



Cisco Application Networking for Siebel 8.0 Solutions Deployment Guide

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Preface

Document Purpose

To address challenges associated with today's mission critical enterprise application deployments, Cisco, in collaboration with Oracle, offers Cisco Application Networking for Siebel 8.0, an enterprise network architecture with best practices and implementation guidance that optimizes application availability, performance, and security and lowers application ownership costs.

Featuring the Cisco Application Control Engine (ACE) and Wide Area Application Services (WAAS) product families, collectively known as Cisco Application Networking Services (ANS), that provide data center, branch, and remote end user application optimization services, this Joint Solution of Cisco application networking with Siebel 8.0 (Joint Solution) addresses the following challenges for Siebel deployments:

- Recovery time and point objectives for business continuity
- End user performance over limited Wide Area Network (WAN) connections

- Application, server, network, and service-oriented application architectures (SOA) security
- Reduced capital and operational costs

Cisco and Oracle cooperated in all phases of the Cisco Application Networking for Siebel 8.0 testing, including lab set-up at Cisco offices, solution functional and performance testing, and this deployment guide. Cisco and Oracle jointly validate that the lab setup and Joint Solution testing represents best efforts in creating a realistic customer deployment and accurate documentation of such deployment.

The purpose of this document is to describe the Joint Solution enterprise network architecture and deployment best practices and guidance.

Prerequisites

The following prerequisites are required to deploy the Joint Solution:

- Working knowledge of the Siebel 8.0 application
- Experience with basic networking and troubleshooting
- Experience installing the Cisco products covered by this network design, including the Cisco ACE and WAAS product families
- Working knowledge of Cisco's Internetworking Operating System (IOS)

Document Organization

The following table provides a brief description of each section.

Section	Description
Solution Overview	A high-level introduction to the solution. Introduces the solution, historical aspects, potential benefits, and scope and limitations.
Solution Architecture	Describes the architecture of the Joint Solution.
Implementing and Configuring the Cisco ACE Solution	Describes configuration and implementation of Cisco ACE within the Joint Solution.
Implementing and Configuring the Cisco WAAS Solution	Describes configuration and implementation of WAAS within the Joint Solution.
Network Management	Describes the network management software used in the Joint Solution.

Solution Overview

Solution Description

The Joint Solution offers optimized Siebel 8.0 application availability, performance, security, and costs by providing application optimization services as follows:

- Application availability

Cisco ACE product family application optimization services for high Siebel 8.0 availability:

- Application health monitoring—Continuously and intelligently monitors application and database availability.
- Server load balancing—Efficiently routes end user and Web services requests to the best available server.
- Network platform health monitoring—Ensures continuity of business operations through mirroring end user transaction states across pairs of network devices.

- Application performance

Cisco ACE and WAAS product family application optimization services for Siebel 8.0 high performance:

- WAN optimization—Provides intelligent caching, compression, and protocol optimization that yields as much as 2 times faster performance (see [Testing and Results](#)).
- Server offloading—Specialized hardware that offers greater processing efficiency for application optimization services listed below, such as server load balancing, Secure Socket Layer termination, and traffic compression, which frees up to 50 percent of application server processing and memory to focus on business logic computations.
- Server load balancing—Substitutes for Siebel native load balancing.
- Secure Socket Layer (SSL) termination—Terminates 15,000 connections per second.
- Transmission Control Protocol (TCP) connection management—Reduces the number of TCP connections to server.
- Server health monitoring—Substitutes for Siebel native server health monitoring.
- Traffic compression—Scalable LZ compression functionality.
- Object caching—Reduce requests to server.

- Application security

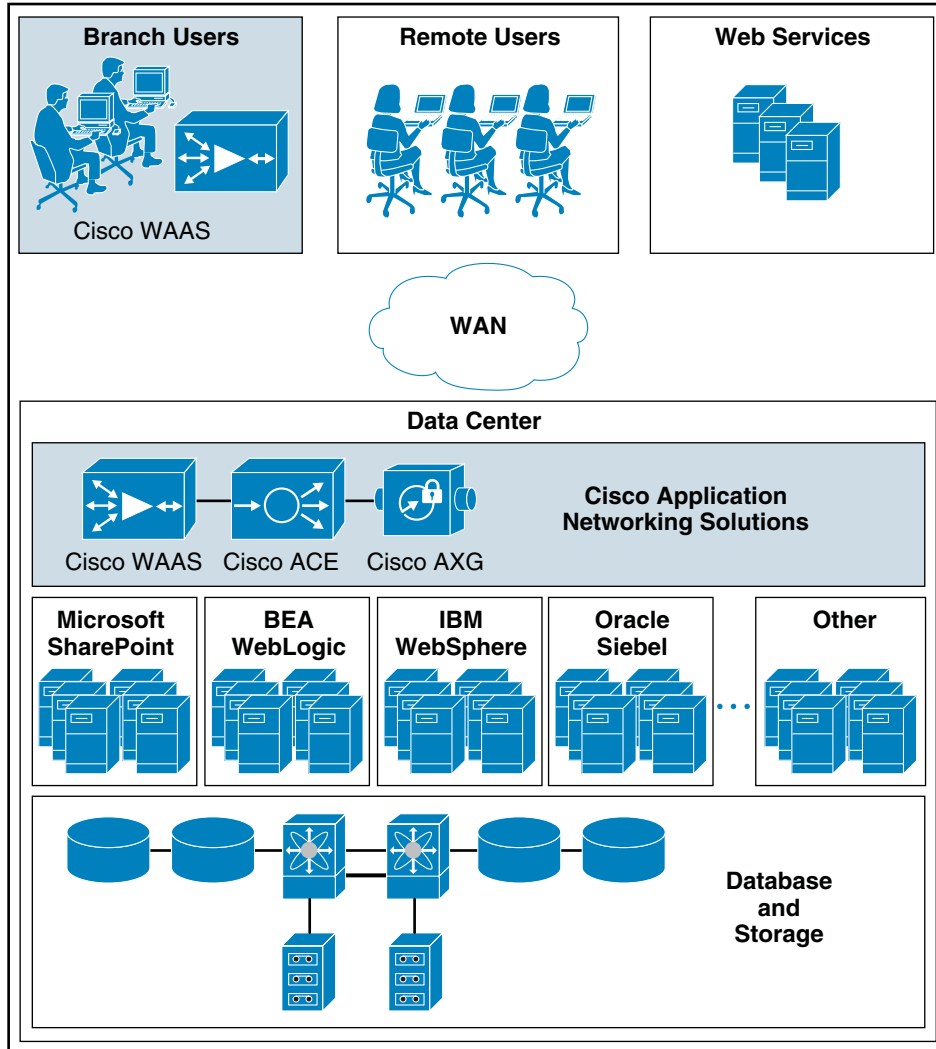
Cisco ACE product family application optimization services for optimized Siebel 8.0 data security:

- SSL termination—Efficiently encrypts and decrypts SSL enabled traffic, which facilitates the use of intrusion detection and prevention solutions before traffic reaches the servers.
- End user access control—Provides Access Control Lists (ACLs) to protect client-to-server traffic from worms and intruders that attack vulnerable open server ports not used by the application.

- Virtualization of application optimization services

Virtualization of application optimization services supplies such services for multiple Oracle and Siebel instances as well as other enterprise applications (see [Figure 1](#)). Specifically, a single physical Cisco ACE can be virtualized into multiple logical Cisco ACEs in which application traffic can traverse between virtualized Cisco ACEs. This virtualization of load balancing is an exclusive Cisco feature.

Figure 1 Virtualization of Application Optimization Services



The application optimization services of the Joint Solution reside in both the data center and the branch to offer end-to-end value, from branch and remote users, all the way through to the database and information storage.

- Data center application optimization services

Cisco ACE and WAAS reside in the data center and are arranged to provide virtualized application optimization services for multiple Oracle and Siebel instances as well as other enterprise applications.

Because of their unique location, these solutions can take intelligent action on end-user traffic before it is routed to the Siebel application servers, including server load balancing, server health monitoring, SSL decryption, TCP connection consolidation, and security access control.

While some of these functions could be provided natively by the Siebel application or third party server based solutions, Cisco networking provides these services cost-effectively, freeing up server processing and memory needs to focus on business logic computation.

- Wide area application optimization services

Cisco WAAS also resides in the branch office and is arranged to provide virtualized application optimization services for all application users in that location. Together with the data center WAAS deployment, the two offer a WAN optimization service through the use of intelligent caching, compression, and protocol optimization.

When the Siebel application servers respond to end-user requests, Cisco WAAS compresses the response and then most efficiently passes it across the WAN with minimal bandwidth usage and maximum speed. Commonly used information is cached both at the WAAS solution in the branch as well as in the Cisco ACE solution in the data center, which significantly reduces the burden on the servers and the WAN (see [Figure 1](#)).

The scope of the lab engineering work pertaining to the Joint Solution consists of:

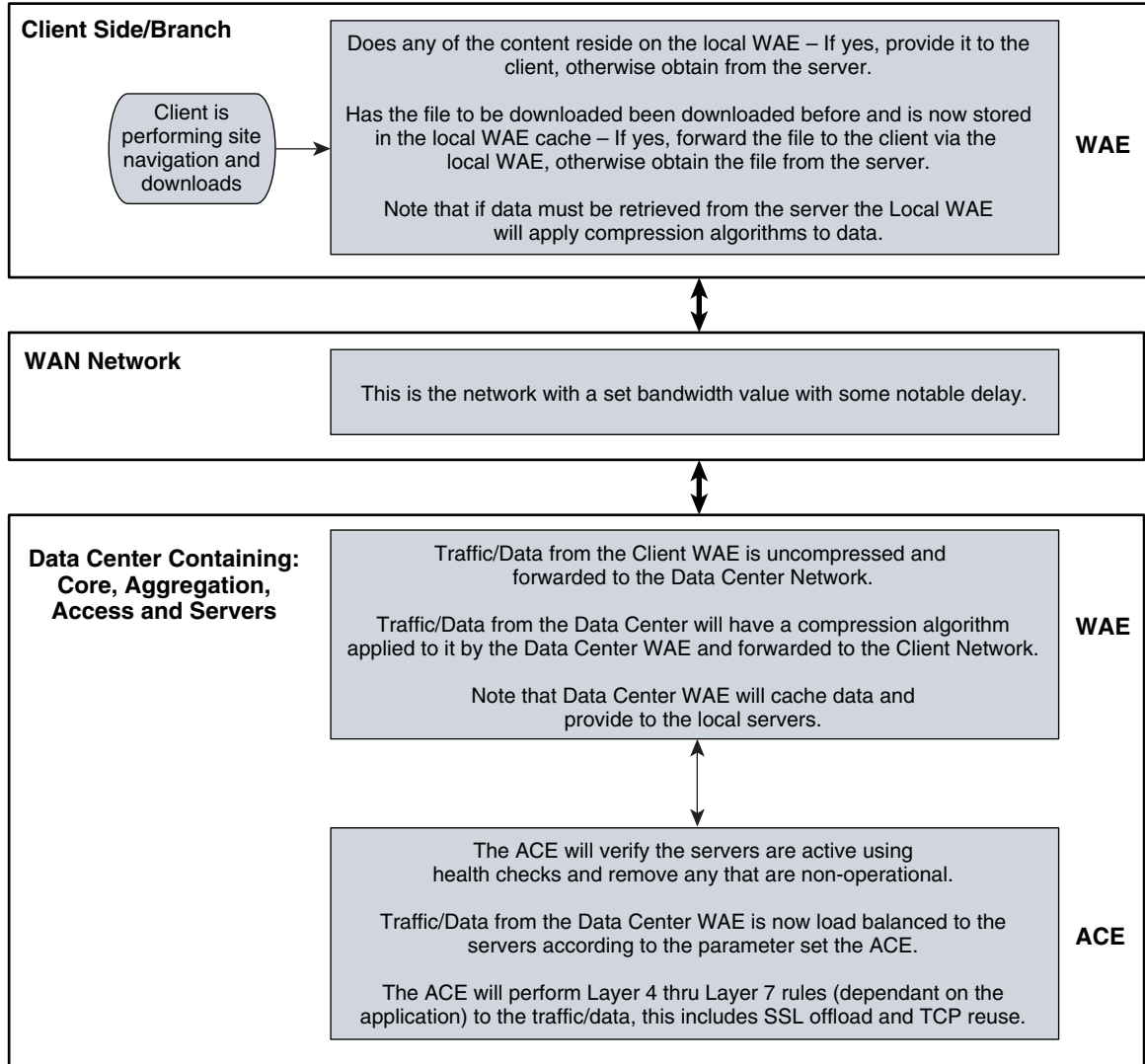
- Functionality and load testing of Cisco WAAS and Cisco ACE, alone and together, with Oracle Siebel 8.0 application, using the *Cisco Data Center Infrastructure Design Guide 2.1*, a Cisco Validated Design, as the data center architecture. For more information on CVD, see www.cisco.com/go/cvd.
- Performance testing of Cisco WAAS and Cisco ACE, alone and together, with Oracle Siebel 8.0 application using HP LoadRunner to simulate concurrent application instances. In these tests, client application traffic originates from branch office to the data center to determine application performance response time. HP LoadRunner and NetQOS products are used to measure response time, traffic, and throughput results.

**Note**

The Cisco Wide Area Application Services (WAAS) software runs on the Cisco Wide-Area Application Engine (WAE).

Process Flow

Figure 2 Process Flow



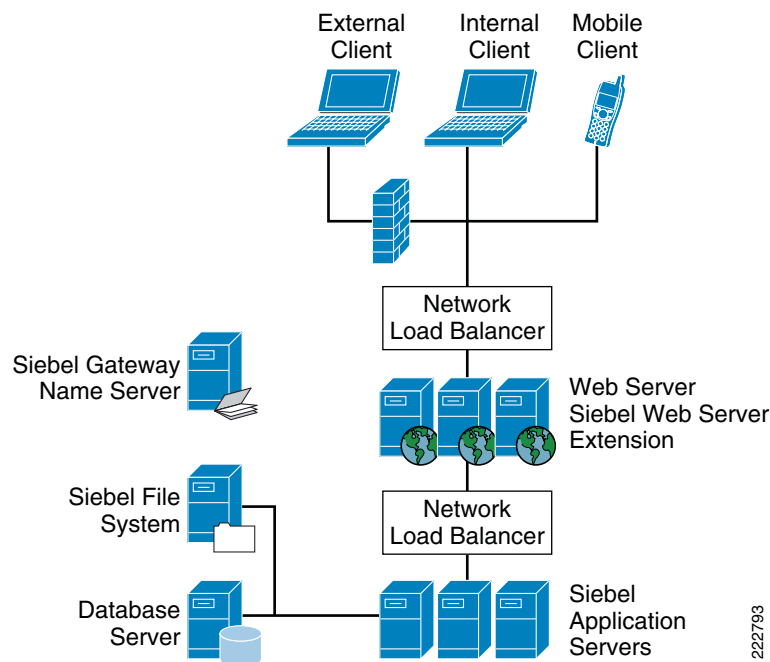
Solution Architecture

Siebel Application Overview

Oracle Siebel 8.0 uses a multi-tiered application framework. The Siebel environment consists of client, application, and database tiers. The client tier comprises devices that access the application via the Web. The application tier can be broken down to two different functions, services that terminate client connections and application object managers (AOM) that perform the business logic. Multiple application components can reside in the application tier providing different business functions. The

database tier contains the data base management system (DBMS) and shared file system. The DBMS serves as a repository for data collections. The shared file system is for attachment storage such as Adobe Acrobat files, fax quotes, and other documents.

Figure 3 Siebel Application Architecture



Siebel Application Architecture

Client Tier

There are multiple client types available on the Siebel platform. The major client types are Web client, mobile client, and dedicated Web client. Wireless and handheld clients are used in specialized applications such as retail and manufacturing.

- Siebel Web client—Siebel Web client uses a Web browser on the local PC. It connects to the Siebel Web server via http (port 80) or https (port 443). No additional software is required. The Web client is easy to maintain since it does not require any software upgrades. Since no Siebel software resides on the local PC, it is not affected by software upgrades and updates on the server.
- Siebel mobile client and dedicated client—The mobile client and dedicated client require additional software installed on the PC. The additional software provides faster throughput with less data transfers for a given transaction by sending only changed data between the client and the server. For remote users, the dedicated client allows disconnected mode and synchronizes with the database when network connectivity is restored.
- Siebel wireless client/Siebel handheld client—These two clients are specialized clients for vertical applications. The wireless client has a translator for Hypertext Transfer Protocol (HTTP) to Wireless Application Protocol (WAP), which is suitable for mobile phones. The handheld client can accommodate information on smaller screens.

Application Tier

The application tier contains two functional areas, services that terminate client connections and business logic.

The former component is called the Siebel Web Server Extension (SWSE). It is an add-on to Microsoft Internet Information Server (IIS). SWSE is responsible for handling Web requests from users. It forwards user requests to the Application Object Managers (AOM) via Siebel Internet Session API (SISNAPI) protocol. Siebel provides native server load balancing for highly-available Web servers. Third party load balancers are supported as well.

There are numerous Siebel application servers that provide different business applications. Each Siebel application component can be run on a single or multiple physical servers. Application components can be load balanced at the component level across different physical server pools. Load balancing can be configured with native Siebel load balancer or a third-party load balancer.

Database Tier

The database tier provides a repository to Siebel application data. It consist of a RDBMS and separate file system store.

