



How to Make Clinicians' Lives Easier

Healthcare organizations are navigating a time of unprecedented change. Soaring costs, declining revenues and ever-expanding government mandates have impacted healthcare organizations across the globe. Added to the mix has been a fierce and accelerating onslaught of cybercrime activity. These dynamics have combined to place extraordinary pressures on the IT staff in healthcare organizations.

Virtual desktop infrastructure (VDI) has proven itself as a compelling resource for healthcare organizations seeking ways to improve productivity, security and compliance. But despite the many potential benefits offered by VDI, numerous healthcare organizations have implemented it only to find that its promise is limited by

their storage solutions, which fall short of adequately supporting the technology. The result, inevitably, is VDI that fails to offer optimal performance and productivity — and, in many cases, the work-arounds that used to address these limitations create difficulties in maintaining security and conforming to compliance mandates.

This paper provides an overview of key healthcare trends that are impacting IT agility and clinicians' efficiency. Also discussed are the benefits of coupling an all-flash storage system with a VDI environment, allowing provider organizations to overcome challenges and see the promise of VDI. This paper also specifically details the ability of Pure Storage's all-flash solution, FlashArray, to fulfill the storage needs of a Citrix VDI.



Business Challenge Summary

According to *Forbes*, 253 healthcare data breaches occurred in 2015, resulting in a loss of more than 112 million medical records. 2016 saw the largest fine ever levied against a healthcare organization for HIPAA violations: \$5.5 million against Advocate Health Care Network.

And it is a problem that is only growing.

Healthcare organizations certainly aren't alone in facing more frequent occurrences of cybercriminal activity. But in the last few years, healthcare organizations have been increasingly singled-out by hackers as prime targets. Cybercriminals are accelerating attacks against healthcare organizations because of the high black market value of medical records as the information is used for conventional and healthcare identity theft. These stolen healthcare identities then impact the organizations again, as services are accessed fraudulently, and endanger legitimate patients via data inaccuracies in their medical records.

As the *Washington Post* reported, every hacked medical record offers a potential wealth of data. Each record contains prized information such as Social Security numbers, birth dates, email addresses, and often bank account and credit card information. But records also contain medical information that can be leveraged in committing fraud. In 2013, a single health insurance credential could be sold for twenty dollars on the black market — ten to twenty times more than the value of a valid credit card number with a security code.

A data breach that occurs within a healthcare organization extracts a fearsome cost. Protected health information is subject to mandatory reporting, and a breach may result in substantial fines for violating HIPAA requirements.

Healthcare organizations must also bear the costs of remediating data breaches. But perhaps most costly, in the long term, is the reputational damage that occurs among patients that have entrusted healthcare providers with the safety of their most sensitive personal information.

Many healthcare organizations have begun to use virtual desktop infrastructure (VDI) to enable the growing demand for mobility. VDI is also a key weapon in the fight against cybercrime, since virtual desktops offer a far greater ability to protect against data breaches than do physical desktops.

But the advantages of VDI are sometimes blunted by a loss of performance when an organization's infrastructure is unable to meet the performance demands of VDI. VDI deployments that are reliant upon spinning disk, hybrid or retro-fit flash storage systems tend to deliver unreliable performance, slowed response times and inconsistent availability. The result is often a diminishment of defenses against data breaches, as organizations sometimes resort to less encryption to accommodate slower performance.

Complementing a VDI with a flash storage system is the answer. The speed of a flash storage system fully meets the I/O demands of even the most voracious VDI, enabling the realization of the full range of potential VDI performance and security benefits.



Key Healthcare Trends

Healthcare professionals work in a hectic, fast-paced, highly-mobile environment often colored by unexpected and urgent situations. Evolutions in technology offer medical professionals unprecedented resources for coping with the pressures and burdens placed upon them.

