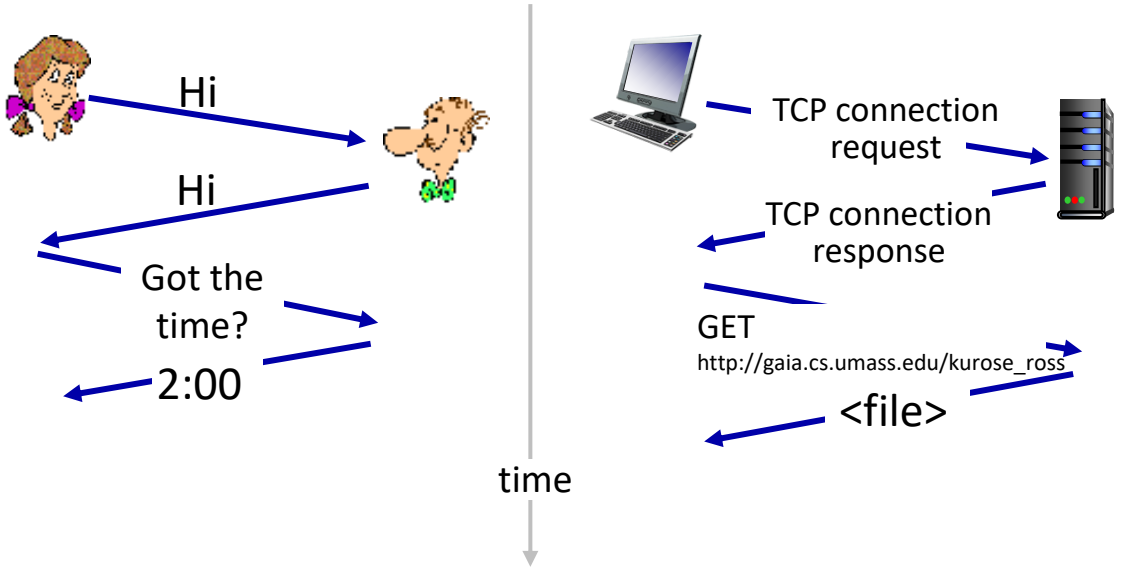
Network protocols:

- computers (devices) rather than humans
- all communication activity in Internet governed by protocols

Protocols define the format, order of messages sent and received among network entities, and actions taken on message transmission, receipt

What's a protocol?

A human protocol and a computer network protocol:



Q: other human protocols?

What is The Internet? (Wikipedia)

The Internet is the global system of interconnected computer networks that uses the Internet protocol suite (TCP/IP) to link devices worldwide. It is a network of networks that consists of private, public, academic, business, and government networks of local to global scope, linked by a broad array of electronic, wireless, and optical networking technologies. The Internet carries a vast range of information resources and services, such as the inter-linked hypertext documents and applications of the World Wide Web (WWW), electronic mail, telephony, and file sharing.