Computer Networks and Applications

COMP 3331/COMP 9331

LIC: A/Prof. Salil Kanhere
Networked Systems and Security Group
CysPri Lab

Course Outline & Logistics
Today's Agenda

- Course (non-technical) details
- Logistics: How we will roll
- What is this course about?
- Introduction to Computer Networks
Website

• [http://www.cse.unsw.edu.au/~cs3331](http://www.cse.unsw.edu.au/~cs3331)

• Everything is posted on the site
  • Course Outline (PLEASE READ THIS THOROUGHLY)
  • Lecture Notes
  • Echo 360 Recordings
  • Lab Schedules, Allocations and Locations
  • Assignments and Lab Exercises
  • Sample Problems
  • Information about Exams
  • Consultation Hours
  • Forum – For discussion
  • Notices Section: Your responsibility to check this from time to time (1-2 times per week) for important updates/changes to schedule
  • Nothing will be handed out in class

Very important
Course Material

- Lecture Notes (on website)
- Links/articles on additional material
- Reference Books:
- Links to programming help
Teaching Strategies

• Lectures
• Labs
  • Hands-on learning
• Assignments
  • U learn basic network programming and protocol design
  • C or Java or Python
• Sample Problems
  • U will gain problem solving skills
Traditional Lectures

Roughly one millennium old
Traditional Lectures

- Little opportunity for expert feedback and deeper insights
Interactive Classes with Peer Instruction

- Parts of the lecture will be reserved for interactive, customized experiences
- Research on how people learn:
  - Everyone constructs their own understanding
  - To learn, you must actively work with a problem and construct your own understanding of it
Peer Instruction

- I will pose carefully designed questions at various points of the lecture
- **Individually** – Think for yourself and select answer
- **Group discussions among students in teams of 3-4**
  - Analyse the problem
  - Discuss relevant solutions/challenges
  - Reach consensus – Entire group should select a common answer
  - Room should be LOUD
- **Class-wide discussion**
  - Led by you
  - Share answers with everyone
  - Your explanations are CRITICAL for fellow students’ learning
- Continue discussions on the online forum
Why Peer Instruction?

- You get a chance to think
- I get feedback as to what you understand
- It’s less boring!
- Research shows it promotes more learning that traditional lectures
Implications

• You will have to come prepared to the lecture by reading prescribed parts of the textbook/lecture notes (or watching videos)
• You will have to actively participate during lecture
• Certain (simpler) parts of the content will be left for self-study
• We will focus on challenging concepts, cutting-edge research, problem solving, etc. during the lectures
• You will get candy !!
Quiz: The most useful super power for a college student would be:

A. Invisibility
B. Lots of $$$
C. Telepathy
D. Weather

E: Some other power (be prepared to discuss)
Labs

• 2 hour lab sessions starting Week 2
• Hands-on experiments
• Variety of networking tools to understand protocol behaviour and evaluate network performance
• **NEW: Mininet emulator**
• 8 lab sessions:
  • 6 Lab Exercises:
    – Marked
    – Lab Report to be submitted one week after your lab
  • 1 practice programming session
  • 1 session on Mininet setup and introduction
• Schedule/exercises on the course web page
• Finalise your slot by end of Week 1
Accounts

- Use your zid/zpass to log into CSE computers
- New to UNSW - https://it.unsw.edu.au/students/zpass/index.html
- You will be automatically added as a student to the course website. Log on using zid/zpass
Getting help

• LiC’s consultations
  • Wed 14 – 15
  • Thu 14 - 15
  • Location: 612, Level 6, K17 (CSE)

• Lab tutors

• Your fellow students

• Forum on course website – BEST OPTION
  • Fellow students benefit from your questions
  • Fellow students can answer your questions
  • Develop a community
  • I will check the forum frequently
Assessment

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labs</td>
<td>15%</td>
</tr>
<tr>
<td>Programming Assignments</td>
<td>25%</td>
</tr>
<tr>
<td>Mid-semester Exam</td>
<td>20%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>40%</td>
</tr>
</tbody>
</table>

**NOTE:** To pass the course, a student MUST receive at least 40% marks on the final exam.

lab = marks for lab exercises (scaled to 15)
assign = marks for the two programming assignments (scaled to 25)
midExam = mark for the mid-semester exam (scaled to 20)
finalExam = mark for the final exam (scaled to 40)
mark = lab + assign + midExam + finalExam
grade = HD|DN|CR|PS if mark >= 50 && finalExam >= 16
         = FL if mark < 50 || finalExam < 16
Be original !!

