Computer Networks

Goals and Motivation

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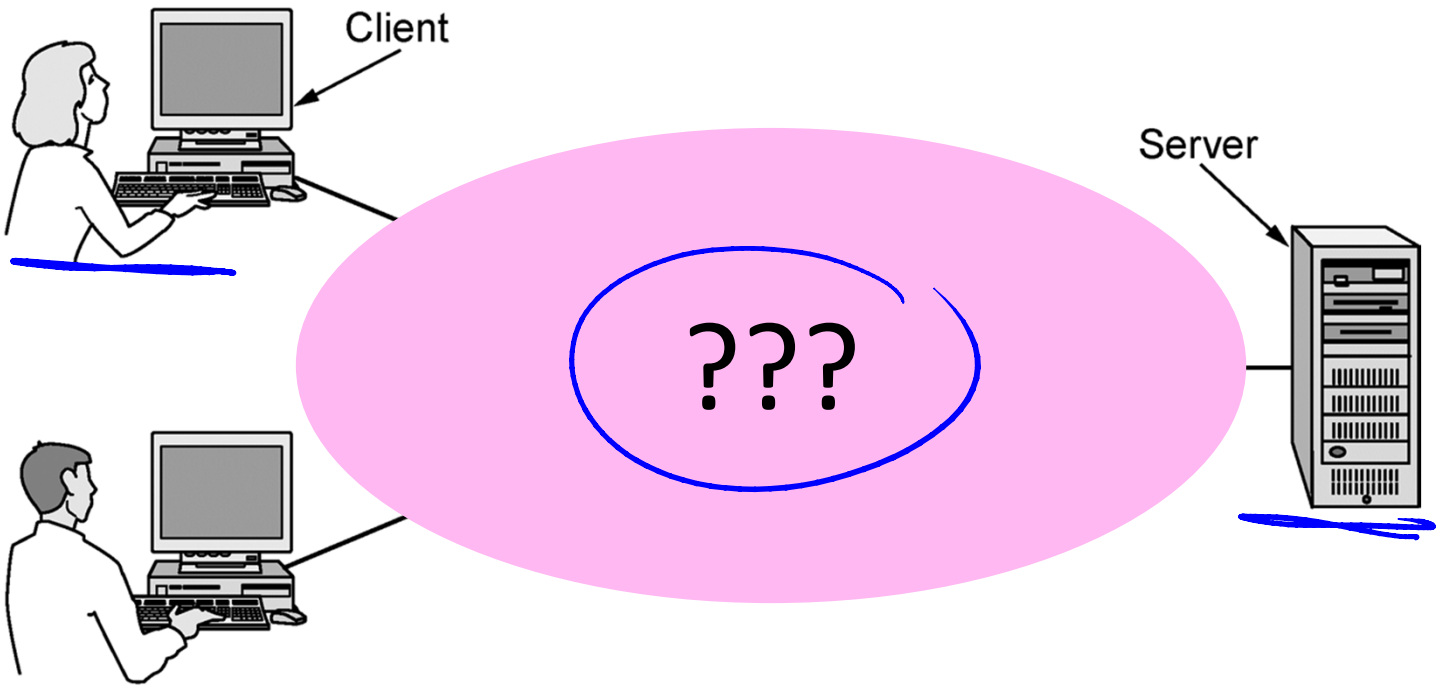
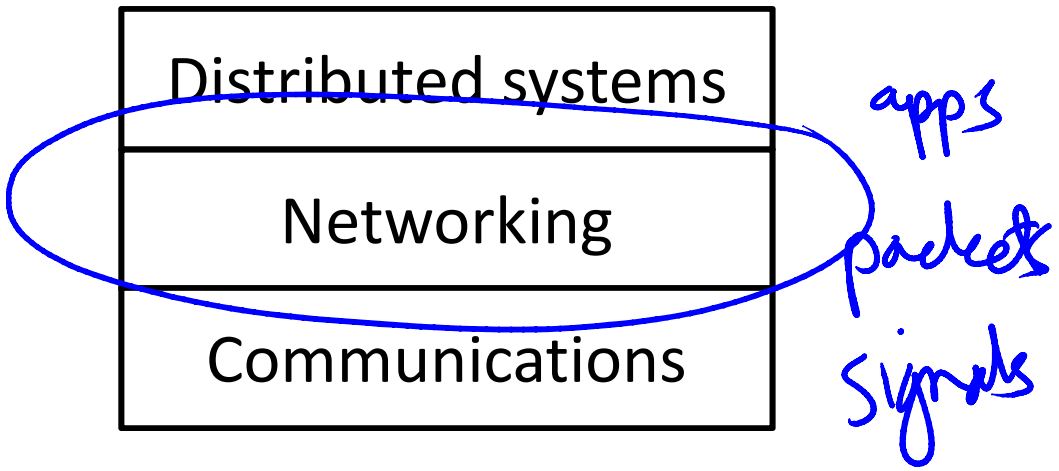
Focus of the course



