

Cut your Storage Costs in Half

How to Cut VDI Storage Costs and Optimize Performance with VERDE Storage Optimizer CachelO Technology.

The Most Secure VDI For Your Data.

The need for costly storage solutions—and lots of it—is a significant challenge to desktop virtualization. NComputing takes a unique and innovative approach to caching that dramatically reduces network traffic to optimize storage, boost performance and cut costs.

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Executive Summary

Compared to a standard, physical desktop infrastructure, desktop virtualization offers reduced management complexity, better desktop control, superior data security and lower infrastructure costs. However, these highly desirable benefits are not always enough to offset the drawbacks inherent in most current desktop virtualization solutions.

One of the largest drawbacks of conventional VDI implementations is storage inefficiency. Traditional desktop virtualization solutions require large amounts of tier 1 storage, which is costly to purchase and complex to manage, which makes large-scale VDI deployments too expensive and slow to be practical.

NComputing created VERDE Storage Optimizer CacheIO technology to overcome this drawback. Storage Optimizer works by taking advantage of local storage on VDI nodes. The technology caches frequently read data on direct attached storage and redirects most of the transient desktop operating system writes to that same local storage. This dramatically reduces the storage network traffic. VERDE Storage Optimizer also leverages the VDI compute node memory for I/O buffer cache providing excellent desktop performance without requiring expensive SSD devices or specialized hardware.

Challenges with traditional VDI storage models

Traditional VDI storage presents several challenges that drive up the cost of storage, including a high number of spindles to handle a large number of IOPS, increased storage network bandwidth, and overall performance issues.

High IOPS within tier 1 storage arrays and across the network

The number of IOPS that each virtual desktop will generate is a key consideration in desktop virtualization. IOPS are the single most important metric in VDI desktop performance. Booting Windows 7, for example, requires many reads and writes, making IOPS performance extremely important.

For traditional desktop virtualization, a large number of IOPS-per-user results in an equally large tier 1 storage requirement. This is because meeting the performance expectations of users accustomed to native desktop-like response times requires investment in bandwidth and infrastructure to support increased network traffic volumes.

Prohibitive cost

The high cost of storage required by traditional VDI results not only from the requirement for high volumes of storage but also from the need for expensive tier 1 disk spindles to achieve desktop-like performance and backup. Customers often cite tier 1 storage CapEx figures up to ten times the cost of equivalent DAS solutions, or up to \$1,000 per user in spindles alone, to achieve an equivalent, native-desktop-like experience.

Performance issues

Standard VDI deployments face particular performance issues when a large number of users start up or log in to their systems at once, generating a storm of IOPS. High storage costs in VDI deployments can often be traced to efforts to address this issue – adding spindles and bus bandwidth to mitigate performance hits during boot or login storms. Some VDI vendors require third-party solutions to address the problem. IT organizations must either purchase vast amounts of additional storage or software that requires integration and management.

How CacheIO works

VERDE's CacheIO intelligently places data in two different places. Data that must be highly available and resilient is stored on a shared storage system, the required NAS. Reads, and the associated redirecting transient writes, go to the direct attached storage (DAS). This means that the DAS only needs to be fast enough to support the desktops on that physical server. There is also the added benefit of using the server's RAM to accelerate both read and write operations. This technical architecture provides the benefits of a Tier 1 storage system with a less expensive infrastructure.

Bringing it Together

To understand how Storage Optimizer works, it may be helpful to compare it to conventional cache technology and terms. L1 and L2 are levels of cache memory. In caching, L1, or Level 1 memory, stores often-used operations to save time by avoiding access to RAM. L2, or Level 2 memory, is analogous to Direct Attached Storage, or DAS. VERDE automatically takes advantage of any spare RAM on the VDI compute node to further cache its DAS images and mitigate boot storms even within given nodes. If spare RAM is not available, the DAS spindles will begin to offload additional IOPS from the SAN to effectively support periods of high I/O activity, such as boot storms, login storms, and application launches.

The Result: A Complex Solution

The cost and complexity of traditional VDI solutions means organizations spend much more on traditional systems in order to get the same performance offered by *NComputing*. Storage costs with Storage Optimizer CacheIO technology can be five to ten times less than that of traditional VDI solutions.

