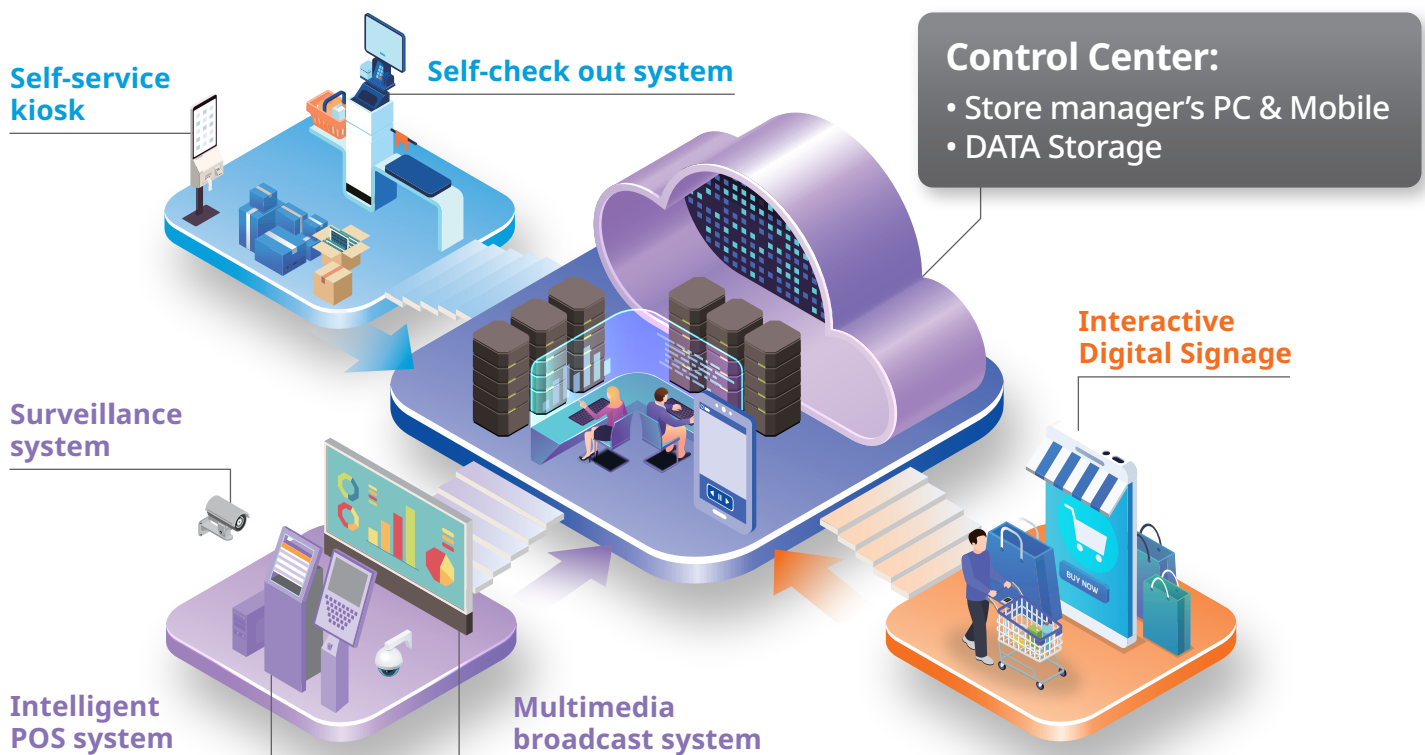# How to Solve Data Integrity Challenge for Frictionless Retail Store

Ferri Embedded Storage

Falling profits, rising costs and difficulty recruiting staff are driving retailers to look at how they can make their operations more efficient. Some retailers have attempted to tackle these challenges by reducing the number of workers on the shop floor. They have implemented technological solutions that automate functions for which employees are currently responsible. For example, some fast food restaurants have used automated ordering machines to replace counter workers, and most supermarkets have installed self-check-out stations to cut the number of required till operators. These initiatives have proven so successful that they are now looking to take this concept further and use technology to run the shop floor entirely, freeing up staff for more productive roles.

