A Riverbed Technology White Paper

Accelerating the Next Phase of Virtualization

Desktop virtualization and wide-area data services

riverbed

DESKTOP VIRTUALIZATION AND WIDE-AREA DATA SERVICES

Introduction: The trend toward desktop virtualization

Like other virtualization products, desktop virtualization holds the promise of dramatically simplified IT infrastructure, cost effective IT utilization and management, with greater security around enterprise data. Vendors such as VMware, Microsoft, and Citrix claim that they can provide enterprises with a new model of enterprise computing, whereby any thin client can be used to securely access company data without the need for an individual to have their own machine, with their own data, and their own applications running on it.

As with most distributed computing models, desktop virtualization is faced with a serious performance challenge when enterprises attempt to use this technology to support distributed users who may be located across the country or across the globe. While some desktop virtualization products attempt to use communication protocols that are designed for wide area networks (WANs), even these products run into two fundamental challenges: bandwidth constraints often limit the amount of data or the number of users who can access virtualized desktops, and latency prevents the users' applications from having local-like performance.

Wide-area data services (WDS) is a class of technology that has rapidly been adopted across enterprises in order to deal with the challenges of bandwidth limitations and latency over the WAN and enabling LAN-like performance for remote users. While WDS has had tremendous success in enabling server virtualization and remote site consolidation, typically WDS has not been deployed to support desktop virtualization environments.

This paper will explore WDS in more detail as it relates to different desktop virtualization models. Three different architectures will be presented for integrating WDS and desktop virtualization. In addition, performance numbers for each architecture will be presented that show acceleration by WDS solutions.

Architecture #1: Centralized virtualization gateways

Architecture #1 (shown in Figure 1) represents the most common deployment style of desktop virtualization today. Enterprises deploy a virtualization technology such as Citrix Presentation Server or VMware VDI in their data centers, essentially sitting in front of the applications that are required by users in the headquarters or remote offices. Those offices are equipped with thin clients or desktop machines that must connect to the virtualization server in order to load a desktop or access any application.

In this model, application data is not traveling over the WAN. The virtualization technology is transmitting the visual representation of the desktop along with changes in the desktop – mouse movements, highlights, or new screens that are loaded by the user are transmitted on an as-needed basis to the customer.

Typically this model requires the IT administrator to set aside a certain amount of bandwidth for each user connection. At the same time, administrators must be cognizant of the latency of any WAN connections that users are working over. While the protocols used to send this virtualized data to the user are optimized for the WAN, increases in latency result in increasingly large slowdowns in the users' perceived performance of the application.

Introducing WDS appliances to this architecture looks much like any other environment – a WDS appliance is deployed to the branch office as well as the data center.

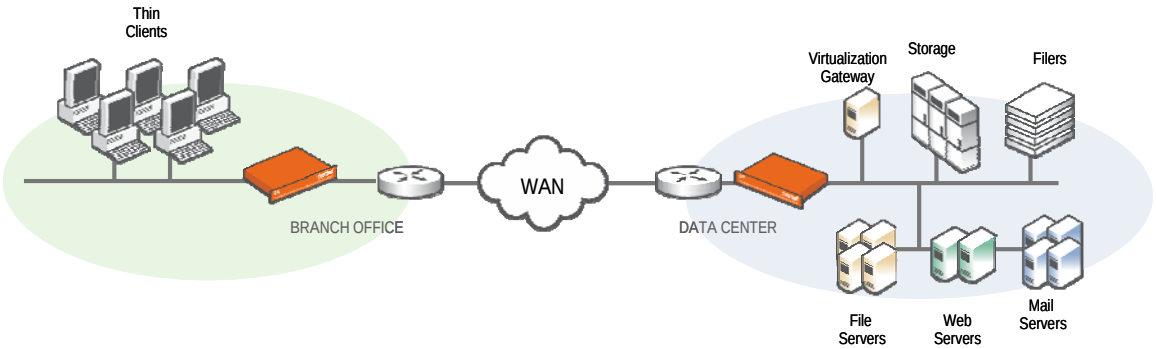

Figure 1. Advanced WDS solutions can be deployed with a centralized desktop virtualization gateway to provide acceleration to end users in some use cases.