A Unique Approach with VERDE Storage Optimizer CacheIO

Storage Optimizer works hand-in-hand with the *NComputing* VERDE gold master model. While the concept of a gold master is used throughout the VDI world, *NComputing* applies it in a unique manner. With Storage Optimizer, the gold master model allows IT organizations to retain single-image management, while allowing users to store persistent personalized data (documents, settings and unstructured data outside user profiles) according to desktop policies.

CacheIO and the VERDE gold master model combine the efficiencies of non-persistent pools with the flexibility of persistent desktops thanks to native system and user state separation. In this mode, virtual desktops run with two layers: a non-persistent system disk layer and a persistent user disk layer. This technology is native to VERDE, requires no third-party tools and introduces no application compatibility issues.

Because the system disk is common to many workloads, Storage Optimizer does not duplicate it on the NAS, instead running it locally and replicating it to any suitable VDI compute nodes. The image runs in a copy-on-write mode with writes stored temporarily for the length of each virtual desktop session. These transient bits never leave the internal storage or scratch space of the VDI compute node executing the desktop.

Writes to persistent user data, on the other hand, are written back to the shared storage volume, with the guest operating system using a cache elevator and asynchronous I/O at the hypervisor level to improve performance. This ensures that user data always resides on tier 1 storage while transient or common data runs on non-critical DAS storage.

Rather than deploying a complex set of data stores and organizing countless Logical Unit Numbers (LUNs) that are served over expensive FiberChannel or iSCSI interfaces, organizations can now deploy a simple Network Attached Storage (NAS) volume for authoritative VDI data. This includes system configuration, policies, user data and gold master image sources. In order to provide the performance necessary for large-scale VDI deployments, CacheIO then distributes the storage processing to local spindles or simple DAS paths.

Technical Performance Characteristics

With Storage Optimizer, many requests never leave the VDI nodes. This reduces the number of required network packets and spindle IOPS. IOPS offloading results in five or fewer SAN or NAS IOPS per desktop, versus 20-50 IOPS per desktop with conventional VDI systems. This means that the Dynamic Desktop Gold Master model can, to a great extent, optimize IOPS across all sessions. This has the following ramifications:

1. System read IOPS approach zero as all reads from the Gold Image are completely cached into memory.
2. Copy-on-Write delta IOPS remain low because both the disk elevator and the buffercache are able to optimize the workload.
3. User Profile IOPS are low at an average of 2 per session, which is about only 5% of the requirements of a physical non-VDI desktop (around 40 IOPS).

Unique benefits of VERDE Storage Optimizer

NComputing Storage Optimizer CacheIO technology addresses those issues of cost, complexity and performance, offering a unique, built-in approach to VDI storage.

Works with existing storage

Because Storage Optimizer takes advantage of underused internal spindles on nodes, network engineers can save money by reducing, re-allocating and re-using storage. In many cases, the existing NAS/SAN can be used for authoritative data stores without upgrading, or Storage Optimizer can take advantage of underutilized, lesser tier storage, reducing expensive Tier 1 storage requirements.

Easily handles boot storms

Storage Optimizer CacheIO technology addresses high- use issues such as boot storms, login storms, and large application launches directly, without the need for additional hardware or software, because it offloads most IOPS from the NAS/SAN. Conventional VDI solutions on the other hand require five to ten times the number of spindles and bus bandwidth.

For example, a midrange laptop computer designed to boot up under Windows 7 might deliver five IOPS under regular use, a common industry average. During boots, anti-virus scans, logins and application launches, this number can easily increase to 50 IOPS. Multiply that by 100 or 1,000 VDI users, and the result is a prohibitively large load on the network, and huge Tier 1 spindle requirements.

Storage Optimizer offloads most of that traffic from external storage on the SAN to low-cost DAS. It also mitigates other problems with conventional VDI, including performance issues with boot storms, and the cost of building out and maintaining bandwidth to support high traffic.

CONVENTIONAL VDI SOLUTIONS MAY REQUIRE AS MUCH AS TEN TIMES THE STORAGE SPINDLES AND BUS BANDWIDTH OF VERDE STORAGE OPTIMIZER CACHEIO TECHNOLOGY.

Reduces network infrastructure

Performance characteristics are not solely a function of the number of required storage spindles. It also depends on the connections between the compute nodes and storage. Network performance and cost calculations often skip over the cost of adding compute nodes and bandwidth to support increased traffic. Faced with performance issues in VDI installations, IT often turns to expensive bandwidth-boosting solutions such as fiber channel, costly switches and 10G Ethernet. Storage Optimizer moves perhaps a tenth of the data of conventional VDI deployments across the network, reducing network bottlenecks. Organizations that already centralize file storage on servers or NAS will require no increase in network bandwidth to deploy storage for a VERDE solution.

