



OVERCOMING FIVE UNIQUE STORAGE CHALLENGES THAT FACE VDI IMPLEMENTATIONS

Hybrid = Fast • De-duplication = Savings • As low as \$18 per endpoint

There is a certain allure to the virtual desktop infrastructure (VDI) paradigm that attracts CIOs periodically. In the past, many CIOs have considered VDI, but have, in many cases, chosen to stick with the tried and true desktop computer. There are a myriad of reasons why this is the case, but, in the end, they generally boils down to a lack of ability to derive sufficient additional value from a VDI solution, particularly when concerned with the big picture economics of the solution. In this white paper, we will review five unique challenges that face VDI deployment and discuss how hybrid storage systems—primarily Tegile—can help organizations defeat said challenges while saving money, improving solution performance and providing users with a state of the art computing environment.

Cost per endpoint

Although different organizations deploy VDI for different reasons, an almost universal concern revolves around the cost of the solution. Typically expressed as a “per endpoint” cost, CIOs seek to find implementations that carry the lowest cost per endpoint while still maintaining acceptable levels of performance.

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“Storage is the No. 1 challenge most IT organizations face when considering virtual desktop (server-hosted virtual desktop or virtual desktop infrastructure) projects.”

Typically expressed as a “per endpoint” cost, CIOs seek to find implementations that carry the lowest cost per endpoint while still maintaining acceptable levels of performance.

In this scenario, the CIO is the decision maker around the acceptable cost per endpoint while the end users will be the decision makers when it comes to gauging solution acceptability from a performance standpoint. This is not something that the CIO can simply dictate; if the resulting solution does not meet end users’ performance expectations, it will be deemed a failure and actively avoided by the user base.

Achieving an acceptable user experience generally involves ensuring that the VDI implementation performs as close to the physical world as possible. This means making



sure that graphics run the way that they are supposed to and that the environment isn't subject to storage I/O constraints that may happen periodically throughout the day.

In the past, achieving a cost per endpoint that was acceptable to a CIO was extraordinarily difficult since ensuring user satisfaction meant deploying rack upon rack of disk spindles to ensure that the solution could withstand even an onslaught of I/O during certain periods of the day. The downside economics of expensive 15K RPM drives simply drove up the unit cost for each endpoint to a point at which, from a financial perspective, VDI didn't make any sense for many organizations.

However, as has been the case since the beginning of the technology revolution, many of the costs related to VDI began to drop. Terminals became less expensive even while they became more powerful and even servers themselves became less expensive. Traditional storage, though, has remained stubbornly pricey, a situation exacerbated by natural disasters that practically halted the hard drive market for a long time.

Even though the hard drive market has largely recovered, traditional spinning disks were never the right solution for a comprehensive VDI deployment. Simply put, traditional disks don't scale economically enough to meet the unique demands of a VDI deployment. That said, when coupled with solid state storage, there remains a place for spinning disk in a VDI solution.

Today, the storage market is exploding with solutions that are tailor-made for VDI and that perfectly address the cost per endpoint question that plagues CIOs. With a combination of solid state drives and rotational storage, VDI storage costs can be brought down to as little as \$18 per endpoint. This is achievable through the implementation of hybrid storage arrays, which combine three separate kinds of storage into one array in order to meet the heavy demands placed on storage by VDI systems.

In a hybrid system, SSD storage is leveraged to improve the overall performance of the entire system, basically acting in such a way as to make the rotational storage appear to operate at orders of magnitude faster than it really does. This blending of storage technologies enables organizations to procure very fast storage at a fraction of the cost of all-flash systems and to meet burgeoning workload needs with ease. In the table to the left, you can see just how impressively low per-endpoint costs have become across the entire current line of Tegile arrays. It should be noted that the IOPS assumptions per workload are extremely conservative, so, in reality, even lower costs are likely. You will see more calculations with these numbers elsewhere in this paper. Further, it is important to note that the prices listed are array list prices. In situations in which the

array is sold at a discount, per endpoint cost will decrease. You will see how this information translates into VDI density per array on the next page of this paper.

