WHITE PAPER

Addressing WAN Optimization in the Integrated Services Router

Sponsored by: Cisco Systems

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EXECUTIVE SUMMARY

The emergence of WAN optimization in recent years has resulted in significant gains to the enterprise in terms of application performance, reduced network costs, and improved employee productivity and customer satisfaction. To date, the majority of WAN optimization efforts have been concentrated in branch deployments and have not been rolled out more broadly in office headquarters or in the data center, in part due to the fact that the first generation of WAN optimization products were available primarily as dedicated appliances. One of the primary drivers of WAN optimization was to deliver applications centrally located in a data center to branch offices with the same efficiency and speed with which they were delivered at an organization's headquarters.

IDC research has found the demand for WAN optimization to be broad based among a large variation in the types of users, types of traffic patterns, and geographical mix of remote offices. As a result, in addition to evaluating the immediate benefit of WAN optimization, customers evaluate a number of factors within their own unique network configuration, including the cost to deploy and manage appliances as well as their relationships and contractual obligations with service providers.

To bring the benefits of WAN optimization to users throughout the entire network, Cisco provides a family of Wide Area Application Services (WAAS) offerings. Designed to optimize network service delivery in a range of form factors, they include dedicated hardware appliances, WAAS on Network Modules for Integrated Services Router (ISR), and WAAS Mobile software. These offerings are joined by the latest additions to the WAAS product portfolio: WAAS on Services-Ready Engine (SRE) for the next-generation ISR (Integrated Services Router G2), Virtual WAAS Software for VMware ESX/ESXi, and WAAS Express, which are software-based solutions that allow companies to deploy WAN optimization to a broader range of deployment options and use cases.

IN THIS WHITE PAPER

This paper describes some of the challenges facing IT managers today, the business drivers behind WAN optimization, and Cisco's WAAS product portfolio. It was developed for companies that are evaluating ways to optimize their network bandwidth usage and that may benefit from deploying WAN optimization in a more broad-based way throughout their network. It is based on ongoing IDC research and analysis, as well as in-depth discussions with two Cisco customers that have implemented router-integrated WAN optimization offerings. The paper describes

the benefits these customers realized by implementing Cisco WAAS, including the ability to gain improved utilization and cost savings through WAN optimization, along with the benefits of streamlined feature and device management of integrating with the Cisco network.

SITUATION OVERVIEW

The network has become the central foundation of many IT operations. Despite the slow economy — indeed because of it — enterprises need IT solutions that help them improve customer service while cutting overall operating expenses. And as competition in the marketplace heats up, it is becoming increasingly important for enterprises to deliver IT solutions not just to employees at headquarters but also to employees in branch offices across the enterprise network. This is because the branch office is the location where the organization is closest to the customer.

IDC finds that the top networking trends for organizations in the remote branch are upgrading the network equipment to optimize the WAN traffic and increasing application response time. This means either installing WAN optimization appliances or upgrading the installed router to achieve this goal. Additionally, customers plan to upgrade the bandwidth available to the remote branch. Employees in branch offices and at headquarters require access to the same corporate data, including voice over IP (VoIP), financial and business applications housed at the corporate data center, and cloud-based Web applications such as CRM tools, sales enablement, and Web conferencing. Unfortunately, it is difficult to deliver network services across large-scale WANs that have the same levels of data and application access as those that are delivered across a headquarters LAN.

Growth in IT Infrastructure Optimization Places Burdens on the WAN

There has been a strong trend for enterprises to consolidate their IT resources into centralized data centers. This trend has been driven by a number of factors, including cost savings, security, and disaster recovery. While consolidation has brought operational benefits and cost reduction, it has also come at a price in terms of application bandwidth expense, application performance, and geographic performance inconsistency.

Even as consolidation has placed greater pressure on the WAN, enterprises are looking to change the way their WAN has been traditionally used. Employee traffic patterns are moving away from traditional hub-and-spoke networks dictated by centralization of IT resources and toward a new dynamic communication that takes into account the needs for employees to have high-performance application access regardless of their location.