Self-service kiosk

Self-check out system

Control Center:
• Store manager's PC & Mobile
• DATA Storage

Interactive Digital Signage

Surveillance system

Intelligent POS system

Multimedia broadcast system

One of the most recent attempts at implementing a worker-free store was undertaken by supermarket giant Tesco as a trial in central London. The trial uses a combination of cameras and weight sensors to determine the products chosen and then automatically charges customers through an app on the user's cell phone after they leave the store. The cameras and sensors throughout the store are responsible for collecting a host of data on the customer and stock levels. This data must be processed and securely stored where it can be accessed immediately in case of dispute resolution.

Traditionally retail systems have used much the same hardware as IT installations, including the same rotational hard disk drives to store data. However, today's modern systems need more than a one-size-fits-all solution. There is a move towards processing data at the edge rather than centrally, meaning that storage solutions must be distributed between multiple devices with different requirements and not centrally on server racks and desktop computers. The types of storage required are also varied, from long-term, enterprise-scale storage in the cloud, to high-performance storage for video applications and compact, low-power storage for handheld devices.

The performance of storage systems is quickly becoming critical to retail workplaces as data-intensive applications, such as high-definition video streams from multiple cameras, are employed, and faster access and higher bandwidth are prioritized. Artificial intelligence (A.I.) solutions are also becoming widely deployed for identifying products in frictionless retail applications. While the throughput of data on rotational drives has improved over the years, implementing faster processing and A.I. will make even that improved performance a bottleneck in a modern real-time system.

NAND Flash Storage

NAND flash devices offer a much more compelling alternative to hard drives for storage in retail systems. They provide higher performance in every important metric, with faster read and write

speeds and higher bandwidth with much lower latency for instant response. They are solid-state devices with no moving parts, meaning they are much more rugged and reliable than hard drive storage. In the past, the cost of NAND flash storage was relatively high compared to rotational devices. Still, the technology has improved, and the price has been reduced to such an extent that the extra benefits offered by NAND easily outweigh any additional cost by a wide margin. NAND devices are now available in high capacities, with form factors small enough to fit in almost any design, even handhelds. They are silent and tolerate temperature variations much better than their rotational counterparts. Finally, they also offer much greater flexibility than hard drives, which are only available for general applications in several form factors. NAND storage solutions come in a wide variety of form factors and formats. Better still, some NAND storage specifications are customizable to fit different applications, meaning that the extra flexibility also comes with fewer compromises to be made in the design stage.

There's no single solution for retail storage solutions. A POS terminal will have different requirements, from a handheld barcode scanner and different requirements for digital signage. However, some traits are common to all those applications, such as availability, data integrity, security and robustness. Unlike hard drives, NAND storage has the flexibility to ensure that it can be tailored to get the maximum cost, performance, ruggedness and power usage balance for each application.
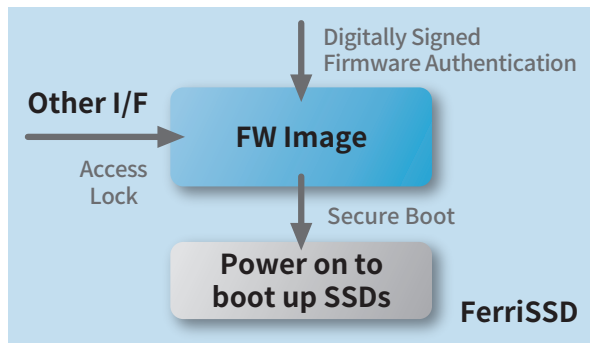

- **Higher performance**
- **More rugged and reliable**
- **Flexibility**
- **A wide variety of form factors**

The Highest Levels of Security

Security is almost certainly an essential requirement for retail storage. In an industry where customers disclose their credit and debit card information regularly, often through wireless communications, having the most challenging possible security is essential for every part of the system, including storage. Fortunately, NAND storage is ideal for secure applications. For example, Silicon Motion's FerriSSD family of devices has authenticated firmware protection, meaning a secure digital signature

must be present for the storage system to start operating. Hackers who attempt to spoof the system by loading compromised firmware will be locked out while an alarm signal is sent to the host processor. The host processor will also alert if a hacker tries to perform unscheduled emergency maintenance. The stored data is also protected through AES 256-bit full disk encryption support with Secured Password Protection. Finally, remote firmware updates can be achieved securely with a secured digital signature when applicable.

