

The Virtualization Practice

White Paper:

Performance Monitoring for Your Citrix® Infrastructure: Considerations and Checklist

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January 2016



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Abstract

Citrix environments incorporate numerous components, including storage, hypervisor, network, delivery controller, provisioning mechanism, XenApp and/or XenDesktop VDAs, Citrix database, and StoreFront. Also, diverse back-end application components, such as file servers and databases, and user-specific items, such as Receiver version and network packet loss, are complex variables that affect the user experience.

At any given time, one or more of these components may fail or experience an issue. Service organizations spend a significant amount of time and effort delving into each of the various components in order to properly address and resolve problems.

Citrix provides a troubleshooting and monitoring tool, Director, with XenApp/XenDesktop 7.x, as well as the Citrix management packs for Microsoft® Systems Center Operations Manager; however, these tools may or may not fully address the requirements of your organization. The purpose of this document is to provide a checklist of monitoring-related criteria that should be considered as part of due diligence by enterprises and service providers to effectively manage performance of their complex Citrix infrastructures.

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I. Introduction

Citrix XenApp and XenDesktop are performance-sensitive applications. Even a slight glitch can result in user disconnects, keystroke lags, or slow screen refresh—all of which can be extremely frustrating for users. Because these technologies are often used to replace or augment traditional applications on local desktops, users expect performance to be comparable, if not better than, that of their existing systems.

Unlike physical desktops, where the performance issues of a single computer affect one user, performance issues with Citrix technologies affect a multitude of users. For example, if the primary server providing user profile services to a Citrix farm or site is slow, all the users of the XenApp or XenDesktop resources will experience slowness. Hence, performance monitoring is one of the critical operations functions in a Citrix infrastructure.

IT departments running Citrix XenApp/XenDesktop walk a tight line to balance user experience requirements, administrator/engineer time constraints, and data center resources in order to effectively provide virtualized applications and/or desktops to users. Is it time to reevaluate whether your existing Citrix monitoring solution really addresses your enterprise requirements?

Monitoring tools are typically implemented to address reactive issues; e.g., a user cannot access a virtual desktop and calls the help desk for assistance. However, the real value of an effective solution is focused monitoring of the entire environment, as well as proactive management of the complete Citrix infrastructure.

What level of monitoring do you need to optimally manage your Citrix infrastructure?

Citrix administrators are constantly tasked with fast resolution of issues—often without insight into the multitude of components that are managed by other administrators, including storage, virtualization, networks/firewalls, etc. Thus, problems such as slowness that reside within components controlled by other administrators cannot easily be troubleshot and resolved.

Reactive Monitoring

Whether a single user or the entire environment is experiencing an issue, individuals ranging from Level 1 staff to escalation engineers to senior administrators may get involved with resolution.

The monitoring tool that is used within the enterprise directly determines whether an issue is quickly resolved as part of the initial call or escalated to senior staff. Ultimately, this translates to time and money. For example, a printing issue that is being experienced by a lawyer may be easily identified by means of a more sophisticated tool and may take 10 minutes to resolve by a Level 1 support person, whereas those enterprises that only use a basic tool may require detailed troubleshooting and escalation, and resolution of that same issue may exceed 10 hours. During this time, the productivity of that lawyer is hampered due to the inability to print contracts.

Some questions to ask yourself:

- How many issues that are escalated to a secondary or tertiary support level could be addressed by the first service contact person if that person had access to a more adequate monitoring system?
- When a Priority 1 issue surfaces and multiple individuals are involved, how much time is spent gaining an understanding of the current status before finding a resolution?
- Is there an adequate monitoring and diagnostic system in place that provides detailed data and forensics to pinpoint issues that occurred at a specific time?

Proactive Monitoring

Of course, the goal of every IT organization is 99.999% uptime. Having the data points to address small issues within the Citrix environment before they become large ones is key.

