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Chapter 1

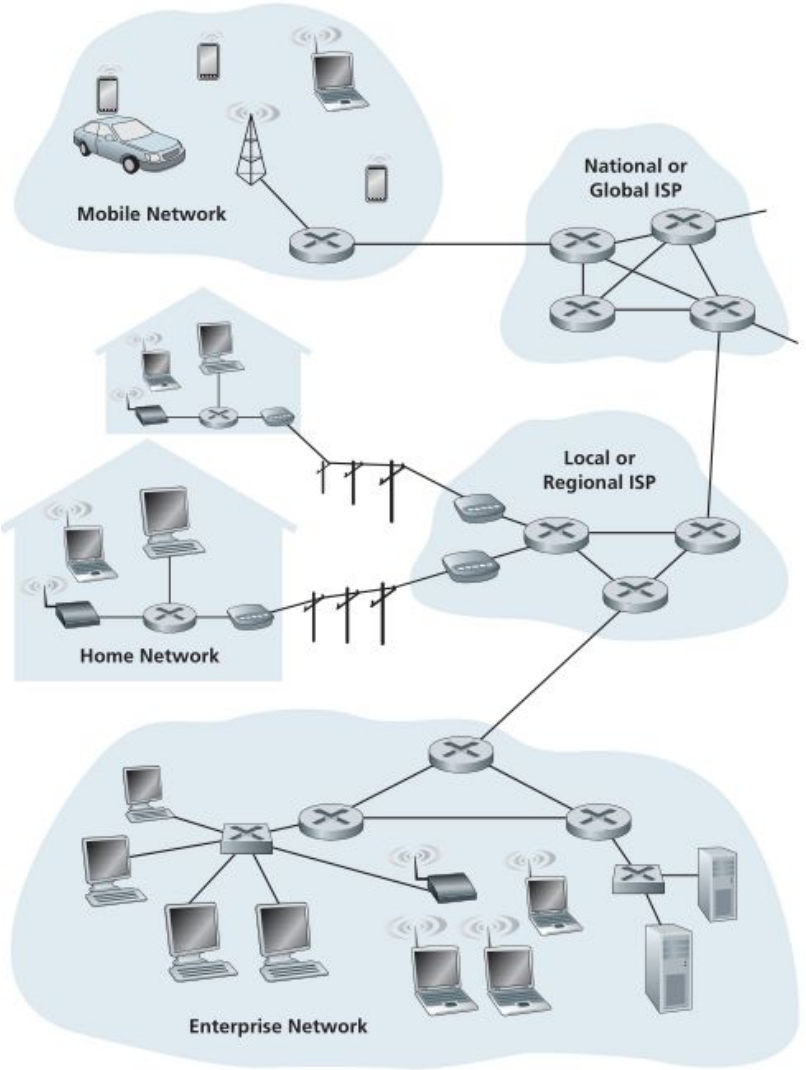
Computer Networks and the Internet

The Internet?

- What you'll learn about the Internet in this course
  - Guiding principles
  - Framework for understanding today's and tomorrow's networks

What access network technologies do you know of?

What network technologies transmit data between cities?



The quest for low latency

Express Lanes

New York and Chicago, America's two great trading centers, are 720 miles apart as the photon flies — about 3.9 milliseconds at the speed of light. But variations in transmission technology or how long the route is can make millions of dollars' worth of difference to high-frequency traders. — *Katie M. Palmer*

