
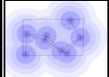


CS525
Advanced Distributed Systems
Spring 2010
[]
Indranil Gupta (Indy)
Wrap-Up
January 19 – May 4, 2010



All Slides © IG

Agenda

- Wrap-Up of Discussion started at Course Beginning
- Articles

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Can you name some examples of Operating Systems?

3

Can you name some examples of Operating Systems?

...

Linux WinXP Unix FreeBSD Mac

2K Aegis Scout Hydra Mach SPIN

OS/2 Express Flux Hope Spring

AntaresOS EOS LOS SQOS LittleOS TINOS

PalmOS WinCE

...

4

What is an Operating System?

5

What is an Operating System?

- User interface to hardware (device driver)
- Provides abstractions (processes, file system)
- Resource manager (scheduler)
- Means of communication (networking)
- ...

6

Can you name some examples of Distributed Systems?

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Distributed Systems Examples

- Client-server (e.g., NFS)
- The Internet
- The Web
- An ad-hoc network
- A sensor network
- DNS
- Kazaa (peer to peer overlays)

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What is a Distributed System?

9

The definition we started with

*A distributed system is a collection of entities, each of which is **autonomous, programmable, asynchronous and failure-prone**, and which communicate through an **unreliable communication medium**.*

- Our interest in distributed systems involves
 - algorithmics, design and implementation, maintenance, study
- Entity=a process on a device (PC, PDA, mote)
- Communication Medium=Wired or wireless network

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A range of interesting problems for Distributed System designers

-
- Routing and Multicast [IP multicast, SRM, RMTP]
- Post and retrieve [Usenet]
- Search [BitTorrent, Google]
- Programming [MapReduce, Pig, Dryad]
- Storage [Databases, HDFS]
- Coordination and Scheduling [EC2, SETI@Home]
- Infrastructures [EC2, S3, AppEngine, CCT, OpenCirrus]
-
-

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A range of challenges

-
- Failures
- Asynchrony
- Scalability
- Security
-

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Laundry List of Topics we've Covered

- Clouds and their predecessors (e.g., Grids)
- Overlays and DHTs
- Sensor motes and TinyOS
- Basics – Lamport timestamps, Consensus, Snapshots, Failure detectors
- Epidemics
- Cloud Scheduling
- Cloud Storage
- Effect of Flash/SSDs
- Peer to peer applications – file systems
- Sensor net routing
- In-network processing in sensor nets
- Distributed monitoring and management

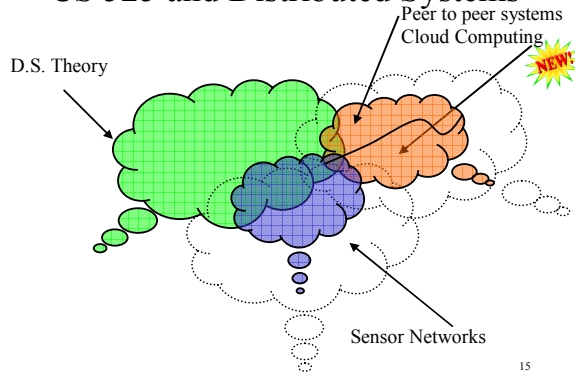
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Laundry List (Continued)

- Probabilistic Membership protocols
- Byzantine-tolerant protocols
- Publish-subscribe
- Distributed debugging
- Real measurement studies
- Industrial Systems
- Green Clouds
- End to end argument
- Old Wine: Old Concepts still applicable
- Structure of Networks
- H. G. Wells, G. Hardin, Christensen, Levin-Redell, Hoffman, Feynman

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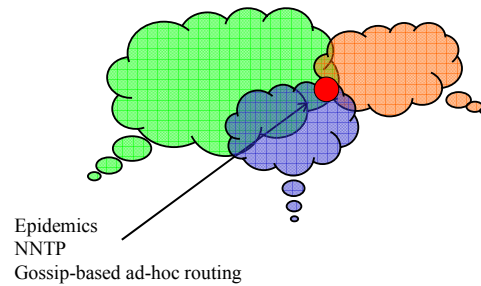
CS 525 and Distributed Systems



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Interesting: Area Overlaps

<Course Project Names Removed since in progress>



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Leftover Work

- Final Project Report Submissions – 11.59 pm, **Friday May 7th, 2010** (email softcopy to indy@cs.uiuc.edu, turn hardcopy in to 3112 SC).
 - At most 12 pages, at least 12 pt font
- **Final extension, Hard deadline**
 - (should contain hard and comprehensive data)
- **Three Best Projects** will be up on website soon after the 7th
- We will work on all projects after the semester, in order to submit them to conferences/workshops!
 - Past CS525 projects (since Fall 2003) have produced a total of about 10 journal papers, about 20 conference papers, and about 10 workshop papers

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Presentations

I hope you liked the selection of papers.

