

Use Cisco WAAS to Optimize WAN Delivery of Microsoft Windows 7 Virtual Desktops Using Microsoft RDP 7.1 (RemoteFX) and RDP 7.0

Cisco Wide Area Application Services (WAAS) Optimizes Delivery of Microsoft Windows 7 Virtual Desktops to Enterprise Branch-Office and Campus Locations

What You Will Learn

Cisco® Wide Area Application Services (WAAS) and Cisco WAAS Mobile with Microsoft Windows Server 2008 R2 Remote Desktop Services (RDS) and Hyper-V provide a scalable and comprehensive Microsoft Windows 7 desktop delivery solution from the data center to remote locations that increases deployment flexibility and allows IT to achieve the benefits of virtual desktop infrastructure (VDI)-based desktop management while improving user experience.

- This solution developed with joint collaboration between Cisco and Microsoft increases employee productivity by combining Microsoft's Virtual Desktop Infrastructure technologies with Cisco's WAN optimization technology.
- Cisco WAAS and Cisco WAAS Mobile provide Microsoft Windows 7 VDI (Remote Desktop Protocol [RDP] 7.0) traffic acceleration and compression and optimized branch-office printing.
- Cisco WAAS and Cisco WAAS Mobile improve user response times and deliver a better subjective user experience.
- Cisco WAAS and Cisco WAAS Mobile optimize Microsoft Windows 7 RDP multimedia redirection (MMR) for Microsoft Windows Media Player content.
- Cisco WAAS scales the number of supported campus and branch-office VDI users over the WAN and helps save bandwidth upgrade costs.
- Cisco WAAS and Cisco WAAS Mobile optimize Microsoft Windows 7 virtual desktops delivered over RDP 7.1 with Microsoft RemoteFX (preliminary testing results; based on Microsoft RemoteFX beta code).

Business Challenges

Desktop virtualization solutions such as Microsoft Windows Server 2008 R2 RDS and Hyper-V, offer new and powerful opportunities for IT to deliver and manage corporate desktops and to respond to users' needs in a flexible way.

Desktop OS migration from Microsoft Windows XP to Windows 7 presents IT with a unique opportunity to host desktops in the data center using VDI. By adopting VDI, IT can satisfy security and compliance mandates and also derive the benefits of increased flexibility in the deployment and management of the corporate desktop.

Most users of VDI-hosted Microsoft Windows 7 desktops reside in campus and branch-office locations that are connected to the data center using the WAN. The bandwidth and latency constraints imposed by the WAN limit the deployment footprint and thus the overall effectiveness of VDI solutions.

Customers face the following challenges in deploying virtual desktop solutions for the enterprise:

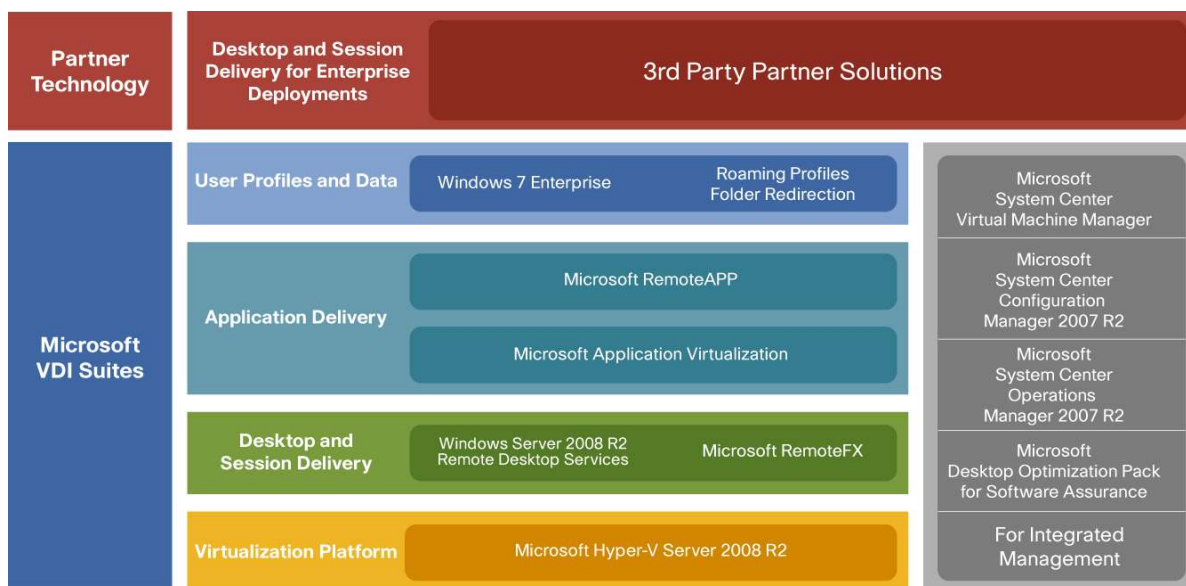
- Poor performance of VDI over the WAN, affecting employee productivity
- High bandwidth consumption, increasing solution costs

