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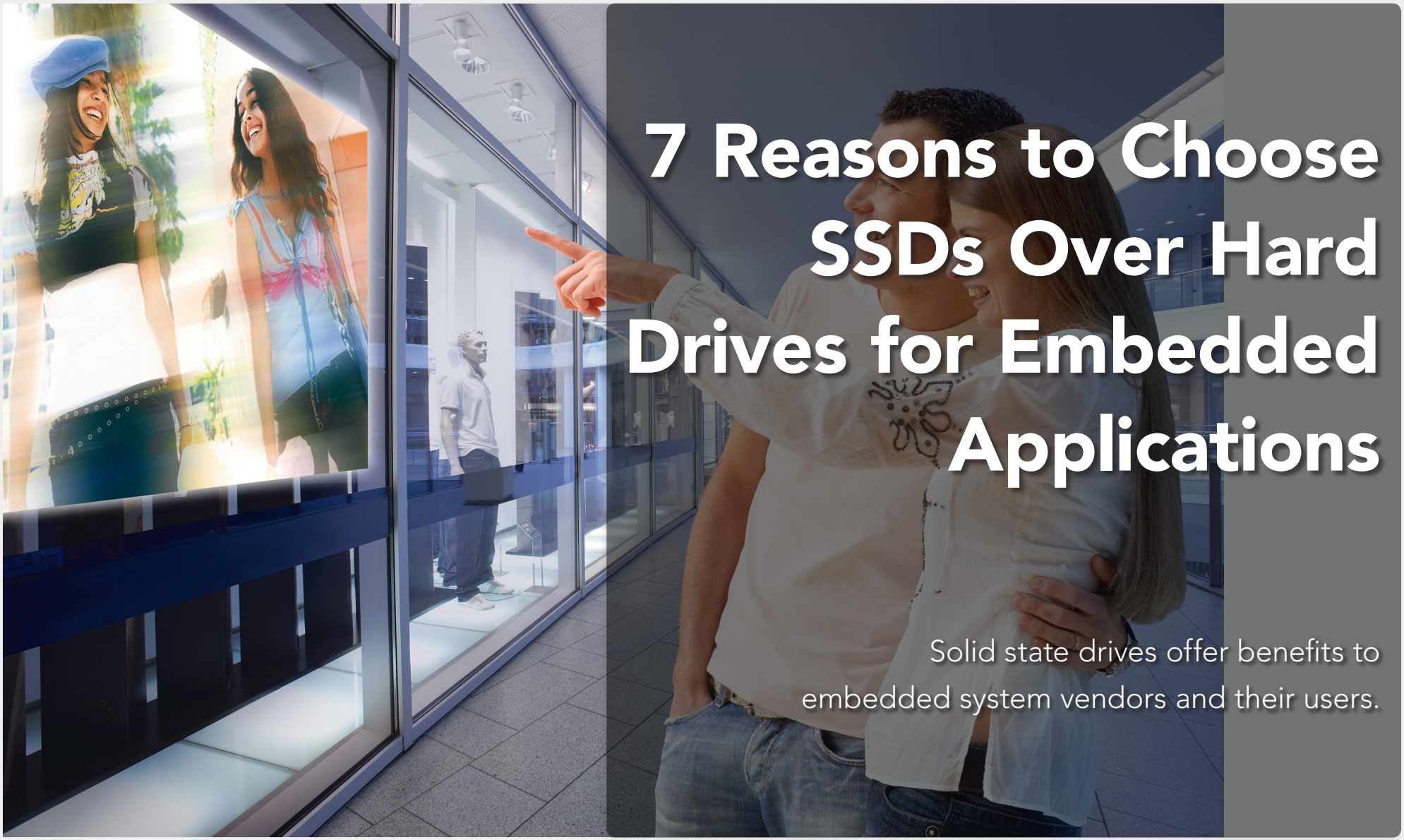

7 Reasons to Choose SSDs Over Hard Drives for Embedded Applications

Solid state drives offer benefits to embedded system vendors and their users.

SanDisk®
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Building embedded system units such as signage controllers and compact controllers is a difficult art. It's a balancing act of performance, space, electrical power, cooling, and, above all, cost. Storage plays a major part in these equations. Until recently, the best option for storage was the smallest hard drive on the market. This typically has a capacity much larger than needed, but that's the nature of the hard disk drive (HDD) business: The smallest drive has a single platter and recording head, which sets a floor on size.

With solid state drives, we now have a way to right-size the storage to the task. SSDs in size steps from 32GB all the way up to 1TB negate the need to use a 500GB HDD for the job. The smaller SSDs save money, power, cooling, space, and cost, while bringing benefits of faster performance and rapid boot times.

With SSDs, you can create better, more versatile products while saving money. This is a win for you and your customers and is clearly the way of the future.

Let's look at the benefits in a bit more detail.

1. Right-Sizing

With a hard drive, finding a drive to match your embedded needs is a Hobson's choice. The smallest hard drive available has a capacity of 500GB. Many embedded applications fit into much smaller drive spaces, from a few megabytes on up. SSDs tailored to the embedded market are entering volume production. Products such as the SanDisk® Z400s drives come in stepped sizes of 32, 64, 128, and 256GB. All of them are attractively priced against the cheapest hard drive.