COST PER ENDPOINT PER WORKLOAD TYPE PER ARRAY				
(ASSUMES MAXIMUM DENSITY)	HA2100	HA2100EP	HA2400	HA2800
ARRAY LIST PRICE	\$ 60,000	\$ 100,000	\$ 168,000	\$ 235,000
LIGHT USER – 15 IOPS	\$ 30	\$ 20	\$ 20	\$ 18
MEDIUM OFFICE USER – 20 IOPS	\$ 40	\$ 27	\$ 27	\$ 24
KNOWLEDGE WORKER – 40 IOPS	\$ 80	\$ 53	\$ 54	\$ 47



I/O storms and ongoing I/O demand

Server virtualization has certainly changed the nature of storage, but that change pales in comparison to what's necessary for a VDI deployment to be accepted by the end user community. In a server environment, while there will be peaks and valleys of performance, there are rarely massive and consistent I/O storms that negatively impact the operation of the environment. However, in a VDI scenario, there are a number of events that can trigger what has been termed an I/O storm capable of introducing lag

into the environment. In fact, it's not unusual to hear horror stories from frustrated end users in these environments. In some cases,

MAXIMUM NUMBER OF ENDPOINTS PER ARRAY PER WORKLOAD TYPE

		HA2100	HA2100EP	HA2400	HA2800
ARRAY IOPS	IOPS	30,000	75,000	125,000	200,000
LIGHT USER – 15 IOPS	15	2,000	5,000	8,333	13,333
MEDIUM OFFICE USER – 20 IOPS	20	1,500	3,750	6,250	10,000
KNOWLEDGE WORKER – 40 IOPS	40	750	1,875	3,125	5,000

users have been forced to wait 20 minutes just to log in to their desktop machine. From a productivity standpoint, as that figure is replicated around the company, the financial impact is significant. The table on the next page outlines the most common causes of I/O storms in a VDI environment.

An I/O storm is a situation in which the underlying storage infrastructure loses the ability to keep up with requests in real-time, thus introducing lag into user's process. If an administrator were to watch storage metrics during an I/O storm, it's more than likely that disk queue length metrics would skyrocket as the number of outstanding requests continued to pile up. In general, when storage is suffering from ongoing and consistent disk queue length issues, the only long-term solution is to provide a way for the storage to be able to deal with requests faster. In a traditional storage environment, this would mean adding additional disk spindles in order to increase the number of IOPS available to service the needs of the solution.

There's just one problem with this approach in a traditional storage environment.

The sheer number of IOPS necessary to deal with certain kinds of I/O storms—such as boot storms—is staggering and would require the purchase and maintenance of a massive number of rotating disks. In essence, the need to support the storm with traditional storage would negate any possible economic benefit that the organization might enjoy from VDI.

In order to combat this issue, organizations are turning to the IOPS rich solid state drive market to support their VDI deployments. By using solid state disks, organizations can deploy VDI solutions with many fewer, albeit more expensive, disks that can more than withstand even the worst I/O storms throw its way.

However, systems such as Tegile's Zebi line of arrays do it one better, too. Rather than just throw flash at the problem, the Zebi arrays are specifically designed to further



reduce the overall impact of these scenarios. Commonly used data—and VDI is the very definition of “common data”—is cached on ultrafast solid state drives. Further, these aren’t your average everyday SSDs. Even the smallest member of the Zebi family packs

What causes an I/O storm?

THERE ARE A NUMBER OF DIFFERENT SITUATIONS THAT CAN CREATE AN I/O STORM IN A VDI ENVIRONMENT

VM boot (“Boot storm”)

Most companies have pretty standard working or shift hours. At the beginning or end of a shift, many, many users will be booting their machines at the same time. Each virtual machine will be reading the storage at the same time in order to accomplish the boot process.

User login (“Login storm”)

Going right along with the boot process, the login process is another particularly I/O intensive part of the daily startup ordeal. During this process, Windows does a lot of profile-related I/O, resulting in major IOPS needs.

Antimalware scan

Traditionally, companies have asked antimalware products to perform full scans at times of the day at which they will have the least impact. However, if those scans do kick off at the same time in a VDI environment, the resulting impact can have a downside effect on users.

Application launch

Some applications can also place a strain on storage, especially when many copies are launched. Consider the VDI scenario in education in which an instructor may ask the entire class to start a program at the same time. Again, this can be detrimental on storage.