System Firmware Protection

Digitally Signed Firmware Authentication

Other I/F

FW Image

Access Lock

Secure Boot

Power on to boot up SSDs

FerriSSD

FerriSSD maintains boot security via secured digital signature authentication

User Data protection

Public Data Protection Regulations

Full Disk Encryption

TCG Opal 2.0

FerriSSD

Customized Data Protection Measures
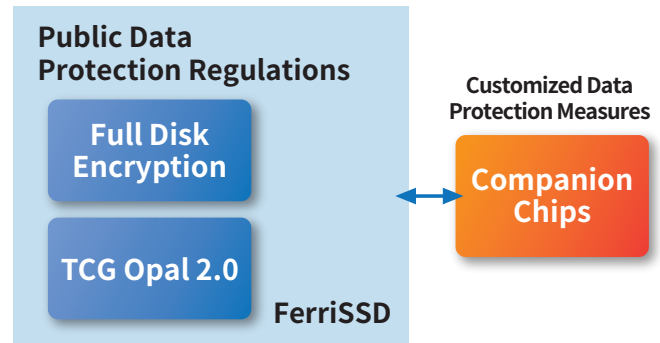
Companion Chips

Full disk encryption is available via TCG OPAL. For optional added security, optional companion chips are added to enhance the security of sensitive user data.

Data Integrity

Next to security, data integrity is probably the next most desired trait for retail applications, especially applications that rely on the IoT. To produce optimal outcomes, the IoT depends on information from many sources, from real-time sensor data and video streams from the shop floor to long-term data on goods and customers extracted from servers. Every piece of data is vital, so integrity is essential. NAND Flash storage devices have many features that can help ensure data integrity in the storage devices and often throughout the system.

For instance, the Silicon Motion FerriSSD range has complete data error detection with recovery engines for enhanced data protection through the full host-NAND-host data path. The data recovery algorithm detects any SSD data path error, including hardware, firmware, and memory errors in SRAM, DRAM or NAND. The devices also have the proprietary IntelligentScan with the DataRefresh feature to combat read disturbance and ensure data retention. The device's firmware intelligently responds to the host behaviour and the working environment to determine where, when and how frequently to scan the SSD When overstressed cells are detected, the DataRefresh function automatically recharges, repairs or retires the cell block, prolonging the storage device's lifetime beyond the specifications typically found in NAND drives. In addition to first-level error correction, FerriSSDs also include a second-level correction scheme using an LDPC (low-density parity check) code and a Group Page RAID algorithm to reduce potential dPPM while extending the service life of the SSD.

Another major part of data protection is ensuring that external effects do not compromise data. FerriSSD supports self-monitoring, analysis and reporting technology (S.M.A.R.T.) and has system-level protection from voltage surges. They have also been designed to offer strong protection against electromagnetic disturbances.

