

# Rethinking Moore's Law<sup>\*</sup>

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<http://hartenstein.de/hartenstein-bio.pdf>

Silicon micro circuits with a feature size of 20 nanometer are not proven to be manufacturable (the „20 nanometer wall“). Around 10 nanometer and less we reach the domain of quantum mechanics. The end of Moore's law is near. Because of cooling problems (up to 120 watts) the microprocessor giga cycle clock speed race has been closed down around the year 2005. Throwing more processor cores onto the problem (up to 80 cores per micro chip pre-announced) could delay reaching the limits. But this is not the silver bullet. A Los Alamos study indicates, that with 16 or more cores less performance is obtained than with 8 cores. An ORNL study claims here, that much more performance cannot be reached only with COTS processor chips. Also using GPGP is not the silver bullet for most application domains. John Hennessy, founder of MIPS and now president of Stanford University, means, that he would be panicking if he would be in industry. Are we facing a decline from growth industry to replacement business?

In addition to the end of Moore's law we have another severe problem: the rapidly increasing energy cost of running all visible and hidden computers including our total computerized cyber infrastructures. Already now Google alone causes 2% of the worldwide electricity consumption. A recent study estimates, that, if current trends continue, the electricity consumption of the internet will grow by the year 2030 up to 30% of to-day's worldwide electricity consumption. A study by Mark P. Mills, however being subject of controversial discussions, estimates that all computers in the US burn up more than 25% of the total electricity consumption of the US. Main reason of the immense electricity consumption of computers is the predominance of the von Neumann paradigm. Summarizing its immense inefficiency, Prof. C. V. Ramamoorthy from UC Berkeley has coined the term „von Neumann Syndrome“. My talk discusses the highly promising impact of Reconfigurable Computing on both, the end of Moore's law and the immense energy cost of computing.

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<http://www.ece.lsu.edu/vaidy/raw/>