Riverbed® Steelhead® appliances can typically remove 60 – 95% of the non-virtualized desktop data from a WAN bandwidth connection. By doing so, their first benefit is to free up significant amounts of bandwidth that will allow additional users to productively use virtualized desktops. In addition, advanced WDS technologies with features such as built-in quality-of-service (QoS) that can prioritize latency-sensitive traffic, and 'fill-the-pipe' solutions can further improve the user experience of virtualized desktops.

The data in chart 1 shows how this is possible. Using Riverbed's unique MX-TCP functionality, combined with its Hierarchical Fair Service Curve (HSFC) QoS technology, users are simultaneously guaranteed bandwidth for their virtual desktop connections and some of the latency impact is mitigated. The results below show operational improvements for particularly common user actions; results will certainly vary based on use case and network design.

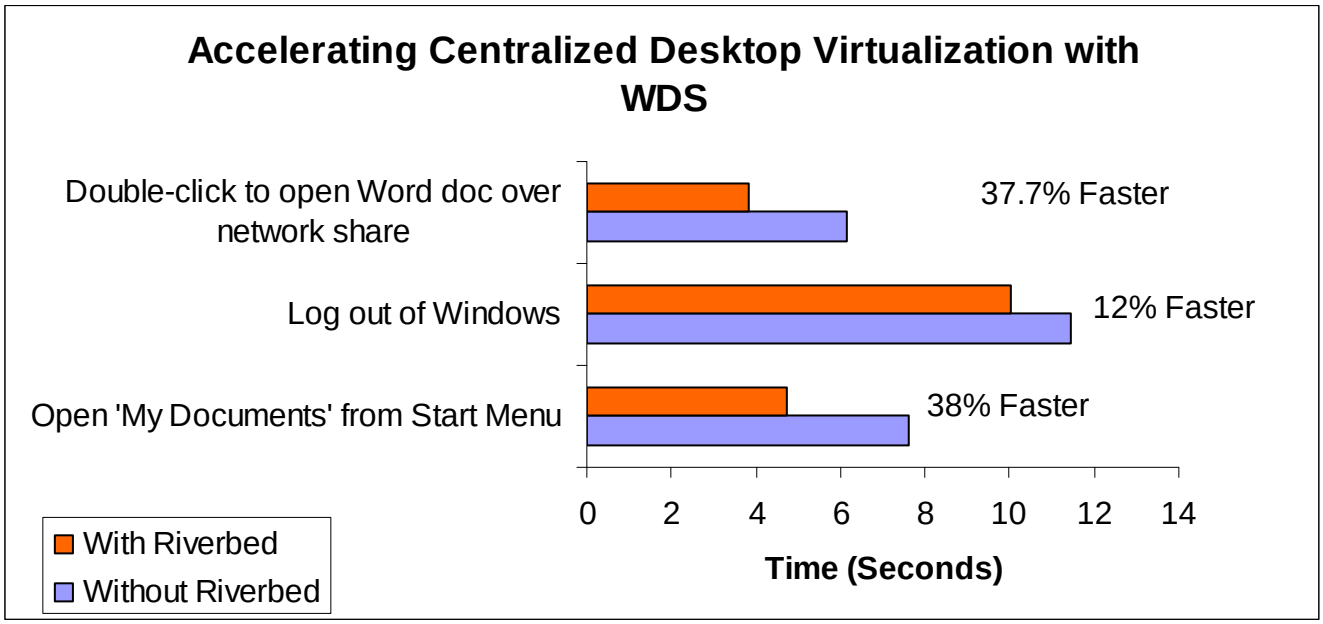

Chart 1. Tests combining Riverbed Steelhead products and the VMware VDI desktop virtualization product running over RDP show performance gains of roughly 10% - 40%. These tests were run in a simulated T1 environment with 100 ms latency. QoS was configured to enable 100% throughput on port 3389. MX-TCP, a Riverbed-specific TCP optimization, was used to ensure full utilization of the connection.

An architecture like this will not produce the maximal utilization for WDS solutions from any vendor. The nature of virtual desktops that are fully centralized is such that typically very little data moves over the WAN. While many vendors like to claim 'orders of magnitude improvement' to virtual desktop traffic, benefits (as shown here) are usually much more modest with this architecture. Thus, enterprises have sought other ways to architect solutions that give them the benefits of virtualized desktops combined with the true benefits of WDS solution.

