What is “Computer Architecture”?

Computer Architecture =
  * Instruction Set Architecture +
  * Machine Organization + ...

CSE 378
Machine Organization
and Assembly Language Programming
Winter 2003

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The Instruction Set: a Critical Interface

What is “Computer Architecture”?

- Coordination of many levels of abstraction
- Under a rapidly changing set of forces
- Design, Measurement, and Evaluation
Instruction Set Architecture
(subset of Computer Architecture)

"... the attributes of a [computing] system as seen by the programmer, i.e., the conceptual structure and functional behavior, as distinct from the organization of the data flows and controls the logic design, and the physical implementation."

- Amdahl, Blaaw, and Brooks, 1964

- Organization of Programmable Storage
- Data Types & Data Structures: Encodings & Representations
- Instruction Set
- Instruction Formats
- Modes of Addressing and Accessing Data Items and Instructions
- Exceptional Conditions

Levels of Representation (61C Review)

High Level Language Program

Compiler

Assembly Language Program

Assembler

Machine Language Program

Machine Interpretation

Control Signal Specification

temp = v[k];
v[k] = v[k+1];
v[k+1] = temp;

lw $15, 0($2)
lw $16, 4($2)
sw $16, 0($2)
sw $15, 4($2)

0000 1001 1100 0110 1010 1111 0101 1000
1010 1111 0101 1000 0000 1001 1100 0110
1100 0110 1010 1111 0101 1000 0000 1001
0101 1000 0000 1001 1100 0110 1010 1111

ALUOP[0:3] <= InstReg[9:11] & MASK
Execution Cycle

Instruction Fetch
- Obtain instruction from program storage

Instruction Decode
- Determine required actions and instruction size

Operand Fetch
- Locate and obtain operand data

Execute
- Compute result value or status

Result Store
- Deposit results in storage for later use

Next Instruction
- Determine successor instruction

Machine Organization

Since 1946 all computers have had 5 components

Processor
- Control
- Datapath

Memory

Input

Output