



# **The Four Key Phases in Desktop Transformation**

***Assess, Design, Migrate, Validate***

*A Methodology to Move to Next-Generation Desktops*

*Whitepaper*

## INTRODUCTION

*This whitepaper has been authored by experts at Liquidware Labs in order to provide guidance to adopters of desktop virtualization technologies. In this paper, we identify the four major phases of a desktop virtualization implementation—Assessment, Design, Migration and Validation -- and the considerations that are involved in each phase. We also outline the role our solutions play in allowing you to complete these phases successfully.*

*Information in this document is subject to change without notice. No part of this publication may be reproduced in whole or in part, stored in a retrieval system, or transmitted in any form or any means electronic or mechanical, including photocopying and recording for any external use by any person or entity without the express prior written consent of Liquidware Labs.*

**Liquidware Labs, Inc.**  
3600 Mansell Road  
Suite 200  
Alpharetta, Georgia 30022  
U.S.A.  
Phone: 678-397-0450  
[www.liquidwarelabs.com](http://www.liquidwarelabs.com)

## CONTENTS

Introduction.....	2
The Virtual Desktop Project Lifecycle: Assess, Design, Migrate, Validate .....	4
Key Considerations For Organizations When Virtualizing Desktops.....	4
Phase One: Assessment .....	7
Start With A Comprehensive Inventory Of The Current Physical Environment .....	7
Data Classification To Identify Good Candidates For Desktop Virtualization .....	9
Adjust Classifications Based On Observed Data .....	9
Phase Two: Design (Poc, Pilot).....	10
Identify “FIT” Desktop User Groups To Create Use-Case Scenarios.....	10
Determine Vendor’s Offerings To Be Incorporated Into The POC .....	11
Determine How User Profiles -- Settings And User Data-- Will Be Handled .....	12
Planning System Capacity To Meet Desktop Performance SLAs .....	13
Determine User Feedback Collection Methods .....	14
Phase Three: Migration .....	14
Roaming Profiles And Folder Redirection .....	14
Limitations of Roaming Profiles And Folder Redirection For Virtual Desktops .....	15
Automating Profile Management with User Virtualization Tools .....	15
Phase Four: Visibility And Validation .....	16
Shared Virtual Desktop Environments Need Performance Validation Solutions .....	16
About Liquidware Labs .....	19

## THE VIRTUAL DESKTOP PROJECT LIFECYCLE: ASSESS, DESIGN, MIGRATE, VALIDATE

Liquidware Labs offers award-winning solutions that support the four major phases in a desktop virtualization implementation – Assessment, Design, Migration and Validation. Our Essentials bundle, which offers Stratusphere FIT, ProfileUnity and Stratusphere UX licenses at affordable and attractive bundle pricing, provides the end-to-end functionality that you will need to move through these phases successfully. In 2011, Liquidware Labs introduced two new products, Stratusphere Designer and FlexApp to further power you through a project. With the Essentials bundle, you can assess your current environment, design the target environment and target desktop image, easily migrate your users to virtual desktop systems and validate that the new systems perform as needed to ensure it is on par with desktop users' requirements and cost.

## KEY CONSIDERATIONS FOR ORGANIZATIONS WHEN VIRTUALIZING DESKTOPS

Many factors, including the need to migrate off of Windows XP, can make this a good time to virtualize your desktops to gain the benefits of easy provisioning, improved manageability, improved security and DR, as well as flexibility of IT resources. However, the move from physical to virtual desktops requires a great deal of planning and fore knowledge in order to ensure successful achievement of your objectives.

Here is an overview of high level considerations:

- Every VDI implementation should start with an assessment of your organization's current physical desktops; and assessments should be repeated for every subsequent user group.
- Assessment metrics should be the foundation for the design of the infrastructure & VM image per group of users.
- Organization should consider leveraging a shared "stateless" VM image design for best performance and lowest cost.
- Consider implementing a user virtualization solution, which allows you to decouple user personalization, settings and data from the image, to replace roaming profiles and folder redirection.
- Leverage user virtualization to allow you to deliver persistent user personalization even with non-persistent VMware® VMs or Citrix® XenApp sessions.
- Migration of user profiles should be from physical to virtual and back again, as well as across multiple OS, as this provides the maximum flexibility in the project lifecycle
- Validate that POCs are meeting performance requirements by comparing to baseline established during the assessment of the physical environment.
- After moving into production, it is essential to have visibility inside the guest VMs as well as the other layers (data center servers and storage, virtualization layer, LDAP, network) to determine the source of performance issues, to plan capacity and to optimize the desktop image and infrastructure over time as the project scales.

