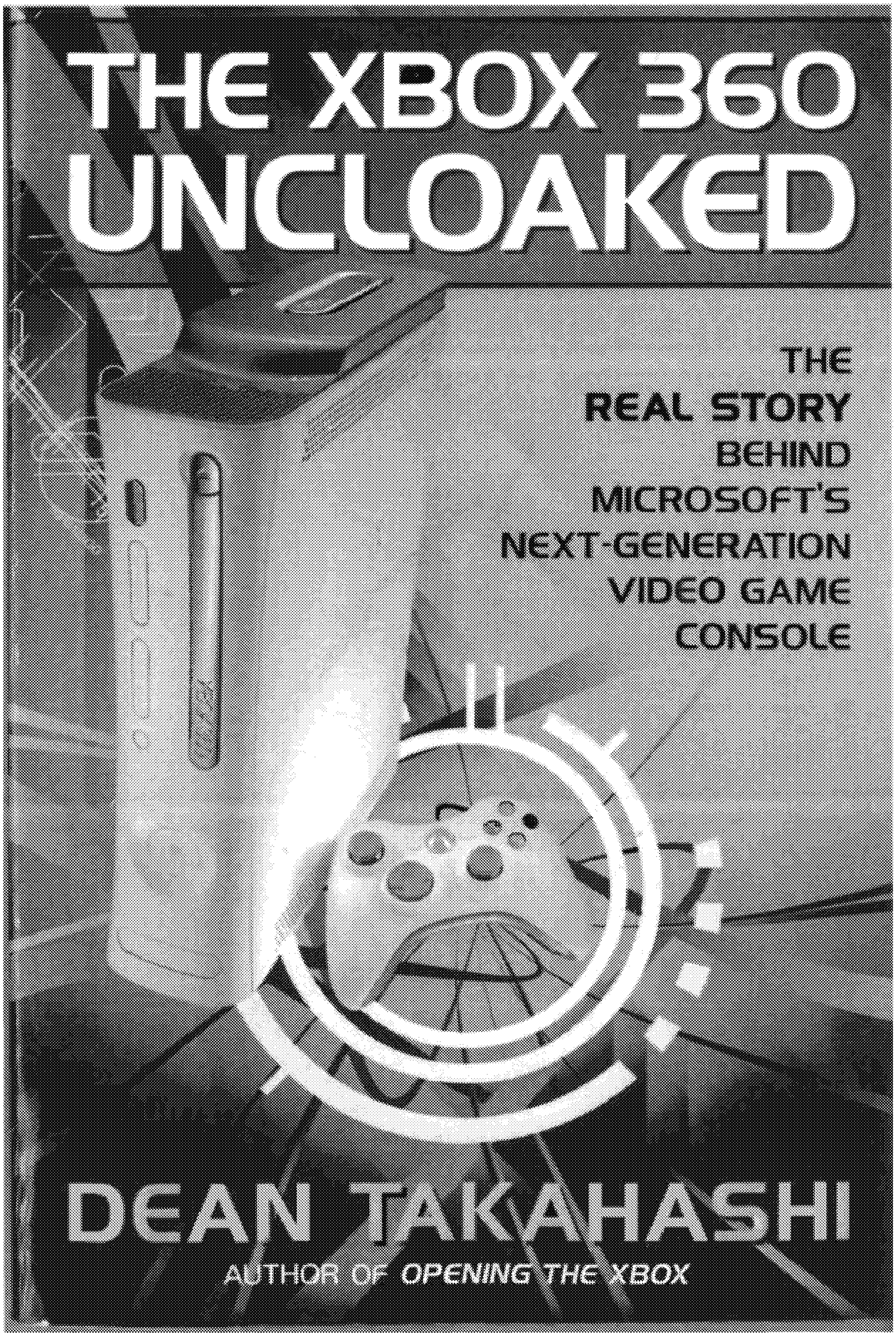
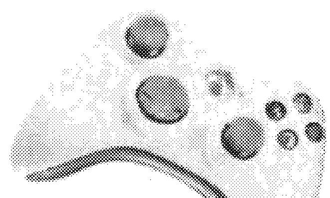


ATI 2119
LG v. ATI
IPR2015-00330

THE XBOX 360 UNCLOAKED

THE REAL STORY BEHIND MICROSOFT'S NEXT-GENERATION VIDEO GAME CONSOLE



DEAN TAKAHASHI

SpiderWorks
For more great books, visit us online at
http://www.spiderworks.com

Published by SpiderWorks, LLC.
http://www.spiderworks.com

ISBN-10: 0-977-78421-5
ISBN-13: 978-0-977-78421-5

Library of Congress Control Number is available from the publisher.

Edited by Dave Mark
Cover Design by Dave Wooldridge
Cover Background Illustration: mecaleha (istockphoto.com)
Interior Page Design by Robin Williams and Dave Wooldridge

elements were essential to making money on Xenon.

"That's not our traditional way of doing business," said Don MacDonald, an Intel executive.