- Limited scalability, reducing the number of users that can be supported
- Poor performance of centralized printing and increased costs of printing at the branch office
- Corporate video-delivery challenges that limit employee training and learning options

Microsoft Windows Server 2008 R2 RDS and Hyper-V Overview

Microsoft Windows Server 2008 R2 considerably improves the platform and tool set for accelerating and extending desktop and application deployments to any device. In addition to the traditional session virtualization scenario that Microsoft Terminal Services enabled for many years, Microsoft Windows Server 2008 R2 now also provides an extensible platform for VDI, using Microsoft Hyper-V as the virtualization platform for Microsoft VDI solutions. VDI is a centralized desktop delivery architecture that allows customers to centralize the storage, operation, and management of a Microsoft Windows desktop in the data center. It enables Microsoft Windows 7 Enterprise and other desktop environments to run and be managed in virtual machines on a centralized server (Figure 1).

Figure 1. Microsoft VDI Solution



Cisco WAAS and Cisco WAAS Mobile Overview

Cisco WAAS is a comprehensive WAN optimization and application acceleration solution that is a crucial component of the Cisco Borderless Networks and Data Center architectures.

Cisco WAAS accelerates applications and data over the WAN, optimizes bandwidth, empowers cloud services, and provides local hosting of branch IT services, all with industry-leading network integration. Cisco WAAS allows IT departments to centralize applications and storage while maintaining productivity for remote branch-office and campus users.

Cisco WAAS Mobile extends Cisco WAAS Software application acceleration benefits to mobile employees who travel outside the branch office and to branch-office and mobile users who access applications hosted in public cloud environments.

Cisco WAAS enables organizations to achieve the following primary IT objectives:

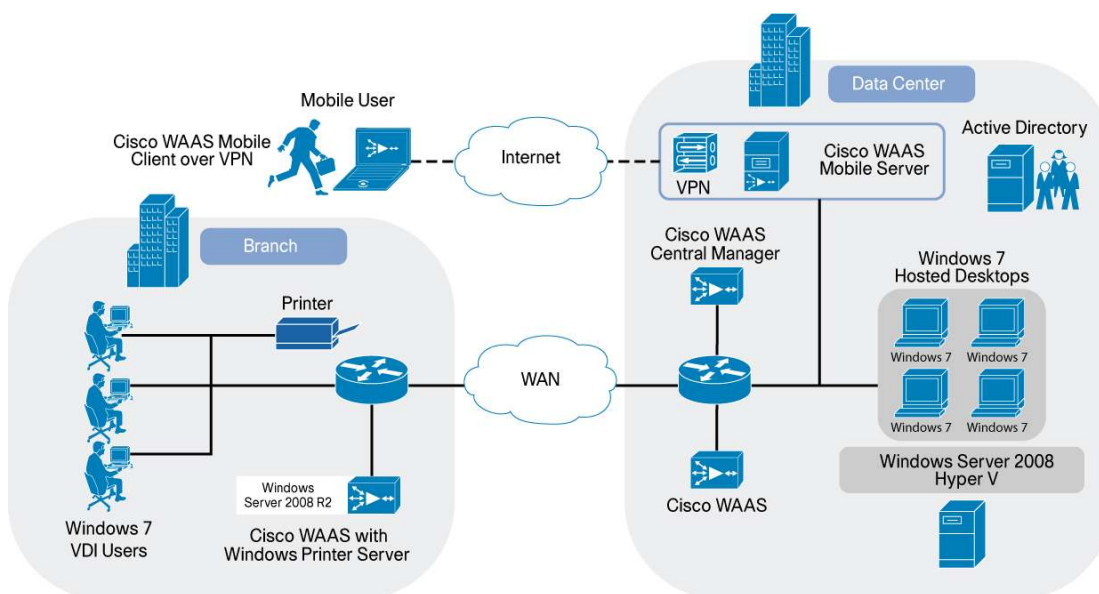
- Application acceleration: Improve the productivity of remote employees.
- IT desktop centralization using VDI: Lower desktop management costs and meet compliance and security mandates.

