Grundzüge der Wirtschaftsinformatik
Introduction to Business Information Systems

Unit 2

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http://www.heppnetz.de/teaching/gwi/

Logistics

- **Lecture**
  - Tuesdays, 13:15 - 14:45, Auditorium Maximum (Building 33)
- **Tutorial and Exercises (Begin: October 17)**
  - Wednesdays, 11:30 – 13:00, Building 33 Room 2401 (in German)
  - Thursdays, 09:45 - 11:15, Building 43 Room 4/126 (in German)
  - Thursdays, 15:00 - 16:30, Building 33 Room 2216 (in German)
  - Thursdays, 16:45 - 18:15, Building 33 Room 2116 (in English)
- **Exam (tentatively, to be confirmed)**
  - December 18, 2007 – 13:00 – 15:00

Office Hours and Contact

Prof. Dr. Martin Hepp

- By appointment only (Tuesdays 15:00 – 16:00)
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- mhepp@computer.org

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- a.richter@unibw.de

Learning Resources (2)

- Course Web page
  - http://www.heppnetz.de/teaching/gwi/
- All slides will be put on-line *after* the lecture
- Some materials may be password protected
  - User: unibw
  - Password: unibw2007
- Test run: Video recording of the lecture for your exam preparation
  - Will be made available online shortly

Structure of the Lecture

Unit 1: Introduction
Unit 2: Central Processing Units
Unit 3: Storage and Data Structures
Unit 4: Input and Output Devices
Unit 5: Software
Unit 6: Networks, Data Interchange, and the Internet
Unit 7: Design, Development, Deployment, and Operations of Information Systems
Unit 8: Office Applications
Unit 9: Enterprise Applications
Unit 10: Supply Chain Applications and E-Business
Unit 11: Management Support Systems
Unit 12: Exam Review

Link to the Previous Unit

- Last Unit: Economic dimension of using computers for mechanizing tasks
- Today: Fundamental principles of computers
  - Why are computers able to execute software?
  - What is the basic structure of any computer?

Assignment from Last Week

- Get the books
- Review the slides
- Read the following paper

  Leonard E. Read: "*I, Pencil. My Family Tree as told to Leonard E. Read*", Dec. 1958

  http://www.econlib.org/library/Essays/rdPncl1.html,

  PDF version:
  http://www.fee.org/pdf/books/I,%20Pencil%202006.pdf

What's a Computer?

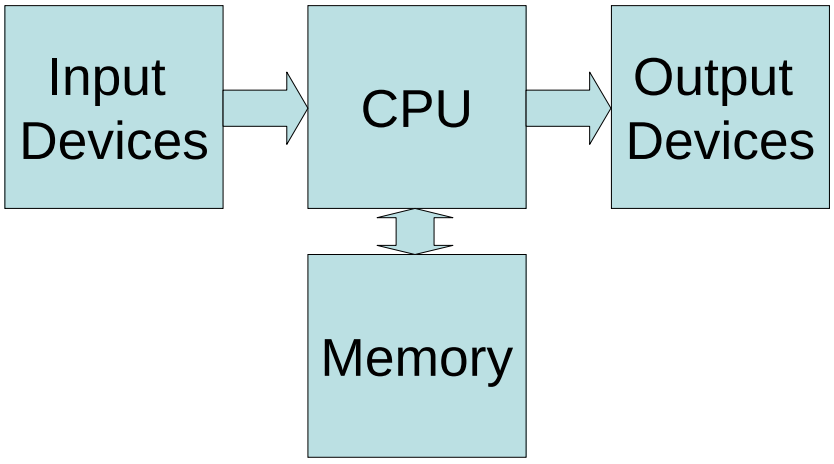
There are lots of intelligent devices...

... but are they computers?

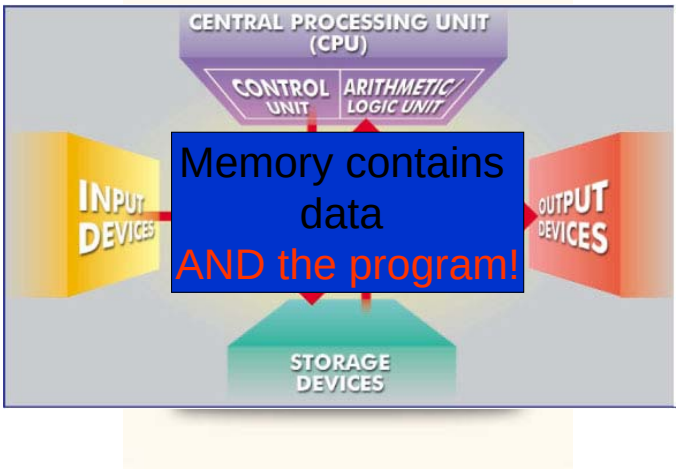
A computer's functionality is not determined at the time of design, but can be changed at any time just by loading new software.