All basic monitoring tools provide some level of detail that could be considered proactive, but is it sufficient for alleviating problems? For example, following a maintenance window system update and reboot, system availability metrics can show status. Synthetic sessions can identify potential issues that users would otherwise experience the next morning, and more importantly, they can enable Citrix IT staff to proactively identify the true source of an issue. Sometimes, what may initially appear to be a post-system update issue is actually unrelated and attributable to storage, hypervisor, network, or another component in the infrastructure. Without specific and exact data that points to the true culprit, many hours could be wasted troubleshooting the wrong component.

More importantly, being able to holistically monitor the entire infrastructure enables architects and managers to effectively plan for future and “what if?” scenarios as they impact both the Citrix and Citrix-related environments, such as the results of a disaster recovery or failover test.

Some considerations:

- How many issues that result in Priority 1 cases could have been resolved if root-cause monitoring had identified them early?
- By identifying and addressing major issues before users are impacted, how much IT administration time and money can be saved?
- If the user experience is consistently high, how would that impact net performance scores or other user ratings?

II. Citrix Environment Monitoring

According to the Uptime Institute *Data Center Industry Survey 2015*, “Operations resources spend twice as much time firefighting as they should. Percentage of time putting out fires: 35% currently; 17% optimally.”

Traditional monitoring tools typically are not sufficient to support a Citrix XenApp/XenDesktop environment. Those tools rely on server resource utilization—

often just CPU and memory—as well as on whether servers can be pinged. Just because a virtual XenApp server or XenDesktop workstation can be pinged does not necessarily mean that it has fully rebooted or registered, and attempts to access that device can be met with failure.

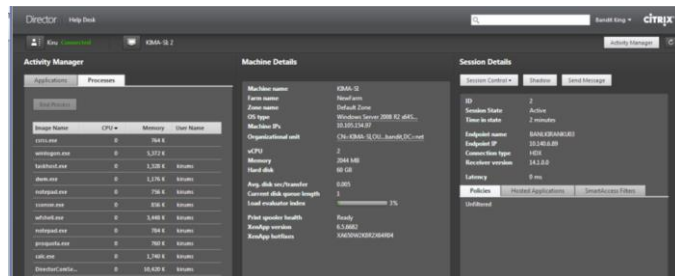
Citrix environments have unique components and requirements that necessitate more robust monitoring tools in order to provide the optimal experience for XenApp/XenDesktop users.

Is your Citrix operations team spending more than 35% of their time firefighting?

Citrix Director

Citrix Director is a monitoring and troubleshooting tool for XenApp/XenDesktop 7.x

implementations. Director is a troubleshooting tool—administrators can search for specific users, see their session and resource usage, shadow their sessions, and terminate any runaway processes or terminate the user session completely.



Citrix Director for basic monitoring and troubleshooting

While the Platinum edition provides access to the full feature set, a subset of functionality is also available for use with the Advanced and Enterprise editions. In particular, the Platinum edition is required in order to view:

- Application usage reporting and trending
- Historical performance
- Network analysis

Does Director address your monitoring and troubleshooting requirements? Or is a more robust tool needed?

While Director provides basic monitoring capabilities, many organizations are realizing that there is a need for a more robust end-to-end performance and monitoring tool that addresses the environment beyond just Citrix core components. For example, IT organizations that run a non-Citrix hypervisor such as VMware® with Citrix XenApp/XenDesktop cannot be managed holistically by means of Director.

Some questions to consider:

- Especially for those administrators who had previously become accustomed to Resource Manager or EdgeSight for managing a XenApp environment, does Director provide sufficient insight into the user session experience?
- Can components, such as NetScaler, Provisioning Services, and even non-Citrix hypervisors, be effectively monitored by means of built-in monitoring tools such as Director and HDX Insight?
- Does Director address your monitoring and troubleshooting requirements? Or is a more robust tool needed?

