

Seagate Portable 2TB External Hard Drive Portable HDD – USB 3.0 for PC, Mac, PS4, & Xbox - 1-Year Rescue Service (STGX2000400), Black

[Visit the Seagate Store](#)

4.6 ★★★★★ 246,061 ratings

#1 Best Seller in External Hard Drives

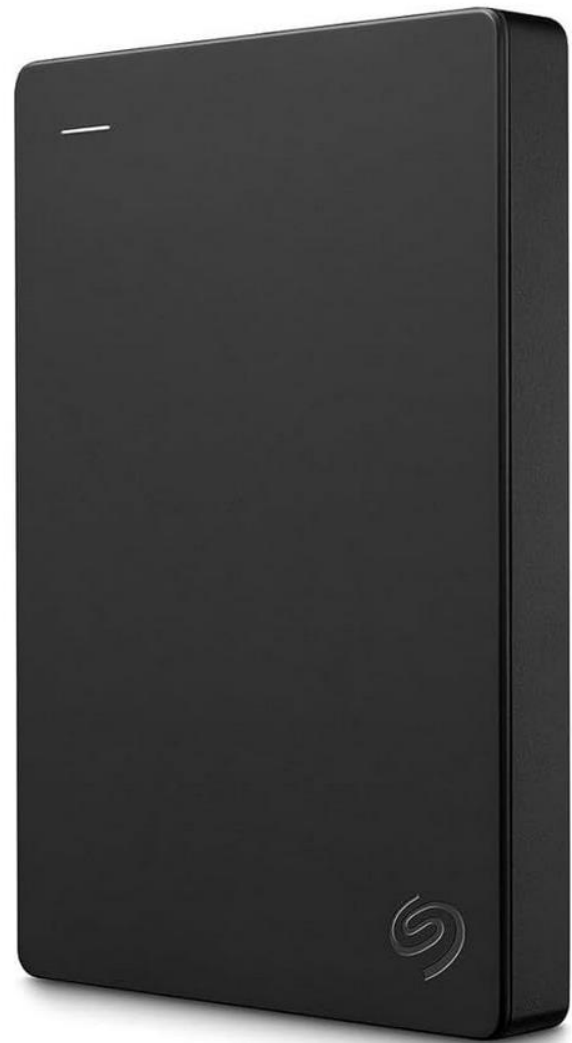
\$97<sup>99</sup>

# CMPT 120

Lecture 31 – Under the Hood

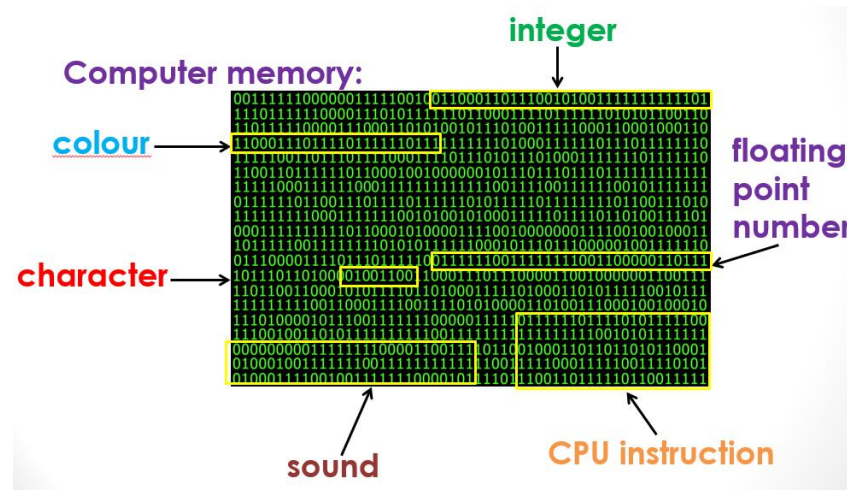
Binary Encoding

Binary-Decimal Converter



# Last Lectures

- Solved our jellybean problem! Yay!
- We **lifted the hood** and started to have a close look at the computer memory!
  - ✓ Why computers use 0's and 1's to represent everything