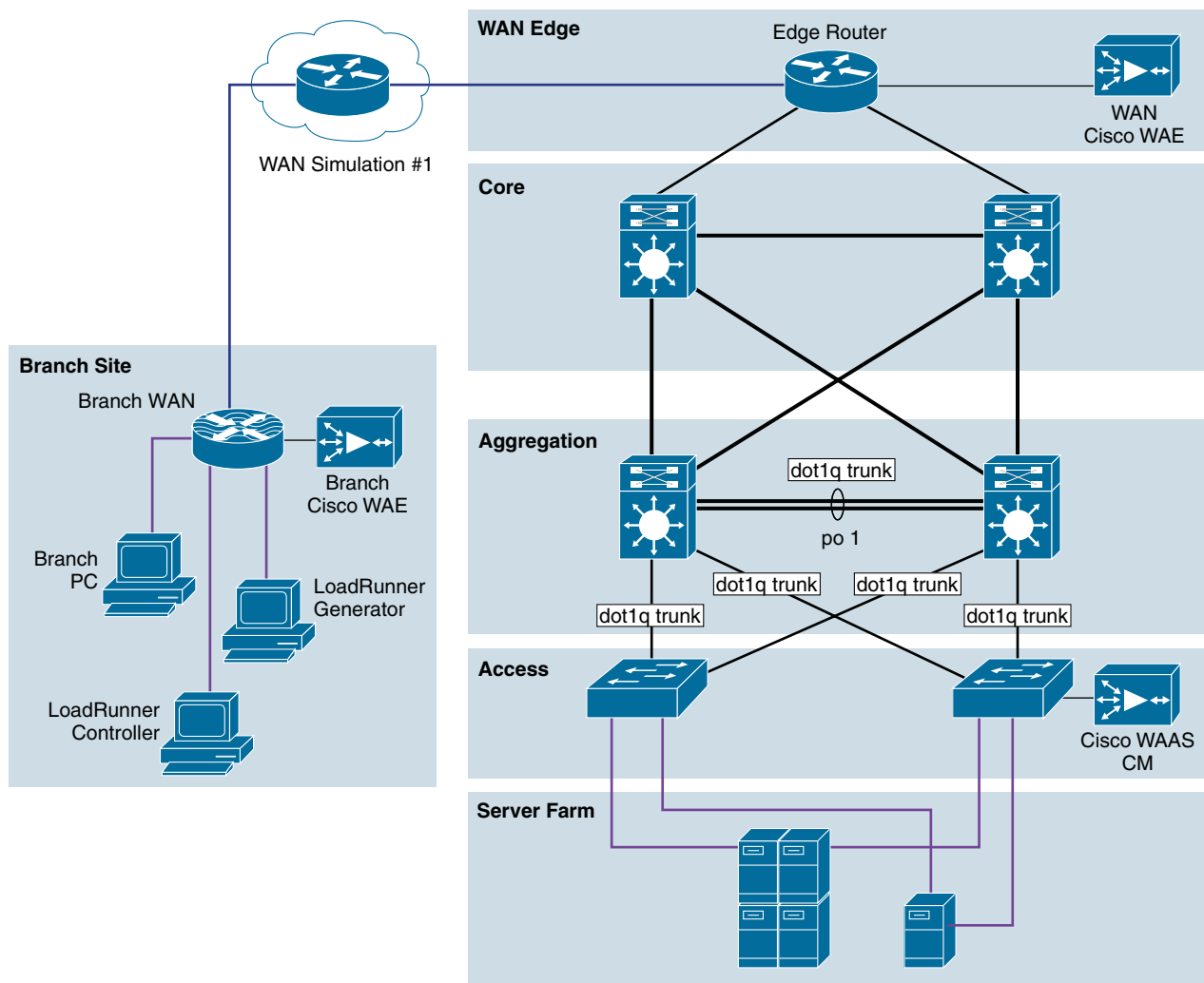
- File system—The Siebel File System (SFS) is a server with a shared directory that provides CIFS access to other Siebel servers. The SFS is a shared storage area for images, reports, documents, and other data. A pointer in the database record locates the file in the SFS.
- Database Server—The database server is the main data store for the Siebel application. The Siebel application servers connect directly the database server. Oracle 10g is the database used in this deployment.

Gateway Name Server

Gateway name server is a repository for configuration information for each Siebel server. It has configuration information about the Siebel Enterprise.

Application and Application Networking Architecture

Figure 4 Application and Application Networking Architecture



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The Joint Solution uses WAAS to enhance performance and Cisco ACE to reduce the load on resources in the server farm. The WAAS and Cisco ACE each provide a unique benefit to the solution, however there are additional benefits when they are used together as the two solutions are complimentary. The Cisco ACE provides load balancing to the server farm. If the application uses SSL, then the Cisco ACE can provide SSL termination offload, thereby increasing efficiency by removing the load on the servers' resources and allowing the servers to process more transactions. Increased server efficiency also results if the Cisco ACE is used to provide TCP reuse.

The Joint Solution architecture is based on the Enterprise Branch Wide Area Application Services Design Guide (Enterprise Branch Design) and the Data Center Infrastructure Design Guide 2.1, both found at www.cisco.com/go/srnd.

In the Joint Solution architecture, the WAAS Solution is installed within the Cisco Wide Area Application Engine (WAE) Appliances.

Enterprise Branch

The Enterprise Branch Design shows the Cisco WAE appliance connected to the local branch router, typically a Cisco Integrated Services Router (ISR). The design provides scalability and availability as compared to installing a Cisco WAAS Network Module within a Cisco ISR as the Cisco ISR must share its resources.

HP Mercury LoadRunner, running on a personal computer in the branch, simulates users that would perform certain tasks in the application.

The traffic is redirected to the Cisco WAE via Web cache communications protocol (WCCP) from the branch router. The Cisco WAE performs the following functions:

- Locally cached—If the data that is being requested is locally cached, the Cisco WAE responds to the requestor with the cached data and requests only required data from the server farm. This allows the WAN to become more efficient as only “needed data” requested.
- New data—If the data that is being forwarded to the server farm or coming from the server farm, the Cisco WAE performs compression algorithms on the data allowing for the WAN to become more efficient.

WAN Simulation

The WAN simulator provides simulations of the following WAN links:

1. WAN Type 1 (Intracontinental or T1)
 - a. Bandwidth - 1.544 Mbps, ESF, B8ZS, Delay - 100 mS, Loss - drop one packet in every 1000 packets (0.1%)
2. WAN Type 2 (Intercontinental)
 - a. Bandwidth - 512 Kbps, ESF, B8ZS, Delay - 200 mS, Loss - drop one packet in every 500 packets (0.2%)

Data Center

The data center (DC) follows the design guidelines found in the Data Center Infrastructure Design Guide 2.1, a Cisco Validated Design found at <http://www.cisco.com/go/srnd>. The design consists of a data center WAN router, core, aggregation, and access Ethernet switching, and the server farm where the application resides. In this document, the focus is on the DC WAN router, aggregation, and the server farm. The core Ethernet switching provides routing to and from the DC WAN router and the aggregation. The access Ethernet switching provides Layer 2 connectivity for the server farms to the aggregation.

The DC WAN router performs the same function as the branch WAN router by redirecting traffic to the DC Cisco WAE. The DC Cisco WAE performs the following:

- Locally cached—If the data that is being requested is locally cached, the Cisco WAE responds to the requestor with the cached data and requests only required data from the branch. This allows the WAN to become more efficient as only “needed data” is requested.
- New data—If the data that is being forwarded to the branch or coming from the branch, the Cisco WAE performs compression algorithms on the data allowing for the WAN to become more efficient.

Included in the data center is the Cisco WAAS central manager (CM), which runs on the Cisco WAE appliance. The Cisco WAAS CM provides a centralized mechanism for configuring Cisco WAAS features and reporting and monitoring Cisco WAAS traffic. It can manage a topology containing

thousands of Cisco WAE nodes and be accessed from any Web browser using SSL. The Cisco WAAS CM can be configured for high availability by deploying a pair of Cisco WAE appliances as central managers.

Within a Cisco WAAS topology, each Cisco WAE runs a process called central management system (CMS). The CMS process provides SSL-encrypted bidirectional configuration synchronization of the Cisco WAAS CM and the Cisco WAE appliances. The CMS process is also used to exchange reporting information and statistics at a configurable interval. When the administrator applies configuration or policy changes to a Cisco WAE appliance or a group of Cisco WAE appliances, the Cisco WAAS Central Manager automatically propagates the changes to each of the managed Cisco WAEs. Cisco WAEs that are not available to receive the changes will receive them the next time the appliances become available.

The aggregation segment contains Cisco ACE, which provides the following features:

- **Virtualization**—Virtualization is device partitioning into multiple contexts, where each context can be configured for different applications and is independent of any others. In the Joint Solution, Cisco ACE is configured with the Admin context and the Siebel context. Note that the Cisco ACE can support up to 250 contexts.
- **Session persistence**—Session persistence is the ability to forward client requests to the same server for the duration of the session. Siebel 8.0 requires either source Internet Protocol (IP) based session persistence or HTTP cookie based session persistence.
- **Transparent interception**—Transparent interception performs a Network Address Translation (NAT) function to conceal the real server IP address that is residing in the server farm. The Siebel context is configured with a Virtual IP (VIP) that provides a single address that users use to connect to the server farm. This allows users to access the Siebel application by placing a single IP in the Web browser.
- **Allowed server connections**—Allowed server connections is the maximum number of active connections value on a per-server basis and/or globally to the server farm.
- **Health monitoring**—Health monitoring is used to track the state of the server and determine its ability to process connections in the server farm. The Siebel context used a compound probe to determine if servers are operational and responding to HTTP requests.

Cisco ACE provides load balancing of the traffic to the server farm using one of the following methods: Round Robin, Weighted Round Robin, Least Connections, Hash address, Hash cookie, Hash Header, and Hash URL. In the Joint Solution, Least Connections was used, which selects the server with the fewest number of server connections. Cisco ACE is also used to provide SSL offload and TCP reuse.

Inter-chassis Cisco ACE redundancy was used, in which a Cisco ACE module in one Cisco Catalyst 6500 Series Switch chassis is protected by a Cisco ACE module in a peer Cisco Catalyst 6500 Series Switch chassis connected by a fault tolerant (FT) VLAN. The FT VLAN is used to transmit flow-state information, configuration synchronization information, and the redundancy heartbeat.

Server Farms

The Web server farm consisted of three Microsoft IIS Web servers with SWSE. A separate application server farm consisted of three Siebel application Servers connected to Oracle Database 10G.

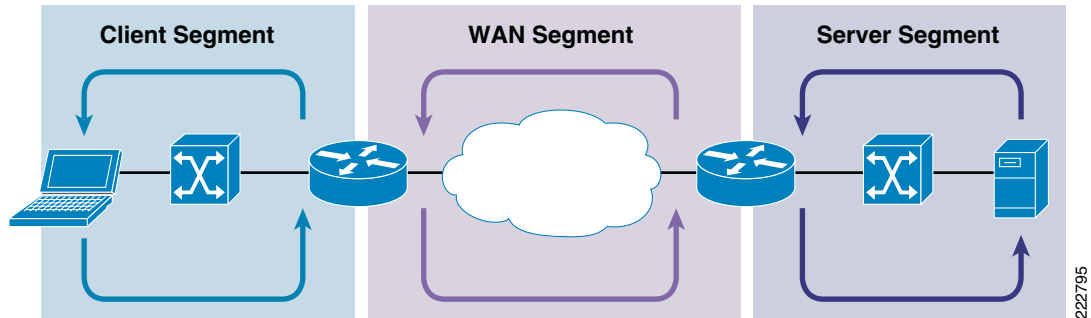
The Siebel application resides on the Windows 2003 Enterprise Edition server operating system, with 3.4 GHz Intel Pentium D processors and 2 GB of RAM and 2 80 GB SATA hard drives.

Oracle Database 10G resides on the Windows 2003 Enterprise Edition server operating system with two 3.4 GHz dual core Intel Xeon processors and 3.25 GB of RAM and 2 80 GB SATA hard drives.

Packet Flow Without Cisco WAAS and Cisco ACE

Application packet flow from a remote site can be categorized into three segments, client, WAN, and server.

Figure 5 Normal Packet Flow



Client Segment

The client segment is defined as the location into which users are connected that allows them to obtain or retrieve data from the application residing on the server farm. Users have connected personal computers (PC) to a local external switch or an integrated switch/router. When a user opens a browser and provides a URL that points to the application residing on the server, the data is sent from the PC to the switch. The switch forwards the data to the router that connects to the wide area network (WAN).

WAN Segment

The WAN provides the connectivity from the client location to the data center where the server farm is located. The WAN is provided by a service provider (SP) with a given service level agreement (SLA). The WAN inherently introduces delay and packet loss to the data traffic (packets).

Server Segment

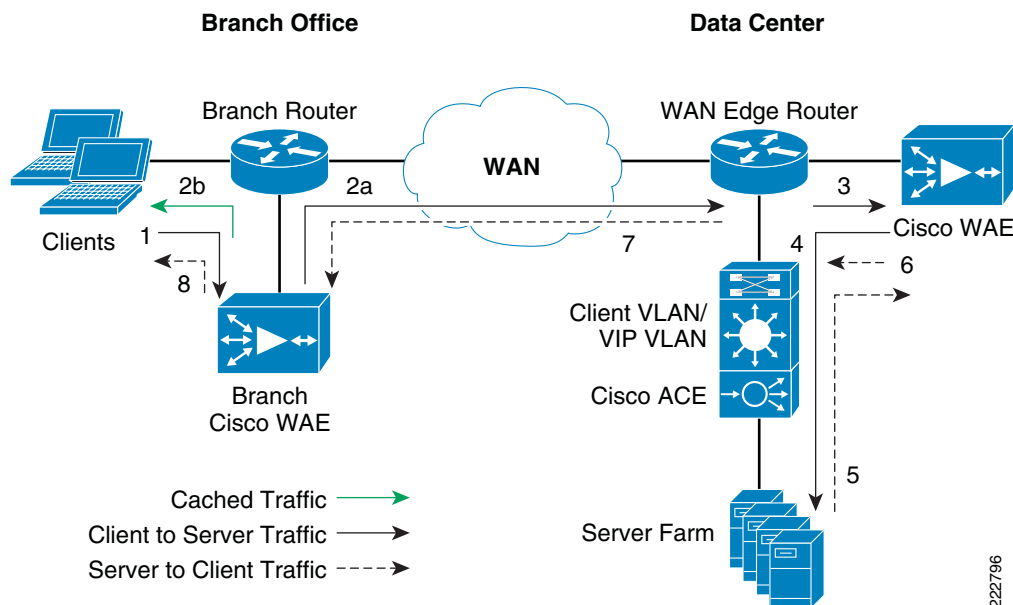
The server segment consists of a highly available and resilient core, aggregation, and access Ethernet switching. The core routes the data traffic to and from the WAN and the aggregation layer. The aggregation layer provides consolidation of multiple access layers and routes the access layer traffic into the core. The aggregation layer also takes the data traffic from the core layer and sends it to the appropriate access layer. The access layer provides connectivity to the server farm where the applications reside. The data traffic (URL, per the example) from the client segment transverses the data center until the data traffic is received by the appropriate server. The server's application responds to the request and responds back to the user by forwarding the appropriate data back the client segment.

Response Times

Transaction response time consists of server response time and WAN round trip time. Delays in the WAN or the time to process a request on a server lead to a longer wait times for data to be viewed by the end user.

Packet Flow with Cisco WAAS and Cisco ACE

Figure 6 Packet Flow with Cisco WAAS and Cisco ACE



The following sequence describes the handshake between a client and the server farm and the data transfer phase:

1. The client sends a TCP SYN (synchronize) packet to the server farm VIP address. The packet is forwarded to the branch router. The branch router intercepts the packet with WCCP and forwards it to the branch Cisco WAE appliance.
2. a.) The branch Cisco WAE applies a new TCP option (0x21) to the packet if the application is identified for optimization by an application classifier. The branch Cisco WAE adds its device ID and application policy support to the new TCP option field. This option is examined and understood by other Cisco WAEs in the path as the ID and policy fields of the initial Cisco WAE device. The initial ID and policy fields are not altered by another Cisco WAE. The packet is forwarded to the branch router and then to the WAN. b.) During the data transfer phase, if the requested data are in its cache, the branch Cisco WAE returns its cached data to the client. Traffic does not travel through the WAN to the server farm. Hence both response time and WAN link utilization are improved.
3. The packet arrives on the WAN edge router. The WAN edge router intercepts the packet with WCCP and forwards the packet to the data center Cisco WAE.
4. The data center Cisco WAE inspects the packet. Finding that the first device ID and policy is populated, it updates the last device ID field (first device ID and policy parameters are unchanged). The data center Cisco WAE forwards the packet to the WAN edge router. The edge router forwards it to the Cisco ACE. The Cisco ACE forwards the packet to the server farm VLAN with TCP option 21 removed. TCP options are usually ignored by the server, even if it is still in place. The Cisco ACE performs load balancing to the data traffic. Other functions the Cisco ACE performs include SSL offload, TCP reuse, cookie and IP sticky pertinence.

5. The following steps are for reverse traffic flow. The server farm sends the SYN/ACK packet back to the client with no TCP option. The packet from the server farm VLAN is matched and forwarded to the Cisco ACE and then to the WAN edge router. The WAN edge router forwards the packet to the data center Cisco WAE. The data center Cisco WAE marks the packet with TCP option 0x21. During the data transfer phase, the data center Cisco WAE caches the data if the data are not in its cache.
6. The data center Cisco WAE sends the packet to the WAN edge router.
7. The packet travels through the WAN and arrives at the branch router. The branch router intercepts the packet and forwards it to the branch Cisco WAE. The branch Cisco WAE is aware of the Cisco WAE in the data center because the SYN/ACK TCP option 0x21 contains an ID and application policy. The auto-negotiation of the policy occurs as the branch Cisco WAE compares its application-specific policy to that of its remote peer defined in the TCP option. At this point, the data center Cisco WAE and branch Cisco WAE have determined the application optimizations to apply on this specific TCP flow. During the data transfer phase, the branch Cisco WAE caches the data if the data are not in its cache.
8. The packet is forwarded to the branch router and then to the client.

Implementing and Configuring the Cisco ACE Solution

Implementation

Implementation Overview

The Cisco ACE module used in this solution is deployed in a Cisco Catalyst 6509 switch in the data center aggregation layer. The Cisco ACE module is deployed in routed mode where multiple client and server side VLANs support unique IP subnets. In this deployment mode the Cisco ACE acts as the default gateway for the Web and application servers. Two Cisco ACE application contexts are used. Load balanced traffic traverses from the Web server farm to the application server farm on the same physical Cisco ACE. Cisco ACE is the only product on the market that accommodates and forwards traffic in multiple virtual contexts within the same hardware device.