Architecture #2: Distributed Virtualization Gateways with Centralized Data

With architecture #2 (shown in Figure 2),, IT administrators deploy a desktop virtualization gateway locally for branch office users. This local gateway allows users to access their desktops within a LAN's reach, ensuring that simple operations such as logging in, finding a local file, or printing are similar or the same in performance to that of a typical desktop.

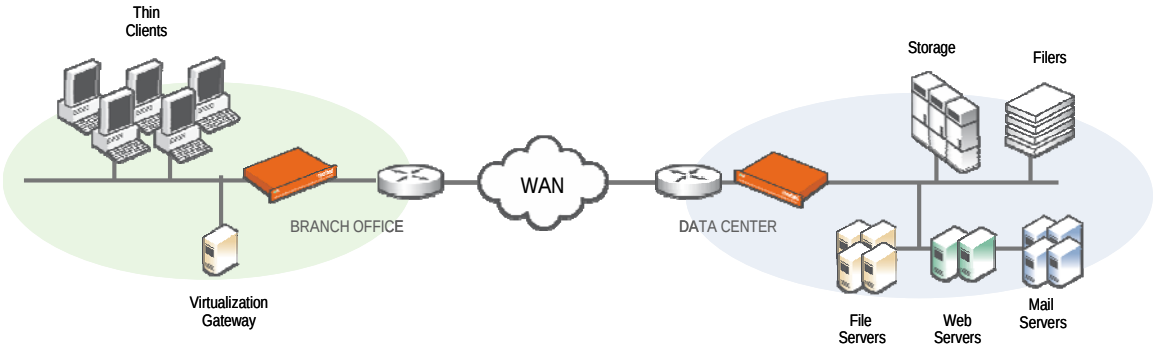

Figure 2. With the distributed desktop virtualization gateway model, users get local access to their virtualized desktops, but all data and applications are still centralized. WDS accelerates data, file, and application access.

Most enterprise IT administrators will concur that their biggest security concerns are focused on the data that employees use, and this model still maintains centralized applications and data. Thus, while this architecture requires slightly more distributed IT infrastructure than architecture #1, it represents a middle-ground that gives users fast desktop access with only minimal additional IT required. This means that IT administrators can still pursue a consolidated data and infrastructure along with virtualizing desktops for greater security.

Adding WDS to the mix in this architecture provides tremendous benefit because much of the traffic now running over the WAN consists of typical application or data requests. These are the types of requests that WDS is fine-tuned to handle: file-sharing, document management, web-based applications can all perform with LAN-like speeds. At the same time, because users are still accessing their desktops through a virtualized interface, the data is still secure. Finally, due to WDS's capabilities to dramatically accelerate backups in addition to common user application requests, IT managers can regularly and reliably backup desktop images over the WAN to a central location, without clogging up the network.

Chart 2 shows an example of the performance increase enabled to back up VDI desktop images over the WAN with WDS. In this example, a VMware VDI gateway was deployed in a simulated branch office, connected via a T1 with 100 ms latency to headquarters. Though not graphed here, WDS was able to eliminate 99% of the data that previously moved over the WAN. All data and applications remained in HQ.

