

## How Cisco IT Advances Data Center Consolidation with Wide-Area Application Services

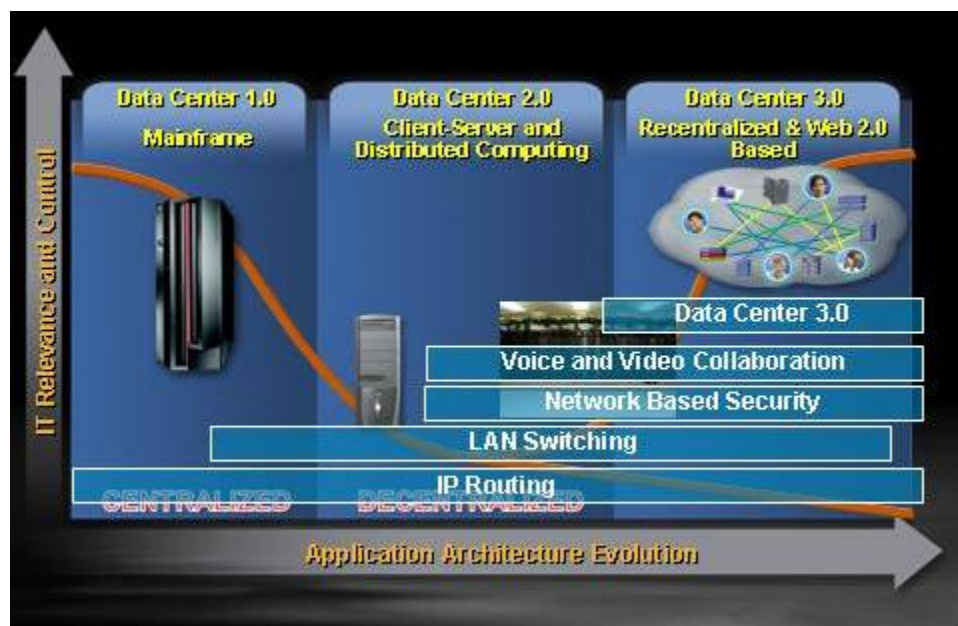
Cisco WAAS optimizes WAN bandwidth and speeds up application performance for branch-office employees.

### Business Opportunity

Cisco's application architecture has shifted over the years, reflecting general trends in enterprise data centers. The first phase, which Cisco now calls Data Center 1.0, relied on centralized mainframes. In the next phase, Data Center 2.0, the pendulum swung toward a highly distributed architecture, with each branch office maintaining its own print, application, and file servers. Extreme decentralization came at a price: a proliferation of server platforms and operating systems increased capital and operational expenses and complicated disaster recovery.

Today Cisco IT is recentralizing its data center infrastructure. This approach, known as Data Center 3.0, combines the best of its predecessors (Figure 1). The centralized element is a unified network fabric that connects Cisco servers and storage devices into a resilient, scalable, and easily managed fabric. The distributed elements are servers and storage that can reside anywhere, providing virtualized services to different organizations throughout Cisco.

**Figure 1.** Cisco's Evolution to Data Center 3.0



Cisco's business goals for the data center consolidation effort are to:

- Increase server and storage utilization.** When every Cisco branch had its own servers, average CPU utilization hovered near 5 to 15 percent for Windows and Linux servers and 10 to 30 percent for Unix servers. Storage utilization was approximately 20 percent. In consolidated data center environments, both CPU and storage utilization increase to around 70 percent. "Increasing server and storage utilization

ultimately leads to significant cost avoidance and a lower total cost of ownership,” says John Nelsen, network and data center services architect, Cisco.