Cloud-Based Services, Virtualization, and Server-Centric Computing

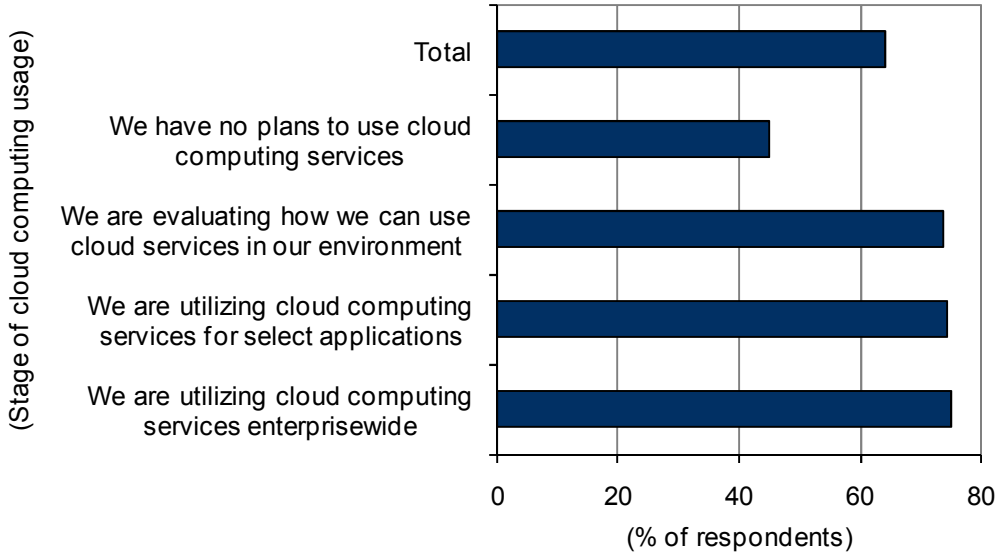
Other factors influencing application performance are growth both in cloud-based services and in virtualization. The adoption of cloud computing, which IDC expects to grow to $44 billion by 2013, promises to improve the agility, efficiency, and

cost-effectiveness of IT operations for the enterprise. However, as a greater number of applications are delivered via the cloud, the performance demands on the WAN increase. End-user experience can deteriorate and bandwidth utilization can increase because application data must now traverse the WAN. IDC's recent *Enterprise Communications Infrastructure Survey* found that three out of four customers that are using cloud computing are looking to incorporate application acceleration into the network (see Figure 1).

FIGURE 1

Cloud Adoption Driving the Use of Application Acceleration

Q. How important is integrating application acceleration products/feature sets into your network architectures?



n = 216

Source: IDC's *Enterprise Communications Infrastructure Survey*, 2010

Similarly, the trend toward desktop virtualization and server-centric computing also increases the dependence on the WAN. Desktop virtualization has helped reduce costs and simplified management of users' desktops. Server-centric computing solutions such as Citrix application virtualization and Microsoft Terminal Services provide great freedom and flexibility to companies, enabling consolidated management of systems by remote employees and giving employees access to mission-critical applications and servers while on the road. Both solutions, however, depend on data transfer across the WAN, further adding to the WAN workload and increasing the criticality of WAN performance.

Effects of Globalization and the Distributed Workforce on the WAN

The globalization of business introduces additional stresses on the WAN. It has become common for enterprises to locate all critical business functions in geographically remote locations. A company could have its headquarters in the United States, with customer service handled in India, manufacturing in China, and R&D in Eastern Europe. For such a globalized business, WAN performance is business critical, as employees in each region require the same level of application performance as employees sitting near the data center.

As companies become more globalized, their workforces are becoming more distributed as well. A larger percentage of the workforce operates remotely from branch offices or from home, while managers, sales representatives, and other knowledge workers are spending increasing amounts of time on the road. All of these employees require high-performance access to corporate applications and data, regardless of their location.

Bandwidth Costs/Carrier Relationships

As the amount of data carried by the WAN and the importance of meeting application service-level agreements increase, the importance of bandwidth costs and relationships with carriers increases as well. With escalating bandwidth usage come increased costs, which organizations must manage as best they can.

Further, with greater globalization, as businesses venture further afield from their home markets, they must enter relationships with a greater number of carriers. Often, per-megabit bandwidth costs are highly inconsistent from region to region or country to country, and businesses find that the treatment they receive from carriers in remote markets is not as favorable as the treatment they receive in their home markets.

Expanding WAN Optimization from the Data Center Throughout the Enterprise

The upshot of these trends is that WAN bandwidth has become a scarce resource within the enterprise, the costs of provisioning and maintaining bandwidth are high, and guaranteeing network/application performance has become more of a challenge. Businesses are now looking to WAN optimization solutions, essentially products that optimize WAN communications, to increase network performance and throughput while reducing costs to the enterprise. Typically, WAN optimization products compress data streams, monitor traffic flows, prioritize traffic, optimize bandwidth, and provide file caching. They also optimize and accelerate the performance of particular applications.