Focus of the course (2)

- Three “networking” topics:



- We’re in the middle

The Main Point

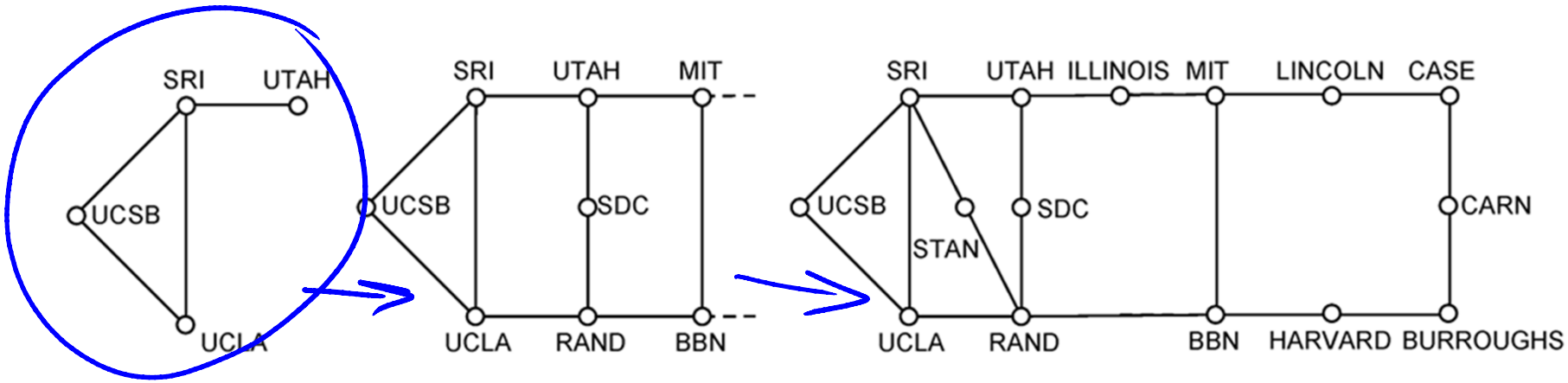
1. To learn how the Internet works »
   - What really happens when you "browse the web"?
   - What are TCP/IP, DNS, HTTP, NAT, VPNs, 802.11 etc. anyway?
2. To learn the fundamentals of computer networks

Why learn about the Internet?

