This little thing called qubit

qubit (or qubit) stands for "quantum bit". In classical computation one uses **bits** for computation whereas **qubits** are used in quantum computation.

What is a bit ?

A bit is used in classical computation to carry information. It is an electrical state with two levels, for instance 1 Volt and 4 Volts. At each state is associated a numeric value: 0 or 1. This is the basic of binary numeric system.

In computers, classical microprocessors are running billions of operations using bits every second. Therefore your computer encode all values into a series of bits. For instance the value 7 is encoded as follow in a byte (a byte is a set of 8 bits):

0 0 0 0 0 1 1 1

I won't explain how to encode and decode values from mathematical value to binary value, someone else already did that right:

https://ccm.net/contents/57-binary-encoding

You'll need to be ease with this to understand what follows.

What is a qubit ?

Classic bits are based on voltage associated to binary level 0 or 1, while qubits are based on quantum states.

A qubit is a particle and has 2 base states noted |0> and |1> (called Dirac notation, we'll see that in detail later). As a quantum particle, it is in superposed state before being read. Like the cat that is both dead and alive before you open the box.

Let's come back to the previous experiment:
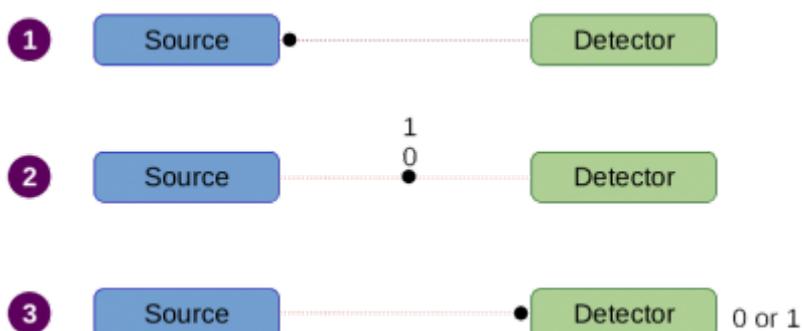
When the particle leaves the source it is in superposed state: i.e. a probability combination of |0> and |1>. When it comes to the detector, decoherence happens and the particle collapses to a fixed state |0> or |1>.

But manipulating qubits alone is quite useless. But the same way we can group bits into sets, qubits can be grouped into **registers**.
A quantum register is a set of several qubits we will use for computing.

You must wonder what is the point of qubits since we get 0 or 1 in the end like bits… all is about probabilities in the middle. Be patient we'll see that later.

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