# EE542
# Lecture 1: Introduction
## Internet and Cloud Computing

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# Goals

- Internet
  - Computer Networking
  - Internet protocols
  - Network Security
  - Networking Applications
- Cloud Computing
  - Networked Computers
  - Parallel Computers
  - Internet of Things
  - Big Data Analytics
  - Artificial Intelligence and Machine Learning
  - Hardware Accelerated Processing
- No Time to Waste

# Logistics

- Lectures
  - Mondays and Wednesday
- Assignments
  - Paper Reading (Slide Submissions)
  - Laboratory Assignments (Reports, Forum Posts, and Demos)
  - Final Project (Report, Presentation, and Demo)
- Instructor: Young Cho
- Teaching Assistants: Yude Wei and Haonan Wang
- Web Sites
  - Blackboard
  - Amazon Web Services

# Course Syllabus

- Attendance
- Reading List
- Laboratory Assignments
- Final Project
  - Final Project Pitch
  - Final Report

# Project

- Laboratory Assignment
  - Individual or Team
  - Youtube Video Recordings
- Tools
  - VirtualBox
  - Amazon Web Services or others
  - Linux network API (sockets, pcap lib, and etc.)

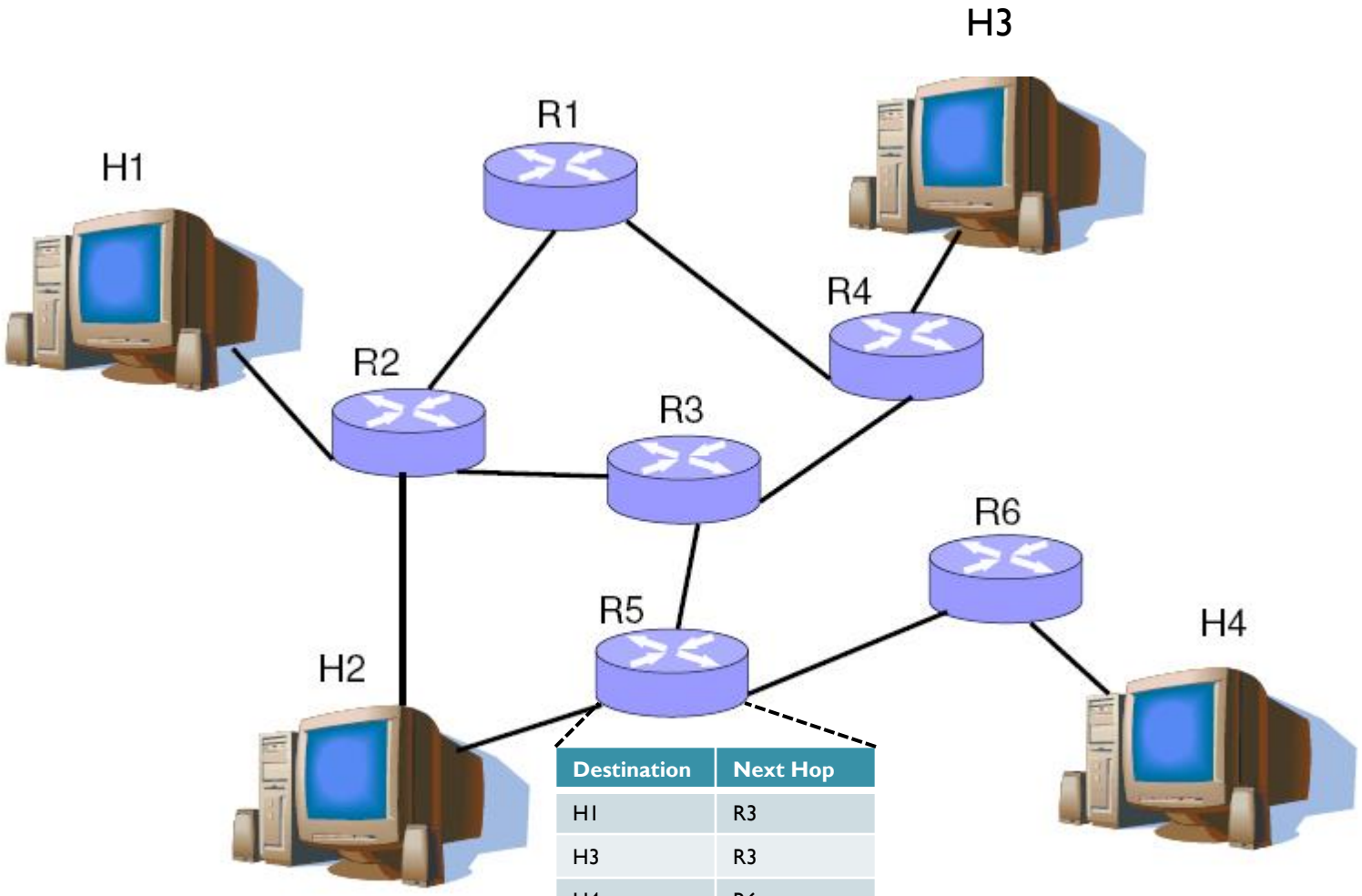
# Perspective

- A Huge Domain
- Main Topics
  - New Directions on Internet
  - Machine Learning on Cloud
- Methodology
  - Protocol Design
  - Internet of Things
  - Machine Learning
- How to not waste time
  - Work on your own research
  - Publish a paper?!

# The Internet

- Computer Networks
  - Network interfaces
  - Switches
  - Routers
  - Firewalls and etc…
- Software
  - Network protocols
  - Operating System interface
  - Application level interface
- Hardware
  - Lightweight microprocessors
  - Hardware accelerators
  - Network processors

