

CSCI 4431/6431

Computer Networks

Prof. Timothy Wood
George Washington University

timwood@gwu.edu

Computer Networks have become a fundamental technology in our lives.

- Do you know how they work?

Why learn about networks?

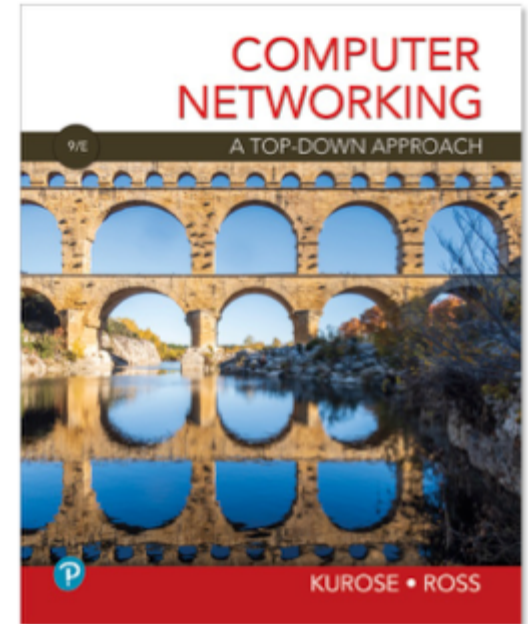
- Become a network engineer
- Become a better programmer

Why learn about networks?

- Become a network engineer
- Become a better programmer
- **Become a better systems architect**

How we will learn about Networks

- With a "top-down" approach
- Start with applications and move down the protocol stack
- Socket programming
- Labs with wireshark
- Projects to learn protocol specification



Computer Networking: A Top-Down Approach

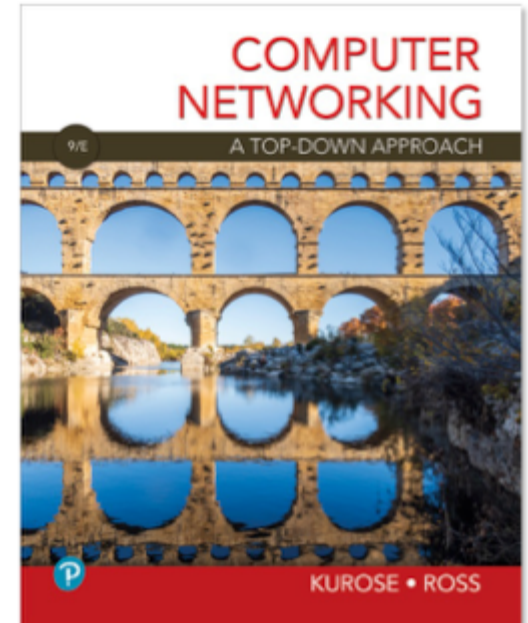
9th edition

Jim Kurose, Keith Ross

Pearson, 2025

Course Textbook

- A great book!
- Prof. Jim Kurose is a legend
- His videos and slides may be enough, but the book is a great reference
- Available at GW library



Computer Networking: A Top-Down Approach

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Networks Baseline Survey

- Complete [this survey](#)
- Goal: give me a sense of your basic knowledge around computer networking
- It's also a quiz! **Full credit for completion.**



Partner up

Activity: Draw a picture of the Internet

Chapter 1 - Slides 1-24

- What is the Internet?
- What is a protocol?
- Network edge: hosts, access network, physical media

Slides: https://gaia.cs.umass.edu/kurose_ross/ppt-9e/Chapter_1_v9.0.pptx

Video Break: The Internet at 5 3 Levels

<https://www.youtube.com/watch?v=0EqKnvzo3no>

Sit back and relax...

Intermission

Short break!

Chapter 1 - Slides 25 - 58

- Network core: packet/circuit switching, internet structure
- Performance: loss, delay, throughput

Chapter 1 - the rest

- Security
- Protocol layers, service models
- History

Watch Jim's videos for homework!

Deeper Dive on Network Performance

Activity: Chapter 1 Worksheet

- Factors that affect performance in networks
- Work together with a partner
- Slides: <https://gw-computer-networks-f26.github.io/>
- Turn in at end of class

Circuit vs. Packet Switching

- **Circuit switching:** reserve a dedicated share of the link for the whole session
 - Idle reserved capacity still belongs to you — others cannot use it
 - If all circuits are taken, new users are **blocked**
- **Packet switching:** no reservation; send when you have data
 - When demand exceeds link capacity, packets **queue**
 - If the buffer fills, packets are **dropped**
- Tradeoff: guaranteed idle waste vs. shared efficiency with delay/loss

Easy to Confuse Delays

- **Transmission delay** = L / R
 - How long to push L bits onto the wire at rate R
 - Changes when the link rate or packet size changes
- **Propagation delay** = distance / s
 - How long for a bit to travel the path at speed s
 - $s \approx 2 \times 10^5$ km/s in fiber/copper; $\approx 3 \times 10^5$ km/s in space
 - Independent of R — faster equipment does not shorten the path
- End-to-end delay has both; either one can dominate

Store-and-Forward and Throughput

- **Store-and-forward:** a router must receive an *entire* packet before forwarding it
- **Throughput** is limited by the weakest useful rate along the path
 - Shared links, idle links, and load all affect what each user actually gets
 - Upgrading the wrong segment may not help

Wrap up and Homework

- Watch videos 1.5 - 1.7
 - 1.5 Protocol Layers and Their Service Models
 - 1.6 Networks Under Attack
 - 1.7 History of Computer Networking; Chapter 1 Summary
 - 1.8 Supplemental: Who Uses the Internet?
 - 1.8 Supplemental: Who Controls the Internet?
- Complete Student Info form
- Join Discord server

Chapter 1 Resources

- Slides
- Practice Problems
- Videos (Full playlist):
 - 1.1 What is the Internet?
 - 1.2 The Network Edge
 - 1.3 The Network Core
 - 1.4 Performance: Delay, Loss and Throughput in Computer Networks
 - 1.5 Protocol Layers and Their Service Models
 - 1.6 Networks Under Attack
 - 1.7 History of Computer Networking; Chapter 1 Summary
 - 1.8 Supplemental: Who Uses the Internet? and 1.8 Supplemental: Who Controls the Internet?