# Monitoring Your Cisco WAAS Network

This chapter describes the monitoring tools available in the Cisco WAAS Central Manager GUI that can help you monitor activity, configure flow monitoring, and customize reports.

For information on Cisco WAAS system logging and troubleshooting, see the chapter Troubleshooting Your Cisco WAAS Network.

**Note** Throughout this chapter, the term Cisco WAAS device is used to refer collectively to the WAAS Central Manager and Cisco Wide Area Application Engines (WAEs) in your network. The term WAE refers to WAE and Wide Area Application Virtual Engine (WAVE) appliances, and Cisco Virtual WAAS (vWAAS) instances.

This chapter contains the following sections:



# Viewing System Information from the System Dashboard Window

The Cisco WAAS Central Manager GUI allows you to view general and detailed information about your Cisco WAAS network from the System Dashboard window. This section describes the System Dashboard window and contains the following topic:



**Note** For information on viewing the alarm panel and on viewing device alarms, see Cisco WAAS Central Manager Alarm Panel in the chapter "Troubleshooting Your Cisco WAAS Network."

The following figure shows the **System Dashboard** window.

***Figure 1: System Dashboard Window***


The information displayed in the charts in the System Dashboard window is based on a snapshot of your WAAS network that represents the state of your WAE devices at the end of every two polling periods. You can configure the interval between polls in the Cisco WAAS Central Manager GUI (**Configure > Global > System Properties > System Properties > system.monitoring.collectrate**). The default polling rate is 300 seconds (5 minutes). Alarms are presented in real time and are independent of the polling rate.

# Monitoring Graphs and Charts

The default **System Dashboard** window contains the following graphical displays about the application traffic processed by your Cisco WAAS system:

- Traffic Summary, on page 16 chart: Displays the applications with the highest percentage of traffic in the WAAS network for the last hour.
- Effective WAN Capacity, on page 15 graph: Displays the effective increased bandwidth capacity of the WAN link as a result of WAAS optimization, as a multiple of the actual bandwidth.
- Traffic Volume and Reduction, on page 16 graph: Displays the original and optimized traffic volume and percentage of traffic reduction over the last hour.
- Compression Summary, on page 15 chart: Displays the ten applications with the highest percentage of traffic reduction for the Cisco WAAS network for the last hour. The percent calculation excludes pass-through traffic.

Numbers shown in charts and graphs are rounded to whole units (KB, MB, or GB), while those displayed in tables are rounded to three decimal places. Data values exported to CSV files are in bytes, and are therefore, not rounded.

You can customize the graphical displays and tables that are displayed on the system dashboard. For more information, see Customizing a Dashboard or Report, on page 10. Individual charts are described in more detail in Cisco WAAS Chart Descriptions, on page 14.

Much of the device, statistical, and alarm information that is presented in the system dashboard and associated graphs and charts is also available programmatically through the monitoring API.

**Note** You must synchronize the clock on each WAE device within 5 minutes of the primary and secondary Cisco WAAS Central Managers for statistics to be consistent and reliable. For information on using an NTP server to keep all your Cisco WAAS devices synchronized, see Configuring NTP Settings in the chapter "Configuring Other System Settings." Additionally, if the network delay in the Central Manager receiving statistical updates from the WAEs is greater than 5 minutes, statistics aggregation may not operate as expected.

**Note** For information on how to troubleshoot device alarms, see in the chapter "Troubleshooting Your WAAS Network."

# Viewing Device Information

This section describes how to use the Cisco WAAS Central Manager device windows:

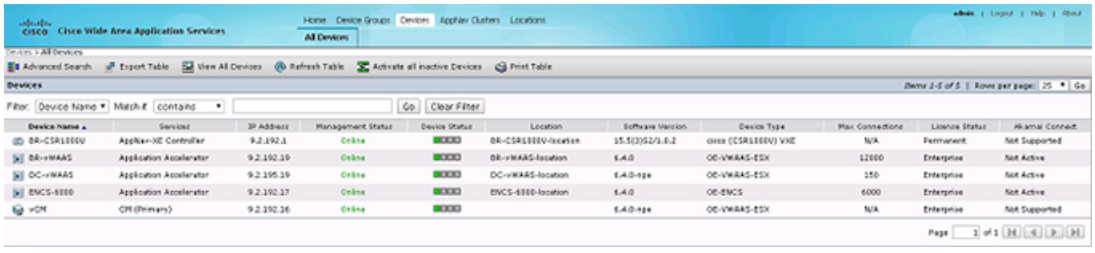
- The Devices Window, on page 3 displays a list of and basic information for all Cisco WAAS devices.
- The Device Dashboard Window, on page 6 displays detailed information about a specific device, such as the installed software version and whether the device is online or offline.
- The Device Status Dashboard Window, on page 7 displays traffic information for all Cisco WAAS devices.
- The Viewing and Unlocking Device Users, on page 9 window displays the list of users, in table format, with information including username, number of login failures, and time of last login failure.

## Devices Window

The Devices window lists all the Cisco WAAS devices that are registered with the Cisco WAAS Central Manager. To view this list, in the Cisco WAAS Central Manager GUI choose **Devices** > **All Devices**.

The **Devices** window appears.

***Figure 2: Devices Window***




The **Devices** window displays the following information about each device:

- Services enabled on the device. For a description of these services, see the "Service Descriptions" table below.
- IP address of the device.

- Management Status (**Online**, **Offline**, **Pending**, or I**nactive**). For more information about the status, see Device Alarms in the chapter "Troubleshooting Your Cisco WAAS Network." A tool tip is displayed when you hover your cursor over the individual device **Management** status. It shows the timestamp for offline devices and the timestamp for the latest configuration for online devices.
- Device Status. The system status reporting mechanism uses four alarm lights to identify problems that have to be resolved. Each light represents a different alarm level as follows:
  - **Green**: No alarms (the system is in excellent health)
  - **Yellow**: Minor alarms
  - **Orange**: Major alarms
  - **Red**: Critical alarms

When you hover your mouse over the alarm light bar, a message provides further details about the number of alarms. Click the alarm light bar to troubleshoot the device. For more information, see the chapter Troubleshooting Your Cisco WAAS Network.

- **Location associated with the device**: For more information about locations, see the chapter Using Device Groups and Device LocationsYou can view reports that aggregate data from all the devices in a location. For more information, see Location-Level Reports, on page 37.
- **Software version installed and running on the device**: For Cisco WAAS Express and AppNav-XE devices, both the Cisco IOS and the Cisco WAAS Express or AppNav-XE software versions are shown.
- **Device Type**: If you see a type such as Cisco WAAS Express and AppNav-XE devices, the router platform is displayed. For Cisco vWAAS devices, **OE-VWAAS** is displayed, and for Cisco WAAS for Cisco Integrated Services Routers (ISR) devices, **ISR-WAAS** is displayed. For ENCS devices, **OE-ENCS** is displayed.
- **Max Connections**: The maximum number of connections that can be handled by the device.
- **License Status**: Displays the installed licenses. See the "License Status Descriptions" table below for a description of the possible values.
- **Akamai Connect**: Displays the Akamai Connect license status for the device whether the license is supported, active or disabled for the device.

WAE devices that are at a later software version level than the Cisco WAAS Central Manager are displayed in red. Also, if the Standby Cisco WAAS Central Manager has a different version level from the Primary Cisco WAAS Central Manager, the Standby Cisco WAAS Central Manager is displayed in red.

You can filter your view of the devices in the list by using the **Filter** and **Match If** fields above the list. Enter a filter string in the text field and click **Go** to apply the filter. The filter settings are shown below the list. To to clear the filter and show all the devices, click **Clear Filter**. Filtering allows you to find devices that match the criteria that you set.