More Choices, More Flexibility

Besides the comprehensive security and data integrity functionality, NAND storage devices have many other features that make them ideal for a host of retail applications. For example, the devices can be configured to support different applications and price points. The designer can configure the devices in SLCmode, MLCmode and TLCmode depending on the performance and durability requirements of the application.
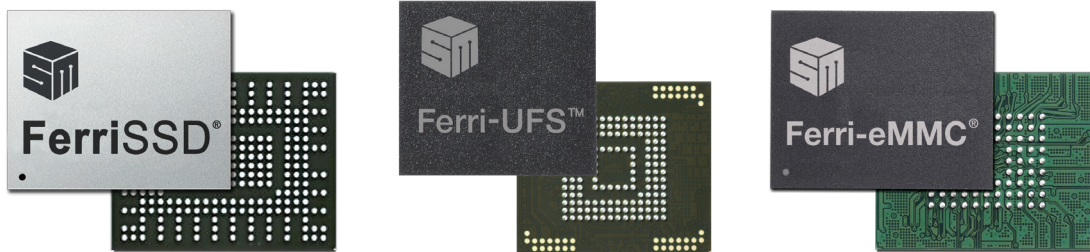
Multiple connectivity choices are also available, with the FerriSSD range providing options for NVMe 1.3, PCIe Gen3, SATA and PATA protocols for use cases that require fast access speed in a small flexible form factor, such as video storage. The Ferri-UFS family complies with the latest UFS2.1/3.1 standard and offers high-performance storage and low power, making it ideal for portable and battery-powered applications. Finally, the Ferri-eMMC family fully complies with the JEDEC standards for the eMMC 4.5/5.0/5.1 protocols. Ferri-eMMC memory provides high data integrity and reliability in a 100/153-ball BGA package for easier PCB design and low-cost manufacture.

FerriSSD modules have advanced controller technology and passive components integrated for faster design times. If those choices weren't enough, then the firmware of the storage device can also be tailored to provide the best specifications for each application, including higher TBW (total byte written) and a better customer experience. The customization can be achieved securely, either locally or remotely, to offer easily upgradeable, highly reliable and differentiated retail storage solutions. Other FerriSSD products are available in various densities and modular formats from M2 size up to the standard 2.5" form factor to ensure the designer always has the most suitable memory solution for each new product. FerriSSD memory devices also operate optimally across a wide temperature range between -40°C to 85°C. This allows them to be designed into devices intended for outdoor environments and used in applications such as industrial freezers. The high maximum operating temperature also makes FerriSSD devices ideal for use in compact, fanless, handheld products.
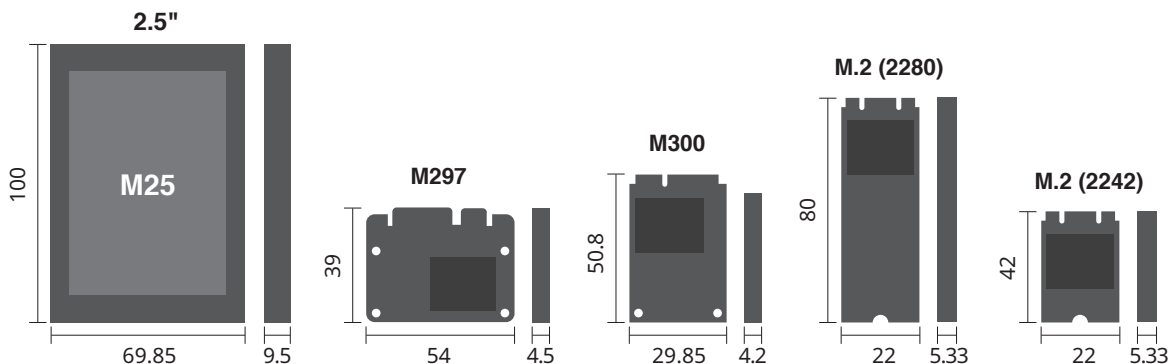
Summary

The retail space is changing rapidly, and retailers are turning to technology to help them manage their business and offer their customers a tailored experience. Legacy I.T. technology, such as rotational storage, can no longer provide the performance and toughness required in the small form factors. NAND storage has all the attributes necessary for retail requirements for today and tomorrow. Silicon Motion's FerriSSD range provides many options, which have the flexibility to quicken development time and allow drop-in upgrades, enhance the overall performance of storage while eliminating downtime, and reduce the total cost of ownership.

For more information about Automotive-grade SSD controller products, please go to
www.siliconmotion.com

SiliconMotion