Drobo™ Hybrid Storage™

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Introduction

Storage has traditionally been difficult to understand and manage, especially for those not in the storage industry. Tasks such as pooling drives, scaling capacity, and protecting against data loss are complex for businesses and individuals alike. In addition, the explosion of rich media and unstructured data requires more sophisticated digital storage. Plus, legacy solutions can also be too complex or too limited for today's needs, especially if users are also demanding a fast and reliable storage system.

Drobo™ products deliver breakthrough ease-of-use, affordability and value through our patented BeyondRAID™ and hybrid storage technologies. Now businesses and professionals will have the *best storage experience ever*.

Drobo BeyondRAID technologies enable a unique combination of simplicity and storage sophistication in stark contrast to legacy storage systems. Drobo's are part of a new breed of storage systems focused at small to medium sized business users. Advantages include: data safety and real-time capacity expansion, with an overall design that addresses diverse workload needs such as media, virtualization, and cloud-attached storage. Drobo's provide an easier way for a non-IT person to deploy and manage a performance storage system without the enterprise price tag.

Hybrid storage is a Drobo technology that automates the provisioning, deployment and performance acceleration for a fast tier of solid state drive (SSD) storage in the Drobo B1200i array. Users can now take advantage of traditional hard disk drive (HDD) capacity plus SSD acceleration across all of their applications. This process happens automatically and transparently as soon as SSD drives are added to the deployed Drobo. Because, Drobo is aware of the differences between streaming and transactional data, it enables instantaneous and intelligent data tiering to increase performance by directing transactional data to the SSDs.

Industrial design is one of the many benefits of this very cool looking product family. It's award winning designs successfully marry style and usability. Whether your Drobo is simply sitting on your desk or traveling with you to the Galapagos Islands for a shoot, you can rest assured that your Drobo is up to the challenge.

The Drobo user interface extends beyond the status lights on the front of every Drobo. It also includes a desktop application which provides a multi-device administration dashboard for all directly connected Drobos as well as those located on a local area network (LAN).

Four white papers describe why Drobo provides user's with a truly modern storage experience:

1. **BeyondRAID** breaks down the barriers of a traditional RAID implementation to greatly simplify storage deployment and management, and it protects both data and files

2. **Hybrid Storage** is enabled by BeyondRAID. It delivers automatic storage optimization based on the type (or "tier") of the data or files stored

3. **Industrial Design** highlights that it is possible to combine functionality, style, usability, manufacturing quality, and a lot more into a very cool looking product line

4. **User Interface** makes pooling drives in a single chassis easier than previously possible

This white paper explains Drobo BeyondRAID and its associated benefits.

What is Hybrid Storage?

Drobos' intelligently handle data for added resiliency, performance, and management. These capabilities break down into two main areas:

1. Drobo knows the difference between data and non-data; traditional RAID does not. This allows Drobo to provide benefits including:

    *   An *array-level* capacity gauge

    *   Virtual hot-spare

    *   Proportional rebuild times

    *   Automatic space reclamation for deleted data, and much more

2. Drobo is aware of the difference between streaming and transactional data, this enables instantaneous and intelligent data tiering. As data is written, it is analyzed in flight and placed on the correct media (SSD or HDD) to maximize performance.

Using SSDs in a Drobo has many benefits including the elimination of the time lag that can occur with other tiering solutions that have to analyze I/O patterns before placing data to the appropriate tier.

SSDs Enable Hybrid Storage

By design, all the disk drives in a Drobo create a single storage pool. Because of this, users do not need to think about pooling drives or creating RAID groups. Also, drives of different sizes and types can be used together. This makes Drobo ideal to use SSDs and HDDs together in the same chassis. To support drives of different sizes and types, a Drobo virtualization layer sits on top of the physical drives.

