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Boot Enhanced Storage Technology (BEST) in a Hyperscale Environment

## Boot Enhanced Storage Technology (BEST) in a Hyperscale Environment

Innovative SSD drive technology that offers segmented storage capable of separating operating systems and company data can provide a redundant, stable solution that prepares today's Data Centers for the demands of the future. In this paper, we would like to show the advantages of adopting LITE-ON's Boot Enhanced Storage Technology (BEST) based on NVMe M.2 SSD.

Boot drives are an essential component of a modern server. The boot drive is the medium in which the main operating system resides. During initialization, the CPU executes the operating system by reading off the drives. However, the boot drives are often overlooked, and they should not be.

From the 1980s to the late 2000s, hard disk drive (HDD) technology was sufficient to meet the boot drive needs of Data Centers serving enterprise applications. But since 2010, solid state drive, or SSD technology has been growing in popularity in all areas of the storage industry, and boot drives are no exception. However, the currently popular form factor is still dominated by legacy form factors left over by the HDDs, mainly 2.5" SATA.

### Boot Enhanced Storage Technology (BEST)

BEST is basically a PCIe AIC (Add in card) form factor that can accommodate 2x NVMe M.2 based SSD. The AIC has an NVMe RAID chip from Marvell 88NR2241 that can do 4 PCIe lanes upstream to the host and 8 PCIe lanes downstream to the 2 SSD drives, so each drive gets 4 PCIe lanes.

The size of the AIC can come in HHHL (Half Height Half Length) standard PCIe sizes or we can further cut the HH (Half Height) in half and mount the M.2 drives back to back to save even more space. Furthermore, we can adopt the design of the AIC into a U.2 connector and fit 2x M.2 drives in a U.2 form factor.

LITE-ON will initially design with the most popular 2280 and 22110 form factors in mind. If the industry changes, we can accommodate other form factors with no disruption to the server host hardware.

### Advantages of BEST

1) BEST takes advantage of the most popular form factor, which translates to the best TCO based on economies of scale. 2) The simplicity of the server offers just NVMe interface and dropping legacy interfaces. 3) BEST provides flexibility for various applications depending on their requirements. 4) BEST offers compact solutions and isolates the boot drive from data drives. 5) BEST can offer the RAID 1 mirroring feature, which can provide redundancy on a server at minimal additional cost.

## Taking Advantage of a Popular Form Factor

A common pitfall is for customers to choose a particular form factor for their system, only to find that the industry has gone to another form factor. This creates a problem in which the server is designed with a form factor (believed to be mainstream), but by the time the server goes into production, the form factor has become legacy. Examples of such form factors are mSATA, slim SATA, mini PCIe, and 1.8" SATA. Extra cost and effort must then be expended to secure the ever-dwindling supplies of such legacy form factors in the marketplace. Some Data Center customers have sometimes resorted to securing years of components in order to ensure that they can build legacy form factors. BEST is designed currently with the most popular form factor M.2 NVMe 2280 or 22110.

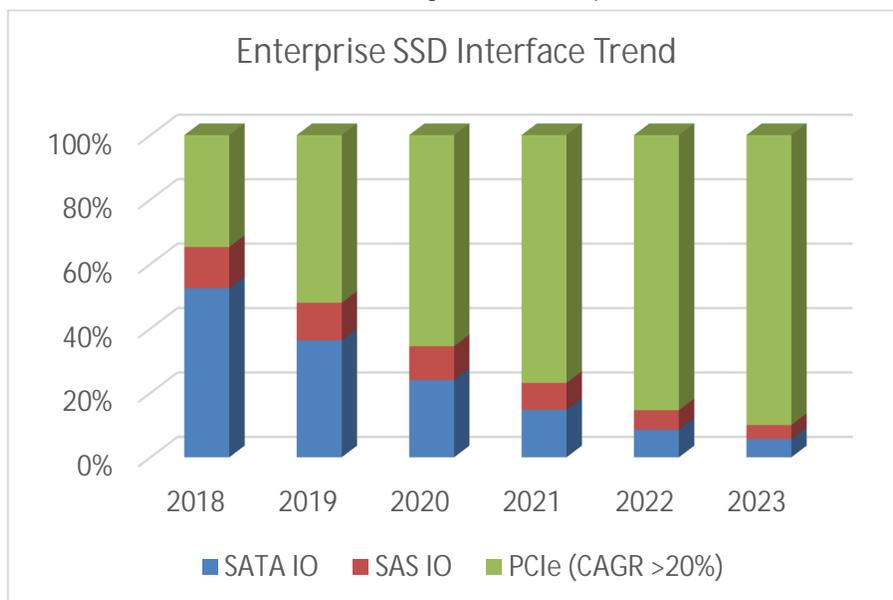
However, it is possible that M.2 2280 or 22110 could fall out of favor in the marketplace. BEST with its AIC design can serve as a hardware mechanical abstraction layer for the server host without committing to one particular form factor. The AIC can be redesigned with the latest popular form factor without disrupting compatibility with the server host. New form factors can be introduced with a minimal amount of pain. An already deployed server can also be backward compatible if servicing is required.

