

Integration Guide: Unidesk[®] and Tintri

Unidesk VDI management software for Citrix XenDesktop[®] and VMware Horizon View[™] and Tintri VM-aware storage are an ideal combination for high performance, easy-to-manage VDI. This white paper provides benefits and design considerations for deploying Unidesk with the Tintri VMstore[™] storage appliance.



Introduction

Unidesk VDI management software for Citrix XenDesktop® and VMware Horizon View™ and Tintri VM-aware storage are an ideal combination for easy-to-manage, high performance VDI. Unidesk is the simpler, more powerful alternative to the separate desktop provisioning, application virtualization, image management, profile management, user virtualization, and storage optimization tools typically needed to create and manage virtual desktops. Tintri VM-aware storage is designed and optimized specifically for virtualization, delivering unprecedented performance and ease of use.

This white paper offers benefits and design considerations for deploying Unidesk with Tintri VM-aware storage, and provides:

- An overview of Unidesk desktop layering technology;
- A technical look at Unidesk infrastructure components and requirements;
- An understanding of how Unidesk desktop layering increases desktop density on Tintri storage arrays and maximizes IOPS by leveraging the Tintri multi-level cell (MLC) flash;
- A guideline for how to integrate Unidesk with Tintri;
- Observations joint customer William Woods University, along with charts and screen shots from their Tintri/Unidesk implementation.

Audience

The intended audience for this white paper is VDI project leads, field consultants and sales engineers who want to test or deploy Unidesk VDI management in conjunction with Tintri storage and VMware vSphere in desktop virtualization implementations using Citrix XenDesktop or VMware Horizon View.

Out of Scope

This document does not provide all configuration details for using a Tintri storage appliance or implementing VMware infrastructure. Contact the product manufacturer for information about implementing these products.

Unidesk Glossary of Terms

To fully understand how Unidesk integrates with Tintri, it helps to understand common Unidesk terms.

Unidesk Term	Definition
Application Layer	An IT-created layer that includes an application or set of applications. You can assign one or more App layers to one or more Unidesk virtual desktops.
Operating System Layer	An IT-created layer that includes the Microsoft Windows Operating System. You can assign one OS layer to one or more Unidesk virtual desktops.
User Layer	<p>An automatically-assigned layer that contains all of a user's personalized content. There is one User Layer per desktop. The User layer captures:</p> <ul style="list-style-type: none"> • Computer name • Security Identifier (SID) • Windows Profiles • Customized settings and configurations • User-installed applications <p>As users make changes to their desktops, Unidesk saves them in the User Layer. All desktop writes are stored in this layer.</p>
CacheCloud®	A system of virtual appliances that replicate operating system, application, and user layers across an enterprise network. CacheCloud uses Unidesk Composite Virtualization™ technology to synthesize the layers into full, storage-efficient, persistent desktops.
CachePoint® Appliance	A virtual appliance that manages the layers and virtual desktops that you deploy to end users.
Desktop	A hosted virtual machine made up of one Operating System Layer, one or more Application Layers, and a User layer.
Gold Image	A virtual machine configured with an operating system and any desired applications that Unidesk can import to create an Operating System Layer.
Installation Machine	A special type of virtual machine that acts as a staging area for the creation of Application Layers as well as versions of Operating System and Application Layers.
Management Appliance	A virtual appliance that coordinates all of the communication in the Unidesk environment. It includes the Management Console and the management infrastructure that controls the workflow of managing virtual desktops.
Management Console	The Web-based management console that allows you to manage all of the components in the Unidesk environment. This console is accessed from the Management Appliance.



Master
CachePoint
Appliance

A special CachePoint Appliance that hosts a copy of all layers and versions of layers in the Unidesk environment. It also manages all of the Installation Machines used to create Operating System Layers and layer versions.

1. Unidesk Topology

As illustrated in Figure 1, Unidesk provides a virtual layered disk (or C: drive) to all of the virtual desktops hosted on VMware virtual infrastructure. Administrators use the Unidesk management interface to create, manage, update, and report on the desktop virtual machines in the environment. As directed by the administrator, the Unidesk software builds, deletes, reconfigures, backs up, and snapshots virtual desktops.