Special mention presentations

- Everyone! (difficult to pick “best ones”)
- General comments to all for future presentations:
 - Keep an eye on the clock
 - Defer questions to end or offline if necessary
 - Plan for > 1 minute per slide

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Reviews

Tough work, but
only way to ensure you remember
main ideas in paper
and your thoughts when you read it

Please preserve your reviews!

I hope you enjoyed writing them.

If your complaint is about the large number of
papers....

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Reviews

Tough work, but
only way to ensure you remember
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and your thoughts when you read it

Please preserve your reviews!

I hope you enjoyed writing them.

If your complaint is about the large number of
papers....you're right

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Articles

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Articles for this Class

- H. G. Wells, "World Brain"
- G. Hardin, "The tragedy of the commons"
- C. M. Christensen, "How can great firms fail? Insights from the hard disk drive industry"
- Levin and Redell, "How (and how not to) write a good SOSP paper"
- R. Hoffman, "Why Buy That Theory?"
- R. P. Feynman, "The Chief Research Scientist..."

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H. G. Wells

- H. G. Wells, "World Brain" (1938)
 - Encyclopedias written "for gentlemen by gentlemen"
 - H. G. Wells seeks a University that is world-wide, and a base of knowledge that is global
 - He seeks a "Permanent World Encyclopedia"
 - That can be read by anyone anywhere
 - That can be updated by anyone and from anywhere
 - That will be an archive of humanity and its actions
 - That will be an extension of humanity's memory
 - And he wrote this before the Internet was invented!
 - Has this been realized?
(article taken from book "World Brain", published 1938)

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G. Hardin

- G. Hardin, "The tragedy of the commons" (1968)
 - Adam Smith in 1776 in "*The Wealth of Nations*" popularized the "invisible hand," the idea that an individual who "intends only his own gain," is, as it were, "led by an invisible hand to promote...the public interest"
 - Basis for stock markets and much of today's economics!
 - However, if there is a commons (think: open pastures, stock market, Internet, p2p, clouds, national parks, etc.), then the tragedy is that everything will be depleted so much that nothing will stay common anymore
 - Example of free pastures for farmers with herds of sheep: "Each man is locked into a system that compels him to increase his herd without limit -- in a world that is limited."
 - Hardin concludes: "It is our considered professional judgment that this dilemma has no technical solution."
 - This essay motivated the development of game theory, and more recently selfish routing algorithms
 - The tragedy of the commons is very visible in p2p systems (freeloading). Does it also reflect in Wikipedia?
 - The argument says there are no technical solutions, which means you need to incentivize (or de-incentivize) humans to solve the problem

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Levin-Redell, Christensen

- Levin and Redell, “How (and how not to) write a good SOSP paper”
 - original idea to a real problem
 - comprehensive and mature evaluation
 - chronological and logical presentation
 - C. M. Christensen, “How can great firms fail? Insights from the hard disk drive industry”
 - “Disruptive technologies”: Fig 1.7, page 17
 - Can replace existing technology overnight – when enough for market’s requirements.
 - Examples of disruptive technologies seen in CS525: Clouds, p2p, sensor networks
- (article taken from Innovator’s Dilemma, C. M. Christensen)*

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R. Hoffman, Why Buy that Theory

A theory that explains an observable phenomenon

– Occam’s Razor –

“Plurality should not be assumed beyond necessity”

The simplest explanation of a phenomenon is the best one

- Is Portable: are lessons applicable to other areas?
- Stimulates other Research: other people to work in the same / similar areas
- Story telling matters: breaking the complex world down into simple and understandable parts

(article taken from “Best American Science Writing, 2003”, Ed: J. Cohen)

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Richard Feynman

- R. P. Feynman, “The Chief Research Scientist of the Metaplast Corporation”
 - The wilder the idea, the better it is. But only as long as you keep working on it.

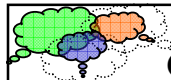
(article taken from “Surely you’re joking, Mr. Feynman”, R.P. Feynman)

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Questions?

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(Don’t forget!)



CS525 Course Evaluations

- Main purpose: to evaluate how useful this course was to you (and to get your feedback that will help improve future versions of the course)
- I won’t see these evaluations until after you see your grades
- Fill them online (ICES has/will send you instructions)
- Optional Instructor Questions (please write answers on reverse side)
 - **Item:** Should the course projects remain open or be assigned like Machine Problems?
 - **Item:** How much has the peer reviews helped with respect to your project? State any positives and/or negatives you see.
- You will be able to fill out course evaluations online until next week, but don’t forget!

All the Best for Your Project!

Have a good summer.

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