Citrix Management Packs for Microsoft Systems Center Operations Manager

The Citrix management packs for Microsoft Systems Center Operations Manager (SCOM), which are licensed from Comtrade®, are provided only for XenApp/XenDesktop Platinum edition subscribers; customers that have purchased VDI, Advanced, or Enterprise licensing have no entitlement to these management packs.

In order to realize real benefit from these management packs, an organization must properly implement and maintain SCOM, and both the Microsoft and Citrix data must be monitored daily as part of production. Because SCOM encompasses so many aspects of the IT infrastructure, skillful administration and monitoring is often handled by a few individuals that may or may not fully understand the Citrix environment.

Do the Citrix management packs address your monitoring and troubleshooting requirements? Or is a more robust tool needed?

Some questions to consider:

- Is SCOM already successfully implemented, maintained, and actively used within your organization?
- Do the SCOM administrators have a good understanding of the various Citrix components, and can they effectively monitor and configure alerts on production-impacting issues relating to XenApp/XenDesktop?
- Do the Citrix management packs provide sufficient insight into all aspects of the user experience?
- Do you have the need to extend SCOM to monitor just the Citrix tiers that are part of XenApp/XenDesktop Platinum licensing, or do you also need to purchase other management packs that support virtualization, storage, network, and other system components in order to provide a holistic view of the environment?
- Do the Citrix administrators have access to the SCOM data for researching and troubleshooting issues?

III. Determining Business and Technical Requirements

Business Requirements

A typical IT organization features many distinct technologies from a myriad of vendors, making it difficult for staff members to each specialize in a specific technology, such as Citrix. If the staff is currently spending 35% of its time firefighting, and this amount could be reduced to 17% with the adoption of an effective monitoring tool, significant effort could instead be directed toward proactive endeavors. If these numbers are reflective of your organization, the productivity gains associated with adding a monitoring tool are quickly justified from a business perspective and are defensible from a cost standpoint.

However, business requirements go deeper than hard costs. The following should also be factored into the business decision:

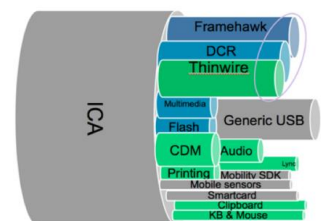
- How many customers have been lost due to downtime or major issues associated with the Citrix infrastructure?
- How much management time is currently spent on regaining customer confidence, as well as post-issue incident reports and documentation?
- What licensing models are available for the performance monitoring tools under consideration, and how does that fit into present and future growth?

Technical Requirements and Key Considerations

As part of the initial assessment to determine technical need, the inherent capabilities of Director should be analyzed in order to determine whether it will be sufficient for addressing enterprise requirements. In addition to facilitating this determination, analyzing the competencies of Director will enable the organization to understand Citrix monitoring and troubleshooting criteria in general, determine criteria importance, and prepare for vendor discussions.

If it is determined that a more robust tool is indeed required in order to provide the needed performance monitoring requirements, the following should be considered:

- **Virtual Server/Desktop Monitoring.** Resource monitoring—i.e., CPU, memory, and disk—is not sufficient for ensuring good Citrix performance. Citrix monitoring and reporting needs are very specific to the Citrix infrastructure. The monitoring solution must be aware of the unique way that Citrix servers, desktops, and applications function and should provide insights and diagnostics that help administrators identify and troubleshoot problems. An effective monitoring solution must address questions such as:
 - Is a process hugging CPU 0 while other processors are dormant?
 - Are Citrix services running properly?
 - Is a runaway process present?



