Chapter 1: Fundamentals of Quantitative Design & Analysis (Part 1)

What is computer architecture?

Why study computer architecture?

Common principles

What is Computer Architecture?

Previously, Computer Architecture ~ ISA

Instruction set architectures

- Most ISAs today are general-purpose register based
    - Operands may be registers or memory locations
    - Register-memory vs. load-store
- Addressing modes
    - Register, immediate, displacement, …
- Operand sizes
    - 8 bits, 16 bits, 32 bits, 64 bits, SP and DP FP
- Operations: Arithmetic, memory, control flow, floating point
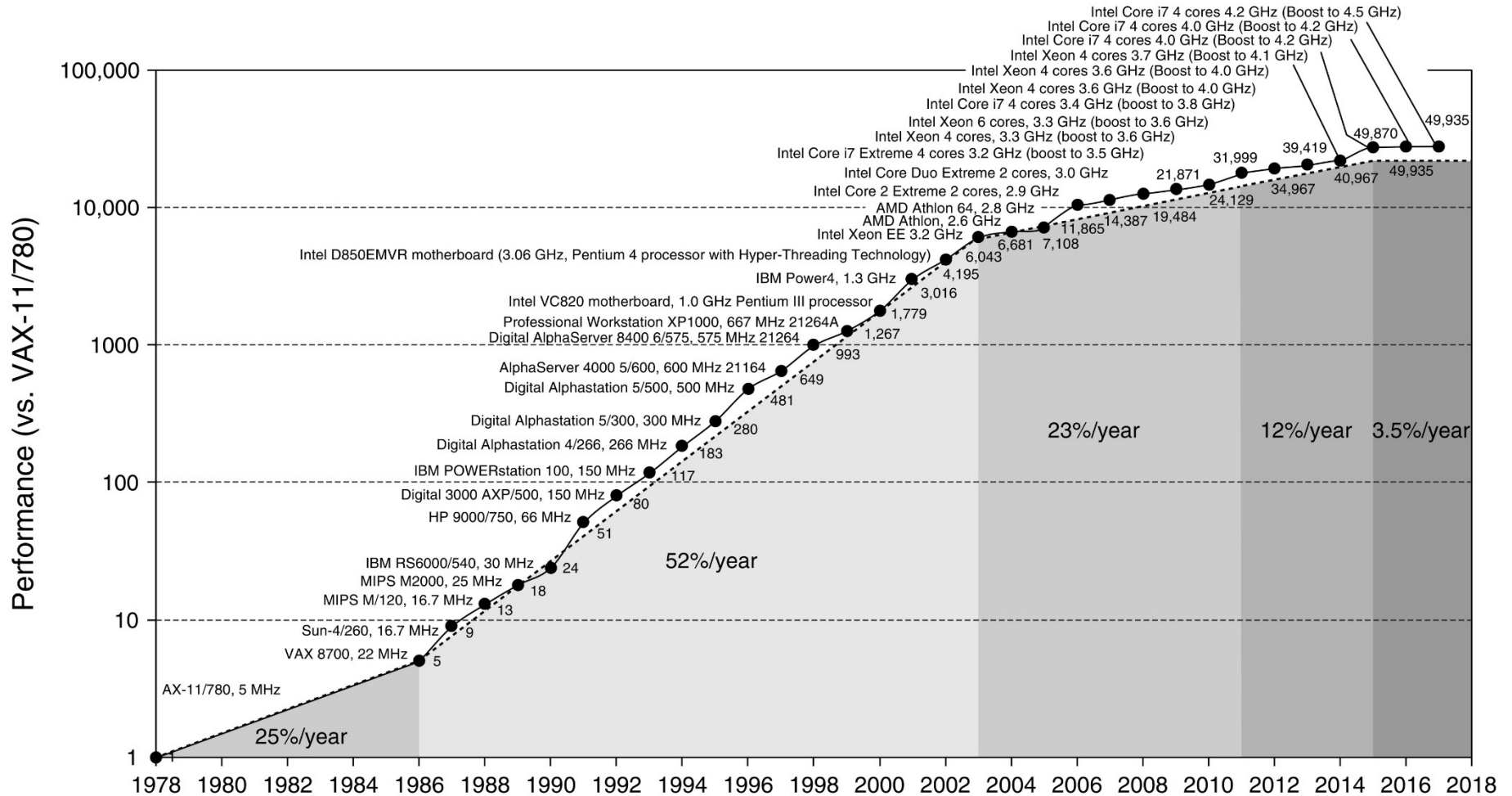- Encoding: fixed vs. variable length

