CS305
Computer Architecture

Parts of a Computer
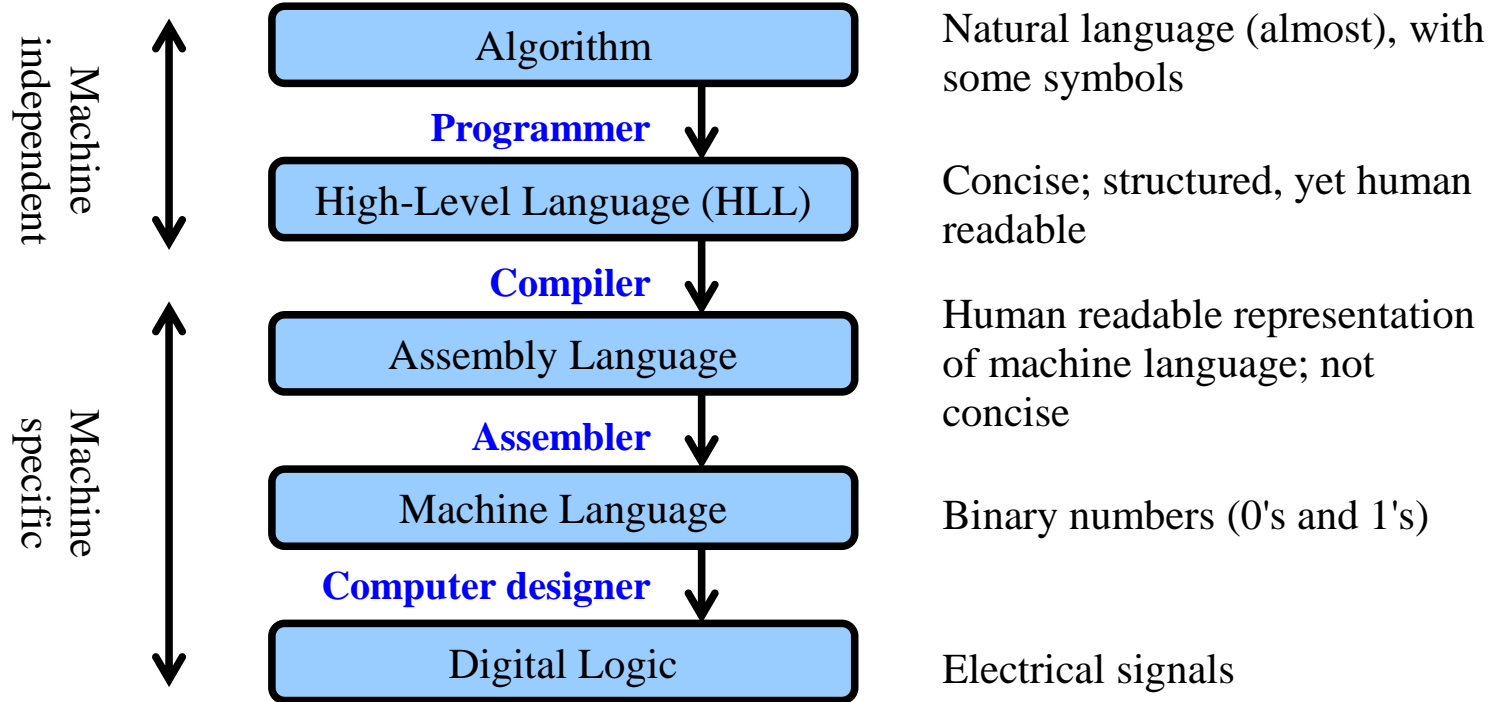
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A Hierarchy of Languages

	Algorithm	Natural language (almost), with some symbols
Machine independent	↕ **Programmer** ↓	
	High-Level Language (HLL)	Concise; structured, yet human readable
	Compiler ↓	
	Assembly Language	Human readable representation of machine language; not concise
Machine specific	**Assembler** ↓	
	Machine Language	Binary numbers (0's and 1's)
	Computer designer ↓	
	Digital Logic	Electrical signals

An Example

Algorithm:
Compute the sum of…

C code:
a = b + c;
d = e + f;

Assembly code:
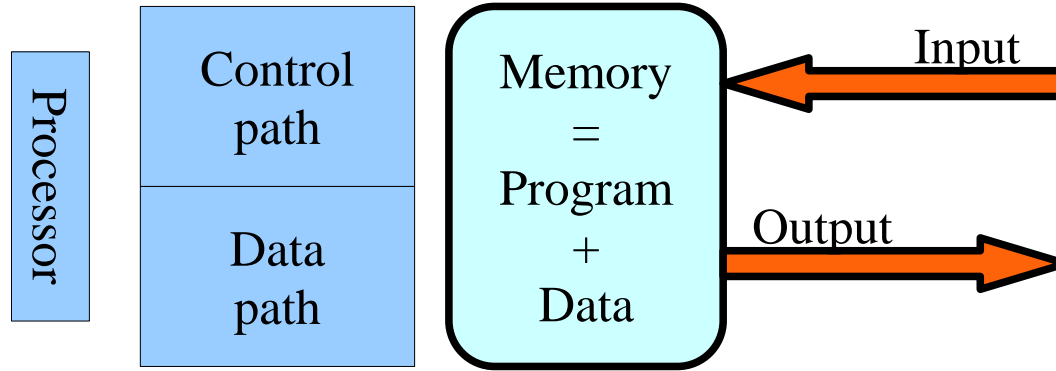| lw | $s1, 4($s0) |
lw	$s2, 8($s0)
add	$s3, $s1, $s2
sw	($s0), $s3
lw	$s3, 16($s0)
lw	$s4, 20($s0)
add	$s5, $s3, $s4
sw	12($s0), $s5