2. SSD Prices Are Declining

Flash technology is still evolving rapidly, and capacity improvements are occurring faster than Moore's Law, doubling as frequently as every year or so. This impacts the embedded space by regularly reducing drive prices at any given capacity. SanDisk is projecting its next-generation Z400s drives will have disk-like pricing.

In contrast, hard drive technology has hit a wall. Capacity increases require major steps in technology, such as moving to shingled writes operations; this is difficult to cost-justify in low-capacity hard drives such as those used in the embedded market. With the realization that we've reached the bare minimum configuration of components in today's generation of hard drives (one head, one platter, one motor, one actuator, etc.), there is no room for lowering the base cost of a drive. Accordingly, hard drive prices have bottomed and are not likely to improve much.

The implication is that if SSDs can beat HDDs in price today, they will run way below them in the future. This is something to bear in mind for programs with a multiyear life expectancy.

3. Reliability Is Better With SSDs

Intuitively, no mechanical parts and low power consumption make SSDs much more reliable than any HDD. With all its moving parts, a hard drive is more prone to failure, especially if the drive is frequently stopped or started to conserve power. The start-stop process can lead to heads contacting media, and this has the potential to build up enough damage that the drive becomes unusable.

Hard drive vendors will point to the limited number of writes that

an SSD can handle, but today this is in the hundreds to thousands of full drive writes, which well exceeds the needs of the embedded market. Where this isn't the case, picking the next largest SSD will extend the write life considerably.

4. Embedded SSDs Are Much More Robust

Hard drive specifications emphasize limiting shock and vibration, both of which can seriously damage the drive. This is actually quite a complex but subtle problem. The drive has a head positioner that uses a servo system to keep the head on track. This servo is a mechanically "stiff" system that aggressively resists any movement off track. Vibration stresses this system's electronics and can cause circuit failure to occur within even a few days. Unfortunately, drives are very sensitive to fan noise, especially the high-speed miniature fans used in small systems.

It goes without saying that a lack of moving parts makes this a nonissue for SSDs.

5. Performance

The uninformed might think that high performance isn't a major concern in the embedded market, but this is most definitely not the case. A point-of-sale terminal that takes seconds to display screens will be hated by customers and checkout staff in no time flat, especially if it's tied into a scanning application. In the retail segment, a smart display that updates after the customer has turned away is useless.

The fastest hard drive can only manage 300 random-address write or read operations per second, and the small, slow drives that are used in embedded systems can realize fewer than 100. Even the slowest SSD is able to manage thousands of random-address writes or reads per second.

This speed difference makes an SSD dramatically more responsive, which translates into much greater user satisfaction. Everything from initial boot-up to responding to screen changes is much crisper, and the value perceived by the user of an SSD-based unit is substantially greater than that of the slower hard drive-based products.

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6. Power Matters

The embedded market is very sensitive to power usage. Equipment is often running 24/7, while some markets such as retail are striving for minimal operating expense. Any solution that inherently addresses power is worth exploring. In the case of storage, we are talking significant numbers.

Hard disk drives range in power use from 2 to 15 watts, while a 32GB mSATA SSD reduces power consumption to milliwatts. This is a huge difference in a low-power embedded system such as a point-of-sale terminal, where all the other electronics may together consume just a few watts.

Idling power is an issue as well. Hard drives need to spin continuously, or else access to data takes several seconds each time the drives starts up. Because that delay is usually unacceptable, the 2 watts of power for an HDD is a continuous load in most use cases, while an idle SSD uses hardly any power at all.

There's another payoff from that very low power in the SSD: Cooling is much easier. Typically, an HDD will require some airflow or it gets hot, resulting in a shorter working life and noticeable hot spots that may discomfort a user. Adding a fan to cool the drive uses even more power. More importantly, even the smallest fan is noisy, and the need for airflow means the case has to have a vent aperture, making it much less spill-proof or secure.

7. Space Is Limited

Space is a problem in all embedded solutions. A large drive typically needs to be placed behind a screen or board or in some sort of power bulge on the case. The only option with a hard drive is to use a 2.5-inch drive form factor. It is possible to get ultrathin drives, but these command a price premium and are less reliable in the high-shock or high-temperature environments that we see in the embedded space.

In contrast, mSATA SSDs are just 2 inches long by 1.25 inches wide, and just 1/8th inch thick. With their low power, they can fit in the frame of a display or in the plane of the circuit board. If the mSATA form factor isn't small enough, M.2-sized drives are just 1/8th inch thick by 0.86 inch wide by 1.6 inches long.

With these small footprints, there's extra space for other components and an opportunity to shrink the overall product.

Use Cases

Point of sale	The POS terminal is space-conscious; it needs a fast drive to deliver agile responses to the user selecting or scanning.
Signage	Smart signage must respond quickly to changes or the customer is out of view.
Interactive kiosks	Like signage, a moderate to large repertoire of images needs to be quickly delivered to the user to maintain attention.
Home control systems	Home control systems Size is an issue in these systems, and being "green" is an important selling factor.

The following looks at a set of use cases for fast embedded drives that would benefit from SSDs:

SSDs are clearly the way to move forward in the embedded space, with benefits to both embedded system vendors and their users. It's time to cut the hard drive loose and join the future.

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