CS 451: Distributed Systems

- Professor: Marty Humphrey
- Tuesday-Thursday 12:30-1:45
- Thornton D223

Computer Technologies/Milestones of Interest

- 1961
  - Kleinrock: Packet Switching theory

- 1969
  - First ARAPNET: UCLA, Stanford Research Institute (SRI), UCSB, Utah (50 kbps)

- 1971
  - ARAPNET: 15 nodes
  - First EMAIL program

More

1972
- RFC 318: Telnet specification

1973
- Bob Metcalf’s Harvard PhD Thesis outlines Ethernet
- Bob Kahn and Vint Cerf: basic Internet ideas

1974
- Cerf/Kahn: TCP

1975
- First ARAPNET mailing list
- UNIX talk (70s)

1976
- UUCP

More

1978
- TCP split into TCP and IP
- First MUD

1979
- USENET established
- First smiley in email :^)

1981
- CSNET (NSF)

1983
- First nameserver (at Wisconsin)

1984
- DNS introduced

1985
- Symbolics.com is the first registered domain
  - You are born

1986
- NSFNET created (with 5 supercomputer centers)

1987
- Number of hosts breaks 10,000
  - Perl

1988
- First Internet worm (infects 6,000 of the 60,000 known hosts)
  - IRC

1989
- First “make money fast” post

More

1990
- ARAPNET ceases to exist
  - ARCHIE released

1991
- Gopher released
- WWW released (Tim Berners-Lee)
- US High Performance Computing Act (Gore)
- First “help me build Linux” post

1992
- Number of hosts breaks 1,000,000
  - First MBONE audio multicast
  - “surfing the Internet”
<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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</table>
| 1993 | - Whitehouse comes on-line  
- Mosaic |
| 1994 | - Order a pizza from Pizza Hut  
- First banner ads (on hotwired.com, for Zima)  
- First mass spamming  
- Amazon founder Jeff Bezos is hiring  
- First mention of Yahoo (“…database of 21,000 URLs…”) |
| 1995 | - Sun launches Java  
- RealAudio  
- WWW traffic passes FTP traffic  
- Net-related companies (e.g., Netscape) go public  
- Ebay  
- PHP  
- Wiki |
| 1997 | - Business.com sold for $150,000  
- “weblog” coined  
- AOL IM |
| 1998 | - Compaq pays US $3.3 million for Altavista  
- First mention of google.stanford.edu |
| 1999 | - Business.com sold for $7.5M  
- Napster |
| 2000 | - Massive denial-of-service attack against Yahoo, Amazon, and eBay  
- AOL acquires Time-Warner  
- RSS v1.0 |
| 2001 | - iPod |
| 2002 | - Friendster  
- RSS v2.0 |
| 2003 | - MySpace  
- Google offers to buy Friendster for $30M  
- Skype  
- Second Life  
- del.icio.us |
| 2004 | - Facebook  
- Flickr |
| 2005 | - YouTube |
| 2006 | - Google buys YouTube for $1.65B in stock |
| 2007 | - ????
Distributed System Definitions

• “A distributed system is a collection of independent computers that appear to the users of the system as a single computer.” [Tanenbaum]
• “A distributed system, consists of discrete software agents that must work together to implement some intended functionality.” [Web Services Architecture, W3C Working Draft 8 August 2003; http://www.w3.org/TR/ws-arch/]
• “A system in which components located at networked computers communicate and coordinate their actions only by passing messages.” (Coulouris et al. 2001 – our textbook)

Overview of “CS451: Dis Systems”

• A balance of “more theoretical” with “more practical”
  • More theoretical” ➔ classroom, book and written HWs
  • More practical” ➔ classroom, book and programming assignments
• Combination of: Algorithms, APIs, and protocols
• Concepts we will look at (with help from the textbook):
  • Sys models, networks, IPC, dis objects, security, DFS, Name services, time + global states, coordination and agreement, transactions, P2P
• Technologies that we will/might use for programming assignments
  • Sockets, TCP, XML, Web services, Java RMI, RSS, Gnutella

Class Logistics

• http://www.cs.virginia.edu/~humphrey/cs451
• How do we make-up classes? Thurs night AND/OR Friday afternoon?
  • How about: Thurs night 7-8:15 AND Fri 3-4:15 ??
• Office hours:
  • How about Mon 2-4pm
• TA: Ray Buse (buse at cs.virginia.edu)
• Please purchase the book soon! (4th ed.)

Coursework

<table>
<thead>
<tr>
<th></th>
<th>What</th>
<th>When</th>
<th>Weight</th>
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</thead>
<tbody>
<tr>
<td>Textbook and the Web</td>
<td>every class</td>
<td>10 %</td>
<td></td>
</tr>
<tr>
<td>Class participation</td>
<td>every class</td>
<td>20 %</td>
<td></td>
</tr>
<tr>
<td>Midterm</td>
<td></td>
<td>20 %</td>
<td></td>
</tr>
<tr>
<td>Written homeworks / Program assignments</td>
<td>5-7</td>
<td>50 %</td>
<td></td>
</tr>
<tr>
<td>Final exam</td>
<td>finals week</td>
<td>20 %</td>
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</tbody>
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Approach of class

• Slides will NOT EXACTLY follow text
  • Why? Provides a different perspective on material
  • Therefore: you must read text as well as course materials
• Slides will be posted AFTER class
  • Why? Slides are prepared JIT
• What you will learn
  • What a distributed system does
  • How a distributed system is implemented
  • Focus: Internet-based Distributed Computing

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