

**Lecture 1 – Introduction**

2004-08-30



Lecturer PSOE Dan Garcia

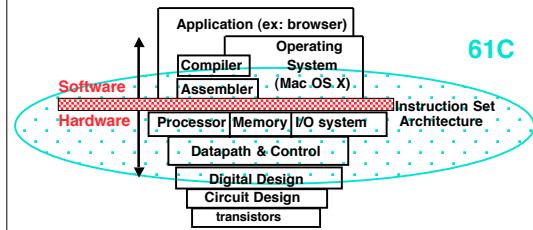
www.cs.berkeley.edu/~ddgarcia

New show this Fall ⇒  
**“Father of the Pride”**

is the 1<sup>st</sup> attempt at prime-time  
 3D animation. “An Adult  
 Comedy from makers of Shrek”,  
 premieres Tues 9pm on NBC.



**What are “Machine Structures”?**

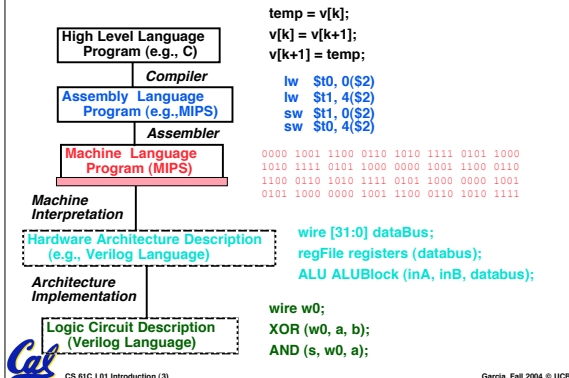


\* Coordination of many

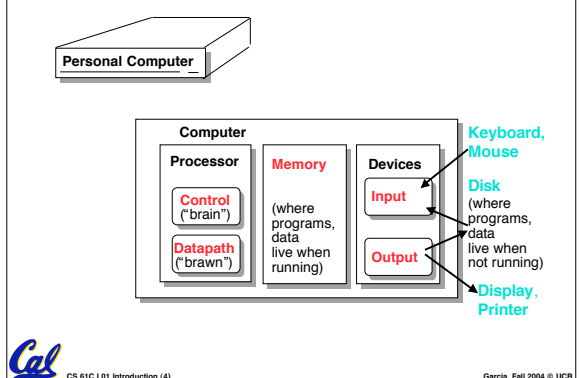
*levels (layers) of abstraction*



**61C Levels of Representation**



**Anatomy: 5 components of any Computer**



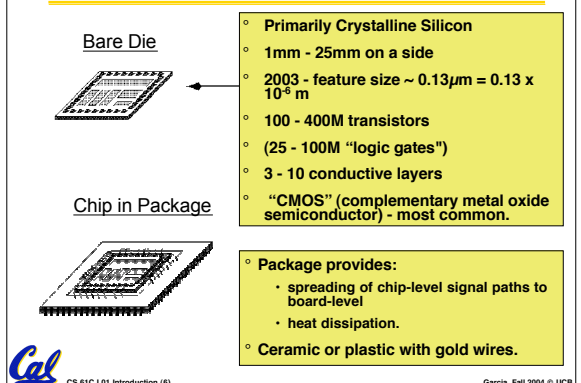
**Overview of Physical Implementations**

*The hardware out of which we make systems.*

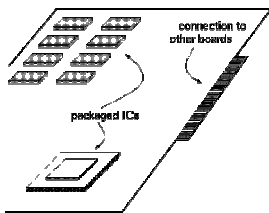
- Integrated Circuits (ICs)
  - Combinational logic circuits, memory elements, analog interfaces.
- Printed Circuits (PC) boards
  - substrate for ICs and interconnection, distribution of CLK, Vdd, and GND signals, heat dissipation.
- Power Supplies
  - Converts line AC voltage to regulated DC low voltage levels.
- Chassis (rack, card case, ...)
- holds boards, power supply, provides physical interface to user or other systems.
- Connectors and Cables.



