### **RISC Architecture** Ch 12

Some History Instruction Usage Characteristics

Large Register Files Register Allocation Optimization

RISC vs. CISC

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# Major Inventions in Computer Architecture

- General purpose computer
  - Howard Aiken, Mark I, 1944
    - relays, 17m long, 2.4m tall
    - 500 miles of wire, 5 tons
    - · 3 million connections
    - 6 sec mult, 12 sec div
    - · IBM ASCC (automatic sequence controlled calculator)

· turned off last time 1959



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### Major Inventions in Computer Architecture



- J. P. Eckert and John Mauchly, Eniac, 1946
  - 1500 relays
  - 18000 vacuum tubes 70,000 resistors
  - 20 accumulators
  - 10 digits
  - modify program by rewiring

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### Major Inventions in Computer Architecture

- · Stored Program Computer
  - store both program and data in memory
  - John von Neumann, 1945
    - Electronic Discrete Variable Automatic Computer (EDVAC) prototype
  - Maurice Wilkes, 1949
    - Electronic Delay Storage
       Automatic Calculator (EDSAC)
    - · first fully operational stored prog computer
  - software was born

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# Major Inventions in Computer Architecture



- Floating Point hardware
- Gene Amdahl, 1953
- IBM 704
  - · OS allowed for batch processing
    - combine existing commands into new commands
  - 5 kFLOPS
  - 19 units produced

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# Major Inventions in Computer Architecture

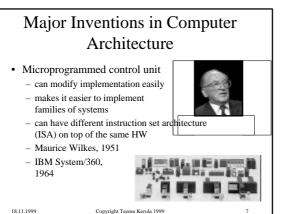
- · Family of computers with different implementations of the same architecture
  - Computer system can grow within the family and all SW will still run
  - Need faster/bigger ⇒ buy a faster/bigger system in the family
  - Gene Amdahl
  - IBM S/360

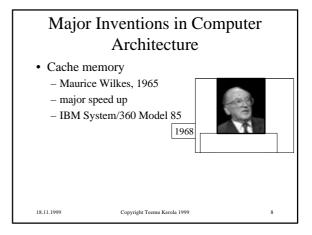
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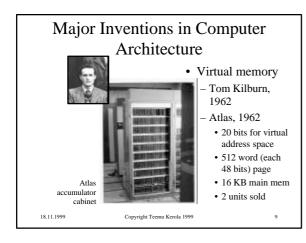
- DEC PDP-8

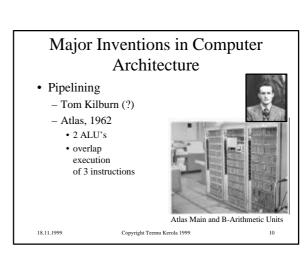
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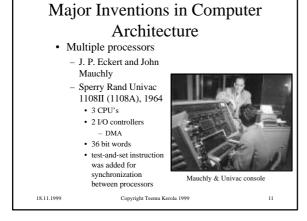


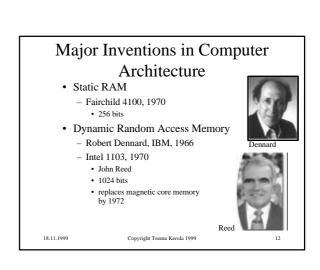












# Major Inventions in Computer Architecture • Single chip microprocessor - Federico Faggin, Marcian E. (Ted) Hoff, and Stan Mazor - Intel 4004, 1971 • 2250 transistors • 4 bit words • 60K OPS • Japanese investors abandoned failed project (!)

# Major Inventions in Computer Architecture

- · Vector processors
  - operate on entire vectors with one instruction
  - Texas Instrument Advanced Scientific Computer (ASC), 1971
    - · W. Joe Watson
    - 4 pipelines
    - · vectors stored in memory
    - · 7 machines built
    - · vectorizing Fortran compiler
    - theoretical max speed 50 MFLOPS
    - · slow scalar unit

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# Major Inventions in Computer Architecture

• ... ??? ...

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Major Inventions in Computer Architecture

- Reduced Instruction Set Computer (RISC)
  - John Cocke, 1974
  - IBM 801 (prototype), 1979
  - project cancelled because instruction set not compatible with OS/360



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