What Was Implemented

Key features implemented on the Cisco ACE module to support this application are:

- Virtualization
- Server health monitoring
- Layer 7 load balancing
- Persistence based server cookie
- SSL termination
- TCP reuse
- Connection replication for stateful failover

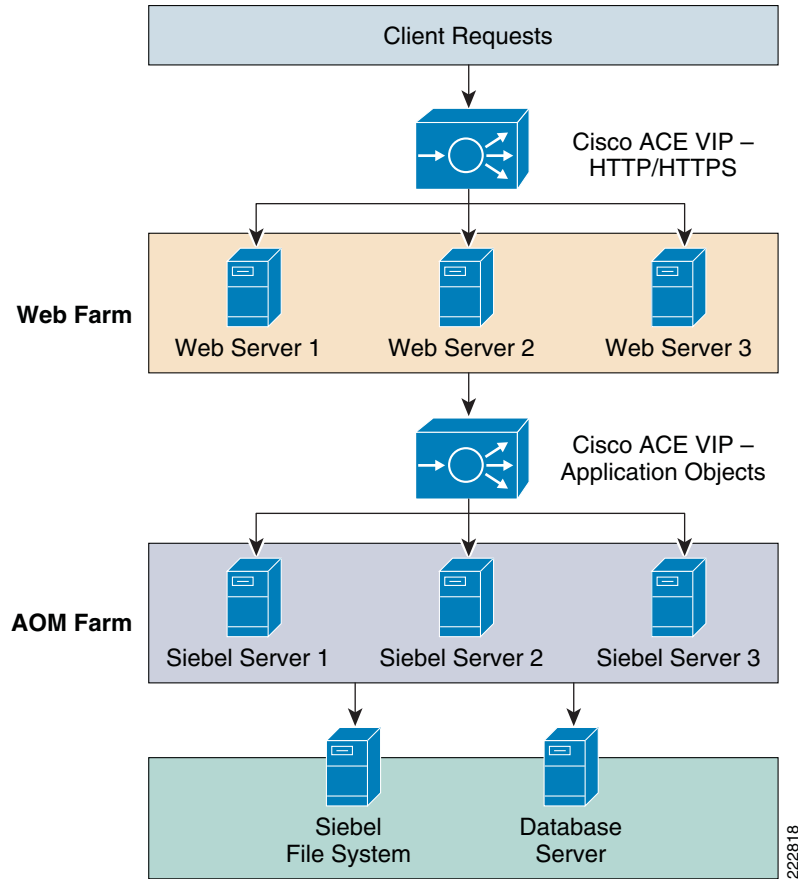
What Was Not Implemented/Tested

The following was not implemented in this solution:

- Cisco ACE inserted cookie
- Layer 4 load balancing
- Persistence based on source IP address

Network Topology

Figure 7 Network Topology



Two virtual ACE contexts are used in this deployment. A logical diagram is easier to demonstrate multiple contexts in the Cisco ACE. IP addresses for this topology are shown in [Table 1](#).

Table 1 IP Addresses for Network Topology

Name	VLAN	IP Address
Cisco ACE VIP – http/https	101	13.1.101.41
Web Server 1	42	13.1.42.57
Web Server 2	42	13.1.42.58
Web Server 3	42	13.1.42.59
Cisco ACE VIP – http/https	100	13.1.40.42
Siebel Server 1	41	13.1.41.54

Table 1 IP Addresses for Network Topology

Siebel Server 2	41	13.1.41.55
Siebel Server 3	41	13.1.41.56
Database Server	100	13.1.40.53
Siebel File System	100	13.1.40.53

Hardware or Components

Table 2 Hardware

Product	Chassis	Modules	Interfaces	Memory
ACE20-MOD-K9	Must be inserted into a Cisco Catalyst 65XX chassis	N/A	Console port	957928 kB



Note

For the data center infrastructure, refer to the *Data Center Design and Implementation Guide* at <http://www.cisco.com/go/srnd>.

Software

Table 3 Software

Product	Software/Code Version
SC6K-3.0.0A14-ACE	c6ace-t1k9-mz.3.0.0_A1_6_1.bin
ACE-VIRT-250	ACE-VIRT-250
ACE-SSL-20K-K9	ACE-SSL-20K-K9
ACE10-16G-LIC	ACE10-16G-LIC
ACE-08G-LIC	ACE-08G-LIC

Features and Functionality

Table 4 *Features and Functionality*

Product	Features and Functionality Used in the Solution
ACE20-MOD-K9	<ul style="list-style-type: none"> • Virtualization • Load balancing • Session persistence • Server health monitoring • SSL offload (up to 15,000 SSL sessions via licensing) • TCP reuse • Support for redundant configurations (intra-chassis, inter-chassis, inter-context)

Features, Services, and Application Design Considerations

The Siebel application architecture is flexible. Components within the multi-tiered framework can be on single or multiple servers. Traffic flow from the clients to the servers have clean boundaries between the different tiers. [Figure 7](#) shows Cisco ACE can load balance Web servers and application object servers.

Cisco ACE Virtualization

- Contexts—Cisco ACE can be operated in a multiple contexts; up to 250 virtual contexts are supported in a single Cisco ACE. In this deployment, three contexts are used, Admin, WebFarm, and Siebel. The Admin context is the administration context for management of the Cisco ACE itself. Cisco ACE resources are assigned from the Admin context. The WebFarm and Siebel contexts are user-defined contexts. The WebFarm context hosts Web servers. The Siebel context hosts the Siebel application servers.
- Role Based Access Control (RBAC)—Cisco ACE comes with a number of system-defined roles. RBAC is used to control access to the contexts. Running show roles lists the system-defined and user-defined roles.

Server Farms and Health Probes

Server farms are groups of hosts providing similar services in the network. There are two server farms in this deployment, Web server farm and application server farms. Server health check monitors the servers within the server farm. Cisco ACE takes the server out of rotation in the event that the server is down or services are unavailable. Numerous pre-configured health probes are available on the Cisco ACE, such as http, https, ping, etc. Http probe is used to monitor both Web server farm and application server farm.

More information on health probes is available in the Cisco ACE server load-balancing configuration guide:

http://www.cisco.com/en/US/docs/interfaces_modules/services_modules/ace/v3.00_A1/configuration/lb/guide/slbgd.html.

Loadbalancing/TCP Reuse/SSL Termination

Cisco ACE supports both Layer 4 and Layer 7 load balancing. Layer 7 loadbalancing is deployed in this environment. Layer 7 load balancing must be used since cookie sticky, TCP re-use, and SSL termination are enabled. TCP reuse saves server CPU resources by re-using existing TCP connections to the server.

SSL processing can take a significant amount of CPU processing cycles. Network hardware-assisted SSL termination can reduce overall server load on the Web servers. Cisco ACE supports SSL 3.0 and TLS 1.0.

Scalability and Capacity Planning

Server farms can increase application scalability and availability by load balancing applications services with multiple servers. In the event a server is down, other servers within the server farm can assume the load. Additional servers can be added to the server farm for scalability. SSL and TCP reuse can reduce additional load on the server farms.

High Availability

Cisco ACE High Availability

The Cisco ACE has many high availability features. It is an active/active system. Multiple contexts can be active simultaneously on both devices in a HA configuration. When the Cisco ACE is deployed in an inter-chassis configuration, configuration and state information are preserved. Failover between the Cisco ACE is stateful. Client connections are preserved in Cisco ACE failovers.

Server Farm High Availability

High availability and scalability is achieved by load balancing multiple servers within the server farm. Multiple levels of availability are available on the Cisco ACE, such as ping probes, server farms, and backup server farms. [Scalability and Capacity Planning](#) describes individual server failures and recovery methods.

Configuration Task Lists

This section describes the steps necessary to configure the equipment.

MSFC Configuration

A Cisco ACE module interacts with clients and servers via VLANs that are set up in Cisco Catalyst 6500 Series/Cisco 7600 Series Supervisor Engine 720 (Sup 720). These VLANs must be configured on Sup720 to be allowed to be sent to the Cisco ACE module. Without this configuration, by default Cisco ACE does not receive any traffic from any VLAN.

The following sample configuration steps are performed on the MSFC. Refer to [Appendix A—Cisco ACE Configuration](#) for a complete configuration.

Step 1 Create Cisco ACE VLANs for client, server, and fault tolerant traffic:

```
vlan 220
```

```

name ACE-CLIENT
!
vlan 221
name ACE-SERVER
!
vlan 500
name ACE-FT-VLAN
!

```

Step 2 Add the SVCLC configuration.

For this deployment, Cisco ACE is installed in slot 4 in the Cisco Catalyst 6500 chassis. The following configuration needs to be added to allow Cisco ACE-specific VLAN traffic to be directed towards Cisco ACE:

```

svclc multiple-vlan-interfaces
svclc module 4 vlan-group 40
svclc vlan-group 40 41-43,82,100,101

```

Step 3 Add the Switch Virtual Interface (SVI) configuration.

The SVI (interface VLAN) configuration defines Layer 3 instance on the router MSFC. The Cisco ACE client side VLAN SVI configuration is:

```

WebFarm
interface Vlan101
description ACE-Client vlan Web Farm
ip address 13.1.101.2 255.255.255.0
standby 1 ip 13.1.101.1
standby 1 timers 1 3
standby 1 priority 115
standby 1 preempt delay minimum 1

Application Farm
interface Vlan100
description DC server VLAN and AOM Farm client vlan
ip address 13.1.40.2 255.255.255.0
standby 1 ip 13.1.40.1
standby 1 timers 1 3
standby 1 priority 115
standby 1 preempt delay minimum 1

```

WebFarm Context Configuration

The following steps need to run in the WebFarm context.

Remote Management Access

To access the Cisco ACE module remotely using Telnet, SSH, SNMP, HTTP, or HTTPS or to allow ICMP access to the Cisco ACE module, a policy must be defined and applied to the interface(s) the access is entering.

The configuration steps in this section are required for both the Admin context and the application context. The following example is for the application context. Refer to [Appendix A—Cisco ACE Configuration](#) for a complete configuration.

Step 1 Configure class-map of type management:

```
class-map type management match-any REMOTE-MGMT
  2 match protocol ssh any
  3 match protocol telnet any
  4 match protocol icmp any
  5 match protocol http any
  6 match protocol https any
```

Step 2 Configure policy-map of type management:

```
policy-map type management first-match REMOTE-ACCESS
  class REMOTE-MGMT
    permit
```

Step 3 Apply policy-map to the VLAN interfaces:

```
interface vlan 41
  service-policy input REMOTE-ACCESS
interface vlan 101
  service-policy input REMOTE-ACCESS
```

Configuring Interface(s) and Default Gateway

Interface VLANs need to be configured for Layer 3 connectivity to Cisco ACE. Service policies for load balancing, security, and management access to Cisco ACE are also applied at the interface VLAN level.

The configuration steps in this section are required for both the Admin context and the application context. The following example is for the application context. Refer to [Appendix A—Cisco ACE Configuration](#) for a complete configuration.

Step 1 Define an access-list to permit/deny traffic through:

```
access-list ALLOW-TRAFFIC line 8 extended permit ip any any
access-list ALLOW-TRAFFIC line 9 extended permit icmp any any
```

Step 2 Configure IP address; IP address and network mask of the interface(s):

```
interface vlan 41
  description web farm vlan
  ip address 13.1.41.2 255.255.255.0
  alias 13.1.41.1 255.255.255.0
  peer ip address 13.1.41.3 255.255.255.0

interface vlan 101
  ip address 13.1.101.14 255.255.255.0
  alias 13.1.101.13 255.255.255.0
  peer ip address 13.1.101.15 255.255.255.0
```

Step 3 Apply management access policy and access-group to the interface(s), no shut of the interface(s):

```
interface vlan 41
  access-group input ALLOW-TRAFFIC
  access-group output ALLOW-TRAFFIC
  service-policy input REMOTE-ACCESS
  no shutdown
interface vlan 101
  access-group input ALLOW-TRAFFIC
  access-group output ALLOW-TRAFFIC
  service-policy input REMOTE-ACCESS
  no shutdown
```

Step 4 Default gateway can be configured as:

```
ip route 0.0.0.0 0.0.0.0 10.1.220.1
```

Step 5 Verify interfaces are recognized by MSFC and operational.

Type **show interface** and verify the VLANs are up and assigned from the supervisor.

Here is an example of a working output:

```

vlan220 is up
  Hardware type is VLAN
  MAC address is 00:1b:d5:9b:88:ed
  Virtual MAC address is 00:0b:fc:fe:1b:02
  Mode : routed
  IP address is 10.1.220.5 netmask is 255.255.255.0
  FT status is active
  Description:Client side vlan
  MTU: 1500 bytes
  Last cleared: never
  Alias IP address is 10.1.220.4 netmask is 255.255.255.0
  Peer IP address is 10.1.220.6 Peer IP netmask is 255.255.255.0
  Assigned from the Supervisor, up on Supervisor
    53808467 unicast packets input, 17900167965 bytes
    7331701 multicast, 7776 broadcast
    0 input errors, 0 unknown, 0 ignored, 0 unicast RPF drops
    91028995 unicast packets output, 5455629020 bytes
    4 multicast, 5202 broadcast
    0 output errors, 0 ignored

vlan221 is up
  Hardware type is VLAN
  MAC address is 00:1b:d5:9b:88:ed
  Virtual MAC address is 00:0b:fc:fe:1b:02
  Mode : routed
  IP address is 10.1.221.2 netmask is 255.255.255.0
  FT status is active
  Description:Server side vlan
  MTU: 1500 bytes
  Last cleared: never
  Alias IP address is 10.1.221.1 netmask is 255.255.255.0
  Peer IP address is 10.1.221.3 Peer IP netmask is 255.255.255.0
  Assigned from the Supervisor, up on Supervisor
    83222640 unicast packets input, 95861661879 bytes
    1118208 multicast, 47974 broadcast
    0 input errors, 0 unknown, 0 ignored, 0 unicast RPF drops
    53089290 unicast packets output, 4304456323 bytes
    4 multicast, 14950 broadcast
    0 output errors, 0 ignored

```

Probes

Cisco ACE uses probe, one of the available keep-alive methods, to verify the availability of a real server. Probe is configured by defining its type and name.

There are different types of probes that can be configured on Cisco ACE:

```

dns      Configure dns probe
echo     Configure echo probe
finger   Configure finger probe

```

```
ftp      Configure ftp probe
http     Configure http probe
https    Configure https probe
icmp     Configure icmp probe
imap     Configure imap probe
ldap     Configure ldap probe
pop      Configure pop probe
radius   Configure radius probe
scripted Configure script probe
smtp     Configure smtp probe
tcp      Configure tcp probe
telnet   Configure telnet probe
udp      Configure udp probe
```

HTTP probe is used to check the availability of the Web farm.

```
probe http http-probe
  interval 30
  expect status 200 200
```



Note

The above configuration uses the default request method GET and default URI /.

Real Server

Cisco ACE selects the real server and sends traffic based on certain sets of criteria. When configuring a real server, be aware that real server name is case sensitive. The minimum configuration needed for rserver configuration is IP address and making the rserver inservice. Same rserver can be used in multiple server farms (shown later in the document). If an rserver is made no inservice at the rserver level, then it is taken out of rotation from every server farm at which it is configured. This provides the flexibility to take a server completely out of rotation with a single command.

```
rserver host webservr1
  description Siebel web server
  ip address 13.1.41.57
  inservice
rserver host webservr2
  description Siebel web server
  ip address 13.1.41.58
  inservice
rserver host webservr3
  description Siebel web server
  ip address 13.1.41.59
  inservice
```

Server Farm

A server farm is a logical collection of real servers (rservers) that load balancer selects based on certain sets of criteria. As with real server, serverfarm name is also case sensitive.

Basic server farm configuration includes adding rservers and probes to the server farm.

```
serverfarm host WEBFARM
  probe http-probe
  rserver webservr1 80
    inservice
  rserver webservr2 80
    inservice
  rserver webservr3 80
    inservice
```


Layer 7 Load Balancing

Cisco ACE uses class-map, policy-map, and service-policy to classify and enforce a Layer 7 policy. Cisco ACE uses additional information, such as URL, HTTP header, or cookie to make a load balancing decision. The following example shows the configuration steps for URL-based matching:

Step 1 Configure Class-map of type HTTP:

```
class-map type http loadbalance match-any L7_WEB
  2 match http url .*
```

Step 2 Configure HTTP parameters (optional):

```
parameter-map type http HTTP_PARAMETERS
  server-conn reuse
  case-insensitive
```

Step 3 Configure virtual IP address (VIP) using class-map of type match-all:

```
class-map match-all L4_WEB_VIP_CLASS
```

Step 4 Configure policy-map of type loadbalance to associate server farm:

```
policy-map type loadbalance first-match L7-WEB-MATCH
  class L7_WEB
    sticky-serverfarm sn_cookie
```

Step 5 Configure policy-map multimatch to associate to the first-match above:

```
policy-map multi-match L4-WEB-VIP
  class L4_WEB_VIP_CLASS
    loadbalance vip inservice
    loadbalance policy L7-WEB-MATCH
    loadbalance vip icmp-reply
    loadbalance vip advertise active
```

Step 6 Apply policy-map to the interface VLAN:

```
interface vlan 101
  service-policy input L4-WEB-VIP
```

Stickiness (Session Persistence)

Session persistence or sticky configuration allows multiple connections from the same client to be sent to the same real server by Cisco ACE. Cisco ACE supports stickiness based on source/destination (or both) IP address and HTTP cookies.

Cookie Sticky

Cookie Sticky is used in this deployment.

Step 1 Define sticky server farm:

```
sticky http-cookie _sn sn_cookie
  replicate sticky
  serverfarm WEBFARM
```

Step 2 Apply sticky server farm to a loadbalance policy:

```
policy-map type loadbalance first-match L7-WEB-MATCH
class L7_WEB
    sticky-serverfarm sn_cookie
```

Step 3 Configure policy-map multimatch to associate to the first-match above:

```
policy-map multi-match L4-WEB-VIP
class L4_WEB_VIP_CLASS
    loadbalance vip inservice
    loadbalance policy L7-WEB-MATCH
    loadbalance vip icmp-reply
    loadbalance vip advertise active
```

Step 4 Apply policy-map to the interface VLAN:

```
interface vlan 101
    service-policy input L4-WEB-VIP
```

SSL Termination

SSL termination configuration on Cisco ACE provides SSL traffic termination on Cisco ACE instead of on the servers. This allows the offloading of server resources and also provides HTTP request inspection for various load balancing functionality.