**Integrated Circuits (2003 state-of-the-art)**



## Printed Circuit Boards



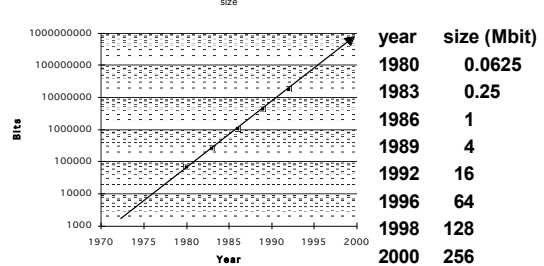
- fiberglass or ceramic
- 1-20 conductive layers
- 1-20in on a side
- IC packages are soldered down.



CS 61C L01 Introduction (7)

Garcia, Fall 2004 © UCB

## Technology Trends: Memory Capacity (Single-Chip DRAM)



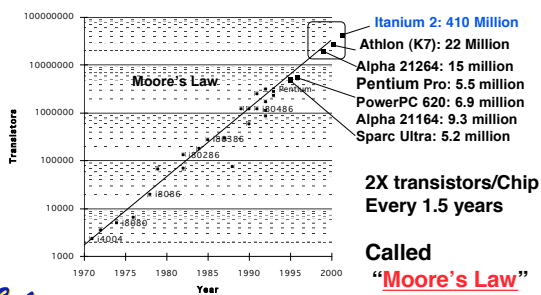
- Now 1.4X/yr, or 2X every 2 years.
- 8000X since 1980!



CS 61C L01 Introduction (8)

Garcia, Fall 2004 © UCB

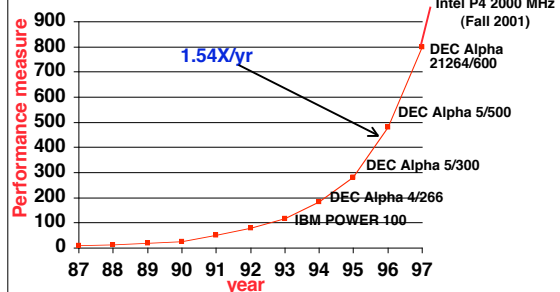
## Technology Trends: Microprocessor Complexity



CS 61C L01 Introduction (9)

Garcia, Fall 2004 © UCB

## Technology Trends: Processor Performance



We'll talk about processor performance later on...



CS 61C L01 Introduction (10)

Garcia, Fall 2004 © UCB

## Computer Technology - Dramatic Change!

- Memory
  - DRAM capacity: 2x / 2 years (since '96); 64x size improvement in last decade.
- Processor
  - Speed 2x / 1.5 years (since '85); 100X performance in last decade.
- Disk
  - Capacity: 2x / 1 year (since '97) 250X size in last decade.



CS 61C L01 Introduction (11)

Garcia, Fall 2004 © UCB

## Computer Technology - Dramatic Change!

- State-of-the-art PC when you graduate: (at least...)
- Processor clock speed: 5000 MegaHertz (5.0 GigaHertz)
- Memory capacity: 4000 MegaBytes (4.0 GigaBytes)
- Disk capacity: 2000 GigaBytes (2.0 TeraBytes)
- New units! Mega => Giga, Giga => Tera

(Kilo, Mega, Giga, Tera,



Come up with a clever mnemonic, fame!