***Table 1: Service Descriptions***

| Service | Description |
|---|---|
| CM (Primary) | The device has been enabled as the Primary Cisco WAAS Central Manager. |
| CM (Standby) | The device has been enabled as a Standby Cisco WAAS Central Manager. |

| Service | Description |
|---|---|
| Application Accelerator | The device has been enabled as an application accelerator. |
| AppNav Controller | The device has been enabled as an AppNav Controller. |
| AppNav-XE Controller | The device is a router using Cisco IOS XE with the AppNav-XE controller functionality enabled. |
| WAAS Express | The device is a router using Cisco IOS with the Cisco WAAS Express functionality enabled. |

*Table 2: License Status Descriptions*

| License Status | Description |
|---|---|
| Not Active | No license is installed, or the first configuration synchronization has not yet occurred. |
| Transport, Enterprise | The listed licenses are installed. |
| Active | A router device is registered, but the first configuration synchronization has not yet occurred. |
| Permanent | A router device has a permanent license installed. |
| Evaluation, Expires in X weeks Y days | A router device has an evaluation license installed and it expires after the indicated period. |
| Expired | A router device has an expired evaluation license. A permanent license must be obtained for this device to operate. |
| N/A | The license status is not applicable because the device version is 4.0. |

**Note** After the devices has been registered to the Cisco WAAS Central Manager, a Cisco WAAS Central Manager DB VACUUM (runs between 1 AM – 2 AM) process takes more time (Min:2 min, Avg:7 min, Max:25min) due to the augmented load on computing resources.

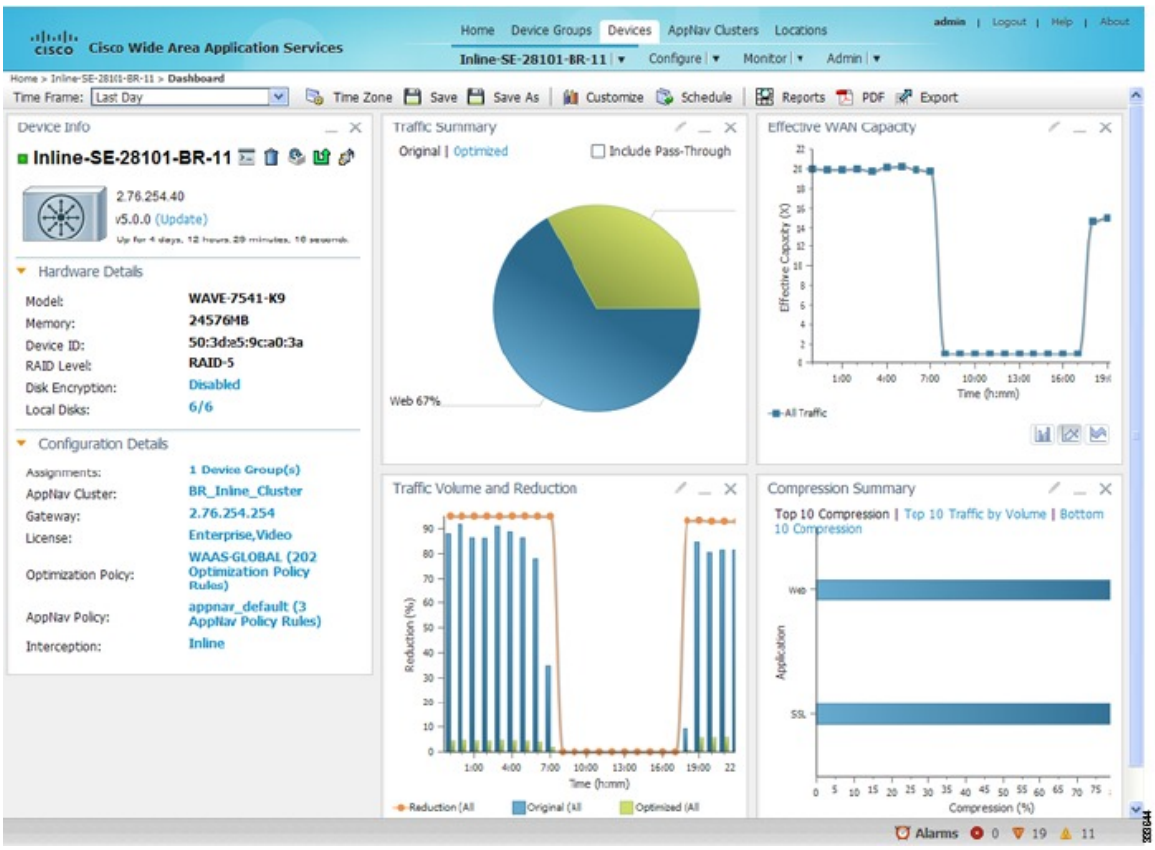
- A few of the WAEs may go temporarily offline. They are online automatically once the VACUUM process is complete.
- **Statistics Aggregation** threads may take more than 5 minutes and the same would be indicated in the logs. As a result statistics samples, might be missing at network level.
- **User**, including the administrator will not be able to use (login) the Cisco WAAS Central Manager as the complete DB will be locked.

# Device Dashboard Window

The **Device Dashboard** window provides detailed information about a Cisco WAAS device, including device model (such as WAVE-7541-K9 or OE-VWAAS-KVM), IP address, interception method, and device-specific charts.

To access the **Device Dashboard** window, choose **Devices** > *device-name*.

***Figure 3: Device Dashboard Window***




The **Device Dashboard** window for a Cisco WAAS Express or Cisco AppNav-XE device looks slightly different. It lacks some WAE-specific information and controls.

The following tasks are available from the **Device Dashboard** window:

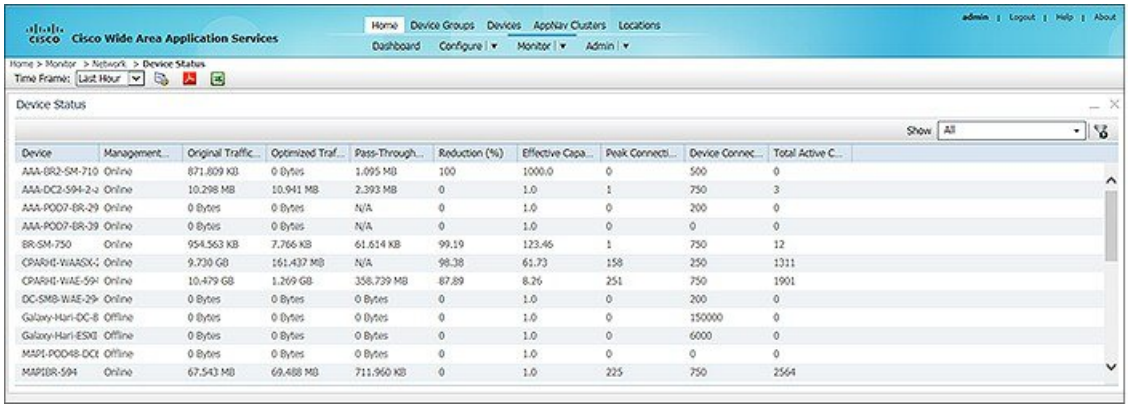
- View charts and graphs about the application traffic processed by the selected WAE device. (No charts or graphs are displayed if a Cisco WAAS Central Manager device is selected.)
- Customize the charts displayed in the window. For more information, see Customizing a Dashboard or Report, on page 10 and Cisco WAAS Chart Descriptions.
- View basic details, such as whether the device is online, the device's IP address and hostname, the software version running on the device, and the amount of memory installed in the device, the license status, and so forth.
- View the device groups to which the device belongs. For more information, see the chapter "Using Device Groups and Device Locations". (Not available on AppNav-XE devices.)

