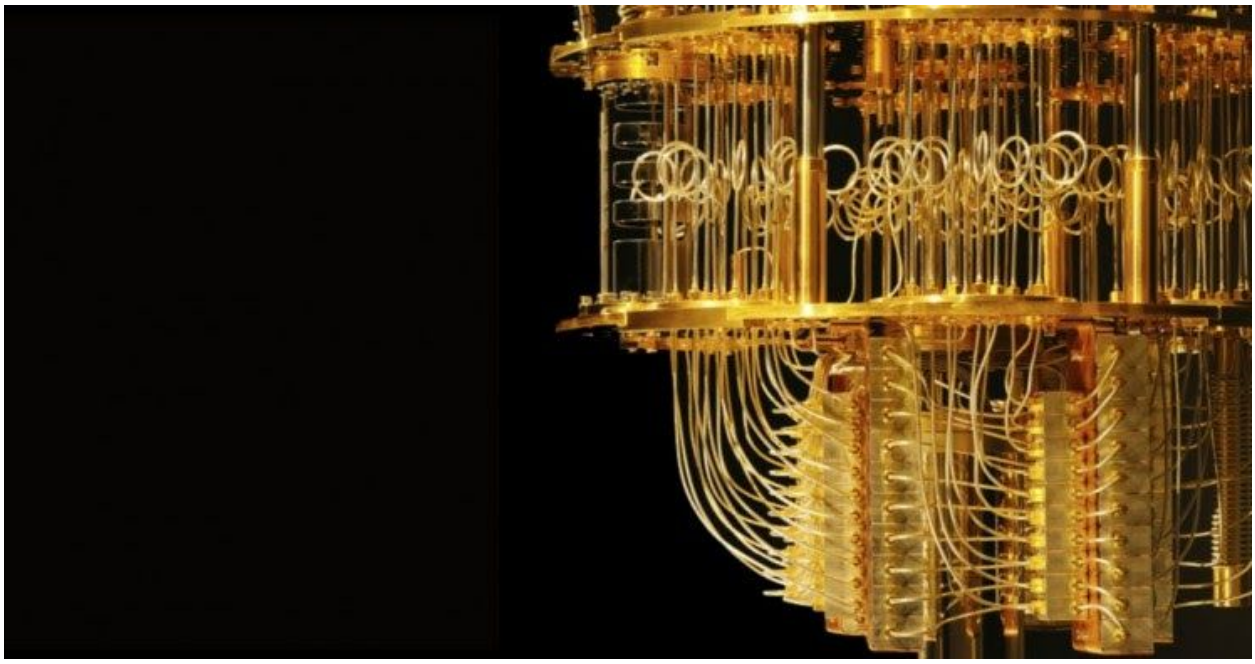
Quantum Computers



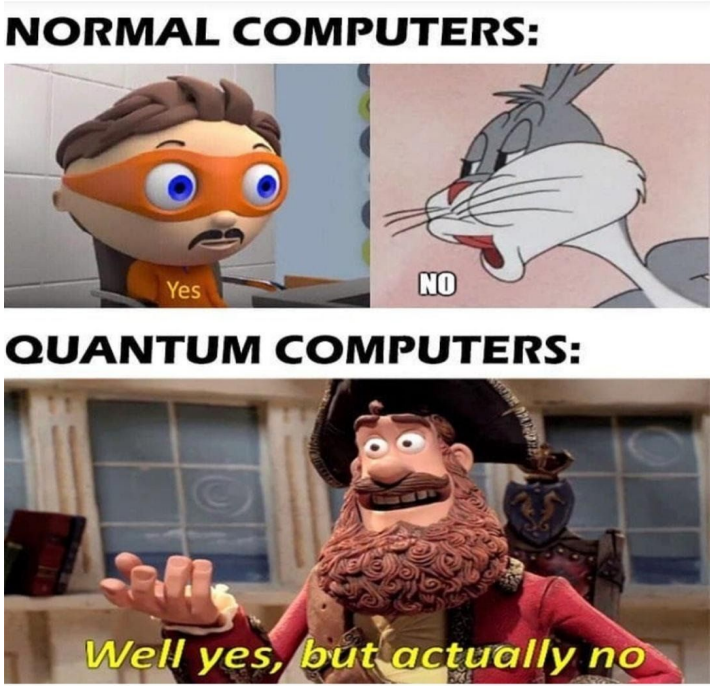
So, have you seen the computers in 1930s or 1950s they were huge by huge I mean they would need an entire room to fit in, Since then scientist have working on to make those computers smaller and powerful at the same time and by computer I mean the transistor which combined together in a logical manner forms logic gates and combinations of logic gates we can do simple arithmetic solving like plus, minus, multiply....