Enterprise customers have been rapidly adopting WAN optimization, reflected by the fact that the market has grown to over $1 billion in size and is expected to generate about $1.5 billion in revenue by 2014. This growth is in spite of the fact that most of the WAN optimization technology released to date has been best suited for data center deployments, and there has been little deployment of WAN optimization solutions to remote branch offices, despite the obvious need for them there.

As vendors release products better suited to branch office deployments and more enterprises implement them remotely, the benefits to the organization will increase exponentially. These products tailored for the branch not only will contribute to reducing operational/bandwidth costs but also will improve application service levels. This in turn will lead to improved employee and user productivity and greater customer satisfaction as front-line employees realize better performance when accessing critical corporate applications.

CISCO ROUTER-INTEGRATED WAN OPTIMIZATION SOLUTIONS

Cisco is one company that has introduced solutions to address these challenges. Cisco has been providing WAN optimization offerings as part of its overall Application Networking Solutions portfolio that covers both the branch and the data center for a number of years. Cisco's Application Velocity Network Services — a key part of Cisco's Borderless Network architecture — is designed to provide networkwide, fully integrated application intelligent technologies designed to optimize networking and application delivery across the enterprise network and incorporates visibility features and technologies like Network Based Application Recognition (NBAR), Network Analysis Module (NAM), Service Advertisement Framework, and other optimization technologies like performance routing (PfR). Because Cisco WAAS provides the bridge between the data center and the remote branch, it is also a critical component of the Cisco Data Center Business Advantage, Cisco's vision for next-generation data center technology.

Cisco offers WAN optimization technology known as Wide Area Application Services. Cisco WAAS offers a variety of form factors that provide different features and functions, price points, and scalability to adapt to a variety of customer needs.

Cisco WAAS is an application acceleration and WAN optimization solution designed to optimize the performance of any TCP-based application operating over a WAN. WAAS Software contains optimization features at both the transport and the application layers and can be deployed in a variety of environments, integrated either as a software-based solution or as hardware-based appliances.

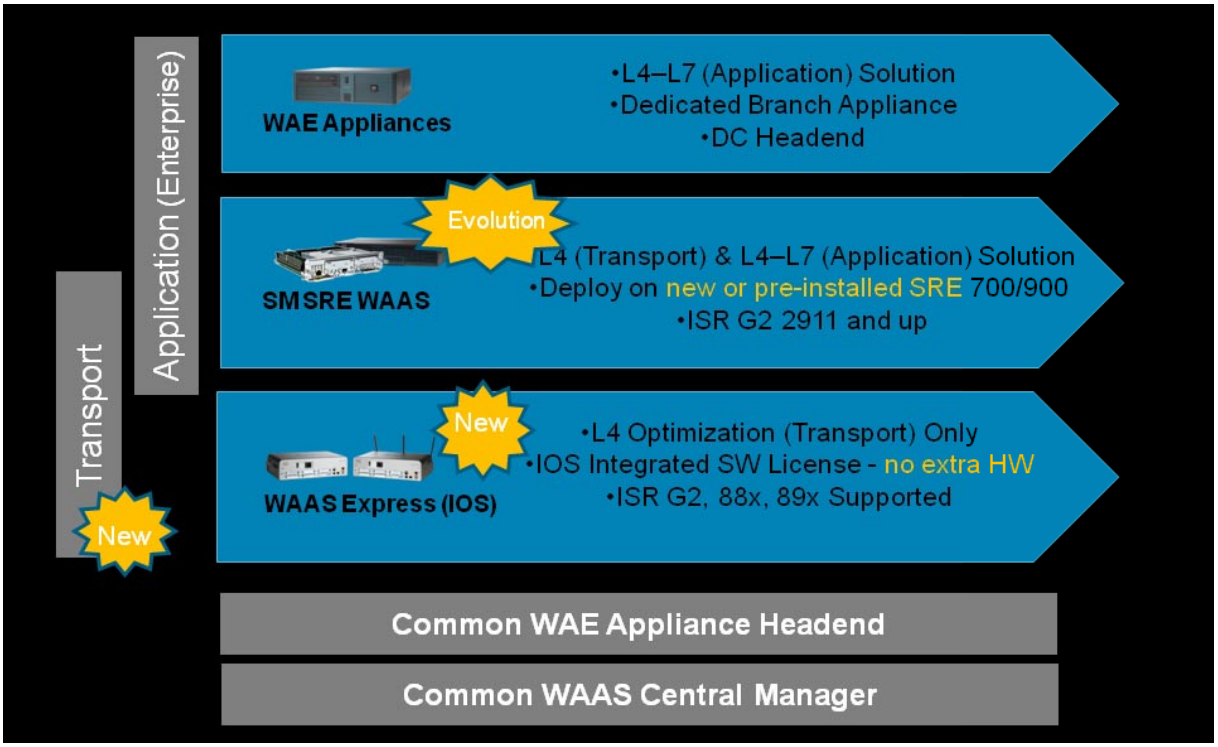
For hardware-based appliances, Cisco WAAS offers the Wide Area Virtualization Engine (WAVE) and the Wide Area Application Engine (WAE). With dedicated processors, memory, and virtualization engines, they are designed to handle highly complex environments in terms of application/data complexity and are more complex to deploy. They perform WAN optimization focused on Layer 4 to Layer 7 (application layer) and host Windows Services through virtualization components at the branch; moreover, these appliances are positioned for data center headend and large dedicated branch deployments.