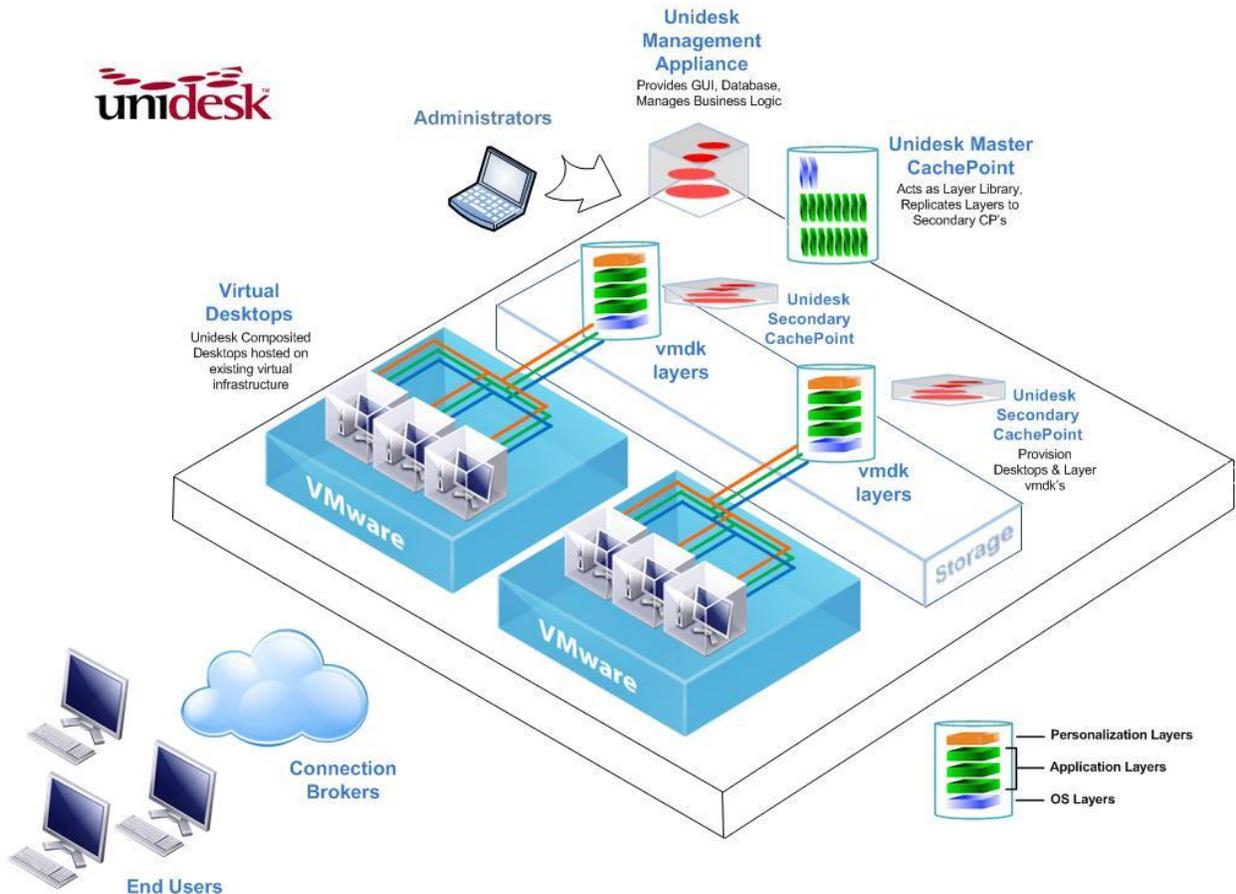


Figure 1: Unidesk topology

The Management Appliance communicates with the CachePoint Appliances in the environment. A single Master CachePoint Appliance maintains a copy of every Operating System and Application Layer in the environment. Additional CachePoint Appliances, deployed to individual VMware vSphere servers, manage cached copies of all the layers and the composite virtual disks for all of the Unidesk desktops they support.

2. Unidesk Deployment

Unidesk implementations include two types of virtual appliances: the Unidesk Management Appliance and the Unidesk CachePoint Appliance. To deploy these appliances, the installer will automatically download and import the OVF packages for you.

2.1. Unidesk Management Appliance

The Management Appliance hosts the Web-based management console that administrators use to manage desktops and the Unidesk infrastructure. There is typically one Management Appliance in each Unidesk environment.

The Unidesk Management Appliance has the following attributes:

- Operating System: CentOS 6.2
- Size on disk: 10GB VMDK plus required VMware files
- CPU: 1 vcpu
- Assigned memory: 2048 MB
- Local database: MySQL

The Management Appliance maintains a local database that contains all desktop information, layer information, desktop assignments, and security details. You should back up this appliance on a regular basis using standard third party image backup tools (for additional details, see the Unidesk Recovery Concepts Guide)

2.2. Unidesk CachePoint Appliances

The first CachePoint Appliance deployed in your environment is the Master CachePoint Appliance. This CachePoint Appliance maintains a copy of every OS and Application Layer that exists in the Unidesk environment. The Master CachePoint Appliance can also host desktops, but in larger environments, Unidesk typically recommends that a dedicated CachePoint Appliance (a desktop CachePoint Appliance) be deployed. A new CachePoint is typically deployed for every 64 desktops (64 desktops per data store) when using standard SAN. However, Tintri incorporates solid state drive (SSD) technology with automated data placement to ensure that only active data is kept in flash. Because Unidesk stores Windows OS layer and application layers only once per CachePoint, these layers stay active and never leave the Tintri flash. As a result, Unidesk desktop density will be much greater on Tintri storage.

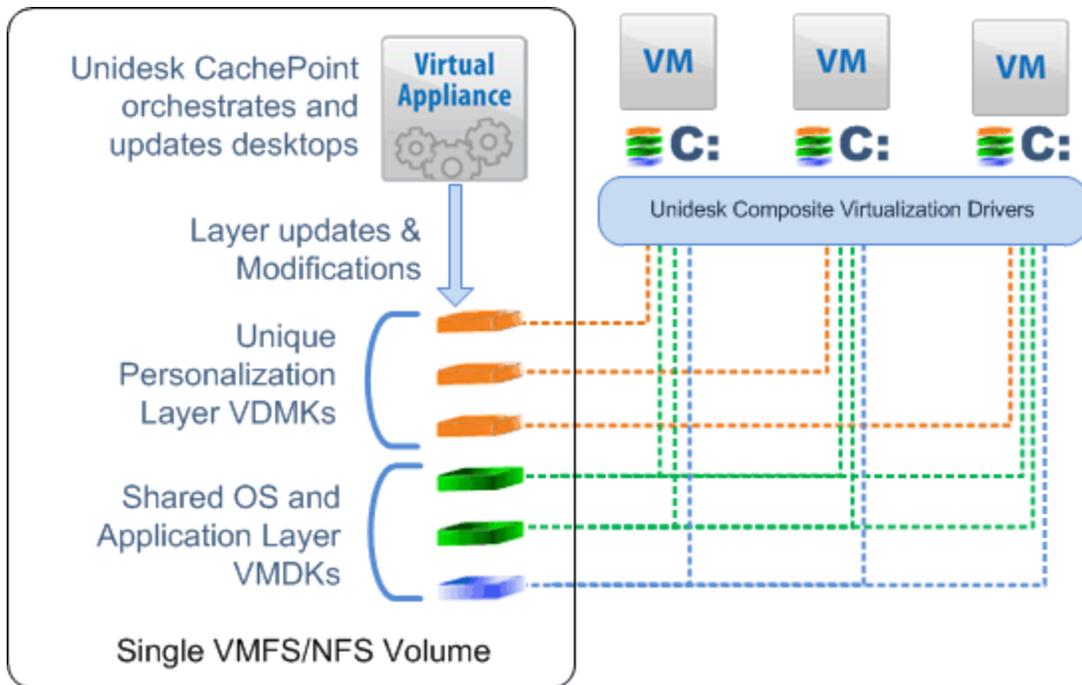


Figure 2: Unidesk topology

As shown in Figure 2, the Unidesk CachePoint Appliance has the following attributes:

- Operating System: CentOS 6.2
- Size on disk: 18GB Base OS VMDK plus VMware required files
- CPU: 2 vcpu
- Assigned memory: 2048 MB
- Local database: MySQL

2.3. Unidesk Storage Considerations

When sizing CachePoint storage, you can take advantage of Unidesk's three types of storage tiers:

- Archive Tier
- CachePoint and Layers Tier
- Boot Images Tier

2.4. Archive Tier

User layers are backed up to a dedicated archival storage tier. This User Layer backup is used for both desktop repair and desktop recovery operations. Administrators can use lower cost, higher capacity storage for backups and archival history, instead of using Tintri storage.

