

Trends in Technology

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Abstract

Any attempt to assess trends or future directions enforces learning modesty in view of the interdependencies spanning the whole field of science and technology, even constraining us to a short list. But the increasing dependency of our economic and scientific development and the lead time between laboratory and market of more than a decennium make it both an opportunity as well a prerequisite for meaningful planning of our future.

Everybody is aware of the fact that continued exponential advancement of cannot be sustained forever - even in semiconductor and computer technology- but predictions of limits have been proven wrong in the majority of cases in the past. The predicted boundaries have been shifting nearly at the same speed as the improvements in technology. Some of these developments and the impressive efforts to make this happen and the obstacles to be overcome will be discussed.

Both the efforts in semiconductor and computer technology in the pursuit of Moore's Law in lithography, design, interconnection, architecture and cost management in light of potential diminishing returns as well as arising scenarios for a "beyond transistor" or "post silicon" area and their associated paradigm changes will be addressed.

Can we already see upcoming replacements for the silicon technology or are there final technical and economic limits to the viability of such technologies?

What are the options until a replacement is available, i.e. are there options for "Moore by other means" to bridge the gap until feasible new technologies are ready?

The evolution of semiconductor technology has been congenially symbiotic with the developments of storage and communication technology. How will new emerging technologies complement this in light of the changing market opportunities as e.g. mobile electronics, embedded electronics, photo electronics, or new man-machine interfaces?

Increasingly we are also dealing with a plethora of technologies of different histories merging and empowering also other fields of science. As economic force these technologies might be only at their beginning, becoming multidimensional and all pervasive. The one-dimensional landscape of silicon might change into a scenario of an interfacing plethora of sciences as varied as biotechnology, nano-mechanics or optical technologies.

Combine this with the innovative power and dynamics of silicon technologies applied to an integrated spectrum of electronics, photonics, ubiquitous networks and optical connections, i.e. chips with hybrid technologies encompassing processors, DRAMS, RF, MEMS, sensors, passive components and optical technologies and arrive at a scenario where previously utopian features will not look so utopian anymore. The future might not only be the quest for smaller but also for the more complex and intelligent.

Statements about the future, have often not only underestimated the ingenuity of scientists and engineers, but also misjudged the pace of technology and its impact on other fields of science, society and economy - this paper might be included - but nevertheless it looks like "the best is still ahead".