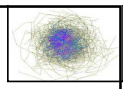
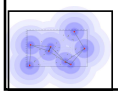



CS525
Advanced Distributed Systems
Spring 2010

Indranil Gupta (Indy)

Wrap-Up

January 19 – May 4, 2010




Agenda

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

Can you name some examples of Operating Systems?

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

…

What is an Operating System?

What is an Operating System?

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

Can you name some examples of Distributed Systems?

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)

What is a Distributed System?

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

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]
-
-

A range of challenges

-
- Failures
- Asynchrony
- Scalability
- Security
-

Laundry List of Topics we've Covered

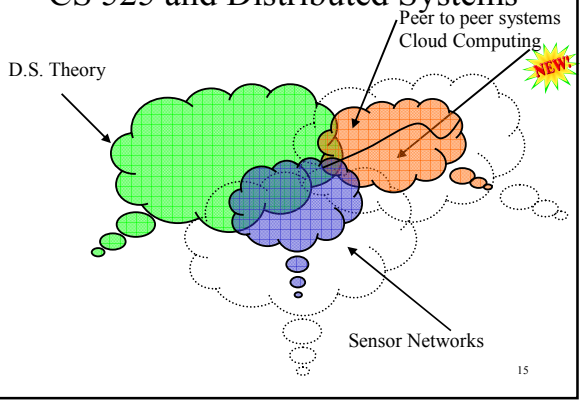
- Clouds and their predecessors (e.g., Grids)
- Overlays and DHTs
- Sensor motes and TinyOS
- Basics – Lamport timestamps, Consensus, Snapshots, Failure detectors
- Epidemics
- Cloud Scheduling
- Cloud Storage
- Effect of Flash/SSDs
- Peer to peer applications – file systems
- Sensor net routing
- In-network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

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

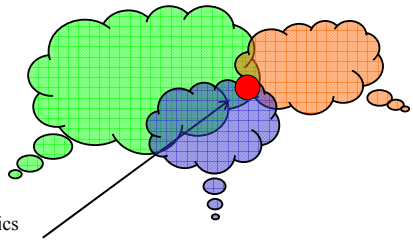
- H. G. Wells, G. Hardin, Christensen, Levin-Redell, Hoffman, Feynman

CS 525 and Distributed Systems



Interesting: Area Overlaps

<Course Project Names Removed since in progress>



Epidemics
NNTP
Gossip-based ad-hoc routing

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

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

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….

Reviews

Tough work, but
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Please preserve your reviews!

I hope you enjoyed writing them.

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

Articles

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…"

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)

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 wills 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

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 requriements.
  - Examples of disruptive technologies seen in CS525: Clouds, p2p, sensor networks

(article taken from Innovator's Dilemma, C. M. Christensen)

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)

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)

Questions?

(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.