Computer and Peripherals

CPU, Memory, Input & Output Devices

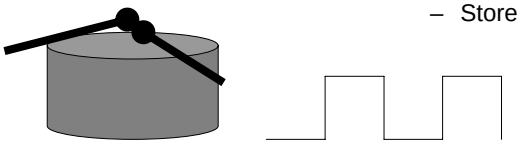


Computer: Von Neumann Architecture



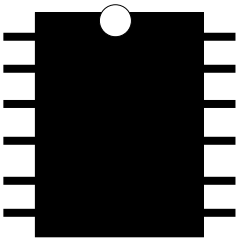
CPU: Central Processing Unit

- The CPU is the heart of any computer.
- It is controlled by an internal or external clock generator.
- The CPU can execute a small set of simple commands.
- At each „beat“ of of the clock, it executes the next step
  - Fetch next command
  - Retrieve operands (values)
  - Execute command
  - Store results



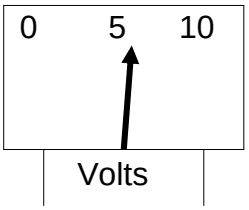
Memory

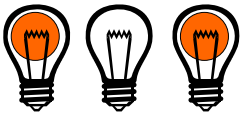
Bookshelf



Analog vs. Digital Computers

- There are two principal ways of implementing a computer:
  - **Analog**: A value is represented by a respective voltage (1 = 1 volts, 2 = 2 volts, ...)
  - **Digital:** Values are represented **by a pattern** (combination) of multiple signals that can take only one of two voltage levels.