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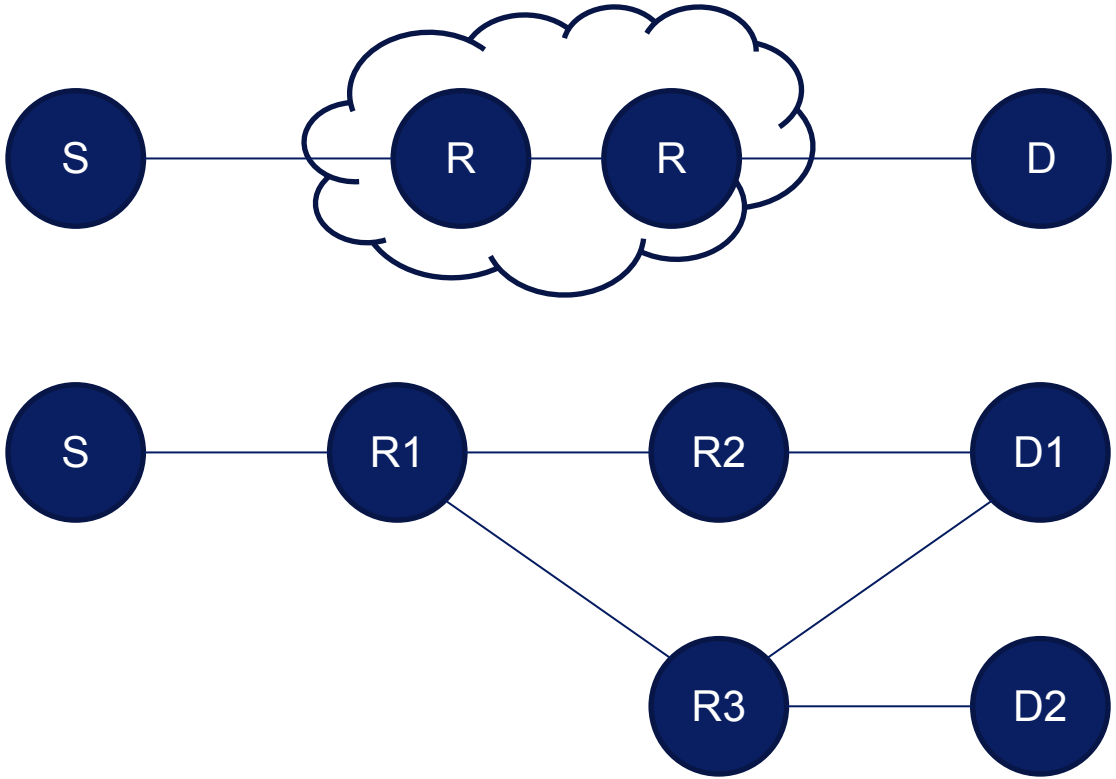
Communication Example

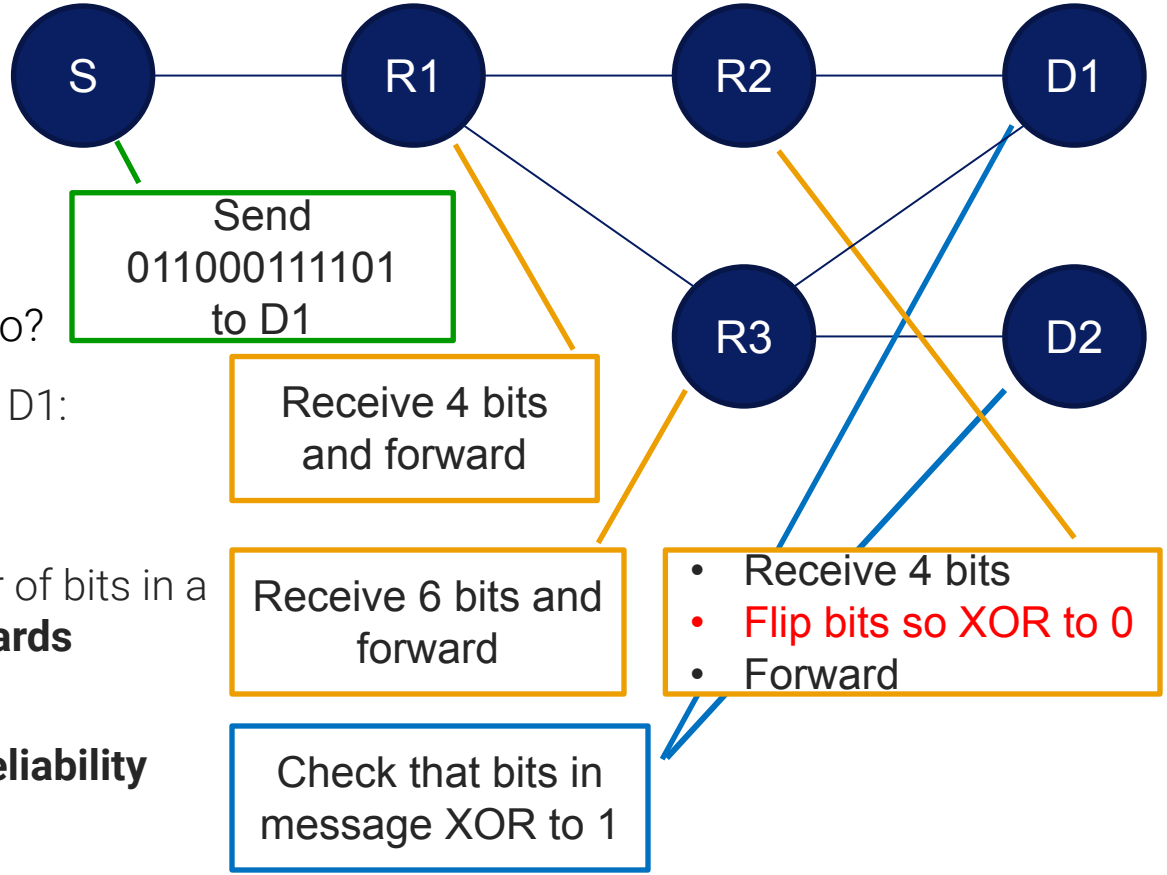
- Setup
  - Form 6 groups
  - Only adjacent groups can speak to each other
  - Begin by contacting your neighbors to learn their functionality
- Goal
  - Send message from the sender to the destination