CS 61C L01 Introduction (12)

Garcia, Fall 2004 © UCB

## Technology in the News

- **BIG**
  - LaCie the first to offer consumer-level 1.6 **Tera**byte disk!
  - \$2,200
  - Weighs 11 pounds!
  - 5 1/4" form-factor
- **SMALL**
  - Pretec is soon offering a **12GB** CompactFlash card
  - Size of a silver dollar
  - Cost?



www.lacie.com/products/product.htm?id=10129  
www.engadget.com/entry/4463693158281236/



CS 61C L01 Introduction (13)

Garcia, Fall 2004 © UCB

## CS61C: So what's in it for me?

- Learn some of the big ideas in CS & engineering:
  - 5 Classic components of a Computer
  - Data can be anything (integers, floating point, characters): a program determines what it is
  - Stored program concept: instructions just data
  - Principle of Locality, exploited via a memory hierarchy (cache)
  - Greater performance by exploiting parallelism
  - Principle of abstraction, used to build systems as layers
  - Compilation v. interpretation thru system layers
  - Principles/Pitfalls of Performance Measurement



CS 61C L01 Introduction (14)

Garcia, Fall 2004 © UCB

## Others Skills learned in 61C

- **Learning C**
  - If you know one, you should be able to learn another programming language largely on your own
  - Given that you know C++ or Java, should be easy to pick up their ancestor, C
- **Assembly Language Programming**
  - This is a skill you will pick up, as a side effect of understanding the Big Ideas
- **Hardware design**
  - We think of hardware at the abstract level, with only a little bit of physical logic to give things perspective
  - CS 150, 152 teach this

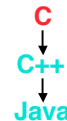


CS 61C L01 Introduction (15)

Garcia, Fall 2004 © UCB

## Course Lecture Outline

- Number representations
- C-Language (basics + pointers)
- Storage management
- Assembly Programming
- Floating Point
- make-ing an Executable
- Caches
- Virtual Memory
- Logic Design
- Introduction to Verilog (HDL)
- CPU organization
- Pipelining
- Performance
- I/O Interrupts
- Disks, Networks
- Advanced Topics



CS 61C L01 Introduction (16)

Garcia, Fall 2004 © UCB

## Texts



- Required: **Computer Organization and Design: The Hardware/Software Interface, Third Edition**, Patterson and Hennessy (COD). *The second edition is far inferior, and is not suggested.*



- Required: **The C Programming Language**, Kernighan and Ritchie (K&R), 2nd edition
- Reading assignments on web page



CS 61C L01 Introduction (17)

Garcia, Fall 2004 © UCB

## Tried-and-True Technique: Peer Instruction

- Increase real-time learning in lecture, test understanding of concepts vs. details
- As complete a “segment” ask multiple choice question
  - 1-2 minutes to decide yourself
  - 3 minutes in pairs/triples to reach consensus. Teach others!
  - 5-7 minute discussion of answers, questions, clarifications
- Buy PRS transmitters from ASUC student store or others



calmatrix.berkeley.edu/Student%20Life/Files%20Market/714@211.3sqlia3dbgf.2@

CS 61C L01 Introduction (18)

Garcia, Fall 2004 © UCB

## Peer Instruction

- Read textbook, review lectures (new or old) **before class**
  - Reduces examples have to do in class
  - Get more from lecture (also good advice)
- Fill out 3-question Web Form on reading (**deadline 9am before lecture**)
  - Graded for effort, not correctness
  - Count for “effort” points



CS 61C L01 Introduction (19)

Garcia, Fall 2004 © UCB

## Weekly Schedule

There IS discussion and lab this week...



CS 61C L01 Introduction (20)

Garcia, Fall 2004 © UCB

## Homeworks, Labs and Projects

- **Lab exercises** (every wk; due in that lab session unless extension given by TA)
- **Homework exercises** (~ every week; (HW 0) out now, due in section next week)
- **Projects** (every 2 to 3 weeks)
- All exercises, reading, homeworks, projects on course web page
- We will DROP your lowest HW, Lab!
- Only one {HW, Project, Midterm} / week



CS 61C L01 Introduction (21)

Garcia, Fall 2004 © UCB

## 2 Course Exams + 2 Faux Exams

- **Midterm: Early 8th week, room TBA**
  - Give 2 hours for 1 hour exam
  - Open Book / Notes
  - Review session TBA
- **2 Faux Midterms for feedback**
  - Honor system: take @ home, tell us your score for each question, we check off.
  - A bad score won't hurt. Not doing it will.
- **Final: Sat 2004-05-14 @ 12:30-3:30pm**
  - You can *clobber* your midterm grade!
  - (students last semester LOVED this...)



