Virtualization Strategies: Citrix

Insight

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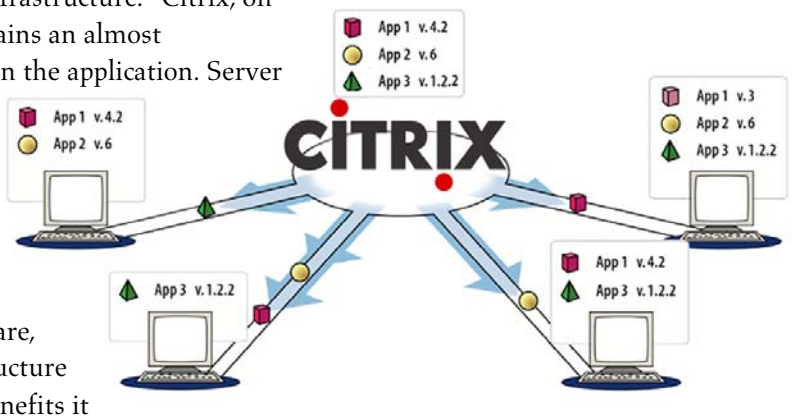
6 June 2008

Citrix arguably has as long a history as anyone selling virtualization for x86 servers. What the company long called Presentation Server (recently renamed XenApp) is a form of what, today, is often called application virtualization; it estimates over a million servers so virtualized in production. Citrix has broadened considerably over the last few years. XenApp continues to contribute the bulk of company revenues, but Citrix no longer pushes it as the solution to seemingly every conceivable customer problem. And Presentation Server has itself advanced, for example with major new application "streaming" capabilities in the 4.5 release.

What hasn't changed is Citrix' fundamental worldview—the lens through which it views the market. VMware is primarily focused on virtualized server infrastructure and automating the workflows associated with the virtual machines that run across that infrastructure.[1] Citrix, on the other hand, maintains an almost monomaniacal focus on the application. Server virtualization is now a major part of its toolkit, the fruits of its 2007 acquisition of XenSource.[2] But there's a difference in perspective. For VMware, virtual server infrastructure and the operational benefits it brings to the datacenter is an end in itself. For Citrix, it's better thought of as the means to deliver applications from the datacenter to the desktops (or other client devices) of users.



The Company and its Portfolio

Citrix had earlier products, dating back to a multi-user version of OS/2, but its current lineup—specifically XenApp—is most directly traced to WinFrame in 1995, a multi-user version of Windows based on Windows NT 3.51 source code that Citrix licensed from Microsoft. Essentially, this let multiple users run applications from terminals, thus enabling Windows to support multiple users simultaneously in ways akin to Unix and other multi-user operating systems.

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1 See our *Virtualization Strategies: VMware*.

2 See our *Citrix Buys XenSource*.

A couple of years later, things got complicated and ugly. In February 1997, Microsoft said it wouldn't renew Citrix' NT license because Microsoft planned to create its own version of multi-user Windows. Citrix' stock plunged. However, by May the two companies came to a licensing agreement that likely saved the company. Citrix gave Microsoft access to the multi-user technology that would become Terminal Services (codenamed "Hydra" at the time) and the remote display technology that would become Remote Desktop Protocol (RDP). Citrix also agreed not to compete with Terminal Services; in other words, it agreed to stop enhancing WinFrame. In return, Microsoft paid Citrix $75 million plus subsequent royalties and, critically, agreed to allow Citrix to develop products that built on top of the Microsoft platform.

The first such product to run on top of Windows Terminal Services was MetaFrame. Although Terminal Services are by themselves sufficient for multiple users to run applications remotely, MetaFrame provided many features to improve application management, performance, and security. As a practical matter, thin client installations of any scale making use of Microsoft Terminal Services complemented them with MetaFrame. And, though MetaFrame subsequently evolved into Presentation Server and now XenApp, this remains largely true today.

Citrix built out its product line over time, both organically and through acquisition. The most significant acquisition was of XenSource in 2007. XenSource was the commercial entity that grew out of the Open Source Xen Project at the University of Cambridge. With Xen, major Linux distributors, leading ISVs, and Tier 1 system vendors coalesced around a single arrowhead, whereas previously it was unclear whether any of the fragmented, under-resourced Open Source virtualization projects would ever achieve critical mass. As a result, Xen is the native hypervisor that's used in everything from many flavors of Linux to Sun's xVM to Amazon's EC2 cloud computing offering.[3] XenSource built commercial virtualization solutions around the Xen engine that are now available from Citrix under the XenServer product brand.

From a virtualization perspective, Citrix' product line today consists of three major components: XenApp, XenDesktop, and XenServer. This new nomenclature represents a general product renaming on the heels of the company's acquisition of XenSource. One goal was clearly to establish consistency across the different components of Citrix' end-to-end virtualization lineup. It was also an opportunity to break from the "Presentation Server" name which, while well-established, is also associated with a narrow set of capabilities that the product had since expanded on considerably.

