



**Blinding, sometimes scorching, insights
into the global electronics industry.**



The BRIGHTEST IDEAS *in* ELECTRONICS

The top editors of Electronic News, Electronic Business and EDN sat down with John Daane, president and CEO of Altera; Roy Vallee, chairman and CEO of Avnet; Bernard Meyerson, chief technologist at IBM; Lothar Maier, CEO of Linear Technology; Walden Rhines, chairman and CEO of Mentor Graphics; James Truchard, president and CEO of National Instruments; and Brian Halla, chairman and CEO of National Semiconductor. What follows are excerpts of that conversation.

Q: Looking forward, will technology be the differentiator?

Meyerson: If you're implying that technology is commoditized to the point that everyone can step back and make their living on design alone, I would say, 'no.' The fact of the matter is, technology can be a very significant differentiator. The trick is not to ever fool yourself that it's the only differentiator. A consumer buys systems. That consumer doesn't buy an actual chip, per se. There's a whole lot more to getting to a system than the chip itself or the technology underlying it. Leveraging the technology sometimes requires incredible mastery of the software at the opposite end of the spectrum. It's the ability to integrate, to build the ecosystem that drives the quality result the consumer looks for that actually differentiates you. Technology is one underlying element you can't ignore.

Truchard: Innovation is often the driver of success. Innovation is backed by technology. We have to have the support for the innovation. Many times, technology is a key component to innovation.

Q: What do you actually mean by 'technology'? If you ask Intel, they would say their process technology is their technology more than their

Core Duo architecture. On the other hand, someone else might think it's their processor.

Maier: The basis is really invention, even with the microprocessor. Somebody had to invent that. The technology allows you to extend that invention, but the core of our industry is the creativity and the invention that comes from people's imagination. That's what drives this business. Technology is just one of the tools that help us move forward.

Q: As we start getting into some outrageously expensive chip technology, though, not as many people will be able to justify those expenses. How does that affect all of this?

Rhines: They're shifting their cost base at the same time they attack design. If you look at the move to a greater degree of fabless or 'fab lite,' that frees up a lot of resource that was being spent in redundant process development and allows them to channel in other areas of differentiation. Design is the most obvious, but there are others, as well. On the design side, by focusing their resources, they pick areas of technology where they can build an infrastructure and a base of design IP [intellectual property] and design expertise. They can then differentiate themselves by a superior understanding of the system-design requirements and the definition and the execution of those designs and, at the same time, reduce that cost that appears to be becoming prohibitive through design reuse and being able to support those designs more cost-effectively.

Truchard: That's exactly right. As chips become more complex, more function will be put on their chips. Then, the real issue is the software that supports these chips and provides the specialization that's needed.

Back row, left to right; Brian Halla, National Semiconductor; Bernard Meyerson, IBM; John Daane, Altera; and Roy Vallee, Avnet Inc. Front row, left to right; Walden Rhines, Mentor Graphics Corp; Lothar Maier, Linear Technology; and James Truchard, National Instruments Corp.



Andy Grove came from Hungary. He'd be sent back today. 'Sorry Andy, visa denied.'

— Brian Halla, CEO,
National Semiconductor

These chips can have a lot of complexity. Some processor has to define the complexity that's needed. It's the software that can make this happen.

Vallee: All of those comments play into the high-unit-volume market, with consumer devices as the icon. But from a distributor's perspective, there's still a significant market out there for standard products like analog that are used across all systems and really don't make sense to be integrated into the SOC [system on chip], and then programmables, which are huge distribution items and which can be standard-produced. Maybe the market is bifurcating between these blockbuster megachips that are highly integrated, high-volume ASSPs [application-specific standard products], and these standard products that are going to be used across a broad base of systems.

Daane: We talked about this five years ago. At that time, it was like saying the Earth is round to a group that believed it was flat. We said the costs were going to increase for semiconductor design, and that would cause the industry to have to go through a major shift. There are two things people are doing today in reaction to the high cost of design. Number one is they're trying to move design to a lower cost location. That's one way to continue to afford to design—to move to an area where engineers cost less. I think that is ultimately a Band-Aid, because as you move forward with Moore's Law, the technology simply will continue to cost more with every process node. That one-time benefit you got is simply that. Ultimately you're going to fall victim to the increasing cost of Moore's Law. Number two, I think the dynamic happening in the industry today is companies are trying to gain market share within their segment. One way to afford the increased R&D spend at any process node is having more market share. We're seeing semiconductor companies divest themselves of operations that are not part of their core and then reacquire around their core to increase market share. I'd agree fundamentally that there are going to be lots of technologies that make up semiconductors. But the products that best ride Moore's Law long term are programmable types of products, meaning DSPs, microprocessors, microcontrollers, and I'm sure there will be others over time. The advantage of a programmable product is you can produce one standard

product, sell it to 1000 customers, and, through that process, aggregate enough business to continue the investment in technology.