CS 61C L01 Introduction (22)

Garcia, Fall 2004 © UCB

## Your final grade

- **Grading (could change before 1st midterm)**
  - 15pts = 5% Labs
  - 30pts = 10% Homework
  - 45pts = 15% Projects
  - 75pts = 25% Midterm\* [*can be clobbered by Final*]
  - 135pts = 45% Final
  - + Extra credit for EPA. What's EPA?
- **Grade distributions**
  - Similar to CS61B, in the absolute scale.
  - Perfect score is 300 points. 10-20-10 for A+, A, A-
  - Similar for Bs and Cs (40 pts per letter-grade)
  - ... C+, C, C-, D, F (No D+ or D- distinction)
  - **Differs:** No F will be given if all-but-one {hw, lab}, all projects submitted and all exams taken
  - We'll “ooch” grades up but never down



CS 61C L01 Introduction (23)

Garcia, Fall 2004 © UCB

## Extra Credit: EPA!

- **Effort**
  - Attending Dan's and TA's office hours, completing all assignments, turning in HW0, doing reading quizzes
- **Participation**
  - Attending lecture and voting using the PRS system
  - Asking great questions in discussion and lecture and making it more interactive
- **Altruism**
  - Helping others in lab or on the newsgroup
- **EPA! extra credit points have the potential to bump students up to the next grade level! (but actual EPA! scores are internal)**



CS 61C L01 Introduction (24)

Garcia, Fall 2004 © UCB

## Course Problems...Cheating

- What is cheating?
  - Studying together in groups is **encouraged**.
  - Turned-in work must be **completely** your own.
  - Common examples of cheating: running out of time on an assignment and then pick up output, take homework from box and copy, person asks to borrow solution "just to take a look", copying an exam question, ...
  - Both "giver" and "receiver" are equally culpable
- Cheating on homeworks: **negative points for that assignment** (e.g., if it's worth 10 pts, you get -10)
- Cheating on projects / exams; At least, **negative points for that project / exam**. In most cases, **F in the course**.
- Every offense will be referred to the Office of Student Judicial Affairs.  
[www.eecs.berkeley.edu/Policies/acad.dis.shtml](http://www.eecs.berkeley.edu/Policies/acad.dis.shtml)



CS 61C L01 Introduction (25)

Garcia, Fall 2004 © UCB

## Enrollment

- We will not be enforcing the CS61B prerequisite this semester.



CS 61C L01 Introduction (26)

Garcia, Fall 2004 © UCB

## Teaching Assistants

- Paul Burstein
- José María González [co-head TA]
- Andy Carle [co-head TA]
- Andrew Schultz
- Slav Petrov
- Steven Kusalo



CS 61C L01 Introduction (27)

Garcia, Fall 2004 © UCB

## Student Learning Center (SLC)

- Cesar Chavez Center (on Lower Sproul)
- The SLC will offer directed study groups for students CS 61C. This will be our first semester supporting CS 61C with a study group, but based on our pilot offering of tutoring in Spring 2004, we believe that it will be well received. We will also offer Drop-in tutoring support for about 20 hours each week. Most of these hours will be conducted by paid tutorial staff, but these will also be supplemented by students who are receiving academic credit for tutoring.



CS 61C L01 Introduction (28)

Garcia, Fall 2004 © UCB

## Summary

- Continued rapid improvement in computing
  - 2X every 2.0 years in memory size;
  - every 1.5 years in processor speed;
  - every 1.0 year in disk capacity;
- Moore's Law enables processor (2X transistors/chip ~1.5 yrs)
- 5 classic components of all computers  
Control Datapath Memory Input Output



Processor

CS 61C L01 Introduction (29)

Garcia, Fall 2004 © UCB