XenApp

XenApp is the Citrix product family formerly known as Presentation Server.[4] Historically, it focused on what can be thought of as presentation-layer virtualization—although Citrix positions it today as server-side application virtualization. This style of virtualization separates the user interface displayed on a client from the application processing, which is done on a server.

XenApp runs on top of Windows Terminal Services on a back-end server, where it provides a variety of remote access and application publishing functions.[5] In this manner, a single copy of each client application is installed and managed in a centralized application store from where it's delivered to client devices. Advantages include both improved security and reduced management costs —because the application is being largely managed once rather than on each user device.

Multiple systems running XenApp can be combined into a "server farm" and managed as a

[3] See our *Web Services Flow Down Amazon* and *Defining Cloud Computing*.

[4] The currently shipping 4.5 version of Presentation Server hasn't actually been renamed. "XenApp" will kick-in at the product level with the next major release (codenamed "Delaware").

[5] Beginning with Windows Server 2003, Terminal Services are a Windows Server "role" rather than a separate kernel and product as they were previously.

Product	*Edition*	*Comments*
XenApp Application virtualization and delivery	Advanced	Traditional Presentation Server: remote access to server-side apps
	Enterprise	Adds ability to stream applications to any type of client and virtualize them locally
	Platinum	Adds a variety of monitoring and security tools
XenServer Server virtualization	Express	Trial version for one server—hypervisor plus management
	Standard	Adds ability to manage multiple servers from one console
	Enterprise	Adds XenMotion (live VM migration) and resource pooling
	Platinum	Adds dynamic provisioning of application workloads to physical and virtual servers
XenDesktop Desktop virtualization and delivery	Express	Trial version for up to 10 users
	Standard	Basic virtual desktop infrastructure (VDI)
	Advanced	Adds live migration for VMs and provisioning tools that reduce storage requirements
	Enterprise	Adds dynamic delivery of applications into virtual desktops
	Platinum	Adds additional tools related to performance and remote support

single entity. The farm stores static configuration information in the IMA (Independent Management Architecture) Datastore that can reside either on one of the XenApp servers or in a database elsewhere on the network. The farm also automatically assigns one of its members to function as a Data Collector to maintain dynamic information about the servers. Among other functions this Data Collector connects clients to the appropriate XenApp server.

Clients can connect to XenApp servers using Microsoft's Remote Desktop Protocol (RDP). Citrix also offers its own Independent Computing Architecture (ICA) protocol. ICA had significant performance advantages over RDP in the past and generally remains faster today—although the delta has decreased. ICA also retains incremental features such as SpeedScreen (to optimize perceived latency on slow connections) and Session Reliability (a keep-alive capability). One often thinks of a XenApp client as being a thin client. However, in fact, most are regular desktops—usually, but not necessarily, Windows-based. The applications can be accessed in a number of ways using the Citrix Program Neighborhood window and a Web interface; an agent can also drop published applications into the Start menu for a similar look-and-feel to locally-installed programs.

Server-side application virtualization remains a useful way to deliver applications to always-connected desktop systems—especially when security and other considerations tilt towards keeping the client environment as controlled and locked-down as possible. However, for situations where tight control isn't so important and the client device, such as a laptop, may not always be connected, Citrix introduced alternative client-side virtualization in XenApp 4.5 Enterprise and Platinum Editions.

As the name implies, with client-side virtualization the application actually runs on the client. However, in this case, the application isn't installed in the usual manner. Rather, it is "streamed" down

to the client when it is first requested and it runs out of an application container that can be thought of as a sort of local cache. Once the application has been downloaded, it can run whether it's online or not (assuming, of course, that the application can otherwise run offline). Updates likewise stream down when available.

It's not really a separable component in the XenApp architecture, but this application streaming approach is closely tied to application containers in the vein of Trigence AE.[6] These containers allow streamed applications that would normally conflict to run together on the same system. "DLL hell" is a common shorthand for one cause of this problem on Windows systems; one program wants version 1.x of a library and another wants 2.x and neither can make do with the version needed by the other. This particular problem isn't the major, major headache it once was, but there are still plenty of issues associated with, for instance, running different versions of the same program on one system. Application containers pull tricks such as hiding files and registry information between applications to smooth over such problems.

Thus, XenApp can now cover a lot more territory than it could in the past. Indeed, with the introduction of application streaming, it's no longer even necessarily about delivering applications just to desktops. Although it's more a concept than something seen much in the wild, the idea of combining streaming application delivery with a repository that holds a modest number of operating system or operating system plus middleware images is starting to be discussed as an alternative to pre-building the whole combination as a virtual or other form of appliance.