In order to address these considerations in a logical manner, we recommend that you build upon a four-phased organized process for a successful deployment. The four phases are as follows:

**Assess:** In this phase, you will acquire an overview of your entire current desktop environment to ascertain which physical desktops are good candidates for virtualization and the pilot. You can then create use-case scenarios for good candidates, as well as gather resource metrics for capacity planning of the infrastructure required to support the pilot user groups. You will also begin the process of classifying user and desktop data in order to create a baseline of the physical desktops to benchmark your progress in succeeding phases.

**Design:** In this phase, you will leverage your desktop use-case scenarios in order to determine the appropriate desktop architecture and image design needed to deliver the required user applications. You will also evaluate the different vendor product offerings and construct the proof-of-concept (POC) design that will be delivered in the pilot. The pilot will foster learning and provide a means for testing assumptions to see if they hold valid. Finally you will test- user feedback-collection methods and schedule periodic feedback collection.

**Migrate:** In this phase, you will leverage user virtualization for automated “any time” migrations of user settings and data from the existing physical to the virtual desktops. You will also conduct the pilot with actual users to test out the POC, and see how well systems perform. The key aspect in this phase is to ensure that the user experience of the virtual desktop is on par with the physical systems with regard to login times, application availability, network response times, etc. It is critical to have scheduled, objective measurements of the user experience to verify you are on target.

**Validate:** Because you no longer have a direct interaction with a piece of hardware when troubleshooting, it is strongly recommended that you leverage a diagnostics and validation solution for a number of reasons. During POC and pilot, you can measure the virtual desktops and compare with the physical desktop design. If you experience issues, you can diagnose the cause and remediate issues quickly. Once in production and beyond, as you scale the environment and add users and applications, you can determine their effects on system performance or whether you need to balance workloads or add capacity. Because virtual desktops leverage shared systems, you need a solution that provides visibility into entire stack including protocols, end points, storage, network, and resource pool reservations -- by application, user, group, and over custom time periods.

Below is a brief description of Liquidware Labs solutions contained in the Essentials bundle, which are instrumental in progressing through the four-phase approach.

**Liquidware Labs Stratusphere FIT™** is the industry-leading assessment solution, used by today's largest systems integrators and professional services organizations worldwide. This solution monitors and logs a variety of key individual desktop and user performance metrics. Our VDI Fit analyzer feature generates detailed reports to provide insight into your organization's application and user consumption of network, storage, CPU, memory and other compute resources. This comprehensive portrait of your environment becomes the basis for proper design and sizing of infrastructures resources and virtual desktop images needed for each unique group of users.

**Liquidware Labs ProfileUnity™** migrates and delivers a flexible user workspace by making existing user profiles universally compatible with any Windows OS (XP/2000/Vista/Win 7). This solution can replace roaming profiles and folder redirection in virtual desktop projects, and supports “anytime migration” of Windows native user profiles and data to Citrix® XenApp, Citrix® XenDesktop, VMware® View, Terminal Services, and physical Windows® 7 environments.

**Liquidware Labs Stratusphere UX™** provides you with end-to-end visibility to ensure desktops are consistently delivered with the best user experience available. The solution proactively ensures high quality user experience by providing an ongoing and constant rating of enterprise desktop performance— by application, group, or user. The solution tracks hundreds of metrics on all integral components, so administrators have the data they need to spot trouble areas, prevent problems, model changes and maintain high efficiency and performance.

In 2011, Liquidware Labs introduced two new products, Flexapp and Stratusphere Designer:

**Liquidware Labs FlexApp™** technology enables users to install their own applications in virtual and physical desktop environments without affecting the underlying base image of the machine. FlexApp enables a virtually limitless number of applications to be stored separately from the Windows operation system yet 'snapped-in' in only seconds at login. FlexApp fills a void in the virtual desktop market and expands the user candidate pool for VDI by empowering users to install the applications they need to be productive.

**Liquidware Labs Stratusphere Designer™** is an automated image, host, and storage designer for organizations migrating to Windows 7 using VDI. When the assessment is completed, Stratusphere Designer can use the metrics derived from Stratusphere FIT to deliver image, host, and storage designs for the best 'many-to-one' shared-image strategy, which can reduce the storage footprint and ongoing management costs. Stratusphere Designer also delivers an easy-to-understand bill of materials report that includes the image design strategy, the number of virtual host chassis and configurations needed (CPU, memory, network, storage host bus adapters), and the number of physical disks required to achieve the design and to host the virtual environment.

## PHASE ONE: ASSESSMENT

The initial assessment is the single-most important step in a desktop virtualization initiative. This phase is the anchor of the entire rollout, providing the needed data to guide successful decision-making at every subsequent phase. Organizations who have skipped this step often hit roadblocks later, when they scale and add new users, only to find the infrastructure can't support them. Production is the wrong time to discover these kinds of problems. With a proper assessment, you can prevent mistakes from becoming serious issues later.