- **Reduce operational costs.** Cisco currently has more than 9360 servers, with one system administrator for every 72 servers. Cisco IT wanted to improve the ratio from 1.72 to 1.250, which would require automation that is only possible in a consolidated data center environment.
- **Speed up deployment of new applications and services.** In an automated, centralized data center, new services can be deployed quickly and just once, in the data center, instead of once for each branch office.
- **Facilitate disaster recovery.** A centralized data center architecture offloads the responsibility for backup and recovery from branch offices.
- **Standardize across all Cisco lines of business.** “When the data center was distributed, enforcing existing Cisco IT data center standards became more challenging,” says Nelsen. “By bringing servers, storage, and applications back to our data centers, we will significantly reduce redundant efforts and nonstandard deployments, both of which increase expense.”
- **Provide adequate power and cooling for new systems.** New blade servers can overload cooling, server I/O, and network connectivity, especially in branch offices not equipped for demanding power and cooling loads. By consolidating the data center, Cisco IT could more cost-effectively add the power, cooling, and bandwidth that blade servers need to realize their potential.

Consolidating Cisco’s data center architecture would require overcoming two challenges. First, Cisco IT needed a way to optimize bandwidth to accommodate the increase in traffic when Cisco’s field sales offices began accessing services over the WAN instead of hosting them on their office LANs. Second, to avoid productivity loss for branch-office employees, Cisco IT would need to accelerate application performance so that employees would experience LAN-like performance over the WAN.

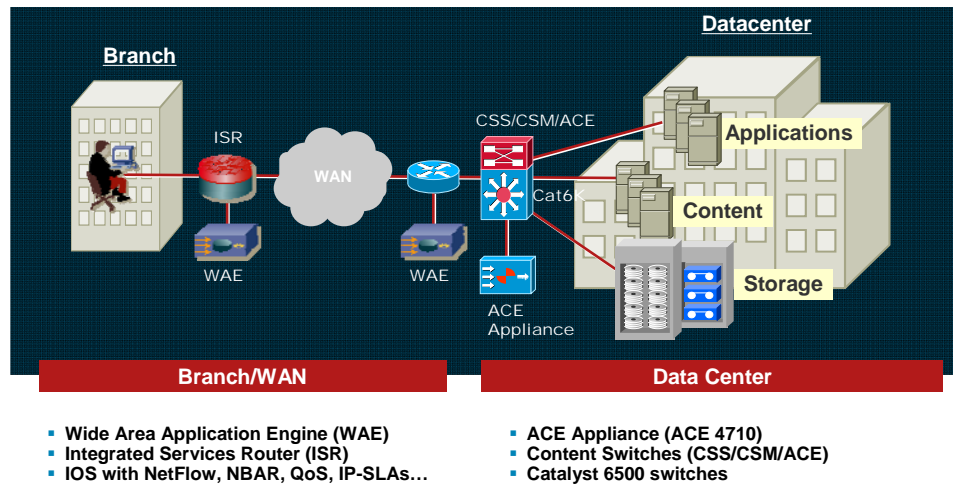
## IT Project

### Platform Selection

A major criterion for the application-acceleration solution was to not interfere with the way employees use applications. “This ruled out Citrix application accelerators, which require users to log on to a different environment to use their applications,” says Jim Palermo, IT project manager at Cisco. Another requirement was to accelerate all TCP-based applications, not just HTTP, but also Microsoft Exchange and Common Internet File System (CIFS) traffic. Cisco IT was already accelerating HTTP by using Cisco Application Content and Networking Services (ACNS) to cache static HTML objects and preposition content such as video and large operating system patches.

Cisco IT found its solution for WAN optimization and application acceleration in Cisco Wide Area Application Services (WAAS). Currently, Cisco WAAS is being used to provide Wide Area File Services (WAFS) and accelerate Oracle, SAP, and Microsoft Exchange applications (Figure 2). Cisco branch-office employees use the centralized applications and file systems exactly as they did when the applications and file systems were hosted locally because Cisco WAAS operates in the network layer and is not noticeable to users. If an employee in Bulgaria visits a webpage hosted in Cisco’s San Jose data center, for example, the Cisco Wide Area Application Engine (WAE) intercepts the request and sends it to the data center. The Cisco WAE in the data center intercepts the request and processes it, using multiple optimization and compression techniques to minimize bandwidth and accelerate application performance.