With its latest product releases, Cisco is continuing to innovate its WAAS product offerings for a wider range of deployments and use cases. These offerings include WAAS on SRE for the ISR G2 router, released at the end of 2Q10, and WAAS Express, released in 3Q10. Both are WAAS Software–based products. These two new products are intended to complement Cisco's line of WAE appliances by

enabling WAN optimization deployments into branch office environments with relatively low application and data complexity and require simple deployment. For a graphic depiction of Cisco WAAS product line positioning, see Figure 2.

FIGURE 2

Cisco Router-Integrated WAN Optimization Portfolio for Branch



Source: Cisco, 2010

WAAS on SRE

WAAS on SRE is a router-integrated hardware module–based method of deploying WAN optimization services. Cisco SRE modules are high-performance router blades for Cisco ISR G2 that have their own processors, storage, and network interfaces and that provide the capability to host Cisco, third-party, and custom applications. SREs can run a number of services, including network monitoring, network management, collaboration, and security services, all deployable on the same module.

Cisco has been offering WAN optimization using hardware modules on the router since 2004. What's new with WAAS on SRE is that customers can deploy WAN optimization as an on-demand software module. As a software-based component, WAAS on SRE runs on general-purpose Services-Ready Engine hardware, which means customers can get the benefit of WAN optimization directly in the router without requiring a dedicated network module. This increases the flexibility and deployment options for WAN optimization deployment.

Flexible Deployment Options

With WAAS on SRE, enterprises have a more flexible set of deployment options, including:

- **Deploy router with SRE and WAAS preloaded.** For customers that know they want to take advantage of WAN optimization from the outset, routers can be shipped with an SRE module already installed and WAAS preloaded.
- **Deploy WAAS remotely on a blank SRE.** Routers can be purchased and configured with blank SREs, which leave headroom for future growth and deployment options. When the enterprise decides it needs to implement WAN optimization into particular portions of its network, it can deploy WAAS remotely onto the blank SREs of the required routers as a software deployment, saving the costs of a truck roll.
- **Replace current application remotely with WAAS.** Customers currently running other services on their SREs can replace those applications with WAAS. This can be conducted remotely from a central management console.

Centralized Management, Choice of Blade Hardware

To simplify management, Cisco provides a variety of ways for customers to manage their WAAS on SRE deployments. In addition to integrated router management via command line interfaces and scripts, WAAS on SRE can be managed using GUI-based tools such as Cisco Configuration Professional (CCP) for single-branch deployments, CiscoWorks LAN Management Solution (LMS) for larger deployments, and WAAS Central Manager as part of the WAAS central management tool. These tools enable organizations to manage hundreds of sites from a central location.

Cisco offers its customers a choice of two SRE blade hardware options to handle different size workloads: The 700 SM has a single-core processor and scales up to 500 TCP connections with up to 20Mbps WAN bandwidth, while the 900 SM has a dual-core processor and is designed for up to 1,000 TCP connections and up to 50Mbps WAN bandwidth.

WAAS Express

WAAS Express is an even more fundamental disruption of the WAN optimization model. Unlike WAAS on SRE, which enables WAN optimization to be deployed as a software layer onto a general-purpose hardware module, WAAS Express incorporates WAN optimization technologies directly into the Cisco IOS. WAAS Express became generally available in the third quarter of calendar year 2010.

