

## Accurate End-To-End Performance Management Using NetQoS SuperAgent and Cisco Wide Area Application Services

IT organizations are increasingly relying on best-in-class end-to-end performance analysis and management tools to validate application performance and isolate problem areas. Application acceleration and WAN optimization solutions have historically not been interoperable with such solutions because of a fundamental lack of network-layer transparency and TCP proxy architectures. Cisco® Wide Area Application Services (WAAS) is a network-transparent solution that provides industry-leading interoperability with any such solution. Cisco and NetQoS have now created the industry's first integrated management interface to overcome the TCP proxy architecture limitation. NetQoS SuperAgent uses the new management interface on all WAAS devices to provide customers end-to-end real-time application response time reports that quantify precisely the benefits of their Cisco WAAS deployments. NetQoS is a network performance monitoring vendor and integration with Cisco WAAS 4.0.13 enables customers to monitor end-to-end application response time improvements before and after the Cisco WAAS deployment accurately and seamlessly.

### Challenges in Monitoring Application Performance

Most WAN optimization solutions implement a non-transparent TCP proxy architecture or a non-transparent tunnel architecture to provide optimization to user flows. While this approach certainly may help overcome application performance barriers, these architectures create challenges when attempting to use most end-to-end application performance analysis tools. These challenges are mainly the result of the following problems:

- **Lack of network layer transparency:** With deployment of acceleration solutions that do not preserve critical network-layer and transport-layer information (such as IP addresses and TCP ports), end-to-end performance monitoring systems such as NetQoS SuperAgent may not be able to distinguish application flows from one another or may see only flows between accelerators rather than between end nodes
- **Localized handling of TCP:** With deployment of acceleration solutions that employ a TCP proxy to locally manage TCP at each accelerator near each endpoint, end-to-end performance monitoring systems lose visibility to the actual round-trip time (RTT) of a given flow because of the localized TCP handling. Such systems see immediate TCP acknowledgment as the accelerator close to the end node acknowledges TCP segments that have been received prior to optimization and transmission

These two problems together are called WAN optimization controller (WOC) distortion.

Figure 1 shows a nontransparent accelerator solution deployed in a network. Notice that the original IP addresses and TCP port information for optimized user-to-server connections are not preserved by such a solution. Thus, this solution affects the visibility of the end-to-end performance management solution and could negatively affect its ability to accurately report and

graph information. Furthermore, with a TCP proxy architecture, local accelerators acknowledge TCP segments that have been received before sending the actual data across the network. This behavior skews response time analysis, because the performance management solution sees near-immediate acknowledgment of data even though the data has not yet been transmitted over the WAN.

**Figure 1.** WOC Distortion: Nontransparent TCP Proxy Architecture

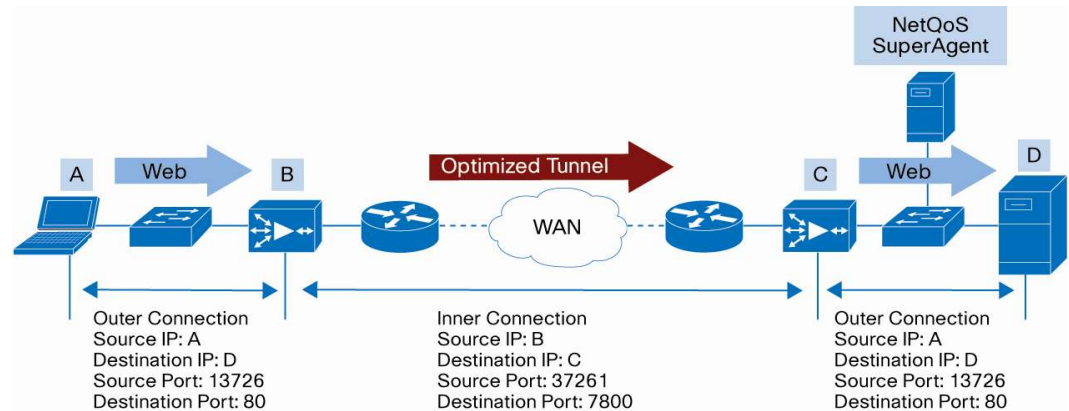


Figure 2 shows the effect of using a TCP proxy architecture on response time analysis. The left part of the figure shows the response time analysis prior to deploying the accelerator solution. The performance management solution (such as NetQoS SuperAgent) measures the amount of time taken to receive an acknowledgment to a TCP segment that has been transmitted; thus, the response time composition is largely related to the latency encountered in the WAN. The middle part of the figure shows the inaccurate response time analysis after deploying an accelerator solution that uses a TCP proxy: that is, where the local accelerator immediately acknowledges TCP data that has been received. This measurement is deceptive, because the data has not yet traversed the WAN and has simply been placed in the TCP receive buffer on the local accelerator, and the sender has been acknowledged. The actual user response time, shown at the right of the figure, accurately represents the user experience.