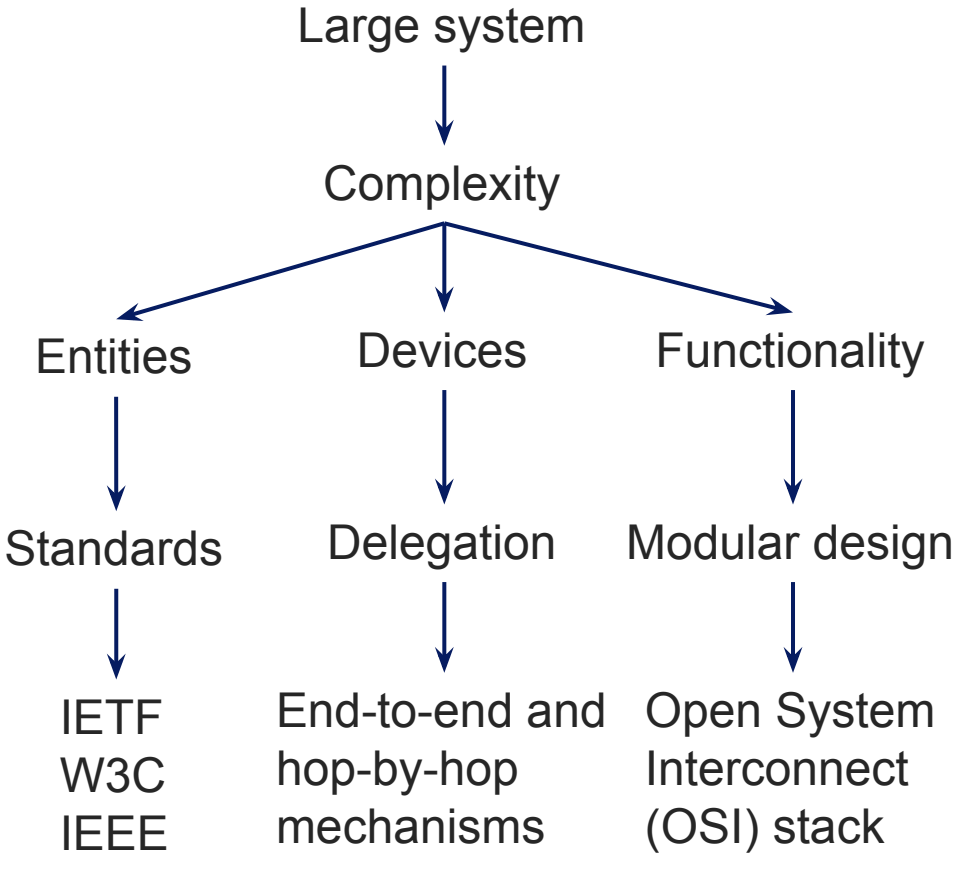
Network example follow-up

What problems did our setup run into?

