FuzeDrive Back Grounder: Virtualization

Storage Device Virtualization

In its simplest description, Storage Device Virtualization combines disparate storage devices and presents them to upper layer applications as a single high performance virtual storage device.

Analagous to how virtualization abstracted operating systems from server hardware, storage device virtualization creates an abstraction layer between media and applications, freeing those applications from device dependencies.
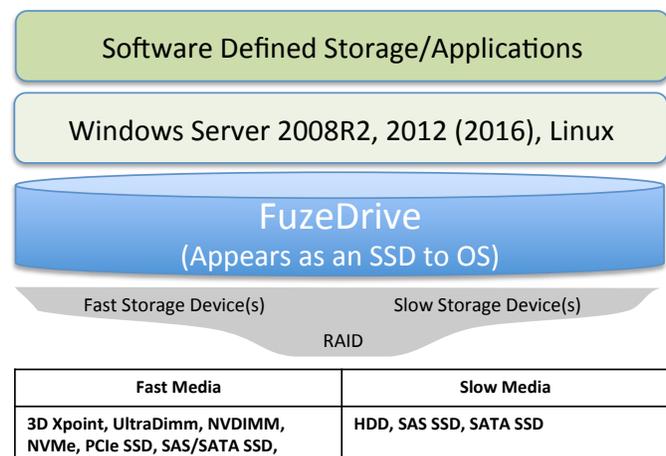
Storage device virtualization should not be confused with Software Defined Storage (SDS), rather it should be viewed as an augmentation to SDS. It enhances SDS by shielding the applications from devices, therby increasing simplicity. Since the virtual disk incorporates fully automated real time tiering technology, it provides a cost effective, high performance alternative to all flash solutions.

An additional benefit of the abstraction layer provided by device virtualization is the ease with which emerging technologies such as NVDIMM and 3D Xpoint can be integrated into solutions.

As performance and/or capacity needs change, or devices indicate potential failure, storage device virtualization provides the ability to live migrate devices while online. Similarly, upper level application upgrades will not impact the underlying hardware.

Storage Device Virtualization forms the foundation upon which Enmotus' data rich features are based, enabling our unique ability to actually see what your storage devices are doing, and act upon their behavior to provide ongoing optimization as well as the advanced analytics required to proactively manage your storage.

Enmotus FuzeDrive utilizes a new approach to disk (device) virtualization. Blending fast storage media devices with capacity centric storage media results in a solution with the performance characteristics of the fast media and cost points approaching the capacity media. The resulting virtual disk enables real time automatic data tiering inside servers and workstations. It is used to virtualize a broad range of **direct attached storage** devices from PCIe SSDs, NVMe SSDs to everyday hard drives and RAID volumes as well as emerging memory class storage such as NVDIMMs and 3D Xpoint.

Software Defined Storage/Applications		
Windows Server 2008R2, 2012 (2016), Linux		
FuzeDrive (Appears as an SSD to OS)		

Fast Storage Device(s)   Slow Storage Device(s)

RAID

Fast Media	Slow Media
3D Xpoint, UltraDimm, NVDIMM, NVMe, PCIe SSD, SAS/SATA SSD,	HDD, SAS SSD, SATA SSD

FuzeDrive abstracts the underlying storage devices and creates a virtual drive that presents itself to the operating system as an SSD

FuzeDrive utilizes an on-the-fly primary storage statistical remapping technology called MicroTiering™. This provides several benefits.

- Performance for both reads and writes approaches the native performance of the SSD because the SSD is the primary storage in the hybrid volume
- Solution costs 5X-10X lower than all flash because the bulk of the volume capacity is made up from cost effective storage
- System can easily be configured to your specific application requirements because any ratio of fast (e.g. SSD) to slow (e.g. HDD) storage can be accommodated.
- Reduces overall system power because data does not need to be continuously "flushed" to slower storage
- Significantly lower CPU utilization because the virtualization mapping architecture typically consumes less than 1% CPU overhead

Target Applications:

FuzeDrive is used wherever full SSD or all-flash performance is desired in primary storage applications, but the cost is too high. The hybrid approach of FuzeDrive supports equivalent performance in many cases to all-flash but a cost point closer to hard drives on a $/GB basis.

The value propostion of Enmotus' FuzeDrive is built around a fundamental principle: most applications do not use more than 5-10% of their total accessible storage at any particular time. Most usage patterns do not have random IO across a wide LBA range. This is a statistical phenomenon, where random IO by applications, stays within the bounds of a few 100 GB - not beyond. Multiple applications (including Virtual machines) tend to replicate this pattern in clumps.

For many applications, implementing an all-flash solution to guarantee a certain quality of service is a *very* expensive way to implement storage given the 10x+ cost delta between flash and hard disk drive solutions. This is especially true for very large 10-100TB systems. Hence, FuzeDrive provides a way to balance that performance-cost equation.

For caching implementations, we often see the "5% rule" which implies that the size of the SSD should be around 5% of the total storage volume. This is a cache only rule and doesn't apply as rigidly to tiering and virtual disk architectures. This is because cache has a diminishing return on performance as they become larger given they take more CPU horsepower to manage their tables and reserved media, plus the cache itself starts to become a bottleneck as you can only storage so much information in a look-aside, reservation based scheme.

FuzeDrive breaks this rule, and in particular with MicroTiering, given there is no reservation scheme and all capacity is usable (even the SSD), 10/90, 20/80, 50/50 schemes are all supported with no penalty on CPU or capacity. Furthermore, as the SSD is treated as primary storage, streaming as well as random data sets are supported equally well (or at least as well as the underlying SSD can support).

Instances exist where an all flash solution is the best choice, but other than rare cases, the IO usage patterns adhere to the same pattern of IO access remaining localized. This being the case, the benefits of virtualization technology apply to all flash solutions as well. For example, NVMe technology provides the best speed, while SAS or SATA flash is more cost effective. Virtualizing these 2 classes of storage provides best in class economics for performance and capacity for an all flash solution.

Emerging memory class technologies, such as NVDIMMs and 3D XPoint, play well into virtualization as well. These high speed, albeit costly, memory provides a ultra-high performance third tier in a virtualized solution.

About Enmotus

Enmotus develops intelligent storage acceleration software for next generation data center, web scale and profesional workstation applications. Our storage device virtualization software, FuzeDrive, enables system builders and IT managers to easily build hybrid storage solutions using any standard block storage device, including NVDIMM, NVMe, PCIe SSDs and SAS/SATA storage devices, presenting them as a real time automated tiered devices within Windows or Linux based operating systems. Fully compatible with all mainstream applications, FuzeDrive implements a rich set of device management tools that allow users to see data activity, fast tier media or file distribution across tiered devices and manually pin files to any tier.

Enmotus was founded by storage and virtualization experts. For more information, please visit www.enmotus.com or contact us at info@enmotus.com.

"Simplicty is the ultimate sophistication"

- Albert Einstein