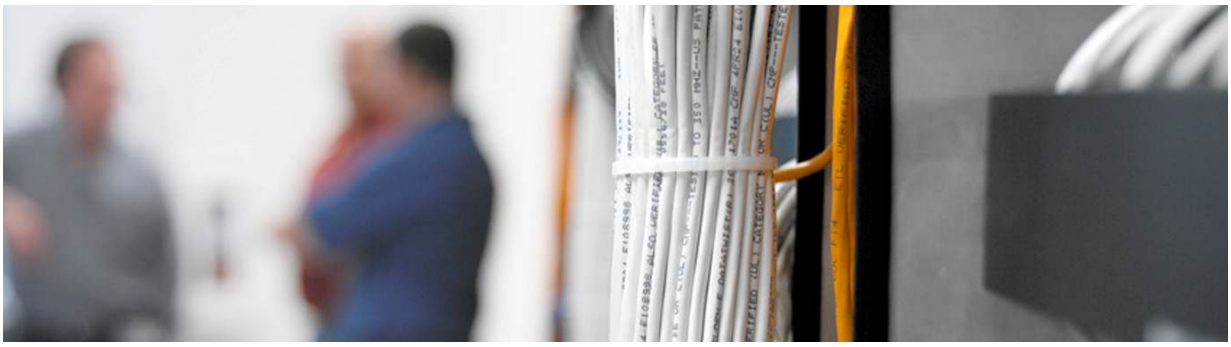
White Paper

# Cisco WAAS WAN Optimization for Centralized Email Services



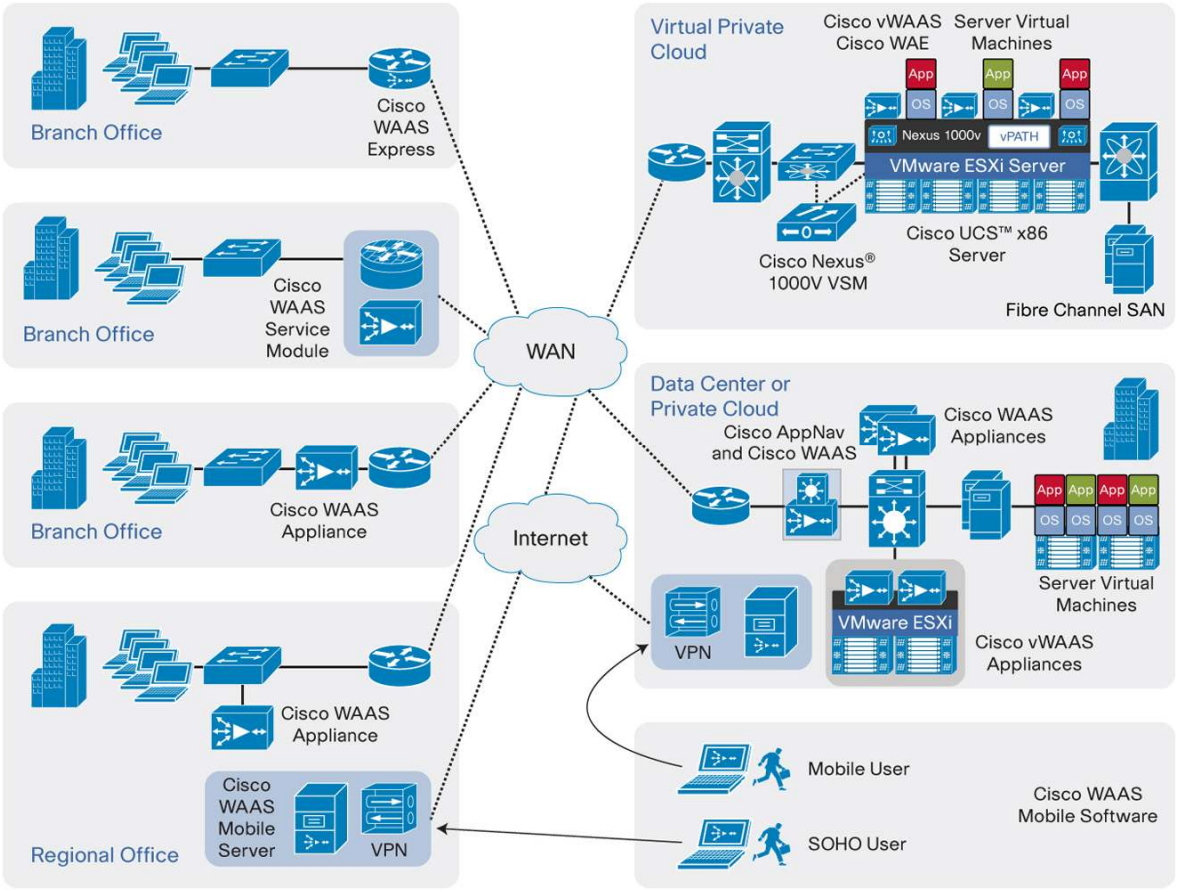
## What You Will Learn

Cisco® Wide Area Application Services (WAAS) empowers IT departments to provide a consistent user experience for core business applications across WAN links in branch-office remote sites. This document focuses on email services in the enterprise and Cisco WAAS Software Release 5.0 optimizations for dramatic throughput improvements when accessing centralized email servers through the Messaging API (MAPI), Encrypted MAPI (EMAPI), Simple Mail Transfer Protocol (SMTP), Post Office Protocol 3 (POP3), Internet Mail Access Protocol (IMAP), Remote Procedure Call (RPC), and any other TCP-based protocol. This document examines the optimizations provided by Cisco WAAS and describes how Cisco WAAS enables acceleration of email services.

## Challenges

Enterprise IT departments are increasingly challenged to provide high-quality service to employees while managing costs. Pressure to reduce capital expenditures (CapEx) and operating expenses (OpEx) continue to force IT teams to do more with less while maintaining a high-quality user experience across core enterprise applications. Email is by far the most widely used tool for enterprise communications, providing employees with the capability to send widely distributed announcements and to share information and files for collaboration. In the LAN environment, this sharing and the increasing sizes of mailboxes can be obscured by robust bandwidth between clients and servers, but at branch offices, IT must consider WAN links and application congestion. The user experience of just opening the email inbox can turn into a lesson in extreme patience. Cisco WAAS can help address these challenges and deliver a consistent application experience to remote branch-office users. Figure 1 shows an overview of some typical Cisco WAAS deployment scenarios.