Q: There's been a big debate over H1-B visas. Are they a way of providing lower-cost labor in the United States as many of the newspaper articles suggest, or is it more a question of not enough qualified people?

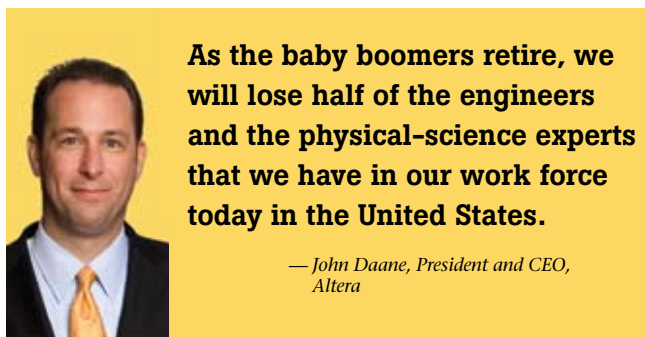
Halla: The common reaction is there are 128,000 jobs that foreigners are trying to steal. We all know that within the K-12 pipeline, we don't have enough people coming down that pipe from the United States to fill all those jobs. Our politicians think the United States has always been ahead in technology. As recently as 1957, when we saw Sputnik go up, we found out loud and clear that we weren't. We were behind in the space race. Eisenhower threw in \$1 billion, which was a lot of money in those days. Johnson created NASA, and Kennedy challenged the country to put a man on the moon. By the way, Eisenhower also created the National Defense Education Act to try to stimulate interest in math and science. If you go back and look, the space race created the mainframe race, and mainframes got hotter as they got faster, so these three guys came in and started this company called Intel and replaced the ferrite-core magnets on the back of mainframes with DRAM. That started the semiconductor industry. They took DRAM technology and created the microprocessor. Meanwhile, DARPA [Advanced Defense Research Projects Agency] tied together supercomputers to create super supercomputers, and the by-product of that was the Internet. With the Internet, you got Yahoo! and eBay and Google. If you dissect that and try to figure out how much of that can happen again—we didn't even get back into the space race without the help of Werner von Braun, who used Redstone rockets that were used to fire missiles into London because our own missiles were blown up on the launch pad. Andy Grove came from Hungary. He'd be sent back today. 'Sorry Andy, visa denied.' Then, you've got Google founded by Sergei [Brin], eBay founded by Pierre [Omidyar], and Yahoo! founded by Jerry Yang. Not only could we not do it today, we didn't do it then. Not allowing the best and brightest to come into this country and help us advance our own cause is the wrong thing to do. And it's all in the name of the politicians thinking they're representing their constituencies. I don't think their constituencies think that way anymore. They all want to maintain the technology leadership. They don't understand why we're losing it and our politicians are doing nothing.

Daane: As the baby boomers retire, we will lose half of the engineers and the physical-science experts that we have in our work force today in the United States. We're



not replacing those individuals, so we are dependent on bringing foreign nationals into the United States. Otherwise, the jobs are going to go offshore. In EEs, if you look at advanced degrees, 50% of the master's students and 70% of the PhDs are foreign nationals. We're bringing people in, educating them in our best universities, and, instead of keeping them here, we're sending them home to compete with us. We're fundamentally at a point where the United States is pushing jobs offshore, not trying to keep them here to replace the workers that will be retiring in the next 10 to 15 years.

Meyerson: I think it's worse than that. The reality has set in throughout the rest of the world that these are precious skills. You go to China and look around at the universities. I've given talks there. In the United States, the talk would draw 100 attendees. They'll fill an auditorium of 5000 people. This has become a matter of national



pride and honor. They attract back the best and the brightest to form the leadership that is the core nuclei of companies. They define them as 'national treasures.' It's understood elsewhere where the value is. And, by the way, it doesn't have to be that way. In Fishkill [NY], we have the United Nations of technology. We have Samsung from Korea, AMD with their folks from Dresden, Sony and Toshiba, Chartered from Singapore—you can create a nucleus that has enough technical clout so that people will come, and they will stay because it's the best of breed. The trouble is that other companies have also figured out that trick. We're not working hard enough here to keep it. It's painful.