XenServer

In a nutshell, XenServer is server virtualization, based on the Xen hypervisor. It spans a variety of editions from a basic single-server version to one that can dynamically provision virtual and physical servers (along with their associated application workloads) with shared storage across multiple pools. It was acquired along with XenSource in 2007. It represents a major departure for Citrix in one sense but reflects its roots in others.

On the one hand, Presentation Server and various products that the company acquired from the outside over the years were all concerned with accessing and delivering applications in various ways. XenServer, like most of VMware's products, is more about making back-end datacenter infrastructures more efficient and simpler to operate. Not the same thing.

On the other hand, it's worth remembering that Citrix got its start by essentially providing a way for multiple users to simultaneously use operating systems that weren't designed for that purpose. Server virtualization—such as that provided by the XenServer hypervisor—is, in a sense, just a different cut at slicing and dicing, though the particulars are much different. It's also worth noting that server virtualization is really about separating server hardware from the application workloads running on top of them. So while XenApp focuses on virtualizing the user tier of apps, XenServer is, in a sense, virtualizing the logic and data tier of those same apps.

There are analogs in the way Citrix' business model has evolved as well. Just making Windows "multi-user" used to be a big part of what Citrix sold. Then Microsoft rolled out a Terminal Services version of Windows and eventually folded those functions into the standard Windows kernel. Citrix stayed in business by building software and services that leverage that technology base. Similarly, the hypervisor layer that is at the core of XenServer will be increasingly "commoditized"—at least in the sense that it's hard to charge much money for just the hypervisor piece. The money is in the management of the virtual machines and the higher-level services that run on top of a virtualized infrastructure.

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[6] See our *Trigence AE—Encapsulating Applications*. Microsoft's SoftGrid, derived from its Softricity acquisition, is perhaps the product most akin to XenApp application streaming in toto.

Like VMware's Virtual Infrastructure products, Citrix sells XenServer in a series of editions that include increasingly sophisticated capabilities. The Express Edition includes the hypervisor and a management console for a single server; it's free. The Standard Edition adds multi-server management. The Enterprise Edition adds XenMotion (live migration of VMs among server pools with shared storage) and associated tools to control resource use. Citrix doesn't yet offer much in the way of services, such as backup, that sit on top of this infrastructure foundation but contends that its architecture minimizes this requirement by allowing customers to continue using the same tools they use to manage their physical servers today. Furthermore, some value-add services are provided by partners today. For example, Marathon Technologies has both fault tolerance (everRun VM) and disaster recovery (everRun SplitSite) products that run on top of XenServer.

XenServer's Platinum Edition adds dynamic provisioning of physical and virtual servers. This function is provided by the Citrix Provisioning Server, a product acquired when Citrix bought Ardence in 2007. Provisioning Server can stream the operating system, applications, and server configuration information on-demand. That is, instead of booting from a local disk, it will boot from a "vDisk" on a NAS or SAN; Provisioning Server then streams the assigned workload. Servers can even run diskless if desired. It can also provision physical server and VM images in a more conventional manner.

XenDesktop

XenDesktop, in a sense, bridges the worlds of server virtualization and application delivery. Furthermore, like XenApp, its premium editions add capabilities that effectively change the personality of the product—that is to say they expand in fundamental ways the uses to which the product can be put.

As with XenServer, there's now an Express Edition that lets potential customers pilot the software for free; it includes the back-end VM infrastructure (XenServer) and a Desktop Delivery Controller for up to ten users. The Standard Edition adds secure remote access and removes the user limit. The Advanced Edition adds XenMotion and VM Resource Pooling to the server infrastructure and Virtual Desktop Provisioning (essentially, management and provisioning tools for larger-scale installations). Among other benefits, Virtual Desktop Provisioning allows multiple personalized desktops to be delivered from a single master image —an approach that can dramatically reduce storage costs for mid-to-large-sized Virtual Desktop Infrastructure (VDI) deployments.[7]

Up to this level in the product line, we're talking about a fairly plain vanilla virtual desktop infrastructure (VDI). Each operating desktop session runs within a VM on a back-end server. Each session is a full operating system instance with its associated applications. The presentation layer of that OS instance is then delivered to the client—using ICA in this case. The connection broker in the Desktop Delivery Controller handles connecting users to the appropriate instances on the server. There are many additional wrinkles associated with resource allocation and using generic software images for groups of users, but those are the basics.

However, Citrix has broader ambitions for XenDesktop than being just another VDI play. Rather, they talk about a concept they call "Desktop Delivery." This differs from the usual case in that the Desktop Delivery Controller identifies the user and dynamically assembles his or her personalized virtual desktop image on the server. The appropriate OS image is then streamed into the hosting environment (whether a VM or a PC blade) and married to the user profile and the user's applications. XenApp for Virtual Desktops, a specialized version of the application streaming described earlier, provides the application integration.[8] This version of XenApp is included

[7] Citrix' data shows that provisioning can cut storage costs by $300 to $500 per user.