- R1 did not know which path lead to D1: **addressing** and **routing**
- R1 and R3 did not agree on number of bits in a packet: **medium access** and **standards**
- R2 introduced errors: **end-to-end reliability**



Argument for layered architecture



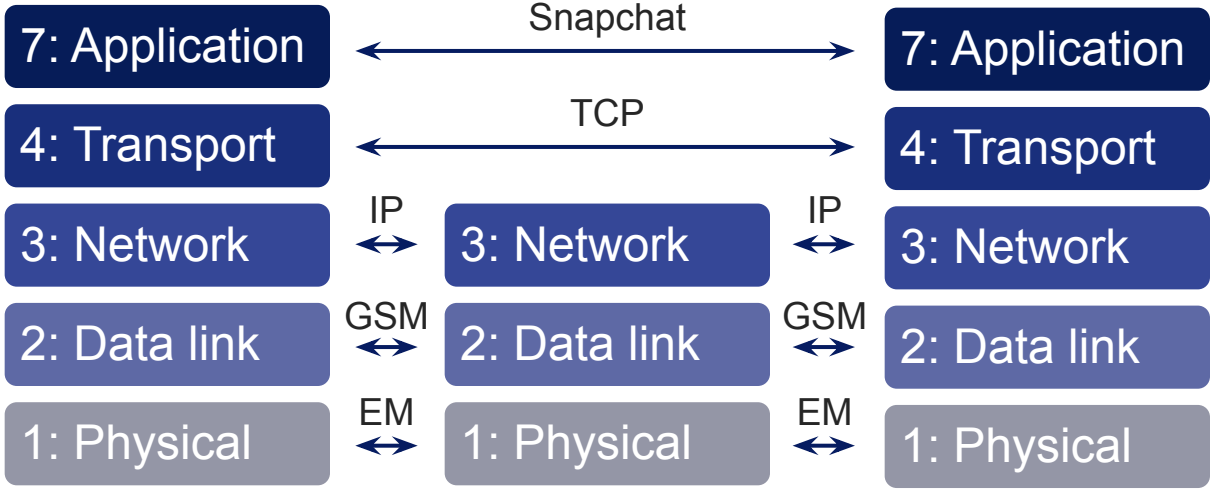
Mail example:

Internet protocol stack

Encapsulation:

Functionality:

- services
- E2E comm.
- addressing, routing
- medium access, reliability
- modulation

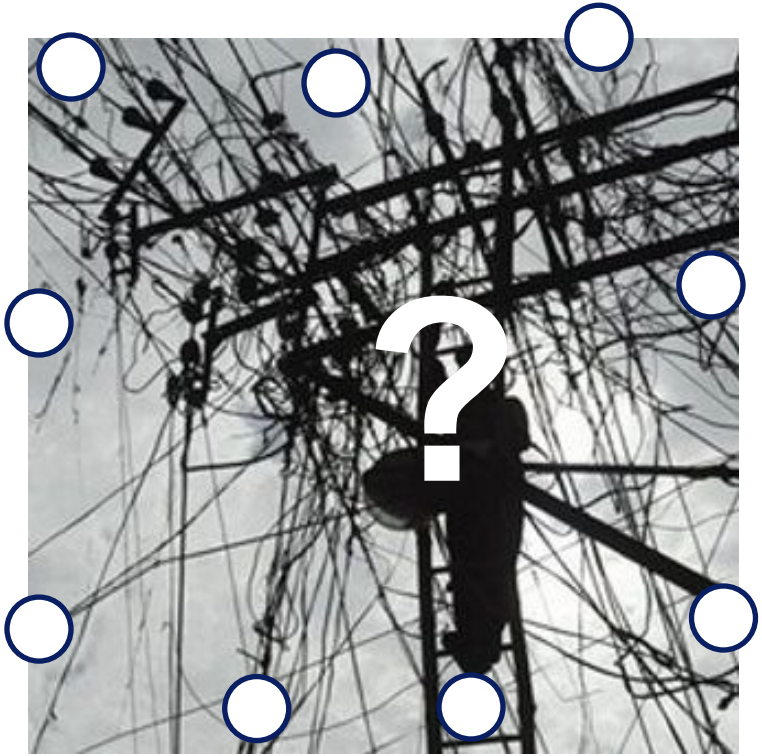


Transmits:

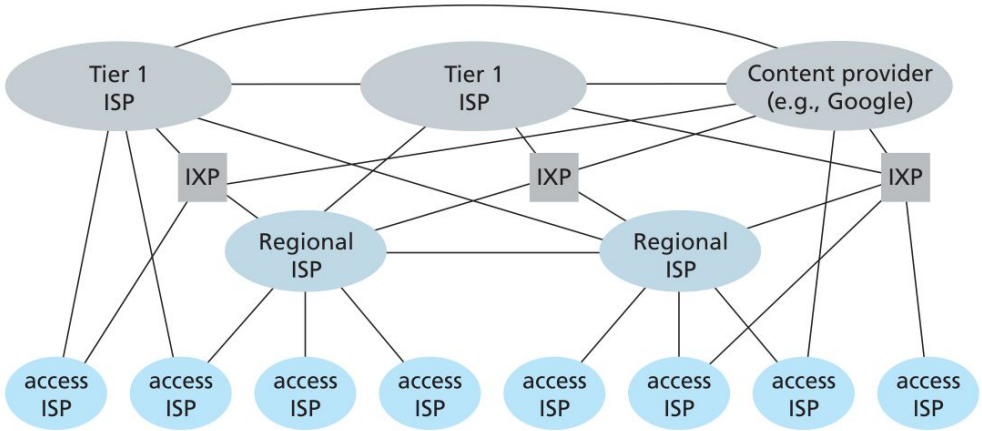
- messages
- segments
- packets (datagrams)
- frames
- symbols

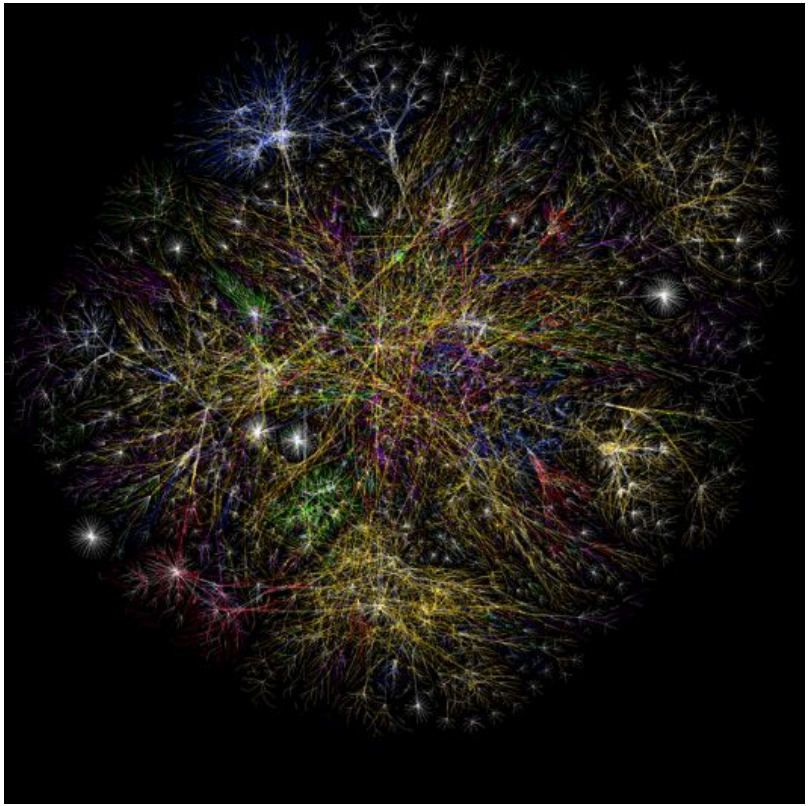
Growth of the Internet

- How to connect Internet hosts?
  - For best end-to-end performance?
  - For lowest cost of connecting additional nodes?
  - Lower delay
  - To allow regional growth?
  - Global connectivity?