**Figure 1.** Cisco WAAS Enterprise Deployment




## Cisco WAAS WAN Optimization Solution

Cisco WAAS is a multilayer application acceleration and WAN optimization solution that improves application performance over the WAN, enabling IT departments to provide centralized core applications, while providing acceleration and optimizations to maintain an acceptable end-user experience. The specific acceleration for email applications and the associated protocols is achieved through Cisco WAAS optimization features such as:

- Transport flow optimization (TFO): TFO provides standards-based, field-proven throughput improvements for TCP-based applications while maintaining packet-network friendliness and safe coexistence with other network nodes communicating using standard TCP implementations. TFO terminates TCP sessions locally and transparently optimizes flows that traverse the WAN, thereby shielding communicating nodes from WAN conditions. TFO includes the following components, each providing specific acceleration for email services:
  - Large initial windows: Client email connections more quickly exit the TCP slow-start phase and enter congestion avoidance, thereby allowing quicker startup in email throughput.

- Window scaling: Cisco WAAS transparently increases the TCP message window capacity of optimized TCP connections to allow more data to be in transit across the WAN, thereby improving email throughput.
- Advanced congestion handling: Through intelligent handling of TCP message congestion scenarios, Cisco WAAS can more efficiently retransmit lost data when necessary and return to higher levels of throughput on the network much more quickly, resulting in better email application performance.