In particular, technology can aid in helping healthcare organizations adapt to the following five major trends in the healthcare industry:

- 1. EHR Deployment:** As recently as 2008, only one in five clinics had adopted the use of electronic health records (EHRs). Partly driven by mandates specified in the American Recovery and Reinvestment Act, the adoption of EHRs had soared to nearly nine in ten clinics by 2016. The exploding use of EHRs has generated a need for tools that facilitate and streamline the modern reliance upon electronic records.
- 2. Clinician Remote and Affiliate Access:** Enabling remote access for both patients and healthcare professionals has grown into a foundational technology in the healthcare industry. According to the American Hospital Association, more than half of all hospitals had deployed remote access technologies by 2013, with many more in the early stages of implementing remote access capabilities. The expansion of healthcare affiliate networks has also increased the demand for remote access technologies.
- 3. Mobile and Application Security:** Healthcare records are prized by hackers because of the wealth of personal and financial information that they contain. This places healthcare organizations squarely in the sights of some of the world's most capable and technologically advanced cybercriminals. The trend toward mobility combines with the tempting target of healthcare records in driving an expanding need for security-enhancing technology.
- 4. Data Governance and Compliance:** With the rapid move to EHRs and corresponding digitization of healthcare data, more focus needs to be placed on security and governance of healthcare data.
- 5. Legacy Infrastructure Adaptation:** Countless non-EHR clinical and legacy business applications are in use at healthcare organizations throughout the world. Most of these legacy tools fail to meet security needs and users' expectations, particularly when compared to consumer apps and apps from other industries. As a result, many healthcare organizations rely upon the ability of modern tools such as VDI for interfacing with legacy tools, adding functionality and bringing mobility and security capabilities up to modern standards.





How Citrix Addresses Healthcare-Centric Use Cases

Citrix solutions such as XenApp, XenDesktop and Enterprise Mobility Management technology provide healthcare organizations with the technological tools they need to remain agile, competitive and secure. Citrix solutions help to reduce healthcare IT operational costs while embracing trends toward mobility and remote access.

When deployed by healthcare organizations, Citrix solutions specifically help to:

- **Make IT more agile and flexible**, helping healthcare organizations meet and exceed the diverse needs of constituents and affiliates. Staff productivity is enhanced through the enablement of mobile access using any device.
 - Provide a scalable, agile environment that accommodates growth and change in the business
 - Enable automated maintenance, upgrades and infrastructure enhancements
 - Streamline the process of incorporating or transitioning legacy infrastructure components
- **Improve clinician access, workflow and experience**, helping deliver better value for patients and improving quality of care.
 - Support anytime, anywhere, any device work model
 - Ensures seamless standardized experience for all users
 - Eliminates inconvenience of “hospital-only” apps or apps that are not available on some devices or in some scenarios
- **Enhance security and compliance**, assuring the adherence to all U.S. government rules and mandates applying to the storage and exchange of healthcare information.
 - Ensure that applicable laws, regulations and rules are followed with regard to use of patient information

Citrix Ready Healthcare Program Overview

The Citrix Ready Healthcare Solutions program has been launched with the sole objective of building and sharing a library of white papers and case studies that portray the best integrated joint solutions for healthcare. Each of these documents illustrates the teaming of a Citrix partner and Citrix solution in helping healthcare institutions enhance seamless, instant and secure access to patient information and optimized patient care.

This program will serve to identify and showcase partner technologies such as single sign-on, voice dictation, zero-clients and all-flash storage. All spotlighted partner technologies work to seamlessly enhance healthcare solutions that help clinicians become more productive and provide a better patient experience, without compromising regulatory compliance. All solutions selected to the Citrix Ready Healthcare program support smooth and reliable integration with the latest Citrix XenDesktop and XenApp versions. These solutions address one or more of the below key objectives that have been identified as essential needs for healthcare institutions today:

1. Making IT more agile and flexible
2. Improving clinician access, workflow and experience
3. Enhancing data security and compliance



Overview of Pure Storage FlashArray

Pure Storage was founded with a simple philosophy in mind: That 100 percent flash storage could and should be made affordable and simple so the vast majority of enterprise applications can take advantage of the numerous benefits flash memory affords.

