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Damon Robertson
Coolspirit Ltd

Our address
24 The Bridge Business Centre
Beresford Way
Chesterfield
S41 9FG

Get in touch
Call us on: 01246 454222
Email us: web@coolspirit.co.uk
Find us: View location map
Web: www.coolspirit.co.uk

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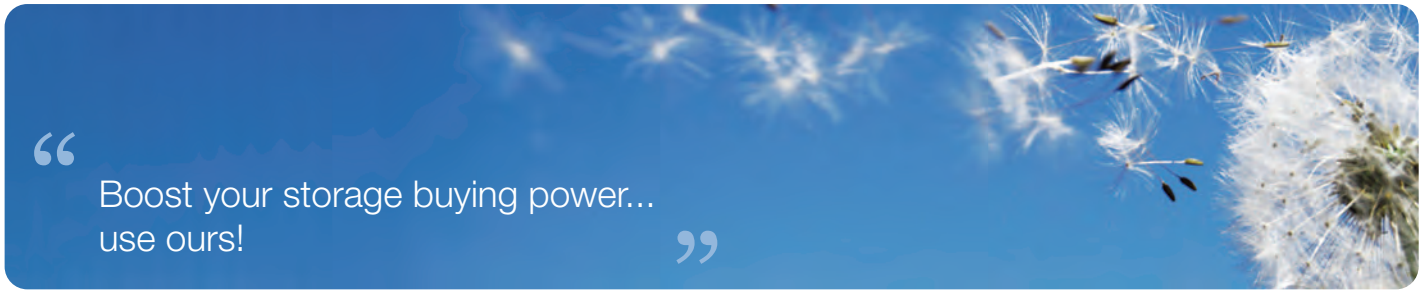

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Dot Hill AssuredUVS™

Unified Virtual Storage

Using Storage Virtualization to Maximize Performance and Scalability in Rich Media Environments

A Dot Hill White Paper

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At Last: Low Cost "Rich" Storage for Performance Demanding "Rich" Media

The Rich Media Storage Dilemma

Introduction

The fast paced world of digital content creation, production, editing, and broadcast is getting faster. Digital film, high definition (HD) video in 1080P, Digital Cinema new 2K/4K formats, with detailed rendering, complex graphics and special effects, are all pushing performance requirements as never before. It has gotten to the point where these demands are regularly exceeding the capabilities of current systems.

Throughput Bottleneck

One of the biggest culprits to the performance throughput bottleneck is the storage. Storage systems are an inherently limiting factor. They're not normally designed for high throughput. When high throughput is a primary design goal, both the wallet and IOPS tend to suffer greatly. In an era of tight budgets and tighter deadlines, the storage system tradeoffs, leaves the unacceptable choice of bust the budget or delay the deadlines.

The many factors that influence storage performance:

- Number of disk drives in the system
  - System performance cannot exceed the sum of the performance of the drives
- Type of disk drives
  - Each drive type has different performance, although FC and SAS are very similar
    - SATA
    - SAS
    - Parallel SCSI
    - Fibre Channel
- Speed of the disk drives
  - Higher RPM = higher performance
    - 7,200 RPM
    - 10,000 RPM

        - 15,000 RPM
- Amount of storage system cache
    - Greater cache can increase performance
        - From 256MB up through 128GB
- Storage system interface
    - Each interface has a max throughput:
        - Parallel SCSI – 80MBps, 160MBps, 320MBps
        - Fibre Channel – 200MBps (2Gbps), 400MBps (4Gbps), 800MBps (8Gbps)
        - iSCSI and/or NAS – 125MBps (1Gbps), 1.25GBps (10Gbps)
        - SAS – 300MBps (3Gbps)
- Storage system RAID
    - Disk failures in certain RAID types will significantly degrade performance:
        - RAID, 0,1,3,4,5,6,10,50,60
- Total storage system controller throughput
    - Overall throughput of the storage system controller as affected by all of the above
    - Plus processing (CPU) performance
    - And software overhead
- Number of storage systems per application
    - Data migrations increase as data is moved around to consolidate on specific systems

This storage bottleneck worsens as more users collaborate on projects and more projects are worked simultaneously. Many organizations attempt to solve the problem by adding more storage systems. Although that will temporarily ease the pain, it only postpones it and introduces other serious issues that then have to be addressed. Significant issues include production disruptive data migration and extra scheduled application downtime.