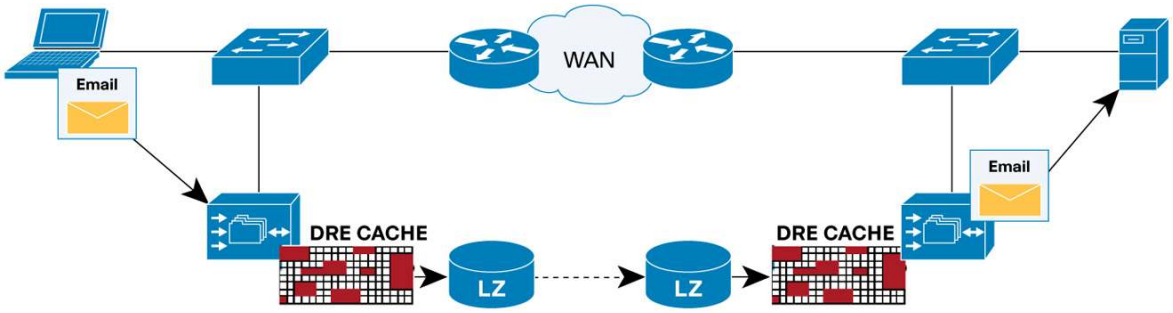
- Data redundancy elimination (DRE): DRE is an advanced form of network compression that allows Cisco WAAS to maintain a database of byte sequences previously seen traversing the network. This information is used to prevent redundant transmission patterns from traversing the network. For repeated patterns, only pattern identifiers need to be sent, and the original message is then rebuilt in its entirety by the distant appliance. This feature enables significant levels of compression and helps ensure message and application coherency because the original message is always rebuilt and verified by the remote Cisco WAAS device. Because DRE is application agnostic and bidirectional, it is effective regardless of the direction of traffic flow. Data patterns identified for one application protocol can be reused by other applications, and patterns that have been identified for one direction of traffic flow can be reused to remove redundancy in traffic flowing in the other direction. With DRE, email and attachments are stored as previously seen transmissions, and if redundant segments are identified, such as an email or an attachment that has been seen before, significant levels of compression can be achieved.
- Lempel-Ziv (LZ) compression: LZ compression is a standards-based compression that can be applied to further reduce the amount of bandwidth consumed by a TCP flow. LZ compression can be used in conjunction with DRE or independently. LZ compression can provide from 2:1 to 4:1 compression, depending on the application being used and the data being transmitted. This feature is especially helpful for data that has not been previously seen and suppressed by DRE because the pattern identifiers are highly compressible.
- Microsoft Exchange optimization: Microsoft Exchange email relies on the MAPI messaging interface, used over RPCs, to deliver email, calendaring, contacts, and more to Microsoft Outlook users for collaboration and productivity. As with many applications operating over a WAN, Microsoft Exchange performance is constrained by bandwidth limitations and latency found in the WAN. Cisco WAAS provides a number of acceleration services for Microsoft Exchange to improve performance. Unlike other solutions that provide acceleration for Microsoft Exchange, Cisco WAAS acceleration for Microsoft Exchange was developed in conjunction with Microsoft to help ensure protocol correctness and compatibility with all major versions of Microsoft Exchange (including Microsoft Exchange 2000, 2003, 2007, and 2010), with native support for both encrypted and unencrypted traffic, without relying on reverse engineering of protocols.
  The acceleration capabilities provided by Cisco WAAS for Microsoft Exchange include:
  - EMAPI: EMAPI is supported with network, security, and application transparency and complies with Microsoft's Kerberos security negotiation. No configuration changes are required on the client or server to support Cisco WAAS acceleration.
  - Asynchronous write operations: Write operations for sending email and attachments are acknowledged locally. Local generation of responses allows clients to fully utilize WAN bandwidth.
  - Object read ahead: Objects being fetched from the server, such as email, calendar items, and address books, are fetched at an accelerated rate, with Cisco WAAS prefetching these objects on behalf of the user. This feature helps mitigate the send-and-wait behavior of Microsoft Exchange and Outlook.

- Messages decompression: Cisco WAAS can automatically defer native compression provided by Microsoft Exchange Server and Outlook in favor of Cisco WAAS DRE and persistent LZ compression. Cisco WAAS can also natively decode messages encoded by Microsoft Exchange or Outlook to provide additional levels of compression. Full data coherency is preserved end to end.
- DRE hints: Cisco WAAS provides hints to the DRE compression process based on the message payload, resulting in better compression and overall improvement in DRE efficiency.
- Payload aggregation: Cisco WAAS recognizes many Microsoft Exchange messages that are small in nature and can either batch these messages together for optimized delivery or dynamically adjust DRE and LZ compression to improve compression ratios for these messages.

## Email Acceleration Example

When a remote user is sending or receiving email, Cisco WAAS applies the appropriate optimizations to improve the performance of the email application, resulting in reduced bandwidth utilization and dramatically faster remote-office user email performance. Figure 2 shows a common user scenario, described here, demonstrating how Cisco WAAS learns network traffic patterns and optimizes application flows.

