VMware App Volumes and Horizon 6: the Lowest Capital and Operational Costs for VDI

WHITE PAPER

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VMware sees cost reduction in end-user computing as a journey. This paper provides details on one of the technology initiatives that has driven down both capital and operational costs. The overall journey (so far) is described in a summary document: Cost Leadership in End-User Computing: Virtual Desktops, Real Savings.

Desktop application management and associated packaging is a major expense for most large organizations. VMware App Volumes™ provides a simple, inexpensive way to manage applications and application hierarchies for virtual desktop infrastructure (VDI) deployments without the need for packaging.

Implementation of App Volumes offers significant savings for organizations looking to move from a conventional packaged model. There is an immediate (and often significant) savings in capital costs by reducing storage requirements and a reduction in future support costs. Since App Volumes is delivered as a part of VMware Horizon® 6 Enterprise Edition, for many customers using VMware products there will be no additional license fees. App Volumes can also be acquired as a standalone product, for use with any other VDI product.

The cost comparisons presented in this document refer to implementations using Horizon 6 Enterprise Edition.

App Volumes Model

App Volumes provides a system for managing desktop applications, designed to be easy to administrate and minimize total cost of ownership (TCO).

The App Volumes model is simple. Each desktop application is installed once (on the *provisioning computer*) and all desktops using this application map to these files by use of virtual drives. All components necessary to run the application are accessible on the provisioning computer. Collections of components comprising the applications are known as *AppStacks*, making them easy to deliver and assemble within App Volumes.

AppStacks and writable volumes are stored within hypervisor datastores in VMDK file format and attached to the virtual machine using standard hypervisor functionality. Attachment to a native OS-based file system is still possible, if so desired, using VHD In-Guest Operation Mode.

This makes the system easy to understand for application support staff, system administrators and end users. Conventional packaging systems rely on each desktop client having its own installation, with the associated complications of increased storage volume and additional labor costs to resolve problems. App Volumes manages the connection between applications in a simplified manner, rather than through a collection of functions connected by many complex OS resources. The implication is a significant reduction in both storage volume and the time taken to deliver applications to users.

To provision a new application through App Volumes, a system administrator or application support engineer must first create the application within App Volumes as an AppStack, specifying the data store where the application will be located. Once this has been done, the administrator starts the provisioning process within App Volumes, logs into the provisioning computer to install the application, and finally returns to the App Volumes console to specify that the provisioning is complete. App Volumes now contains all the information required for running the application on client desktops. Adding an application to an AppStack (whether new or existing) is typically about 80 percent faster than packaging the same application through traditional methods.

Installation of the application to a client consists only of mapping to the data store and setting the relevant environment variables, all of which information is available from the App Volumes server.

The App Volumes Console provides a means of centrally managing applications, giving information such as number of clients using a particular application, which is useful for such problems as counting licenses. Applications are simple to provision and can be delivered in near-real time.

Reducing Infrastructure Costs with App Volumes

There are three principal areas in which App Volumes can contribute to savings:

- Reduced cost of storage capacity—the most visible and immediate benefit
- Reduced time to make an application available to users
- Faster deployment to desktop

Since each application is installed only once on the provisioning machine, there is only one set of files per application, rather than copies of files on each client. Large savings can be made on storage where the application has a large user base: Simply install once and deliver multiple times.

Where applications are packaged, there can be many iterations of the packaging cycle. This increases labor costs for application teams and the staff assigned to manage the packages, and results in intangible costs due to longer rollout times for desktop applications (for example, loss of business opportunity). Under the App Volumes model, the application is not packaged, so these costs are not incurred.

During rollout to the users, each application is deployed to the desktop in seconds, as only settings are changed and no files are copied or unpacked, increasing user productivity.

App Volumes combines the advantages of both persistent and nonpersistent virtual desktop infrastructure. The desktops can be nonpersistent, in that all applications are provisioned at login time, providing the highest degree of control in desktop application management. Issues such as old versions of software and incompatibility between software layers are minimized. However, the applications themselves are persistent as they are provisioned from permanent installations on the provisioning computers, minimizing errors as each application is attached from the desktop. This means fewer hours spent by support staff resolving desktop issues.