- View the users that are defined on the device and unlock any locked-out users. For more information, see Viewing and Unlocking Device Users, on page 9. (Not available on WAAS Express and AppNav-XE devices.)
- To update the software on the device, click **Update**. For more information, see the chapter "Maintaining Your Cisco WAAS System." (Not available on WAAS Express and AppNav-XE devices.)
- To establish a Telnet session into the device and issue CLI commands, click the **Telnet** icon.
- To delete the device, click the **Delete Device** icon.
- To reapply the device configuration from the Cisco WAAS Central Manager to the device, click the **Full Update** icon. (Not available on Cisco WAAS Express and AppNav-XE devices.)
- To reboot the device, click the **Reload** icon. (Not available on Cisco WAAS Express and AppNav-XE devices.)
- To restore the default predefined policies on the device, click the **Restore Default Policies** icon. For more information, see Restoring Optimization Policies and Class Maps in the chapter "Configuring Application Acceleration." (Not available on Cisco AppNav-XE devices.)
- Assign and unassign the device to device groups. For more information, see the chapter "Using Device Groups and Locations." (Not available on Cisco AppNav-XE devices.)
- For a Cisco WAAS Express device, a **WAAS Enabled Interfaces** item shows the number of interfaces on which Cisco WAAS optimization is enabled. You can click the number to go to the **Network Interfaces** configuration window, which displays device interface details and allows you to enable or disable optimization on the available interfaces. For more details, see Enabling or Disabling Optimization on Cisco WAAS Express Devices in the chapter "Configuring Network Settings."
- For a Cisco WAAS Express device, you can view the DRE item to determine if the device supports data redundancy elimination (DRE) optimization, which is not supported on some Cisco WAAS Express device models. This item reads **Supported** or **Unsupported**.
- For a Cisco WAAS Express device, you can view the SSL item to determine if SSL acceleration is available. This item reads **Available** or **Unavailable**.
- For a Cisco vWAAS device, the **No. of CPUs**, **Max TCP Connections**, and **Interception Method** fields are shown. For more details, see the chapter "Configuring Traffic Interception."
- On an AppNav Controller, an **AppNav Cluster** item shows any defined AppNav Clusters. You can click a cluster name to go to that cluster's home window. Also, an AppNav Policy item shows defined AppNav policies, if any. To go to the **Policy Configuration** window, click a policy name.

# Device Status Dashboard Window

The **Device Status Dashboard** window lists all the Cisco WAAS devices that are registered with the WAAS Central Manager. To view this list, from the Cisco WAAS Central Manager choose **Home** > **Monitor** > **Network** > **Device Status**.

*Figure 4: Device Status Dashboard Window*




The following table displays information about each column in the **Device Status Dashboard** window:

*Table 3: Device Status Dashboard Window Field and Columns*

| Device Status Field or Column | Device Status Column Description |
|---|---|
| Time Frame drop-down list | Choose one of the following time frame to display status for the device:<br>• Last Hour<br>• Last Day<br>• Last Week<br>• Last Month<br>• Custom dates<br>**Note** Data for **Management Status** and **Active Connections** is displayed only when you select **Last Hour**.<br>For more information on time frames, see Customizing a Dashboard or Report, on page 10 |
| Device | The name of the device. |
| Management Status | A status of Online, Offline, Pending, or Inactive. For more information on device management status and alarms related to device management status, see Device Alarms in the chapter "Troubleshooting Your Cisco WAAS Network." |
| Original Traffic | The amount of original traffic, in GB, passing through the device. |
| Optimized Traffic | The amount of optimized traffic, in GB, passing through the device. |
| Pass-Through Reduction (%) | The percentage of traffic reduction for the time period specified in the Time Frame drop-down list. |

| Device Status Field or Column | Device Status Column Description |
|---|---|
| Effective Capacity (X) | The effective bandwidth capacity of the device as a result of optimization. |
| Peak Connection | The peak optimized connections for the device. |
| Device Connection Limit | The maximum connection limit for the device. |
| Total Active Connections | The total number of current active connections for the device. |

## Device Status Report

You can choose to view the **Device Status** report as a **.pdf** or a **.csv** file by selecting the respective icons on the dashboard. The Time Zone option enables you to customize the time zone for the report, based on your preference. For more information on setting time zones, see Customizing a Dashboard or Report, on page 10.

You can filter your view of the devices in the list by using the Filter and Match If fields above the list. Enter a filter string in the text field and click the Go button to apply the filter. The filter settings are shown below the list. Click the Clear Filter button to clear the filter and show all devices. Filtering allows you to find devices in the list that match the criteria that you set.

# Viewing and Unlocking Device Users

To view the users defined on a Cisco WAAS device, choose **Devices** > *device-name* and then, from the **Device Name** menu, choose Device Users. On a Cisco WAAS Central Manager device, choose **CM Users**.

The list of users is displayed in a table, which shows the username, number of login failures, maximum number of login failures allowed, and the time of the last failed login. To view the details of a user, click the **View** icon next to that username.

If a user is locked out because the user has reached the maximum number of failed login attempts, unlock the user by checking the check box next to the username and clicking **Unlock** below the table.

# Detecting and Resolving Configuration Conflicts

### Before you begin

Configuration conflicts between the device group and devices are difficult to identify at the device group level. Whenever configuration conflicts occur, they show up in the **Force Device Group Detection** page. The Cisco WAAS Central Manager provides an easy way to identify, view and resolve these configuration conflicts.

**Note** **Force Device Group** detection is not applicable for Cisco routers.

**Procedure**

**Step 1** To to see the impacted **Device Name**, **Device Group Name** and **Page Name**, from the Cisco WAAS Central Manager choose **Home > Admin > Force Device Group > View Pages**. This lists all the device groups that have conflicts with the devices and on which page.

**Step 2** Click on the page link to navigate to the corresponding page to correct the configuration conflict.

# Customizing a Dashboard or Report

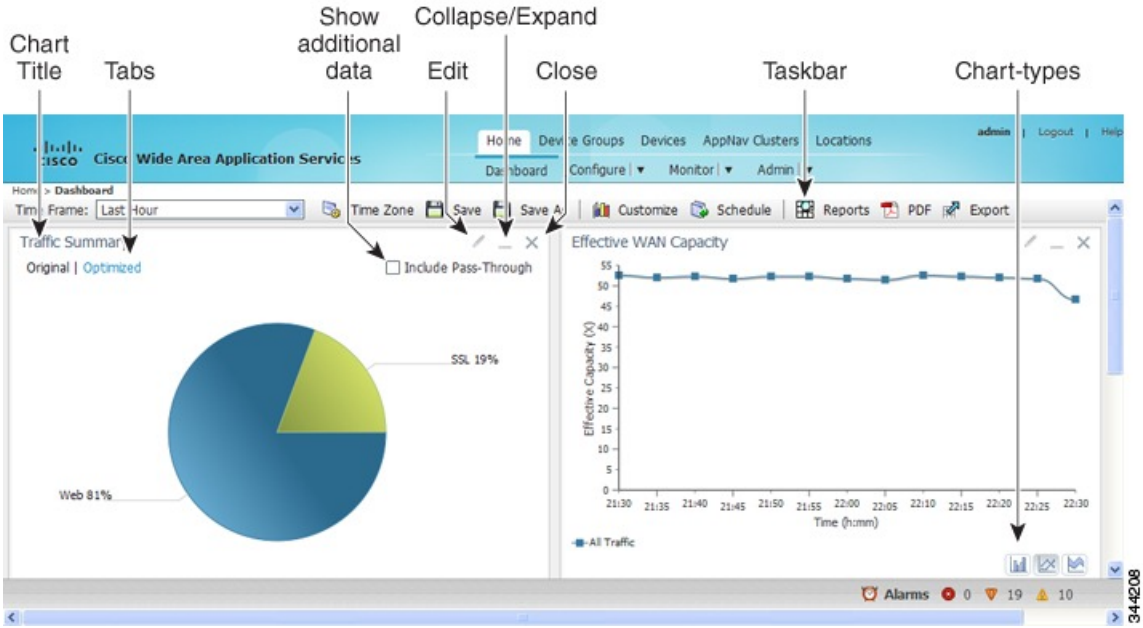
You can customize the system and device dashboards and reports, if any, in the same way. For more information about creating custom reports, see Managing Reports, on page 51.

This section contains the following topics:

## The Cisco WAAS Central Manager Report Panel

The following figure shows a sample report.

***Figure 5: Report Pane***




Taskbar icons and controls across the top of the dashboard or report allow you to do the following:

- **Time Frame**: Allows you to choose one of the several common time frames from the drop-down list:
  - **Last Hour**: Displays data for the past hour, in five-minute intervals (default). You can change the interval using the **System.monitoring.collectRate** configuration setting described in Modifying Default System Properties in the chapter "Configuring Other System Settings."

- **Last Day**: Displays data for the past day (in hourly intervals).
- **Last Week**: Displays data for the past week (in daily intervals).
- **Last Month**: Displays data for the past month (in daily intervals).
- **Custom**: Enter starting and ending dates in the From and To fields. Click the calendar icon to choose dates from a pop-up calendar.

The time frame setting is stored individually for each report and Central Manager user. Additionally, the **System.monitoring.timeFrameSettings** system property controls the system default time frame setting. For more information, see Modifying Default System Properties in the chapter "Configuring Other System Settings."