1. Curiosity »
2. Impact on our world »
3. Job prospects!

From this experimental network …

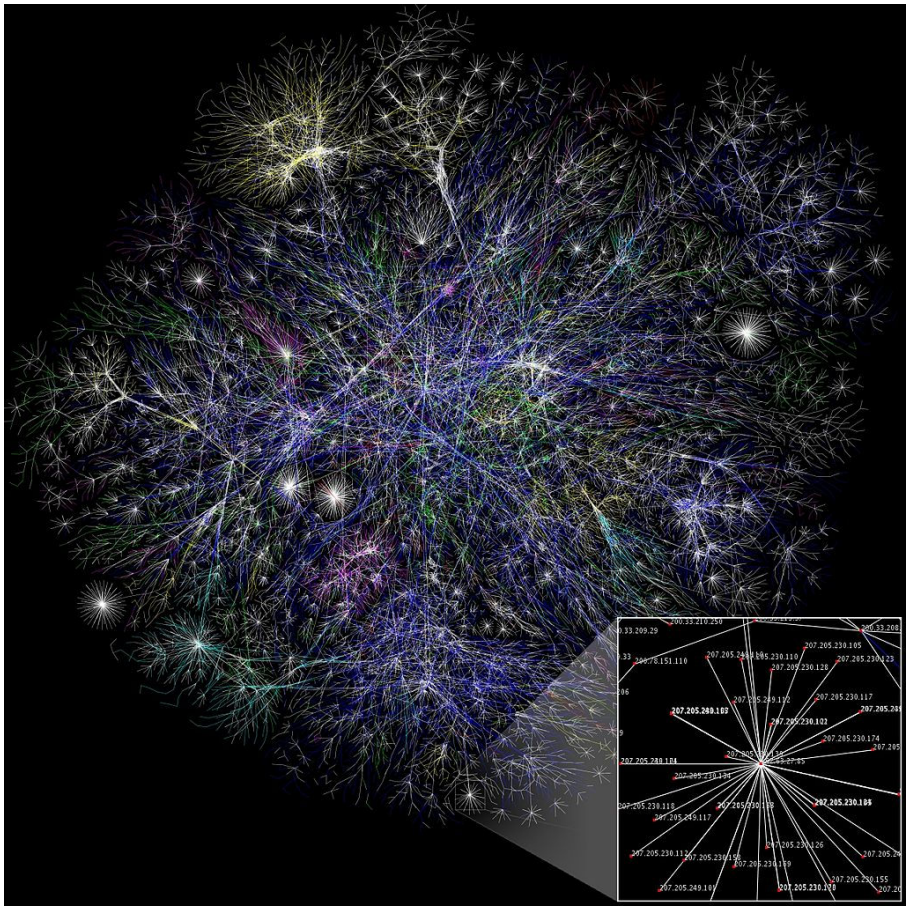
ARPANET ~1970



(a) Dec. 1969. (b) July 1970. (c) March 1971.

To this!
Internet ~2005

- An everyday institution used at work, home, and on-the-go
- Visualization contains millions of links



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Internet – Societal Impact

- An enabler of societal change
  - Easy access to knowledge
  - Electronic commerce
  - Personal relationships
  - Discussion without censorship

Internet – Economic impact

- An engine of economic growth
  - Advertising-sponsored search
  - “Long tail” online stores
  - Online marketplaces
  - Crowdsourcing

The Main Point (2)

1. To learn how the Internet works
2. To learn the fundamentals of computer networks
   - What hard problems must they solve?
   - What design strategies have proven valuable?

Why learn the Fundamentals?

1. Apply to all computer networks
2. Intellectual interest »
3. Change / reinvention »

Fundamentals – Intellectual Interest

- Example key problem: Reliability!
  - Any part of the Internet might fail
  - Messages might be corrupted
  - So how do we provide reliability?
- Reliability solutions
  - Codes to detect/correct errors
  - Routing around failures ...

Fundamentals – Intellectual Interest (2)