Machine code:
...0...1...
...0...1...
...0...1...
...0...1...
...0...1...
...0...1...
...0...1...
...0...1...

Digital logic:
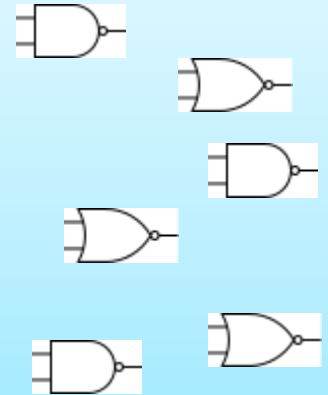
Von Neumann Architecture

- The stored program concept: program (instructions) as well as data are stored in memory

- Processor *fetches* instructions from memory, and *executes* them on *data* (also fetched from/to memory)
  - Example from previous slide: LW and SW instructions
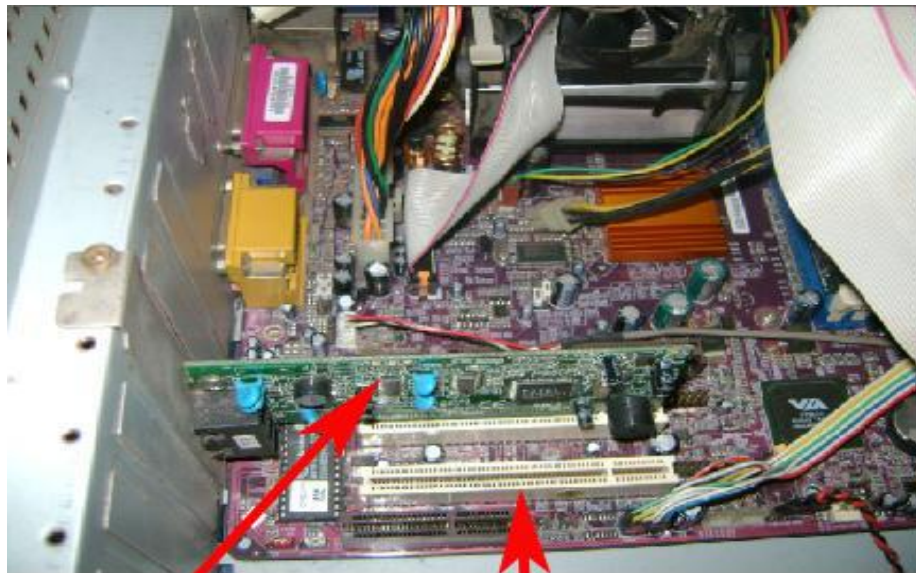
The Five Components

- All computers have these five components: input, output, memory, [data path + control path = processor]
- <u>Underlined</u> aspects: topics in <u>this</u> course