App Volumes Costs and Example Configurations

The following practical examples show how different organizations could implement VMware App Volumes as part of Horizon 6 Enterprise, together with estimated costs and comparisons to an equivalent conventional packaged implementation. Two cases are considered – firstly using App Volumes with a typical network storage solution (for example, a shared hybrid array) and second to show the additional savings available by using App Volumes in conjunction with VMware Virtual SAN™ (also delivered with Horizon 6 Enterprise Edition).

In all cases the storage costs are significantly lower using App Volumes, with savings ranging from $9 up to $366 per user, depending on the type of environment and the scope of the infrastructure transformation. The figures also indicate greater savings for more complex environments with a large number of desktop applications (where packaging effort is high), or a large number of users (with a consequent large number of application deployment errors).

Cost Assumptions for Storage Components

The figures in the following table are used as the basis for determining storage costs, and hence storage savings. All costs are list prices. Discounts would be applied,[1] we assume evenly for all options. List prices for the switch and drives were taken from public Web sites mid-August 2015. The cost per GB for shared storage is a conservative figure based on a combination of our business case data and analyst estimates.

The various drive costs are only used in the calculations for App Volumes on Virtual SAN. Virtual SAN only (without App Volumes) costs are covered in a separate document: VMware Virtual SAN and VMware Horizon 6: Cost Leadership Through Storage Savings.

Component	Make/Model	Cost	Unit
Shared Storage Array	Any	$5	per GB
32 Port Ethernet Switch	Brocade ICX 6650 32 ports 10Gb Switch with SFP+ transceivers	$14,489	each
1.2TB SAS Drive	10K RPM 6Gbps 2.5in Hot-plug	$583	each
600GB SAS Drive	10K RPM 6Gbps 2.5in Hot-plug	$399	each
300GB SAS Drive	10K RPM 6Gbps 2.5in Hot-plug	$209	each
120 GB Solid State Drive	6 Gbps 2.5in hot-plug	$259	each

Figure 1: Storage Component Cost Assumptions

Operational Cost Savings: Assumptions and Methodology

Cost reductions using App Volumes have been calculated using the following assumptions:

- Average time to package an application is 60 minutes, which corresponds to initial packaging and to new releases of existing applications. With App Volumes, the time reduces to 12 minutes for an installation on a provisioning computer, yielding a savings of 48 minutes per application update.
- Time to deliver one application to a desktop is 10 minutes without App Volumes, as an installation is required. Time to deliver one application to a desktop is 1 minute with App Volumes, as only settings are changed on the target machine.
- Application delivery failure rate is 12 percent without App Volumes, with an average repair time of 3 minutes. This represents a conservative estimate, as it assumes a probability of only 12 percent that delivery of any given application will fail over the course of a year, regardless of the number of times the application is repackaged. Rates for these failures are assumed to be negligible with App Volumes.

1. The actual discount levels achieved would depend on multiple factors, including (but not limited to) volume of overall purchase, status of existing relationships with suppliers, duration of contractual commitments, and external market conditions. Because "mileage may vary" widely, we have worked from list prices as a reliable and objective basis for cost estimates and comparisons.

- Storage reductions with App Volumes typically vary between 40 and 70 percent for a persistent image and between 20 and 40 percent for nonpersistent images. For the examples presented, cautious midpoints of 55 percent and 30 percent are used.
- An average application undergoes four updates per year.
- Annual salary for support staff to resolve desktop issues is $72K, working 1,920 hours per year with a 25 percent overhead for benefits and other costs.

The number of GB saved by using App Volumes is determined as follows:

*total storage volume * percentage reduction*

For persistent images, the total storage volume is:

*number of users * size of image*

The operational savings consists of two components: time saved in packaging and time saved fixing failed application delivery. Time saved in packaging is:

*number of applications * updates per year * time saved per update*

Time saved in fixing delivery failures is:

*number of users * applications per user * updates per year * delivery failure rate*

The sum of these two time totals is multiplied by the cost of IT support staff to yield a yearly operational cost savings.

Example 1 – Large Domestic Call Center for a Retail Bank

In this example, the users are task workers, carrying out a usually predictable set of functions. The routine nature of the work means only a limited set of applications is required on the desktop.

Storage Savings

In this scenario, there are 5,000 users, each with a light image load. Nonpersistent images are used, with a 30 GB base image. There are two base images. A total of 31 TB of storage capacity is needed, to support replication of base images across servers. Since the images are nonpersistent, there is no user data storage requirement. The storage capacity savings is assumed to be 30 percent with App Volumes.