Pure Storage FlashArray offers many features that work to enhance security while improving productivity, including the following:

- **Security:** Since encryption is built in, FlashArray enables always-on, automated encryption without an associated performance loss. Key encryption is also handled automatically, eliminating the common fear of losing encryption keys — often a factor in organizations choosing to forego the security benefits of encryption. As a result, healthcare organizations can enjoy faster performance *and* enhanced security.
- **Cost Efficiency:** FlashArray's ability to ensure that only unique data is stored provides the industry's most granular and complete data reduction, helping healthcare organizations realize significant savings on storage capacity. Deduplication enables better performance, greater reliability and enhanced security through the benefits of efficient storage.
- **Resilience:** Through the Citrix Ready Validation Program, Pure Storage is able to demonstrate that it can deliver consistent end-user experience with sub-millisecond latency for up to 2,500 users on a three rack unit (RU) array.
- **Scalability:** Healthcare systems can easily scale as their organizations grow and also consolidate business critical applications onto their FlashArray without impact to operations.

FlashArray's speed, efficiency and always-on reliability help to improve clinicians' system access, workflows and user experience. It supports the enhancements to data security and regulatory compliance that so many healthcare organizations struggle to enact.

Pure Storage's data reduction technologies are particularly effective in Citrix XenApp and XenDesktop environments, and were instrumental in the selection of FlashArray as a Citrix Ready product. FlashArray is the simplest storage option for VDI.

management simplicity and do-more-with-less storage capability.

Organizations can also rapidly deploy with confidence their VDI environments with a pre-validated and tested reference architecture, FlashStack, that includes market leading Cisco compute and networking with Pure Storage and XenDesktop.

- **Remote Management:** FlashArray is designed to be mobile-friendly, providing remote capabilities for managing the arrays.

THE PURE STORAGE ADVANTAGE



ALL-FLASH SPEED AND SECURITY

VDI security (always-on encryption) and mobility with consistent <1ms latency that outperforms a laptop with local SSD.



100% FLASH FOR LESS THAN DISK

Realize TCO below the cost of disk with data reduction of > 10:1 and 2-3x savings on data center power, cooling, and real-estate for VDI workloads.



SIMPLEST ADMINISTRATION

Desktop admins don't want to be storage admins. Pure Storage is simple to install and configure — it's the easiest storage you'll ever manage.



SCALE AND RELIABILITY

With your organization's productivity on the line, VDI is mission-critical. Pure Storage delivers high availability, consistent performance, and non-disruptive operations.



MULTIPLE WORKLOADS

Consolidate XenDesktop VMs alongside server and database workloads with no performance impact.



STATELESS OR PERSISTENT

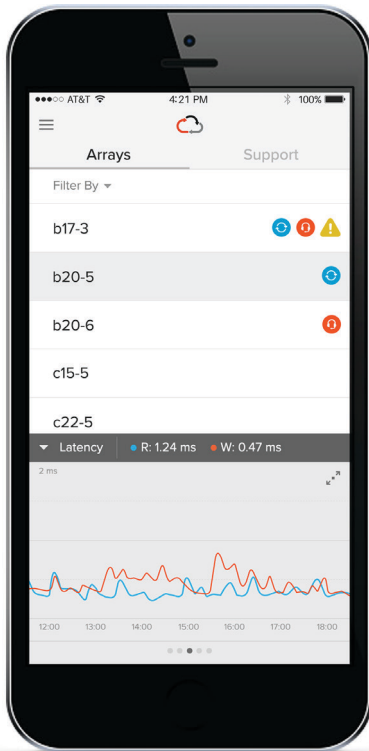
Both stateless and persistent desktops reduce to the same space on the FlashArray.

Features unique to FlashArray include:

- **Platform Simplicity:** FlashArray employs a set-and-forget system designed to simplify management for VDI administrators. Beginning with FlashArray's easy plug-and-play installation, its automation, self-diagnostic and self-management capabilities all combine to make FlashArray the most user-friendly flash storage solution on the market — more petabytes can be managed per storage administrator. And FlashArray's always-on, up to 10:1 data reduction is the best in the industry, offering an unequalled combination of

Operation-monitoring and problem-solving can be performed remotely from any device using a mobile app.

- **Predictive Determination:** FlashArray's predictive analytics and proactive, personalized support effectively eliminate problem blindsides and downtime. FlashArray delivers status telemetry every 30 seconds to Pure Storage support specialists. Any problems are caught quickly and resolved before developing into major issues that impact performance or system availability.



