

## Who needs fabs anyway?

by Jonathan Sidener

Robert Kahn, considered one of the fathers of the Internet for his part in inventing its cornerstone technology, came across a new technological concept in San Diego in the 1980s.

**SEMICONDUCTORS** - In the 1990s, the cost of building a semiconductor fabrication plant passed the \$1 billion mark. Today, a state-of-the-art plant could cost from \$5 billion to \$10 billion, according to analysts' estimates. CNS Photo by Earnie Grafton. At the time, Silicon Valley was hitting its stride. Chip fabrication plants - or fabs - were rising around the world. It was an era typified by AMD founder Jerry Sanders' often-quoted boast, "Real men have fabs."

Kahn, who was at the Defense Department's technology agency, DARPA, at the time, saw a project he funded at San Diego-based Linkabit go in the opposite direction. The Linkabit engineers designed Kahn's chip and then handed off the manufacture to an outside fab.

"It put fabless development into the psyche of everyone dealing with that project," Kahn said in a 2003 presentation at University of California San Diego.

Those early outsourced chips became minor footnotes in the history of semiconductors, but they also foreshadowed a key piece of the San Diego tech economy. Today, San Diego County is a hotbed of fabless chip development, with more than 20 chip firms. Businesses such as Entropic, NextWave and PulseLink focus their energies on designing chips - drawing blueprints for the microscopic circuits that will bring their innovations to life. They leave the actual carving of the electronics onto tiny pieces of silicon to so-called foundries in South Korea, Taiwan, Singapore and other foreign countries.

While these emerging companies make chips in relatively small quantities, San Diego-based wireless giant Qualcomm has sold more than 3 billion chips for cell phones and has never owned a fab.

Big tech companies such as Intel, IBM and Texas Instruments plunged into a fab frenzy in the 1980s and 1990s, building facilities in Oregon, Arizona, New Mexico, Texas, New York and other states. But for the most part, the trend bypassed San Diego. A small fab operated by LSI Logic in the 1980s was apparently the only commercial fab to operate in San Diego.

"I can confirm that there are no commercial fabs in San Diego today," said George Burns, president of Strategic Marketing Associates, which monitors fab equipment suppliers. "It's a little too dirty of an industry for an urban area like San Diego."

There are several other reasons why San Diego is a fables town. One of the biggest is the relative youthfulness of the tech industry here. For companies launching in the 1990s or this decade, fabs have been far too expensive.

In the 1980s it cost millions to build fabs. As engineers found ways to squeeze more circuits onto a chip, complexities and prices rose. In the 1990s, the cost of building a fab passed the \$1 billion mark. Today, a state-of-the-art fab could cost from \$5 billion to \$10 billion, according to analysts' estimates.

The alternative, the modern foundry industry, took shape in the late 1980s and early 1990s. Companies such as Chartered Semiconductor Manufacturing, Taiwan Semiconductor Manufacturing and United Microelectronics built offshore fabs and leased manufacturing capacity to smaller companies.

In the early years, the foundries struggled to keep pace in the arms race fueled by established chip makers such as Intel and AMD. Fabless companies were seen as having equipment that lagged behind on the technology curve, which was the unstated message of Sanders "real men have fabs" quip.

Today, with the chip industry shift toward fabless production, foundries have more resources and have narrowed - or in some cases eliminated - the technology gap, said Jody Shelton, co-founder and executive director of the Global Semiconductor Association, the trade association formerly called the Fabless

Semiconductor Association.

"There is no stigma to being fabless today," Shelton said. "The foundries have to have competitive technology. In many cases it's on a par with (the companies making their own chips) and in some cases it's better."

Shelton's group has seen its membership grow from 500 in 1999 to 1,350 in 2006. During that same period, revenue of its members grew from \$10.2 billion to \$49.5 billion.

The group has 18 members from the San Diego area, including Qualcomm, the association's largest member.

Qualcomm inherited its early fabless strategy from Linkabit, an earlier company founded by Irwin Jacobs. The idea came from Linkabit engineer Al Theile, a former Texas Instruments employee, said Rich Kerr, who was a director of chip engineering at Linkabit. Kerr, a longtime Qualcomm employee is now a senior vice president at fabless chip company NextWave.

In its early days, Qualcomm had modest needs for chips to supply its truck tracking business Omnitrack, and the fabless method worked well.

While the cell phone chip company is large enough to build its own fab, it plans to remain fabless, said James Clifford, senior vice president and general manager of operations for Qualcomm CDMA Technologies.

"It's a good model," Clifford said. "Most of us come from a fab background. When you have a fab, you spend a lot of time keeping the fab filled."

In the years before the foundry industry was established, being fabless meant Clifford and others had to work to find someone to make their chips.

"I remember going to companies such as Intel and trying to convince them to make our chips," he said.

Companies launching more recently face similar hurdles, although now there's no real debate over which road to take.

"If you're not Intel, there's really no prospect of building a fab," said Tim Pappas, vice president of operations for Entropic. The company makes home entertainment networking chips, used by customers such as Verizon to distribute content throughout homes.

Entropic shipped its 10 millionth chip last year, and all were manufactured at foundries in various Asian countries.

While the foundry industry was established as Entropic launched, the company faced some of the same issues as Qualcomm. Pappas made many trips to Asia negotiating to get time in the fabs.

"We learned a lot about doing business in Asia," he said. "You could threaten to camp out until they said they'd give you foundry time, but it wouldn't make any difference. It's all about building relationships.

"In the beginning you want to fly over there, or call, and ask about your project, but you can't. You haven't earned the right to bother them that much."

Now that Entropic is ordering chips by the millions, things have changed, Pappas said.

"Once you've arrived, it's different," he said. "Now they call us. Now they fly to see us."

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