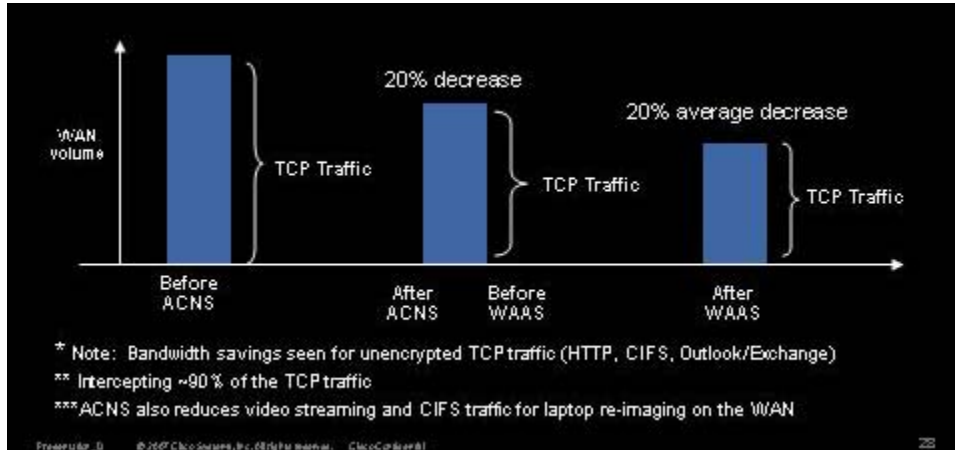
**Figure 2.** Cisco WAE Appliances or Modules are Deployed in Branch Offices and the Data Center



### Deployment Process

Cisco IT began developing a WAAS business case and architecture in March 2007. Late that year, Cisco conducted a proof of concept in seven remote offices in Europe and emerging markets and the Amsterdam data center. "We designed the proof of concept to validate the business case for WAAS and confirm the stability of the technology," Palermo says. The emerging markets theater was chosen for the pilot because Cisco WAAS delivers the biggest performance improvements in locations with limited WAN bandwidth. Cisco IT is deploying only one Cisco WAE appliance in each branch. If it fails, traffic continues to flow through to the data center but is not accelerated.

The proof of concept demonstrated that WAAS reduced the volume of TCP traffic by about 20 percent. This, combined with a 20 percent bandwidth reduction already achieved with Cisco ACNS, results in a total bandwidth savings of 40 percent (Figure 3).

**Figure 3.** Bandwidth Savings Summary Using WAAS

“Restricting the deployment to a few offices limits the benefits,” says Palermo. “But the proof of concept did give us a glimpse of the magnitude of benefits possible when we deploy WAAS across the Cisco enterprise.”

### Global Pilot

Since the proof of concept, Cisco IT has been focusing on global design for WAAS and a support strategy. By June 2008, Cisco IT had added 14 additional offices, some in each geographic theater. This pilot addressed two additional challenges of a global rollout:

- Helping ensure that Cisco ACNS and Cisco WAAS can co-exist
- Integrating Cisco WAAS with the Cisco Intrusion Prevention System (IPS). “We need to make sure that when the Cisco WAE in the data center intercepts traffic, it does not appear to be a malicious host,” Palermo says.

### Results to Date

#### Faster Application Performance

Table 1 shows the results of one test measuring improvements to application performance over the WAN. The exact improvements vary based on latency, bandwidth, and whether Cisco ACNS is used.

