Reed Electronics Group

MICROPROCESSOR REPORT

www.MPRonline.com

THE INSIDER'S GUIDE TO MICROPROCESSOR HARDWARE

CPU Marketing: The Next Frontier

Will 'Intel Inside' Matter for Smartphones? History May Tell.

By Tom R. Halfhill {12/14/09-01}

Since the 1990s, AMD and Intel have been marketing their microprocessors directly to consumers, using strategies that resemble the mass marketing of automobiles, fast food, laundry detergent, and other consumer products. But it wasn't always that way. In the 1980s, the idea seemed as silly as marketing capacitors directly to the general public. Even when casual users started buying home computers, the microprocessor was a virtually invisible component inside a case sealed with a warning sticker: "No user-serviceable parts inside."

Today, PC processors have abstract brand names far removed from component-catalog part numbers: Atom, Athlon, Celeron, Core i7, Sempron, Pentium, Phenom, Turion. Thanks to co-op advertising arrangements between CPU vendors and retailers, these brand names are promoted as heavily as any other mass-market brands: Accord, Corolla, Mustang, Big Mac, Whopper, Clorox, Tide. PC processors are advertised on general-interest websites, in daily newspapers, and on network TV. They're just another consumer product now.

The transition of microprocessors from anonymous electronic components to consumer products is a fascinating study that was the subject of a recent discussion panel at the Computer History Museum in Silicon Valley. "Microprocessor Marketing Wars: Chip Makers Discover the Consumer" featured five panelists who worked at AMD, Intel, and Motorola during the years when PC processors made this historic transition.

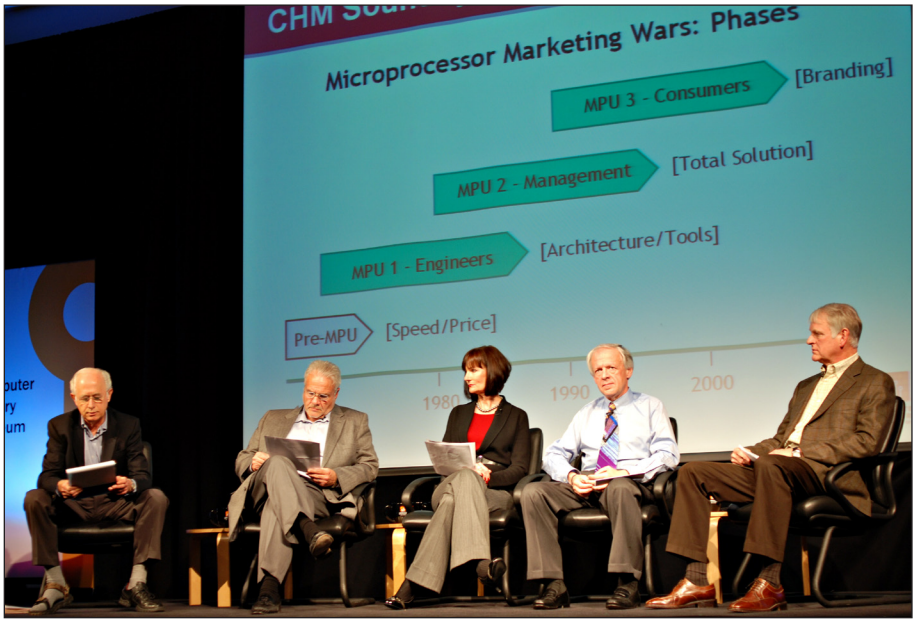

Photo by Tom R. Halfhill

A lunchtime discussion about microprocessor marketing at the Computer History Museum on November 20 brought together five panelists: (from left) moderator David Laws, formerly of AMD; Jack Browne, formerly of Motorola; and Melissa Rey, Claude Leglise, and Dave House, formerly of Intel.

But it's not just a history lesson. As personal computing moves from desktop PCs to smartphones and other pocket-size devices, the semiconductor industry is nearing another historic watershed. Right now, few consumers know or care about the microprocessors in their mobile devices. Will that change? Will marketing campaigns influence future consumers to buy a smartphone with one kind of microprocessor instead of another?

