

The Most Important Company In the World

Intel, Moore's Law,
and the
Heartbeat of Civilization

Michael S. Malone

Intel Corporation is the world's most important company—and for all the wrong reasons.

It's not the most valuable company. It was once for a brief period a decade ago; but these days that title usually belongs to Apple.

It's not the most successful company, nor the fastest growing, nor the most admired, nor the most profitable. At various times, Intel has been all of those things. But not lately; in fact for the last five years, the company's financials have been relatively flat—indeed, Intel's stock price, after a long slide, is just getting back to where it was in 2008.

Intel was also once considered the best run company in the world. But that was more than a decade ago, under the leadership of Andy Grove, arguably the greatest CEO of the last half-century. But Grove was three CEOs ago—and though the new CEO shows promise, he's only been on the job a few months... and the jury is still out.

In fact, Intel isn't even talked about much these days even in Silicon Valley. The excitement has long since moved on to hot streaking young social networking companies like Google, Twitter, and LinkedIn. And you would be hard-pressed to find a young employee at any of those companies who could recount to you Intel's story, or how computer chips are made.

And yet, Intel still remains in the position it first captured almost forty-five years ago: the world's most important company.

Why? Because, at the end of 1969, a team at Intel built the first working microprocessor—the single most influential invention of the modern world. And, with perhaps 100 billion of them in use (ten for every human being) it is also the most ubiquitous invention in history.

The microprocessor can be credited with inventing the world we now live in. It did so through the many products and services it made possible: the personal computer, the smart phone, and most of all, the Internet. But even more so because the microprocessor is the ultimate manifestation of Moore's Law.

Fifty years after it was first devised by Dr. Gordon Moore, who would soon thereafter co-found Intel, most people have a basic notion of what Moore's Law is—which itself is remarkable, given its humble origins as an article in an obscure new tech industry called static-Random Access Memory chips for an electronics trade magazine. They will tell you that it means that computer chips get more powerful, or less expensive, every year.

That's not a bad description. It does, in fact, capture the most salient characteristic of Moore's Law, the one Gordon first noticed way back when there had only been a couple generations of these revolutionary memory chips: that integrated circuits (i.e., computer chips) do seem to

double in performance every couple years. More specifically, either the same chip model drops in price by half during that interval, or, for the same price you can buy a new chip model that doubles in value by some combination of reduced price, smaller size or greater performance (processing speed, data storage, etc.)

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Twenty generations later, though the rate has slowed slightly, the Law is still in effect. And, thanks to this doubling, those memory chips that Dr. Moore first plotted, which had a couple thousand transistors on-board, now contain more than three billion. The simple features on the surface of those early chips has been replaced by a enough channels, pipes, and gates to equal all of the buildings, streets, powerlines, and plumbing in a large city. And these miracles of design are matched by another miracle of manufacturing—a modern multi-billion dollar chip fabrication factory is more complicated than the Apollo program—that worldwide produces more than 10 billion of these chips per year.

Impressive indeed, but that only explains why technologists should know Moore's Law. Why is it also taught now to school kids, and why does every company, every entrepreneur, and every government in the developed world continuously track the progress of the Law?

The answer is that Moore's Law didn't stay confined to the world of memory chips, or even, beginning in the early 1970s, microprocessors—those remarkable chips that combined logic, memory and input/output on a single chip; the “computer on a chip.” Rather, thanks to the microprocessor and a lot of software code, the chip business burst out of its original confines of mainframe computing and began its march out across every sector of modern civilization: education, warfare, transportation, communication, energy, defense, housing, and on and on.

It did so not just because each new click of Moore's Law opened up a whole new set of business opportunities, but also because in each of those sectors it soon became clear that if there was any way to embed these processors into your business, it too would begin to exhibit the same steep doubling curve of the Law itself. Put processors in an automobile, thus giving it a ‘brain’ and suddenly the car could tune itself and run at maximum efficiency—meaning that it went to the garage every 100,000 miles instead of 2,000. Add processors to the computing side of the Human Genome project and it was completed in ten years instead of fifteen. And put them into telephones and notepads and you set off a trillion dollar new industry—social networking—that becomes the fast-growing, and most widely adopted, business ever.

You cannot change every industry on the planet and redirect the course of history without changing what it means to be a human being. Look back at the future as it was predicted in the late 1950s when Robert Noyce, Intel's other co-founder, was inventing the integrated circuit. Ours was to be a Jetsons world of atomic-powered homes and flying cars and personal robots doing all of the dirty work of daily life. None of it came true, of course, not least because this was a vision of a mechanical world—and powerful, reliable machines turn out to be really hard to build, especially by the millions and billions.

Semiconductors, especially the microprocessor, offered us a different path. Faster, easier, and rather than an extension of the world we already knew, a whole new reality—a digital world filled with all sorts of wondrous new products and services: personal computers, smartphones, video games, and most of all the Internet. It was worth the trade—not least because they worked.

But the biggest invention of our digital age is one we rarely think of: ourselves.

It is human vanity to believe that we can live through a period of radical change—like the digital revolution that we have now experienced for three generations—without being changed ourselves. But we are different, even from our grandparents, and not least in how we have assimilated living in a world of continuous, accelerating change.

Mankind lived for hundreds of thousands of years with almost no change. Then, with the Industrial Revolution, we learned to inhabit a world of continuous improvement. But now, we deal with lives that experience the equivalent of an Industrial Revolution every few years. We've survived it, we've adapted to it, and now we are learning to thrive in it. And, though we barely noticed the change, we now live differently, learn differently, communicate differently, and ultimately think differently. We didn't get our atomic helicopters, but what we did get—instant access to all of the world's knowledge—was a better deal.

In other words, we have internalized Moore's Law. Its beat is now our heartbeat; its pace of change is now the heartbeat of civilization.

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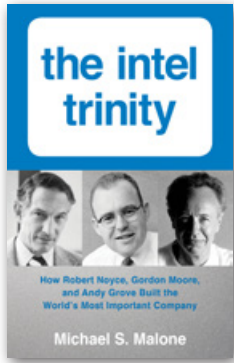
And that is why, even if it has grown middle-aged and slightly gray-haired, Intel remains the most important company in the world. It was, and is, and with luck, will always be the keeper of the flame of Moore's Law.

The ferocious Andy Grove, the third member of the Intel Trinity, lashed Intel to Moore's Law, bound their fates together—and whenever the company slipped under this heavy yoke, or quailed at this enormous responsibility, it was Grove who whipped, threatened, and cajoled Intel to regain the pace.

From the day it invented the microprocessor, and even before, Intel has never failed to keep Moore's Law on track—and in the processor it has forced all of its competitors to do the same. And it is that historic commitment, ingrained in the company's DNA by the three men who led it for its first thirty years, that has made possible all of those more famous products and services of the digital age. Every day, more and more of the world is built upon and depends upon Moore's Law. And like Atlas, Intel holds that digital world on its shoulders.

We can only hope that it doesn't grow weary of this duty anytime soon and set its burden down, because the world after Moore's Law and Intel will likely not be one we want to live in. 🙏

Info



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ABOUT THE AUTHOR | Michael S. Malone has covered Silicon Valley and high tech for more than thirty years, and he was twice nominated by the *San Jose Mercury News* for the Pulitzer Prize for investigative reporting. He is the author or coauthor of more than a dozen award-winning books, including *The Virtual Corporation* and *The Future Arrived Yesterday*, and a regular editorial writer for the *Wall Street Journal*. Malone holds an MBA from Santa Clara University, where he is an adjunct professor. He is also an associate fellow of the Said Business School at Oxford University and is a Distinguished Friend of Oxford.

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