2.5. CachePoint and Layers Tier

The designated data store for this tier contains the CachePoint Appliance itself and all layers used by the associated desktops. This storage tier is the focus for most of the desktop I/O. Administrators should host this tier on Tintri storage to leverage the fault tolerance provided by its active-passive dual-controller architecture, and the high performance provided by its SSD-based MLC flash tier.

User Layer

Each desktop assigned to a CachePoint Appliance is provisioned with a unique User layer that stores all user and machine-specific information. Two VMDK files make up the User Layer. Both are thin provisioned and stored alongside the other Unidesk layers within the CachePoint storage structure. User layers require a minimum of 400 MB per desktop. How much the User layer grows depends on the amount of data written to the desktop, the number of applications that the user installs, and the size of the local profile.

When you create a desktop, you can define the maximum size for the User Layer. This feature enables administrators to effectively limit the amount of data and user-installed applications that end users can store on their virtual desktops.

Shared Layers

All persistent and non-persistent Unidesk desktops associated with a specific CachePoint Appliance share the Operating System and Application Layers, greatly reducing the amount of disk space required for VDI and increasing the density of how many desktops can be hosted on a single Tintri storage appliance.

For example, a Windows 7 32-bit gold image imported as a Unidesk OS layer that requires 14 GB of disk space is only stored once per CachePoint. All desktops assigned this OS layer that are hosted on the same CachePoint Appliance use the same VMDK file, eliminating all redundant Windows OS storage. So, if 100 Unidesk layered desktops are hosted on a single Tintri appliance, they will only require 14 GB of Windows storage, instead of the 1.4 TB of Windows storage required by 100 full-sized virtual desktops.

To estimate the space that Application Layers use, simply calculate the space that each application uses on the disk, based on how much storage changes at the block level. For example, if 1.5 GB of storage is changed after an application is installed on a regular desktop, then that is how much storage will be required by the Application layer. Add up the size estimate for all the Application layers you plan to deploy to desktops on a CachePoint, and that is the total amount of storage space required. Like the OS layer, Application layers are shared across all of the desktops on a single CachePoint, greatly reducing the storage footprint.

For an idea on application sizing, review the following list of well-known applications. Note your size may vary depending on your method of installation.

Application	Size in GBs
Windows 7 Pro SP1 64 bit	21
Windows 7 Pro SP1 32 bit	14
Windows XP Pro SP3 32 bit	7.5
MS Office 2010 (32 bit on 64 bit OS)	2
MS Office 2007 (32 bit on 64 bit OS)	1.4
Firefox 11	0.5
Adobe Photoshop 5.1	2.2
Adobe Premiere Elements 9	3.2
Adobe Reader 10	0.9
7 Zip	0.4
do PDF Creator	0.4

Skype 5.9	0.4
EverNote	0.7
FoxIT Reader	0.5
FilZilla FTP Client	0.4
vCenter Client 5.1	2.8
iTunes 10	0.9
Systracer	0.3
View Agent 5.1	0.65
Visio 2007 (32 bit on 64 bit OS)	1.2
Visio Premium 2010 64 bit	2.1
Microsoft Lync 2010 Client	0.8
Notepad++ 6.1.5	0.4
Snagit 11 w/.Net4	1.8
Oracle 11G Client	1
VNC Viewer 5.0.1	0.4
SAP Crystal Reports	2.5
Adobe Pro X	2.5

2.6. Boot Images Tier

The data store assigned to the Boot Images tier contains the desktop Virtual Machines assigned to that desktop, their boot disks, and the Windows kernel and page file.

3. Tintri VM-Aware Storage

Tintri VM-aware storage is well-suited for Virtual Desktop Infrastructure (VDI), and is proven to be an ideal storage target for Unidesk desktops.

Tintri's flash-based architecture provides the consistent, predictable I/O performance required for a high performance user experience. Its VM-aware architecture offers a simple to manage, cost-effective storage platform that meets the performance demands of hundreds of VMs.



With Tintri, you get:

- Predictable VM performance. The Tintri file system delivers performance for each Unidesk layered desktop out of Flash, without manual configuration or VM placement.
- Lowest cost per VM. Unidesk's storage reduction through shared layers and Tintri's data compression makes flash highly efficient and cost-effective. You can run up to 1,000 Unidesk virtual desktops on a single Tintri appliance.
- Instant performance bottleneck visualization. Tintri's real-time VM and vDisk-level insight on IO, throughput, end-to-end latency and other key metrics enables rapid VDI performance diagnosis.

3.1. Tintri Features

Tintri looks at storage in a very different way than traditional SAN arrays – Tintri manages storage on a per-VM basis rather than at the block level. This provides very useful functionality, especially in the area of reporting. Tintri also incorporates sophisticated algorithms for managing files in its SSD tier to ensure that almost all reads and writes are to/from SSD, resulting in outstanding I/O performance.

Other key Tintri features include:

- Auto Disk Alignment
- Storage De-duplication and Compression
- VM Pinning
- Scale-out Architecture
- Single NFS Datastore
- Simple Intuitive Management
- Per VM reporting
 - Instant VM bottleneck visualization
 - Read/Write Statistics
 - Change Dashboard

3.2. Storage Capacity Optimization with Unidesk and Tintri

The cost of storage has traditionally been one of the biggest challenges with VDI. For example, if an average desktop is 40 GB in size, 500 full-sized persistent virtual desktops would require **20 TB of SAN storage** just to meet capacity requirements.

VDI becomes much more space-efficient and cost-effective with Unidesk and Tintri. The Tintri VMStore T540 is configured with 8 X 300 GB SSD drives and 8 X 3 TB SATA drives, for 13.5 TB of usable storage. 500 persistent or non-persistent Unidesk desktops will easily fit on a single Tintri array, with half of the array left to handle another 500 desktops or non-VDI workloads. Let's see how.