Quantum computers are based on Quantum mechanics, have you heard this before? Probably in the latest avengers movie, quantum mechanics explains the most simplest things around us like electron, photon, nucleus, atoms... but when you look into them they don't really obey the rules as the world around us does, Scientist made use of these quantum properties in particular the two most important quantum superposition and quantum entanglement.

Ok enough of that lets see what's happening inside a quantum computer , in a quantum computer the transistors are made smaller or I should say very small because they are now the size of an atom. In a normal computer there are bits and they carry information in the

form of 0 and 1, a bit can have a 0 or a 1 not both but in quantum computers there are quantum bits or in short qubit, these qubits are fascinating, they can exists in 0 and 1 at the same time, this is what gives quantum computers its superior computing power.

By 0 and 1 one I mean the spin of an electron, in your chemistry classes you would have learned electrons have some spins. There are two types of spins, spin up and spin down where spin up corresponds to 1 and spin down to 0. Qubits can be a nucleus, proton or an electron, commonly it's an electron, When you are measuring the spin of the qubit it has to decide on one but before you measure It will have the probability of both spin up and spin down which is known as quantum superposition And now comes quantum entanglement which is even more interesting, what you have is the ability to have two qubits in superposition state that essentially can only be understood with a collective element of both qubits.



This meme makes the picture clear, classical computers are very straight forward either it will be a 1(yes) or 0(no), but in qubits there are just probabilities.

Without going much deep, I have one more example to clear the difference between bits and qubits, For example if you have 2 bits and 2 qubits then the possible outcomes with both,

BITS	QUBITS
00	00>
10	01 + 10>
01	01 – 01>
11	11>

In the above table you can see, If we have the values of the 2-bits then the outcome is fixed to one for example if the values are 0 and 0, then the outcome is limited to only 00, but that's not the case with qubits here you are having the probability of all the four outcomes, So as you can see 2qubits actually contain 4bits of information, If you keep going you will find out that n qubits contains information equivalent to 2^n classical bits.

So, I think you shall be convinced by now that with so much power you can play valorant at 1000fps or finally able to run cyberpunk at max setting with no lag, well you can't do that , a quantum computer can't replace a classical computer(the one which you use at home) , infact these tasks will be much slower on the quantum computer, you see quantum computers can only perform certain calculations way faster than that of the classical computer, the speed of performing individual tasks to reach the final answer hasn't increased , **the total number of task to reach that final answer has decreased** , which in turn makes the whole calculations much faster.

Don’t be sad if you can’t run games on that, in fact you can do much better things on that like calculating the effects of global warming, artificial intelligence, logistics, astrophysics..... many more things . Coming back to my starting line that earlier computers need an entire room to fit in well that hasn’t change with quantum computers you see the outputs from the quantum computers get disturbed when it gets in contact with heat so we have to keep them cool or I should say way cooler , folks at D wave are able to achieve a temperature of 0.015 kelvin almost close to 0 kelvin or absolute zero and to do that it needs an elephant size cooling system, D wave is the only company which has started making commercial quantum computers and few of their buyers are google, nasa, los alamos national laboratory among many others, the future of quantum computers looks bright.

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