ECE 154A
Introduction to Computer Architecture

Introduction
What this class is about

Coordination of many levels of abstraction

Hardware
- Processor
- Memory
- I/O system
- Datapath & Control
- Digital Design
- Circuit Design
- Transistors

Software
- Application (ex: browser)
- Compiler
- Assembler
- Operating System
- (Mac OS X)

Instruction Set Architecture

ECE 154A

Coordination of many *levels of abstraction*
Few historical trends

- EDSAC, University of Cambridge, UK, 1949
  - On of the first digital store-program computer
  - Mercury delay lines for memory
  - Derated vacuum tubes for logic
  - Up to ~800 36-bit words

- Intel Core i7-2600K Sandy Bridge (2011-)
  - 32 nm process
  - 1.16 billion transistors
  - Chip area 216 mm²
  - 64 bit
  - 3.4 GHz
  - 4 cores
  - 8M cache

How did we get there?
Few historical trends

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- On of the first digital store-program computer
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- Intel Core i7-2600K Sandy Bridge (2011-)

- ~2x trans. per chip every 2 years
- 32 nm process
- 1.16 billion transistors
- Chip area 216 mm²
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Few historical trends
What is next?

- Need for novel computer architectures due to
  - emergence of new computing classes

- Emerging challenges:
  - Looming end of Moore’s law
  - “Power Wall” due to the end of Dennard scaling (as transistors get smaller the power density no longer remains constant)
  - “Memory Wall” due to growing gap in performance metrics between memory and logic components

Bell’s law of computing classes

“Roughly every decade a new, lower priced computer class forms based on a new programming platform, network, and interface resulting in new usage and the establishment of a new industry.” (Gordon Bell)