- IT branch-office and data center consolidation and WAN optimization: Reduce branch-office IT costs.
- Branch-office IT agility: Provide local branch-office IT services such as printing without additional servers.
- Migration of business applications to the cloud: Reduce infrastructure costs.
- Service agility: Lower operating costs (OpEx) with on-demand WAN optimization using:
 - Cisco WAAS Express (Cisco WAAS on Cisco IOS® Software on Cisco Second-Generation Integrated Services Routers (ISR G2) branch-office routers)
 - Cisco WAAS on Cisco Services-Ready Engine (SRE) Modules on Cisco ISR G2
- Simplified data protection: Ease compliance and business continuity.

Cisco WAAS and Microsoft Windows Server 2008 R2 RDS and Hyper-V Solution for Microsoft Windows 7 Delivery

Figure 2 shows the components of the Cisco WAAS and Microsoft Windows Server 2008 R2 RDS solution, developed with support from Microsoft and tested by Cisco.

Figure 2. Microsoft Windows 7 VDI Solution with Microsoft RDS and Hyper-V, Cisco WAAS, and Cisco WAAS Mobile



Microsoft Solution Suite: Virtualizes and Centralizes Desktops

- Microsoft Windows Server 2008 R2 RDS provides a common infrastructure for session virtualization and VDI and uses RDP 7.0 (for R2) or RDP 7.1 (in Service Pack 1) for desktop delivery.
- Microsoft Hyper-V on Microsoft Windows Server 2008 R2 provides the infrastructure to host virtual Microsoft Windows 7 desktops.
- Microsoft Active Directory provides user authentication.
- RDP 7.0 or RDP 7.1 with Microsoft RemoteFX provides display, print, and multimedia redirection.

Cisco WAAS: Improves RDP 7.1 with Microsoft RemoteFX and RDP 7.0 Performance and Reduces Bandwidth Demands

- Cisco WAAS Appliances deployed on both sides of the WAN optimize RDP 7.1 with Microsoft RemoteFX and RDP 7.0 traffic between the end users and the data center using a sophisticated combination of TCP flow optimization (TFO), which reduces the effects of the WAN, persistent session-based compression, and data redundancy elimination (DRE).

- The data center also hosts a Cisco WAAS Central Manager, which is used to manage the Cisco WAAS solution from a central point.
- The branch-office Cisco WAAS Appliance also provides print services locally to the branch-office users by running Microsoft Windows Print Services on the appliance.
- Cisco WAAS Mobile Software on mobile-worker laptop computers reduces the effects on the WAN through a combination of TFO, compression, and DRE. The Cisco WAAS Mobile headend device and the Cisco Adaptive Security Appliance (ASA) VPN device are located in the data center.

Testing Scenarios

This document presents solution benefits for remote users accessing their Microsoft Windows 7 VDI desktops in the data center.

The tests measured performance improvement (response time) and WAN bandwidth optimization (WAN data reduction) when branch-office and mobile users are running standard office productivity tasks on the VDI desktops, accessing video using MMR, and printing documents in the branch office.

Table 1 summarizes the activities and WAN bandwidth conditions.

Table 1. VDI Test Activity Details

User Type	Activity	Display Protocol	WAN Condition		
			Bandwidth	Round Trip	Packet Loss
Branch office	Log in and use email, web, and Microsoft Word and PowerPoint (10 users)	RDP 7.0	1.544 Mbps	80 ms	0.1%
	Access video using MMR				
	Print jobs in the branch office				
	Log in and use email, web, and Microsoft Word and PowerPoint (2 users)	RDP7.1 with Microsoft RemoteFX* (beta code)	10 Mbps	80 ms	0.1%
Mobile	Log in and use email, web, and Microsoft Word and PowerPoint	RDP 7.0	768 kbps	80ms	1.0%
	Access video using MMR				
	Log in and use email, web, and Microsoft Word and PowerPoint	RDP7.1 with Microsoft RemoteFX* (beta code)	1.5 Mbps	80ms	1.0%

* **Note:** Testing on RDP 7.1 with Microsoft RemoteFX is currently in progress. Preliminary test results based on two-user testing for RDP 7.1 with Microsoft RemoteFX are presented in this document. Testing results with more users will be made available after the RDP 7.1 with Microsoft RemoteFX testing is complete.