**Figure 2.** Cisco WAAS Email Acceleration Example




1. A user in a remote office connects to a mail server and downloads an email that another user from a different remote office has sent. The message includes a 5-MB Microsoft PowerPoint attachment. Because the Cisco WAAS system has never seen this data before, it will begin to learn the traffic patterns from the operation and store the traffic segments locally in its DRE cache. During the operation, the Cisco WAAS device will be adding the patterns to its DRE database, and it also will be examining the traffic patterns for repeated sequences and eliminating any redundancy found. In addition to performing pattern matching and redundancy elimination, Cisco WAAS will compress the resulting data in flight using LZ compression and optimize the TCP connection on behalf of the client and the server. The result of this operation is as follows:
   - DRE identifies new traffic patterns and stores this information locally to eliminate redundancy from future transmissions. DRE may identify and suppress repeated sequences even within the single transfer.
   - LZ compression reduces the size of all messages being exchanged between the mail client and server.
   - TFO enables the client and server to communicate more efficiently.
   - The user experiences superior email performance.

2. The user then opens the attached presentation and saves the file to the desktop. After making several modifications to the file, including adding new images and new slides and deleting slides, the user emails the revised presentation to the original author in the other remote office. The operation is completed with a LAN-like response time, because DRE isolates the changes within network transmissions, sends instructions to the distant Cisco WAAS device as to how to rebuild the message in its entirety, and includes only the changed byte patterns. In addition to the high levels of redundancy elimination, LZ compression and TFO are applied. In this way, Cisco WAAS safely isolates changes while eliminating redundancy from network traffic patterns, decreasing bandwidth consumption, and providing high levels of throughput across the WAN. The user's email transfer is significantly accelerated across the WAN.
3. The same user then decides to drag and drop the presentation to a shared folder on the data center's network-attached storage (NAS) device. Cisco WAAS identifies the transmission, and DRE again suppresses the redundant traffic patterns. Because DRE is application agnostic and bidirectional, files transferred through one protocol (in this case, email) help provide compression for transfers for any other protocol (in this case, Common Internet File System [CIFS]). The user again experiences LAN-like performance when accessing the centralized NAS device.

This scenario is one of many in which Cisco WAAS can provide LAN-like application performance while enabling consolidation of email and other services. In this scenario, if the email were sent to a large group of users in the same location, the download performance of the email for each subsequent user would be LAN-like and require little bandwidth consumption as a result of the optimization capabilities of Cisco WAAS.

Figure 3 and 4 show the performance improvements of two email scenarios.

**Figure 3.** Cisco WAAS 2-GB Email Attachment Optimization

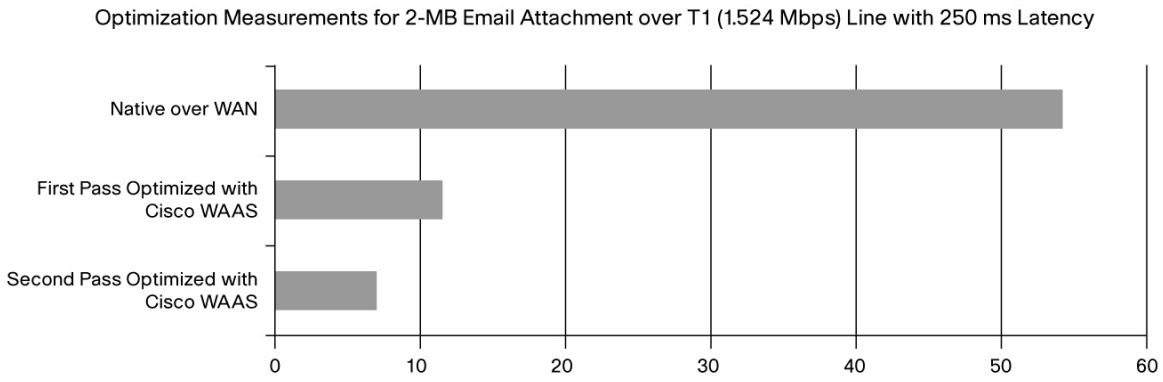
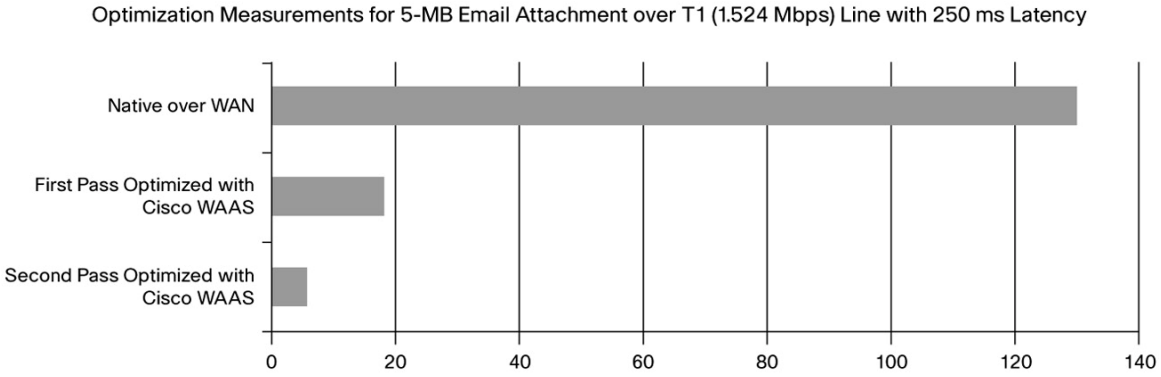