ICA/HDX virtual channel visibility

- **User Experience Monitoring.** Since user experience is a key to the success of Citrix deployments, a Citrix performance management tool must be able to monitor the user experience and alert you to situations in which users are seeing performance issues. This can be achieved in two ways:

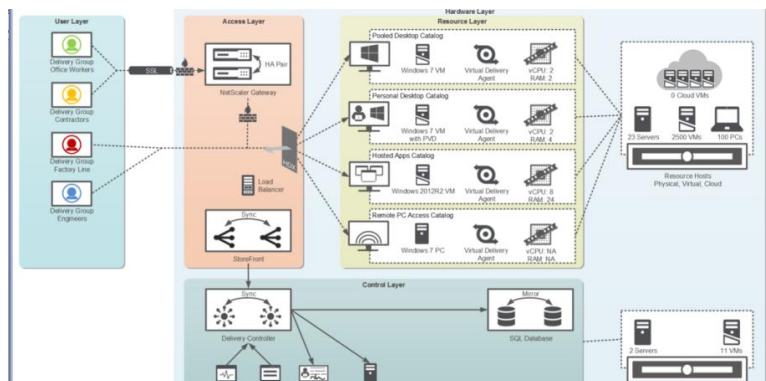
Monitoring Criteria	Synthetic Monitoring	Real-User Monitoring
Description	Emulate user sessions by means of a script (e.g., user login, app launch, perform tasks, logoff)	Monitor actual user access to virtualized apps and desktops
Measure	Periodic launch of consistent script	Actual user session launch
Workload characteristics	Can be performed during business hours, overnight, or after system changes	Incorporates variety of applications, user devices, and networks
Value	Understand how system health affects user experience	Alert for negative user experience items and address help desk issues quickly
Benefit	Can be used proactively to test and monitor user experience, including in different locations on the network	Granularly gauge user experience and system performance

Based on real-world experience, it is recommended that enterprises consider the adoption of a combination of both approaches: synthetic and real-user monitoring.

- **Visibility into Citrix XenApp and XenDesktop Usage and Performance.** The Citrix XenApp servers that support HDX sessions and the virtual desktops that users access through Citrix XenDesktop are the most critical components of the infrastructure. Visibility into all aspects of performance and usage of these components is crucial for proactive detection, accurate diagnosis, and immediate resolution of problems. Some of the key questions that must be answered specific to XenApp and XenDesktop visibility include:
 - Which users are logged in and what was login time? For how long has each session been open?
 - How long did it take for the user to log in to XenApp or XenDesktop? And how many milliseconds were recorded for Active Directory authentication, drive mapping, applying group policies, profile loading, etc.?
 - Which applications is the user accessing?
 - What is the resource utilization of each user session?
 - Which applications are responsible for the highest resource usage?

- What is the bandwidth usage by each user, and which of the virtual channels are consuming significant bandwidth (e.g., printer, video, or audio traffic)?
 - Are there any printing issues corresponding to these sessions?
 - Are users experiencing excessive disconnects?
 - Who are the most resource-intensive users?
 - Do any of the users have very large profiles, and if so, why?
 - Within user sessions, which URLs have been accessed that cause high resource utilization?
 - Does the Citrix resource experience unusual or unexpected usage patterns due to users accessing web content that is inappropriate?
- **Citrix Delivery Controller.** The Delivery Controller is responsible for authenticating user access, validating license availability, and assigning the user's session to the appropriate server or desktop. As such, monitoring the responsiveness of the Delivery Controller is critical for site functionality. Some items to consider:
 - Are Delivery Controllers adequately sized?
 - Are there failed sessions or desktops?
 - Are there unregistered servers or desktops?
 - **Single Unified Console for Monitoring and Management.** Citrix provides different consoles for the administration of XenApp/XenDesktop, NetScaler, StoreFront, licensing, Provisioning Services, and more. Manually sifting through multiple consoles and correlating metrics across consoles takes time. A better option is to have a performance monitoring tool that consolidates the data from the various consoles and presents a holistic view. Some questions to consider:
 - If there are slow boot times or many retries for a desktop or server deployed via Provisioning Services, or if a NetScaler device were overloaded, would an administrator have a way of knowing this without logging into the respective console?
 - How many logins to multiple consoles are required when researching an issue?
 - **Root-Cause Analysis.** Citrix is the front end for key business applications including