WAN Optimization Incorporated Directly into IOS

Cisco WAAS Express is a key component of the Cisco WAAS product portfolio and extends the Cisco WAAS product portfolio with an IOS-based software solution integrated into the ISR G2 that offers bandwidth optimization and application acceleration capabilities. With its small footprint, Cisco WAAS Express is designed to be a cost-effective WAN optimization solution and to increase remote user

productivity, reduce WAN bandwidth costs, and offer investment protection by interoperating with existing Cisco WAAS infrastructure.

Cisco WAAS Express is designed to provide network transparency, improve deployment flexibility with on-demand service enablement, and integrate with native IOS-based services such as security, NetFlow, and QoS. It is interoperable with WAAS on SRE modules and WAAS appliances and can be managed by a common WAAS Central Manager.

The WAAS Express model follows the evolution of other router-based functionality. Technologies such as security and VoIP started outside the router as network overlays provide via dedicated devices, then migrated into the router as blade-based technologies, and ultimately have been incorporated into the IOS. WAAS Express represents the corresponding step in WAN optimization.

Focused on Layer 4 (network layer) optimization, WAAS Express incorporates key bandwidth optimization and application acceleration technologies, including compression, TCP optimization, autodiscovery, and data redundancy elimination. It is a key component of the Cisco WAAS product portfolio and extends its WAN optimization solution across the entire ISR G2 family.

Cisco WAAS Express is designed to provide cost-effective IOS-based WAN optimization that increases the amount of available bandwidth for small to midsize branch offices and remote locations while accelerating TCP-based applications operating in a WAN environment. It natively uses the capabilities of IOS software integrated into the ISR G2 product family. Because it is integrated into IOS, it offers a small-footprint, cost-effective solution that transparently integrates into the ISR G2 product family.

Since it is part of the router IOS, WAAS Express does not require dedicated hardware and can scale to routers throughout the organization, even small branch office routers. With WAAS Express, the administrator sets up WAN optimization policies as a deployment option during router configuration, similar to setting up TCP policies, all handled via a simple command line prompt. WAN optimization can be treated as a standard router feature that can be turned on and off as the administrator sees fit.

WAAS Express can be controlled centrally through a WAAS Central Manager from the headend and is the lowest-cost alternative that Cisco offers for use in branch offices. Cisco is positioning WAAS Express toward branch office applications and use cases with the lowest levels of application/data complexity and deployment complexity, while the dedicated hardware of WAAS on SRE and WAE appliances enables them to handle higher levels of application and deployment complexity.

ADDRESSING CUSTOMER CHALLENGES WITH ROUTER-INTEGRATED WAN OPTIMIZATION

To understand customers' perspectives on WAN optimization and their experiences implementing Cisco WAAS, IDC interviewed two early adopters of WAAS Express and WAAS SRE: a North American chain of drugstore retail outlets and a European-based, highly diversified multinational industrial equipment manufacturer.

North American Drugstore Retailer Extends the Life of Its Network

The North American retailer interviewed for this study initially implemented Cisco WAN optimization several years ago. The retailer offers a photo printing service in which customers can upload their photos on its Web site and have them printed at their local retail location. Even with image compression technology, the amount of bandwidth required by the images was becoming very large.

About two years ago, looking to defer capital costs required to upgrade its network to handle the necessary capacity, the company decided to implement WAN optimization in its data center. After evaluating several WAN optimization vendors, it decided upon Cisco due to its leadership in the space. "We thought it was a safer bet that Cisco would stand behind their product and support it over time," commented the retailer's Director of IT. "We wouldn't want to buy from a company for whom that is not their focus."

With its latest network refresh, the retailer made the decision to implement WAAS SRE at individual store locations, which will help alleviate the network load at each location and facilitate store-to-store data transfers. It is currently in the process of rolling out WAAS SRE modules into store locations throughout its network.

The company credits its experience with WAN optimization with helping it extend the life of its network and notes that if it extends the life of the network by even a year, then the WAN optimization technology more than pays for itself. In the words of the Senior Manager, "WAN optimization is something all organizations need to look at; it is a logical approach to extending the life of networks."

Major Multinational Sees Significant Boost in Network and Application Performance

A European-based multinational with over 100,000 employees in over 1,000 offices in more than 100 countries around the world is highly dependent on its network to deliver applications that are critical for employees to perform their job functions. Finding its application performance lacking, the company decided that it needed "help" in terms of boosting performance across the network.

The company considered an application-by-application approach, but the complexity of managing a different solution for each application it supported was prohibitive. Instead, it opted for a single WAN optimization technology so that it could cover the needs of all applications.