Scalability Walls

Nothing kills productivity faster than running out of storage capacity. Adding storage systems, or additional capacity to current storage systems, is an interim Band-Aid. Adding storage systems has the previous mentioned issues with production disruptive data migration and extra scheduled

application downtime, plus the application disruption of storage provisioning. Adding additional capacity to the current storage system also has application disruptive storage provisioning. Capacity in this case will have increased while the system throughput stayed static or only marginally increased. This means throughput performance relative to the capacity (per GB or per TB) will decrease.

Data Protection Complexity

The persistent human tendency to treat the urgent symptoms of performance and capacity issues with the quick salve causes storage systems to multiply rapidly leading to infrastructure sprawl. Each storage system has its own data protection management with unique snapshots, replication, and mirroring. Admin time must be allocated to every storage system. And if there are multiple storage models and/or vendors, it gets far more difficult as each vendor and model requires unique data protection operations and knowledge. It often gets incredibly time consuming and very ugly.

The Rich Media Storage Resolution

Dot Hill Storage, when combined with Dot Hill AssuredUVS™, solves each and every one of these Rich Media storage issues without busting the budget.

Eliminating the Throughput Bottleneck

The Dot Hill AssuredUVS is a linearly scalable high performance storage virtualization system designed from the ground up to provide the performance Rich Media requires. The AssuredUVS controller works in active-active pairs. Each pair provides up to 1.6GBps throughput. It does not stop there. The AssuredUVS controllers are clusterable up to 4 controller pairs in a "pay-as-you-grow approach". The current tested maximum total throughput of approximately 6.4GBps. Just as importantly, the AssuredUVS shines in individual session performance as well.

Storage Pooling For Linear Scalability

The marvel of the Dot Hill AssuredUVS system comes from its ability to unify and virtualize all of the storage systems (RAID arrays and/or JBOD) that sit behind it.

