Week 1:
I. Syllabus
II: Internet Concepts

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1. Background
   (a) Assistant Professor ODU, 2002-
x: Digital Libraries, HCI,
   recommender systems
   (b) PhD Experimental Psychology
       2001, Vrije Universiteit Brussel
   (c) Los Alamos National Laboratory
   (d) Vrije Universiteit Brussel

2. Contact:
   (a) Home page:
       http://www.cs.odu.edu/~jbollen
   (b) Course URL:
       http://www.cs.odu.edu/~jbollenCS312
   (c) Room: 228-3, office hours:
       Wednesday 3:30-5:30 +
       appointment
Goals of the Course

Provide students with:

1. Understanding of Internet architecture and protocols
2. Successful utilization of Internet tools
3. Appreciation and use of utilities
4. Study of Internet related issues
5. Comprehensive knowledge of HTML
6. Web design issues
Syllabus

1. Textbooks:
   (a) In-LineOn-Line: Fundamentals of the Internet and WWW by Greenlaw and Hepp
   (b) Text will be used where applicable

2. Grade distribution
   (a) Homework, quizzes, participation: 10%
   (b) Two projects: 30%
   (c) One midterm exam: 30%
   (d) Final Exam: 30%

3. Grading
   (a) Homework, quizzes, assignments: scale 10

(b) Exams (midterm and final): scale 30

(c) Final grading on curve

(d) Linear scale: A=90-100, B=80-89, C=70-79, D=60-69, F = other

(e) No submission or late submission = 0/10, ALWAYS

4. Note:
   (a) Don’t panic: every single homework and quiz is only fraction of final grade
   (b) Process: I teach, you study, I test. The quizzes/exams are not the subject of study.
Course Perspectives

Internet of the Past

1. History of the Internet
2. Definition of Basic Terms
3. Earlier Internet tools
4. Internet Protocols
Course Perspectives, II

Internet of the Present:

1. Current tools
2. Current uses
3. Browser Overview
4. World Wide Web Overview
5. Search engines:
   (a) Principles, types
   (b) Search strategies
6. HTML
   (a) Understanding HTML Code
   (b) Building Web pages
   (c) Forms, pop-ups, Javascript
Course Perspectives, III

1. Internet Issues
   (a) Security
   (b) Privacy
   (c) Censorship/Filtering/Content

   Rating
   (d) Accessibility
   (e) Growth Issues

2. Future of the internet
Internet Facts

Major surge in 90s due to WWW
Who uses the internet?
1. 35 years old
2. Annual household income $60,000
3. 56% have college degree
4. 69% male: how long?
5. 46% married
6. Political views?
7. English speaking?

Some links

2. http://mappa.mundi.net/ Mappa Mundi
Every Day Uses of the Internet

Ways internet can Influence or even revolutionize our every day life

1. News and information
   (a) Pollen Count
   (b) Tunnel traffic
   (c) Hurricane updates
   (d) Stock Market
   (e) Banking

2. Shopping and recreation
   (a) CDs, books
   (b) On-line auctions
   (c) Games, MUDs, music

3. Communication
   (a) Many to many: e-mail, chat, IM, web sites, FTP servers, Digital Libraries
   (b) Decentralized, rapid interpersonal-group communication
   (c) This is pure Third Wave technology
Why the internet can not be ignored

1. Social
   (a) Extensive personal communication networks
   (b) Discussion forum for politics, ethics, and recent events
   (c) In times of big media conglomerates: only way to hear dissenting voices
   (d) Pure and unadultered democracy

2. Professional
   (a) Significant part of our economy
   (b) Integrated with everyday operation of most businesses
   (c) Enhance your efficiency
   (d) Knowledge is power
What is this Internet?

