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Computers have been improved over the years. Such as computers which took a lot of space, now fit in our pockets or even can be implanted in our bodies. This phenomenon is only possible because of the miniaturization of transistors.

There is introduces a bad news aka a digital roadblock, rate of miniaturization of transistors is slowing down. And its happening parallel to having AI and big datas in our device software's. Our devices provides us many services such as face recognition, etc. but since the limitation in our hardware technology, the software aspect may also be affected as well.

You may have experienced the frustration of an old smartphone or tablet grinding slowly to a halt over time under the ever-increasing weight of software updates and new features. There should be a soloution to this and there is!. The semiconductor industry is very well aware of this and is working on all sorts of creative solutions, such as going beyond transistors to quantum computing or even working with transistors in alternative architectures such as neural networks.

The reduction in the rate of miniaturization of transistors, is the increase in the complexity of the manufacturing process.

Before inventing the integrated circuit based on pure crystalline silicon wafers, the transistors used to be big, bulky devices.by improving and shrinking the size of transistors, nowadays we can place more than 260 transistors across a single

red blood cell. smaller transistors are faster switches, and smaller transistors are also more efficient switches.

Transistor schema: they are built layer by layer, on a pure crystalline silicon wafer. And every tine feature of the circuit is projected onto the surface of the silicon wafer and recorded in a light-sensitive material and then etched through the light-sensitive material to leave the pattern in the underlying layers.

As the transistor features got small and smaller, there was challenges due to the physical limitations. The semi-conductor factories would spend more money on this business. There was a new and cost-effective way in which the method was using molecular engineering and mimicking nature down at the nanoscale dimensions of our transistors.

One useful way for manufacturing semiconductors is to inspire from nature. Self-assembly is seen in the nature various times.it is a robust solution and it may useful for us since its useful for the nature.

One type of self-assemble material is called a block co-polymer. consisting of two polymer chains just a few tens of nanometers in length. But these chains hate each other. They repel each other. But we bond them together cruelly as they want to separate from each other. This built-in frustration will go all along the system till a shape is formed, which is nanoscale, regular, periodic. Which is what we need for the transistor arrays.

Using unsymmetrical molecules, enables us to create more elaborate structures. In unsymmetrical molecules, one polymer chain is significantly shorter than the other. Shorter chains forming a tight ball in the middle, forms the self-assembled structure.

In fact, we use molecular engineering to self-assemble nanoscale structures. We use chemistry, chemical engineering, to manufacture the nanoscale features that is needed for transistors.

The next challenge is to position these structures in the integrated circuit. This is possible by using wide guide structures that pin down the self-assembled structures, anchoring them in place and forcing the rest of the self-assembled structures to lie parallel, aligned with our guide structure.

The combination of these two challenges is called as "directed self-assembly". One of the other challenges to this approach is, that the whole system needs to align almost perfectly, because any tiny defect in the structure could cause a transistor failure. We use molecularly perfect system because there is billions of transistors in a single circuit.

Directed self-assembly method is a new and exciting disruptive technology. Yet its still in the development stage. But by having them introduced to semiconductor industry, and few years of development, this could become the new era of the molecule manufacturing.

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