Moore’s law: a path going forward

This paper deals with the applications of Moore’s Law in the technological advancement in the area of semiconductor Industry for 50 years. Semiconductor plays a vital role in the foundation of communication systems and is the basis of the Internet of Everything(IoE). However, the future predictions by the Moore’s Law were not considered valid after 50 years because of its ambiguous prediction since it was not a physical or natural law but a mere observation by Gordon Moore. The present scenario of increasing costs and efficiency of the integrated circuits pose a challenge to the developmental aspect. Introduction of 3D transistors which enhance the capability of CMOS Technology lead to increasing capabilities. In addition to the scaling of CMOS technology beyond 14nm, there are leading technology options on the horizon beyond CMOS with potential design benefits that can advance Moore’s Law well into the future.

Since this paper mainly deals with the concept of Moore’s law we will first define as to what this law is. The Moore’s Law states that “The transistors used in integrated circuits per inch doubles every year.” This law gave a lot of advantages to the field of electronic technology by decreasing the cost of the high – powered equipment which came down to a greater extent. The machines which had an application of Moore’s law were faster than those which didn’t. The transitions which have continued since the past years i.e from bipolar to MOSFETS, to CMOS, to voltage scaling and power efficient scaling have contributed significantly to the current scenario of developments in the silicon technology.

A trend towards making a digital, high-quality feature from integrated analog components like PLLs, I/Os, and thermal sensors have an application to improve the leading technology Intel i.e from 22nm to 14nm technology nodes. By contrast, the clock rates of the microprocessors have a relatively slow enhancement in the past few decades since there has been more stress towards the power efficient parallel architectures. But the improvements in the area density and power should keep pace with aggregate system bandwidth requirements as well. A type of semiconductor memory that uses flip-flops to store bits called static random access memory remains the workhorse for all various VLSI applications. But voltage scaling for power efficiency has created a challenge for the memory to operate in lower voltages. The most advanced 14nm FINFET has improved the SRAM voltages. With ever increasing memory requirements for the new applications such as high-resolution graphics and cloud computing, the traditional memories are not sufficient. Hence the use of the capacitor within an integrated circuit which serves the purpose of random access semiconductor memory called DRAM(Dynamic Random Access Memory) and EDRAM’s have been an alternative. Optimization at the system level is required for obtaining the full advantages of these new technologies as we are moving forward. An extension beyond the 2D scaling trajectory as predicted by Moore’s law called the

Monolithic 3D(M-3D) has emerged as an alternative for the integration technology that reduced the gaps significantly between the transistors and the interconnect delays which have added to achieve high performance in low cost. But logic-to-logic memory integration still remains an open area. The use of embedded multi-chip interconnect bridge in which a tiny silicon bridge is embedded in the packet substrate has provided a good chip-to-chip connection for high data bandwidth. For achieving economic benefits, the re-optimization of the overall systems architectures and configurations would become an important aspect.

Almost in every field whether it be communication or IoE, Moore’s law has played its role. It has application in the technological advancement related to computing devices and has enabled it to become a seamless and powerful force in day-to-day life.

More recently, speculations have focused on the economic end of Moore’s law. Because Moore's law suggests exponential growth, it is unlikely to continue indefinitely but in fifty years, it has vast contributions in the field of semiconductor technology, however, its technical benefits seem to have been declining. Reliability would become a major issue as well. It has been a strong belief that a new definition to the Moore’s Law would bring a new innovation in the Information Technology as it would bring a coordination among the technologies instead of miniaturization of long-existing technologies. Moore’s law has thrived to result in continuous innovation, rigorous and technology execution. And it will continue to power us into the future of CMOS and beyond. For Future Si technologies, the introduction of Enhancement mode Gallium Nitride transistors has been introduced.

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