What IS the Internet?

Charles Severance
http://www.egr.msu.edu/user/crs/

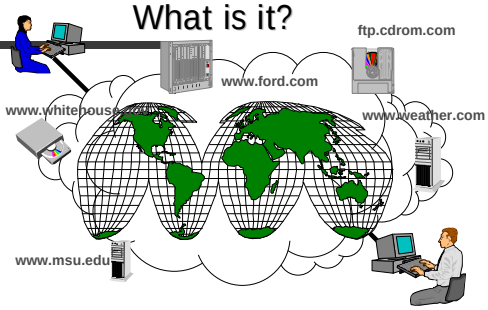
Internet in 1996

- A really really big slow multimedia CD-ROM which keeps getting better and keeps your phone line busy.
- “New media, tend to encapsulate all older media” - Marshall McLuhan, "Understanding Media: The Extensions of Man"

Internet as a Media

- **Music Videos**
- **Magazines**
- **Catalogs**
- **Home Shopping Club**
- **Phone Company**
  - **Long Distance Videophone**
  - **Phone Number Directory**
- **Maps**
- **Software Store**
- **Cable TV**
  - **Weather Channel**
  - **Discovery Channel**
  - **ESPN**
  - **COURTTV**
- **Radio - RealAudio**
- **The Library**
- **The Newspaper**
- **FAX Machine**

What is it?



Things the go “bump” in the Net

- In the Internet we generally interact with three types of things - and we need to know their names
  - Computers - Have an address and name
  - People - Have one or more E-Mail addresses
  - Documents - Have Uniform Resource Locators

Connecting to Computers

- Each computer connected to the Internet must have an IP address
  35.8.2.41
- This address is assigned by the organization connected to the Internet
- Even dial-up conections are given an address when they dial-up

Domain Names for Computers

- Numeric addresses can change as an organization reorganizes its network
- Each computer may also have a Domain Name

scully.egr.msu.edu

It is named "scully"

This computer belongs to the MSU College of Engineering

E-Mail - Contacting People

- E-Mail addresses consist of a account name and an Internet Domain Name

crs@egr.msu.edu

Account Name **Domain Name**

- E-Mail addresses are like phone numbers - on your business card

URL - All About Data

Where to get the data

How to Display the data

http://www.egr.msu.edu/~crs/crs.gif

How to retrieve the data

What data to get

How does the Internet Work?

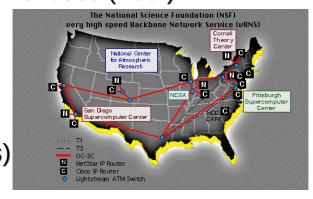
- The Internet is a hierarchy
- National and International Service Providers
- Regional Service Providers
- Local Service Providers

Who is in Charge?

- Internic (http://rs.internic.net/)
  - Domain name registry
  - Network numbers (IP Address Ranges)
- Internet Engineering Task Force (www.ietf.org)
  - Internet protocols
  - Internet technical details

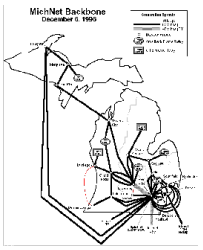
Top Level Service Providers

- Use Long-Distance dedicated lines
- 45Mb/Sec -> 1GB/Sec (fiber)
- Often phone companies
- Interact at 5 NAPs (Net Access Points)



Regional Service Providers

- Size roughly a state
- There may be many competing regionals
  - MichNet (Merit, Inc.)
  - Ameritech
  - CICNET
- Often there is some cooperation



Michigan State University

- Member of MichNet and CICNet
- 45Mb/Sec (DS3) connection through Ann Arbor to the National Network
- Large organizations typically connect directly to a regional or even national network

Local Service Providers

- In the Lansing Area
  - MSU Faculty, Staff, and Students “free”
  - K-12 Teachers get it “free”
  - AT&T, MCI, Merit
  - America On-Line, Compuserve
  - TCI Cable Modems
  - Sojourn, Voyager, Arrownet
- Yellow pages has about 10 companies

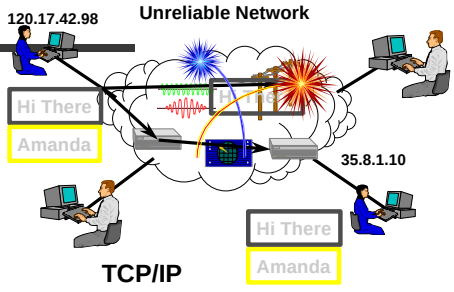
International Internet

- University of London - 23rd Internet site
- Other countries have a different relationship between government, Universities, and phone companies
- Governments pushed “Non-Internet” network technologies - for a while
- Phone systems are pretty compatible

What is a “Packet”?