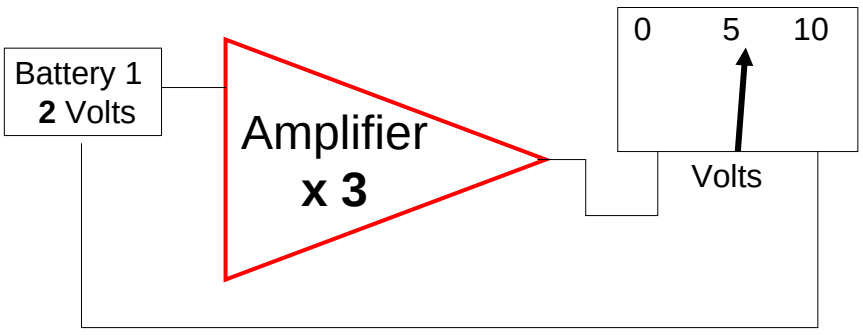




Analog Adding

2 + 4 = 6

Analog Multiplication



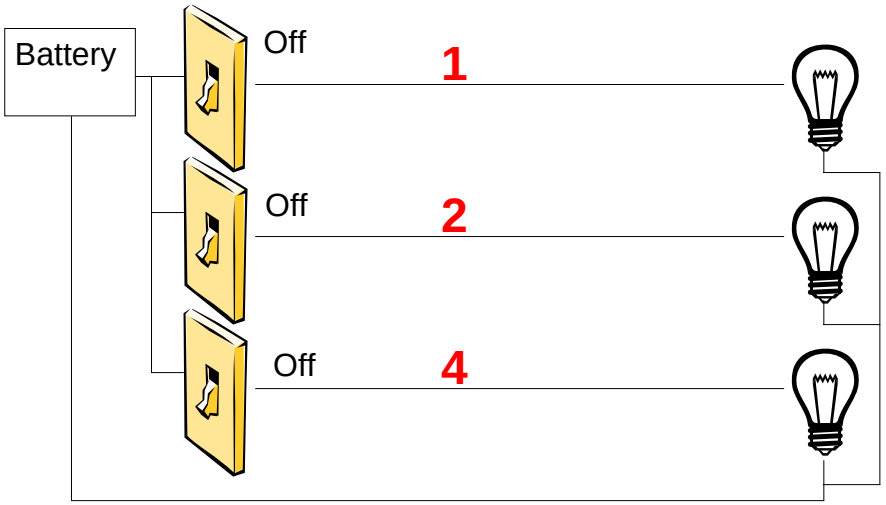
2 * 3 = 6

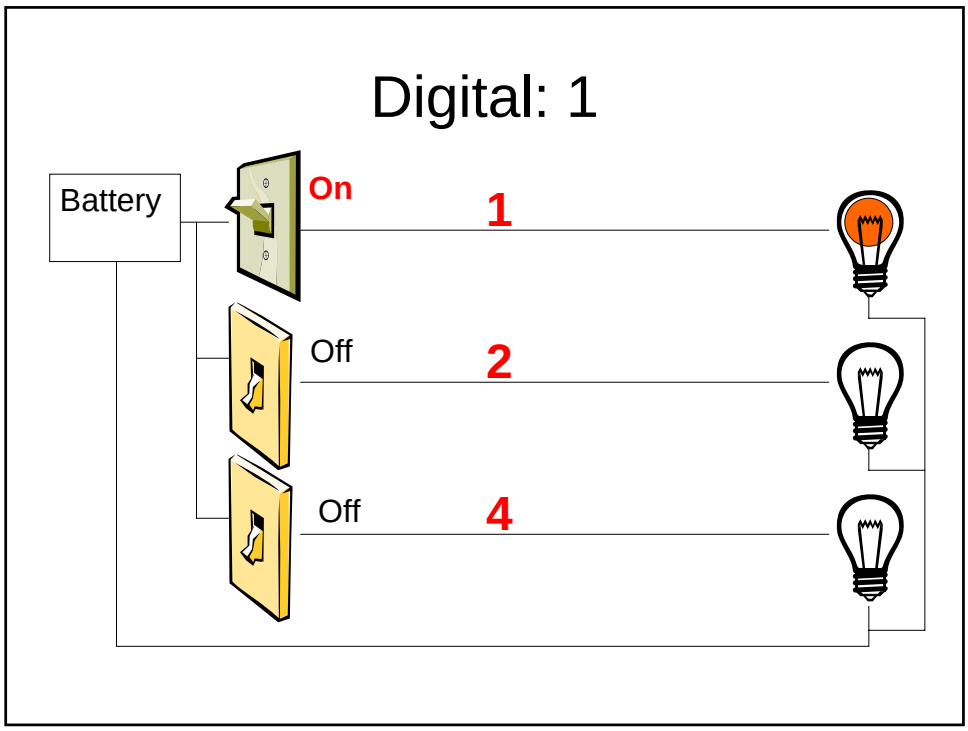
Problems with Analog Systems

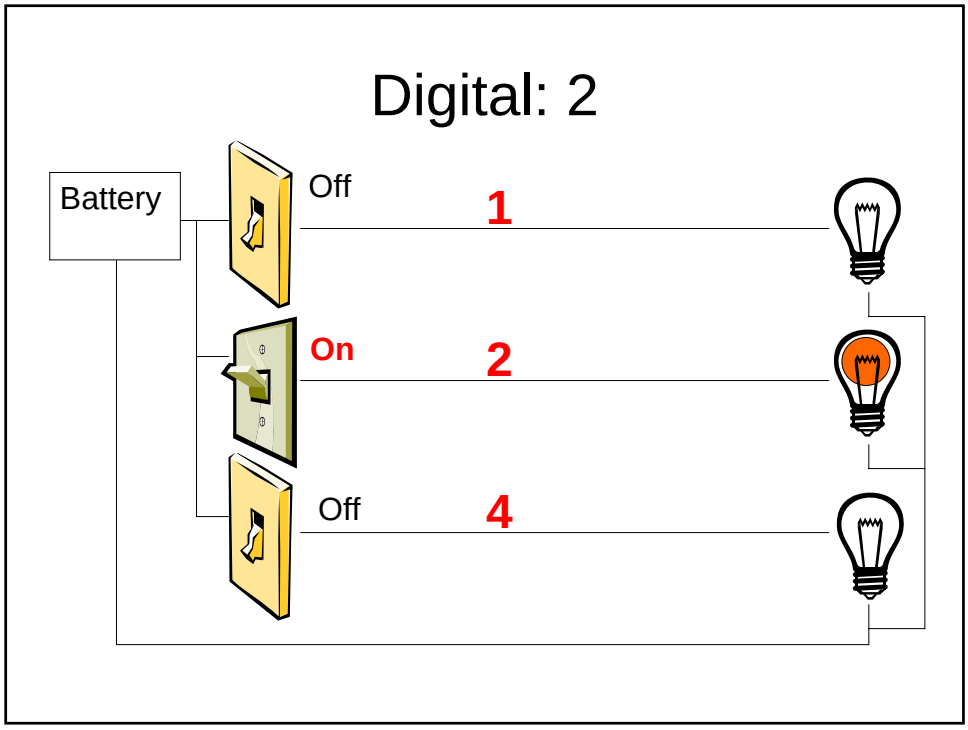
- Expensive
- Lack of Reliability
- Transmission Errors