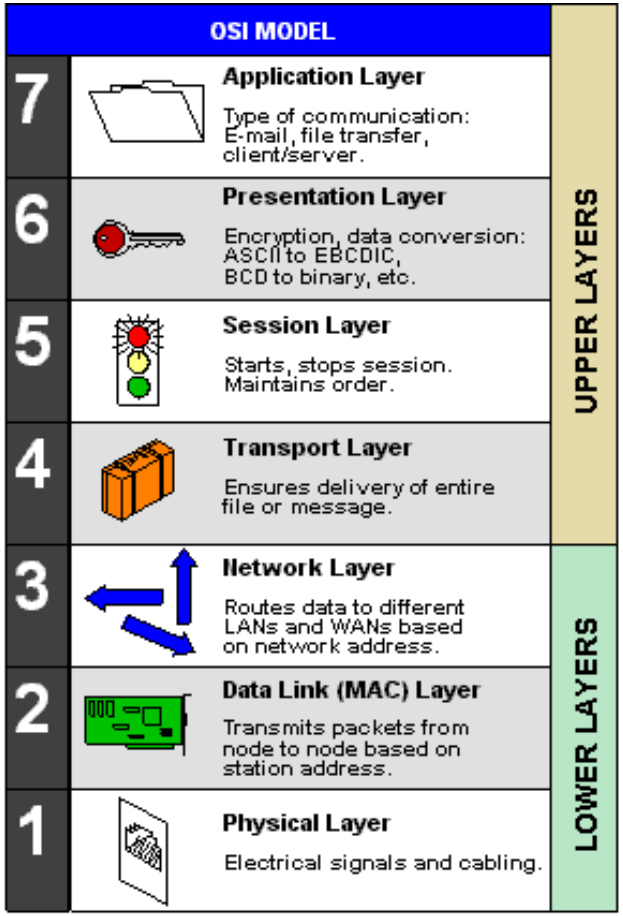
# Computer Network




| Destination | Next Hop |
|---|---|
| H1 | R3 |
| H3 | R3 |
| H4 | R6 |

# Computer Network Hardware

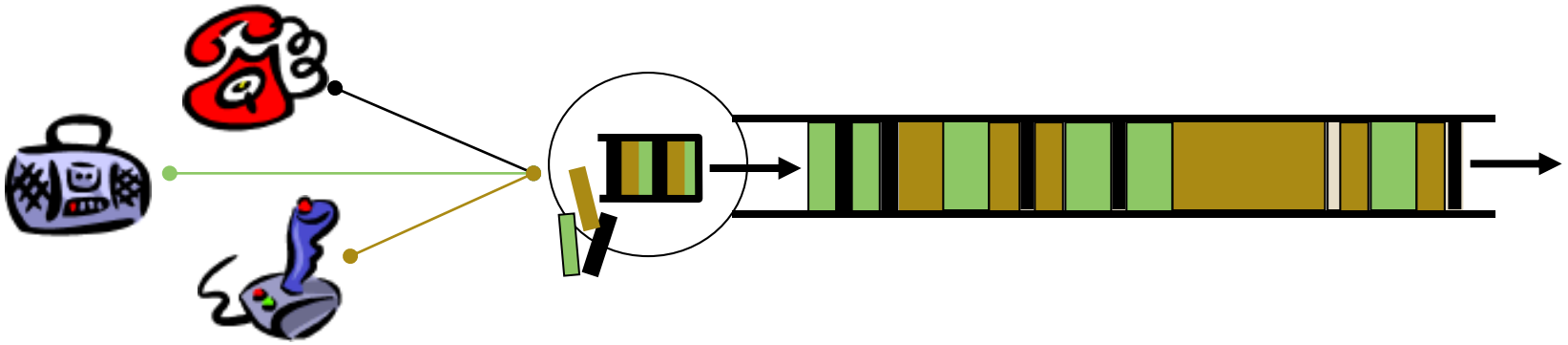
# Open System Interconnection




*From computer desktop encyclopedia © 2004*