We have assumed 200 desktops are supported per host server and each server can be fitted with 5 drives.

Savings of 25 percent are realized if a conventional packaged solution on a shared storage array is migrated to App Volumes. If Virtual SAN is also used, the savings could be 69 percent.

SHARED STORAGE ARRAY COSTS		QUANTITY	COST
	Storage capacity (GB)	31,000	$155,000
	32-port – 10 Gb Ethernet switch	2	$28,978
Total			**$183,978**
Cost per user			**$36.80**

SHARED STORAGE WITH APP VOLUMES COSTS		QUANTITY	COST
	Storage capacity reduction	30%	
	New storage capacity (GB)	21,700	$108,500
	32-port – 10 Gb Ethernet switch	2	$28,978
Total			**$137,478**
Cost per user			**$27.50**

APP VOLUMES ON VIRTUAL SAN COSTS		QUANTITY	COST
	32-port – 10 Gb Ethernet switch	2	$28,978
	300 GB SAS drive	75	$15,675
	120 GB solid-state SAS drive	50	$12,950
Total			**$57,603**
Cost per user			**$11.52**

PER-USER SAVINGS	VALUE	PERCENTAGE
Shared storage with App Volumes	$9.30	25%
App Volumes on Virtual SAN	$25.28	69%

Table 1: Storage Cost Comparison – Retail Bank Domestic Call Center

Operational Savings

In total, 50 applications are in use, with the majority (around 80 percent) of users having only 10 applications on their desktop and the remaining 20 percent averaging 20 applications—an average of 12 applications per user overall.

PACKAGING SAVINGS (ANNUAL)		QUANTITY	COST
	Package delivery and repackaging (1)	160	$7,500
	Failed application delivery (2)	360	$16,995
Total			**$24,495**
Savings per user	**(annual)**		**$5**

Notes

1. 50 * 4 * (48 minutes) = 160 hours
2. 5000 * 12 * 12% * (3 minutes) = 360 hours

Table 2: Operations Cost Comparison – Retail Bank Domestic Call Center

Example 2 – Medium-Sized, Multisite Engineering Consultancy

In this example, the work in the organization encompasses a wider range of functions, often compute- and storage-intensive. Support staff performs more routine tasks. However, the knowledge workers comprising the majority of the workforce use a more demanding set of tools, such as business applications and data analysis systems. A wide variety of applications is used with a medium level of desktop customization.

Storage Savings

In this scenario, there are 3,000 users, each with a medium image load. Persistent images are used, with a 30 GB base image size plus 20 GB per user. A total of 150 TB of storage capacity is needed, to store a full 50 GB image for each user. The storage capacity savings is assumed to be 55 percent with App Volumes.

We have assumed 100 desktops are supported per host server and each server can be fitted with 4 drives.

Savings of 53 percent are realized if a conventional packaged solution on a shared storage array is migrated to App Volumes. If Virtual SAN is also used, the savings could be 90 percent.

SHARED STORAGE ARRAY COSTS		QUANTITY	COST
	Storage capacity	150,000	$750,000
	32-port – 10 Gb Ethernet switch	2	$28,978
Total			**$778,978**
Cost per user			**$259.66**

SHARED STORAGE WITH APP VOLUMES COSTS		QUANTITY	COST
	Storage capacity reduction	55%	
	New storage capacity (GB)	67,500	$337,500
	32-port – 10 Gb Ethernet switch	2	$28,978
Total			**$366,478**
Cost per user			**$122.16**

APP VOLUMES ON VIRTUAL SAN COSTS		QUANTITY	COST
	32-port – 10 Gb Ethernet switch	2	$28,978
	1.2 TB SAS drive	60	$34,980
	120 GB solid-state SAS drive	60	$15,540
Total			**$79,498**
Cost per user			**$26.50**

PER-USER SAVINGS	VALUE	PERCENTAGE
Shared storage with App Volumes	$137.50	53%
App Volumes on Virtual SAN	$233.16	90%

Table 3: Storage Cost Comparison – Medium-Sized, Multisite Engineering Consultancy

Operational Savings

We have assumed a total of 150 applications and an average of 30 applications per user.

