Today's lesson:

BINARY

01011 101 010 01010 10100 101 01

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The **binary** number system, also called **the base-2** number system, is a method of representing numbers by **using** combinations of only two numerals: zero (0) and one (1).

Computers use **the binary** number system to manipulate (change) and store all of their data including numbers, words, videos, graphics, and music.

Today's lesson:

We usually use a **base-10** numeral system (also known as decimal).

For example, to us
"**three hundred fifty one**" means:

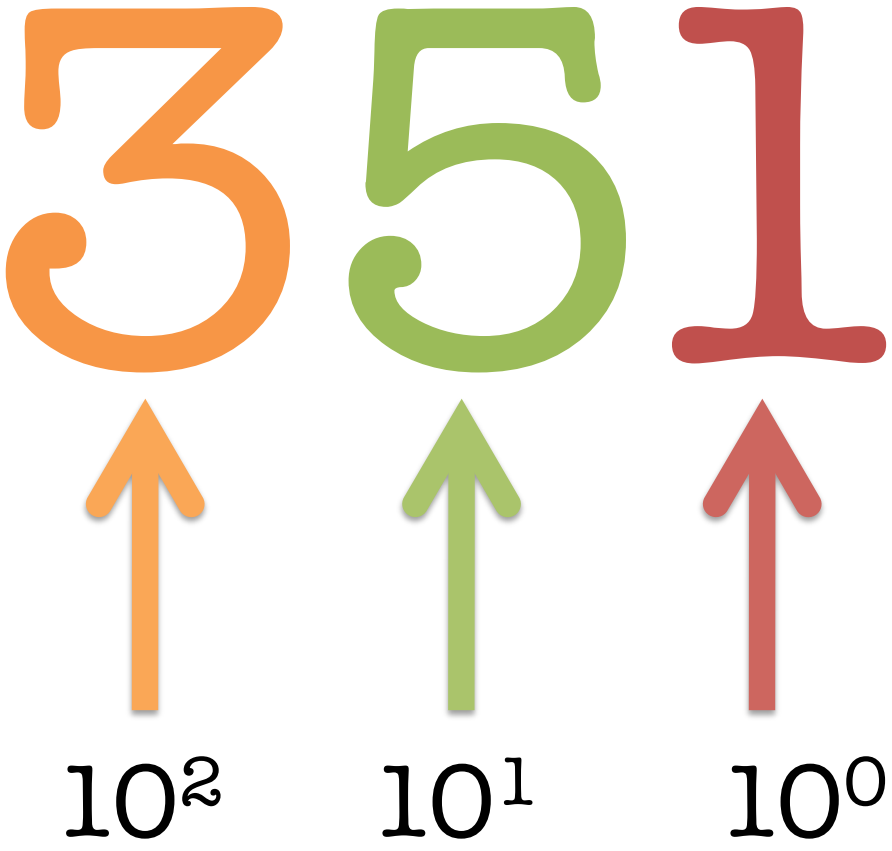
In other words,

$$
\begin{array}{r}
300 \\
50 \\
+\quad 1 \\
\hline
351
\end{array}
$$

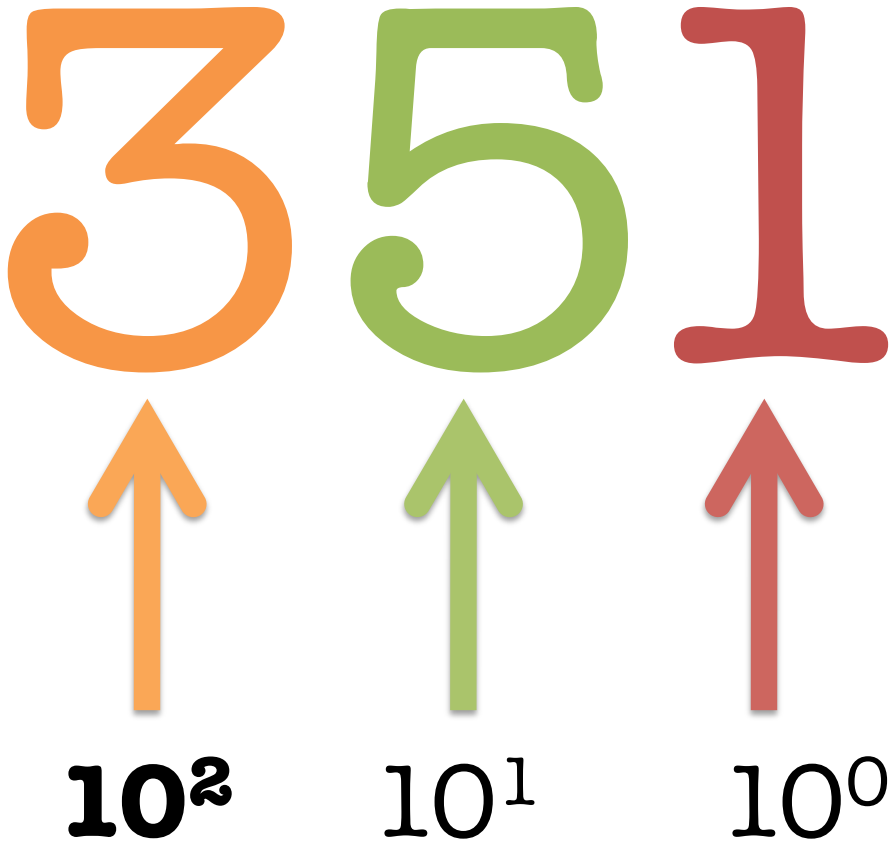
We usually say the
3 in the hundreds place,
the 5 is in the tens place,
and the 1 is in the ones place.

351

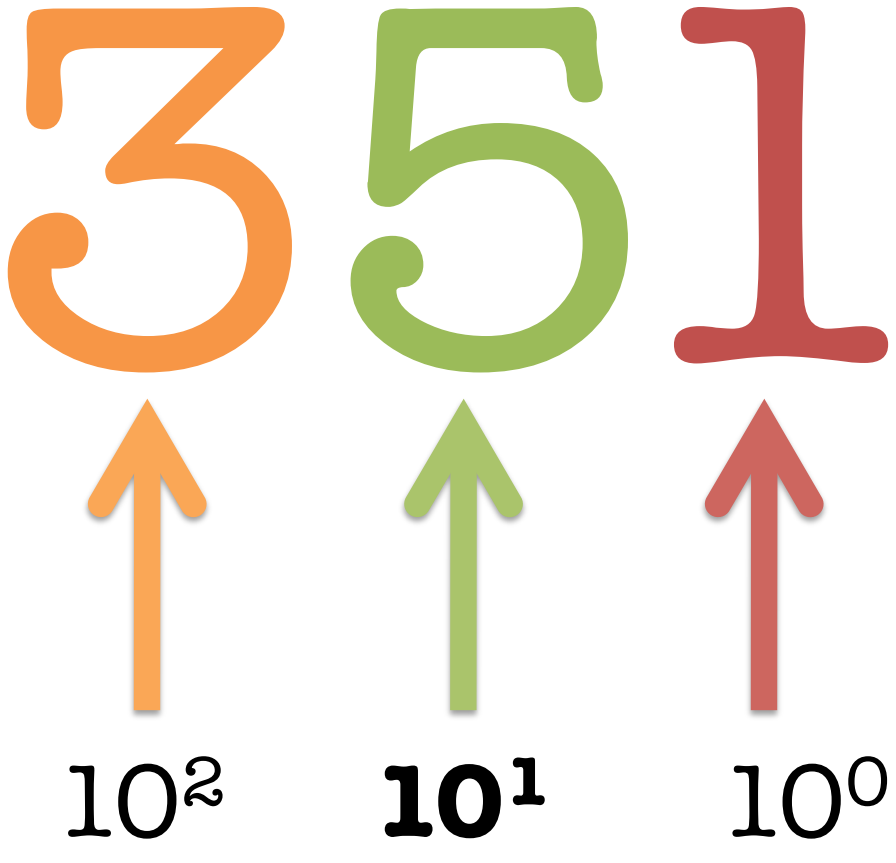
But what we're actually saying ...