### START WITH A COMPREHENSIVE INVENTORY OF THE CURRENT PHYSICAL ENVIRONMENT

All organizations are challenged to monitor and manage their desktops – and there is no mystery as to why. Users can be located anywhere and their computing devices are where they are, which is not necessarily where the desktop administrators are. Desktop users are constantly customizing their desktops, so that no two are exactly the same. Even within the same group, they can be operating with different versions of OS and applications. They can work offline or online, and they may have multiple machines – representing diverse device types – from which they work. However, it is critical to capture an accurate and detailed picture of your physical environment in order to migrate your desktops to a virtual platform.

Stratusphere FIT obtains the essential data directly from desktops in a structured process, thus preventing errors in gathering the data or in analyzing it. Utilizing a unique, patented, proprietary approach, Stratusphere FIT deploys connector keys to target desktops and can collect data from hundreds or even thousands of physical machines, no matter where they are. You can collect information from your entire population of users or just a group. Stratusphere FIT also monitors and logs critical desktop and key user performance metrics at all levels of your current infrastructure – from the user desktop, the datacenter, storage and network – and packages this information in a series of reports that support analysis, decision-making, and ultimately design, of the virtualized environment.

The initial assessment data must include:

- Inventory of machines including configuration details (CPU, memory, disk, network, monitors, printers, peripherals, age, location / host, time in use)
- Inventory of applications for virtualized and non-virtualized applications, including versions and patch levels, including time in use
- Inventory of users and groups (user groups are defined in Active Directory or any LDAP directory)
- CPU consumption including by system and by user, machine, application
- Memory consumption (including swapping and page faults), by user, machine, application
- Network consumption and performance by user, machine, application
- Disk consumption and performance by user, machine, application
- User logon durations (the time it takes a user logon to complete)
- Application load times (the time it takes an application to load and initialize)
- Graphics intensity to identify the level of graphics and screen refresh demands by user, machine, and application
- Non-responding applications
- Unused applications
- Network latency
- Network application response times
- Failed or dropped network connections

As you can see, this is a comprehensive and lengthy list of data to be collected. In addition, the frequency and scope of data collection should be tailored to your needs and purpose. You will need to decide whether you want to collect data from an entire group or just a sampling of users and desktops. You will also need to decide the duration of the collection period; we recommend a 15-day minimum. Finally, you need to determine the frequency of the data collection, for example, once an hour or even once a day for remote sites. These parameters can be set within Stratusphere FIT which then feeds collected data into the Stratusphere Hub virtual appliance. There it is aggregated to provide purpose-built centralized reporting for both initial assessments and ongoing diagnostics.

## DATA CLASSIFICATION TO IDENTIFY GOOD CANDIDATES FOR DESKTOP VIRTUALIZATION

Once you have gathered data, the next step is to sort it within a classification system to identify the desktops, users and applications that are a good candidates for virtualization and which are not. If the classification system is well designed, it will further support data-collection needs in the pilot and production phases, helping to identify the virtual desktops, users and applications that are experiencing degradation or problems. The classification system should be explanatory –in other words, it should not only classify but should also help explain “why” in a way that is clear to you.

Some important guidelines to keep in mind are:

- Use multiple data elements, since no single element is sufficient for good classification
- Classify over a period of time, individual spikes or lulls can be misleading unless they occur frequently
- Associate classification to groups, so that you can not only see how individual users or desktops are classified, but also how groups are classified – for example, by users, by location or by shared resources.

Stratusphere FIT is a fully automated system that utilizes a classification approach in which each data element is sub-classified into “bins.” These sub-classification bins are rolled up into an overall classification system. Bins can be defined manually or automatically, based on population percentages, value clusters, or other techniques. The assignment of data values into bins, and the assignment of the overall classification for each individual (machine, user or application,) can be done by simple boundary value comparisons, or by some degree of fuzzy logic. Binning has three strengths, namely its ease of setup, its speed of calculation, and its resulting explanatory power.

## ADJUST CLASSIFICATIONS BASED ON OBSERVED DATA

Stratusphere FIT also allows you to integrate your personal expertise, industry experience and company knowledge into the classification model. You can make changes, adjustments and overrides based on known issues, internal criteria or observed data. During the pilot phase, when you have obtained information from users based on actual experience, classification system will provide insight, as below:

- **Feedback** shows how the classifications compare to observed data
- **Controls** allow adjustment of the classification system to better fit observed data, along with the ability to test these changes
- **Overrides** enable the classification system to allow for known cases or exceptions, for example specific users or applications that are known to be a bad fit for desktop virtualization.

Stratusphere FIT generates BIRT reports that provide summaries and drill-down information in easy-to-understand layouts so you are equipped with decision-support information at a glance. Information is sorted by resource utilization by user, desktop and application and into what desktops are good candidates for virtualization.