**Note** If you create a chart with a custom date setting that spans more than two months prior to the current date, data for the most recent two months are plotted with daily data and data for all the earlier months are plotted with aggregated monthly data. The chart might appear to have a large drop in traffic for the most recent two months because the daily traffic totals are likely to be much smaller than the monthly traffic totals. However, this difference is normal.

- **Time Zone**: Allows you to choose one of the following options from the Time Zone drop-down list:
  - **UTC**: Sets the time zone of the report to UTC.
  - **CM Local Time**: Sets the time zone of the report to the time zone of the WAAS Central Manager (default).

When you change the time zone, the change applies globally to all reports. The time zone setting is stored individually for each Cisco WAAS Central Manager user.

- **Save**: Saves the dashboard or report with its current settings. The next time you view it, it is displayed with these settings.
- **Save As**: Saves the report with its current settings under a new name. A dialog box allows you to enter a report name and an optional description. You can enter only the following characters: numbers, letters, spaces, periods, hyphens, and underscores. The report will be available in the **Monitor > Reports > Reports Central** window.
- **Customize**: Allows you to add a chart or table to a dashboard or report. For information on adding a chart or table, see Adding a Chart or Table, on page 12.
- **Schedule**: Allows you to schedule reports to be generated once, or periodically, such as hourly, daily, weekly, or monthly. When a scheduled report is generated, you can have a PDF copy of the report e-mailed to you automatically.
  - In the **Date** field, enter the schedule date in the format **DD/MM/YYYY**, or click the calendar icon to display a calendar from which to choose the date.
  - From the **Hours** drop-down list, choose the hours. The time represents the local time at the WAAS Central Manager.
  - From the **Minutes** drop-down list, choose the minutes. The time represents the local time at the Cisco WAAS Central Manager.

- From the **Frequency** drop-down list, choose **Once**, **Hourly**, **Daily**, **Weekly**, or **Monthly** to set the report frequency.
- In the **No. of Reports** field, enter the number of times that a reoccurring report is to be generated. After a report is generated a specified number of times, the report is no longer generated.
- In the **Email Id(s)** field, enter the email addresses of the report recipients, separated by commas.
- In the **Email Subject** field, enter the subject of the email message.

- **Reports**: Allows you to view the scheduled reports. For instructions about viewing scheduled reports, see Viewing or Deleting a Scheduled Report, on page 55.
- **PDF**: Generates a PDF format of a report, including the charts and table data. To include a custom logo in your PDF report, choose **Home Dashboard > Admin> Custom Logo**, and then click **Upload**. The custom logo is displayed in the PDF format of the report. Additionally, when you schedule a report, you can select **Custom Logo** for the logo to appear on the scheduled report. This option is available only when you have uploaded the custom logo.
- **Export**: Exports the chart and table statistical data to a CSV file. The statistical data shown in charts is rounded to whole units (KB, MB, or GB), while the exported data contains exact byte values.

Controls at the top of individual charts allow you to customize the chart as follows (not all controls are available in every chart):

- **Chart title**: Allows you to click and drag in order to move the chart to a different location in the report pane.
- **Edit icon**: Allows you to edit the chart settings, as described in Configuring Chart Settings, on page 13.
- **Collapse/Expand icon**: Allows you to collapse or expand the chart. When a chart is collapsed, this icon changes to Expand, which restores the chart to its normal size.
- **Close icon**: Closes the chart.
- **Tabs**: Allows you to have a choice of multiple tab views that you can access by clicking the desired tab name. Note that not all charts have this feature.
- **Check box to show additional data**: Allows you to check the check box labeled with an optional data statistic to include the data in the chart. Note that not all charts have this feature.

Chart-type icons at the bottom of individual charts allow you to choose the chart type as follows: **column chart**, **line chart**, **area chart**, **stacked line chart**, **stacked area chart**. Note that not all charts have this feature.

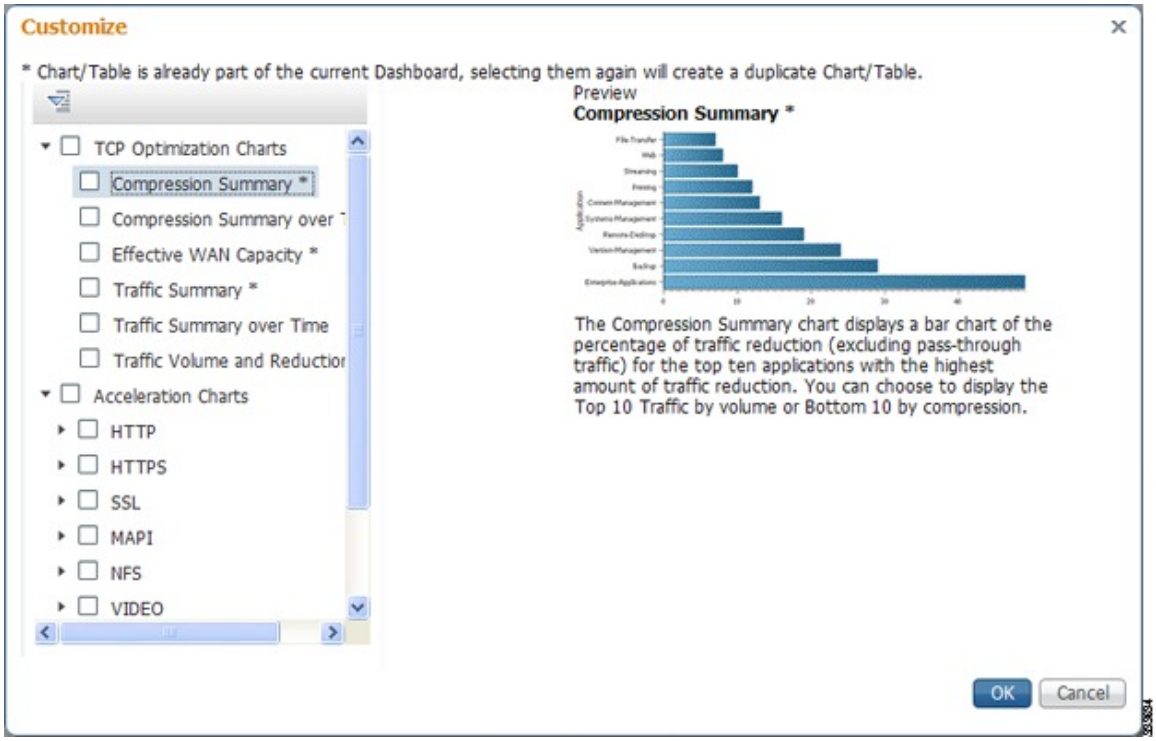
# Adding a Chart or Table

**Procedure**

**Step 1** From the dashboard or report chart panel, click the **Customize** icon in the taskbar.

The **Customize** window is displayed.

*Figure 6: Customize Window*




**Step 2** Expand any of the chart categories by clicking on the small triangle next to the corresponding category.

**Step 3** Check the check box next to each chart or table that you want to be displayed as a report. Individual charts are described in more detail in Cisco WAAS Chart Descriptions, on page 14.

Charts that are currently included in the dashboard or report are marked with an asterisk (*). A report can contain a maximum of eight charts and tables (the **Network Summary report** can contain 12 charts and tables).

**Note** At the Cisco WAAS Express device level, only charts for supported accelerators are available.

**Step 4** To preview a chart, click the chart's title. The preview is displayed on the right of the pane.

**Step 5** Click **OK**.

**Step 6** To delete a chart or table from a dashboard or report, click **Close** on the chart and save the report.

# Configuring Chart Settings

**Procedure**

**Step 1** Click the **Edit** icon in the upper right corner of a chart.

The **Settings** window is displayed.

**Note** Not all settings are available for all chart types.

**Step 2** (Optional) From the **Traffic Direction** drop-down list, choose one of the following options:

- **Bidirectional**: Includes LAN-to-WAN traffic as well as WAN-to-LAN traffic traveling through this WAAS device.
- **Inbound**: Includes traffic from the WAN to the client through this Cisco WAAS device.
- **Outbound**: Includes traffic traveling from a client to the WAN through this Cisco WAAS device.