“Patch Tuesdays”

On the second Tuesday of each month, Microsoft releases a slew of new patches for Windows and a number of other products. On Patch Tuesday, these patches are often delivered to a company’s systems without regard for the I/O load. As a result, there is potential for a huge I/O storm to be caused as all servers or hosted desktops attempt to simultaneously install new updates.

a whopping 600 GB of SSD into the box, significantly improving the chances of a cache hit while effectively eliminating I/O storms.

But that’s not all. Tegile’s comprehensive de-duplication technology works on both the system’s solid state storage as well as its rotational storage, providing customers with the best of both possible worlds. Further, with the Tegile Zebi line of arrays, the more than you can de-duplicate, the better off your overall system performance will be. After all, if you can get more de-duplicated data into that solid state drive, you’ll be reading even more data from super-fast storage.

Runaway capacity needs

It’s at this point in the VDI process at which many simply ask the question, “Why not just go with an all-flash array?” There is one simple answer: Economics.

Storage design has always been about the proper balance between storage performance and storage capacity. One has to look no further than any vendor that sells a tiered storage solution to see that this is a fact in the market.

The appeal of an all-flash array shouldn’t be underestimated, either. After all, the mere fact that these systems boast a full complement of solid state drives means that they will perform like rock stars. However, bear in mind that, as mentioned, storage design is a careful balancing act between ensuring sufficient IOPS to meet workload demands while also supporting sufficient storage capacity to meet user needs. Even with all of the data reduction features

in the world built in, today’s all-flash storage players can’t play on capacity as well as hybrid arrays.

Although VDI lends itself very well to data reduction techniques such as de-duplication, as VDI becomes ever more mainstream, users demand access to a system that closely mimics that physical desktop experience, right down to being able to save files, customize the system and sometimes even install new software.



Simply put, VDI requires a whole lot of disk space in this scenario.

Over time, this need to customize means that the product VDI image in use by each user begins to drift away from the normal, thus requiring the use of more and more disk space over time. As previously mentioned, Tegile's Zebi line of arrays can de-duplicate both SSD and rotational storage, this providing storage multiplier benefits at all aspects of the storage paradigm.

Different protocols for different needs

It's true that VDI systems need powerful and fast storage to work its magic. However, there are different ways for an organization to deploy VDI. In some scenarios, just using Fiber Channel or iSCSI to store virtual hard drive files is sufficient. In other scenarios, however, the organization may wish to store virtual machine files in one way and use a more traditional file-based storage method to store user files and documents. For example, a Fiber Channel or NFS connection would be used to host the VDI solution's virtual hard drive files while an NFS or CIFS/SMB array partition would be used to store the file based information.

This combination of hybrid with both SAN and NAS connectivity makes this possible with the Tegile Zebi line of arrays, each of which feature all of the protocol options that you'll need to build out your VDI environment any way you like. Zebi supports iSCSI, Fiber Channel, NFS and CIFS/SMB.

Unacceptable latency

VDI operates on the concept that images files will be used as the underlying desktop environment that is deployed out to users. In looking at a lab scenario, desktops are basically destroyed and rebuilt on the fly. In a traditional storage environment, the act of build a new desktop can take a little time, but the act of replicating this process thousands of time can introduce serious latency into the process. In fact, in some situations, desktop provisioning can take *hours*.

With Tegile, however, desktop provisioning, even for hundreds of virtual machines can be accomplished in just minutes thanks to Tegile's unique architecture and the company's Metadata Accelerated Storage System (MASS). With MASS, rather than having to physically build hundreds of new desktop endpoints, metadata can be manipulated very quickly, providing the exact same outcome, but in a fraction of the time.

Summary

Although VDI storage challenges appear difficult to overcome, there is hope. Gartner notes that “[n]ear cost parity can be achieved with the right architectural choice including server, storage, and networking.” Further, this statement assumes that the solution is being deployed in a way that meets ongoing user needs and results in a high level of user satisfaction. Hybrid storage arrays, such as the Zebi line of arrays sold by Tegile, are purpose-built to solve these and other kinds of challenges. From enabling mass creation of new desktops in mere seconds thanks to MASS (Metadata Accelerated Storage System) to perfectly balancing the need for speed with the need for savings, Tegile has a solution that can fit just about any need.



To learn more about Tegile Zebi storage solutions for desktop virtualization, please visit or call us at:

<http://www.tegile.com/solutions/desktop-virtualization-solutions>

Toll Free 1-855-583-4453

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