CON101: Post Silicon Architectures

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The silicon chip technology is reaching its end and starting to deviate from Moore's law which was though around 40 years ago. Transistors are a very critical component of every chip design. Right now are achieving a 5 nm design. Going beyond this won't be possible due to quantum scale effects and new technologies would be needed to replace our silicon chip soon.
Here a 5 post-silicon technologies -

1. **Quantum Computers** - With the ability to represent a superposition quantum state, they can run millions of computations at once. Another reason for a performance boost is that each qubit added to a machine exponentially increases the calculative ability of the computer. Still, this technology faces a few problems like the fact that the system has to be cooled to near absolute zero. Another issue is that quantum computers deal with situations differently and can only deal with specific problems and are not a replacement to conventional computing so they may be good at cracking encryption or predicting the stock market. Still, when it comes to tasks like booting a laptop, these are not that practical. Classical algorithms will probably win in sheer speed linear calculation. Thus, quantum computers do have a place in specific applications, but it's probably not going to replace our desktop computer.

2. **Nanomagnetics** - There are many advantages of SSDs over magnetic hard drives that use millions of magnets. Now, a processing chip can utilize a similar type of magnetic technology via swirling scale tornadoes of magnetism which can flow through a nano-wire network in a manner that reproduces the behaviour of logic gates. As an example, here, clockwise rotation can mean 1 and anticlockwise is 0. These vortices retain their winding without any power; hence this type of nanomagnetic chip would use very little energy. They are thus making this technology an excellent candidate to replace silicon.

3. **Optical Transistors** - The most significant problem faced by this technology is that light has a relatively large wavelength, nowhere close to the threshold achieved by silicon. However, there is a solution called a surface plasmon. A surface particle can be excited on the surface of materials. It can travel like a photon and hence are faster than a typical silicon computer and more im-

portantly it's even more efficient than a silicon chip-set. Such Light computers can be up to 5000 times faster than conventional computers, and for processors, this means achieving a terahertz clock rate. There are already some companies that are using light technology but reaching a plasma-light computer would take quite some time.

4. **Gallium Nitrate** - There is one material that might replace silicon and its called gallium nitride. Gallium nitride is also a semiconductor compound and can conduct electrons thousand times more efficiently than silicon. It can handle higher voltages and temperatures thanks to the band-gap. One of the few hurdles faced by this technology is that Gallium is typically used in the depletion type devices, so a transistor would be stuck on one position even when the gate voltage is zero.

5. **Liquid transistor** - These circuits are made of Gallium and iridium, and they can react with different voltages. A lot of research is going on these liquid metal transistors.