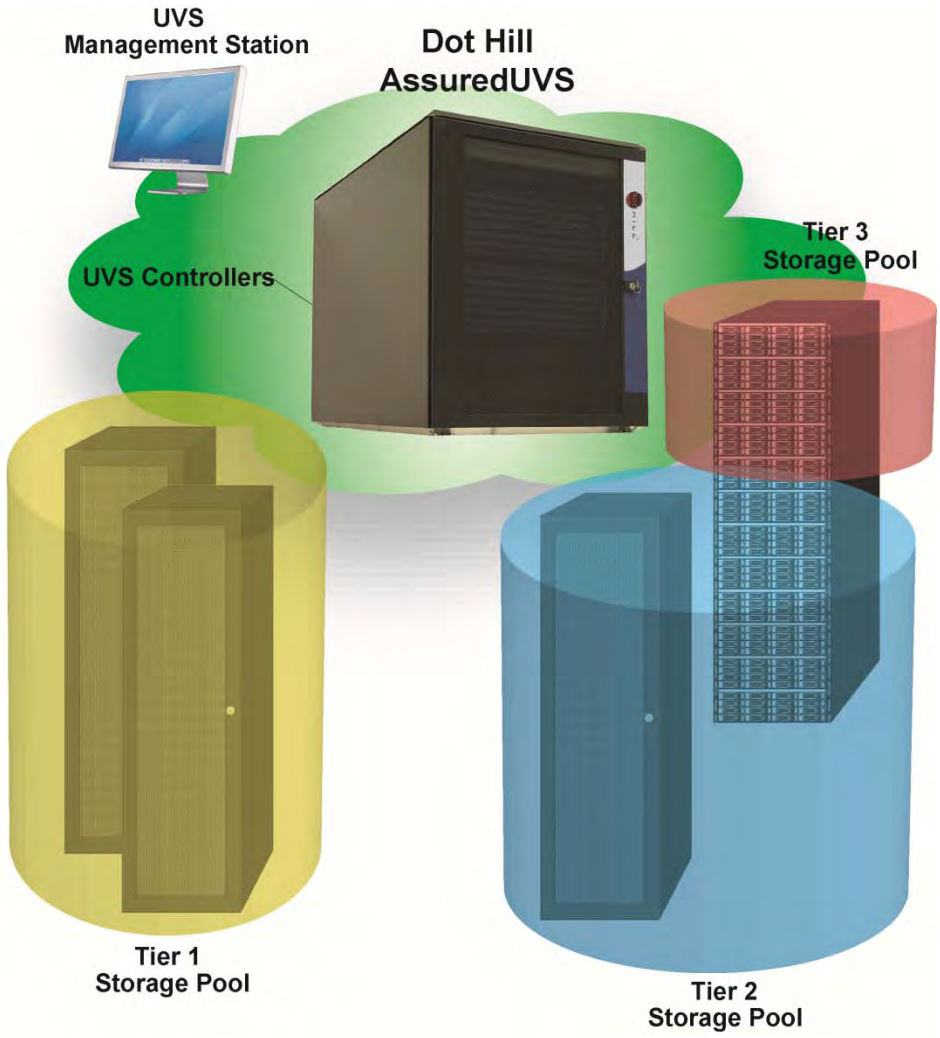

Figure 1: AssuredUVS System

This virtualization decouples the application storage image from the physical storage allowing the physical storage to be manipulated online completely transparently to the applications. The AssuredUVS system then constructs unified storage pools that span multiple LUNs within a storage system or across multiple storage systems. Capacity can be added without application downtime or disruption.

Adaptive Striping For Unmatchable Performance

The AssuredUVS system overcomes the performance limitations of storage systems by striping across two or more storage systems and load balancing across them all. The striping can be dynamically

expanded as new storage is added to the pool. This expands both the storage pool capacity and its usable bandwidth. Stripe size is increased proportionally by the additional new storage. The new faster storage will enhance the entire heterogeneous pool with all its capabilities. If storage performance is temporarily degraded from a disk failure/recovery, the stripe size adjusts to reduce the impact on the total pool bandwidth.

The downside to striping is an increased probability of a failure. (More systems increase that probability.) The AssuredUVS eliminates that issue by replicating then migrating the data so that it can also be contained in a single storage system. This increases resilience without reducing performance.