By ensuring that the customer's servers can always use the most popular form factor in the market place, we can ensure that our customers can always enjoy the best economies of scale and lowest TCO.

## Simplifying the Server Interface Support

In 2019, most common interfaces for storage are SATA, SAS, and PCIe. For data drives, the trend is clear, while PCIe is growing significantly, SAS is flat, and SATA is declining.

Forward Insight, Q1 2019 Report



However, in the boot drive segment, SATA is still holding steady. PCIe is growing but not fast enough, and SAS is traditionally not a factor in boot. Due to the explosion of form factors associated with PCIe, there are customers who like to stick with SATA 2.5" to hedge against changing form factors.

In the last section, we showed that it is possible to use BEST as a hedge to lower the risk of picking the wrong form factor. Therefore, with the hedge against changing form factors, servers can be designed with only PCIe slots without SATA support. This can reduce the complexity of server design and further lower costs. Furthermore, existing servers, using BEST, can still take advantage of PCIe interface in the coming years even if the motherboard doesn't come with M.2 slots natively. Existing servers can migrate to use PCIe as boot with minimum HW changes.

## Feature Flexibility of BEST

BEST also offers the flexibility of the features of a boot solution. There are certain applications like OLTP (Online Transaction Process) or financial transactions that require PLP (Power Loss Protection) to ensure data protection. Some applications are able to use client drives as boot drives. BEST allows customers to adopt different grades of SSD using the same AIC platform. If PLP is required, then we suggest putting in Data Center grade SSD. If costs are more of a concern, then it is possible to use client grade SSD. However, the underlying AIC card can be reused and shared among different applications.

## Compact Footprint and Isolated from Data Drives

BEST comes in a compact footprint adhering to the PCI-SIG spec, so it doesn't take much space in the server host. Depending on the server designer, it can be placed in the front, middle, or back of the server. Only 1 x4 PCIe slots are needed for 2 boot SSDs. Extra slots can be saved for other applications like AI, which requires lots of graphic cards. Furthermore, BEST is isolated from the data drive so there won't be accidental removal of the boot drive during servicing.

## Cost Effective Redundancy

BEST uses the Marvell 88NR2241, which can do RAID 1 mirroring across 2 M.2 NVMe SSD. If one M.2 boot drive fails, the server can rely on the other M.2 boot drive. For certain enterprise level applications in a Data Center, redundancy is important to maintain the high availability of the server for ready access. BEST can provide RAID 1 redundancy at a minimal cost to the customer. Expensive RAID HBA cards are no longer needed to provide boot drive redundancy. Failure to maintain a certain amount of uptime in a Data Center can result in loss of business or even fines from the end user. Therefore, paying a little extra upfront for redundancy can pay big dividends a couple of years down the road.

The most efficient and cost-effective data management system should be reliable, secure, and redundant, with maximum availability of resources both for handling OS level tasks and maximizing data storage. Implementing BEST can make a company's SSD-based data management system more economical and efficient. In a hyperscale, or hyper-converged, computing infrastructure environment, it allows users to separate operating system drives

from data drives, and potentially minimize unused legacy interface. Using BEST's RAID 1 mirroring feature can achieve redundancy, so the servers will maintain high availability in the Data Center. BEST is the ideal solution because it can provide high availability, scalability, and a lower TCO than traditional in-server storage solution.

For more information, please visit [www.liteonssd.com](http://www.liteonssd.com).



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