DAC 50th Anniversary Keynote

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Editor’s notes:
This article is based on a visionary talk presented at the 50th DAC. It illustrates the role of EDA in shaping the semiconductor industry in the past 50 years, and its exciting technical challenges in the next 50 years to shape the big systems.

—Yervant Zorian, Synopsys

The EDA industry has been a tremendous place to be in the last 50 years. The reason is the same as any other exciting industry, consisting of two things: First, the exciting, tough, and technical problems to solve that make a real difference, that change the world, and that change the way we do things; and second is the financial growth and opportunity. To start new companies, grow those companies, and grow small companies into big companies. It’s true today in social networking and biotechnology, but also semiconductor electronics and EDA.

Probably no technical challenge or change has been greater than what’s happened because of EDA over the last 25 years. With about a 3% per year growth in the number of electronics engineers, the number of transistors designed and produced has increased five orders of magnitude in 25 years, enabling products we never imagined possible.

And with those technical challenges has come growth. In an industry where our customers did largely manual design in the 1960s and well into the 1970s, following an approach of "design it, build it, test it, and redesign it". Automation has now created a flow and an industry of over $6 billion dollars.

But as you know, all good things have to come to an end. And we hear about Moore’s Law, it’s coming to an end. Even Gordon says no exponential can be forever. And yet for a dying law, it’s doing pretty well. You take a look at the percent of wafers produced with each technology node, and what you notice in the last four, and soon to be another generation, that the slope of adoption of new technology has accelerated, not slowed. Ramp-up is happening even faster. And if you look at the technology challenges we face today, just to implement 20, 14, and 10 nanometer processes, we’re undergoing one of the most disruptive changes that we’ve seen in years: a
totally new transistor structure in FinFET. Design automation tools never had to worry about thermal analysis or stress in the past, and yet it’s a major requirement now. As is reliability, electromigration, and other things that now the designer has to worry about with the help of tools from start-ups and from established EDA companies. And we really, seriously need another two orders of magnitude in power reduction. Technical challenges continue coming as we follow this Moore’s Law path.

But there is something else—something very, very unique about the semiconductor industry—that’s different from others industries. Most industries mature: steel, textiles, cotton, coffee. They all reach a point where their unit volume growth slows to single digits. Even more recent industries, cell phones and computers, are low double digits in terms of unit growth. As we move beyond that Moore’s Law era, that unit growth is what is going to create the next big wave of excitement, far bigger than the one we’ve come through. Transistor units grow at 72% per year, unlike any other commodity in history, continuing a compound average growth rate far greater than any other of the historical growths of industries. That powers a learning curve.

That learning curve is a log-log plot of the cost per unit versus the cumulative number of units produced. It’s a perfect straight line. It is for every industry, but it is much more perfect and longer for the semiconductor industry because of that unit growth. Now Moore’s Law is merely a mechanism that has helped us stay on that learning curve for a period of time. But the future will continue as long as the unit growth continues. And incidentally, I’d like to point out that the EDA industry has stayed on an exactly parallel learning curve, if you examine EDA revenue per transistor, as it must. If not, then we would drag down the semiconductor industry and become a bigger and bigger percent of its revenue.

So what comes next? When Moore’s Law makes it difficult, or not cost-effective, to shrink in the xy plane, we grow in the third dimension. We add layers, we build 3D devices, we do more functions per dollar by integrating photonics, by integrating mechanical functions or new materials, and stay on that learning curve with all that growth. There are plenty of technical challenges, and they’re exciting ones. But what about the economic growth?

The EDA industry, thus far, has been powered by the semiconductor industry, taking it from manual design of chips to automated design. And as that revenue for EDA grew, it flattened out at 2% of semiconductor revenue and has been at that 2% for the last 15 years, almost constant. It’s a $300 billion semiconductor industry, so therefore it’s about a $6 billion dollar EDA industry. But the big thing yet to come is the growth driven by the systems design world adoption of automation, and that systems world is right about where the semiconductor industry was in the late 1960s and early 1970s in terms of design methodology. We’re talking about a $1.9 trillion dollar industry, 2% of that $38 billion, is six times what the EDA industry is today. And that opportunity is real.

The importance and significance of it was introduced to me by our keynote speaker today, Gregg Lowe, when in the early to mid-1980s he, as the account manager for Texas Instruments for BMW, took me in to visit Herr Dr. Wolfgang Ziebart, who at that time was head of engineering for BMW. And Gregg had the task of convincing BMW they should design digital signal processors into their cars. We visited them many times. Herr Dr. Ziebart eventually became CEO of Infineon. But while he was head of engineering at BMW, he did indeed not only design in digital signal processors, but was a leader in the wave of other automotive electronics.

Gregg did his job, and the industry has expanded to the point where the bill of materials of an automobile today is approaching 50% electronics. The semiconductor industry didn’t adopt EDA because they WANTED to; they did it because the complexity became too great to do it manually. The same thing is happening in the automotive industry. And not just the automotive industry, it’s happening in the systems business in general. Not just planes, trains, cars, but big systems, as Gregg will address today, the Internet of Things. We are going from hundreds of millions of electronic components to billions of components, sensors, intelligent sensors, machine communication, and processing of data that will solve the really big problems in the world. The technical challenges and the growth for the next 50 years are far greater than the 50 years we’ve come through. It’s going to be a great, great time to be in a great industry.

Thank you.
Wally Rhines is Chairman and Chief Executive Officer of Mentor Graphics, a leader in worldwide electronic design automation with revenue of $1.1 billion in 2012. During his tenure at Mentor Graphics, revenue has more than tripled and Mentor has grown the industry’s number one market share solutions in four of the ten largest product segments of the EDA industry. Prior to joining Mentor Graphics, Rhines was Executive Vice President of Texas Instruments’ (TI) Semiconductor Group, sharing responsibility for TI’s Components Sector, and having direct responsibility for the entire semiconductor business with more than $5 billion of revenue and over 30,000 people. During his 21 years at TI, Rhines managed TI’s thrust into digital signal processing and supervised that business from inception with the TMS 320 family of DSP’s through growth to become the cornerstone of TI’s semiconductor technology. He also supervised the development of the first TI speech synthesis devices (used in “Speak & Spell”) and is co-inventor of the GaN blue-violet light emitting diode (now important for DVD players and low energy lighting). He was President of TI’s Data Systems Group and held numerous other semiconductor executive management positions. Rhines has served five terms as Chairman of the Electronic Design Automation Consortium and is currently serving as co-vice-chairman. He is also a board member of the Semiconductor Research Corporation and First Growth Family and Children Charities. He has previously served as chairman of the Semiconductor Technical Advisory Committee of the Department of Commerce, as an executive committee member of the board of directors of the Corporation for Open Systems and as a board member of the Computer and Business Equipment Manufacturers’ Association (CBEMA), SEMI-Sematech/SISA, Electronic Design Automation Consortium (EDAC), University of Michigan National Advisory Council, Lewis and Clark College and SEMATECH. Dr. Rhines holds a Bachelor of Science degree in metallurgical engineering from the University of Michigan, a Master of Science and PhD in materials science and engineering from Stanford University, a Master of business administration from Southern Methodist University, and an Honorary Doctor of Technology degree from Nottingham Trent University.

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