Halla: And, by the way, we're getting fewer and fewer applicants into the master's and PhD programs because they know their chances of staying here are significantly reduced. So they're going to the University of London and the University of Singapore. Our universities are being underfunded by DARPA and the NSF [National Science Foundation], and the people that used to pay full fare are not coming here. A professor at Harvard and Berkeley was speaking in China. They received an Agilent

network analyzer as a donation. It was \$110,000. The professors would horde it, wheel it from lab to lab, and they had to sign up for it four days in advance. The professors goes to China—Xinhua University—and, after his speech, they give him a tour. He notices that, in every single lab, they have an Agilent network analyzer. Most of them had never been turned on or plugged in, but they're there when they're needed. Now, back to Fishkill. The whole technology race that let the DRAMs run cooler and faster came from the transistor invented by Bell Labs in 1947. Where's Bell Labs? Where's Xerox PARC [Palo Alto Research Center]? Where is SRI [Stanford Research Institute]? Where is the Watson Lab? In our infinite wisdom, we haven't let anyone get big enough to afford that.

Vallee: The issue of H1-B visas is about the talent pool and technical capabilities. I also question what's going on from an economics perspective. While we are cranking up Sarbanes-Oxley in America, making it more difficult and more costly for businesses to survive here, it is much easier and more cost-effective to survive elsewhere. If you look at corporate tax rates in other countries and the United States, and then take it down to the individual level, the taxation on stock options and the appreciation for stock-based compensation, here it is becoming a dirty word, and there it is the way forward. You apply yourself, you work hard, you create value in the form of products and services, and in return you get rewarded for that economically. In addition to this whole technical shortage issue, we've got an economics issue where the United States is becoming noncompetitive on a global stage.

Q: You're the leaders of the electronics industry. How do you solve this problem?

Halla: If you look at what's happened over the past year and a half, every technology industry association, whether it's the National Academy of Sciences or the AEA [American Electronics Association] or the Semiconductor Industry Association, they all published white papers. All those white papers called for the same things from politicians: Eliminate the H1-B visa cap altogether and increase the funding for basic research. I'm not talking about the amount paid for Hurricane Katrina or the bird flu. I'm talking about a fraction of that. All these white papers said the same thing. The Democrats jumped on it and they came out with the Innovation Agenda after visiting the Bay Area, Boston, Texas, and Arizona. The Innovation Agenda called for all the same things with the addition of independence from the Middle East on oil. The Republicans immediately responded with PACE [Protect America's Competitive Edge]. Then, the president wisely picked it up and put it in his State of the Union speech and called it the American Competitiveness Initiative. Now we have 100% agreement. You know how much got done

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— Bernard Meyerson, VP and Chief Technologist, IBM

by the 109th Congress? Nothing. H1-B visas turned into an 800-mile fence on the southern border of the United States to keep out illegal immigrants. I don't think our politicians represent their constituencies anymore. It's the great debate. They've lost their roots.

Q: What about government-supported research organizations, such as IMEC [Interuniversity Microelectronics Center] in Belgium?

Meyerson: Although it's a very good quality effort, it isn't an integrated effort. The problem nowadays is the complexity of the technology we're generating is almost mind-numbing. Unless you can do an integrated result where you can validate that all the materials behave as expected at the native dimensions where they're going to be utilized, you don't know if you have the answer. You can't do that at a place like IMEC. It also doesn't have the mindset, in my experience, to drive hard enough. It's a good start, but it's not the answer.

Rhines: We do have massive cooperative efforts. The GRC [Gordon Research Conferences], SEMATECH [Semiconductor Manufacturing Technology]—many of these are of the same ilk as IMEC, and they put resources together where they can test results. But, even more so, in the free market, we have alliances being put together. There is the IBM alliance associated with process technology and the activity of companies trying to get standardization on design rules for building designs in different foundries. All of these things work in getting economies of scale the same as IMEC works for the economy of scale for pooled R&D in a single operation.

Halla: But IMEC is more precompetitive.

Rhines: SRC [Semiconductor Research Corp] is a precompetitive institution in the United States. GRC is precompetitive. SEMATECH has been precompetitive. So, we do have precompetitive groups in the United States.

Q: The universities in the United States appear to be much closer to the commercialization stage, though, if you look at schools like Berkeley,**Stanford, and Georgia Tech. Is that right?**

Rhines: Funding for the physical sciences from the government has been in steady decline in favor of funding for Homeland Security, the NIH [National Institutes of Health], and biosciences. The institutions in the United States have to survive in a more competitive funding environment with a great degree of their funding coming from industry as opposed to ARPA [Advanced Research Projects Agency], DARPA, and grants.

Halla: It's a quicker payback on the funding that they're looking for. If you want an 18-month payback, that's anything but basic research. That's D [development], not R [research].