A Unidesk implementation for 500 persistent virtual desktops would require 1 Unidesk Master CachePoint, 5 Unidesk Desktop CachePoints, and 5 data stores (one for each Desktop CachePoint), for a total of **5.8 TB of storage**. Non-persistent Unidesk desktops would require even less: only **3.5 TB of storage**.

Here are the details for calculating these figures:

- 500 desktops
- 16 GB for the OS layer
- 200 GB for Application layers and layer versions
- 5 GB for each User layer (persistent desktops only)
- 4 GB for boot images (vSwap, pagefile, dump file)

The calculation looks like this: *((OS layer size + Application layers size) * (# of Desktop CachePoints + 1 Master CachePoint) + (# of desktops * size of User layer) + (Boot images * # of desktops) = Total Space Required*

Plugging these numbers in: $((16+200)*6) + (500*5) + (500*4) = 5.8 \text{ TB}$

Getting further into the details, each CachePoint stores only one copy of the OS and Application layers. The storage used would be about 1.3 TB ((16 GB OS layer + 200 GB Application layers) * 6 CachePoints). Spread across all five Desktop CachePoints are the desktops. Each desktop has its own User layer that, together, require an additional 2.5 TB (500 desktops * 5 GB User layer). The boot images will use 2 TB of storage (4 GB per boot image * 500 desktops). This brings the amount of space used to 5.8 TB. That's a **savings of 14.2 TB, or 71%** for persistent virtual desktops.

The VDI storage footprint can be reduced even further by implementing non-persistent virtual desktops with Unidesk. By choosing the minimum User layer size of 400 MB, only .2 TB would be required for User layer storage instead of 2.5 TB. The capacity requirement for 500 non-persistent virtual desktops would then be 3.5 TB. That's a **savings of 16.5 TB, or 83%** for non-persistent virtual desktops.

3.1. Storage IO Optimization with Unidesk and Tintri

In any VDI environment, IOPS are an important consideration. Without the proper amount of IOPS, desktops will feel sluggish, take longer to reboot, and require more time for login/logout. Figuring out IOPS requirements is not always a simple matter. Knowing your users' work habits (low, medium or high workloads), how bursty VDI will be (i.e. boot storms), and how long those bursts will be sustained are all important considerations.

Traditionally, IOPS has required careful balancing between server, SAN storage, and networking, and over-provisioning of SAN storage to make up for the higher latency and longer data access times of spinning disk. Tintri storage and the data pattern created by Unidesk shared layers eliminate this complexity and deliver outstanding IO performance.

A single Tintri VMstore with mixed SSD and SATA can provide up to 75,000 IOPS. During writes from VMs, Tintri writes data first to the SSD-based multi-level cell (MLC) flash. Automated data placement algorithms move this data to the SATA drives in the background as it becomes cold. When the data becomes hot again, it is brought back into the MLC flash.

The data pattern created by Unidesk layering technology takes full advantage of the Tintri MLC flash. The **1.3 TB of shared application and OS layer storage** needed for 500 desktops easily fits on the 2.4 TB Tintri SSD drives. Since a single Windows layer and single layers of all applications are shared by all of the Unidesk desktops, these layers stay "hot" and remain on the MLC flash for outstanding I/O performance. Cooler User layer data will be migrated by Tintri to the higher capacity SATA drives as needed.

3.2. Power and Space Saving Benefits of Unidesk and Tintri

There is also significant savings in power and cooling as well as space in the datacenter with Tintri and Unidesk. Traditional SAN would require almost 4.5 shelves of 15K drives. With Tintri, only one shelf with a power footprint of a half shelf is required.

3.3. Unidesk Design Considerations with Tintri

Deploying Tintri requires a 10Gb/s network infrastructure. Tintri will create a single NFS datastore with a very high rate of performance. With Tintri, the design consideration for Unidesk CachePoints will not be I/O related, but instead will be based on how many desktops can be managed with a single Unidesk CachePoint. Based on customer feedback and internal testing, up to 100 desktops can be managed by a single Unidesk CachePoint virtual appliance with Tintri storage. And, as shown in the previous section, close to 1,000 Unidesk desktops can be hosted on a single Tintri storage appliance.

Unidesk desktops are often scheduled to update overnight during non-work hours. Unidesk desktop rebuilds on Tintri storage have been observed to take approximately 6 minutes per desktop. Unidesk limits the number of parallel desktop rebuilds to 4 per CachePoint so as not to adversely impact infrastructure performance. Updating 100 desktops, then, would take ~2.5 hours (100 desktops / 4 desktops per Cachepoint X 6 minutes = 2.5 hours), if all 100 desktops were hosted on a single Unidesk CachePoint. Even if performance was half as good, all desktops on a single CachePoint could still be rebuilt in one maintenance window. Because Unidesk's distributed CacheCloud architecture enables CachePoints to rebuild desktops in parallel, you can update thousands of Unidesk desktops overnight when using Tintri storage.

4. Unidesk and Tintri Customer Example

Customers are having great success implementing VDI with Tintri and Unidesk. One of our joint customers is William Woods University in Fulton, Missouri USA. They have deployed over 350 Unidesk desktops on a single Tintri array, using 7 Unidesk CachePoints with about 50 desktops each.



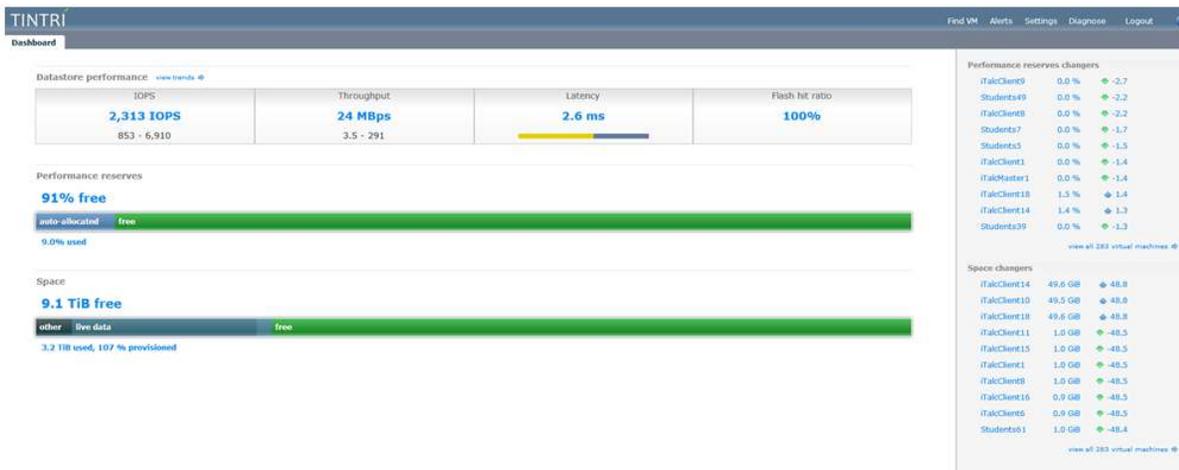
Steven Goodson, Network Administrator at William Woods University, was kind enough to share some observations on the joint solution:

- “One of the best things we like about Tintri is its simplicity. It took 10 minutes to rack and 90 seconds to configure. There are no LUNS or advanced configuration. The storage is presented as a single NFS datastore.”
- “The storage automatically deduplicates data and auto-aligns disks.”
- “While we don't use this feature with Unidesk, you can snapshot and clone VMs directly from the storage. A VIAA plugin is available, should you want to use it.”

- “We have done several firmware upgrades, two of which were conducted during production hours. Yes, I am crazy, but I tend to test the limits of a product. During these firmware updates, none of our desktops was affected in any way.”
- “Tintri’s support, like Unidesk, is top notch. Lightning fast response time 24/7. The best part is I’ve only had to use them twice and the issues were trivial.”
- “As with the install and configuration, the management and monitoring is browser-based and very clean. This makes it simple for even the novice admin to navigate. Below are some sample screenshots with various comments.”
- “Another useful feature is the ability to “Pin” the VMs or VM virtual disks to flash. While the T540 does a great job of managing what data is placed on flash vs. spinning disk, the ability to “Pin” gives us some flexibility with the storage. Tintri has incorporated the necessary warning in the interface about the potential perils of Pinning.”

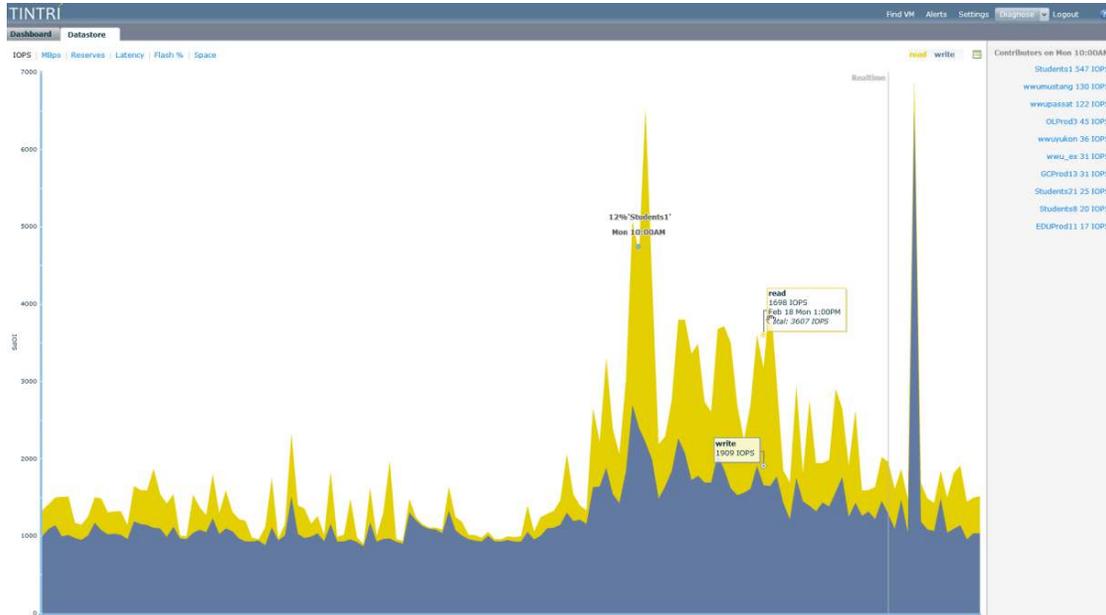
Steven also shared some Tintri reports from his environment. These reports show how Tintri storage is managed on a daily basis, and how it is performing with Unidesk desktops.

This first screenshot is the home page for the Tintri T540. It provides the combined statistics of the storage and all VM’s running on it.



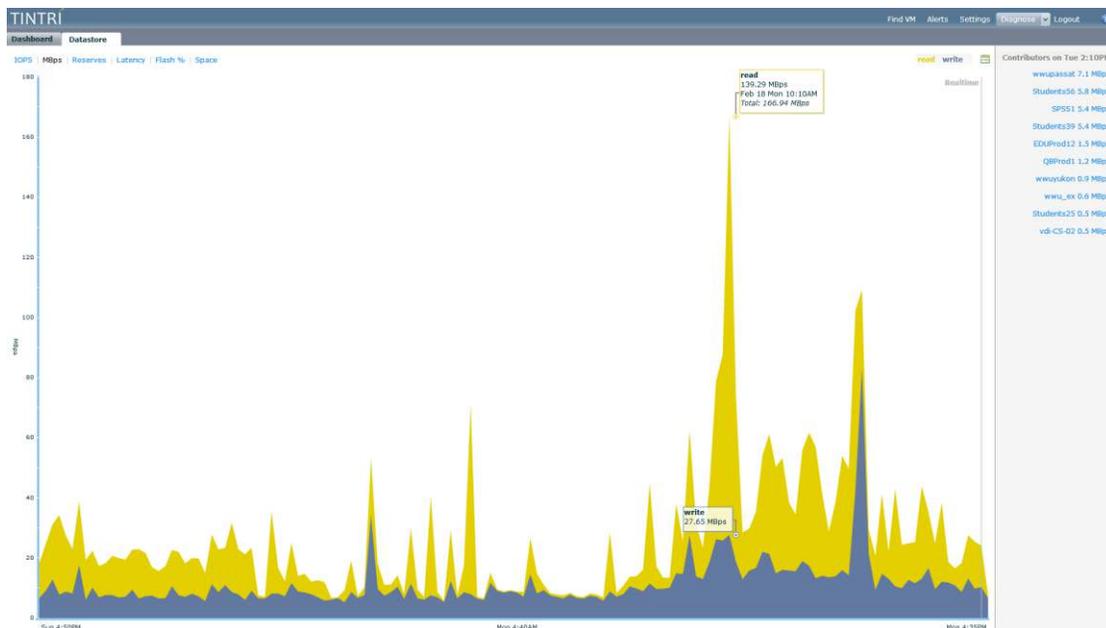
Note that the 350 Unidesk desktops are not even working hard. Tintri still has 91% space available in its SSD cache. Also note there are 9.1 TBs of storage available, largely due to Unidesk’s small capacity footprint. This enables the Tintri appliance to be used for other workloads, including Microsoft Exchange servers.