# Internet Protocol

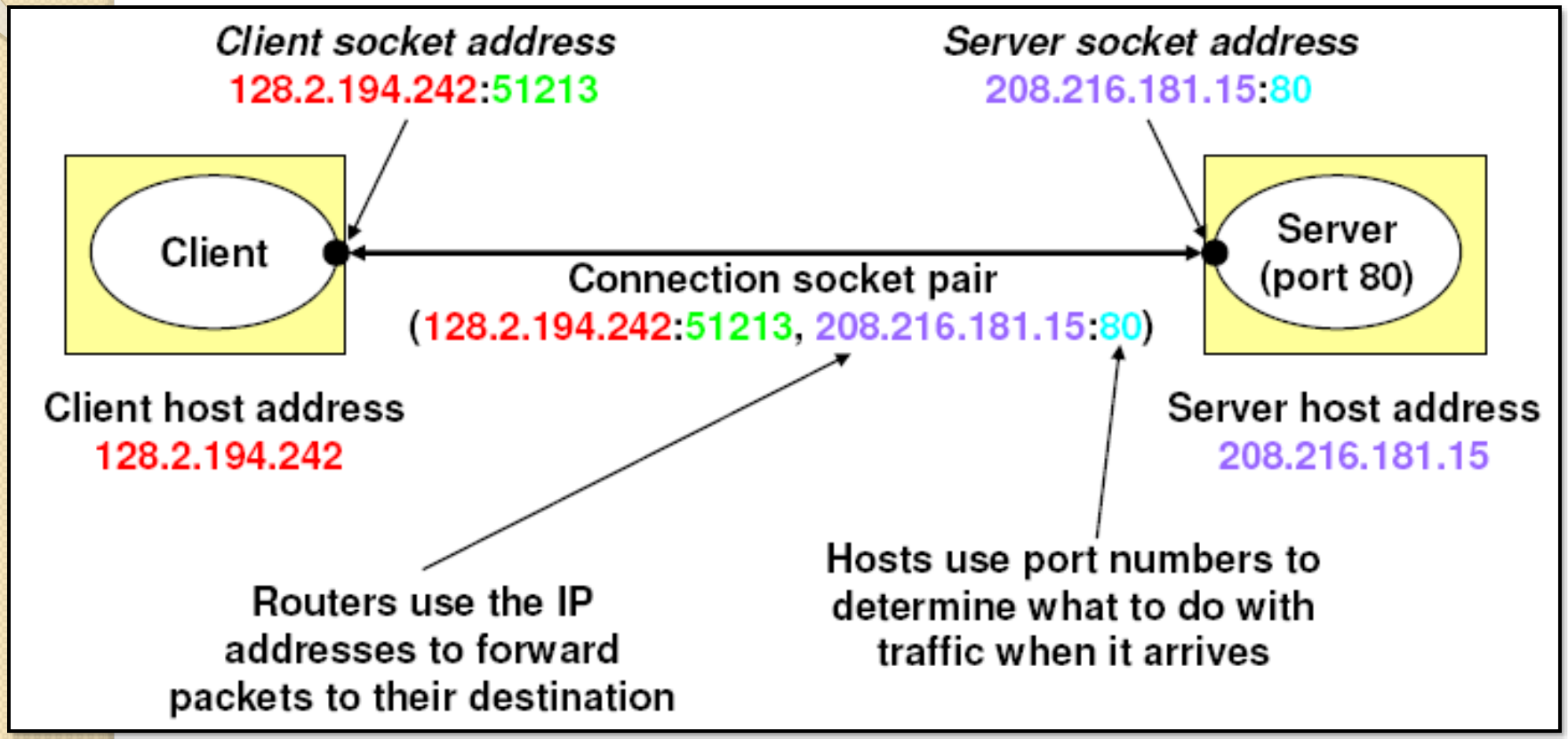
Problem: Network Overload



Solution: Buffering and Congestion Control

- Short bursts: buffer
- What if buffer overflows?
  - Packets dropped
  - Sender adjusts rate until load = resources → "congestion control"