Maier: The challenge US companies have is not a matter of individual issues. It's the additive effect of all of them. It's Sarbanes-Oxley, H1-B, predatory litigation—all of those things add up to a very difficult competitive landscape. That's why you find companies moving most of their operations outside the United States. It's the complexity of doing business at the city, state, and country level. For all of us here, we have operations around the world. You can compare what it's like doing business in Singapore versus the United States. It's a probusiness environment.

Halla: At the end of the day, this country is still the IQ magnet. It's been well-articulated what has to happen.

Q: What effect will private equity have on the electronics industry?

Halla: If you just take Freescale as an example, if you were Delphi, you would wonder whether they're putting everything they can into R&D for the next generation of technology and the one after that—or whether they're cleaning up their books and trimming their balance sheet for that eventual re-IPO [initial public offering].

Maier: I think there's a genuine concern among the customer base that companies that engage in private equity will reduce their development efforts and lose their direction in regard to providing innovation for customers. I visit customers all the time, and one of the questions they've never asked me before is: 'Have you guys been approached by a private equity firm?' They're concerned about whether you're going to trade the longer view, investing in your technology and your products, versus trying to drive the company to some payday a few years in the future. That's a big concern for this industry.

Truchard: In 2001, when we had the big downturn, everyone in our industry cut back and laid people off. We doubled our R&D staff over the next four years. That proved to be a very wise decision. But I don't think I



could have made that decision if I weren't a major shareholder. I could tell the investors on Wall Street that I was going to double down and invest in R&D. Companies that did those cuts find themselves without the latest technology and not able to compete as effectively as they could have if they had continued to invest in R&D.

Q: That sounds like a dilemma. If you're a public company, your shareholders won't allow you to invest in R&D. And if you're bought by a private equity firm, they're going to convert all your revenue into debt service.

Halla: No. I think the shareholders will support R&D. Our shareholders are always asking us if our R&D spending is enough.

Truchard: CEOs have to have the guts to tell shareholders that this is what it's going to take to get the right end result.

Meyerson: I think you need to decouple R from D. I've been able to predict fairly accurately which companies would exit technology by just looking at the R investment. It's a long pipeline, and that's something our government doesn't realize. You're talking about a 10- to 20-year horizon for a lot of the R that becomes D and feeds the pipe. What worries me is: We don't have an appreciation of making those investments. We've been incredibly fortunate in our case because the State of New York—for whatever reasons, whether it was great insight or wanting to put jobs in the Hudson Valley—they've invested an astonishing sum of money in Albany. At that time, it had nothing. And they build an R center. Don't confuse it with D. We're talking 45-, 32- and 22-nm technologies, ultraviolet, and all of that. It is such a rare thing nowadays, though, to see people put money in the R side. We've gotten comfortable with R&D being one word. My background as a hard-core physicist tells me that R&D are not the same thing. We easily kill the R because the shareholder will not see the negative consequences for five to 10 years—by which time the person who killed the R is long gone. If I have one contribution, I'd like us to make, it's separating those words. That's why you don't have people in the universities pushing the frontier anymore. In Watson, we still have a crew of people who do this. But the demise of Bell Labs was a nightmare for us. They kept us honest. There was a huge battle back and forth. It drove all of us. Now, we don't have Sarnoff or Bell. When the R dies, you can hide it for a long time—until the D collapses.

Q: Wasn't one of the drivers back then the fact that Bell Labs didn't enforce the patents on the transistor?

Rhines: It's a little different from that. What they did in 1947 was offer an open license, which leveled the playing field by licensing 50 companies. Those 50 companies went off and developed semiconductor technology. Because they had been on a level playing field, they now freely cross-licensed each other. It was accompanied by a legislative environment that had no circuit of appeals for federal patents, so royalties were at a very minimal level—less than 1% in the most successful case. Companies found it better to cross-license, and this created the most innovative period in history because patents were pulled out of the equation. Without patents, everyone could stand on everyone else's shoulders, and we had innovation like we had never seen before. What we have



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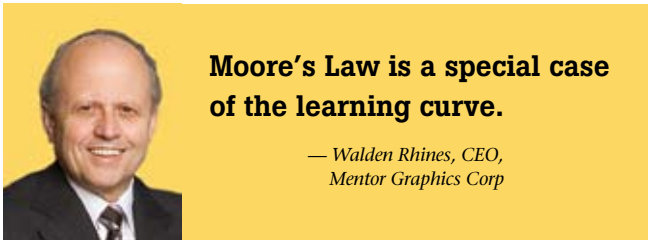
—Lothar Maier, CEO,
Linear Technology

now is litigation, torts, and all sorts of other things. Principally, it's for the purpose of protecting those who have stopped innovating and allowing them to enforce or collect money for innovations that were done years ago. That has certainly made it more difficult for innovative companies to pop up and for innovative people to get their ideas into the market.