The default parameters built into Stratusphere FIT to gauge desktop virtualization fitness are based on recommendations of major virtualization vendors, industry standards and our own internal expertise gained by performing hundreds of assessments over the last decade. However, because each organization has their own unique considerations, these parameters can be adjusted accordingly to ensure relevance to your specific needs.

At the end of the assessment, you will be in a position to select the optimum user group(s) for the proof-of-concept (POC) and pilot phases.

## PHASE TWO: DESIGN (POC, PILOT)

Having accurate and precise information from the Assessment phase is critical to designing the appropriate infrastructure and virtual desktop image for your users. Top considerations in the Design phase include:

- Selecting a group of test desktop users for the POC/pilot
- Developing use-case scenarios based on test candidates selected during the assessment
- Determining which technologies (and which vendors' offerings) will be incorporated into the overall architecture in order to meet the requirements of the use-case scenarios
- Determining how user settings and user data will be handled
- Planning capacity and sizing of the systems that will be needed to support user SLAs
- Determining how, when and how often to collect feedback from users
- Incorporating tools into the overall design for ongoing assessment and diagnostics of system performance through the pilot and into production

### IDENTIFY "FIT" DESKTOP USER GROUPS TO CREATE USE-CASE SCENARIOS

Once you have had the opportunity to canvas your organization and segregate a population of good candidates for virtualization, you now have an appropriate group who should become the basis for a POC and participate in the pilot phases. The next step is to outline their requirements in detailed use-case scenarios which represent system behavior as well as how the users are intended to interact with the new system.

This paper does not provide in-depth guidance on designing use-cases. In this section, we only cover the high level considerations that should be part of your exercise. Designing use cases is a discipline unto itself and requires the expertise and experience of highly trained professionals. If you do not have the internal expertise or staff cycles to support the creation of use cases, we strongly recommend that you use an outside professional services group to perform this work. For your desktop implementation, you will likely require multiple if not dozens of use cases to define the scope of the new system.

Your use-cases will need to identify at a minimum:

- Users (Actors)
- Goals of users
- Goals of functional group
- Corporate goals
- Stakeholders or others who will be involved or affected by the outcome of the use case
- Preconditions (or conditions that must be met for the use case to start)
- Triggers (events that cause the use case to start)
- Course of events or flow
- Alternative paths or exceptions
- Post conditions
- Business rules (based on internal processes)

The data collected in the Assessment phase with Stratusphere FIT can provide much of the data about user workload and system behavior to assist you in creating meaningful and relevant use cases which would be the basis for the POC and pilot. Subsequently, you can apply the same objective metrics if you choose to evaluate multiple pilots with different users or with different vendors' products.

### DETERMINE VENDOR'S OFFERINGS TO BE INCORPORATED INTO THE POC

The use-case scenarios become the basis for choosing from different vendors' component offerings, and designing and building out the system with the features and capacity to support users. This paper is not designed to provide a detailed overview of specific virtualization vendor's offerings, nor do we make any specific recommendations. Liquidware Labs solutions are platform-agnostic and support VMware View, Citrix XenDesktop, and Microsoft HyperV and Windows 7, and are VMware and Citrix certified, so you can utilize them regardless of which platform you choose. However, there are many ways to deliver virtual desktops, and you will need to understand the following offerings in order to best meet the requirements outlined in your use-case scenarios.

**Session virtualization** or "Application Hosting" is represented by Citrix XenApp (formerly Citrix WinFrame Server, Citrix MetaFrame Server and Citrix Presentation Server). In this approach, multiple users all log into a single image of an OS, applications, and desktop configuration. Citrix XenApp utilizes Citrix's proprietary layer protocol, Independent Computing Architecture (ICA). All of the applications, settings, configurations and data used are kept and run centrally. Session virtualization is successful when all users can be productive using a one-size-fits-all configuration of OS and applications. Session virtualization's main advantage is that it is fairly straightforward to deploy. However, it doesn't easily support the need to run multiple OS images, nor can you provide user personalization with this solution alone.

**VDI (Virtual Desktop Infrastructure)** was coined by VMware to describe an approach in which virtual machines (VMs) support desktops. Instead of sharing one instance of the OS, applications and desktop configuration, each user has access to a VM. You can customize this approach to the type of user you have. On one hand, users can login and get a "fresh, non-persistent" VM from a shared image pool. At the other extreme, a user can access a persistent VM created specifically for them, which they get all the time. VMware View is essentially a connection broker and management solution that delivers vSphere VMs to users as needed. Citrix XenDesktop performs much the same work as VMware View and can deliver desktops as VMs or as application hosting via XenApp. VDI requires much more upfront planning and design to ensure the infrastructure is robust enough to meet the organizations' need. This approach can also become more complex if large numbers of images must be supported.