The next screen shows IOPS, throughput, latency, and flash hit ratio. A slider enables you to see individual statistics at any point in time. It can also be “dragged” to scale the period. On the right, high I/O virtual machines are shown, along with their IOPS.

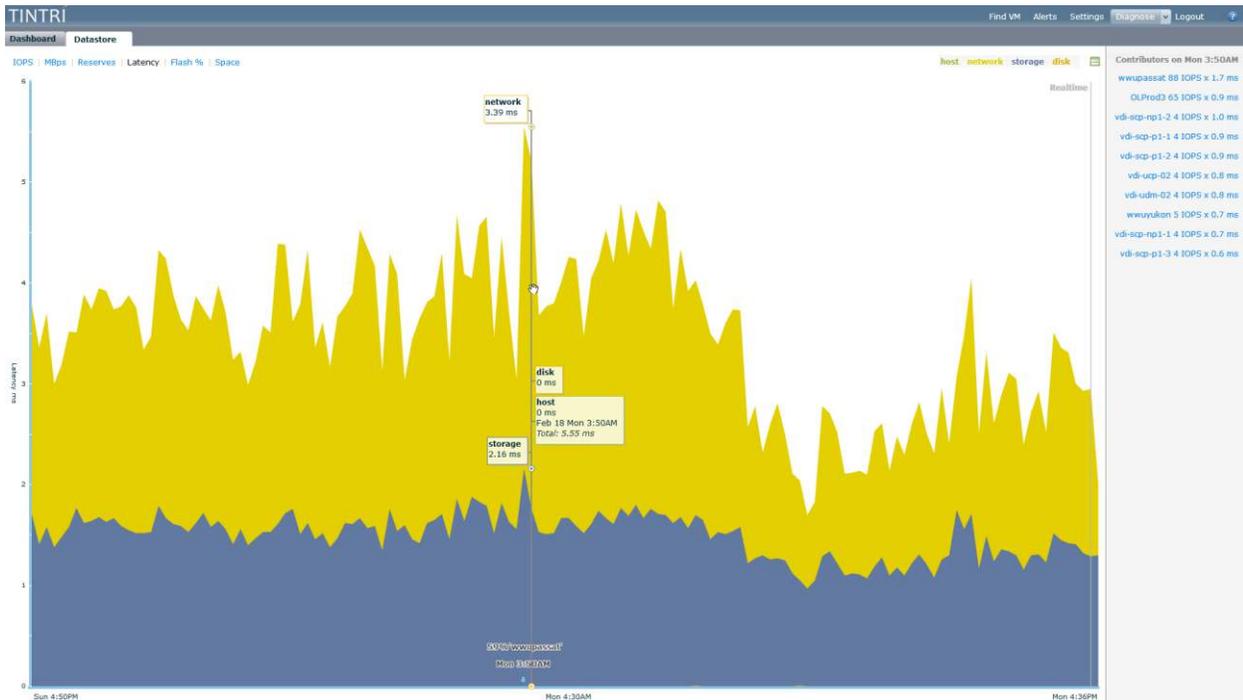


Note the I/O peak of almost 10K Read/Write IOPS is on Monday morning when William Woods’ student users are starting to use the desktops after the weekend. Tintri’s ability to handle this level of bursty I/O is key for VDI.

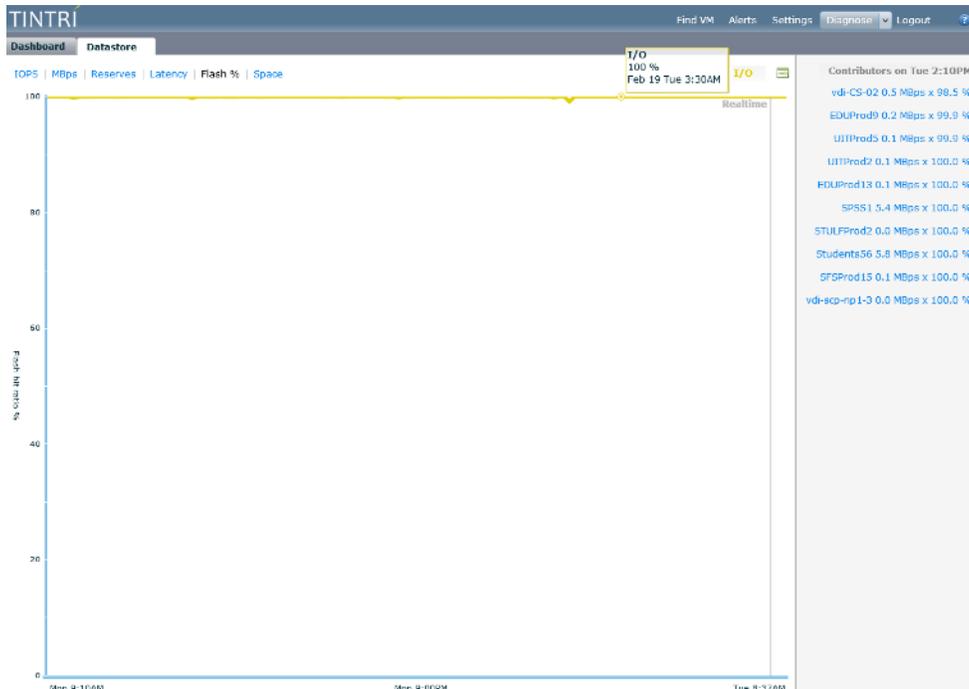
The next chart illustrates the highest I/O peak of almost 200 MB/s.



