White Paper

Cisco IWAN Application Optimization: Increase Productivity While Deferring Bandwidth Upgrade Costs

New Application Deployment Models Add to Bandwidth Challenges

Companies experiencing steady year-over-year growth often grapple with the amount of application bandwidth available for branch offices over their WAN. Today, line-of-business managers now seem to tap into the cloud directly—often through their corporate networks—to launch new applications with the swipe of a credit card.

Software as a service (SaaS) and public clouds make it possible for them to do so easily on their own without consulting the rest of the business, and this situation has resulted in the proliferation of media-rich applications. The rapid increase in the number of devices connecting to corporate networks—along with other trends such as bring-your-own-device (BYOD) environments, guest access, and the Internet of Things (IoT)—add to the bandwidth demands that IT is trying to address.

As a result, application bandwidth at branch offices has become a major topic for many businesses. Factors include application performance as newer applications consume more bandwidth as well as escalating carrier costs as enterprises are forced to purchase additional connections.

Network connections bog down because the existing bandwidth at branch offices is not sufficient for the rate of traffic. Traffic jams ensue, and users complain (to IT, of course) about slow performance. While the business units that added the applications that cause the traffic jams are demanding more bandwidth, they also are demanding reduced costs. Yes, they want their applications to move at the speed of light, but at the same time they don't want to pay for premium network connections. They also view network latency as a critical performance metric, knowing that high latency equals poor application responses and leads to poor end-user productivity.

Thus, the need to optimize application traffic to efficiently handle high-bandwidth software has reached the critical stage—especially with the greater majority of employees now working in branch offices, and most customers are served from these locations. Although low-cost Internet connections have increased in reliability and are more economical compared to dedicated links, companies still need to enable application optimization that allows them to intelligently manage WAN capacity with real-time network status as well as accelerate and prioritize the most critical applications to meet user expectations. This situation makes it possible to effectively take advantage of the less-expensive bandwidth and to avoid compromising application performance, availability, and security.

An Application-Centric Approach Is Required

Taking an application-centric approach to solve the bandwidth challenge is particularly important given IT is under pressure to deliver on business outcomes. IT needs to overcome the network complexity that has come with device and topology management, and instead shift to a policy-based model constructed upon application and user priorities.

Cisco helps enterprises mitigate the application bandwidth challenge through the Cisco® Intelligent WAN (IWAN) architecture. As the volume of content and applications traveling across networks grows exponentially,

organizations can optimize their WAN investments through the four-pillared, application-centric approach provided by Cisco IWAN:

- **Transport-independent connectivity:** A dynamic, multipoint VPN-based overlay across all available connectivity points provides one network with a single routing domain. This domain can be easily multihomed across different connection types, including Multiprotocol Label Switching (MPLS), broadband, and cellular. Enterprises gain the flexibility to use any available connectivity platform and can add or replace network connections without modifying the network architecture.
- **Intelligent path control:** With Cisco Performance Routing (PfR), Cisco IWAN improves application delivery and WAN efficiency. Cisco PfR dynamically controls data-packet forwarding decisions by analyzing application types, performance, policies, and path status.
- **Application optimization:** This pillar features advanced network services that provide visibility into application performance, help optimize WAN link performance, and offload the WAN with intelligent caching:
  - Cisco Application Visibility and Control (AVC): A suite of services in Cisco network devices that provides application-level classification, monitoring, and traffic control
  - Cisco Wide Area Application Services (WAAS): A software- and hardware-integrated, cloud-ready WAN optimization and application acceleration solution
  - Akamai Connect: A fully integrated solution from Cisco and Akamai that provides next-generation optimization by combining best-in-class WAN optimization and intelligent caching
- **Secure connectivity:** Cisco IWAN enables IT to send traffic over the public Internet by taking advantage of varying VPN, firewall, network segmentation, and security features.