**Figure 4.** Cisco WAAS 5-MB Email Attachment Optimization




## Microsoft Exchange and Outlook Example

Microsoft Exchange Server and Outlook clients use MAPI extensively. Cisco WAAS provides application-specific optimizations for MAPI and EMAPI and the various server and client configurations, including cached mode. Cisco WAAS provides a number of acceleration services for MAPI to help improve performance. This acceleration provides:

- Reduced send and receive times for email messages and improved response times for interactive control operations
- Fast downloads of the Microsoft Outlook offline address book while significantly reducing bandwidth consumption because this is a redundant transfer across the user population
- Fast cleanup of emails from the outbox (in cached mode, email messages will remain longer before they are cleaned from the outbox); Cisco WAAS 5.0 optimizes the send operation, which helps accelerate cleanup of the outbox

With Microsoft Exchange Server 2010, the EMAPI setting for connections is by default set to “required,” which means that Microsoft Outlook clients will also need to have EMAPI traffic enabled to communicate with these servers. From a Cisco WAAS standpoint, the capability to support a scalable optimization solution for this traffic requires the Cisco WAAS devices to become part of the Microsoft Active Directory trust domain. Cisco WAAS does not require any Active Directory configuration changes or the addition of new domain controllers to support the Microsoft Exchange EMAPI solution.

The main element affecting the scalability of Cisco WAAS support for Microsoft Exchange and Outlook deployments is the participation of Cisco WAAS in the Active Directory trust domain. The core Cisco WAAS system can be configured to join the Active Directory domain with either a machine workstation account or a defined-user account. The recommended setup is a workstation account because this approach provides greater security and requires less ongoing maintenance such as management of password expiration renewals.

Setting up the Cisco WAAS devices into the Active Directory domain can be performed through the Cisco WAAS Central Manager under the device or device group settings, or on each Cisco WAAS system through the command-line-interface (CLI). Consistent settings for both Domain Name Service (DNS) and Network Time Protocol (NTP) on the core and edge Cisco WAAS devices is vital to the devices’ proper participation in the Active Directory trust domain and the use of Kerberos authentication. Table 1 lists the main configuration processes for setting up Cisco WAAS for the Active Directory trust domain.

**Table 1.** Microsoft Outlook and Exchange Email Optimization Requirements

| Cisco WAAS Setup | Description | Benefits |
|---|---|---|
| **Configure NTP, DNS, and domain.** | • Configure name server.<br>• Configure NTP server.<br>• Define domain name. | • Makes Cisco WAAS an active member of the Active Directory trust domain<br>• Provides time synchronization, which is vital to Kerberos communications |
| **Enable SSL settings on all Cisco WAAS devices.** | WAN security uses the same SSL accelerator service. | • Uses the SSL accelerator service for EMAPI traffic<br>• Helps ensure that WAN security does not affect SSL application optimization-accelerated service sizing |
| **Core Cisco WAAS joins Active Directory as a workstation account or user account.** | • Through the Cisco WAAS Central Manager or Cisco WAAS CLI:<br>◦ Configure core WAAS devices to join Active Directory domain under a workstation account.<br>◦ Configure a user account on the Cisco WAAS device to join and access the domain and key distribution center (KDC). | • Setting the Cisco WAAS core devices up as workstation accounts is the recommended deployment model.<br>• User accounts will need to be replicated across any domain supported by the core Cisco WAAS device. |
| **Define Cisco WAAS workstation or user account permissions.** | • On the domain controller, delegate read-only access to the root of the Active Directory database.<br>• The core Cisco WAAS device will copy the Microsoft Exchange Server's private key for EMAPI traffic flows. | • Eliminates misconfigurations that may affect service<br>• Increases productivity by identifying questionable configurations<br>• Accelerates time to service<br>• Increases network serviceability |