**Step 3** (Optional) From the **Access Mode** drop-down list, choose one of the following options:

- **Both**: Displays statistics for both single-sided and double-sided optimization.
- **With WAAS Peer**: Display statistics for double-sided optimization.
- **Without WAAS Peer**: Displays statistics for single-sided optimization.Use these options are to include or exclude single-sided optimization. The single-side statistics option is available only for the **Traffic Summary**, **Effective WAN Capacity**, **Traffic Volume and Reduction**, **Compression Summary**, **Traffic Summary over time**, **Compression Summary over time**, **Throughput Summary** and **Optimized Connections Over Time** charts.

**Step 4** (Optional) From the **Select Series For** drop-down list, choose one of the following:

- **Application**: The chart data is based on application statistics.
- **Classifier**: The chart data is based on classifier (class map) statistics.

**Step 5** (Optional) In the **Application** or **Classifier** list, check the check box next to the applications or classifiers whose statistics you want to include in the chart data. To include all the applications, check the **All Traffic** check box. You can filter the list items by using the **Quick Filter** above the list. These lists are available only for some chart types.

**Step 6** (Optional) Some charts have other types of data series from which to choose. Check the check box next to each of the data series that you want to include in the chart data.

**Step 7** Click OK.

**Note** Data collection for applications and classifiers occurs at slightly different times in the Cisco WAAS Central Manager. Therefore, the statistics can be different when viewing the same time period for an application and a classifier that report similar data.

# Cisco WAAS Chart Descriptions

This section describes the charts that you can choose to include in a dashboard or report. For tables that provide information on system, device, traffic and acceleration, see Cisco WAAS Table Descriptions, on page 30,

The following chart categories are available:

All charts are created using the Cisco WAAS Central Manager local time zone, unless the chart settings are customized to use a different time zone.

**Note** At the device level for Cisco WAAS Express devices, only charts for supported accelerators are available. In all charts, pass-through traffic for Cisco WAAS Express devices is considered as zero.

# TCP Optimization Charts

The following TCP optimization charts are available:

## Compression Summary

The **Compression Summary** chart displays a bar chart depicting the percentage of traffic reduction (excluding pass-through traffic) for the top ten applications with the highest percentage of traffic reduction. Two additional tabs allow you to see the compression of the top ten applications by volume and the bottom ten applications with the lowest compression.

Formula:

% Reduction Excluding Pass-Through = (Original Excluding Pass-Through – Optimized) / (Original Excluding Pass-Through)

## Compression Summary Over Time

The **Compression Summary Over Time** chart displays a graph of the percentage of total traffic that was reduced by using the WAAS optimization techniques. This chart excludes pass-through traffic in the results. You can customize the chart by choosing specific applications to include. The default is all traffic.

Formula:

% Reduction = (Original Excluding Pass-Through – Optimized) / (Original Excluding Pass-Through)

## Effective WAN Capacity

The Effective WAN Capacity chart displays the effective increased bandwidth capacity of the WAN link as a result of WAAS optimization. You can choose which applications to include. The default is all traffic.

**Formula**:

Effective WAN Capacity = 1 / (1-% Reduction Excluding Pass-Through)

% Reduction Excluding Pass-Through = (Original Excluding Pass-Through – Optimized) / (Original Excluding Pass-Through)

## Throughput Summary for TCP Optimization

The Throughput Summary chart displays the amount of average and peak throughput for the LAN-to-WAN (outbound) or WAN-to-LAN (inbound) directions depending on the selected tab. The throughput units (KBps, MBps, or GBps) at the left side vary depending on the range. The Peak Throughput series is not applicable for Last Hour graphs. This chart is available only at the device and location levels. The chart, which is in PDF, displays a maximum of 10 series.

**Formula**:

% Reduction Excluding Pass-Through = (Original Excluding Pass-Through – Optimized) / (Original Excluding Pass-Through)

**Note** The WAN to LAN Throughput and the LAN to WAN Throughput charts for the Last Week and Last Month time periods do not display peak throughput data until after two days of data have accumulated. You may see 0 for peak throughput if it has been less than two days since a new WAAS software installation or upgrade.

## Traffic Summary

The Traffic Summary chart displays the top nine applications that have the highest percentage of traffic as seen by Cisco WAAS. Each section in the pie chart represents an application as a percentage of the total traffic on your network or device. Unclassified, unmonitored, and applications with less than 2 percent of the total traffic are grouped together into a tenth category named Other Traffic (shown only if it totals at least 0.1 percent of all traffic). You can choose to display Original traffic or Optimized traffic by clicking the tab, and you can include pass-through traffic by checking the Include Pass-Through check box.

**Formula:**

(App Traffic/ Total Traffic) * 100

App Traffic is the Original traffic (Original Excluding Pass-Through) or Optimized traffic (Optimized Excluding Pass-Through) flowing for an application.

## Traffic Summary Over Time

The Traffic Summary Over Time chart displays a graph depicting the amount of original or optimized traffic, depending on the selected tab. You can include pass-through traffic by checking the Pass-Through check box. You can customize the chart by choosing specific applications to include. The default is all traffic.

## Traffic Volume and Reduction

The Traffic Volume and Reduction chart compares the amount of original and optimized traffic in a bar chart and displays the percentage of traffic reduction as a line. Pass-through traffic is excluded. The traffic units (bytes, KB, MB, or GB) at the right side depend upon the range. The percentage of traffic reduction is shown at the left side of the chart. You can customize the chart by choosing specific applications to include. The default is all traffic.

**Formula:**

% Reduction Excluding Pass-Through = (Original Excluding Pass-Through – Optimized) / (Original Excluding Pass-Through)

# Acceleration Charts

This section contains the following topics:

## HTTP Acceleration Charts

This section contains the following topics:

### HTTP: Connection Details

The **HTTP Connection Details** chart displays the HTTP session connection statistics, showing the average number of active HTTP connections per device (at the device level, it shows the exact number for the last hour.) Click the **Details** tab to display the newly handled HTTP connections, optimized connections, dropped connections, and handed off connections over time.

### HTTP: Effective WAN Capacity

The HTTP Effective WAN Capacity chart displays the effective bandwidth capacity of the WAN link as a result of HTTP acceleration, as a multiplier of its base capacity. The capacity data for all traffic and HTTP traffic is shown.

**Note** If the chart has no data, monitoring may be disabled for the application definition that includes this type of traffic. Verify that monitoring is enabled for the web application.

### HTTP: Estimated Time Savings

The **HTTP Estimated Time Savings** chart displays a graph of the estimated percentage of the response time saved by the HTTP accelerator due to SharePoint prefetch optimization and metadata caching.

### HTTP: Optimization Count

The **HTTP Optimization Count** chart displays a graph of the number of different kinds of optimizations performed by the HTTP accelerator. These optimizations are displayed in different colors. The optimizations included in this chart are metadata caching and SharePoint prefetch.

### HTTP: Optimization Techniques

The **HTTP Optimization Techniques** pie chart displays the different kinds of optimizations performed by the HTTP accelerator. The optimizations included in this chart are metadata caching, suppressed server compression, SharePoint prefetch, and DRE hinting.

### HTTP: Response Time Savings

The **HTTP Response Time Savings** chart displays a graph of the round-trip response time saved by the HTTP accelerator due to metadata caching and SharePoint prefetch optimizations. These optimizations are displayed in different colors. The time units (milliseconds, seconds, or minutes) at the left side depend on the range.

## HTTPS Acceleration Charts

This section describes the following charts:

### HTTPS: Connection Details

The **HTTPS Connection Details** chart displays the HTTPS session connection statistics, showing the average number of active HTTPS connections per device (at the device level, it shows the exact number for the last hour). Click the **Details** tab to display the newly handled HTTPS connections and optimized connections.

### HTTPS: Effective WAN Capacity

The **HTTPS Effective WAN Capacity** chart displays the effective bandwidth capacity of the WAN link as a result of HTTP acceleration, as a multiplier of its base capacity. The capacity data for all traffic and SSL traffic (which includes HTTPS traffic) is shown.

**Note** If the chart has no data, monitoring may be disabled for the application definition that includes this type of traffic. Make sure that monitoring is enabled for the SSL application.

### HTTPS: Estimated Time Savings

The **HTTPS Estimated Time Savings** chart displays the estimated percentage of response time saved by using metadata caching for HTTPS connections.

### HTTPS: Optimization Count

The **HTTPS Optimization Count** chart displays a graph of the number of different kinds of metadata caching optimizations performed by the HTTPS accelerator. These optimizations are displayed in different colors.