With SSL termination on the Cisco ACE, client to Cisco ACE traffic is SSL encrypted, but Cisco ACE to server traffic is clear-text. The configuration steps to implement front end SSL termination are:

Step 1 Generate key:

```
crypto generate key 1024 siebelweb.key
EDAL-AGG1-ACE/WebFarm# sh crypto key all
Filename                               Bit Size Type
-----                               -
siebelweb.key                           1024     RSA
```

Step 2 Define CSR parameters set:

```
crypto csr-params testparms
country US
state California
locality San Jose
organization-name ESE
organization-unit ESE
common-name www.testsiebel.com
serial-number cisco123
```

Step 3 Generate csr:

```
crypto generate csr testparms siebelweb.key

-----BEGIN CERTIFICATE REQUEST-----
MIIBrjCCARcCAQAwbjELMAkGA1UEBhMCVVMxEzARBgNVBAgTCkNhbg1mb3JuaWEx
ETAPBgNVBACTCFNhbiBkb3NlMQwwCgYDVQQKEwNFU0UxDDAKBgNVBAstA0VTRTEb
MBkGA1UEAxMSd3d3LnRlc3RzaWVlZWwvY29tIGFMA0GCSqGSIb3DQEBAQUAA4GN
ADCBiQKBgQDE02Kx05XSi6FqwUCJ4py58NTfTiGDu/MczEt6ejVCVnLmRdakPXQo
vjy3ALatZe6p7IqjBDvoPSU/no6g2nAKqqObkwkmNCTep6rwNwBSlyXoh91VvwZI
FhWYmDgV5jYInPRT5qHmv5RXJK9YiMwhcQOSqJzCgF+L5RZP8aUUOQIDAQABAAw
DQYJKoZIhvcNAQEEBQADgYEARr1CUrhloKmhRtAtBeDuRmb4w6QOymrg6m8vwJ0S
ywc03F4BBoFgfPmSACrSW/qyFjGYLK0dYbZV0xq+min2932zN2e61VAdHtuFLt0/
ACKOTAtGFxe849WoEghuKvICV/RZslNXgNAO4/udL6p7vQ02+sSFqLQ9OQ0fWX2n
```

```

wo8=
-----END CERTIFICATE REQUEST-----

```

Step 4 Obtain certificate:

An SSL certificate can be obtained from various Certificate Authority (CA) companies like VERISIGN. A local certificate server was used to generate the certificate.

Step 5 Import the key from the certificate server:

```

EDAL-AGG1-ACE/Siebel# crypto import ftp 13.1.40.53 anonymous siebelweb.cer
siebelweb.cer
Passive mode on.
Hash mark printing on (1024 bytes/hash mark).
#
Successfully imported file from remote server.

```

Step 6 Validate certificate using key:

```

EDAL-AGG1-ACE/WebFarm# crypto verify siebelweb.key siebelweb.cer
Keypair in siebelweb.key matches certificate in siebelweb.cer.

```

Step 7 Configure SSL parameters and SSL proxy service:**a.** SSL parameter configuration:

```

parameter-map type ssl SSL_PARAMETERS
  cipher RSA_WITH_RC4_128_MD5
  version TLS1

```

b. SSL proxy service configuration:

```

ssl-proxy service SIEBELWEB_SSL
  key siebelweb.key
  cert siebelweb.cer

```

Step 8 Configure class-map (for VIP) and policy-maps:

```

class-map match-all L4_SSL_VIP_CLASS
  2 match virtual-address 13.1.101.41 tcp eq https

policy-map type loadbalance first-match L7-SSL-MATCH
  class L7_WEB
    sticky-serverfarm sn_cookie

policy-map multi-match L4-WEB-VIP
  class L4_WEB_VIP_CLASS
    loadbalance vip inservice
    loadbalance policy L7-WEB-MATCH
    loadbalance vip icmp-reply
    loadbalance vip advertise active
  class L4_SSL_VIP_CLASS
    loadbalance vip inservice
    loadbalance policy L7-SSL-MATCH
    loadbalance vip icmp-reply
    loadbalance vip advertise active
    ssl-proxy server SIEBELWEB_SSL

```

Step 9 Apply multi-match policy-map to service-policy at interface level or globally:

```

interface vlan 101
  description ACE WEBFARM client vlan
  ip address 13.1.101.14 255.255.255.0
  alias 13.1.101.13 255.255.255.0
  peer ip address 13.1.101.15 255.255.255.0
  no icmp-guard

```

```
access-group input ALLOW-TRAFFIC
access-group output ALLOW-TRAFFIC
service-policy input REMOTE-ACCESS
service-policy input L4-WEB-VIP
no shutdown
```

Siebel Application Manager (AOM) Context Configuration

The following steps need to run in the Siebel application context. Siebel load balancing must use rules from lbconfig.txt. Section two contains the rules for Cisco ACE.

This is a cleaned up lbconfig.txt; only the relevant AOM are defined.

```
#This is the load balance configuration file generated by the Siebel srvmgr
"generate lbconfig" command.
#It contains two sections. Section one contains load balancing rules to be used
by Siebel session manager.
#Section two is intended for 3rd party load balancers. Before modifying the con
ent of this file please
#read the chapter on SWSE configuration in the Siebel Bookshelf.
#Section one -- Session Manager Rules:
VirtualServer=9:appsrvr1:2321;13:appsrvr2:2321;11:appsrvr3:2321;
*****
#Section two -- 3rd Party Load Balancer Rules
#Component Rules:
/SBA_80/SalesCEObjMgr_enu=appsrvr3:2321;appsrvr2:2321;appsrvr1:2321;
/SBA_80/SCCObjMgr_enu=appsrvr3:2321;appsrvr2:2321;appsrvr1:2321;
#Server Rules:
*/!9.*=appsrvr1:2321;
*/!d.*=appsrvr2:2321;
*/!b.*=appsrvr3:2321;
#Round Robin Rules:
/SBA_80/SalesCEObjMgr_enu/RR=appsrvr3:2321;appsrvr2:2321;appsrvr1:2321;
/SBA_80/SCCObjMgr_enu/RR=appsrvr3:2321;appsrvr2:2321;appsrvr1:2321;
```

Virtualization

Virtualization is a method to allocate available resources into two or more contexts for security and management purposes. Up to 250 (5 with no additional license requirements) contexts can be configured on Cisco ACE. Resources can be allocated to each context to avoid a single context consuming the entire pool of resources. This document only covers key virtualization configuration. Within each context, Domains and Role Base Access Controls (RBACs) can be further configured to provide additional security and access control to the resources.

Step 1 Create resources for the context:

```
resource-class WebFarm
  limit-resource all minimum 20.00 maximum unlimited
  limit-resource sticky minimum 40.00 maximum equal-to-min
resource-class siebel-resource
  limit-resource all minimum 20.00 maximum unlimited
  limit-resource sticky minimum 40.00 maximum equal-to-min
```

Step 2 Create the WebFarm and Siebel Contexts and associate them with correct resources:

```
context Siebel
  allocate-interface vlan 42
```

```

allocate-interface vlan 100
member siebel-resource
context WebFarm
allocate-interface vlan 41
allocate-interface vlan 101
member WebFarm

```

Redundancy/High Availability

To provide high availability and redundancy, Cisco ACE can be set up and configured in a redundant mode. Cisco ACE can be configured in a typical active/backup redundancy mode or active/active (per context) redundancy mode.

```

! Configure FT interface
ft interface vlan 43
ip address 192.168.100.1 255.255.255.0
peer ip address 192.168.100.2 255.255.255.0
no shutdown
! Configure FT peer
ft peer 1
heartbeat interval 200
heartbeat count 20
ft-interface vlan 43
! Create a fault tolerant group - one for each context
ft group 1
peer 1
priority 120
associate-context Siebel
inservice
ft group 2
peer 1
priority 120
associate-context WebFarm
inservice

```

By assigning context(s) to an FT group, a network administrator can create multiple groups for multiple contexts where the ACTIVE contexts can be distributed among the two Cisco ACE modules. This setup provides active/active redundancy setup for load sharing and high availability.

Management Access Configuration

Refer to the step-by-step instructions in [WebFarm Context Configuration](#). The access and permission list is the same. This is the interface configuration with different IP addresses:

```

interface vlan 42
description application farm vlan
ip address 13.1.42.2 255.255.255.0
alias 13.1.42.1 255.255.255.0
peer ip address 13.1.42.3 255.255.255.0
no icmp-guard
access-group input ALLOW-TRAFFIC
service-policy input REMOTE-ACCESS
no shutdown
interface vlan 100
description ACE AOM client vlan
ip address 13.1.40.11 255.255.255.0
alias 13.1.40.10 255.255.255.0
peer ip address 13.1.40.12 255.255.255.0

```

```
no icmp-guard
access-group input ALLOW-TRAFFIC
service-policy input REMOTE-ACCESS
service-policy input L4-APPS-VIP
no shutdown
```

Configuring Interface(s) and Default Gateway

Refer to the step-by-step instructions in [WebFarm Context Configuration](#). This is the configuration:

```
ip route 0.0.0.0 0.0.0.0 13.1.40.1
```

Probes

Refer to the step-by-step instructions in [WebFarm Context Configuration](#).

HTTP probe is used to check the availability of the application farm. It checks port 2321 of the Siebel Servers.

```
probe http scbroker-probe
port 2321
interval 30
passdetect interval 10
passdetect count 1
request method get url /SBA_80/scbroker
expect status 100 200
```

Real Server

Cisco ACE selects the real server and sends traffic based on certain sets of criteria. When configuring a real server, be aware that real server name is case sensitive. The minimum configuration needed for rserver configuration is IP address and making the rserver inservice. The same rserver can be used in multiple server farms (shown later in the document). If an rserver is made no inservice at the rserver level, then it is taken out of rotation from every server farm at which it is configured. This provides the flexibility to take a server completely out of rotation with a single command.

```
rserver host appsrvr1
description Siebel application server
ip address 13.1.42.54
inservice
rserver host appsrvr2
description Siebel application server
ip address 13.1.42.55
inservice
rserver host appsrvr3
description Siebel application server
ip address 13.1.42.56
inservice inservice
```

Server Farms

A server farm is a logical collection of real servers (rservers) that load balancer can select based on certain sets of criteria. As with real server, serverfarm name is also case sensitive.

The Siebel application requires Layer 7 load balancing for the AOM. Each application must be defined as its own server farm. Each server must also be defined as a server farm for direct server access. The total number of server farms is two times the number of AOMs plus the number of servers. In this case, seven server farms must be defined for two applications

Step 1 Define each server as serverfarm for direct server mapping.

```
serverfarm host APPS1FARM
  probe scbroker-probe
  rserver appsrvr1 2321
  inservice
serverfarm host APPS2FARM
  probe scbroker-probe
  rserver appsrvr2 2321
  inservice
serverfarm host APPS3FARM
  rserver appsrvr3 2321
  inservice
```

Step 2 Define the CallCenter application server farm. RR is the reconnect request server farm. Retry requests are forward to the RR server farm is the initial request is rejected.

```
serverfarm host SCCOBYMGR_FARM
  probe scbroker-probe
  rserver appsrvr1 2321
  inservice
  rserver appsrvr2 2321
  inservice
  rserver appsrvr3 2321
  inservice
serverfarm host SCCOBYMGR_FARM_RR
  probe scbroker-probe
  rserver appsrvr1 2321
  inservice
  rserver appsrvr2 2321
  inservice
  rserver appsrvr3 2321
  inservice
```

Step 3 Define the eSales application server farm. RR is the reconnect request server farm. Retry requests are forward to the RR server farm is the initial request is rejected.

```
serverfarm host SALESCEOBYMGR_FARM
  probe scbroker-probe
  rserver appsrvr2 2321
  inservice
  rserver appsrvr3 2321
  inservice
serverfarm host SALESCEOBYMGR_FARM_RR
  rserver appsrvr2 2321
  inservice
  rserver appsrvr3 2321
  inservice
```

Layer 7 Load Balancing

Cisco ACE uses class-map, policy-map, and service-policy to classify and enforce a Layer 7 policy. Cisco ACE uses additional information such as URL, HTTP header, or cookie to make a load balancing decision. The following example shows the configuration steps for URL-based matching.

The following example shows the configuration steps needed:

Step 1 Configure Class-map of type HTTP for the different application component and server requests:

```

class-map type http loadbalance match-any L7_APPSERVER_1_CLASS
  2 match http url .*!/9\. method POST
class-map type http loadbalance match-any L7_APPSERVER_2_CLASS
  2 match http url .*!/d\. method POST
class-map type http loadbalance match-any L7_APPSERVER_3_CLASS
  2 match http url .*!/b\. method POST
class-map type http loadbalance match-any L7_SALESCEOBJMGR_CLASS
  2 match http url .*/sba_80/sseobjmgr_enu method POST
class-map type http loadbalance match-any L7_SALESCEOBJMGR_RR_CLASS
  2 match http url .*/sba_80/sseobjmgr_enu/rr method POST
class-map type http loadbalance match-any L7_SCCOBJMGR_CLASS
  2 match http url .*/sba_80/sccobjmgr_enu method POST
class-map type http loadbalance match-any L7_SCCOBJMGR_RR_CLASS
  2 match http url .*/sba_80/sccobjmgr_enu/rr method POST
    
```

Step 2 Configure connection parameter, which sets the connection timeout for idle sessions:

```

parameter-map type connection TCP_PARAMETER
  set timeout inactivity 86400
    
```

Step 3 Configure virtual IP Address (VIP) using class-map of type match-all:

```

class-map match-all L4_APPS_VIP_CLASS-2321
  2 match virtual-address 13.1.40.42 tcp eq 2321
    
```

Step 4 Configure policy-map of type loadbalance to associate server farm. Each of the class mapS is associated with a specific server farm:

```

policy-map type loadbalance first-match L7-APPS-MATCH
  class L7_SCCOBJMGR_CLASS
    serverfarm SCCOBJMGR_FARM
  class L7_APPSERVER_1_CLASS
    serverfarm APPS1FARM
  class L7_APPSERVER_2_CLASS
    serverfarm APPS2FARM
  class L7_APPSERVER_3_CLASS
    serverfarm APPS3FARM
  class L7_SALESCEOBJMGR_CLASS
    serverfarm SALESCEOBJMGR_FARM
  class L7_SCCOBJMGR_RR_CLASS
    serverfarm SCCOBJMGR_FARM_RR
  class L7_SALESCEOBJMGR_RR_CLASS
    serverfarm SALESCEOBJMGR_FARM_RR
    
```

Step 5 Configure policy-map multimatch to associate to the first-match above:

```

policy-map multi-match L4-APPS-VIP
  class L4_APPS_VIP_CLASS-2321
    loadbalance vip inservice
    loadbalance policy L7-APPS-MATCH
    loadbalance vip icmp-reply
    loadbalance vip advertise active
    connection advanced-options TCP_PARAMETER
    
```

Step 6 Apply policy-map to the interface VLAN:

```

interface vlan 100
  description ACE AOM client vlan
  ip address 13.1.40.11 255.255.255.0
  alias 13.1.40.10 255.255.255.0
  peer ip address 13.1.40.12 255.255.255.0
  no icmp-guard
  access-group input ALLOW-TRAFFIC
  service-policy input REMOTE-ACCESS
  service-policy input L4-APPS-VIP
    
```



```
no shutdown
```

Configuration and Menus

See [Appendix A—Cisco ACE Configuration](#).

Troubleshooting Configuration

These show commands can help troubleshoot issues with the configuration:

- **show stats**—Displays the statistical information relating to the operation of the Cisco ACE.
- **show service-policy *policy_name***—Displays the statistics for service policies enabled globally within a context or on a specific interface.
- **show serverfarm *name* detail**—Displays the summary or detailed server-farm statistics.
- **show rserver *rserver_name* detail**—Displays the summary or detailed statistics for a named real server or for all real servers.
- **show probe**—Displays the probe information including script probes.
- **show arp**—Displays the current active IP address-to-MAC address mapping in the ARP table, statistics, or inspection or timeout configuration.
- **show arp statistics**—Displays the ARP statistics for all VLAN interfaces.
- **show context**—Verifies the auto-sync configuration of all contexts.
- **show ft group status**—Verifies FT status of all configured context in the Cisco ACE.
- **show ft peer detail**—Verifies the state of FT peering.
- **show resource usage**—Displays the resource usage for each context.
- **show np *NP_number***—Displays the hardware information stored on the three network processors.

Implementing and Configuring the Cisco WAAS Solution

Implementation

Implementation Overview

The Cisco WAAS solution requires a minimum of three Cisco Wide Area Application Engine (WAE) appliances to auto-discover and deliver applicable application optimizations. One Cisco WAE is placed in the enterprise data center and the other at the branch site. The enterprise data center Cisco WAE is placed on the WAN edge connected to the WAN router. The third Cisco WAE is used for the Central Manager. The architecture offloads the Cisco WAE device from the local branch router and leverages the available ports on a local switch. This design provides scalability and availability for the solution.

What Was Implemented

Cisco WAAS technology requires the efficient and predictable interception of application traffic to produce results. It is critical that the Cisco WAE device see the entire TCP conversation. At the WAN edge, Cisco routers support the following four methods of traffic interception:

- Policy-based routing (PBR)
- Web Cache Communications Protocol (WCCP) v2
- Service policy with Cisco ACE
- Inline hardware

WCCPv2 is the most common method used in the remote branch environment; therefore, WCCPv2 has been leveraged for this solution.

**Note**

Cisco WAEs “out of box” have a standard set of application variables and ports that are defined for optimization. In this solution no changes need to be made to the standard default configuration of the Cisco WAEs.

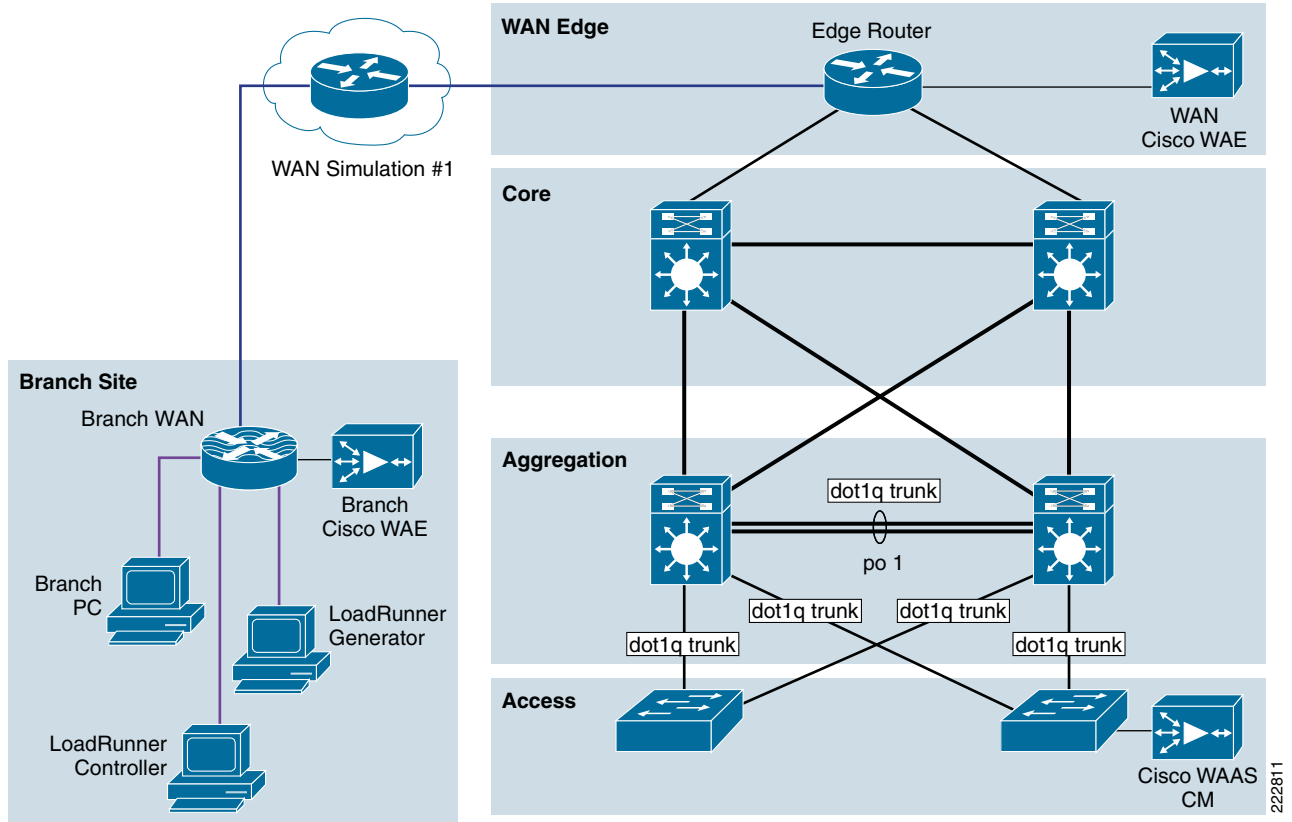
What Was Not Implemented

The following was not implemented in this solution:

- Cisco WAAS Network Module in which Cisco WAAS is installed in an integrated services router, providing a comprehensive solution within a single platform. This architecture provides less scalability and should be considered for use with a branch with a small number of users.

