COMP 790-088
Networked and Distributed Systems

◆ There are 2 handouts:
  - » **Course outline**
  - » **Lecture 0 slides**

◆ Please get a copy of each

COMP 790-088
Networked and Distributed Systems

Networked and Distributed Systems

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URL: *http://www.cs.unc.edu/~jasleen/Courses/Fall09*

Networked and Distributed Systems
So what is this course about?

- ◆ Two courses squeezed into one?
  - » Yes
    - ❖ Comp 631: Computer Networks
    - ❖ Comp 734: Distributed Systems
  - » No
    - ❖ Redesigned to include:
      - ◆ Principles for designing computer networks
        - – Insights used to achieve world-wide scale
      - ◆ Design of several prominent distributed systems
        - – DNS, P2P systems, CDNs, Distributed File Systems

  - » Emphasis on design challenges and approaches
    - ❖ Not many fine-details will be covered (unlike both previous offerings)
    - ❖ For details, you will have to refer to the textbook or research papers

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Networked and Distributed Systems
So what is this course about?

- ◆ This course is about the Internet's protocols and distributed services
  - » Other networks exist too: Phone networks, ATM, …

- ◆ Course can be broken into two parts:
  - » Part 1: Design of Computer Networks

    How do you design a global-scale network that can be used to transfer information efficiently between end-users and applications?
  - » Part 2: Design of Distributed Systems

    How do you design (massively) multi-user and global-scale systems and applications on top of such a network?

- ◆ Emphasis on common design principles
  - » Service models, Hierarchy, Randomization, Virtualization, Indirection, …

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Requirements for a Global Network
Issues to be studied in Part 1

◆ Small Networks
 » Point-to-point links
  ❖ Issues: error detection, error recovery
 » Multiple access links
  ❖ Issue: contention-resolution
 » Switched networks
  ❖ Issue: datagram-switching vs virtual-circuit switching

◆ Global scale and Autonomous co-existence
 » Scalable Addressing
 » Routing and Forwarding

◆ Reliability and Congestion-control
 » Challenges: scale, estimation, …

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Part 1 Topics
The Internet's Protocol Layers

◆ Transport protocols (TCP)
 » Congestion control and Reliability

◆ Internet routing architecture and algorithms
 » Distance vector, Link state, BGP

◆ The Internet Protocol (IP)
 » Scalable addressing

◆ Link-layer media access protocols
 » Token rings, 802.11

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Massively Large-scale Distributed Systems
Issues to be studied in Part 2

◆ Name resolution:
  » Domain Name System
    ❖ Issues: scale and autonomy
◆ Information sharing:
  » Peer-to-peer file-sharing systems
    ❖ Issues: scale, churn, fault-tolerance
◆ Content distribution:
  » Overlay Networks
    ❖ Issues: resilience, autonomy
  » P2P Content-distribution systems
    ❖ Issues: scale, incentives
◆ Distributed File Systems
  » Google
    ❖ Issues: consistency, scale

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Course Topics
What will not be covered in this course?

◆ We will not discuss fine details of most protocols

◆ We will not discuss implementation details of most systems we study

◆ We will not cover:
  » Any specific technology
  » Socket programming
  » Application-layer protocols (other than DNS)

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Course Administrivia
Prerequisites

◆ I assume that you have:
  » A working knowledge of the UNIX program development environment

  I also assume you are:
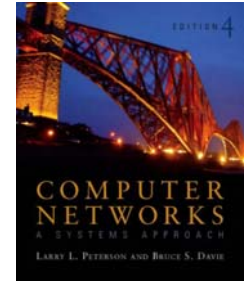 » Comfortable with socket programming (in any language)

Course Administrivia
References

◆ *Computer Networks: A Systems Approach*
  » Peterson and Davie

◆ Several research papers

Course Administrivia
Other resources

- ◆ Course web page
  - **http://www.cs.unc.edu/~jasleen/Courses/Fall09**

- ◆ Your source for copies of all handouts, homework assignments, lecture notes, course emails, …
  - » If you miss class (bad idea!) you can see if anything was distributed in class by checking the web site
  - » (I don't keep extra copies of class handouts)

How many of you do not need hard copies (printed on paper) in class?

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Course Administrivia
Grading (all percentages approximate within 10%)

- ◆ Programming and written assignments (25%)
  - » Roughly 4 in the semester

- ◆ Course Project (25%)
  - » Implement and evaluate a network protocol or a distributed system as an application-layer overlay
  - » Groups of 2 (or 3)

- ◆ Exams
  - » All exams are _oral_
  - » Midterm examination (15%)
    - ❖ Around mid-October
  - » Final examination (25%)

- ◆ Class participation (10%)

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Course Administrivia
Honor Code: Policy on collaboration

◆ Working in groups on assignments is OK but…
  - » You can only collaborate with other students in <u>this</u> course
  - » You can only collaborate on understanding the assignment and possible approaches
    - ❖ Every student must craft their own final solution
    - ❖ Every student must fully write up their own solution
  - » All collaborators <u>must</u> be acknowledged in writing
  - » Code may *never* be shared
  - » Collaboration on the mechanics of programming is OK
    - ❖ Debugging or designing each other's programs is *not* OK

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Reading Assignment
Networking Basics

◆ Layered architecture
◆ Packets, headers
◆ Encoding
◆ Framing

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