### HTTPS: Optimization Techniques

The **HTTPS Optimization Techniques** pie chart displays the different kinds of optimizations performed by the HTTPS accelerator. The optimizations included in this chart are metadata caching, suppressed server compression, and DRE hinting.

### HTTPS: Response Time Savings

The **HTTPS Response Time Savings** chart displays a graph of the round-trip response time saved by the HTTPS accelerator due to metadata caching optimizations, which are displayed in different colors. The time units (milliseconds, seconds, or minutes) at the left side depend on the range.

## SSL Acceleration Charts

This section describes the Secure Sockets Layer (SSL) charts:

### SSL: Acceleration Bypass Reason

The Secure Sockets Layer (SSL) Acceleration Bypass Reason pie chart displays the reasons because of which SSL traffic is not accelerated: version mismatch, unknown, nonmatching domain, server name indication mismatch, cipher mismatch, revocation failure, certificate verification failure, other failure, and non-SSL traffic.

### SSL: Connection Details

The SSL Connection Details chart displays the SSL session connection statistics, showing the average number of active SSL connections per device (at the device level, it shows the exact number for the last hour). Click the **Details** tab to display the newly handled SSL connections, optimized connections, handed-off connections, dropped connections, HTTPS connections, and Independent Computing Architecture (ICA) connections over SSL.

### SSL: Effective WAN Capacity

The SSL Effective WAN Capacity chart displays the effective bandwidth capacity of the WAN link as a result of SSL acceleration, as a multiplier of its base capacity. The capacity data for all traffic and SSL traffic is shown.

All the charts above display the cumulative statistical data of single sided and dual sided ssl counters.

**Note** If the chart has no data, monitoring may be disabled for the application definition that includes this type of traffic. Verify that monitoring is enabled for the SSL application.

## MAPI Acceleration Charts

This section describes the Messaging Application Programming Interface (MAPI) charts:

### MAPI: Acceleration Bypass Reason

The **Messaging Application Programming Interface (MAPI) Acceleration Bypass Reason** pie chart displays the reasons because of which encrypted MAPI traffic is not accelerated: acceleration disabled, secret retriever disabled, unsupported cipher, unsupported authentication mechanism, misconfigured domain identity, failure in secret retrieval, general security failure, insufficient system resources, and recovery mode connections.

Click the **Non-Encrypted** tab to display the bypass reasons for unencrypted MAPI traffic: reservation failure (non-overload), reservation failure (overload), signed MAPI request, malformed RPC packet, handover request from peer, unsupported server version, user in denied list, unsupported client version, secured connections (encrypted), unsupported DCERPC protocol version, association group not tracked, and other.

### MAPI: Average Response Time Saved

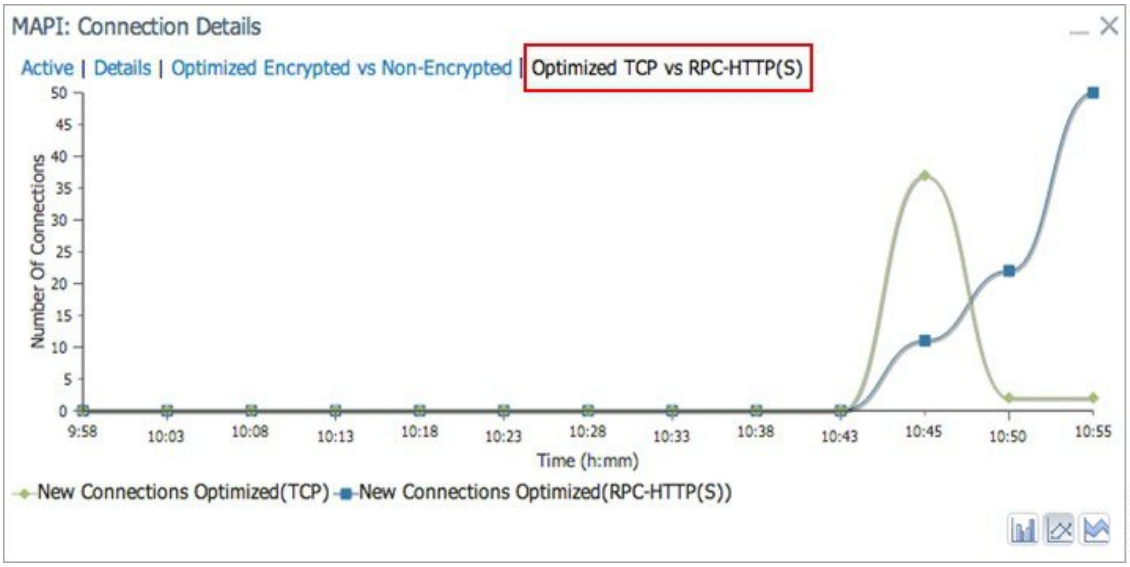
The **MAPI Average Response Time Saved** chart displays a graph of the estimated percentage of response time saved by the MAPI accelerator. The time units (microseconds, milliseconds, seconds, or minutes) at the left side depend upon the range.

### MAPI: Connection Details

The MAPI Connection Details chart displays MAPI session connection statistics, showing the average number of active MAPI connections per device (at the device level, it shows the exact number for the last hour). In addition to information on newly handled MAPI connections, optimized connections, handed-off connections, dropped connections, and optimized vs. non-encrypted MAPI connections, WAAS Version 5.5.3 and later also provides information on optimized TCP vs. RPC-HTTP(S) MAPI connections, as shown in the following figure. Cisco WAAS Version 6.4.3 and later includes information on MAPI over HTTP connection in the following chart.

- To display the newly handled MAPI connections, optimized connections, handed-off connections, and dropped connections, click the **Details** tab.
- To display the new encrypted and unencrypted MAPI connections, click the **Optimized Encrypted vs Non-Encrypted** tab.
- To display the new optimized TCP and RPC-HTTP/S connections, click the **Optimized TCP vs RPC-HTTP(S)** tab.

*Figure 7: Example of MAPI: Connection Details Chart*




## MAPI: Effective WAN Capacity

The **MAPI Effective WAN Capacity** chart displays the effective bandwidth capacity of the WAN link as a result of MAPI acceleration, as a multiplier of its base capacity. The capacity data for all traffic and MAPI traffic is shown.

**Note** If the chart has no data, monitoring may be disabled for the application definition that includes this type of traffic. Verify that monitoring is enabled for the Email-and-Messaging application.

## MAPI: Request Optimization

The **MAPI Request Optimization** chart displays the percentage of local and remote MAPI command responses. A local response is a response that is sent to the client from the local WAE. A remote response comes from the remote server. Click the **Encrypted vs Non-Encrypted** tab to display the percentage of local and remote responses for encrypted and unencrypted MAPI connections.

## MAPI: Response Time Optimization

The **MAPI Response Time Optimization** chart compares the average time used for local and remote MAPI responses. The time units (microseconds, milliseconds, seconds, or minutes) at the left side depend upon the range. Click the **Encrypted vs Non-Encrypted** tab to display the average time used for local and remote responses for encrypted and unencrypted MAPI connections.