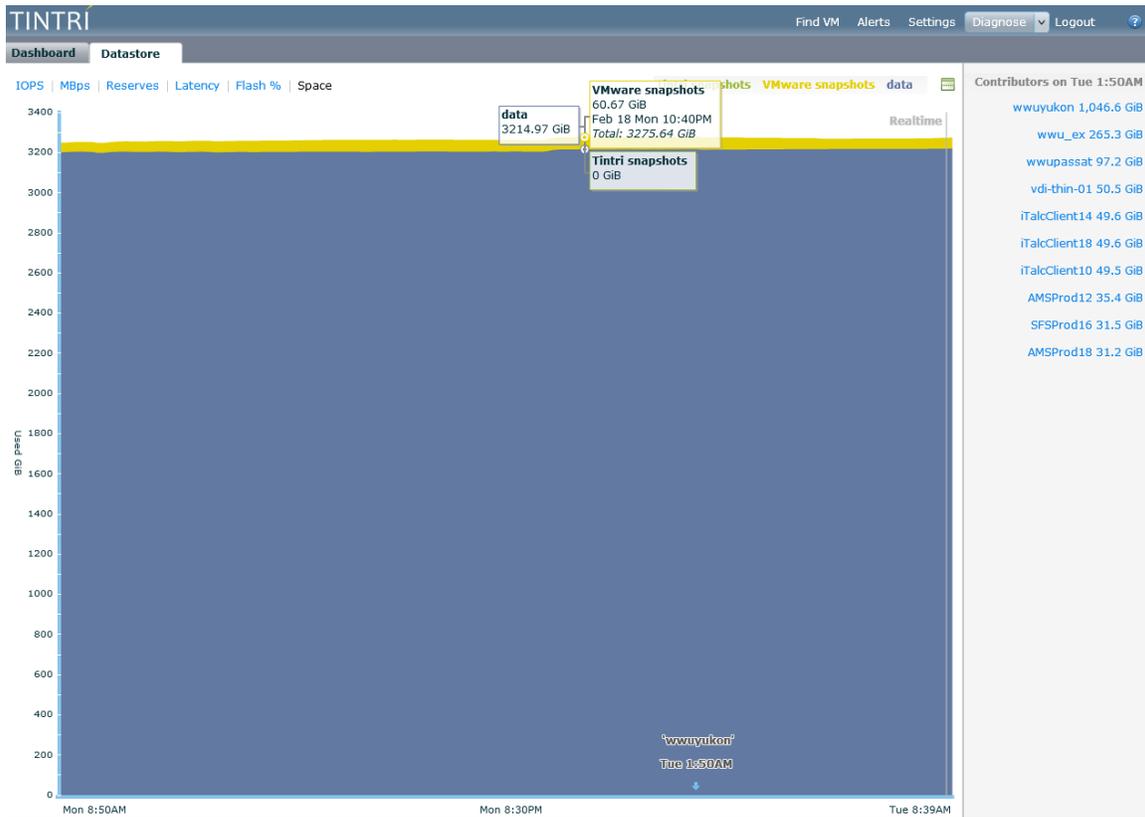
This screen shows network and storage latency. Both are very low at less than 3.4 ms, with the network portion shown in yellow responsible for higher total.



This next screen illustrates how the combination of Unidesk shared layers, Tintri MLC flash, and Tintri's intelligent placement algorithms deliver exceptional I/O performance. As expected, about 99% of I/O is coming from flash.



The next screen shows the heavy users of storage capacity and where the use comes from. Here almost all the storage is from data (basically VMDK files).



While these screens look at the Tintri storage as a whole, the same charts can be applied to individual VMs to view statistics and graphs on a per-VM basis.

One of the most useful views is looking at the VMs themselves, and sorting the VM workloads by column. The following screens show VMs sorted first by highest latency, then by highest IOPS. Additionally, the latency is broken out into storage, network, host and disk. This is very helpful in troubleshooting poor performing VMs, since you can see in detail where the problem really is.

VM	IOPS	MBps	Reserve...	Latency ms	Flash hi...	Provisio...	Used GiB	Host	Snapsh...
GCProd11	13	3.2	0.2	4.1	100	227	5.3	vdi-esx-01....	
wwupassat	121	2.5	1.1	2.0	100	276	97.2	vdi-esx-01....	
REGPROD3	17	0.3	0.0	1.5	100	224	3.9	vdi-esx-02....	
GCProd6	9	0.2	0.0	0.0	100	234	12.8	vdi-esx-02....	
wwuyukon	157	9.1	1.1	1.2	100	1,950	1,046.6	wwuesx01....	
EDUProd1	18	0.5	0.0	1.1	100	224	8.5	vdi-esx-01....	
wwu_ex	28	1.0	0.6	1.1	100	662	265.3	wwuesx01....	
Jenzabar1	12	0.2	0.0	1.1	100	158	0.8	vdi-esx-01....	
vdi-scp-np1-2	4	0.0	0.0	0.9	100	18	2.2	vdi-esx-02....	
iTalcClient14	12	0.7	0.0	0.9	100	228	49.6	vdi-esx-03....	
wwumustang	32	0.5	0.1	0.9	100	124	30.1	vdi-esx-01....	
iTalcClient10	22	1.3	0.1	0.9	100	228	49.5	vdi-esx-01....	
AMSPProd12	6	0.1	0.0	0.9	100	224	6.9	vdi-esx-01....	
EDUProd14	13	0.2	0.0	0.9	100	237	6.4	vdi-esx-01....	
EDUProd11	3	0.1	0.0	0.8	100	214	8.6	vdi-esx-02....	
GCProd13	6	0.1	0.0	0.8	100	234	5.4	vdi-esx-03....	
OLProd3	6	0.1	0.0	0.8	100	234	6.5	vdi-esx-03....	
vdi-udm-02	6	0.1	0.0	0.7	100	10	2.5	vdi-esx-01....	
iTalcClient4	3	0.0	0.0	0.7	100	228	1.0	vdi-esx-02....	
QBPProd22	8	0.2	0.0	0.7	100	160	12.6	vdi-esx-02....	
QBPProd16	5	0.1	0.0	0.7	100	160	1.0	vdi-esx-03....	
ARTProd5	6	0.2	0.0	0.7	100	204	2.5	vdi-esx-01....	
PresOFCProd4	39	1.1	0.0	0.7	100	207	7.7	vdi-esx-01....	
iTalcClient18	169	4.5	0.0	0.7	100	228	49.6	vdi-esx-03....	
MKTProd2	13	0.3	0.0	0.7	100	202	20.4	vdi-esx-02....	
BusSrvProd4	10	0.1	0.0	0.7	100	254	4.5	vdi-esx-03....	
vdi-scp-p1-3	4	0.0	0.0	0.7	100	18	2.2	vdi-esx-03....	
UITProd5	44	1.1	0.0	0.7	100	237	43.6	vdi-esx-01....	
UITProd3	8	0.2	0.0	0.7	100	257	12.0	vdi-esx-01....	
QBPProd14	5	0.1	0.0	0.6	100	160	0.9	vdi-esx-02....	