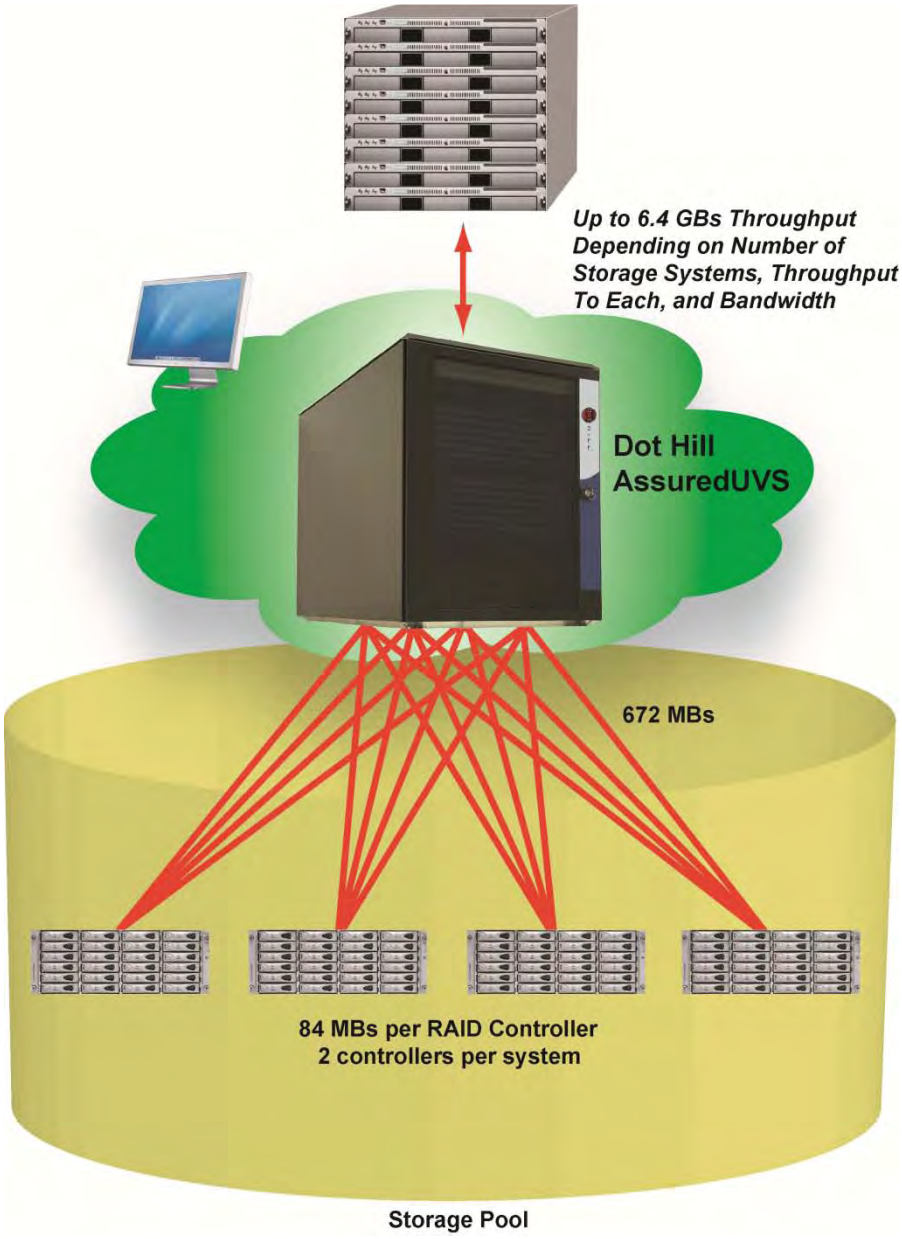

Figure 2: AssuredUVS Adaptive Striping

Application Non-disruptive Data Migration

Data migration within an AssuredUVS storage pool is completely application non-disruptive. Data migrations between AssuredUVS storage pools or between an AssuredUVS storage pool and external storage, is only momentarily application disruptive to redirect the application.