Solution Benefits

Performance Acceleration for Microsoft Windows 7 Display

The combined solution accelerates the performance of all applications accessed through Microsoft Windows Server 2008 R2 RDS such as Microsoft Exchange for email and calendaring, Microsoft Office for the use and sharing of Microsoft PowerPoint presentations and Microsoft Word documents, and Microsoft Internet Explorer 9 for browsing enterprise websites.

- Cisco WAAS accelerates VDI display performance by up to 44 percent (Figure 3) under light WAN use conditions.
- Cisco WAAS accelerates VDI display performance by up to 61 percent (Figure 4) under heavy WAN use conditions. Users experience response times that are more than twice as fast with Cisco WAAS. The morning and peak office work hours are the typical times when WAN links near congestion.

- Cisco WAAS performance benefits under both light and heavy WAN use conditions are similar, demonstrating that Cisco WAAS can provide consistent performance acceleration even as WAN link use increases due to increasing number of users.
- Cisco WAAS offers superior subjective user experiences such as faster menu drawing, Microsoft PowerPoint transitions, and screen updates under WAN use conditions.

Figure 3. Cisco WAAS Performance Acceleration under Light WAN Utilization

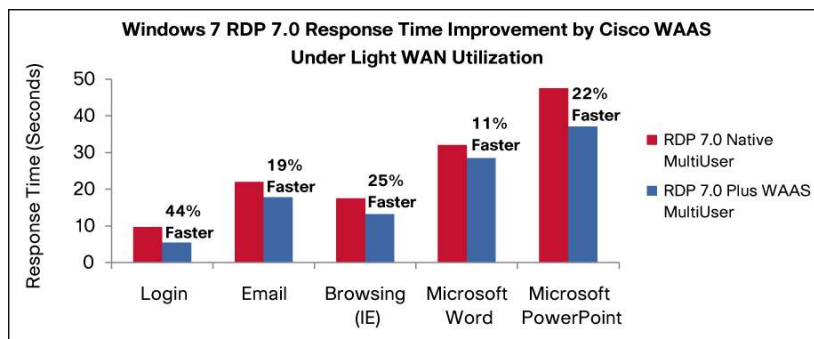
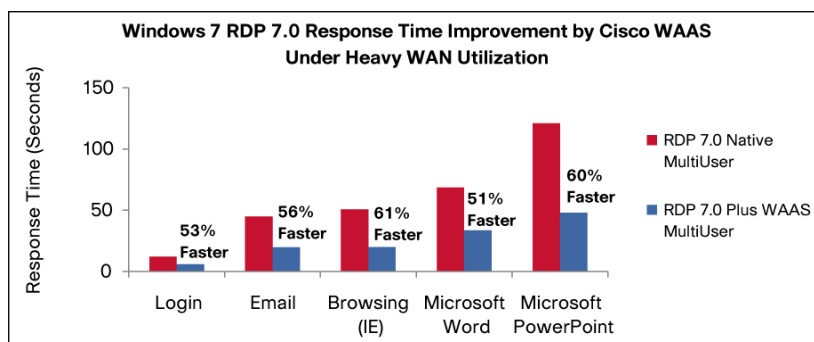


Figure 4. Cisco WAAS Performance Acceleration with Heavy WAN Use



Bandwidth Optimization for Microsoft Windows 7 RDP 7.0 with Microsoft RemoteFX

Cisco WAAS considerably helps save expensive WAN costs by reducing VDI WAN bandwidth consumption for desktop display

- Cisco WAAS reduces bandwidth use by up to 55 percent for RDP 7.0 display (Figure 5).
- Cisco WAAS reduces bandwidth use by up to 53 percent for Microsoft RemoteFX* display (Figure 6).
- Cisco WAAS Mobile reduces bandwidth by up to 67 percent for RDP 7.0 display (Figure 7).
- Cisco WAAS Mobile reduces bandwidth by up to 52 percent for Microsoft RemoteFX* display (Figure 8).

As the number of users in the branch office increases, the compression offered by Cisco WAAS improves as the DRE function finds repeatable display patterns across multiple user sessions and optimizes them.

Also, in actual production networks, the DRE disk cache builds up over several days and contains a much longer cache history, which can result in higher levels of compression in production deployments than the levels typically found in lab testing.