Cico IWAN solves the challenge of creating a secure, reliable, and optimized WAN fabric by delivering uncompromised user experiences over any connection—desktop, laptop, and all mobile devices. By taking an application-centric approach to networking, Cisco IWAN also promotes better business outcomes, which lead to improved application experiences, lower costs, and IT simplicity as well as security and threat defense.

Initial Steps for Optimizing WAN Traffic

Cisco IWAN enables IT to maintain a high-quality experience despite the changes in how applications are delivered—migrations to the cloud, data center consolidations, and the adoption of SaaS. Cisco IWAN also addresses the needs of the new business models that require the digitization of the enterprise, which results in more bandwidth-intensive, latency-sensitive applications such as video. These new business models also generate huge growth in HTTP traffic, especially with respect to mobility and the BYOD trend.

The IWAN architecture helps enterprises take the initial steps to streamlining WAN traffic through three key application-optimization attributes:

- **Network visibility:** The first step to optimize application traffic is to understand what is running on the corporate network: IT needs to know when new applications are deployed. IWAN solves this challenge by providing comprehensive Layer 7 application-level visibility and control that uses technologies such as deep packet inspection. To generate a visualization of what's on their network, enterprises can export data from their routing platform to management and visualization tools such as Cisco Prime™ Infrastructure products as well as the Cisco third-party ecosystem, including the following vendors:
  - LiveAction: LiveAction software
  - Glue Networks: Gluware

    - Plixer: Scutinizer
    - CA Technologies: Network Flow Analysis
    - InfoVista: 5View Application Usage Manager
- **Quality of service (QoS):** Another important component of the IWAN architecture is QoS. After IT gains visibility into all applications running over the WAN, it can apply QoS policies to each application while working within the confines of the existing WAN. This network service helps ensure the WAN is carved up intelligently and that each application receives the proper access priority.
- **Path control:** This attribute steers application traffic based on a combination of QoS policies and real-time traffic conditions. As is the case with QoS, the visibility provided by Cisco IWAN allows enterprises to steer traffic intelligently based on the measured performance of the network rather than just server reachability. For example, many branch offices deploy a backup connectivity pipe that's activated only if the primary pipe is down. But with intelligent path control, enterprises can keep both pipes active at the same time to increase capacity. Low-cost Internet circuits can be used because Cisco PfR helps ensure the links meet the requirements of any of the applications sent over the links.

These application-optimization capabilities deliver value because although bandwidth costs do tend to decrease over time, the rapid growth in traffic still accelerates bandwidth needs that exceed many corporate budgets. QoS and path control alone cannot solve the challenges of application traffic bursts and latency problems. If there are constraints, such as a brownout, enterprises also need to prioritize their traffic with the limited bandwidth capacity they already have.

Taking WAN Optimization to the Next Level

By applying WAAS and Akamai Connect **traffic optimization** principles—TCP optimization, data compression, and data-redundancy elimination—Cisco IWAN allows enterprises to make even better use of their available bandwidth. End users will think T1 links perform just as well as 10 Mbps cable circuits or that IT has brought the application back to their local branch office. Some end users may even think IT has upgraded the circuit bandwidth.

That's because Cisco WAAS and Akamai Connect application-optimization services effectively reduce the WAN bandwidth consumption of applications, allowing enterprises to squeeze more out of their existing pipe while maintaining the ability for applications to travel at normal speeds. Instead of buying point solutions reactively to overcome application problems for the short term, IWAN allows enterprises to proactively plan ahead for new applications and unexpected usage spikes.

The next step in elevating WAN optimization is the Cisco IWAN use of Layer 7 **application-specific optimizers**. These optimizers increase the transport speed of high-demand chatty traffic such as Messaging Application Programming Interface (MAPI) for Microsoft Exchange, Server Message Block (SMB) for Microsoft file sharing, and Citrix ICA for virtual desktop infrastructure.

Cisco WAAS Layer 7 optimizations provide latency-mitigation techniques to chatty applications such as the ones listed previously. Some of these techniques include prefetching data ahead of client requests; asynchronously acknowledging packets to allow the clients and servers to continue sending data; and providing server responses locally to certain client requests.