The coming collision between ARM and Intel in smartphones could be the force that brings PC-style microprocessor marketing to this new frontier—much as the competition between AMD and Intel sparked the first round of marketing wars.

Photo by Tom R. Halfhill

Claude Leglise was Intel's marketing manager for all x86 processors from the 8086 to the 486.

Fortunately for Intel, IBM picked the x86 for its first personal computer, the original IBM PC of 1981. Among other processors, IBM evaluated the Intel 8086, Intel 8088, and Motorola 68000 for this landmark design. The 68000 was by far the most powerful, but it had a 16-bit I/O bus, which required expensive 16-bit peripheral chips.

In contrast, Intel's 8088 was a downsized version of the 16-bit 8086 that replaced the 16-bit I/O bus with an eight-bit bus. CPUs required numerous peripheral chips in those days, because system logic had not yet been integrated. The 8088 significantly reduced IBM's system costs while still delivering 16-bit computational performance.

Phase 1: Marketing to Engineers

Before speculating about the future, let's review how we got where we are today. The CHM panelists agreed that consumer marketing of microprocessors began at Intel. But it was a long, difficult process, and there were two intermediate stages.

At first, microprocessors were marketed only to engineers, just like other board-level electronic components. Nobody else cared. Indeed, from Intel's invention of the commercial microprocessor in 1971 until the 1980s, almost nobody else knew what a microprocessor was. (For our in-depth report on the invention of the Intel 4004, the first standard-part microprocessor, see *MPR 12/18/06-01*, "The Intel 4004's 35th Anniversary.")

CHM panelist Claude Leglise recalled the Paleozoic Era of microprocessor marketing. From 1982 to 1990, Leglise was the marketing manager for the Intel 8086, 8088, 286, 386, and 486. In the early days, he told the CHM audience, his total marketing budget for a new processor was $125,000. That sum covered everything from advertising production to insertions in a few trade journals like *EDN*. The sole purpose of this bare-bones marketing campaign was to call the new parts to the attention of design engineers. The engineers cared about nothing but cost, performance, the CPU architecture, and development tools.

After Motorola introduced the 16/32-bit 68000 processor in 1979, Intel suffered a technical disadvantage. Intel's x86 processors had segmented memory addressing, which divided the memory map into noncontiguous partitions. The 68000 had linear memory addressing, which simplified programming. Hardware engineers liked the x86, because it was supported with good design tools, but software engineers preferred the 68000. The software engineers started gaining the upper hand.

Phase 2: Marketing to Management

While Intel was gaining a foothold in 16-bit PCs, Motorola began winning high-visibility designs in early 32-bit workstations, establishing the 68000 as a higher-performance alternative. Intel responded in 1981 with the 32-bit iAPX 432, but it was a slow, complex design that soon failed.

Intel tried again in 1985 with the i960 RISC processor and the x86-compatible 386. Of these two 32-bit designs, only the 386 achieved major success. (See *MPR 2/17/09-01*, "How Intel Got Big.")

Intel was the last of the seven major CPU vendors at that time to introduce a credible 32-bit processor. To overcome this disadvantage, Leglise proposed a radically different marketing strategy. He asked Intel CEO Andy Grove for permission to advertise the 386 in *The Wall Street Journal*. Leglise's plan was to leapfrog engineering managers and appeal directly to executive management—higher-level decision-makers who were nontechnical and less aware of Intel's laggard position in the 32-bit market.

Grove's first reaction: "Nobody reads the *Journal* except accountants." Leglise replied that top executives read the paper, too. Grove asked how much money the advertisement would cost. Leglise said $70,000—for one day. "I was sent packing," Leglise recalled.

But Leglise persisted and eventually convinced the tightfisted Grove to spend the money. In fact, Grove agreed to splurge on two big advertisements in the *Journal*. The first appeared in August 1985 and was intended to stop customers from looking elsewhere before Intel could introduce the 386.