Datstore:287 of 287 VMs, 2,703 IOPS, 52 MBps, 5.4 % reserves, 3,275 GiB used, 107 %
 Selected: 1 VM, 13 IOPS, 3 MBps, 0.2 % reserves, 5.3 GiB used [Show graphs](#)

Following is the same view, sorted by highest IOPs instead of latency.

VM	IOPS	MBps	Reserve...	Latency ms	Flash hi...	Provisio...	Used GiB	Host	Snapsh...
iTalcClient18	169	4.5	0.0	0.7	100	228	49.6	vdi-esx-03....	
wwuyukon	157	9.1	1.1	1.2	100	1,950	1,046.6	wwuesx01....	
wwupassat	121	2.5	1.1	2.0	100	276	97.2	vdi-esx-01....	
UITProd5	44	1.1	0.0	0.7	100	237	43.6	vdi-esx-01....	
PresOFCProd4	39	1.1	0.0	0.7	100	207	7.7	vdi-esx-01....	
wwumustang	32	0.5	0.1	0.9	100	124	30.1	vdi-esx-01....	
wwu_ex	28	1.0	0.6	1.1	100	662	265.3	wwuesx01....	
iTalcClient10	22	1.3	0.1	0.9	100	228	49.5	vdi-esx-01....	
EDUProd1	18	0.5	0.0	1.1	100	224	8.5	vdi-esx-01....	
REGPROD3	17	0.3	0.0	1.5	100	224	3.9	vdi-esx-02....	
MKTProd2	13	0.3	0.0	0.7	100	202	20.4	vdi-esx-02....	
GCProd11	13	3.2	0.2	4.1	100	227	5.3	vdi-esx-01....	
EDUProd14	13	0.2	0.0	0.9	100	237	6.4	vdi-esx-01....	
iTalcClient14	12	0.7	0.0	0.9	100	228	49.6	vdi-esx-03....	
Jenzabar1	12	0.2	0.0	1.1	100	158	0.8	vdi-esx-01....	
EDUProd13	11	0.1	0.0	0.5	100	204	26.5	vdi-esx-03....	
BusSrvProd4	10	0.1	0.0	0.7	100	254	4.5	vdi-esx-03....	
GCProd6	9	0.2	0.0	1.4	100	234	12.8	vdi-esx-02....	
UITProd1	8	0.1	0.0	0.5	100	227	1.7	vdi-esx-02....	
QBPProd22	8	0.2	0.0	0.7	100	160	12.6	vdi-esx-02....	
UITProd3	8	0.2	0.0	0.7	100	257	12.0	vdi-esx-01....	
Students23	7	0.2	0.0	0.6	100	218	2.2	vdi-esx-02....	
ARTProd2	7	0.1	0.0	0.6	100	222	17.6	vdi-esx-02....	
GCProd13	6	0.1	0.0	0.8	100	234	5.4	vdi-esx-03....	
Students33	6	0.1	0.0	0.6	100	218	1.3	vdi-esx-01....	
UITProd2	6	0.1	0.0	0.6	100	247	14.8	vdi-esx-01....	
ARTProd5	6	0.2	0.0	0.7	100	204	2.5	vdi-esx-01....	
OLProd3	6	0.1	0.0	0.8	100	234	6.5	vdi-esx-03....	
GCProd10	6	0.1	0.0	0.5	100	214	4.9	vdi-esx-01....	
QBPProd10	6	0.1	0.0	0.5	100	160	1.0	vdi-esx-01....	

Datstore:287 of 287 VMs, 3,014 IOPS, 44 MBps, 5.4 % reserves, 3,276 GiB used, 107 %
 Selected: 1 VM, 169 IOPS, 5 MBps, 0.0 % reserves, 50 GiB used [Show graphs](#)

Conclusion

At Unidesk, we are always excited when our technology alliance partners show that they really understand the requirements of VDI. As this white paper proves, Tintri delivers. Whether you choose Citrix XenDesktop or VMware Horizon View for desktop access, Unidesk and Tintri offer an ideal combination for low cost, high performance, easy-to-manage VDI.

Unidesk is the simpler, more powerful alternative to the complex tools traditionally needed to create virtual desktops, package applications, manage images, keep user changes, and optimize storage. Tintri provides exceptional VDI storage performance for VDI read and write operations, along with excellent reporting and troubleshooting tools.

With Unidesk reducing the storage footprint more than 70% for persistent desktops and more than 80% for non-persistent desktops, you can host almost 1,000 desktops on a single Tintri storage array, or use the extra space to handle non-VDI workloads. Unidesk layering technology also creates the ideal data pattern for Tintri MLC flash, so you can provide more than enough IOPS to satisfy your most demanding power users.

Together, Unidesk and Tintri are an ideal solution for small VDI environments running a few hundred desktops, or large enterprise deployments running several thousand.

About Unidesk Corporation

Unidesk Corporation (www.unidesk.com) provides the management platform that accelerates the movement of Microsoft Windows desktops® to the cloud. Unidesk® layering technology enables Virtual Desktop Infrastructure (VDI) to deliver more applications, satisfy more use cases, and offer a more personal user experience with less IT effort and less storage. By connecting to Unidesk desktops from Citrix XenDesktop®, VMware Horizon View™ and other brokering solutions, customers expedite VDI projects, reduce desktop operations costs up to 30%, cut VDI storage capacity requirements up to 85%, and enhance worker productivity. Unidesk Corp. is a privately-held company with headquarters in Marlborough, Mass, USA.

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