Network Topology

Figure 8 Network Topology



Hardware or Components

Table 5 Hardware

Product	Chassis	Modules	Interfaces	Memory
WAE-7326-K9	WAE-7326-K9	N/A	2 10/100/1000 Ethernet, serial port	4 Gbytes, 144 GB SCSI HD
WAE-612-K9	WAE-612-K9	N/A	2 10/100/1000 Ethernet, serial port	2 Gbytes, 144 GB SCSI HD

222811

Software

Table 6 **Software**

Product	Software/Code Version
SF-WAAS-4.0-SC-K9	4.0.13
WAAS-ENT-APL	Cisco WAAS Enterprise License for 1 Cisco WAE Appliance
SF-WAAS-4.0-SC-K9	4.0.13
WAAS-ENT-APL	Cisco WAAS Enterprise License for 1 Cisco WAE Appliance

Features and Functionality

Table 7 **Features and Functionality**

Product	Supported Features and Functionality Used in the Solution
WAE-7326-K9, WAE-612-K9	Transport Flow Optimization (TFO) Data Redundancy Elimination (DRE), LZ compression

Features, Services, and Application Design Considerations

Most multi-tiered applications support Web-based clients in addition to native application clients. Web-based clients use port 80 to communicate to the Web server. Applications in this test use port 80. In the context of Cisco WAAS, port 80 is accelerated by default; no further configuration in the Cisco WAE is necessary unless the application requires ports that are not part of the default application profile. For applications that use TCP ports that are not defined in the default application profile, you must define ports to the existing application profile or create a new application profile with the associated ports. With the recommended design of Cisco WAAS at the WAN edge, client data only traverse the Cisco WAEs once, at the ingress/egress of the data center. Further application communication between the Web servers, application servers, and database servers are within the data center and are not affected by Cisco WAAS.

Transport Flow Optimization (TFO), Data Redundancy Elimination (DRE), and Lempel-Ziv (LZ)-compression, the three key technologies of Cisco WAAS, are enabled by default. Each of these features and functions are described in [Features and Functionality](#). The net results are reduced traffic and decreased latency across the WAN. Since Cisco WAAS deployments are transparent to the network and application, applications do not need to be aware of the added functions and continue to work as-is, but with decreased response time and increased traffic throughput and transactions.

Additional information on Cisco WAAS data center and branch designs are available at:

- *Enterprise Data Center Wide Area Application Services (WAAS) Design Guide*
http://www.cisco.com/application/pdf/en/us/guest/netsol/ns377/c649/ccmigration_09186a008081c7da.pdf
- *Enterprise Branch Wide Area Application Services Design Guide (Version 1.1)*
http://www.cisco.com/application/pdf/en/us/guest/netsol/ns477/c649/ccmigration_09186a008081c7d5.pdf

Scalability and Capacity Planning

Cisco WAE farms can scale up to 32 devices with WCCP and up to 16000 with Cisco ACE load balancing. Cisco WAAS services scale linearly in a N+1 configuration. In addition to the Max Optimized TCP connections, the fan out ratio between the DC Cisco WAE and branch Cisco WAE have to be considered. The fan out ratio is determined by a number of factors, such as the number of Cisco WAEs in the branch offices, amount of network traffic, and number of TCP connections. A sizing tool is available internally that can help automate sizing decisions. NetFlow, NetQoS, and other network analysis tools can provide additional traffic flow information for increased accuracy in scalability and capacity planning.

Table 8 Cisco WAE Family Performance and Scalability

Device	Max Optimized TCP Connections	Max CIFS Sessions	Single Drive Capacity [GB]	Max Drives	RAM [GB]	Max Recommended WAN Link [Mbps]	Max Optimized Throughput [Mbps]	Max Core Fan-out [Peers]	CM Scalability [Devices]
NME-WAE-302	250	N/A	80	1	0.5	4	90		
NME-WAE-502	500	500	120	1	1	4	150		
WAE-512-1GB	750	750	250	2	1	8	100	5	500
WAE-512-2GB	1500	1500	250	2	2	20	150	10	1000
WAE-612-2GB	2000	2000	300	2	2	45	250	30	2000
WAE-612-4GB	6000	2500	300	2	4	90	350	50	2500
WAE-7326	7500	2500	300	6	4	155	450	96	
WAE-7341	12000	12000	300	4	12	310	800	200	
WAE-7371	50000	32000	300	6	24	1000	1500	400	

Branch devices range from the NME-WAE-302 for very small offices to the 612-4GB or even higher models for bigger branch sites. WAE 7326 and up are designed for data center installations.

High Availability

Cisco WAAS deployments are transparent to the application. The application client and server do not know Cisco WAAS is optimizing traffic flows. High availability is built into the WCCP interception. When WCCP is not active or if Cisco WAAS devices are not functioning, WCCP does not forward traffic to the Cisco WAEs, resulting in un-optimized traffic flow. This is the worse case scenario; traffic flow continues but is not optimized.

Device High Availability

The Cisco WAEs have many built-in high availability features. The disk subsystem is recommended to be configured with RAID 1 protection. RAID 1 is mandatory when two or more drives are installed in the Cisco WAE. With RAID 1, failure of the physical drive does not affect normal operations. Failed disks can be replaced during planned downtime. Multiple network interfaces are available. Standby interfaces can be configured for interface failover. A standby interface group guards against network interface failure on the Cisco WAE and switch. When connected to separate switches in active/standby mode, the standby interface protects the Cisco WAE from switch failure.

N+1 Availability

Cisco WAEs and the network provide additional high availability (HA) capabilities. Routers can be configured redundantly providing HSRP or GLBP services. Cisco WAEs can be configured in a N+1 configuration. N+1 configuration provides scalability and availability. This design calls for N number of Cisco WAEs for a specific workload, then add a standby Cisco WAE. Since the workload always distributes evenly among the Cisco WAEs, the standby Cisco WAE is utilized, reducing overall workload. In the event that a Cisco WAE fails, the rest of Cisco WAEs can resume normal workload.

Configuration Task Lists

The following subsections describe the information required prior to configuration of the equipment.

Central Manager

Central Manager (CM) is the management component of Cisco WAAS. CM provides a GUI for configuration, monitoring, and management of multiple branch and data center Cisco WAEs. CM can scale to support thousands of Cisco WAE devices for large-scale deployments. The CM is necessary for making any configuration changes via the Web interface. In the event of CM failure, Cisco WAEs continue to function, however changes cannot be made using the Web pages on the CM until the CM comes back online.

Cisco WAEs need to connect to the CM on the initial setup. The registration process adds the Cisco WAE to the CM and initializes the local Cisco WAE data base. When disk encryption on the Cisco WAE is enabled, the CM must be available to distribute the encryption key in the event the Cisco WAE reboots.

Centralized reporting can be obtained from the CM. Individually, the Cisco WAEs provide basic statistics via the CLI and local device GUI. System-wide application statistics are available from the CM GUI. Detailed reports such as total traffic reduction, application mix, and pass-through traffic can be obtained from CM GUI.

The following example shows the configuration steps needed to configure CM.



Note

At least one Cisco WAE must be the Central Manager. Adding backup Central Managers increases availability. Central Managers should be installed in the data center with other critical servers, not near the branch- or WAN-facing segments.

Step 1

Configure the device to be Central Manager. It is set to application-accelerator mode by default:

```
device mode central-manager
```

Step 2 Configure the Central Manager IP address:

```
interface GigabitEthernet 1/0
ip address 13.1.40.8 255.255.255.0
```

Step 3 Set up the default gateway:

```
ip default-gateway 13.1.40.1
```

Step 4 Set the primary interface. Cisco WAAS supports multiple network interfaces type, port channels, and standby interface. Cisco WAAS uses the primary interface for traffic interception and delivery. The primary interface must be defined:

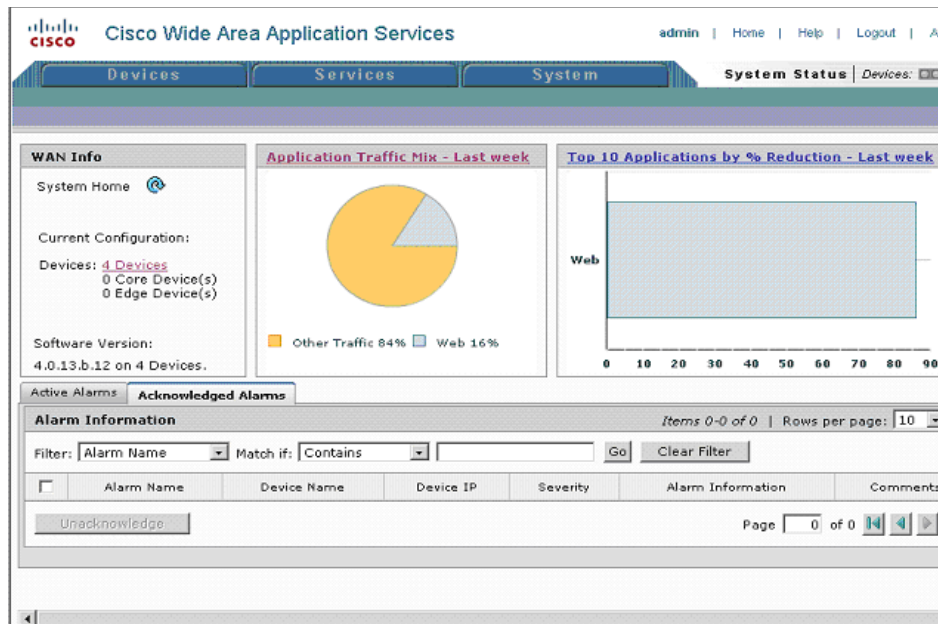
```
primary-interface GigabitEthernet 1/0
```

Step 5 Define the NTP server. Traffic statistics are captured and forward to Central Manager and NetQos. The time stamp on each packet needs to be accurate. All Cisco WAEs and routers should synchronize to the same NTP server:

```
ntp server 13.1.5.2
```

Step 6 Initialize the Configuration Management System (CMS) database. The CMS contains configuration rules and information. The Central Manager is the repository of CMS data:

```
cms enable
```

Step 7 Login to the CM Web GUI on port 8443 after the CM is up and running. The initial CM screen is an overview of the health of the system. It contains information on number of devices, status, application traffic, and optimization rate.**Figure 9** Cisco WAAS Central Manager

Branch and Data Center Router

The branch and data center router provides WCCP interception points for Cisco WAAS. Without WCCP interception, Cisco WAAS does not know where to obtain and optimize traffic flow. Different methods of interception and redirection are supported by routers and switches. Redirection methods depend on the speed requirement and router/switch platform. In this deployment, Generic Router Encapsulation (GRE) redirection is used.

The loopback interface on the router is essential for identifying the router ID. While any IP address can be used to identify the router ID, the loopback interface is preferred over the physical interfaces. Loopback interfaces are always available; there are no physical ties to them. Other routing protocols also use loopback interfaces as a preferred method for naming the router ID. With the IP address tied to a specific physical interface, when the physical interface goes down, the IP address becoming unavailable, causing unexpected issues with WCCP groups.

Step 1 Configure the loopback interface:

```
interface Loopback0
 ip address 13.1.15.3 255.255.255.255
```

WCCP service 61 and 62 direct the router to re-route traffic from the interface to the WCCP group. Service 61 redirects ingress traffic and service 62 redirects egress traffic. Both service 61 and 62 are needed to complete redirect bi-directional traffic flow. WCCP is an open standard. Other equipment that implements the WCCP protocol can participate in the WCCP group. Passwords should be assigned to WCCP groups to prevent rogue traffic interception and redirection.

Step 2 Configure WCCP service 61 and 62 with a password:

```
ip wccp 61 password cisco
ip wccp 62 password cisco
```

Step 3 Configure the Cisco WAE VLAN. The Cisco WAE needs to reside in its own subnet for WCCP interception:

```
interface Vlan301
 description WAE vlan - 301
 ip address 13.1.12.1 255.255.255.0
```

Step 4 Exclude the WAW subnet from interception since we are using a single interface to intercept incoming and outgoing packets. The interception exclusion is required because the router does not discriminate traffic from the Cisco WAE for client/server. Traffic must be redirected to the Cisco WAE after it is optimized by the Cisco WAE; the effect would be forwarding loop.

```
ip wccp redirect exclude in
```

Step 5 Enable the NetFlow collection for outgoing traffic from the Cisco WAEs:

```
ip flow egress
```

Step 6 Assign the Cisco WAE VLAN to physical port:

```
interface FastEthernet1/0
 description WAE port
 switchport access vlan 301
```

Step 7 Configure the client VLAN. This is the VLAN or interface for WCCP interception:

```
interface Vlan300
 description client vlan - 300
 ip address 13.1.11.1 255.255.255.0
```


- Step 8** Configure WCCP interception service 61 and 62 on the client VLAN. All ingress/egress packets from this VLAN/interface are forwarded to the Cisco WAE for optimization:
- ```
ip wccp 61 redirect in
ip wccp 62 redirect out
```
- Step 9** NetFlow statistics is configured for all outbound traffic:
- ```
ip flow egress
```
- Step 10** Configure NTP to synchronize to a master clock. Traffic statistics are captured and forwarded to Central Manager and NetQos. The time stamp on each packet needs to be accurate. All Cisco WAEs and routers should synchronize to the same NTP server.
- ```
ntp server 13.1.15.2
```
- Step 11** Configure NetFlow to send information to the collector. Notice NetFlow also uses loopback interface as the source address. NetFlow sends statistics from the Cisco WAE and router to the NetFlow aggregator. NetFlow statistics can be overwhelming for smaller connections. It is recommended that Cisco WAAS optimize NetFlow transfers.
- ```
ip flow-export source Loopback0
ip flow-export version 5
ip flow-export destination 10.1.70.10 9995
```
-

WAE-612-K9, WAE-7326-K9

- Step 1** Set device mode to accelerator. Cisco WAE can be set up as application accelerator or Central Manager. By default application-accelerator is enabled:
- ```
device mode application-accelerator
```
- Step 2** Configure the Cisco WAE IP addresses:
- ```
interface GigabitEthernet 1/0
ip address 13.1.12.2 255.255.255.0
```
- Step 3** Set up the default gateway:
- ```
ip default-gateway 13.1.12.1
```
- Step 4** Set up the primary interface. Cisco WAAS supports many type of interfaces, including local network failover. Designating a primary interface is required. Cisco WAAS uses this interface for interception and redirection.
- ```
primary-interface GigabitEthernet 1/0
```
- Step 5** Turn on WCCP version 2:
- ```
wccp version 2
```
- Step 6** Add the router to the router list:
- ```
wccp router-list 1 10.1.20.1
```
- Step 7** Set up tcp promiscuous mode to accept all traffic from the interface. The WCCP password is the same for all devices in the WCCP group, including routers:
- ```
wccp tcp-promiscuous router-list-num 1 password cisco
```

- Step 8** Set up NTP server. Traffic statistics are captured and forwarded to Central Manager and NetQos. The time stamp on each packet needs to be accurate. All Cisco WAEs and routers should synchronize to the same NTP server.

```
ntp server 13.1.15.2
```

- Step 9** Set up Central Manager address. The Cisco WAE needs register to the Central Manager for statistics reporting and management. Configurations on a per device basis can be perform by the CLI and device GUI. Site wide or Cisco WAAS group have to be perform by the Central Manager. The Central Manager can run operations on thousands of Cisco WAEs at once, saving precious time managing the Cisco WAAS infrastructure:

```
central-manager address 13.1.40.8
```

- Step 10** Enable CMS. This command initializes the local database and connects to the Central Manager:

```
cms enable
```

- Step 11** Set up NetFlow to send Cisco WAAS statistics to the NetFlow Aggregator. Notice the host IP address is not the NetFlow Aggregator, but the management station. The management station opens another connection to the Cisco WAE to inform the IP address of the aggregator:

```
flow monitor tcpstat-v1 host 10.1.70.11
flow monitor tcpstat-v1 enable
```

## Configuration and Menus

See [Appendix B—Cisco WAE Configurations](#).

## Troubleshooting Configuration

### Cisco WAE Commands

These show commands can help troubleshoot issues with the configuration:

- **sh wccp status**—Verifies WCCP V2 is enabled.
- **sh wccp services**—Verifies WCCP service 61 and 62 are active. Service 61 and 62 must be active.
- **sh wccp routers**—Verifies the router can see the Cisco WAE. Notice that the router ID is the router loopback address. Sent To is the router interface on the Cisco WAE VLAN. All routers are defined and visible on the Cisco WAE.
- **sh statistics dre**—Checks DRE usage. There are two sections in the statistics. One is encode, traffic coming in to the Cisco WAE from the client/server. The Cisco WAE needs to compress the incoming traffic with LZ compression then apply DRE. Another is the decode, traffic coming from the peering Cisco WAE, DRE lookup is performed and traffic uncompressed. These statistics are useful for finding compressibility of the data.
- **sh tfo connection summary**—Verifies Cisco WAAS clients are using Cisco WAAS for connectivity. Show tfo connections show all optimized paths in the Cisco WAE. The policy field indicates which optimization method is active for the specified link. F shows the link is fully optimized, which includes DRE, TFO (shown as TCP Optimization), and LZ compression. Pass-through connections are connections that are not optimized.