This lavish ad spanned eight pages and emphasized the importance of x86 software compatibility. Intel insiders sometimes call it "the religious ad," because it promised

a form of eternal life for software. Although the 386 wasn't officially announced yet, Intel said the new processor would be followed by another processor called the 486 that would also be software compatible.

The 386: Last But Not Least

In October 1985, Intel finally unveiled the 386 with a three-page spread in *The Wall Street Journal*. This ad proclaimed that 30 major corporations had already committed $75 million to the 386 and concluded that the chip was "worth the wait."

As Leglise predicted, the suits ordered their technical managers to adopt the 386, and Intel's late arrival to the 32-bit market was overlooked. "We were dead last to market," said Leglise. "It never came up. We were never written up as being late."

Photo by Tom R. Halfhill

Melissa Rey was a marketing communications manager at Intel who promoted all the x86 processors from the 8086 to the 386.

After Intel ramped up 386 production, the company made another radical marketing move. Although 286 processors were still selling in volume, Intel pronounced them obsolete in the wake of the 386. Intel wanted to kill the 286 quickly. AMD was making competitive 286 clone chips but didn't have a 386-class design.

This cannibalistic strategy became known as the "Red-X" campaign, because Intel's ads for the 386 superimposed a bold, red "X" over "286." A few years later, Intel repeated this strategy when the 486 superseded the 386. Intel portrayed the 486 as the next-generation design for corporate computing, promoting the new processor to information-technology managers at Fortune 500 companies.

Microprocessor marketing had entered its second phase—selling to high-level managers who cared more about system-scale solutions and software investments than about the technical specifications of electronic components.

Phase 3: Marketing to Consumers

By the early 1980s, it had become obvious that the PC market was going to be very important. Intel's design win at IBM was crucial, but it wasn't a foregone conclusion that IBM would stick with the x86 architecture for subsequent PC designs.

Motorola's 68000 was clearly superior. In fact, Intel was so intimidated by the 68000 that it devised a marketing campaign known internally as "Operation Crush." To start the campaign, Intel marketer William Davidow prepared a secret presentation called "Selling the Dog." The dog was the 286, Intel's sequel to the 8086 that still couldn't match the 68000.

In 1984, Intel was relieved when IBM chose the 286 for its next-generation PC, the PC/AT. IBM decided that compatibility was more important than performance. But Grove formulated another marketing message, one that still echoes today. The only important difference between the IBM PC and PC/AT, Grove said, was Intel's microprocessor. It was the 286 that made the PC/AT a faster, better computer. Indeed, the IBM PC/AT was virtually the Intel PC/AT. In addition to the CPU, Intel made all 24 of the other logic chips in the machine—every chip but the RAMs, a line of business that Intel was abandoning.

Around this time, Intel's marketing people began toying with the idea of marketing microprocessors directly to consumers. Melissa Rey, who was a senior marketing communications manager at Intel from 1978 to 1988, recalled conversations in the mid-1980s about ways to "Dolbyize" the microprocessor.

At that time, Dolby Laboratories licensed its patented noise-reduction technology to manufacturers of cassette tape recorders and players. The licenses required manufacturers to display the Dolby name and logo on the machines, usually next to a switch that turned the feature on or off. Consumers quickly grasped the value of hiss reduction, even though few people but audiophiles understood how Dolby's companding technology worked.

Intel's marketing managers yearned to duplicate Dolby's success by promoting their PC processors to casual users who were equally oblivious about microprocessor technology. Other inspirations for this type of marketing were NutraSweet, Teflon, and, especially, Gore-Tex—the mysterious fabric that's waterproof but breathable. The high concept was to sell the benefits of the technology, not the technology of the technology.

The Birth of the Pentium

Ironically, a trademark obstacle helped Intel launch the consumer phase of microprocessor marketing. Ever since the days of marketing processors to engineers, Intel had branded its chips with numbers: 8086, 8088, 286, 386, 486. But plain numbers can't be trademarked, so any company could sell a 286 (as AMD did). Starting with the 586, Intel decided to use abstract names invented by consultants who specialized in product branding. Thus was born the Pentium in 1993.