The protocols also invoke local client responses instead of waiting for the origin server to respond. IWAN also shrinks and consolidates the number of messages traveling over the WAN.

To further enhance traffic optimization, Cisco has integrated HTTP object caching powered by Akamai—the leader in content delivery and HTTP caching on the Internet—into Cisco IWAN through Cisco WAAS. Through Akamai Connect services, HTTP content from the corporate network or Internet can be locally cached for additional users accessing the same content. Providing local HTTP caching generates benefits across several use cases:

- **Intranet content:** Mobile apps, live video, and video on demand (VoD)
- **Connected cache:** Omni Channel and Apple iOS
- **Dynamic URL cache:** Training through YouTube
- **Generic Internet cache:** Internet browsing and guest Wi-Fi
- **Content prepositioning:** Digital signage and product catalogs

Traditional traffic and application-specific WAN optimization require a dual-ended solution with traffic flowing between WAN optimization devices at each branch office and the data center. When businesses adopt local Internet access at their branch office, they normally lose the benefit of optimization as the traffic goes straight to the Internet.

But with Cisco WAAS (a component of the Cisco IWAN architecture) devices that feature application optimizers and Akamai Connect for local HTTP caching, enterprises can now cache the content on that same WAAS device that performs the WAN optimization. The device caches HTTP content across network topologies such as WAN only, backhauled and direct Internet-access. Local caching thus plays a key role as HTTP traffic volume, from public and private clouds, keeps increasing on the enterprise network.

Managing and Scaling WAN Traffic

The Cisco WAAS Central Manager (WCM) allows businesses to manage both the application-optimization services provided by Cisco WAAS branch-office devices and Akamai Connect. The WAAS Central Manager can be hosted on a virtual machine running on a generic server or an actual hardware appliance, typically hosted at the data center. The WCM allows IT to bring new WAAS devices (physical, virtual, and integrated) into the network through a single point of management to allow for consistent policies across the enterprise. IT can easily apply changes as well as manage and monitor thousands of devices from one location.

Cisco AppNav technology enables customers to virtualize WAN optimization resources in the data center and in the branch office by pooling them into one elastic resource—in a manner that is policy-based and on-demand with the best available scalability and performance. Managed by Cisco WAAS Central Manager, Cisco AppNav is supported on Cisco 4000 Series Integrated Services Routers (ISRs), Cisco ASR 1000 Series Aggregation Services Routers, and Cisco Cloud Services Routers 1000V (CSR 1000V) as well as Cisco WAAS appliances.

Enterprises can use Cisco AppNav to scale their application optimization capabilities within the IWAN architecture without sacrificing performance and without adding to the operational complexity. The solution provides a clustering mechanism that can address the network resiliency that highly available business services need. Cisco AppNav also natively addresses the challenges posed by today's multipath WAN architectures, which may cause directional asymmetry of user traffic.

The solution can also apply flexible and intelligent policies to address the dynamic needs of WAN optimization. These policies can distribute user traffic flows based on business constructs (such as application or remote location) and deploy new groups of Cisco WAAS devices on-demand or based on dynamic load feedback from active Cisco WAAS devices.

For example, IT can dedicate specific WAAS devices to handle only specific business-critical applications while allocating other devices for noncritical applications. IT thus gains more granular control over how the application traffic is distributed without sacrificing or interrupting application performance.

WAN Optimization ROI

In addition to increasing end-user productivity by improving application performance across the WAN, implementing Cisco IWAN application optimization at branch offices allows an enterprise to delay the need to upgrade bandwidth. A company with branch offices running T1 connections, for example, would typically see 20 to 50 percent in bandwidth growth each year.[1] By deploying IWAN, they can subsequently defer upgrading to a 10 Mbps line for after 4 years and lower their cost per office by 37%.