The following is sample output from **sh tfo connection summary**. F,F,F,F means the connection is fully optimized with DRE/LZ and TCP Optimization.

```
Optimized Connection List
Policy summary order: Our's, Peer's, Negotiated, Applied
F: Full optimization, D: DRE only, L: LZ Compression, T: TCP Optimization
Local-IP:Port Remote-IP:Port ConId PeerId Policy
13.1.11.3:49520 13.1.40.41:80 43357 00:14:5e:ac:3a:47 F,F,F,F
13.1.11.2:9146 13.1.40.41:80 55532 00:14:5e:ac:3a:47 F,F,F,F
Pass-Through Connections
Local-IP:Port Remote-IP:Port Conn Type
13.1.42.54:445 13.1.11.2:5401 PT In Progress
```

## Router Commands

- **sh ip wccp 61**—Verifies WCCP service 61 and 62 are active. This command shows global wccp information and how the packets are redirected. Redirect and group access-list issues are easier to troubleshoot with this output. Service 62 should also check with **sh ip wccp 62**.
- **sh ip wccp 61 detail**—Checks WCCP client hash or Layer 2 assignments. This command also checks the status of the WCCP client, namely the Cisco WAEs. **sh ip wccp 61** shows global WCCP information; this command shows detailed WCCP client information. Hashing assignments (Cisco WAE bucket assignments), client ID, and client status are found in the output.
- **sh ip wccp interface detail**—Verifies which interface has WCCP configured. Identify all interfaces within a router or switch that have WCCP configured with ingress or egress for exclude-in redirection. Another way to get this information is with **sh run**; examine each interface.
- **sh ip wccp 61 view**—Verifies WCCP group membership. Check service 62 as well.

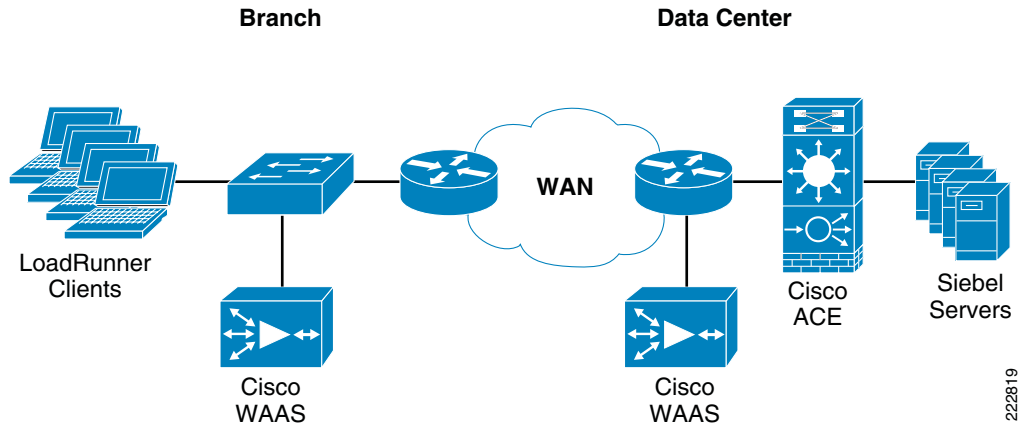
## Testing and Results

The tests were simulations of a series of tasks performed by Siebel users during a typical working day. They were broken down into three categories.

- Document upload
- Document download
- Site navigation

In this testing scenario, the PC running the HP Mercury LoadRunner testing application was attached to the branch office Cisco ISR router which is connected back to the data center Cisco WAAS edge router via T1 to simulate a WAN connection using multiple speeds. The testing was performed at full T1 speed with 100 ms delay to simulate a typical intra-continental circuit and also at 512 Kbps speed with 200 ms delay to simulate a typical inter-continental circuit.

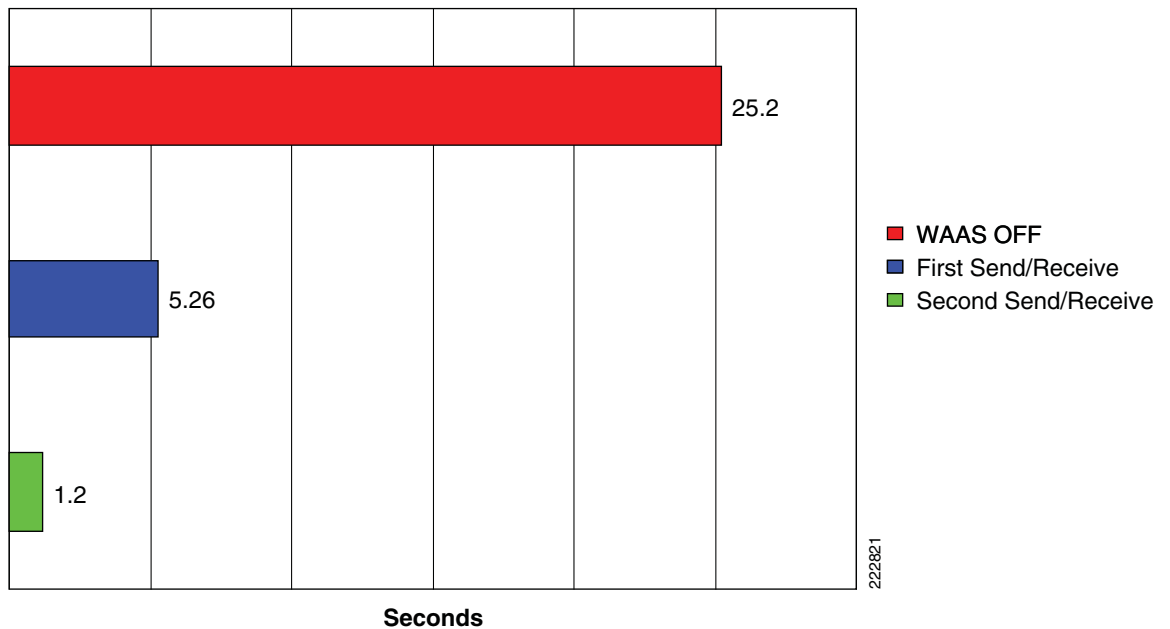
**Figure 10** Testing Scenario



This network scenario included Cisco WAAS application acceleration devices at the branch office and the data center. At the branch office a Cisco WAE-612 was connected on a separate VLAN. WCCP was enabled on the router to redirect client and WAN traffic to the Cisco WAAS device. At the data center two Cisco WAAS devices were installed. The first was the Cisco WAAS Central Manager Cisco running on a Cisco WAE-612. This is connected to a VLAN to the MSFC on the Core switch.

**Figure 11** Document Upload—With and Without Cisco WAAS T1 Link

1MB doc upload

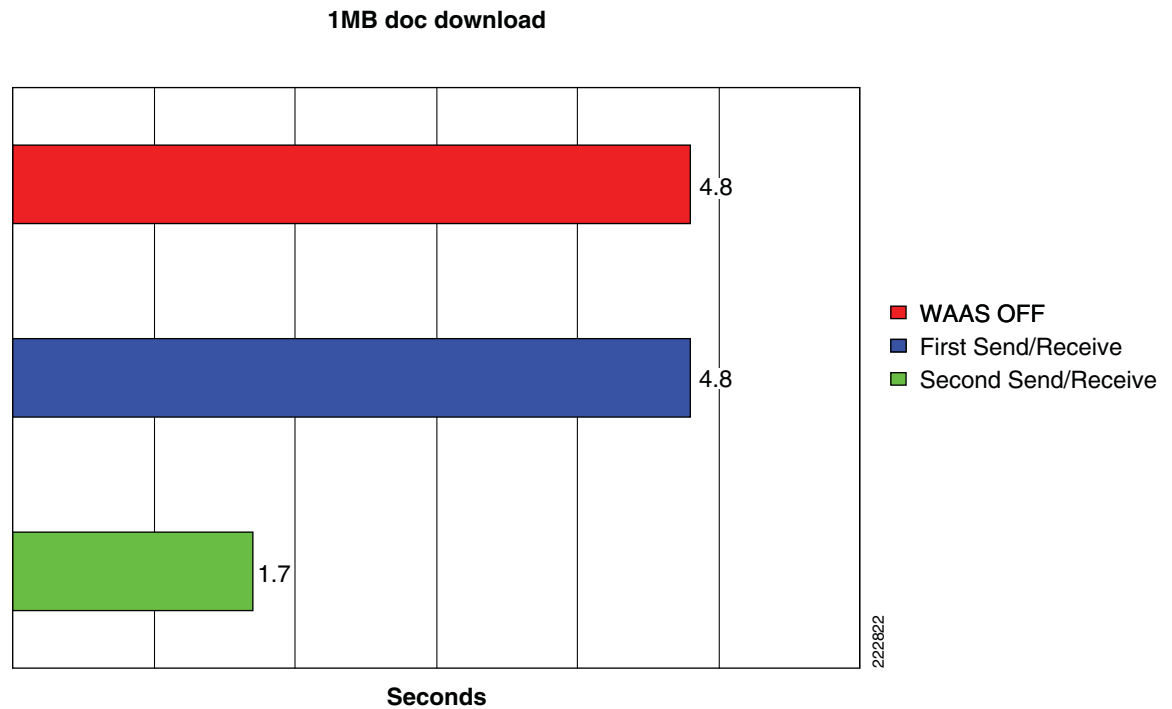


## Document Attachments

Document attachments in the Siebel application is for storing of data such as quotes, fax, spreadsheet, and other related information relevant to a specific opportunity or contact. A download and upload test was performed on the T1 link. Document upload is significantly faster with Cisco WAAS (see

Figure 11). This is uploading attachments via http to the Siebel application. Blue/green bars are Cisco WAAS on. The initial Cisco WAAS pass is 5X faster than without Cisco WAAS; subsequent uploads are almost instantaneous at LAN-like speeds. TFO and DRE cache are accelerating the transfer.

**Figure 12 Document Download—With and Without Cisco WAAS T1 Link**



Document download is also faster with Cisco WAAS (see Figure 12). Siebel compresses the file before storing on the Siebel File System. The actual file download is 775 KB. Local application cache increases native file download speeds. A second send/receive with Cisco WAAS is almost three times as fast. Blue/green bars are Cisco WAAS on.

## Site Navigation

**Table 9 512kbs Circuit with 200 msec. Delay**

|                             | Cisco WAAS Off | Cisco WAAS On |
|-----------------------------|----------------|---------------|
| Total Transactions          | 873            | 1,883         |
| Throughput in bytes         | 91,653,566     | 18,104,116    |
| Ave Throughput (bytes/sec.) | 50,862         | 102,167       |
| Ave Hits per second         | 8.43           | 17.7          |

Table 9 shows all data points are nearly double with Cisco WAAS enabled on a 512kbs circuit (doubling the number of transactions and throughput). The Siebel application is almost unusable with 512kbs circuit with 40 concurrent users until Cisco WAAS is enabled due to high latency. Login times (not shown) were reduced from 167 seconds down to 12 seconds. This example clearly demonstrates that

using Cisco WAAS can bring immediate relief to WAN bottlenecks. Instead of increasing WAN capacity, which is a monthly recurring cost, adding Cisco WAAS can yield the same result without additional WAN capacity and recurring costs.

**Figure 13** T1 Circuit with 100 msec. Delay

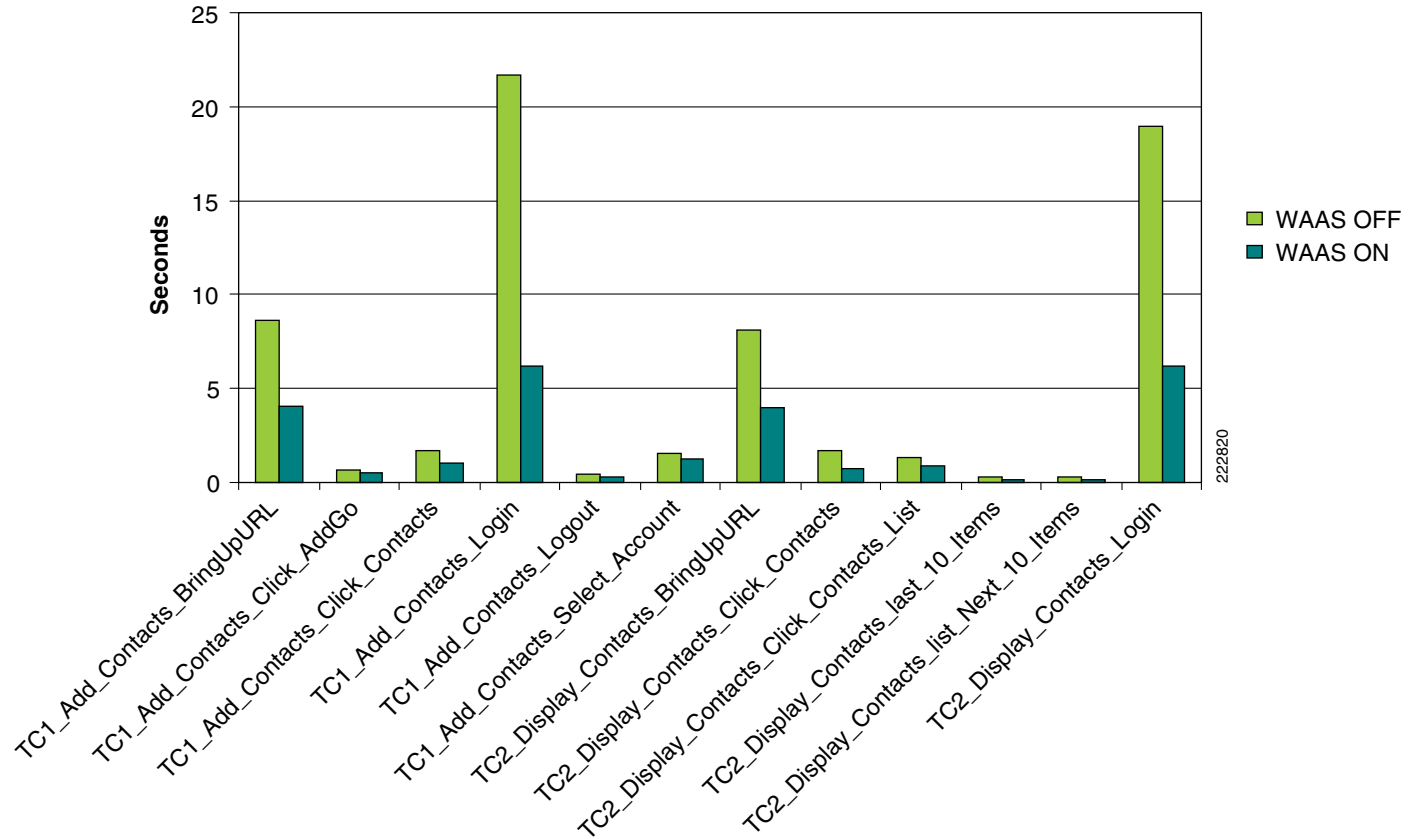


Figure 13 shows T1 circuit with HP Mercury LoadRunner response time for each of the actions. The average response time is reduced by 45%. The login process is three times as fast with WAAS and two times as fast for these other site navigation transactions.

### Summary of Results

All of the WAAS test results indicate significant round trip time and bandwidth savings performance improvements. Average site navigation application response time is reduced by 45%. Document attachment upload and download times are two to ten times faster. In the case with a 512kbs line, application response time is well over 100 seconds for logins to the application. With WAAS, login time is reduced to an average of 12 seconds.

Cisco WAAS can drastically reduce bandwidth consumption and application response time.

# Network Management

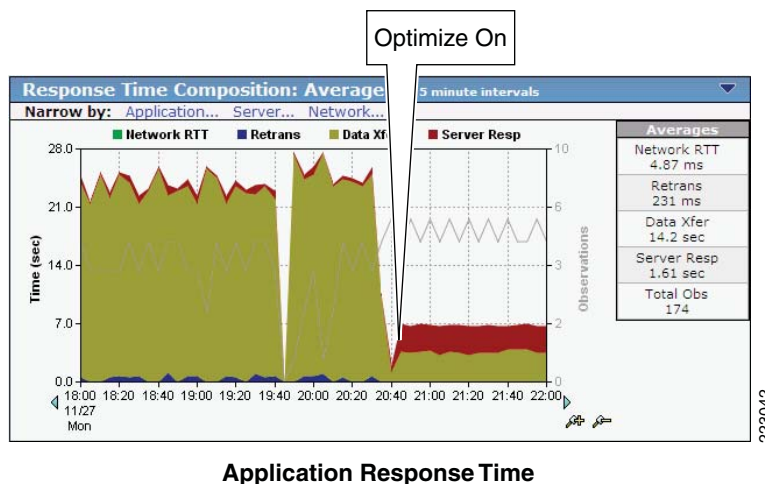
This section focuses on the network management system (NMS) that was used to monitor and provide results indicating the benefits of the Cisco WAAS optimization. The NMS tool used was NetQoS SuperAgent with NetQoS Collector and Reporter. NetQoS Collector gathers the pre-optimized traffic and reports the data to the NetQoS SuperAgent. The NetQoS SuperAgent provides details on the protocols and applications traversing the network(s), including:

- Response time
- Data transfer time
- Retransmission delay
- Network round trip time
- Effective network round trip time
- Performance by the server
- Performance by the network

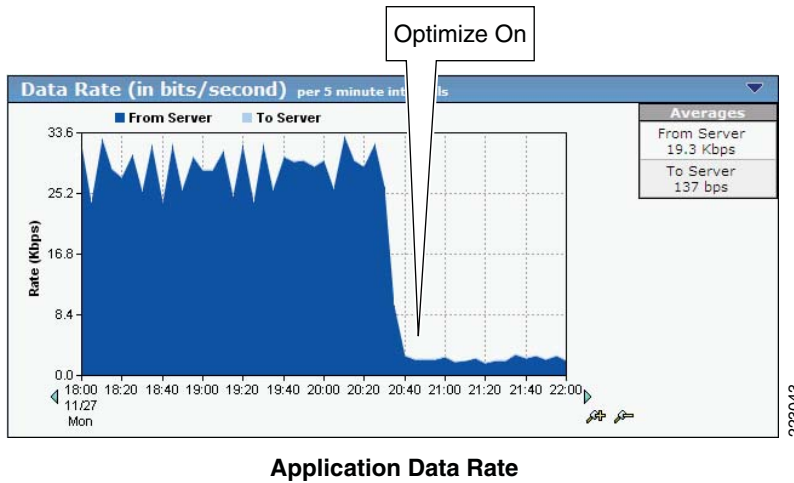
This information provides the baseline of the application under test with valid overall transaction times (end user experience).