**Table 1.** Performance Improvement in Branch Offices Using Cisco WAAS

<b>Activity</b>	<b>Performance Improvement for First Access</b>	<b>Performance Improvement for Second Access, After Content Has Been Cached</b>
View intranet page	86%	90%
View cisco.com page	49%	78%
Browse Livelink	59%	60%
Open a file from within Livelink	61%	93%
Upload a 3.11MB PowerPoint file with Common Internet File System (CIFS) protocol	32%	84%
Download 3.11MB PowerPoint file with CIFS	32%	99%
Download a 3.11MB PowerPoint file with Microsoft Exchange	9%	42%

### **Increased Productivity**

WAN acceleration measurably improves Cisco employees' productivity. "Assuming that each user accesses 20 HTTP pages daily, saving 30 seconds on each page results in 10 minutes of regained time," says Nelsen. The time savings add up: If each of 2000 remote employees in Emerging Markets branch offices saves 10 minutes daily from improved application performance, Cisco will save US\$7 million annually. Personnel and equipment costs for the program total US\$5 million, which means the investment will pay for itself in less than one year.

Cisco IT administered a survey to internal users on their impressions of application acceleration. Fifteen percent responded, the majority of whom were impressed with how much more quickly they could download a document from Livelink, SharePoint, or a file server, according to Palermo. And when files on a local server in the Moscow branch office were moved to a larger file server in the Amsterdam data center, Moscow employees barely noticed the difference. Gains will be even larger when WAAS is deployed between the Amsterdam and San Jose data centers, where most applications are hosted. "We have definitely optimized HTTP traffic, and hope to increase performance even more," Palermo says.

### **Lower Operating Expenses**

Cisco WAAS makes it feasible to consolidate servers in a centralized data center by enabling employees to access them over the WAN as quickly as if they were hosted on the LAN. By consolidating servers, Cisco is reducing its maintenance and operating costs and freeing up bandwidth for backups, application expansion, and other needs.

### **Capital Cost Avoidance**

By reducing storage and server infrastructure at branch offices, Cisco IT anticipates avoiding US\$6.5 to \$10.5 million in capital costs by 2011.

## Next Steps

After the global pilot is completed, a design steering committee will approve a global design and agree on a support plan. Then, after a readiness review, Cisco IT will deploy Cisco WAAS on a global basis, as follows:

- **Deploy WAE appliances or modules in branch offices.** Cisco has approximately 300 global offices that have less than 45Mbps bandwidth. Cisco partner IBM will deploy Cisco WAAS in these offices during the remainder of fiscal year 2008 and part of fiscal year 2009. Configuring the WAN gateway at each office to intercept certain requests and forward them to the Cisco WAE device will take only a few minutes and occur during nonbusiness hours.
- **Deploy WAE appliances or modules in 250 extranet sites.** Cisco plans to deploy WAAS to extranet partner sites to improve performance between those sites and Cisco's data centers.
- **Deploy in ten global data centers.** Seven of these are regional data centers hosting Microsoft Exchange or IBM Rational ClearCase. Cisco IT will deploy the Cisco WAE devices in clusters with load balancing. The plan is to coordinate the Cisco WAE deployment with the Cisco IT Fleet Management Program, an ongoing plan to continually refresh the core IT infrastructure in phases.
- **Provide Cisco WAAS Mobile Client software to mobile employees.** With the client software installed on their PC or laptop, mobile employees will be able to enjoy accelerated application performance from hotel or home. This project is expected to be funded in 2009.
- **Accelerate traffic between data centers.** "Once we become comfortable with WAAS, we can begin to look into the mesh functionality," says Nelsen. "The concept of ubiquitous WAAS is important to our evolving global data center strategy."
- **Work with the business unit to enhance Cisco WAAS to handle streaming video.** "Ideally, branch offices want to accelerate all types of content delivered over the WAN, including streaming video," says Palermo.

When it is available, Cisco IT plans to deploy the new version of Cisco WAAS, which will provide additional acceleration for popular protocols such as HTTP, Messaging Application Programming Interface (MAPI), Network File System (NFS) v3, and Secure Sockets Layer (SSL.) The new Cisco WAAS device will also use virtualization techniques to operate multiple, virtual instances of Windows. The result will be to create consolidated, virtualized services "in a box" for branch offices and extranet partner sites.