Storage Wars: Flash vs. Disk

Flash Cards, Small Hard Drives Joust for Mobile Market

By Mike Feibus

The simmering battle for market share between hard-disk drives and flash-memory cards has been heating up now that mobile computers are taking on more and varied shapes. Hewlett-Packard's recently introduced OmniBook 300 is but one—albeit one of the more highly publicized—recent attempt to create a new category for smaller-than-subnotebooks-but-bigger-than-PDAs computing devices.

This emerging form factor represents the turf that hard-disk drives and flash-memory cards are battling to control. Both sides generally agree that 1.8-inch and eventually 1.3-inch hard disks will dominate notebook PC storage in coming years, as those form factors approach the capacities needed to take business from 2.5-inch drives, the current ruler of the roost. Notebook computers need the capacities offered by magnetic media to run Windows applications.

Both sides also believe that solid-state storage will be used in the lion's share of handheld computing devices powered by AA batteries. The importance of battery life in these systems precludes disk usage. Further, handheld devices aren't expected to run a full suite of applications and thus don't need 100 Mbytes or more of storage.

It's the growing number of computing devices in between notebook and handheld that both sides believe they will own. What the mix turns out to be—and how big this computing segment ends up becoming—was the subject of a debate conducted at the recent MicroSystems Forum. Jim Miller, president and chief executive of MiniStor Peripherals, represented the magnetic medium while Leon Malmed, vice president of sales and marketing at SunDisk, heralded the cause of flash memory.

What Price Flash?

Although the debate was lively, with the two hurling nearly as many jabs at their opponent as at their opponent's product, Miller and Malmed really had only one fundamental disagreement: whether the cost per megabyte of flash storage would ever drop below that of hard disk. That's to be expected because cost undoubtedly will prove to be the biggest factor in determining

MiniStor Peripherals' Jim Miller

whether flash ultimately becomes a niche, or whether it dominates the market for mobile computing storage.

To be sure, flash has some compelling advantages over the magnetic medium. For example, flash-memory cards draw an order of magnitude less power than hard-disk drives—1.8-inch drives consume about 600 mA max, compared to about 50 mA max for flash cards. And with average access times for 1.8-inch drives around 15 ms, flash cards are also nearly 100 times faster.

However, flash-memory cards are also more expensive today on a cost-per-megabyte basis. Figure 1 compares Malmed's and Miller's forecast for the cost per megabyte of flash cards and hard drives. Note that Malmed chose to compare flash costs to that of more expensive 1.3-inch hard drives. Eventually, the cost per megabyte of 1.3-inch drives will reach that of 1.8-inch drives, although the smaller form-factor devices are significantly more expensive through the forecast period.

Predictably, Miller contended that although the cost per megabyte of flash will approach magnetic disks over time, "I believe you'll find that it never crosses over." He predicted that 1.8-inch hard disks would be selling for no more than $1/Mbyte in 1998, while flash cards will be selling for $5/Mbyte to $8/Mbyte.

For his part, Malmed predicted that the cost per megabyte of flash will cross that of hard-disk drives as early as 1996. "There's no question that flash will cross over," Malmed said. "We might be off by a year or two. But there's no question, knowing where the technology is going, that there will be a crossover." He said that flash-memory card prices are declining about 55% per year, compared to about 40% annually for 1.8-inch drives.

Miller countered by saying that "rotating memory will always be the most cost-effective way to go. If you think of what a flash drive is going to cost you, you can buy a helluva lot of AA batteries for the difference."

Malmed reminded Miller that the added cost of flash today is worth the relative millennium of battery life (in notebook PC years) it affords over hard disks. "Would you like to change the battery in your watch every 10 hours?" Malmed retorted.

Other Factors

Although the two men generally agreed on the merits of hard disks and flash cards, they squabbled over the
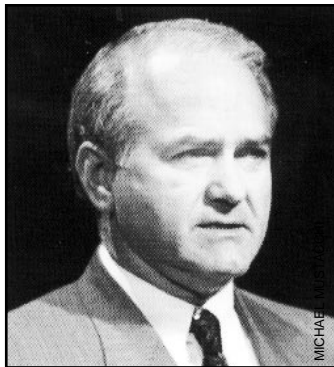
attributes' relative importance.

For example, Miller reminded the audience that a typical suite of applications—including Windows and a word processor, spreadsheet, presentation package, communications program, and a smattering of utilities and games—totals about 80 Mbytes. The minimum level of storage that users will accept in new systems continues to rise dramatically—not only because of software's insatiable appetite for storage space, but also because of growing data files and users' seemingly fruitless desire to leave room for expansion.

