CSC2209
Computer Networks

The Internet

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Administrivia

- Project presentations on Friday next week
  - 9 to 12?

- Lecture schedule has been slightly changed
  - Next lecture:
    - M. Gritter and D. Cheriton. An Architecture for Content Routing Support in the Internet. USITS 2001.
    - P. Francis and R. Gummadi. IPNL: A NAT-Extended Internet Architecture. Sigcomm 2001.

Old Network Research

- Can we make X work over networks/Internet?
  - Find a problem, build a solution
  - Flight reservations, radio, TV, fax, read newspaper, etc…
  - Can we help the user find stuff on the Internet?
  - Can we get the bits to the user (faster, better, cheaper, sooner)?
  - Can we let users communicate (sync./async.)?

- How many types of Internet systems are there?
  - Delineate on functionality

Internet Systems

- What functionality do Internet systems implement?
  - Search (DNS, Google)
  - Communication (Skype, e-mail)
  - Delivery (file-sharing, Web)

Newer Questions

- Dependency on communications
  - Can we make the network more reliable?
- Configuration, ease-of-use
  - Can non-technical users use networks?
  - Autoconfiguration, zero-configuration, self-healing…
- Making them secure
  - Viruses, spam, DoS, identity theft, Trojan horses

- Are the old research-like questions still relevant?

Newer Questions

- Dependency on communications
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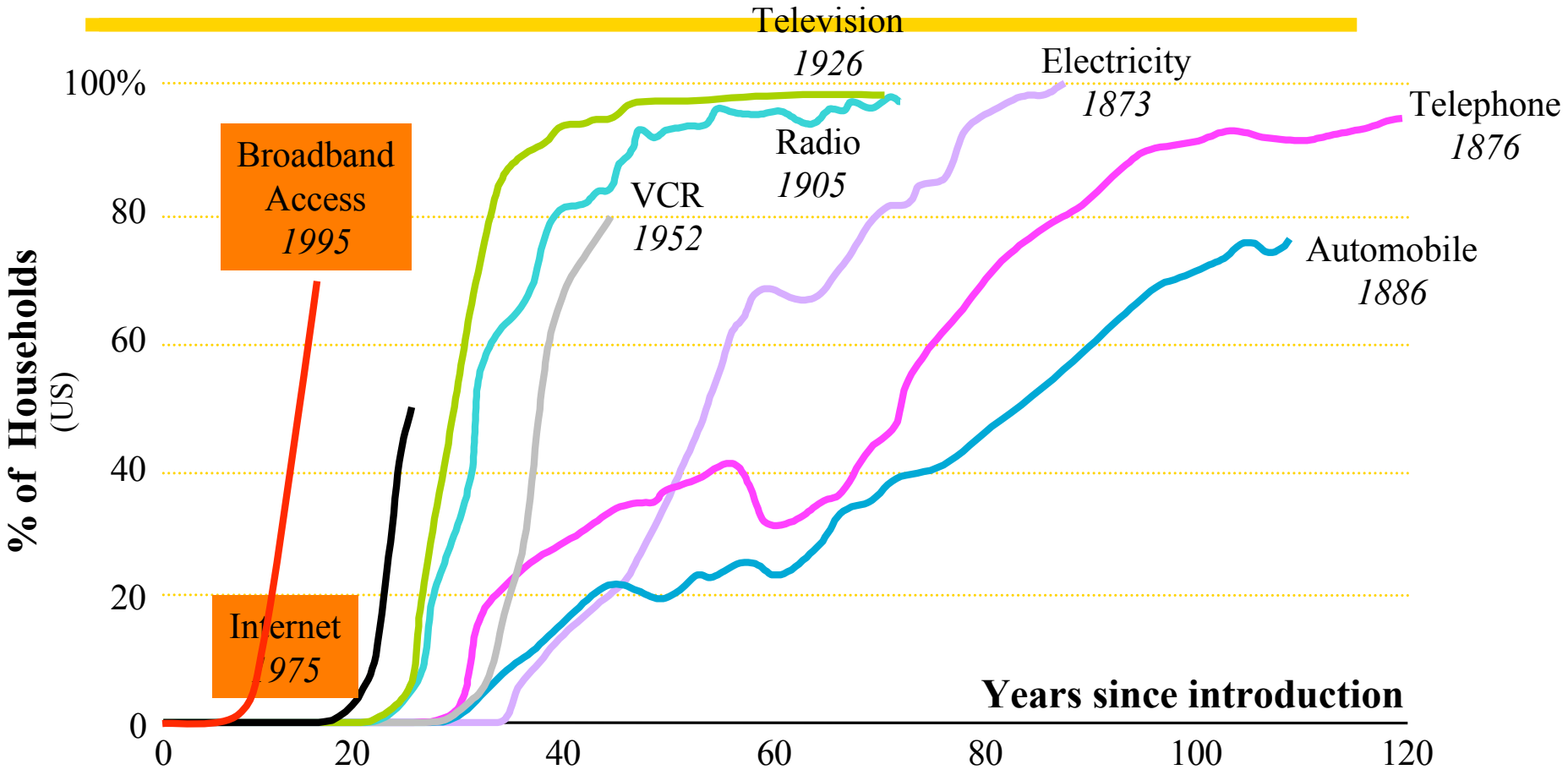
- Are the old research-like questions still relevant
  - Yes, if new/disruptive technology emerges
  - What communication technology emerged in 2000's?

Internet/broadband: one of the fastest applications ever introduced



2005 = 30% broadband / 2010 = 70% broadband estimate

Source: Michael Fox and Forbes Magazine, Morgan Stanley

Today's Hot Technology Trends

- Examples?

Today's Hot Technology Trends

- Examples?
  - Social information (e.g., Amazon, Google)
  - Mobile computing everywhere
    - Cell-phones, sensor-nets, Bluetooth

Internet Systems Incorporating Social Information

- Several very successful examples
  - Google, Amazon, YouTube, MySpace, etc…
- Lots of new ideas floating around
  - Flight tickets' prices
  - Price checking
  - Spam filtering
  - Your own idea here…
- Paradigm shift:
  - New systems/workloads /algorithms are unpredictable
  - Engineers not used to design for unpredictability
    - Source of many tussles

Tussle in Cyberspace

- Old world: design systems to make choices
- New world: design systems to allow choices
- Multiple competing interests on the Internet

Tussle in Cyberspace

- Old world: design systems to make choices
- New world: design systems to allow choices
- Multiple competing interests on the Internet
  - Content value
    - Content with high value for users appears the same to ISP
  - Net neutrality
    - ISPs want pricing schemes, content providers don't
  - Investment in infrastructure vs. open interfaces
  - greed (local traffic optimization vs. social optimum)
  - privacy and anonymity vs. societal goals

Rules of Thumb

- Design for flexibility
- Design for outcomes
- Design for lots of choices

- Any challenges?

Design for Flexibility

- Flexibility might decrease efficiency
- Flexibility might increase complexity
- Flexibility might make it hard to secure

- ANTS?

Design for Outcomes

- Very, very hard to do
  - "My intuition is often wrong"

Design for many choices

- Many choices confuse users
  - Huge configuration problems
- Very, very hard to get the right balance between enough choices without configuration nightmares

- Many choices are hard to secure