PACKAGING SAVINGS (ANNUAL)		QUANTITY	COST
	Package delivery and repackaging (1)	480	$22,500
	Failed application delivery (2)	540	$25,313
Total			**$47,813**
Savings per user	**(annual)**		**$16**

Notes
1. 150 * 4 * (48 minutes) = 480 hours
2. 3000 * 30 * 12% * (3 minutes) = 540 hours

Table 4: Operations Cost Comparison – Medium-Sized, Multisite Engineering Consultancy

Example 3 – Large Scientific Institution

Possible examples of this type of organization include national or multi-government centers responsible for fundamental research or leading-edge, science-based projects. The users are highly computer-literate and often able to code. The desktop is of high specification and highly customized, with a broad variety of specialized applications.

Storage Savings

In this scenario, there are 1,000 users, each with a heavy image load. Persistent images are used, with a 30 GB base image and 50 GB per user for data. A total of 80 TB of storage capacity is needed, to store a full 80 GB image for each user.

We have assumed 50 desktops are supported per host server and that each server can be fitted with 5 drives.

Savings of 51 percent are realized if a conventional packaged solution on a shared storage array is migrated to App Volumes. If Virtual SAN is also used, the savings could be 85 percent.

SHARED STORAGE ARRAY COSTS		QUANTITY	COST
	Storage capacity	80,000	$400,000
	32-port – 10 Gb Ethernet Switch	2	$28,978
Total			**$428,978**
Cost per user			**$428.98**

SHARED STORAGE WITH APP VOLUMES COSTS		QUANTITY	COST
	Storage capacity reduction	55%	
	New storage capacity (GB)	36,000	$180,000
	32-port – 10 Gb Ethernet switch	2	$28,978
Total			**$208,978**
Cost per user			**$208.98**

APP VOLUMES ON VIRTUAL SAN COSTS		QUANTITY	COST
	32-port – 10 Gb Ethernet switch	2	$28,978
	600 GB SAS drive	60	$23,940
	120 GB solid-state SAS drive	40	$10,360
Total			**$63,278**
Cost per user			**$63.28**

PER-USER SAVINGS	VALUE	PERCENTAGE
Shared storage with App Volumes	$220.00	51%
App Volumes on Virtual SAN	$365.70	85%

Table 5: Storage Cost Comparison – Large Scientific Institution

Operational Savings

We have assumed 250 applications and an average of 20 applications per user. The work is extremely diverse, but the specialized nature of the work means each user concentrates on relatively few applications.

PACKAGING SAVINGS (ANNUAL)		QUANTITY	COST
	Package delivery and repackaging (1)	800	$37,500
	Failed application delivery (2)	120	$5,625
Total			**$43,125**
Savings per user	**(annual)**		**$43**

Notes

1. 250 * 4 * (48 minutes) = 800 hours
2. 1000 * 20 * 12% * (3 minutes) = 120 hours

Table 6: Operations Cost Comparison – Large Scientific Institution

Typical Implementation Methods for Maximum Cost Efficiency

Initially, you will probably have a large desktop environment and it can be difficult to know how best to start your implementation of a new desktop management system. There are two typical strategies—green field and brown field—and both can be used effectively.

Green Field Method

Sometimes there will be an opportunity to deploy App Volumes completely from scratch. An example might be the setting up of a new line of business, when new employees and support staff are hired and new equipment can be purchased. Alternatively, your company might be relatively new and no mature desktop management system is yet in operation.

In cases such as this, a major project would have to be undertaken, whatever desktop management system is eventually selected. This method has the following advantages over the brown field method:

- Budget will already be available, so there should be no problem with any justification of CapEx spend.
- Sticking with the existing environment (if one even exists) is not a requirement, and an optimum solution can be designed from scratch. A packaged solution and App Volumes will not have to coexist.
- During the planning and justification phase, a choice will have to be made for a desktop management system. The cost advantages of App Volumes should become apparent at this stage, and buy-in can be obtained from management.

There may also be significant problems to be overcome if another desktop management system is in use elsewhere in the organization, even one acknowledged to be inferior. There will be a large volume of work for support staff to set up all the necessary applications on the provisioning computers, and it might appear to be less expensive (initially, at least) to use whatever packaged applications are available for the new group, and create new packages for the remainder of the requirements.