Pure Storage Solution Detail

Pure Storage has been selected to participate in the Citrix Ready Healthcare program because it adds value to healthcare organizations. Pure Storage's flash storage solution, FlashArray, has consistently demonstrated the ability to work in symbiosis with Citrix in providing seamless, secure access to the applications and data that healthcare organizations require in providing optimal care for their patients.

Pure Storage Makes IT More Agile

A growing number of healthcare organizations and clinicians use BYOD programs, which offer unprecedented levels of convenience and utility, while also posing a significant security risk. FlashArray helps assure that data is locked-down, secured and encrypted in the data center, supporting the productivity and user convenience that BYOD and mobile environments make possible.

Administrators also benefit from the Citrix/ Pure partnership. IT shops are typically small and minimally staffed in healthcare organizations. With FlashArray, healthcare providers are no longer required to maintain a dedicated storage expert on staff. IT is made more agile by simplifying accessibility and availability to administrators.

Pure Storage Improves Clinician Access, Workflow and Experience

Clinicians' workflows are enhanced with the ability to freely move from patient to patient, and room to room, while maintaining continuous sessions as needed, and quickly tapping into and out of endpoints as desired.

FlashArray offers extensive integration across Citrix XenDesktop and XenApp, providing improved systems access, workflow and user experience for clinicians while also improving IT efficiency in healthcare organizations.

Pure Storage Enhances Data Security and Compliance

Mounting government mandates and soaring costs have combined to pressure organizational leadership into seeking out tools that can aid in compliance, and that can help to improve efficiencies of operation. The teaming of Citrix with Pure Storage provides a partnership that addresses all of these concerns for healthcare organizations.

Select the solution that is built for:

- Virtual Desktop Infrastructure
- Virtual Server Infrastructure
- Private or Hybrid Cloud
- Remote or Branch Office to Large Enterprise
- Relational Databases
- Next generation apps

The following are among the most important benefits that FlashArray provides for healthcare organizations:

- **Encryption for HIPAA Compliance:** FlashArray provides built-in automatic HIPAA-compliant encryption without performance degradation. FlashArray also handles key encryption automatically.
- **Evergreen Storage:** FlashArray puts an end to forklift upgrades and migrations by offering a SaaS-like subscription to all applicable software, support and hardware. Organizations can deploy FlashArray once, and then upgrade as needed with no downtime.
- **Customer Experience:** Pure Storage's Satmetrix-validated 2016 NPS score of 83 places it in the top 1 percent of businesses in customer satisfaction, and makes Pure Storage the #1 recommended technology vendor — by a wide margin.



A Proven Partnership that Enhances Security, Eases Administrative Burdens and Improves Productivity

Citrix solutions provide healthcare professionals with seamless access to mission-critical apps and patient data, from anywhere, and with any device. Deployed by more than 330,000 organizations worldwide with more than 100 million users, more than 90 percent of the world's largest healthcare organizations currently rely upon Citrix solutions.

Pure Storage's FlashArray perfectly complements Citrix solutions in serving healthcare organizations, particularly in the support of VDI environments. A Forrester Research study recently studied the benefits of teaming healthcare VDI environments with FlashArray flash storage. A healthcare provider that had switched to FlashArray in support of their VDI were evaluated,

SCALE CONFIDENTLY AND SEAMLESSLY

From pilot to production, scale your VDI without disruption. Pure Storage FlashArray//m has been validated as a Citrix Ready product and has passed Citrix Ready VDI Capacity Program for Storage Partners verification tests.

ALL-FLASH VDI STORAGE
Starting at less than \$50k

EXAMPLE CONFIGURATIONS

	//m10	//m20	//m50	//m70
CITRIX XENDESKTOP VMs	100 – 1,200	800 – 2,500	2,500 – 5,000 +	5,000 +
RAW CAPACITY	Up to 10 TB	Up to 40 TB	Up to 88 TB	Up to 136 TB
USABLE VDI CAPACITY*	Up to 50 TB in 3U	Up to 200 TB in 3U	Up to 440 TB in 7U	Up to 680 TB in 11U

* Assuming 10x data reduction (virus scanning and constant patching)

with the goal of determining the benefits of FlashArray for composite mid-market regional healthcare providers.

