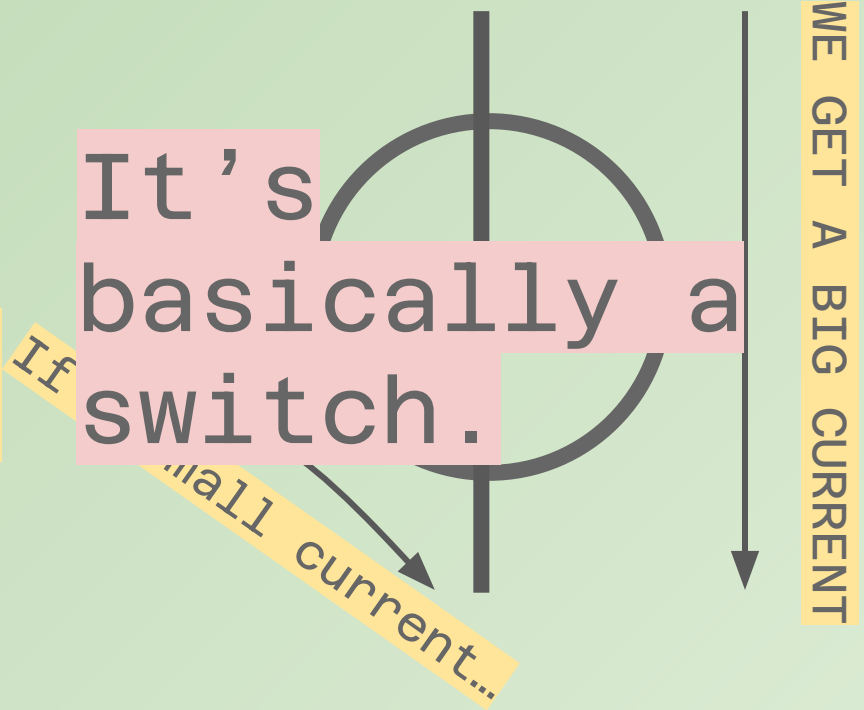

OX
CB
BARE
METAL

WTF is a transistor?



Representing a switch

The “why” of base 2 (or, “binary”)

ON (1)

OFF (0)

And a switch is basically a single

bit ← Short for “binary digit,” coined by John W. Tukey in 1945.

Stringing bits together

Bit	Single digit	0, 1
Nibble	Two digits	01,00,10,11
Byte	8 bits	01011001

Base									
Decimal	0	1	2	3	4	8	10	16	31
Binary	0	01	10	11	100	1000	1010	10000	11111
Octal	0	1	2	3	4	10	12	20	37
Hexadecimal	0	1	2	3	4	8	A	10	1F

200	Even	0

Converting: the easy way

Converting: the easy way

200	Even	0
200 ÷ 2	Even	0

Converting: the easy way

200	Even	0
200 ÷ 2	Even	0
100 ÷ 2	Even	0

Converting: the easy way

200	Even	0
200 ÷ 2	Even	0
100 ÷ 2	Even	0
50 ÷ 2	Odd	1

Converting: the easy way

200	Even	0
200 ÷ 2	Even	0
100 ÷ 2	Even	0
50 ÷ 2	Odd	1
25 ÷ 2	Even	0

Converting: the easy way

200		Even	0
200	÷ 2	Even	0
100	÷ 2	Even	0
50	÷ 2	Odd	1
25	÷ 2	Even	0
12	÷ 2	Even	0

Converting: the easy way

200		Even	0
200	÷ 2	Even	0
100	÷ 2	Even	0
50	÷ 2	Odd	1
25	÷ 2	Even	0
12	÷ 2	Even	0
6	÷ 2	Odd	1

Converting: the easy way

200		Even	0
200	÷ 2	Even	0
100	÷ 2	Even	0
50	÷ 2	Odd	1
25	÷ 2	Even	0
12	÷ 2	Even	0
6	÷ 2	Odd	1
3	÷ 2	Odd	1

Converting: the easy way

200	Even	0
200 ÷ 2	Even	0
100 ÷ 2	Even	0
50 ÷ 2	Odd	1
25 ÷ 2	Even	0
12 ÷ 2	Even	0
6 ÷ 2	Odd	1
3 ÷ 2	Odd	1
1 ÷ 2	No carry	0

Base			
Decimal	64	159	318
Binary			
Octal			
Hexadecimal			

Base			
Decimal	64	159	318
Binary	1000000		
Octal	100		
Hexadecimal	40		

Base			
Decimal	64	159	318
Binary	1000000	10011111	
Octal	100	237	
Hexadecimal	40	9F	

Base			
Decimal	64	159	318
Binary	1000000	10011111	100111110
Octal	100	237	400
Hexadecimal	40	9F	13E

Numeric size

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

11001000 is an **8 bit** number.

200		Even	0
200	÷ 2	Even	0
100	÷ 2	Even	0
50	÷ 2	Odd	1
25	÷ 2	Even	0
12	÷ 2	Even	0
6	÷ 2	Odd	1
3	÷ 2	Odd	1
1	÷ 2	No carry	0

Your turn

Derive the 8-bit BIN and HEX equivalents for…

66	01000010	42
123	01111011	7B
253	11111101	FD
491	IT'S A TRAP! NOT 8 BITS!	

Number size

Its physical impacts on memory

Byte	8-bit values
Half word	16-bit values
Word	32-bit values
Double word	64-bit values

Number size

Representation in programs: how many bytes?

```
Python      a = 5
C           int a = 5;
Assembly    a:      .word     5
```

Math

Because we have to

	111
5	101
+3	+011
8	1000

Math

Because we have to

	111	
	5	101
	+5	+101
	10	1010

Math

Negative numbers in base 2

Math

Negative numbers in base 2

```
  5      101
+(-3)   +101
-----   ----
  2     1010
```

111

So...what's:

16363 + (-32767)?

(In Base 2)

Vocab review

What do all of these terms mean?

Bit

Nibble

Byte

Half word

Word

Double Word