→ Dominance of Digital Computers

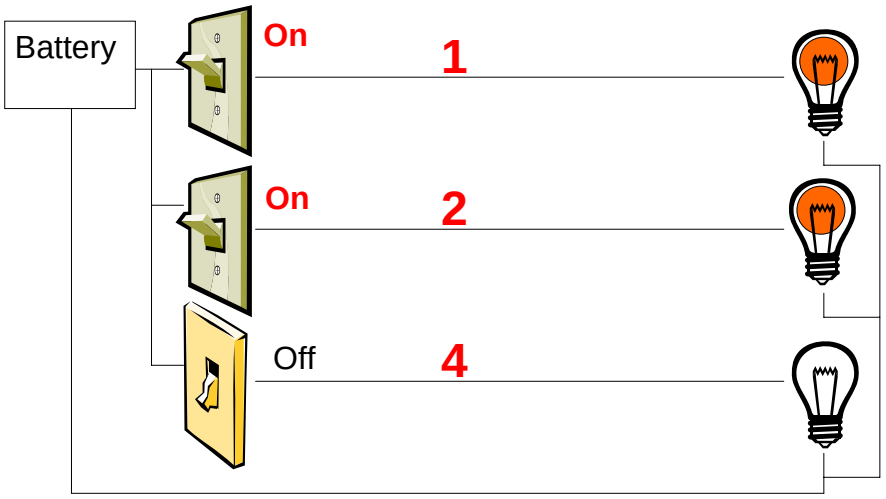
Digital



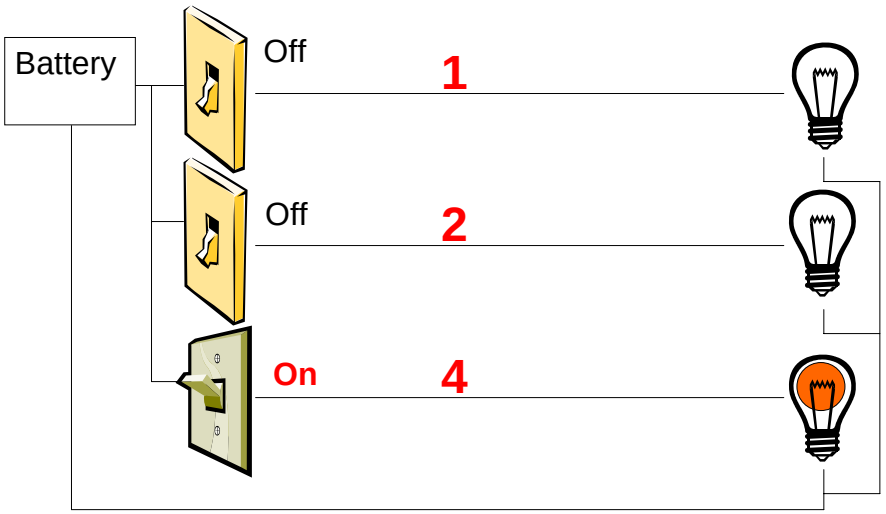

Digital: 1
Battery
On
1
Off
2
Off
4


Digital: 2
Battery
Off
1
On
2
Off
4

Digital: 3

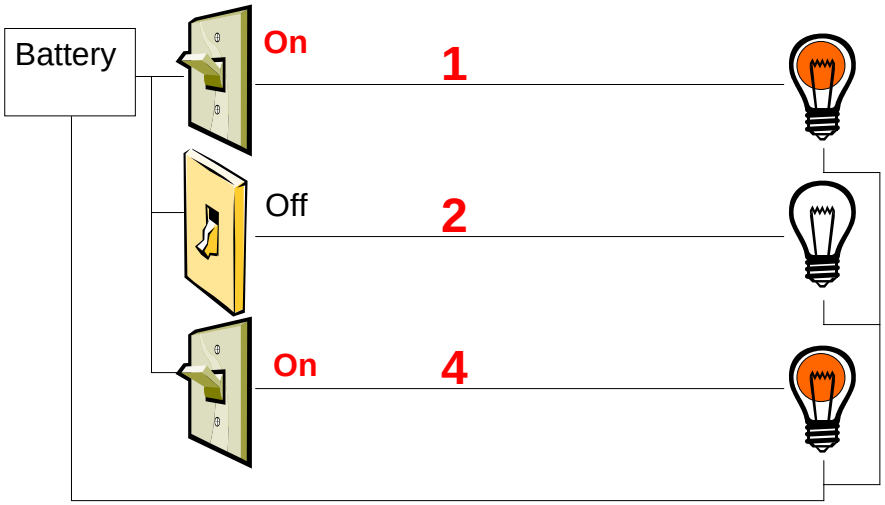


Digital: 4



How would the number 5 be represented?