** Note: Testing on RDP 7.1 with Microsoft RemoteFX is currently in progress. Preliminary test results based on two-user testing for RDP 7.1 with Microsoft RemoteFX are presented in this document. Testing results with more users will be made available after the RDP 7.1 with Microsoft RemoteFX testing is complete.*

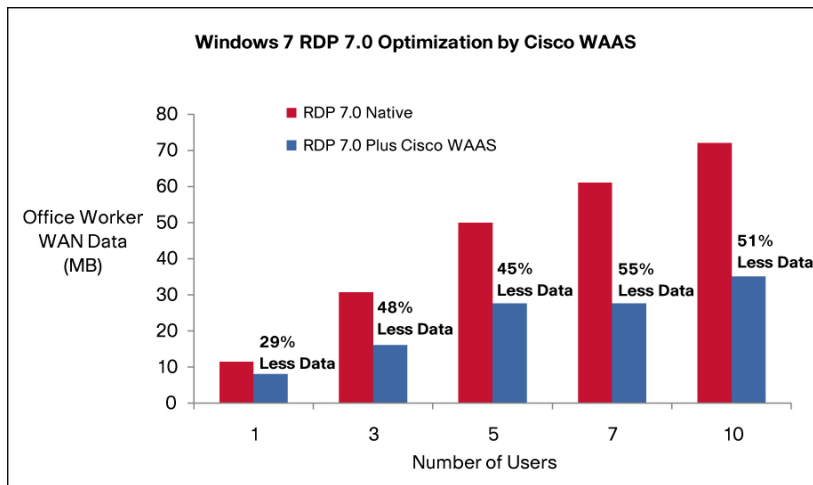
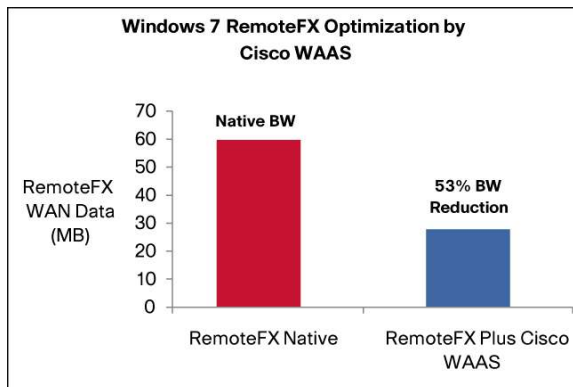
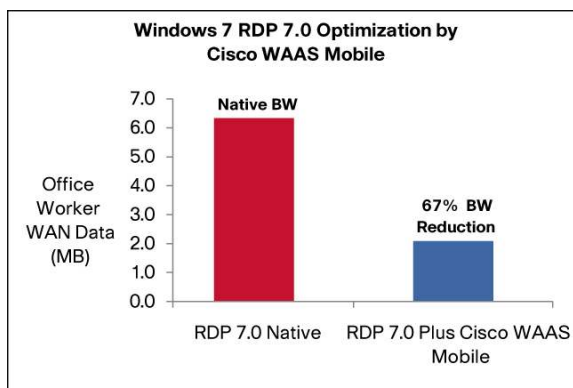
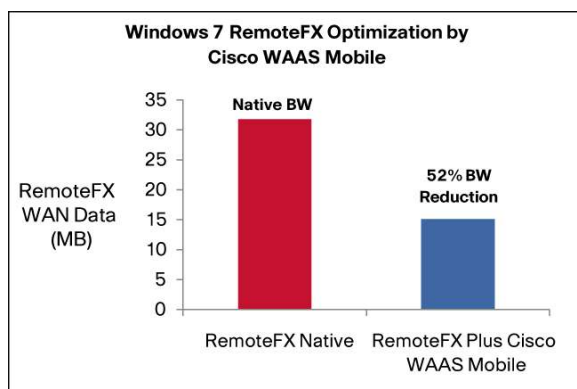
Figure 5. Microsoft Windows 7 RDP 7.0 Bandwidth Optimization by Cisco WAAS**Figure 6.** Microsoft Windows 7 RDP 7.1 with Microsoft RemoteFX Bandwidth Optimization by Cisco WAAS**Figure 7.** Microsoft Windows 7 RDP 7.0 Bandwidth Optimization by Cisco WAAS Mobile

Figure 8. Microsoft Windows 7 RDP 7.1 with Microsoft RemoteFX Bandwidth Optimization by Cisco WAAS Mobile

Bandwidth Optimization for Microsoft Windows 7 RDP 7.0 MMR-Based Video Delivery

RDP 7.0 supports multimedia-based redirection for Microsoft Windows Media Player. This support allows the VDI desktop to stream multimedia content directly to the client for rendering on the local client. This process offloads the VDI desktop and also eliminates the higher WAN bandwidth consumption associated with server-side video rendering.