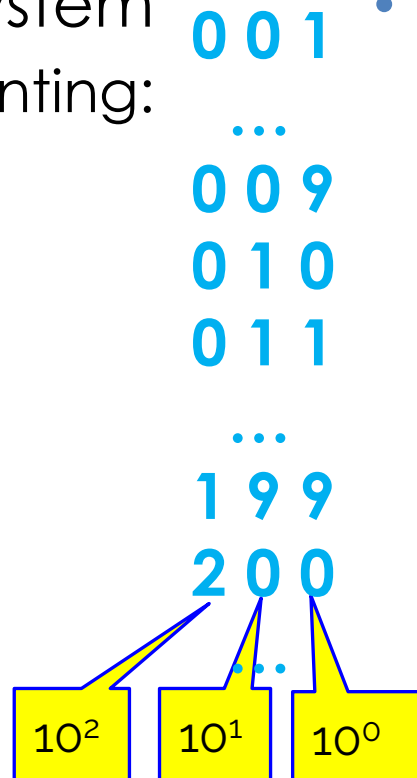


- ✓ Learnt how to count in binary -> **homework!**
- ✓ Read binary numbers as decimal numbers and as ASCII characters

# Review -

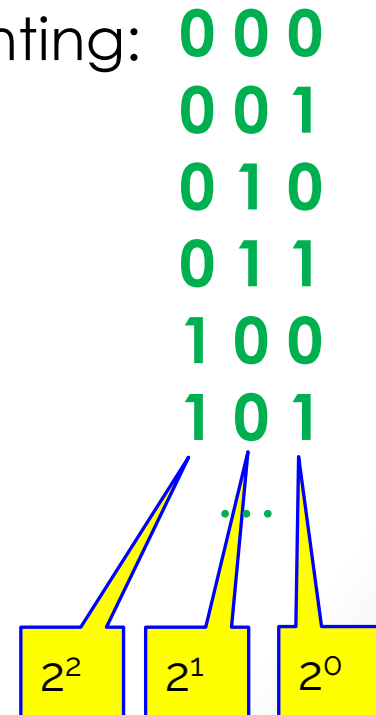
## Decimal numeral system

- Positional system
  - When counting:



## Binary numeral system

- Positional system
  - When counting:

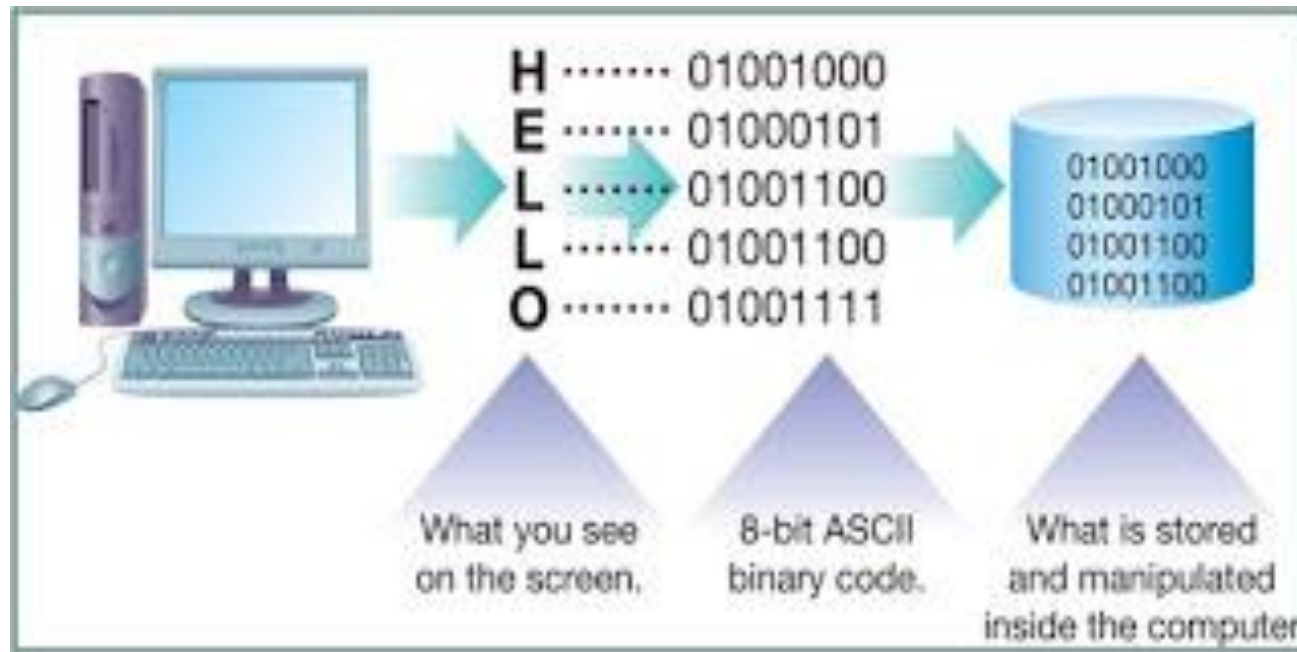


# Today's Menu



- Continue looking **under the hood**, continue having a close look at the computer memory!
  - Convert decimal numbers into binary numbers
  - Why does **255** mean **full on green**?
  - What does Kb, Mb, Gb, etc. stand for?
  - Create a binary decoder
- Can we write a converter program that convert binary numbers into decimal numbers?

# How computers represent characters



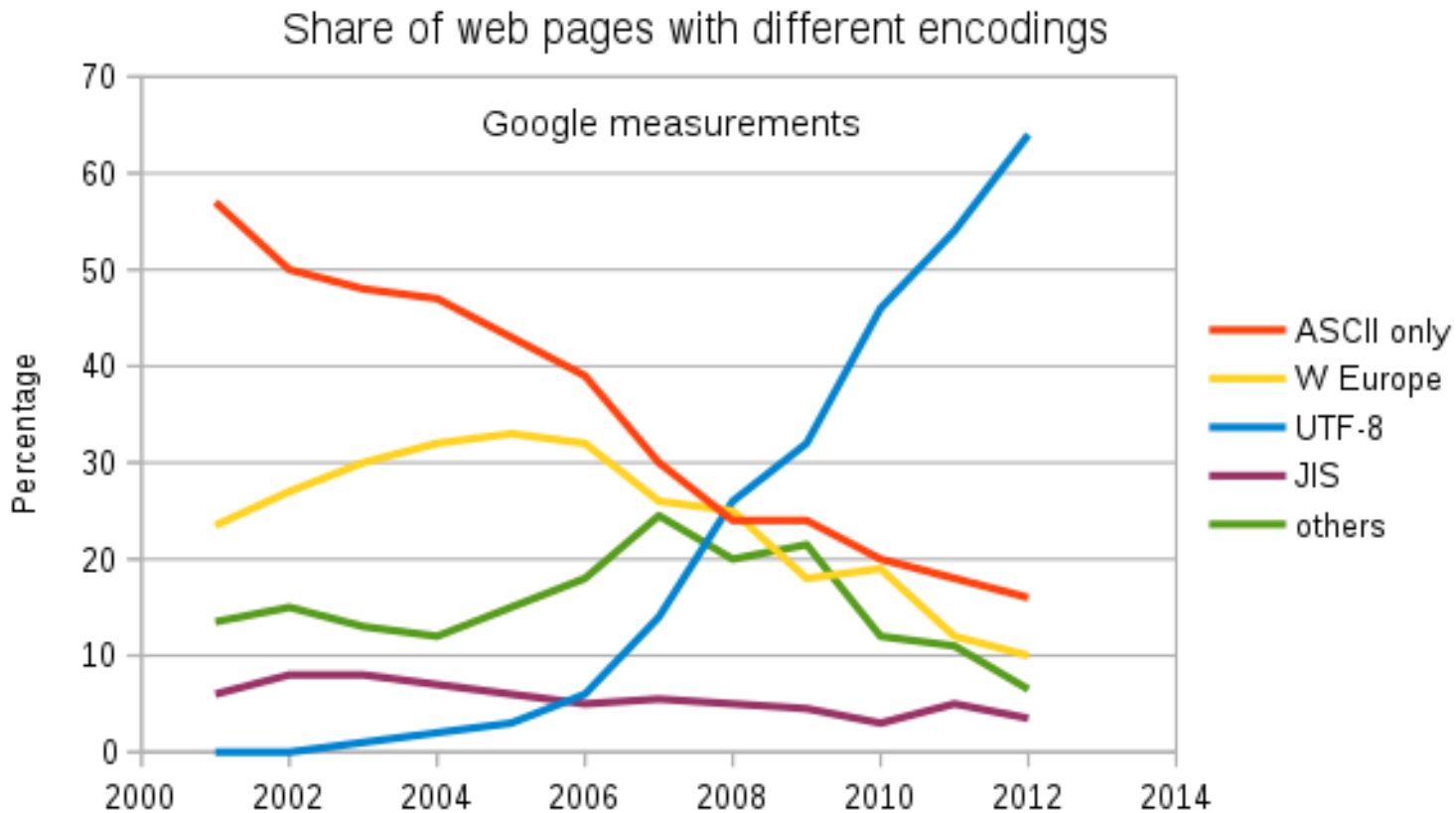
Source: [http://1.bp.blogspot.com/\\_e8aZh22zXKM/TMeR\\_fL8aI/AAAAAAAAAAo/pIR08vVLkz0/s320/Hello\\_World.jpg](http://1.bp.blogspot.com/_e8aZh22zXKM/TMeR_fL8aI/AAAAAAAAAAo/pIR08vVLkz0/s320/Hello_World.jpg)