Microsoft Exchange, Salesforce®, healthcare applications like Epic® and Cerner®, ERP applications like SAP®, etc. Because a Citrix infrastructure



A Citrix infrastructure is comprised of many tiers

comprises many components, the root cause of an issue may or may not be a specific Citrix product. For example, an underlying storage issue may be causing slowness, rather than a virtualized server or desktop. As such, monitoring tools that incorporate not just Citrix-specific components, but also all related tiers, provide the most benefit. Discover the dependencies in your infrastructure and use these dependencies for correlation and root-cause diagnosis. Tools that do this will save you hours of troubleshooting time. Some items to ponder:

- Are monitoring requirements limited to just the Citrix and virtualization tiers, or can you also include your core application tiers in order to provide a comprehensive solution?
- Can your hypervisor be monitored as part of your complete solution?
- **Performance Monitoring That Stays Current with Citrix Advancements.** Citrix technologies are rapidly evolving. For example, the Citrix architecture changed significantly with the release of XenDesktop 7.0. New capabilities like Framehawk and GPU (graphics processing units) technologies have been added. Please consider:
 - Does the performance monitoring tool closely align with each Citrix release? For example, Framehawk was released in late 2015; how long did it take for each monitoring vendor to incorporate Framehawk into its solution?
- **Forensics and Reporting.** Perhaps even more important than monitoring and troubleshooting are the forensics associated with the captured data. In addition to being able to research what happened between 2:00 PM and 3:00 PM yesterday, a performance tool that provides inherent reports to support additional hardware requests, address management requests, and substantiate compliance greatly facilitates administration. Consider the following:
 - How much time could be saved if a performance monitoring tool could be used to compare baseline data to various usage times in order to assess budget requirements?
 - How important are tools that facilitate performance optimization and capacity planning?

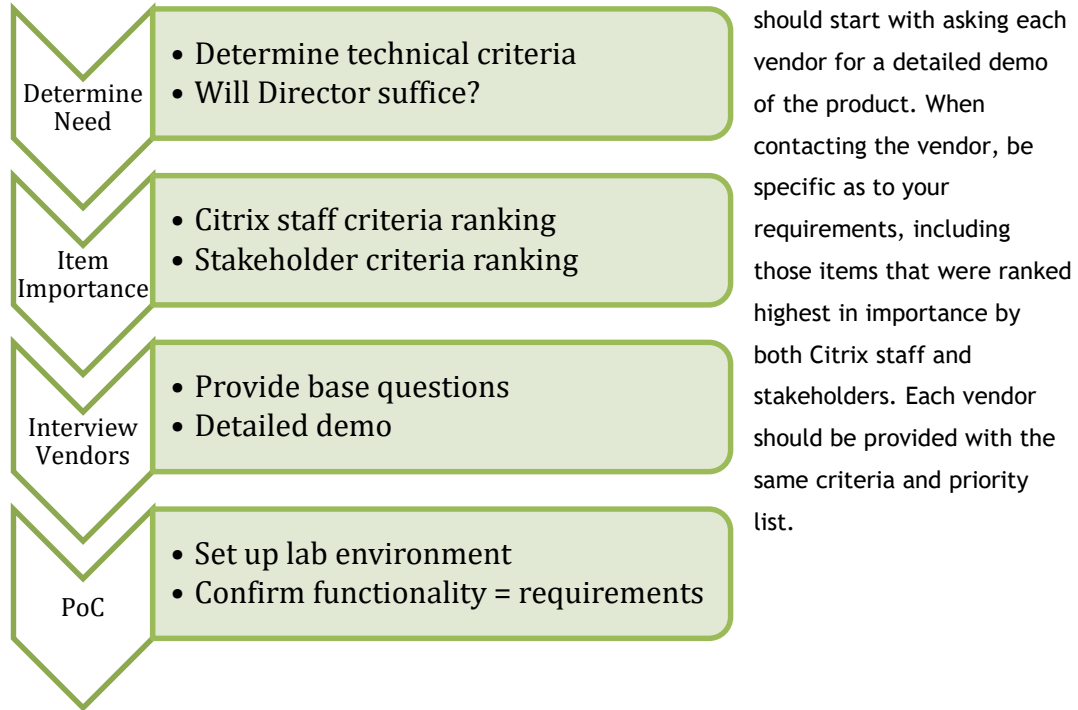
Especially for those individuals who have not previously embarked on an analysis of technical requirements as related to a Citrix monitoring solution, the specific items listed in the subsequent checklist section may be useful.