Brown Field Method

In organizations with an established desktop management system or methodology, it will not usually be possible to implement App Volumes using the same techniques as with a clean, green field project.

Generally speaking, a brown field implementation is more difficult than a green field project, as both existing and new desktop management systems will have to coexist, probably for an extended period. This may prevent the full cost benefit of App Volumes from being realized, at least until the migration is complete.

On the other hand, there are the following advantages to this method:

- There is opportunity to start small, first with an experimental setup, then with a pilot group of users.
- Knowledge is gained as the project proceeds, so that the final solution is likely to be more optimal, and hence more cost effective.
- Project deadlines may be less critical, as the lack of “big bang” makes slippage less visible or disruptive. Additionally, time taken at the start to ensure that the implementation is done correctly can make it easier to make up lost time later.

The co-existence of two systems may present the following problems:

- Applications must be kept in sync on both systems until all users of a particular application are migrated. For applications used across business lines, or by large numbers of users, this might be an extended period.

- If an application upgrade is absolutely necessary during the period of parallel running—a version might be going out of support, for example—the upgrades must be done on both systems, increasing the workload for the support team.
- It is difficult for a user to be working "live" on both systems simultaneously. The problems this presents are likely to be impractical to solve. It will probably be necessary to have a fast, reliable means of rolling a user, or group of users, back to the old system if problems are encountered in the migration.
- Super users with requirements for large numbers of applications might have to be taken out of both systems entirely for the period of the migration. They would require custom desktop setups, with the attendant management problems.

Real-World Success: One Manager's Story

"When I first heard about App Volumes, I wasn't sure it would be of great benefit to my organization, as we already had a mature desktop application management system. My desktop manager thought it was worth looking at though, so we carried out a study to decide whether or not it was worth buying, both from a cost-saving point of view and for any soft benefits it would bring.

"The more we looked it, the better App Volumes seemed, especially as we'd recently implemented Virtual SAN, with which there seemed to be particular synergies.

"The primary sell was on disk space. It's incredibly wasteful having multiple copies of software, which are installed one time and then never change. This may not have been a big issue in the days when all users had a physical C: drive attached to their PC and saving space on it was not something anyone really cared about. Now that we have VDI, it's become incredibly important, as with centrally managed desktop storage each gigabyte of storage saved translates immediately into a dollar value.

"This is important for backups, too. The software files don't change, so they're not backed up every day, but we still do full backups every week, so all multiple copies of files represent a big waste of tape.

"Our biggest win had nothing to do with hardware savings, though. App Volumes strongest point, in my opinion, is the simplicity of the model, where an application is installed on its own virtual disk. Everyone can understand this easily, once it's explained to them, and I always see a positive reaction when someone hears the applications don't have to be packaged.

"The packaging process is a big time waster here. Packaging desktop software isn't something application support people really want to learn about, so the job tends to be delegated to a single member of the team, which is far from ideal. The release cycle can take weeks, once you take account of building packages, testing them, then the submission and release. When all you have to do is install the software onto a private virtual disk, a lot of these delays are cut out.

"Once the project is complete, we might even be able to redeploy the packaging team to more productive and interesting work.

"One word of caution—the implementation must be carefully planned. We didn't manage to think of any easy way to make the old and new systems coexist, so parallel environments had to be built. Groups of users with common desktop environments were identified and migrated to the new environment over a series of weekends. Software releases had to be frozen in the last stages of building the App Volumes environment. We thought we had everything covered, but there were a few panics on some of the Monday mornings!

"All in all, it's been a highly successful project. We now have a simpler, more efficient, and less expensive system than before."

Conclusion

The most immediate benefit of App Volumes is that it simplifies and reduces storage requirements for VDI images. It does this by holding centralized versions of software, eliminating replicas usually held by each user in a private area. The more complex the image, the greater the savings.

Operational costs are also reduced. Installation onto a desktop client (in reality, changing just a few settings) is quick and simple, translating into fewer hours by support staff. Because there is no need to package applications, the release cycle for applications is shorter and cheaper. New applications can be made available more rapidly to users and changes to application entitlements for individuals or for groups of users can be made in near-real time.

These benefits multiply for larger and more complex environments. All large enterprises should consider App Volumes for VDI deployments: for the huge cost savings it can bring, for the simplicity of its operating model, and to accelerate application delivery.

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