- Like an Envelope and a Letter
- A packet has “from” and “to” address
- Can arrive out of order or not at all
- Hosts must reassemble messages

120.17.42.98	35.8.1.10	Amanda
From	To	Data

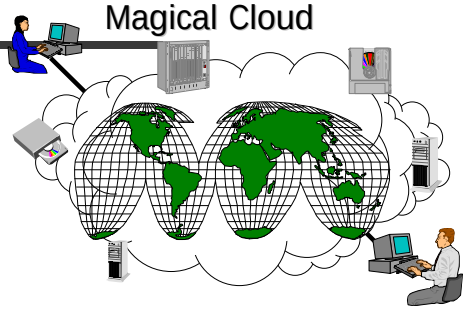


Probing the Internet

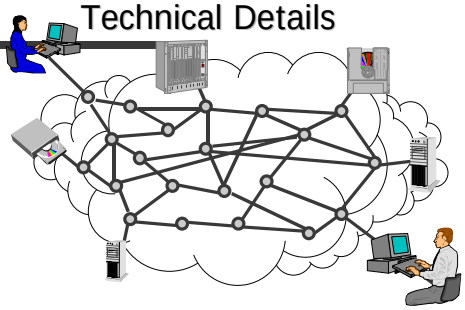
- The most fundamental Internet command is ping
- Send a single packet
- Destination replies
- Time it

```
Microsoft(R) Windows NT(TM)
(C) Copyright 1985-1996 Microsoft Corp.

C:\>ping stanford.edu

Pinging stanford.edu [36.56.0.10] with 32 bytes of data:

Reply from 36.56.0.10: bytes=32 time=60ms TTL=243
Reply from 36.56.0.10: bytes=32 time=50ms TTL=243
Reply from 36.56.0.10: bytes=32 time=60ms TTL=243
Reply from 36.56.0.10: bytes=32 time=60ms TTL=243

C:\>
```

Magical Cloud



Technical Details



Exposing Details - Traceroute

- Normally cannot determine the routing details
- Traceroute (tracert) - Sends packets 1,2,3,4.. hops and gets a reply
- Shows the route - may change an instant later
- There are Web sites which can do traceroute

tracert www.cs.stanford.edu

```
C:> tracert www.cs.stanford.edu
Tracing route to www.cs.stanford.edu [36.56.0.10]
over a maximum of 30 hops:

  1   10 ms   <10 ms   <10 ms  eng-gw-fd1.msu.edu [35.9.32.1]
  2  <10 ms   <10 ms   <10 ms  cc2-gw-fd00.msu.edu [35.8.100.1]
  3  <10 ms   <10 ms    10 ms  fdd0-0.msu2.mich.net [35.9.6.3]
  4  <10 ms    10 ms   <10 ms  hss1-2.michnet1.mich.net [35.125.0.1]
  5  <10 ms    10 ms    10 ms  cpe3-fddi-1.WillowSprings.mci.net [192.203.195.5]
  6   30 ms    10 ms    20 ms  borderx2-hssi2-0.WillowSprings.mci.net [204.70.104.117]
  7   10 ms    10 ms    20 ms  core2-fddi-1.WillowSprings.mci.net [204.70.104.65]
  8   60 ms    60 ms    60 ms  bbn-planet.SanFrancisco.mci.net [166.48.15.254]
  9   60 ms    60 ms    60 ms  bbn-planet.SanFrancisco.mci.net [166.48.15.254]
 10   60 ms    60 ms    60 ms  su-pr1.bbnplanet.net [131.119.0.199]
 11   60 ms    61 ms    60 ms  sunet-gateway.stanford.edu [198.31.10.1]
 12   60 ms    60 ms    60 ms  Core-gateway.Stanford.EDU [171.64.1.33]
 13   60 ms    60 ms    60 ms  Gates-1-gateway.Stanford.EDU [171.64.1.68]
 14   61 ms    60 ms    70 ms  labrea.Stanford.EDU [171.64.67.150]

Trace complete.

C:\>
```

