Residential access: cable modems

Diagram: http://www.cabledatacomnews.com/cmic/diagram.html

Source: Computer Networking – Jim Kurose, 3rd Edition
Cable Network Architecture: Overview

Typically 500 to 5,000 homes

Source: Computer Networking – Jim Kurose, 3rd Edition
Cable Network Architecture: Overview

FDM:

Source: Computer Networking – Jim Kurose, 3rd Edition
Company access: local area networks

- company/univ local area network (LAN) connects end system to edge router
- Ethernet:
  - shared or dedicated link connects end system and router
  - 10 Mbs, 100Mbps, Gigabit Ethernet
- LANs: chapter 5

Wireless access networks

- shared wireless access network connects end system to router
  - via base station aka “access point”
- wireless LANs:
  - 802.11b (WiFi): 11 Mbps
- wider-area wireless access
  - provided by telco operator
  - 3G ~ 384 kbps
    - Will it happen??
    - WAP/GPRS in Europe
Home networks

Typical home network components:
- ADSL or cable modem
- router/firewall/NAT
- Ethernet
- wireless access

Internet has proliferated rapidly

<table>
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<tr>
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<th>Hosts</th>
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### WWW Growth:

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<th>Sites</th>
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</table>

Sites = # of web servers (one host may have multiple sites by using different domains or port numbers)

Please refer to the website in the slide (Hobbes’ Internet Timeline for Latest statistics)
Network Evolution: Spiral

Commodity (Commercialization)

Privatization (+ Partners)

Commercial ISPs

Gigabit Testbeds

Internet3

Testbeds

Academic Networks

[ARPAnet]

[NSFnet]

[ANSnet]

Gigabit Testbeds

[νBNS, Abilene]

12. SingAREN, APAN]

R&D/Experimental

R&D/Production (+ Partners)

Source: Prof Goto, www.apan.net

Traffic Characteristics:
Research networks vs. Commodity Internet

- Other
- Multicast
- SMTP
- DNS
- shell/cmd
- ssh
- NNTP
- Games
- FTP
- Web
Internet2 Mission

Facilitate and coordinate the development, deployment, operation and technology transfer of advanced, network-based applications and network services to further research and higher education and accelerate the availability of new services and applications on the Internet.

Internet2 Member Universities

[Map of the United States showing Internet2 member universities]

http://www.internet2.edu
Abilene Network

1999

33 Total Access Points

Optical Internet Architecture

Both sides of 4/BLSR 1:1 span ring used for IP traffic

SONET → OADM

3 OC-48 Tx
1 OC-48 Rx

Asymmetric Tx/Rx lambdas that can be dynamically altered

Traditional SONET Restoral

Low priority traffic that can be buffered or have packet loss in case of fiber cut

High Priority Traffic Cannot exceed 50% of bandwidth in case of fiber cut

Traditional SONET Gear
Future look

Our 25 year mission: to go where no network has gone before!

Space: the final frontier

Courtesy: Dr. Vint Cerf
Interplanetary Internet Status

- Part of the Mars Mission Plan
- Possible Earth/Moon mission 2001
- Low Mars Orbit and Areosynchronous satellites by 2008
- Mars Outposts by 2010
- Possible Orbiting manned mission 2018
- Possible Manned Mars station 2030??
- Stable Interplanetary backbone 2040?

Courtesy: Dr. Vint Cerf
As with many new developments, the most significant results and applications of the Next Generation Internet have not even been thought of yet," said George Strawn, division director for NSF's Division of Advanced Networking Infrastructure and Research. "The best is yet to come."