Network of networks

or

A global system of network computers
together with their users and data

Federal Networking Council (FNC) defines:

1. global information system
2. linked by globally unique address space based on IP
3. supports communications through TCP
4. provides high level services layered on top of this architecture
History overview

1. Began life as ARPA/DARPA research project
   (a) Need to share computing power
   (b) Connect computers of important institutions
       i. UCLA
       ii. Univ. Utah
       iii. Stanford
   (c) Built in redundancy and resistance to damage
   (d) Demonstrated feasibility of packet vs. circuit switching

2. Expanded throughout the 70s
   (a) growth of LANs
   (b) Internationalization

3. big push in 1980
   (a) general and commercial usage
   (b) TCP/IP standardization
   (c) NSFnet

4. 1990s: big growth in services and usage
Internet History: important concepts

1. ARPAnet
2. TCP/IP
3. NSFnet
4. BITnet
5. USEnet

Some links:
A timeline

1. 1956 - Sputnik spawns ARPA
   http://www.webopedia.com/Term/A/ARPANET.html

2. 1962 - RAND packet switching
   http://www.webopedia.com/Term/P/packet_switching.html

3. 1971 - 15 nodes, 23 hosts

4. 1970’s - E-mail:
   http://www.webopedia.com/Term/e/e_mail.html

5. 1972 - Telnet:
   http://www.webopedia.com/Term/T/Telnet.html


7. 1976 - UNIX:
   http://www.columbia.edu/~rh120/ch001j.c11

8. 1979 - USEnet:
   http://www.faqs.org/faqs/usenet/what-is/part1/


10. 1982 - TCP/IP: http://www.yale.edu/pclt/COMM/TCPIP.HTM

11. 1983 - Desktop workstations

12. 1984 - DNS 1000 hosts
    http://www.dns.net/dnsrd/

13. 1986 - NSFnet
    http://www.webopedia.com/Term/N/NSFnet.html

14. 1987 - >10,000 hosts
15. 1989 - ¿100,000 hosts
16. 1991 - Gopher
   http://www.webopedia.com/
17. 1992 - WWW (Cern)
   http://www.w3.org/
Notes

1. The Wild Wild West marketplace of the future has its origins in public funding!
   (a) Reliance on OPEN standards
   (b) No proprietary, commercially inspired formats or protocols
   (c) Demonstrates power of public efforts
   (d) Information must be free

2. Merger of consistent hardware and software advances over the years
   (a) Physical network: routers, LANs, hubs, servers, hosts, etc
   (b) Operations: packet switching, TCP/IP, communication protocols
How it all works: Basic principles of operation

Basic Notions:

1. Network
   (a) Initial DARPA design concerns
   (b) Bursty activity
   (c) Sparse connections
   (d) Reliability
   (e) Efficient addition of new networks

2. Address Space: IP numbers

3. IP: Packet switching and routing vs. circuit switching

4. TCP: set of communication protocols on top of IP

5. Client-server model
IP Addresses

1. Each host on network needs ID
2. Domain names we see are in fact translated to IP numbers
3. IP numbers:
   (a) four bytes
   (b) network component and host

   (c) vetted by Network Information Center

```
10100010 10100010 11010010 00000010
```

network  host
Where have all the IP addresses gone?

You’ll seldomly see one due to domain name resolvers:

1. Internet servers that store list of IP addresses and hostnames
2. Translate hostnames to IP addresses
3. Transparant: user does not notice

4. Accredition by number of institutions:
   (a) Accreditation by InterNIC: 
   (b) ICAN: 
       [http://www.icann.org/](http://www.icann.org/)
Domain names

1. Hierarchical structure

2. Top level domains:
   (a) com, .edu, .gov, .int, .mil, .net, and .org
   (b) Unrestricted access to .com, .net and .org
   (c) All others restricted purpose

3. Domains within domains

4. Example: pespmc1.vub.ac.be

5. Country Code Top Level Domains:
   e.g. .uk, .jp, etc

6. Recent expansions: .biz, .mil, etc
“The Net interprets censorship as damage and routes around it.”

http://livinginternet.com/?i/iw_packet.htm

What’s a packet?