Works with any virtual desktop

Conventional VDI technologies require third-party software or other workarounds to support both Windows and Linux. Unique among VDI vendors, *NComputing* treats Windows and Linux virtual desktops as equal citizens, providing benefits that are as strong for Linux desktop workloads as they are for Windows.

Caches at data center and Branch levels

NComputing is the only vendor to offer a true caching solution at the branch as well as the data center. Branches that require SAN storage because of a large number of users can save costs at the branch level as well. In many cases, branch locations with many users can use commodity NAS equipment rather than costly tier 1 SAN to deliver VDI to local users.

What is Branch?

Branch is component within VERDE that enables remote office locations to have a productive and streamlined user-experience while retaining the centralized management characteristics of VERDE.

Automatic workload balancing and tuning

For efficiency, Storage Optimizer automatically groups desktop workloads onto nodes that already have a cache of gold images. This approach, already in use by *NComputing*, has been extended in Storage Optimizer to take better advantage of the cache.

In general, automatic tuning means the entire VDI system is always tuned for maximum efficiency and availability. IT personnel never need to determine what cache is available where or how workloads should be grouped for maximum efficiency. Storage Optimizer handles it all.

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Off-hours synchronization

Scheduling and synchronization in traditional VDI deployments can affect user performance, especially when synchronization is performed on-demand. If a user launches a non-cached desktop and the system begins synchronization immediately, performance is affected for all users on that node. Instead, Storage Optimizer schedules synchronizations, replications and cache updates to occur when the system is not in use, thus eliminating impact to users. Synchronization can even be scheduled individually by compute node, allowing IT administrators to stagger caching to meet network constraints.

Security enclaves eliminate cross talk

Storage Optimizer addresses potential security issues around VDI deployments with settings that eliminate network cross-talk, which is caused when groups of users with different security permissions access the network simultaneously through the same channels. It can prevent this through easy-to-establish security enclaves that restrict simultaneous cache synchronization at the firewall level. For organizations with strict network security constraints, enclaves can eliminate cross talk by ensuring that replication occurs at different intervals, controlled by a policy-based firewall. This mechanism is generally compliant with

the highest standards of network security even within trusted organizations such as defense and healthcare.

Summary

The need for extensive and expensive tier 1 storage to make conventional VDI deployments perform properly is a central issue with many VDI technology vendors. *NComputing* VERDE addresses the issue at its core with its unique native CacheIO technology. Without third-party components, Storage Optimizer offloads IOPS from the NAS/SAN, dramatically reducing the number of storage spindles and bandwidth needed. The result is huge storage cost savings and better performance—tier 1 storage costs may be up to ten times lower than a conventional VDI solution. Reducing storage also slashes network infrastructure needs and management costs, since less network traffic means far less bandwidth demands.

It is easy to implement even for complex use cases, and automatically manages issues such as load balancing, tuning and off-hours synchronization. A comprehensive and universal solution, it works with all desktops, both Windows and Linux, and all topologies, whether centralized or distributed branch architectures. Installations with security concerns can use its ability to eliminate network cross talk without losing the benefits of centralized, single-image management.

In short, by solving the issue of costly storage requirements and performance hits at its roots, *NComputing* VERDE Storage Optimizer CacheIO technology restores the original promise of VDI – a truly cost-effective method of delivering native desktop performance to users, while returning control of those desktops to IT.

Additional Resources

Articles

- [Understanding Successful VDI Implementation](#)
- [How Government Entities Can Deploy Linux and Windows Virtual Desktops](#)
- [Managing User Profiles within Traditional or Virtual Desktop Settings](#)

Case Studies

- [U.S. Department of Defense: The solution for the mixed world of Windows and Linux](#)
- [Chuo University: A Desktop Cloud Environment for Anywhere, Anytime Learning](#)
- [Gruppo api: Reducing Operating Costs by 30% with VDI](#)
- [LMU Munich: Streamlines IT operations and improves service to students](#)

Documentation

- [VERDE VDI Datasheet](#)

Whitepapers

- [How VDI Secures Your Data](#)
- [Cut your Storage Costs in Half](#)

