History of UConn User-Facing Virtualization

UITs has offered user-focused virtualization services since 2002. Initially positioned as a niche service, the Citrix service has solved several use cases for the University, including remote access to administrative tools, securing legacy applications, and large-scale, immediate deployments of problematic client software. While the deployment has remained under 200 concurrent user connections limited to mainly staff and some faculty, the service has proven to provide consistent, stable access to key applications.

In addition to this service, UITS offers the SkyBox service, which provides on-demand virtualized Microsoft Windows desktops to undergraduate and graduate students for use in labs and on personal devices. The virtual desktops include general-purpose software, used by most students, as well as software that is targeted to specific populations. Since 2011, SkyBox has served a key need of students by delivering access to important academic applications from any computer with an Internet connection.

Choosing the Right Tool for the Job
The SkyBox service is a visible, widely-used service. As faculty leverage the technology to ensure that students have access to needed software, SkyBox has become integrated into the University’s core function of teaching and learning. The adoption has been positive, and the infrastructure required to provide the service has scaled to meet the University’s current usage needs. Because of the nature of the service, each person that logs into the system is assigned a full desktop image, requiring substantial hardware requirements (Hard Disk, RAM, CPU) dedicated to a single user, even for light tasks that can be delivered without such expensive hardware resources.

While UITS is committed to investing in the SkyBox service and looking for additional use cases for the service, we also recognize that there are some use cases that could be more efficiently satisfied through virtualization of applications rather than with an entire desktop environment. We gain efficiencies through application virtualization because virtualization happens at the application layer rather than at the infrastructure layer.

The proposed plan is to enhance and expand the application virtualization service, tentatively named AppLibrary. The Citrix environment could be built out to provide access to 700 concurrent users and to serve the entire UConn population as opposed to discrete populations. In conjunction with SkyBox, the UConn AppLibrary service is meant to provide UConn students, faculty, and staff with options to choose the service that they feel will best meet their individualized use cases.
UConn AppLibrary Service

The new service model of delivering virtualized access to UConn software packages will be based on Citrix XenApp. The platform allows for installation of software packages into a central repository, with the ability to set specific entitlement for packages to specific users or groups of users. Users will see only the applications they have access to run, those applications will be available on all desktop and mobile platforms, and settings and customizations will be retained and accessible on all platforms. Furthermore, Citrix XenApp has the capability to interact with native devices so that users will have, through their virtualized applications, access to printers, local hard drives, external (USB) drives, and file shares (such as the p drive).

The AppLibrary will serve applications for which UConn has site licenses, which will be negotiated and managed through the UConn Software Group. Software with licenses that are restricted to smaller populations can also be deployed in the AppLibrary efficiently and targeted to only licensed users. In Citrix XenApp, multiple applications are installed on a single server/image and Active Directory groups are used to authorize use of particular applications, as needed. This eases administrative burden by allowing administrators to utilize existing technology to configure an application once but provide a different mix of software to various populations based on group membership.

*Note: Some applications may not conform to this model and will require a dedicated image to serve applications through Citrix XenApp. However, most of the University’s application will not require this treatment. Also, in cases where an image is required, that image doesn’t require additional software packages (e.g., Microsoft Office) to be installed and maintained.*

**Application Delivery for IT**

An additional benefit that the AppLibrary service is expected to provide the University is the ability to deploy applications as needed, without the need for additional configuration and maintenance. In this case, IT professionals who manage labs and desktop images will be able to integrate any software deployed through Citrix XenApp into their own native environment. By installing the Citrix Receiver software on lab images, vPC users can benefit from the reduced image size as well as reduced maintenance and overhead required to update and maintain software.

A particularly helpful use case is SkyBox, where it is anticipated that specialized software can be installed and maintained on the SkyBox image, with general-purpose software delivered through Citrix XenApp. While this isn’t the primary purpose of the AppLibrary service, these technologies help the University leverage existing investments to and gain additional benefits through integration.
Roles & Responsibilities

Service Management
UConn AppLibrary service management will remain a function of UITS Server Support. As with other UITS services, the service manager role will have full authority and accountability over the service. The Service Manager is tasked with managing the operational needs of the service, as well as evolving the service over time to meet the changing needs of our users.