1. Component of file also known as datagram
2. Specified length for certain systems, e.g. 1.5kb
3. Contains:
   (a) Origin: IP address of sender
   (b) Destination: IP address of receiver
   (c) Length in bytes
   (d) Number of packets, and sequence number

Routing:

1. Packets for same file can take different routes
2. Routers pass packets from one network to the other
3. Use of forwarding tables
   (a) Determine where packets with given destination will be passed on to
   (b) Many intermediate routers are possible: they communicate
   (c) Forwarding tables: static or routing algorithms
Routing demo
# Two messages

<table>
<thead>
<tr>
<th>file 1:</th>
</tr>
</thead>
</table>
| It was twenty years ago today, that  
Sgt. Pepper taught the band  
to play They’ve been going  
in and out of style  
But they’re guaranteed to raise a smile. |

<table>
<thead>
<tr>
<th>file 2:</th>
</tr>
</thead>
</table>
| Let me take you down,  
’Cos I’m going to Strawberry Fields.  
Nothing is real  
And nothing to get hungabout.  
Strawberry Fields forever. |
Some notes

**Advantages:**
1. Robust and redundant
2. Optimization of routers allows efficient transfer
3. Perfect for bursty activity

**Disadvantages:**
1. Not very suitable for streaming purposes
2. Delayed packages, etc make continuous transfer difficult
3. No dedicated lines
Internet Connectivity: the last mile

1. Dial-up modem to OSP or ISP
   (a) Simplest
   (b) Least Expensive
   (c) Go through a remote computer
   (d) SLIP - PPP connection

2. Dedicated Network Access

3. Remote Network Access

4. Schools

5. Internet on your TV - webTV:
Some tools: demos

Routing and packet switching trace:
- traceroute IP or hostname

DNS lookup:
- host IP or hostname

check on host:
- ping hostname
Traceroute

trace route to www.google.com (216.239.41.99), 30 hops max, 38 byte packets
1  10.1.158.1 (10.1.158.1) 11.796 ms 10.598 ms 12.787 ms
2  nrfkSYSR01−fex020200 (68.10.9.161) 11.086 ms 11.480 ms 12.082 ms
3  nrfkdsrc02−gew0303.rd.hr.cox.net (68.10.14.13) 9.367 ms 11.020 ms
4  nrfkbbrc02−pos0101.rd.hr.cox.net (68.1.0.26) 29.469 ms 15.020 ms 9.567 ms
5  nrfkdsrc02−gew03010999.rd.hr.cox.net (68.1.0.31) 17.272 ms 34.144 ms
6  ashbbbpc01pos0100.r2.as.cox.net (68.1.1.19) 16.643 ms 16.431 ms 18.338 ms
7  ge−2−3−0.r02.asbnva01.us.bb.verio.net (206.223.115.112) 15.903 ms 17.508 ms
8  ge−1−1.a00.asbnva01.us.ra.verio.net (129.250.26.97) 30.588 ms 20.451 ms
9  ge−3−2.a00.asbnva01.us.ce.verio.net (168.143.105.58) 16.176 ms 16.728 ms
10 216.239.47.121 (216.239.47.121) 16.007 ms 17.379 ms 18.075 ms
11 216.239.49.37 (216.239.49.37) 19.205 ms 29.800 ms 17.368 ms

Host

[root@home root]# host www.google.com
www.google.com has address 216.239.41.99
[root@home root]# host pespmc1.vub.ac.be
pespmc1.vub.ac.be has address 134.184.131.111
Ping

[root@ip68-10-238-202 root]# ping pespmc1.vub.ac.be
PING pespmc1.vub.ac.be (134.184.131.111) from 68.10.238.202: 56(84) bytes
64 bytes from pespmc1.vub.ac.be (134.184.131.111): icmp_seq=1 ttl=235 time=113 ms
64 bytes from pcp.vub.ac.be (134.184.131.111): icmp_seq=2 ttl=235 time=106 ms
64 bytes from pcp.vub.ac.be (134.184.131.111): icmp_seq=3 ttl=235 time=104 ms
64 bytes from pcp.vub.ac.be (134.184.131.111): icmp_seq=4 ttl=235 time=107 ms
64 bytes from pcp.vub.ac.be (134.184.131.111): icmp_seq=5 ttl=235 time=105 ms

--- pespmc1.vub.ac.be ping statistics ---
5 packets transmitted, 5 received, 0% loss, time 4007 ms
rtt min/avg/max/mdev = 104.812/107.679/113.252/2.991 ms