**Application virtualization** refers to an approach in which applications run separate from the OS and user hardware. The application resides on a centralized server, and users are streamed the parts of the application as they need to in order to perform tasks. Examples of application virtualization solutions include VMware ThinApp and Microsoft App-V. Strictly speaking, application virtualization is not desktop virtualization; however this approach by itself can be more than adequate for many desktop users' needs. Users can implement application virtualization independently without further need to implement VDI or user virtualization.

**User virtualization** describes a group of technologies that capture and manage user information (settings, data, configurations and preferences) that make each user's desktop unique. The idea of virtualizing the user state has been around since Microsoft introduced roaming profiles with Windows 2000 to save user settings to a network share. Folder redirection, where the user data is saved to a folder on the network has also been considered user virtualization traditionally. User virtualization in the context of desktop virtualization, however, means decoupling

the user profile from the OS and hardware, to create a flexible user profile that can be matched to either a physical or virtual desktop upon logon. Like application virtualization, user virtualization is an adjunct technology to desktop virtualization. It can be applied to physical systems to gain many benefits without ever virtualizing the desktop.

However, user virtualization plays an essential role in VDI if you plan to virtualize cost effectively. The key to ROI is being able to migrate as many of your workers to virtual desktops as possible. But in order to scale up, you need to use the most efficient architecture, which in current best practices, has been defined as “stateless, non-persistent linked clones.” This approach leverages a layering model in which a master base image contains the OS and applications that the entire organization will use. Thin application technology provides the next tier of applications, typically those used by a department or group. When this approach is used with a user virtualization solution, you can also layer in “persistent” user profiles.

Combining user virtualization for persistent profiles with non-persistent stateless VMs offers a number of benefits:

- It is cost effective and can reduce the amount of storage required
- Multiple images to support multiple operating systems can be used
- If a problem develops with a virtual desktop, users can exit and logon to get a fresh new desktop
- All users still retain all their personalization and retrieve their profiles upon logon

### DETERMINE HOW USER PROFILES -- SETTINGS AND USER DATA-- WILL BE HANDLED

Depending on the approach you take to virtualizing a specific user group, you may or may not need to consider delivering a persistent user profile as part of users’ desktop experience. If you decide that you need to allow your users to retain the ability to personalize their desktops, you have a number of different methods to handle their user profiles, including roaming profiles, folder redirection or by leveraging a user virtualization solution.

A user profile is the collection of files and settings unique to that individual user, such as the Windows® user profile, desktop settings, documents or other media output, pictures, icons, internet shortcuts, etc. Most people experience this through their own local user data and profile information on their local C:\ drive. In the physical world the user is tied to the machine. User virtualization allows you to decouple user personalization from any specific drive and make it portable. This would mean that, no matter where or how users got into their systems, they could access their profiles which would retain all the personalization they created over time.

Liquidware Labs ProfileUnity is a good option to manage user profiles in your desktop virtualization projects. ProfileUnity separates user profiles, configurations, and data from the Windows OS, enabling organizations to have much more flexibility in how they will deliver desktops to their users, whether it is traditional physical, “hot desking” or virtual desktops. ProfileUnity is covered more thoroughly in the “Phase Three: Migration” section of this document.

## PLANNING SYSTEM CAPACITY TO MEET DESKTOP PERFORMANCE SLAS

The recommendations in this whitepaper lay out the considerations of capacity planning; but do not provide “how-to” instruction. Accurate well-researched capacity planning is critical in your design phase. Too much capacity and you incur excessive expense; too little capacity and you are setting yourself up for performance issues. The metrics captured in the initial assessment will help you to create a baseline of your target system capacity. However, it should be noted that this will not be a one-to-one calculation; meaning there is considerably more to sizing than simply totaling up the overall CPU, disk and RAM capacity represented by your physical PCs. You must consult the major platform vendors’ sizing recommendations as well as reference architectures. If there are no individuals in your organization with a sufficient background in this area, it is strongly recommended that you turn this process over to skilled outside experts.

Over the course of the pilot, as you experience how your virtual desktops actually perform, you may need to address workload balancing and failover—ensuring that virtual machines, or VMs, are distributed in such a way that makes the most efficient use of a server's computing resources.

CPU cycles, memory and I/O capacity will each limit the number and affect the performance of virtual desktops that are hosted on one server. The total CPU, memory and I/O demand of all the VMs on a server should never exceed the total CPU, memory and I/O capacity of the host server. In addition, it is critical that each individual virtual desktop disk (vmdk) is allocated adequate storage or it may become unstable.

For sure, storage needs will increase over time as more or larger VMs are added to the infrastructure, so it's important to monitor and plan for storage growth—not just server growth. Administrators need to look not only at the amount of storage being utilized, but also at the throughput and input/output operations (IOPS) as well as data throughput. Again, we strongly recommend that you work with the virtual platform vendors as well as your storage vendors for their reference architectures on this topic. Today’s storage vendors provide a myriad of technologies such as de-duplication and thin provisioning that can be used to reduce storage requirements, so it is important to include their recommendations early in the planning process.