**Figure 2.** WOC Distortion: Deceptive Response Time Reporting

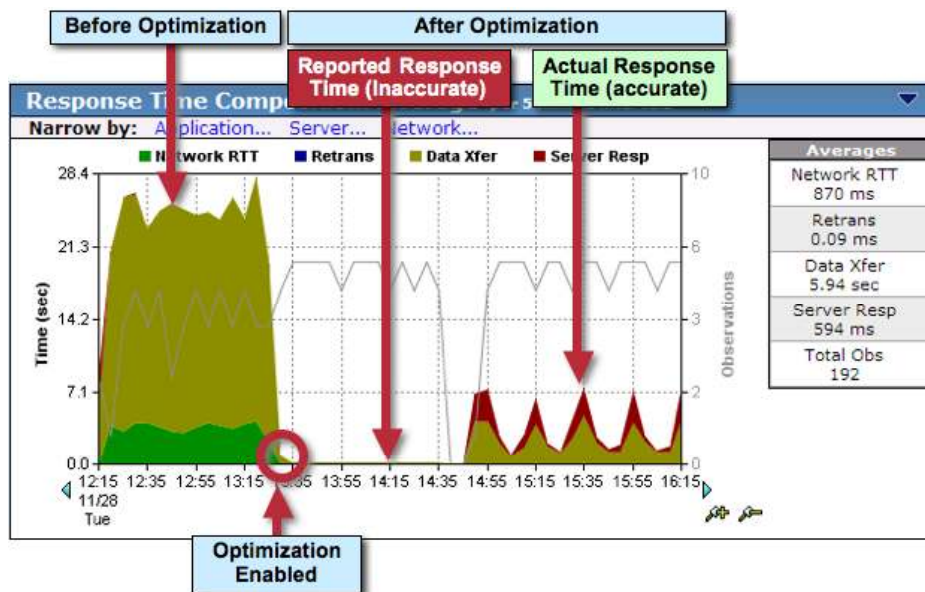
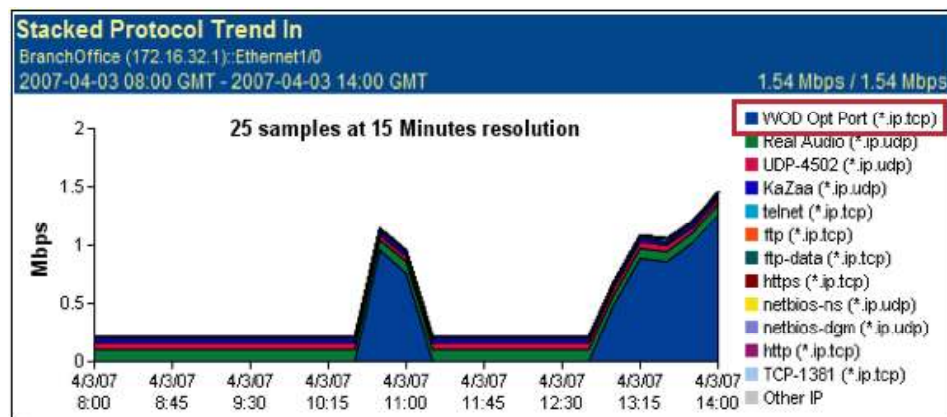


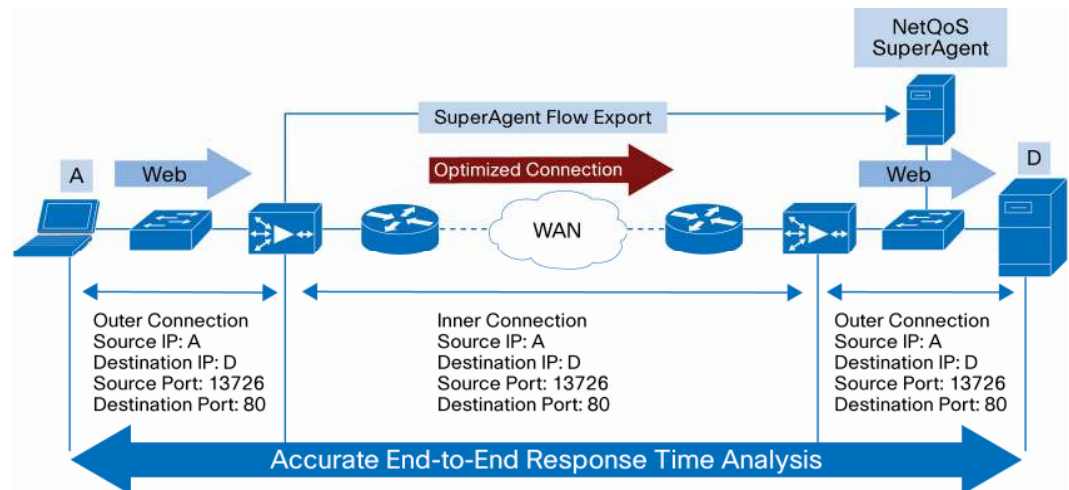
Figure 3 shows the effect of a nontransparent accelerator solution. As shown in the figure, flows that are optimized by the nontransparent accelerator solution are bundled into a single category because of the lack of transparency and use of service ports.