Digital



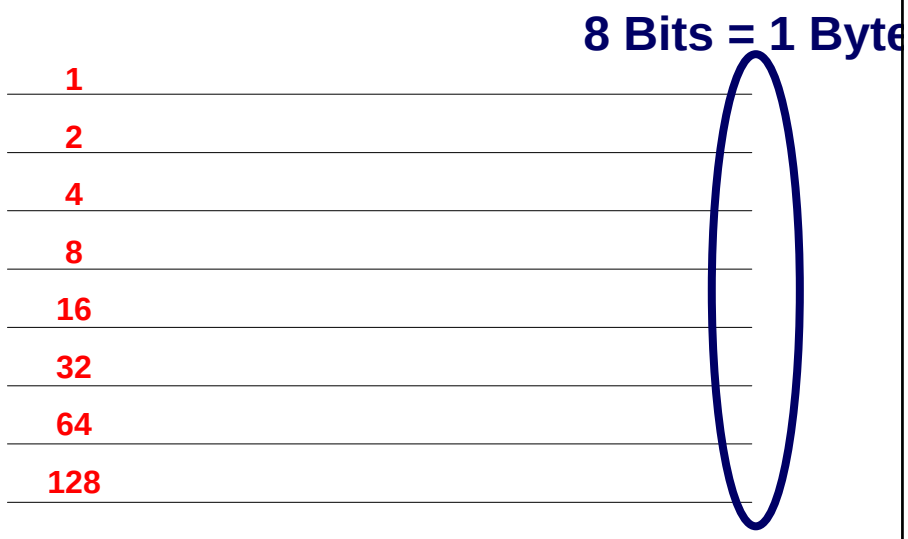
Binary Numbers

4	2	1	Value
Off	Off	Off	0
Off	Off	On	1
Off	On	Off	2
Off	On	On	3
On	Off	Off	4
On	Off	On	5
On	On	Off	6
On	On	On	7

Binary Numbers

4	2	1	Value
0	0	0	0
0	0	1	1
0	1	0	2
0	1	1	3
1	0	0	4
1	0	1	5
1	1	0	6
1	1	1	7

Usually 8 Wires



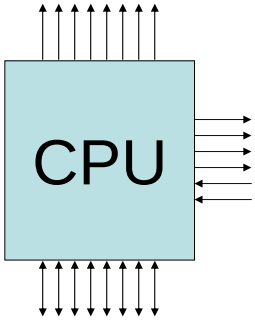
One byte represents any number from 0 through 255

128 Bit 7	64 Bit 6	32 Bit 5	16 Bit 4	8 Bit 3	4 Bit 2	2 Bit 1	1 Bit 0	
0	0	0	0	0	0	0	**1**	1
0	0	0	**1**	0	**1**	0	0	20

Address and Data *Bus*

Two sets of wires that represent binary values

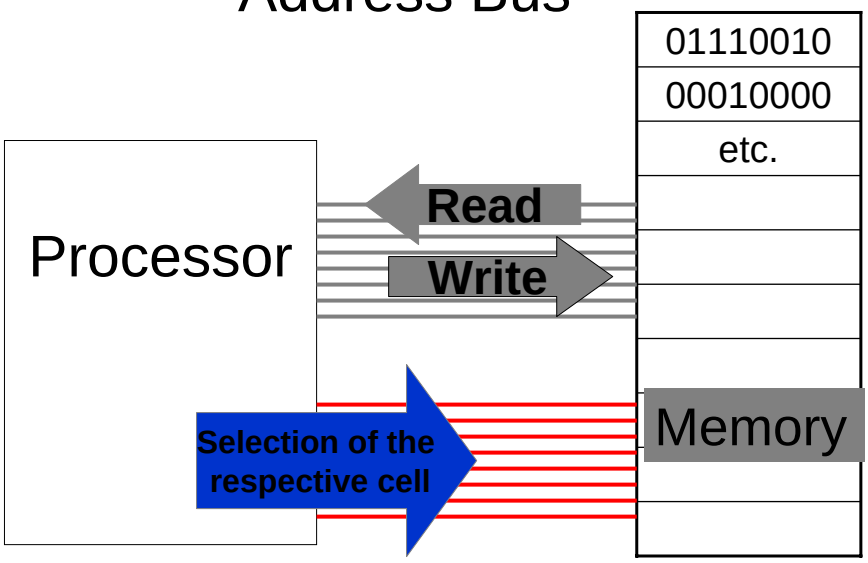
Address Bus:
Which memory cell is to be used?