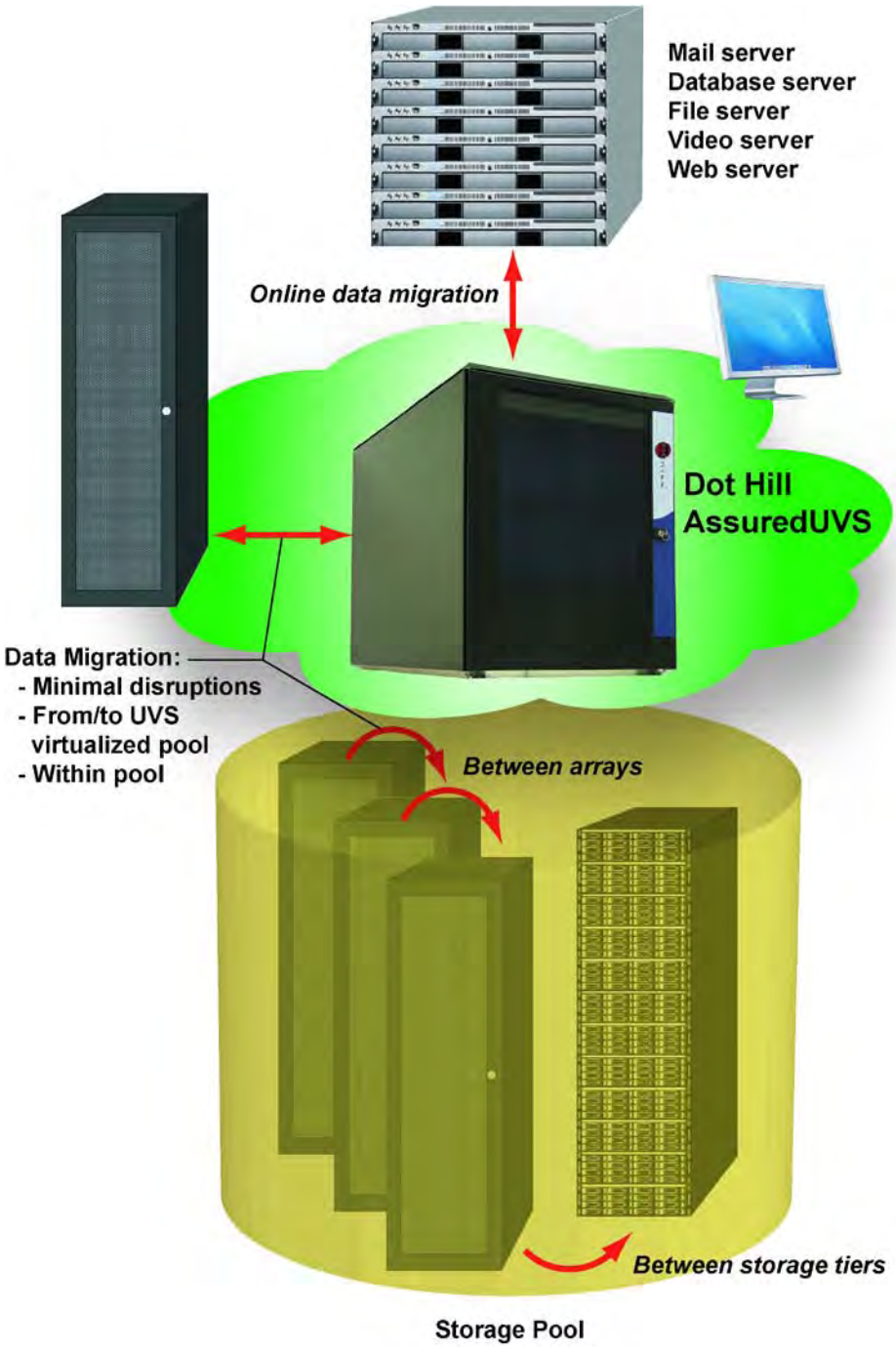

Figure 3: AssuredUVS Data Migration

Thin Provisioning Application Non-Disruptive Provisioning and Just-In-Time-Storage

The AssuredUVS system Thin Provisioning makes each application file system believe it has the maximum possible storage capacity it can utilize.