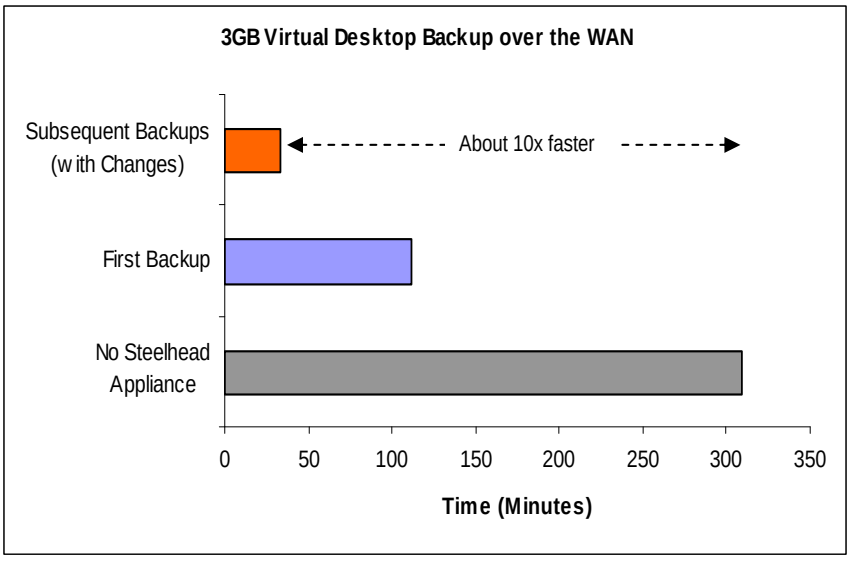

Chart 2. Backup of desktop images over a T1 with 100ms latency using WDS solutions can be accelerated dramatically. This compliments a local desktop virtualization gateway by enabling all desktop images to be stored centrally, yet still accessed locally.

Architecture #3: Application Streaming

Architecture #3 (shown in Figure 3) represents a relatively new model for desktop virtualization that is now emerging. Using application streaming technologies such as Microsoft SoftGrid and VMware Thinstall, IT administrators can now give users an application license only when they need it. With this model the application is "streamed" to the user when they request it, and then un-installed after they are finished using it. In addition to other desktop virtualization benefits, this approach can potentially help IT administrators cut the costs associated with application licenses.

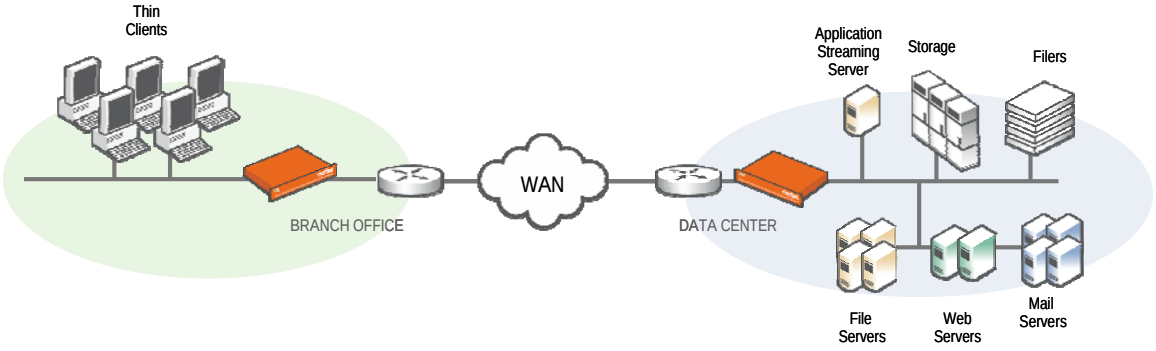

Figure 3. The application streaming model, similar to the centralized desktop virtualization model, permits LAN-like access while keeping all key resources centralized.

With an application set up to stream, an end-user is not only required to download the file or data they are looking for, but they are also required to download the application itself. This naturally requires significantly more bandwidth, and may present a major productivity issue unless WDS is used to accelerate the transfer.

Chart 3 shows some examples of the performance increase given to typical applications when accessed over the WAN with WDS. In this example, a VMware VDI gateway was deployed in a simulated branch office, connected via a T1 with 100 ms latency to headquarters. All data and applications remained in HQ.

