Introduction

CSci551: Computer Networks
SP2006 Thursday Section
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Course Topics

- Introduction
- Design principles
- Unicast routing
- Transport protocols, congestion control, and queueing
- Integrated and differentiated services
- Wireless and mobile networking
- [midterm]
- Network modeling
- Web protocols and caching
- Multicast
- Security
- Peer-to-peer protocols
- Current topics
  - your paper here?

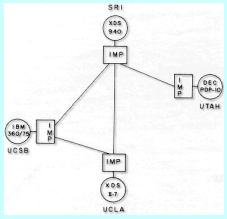
Focus of the Class

- Protocols and mechanisms
  - We will not deal with how bits move in physical media (you did this in EE450)
- We look at:
  - Protocol rules and algorithms
  - Mechanism tradeoffs
  - Why this way and not another?
  - Interactions between protocols (in large numbers)
- Perspective:
  - engineering and a *systems* approach
  - less emphasis on theory and classical performance modeling

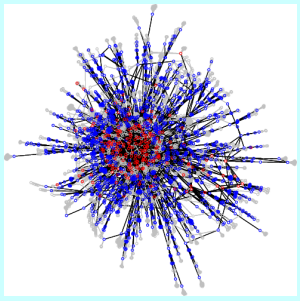
What networks should we study?

- wireless network (wifi 802.11, wimax, …)
  - base stations and hardware
  - mesh networks
- peer-to-peer networks (limewire, bittorrent, etc.)
  - protocols and applictions
- VPNs
  - another kind of "network" overlayed on the internet
- ATM (Asynchronous Transfer Mode)
  - circuit switched, fixed-size packets, has QoS
  - compare to MPLS?
- telephone network
- the Internet

The Internet, Circa 1969

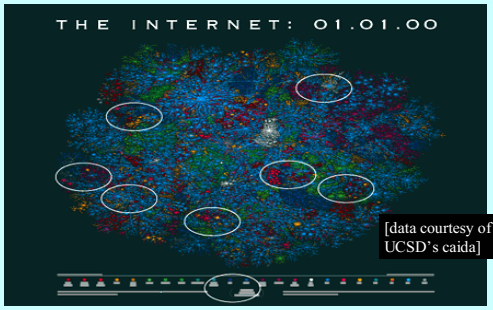


A 1999 Internet ISP Map



[Cable and Wireless's network; data courtesy of Ramesh Govindan and ISI's SCAN project, 1999]

The Internet, Posterized, Circa 2000



Internet Development Mantra

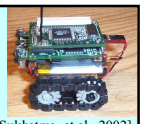
Quote from a t-shirt commonly worn at IETF meetings:

"We reject kings, presidents and voting. We believe in rough consensus and running code." (Dave Clark)

What about *Future* Networks?

- sensor networks
- high-speed wireless mesh networks
- ubiquitious QoS
- (maybe very different security models)
- ubiquitious satellites
- optical networks

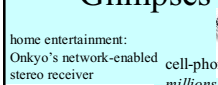
Glimpses of the Future?



USC Robo-Mote

[Rahimi, Sukhatme, et al., 2002]

home entertainment: Onkyo's network-enabled stereo receiver



cell-phones: *millions* of IP-enabled handsets today

Tibet & Britten RFID tag

UCB Mote: an 8-bit sensor node with non-IP based networking

http://www.picoweb.net/ (an 8-bit web server with Ethernet)

PC/104

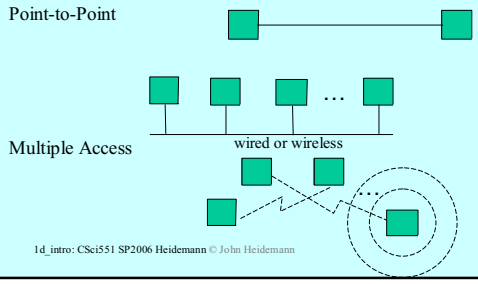
a sensor network (tracking the truck)

can we apply Internet principles elsewhere?

Some Definitions

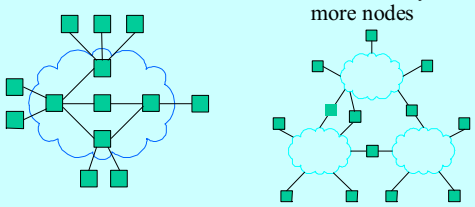
- *Host*: computer, desktop, PDA, light switch, etc. (also a *node)*
- *Link*: path followed by bits.
  - Wire or wireless
  - Broadcast, point-to-point, and in-between
- *Switch*: moves bits between alternate links
  - Packet switching: stateless, store and forward
  - Circuit switching: stateful, cut through
  - other terms: *hub, router, base-station*

Networks

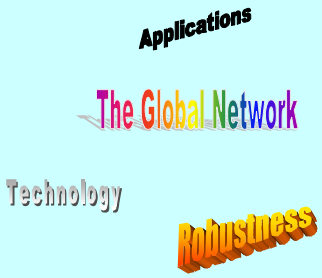


Internetworks

- A network can be defined recursively as...
  - Two or more nodes connected by a link, or
  - two or more networks connected by two or more nodes



What Are the Problems?



Problems with Networks that We Should think about

- performance
  - some changes in performance change use
  - but there is a limit to how much performance matters
  - correlated issues may matter (congestion, etc.)
- ubiquity or availability
- security and accountability
- robustness and reliability

What Are the Problems?

But scale in what sense?

- *always define what **kind** of "scale" you mean*
- many different kinds of scale
  - constant performance as more users and devices
  - distance
  - bandwidth
  - number of users
  - cost of management
  - certainly other dimensions…

Application Considerations

- Application input to network: traffic…
  - data rate
  - pattern (bursty or constant bit rate)
  - destination (multipoint or single destination, mobile or fixed)
- Network service delivered to application
  - delay, jitter sensitivity
  - loss sensitivity
  - price sensitive
- will talk about specific app classes in [Clark88a]

Sample Applications

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