# Internet Organization



[redacted] Fri, Aug 10, 10:33 AM (10 days ago)

to Young

Hello Professor,

My name is [redacted] and I had taken the CS558L class with you last fall. I have been interning at Sony PlayStation with the PlayStation Now team for the summer(referred by you) and will also be continuing during the fall. I wanted to tell you a little about the work I have been doing this summer. I can also send a detailed report on the same by next week.
I have been interning with the Core Engineering team at PlayStation Now which is responsible for maintaining the backbone infrastructure for the streaming service ie they have their own reliable communication protocol which runs on top of UDP along with their own Congestion Control Algorithm which helps with efficient data delivery.
I have been working on improving their congestion control protocol and wrote a Version 2 of it which addresses specific important changes as to how it reacts when the Client side network bandwidth changes along with better response to loss/delay conditions on the network as well as increased the speed of recovery when it falls low making sure it doesn't cause any corruption during the fast increase . Additionally they employ a FEC methodology to check for available bandwidth on the network which I had to modify a bit for the Congestion Control Algorithm.

This was just a brief summary but I could send you the entire report by next week. I also wanted to mention that now that I have started working in the industry, it's amazing to see the startling resemblance with the type of projects we had done as part of our academic coursework with real world applications . I would never have imagined that the world's biggest companies are working with the kind of technology we had played with in class  and I am very grateful to you for providing us with such an enriching experience.

Additionally, I would like to know if you could supervise my Fall internship CPT in the same company.
Looking forward to your reply.

Thank You once again for everything :)

•••

[redacted]

# Internet

- Understand Internet
  - Learn the computer network
  - Understand and manage routing tables
  - Low level network packet processing
- Building a Network Protocol
  - Application-Level Protocol
  - Handle basic control level protocol
  - Resolve communication problems on Internet
  - Modification to kernel level modules

# Online Course Tools

- Please use Blackboard
  - Announcements
  - Laboratory Assignments
  - Reading Assignments
  - Forum Discussions
- Forum is very important
  - Post all of your questions and answers
  - Ask and Answer whatever you need
  - We will attempt to keep track of your contributions

# Reading Assignments

- 10 Assignments Posted
  - Read
  - Submit Summary Slides
- Summary PowerPoint Slides
  - Summary slides of your understanding
  - At least one hand drawn diagram
  - Summary tables, if possible
  - Usually, Due Tuesdays at 11:59 PM

# Laboratory Assignments

- Submit Archive of Laboratory Results
  - Summary PowerPoint Slides
  - Source Code and README instructions for code
  - Usually Saturday 11:59 PM
- YouTube demonstration video
  - Usually, the following Monday 11:59 PM
- Scoring
  - On-time Submissions (no exceptions)
  - Multiplied by 1.0 if on-time
  - Multiplied by 0.5 if late
  - Demonstration Videos on YouTube
  - Internet Accessible Link to the Archive (ZIP) of all

# Laboratory Summary Slides

- Represent Essential Aspects of the Lab
- Diagrams for Hardware/Software Configurations
- Figures and Flowcharts describing Algorithms
- Tables to summarize results
- Do not copy and paste of some other person's diagram/work
- Original diagrams and tables created by you
- Sufficient Descriptions using Fewest Words

# Incorporating Videos in Presentation/Demo

- Use Smartphone Camera
  - Capture your audio and video
  - Prove your work/progress
- Screen Capture Software
  - http://www.maartenbaert.be/simplescreenrecorder/
  - https://www.ispringsolutions.com/ispring-free-cam
  - https://getsharex.com/
  - Or other screen capture software
- Content
  - Capture essential steps with result narrative
  - Show the completed result of the Lab
  - Include Powerpoint Slides for diagrams and tables, if needed

# Conclusion

- Laboratory Assignments due this Saturday
- Laboratory Demo Video link due Monday
- Reading Assignment Presentation due Tueday