Today, when processor brand names are as common as caches, it's hard to remember that the Pentium provoked an industrywide spasm of laughter and ridicule. To many techies, it seemed like a ludicrous name for a microprocessor.

Actually, the name wasn't completely abstract. "Pent" is the Greek root for "five," and the Pentium was the

fifth-generation x86 microarchitecture. The suffix "ium" was supposed to invoke the name of an element, because Intel's marketers wanted consumers to accept "Pentium" as an element or ingredient, much like NutraSweet, Teflon, or Gore-Tex. However, Intel's wordplay only added to the mirth. Critics wondered whether the sixth-generation x86 would be named Sextium.

Intel stuck to its guns and promoted the Pentium so heavily that it soon became a widely accepted and desirable brand. Later processors were named the Pentium Pro, Pentium II, Pentium III, and Pentium 4. (By the end of that line, Intel decided that Roman numerals were too hard for Joe Six-Pack to decipher.) Indeed, the brand became so famous that Intel recently revived it for some PC processors that have completely different microarchitectures. As Intel's website proclaims, Pentium is "the reliable choice for more than 15 years."

In 1999, AMD renamed its x86-compatible K7 processor the Athlon, affirming that processor brand names were here to stay. Microprocessor marketing had entered its final phase.

The 'Intel Inside' Campaign

A key part of Intel's consumer-marketing strategy was co-op advertising, not just branding. In addition to promoting its microprocessors, Intel wanted to make its corporate name as recognizable as Sony's or Apple's. Intel began spending big bucks on TV commercials, magazine ads, and other promotions. To amplify that campaign, Intel created a cooperative advertising program with its customers.

At the CHM panel discussion, Dave House, a former Intel senior vice president, recalled the birth of the "Intel Inside" program. House noted that Intel usually reduced the prices of its PC processors by about 30% a year, as Moore's law and manufacturing improvements made production more efficient. In the early 1990s, Intel decided to cut prices by only about 20% a year. With the extra profits, Intel could sponsor co-op advertising with its customers, the PC OEMs.

OEMs received a 6% rebate on everything they purchased from Intel. The rebates went into a special marketing fund with separate accounts for each OEM. Intel reimbursed the OEMs for half the cost of retail advertising that qualified for the Intel Inside program, up to the limit of the money in their account.

Asian OEMs immediately welcomed the program, House said. Asian PC users tended to be more technical and brand conscious. For years, the Asian OEMs had been lobbying Intel to promote its processors and corporate brand more aggressively. But in those days, Asian OEMs were third-tier players. It took a while longer for the first- and second-tier OEMs—U.S. and European companies—to embrace the program. The economics were compelling, however, and all the OEMs were soon on board.

The Intel Inside badge started appearing on product packaging and retail placards—and in print advertising and TV commercials. As the World Wide Web emerged, the badge became ubiquitous online as well. AMD followed with a similar program. Semiconductor companies whose names were once known only to engineers soon became as widely recognized as the long-established consumer-electronics companies.

Photo by Tom R. Halfhill

Dave House, a former Intel senior vice president, helped run Intel's microprocessor business from 1978 to 1991.

Motorola's Brand Fades

One semiconductor company left behind by this revolution in microprocessor marketing was Motorola. Ironically, Motorola had already enjoyed wide brand recognition among consumers long before Intel conceived the Intel Inside campaign. For decades, Motorola's name had been associated with radios, TV sets, and hi-fi equipment.

After Intel launched the commercial microprocessor industry in 1971, Motorola followed with some influential designs. The eight-bit Motorola 6800 was the inspiration for the popular MOS Technology 6502, the CPU in the Apple I, Apple II, Commodore PET, Commodore 64, Atari 800, and other early personal computers. The 6800's successor, the 16/32-bit 68000, was the most powerful processor of its day. It was the CPU in Apollo workstations (later acquired by Hewlett-Packard), Sun workstations (before SPARC), the Apple Macintosh, Commodore Amiga, Atari ST, and other second-generation personal computers.