[8] XenDesktop includes both server-side and client-side application virtualization components; the license restricts the use of XenApp to just delivering

with the Enterprise and Platinum Editions of XenDesktop.[9] Platinum differs from Enterprise in that it adds additional tools for performance monitoring, WAN optimization, and remote desktop support. By dynamically assembling each user's desktop at runtime from a common set of master images, users effectively get a "new" PC each time they log in, free from many of the corruptions and conflicts that tend to accumulate on traditional PCs over time.

Citrix Strategy Overview

Just two statements capture a great deal of Citrix' essence over the years.

The first is that it presents perhaps the longest running and most intense example of (mostly) friendly co-opetition with Microsoft. Microsoft is, after all, a company whose ISV ecosystem philosophy often seems to be something along the lines of "commandeer and extinguish" rather than something more partner-friendly. And, as we have seen, Microsoft indeed came close to carrying out such a game plan with Citrix as well.

However, Citrix has proven adept over the years at building atop Microsoft's core platforms in ways both sophisticated and profitable for both firms. As a result, although Microsoft continues to build additional functions into its operating systems and other software, Citrix has likewise added capabilities to its products and thereby maintained comfortable differentiation. As Microsoft rolls out its own Hyper-V hypervisor in Windows Server 2008, expect the dynamic to remain much the same for server-side virtualization. Just-built-into-the-OS will be fine for many users, especially those with relatively modest needs, but Citrix will continue to be the partner of choice for augmenting Microsoft with more sophisticated application delivery tools.

However, the second key aspect of the historical Citrix—a narrow focus on presentation-layer virtualization—is increasingly out the window. And, with it, an identity defined by a presence in almost every Fortune 500 company—but only for a narrow slice of uses and users. Rather, the company can now play across a broad swath of the mass market virtualization landscape from server infrastructures through delivering applications to clients in a wide variety of ways depending upon the user (and IT) need.

Xen and XenSource are a huge part of this transformation. In part, it's because they added server virtualization to Citrix' portfolio. But this isn't just about adding a new line of business. XenServer is a capable product suite, albeit one that is perhaps more dependent on partners than that of VMware's to deliver a full range of infrastructure services.[10] However, product capabilities notwithstanding, Citrix isn't the obvious go-to choice if your needs are solely about datacenter virtualization.

Rather, XenServer gains its greatest value as part of Citrix because of what it adds to the whole. Now, rather than being tied to forms of application virtualization that leverage Microsoft Terminal Services on the back-end, Citrix can use techniques like virtual desktop infrastructure that leverage server virtualization. Adding recently developed application streaming and provisioning capabilities to the mix makes the whole really greater than the sum of its parts. That's an overused phrase, but accurately describes how Citrix has pulled together relatively disparate technologies and products into an increasingly coherent and powerful application delivery story and capability.

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applications into desktops.

9 It's possible to substitute many of the components in this architecture. For example, VMware ESX and Microsoft's Hyper-V can serve as the back-end virtualized infrastructure. Either Citrix' full XenApp or Microsoft's SoftGrid can perform the application integration. However, in many cases, the pricing will be lower with the integrated suite.

10 Citrix makes heavy use of partners in other ways as well. For example, it doesn't build its own clustered file system and backup capabilities, but relies on storage partners like NetApp to do the heavy lifting there. Xen also remains an Open Source project. Although Citrix is a major contributor, the likes of Novell and Red Hat also work on the project.

Conclusion

It used to be that Citrix seemingly viewed every application access need as a cry for a Presentation Server implementation. Or to put it another way, their typical pitch went something along the lines of "Presentation Server is the answer; what's your problem?" Even as recently as the run-up to their iForum show in the autumn of 2007, it still wasn't clear exactly how their various products fit together outside of a Presentation Server context. And their Web site still puts Presentation Server front and center—500 million dollar XenSource acquisition notwithstanding.

I'd say "what a difference a year makes!" but it's actually been more like just six months. Although understanding how all the bits and pieces fit together is still a bit of a complicated process, Citrix has made great strides both on the development and marketing sides in fashioning a coherent product set and story around application delivery. If XenApp in its basic form (née MetaFrame, and then Presentation Server) is still often going to be proposed as the answer when the Citrix sales rep calls, it's certainly not the only thing. There's also application streaming, virtual desktops, server virtualization—or, most likely, some combination of those and other Citrix products. Citrix has assembled a virtualization portfolio that ultimately isn't really about virtualization so much as an end goal. Rather it's about using various virtualization techniques and technologies to deliver applications. In its scope—at a minimum—it's a unique virtualization play.