**Figure 3.** WOC Distortion: Loss of Application Visibility for Optimized Flows



WOC distortion presents a significant challenge to IT organizations that need accurate end-to-end performance analysis. Cisco WAAS is a transparent solution that has always provided network transparency, giving such systems application visibility. However, much like other nontransparent solutions, Cisco WAAS implements a TCP proxy that, in the past, caused response time analysis to be skewed because of the localized handling of TCP. Cisco WAAS and NetQoS have created the industry's first integrated management interface to overcome this limitation. NetQoS SuperAgent uses the new management interface on all WAAS devices to measure end-to-end response time, from the client to the server over a WAAS-optimized link. The 4.0.13 release of Cisco WAAS devices will have the ability to export the necessary TCP/IP information to NetQoS SuperAgent via the management interface. This ensures that end-to-end application response time reporting is accurate even in the presence of WAN acceleration devices that implement TCP proxy architecture (Figure 4).

**Figure 4.** Cisco WAAS with NetQoS SuperAgent Flow Export Enables End-to-End Response Time Analysis



The integration between Cisco WAAS and NetQoS SuperAgent 7.2 offers a solution that can accurately measure performance of crucial metrics in specific segments such as LAN (outer connection A or D), WAN (inner connections), and server side (outer connection D). The remainder of this document examines some of the main graphs.

### Integration Details

Central to the integration of Cisco WAAS and NetQoS SuperAgent is a Cisco WAAS Software feature called the Flow Agent. This feature is part of the standard Cisco WAAS Software image and an integral component of the management interface. This feature is typically configured on the remote-office Cisco Wide Area Application Engine (WAE) Appliance, and when configured, collects relevant data on the LAN side and sends the flow information to the NetQoS SuperAgent management console (shown in Figure 4). The NetQoS aggregator receives the data sent by the Cisco WAAS FlowAgent module, processes it, and sends it to the SuperAgent management console for storage and reporting. This can be configured on the Cisco WAAS Central Manager selectively for a single device or amongst multiple (or all) devices using device groups.

Cisco WAAS is fully compatible with tools that depend on Cisco IOS® NetFlow such as NetQoS ReporterAnalyzer (RA) as a result of network transparency. Cisco WAAS maintains the TCP/IP header information necessary for visibility, thereby helping ensure compliance and interoperability with these tools. The integration with NetQoS SuperAgent builds on this foundation to allow IT organizations to examine and validate performance metrics before and after Cisco WAAS is deployed. These performance metrics include the following:

- Average response time: The amount of time taken to complete a transaction between client and server
- Network RTT (NRTT): The amount of time taken to move data from one node to another and receive an acknowledgment that the data has been received
- Server response time (SRT): The amount of time between a server's receipt of a request to the time when the response is sent from that server
- Data rate: The throughput achieved at a particular point in time, measured in bits per second or packets per second

The following figures show how Cisco WAAS both provides compatibility with the performance measurements taken by NetQoS SuperAgent and helps mitigate the negative effects of the WAN on end-to-end application performance. The graphs show that Cisco WAAS dramatically reduces the effects of network latency while improving network throughput and overall application performance.

Figure 5 shows how Cisco WAAS with Flow Agent enabled ensures that NetQoS SuperAgent can accurately measure end-to-end response time.