The Drobo 1200i supports SSDs in the same chassis to create a faster tier of storage for data that is transactional in nature. This type of data really benefits from the faster read/write speeds that SSDs provide. Known as hybrid storage, the Drobo B1200i combines SSDs with HDD technology. This benefits users by redirecting transactional data to the SSDs, essentially using these faster devices as a cache that complements higher capacity but slower and cheaper traditional HDDs.
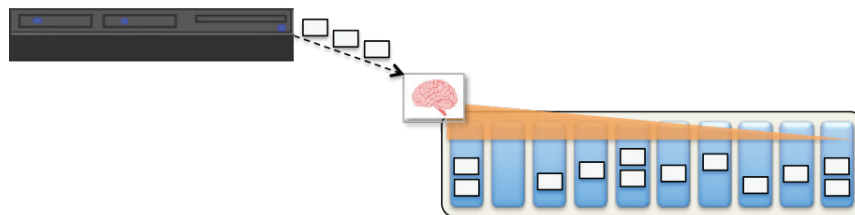

Figure 1. Data is analyzed in-flight as it enters a Drobo and is placed on the drives.

Transactional Data Placement

As data enters the Drobo, even while it's still in flight, it's already being examined, but note that *performance is not impacted*. An additional check determines whether or not the data is transactional in nature. If it is transactional, then the data is written to the faster SSD tier.
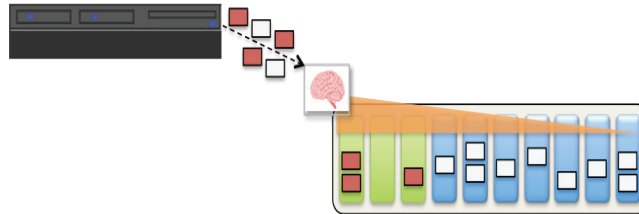

Figure 2. As data is written to the Drobo, transactional data (shown in red) is written to the transactional tier (SSDs) and the remaining data is written to the bulk tier (HDDs).

Even leading hybrid storage arrays that offer similar capabilities are not always aware of the type of data being stored. Often data is first written to bulk storage and then analyzed before it's moved to a higher performance SSD tier. With Drobo, transactional data immediately goes to SSDs ensuring that reads and writes are optimized.

Drobo's hybrid storage functionality allows users to store any type of data and in flight it's automatically optimized for the SSDs. In summary, all mixed data types from VMs in a cluster, Exchange databases/datastores, backup data, or files on a file server are automatically sent to the correct storage media.

One Pool, Multiple Tiers

BeyondRAID technology allows the Drobo B1200i to behave as a single pool of storage. Whether you put 3 drives, 12 drives, or any number in between, they are all managed as a single storage pool.
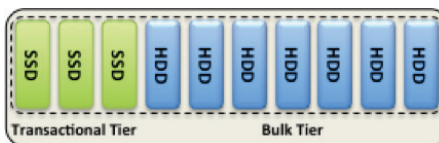

Figure 3. In this 10-drive hybrid array there are two storage tiers, one for frequently accessed transactions and the other for occasionally accessed bulk storage.

It doesn't matter what the split is between HDDs and SSDs (e.g. 8 x HDDs and 2 x SSDs or 9 x HDDs and 3 x SSDs), this hybrid array will be utilized appropriately without any preliminary configuration. All the administrator has to do is install the drives in the Drobo.

Fully Automated Tiering

After data is written to storage, data patterns often change. Sometimes a large amount of data is written to storage and then not read for weeks or even months. Often a small amount of data is written and accessed very frequently. Traditional storage arrays treat all data the same way, this means that if the storage array is optimized for streaming performance, it's unlikely that it's also optimized for transactional performance (see "Streaming vs. Transactional Performance" addendum).

With Drobo's automated tiering, optimization of data doesn't stop after its written to either the transactional or bulk storage tier. As data stored on Drobo is being read, it's also analyzed to look for patterns. Over time, should data on the bulk tier be frequently read, it will start to look more like transactional data and will be migrated to the transactional tier. And, as data on the transactional tier becomes "cold" (few or no read requests), it will be migrated to the bulk tier. These migrations occur in the background and are completely

transparent to the user. Repositioning of data occurs automatically when the storage is being lightly used and doesn't require any administrative interaction.
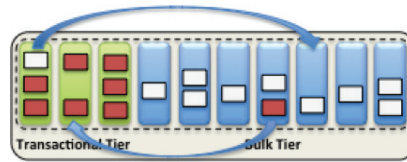

Figure 4. This diagram illustrates data being moved between tiers as it heats up or cools down.