The results were quite impressive, indicating that "...a similar organization could experience an average increase in





profitability...of more than \$1 million over a three-year period — through improved clinician productivity and cost savings in the management and deployment of storage.” And the ROI is estimated to be in excess of \$234,000 over a three-year period. The bottom-line conclusion of the study: “Organizations adopting the right flash-storage solutions are gaining a competitive advantage from a clinical, security, financial and operational perspective.”

In the *2016 Gartner Magic Quadrant*, Pure Storage was recognized as a leader for the

third year in a row. It also ranked at the top in product scoring for virtual desktop infrastructure, server virtualization and online transaction processing, according to *Critical Capabilities Reports for Solid-State Storage*.

Pure Storage's FlashArray storage solution has proven to integrate seamlessly and easily with Citrix environments. FlashArray's selection to the Citrix Ready Healthcare Solutions Program provides healthcare organizations with a proven, reliable solution for enhancing productivity, profitability and security, all while lowering costs and virtually

eliminating systems downtime.

For more information about Pure Storage, please visit: <https://www.purestorage.com/>

To learn more about Pure Storage's all-flash storage solution, please visit: <https://www.purestorage.com/products/flash-array-m.html>

For more information about Citrix application and desktop virtualization, please visit: <https://www.citrix.com/virtualization/>

Appendix

Learn more about the Citrix Ready Marketplace for Healthcare at: <https://citrixready.citrix.com/info/healthcare.html>

To learn more about the Citrix Ready Program partnership with Pure Storage, please visit: <https://citrixready.citrix.com/pure-storage.html>

To learn more about security and performance solutions for healthcare enterprises, contact [Citrix](#) and [Pure Storage](#).

Citrix Validation Program Results

The test was initiated with a realistic load generator of Login VSI simulated Knowledge Workers performing common computing tasks. The highest category of Login VSI Baseline Score was achieved in every single test that was performed. VSI Max was not reached in any of the simulations.

Throughout the testing process, FlashArray delivered up to 100,000 32K IOPS and maintained latency of less than one millisecond — a vivid demonstration of FlashArray's consistent sub-millisecond latency and ability to deliver the best all-flash

VDI end-user experiences. In total, more than 2,500 desktops (32 gigabyte disk size each) were deployed. Only about a terabyte of physical storage was consumed on the FlashArray, a testament to the system's high-performance inline data reduction capabilities (deduplication and compression).

The power footprint for the tested FlashArray//m20 was a mere eight amps (110V), a fraction of what would be required by any mechanical disk storage array. This test configuration consumed three rack units (3 RU) of data center space.

Table 1: Results Summary

Time taken to launch 1,500 VMs	61 per minute/24 minutes total
Login IOPS in Storage Solution	VSI Base: 755 VSI Max average: 1099
Total IOPS in Storage Solution	Peak: 27,600
Storage Cost/Infrastructure cost per user	\$49 per user (for 1,500 users)



About Citrix Ready

Citrix Ready identifies recommended solutions that are trusted to enhance the Citrix Delivery Center infrastructure. All products featured in Citrix Ready have completed verification testing, thereby providing confidence in joint solution compatibility. Leveraging its industry-leading alliances and partner ecosystem, Citrix Ready showcases select trusted solutions designed to meet a variety of business needs. Through the online catalog and Citrix Ready branding program, you can easily find and build a trusted infrastructure. Citrix Ready not only demonstrates current mutual product compatibility, but through continued industry relationships also ensures future interoperability. Learn more at citrixready.citrix.com.

About Pure Storage

Pure Storage (NYSE:PSTG) helps companies push the boundaries of what's possible. The company's all-flash based technology, combined with its customer-friendly business model, drives business and IT transformation with Smart Storage that is effortless, efficient and evergreen. Pure Storage offers two flagship products: FlashArray//M, optimized for structured workloads, and FlashBlade, ideal for unstructured data. With Pure's industry leading Satmetrix-certified NPS score of 83.5, Pure customers are some of the happiest in the world, and includes organizations of all sizes, across an ever-expanding range of industries. For more information, visit www.purestorage.com

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