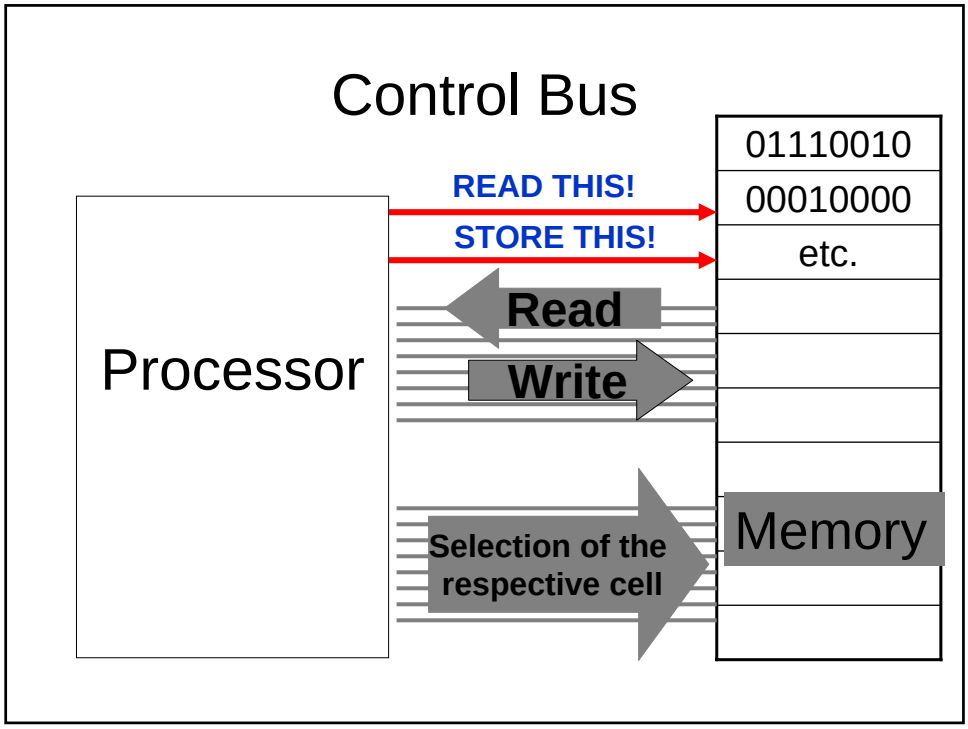


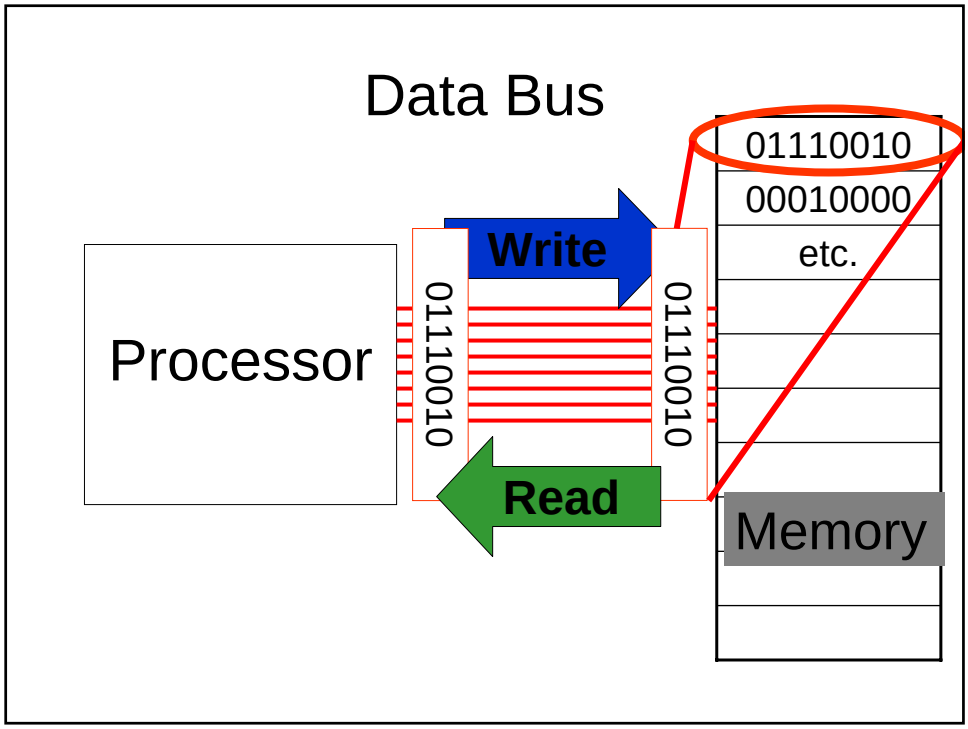
Control Bus:
What should the memory chip do?
When is the CPU ready to take the results?