Tiering Without SSDs

Even without SSDs, Drobo still puts its automatic tiering feature to work. Without SSDs, the advantage of tiering is to eliminate the write penalty when parity data is created. One of the characteristics of Drobo BeyondRAID is the automatic creation of zones of different types. When all of Drobo's HDDs are the same, Drobo lays out zones differently on the transactional tier than it does on the bulk tier.
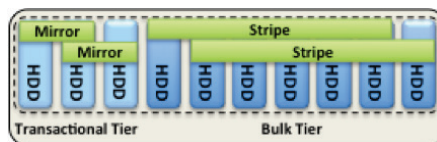

Figure 5. The following example illustrates drobo creating different zone types on transactional and bulk tiers to tune the storage appropriately for hot and cold data.

For example, mirror zones are optimized for writes, whereas stripes are optimized for capacity. Leveraging Drobo BeyondRAID technology, zones are created automatically and altered on the fly ensuring the Drobo is always optimized for transactional and bulk data.

Just Add SSDs

As discussed above, Drobo will automatically optimize for performance and zoning if it only contains HDDs. Should applications need more performance, just introduce at least two SSDs (for single-disk redundancy) or three (for dual-disk redundancy) to the Drobo B1200i. The SSDs then take over as the new transactional tier and all HDDs are then delegated to the bulk tier. Because this migration occurs automatically, the only needed administrative task is to insert new SSD drives into the Drobo unit.

NOTE: Because SSDs eliminate HDD drive seek time, adding them into a Drobo increases both read and write performance. This performance boost is critical in database and email environments that are characterized by frequent read/write requests which are small in nature.

Choosing the Right SSD

Not all SSD drives are the same and choosing the right one can really benefit performance to ensure service level agreements (SLAs) are met. Here are some considerations:

- Although not true in the past, enterprise-grade drives are now available that use MLC flash, significantly driving down the cost/GB

- Enterprise-grade SSDs often have a higher level of overprovisioned space, increasing performance and extending their life

- Enterprise drives are tuned for extended use, these are able to handle more write cycles and use reclamation features such as TRIM and UNMAP to optimize capacity and performance

- Similar to HDDs, SSDs are available with SAS or SATA connectivity. Only enterprise-grade SSDs are available with SAS connectivity

  ◦ Drobo B1200i supports both SAS and SATA drives.

For best performance don't compromise, use enterprise-grade SSDs and HDDs in the Drobo B1200i.

Summary

Drobo was created to solve challenges inherent with storage technologies in SMB and enterprise workgroup environments. Those previously familiar with storage assumed that RAID, that allows drives to be aggregated and protected, was the norm. But it's no longer the norm. Drobo BeyondRAID provides a huge advantage for users that aren't interested in learning about storage in order to protect their data. It also aids storage administrators that desire to manage their storage more efficiently.

Drobo's ability to intelligently redirect transactional data to SSDs, means this array is perfect for small and medium sized businesses that use a lot of rich media-based applications, such as Microsoft Exchange Plus. Hybrid storage tiering takes storage automation to the next level, allowing Drobo to automate the once-complex tasks of data protection, capacity planning, and performance tuning.

Addendum

Streaming vs. Transactional Performance

Streaming Data: when streaming data to and from storage (high volume reading and writing files or storing backup data) the data set is usually quite large and operations are often sequential.

Transactional Data: when small blocks of data, such as metadata or fields in a database, are sent to and from storage, data operations are performed using a random process.

Therefore, streaming and transactional data, and access patterns require different metrics from the storage array in order to maximize performance.

- When streaming large amounts of data, the metric MB/s (number of megabytes per second that can be written to or read from storage) is most important

- When storing data that is transactional in nature, the metric IOPS (number of inputs and outputs per second that can be written to or read from storage) is most important

When evaluating storage performance to ensure it can meet the needs of an application, consider both metrics, MB/s and IOPS. The most intelligent way to have the best of both worlds in business-critical environments is to use hybrid storage that has automated tiering capabilities.