Evolution of ISAs

- Pre-1980s: lots of action → CISC vs. RISC wars → 2 to 3 decades of (almost) stability → new questions again
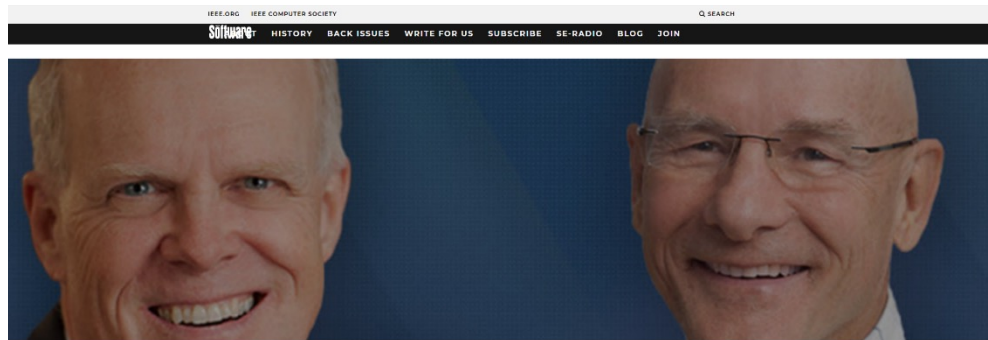
Our main focus: organization

Goals of the Computer Architect
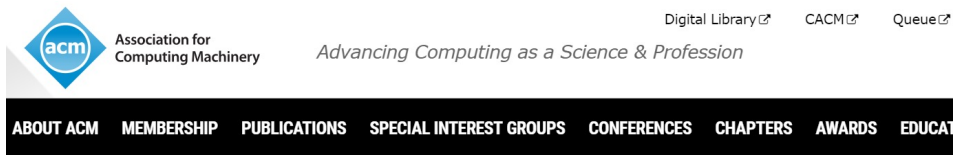
Why Study Computer Architecture? - Historical Trends

Why Study Computer Architecture?

Why Study Computer Architecture Today?

‘Nobel Prize for Computing’: Newly named Turing Award winners foretell a 'new golden age' for computer architecture at ISCA.

John Hennessy and David Patterson Deliver Turing Lecture at ISCA 2018

2017 ACM A.M. Turing Award recipients John Hennessy and David Patterson delivered the Turing Lecture on June 4 at ISCA 2018 ⬀ in Los Angeles. The lecture took place from 5 to 6 p.m. PDT and was open to the public. A video of the lecture can be viewed below.

Titled "A New Golden Age for Computer Architecture: Domain-Specific Hardware/Software Co-Design, Enhanced Security, Open Instruction Sets, and Agile Chip Development," the talk covers recent developments and future directions in computer architecture.

Hennessy and Patterson were recognized with the Turing Award for "pioneering a systematic, quantitative approach to the design and evaluation of computer architectures with enduring impact on the microprocessor industry."

Golden Age of
Computer Architecture!

See slides here:
http://iscaconf.org/isca2018/docs/HennessyPattersonTuringLectureISCA4June2018.pdf

Full video here:
https://www.acm.org/hennessy-patterson-turing-lecture

QnA: Why software community needs to learn about hardware now?
https://youtu.be/3LVeEjsn8Ts?t=4268

Relationship to Prerequisites

Prerequisite

How to design a computer?

This course

How to design a computer WELL?

Emphasis on Quantitative vs. Qualitative

Be sure to check the handout for details on the prerequisites