Software Application Licensing
The UConn Software group assesses and distributes software for UConn, and the group has a broad view of the current University software portfolio as well as ongoing requests and needs. The AppLibrary service will require interface with this group to ensure that software delivered on the service is properly licensed for use.

New software requests originating from the general user population will be required to either provide proof of licensing or work with the UConn Software group to obtain necessary licensing. Upon receiving license confirmation, UITS will install the software and make it available to the appropriate population(s).

Software Deployment, Support, & Maintenance
Requests to deploy properly-licensed software can be made via email or telephone call to the UITS Help Center or by opening a ServiceIT ticket. Once the software is available, UITS User Services will test it in the Citrix XenApp environment. In addition, UITS will create and maintain Active Directory groups to restrict the software available to specific users or groups of users, as needed.

Application support (usage questions, technical support) will continue to be provided by the areas that provide that support today. For installation or configuration problems, UITS Server Support will need to provide necessary access or perform software maintenance. The UITS User Services team will provide support for software packages in the AppLibrary that they support today.

Infrastructure Support
UITS Server Support will be responsible for supporting the Citrix XenApp environment and its infrastructure (including load balancers). UITS Server Support will install, support, and maintain the infrastructure.

Infrastructure Design

Usage
The AppLibrary service is being planned for 700 concurrent users. The scale and design (Appendix A) is based on reference architecture provided by Citrix as well as sizing and design discussions with Citrix. Based on the current peak SkyBox usage along with concurrent usage of the current UITS Citrix deployment, 700 concurrent connections should be an adequate
license count to begin this service. The final design will be completed by UITS Server Support and reviewed by Citrix to ensure the design can meet the usage estimation.

**Servers**
Servers will be housed in both the MSB and HBL Data Centers, operating in an active-passive configuration that is designed to provide high availability. Based on 700 concurrent users, approximately 16 dedicated blades (8 in each location) will be required for the initial design.

**High Availability**
A pair of NetScaler application delivery controllers will front-end the Citrix XenApp environment. The Citrix NetScalers will balance traffic appropriately in addition to providing application or service health monitoring. The Citrix service will be served out of the MSB and HBL data centers such that if service is lost in one data center the other can assume the full service load.

Two Citrix NetScaler SDX 11515 application delivery controllers (ADC) will be used to provide HA services, as well as provide load balancing services. UITS SSG will be responsible for configuration, maintenance, and support of the devices. These ADC’s will also be leveraged to provide load balancing for other university applications, such as Student Administration and HuskyCT.

**Storage**
The XenApp environment will utilize 2 – 4TB of Tier 1 SAN storage.

**Hypervisor**
Citrix’s XenServer will be used to support the XenApp environment. The hypervisor choice will complete the Citrix stack and allow the University to engage a single partner for the support, eliminating troubleshooting confusion and expediting resolution.

**Network**
The network backbone for the Citrix environment will be 10Gbps in both data centers. Firewall services will be provided by the current Fortinet firewalls with dedicated VLANs to segment traffic for backend systems.

**Monitoring**
Citrix HDX Insight will be used to monitor the health of the Citrix service by allowing administrators to inspect and diagnose ICA traffic. HDX Insight integrates into the NetScalers to provide a 360-degree view of ICA traffic and service health. SCOM is also deployed at UITS today and can be used to monitor the server operating system environment.

**Future Scalability & Growth**
- 100 – 200 new additional new licenses per year, depending on adoption rate and usage patterns ($12,500 - $25,000).
- GPU hardware for graphic-intensive applications, such as Adobe suite, CAD programs, etc.
- 2 additional NetScaler SDX 11515 for inter-site redundancy for a true high availability design.
Appendix A: UConn AppLibrary High Availability Infrastructure Design