

Opinion **New Technology Policy Forum**

Eli Noam: Moore's Law at risk from industry of delay

Eli Noam JANUARY 19 2006

Forty years ago, Gordon Moore, the computer electronics pioneer, observed that the power of semiconductors doubled every one to two years and predicted the trend would continue. This rate of progress – about 50 per cent a year – became famous as “Moore’s Law”.

Mr Moore went on to become a giant in the computer field, a founder of microprocessor-maker Intel, a billionaire and recipient of many honours. But he is best known for his eponymous law. It described progress over the following decades pretty well. Computer components became smaller, or more powerful, or cheaper, at roughly the predicted rate. Whereas in 1970 a memory chip would store 1,000 bits, it now holds 32bn. Such progress enables marvels of technology, from CAT scans to video on mobile phones. It also provides an anti-inflationary force to the economy.

Almost immediately, however, people questioned the law’s validity. The basic objection was that an exponential trend of this magnitude could not continue into the far future. Yet Moore’s Law has shown remarkable resiliency. Further progress will come from exotic sources such as three-dimensionality of components, carbon nano tubes, quantum computing, X-ray lithography, system-on-a-chip and new fabrication systems.

Part of the secret of the law’s success has been its move from prediction to self-fulfilling prophesy. It establishes a time line for progress that everyone in this decentralised industry understands. When a company is developing its next generation of components, it knows the overall pace of technology progresses at the rate of Moore’s Law and it must match it. If it falls behind, it must add engineers, money and partners to its development effort. If it is too far ahead, it may end up designing products that are too far ahead of the market to find buyers. If its production costs do not drop fast enough, it must compensate by gaining scale or moving to cheaper shores. Like a giant bell tower, Moore’s Law has helped to synchronise global electronics.

So, in technology, Moore's Law is alive and well. But technology does not operate in a vacuum. No business or government institution can change at 50 per cent a year. While stability and tradition are important, if a fundamental technology progresses far beyond society's ability to absorb its impacts, a growing disconnection occurs. When, in the 19th century, technology proceeded at a rapid pace while social institutions did not, the results were upheavals and revolutions. Today, again, the key elements of the information economy are progressing at a scorching rate, while private and public institutions are lagging behind.

Examples include the way the US lost leadership in mobile wireless and broadband internet because of interminable governmental processes in spectrum allocation. Around the world, it has taken more than a decade to set the rules on interconnection among telecommunication carriers, and they are still far from settled. This has slowed the entry of new-style carriers.

The question of whether new broadband services should be treated in the same time-consuming way as traditional telecommunication has tied regulators in knots and recently created a confrontation between Brussels and Germany. In South Korea, video over the internet requires a broadcasting licence, which has slowed how much the network is used. Patent offices everywhere are falling behind their workload. It may soon take more than five years to get a patent in the US.

In businesses, competitive pressures lead to a speed-up of internal processes or companies fail. But for government the same is not true, even with globalisation. Courts can take years to resolve disputes. Regulators and legislators require years to establish rules. There is an entire industry out there, the main product of which is delay.

Some of the problems of these decision processes are inherent and based on the need to balance social objectives. But others could be remedied. In the US, the delay in courts could be alleviated by tripling the number of judges. Compared with the overall cost of government, judges are cheap. So are patent examiners. Streamlining administrative law, simplifying the appeals process or creating mandatory arbitration mechanisms should not be expensive. The economic benefits would be incalculable.

One needs focus not just on policy substance but also on its process – the small but constant frictions in the mechanism of government that grind down innovation and threaten to repeal Moore's Law where physics could not.

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