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Is Moore’s Law Really Dead

The principle behind Moore’s law was first introduced in 1965, and since then it has driven innovation in the electrical engineering industry. This principle asserts that the performance of leading computer processors doubles roughly every one and a half years and it was proposed originally by Gordon E. Moore. In his 1965 paper he talked about the decreasing space between, size of, and cost of transistors found on integrated circuits. He stated, ”With unit cost falling as the number of components per circuit rises, by 1975 economics may dictate squeezing as many as 65,000 components on a single silicon chip” (G. E. Moore). A number in the range of 65,000 may have been a bold claim in 1965, but the recent flagship processor from Intel – the core i9 13900k – boasts up to 26 billion transistors on a single chip. This dramatic increase, albeit spanning several decades, shows that the original claims from Moore have been able to hold true since its inception. Despite the constant growth that has been prevalent over many years, Moore’s law has seemed to slow down more and more in the recent years. As components get smaller and smaller, we encounter physical boundaries and roadblocks which present many difficulties in the manufacturing processes of newer and faster chips.

With chips being manufactured in the nanometer scale, we encounter some new problems that have never been encountered before. Findings from an article showed that ”Further reduction in insulator thickness would have resulted in unacceptable (and exponential) increases in gate leakage current through direct quantum tunneling” (Theis and Wong). Direct quantum tunneling of electrons through oxide thickness is a phenomenon that shows that even if advances are made in finding processes to allow the manufacturing of smaller and smaller components, other physical limitations will likely arise which can prevent the functionality of ever-smaller components. Another physical challenge that is presented with minute components is the difficulty to discern between activated and deactivated currents. From the same article we learn that, ”Further reduction in operating voltage swing would have resulted in either unacceptably low channel current in the “on” state (unacceptable decreases in switching speed) or increased leakage current in the “off” state (unacceptable increases in passive power)” (Theis and Wong). With these presented difficulties, in order for a future continuation of Moore’s law, the future advances in manufacturing technology will have to present unique solutions. Until this point, the increases in computing power have come from placing more, smaller transistors on the same size chip. Due to these difficulties, solutions will have to come from unique innovations.

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