Data Bus:
For exchanging values
between the memory and the CPU

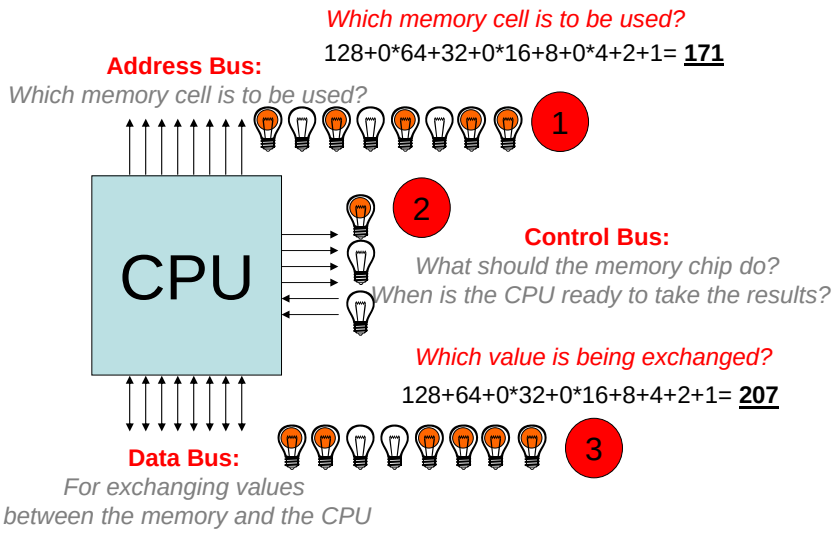
Address Bus




Control Bus
Processor
READ THIS!
STORE THIS!
Read
Write
Selection of the respective cell
Memory
01110010
00010000
etc.


Data Bus
Processor
Write
Read
01110010
01110010
Memory
01110010
00010000
etc.

Address and Data Bus: Example



Memory Size

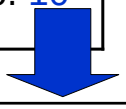
- KB = 1024 Byte
- MB = 1024 * 1024 Byte
- GB = 1024 * 1024 * 1024 Byte
- TB = 1024 * 1024 * 1024 * 1024 Byte

- $1024 = 2^{10}$

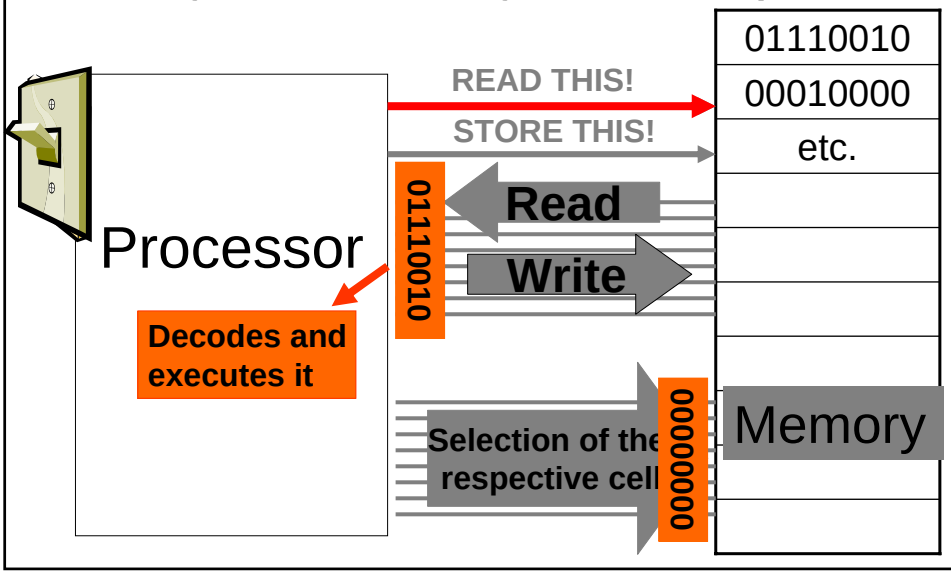
Why does the processor know what to do?

Memory contains values **and** instructions

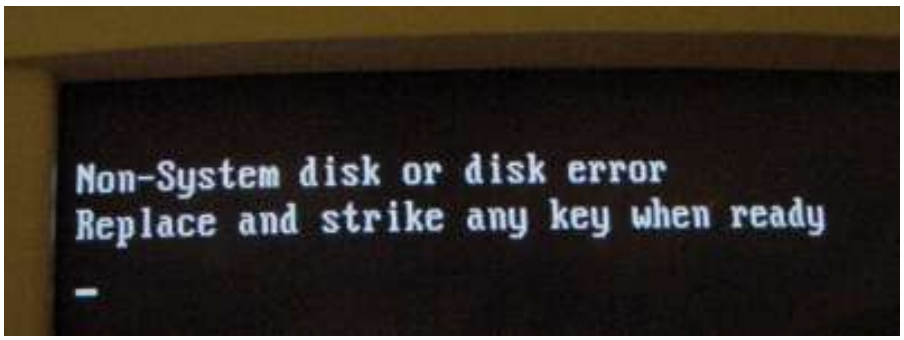
Cell No.	Value	Meaning
0	120	ADD to Buffer
1	4	4
2	140	JUMP to …
3	10	cell no. 10