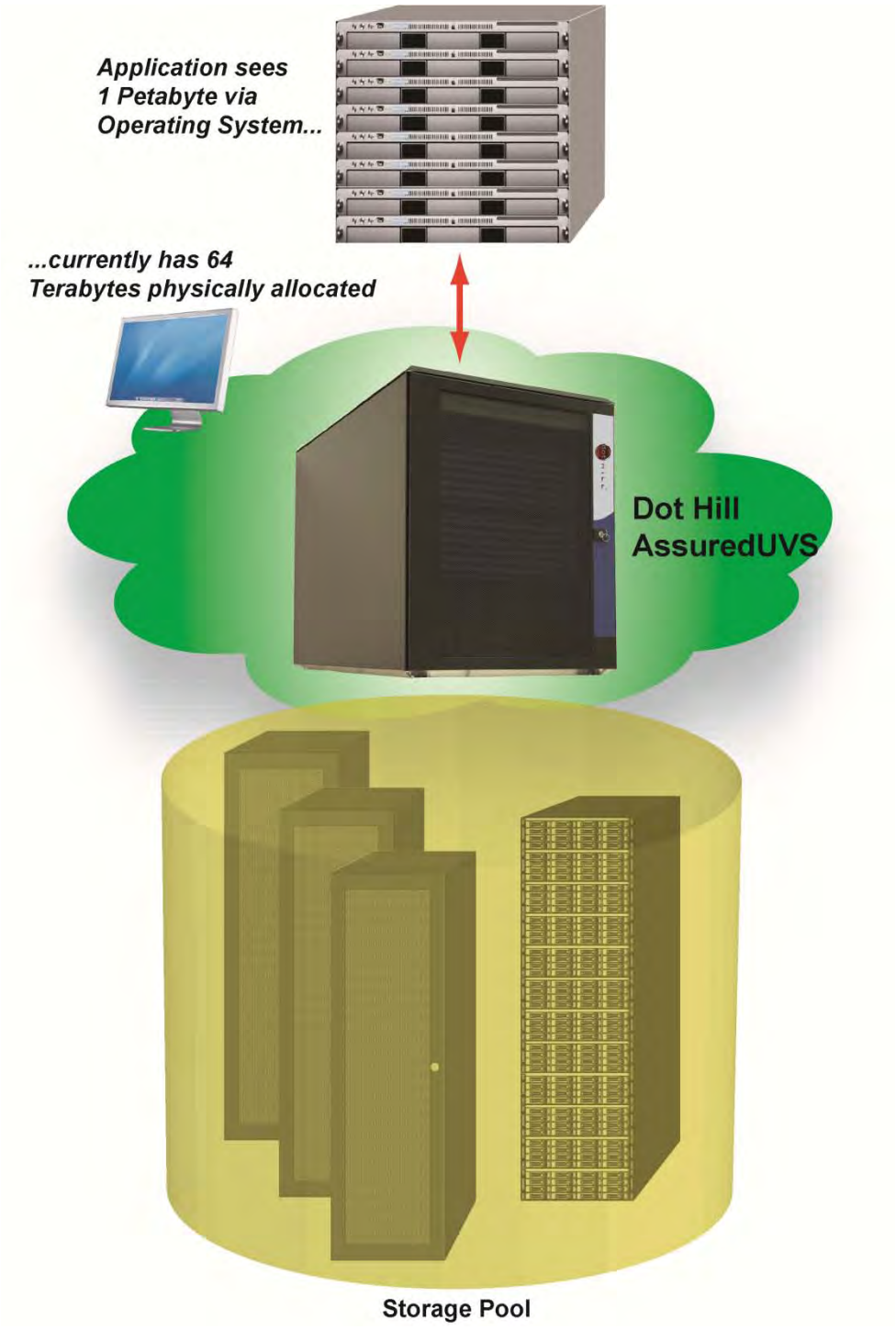

Figure 4: AssuredUVS Thin Provisioning

The actual physical storage allocation is much less and can be whatever the storage administrator designates. Physical storage can be added as needed without ever requiring the application file system to find it or be quieted. As the new storage chunks are added, they are striped according to the current pool structure, so the sparse volumes to grow both in capacity and in performance seamlessly to the application. Thin provisioning allows the physical storage acquisition only when it's needed or "Just-In-Time". Disk drives have historically declined in price by approximately 8 percent per quarter or 30 percent per annum. Therefore, deferring physical storage acquisition significantly reduces cost.

Read & Write Snapshots That Allow Concurrent Collaboration

AssuredUVS Snapshots are mountable as read/writeable data or simply just read. Snapshots can then be mounted and projects worked on concurrently uniquely accelerating collaborative workflows. Snapshots also provide an instantly recoverable version of the data. The incremental Snapshots also reduce the amount of storage required for ongoing data protection lowering data protection costs.