See ASCII Table: <https://www.ascii-code.com/>

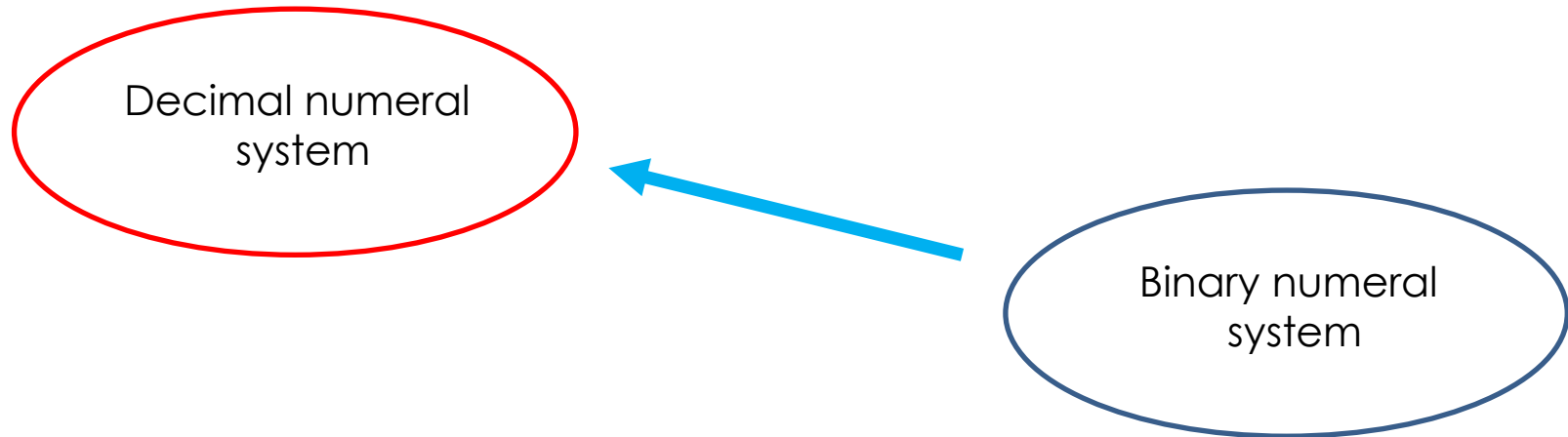
# Unicode UTF - 8

- ASCII uses 8 bits (1 byte) to encode characters using 0's and 1's
- How many different characters can we represent in ASCII with 8 bits (1 byte)?
- Let's have a look: <https://www.ascii-code.com/>
- To type in other languages than English, we may need a lot more than that
- **Unicode** uses **up to 4 bytes** to handle more characters
- Let's have a look: <http://www.unicode.org/charts/>