Finally, it is critical that your network has sufficient bandwidth to support all the requirements of your desktop virtualization implementation, especially if you will rely on streaming or on-demand desktops. Your network design and capacity will strongly depend on which platform vendor you choose, the delivery mode, protocol, number and type of virtual desktop images, applications and online or offline work requirements. As before, this paper does not make recommendations with regard to how to design network architectures to support virtual desktops, and again, we strongly recommend that you work with your existing expert vendors in order to ensure that your network design will be robust enough to support your project.

So far we have spoken about the initial assessment of the physical desktops and users in order to get a starting point to plan capacity for the virtual desktop infrastructure. However, once the project goes into production, it is equally important to continually validate that infrastructure performs as needed as you add users, or add/change VM images.

A solution such as Stratusphere UX that collects data directly from running virtual desktops over time is vitally needed in your ongoing capacity planning activities. Stratusphere UX reports and alerts when user experience and subsystems fall outside of set targets, which can warn you to balance workloads, add storage or otherwise adjust or add capacity.

## DETERMINE USER FEEDBACK COLLECTION METHODS

It is essential that you enfranchise users early in the desktop transformation project. It is very important that you get their feedback on a regular basis about how their virtual desktops perform and the quality of their user experience. If your users are having issues or feel that their productivity is hindered, then you will not have the acceptance you need for successful completion.

You have a number of options as to how you will collect responses from your users. These options run the gamut from software that automates the process of checking systems and desktop performance for bottlenecks and issues, to manual processes, such as surveys, focus groups, onsite observation and one-on-one interviews. A combination of these techniques is best to gain a holistic view of the user experience. However, you want to be sure that you have a reliable means to filter out subjective opinions and apply objective criteria to measure success.

A sophisticated solution such as Stratusphere UX is your best tool to gain objectivity in evaluating virtual desktop performance because you can track every virtual infrastructure layer that can affect user experience. When users complain about slow login times or applications not responding, desktop administrators have one-pane-of-glass in order to first, determine if there really is a problem, and second, to pinpoint the source of the issue, if indeed it does exist. Administrators can see if this is a problem for one or many users, or if the same problems reoccur at the same time of day or intermittently. They can spot trends that can signal misconfigurations, applications behaving badly or overtaxed resources.

Stratusphere UX takes a proactive approach to user experience by providing an ongoing and constant rating of enterprise desktop performance. The solution tracks hundreds of metrics on physical and virtual desktops and infrastructure performance, including many 'in-guest' metrics together with hypervisor, storage, and network metrics.

## PHASE THREE: MIGRATION

Migration from the physical desktop to virtual ones can be painful unless you implement a user virtualization solution that addresses the potential pitfalls of the user migration process.

A user profile is the collection of files and settings unique to that individual user, such as the Windows® user profile, desktop settings, documents or other media output, pictures, icons, internet shortcuts, etc. Most people experience this through their own local user data and profile information on their local C:\ drive. The trick to optimizing user migrations to virtual desktops is to decouple the user profile from the OS and make it truly portable. This would mean that, no matter where or how users got into their systems, they would reliably get the same personalization, quality and consistency of data and settings, just as they do when they log on to their personal laptop or PC today. Windows roaming profiles and folder redirection are thought to meet these needs, but, as we will explain, these methods are inadequate for virtual desktops.

## ROAMING PROFILES AND FOLDER REDIRECTION

A roaming user profile is a user's data, preferences and settings (that would normally be stored locally) that are stored on a centralized file server accessible from any network-joined desktop computer. These profiles are updated when users log on to and log off. Administrator must set up users with roaming profiles; this is not an automatic process. If a roaming profile is created, the login prompt on the local computer checks to see if the user exists in the domain rather than on the local computer; no pre-existing account is required on the local computer.

If the domain login is successful, the roaming profile is copied from the central file server to the desktop computer, where a local account is created for the user. Roaming profiles can be universally applied to Windows desktops whether physical, terminal services and virtual desktop environments.

Some issues with roaming profiles include profile bloat in which these files become very large and thus slowdown login and logoff for users. Also if roaming profiles are used for many users who are all logging on and off at the same time, this could slow down the network considerably.

Folder redirection refers to automatically re-routing I/O to and from desktop folders to storage elsewhere on a network to ensure that users do not store data locally, but to a designated storage location on the network. Folder redirection allows saving data regardless of storage location and separates user data from profile data, thus decreasing the profile size and time required to log on.

Folder redirection was designed to mitigate the issue of profile bloat, or profile sizes becoming so large that logon times become unacceptable.

