382M Lecture 1

OUTLINE

Motivation/tech trends
Admin
Student pictures and questionairs
Course overview

Happy to be teaching class

o got into CS b/c wanted to know how computers work
(heard it was a bunch of binary switches...)

o quantitative field
not just religious wars
if you have a good idea, someone will want
to build it and make $'s

v. history or literature or philosophy -- we can
argue what Nietze meant over beer forever (I'm sure they
would argue that that's what is great about the field; not
my cup of tea)

science == test hypothesis that can be proven wrong

o excellent text
well written, good arguements to provide intuition about ideas
many ideas seem simple -- they are once they are well
explained.

second edition much different than first edition
less basic material, more advanced material

had planned to add outside reading
o new book has much of what I would add
o project will provide opportunity for more advanced
work
- will read a paper here and there for interesting v.
recent ideas.

Motivation: Technology

3 ideas

1. things are changing fast
2. things are changing at different rates
3. --> changing technology trade-offs

lesson 1: Up and to the right

Microprocessor performance:

Figure 1.1 from text

Moore's law story – it was a joke. Someone asked how many transistors will fit on a chip in 5 years, and he answered that it would double every year or year-and-a-half. Has held for 25+ years.

1.54x per year --> 8x in 5 years

o was 1.35 per year unil 1980
--> *architecture* innovations (RISC) --> extra 20% per year

➔ in the 10 years since RISC processors hit the street get a "free" 6x
I have an ultrasparc on my desk
without the ideas in this class, it would be a SPARC 2

Storage capcity

disk 60%/year 4x/3 years *Tech trends slide*
memory 60%/year 4x/3 years *Tech trends slide*

--> Makes life more interesting for rest of CS
(you can try more ambitious stuff)
e..g suppose you file thesis in 5 years

processor: 1200 SPECInt92 (e.g. 1200x a VAX)
(70 SPECInt95?)
memory 0.5-1 GByte
disk: 24 GByte

Makes life exiting for rest of CS
(v. mech eng -- bridge design changes more slowly)
no other industry like this (maybe biotech)

Example: the internet is interesting b/c backbone can run at 10's-100's Mbits
and becase switches are cheap and fast

lesson 2: Things change at different rates

Processor performance: 2x/2 years
Disk performance: 1.4x in 10 years
DRAM perf: 1.4x in 10 years

--> Need to find clever ways to hide performance
of disk and dram

lesson 3: Changing trade-offs

Idea that was good 10 years ago may be wrong today

example VAX built when 64KB was a lot of memory
--> design for dense encoding
today, memory costs 1000x less
--> design for high performance
-->DEC abandons VAX architecture

example: patterson *Slide Lecture 1 Slide 9*
Early 1980's – enough transistors fit on a chip to do 32-bit processor
Supercomputer, Mainframe, Minicomputer on 35%/year curve
Workstation on 55%/year curve
(b.c on one chip)
➔ microprocessors overtake
➔ 1995 – Cray gets bought by workstation company. To add insult to injury, it is the 4th biggest workstation company.

<show patterson fishes slides>

Another way of looking at this – technology trends are interesting when you cross a threshold

e.g. 32-bit uprocessor

e.g. web happens when critical network technology, costs, and critical mass of people arrive

QUESTION: Coming/recent thresholds?

?? NYT says: Next week, Intel, microsoft, baby bells will announce DSL standard for 1.5 Mbit/s modems → movie fits on modem

palm pilot – 1MB computer cheap enough to risk losing; cheap enough to use as appliance rather than computer

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ADMIN

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Text: H&P 2nd edition (not first edition!)
+ a few papers

Grading

10% participation

30% quizzes

low pressure: 2 hour exam; give you 3 hours

<date> 2.106 Taylor 6-9 PM

<date> 2.106 Taylor 6-9 PM

Lecture that day will be Q&A

30% Homework (approx 5 HW's; work in pairs)

30% project (work in pairs)

Project

idea: do some research

focus: good scientific method, quantitative results

format: several midterm checkpoints, oral and written
presentations
(similar to conference)
talk about this more later

Lectures
1 minute review
1 minute outline
20 minute lecture
3 minute admin
24 minute lecture
1 minute summary

admin in middle b/c attention spans
outline/summary important to presentations

philosophy -- write on board instead of slides (or I'll go too fast)
-- encourage discussion
-- feedback
I'll hand out 3x5 cards in a month or so
feedback welcome any time

<OPTIONAL>
If enrollment a problem
first priority to first year CS grad
then to N-year CS grad
then to EECS grad
then CS/EECS undergrad
then everyone else

Homework 1: should be review
<pass it out>

Class pictures -- I'm bad at names

questionare -- name

e-mail
major
year in grad school
advisor
research interests

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COURSE OUTLINE
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Review: ch 1-3 (fast)
    Tech trends
    performance metrics
    instruction sets
    basic pipelining
advanced ILP, pipelining (ch 4)
    dynamic branch prediction
    superscaler, superpipelined
    limits of ILP
memory hierearchy (ch 5)
    caches, memory banks, vector processing...
<exam 1>
I/O, storage (ch 6)
Networks, Interconnect (ch 7)
MPPs (ch 8 + culler chapter 1)
<exam 2>

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SUMMARY
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1. up and to the right!
2. at differnt rates
3. changing trade-offs
    Watch for thresholds to get famous