# Other Character Encodings

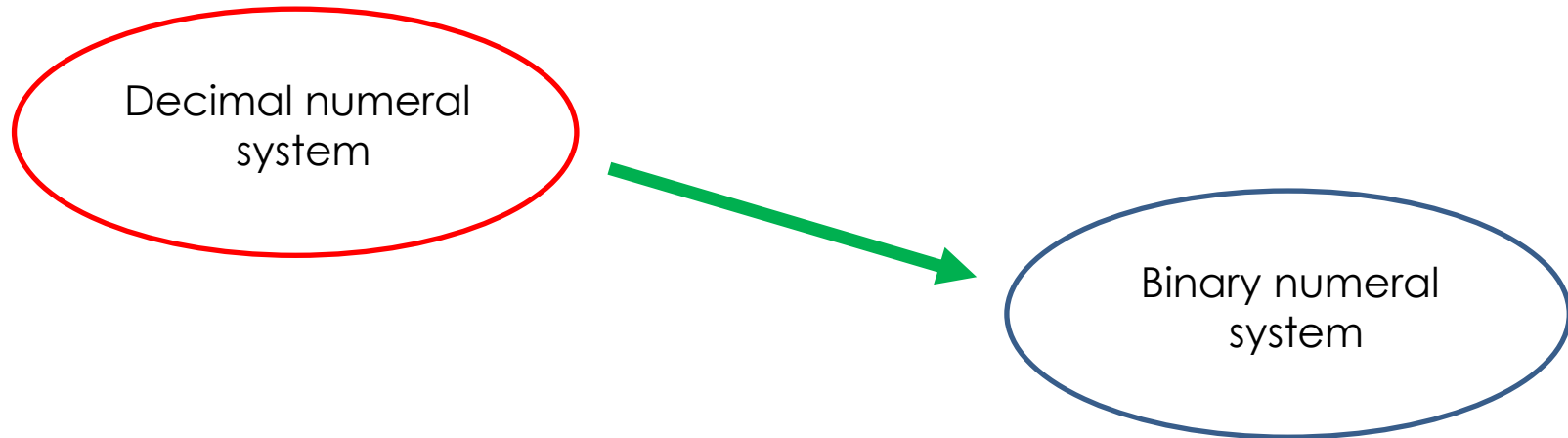


# So far ...





# Let's try ...



# Can we convert these?

Remember:

128	64	32	16	8	4	2	1
-----	----	----	----	---	---	---	---

1	→	00000001
2	→	00000010
3	→	00000011
4	→	00000100
5	→	00000101
6	→	00000110
7	→	00000111
8	→	00001000

9	—	—	—	—	—	—	—
10	—	—	—	—	—	—	—
11	—	—	—	—	—	—	—
12	—	—	—	—	—	—	—
13	—	—	—	—	—	—	—
14	—	—	—	—	—	—	—
15	—	—	—	—	—	—	—
31	—	—	—	—	—	—	—
64	—	—	—	—	—	—	—
255	—	—	—	—	—	—	—
256	—	—	—	—	—	—	—

# What is 106 as a binary number?

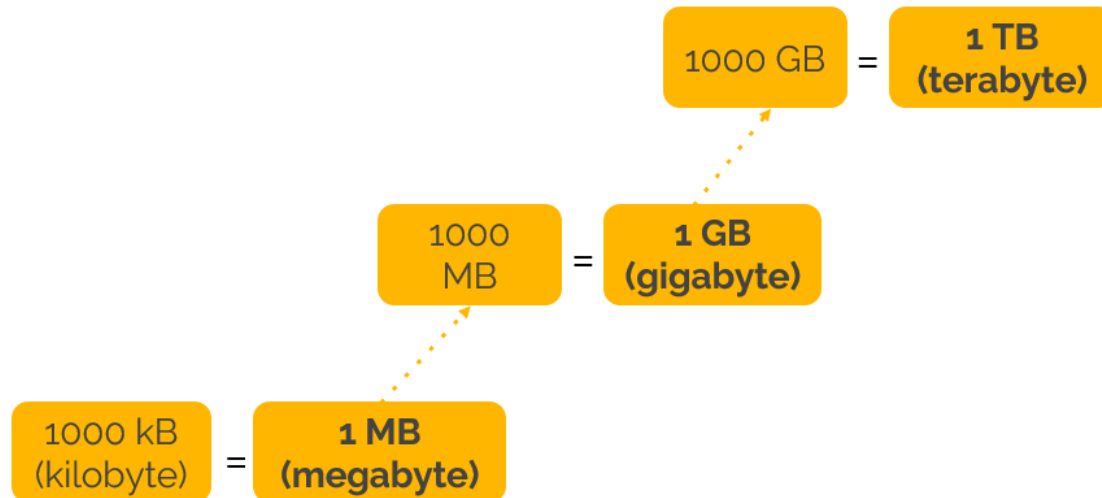
Remember:

128	64	32	16	8	4	2	1
-----	----	----	----	---	---	---	---

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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# What does kb, Mb, Gb, etc. stand for?