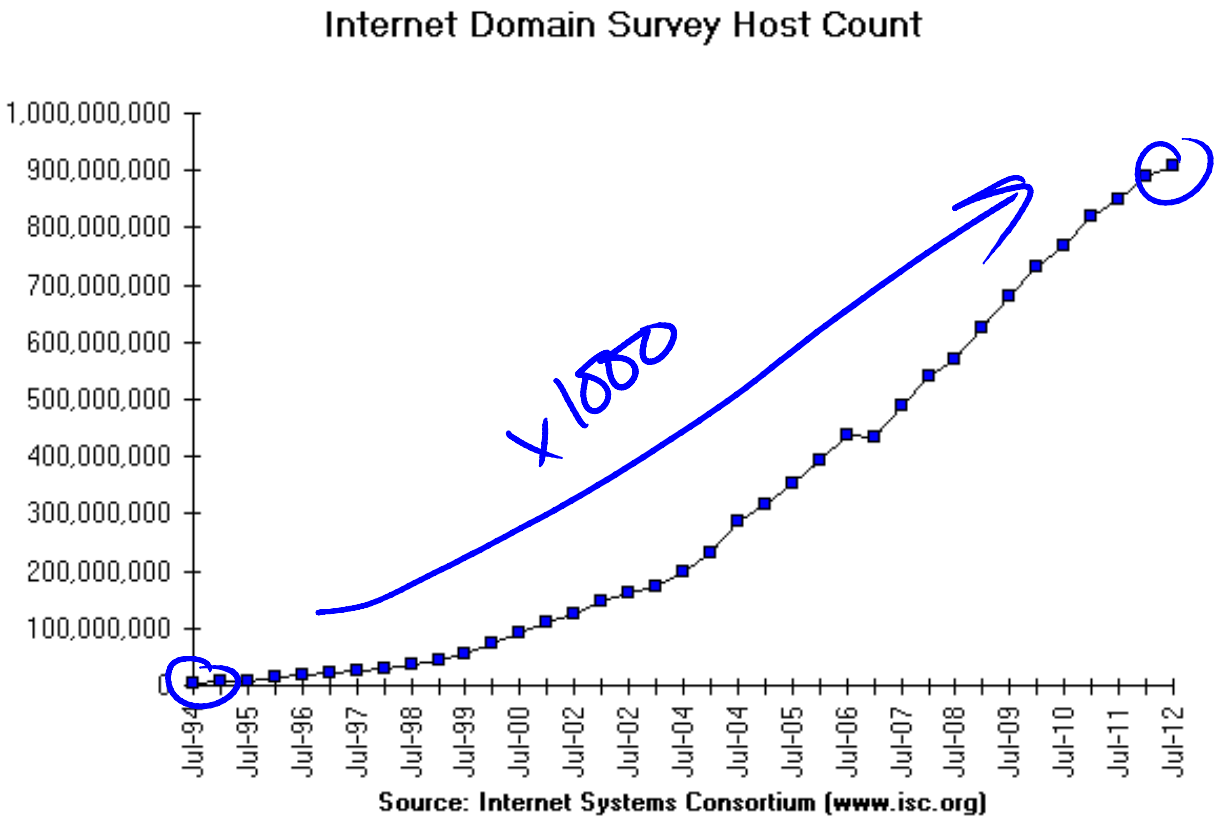
Key problem	Example solutions
Reliability despite failures	Codes for error detection/correction (§3.2, 3.3) Routing around failures (§5.2)
Network growth and evolution	Addressing (§5.6) and naming (§7.1) Protocol layering (§1.3)
Allocation of resources like bandwidth	Multiple access (§4.2) Congestion control (§5.3, 6.3)
Security against various threats	Confidentiality of messages (§8.2, 8.6) Authentication of communicating parties (§8.7)

Fundamentals – Reinvention

- The Internet is constantly being re-invented!
  - Growth over time and technology trends drive upheavals in Internet design and usage »
- Today's Internet is different from yesterday's
  - And tomorrow's will be different again
  - But the fundamentals remain the same

Fundamentals – Reinvention (2)

- At least a billion Internet hosts and growing …



Fundamentals – Reinvention (3)

- Examples of upheavals in the past 1-2 decades

Growth / Tech Driver	Upheaval
Emergence of the web	Content Distribution Networks
Digital songs/videos	Peer-to-peer file sharing
Falling cost/bit	Voice-over-IP calling
Many Internet hosts	IPv6
Wireless advances	Mobile devices

Not a Course Goal

- To learn IT job skills
  - How to configure equipment
    - e.g., Cisco certifications
  - But course material is relevant, and we use hands-on tools

END