

Recall Hack machine instruction format:

A-instr: $\textcircled{0}$ 15 bits.

C-instr: $\underbrace{111}_3 \underbrace{a}_1 \underbrace{c}_6 \underbrace{d}_3 \underbrace{j}_3$

\downarrow Send A or M into ALU?
 \downarrow ALU.
 \downarrow where to save ALU output.
 \rightarrow whether to jump
 \rightarrow load bit for PC.

USE A Register, D Register !!

History of CPUs.

1940's - 1960's - mainframes . CPU = room sized.

early '60s - late '70s - minicomputers. Cabinet-sized.

(PDP-11, DEC VAX)

1970's + - "microcomputers"

\hookrightarrow programmed in assembly.

\hookrightarrow CPU on a chip.

Integrated circuits (IC)

Gordon Moore -
Co-founder of
Intel.

Moore's Law
(prediction - 1965)

of components
on IC will
double every 2 years.

	Trans count	Process size	Clock speed
- Intel 8008 (1972)	3,500 transistors	10 μm	200- 300 kHz.
- Intel 8080 (1974)	6000	6 μm	2 MHz.
- MOS 6502 (1975)	4528	8 μm	1 MHz.
\hookrightarrow BBC Micro, Nintendo, Atari, Commodore 64, Apple II			
- Intel 8088 \rightarrow IBM PC. (1979)			
	80286 (1982)	2 μm	10 MHz
Dr. Vogels	80386 (1985)		20 MHz
	80486		100 MHz
	Pentium (1990's)	500 nm	200 MHz
	\hookrightarrow	\vdots	
	Xeon, Celeron,	14 nm	5 GHz

1980's — RISC machines, "reduced instruction set computing".

Sun Microsystems — SPARC, MIPS

→ ARM. pos: low power.
 simpler.

Con: Need a good compiler.

dominates embedded device market : gaming, phones, cars, ...