

CON Assignment - Post Silicon Computer Architecture

Rishi Shah

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1 Why Silicon will Disappear ?

Silicon is highly volatile in air and is expensive to produce. Silicon is normally difficult to produce. Silicon transistors cant provide more speed and need more power consumption for that. There is a trade off between speed and power consumption. We have to reduce the operating voltage of the circuit to get the speed. According the Moore's law, there would be an exponential growth in power in every year. But the ability of silicon to provide the same is dead. Silicon was once the king of computing world but now its counting its last days.

2 Alternatives

2.1 Graphene- the best alternative

Graphene is an allotrope of carbon similar to graphite. Its honeycomb sheet of carbon atoms. It is harder than diamond and much more elastic than rubber. One can say that it is the hardest existing element. There are many reasons , why we would choose graphene in place of silicon-

- electron mobility 100x faster than silicon
- better conductor of heat
- absorbs only 2.3 percent of reflected light
- it is impervious that is even the smallest atom of helium can not pass through it

Researchers claim that graphene can boost the clock speed of computer chips up to 500Ghz to 1000Ghz range. When we used silicon for frequency multiplier, it generated noisy signals which had to be cleaned and was expensive. With graphene, there are no noisy signals , hence the output is clean and does not require any filtering. Graphene also has a size advantage over silicon. Researcher claim that it is possible to create 10nm transistors from graphene. And these transistors are stable and conductive.

2.2 Photons

When we use silicon, the power is generated through the electrons that is by current. The electrical transmission is costly and power generation is less. Replacement of electrons with photons is considered as an option in the future. Electrons require a lot of energy to move the data and also generate too much heat on the way. This heat generated has to be taken care of which is again expensive and makes the system large. The method of using photons is called optical computing. Optical computing enables faster data transfer, reduces the heat generated and thus the systems made are small.

2.3 Quantum Computing

The computation systems working nowadays use bits to store the data. The data is stored in the form of 0s and 1s. Quantum Computing relies on quantum bits called qubits. They use superconductivity to create and maintain the quantum state. The problem with quantum computing is that working with qubits needs very low temperature. Any amount of heat can cause errors in the working. This is the reason that they are kept at absolute zero temperature. There is superposition of states along with quantum phenomena like the tunneling effects. The qubits are fragile and slightest interaction with the surroundings can distort them.

3 Conclusion

Surely there are various alternatives for silicon. But the king of computing will take time to be replaced as many of the industries are still based on old practises. So silicon will continue to remain the most used material in the field of computer architecture for at least the next 10 years.