### LIMITATIONS OF ROAMING PROFILES AND FOLDER REDIRECTION FOR VIRTUAL DESKTOPS

While roaming profiles and folder redirection can be used to make profiles portable in virtual desktops, they require too much manual intervention by desktop administrators to be used successfully in large desktop environments. VMware and Citrix also offer solutions for addressing user profile portability but these solutions share some of the same issues. Fundamentally, existing solutions on the market today do not provide end-to-end critical migration functionality needed as follows:

- Persistency of user profile from session to session across all types of desktop delivery modes
- Compatibility for and migration across Windows XP to future Windows platforms
- Compatibility across diverse desktop device types
- Automated reduction and management of profile bloat for rapid log on
- Automated migration of user-authored data

### AUTOMATING PROFILE MANAGEMENT WITH USER VIRTUALIZATION TOOLS

Liquidware Labs ProfileUnity is an automated solution that successfully addresses the challenges in managing user profiles in a desktop environment. Whether you are implementing a POC or scaling to production, ProfileUnity makes it easy to deploy new applications, infrastructure resources and personality consistently across your enterprise users and desktops from one central console while migrating existing data and settings from your physical PC's to your next generation desktop strategy.

This innovative approach offers time and cost-saving capabilities to:

- Deploy user desktop settings from one central console
- Migrate user data to VMware View, Citrix XenDesktop & Windows 7
- Manage user experience per User, AD Group, IP Subnet & more

ProfileUnity allows IT staff to automate routine desktop management tasks such as creating application shortcuts, mapping drives, installing printers, and configuring Outlook MAPI profiles. The solution can also modify environment variables, adjust Internet proxy settings, configure RDP connections, and further customize client machines during user logon.

ProfileUnity's unique design enables you to leverage your existing desktop configurations and user personalization for easy migrations to your next desktop strategy. ProfileUnity takes care of migrating existing documents and data stored in the user's home directory as well. The solution features innovative background data synch functionality which can be set to harvest existing critical data and documents from Windows PCs before they are migrated. Documents and data are saved automatically to the user's network share location and are then made available from wherever the user logs on. Local file settings can be remapped to the same network share to invoke best practice methods for data storage and disaster recovery. Offline files settings can be used to support laptops and other PCs which may be offline at times after migration.

### PHASE FOUR: VISIBILITY AND VALIDATION

Management of virtual desktops is very unlike managing traditional desktops. In the physical world, issues are confined to a single piece of hardware, but virtual desktops are delivered through a shared infrastructure. Desktop administrators require ability to "see" and drill down into desktops as well as the virtual stack to address problems and fine-tune performance as well as plan adequately for new users and capacity.

Desktop virtualization will change the way that desktop administrators will perform the following tasks:

- Provisioning new/upgraded applications to users
- Tracking user needs to plan for increased capacity needs, workload spikes or new applications
- Managing user profiles in order to ensure they are kept up to date and optimized to prevent users from experiencing issues. User profiles must be added, modified or retired in real time.
- Monitoring the health of the servers, (both physical and virtual), network and storage systems to ensure that admins are alerted to problems, bottlenecks or aberrations in the system
- Performing checks as needed in the virtualization layer
- Performing scheduled audits of the system in order to ensure that the organization is in compliance with licensing requirements
- Automating desktop related maintenance, such as installing upgrades, service packs, patches, security compliance (antivirus) and backup and recovery.
- Leveraging image-based backup and replication for disaster recovery strategies

Currently many desktop administrators do not have the means to view both the "inside the guest" operations of their desktop VMs to see how applications are performing and affecting the system. In addition to this ability, desktop administrators supporting virtual desktops will need to be able to spot issues in other systems layers of the infrastructure in order to communicate effectively with their fellow administrative teams and resolve issues.

### SHARED VIRTUAL DESKTOP ENVIRONMENTS NEED PERFORMANCE VALIDATION SOLUTIONS

When many users are sharing computer resources, the impact of users on each other and on workloads can become very complicated to predict or diagnose. The increasing sophistication of virtualization technologies, with the ability to schedule CPU activity, over-commit memory and thin-provision shared storage, along with the increased demands on the network, make supporting a virtualized desktop environment even more demanding. If user virtualization is also leveraged, then managing user profiles must also be factored in.

In order to troubleshoot issues, which can arise in any one of a number of areas, desktop administrators need a means of verifying that a problem exists, determine the exact nature of that problem and then collaborate with their peers who support networks, storage and virtualization in order to troubleshoot the issue. In addition to

diagnostics, they need a means of modeling the impact of changes to the infrastructure as they add users or applications. As they scale, they may need to rebalance workloads or add capacity, and they will require a means of capacity planning if resources must be added.

Liquidware Labs Stratusphere UX provides a powerful set of features for the ongoing performance validation of virtual desktops once they are into production.