Challenges in the Internet

- Limited national backbone capability
  - Phone lines max out at 45Mb/sec
  - Need to move to 1Gb/sec+ over Fiber
- Local connections are getting faster
  - 28.8Kb POTS -> 128Kb ISDN -> 10Mb
- Local phone companies feeling a pinch
- Audio and video consume continuous bandwidth - Surfing != Internet Phone

Internet .vs. Telephone

- Telephone company
  - Bandwidth (amount of data) is guaranteed
  - No difference to the phone company between silence and singing
  - Real-time delivery - no pauses
  - Data lines are “synchronous” - You pay whether or not you move data or not
  - Cost is by connection time - long distance

Internet .vs. Telephone

- Internet
  - Data is transmitted in “packets” - no guarantee of bandwidth or reliability
  - Information is broken into many packets
  - Packets can be sent over various links
  - When a system is idle it transmits no packets, using no resources
  - Most systems on the Internet are idle 95+ percent of the time

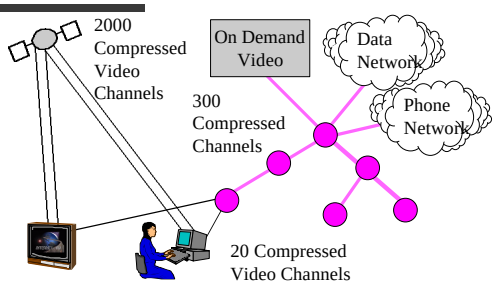
Internet .vs. Telephone

- Will the Internet consume the phone Companies or the other way?
- Internet
  - Wants to guarantee bandwidth real-time
  - Needs to charge for connection time
- Phone Companies
  - Already capable of guaranteed bandwidth
- Who will do it cheaper? Will we care?

Telephone .vs. Cable

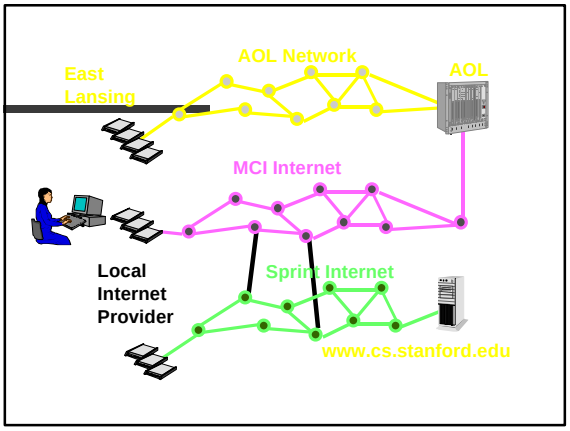
- Holy Grail: fiber-optic two-way digital connection to the telephone pole
- Cable
  - Willing to try new things
  - Fighting with digital satellite
- Telephone
  - Knows data communication
  - Has money

Future of Phone *and/or* Cable?



Internet .vs. AOL

- While the Internet is 30 years old, it has only been popular for a few years
- AOL has been popular for much longer
- AOL worked with 2400 baud modems
- Because of protocol overhead, Internet is only usable with >14,400 bps
- AOL is specific - Internet is very flexible



Internet .vs. AOL

- AOL is a complete solution
  - Content
  - E-Mail
  - National network
  - Regional network
  - Local provider
  - Internet for surfing and E-Mail
- AOL can fund all of its infrastructure

Internet .vs. World-Wide-Web

- World-Wide-Web is one type of information accessed using the Internet
- Internet Chat is one type of information accessed using the Internet
- E-Mail is one type of information accessed using the Internet
- The Internet is the “highway”
- Web, Chat, E-Mail are Bus, Truck, Car

Chuck’s Top 6

- www.switchboard.com
- www.four11.com
- www.mapquest.com
- www.weather.com
- www.intellicast.com
- http://digital.altavista.com

Summary

- Internet is currently very exciting and works pretty well
- Non-nerd people find the Internet useful enough to pay for it
- Internet is not ready to take over Cable TV and Telephone service “yet”
- Today Internet may actually be a bargain