## MAPI: Average Accelerated Client Sessions

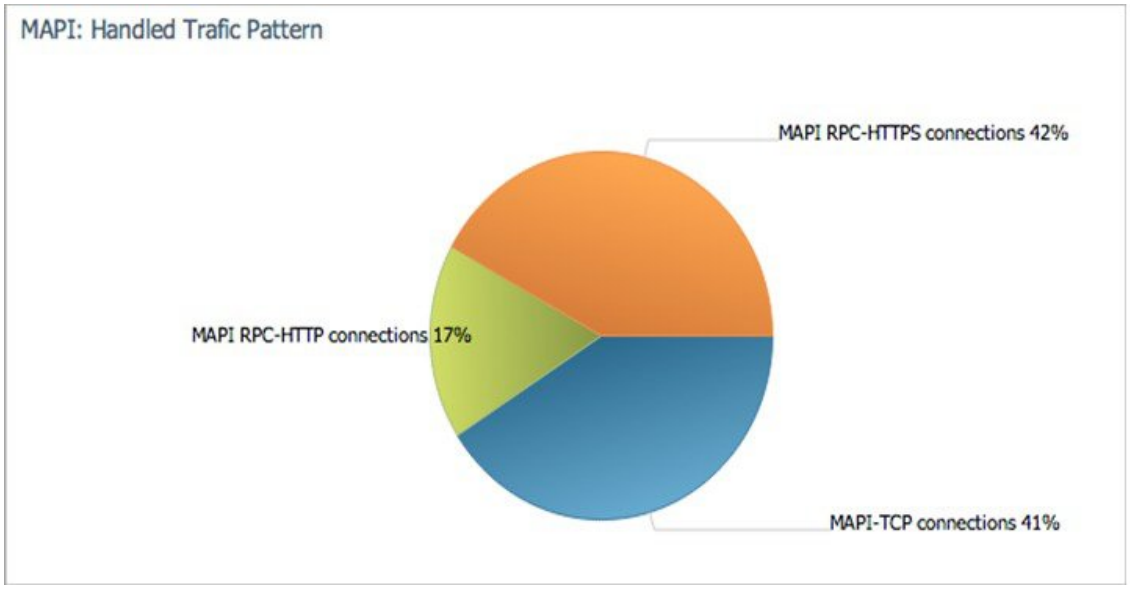
The **MAPI Average Accelerated Client Sessions** pie chart displays the average number of encrypted sessions that are accelerated from different versions (2000, 2003, 2007, and 2010) of the Microsoft Outlook client. Click the **Non-Encrypted** tab to display the unencrypted session counts.

### MAPI: Handled Traffic Pattern

For Cisco WAAS Versions 5.5.3 and later, MAPI Acceleration reports include the MAPI: Handled Traffic Pattern pie chart. As shown in the following figure, this chart displays the percentage of three types of traffic:

- Total handled MAPI connections
- Total handled MAPI RPC-HTTP connections
- Total handled MAPI RPC-HTTPS connections

***Figure 8: Example of MAPI: Handled Traffic Pattern Chart***




## SMB Acceleration Charts

This section describes the Server Message Block (SMB) charts:

### SMB: Average Response Time Saved

The Server Message Block (SMB) Average Response Time Saved chart displays the average response time saved for SMB responses. The time units (milliseconds, seconds, or minutes) at the left side depend upon the range.

### SMB: Client Average Throughput

The SMB Client Average Throughput chart displays the average client throughput for the SMB accelerator.

### SMB: Connection Details

The SMB Connection Details chart displays the SMB session connection statistics, showing the average number of active SMB connections per device (at the device level, it shows the exact number for the last hour). Click the **Details** tab to display the newly handled SMB connections, optimized connections, handed-off connections, dropped connections, and signed connections.

### SMB: Effective WAN Capacity

The SMB Effective WAN Capacity chart displays the effective bandwidth capacity of the WAN link as a result of SMB acceleration, as a multiplier of its base capacity. The capacity data for all traffic and SMB traffic is shown.

**Note** If the chart has no data, monitoring may be disabled for the application definition that includes this type of traffic.

### SMB: Request Optimization

The SMB Request Optimization chart displays the percentage of SMB command responses that use the following optimizations: read ahead, metadata, write, and other.

### SMB: Response Time Savings

The SMB Response Time Savings chart displays a graph of the round-trip response time saved by the SMB accelerator due to the following optimizations, which are displayed in different colors: read ahead, metadata, Microsoft Office, async write, named pipe, print, and other. The time units (milliseconds, seconds, or minutes) at the left side depend on the range.

### SMB: Versions Detected

The SMB Versions Detected pie chart displays the number of SMB messages detected for each SMB version:

- SMB v1.0 optimized, SMB v1.0 unoptimized, SMB v1.0 signed.
- SMB v2.0 optimized, SMB v2.0 unoptimized, SMBv 2.0 signed optimized and SMB v2.0 signed unoptimized.
- SMB v2.1 optimized, SMB v2.1 unoptimized, SMB v2.1 signed optimized, SMB v2.1 signed unoptimized.
- SMB v3.0 optimized, and SMB v3.0 unoptimized, SMB v3.0 signed, SMBv3.0 Encryption L4 optimized, SMBv3.0 Encryption L7 optimized, SMBv3.0 Encryption unoptimized.
- SMBv3.02 optimized, SMB v3.02 unoptimized and SMB v3.02 signed, SMBv3.02 Encryption L4 optimized, SMBv3.02 Encryption L7 optimized, SMBv3.02 Encryption unoptimized.

## ICA Acceleration Charts

This section describes the Independent Computing Architecture (ICA) charts:

### ICA: Client Versions

The **Indepdendent Computing Architecture** (ICA) Client Versions pie chart displays the number of ICA messages detected for each ICA version: online plugin 11.0, online plugin 11.2, online plugin 12.0, online plugin 12.1, Citrix Receiver 13.0, and other.

### ICA: Connection Details

The **ICA Connection Details** chart displays the ICA session connection statistics, showing the average number of active ICA connections per device (at the device level, it shows the exact number for the last hour). Click the **Details** tab to display the newly handled ICA connections, optimized connections, handed-off connections,

and dropped connections. Click the **ICA vs ICA over SSL** tab to display the the number of newly handled ICA connections and the number of newly handled ICA over SSL connections.

### ICA: Effective WAN Capacity

The **ICA Effective WAN Capacity** chart displays the effective bandwidth capacity of the WAN link as a result of ICA acceleration, as a multiplier of its base capacity. The capacity data for all traffic and ICA traffic is shown.

**Note** If the chart has no data, monitoring may be disabled for the application definition that includes this type of traffic. Verify that monitoring is enabled for the Citrix application.

### ICA: Unaccelerated Reasons

The ICA Unaccelerated Reasons chart displays the reasons that ICA traffic is bypassed: unrecognized protocol, unsupported client version, CGP session ID unknown, client on denied list, no resource, and other. Click the **Dropped** tab to display the reasons because of which ICA traffic is dropped: unsupported client version, I/O error, no resource, AO parsing error, maximum sessions reached, and other.

# Akamai Connected Cache Charts

The Cisco WAAS Central Manager provides the following types of monitoring reports for Akamai Connected Cache:

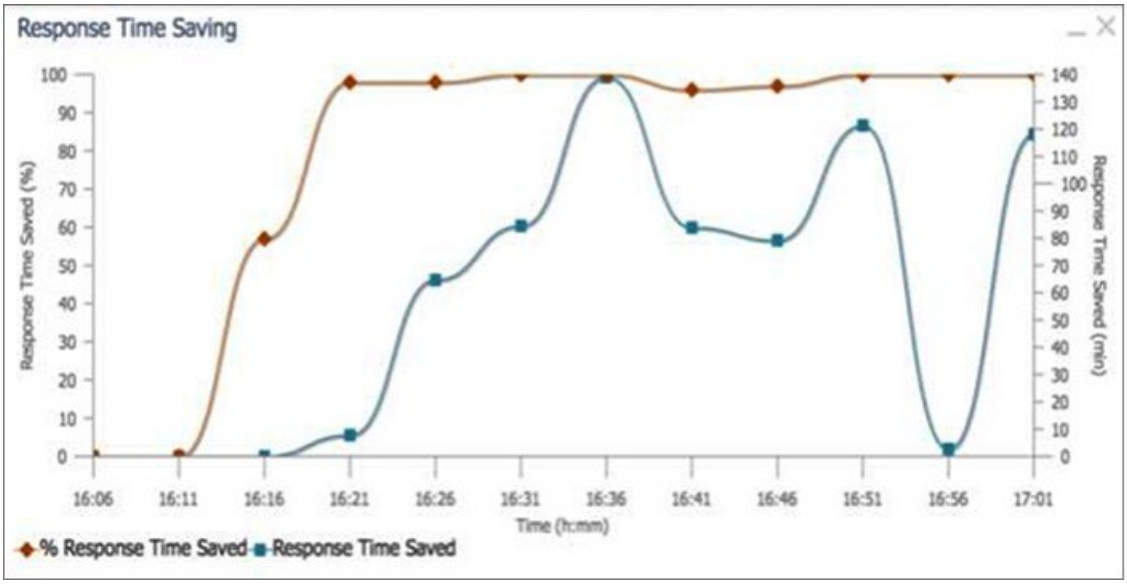
To access the following types of charts, choose **Monitor > Caching > Akamai Connect**.