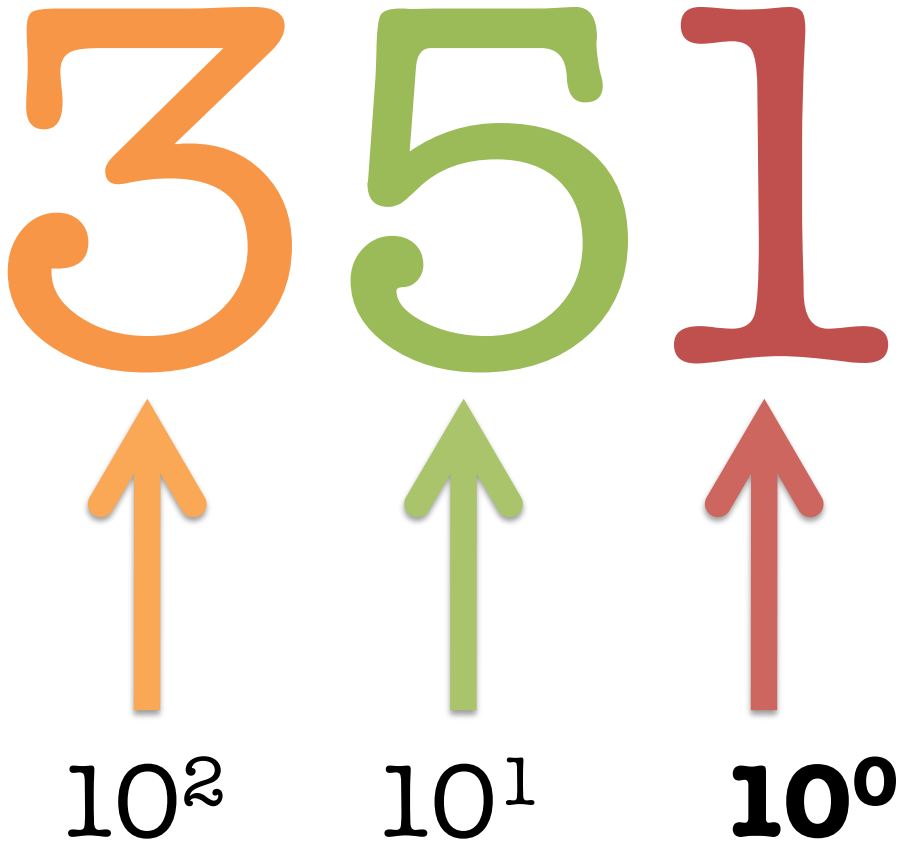
is that 3 is in the 10^2 place ($10^2 = 100$),



and 5 is in the 10^1 place ($10^1 = 10$),



and 1 is in the 10^0 place ($10^0 = 10$).



And so on!

1,000,000 100,000 10,000 1,000 100 10 1

10^6 10^5 10^4 10^3 10^2 10^1 10^0

Please read that

one more time

if it wasn't quite clear.

Go ahead! We'll wait.

So that's why our number system is called 'base 10'.

But binary is base 2.

That means ....

Instead of a “tens” place or
“hundreds” place,
we have a 2 place.
And a 4 place.
And an 8 place.

… 64 32 16 8 4 2 1

… 2^6 2^5 2^4 2^3 2^2 2^1 2^0

We count in binary from **right to left**, marking Os and 1s in each placeholder.

So "**2**" is actually "**one zero**" because there is one in the twos place and zero in the ones place.

1 0

64 32 16 8 4 2 1

3 is **one one** because there is one in the twos place and one in the ones place.

$$2 + 1 = 3$$

					1	1
64	32	16	8	4	2	1

4 is **one zero zero** because there is one in the fours place and zero in the twos place and zero in the ones place.

4 + 0 + 0 = 4

1 0 0

64 32 16 8 4 2 1

5 is **one zero one** because there is one in the fours place and zero in the twos place and one in the ones place.

4 + 0 + 1 = 5

1 0 1

64 32 16 8 4 2 1

6 is **one one zero** because there is one in the fours place and one in the twos place and zero in the ones place.

$4 + 2 + 0 = 6$

1 1 0

64 32 16 8 4 2 1

What is 7 in binary?

64 32 16 8 4 2 1

Good! **7 is 111** (one one one).

$$4 + 2 + 1 = 7$$

				1	1	1
64	32	16	8	4	2	1

What is 56 in binary?

64 32 16 8 4 2 1

Good! **56 is 111000.**

32+16+8+0+0+0 = 56

1 1 1 0 0 0

64 32 16 8 4 2 1

Your turn:

1) Play this game to practice.

http://forums.cisco.com/CertCom/game/binary_game_page.htm

2) Then, do the binary worksheet when you're ready.