IV. Next Steps

Determining the business need and technical criteria, as well as having those criteria ranked by both the Citrix staff and the enterprise stakeholders, are the initial steps for evaluating monitoring solutions.

If it is determined that a third-party tool will best address the technical requirements associated with monitoring, vendor evaluation should commence.

After reviewing the checklist shown in the subsequent section, evaluation of the top vendors



V. Checklist

The following checklist can be used to determine the internal importance and vendor capabilities that best match your requirements for a robust Citrix monitoring solution. The importance to the Citrix administration staff, as well as to the stakeholders and other IT staff, should first be assessed and then compared with the offerings of several vendors.

For a complete list of Citrix Ready partners in the Monitoring & Management Solutions space, please see https://citrixready.citrix.com/category-results.html?category=c1-virtual-appliances/c2-monitoring-and-management-solutions&lang=en_us.

Monitoring of All Data Center Components

<u>Item</u>	<u>Importance to Citrix IT Staff</u>	<u>Importance to Stakeholders</u>	<u>Vendor #1</u>	<u>Vendor #2</u>	<u>Vendor #3</u>
<i>Storage</i>					
<i>Hypervisor</i>					
<i>Network</i>					
<i>XenDesktop Delivery Controller</i>					
<i>Provisioning Services and/or Machine Creation Services</i>					
<i>XenApp and/or XenDesktop VDAs</i>					
<i>NetScaler</i>					
<i>StoreFront</i>					
<i>File servers</i>					
<i>Middleware/server-based apps</i>					
<i>Database servers</i>					
<i>License servers</i>					
<i>Web servers</i>					
<i>Print servers</i>					
<i>Exchange servers</i>					
<i>Active Directory</i>					

Monitoring of User Experience

<u>Item</u>	<u>Importance to Citrix IT Staff</u>	<u>Importance to Stakeholders</u>	<u>Vendor #1</u>	<u>Vendor #2</u>	<u>Vendor #3</u>
<i>Synthetic user sessions</i>					
<i>Actual app response time</i>					
<i>Identify Receiver version</i>					
<i>User device type/OS</i>					
<i>Monitor bandwidth usage of each session</i>					
<i>Granular logon time details</i>					
<i>Application launch times</i>					
<i>Determine high-usage virtual channel(s)</i>					
<i>Track user apps and resources</i>					
<i>System CPU/memory utilization by user</i>					
<i>Network latency and performance between data center and user terminal</i>					
<i>Monitor GPU usage on XD</i>					
<i>User profile load time</i>					
<i>Detect printing issues</i>					

Monitoring of Citrix Key Performance Indicators

<u>Item</u>	<u>Importance</u> <u>to Citrix IT</u> <u>Staff</u>	<u>Importance</u> <u>to Stake-</u> <u>holders</u>	<u>Vendor #1</u>	<u>Vendor #2</u>	<u>Vendor #3</u>
<i>Health of Citrix-specific services</i>					
<i>Resource utilization of each app</i>					
<i>Health of 3 Citrix databases</i>					
<i>Server capacity/ peak usage time</i>					
<i>Network status</i>					
<i>Identify peak CPU/memory causes</i>					
<i>Track Citrix and MS RDS license usage</i>					
<i>Identify large user profiles</i>					
<i>Identify recurring disconnected sessions</i>					
<i>Identify least used/unused apps</i>					
<i>Identify unregistered VDAs</i>					
<i>Identify maintenance mode</i>					
<i>Track active user sessions in NetScaler</i>					
<i>Monitor endpoints</i>					