Akamai Connect provides significant cost savings by offloading the amount of traffic on the WAN by as much as 50 to 90 percent. Besides providing cost savings by deferring bandwidth expansion costs, IWAN also helps IT prepare for future applications that line-of-business managers want to add to the network to promote the business. IT can thus play a bigger role in helping the company increase productivity and revenue.

Cisco IWAN Use Case: Financial Services Firm with 25 Branch Offices

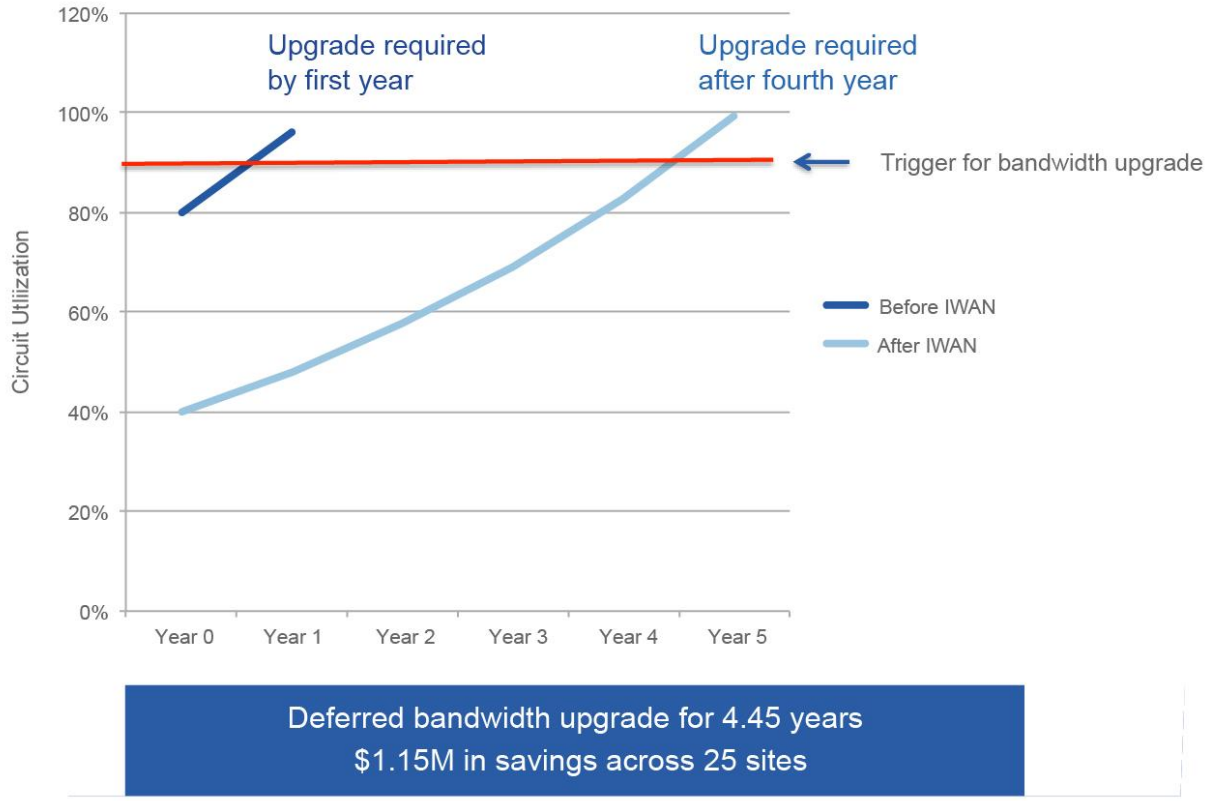
Before Deploying Cisco IWAN

Average circuit utilization:	80%
Utlization trigger point for bandwidth upgrade:	90%
Expected annual bandwidth growth:	20%
Timeline for exceeding bandwidth trigger point:	7.5 months

After Deploying Cisco IWAN

Average circuit utilization:	40%
Timeline for exceeding bandwidth trigger point:	4.45 years
Bandwidth savings:	50%

Figure 1. IWAN with Akamai Connect Financial Benefit



In this case, if the company did not deploy Cisco IWAN, the bandwidth upgrade costs for each of its offices would equate to approximately US$46K, adding up to $1.15M in deferred costs across all 25 offices. The company's total investment to deploy Cisco IWAN was approximately $17K per office—37 percent of the deferred cost per office.