Cisco WAAS can support multiple domains under each encryption service that is set up, which allows a single Cisco WAAS system to support multiple domains across the WAN for accelerated services. Through the Cisco WAAS Central Manager or CLI, administrators can define the domains to which they want Cisco WAAS EMAPI services applied, and both core and edge Cisco WAAS systems will accelerate MAPI traffic from those domains.

## Optimized Email Protocols and Applications

Cisco WAAS devices automatically discover one another during the establishment of the client-to-server connection. No explicit configuration for email optimization is required, because the Cisco WAAS Wide Area Application Engine (WAE) devices classify TCP traffic and apply optimizations automatically based on the application protocol. Cisco WAAS provides out-of-the-box, preconfigured optimization policies for a number of email protocols and applications as well as facilities to create new policies if an email application uses nonstandard ports or protocols. The email protocols that Cisco WAAS automatically identifies and optimizes include:

- MAPI and EMAPI
- POP3 and SMTP
- IMAPv4
- IBM Lotus Notes and Notes RPC
- HP OpenMail
- Quick Mail Transfer Protocol (QMTP)
- Network News Transfer Protocol (NNTP)

## Cisco WAAS MAPI Monitoring and Reporting

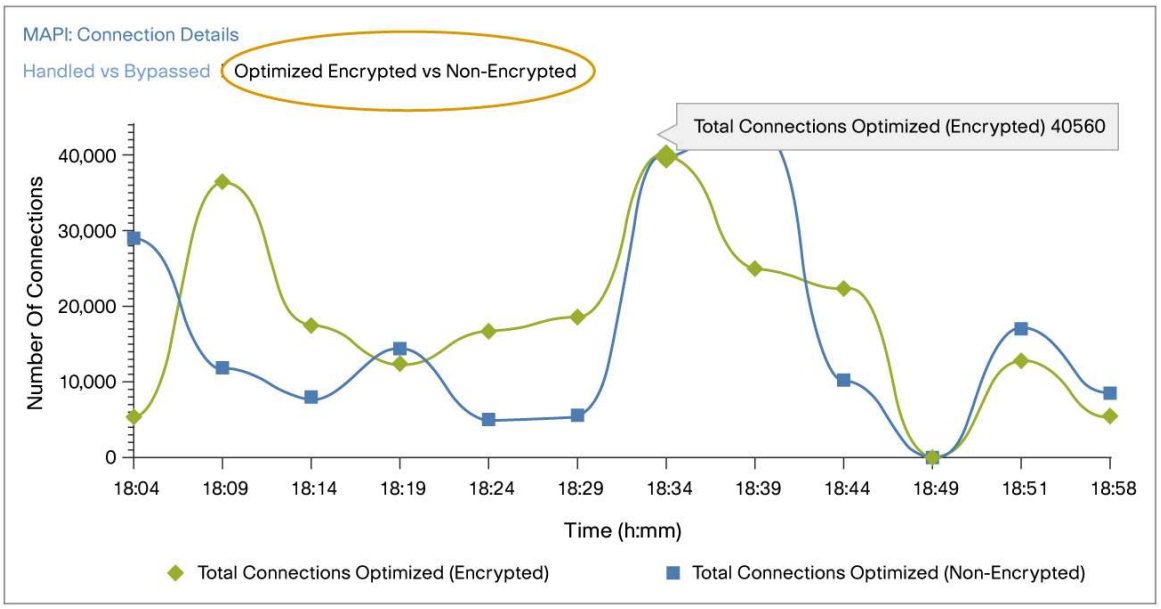
With the Cisco WAAS 5.0 update, many of our monitoring and reporting tools have been updated. These updates include more detailed information and advanced views of data to provide users with a more detailed breakdown of the information provided. Through these tools, Cisco WAAS administrators can examine the effectiveness of their

Cisco WAAS deployments, looking at both optimized and bypassed traffic that has been processed through each system.