**Figure 5.** Cisco WAAS Flow Agent Helps Ensure Accurate Performance Reporting with NetQoS SuperAgent

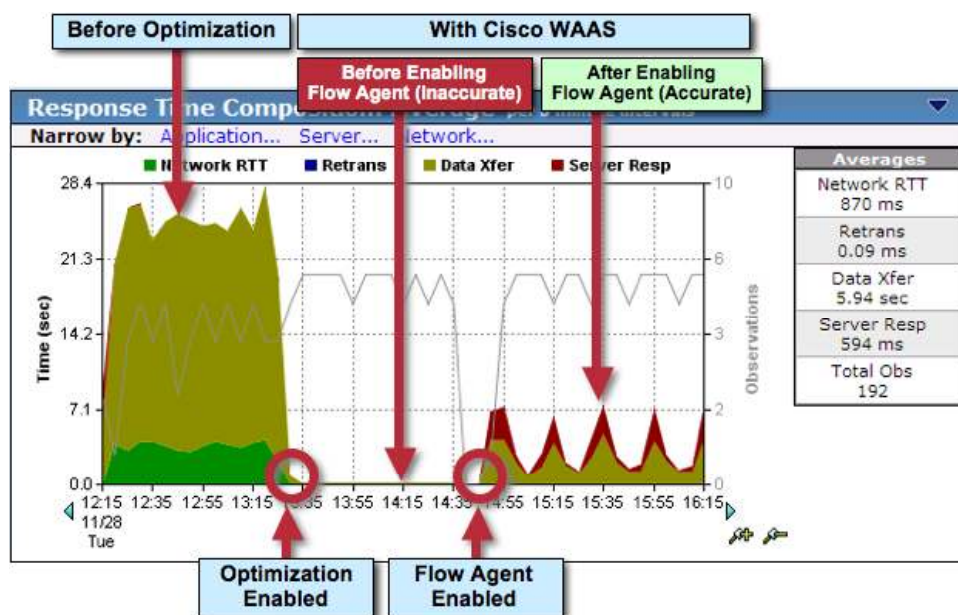
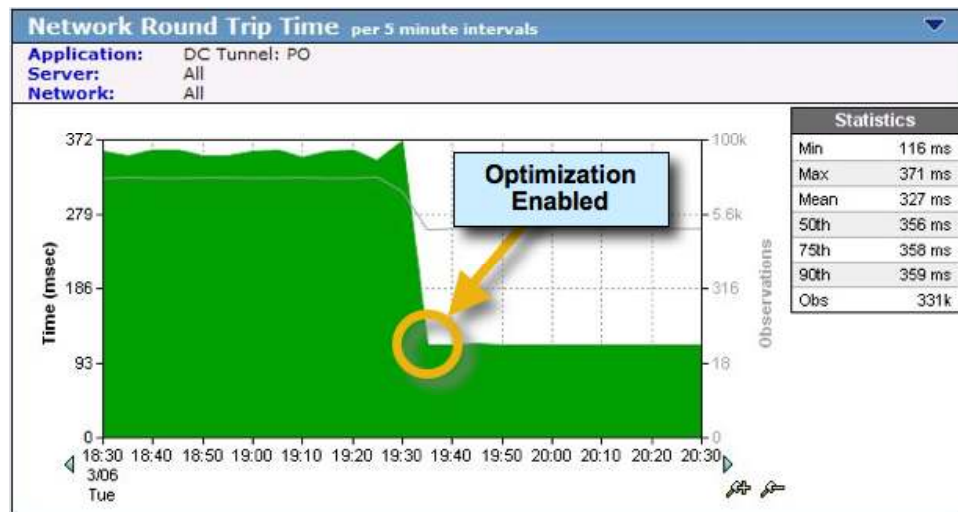


Figure 6 shows how Cisco WAAS optimizations improved application performance and WAN utilization efficiency. By improving efficiency, Cisco WAAS can alleviate congestion encountered on the network, thereby minimizing the perceived RTT encountered on the WAN caused by congested router queues and inefficient bandwidth consumption.

**Figure 6.** NRTT Before and After Cisco WAAS Deployment



## Summary

Cisco WAAS and NetQoS have created the industry's first integrated management interface to overcome the limitation posed by TCP proxy architecture (that exists in all WAN Optimization and Application Acceleration solutions) to accurate reporting of end-to-end application response time. NetQoS SuperAgent uses the new management interface on all WAAS devices to measure end-to-end latency, from the client to the server over a WAAS-optimized link. As a result of this integration, users of Cisco WAAS can quantify precisely the benefits of their Cisco WAAS deployments by allowing them to view reports that accurately monitor and quantify end-to-end application response time monitoring by leveraging NetQoS SuperAgent. In addition, this solution can be used in the evaluation phase to showcase the performance benefits of Cisco WAAS and in phased deployment phase to identify locations that will benefit from Cisco WAAS. Over the long term, the solution may be used to baseline the improved application performance. This solution is easy to deploy and manage successfully over a large network, and it is compatible with all the supported redirection mechanisms, including inline, Web Cache Communication Protocol (WCCP), and server load balancers such as Cisco ACE Application Control Engine, Cisco CSS Content Service Switches, and Cisco Catalyst® 6500 Series Switch Content Switching Module (CSM).



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