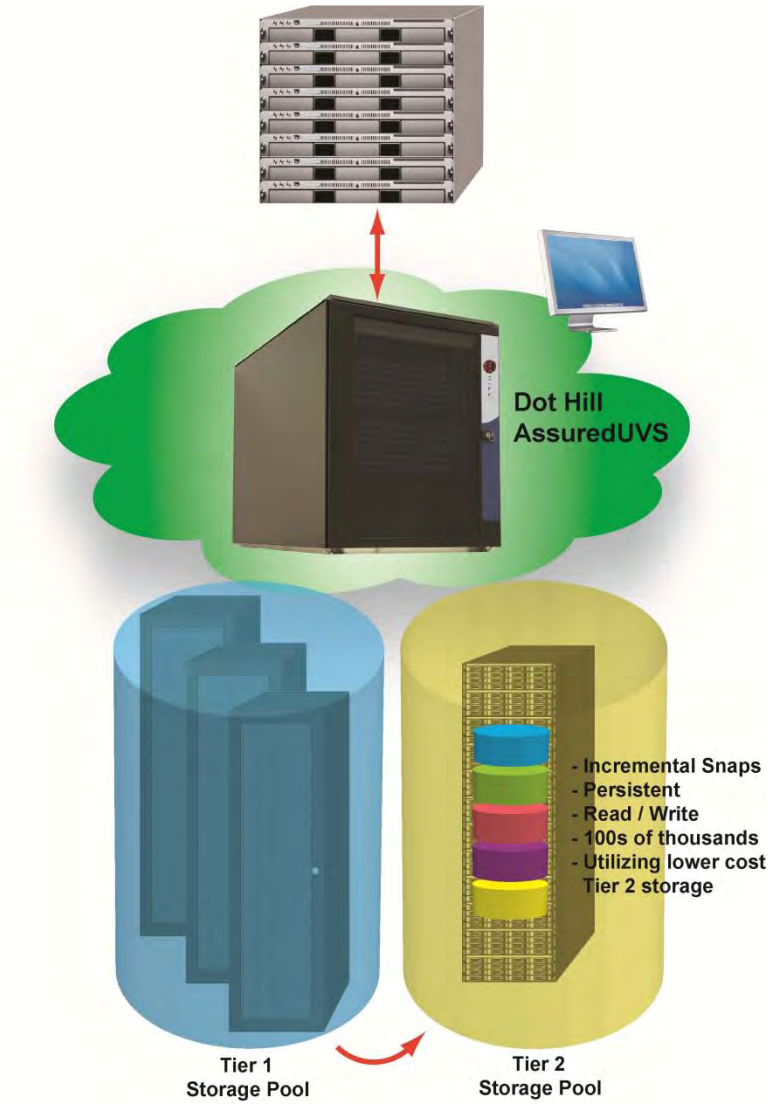

Figure 5: AssuredUVS Snapshots

Enterprise Class Data Protection Without the High Cost

AssuredUVS Mirroring presents a single touch point for replication of all the AssuredUVS pooled storage systems. This is one procedure and policy setting methodology of any-to-any, synchronous or asynchronous data mirroring for all AssuredUVS pooled storage within or between AssuredUVSs. It works in conjunction with AssuredUVS Snapshots and natively across TCP/IP networks, as well as Fibre Channel fabrics, over LAN/MAN/WAN distances. Most importantly, the AssuredUVS Mirror allows the mirrored data to utilize lower cost 2nd tier storage. This significantly lowers the cost of data protection.

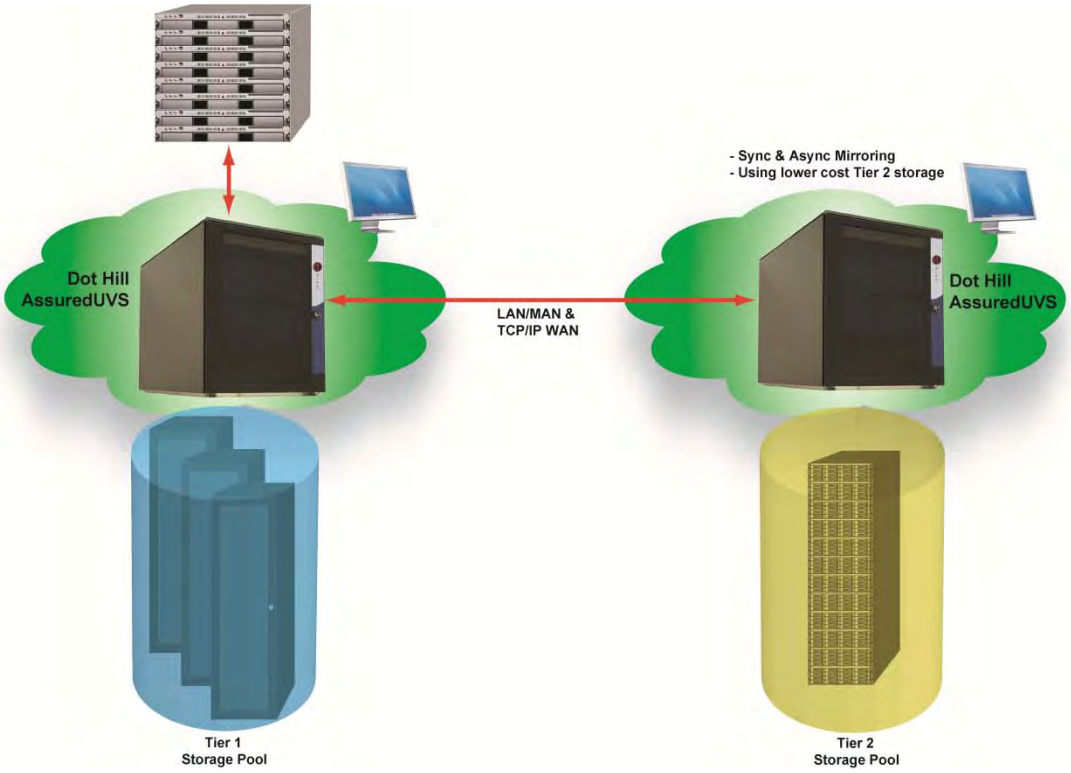

Figure 6: AssuredUVS Mirroring

Conclusion

The Rich Digital Media market has been dealing with a difficult conundrum. Operations must either accept storage induced performance bottlenecks that limit productivity; or complex and very expensive storage systems, which cause other problems requiring additional expense and solutions. Neither is very palatable or acceptable.

Now there is a third choice for Rich Media operations that leverages Dot Hill's AssuredUVS in conjunction with nearly any low cost storage solution, such as Dot Hill's high performance, highly reliable AssuredSAN RAID products. The combination of the two uniquely provides unparalleled storage price performance meeting the performance requirements of Rich Media while reducing the total cost of ownership (CapEx and OpEx) of the storage systems. It is able to do this with clever use of increased utilization through virtualized storage pooling, adaptive striping, application non-disruptive data migration, thin provisioning, read-write snapshots, and mirroring. The net result is unequaled storage performance with Tier 1 storage services at Tier 2 storage prices.