Ultimately, however, Motorola's brand faded in the brighter glow of Intel's ascent. One major setback was IBM's adoption of the x86, which soon became the industry-standard architecture for PCs. Motorola countered by embracing RISC as a higher-performance alternative to CISC, but marketplace resistance was stiff.

Motorola's first RISC design was the 88000. It made its debut in 1988 and wasn't a bad design, but it competed with several other RISC architectures that were similar. Data General's AViiON multiprocessor systems used the 88000 before

moving to the x86. Another vendor, Stratus Computer, began working with the 88000 before switching to Intel's i860 RISC architecture in 1989. Later, Stratus switched again to HP's PA-RISC and then became disenchanted with that architecture, too.

Jack Browne, a former microprocessor marketing manager at Motorola, recalled the short life of the 88000. At first, several companies agreed to use the new processor, but their commitments bore little fruit. "We weren't getting critical mass," Browne said.

According to Browne, a series of meetings with Steve Jobs led to the AIM alliance, in which Apple, IBM, and Motorola collaborated on a new RISC architecture combining elements of IBM's POWER processors and Motorola's 88000. The result was the PowerPC architecture. (See *MPR* 10/16/91, "Apple, IBM, and Motorola Sign Contracts for Far-Reaching Collaboration"; not available online.)

In 1994, Apple switched the Macintosh from the 68K architecture to PowerPC and enjoyed some success. Although the PowerPC fared better than the 88000, Apple was the only vendor shipping large volumes. Ultimately, IBM and Motorola couldn't match the investments in the x86 by Intel and AMD. Feuds between IBM and Motorola didn't help.

In 2004, Motorola spun off its processor business as Freescale Semiconductor, which began life with heavy debt. In 2006, Apple switched the Macintosh from PowerPC to the x86. PowerPC (rebranded the Power Architecture) is now found mainly in embedded systems. (See *MPR 6/27/05-01*, "Apple Drops PowerPC for Pentium.")

Smartphones: the New PCs

Microprocessor marketing has come a long way since Intel's introduction of the 4004 in 1971. However, the revolution has been limited almost entirely to PC and server processors. Graphics processors are aggressively marketed to consumers, especially gamers. But embedded processors remain obscure, despite accounting for about 98% of the microprocessor market by volume. Almost nobody knows which processor is embedded in their cellphone, HDTV, digital camera, digital-audio player, or the host of other consumer products that wouldn't exist without microprocessors.

Embedded-processor marketing has hardly changed since the 1970s. Semiconductor vendors still market the chips almost exclusively to design engineers. Marketing hasn't even entered Phase 2 of the history described above, much less Phase 3. Embedded processors usually have product names dominated by digits, not flashy brand names concocted by a marketing consultant.

Even the few exceptions have little in common with the nerdly competition in the PC market. Canon invented the DIGIC ("Digital IC") brand name for the image-processing chips in its digital cameras. Nikon matched it with Expeed, and Olympus has TruePic. But these companies won't talk publicly about the CPU architectures or other technical specifications of their mysterious SoCs. Instead, they focus on the benefits: faster frame rates, higher pixel resolution, lower noise, and so on.

Photo by Tom R. Halfhill

Jack Browne was the marketing manager for Motorola's high-end microprocessors from 1981 to 1992.

Smartphones may change that. Today, ARM's embedded-processor cores rule the cellphone market. On average, there are at least two ARM processors in each handset, worldwide. Almost no one outside the industry knows it. As long as cellphone designers keep using ARM processors, ARM needn't market directly to consumers.

The next frontier is smartphones, which require more processing power to deliver advanced applications and broadband wireless Internet. Intel hungers for that market, because the growth potential is huge. Smartphones are the next personal computers—perhaps the true personal computers, because they can accompany a person everywhere. Desktop PCs are looking more and more like yesterday's clunky mainframes.

To penetrate smartphones, Intel must overcome the cost and power handicaps of its 31-year-old x86 architecture and move it into the highly integrated SoCs required for handset application processors. Intel's Atom processor and a licensing arrangement with TSMC are the first steps. (See *MPR 4/7/08-01*, "Intel's Tiny Atom," and *MPR 3/30/09-01*, "Intel Will Customize Atom.")