## MAPI Connection Details

Visibility into the Cisco WAAS deployment is essential to understanding the effectiveness on MAPI traffic. Through the enhanced connections report, Cisco WAAS administrators can quickly see the number of MAPI connections that each Cisco WAAS device is processing. In addition, within the same connection details window, the administrator can view the mix of optimized encrypted and unencrypted traffic. This type of visibility helps in the management of the migration of Microsoft Windows Exchange systems by enabling administrators to look into the network itself to see how traffic profiles are transitioning (Figure.)

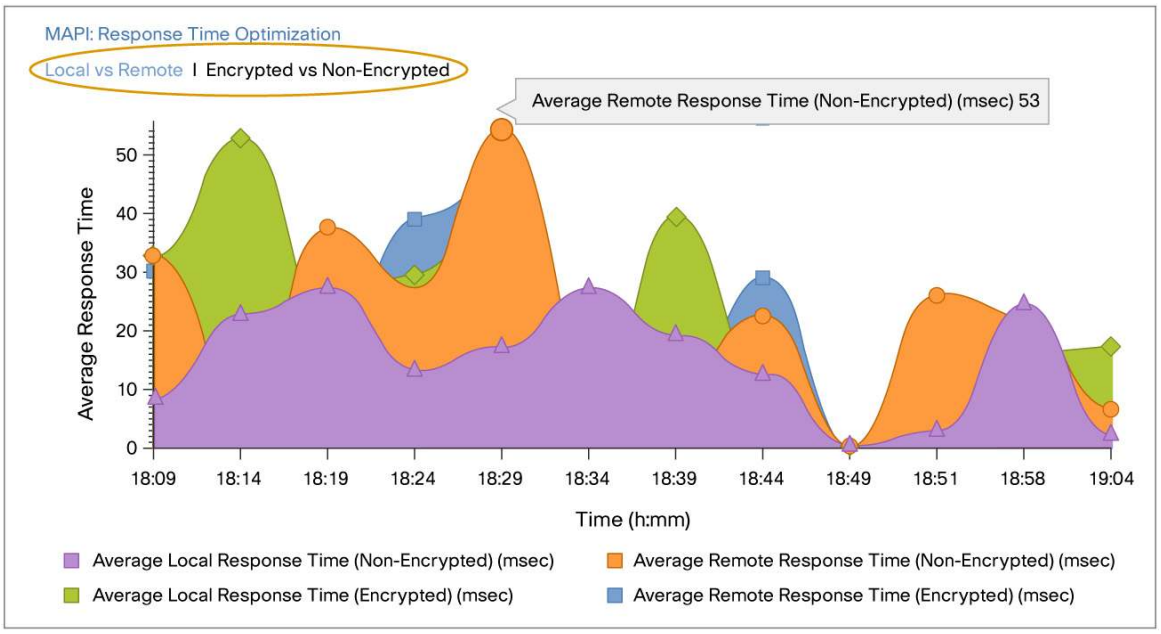
**Figure 5.** MAPI Connection Details




## MAPI Response-Time Optimization

The end-user experience is the ultimate measure of effectiveness for any WAN optimization solution. Users of Microsoft Outlook do not want to wait extended periods of time just for their inbox to load or for emails to be sent out with attachments. The Cisco WAAS MAPI solution optimizes this experience for users with both asynchronous write operations and local acknowledgments along with object read-ahead operations from the remote servers. Visibility into the effectiveness of these functions in the Cisco WAAS deployment is captured in another report; MAPI Response Time Optimization. The administrator can quickly scan this report to see the local and remote response time for MAPI traffic as well as other details about the mix of encrypted and unencrypted traffic (Figure 6).

**Figure 6.** MAPI Response-Time Optimization




## Conclusion

Cisco WAAS provides the tools necessary for IT departments to safely centralize distributed email servers within the data center and provides email acceleration to remote-office users, thereby improving the performance of centralized email services in WAN environments. By applying intelligent optimizations such as DRE, LZ compression, and TFO to email application protocols, Cisco WAAS provides remote-office users with a LAN-like experience when working with consolidated email servers.

## For More Information

For more information about Cisco WAAS, see http://www.cisco.com/en/US/products/ps5680/Products_Sub_Category_Home.html or contact your local account representative.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