Cisco WAAS and Cisco WAAS Mobile offer additional optimization for MMR-based Microsoft Windows media video delivery (video on demand [VoD]). These optimizations provide customers with a viable corporate video-delivery option for employee training and learning needs and reduces the need for costly WAN bandwidth upgrades.

- Cisco WAAS reduces bandwidth by up to 66 percent (Figure 9) for RDP 7.0 MMR.
- Cisco WAAS Mobile reduces bandwidth by up to 51 percent (Figure 10) for RDP 7.0 MMR.
- Cisco WAAS Mobile provides a better subjective user experience for MMR under high latency (200 ms) and lossy network conditions.

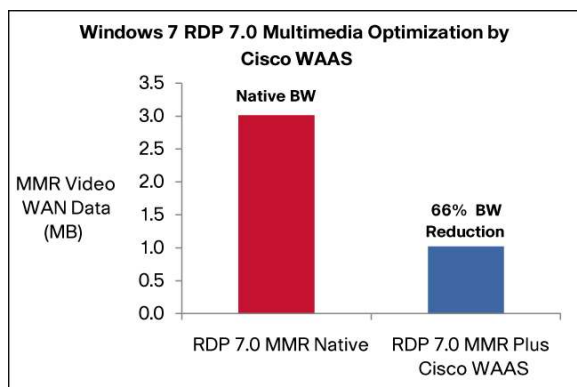
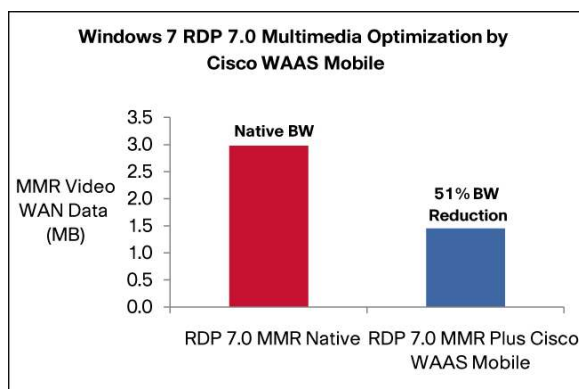
Figure 9. Microsoft Windows 7 RDP 7.0 MMR Optimization by Cisco WAAS

Figure 10. Microsoft Windows 7 RDP 7.0 MMR Optimization by Cisco WAAS Mobile

Optimized Printing

Customers face considerable challenges in printing in VDI environments because the printer at the branch office and the virtual desktop image at the data center are separated by the WAN. Cisco WAAS gives customers flexible choices so they can select the right print topology for their environments.

- Cisco WAAS accelerates centralized printing through print-specific optimizations, data reduction, compression, and TFO to provide up to 89 percent better performance (Figure 11) and more than 90 percent reduction in WAN bandwidth (Figure 12).
- Cisco WAAS provides a Microsoft Windows Print Server-based printing option on the branch-office Cisco WAAS appliances, saving the cost of additional servers at the branch office.