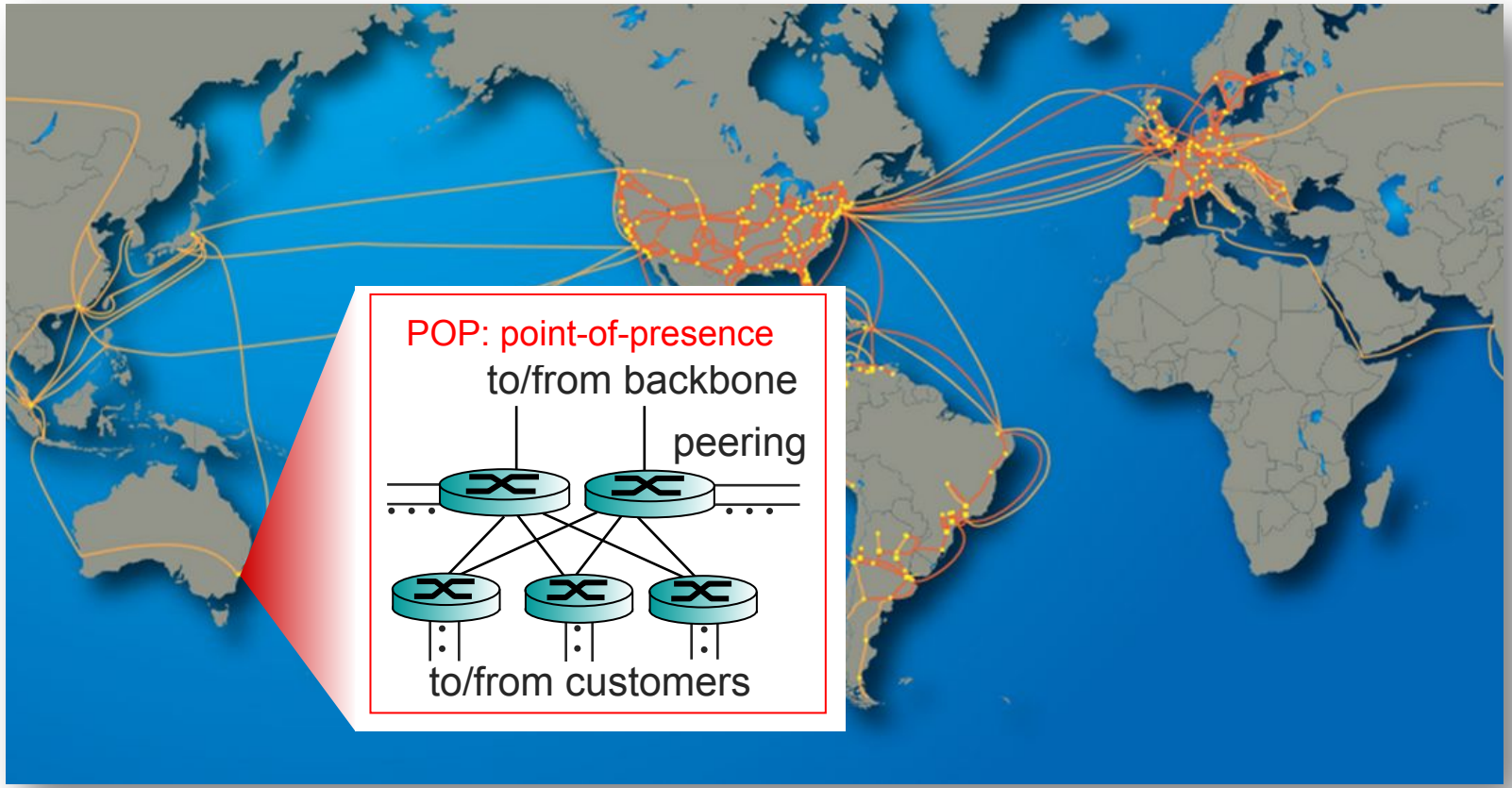


Internet Topology





Tier-1 ISP: e.g., CenturyLink

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