- Input: keyboard, mouse; also <u>disk</u>, network
- Output: monitor; also <u>disk</u>, network
- <u>Memory:</u> different kinds of memory
- <u>Data path + control path = processor</u>
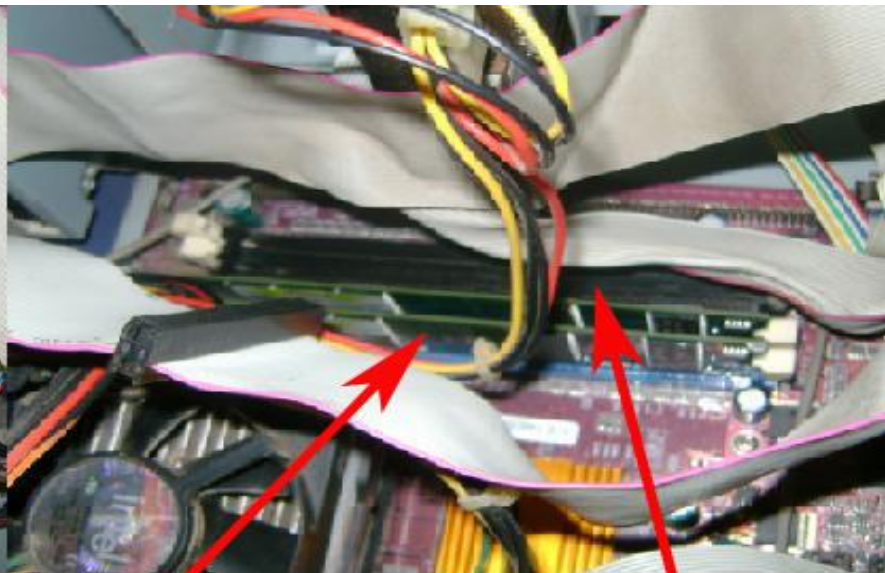
Inside a Computer...
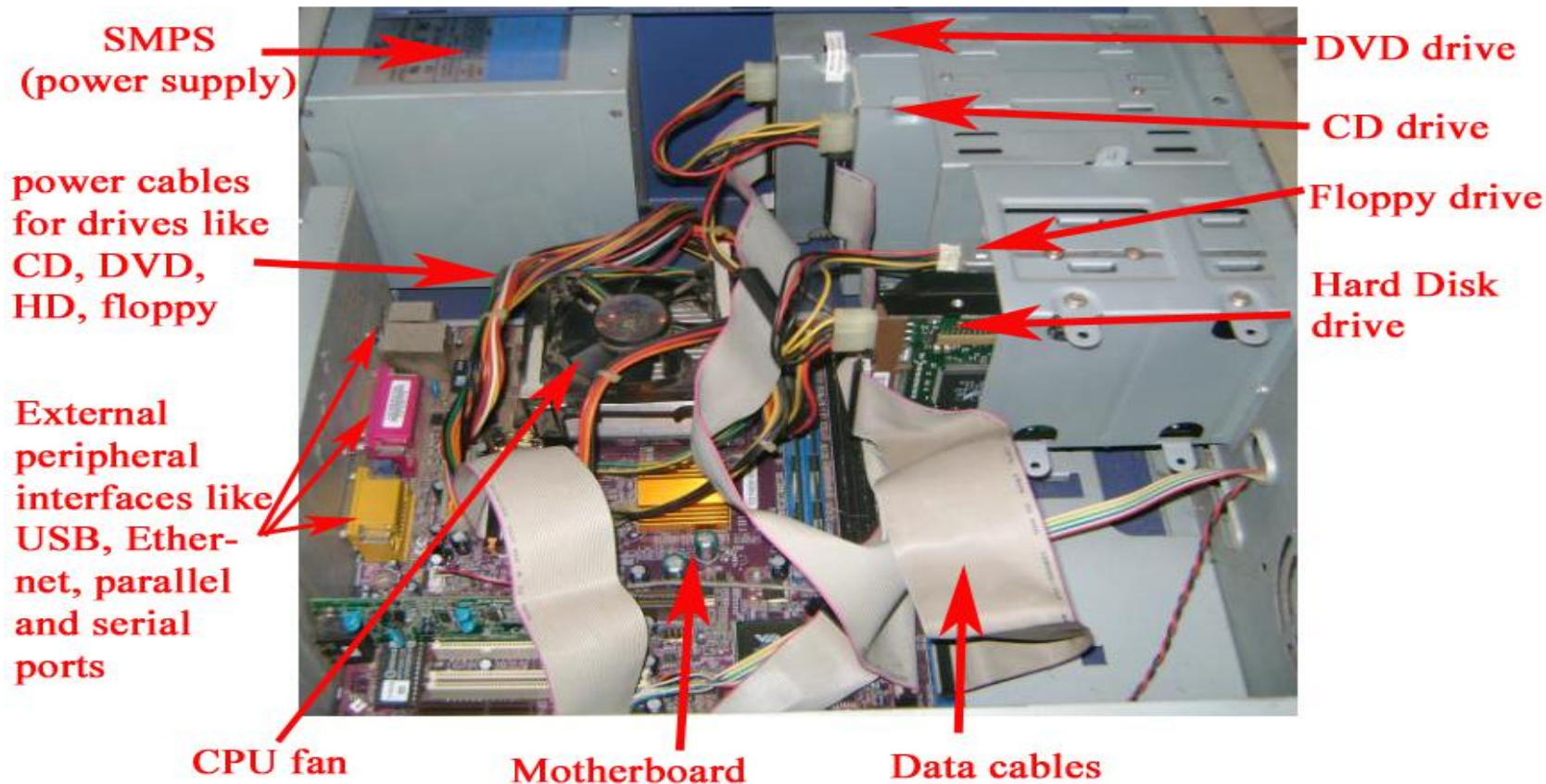
Inside a Computer (continued...)

External modem card

PCI slots for expansion
(add-on cards)

main memory
(RAM) chips

empty slots for RAM
expansion in future

Magnetic Tape

Inside a Computer: Summary

- Integrated circuits, or chips:
  - Flat and black
  - Processor (CPU), main memory, cache memory, etc.
- Motherboard:
  - Houses the various chips
  - Also has many I/O interfaces (PCI, USB, Serial, etc.)
- Secondary memory: non-volatile
  - Magnetic disks, optical (CD/DVD), tape, flash-based (e.g. USB pen-drives, CF cards), floppies (obsolete)