- 1 bit (b)
- 8 bits  $\rightarrow$  1 byte (B)
- 1000  $\rightarrow 10^3 \rightarrow$  kilo  $\rightarrow$  k
- 1000000  $\rightarrow 10^6 \rightarrow$  Mega  $\rightarrow$  M
- 1000000000  $\rightarrow 10^9 \rightarrow$  Giga  $\rightarrow$  G
- 1000000000000  $\rightarrow 10^{12} \rightarrow$  Tera  $\rightarrow$  T



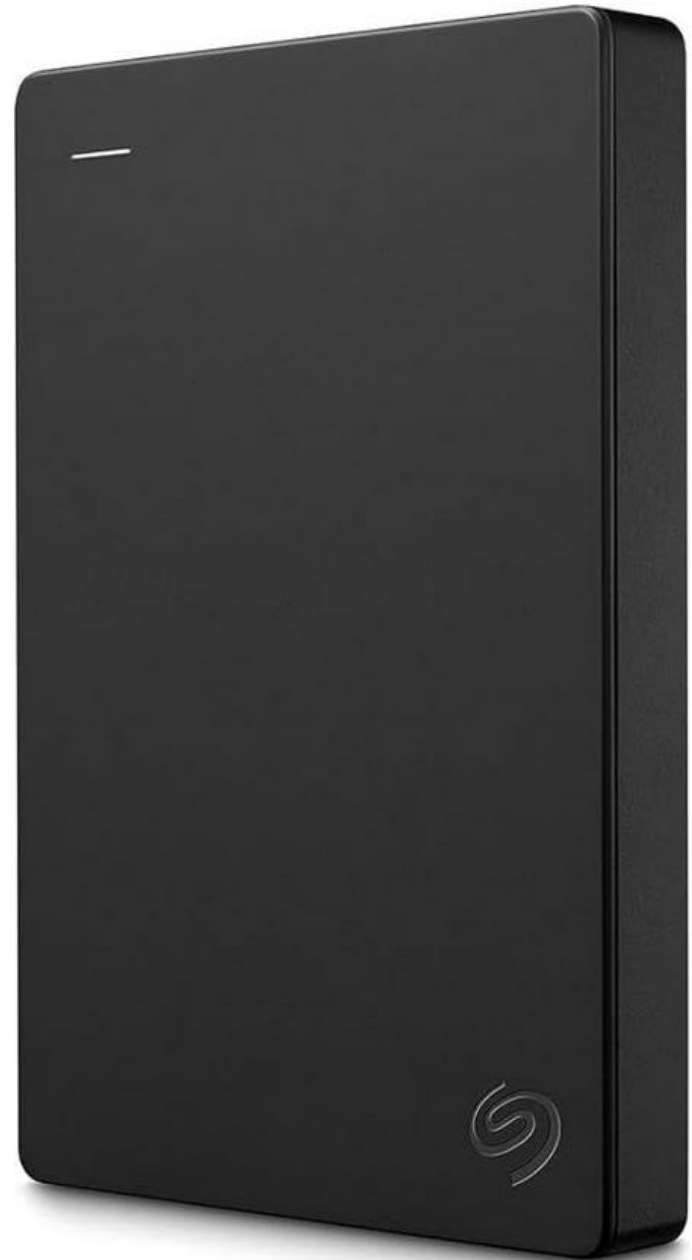
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# Binary decoder?

## Step 1 - Problem Statement

Write a binary to decimal decode program that converts the binary number the user enters.

## Step 2 - Design

# Next Lecture

- Close the hood and move on to  
**the Internet and Big Data!**