- Collaboration
  - You may discuss approaches, not solutions
  - You must submit your own work
  - We strongly support discussions

- Plagiarism
  - Zero tolerance, don’t do it

https://my.unsw.edu.au/student/academiclife/Plagiarism.pdf
https://student.unsw.edu.au/plagiarism
More about exams ….

- Mid-semester Exam (scaled to 20 marks)
  - In-class during normal lecture hours (Week 6)
  - Includes material from Week 1 – Week 5
- Final Exam (scaled to 40 marks)
  - Final Exam Period
  - Comprehensive coverage
- Both exams – Closed book
  - Critical thinking and problem solving questions
  - Not a memory test
  - Sample problem set released very 2 weeks
    - Please attempt these on your own, discuss with friends, forum
    - Solutions will be made available
- Practice problems during lectures
THE INTERNET IS A SERIES OF TUBES
AND THEY'RE FULL OF CATS
What is the goal of a network?

- Allow devices to communicate with one and another and coordinate their actions to work together

- Piece of cake, right?
A “Simple” Task

- Send information from one computer to another
  - Endpoints are called hosts
    - Could be a computer, mobile phone, smart glasses, thermostat, light bulb, ....
  - The plumbing is called a link
    - Physical technology could be Ethernet, DSL, cellular, WiFi, etc.
Is Not Really So Simple
Is Not Really So Simple
Is Not Really So Simple
We only need …

• Manage complexity and scale up
  • Layering abstraction: divide responsibility
  • Protocols: standardise behaviour for interoperability
We only need …

• Manage complexity and scale up

• Naming and addressing
  • Agreeing on how to describe/express a host, application, network, etc.
We only need …

• Manage complexity and scale up

• Naming and addressing

• Moving data to the destination
  • Routing: deciding how to get it there
  • Forwarding: copying data across devices/links
We only need …

- Manage complexity and scale up
- Naming and addressing
- Moving data to the destination
- Reliability and fault tolerance
  - (How) can we guarantee that the data arrives?
  - How do we handle link or device failures?
We only need …

• Manage complexity and scale up

• Naming and addressing

• Moving data to the destination

• Reliability and fault tolerance

• Resource allocation
  • How do we share the network’s capacity?
We only need …

• Manage complexity and scale up

• Naming and addressing

• Moving data to the destination

• Reliability and fault tolerance

• Resource allocation

(Lots of others too)
Pull back the curtain on the Internet
Why should you care?

• To know how the Internet works
  • What may be wrong with your networks
  • When was the last time you went 24 hours without going online?

• Network architects get respect
  • In high demand, get paid well
The Internet is Exciting!

- Rapid growth and success
  - 1977: 111 machines on Internet
  - 1981: 213
  - 1983: 562
  - 1986: 5000
  - 1989: 10,000
  - 1992: 1,000,000
  - 2001: 150-175 million
  - 2002 > 200 million
  - 2011 > 2 billion
  - 2015 > 4 billion
The Internet is Exciting!

- Rapid growth and success.
The Internet is Exciting!

• Rapid growth and success.

• We’re here at the beginning.
  • Most of the growth happened in our lifetime
  • Engine of economic growth
  • Still TONS of untapped potential

Founded in 1998

Founded in 2004
Introduction

Source: Intel
The Internet is Exciting!

- Rapid growth and success.
- We’re here at the beginning.
- Communication is empowering.
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- Rapid growth and success.
- We’re here at the beginning.
- Communication is empowering

(Late 60s)
What is this course about?

1. To learn how the Internet works
   - What really happens when you “browse the Web”?
   - What are TCP/IP, DNS, HTTP, NAT, VPNs, 802.11, …. anyway?
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1. To learn how the Internet works
   - What really happens when you “browse the Web”?
   - What are TCP/IP, DNS, HTTP, NAT, VPNs, 802.11, …. anyway?

2. To learn the fundamentals of computer networks
   - What hard problems must they solve?
   - What design strategies have proven valuable?
   - How do we evaluate network performance?
Why learn the fundamentals?

• Applicable to all computer networks

• Intellectual interest

• Change/reinvention
  • Today’s Internet is different from yesterday’s
  • And tomorrow’s will be different again
  • But the fundamentals remain the same
Pre-requisites

• Good understanding of algorithms, data structures and basic probability
• Proficient in programming: C, Java or Python

This is a first course in computer networks
Where do I go from here?

- COMP 9332: Network Routing and Switching
- COMP 9334: System Capacity and Planning
- COMP 3441/9441: Security Engineering
- COMP 4336/9336: Mobile Data Networking
- COMP 4337/9337: Securing Wireless Networks
- COMP6733: Internet of Things Experimental Design Studio
- Thesis Projects
- Research (Master’s, PhD)