IWAN also allows businesses to build multiple traffic-optimization capabilities into a single platform rather than deploying many appliances, creating 70 to 90 percent in additional savings. The company can avoid buying and managing many devices while also paying less for support and power consumption.

Gaining such cost savings will likely prove critical. Gartner predicts a 20- to 50-percent increase in enterprise bandwidth per year through 2018 for most enterprises.[1] At the same time, Nemertes Research discovered that 60 percent of WAN budgets are flat or declining.[2] Cisco IWAN application-optimization services thus help IT deliver quality user experiences at sustainable costs.

For additional information about how ROI is calculated for Cisco IWAN, refer to the appendix at the end of this document.

Cisco IWAN Building Blocks

The ideal starting point for deploying the Cisco IWAN architecture is to build upon the Cisco 4000 Series ISRs, which are designed and priced for branch offices of all sizes. In 2014, Cisco introduced four new platforms that extend the architecture of the Cisco 4451 ISR into a complete family of Cisco 4000 Series Routers. The full family represents Cisco's greatest advancement in branch-office routing technology in the past 10 years and promises to help IT deliver an uncompromised application experience for any user over any connection, with reliability and security.

IT can take advantage of the Cisco 4000 Series ISR architecture to deliver new services and improve application experiences while at the same time streamlining branch-office infrastructure and reducing management and WAN costs. The five models that make up the family include the Cisco 4451, 4431, 4351, 4331, and 4321 ISRs. With this simplified portfolio (5 models vs. the 10 models in the Cisco Integrated Services Routers Generation 2 [ISR G2]), Cisco covers WAN needs from 50 Mbps up to 2 Gbps with rich network services and a common management platform.

Among the Cisco ISR G2 routers, the Cisco 892-FSP, 1900, 2900, and 3900 models all support IWAN. Any router models 2901 and lower will not be able to run WAAS with Akamai Connect within a single router solution because there is no module slot. However, the 2901 and lower models do support all other IWAN features.

To fully connect the enterprise with consistent network services, the IWAN solution also includes the Cisco ASR 1000 Series for campus and aggregation services and the Cisco CSR 1000V for hybrid cloud.

Figure 2. Enterprise Routing and WAN Services Portfolio

Internal Mind Shift Also Necessary

In addition to providing branch and campus offices with the key application optimization capabilities that Cisco IWAN delivers, enterprises must also promote an internal mind shift when it comes to deploying and managing applications over their WANs. Non-IT personnel must partner with IT to consider the bandwidth implications before purchasing applications, regardless of the WAN optimization infrastructure that's already in place. This necessity is critical because scenarios where non-IT personnel act on their own are becoming less and less controllable in the enterprise.