Wrestling With ARM

Winning SoC designs with engineers may not be enough. As the battle between Intel and ARM heats up, Intel may attempt to repeat the branding strategy that was so successful in the PC market. Will future smartphones proudly boast "Intel Inside" or "Powered by Pentium"? It may seem

For More Information

This article is based on a November 20 panel discussion at the Computer History Museum in Mountain View, California. Additional information and a video recording of the event—"Microprocessor Marketing Wars: Chip Makers Discover the Consumer"—are available on the museum's website and on YouTube:

- *www.computerhistory.org/events/index.php?id=1256148133*
- *www.youtube.com/watch?v=pLzBYfNhRF8*

Another good source is William H. Davidow's *Marketing High Technology: An Insider's View* (Free Press, 1986). Among other things, it describes Intel's "Operation Crush" campaign in detail.

far-fetched. But then, so were the marketing campaigns first aimed at PC shoppers in the 1990s.

Already, Intel is promoting the importance of x86 compatibility among mobile Internet devices and PCs, even though x86-based smartphones have yet to appear and the operating-system platforms will be completely different. Software written for Windows 7 or even Windows Mobile won't run unmodified on the Moblin or Android operating systems, even if all of them are running on compatible x86 chips. Nevertheless, Intel could create an association in the minds of nontechnical users. It wouldn't be the first time a successful branding strategy in one product category was extended to win acceptance for a new product.

Apple has achieved a similar association. The popularity of Apple's most successful embedded system—the iPod digital-music player—has dramatically accelerated sales of the Macintosh. It doesn't seem to matter that Apple's iTunes software runs equally well on Windows PCs. The iPod helped rejuvenate the Mac, and the iPhone is having a similar effect. Although Apple's marketing ignores the CPUs in the iPod and iPhone, Apple has created an air of compatibility—and genuine interoperability—between those embedded systems and the Mac. (In reality, the iPod and iPhone use ARM processors, whereas Macs use the x86.)

If Intel brings consumer-level microprocessor marketing to smartphones, ARM will have to respond, much as AMD did in the 1990s. Unlike AMD, however, ARM will be touting a CPU architecture largely unknown to consumers.

This battlefield may not become as technical as the PC market, where enthusiast websites avidly debate clock speeds, socket standards, cache sizes, memory interfaces, and CPU benchmarks. Instead, the battle may rage over which CPU architecture supports the largest app store, or which smartphone application processor consumes less power, delivering the best battery life. The fight may resemble DIGIC vs. Expeed, not Core i7 vs. Phenom II.

As mobile devices, smartphones depend on factors other than CPU speed for much of their performance. Two factors are network availability and network bandwidth. Rich applications can strain the throughput and responsiveness of a wireless network more than they strain the CPU. Performance will vary from time to time and from place to place—a big difference from desktop PCs.

Nevertheless, as companies vie for the attention of consumers, CPU performance will probably figure into their marketing strategies on some level. For two decades, consumers have been indoctrinated about the advantages of a faster microprocessor. And lately, techies have found ways to overclock the application processors in some cellphones. So, in some quarters, the megahertz race has already begun.

Not a New Challenge

Actually, manufacturers and retailers have faced the challenge of marketing new technology to nontechnical consumers since the invention of the automobile more than 100 years ago. Another challenge came in the 1920s with the commercialization of radio—the first mass-market consumer-electronics product.

Before then, consumer products were pretty easy to use and understand. Marketers soon learned to gloss over the nitty-gritty details of the new technology and trumpet the benefits. As consumer products grow increasingly sophisticated, the challenge keeps mounting.

The keys to any marketing campaign are brand building and repetition. Children who grew up in the 1990s and 2000s using Pentium-powered PCs may well look favorably upon Pentium-powered smartphones. It may not matter if those phones have any significant software compatibility with PCs, or if the Pentium smartphone processor has little in common with a Pentium PC processor.

So it's a good bet that microprocessor marketing will follow microprocessors on their journey from desktops and laptops to pockets and purses.