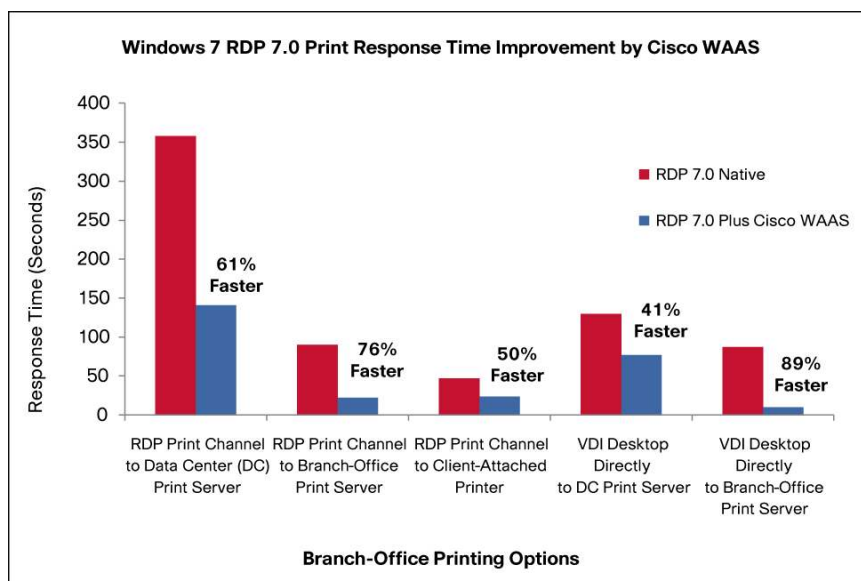
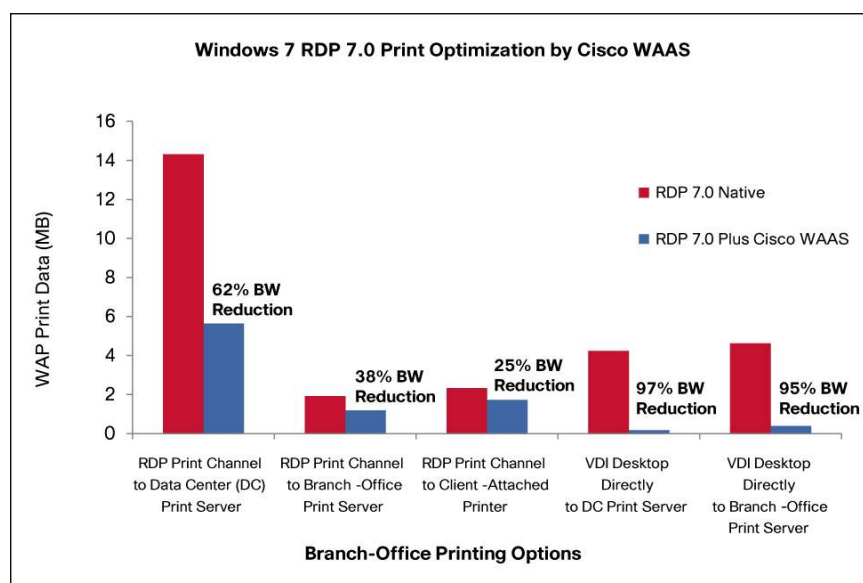
Figure 11. Microsoft Windows 7 RDP 7.0 Print Response Improvements by Cisco WAAS

Figure 12. Microsoft Windows 7 RDP 7.0 Print Optimization by Cisco WAAS

Scalability

Customers typically cannot support more than 5 to 10 users on a T1 link and provide display, print, and video to all these users. This limitation can restrict VDI adoption or require customers to buy more WAN bandwidth.

- Cisco WAAS increases the number of Microsoft Windows 7 VDI users that can be supported on a given infrastructure by two to three times.
- In production networks, this increase can be higher because multiple days of DRE cache history are available, which provides higher compression performance.
- Cisco WAAS provides uniform, scalable performance for all users. It provides a better subjective user experience than native RDP.

Business Benefits

The joint Cisco and Microsoft solution optimizes Microsoft Windows 7 VDI delivery and allows customers to achieve the benefits of VDI. In tests, the solution:

- Improved display performance by up to 44 percent under light WAN utilization
- Improved display performance by up to 61 percent during peak hours when the WAN is heavily used
- Improved printing performance by up to 89 percent and provided the option of a local print server hosted on the Cisco WAAS Appliance in the branch office
- Increased scalability, doubling or tripling the number of VDI clients (2x - 3x)
- Reduce costly WAN bandwidth requirements by up to 55 percent for display, 66 percent for MMR video, and more than 90 percent for printing

Recommendations

Cisco, with the support from Microsoft, has developed the solution presented in this document and has validated the results. This solution testing represents a best effort to create a realistic office worker scenario.

Cisco recommends that customers use the results presented in this document to implement optimized and scalable desktop delivery solutions. These solutions have the potential to lower bandwidth costs, improve the user experience, and provide the benefits of a VDI-based desktop deployment.

Cisco and Microsoft intend to continue to work together to optimize virtual desktop delivery in the enterprise.

For More Information

- Cisco Application Networking Services for Microsoft: <http://www.cisco.com/go/optimizemicrosoft>
- Cisco WAAS Software product information: <http://www.cisco.com/go/waas>
- Microsoft Windows Server 2008 R2 Remote Desktop Services: <http://www.microsoft.com/rds>



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