Intel typically owned its own designs, redesigned its chips on its own schedule, and made them in its own captive factories. Nvidia did the same, with the exception of making its chips at either IBM's factories or those belonging to Taiwan Semiconductor Manufacturing Co. Neither Intel and Nvidia would ever trust each other enough to share their chip designs with each so they could be merged into a single chip. Negotiations with those vendors hit a brick wall.

To Nick Baker and Jeff Andrews, that was OK. They saw that ATI was starting to take the lead in PC graphics chips. ATI was a $2 billion company with 3,000 employees. Its Radeon 9700 chip that came out in August, 2002, was retaking the high-end of the graphics chip market for the first time ever for ATI.

Bob Feldstein, vice president of engineering at ATI, gathered a dozen ATI veterans, including Clay Taylor and Steve Narayan, to contemplate graphics for a game box. They knew that Microsoft wanted to highlight high-definition gaming and launch in the fall of 2005 at the price of a traditional video game console, about $300. They also knew that Microsoft wanted to own the design that ATI would create and fabricate it in a factory of its choosing. While that was a tough hurdle for Nvidia, ATI's Santa Clara team had done such a deal with Nintendo already. It received a fee for the engineering work and a royalty on each console sold. It wasn't as much money as if ATI had made the chip for Nintendo, but it was money that floated to the bottom line.

With that information, they contemplated what they could do, using different teams than the Santa Clara engineers who were again going to work for Nintendo. Feldstein tapped engineers in Marlboro, Mass.; Orlando, Fla., and Toronto, Canada.

"We were doing a chip from the ground up," Feldstein said. "It was kind of liberating. We had long pursued the ideal of photorealism. We could see it up there just on top of the hill. We thought we could deliver fluid reality, and that would truly be a next-generation experience."

They didn't have to worry about making a chip work with all sorts of display resolutions. All they had to worry about was making it run on standard TVs as well as high-definition TVs. (In this case, running at 720P). The engineers tapped pieces of the PC chips that were already in the works to shorten the development schedule, but they also proposed several unique pieces that made the chip different from a PC graphics chip. In essence, they needed to create a machine gun that fired a bunch of dots at a display screen, and they had to make sure that the machine gun never ran out of ammo and never overheated.

Their alternative to the expensive PC graphics chip was to simplify it. They took two different processors that handle separate jobs on the PC graphics chip, and then combined them into a single processor that could handle both jobs. They called this combination processor a "unified shader." A shader is a program that the graphics chip runs to make a 3-D illusion look real. Two types of shaders were necessary. One type noted where an object was in 3-D space. The other gave it the proper lighting, color, and surface texture.

In the ATI design, the unified shader was smart enough to juggle between the two types of shaders. The graphics chip would have 48 unified shader pipelines running at the same time. It wasn't as many as the 64 that Nick Baker originally wanted, but it was better than the 32 the team had expected. But because it was more efficient at balancing the load of work at any given moment, it might actually be able to keep up with a graphics chip that had many more of the separated shaders. The design for this graphics chip was similar to a cook in a fast food restaurant with 48 arms, making both pizzas and tacos at the same time. The result in the restaurant would be more food served, and the result for gamers would be more detailed visuals. Now, games would have objects with realistic fur, hair, grass or cloth.

Jon Peddie, a graphics expert and analyst at Jon Peddie Research, believed that the unified shaders would be an experiment for the entire industry. Microsoft would be taking a chance by being the first to undertake it. The question was whether the unified shaders could balance the workload or not. The system had to efficiently allocate the shaders to either type of processing at any given moment. The unified shaders were less likely to be wasted. But they were complicated.

"Are they more efficient? The answer is yes, no, maybe," Peddie said. "Some observers think unified shaders are not the obvious right answer right now, that we as an industry just have to learn more about how to exploit them, the Xbox360 is a great laboratory. However, in the long term, we expect that the industry will migrate toward a unified architecture, because we'll solve all of the problems with a unified design, and maybe the efficiency will matter less than the flexibility."

The Microsoft engineers also thought about the bottlenecks in the PC and how to deal with the limited amount of memory in the machine. The Xbox had only 64 megabytes of main memory, and Greg Gibson, the system architect, figured that Microsoft would be able to afford about 256 megabytes in Xenon. This was such a scarce resource in PCs that most graphics cards came with their own dedicated memory. This PC approach wasn't an option in a game console because it drove up the costs dramatically. Without that dedicated memory, the graphics chip had to wait a long time to get data from memory. That slowed the machine down, and it was often the reason why console graphics lagged behind the more expensive personal computers that hardcore gamers bought.

So Feldstein's team came up with a solution. They would include a separate chip that held nothing but memory for the graphics chip. The amount of memory was small, about 10 megabytes, but it would allow the graphics chip to keep itself busy with processing tasks rather than go out over the long pathway to main memory. Dubbed "intelligent memory," this added some costs to the box, but it reduced the bottlenecks without requiring a lot more memory. At first, the memory would be a separate chip that was connected to the graphics chip in a common package, or multichip module. Over time, this memory created by

DOCKET ALARM

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts

Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research

With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips

Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.