When you turn on your Computer…



Basic Input / Output System (BIOS)

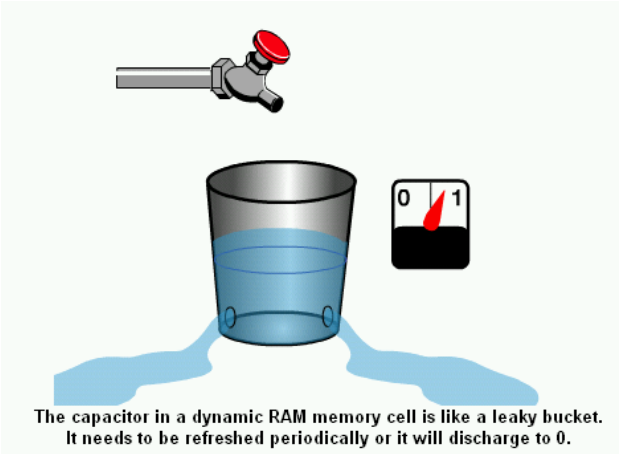


http://computer.howstuffworks.com/bios.htm/printable

Basic Input / Output System (BIOS)

http://computer.howstuffworks.com/bios.htm/printable

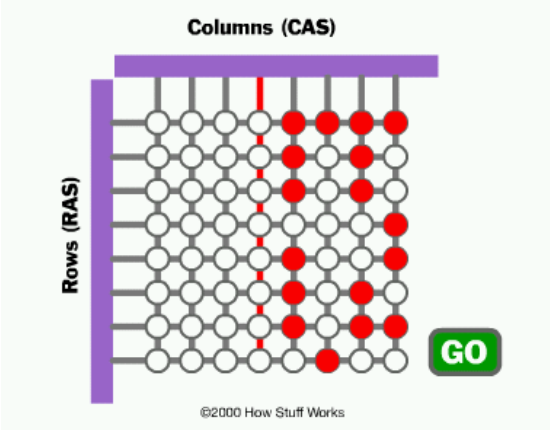
Random Access Memory



The capacitor in a dynamic RAM memory cell is like a leaky bucket.
It needs to be refreshed periodically or it will discharge to 0.

http://computer.howstuffworks.com/ram.htm/printable

Random Access Memory



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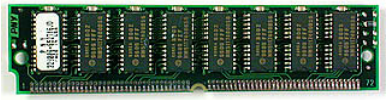
Random Access Memory

SIMM

DIMM



SODIMM

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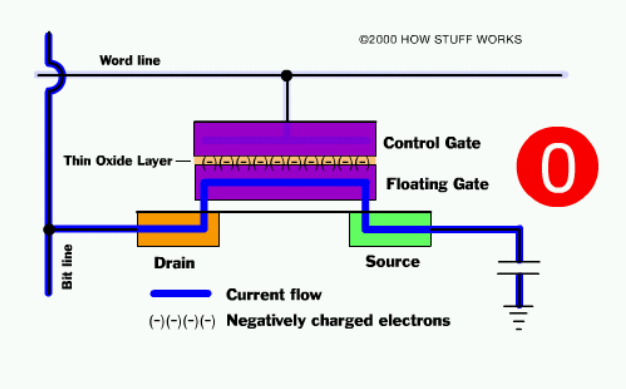
Flash Memory



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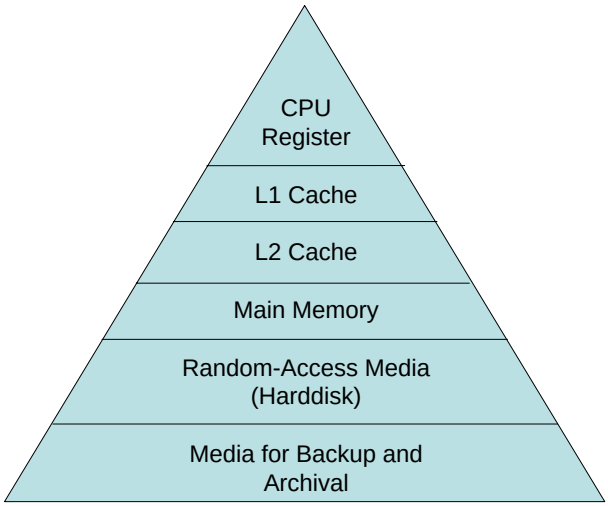
Memory Hierarchy



Thank you!

The slides and additional materials will be available at
http://www.heppnetz.de/teaching/gwi/
shortly.

Don‘t forget: Tutorials will not start until Oct 17!