NetQoS Reporter gathers the optimized traffic and reports the data to NetQoS Super Agent. NetQoS Super Agent uses the data from the NetQoS Collector (un-optimized) and compares it to the optimized traffic, indicating the benefits of optimization using the Cisco WAAS as shown in the generic samples in [Figure 14](#), [Figure 15](#), and [Figure 16](#).

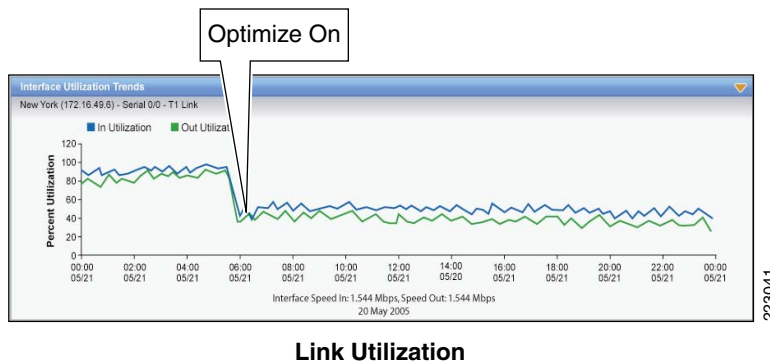
**Figure 14** Benefit of Optimization Using the Cisco WAAS—Application Response Time



**Figure 15** Benefit of Optimization Using the Cisco WAAS—Application Data Rate



**Figure 16** Benefit of Optimization Using the Cisco WAAS—Link Utilization



NetQoS devices passively listen in by using the rspan feature of Cisco routers and switches. They do not poll servers and hence do not add to the server load. For more information about this tool, see:

[http://www.netqos.com/CiscoWAASSolutions/Cisco\\_WAAS\\_overview.html](http://www.netqos.com/CiscoWAASSolutions/Cisco_WAAS_overview.html)

# Appendix A—Cisco ACE Configuration

## Admin Context

```
login timeout 0
hostname EDAL-AGG1-ACE
boot system image:c6ace-t1k9-mz.3.0.0_A1_5a.bin
! define Cisco ACE resource for each server farm
resource-class WebFarm
 limit-resource all minimum 20.00 maximum unlimited
 limit-resource sticky minimum 40.00 maximum equal-to-min
resource-class siebel-resource
 limit-resource all minimum 20.00 maximum unlimited
 limit-resource sticky minimum 40.00 maximum equal-to-min
```



```

access-list ALLOW-TRAFFIC line 8 extended permit ip any any
access-list ALLOW-TRAFFIC line 9 extended permit icmp any any
class-map type management match-any REMOTE-MGMT
 2 match protocol ssh any
 3 match protocol telnet any
 4 match protocol icmp any
 5 match protocol http any
 6 match protocol https any

policy-map type management first-match REMOTE-ACCESS
 class REMOTE-MGMT
 permit

interface vlan 82
 ip address 172.28.210.14 255.255.255.0
 no icmp-guard
 access-group input ALLOW-TRAFFIC
 service-policy input REMOTE-ACCESS
 no shutdown

ft interface vlan 43
 ip address 192.168.100.1 255.255.255.0
 peer ip address 192.168.100.2 255.255.255.0
 no shutdown

ft peer 1
 heartbeat interval 200
 heartbeat count 20
 ft-interface vlan 43

ip route 0.0.0.0 0.0.0.0 172.28.210.1
!define contexts within the Cisco ACE
context Siebel
 allocate-interface vlan 42
 allocate-interface vlan 100
 member siebel-resource
context WebFarm
 allocate-interface vlan 41
 allocate-interface vlan 101
 member WebFarm
ft group 1
 peer 1
 priority 120
 associate-context Siebel
 inservice
ft group 2
 peer 1
 priority 120
 associate-context WebFarm
 inservice
username admin password 5 1faXJEFBj$TJR1Nx7sLPTi5BZ97v08c/ role Admin domain
default-domain
username www password 5 1UZIiwUk7$QMvYN1JASaycabrHkhGcS/ role Admin domain de
fault-domain

```

## WebFarm Context

```

!information for generating certificate
crypto csr-params testparms
 country US
 state California
 locality San Jose

```

```

organization-name ESE
organization-unit ESE
common-name www.testsiebel.com
serial-number cisco123

access-list ALLOW-TRAFFIC line 8 extended permit ip any any
access-list ALLOW-TRAFFIC line 9 extended permit icmp any any

probe http http-probe
 interval 30
 expect status 200 200
!configure TCP reuse
parameter-map type http HTTP_PARAMETERS
 server-conn reuse
 case-insensitive
parameter-map type ssl SSL_PARAMETERS
 cipher RSA_WITH_RC4_128_MD5
 version TLS1

rserver host webservr1
 description Siebel web server
 ip address 13.1.41.57
 inservice
rserver host webservr2
 description Siebel web server
 ip address 13.1.41.58
 inservice
rserver host webservr3
 description Siebel web server
 ip address 13.1.41.59
 inservice
! configure SSL proxy server
ssl-proxy service SIEBELWEB_SSL
 key siebelweb.key
 cert siebelweb.cer

serverfarm host WEBFARM
 probe http-probe
 rserver webservr1 80
 inservice
 rserver webservr2 80
 inservice
 rserver webservr3 80
 inservice
!define cookie sticky group
sticky http-cookie _sn sn_cookie
 replicate sticky
 serverfarm WEBFARM
! match SSL server ip/port
class-map match-all L4_SSL_VIP_CLASS
 2 match virtual-address 13.1.101.41 tcp eq https
class-map match-all L4_WEB_VIP_CLASS
 2 match virtual-address 13.1.101.41 tcp eq www
class-map type http loadbalance match-any L7_WEB
 2 match http url .*
class-map type management match-any REMOTE-MGMT
 2 match protocol ssh any
 3 match protocol telnet any
 4 match protocol icmp any
 5 match protocol http any
 6 match protocol https any

policy-map type management first-match REMOTE-ACCESS
 class REMOTE-MGMT

```

```

 permit
policy-map type loadbalance first-match L7-SSL-MATCH
 class L7_WEB
 sticky-serverfarm sn_cookie
policy-map type loadbalance first-match L7-WEB-MATCH
 class L7_WEB
 sticky-serverfarm sn_cookie
!matching SSL and HTTPS traffic
policy-map multi-match L4-WEB-VIP
 class L4_WEB_VIP_CLASS
 loadbalance vip inservice
 loadbalance policy L7-WEB-MATCH
 loadbalance vip icmp-reply
 loadbalance vip advertise active
 class L4_SSL_VIP_CLASS
 loadbalance vip inservice
 loadbalance policy L7-SSL-MATCH
 loadbalance vip icmp-reply
 loadbalance vip advertise active
 ssl-proxy server SIEBELWEB_SSL

interface vlan 41
 description web farm vlan
 ip address 13.1.41.2 255.255.255.0
 alias 13.1.41.1 255.255.255.0
 peer ip address 13.1.41.3 255.255.255.0
 no icmp-guard
 access-group input ALLOW-TRAFFIC
 access-group output ALLOW-TRAFFIC
 service-policy input REMOTE-ACCESS
 no shutdown
interface vlan 101
 description ACE WEBFARM client vlan
 ip address 13.1.101.14 255.255.255.0
 alias 13.1.101.13 255.255.255.0
 peer ip address 13.1.101.15 255.255.255.0
 no icmp-guard
 access-group input ALLOW-TRAFFIC
 access-group output ALLOW-TRAFFIC
 service-policy input REMOTE-ACCESS
 service-policy input L4-WEB-VIP
 no shutdown

ip route 0.0.0.0 0.0.0.0 13.1.101.1

```

## Siebel Application Farm (AOM) Context

```

access-list ALLOW-TRAFFIC line 8 extended permit ip any any
access-list ALLOW-TRAFFIC line 9 extended permit icmp any any
probe http scbroker-probe
 port 2321
 interval 30
 passdetect interval 10
 passdetect count 1
 request method get url /SBA_80/scbroker
 expect status 100 200

parameter-map type connection TCP_PARAMETER
 set timeout inactivity 86400

rserver host appsrvr1
 description Siebel application server

```

```

 ip address 13.1.42.54
 inservice
rserver host appsrvr2
 description Siebel application server
 ip address 13.1.42.55
 inservice
rserver host appsrvr3
 description Siebel application server
 ip address 13.1.42.56
 inservice
!define server farm for each application (AOM)
serverfarm host APPS1FARM
 probe sbroker-probe
 rserver appsrvr1 2321
 inservice
serverfarm host APPS2FARM
 probe sbroker-probe
 rserver appsrvr2 2321
 inservice
serverfarm host APPS3FARM
 rserver appsrvr3 2321
 inservice
serverfarm host SALESCEOBJMGR_FARM
 probe sbroker-probe
 rserver appsrvr2 2321
 inservice
 rserver appsrvr3 2321
 inservice
serverfarm host SALESCEOBJMGR_FARM_RR
 rserver appsrvr2 2321
 inservice
 rserver appsrvr3 2321
 inservice
serverfarm host SCCOBJMGR_FARM
 probe sbroker-probe
 rserver appsrvr1 2321
 inservice
 rserver appsrvr2 2321
 inservice
 rserver appsrvr3 2321
 inservice
serverfarm host SCCOBJMGR_FARM_RR
 probe sbroker-probe
 rserver appsrvr1 2321
 inservice
 rserver appsrvr2 2321
 inservice
 rserver appsrvr3 2321
 inservice
!define L7 rules for each application component (AOM), this include individual servers
class-map match-all L4_APPS_VIP_CLASS-2321
 2 match virtual-address 13.1.40.42 tcp eq 2321
class-map type http loadbalance match-any L7_APPSERVER_1_CLASS
 2 match http url .*/!9\. method POST
class-map type http loadbalance match-any L7_APPSERVER_2_CLASS
 2 match http url .*/!d\. method POST
class-map type http loadbalance match-any L7_APPSERVER_3_CLASS
 2 match http url .*/!b\. method POST
class-map type http loadbalance match-any L7_SALESCEOBJMGR_CLASS
 2 match http url .*/sba_80/sseobjmgr_enu method POST
class-map type http loadbalance match-any L7_SALESCEOBJMGR_RR_CLASS
 2 match http url .*/sba_80/sseobjmgr_enu/rr method POST
class-map type http loadbalance match-any L7_SCCOBJMGR_CLASS
 2 match http url .*/sba_80/sccobjmgr_enu method POST

```

```

class-map type http loadbalance match-any L7_SCCOBJMGR_RR_CLASS
 2 match http url .*/sba_80/sccobjmgr_enu/rr method POST
class-map type management match-any REMOTE-MGMT
 2 match protocol ssh any
 3 match protocol telnet any
 4 match protocol icmp any
 5 match protocol http any
 6 match protocol https any

policy-map type management first-match REMOTE-ACCESS
 class REMOTE-MGMT
 permit
 ! matching L7 rules with server farms
policy-map type loadbalance first-match L7-APPS-MATCH
 class L7_SCCOBJMGR_CLASS
 serverfarm SCCOBJMGR_FARM
 class L7_APPSERVER_1_CLASS
 serverfarm APPS1FARM
 class L7_APPSERVER_2_CLASS
 serverfarm APPS2FARM
 class L7_APPSERVER_3_CLASS
 serverfarm APPS3FARM
 class L7_SALESCEOBJMGR_CLASS
 serverfarm SALESCEOBJMGR_FARM
 class L7_SCCOBJMGR_RR_CLASS
 serverfarm SCCOBJMGR_FARM_RR
 class L7_SALESCEOBJMGR_RR_CLASS
 serverfarm SALESCEOBJMGR_FARM_RR
policy-map multi-match L4-APPS-VIP
 class L4_APPS_VIP_CLASS-2321
 loadbalance vip inservice
 loadbalance policy L7-APPS-MATCH
 loadbalance vip icmp-reply
 loadbalance vip advertise active
 connection advanced-options TCP_PARAMETER

interface vlan 42
 description application farm vlan
 ip address 13.1.42.2 255.255.255.0
 alias 13.1.42.1 255.255.255.0
 peer ip address 13.1.42.3 255.255.255.0
 no icmp-guard
 access-group input ALLOW-TRAFFIC
 service-policy input REMOTE-ACCESS
 no shutdown
interface vlan 100
 description ACE AOM client vlan
 ip address 13.1.40.11 255.255.255.0
 alias 13.1.40.10 255.255.255.0
 peer ip address 13.1.40.12 255.255.255.0
 no icmp-guard
 access-group input ALLOW-TRAFFIC
 service-policy input REMOTE-ACCESS
 service-policy input L4-APPS-VIP
 no shutdown

ip route 0.0.0.0 0.0.0.0 13.1.40.1

```

# Appendix B—Cisco WAE Configurations

## Branch Cisco WAE Configuration

```

! WAAS version 4.0.13 (build b12 Aug 9 2007)
device mode application-accelerator
hostname BRANCH-WAE-EDAL
!! define the primary interface for the Cisco WAE. Primary interface is the main
interface Cisco WAE uses for intercepting traffic
primary-interface GigabitEthernet 1/0
!
interface GigabitEthernet 1/0
 ip address 13.1.12.2 255.255.255.0
 exit
interface GigabitEthernet 2/0
 shutdown
 exit
ip default-gateway 13.1.12.1
!
no auto-register enable
!
! ip path-mtu-discovery is disabled in Cisco WAAS by default
!
ntp server 13.1.15.2
!
wccp router-list 1 13.1.12.1
wccp tcp-promiscuous router-list-num 1 password ****
wccp version 2
!
username admin password 1 bVmDmMMmZAPjY
username admin privilege 15
username admin print-admin-password 1 29D5C31BFF3D8D25AAD3B435B51404EE 7D891AB40
2CAF2E89CCDD33ED54333AC
!
authentication login local enable primary
authentication configuration local enable primary
!
central-manager address 13.1.40.8
cms enable
!! configure the NetFlow statistics collection
flow monitor tcpstat-v1 host 10.1.70.11
flow monitor tcpstat-v1 enable
!
tfo tcp optimized-send-buffer 2048
tfo tcp optimized-receive-buffer 2048
!
no adapter epm enable
!
policy-engine application
 name Authentication
 name Backup
... snip ...

```

## Data Center Cisco WAE Configuration

```

! WAAS version 4.0.13 (build b12 Aug 9 2007)
device mode application-accelerator
!

```

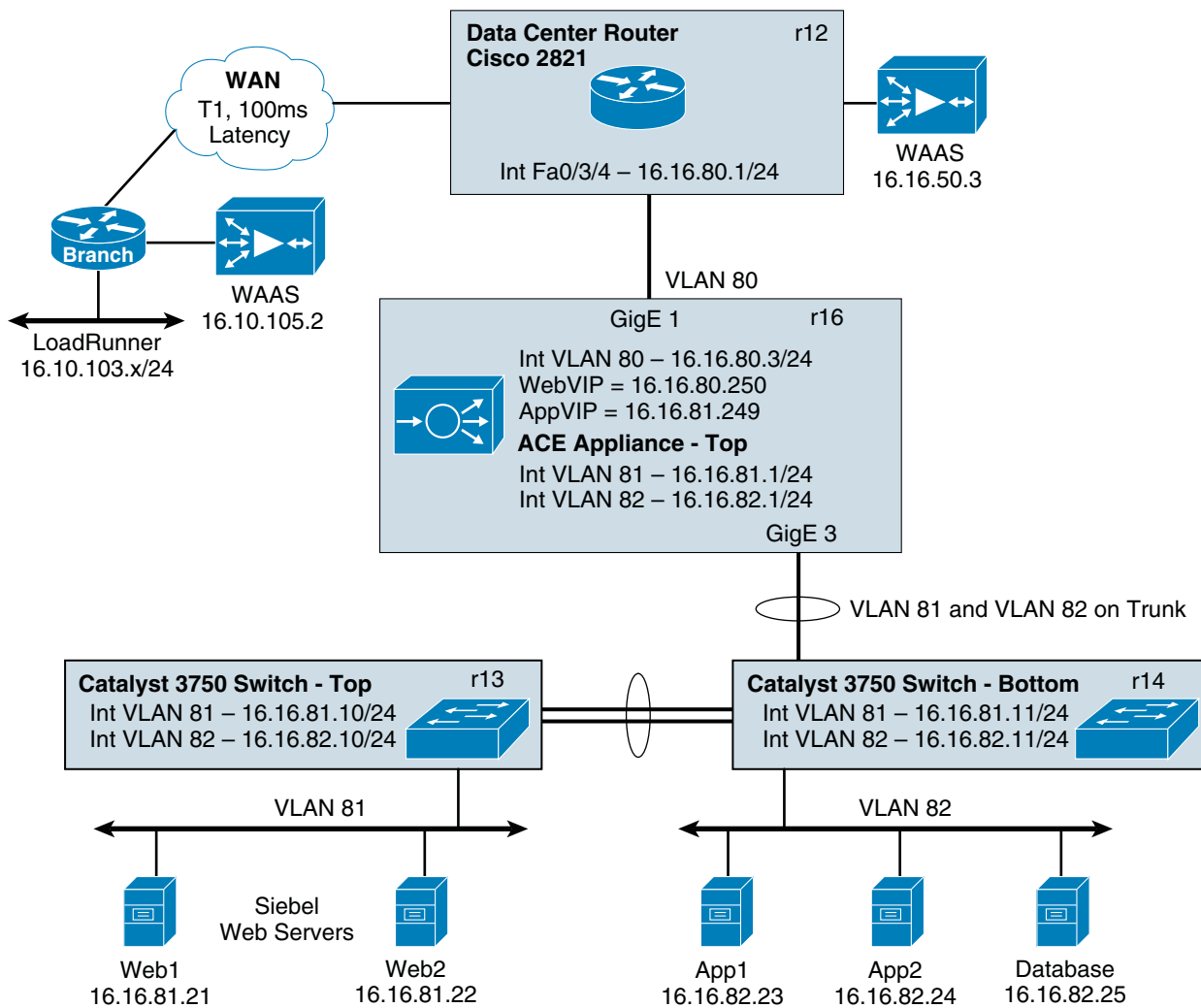
```

hostname DC-WAE-01
!
ip domain-name cisco
! define the primary interface for the Cisco WAE. Primary interface is the main interface
Cisco WAE uses for intercepting traffic
primary-interface GigabitEthernet 1/0
!
interface GigabitEthernet 1/0
 ip address 13.1.13.5 255.255.255.0
 exit
interface GigabitEthernet 2/0
 shutdown
 exit
!
ip default-gateway 13.1.13.1
!
no auto-register enable
!
! ip path-mtu-discovery is disabled in WAAS by default
! designate time server for ntp protocol
ntp server 13.1.15.2
!
wccp router-list 1 13.1.13.1
wccp tcp-promiscuous router-list-num 1 password ****
wccp version 2
!
username admin password 1 bVmDmMMmZAPjY
username admin privilege 15
username admin print-admin-password 1 29D5C31BFF3D8D25AAD3B435B51404EE 7D891AB40
!
authentication login local enable primary
authentication configuration local enable primary
!
central-manager address 13.1.40.8
cms enable
! configure the NetFlow statistics collection
flow monitor tcpstat-v1 host 10.1.70.11
flow monitor tcpstat-v1 enable
!
tfo tcp optimized-send-buffer 8192
tfo tcp original-send-buffer 8192
tfo tcp optimized-receive-buffer 8192
tfo tcp original-receive-buffer 8192
!
! define traffic aceleration
policy-engine application
 name Authentication
 name Backup
...snip...