Meyerson: We have one of the biggest patent portfolios out there. When you're faced with a patent troll, you have exactly two choices. One is that you have patented and protected every imaginable aspect of what you do to run your business, or you pay an unbelievable penalty to that troll because they find the one chink in your armor.

Halla: And there's nothing you can countersue them for.

Meyerson: Yes, because they have generated nothing of value. They will never generate anything of value, as humans or businessmen. When you're our size, you have those two choices. And you're right, it's a huge inhibitor. We've tried ways of addressing it. We've opened up a huge amount of our portfolio in software where people can essentially protect themselves by operating under that enormous armament that we put out there as an umbrella to at least drive innovation in a field that was becoming crippled. But it's going to take legislative change. We cannot afford to cover every iota of space



Moore's Law is a special case of the learning curve.

— Walden Rhines, CEO,
Mentor Graphics Corp

that we work in. It's crippling. It burns up an immense amount of time in a useless pursuit.

Q: What about start-up companies? They don't enter the world anymore to be companies that can grow up and build a product. They have an exit strategy when they're first funded.

Halla: The exit strategy is to be acquired by somebody else. But I don't think anyone begrudges the start-up. I would never call it basic R, but it definitely contributes in a big way.

Rhines: The thing that distinguished the United States in the growth period of the 1990s was the ability to attract capital for new innovation. In the early 1990s, more than 90% of the equity funding was coming through the United States. Now, it's the other way around. Less than 20% is coming through the United States. We have new markets like London and many of those in Asia doing all the fund raising. Some of it is due to Sarbanes-Oxley, some of it is tort litigation, but the end result is that capital no longer predominantly flows through the United States. That could be changed through the legal infrastructure or through tort reform. There are lots of things you can do to improve that environment.

Q: Is it feasible for companies to get together and follow IBM's model and create technology umbrellas?

Meyerson: There's no rule that says you can't take your technology, pool it and operate under a protective umbrella. We built the equivalent of a shield. If you want to be a start-up in the software industry, that's one way to operate cleanly. But I don't know if people are comfortable yet putting that much of their assets on the table. That's not a little thing to give up. But we can't continue the way we are because it will crush the start-ups. I'm a fan of start-ups. They are the soul of this industry. They're just unfortunately in an economic trap where their exit strategies have had to change. But the innovation they drive is astonishing, and they live to innovate. We can't allow that to be crippled for the sake of this country. One of my favorites is Intersil when Greg Williams spun out of Harris,

and 802.11 was a joke. There were a handful of cards out there. A few years later there were hundreds of millions floating around the planet. Effectively, it was a start-up.

Q: So, if someone has a bright idea these days, they should move to China?

Halla: China has a whole program to make it easy for people kicked out of the United States to come to China. In their 11th Five-Year Plan, the word 'innovation' is mentioned 581 times. They are desperate to have what we are losing.

Q: Another element of this is the cost to stay on the Moore's Law road map. Can companies do it alone, or can it only be done as part of a consortium?

Rhines: Moore's Law is a special case of the learning curve. Through shrinking feature size and increasing wafer diameter, we achieved all the cost reduction required to stay on the learning curve for almost 40 years. We will continue to reduce the cost per function out into the future, but it won't be so easy as just reducing feature sizes and increasing wafer diameters. We've got to innovate in other areas, but it will happen. That means 3D structures, packaging, and all sorts of things you can do to achieve the same result.

Meyerson: Moore's Law has become almost an afterthought. In commodity, if you're just going to build DRAM or something else that's well-defined and we already know how to do, it's highly applicable. In the real world of systems, the expectation of a customer in IT is about 90% annual growth rate in function, of which you're getting about 15% from the semiconductor. So, you already know it's in the noise. It's a round-off error in terms of what's happening, and there are good examples where, generation to generation, we've driven by design factors of 10 or 100 times in various attributes, and the technology was back-level. At the level of the product, it's much more complicated than technology. It's necessary but not remotely efficient. Moore's Law has been a godsend in driving down the raw-material costs, but the raw materials are the chips and the micros and the memory. When you start getting to system-level integration, you can have a handheld GPS [global-positioning system] that goes anywhere in the United States and has a listing of every restaurant within 5000 miles of where you're standing. And it fits in your hand and costs you \$400 retail. If you think about what's in there, it's a lot more than the chip set.

Daane: Moore's Law is technically alive. I think the problem people are facing is that economically it's an issue.