Jim Gray's vision of
flash-based storage
anchors this
issue's theme.

A Pioneer's Flash of Insight

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In the May/June issue of *Queue*, Eric Allman wrote a tribute to Jim Gray, mentioning that *Queue* would be running some of Jim's best works in the months to come. I'm embarrassed to confess that when this idea was first discussed, I assumed these papers would consist largely of Jim's seminal work on databases—showing only that I (unlike everyone else on the *Queue* editorial board) never knew Jim. In an attempt to learn more about both his work and Jim himself, I attended the tribute held for him at UC Berkeley in May.

I came away impressed not only that Jim was a big, adventurous thinker, but also that he was one who remained moored to reality. This delicate balance pervades his life's work: The IBM System R folks talked about how in a year he not only wrote nine papers, but also cut 10,000 lines of code. Database researchers from the University of Wisconsin described how Jim, who had pioneered so much in transaction processing, also pioneered the database benchmarks, developing the precursor for what would become the Transaction Processing Council in a classic *Datamation* paper. His Tandem colleagues talked about how he reached beyond research and development to engage with the field and with customers to figure out (and publish!) why systems *actually* failed—which was quite a reach for a company that famously dubbed every product "NonStop"! And Jim's Microsoft coworkers talked about his driving vision to put on the Web a large database that people would actually use, leading him to develop TerraServer, and his ability to inspire and assist subsequent projects such as the Sloan Digital Sky Survey and Microsoft Research's WorldWide Telescope—systems that solved hard, abstract problems and delivered appreciable concrete results.

Given that Jim insisted on designing and implementing actual systems in the present while also focusing on big, future-looking ideas, it is no surprise that he and *Queue* had a natural affinity for one another. While listening to the presentations at Jim's tribute, I began asking myself a question that I imagine was also occurring to others: if Jim were here and if I could have but one conversation with him, what would it be about? For me, the answer was clear: I would want to talk with him about the coming revolution in flash-based storage, the focus of this month's issue of *Queue*. This has been an exciting issue to put together, because as Adam Leventhal's article, "Flash Storage Today," discusses, the economics of flash have promoted it from sideshow to main event: flash is growing from mere curiosity to a new tier in the storage hierarchy—perhaps the first such tier since the introduction of the IBM RAMAC in 1956!

This development is exactly the kind of change that Jim clearly savored—so much so that in listening to his tribute, I began to wonder if he had thought of or published anything on flash-based storage prior to his disappearance. With the rapidly changing economics of flash, Jim would have had to be particularly insightful (at the time of his disappearance, flash was more than twice as expensive as it is now), but it seemed within the realm of possibility. His colleagues at Microsoft didn't know of anything specific he had written on the topic, but directed me to his Web site for his list of papers. Thinking the published work was likely too old and that I had thus probably hit a dead end, I nonetheless went to the site—and what I saw there almost took my breath away: the second-most-recent link was “A Radical View of Flash Disks,” with a link to both a document and a talk. Thanks to the support of Jim's family, we have been able to publish that paper, “Flash Disk Opportunity for Server Applications,” written with his colleague Bob Fitzgerald, in this issue. It is raw, and the numbers are now out of date—but Jim clearly sees the future in front of him, and it is a singular pleasure for the reader to be hoisted onto his shoulders.

Finding Jim's work inspired us to add two other papers to this issue. First, since the time that Jim worked on this problem, one important impediment has been removed: the device-level issues that he describes—issues that have plagued consumer-grade flash-based SSDs (solid-state drives)—have been largely dealt with in the new class of enterprise-grade flash-based SSDs. It is important for practitioners to understand these problems and their solutions; STEC's Pat Wilkison and Mark Moshayedi explain the innards of these important new devices in their article in this issue.

Second, in looking for other work that Jim might have done on flash, we ran across the work of Goetz Graefe, a Hewlett-Packard Fellow who had revisited Jim's “five-minute rule” (the Jim Gray classic that we pointed to online in the May/June issue), wondering if flash had changed the equation. Goetz, too, saw Jim in this work (he dedicated this work to Jim), and it seems especially fitting that Goetz's update of Jim's rule now lives alongside Jim's radical view of a flash-based future.

Enjoy this collection of articles—and the coming revolution in the storage hierarchy that they describe—and take a moment to mourn the loss of a great computer scientist who would have (once again) been in the thick of it all! ◻

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