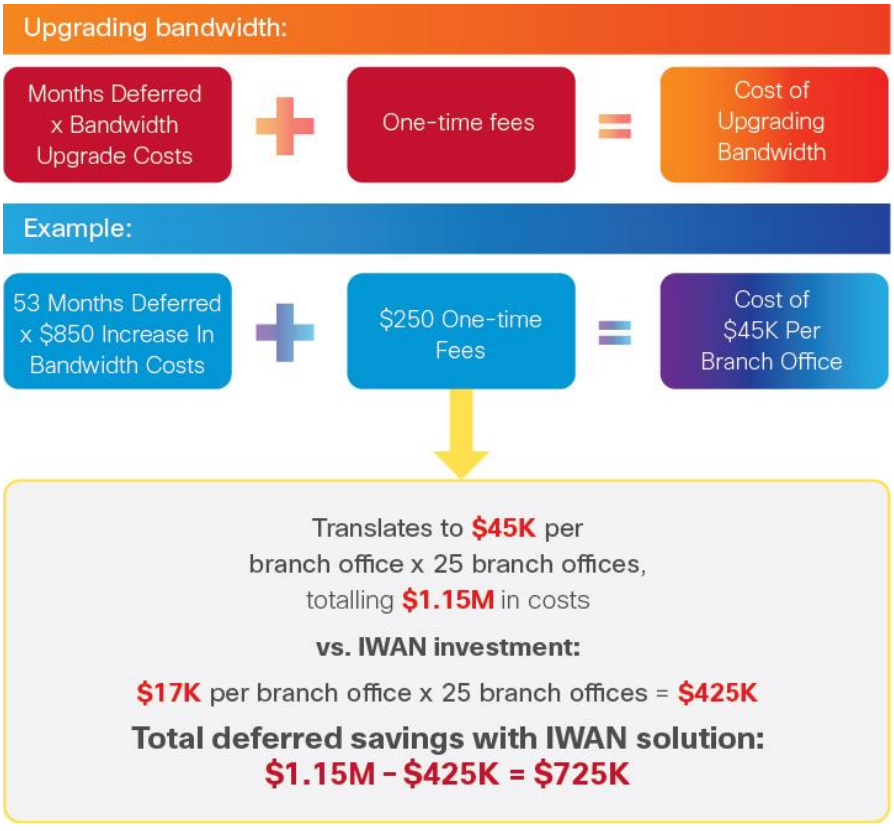
At the same time, IT needs to evolve to a WAN that can quickly respond to business demand. Inevitably, a line-of-business manager somewhere in the company is going to add a new application that consumes the existing bandwidth. But by relying on Cisco IWAN, IT will gain the visibility to know when this situation occurs and the capability to transport the new application traffic in the most efficient way possible. This paradigm not only keeps end users happy with the way their applications perform, it also helps the company defer the expense of upgrading its bandwidth.

For more information about how Cisco IWAN can help your company solve its WAN application bandwidth challenges, please visit http://www.cisco.com/go/iwan, or contact your local Cisco account representative.

Citations

1. Gartner, Forecast Analysis: Worldwide Enterprise Network Services, Q2 2014 Update.
2. Nemertes Research, 2014 WAN Best Practices and Success Factors.

Appendix—Details About Costs Associated with Upgrading Bandwidth vs. IWAN Investment



Deferral Assumptions and Calculation

Assumptions:

- Current utilization is 80 percent.
- Trigger for bandwidth upgrade is 90-percent utilization.
- Expected growth in bandwidth is 20 percent annually (Gartner predicts 20- to 50-percent annually).
- Bandwidth savings for IWAN is 50 percent (customer results show 50- to 90-percent offload).

Table 1. Bandwidth Utilization Over Five Years

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Circuit utilization without IWAN	80%	96% Trigger for bandwidth upgrade reached				
Circuit utilization with IWAN	40%	48%	58%	69%	83%	100% Trigger for bandwidth upgrade reached: **4.45 years**

Bandwidth Upgrade Cost Assumptions and Calculations

Recurring costs:

- Current port: $250 monthly (for port charge)
- Future port: $1100 monthly (for port charge with upgrade)

Cost difference: **$850** (will vary by region and carrier; sample provided is from U.S. carrier)

One-time costs:

- Branch-office upgrade installation and reconfiguration: **$250**.

Costs Associated with Deploying Cisco IWAN Assumptions and Calculations

One-time costs:

- Installation: **$500**
- Hardware and software: **$8,397** (sample customer proposal)

Recurring costs:

- Maintenance and ongoing management: $1,823 (annual) x 4.45 years = **$8,112**

Total IWAN Investment

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- Akamai Connect:
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Printed in USA C11-733999-00 3/15