Stratusphere UX includes patented technology which is unique on the market and does not directly compare with traditional monitoring solutions that apply to systems management. Stratusphere UX is the ONLY solution today that delivers the depth and breadth of actual end user data and response times needed in order to provide a true representation of user experience by tracking the following metrics:

- User Logon Time in Seconds
- Application Launch Time in Seconds
- Application Server Response Time (ART)
- Application Not Responding Information
- Application Usage Tracking / Installed vs. Consumed
- Network Latency / Round Trip Time (NRT)
- Network Connection Failures
- Network Connection Tracking by Port, User & Device to Device
- Disk IOPS per Application
- Disk and CPU Queues
- Visibility into TCP and UDP traffic streams and patterns

In addition, Stratusphere UX has patented technology that allows it to pull all these metrics into an overall VDI UX composite score which then rates virtual desktop performance with an easy to understand Good/Fair/Poor score, which instantly alerts Desktop Administrators to issues. The following chart outlines the key business benefits of Stratusphere UX in the virtual desktop production environment.

## Stratusphere UX Features and Benefits

Features	Business Benefit
Track users through multiple Active Directories and multiple vCenter implementations	When the user has access to AD or vCenter implementations across multiple domains, it can become extremely difficult to measure their experience. Because it does not rely on agents, Stratusphere UX can easily scale to track user experience even in very large deployments.
Read-only access for Desktop Administrators to have information across multiple levels in the resource stack without affecting them	The desktop administrator now has the data they need to track desktop performance both in the guest VM and across servers, storage, hypervisor, virtualization management and network resources without any concern that they can negatively impact other systems.
Scalable and affordable architecture. No Windows server needed. Runs as a Linux virtual appliance across all hypervisor platforms.	Stratusphere UX runs as a virtual appliance. In addition, the solution does not use agents but very lightweight Connector ID key software – essentially, “invisible fingerprints” that track real-time user and machine activity at a virtual or physical network switch. As a result, the solution can easily scale for large environments, but still provides a low overall TCO.
ROI Reporting	Built in report compares numbers of users supported vs. expenses of infrastructure to provide an accurate picture of ROI and ongoing TCO
Safegate API allows users to query and pull data from Stratusphere Hub into their own applications	Organizations can export data to popular 3 <sup>rd</sup> party software packages, such as Crystal Reports, to run reports in familiar formats
Built-in custom reports	Stratusphere UX included out-of-the-box reports to organize essential metrics into understandable and actionable decision-support information
Modeling of changes to virtual desktop environment ahead of executing in production.	It is not always clear what the impact of adding users or new applications will be in the “shared resource” virtual desktop environment. Desktop administrators can easily set up test environments with projected changes and measure performance with Stratusphere UX in order to see if spikes, bottlenecks or other negative impacts arise. This information can be used to rebalance workloads or add server or storage capacity if needed, or even re-engineer applications.
Desktop 360 correlated snapshot of views of entire infrastructure	One pane of glass dashboard that provides a universal view across disparate data center servers and storage, network, AD & vCenter, virtualization layer & users and their machines for end-to-end visibility.
VDI UX composite metric	The composite metric aggregates the key performance indicators in an overall “score” for the desktops, thus rating them Good/Fair/Poor. The solution comes with built-in thresholds, which can be easily adjusted to the baseline determined from physical desktops or customized to industry “best practices.” Virtual desktop ratings are displayed scatterplot diagram so they have instant visibility into compromised desktops. Stratusphere UX is the only solution that has this feature.
Snapshot of all systems taken at same intervals to track source of issues that appear at the same time of day	Desktop administrators can look across server, storage, network, LDAP and virtualization software layers to check performance across all systems at a specific time in order to determine where a problem is originating. This is an especially important feature when problems arise intermittently or when Desktop Administrators must go back to a certain point in time when the issue occurred.
Identify over-provisioned licenses and resources.	Stratusphere UX can uncover applications that users have but are not using. In addition, this solution identifies areas where systems resources are overprovisioned for workloads. In both cases, the solution provides data so that Desktop Administrators can reduce costs by adjusting to actual usage conditions rather than estimating or guesswork.
Cross-platform support for physical, virtual and terminal server sessions.	Customers can reduce the number of solutions in their environments, leading to more consistency and lower overall TCO

## ABOUT LIQUIDWARE LABS

Founded in 2009, Liquidware Labs™ is the leader in desktop transformation solutions for next-generation physical and virtual desktops, including VMware View, Citrix XenDesktop, and Microsoft Windows 7. The company's Stratusphere™ and ProfileUnity™ solutions have been described by analysts as the industry's first 'On-Ramp to VDI,' providing a complete methodology and software that enables organizations to decouple users and applications from the operating system and to cost-effectively assess, design, migrate, and validate the user experience for next-generation desktop infrastructure. Liquidware Labs products are VMware and Citrix certified, and are available through a global network of certified partners. Visit [www.liquidwarelabs.com](http://www.liquidwarelabs.com) for further information.