Administration and Reporting

<u>Item</u>	<u>Importance to Citrix IT Staff</u>	<u>Importance to Stakeholders</u>	<u>Vendor #1</u>	<u>Vendor #2</u>	<u>Vendor #3</u>
<i>Delegated administration</i>					
<i>Ability to drill down within console</i>					
<i>Baseline and trend monitoring</i>					
<i>Intuitiveness of management console</i>					
<i>Ability to generate chargebacks/billing</i>					
<i>SLA metrics/service availability</i>					
<i>Hardware/software inventory</i>					
<i>Length of time data is stored</i>					
<i>Display topology map with alerts</i>					
<i>Forensic data/research user activities</i>					
<i>Trend analysis reports</i>					
<i>Performance prediction reports</i>					
<i>Capacity planning reports</i>					
<i>Publish dashboards for executive access</i>					
<i>Integration with service desk systems</i>					

Monitoring System Functionality

<u>Item</u>	<u>Importance to Citrix IT Staff</u>	<u>Importance to Stake-holders</u>	<u>Vendor #1</u>	<u>Vendor #2</u>	<u>Vendor #3</u>
<i>Agent requirements</i>					
<i>Agentless monitoring</i>					
<i>Multi-data center support</i>					
<i>Multiple time zone support</i>					
<i>Maximum number of devices</i>					
<i>Monitoring system overhead</i>					
<i>High availability setup</i>					
<i>SCOM connector</i>					
<i>SNMP integration</i>					
<i>Root-cause diagnosis</i>					

Vendor Support and Product Development

<u>Item</u>	<u>Importance to Citrix IT Staff</u>	<u>Importance to Stake-holders</u>	<u>Vendor #1</u>	<u>Vendor #2</u>	<u>Vendor #3</u>
<i>Vendor service desk (9-5 or 24x7)</i>					
<i>Vendor delay for new Citrix versions</i>					
<i>Patents or other industry-leading technologies</i>					
<i>Citrix Ready affiliation</i>					

VI. About The Virtualization Practice

The Virtualization Practice, LLC, is a boutique analyst firm concentrating on virtualization and cloud technologies, companies, and organizations. If your product, organization, or company works in, fixes problems within, or enables virtual and cloud environments, we are interested in hearing from you. Our goal is to educate the market about what is out there for virtual and cloud environments.

Jo Harder



Jo Harder has been involved with virtualization for over 16 years. After holding several sales and marketing positions, she started down the path of bits and bytes while at AT&T/Lucent Technologies. She then moved onto Citrix in 1999, where she became a Senior Architect. Her 11-year tenure included a combination of Citrix Consulting and Technical Readiness roles. After leaving Citrix, Jo provided consulting services for various clients for the next year. In her current role at a hosting provider, she is focused on cloud-based solutions for financial industry clients. In February 2015, she was awarded Citrix Technology Professional. Jo's diverse background of sales, marketing, management, and architectural/technical expertise brings a unique perspective to The Virtualization Practice.

VII. References

For a list of the capabilities of Citrix Director included within specific editions of XenApp/XenDesktop, please see <https://www.citrix.com/go/products/xendesktop/feature-matrix.html>.

Uptime Institute, *Data Center Survey 2015* by Matt Stansberry:
https://uptimeinstitute.com/uptime_assets/08200c5b92224d561ba5ff84523e5fdefe6c6b58cbf64c19da7338e185a9c828-survey15.pdf.

ICA/HDX graphic on Page 7 was provided courtesy of Citrix Systems.