Lecture #1
Logistics and Introduction
Instructor and TA

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Course Prerequisites

- CS330 Operating Systems
- CS441 Introduction to Computer Networks
Motivation behind this course

We’re Hiring at Facebook
Help us give people the power to share and make the world more open and connected
Distributed Systems

• Stock Exchange
• Commuter Trains
• Telephone networks

• Air Traffic Control
• Trauma Centers

[Courtesy of Charles Killian]
Flawed Distributed Systems

smh.com.au
The Sydney Morning Herald

TECH

Skype: Outage caused by massive restart after users had downloaded Windows patches

August 21, 2007 - 5:20AM

WASHINGTON — A computer failure in the nation's air-traffic control system caused severe flight delays along the East Coast Friday, the Federal Aviation Administration said.
Cloud Computing?

• **Q:** What is Cloud Computing, exactly?

• **A:** It depends... but a rough definition might be *on-demand internet-based computing*
  – i.e. a bunch of computers which people can use when they want, accessed via a network

• May sound a little familiar...
  – distributed [operating] systems (early 80s), cluster computing (late 80s), grid computing (90s), ...

• “Cloud computing” is the Next Big Thing

[Courtesy of Steve Hand]
Cloud Computing!

Gartner Says Worldwide Cloud Services Market to Surpass $68 Billion in 2010

North America Accounted for 60 Percent of Cloud Services Revenue in 2009

Cloud Computing Is A $100 Billion Market (Merrill Lynch)
Merrill Lynch analyst Kash Rangan believes the addressable market for cloud computing is $100 Billion (that's about twice Microsoft's annual revenue). This is broken down between applications ($48 Billion), platform ($26 Billion), and infrastructure ($35 Billion). Along with Google and Salesforce.com, Microsoft is one of the few companies positioned well across all segments of the industry. Why is this important? "Azure, while slow to take off could accelerate revenue and profit growth by optimizing customer experience and generating cross-sell of services." This is true, but the bigger story is if Microsoft can gain enough traction in cloud computing to offset losses in share by its Windows franchise. At this early stage it is not looking like this will be the case.

"After many years of armadilloing, most notably in the SaaS arena, the core ideas at
So what’s new?

• Two key differences from previous
  – **Scale**: targeting global customer base
  – **Money**: charging (explicitly or implicitly) built in

• Three variant technologies in play:
  – Infrastructure as a Service (**IaaS**)
  – Platform as a Service (**PaaS**)
  – Software as a Service (**SaaS**)

• IaaS & PaaS explicitly charge for resources
• SaaS either bundled rental, or “free”
Course Overview

• Theoretical basis of distributed systems
• Hands-on experience with distributed systems
Topics to Cover

• Distributed Algorithms
• MPI
• Fundamentals of Distributed Systems
• MapReduce
Grading Policy

• 5 Reports: 30% (5/5/5/5/10)
• 1 Quiz: 10%
• 3 Programming assignments: 50% (15/15/20)
• Attendance/Review Quizzes/Quiz grading quality: 10%

• Before mid-term = 5+5+10+15 = 35% (+5%)
• After mid-term = 5+5+10+15+20 = 55% (+5%)
Reports will be graded by you!

- Reports will be split into three groups and given 3/4/5
- 4\textsuperscript{th} report should be in English and will be graded by students who don’t speak Korean
In This Course

• Instead of Yes/No
  – Answers will be: it depends

• Questions we raise
  – What do you think is a computer?
  – What do you think is a distributed system?
  – What are the constraints you have to consider in building a distributed system?
References (I)

• Distributed Systems: Concepts and Design (5th Edition)
  – by George Coulouris, Jean Dollimore, Tim Kindberg
References (II)

• Distributed Systems: Principles and Paradigms (2nd Edition)
  – by Andrew S. Tanenbaum and Maarten Van Steen
References (III)

• Principles of Computer System Design
  – By Jerome H. Saltzer and M. Frans Kaashoek
References (IV)

- Distributed Algorithms
  - by Nancy Lynch