Internet Overview

(got to slide 35 on Jan. 12, rest on Jan. 19)

CSci551: Computer Networks
SP2006 Thursday Section
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What Is the Problem?

What Is….

- Structure
  - **getting started**
  - what and where?
  - getting data there
- Metrics

Getting started: A Host

- host configuration needs:
  - network card, ISP account, IP address, server access (DNS, etc), wireless password
- how much is automated? how much *could* be automated?
  - manually enter password
  - DHCP: Dynamic Host Config Protocol

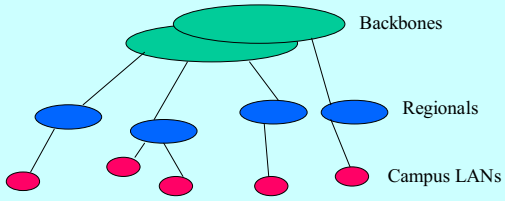
Getting started: A Network

- network configuration needs:
  - router, cables, IP address range, maybe applications or servers on the machines, maybe an internet connection
- automated?
  - not much is automated todays
  - except in some cases (Mac wireless)

Getting started: An ISP

- ISP needs:
  - a big block of addresses
  - connections to one or more other ISPs, *peerings*
  - multiple routers, probably at *exchange point* (a POP or MAE)
  - servers for your users: mail, web, etc.
  - servers for you: monitoring, etc.
  - an AUP (Acceptable Use Policy)
  - a lawyer

Idealized Network Structure

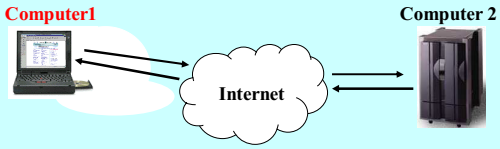


What Is….

The Global Network

- Structure
  - getting started
  - **what and where?**
  - getting data there
- Metrics

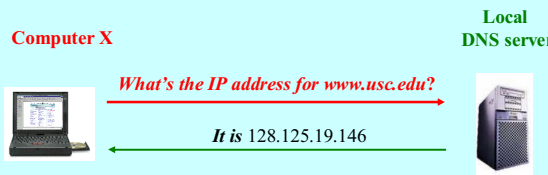
How Do Computers Find Each Other?



Different Kinds of Addresses

- will talk about names, addresses, binding in [Saltzer81a]
- for now, what are names and addresses in the Internet?
  - xxx

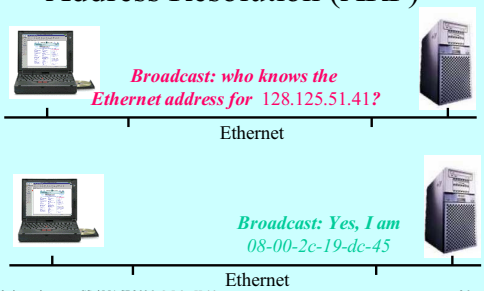
Domain Naming System (DNS)



how does computer X know its own addr? xxx

how does the server know computer X's address? xxx

Finding Ether Address: Address Resolution (ARP)



Finding Things: The USER's Perspective

- search engines
  - google on "cs551 usc"
- http://www.isi.edu/~johnh/TEACHING/CS551/
  - bunch of pieces…
    - prototocol
    - server hostname
    - path

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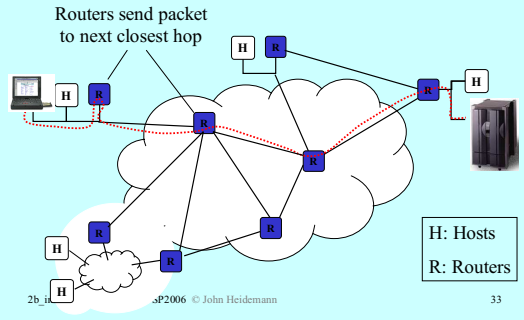
Packet Traveling Through the Internet

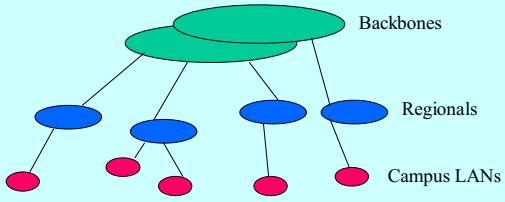


How Do the Routers Know Where to Send Data?

- *Forwarding tables* at each router populated by *routing protocols*.
  - routing tables optimize distance, subject to policies
  - routing tables may have more complete info and are used to compute the routes and populate forwarding tables
  - Forwarding tables then just give next hops
- Default vs. default-free routing
- Will talk more about this next week.

- Got to here on Jan 12; will conclude next time

Why do the packets get there? Internet Economics 101



When you get IP connectivity, you pay someone, who pays someone, who…a *client/provider relationship*

At higher levels, ISPs establish *peering* relationships with each other. They occasionally do *settlements* to pay for interactions.

What Is….

- Structure
  - getting started
  - what and where?
  - getting data there
- **Metrics**
- Failure modes

Network Metrics

- Bandwidth (should really be *bitrate)*
  - Transmission capacity (a.k.a. How many bits can fit in a section of a link?)
- Delay
  - queueing delay
  - Propagation delay (limited by *c*)
- Delay-bandwidth product
  - Important for control algorithms

What Is….

Robustness

- becoming a critical issue
  - cf. the Microsoft memo about "trusted computing" (security robustness)
  - phone networks promise "5 nines" of reliability: 99.999% uptime
    - (= 5 *minutes* of outage per year
  - the Internet is *not* there

Common Network Failures

- location in a 911 call
- router failure
- physical links can fail
- servers at the other end
- misconfiguration of stuff
- congestion
- malware: viruses, worms, denial-of-service, trojans / phishing

(Lack of) Security in the Network

- many things are too easy:
  - virus, worms, trojan horses / phising
  - techniques to improve things: authentication, encryption
    - different things provide different benefits:
      - integrity of data
      - confidentiality
      - authorization
  - disclosure of passwords (snooping, etc.)
- *but* strong security is possible
  - requires *all* of good protocols, implementations, practices, and people

Engineering Trade-offs

Network can be engineered to provide:

- reliability
- low delay / high bandwidth
- low cost

Pick any two

Some Backsliding About Robustness

- NAT boxes
- application-level gateways
- layer-3 caches
- user tweaking
- *all violate the end-to-end principle, and can reduce robustness*

What is…

Technology

Or, how does technology interact with the Internet.

How does tech affect the net?

- technology drives much of the net
  - although marketing and politics also have influence
- examples:
  - world wide web
  - wireless: mobility
    - always connected
    - but makes configuration harder
    - and think about what the end users really care about, not just the technology
  - sensor nets
  - optical networking