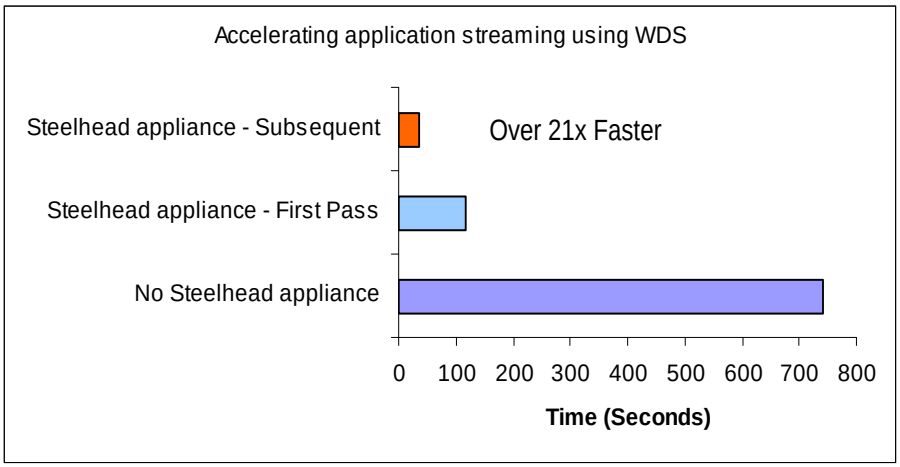

Chart 3. Using WDS to accelerate application streaming provides dramatic results. This test simulated a branch office user downloading PowerPoint and opening a PowerPoint file over the WAN using VMware Thinstall. A T1 with 100ms latency was simulated.

Based on these results, users would experience some delay the first time they install an application; it would be about six times faster than if they were installing it natively over the WAN, but still would not be LAN-like performance. Subsequent installations, however, would be dramatically accelerated. Over 21 times faster performance means that users could stream applications to their desktops without regard to performance or how far away the data center is located.

Architecture #4: Full OS Virtualization

Full OS virtualization is also a newer approach to desktop virtualization (See Figure 4). It provides the same benefits of typical desktop virtualization with greater use of the desktop in a typical manner. With OS virtualization an end-user downloads a complete package that contains the operating system as well as applications.

The power of the full OS virtualization model is that distributed users, even those who are remote and not located in an office, can wield the benefits of desktop virtualization. They can be assured that their operating environment is patched and updated, customized according to the needs of their company, and of course, secure. The problems with this architecture are much like other virtualization models: the farther away the user is, the slower performance is. Additionally, with users regularly downloading large OS images, bandwidth constraints will begin to impact the cost and performance of the data center as well.

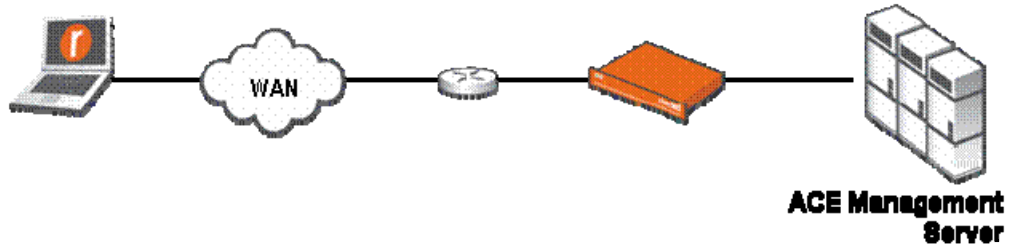

Figure 4. The deployment of ACE OS Virtualization can even be used to accelerate remote and mobile users, using Riverbed Steelhead Mobile software.

With Riverbed, many types of operations can be accelerated. This might include the actual download of the virtualized OS image, as well as the typical operations a user might perform. For example, if Steelhead Mobile client software is installed on the base machine, then the actual download of the virtualized OS image can be accelerated. When Steelhead Mobile is actually installed within the virtual image, then the ongoing transactions of the user will be accelerated. The data below describes not only the speed improvements of operations with Riverbed Steelhead Mobile and OS Virtualization, but also the bandwidth savings that result.

Access : PPT File Download	Without Riverbed	With Riverbed, First Operation	With Riverbed, Subsequent Operations
Time Taken (seconds)	89	40	5
Time improvement	NA	2.2x	22x
Compression Ratio	NA	1.64x	160x

Table 1. Downloading a file in an ACE virtualized environment accelerated by Riverbed Steelhead Mobile produces dramatic results. File downloads are 22x faster and require less than 1% of the original bandwidth.

Conclusion

For enterprises considering a desktop virtualization strategy, Riverbed WDS products will enable users to have LAN-like application performance, while IT administrators can get the security and consolidation benefits of virtualization. Depending on the strategy in use, Riverbed can provide as little as 10% to 40% acceleration in fully centralized virtualized environments, but can be configured to provide five, 50, or 100x faster application access. In addition, Riverbed can offer 10x faster backup and replication of VM images, making distributed, virtualized environments a reality that can provide the best of all worlds.

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