Pg 1 What is moores law?

For a special issue of the journal Electronics, Moore was asked to predict developments over the next decade. Observing that the total number of components in these circuits had roughly doubled each year, he blithely extrapolated this annual doubling to the next decade, estimating that microcircuits of 1975 would contain an astounding 65,000 components per chip.

There's a joke about personal computers that has been around almost as long as the devices have been on the market: You buy a new computer, take it home and just as you finish unpacking it you see an advertisement for a new computer that makes yours obsolete scientists, electrical engineers, manufacturers and journalists extrapolated Moore's Law from his original observation. In general, most people interpret Moore's Law to mean the number of transistors on a 1-inch (2.5 centimeter) diameter of silicon doubles every x number of months.

moore's law implies a quadrupling of computing power due to the combination of more and faster transistors. yet the number of transistors devoted to performing logic operations has not grown exponentially during the last several years. cache memories have increased in size, but this has resulted in only modest performance increases. as a result, computer system power now appears to be doubling every three years, even though ic transistor density is still doubling every two years. if ic transistor density doubles every four years, processor performance may double every 5-6 years. unless computer designers find a better way to use transistors than simply increasing cache size, and a better way to improve performance than simply increasing clock speeds, it will be difficult to continue increasing computer speeds exponentially.

Pg 2 the impacts of moore’s law.

Economic Impact

Performance—aka power—and cost are two key drivers of technological development. As more transistors fit into smaller spaces, processing power increased and energy efficiency improved, all at a lower cost for the end user. This development not only enhanced existing industries and increased productivity, but it has spawned whole new industries empowered by cheap and powerful computing.

Technological Impact

Moore’s observation transformed computing from a rare and expensive venture into a pervasive and affordable necessity. All of the modern computing technology we know and enjoy sprang from the foundation laid by Moore’s Law. From the Internet itself, to social media and modern data analytics, all these innovations stem directly from Moore and his findings.

Societal Impact

The inexpensive, ubiquitous computing rapidly expanding all around us is fundamentally changing the way we work, play and communicate. The foundational force of Moore’s Law has driven breakthroughs in modern cities, transportation, healthcare, education, and energy production. In fact, it’s quite difficult to envision what our modern world might be like without Moore’s Law. Moore's Law, framed by Intel co-founder Gordon Moore, continues to have a significant impact on the electronics sector as the fundamental principle that guides the course of modern computing and the semiconductor industry. One of the economic impacts of the law is that computing devices continue to show exponential growth in complexity and computing power while effecting a comparable reduction in cost to the manufacturer and the consumer. Interdisciplinary bodies such as the Materials Research Society continue to feature improvements and innovations in the process of chemical mechanical planarization, an abrasive cleaning technique used in manufacturing integrated circuits that optimizes the cost and efficiency of the chip. Consequently, the lowered cost of manufacturing and the increased reliability of new technology nodes has resulted in significant improvement in the equity and operating profits of the semiconductor industry and, as a result, the electronics sector.

Marketing has accelerated. The cost of “launch and see” is now higher than the cost of the tools and time needed to test campaigns during development. The opportunity cost of websites, ads and email campaigns that return mediocre results is too high. With inexpensive behavioral tools, we can now launch campaigns with confidence. Big companies use big data to gain an advantage. Yet the quality of your data doesn’t determine the success of your business anymore. It is the quality of your questions — because we can now answer almost any question you have with behavioral science driven by Moore’s Law.

Pg 3. After moore’s law.

“There’s a law about Moore’s law,” jokes Peter Lee, a vice-president at Microsoft Research: “The number of people predicting the death of Moore’s law doubles every two years.” But now the computer industry is increasingly aware that the jig will soon be up. while the benefits of making things smaller have been decreasing, the costs have been rising. This is in large part because the components are approaching a fundamental limit of smallness: the atom. A Skylake transistor is around 100 atoms across, and the fewer atoms you have, the harder it becomes to store and manipulate electronic 1s and 0s. More radically, some hope to redefine the computer itself. One idea is to harness quantum mechanics to perform certain calculations much faster than any classical computer could ever hope to do. Another is to emulate biological brains, which perform impressive feats using very little energy. Yet another is to diffuse computer power rather than concentrating it, spreading the ability to calculate and communicate across an ever greater range of everyday objects in the nascent internet of things. The next logical step, says Mr Snir of Argonne National Laboratory, is “gate-all-around” transistors, in which the channel is surrounded by its gate on all four sides. That offers maximum control, but it adds extra steps to the manufacturing process, since the gate must now be built in multiple sections. As you may know, extreme ultraviolet (EUV) has been waiting in the wings for years now, never quite reaching full readiness due to its extremely high power usage and some resolution concerns. In the mean time, chip makers have fallen back on increasing levels of multiple patterning—multiple lithographic exposures, which increase manufacturing time (and costs).

Now, however, directed self-assembly (DSA)—where the patterns assemble themselves—is also getting very close to readiness. If either technology wants to be used over multiple patterning for 7nm logic, the ITRS says they will need to prove their readiness in the next few months.

for computing to continue to improve at the rate to which everyone has become accustomed, something more radical will be needed. One idea is to try to keep Moore’s law going by moving it into the third dimension. Modern chips are essentially flat, but researchers are toying with chips that stack their components on top of each other. Even if the footprint of such chips stops shrinking, building up would allow their designers to keep cramming in more components, just as tower blocks can house more people in a given area than low-rise houses. Quantum computing proposes to use the counterintuitive rules of quantum mechanics to build machines that can solve certain types of mathematical problem far more quickly than any conventional computer, no matter how fast or high-tech (for many other problems, though, a quantum machine would offer no advantage). Their most famous application is cracking some cryptographic codes, but their most important use may be accurately simulating the quantum subtleties of chemistry, a problem that has thousands of uses in manufacturing and industry but that conventional machines find almost completely intractable. A Canadian firm called D-Wave already sells a limited quantum computer, which can perform just one mathematical function, though it is not yet clear whether that specific machine is really faster than a non-quantum model. The ability to remove the hardware that does the computational heavy lifting from the hunk of plastic with which users actually interact – known as “cloud computing” – will be one of the most important ways for the industry to blunt the impact of the demise of Moore’s law. Unlike a smartphone or a PC, which can only grow so large, data centres can be made more powerful simply by building them bigger. As the world’s demand for computing continues to expand, an increasing proportion of it will take place in shadowy warehouses hundreds of miles from the users who are being served.