```

# Appendix C—Cisco ACE Appliance Configuration and Test Results

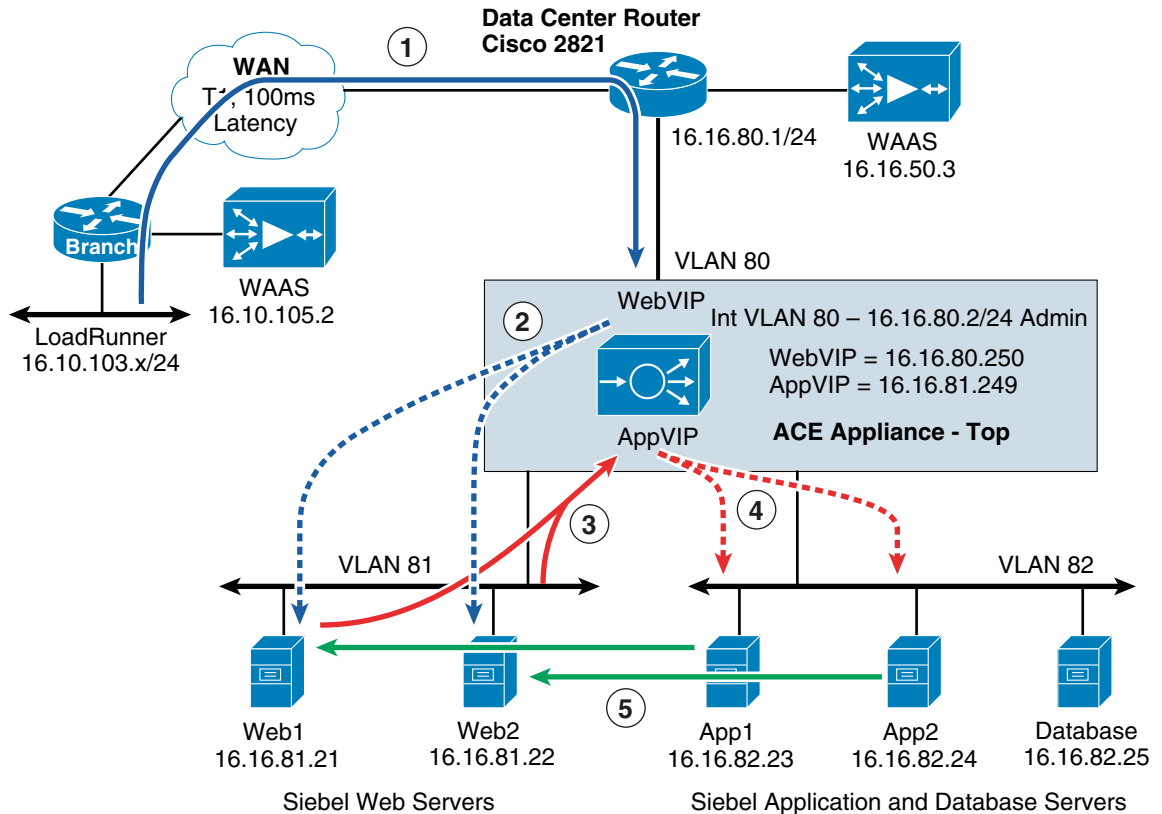
Figure 17 Cisco ACE Appliance Configuration



223510



Figure 18 Cisco ACE Appliance Logical Configuration



223511

## Enterprise Branch

The enterprise branch design shows the Cisco WAE Appliance connected to the local branch router, typically a Cisco Integrated Services Router (ISR). The design provides scalability and availability as compared to installing a Cisco WAAS Network Module within a Cisco ISR as the Cisco ISR must share its resources.

HP Mercury LoadRunner, running on a personal computer in the branch, simulates users that would perform certain routine tasks in the application.

The traffic is redirected to the Cisco WAE through the Web Cache Communications Protocol (WCCP) from the branch router. The Cisco WAE performs the following functions:

- **Locally cached**—If the data that is being requested is locally cached, the Cisco WAE responds to the requestor with the cached data and requests only required data from the server farm. This allows the WAN to become more efficient as only required data is requested.
- **New data**—If the data that is being forwarded to the server farm or coming from the server farm, the Cisco WAE performs compression algorithms on the data, allowing for the WAN to become more efficient.

## WAN Simulation

The WAN simulator provide simulations of standard T1. The following simulation was used:

- WAN Type 1 (Intracontinental)
  - Bandwidth-1.544 Mbps, ESF, B8ZS
  - Delay-100 mS
  - Loss-Drop one packet in every 1000 packets

## Data Center

For this design, the Cisco ACE Appliance is targeted for a small-to-medium data center (DC). The DC follows the design guidelines found in the Data Center Infrastructure Design Guide found at: <http://www.cisco.com/go/srnd>.

The design consists of a DC WAN router, a collapsed core/aggregation, access, and the server farm (where the application resides). In this appendix, the focus is on the DC WAN router, aggregation, and the server farm. The core provides routing to and from the DC WAN router and the aggregation. The access layer provides Layer 2 connectivity for the server farms to the aggregation. For larger deployments, one should consider a separate core and aggregation layer, or a one-arm deployment where the Cisco ACE Appliance connects to a Cisco 6500. For more information, refer to:

[http://www.cisco.com/en/US/partner/products/ps7027/tsd\\_products\\_support\\_series\\_home.html](http://www.cisco.com/en/US/partner/products/ps7027/tsd_products_support_series_home.html)

The DC WAN router performs the same function as the branch WAN router by redirecting traffic to the DC WAE. The DC WAE performs the following:

- Locally cached—If the data that is being requested is locally cache, the WAE responds to the requestor with the cached data and requests only required data from the branch. This allows the WAN to become more efficient as only required data is requested.
- New data—If the data is being forwarded to the branch or coming from the branch, the WAE performs compression algorithms on the data, allowing for the WAN to become more efficient.

Within a Cisco WAAS topology, each Cisco WAE runs a process called central management system (CMS). The CMS process provides SSL-encrypted bidirectional configuration synchronization of the Cisco WAAS Central Manager and the Cisco WAE devices. The CMS process is also used to exchange reporting information and statistics at a configurable interval. When the administrator applies configuration or policy changes to a Cisco WAE device or a group of Cisco WAE devices (a device group), the Cisco WAAS Central Manager automatically propagates the changes to each of the managed Cisco WAE devices. Cisco WAE devices that are not available to receive the update receive the update the next time they become available.



### Note

Cisco WAEs out of box have a standard set of application variables and ports that are defined for optimization. In this solution no changes need to be made to the standard default configuration of the Cisco WAEs.

The aggregation segment contains the Cisco ACE Appliance. The Cisco ACE Appliance provides the following:

- Virtualization—Device partitioning, where the Cisco ACE has multiple contexts. Each context can be configured for different applications and each context is independent of the other. The Cisco ACE is configured with Admin context and the Siebel context. Note that the Cisco ACE can support up to 20 contexts (dependent on the license).
- Session Persistence—The ability to forward client requests to the same server for the duration of the session. The Siebel application requires cookie stickiness session persistence.

- **Transparent Interception**—Performs a NAT function to conceal the real server IP address that is residing in the server farm. The Siebel context is configured with a Virtual IP (VIP) that provides a single address for the users to connect to the server farm with. This allows the users to access the Siebel application by placing a single IP address in the Web browser.
- **Health monitoring**—Used to track the state of the server and determining its ability processing connections in the server farm. The Siebel context used TCP probes to verify if the Siebel Web and Application Servers were available to process connections.

The Cisco ACE Appliance provides load balancing of the traffic bound to the server farm using one of the following methods:

- Round Robin
- Weighted Round Robin
- Least Connections
- Hash address
- Hash cookie
- Hash Header
- Hash URL

Round Robin was used to provide load balancing for the Siebel Web and Application Servers. Round Robin sequentially alternates the connections among available servers.

## Dual VIP, Single Context

The Siebel context was configured with two VIPs. The first VIP, 16.16.80.250, was for inbound traffic from the client network. This traffic was load balanced across the Siebel Web Servers on TCP port 80 traffic. The second VIP, 16.16.81.249, was for traffic from the Siebel Web Servers destined for the Siebel Application Servers on TCP port 2321. [Figure 18](#) details the traffic flow for both VIPs.

## ACE 4710 Configuration

### Admin Context

```

interface gigabitEthernet 1/1 <-- Connection to Client-side network
 description CLIENT-WAN
 switchport access vlan 80
 no shutdown
interface gigabitEthernet 1/2
 shutdown
interface gigabitEthernet 1/3 <-- Connection to Server-side network
 description DC-LAN
 switchport trunk allowed vlan 81-82
 no shutdown
interface gigabitEthernet 1/4
 shutdown

resource-class STICKY
 limit-resource all minimum 0.00 maximum unlimited
 limit-resource sticky minimum 10.00 maximum unlimited

boot system image:c4710ace-mz.A1_7.0.5.bin

login timeout 0

```

```

class-map type management match-any MGMT-TRAFFIC
 description "allowed mgmt traffic to ACE"
 2 match protocol http any
 3 match protocol https any
 4 match protocol icmp any
 5 match protocol ssh any
 6 match protocol telnet any
 7 match protocol xml-https any

policy-map type management first-match REMOTE-MGMT
 class MGMT-TRAFFIC
 permit

interface vlan 80 <--Management Interface
 description "ACE mgmt interface"
 ip address 16.16.80.2 255.255.255.0
 service-policy input REMOTE-MGMT
 no shutdown

ip route 0.0.0.0 0.0.0.0 16.16.80.1

context Siebel
 allocate-interface vlan 80-82
 member STICKY

username admin password 5 1faXJEFBj$TJR1Nx7sLPTi5BZ97v08c/ role Admin domain
default-domain
username www password 5 1faXJEFBj$TJR1Nx7sLPTi5BZ97v08c/ role Admin domain
default-domain

```

## Siebel Context

```

access-list APP-TIER line 16 extended permit tcp host 16.16.81.23 eq 2321 host
16.16.81.249
access-list APP-TIER line 24 extended permit tcp host 16.16.81.24 eq 2321 host
16.16.81.249
access-list NON-RESTRICTIVE line 8 extended permit ip any any
access-list STRICT line 8 extended permit tcp any eq www host 16.16.70.250
access-list STRICT line 16 extended permit tcp any eq https host 16.16.70.250

probe icmp L3 <--Layer 3 Health Probe
 interval 10
 passdetect interval 10
probe http SP-HTTP <--Layer 7 Health Probe
 description "Test HTTP request to Portal Page"
 interval 20
 passdetect interval 10
 request method get url /callcenter_enu/start.swe <--URL checked on Servers
 expect status 200 200

parameter-map type connection WAN
 set tcp wan-optimization rtt 0
 set tcp ack-delay 60
 set tcp mss min 0 max 1450
 tcp-options selective-ack allow
 tcp-options timestamp allow
 tcp-options window-scale allow

```

```

rserver host APP-1 <--Assignment of Siebel Application Servers
 description "Siebel Application Server"
 ip address 16.16.82.23
 inservice
rserver host APP-2
 description "Siebel Application Server"
 ip address 16.16.82.24
 inservice
rserver host SP-1 <--Assignment of Siebel Web Servers
 description "SIEBEL Web Server"
 ip address 16.16.81.21
 inservice
rserver host SP-2
 description "SIEBEL Web Server"
 ip address 16.16.81.22
 inservice

serverfarm host APP-FARM-1 <--Assignment of Siebel App Serverfarm
 probe L3
 rserver APP-1 2321
 inservice
 rserver APP-2 2321
 inservice
serverfarm host SIEBEL <--Assignment of Siebel Web Serverfarm
 probe L3
 probe SP-HTTP
 rserver SP-1 80
 inservice
 rserver SP-2 80
 inservice

sticky http-cookie ACE ACE-COOKIE <--Cookie Insert
 cookie insert
 serverfarm SIEBEL

class-map match-any APP-VIP <--VIP for App Servers used by Web Servers for TCP port 2321
 traffic
3 match virtual-address 16.16.81.249 tcp eq 2321

class-map type management match-any REMOTE-ACCESS
 description "Define Allowed Mgmt Traffic"
 2 match protocol http any
 3 match protocol https any
 4 match protocol telnet any
 5 match protocol ssh any
 6 match protocol xml-https any
 7 match protocol snmp any
 8 match protocol icmp any

class-map match-any SP-VIP-HTTP <--VIP for Web Servers for Clients
 2 match virtual-address 16.16.80.250 tcp eq www

policy-map type management first-match REMOTE-MGMT
 class REMOTE-ACCESS
 permit
policy-map type loadbalance first-match APP-TIER-SLB
 class class-default
 serverfarm APP-FARM-1
policy-map type loadbalance first-match SIEBEL
 class class-default
 sticky-serverfarm ACE-COOKIE <--Load balance with Cookie Stickiness
policy-map multi-match SIEBEL-LB

```

```

class SP-VIP-HTTP
 loadbalance vip inservice
 loadbalance policy SIEBEL
 loadbalance vip icmp-reply active
 connection advanced-options WAN
class APP-VIP
 loadbalance vip inservice
 loadbalance policy APP-TIER-SLB
 loadbalance vip icmp-reply active

interface vlan 80
 description CLIENT-WAN
 ip address 16.16.80.3 255.255.255.0
 access-group input NON-RESTRICTIVE
 service-policy input REMOTE-MGMT
 service-policy input SIEBEL-LB
 no shutdown
interface vlan 81
 description DC-LAN
 ip address 16.16.81.1 255.255.255.0
 access-group input NON-RESTRICTIVE
 service-policy input REMOTE-MGMT
 service-policy input SIEBEL-LB
 no shutdown
interface vlan 82
 description DC-LAN-APP-TIER
 ip address 16.16.82.1 255.255.255.0
 access-group input NON-RESTRICTIVE
 service-policy input REMOTE-MGMT
 no shutdown

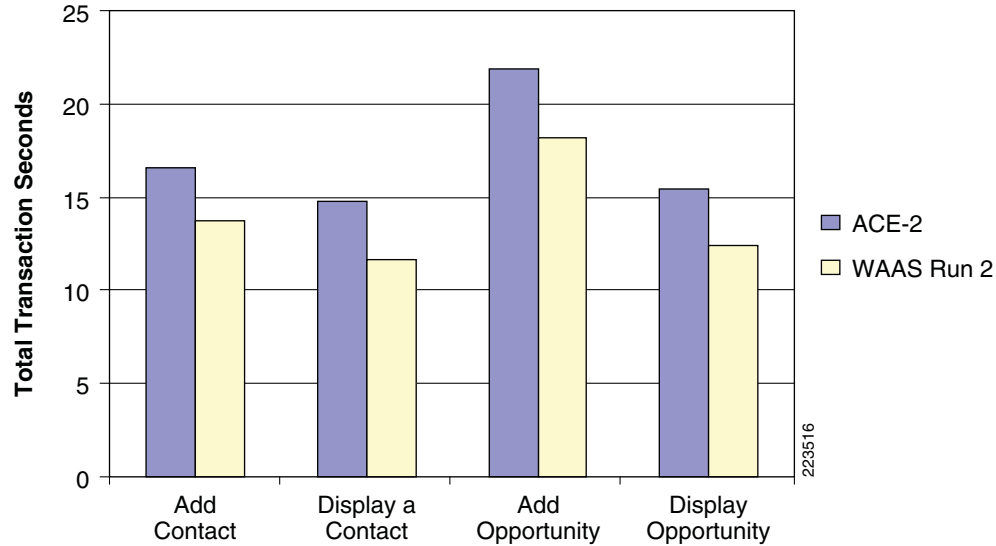
ip route 0.0.0.0 0.0.0.0 16.16.80.1

```

## Test Results

The Siebel call center application was loaded with 40 users. The users ramped up over the five initial minutes and then they started performing four types of site navigation activities that a normal user in a Siebel environment would routinely perform.

The ACE appliance was used to load balance the Siebel application and Web servers as shown in [Figure 17](#). WAAS was used to optimize Web traffic across the WAN connection to the Branch Office. As shown in [Figure 19](#), the use of WAAS in an ACE appliance environment reduced the response time for Siebel Web traffic by up to 20%.

**Figure 19**      **Response Time**

## Appendix D—Cisco Advanced Services

### Cisco Services Help Accelerate and Optimize ANS Deployments

Application deployments are complex projects. Cisco Services can help mitigate the risk of making changes to the environment and accelerate deployment of Cisco ANS solutions. Our product and technology expertise is constantly enhanced by hands-on experience with real-life networks and broad exposure to the latest technology and implementations. Cisco uses leading practices to help our customers define their IT and business requirements and help them deliver fast, secure and highly available application access in a scalable environment.

- The Cisco Application Control Engine Planning and Design Service helps customers accelerate deployment of a Cisco ACE solution for fast, secure application access in a scalable environment.
- The Cisco Application Control Engine Optimization Services help customers continuously update and optimize their Cisco Application Control Engine solution as their applications delivery environment changes.
- The Cisco Wide Area Application Services Planning and Design Service helps customers accelerate deployment of Cisco WAAS solutions and improve application responsiveness across their wide area networks.
- The Cisco Wide Area Application Services Optimization Services help customers maintain or improve application responsiveness across wide area network as their business changes and grows.
- The Cisco Application Profiling Service helps customers host and manage applications more effectively while preserving application performance, security, and availability.

Cisco ANS Services:

[http://www.cisco.com/en/US/products/ps6892/serv\\_group\\_home.html](http://www.cisco.com/en/US/products/ps6892/serv_group_home.html)

[http://www.cisco.com/en/US/products/ps6894/serv\\_group\\_home.html](http://www.cisco.com/en/US/products/ps6894/serv_group_home.html)