Users accepted no less than 80 Mbytes to 120 Mbytes last year, Miller said. The range rose this year to 120 Mbytes to 200 Mbytes, and next year, he predicted that the minimum acceptable disk capacity for most users would be up to 340 Mbytes.

So flash disk capacities—ranging from 1 Mbyte to 40 Mbytes—are unacceptable for the vast majority of computer users, Miller said. On the other hand, neither do 120-Mbyte, 1.8-inch drives offer enough capacity for the average desktop user—although mobile users with 120-Mbyte drives can more closely approximate their desktop than can mobile users with 40 Mbytes of storage.

Malmed countered that battery-powered computer users aren't looking for a full suite of applications. Rather, they want to run a few applications very fast—and for long periods of time before recharging. He said he envisions users dumping data and programs onto flash disks from desktop computers. If it is accepted in the marketplace, storing applications in ROM—as Hewlett-Packard does with the Omni-Book 300—might reduce the need for higher-capacity drives.

In addition to portability, Malmed also emphasized the ruggedness of flash drives, which can withstand shocks of up to 1000 Gs. Miller reminded the audience that few general-purpose notebook PCs have been shocked to death—and most 2.5-inch drives are made to withstand only 10 Gs to 20 Gs. The new 1.8-inch drives, while not as rugged as flash drives, are rugged enough, he said.

Malmed disputed Miller's contention that flash technology is more limiting because of its finite write-cycles ratings. Most flash disks are rated for 10,000 to 100,000 writes. By comparison, hard disk drives have no limitation. Malmed pointed out that flash-memory cards have no practical limitation either—even under heavy usage they will last more than 60 years, he said. And flash disks can be used or transported "without risking head crash or disk crash," he said.

Conclusion

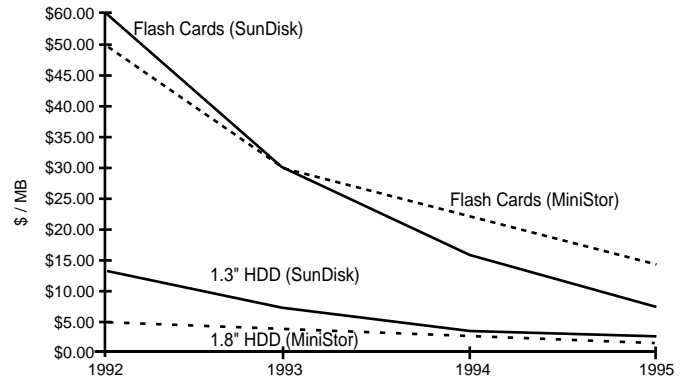As both MiniStor's Miller and SunDisk's Malmed

Figure 1. MiniStor Peripherals, a supplier of 1.8-inch hard-disk drives, and SunDisk, a flash-memory card supplier, clearly disagree whether the cost per megabyte of flash will ever approach that of hard disks. The chart above compares the two companies' cost projections for the two technologies through 1995.

SunDisk's Leon Malmed

admitted, both media likely will survive and thrive throughout the decade. For all of the power and speed advantages that flash offers, it is inconceivable that flash-memory cards will ever match magnetic media for pure capacity. As a result, both agree that hard disks will dominate the desktop for years to come. Likewise, there are storage applications in handheld computing devices that are out of reach for power-hungry hard drives.

The fast-growing market in between is what's up for grabs. Flash memory is armed with potent weapons with which to take that market. In particular, it is much faster, consumes much less power, and is more rugged. Hard-disk drive proponents dismiss the ruggedness argument, saying that flash-memory cards are much more rugged than they need to be—at up to 1000 Gs, they are rated much higher than other handheld computer components. However, most computer users will affirm that they would much rather that their data survived a thud than, say, the display.

So it all comes down to cost—for the same price, users will jump at flash in favor of a hard disk. Unfortunately, cost is flash's weakest line of defense today—and its biggest promise for tomorrow. As even Malmed acknowledged, flash is significantly more expensive on a cost-per-megabyte basis than hard disks.

Whether flash does overtake hard-drive technology on a cost-per-megabyte basis remains to be seen. A plausible scenario is that flash costs approach hard-disk drive costs, and the two technologies divvy the market—and even individual storage devices. As Miller suggested, the "ideal" mobile computing storage device in the future will be a Type III PCMCIA hard disk with a flash-memory disk cache. ♦