The company has deployed Cisco WAAS appliances into 65 "hopping points" — main locations in each country or key region — and has seen significant improvements in application performance and user experience in terms of both metrics tracked and anecdotal user feedback. The project has been so successful that it is planning to deploy the technology into another 100–200 offices, and this second phase is likely to be on WAAS SRE and/or WAAS Express.

The bottom-line benefits have been impressive. The company credits Cisco WAN optimization for reducing its WAN costs and deferring investment in network upgrades. It estimates that WAN optimization has enabled it to reduce the frequency of new WAN investments by a full 50%. The Lead Group Services Manager commented, "We are very happy with Cisco WAAS. It has helped us significantly improve our network and application performance while reducing our overall costs." Looking ahead, the company is planning to expand services to mobile and remote end users while reducing costs and streamlining data center operations.

OPPORTUNITIES AND CHALLENGES FOR CISCO

IDC sees several opportunity areas for both Cisco and its customers as the vendor broadens its WAN optimization offerings:

- **For Cisco — expanding the market.** Partly due to the cost and complexity of current-generation WAN optimization solutions, most WAN optimization efforts are concentrated in the largest remote branch offices. By expanding its offerings to include products whose price, form factor, scalability, and ease of deployment are better suited to branch office deployments, Cisco can increase the total available market for WAN optimization.
- **For customers — realizing greater benefits.** Similarly, customers that currently do not take advantage of the benefits of WAN optimization or that deploy it only in a limited number of remote branch offices can now realize the benefits of WAN optimization in a broader range of use cases. This can help them achieve reduced operating bandwidth costs for items such as bandwidth and server deployment and maintenance, reduced capital expenditures for servers and new networking hardware, greater user productivity due to better network and application performance, and improved customer satisfaction due to better network and application performance.
- **Deployment complexity and reduction in appliances.** Cisco has an opportunity to enable customers to reduce the number of devices at the remote branch. With the Integrated Services Router and WAAS Express, the dedicated hardware is eliminated for those branches that cannot manage a dedicated hardware appliance or would rather save the space at the branch. Moreover, with WAAS on SRE and WAAS Express, deployment is simplified since it is integrated within the router and IOS.

IDC sees a number of challenges for Cisco in this area as well:

- **Overcoming customer reluctance.** Most enterprises consider their network to be mission critical and are hesitant to "crack open" and modify routers that they perceive to be working just fine. Cisco will need to overcome the perception in customers' minds that modifying routers currently carrying mission-critical enterprise traffic to upgrade with WAAS would be too difficult or risky to warrant the effort. It will need to demonstrate that the upgrade itself is simple, seamless, and low risk and will not cause performance problems in their network.

- **Keeping up with changing technology.** The variation of customers' WAN traffic patterns and unique cloud services and application types means that customers' optimization requirements will continue to change over time. Data center transformation and cloud computing will continue to evolve over the next decade, and Cisco will have to provide the network intelligence to keep pace. Cisco will need to leverage its WAN expertise and router installed base to deliver solutions that enable customers to continue to benefit from data center transformations now and into the future.
- **Building a track record in the branch office market.** Cisco will need to build upon its reputation of providing WAN optimization for more complex data center needs and establish a track record of successful customer implementations within the lower-end branch office market. Such customers can act as lighthouse reference customers as Cisco increases penetration in this market and can serve to demonstrate how branch offices and lower-end implementations can benefit from WAN optimization.

CONCLUSION

Enterprises have become increasingly dependent on their networks to deliver applications and data access to users throughout their organization, not only at corporate headquarters but also to branch offices and locations around the world. As employees become increasingly dependent on access to applications to perform their job functions, it is paramount that WANs provide the highest level of performance possible.

Cisco WAAS is a family of WAN optimization products designed to improve application performance over enterprise wide area networks. It includes dedicated appliances designed to optimize network traffic at the data center as well as the newly released WAAS on SRE, a router-integrated WAN optimization offering that can be installed on ISR G2 branch office routers, and WAAS Express software-based WAAS offerings on ISR G2 — all of which can be managed centrally with the WAAS Central Manager.

IDC spoke with two Cisco customers that have adopted Cisco WAAS and are early implementers of WAAS on SRE. These customers have realized a number of business benefits from the technology, including extending the life of their network infrastructure and providing improved application access to their end users. Any enterprise looking to provide the best possible experience to users throughout the organization could benefit from examining and adopting WAN optimization technology.