**Note** Except for the **Top Sites** chart, you can view monitoring information at the device, network, location, or AppNav cluster levels.

## Response Time Savings

As shown in the following figure, the **Response Time Savings** chart displays the aggregated amount of time saved due to Akamai Connect caching, showing the response time saved as a percentage, and total response time saved, for cache hit transactions, in minutes.

*Figure 9: Example of Response Time Savings Chart*




The Cisco WAAS Central Manager performs the following percentage calculations:

- Total response time saved
- Total adjusted download time
- Total response time without cache (total response time saved plus total adjusted download time)

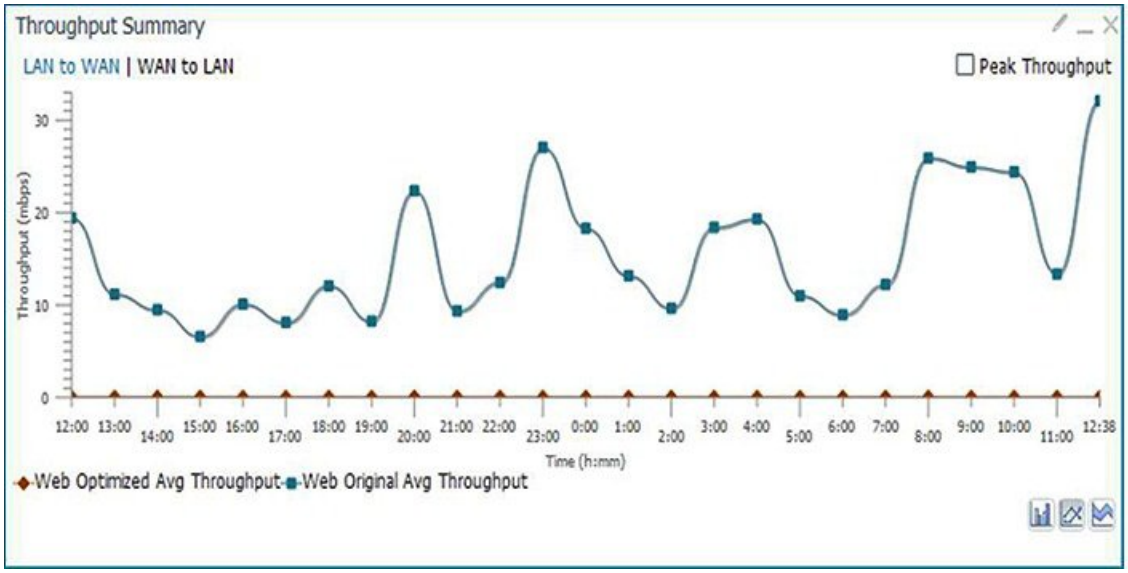
**Note** Output from the show statistics accelerator http CLI command also displays information on response time, including the **Total Time Saved** and **Percentage of Connection Time Saved** fields. For more information on Cisco WAAS CLI commands, see the *Cisco Wide Area Application Services Command Reference Guide*.

## Throughput Summary for Akamai Connect

The Throughput Summary chart displays information on web-optimized and original throughput. Depending in the tab you click for this chart, LAN-to-WAN (outbound) or WAN-to-LAN (inbound), throughput is displayed. The WAN-to-LAN report is the default report.

If you hover your mouse over a bar, the total optimized or average throughput, in KBps, for a given time range is displayed.

*Figure 10: Example of Throughput Summary Chart*



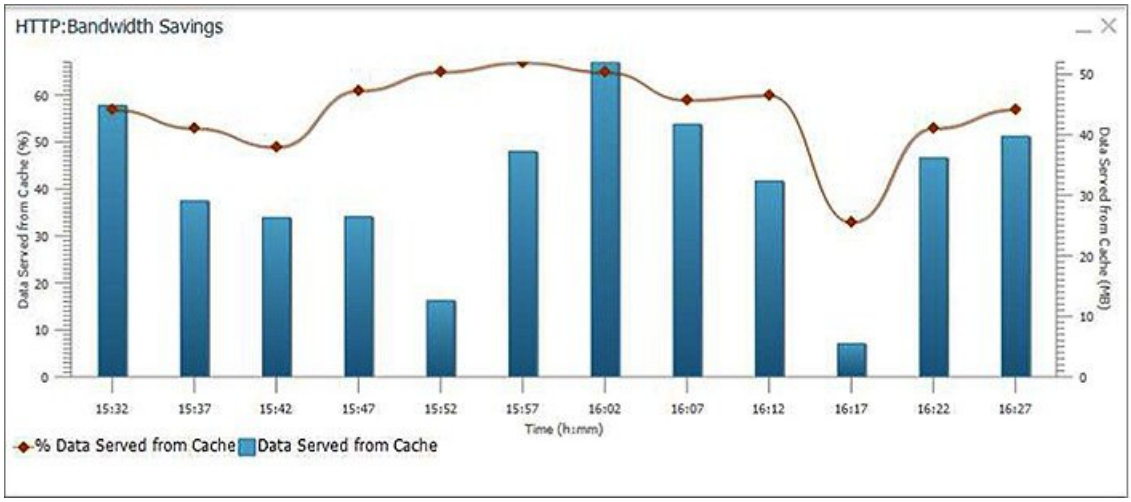

## HTTP: Bandwidth Savings

The HTTP: Bandwidth Savings chart displays how much traffic, by percentage, is actually served by the Cache Engine (CE) that did not have to be fetched from the source.When this information is combined with overall incoming traffic into the router from the WAN, it indicates how effective the cache is in boosting the WAN performance in terms of request-response latency. The combination of the incoming (WAN) traffic flow to the router, plus the WAN data offload incoming traffic provides a truer measure of the traffic flow the router's clients (in aggregate) experience.

As shown in the following figure:

- The bar graph is the absolute byte count for data served out of cache for the specified interval
- The line graph represents the percentage of total bytes requested that were served out of cache for the specified interval.

*Figure 11: Example of HTTP Bandwith Savings Chart*

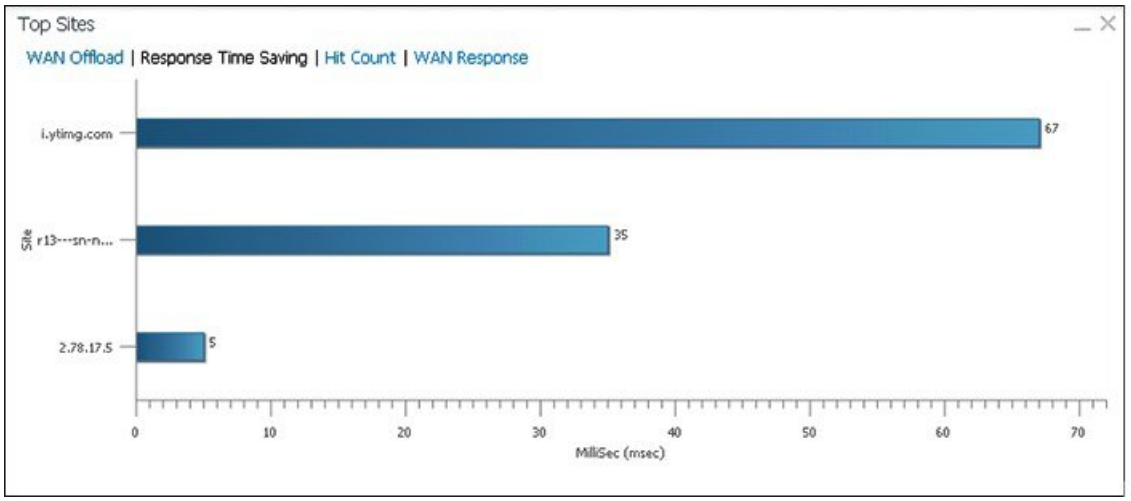



## Top Sites

The Top Sites chart displays the top sites being served by the Cache Engine in terms of hostname and traffic, in bar chart format. The Top Sites chart displays the following types of information:

- **WAN Offload (Default report)**: The top URLs by number of bytes served out of the cache, and as a result did not come over the WAN.
- **Response Time Saving**: The response time saved due to Akamai Connect caching. The time unit, (milliseconds, seconds, or minutes) at the bottom of the chart depend on the time range specified for the chart.
- **Hit Count**: The top URLs by number of cache hits.
- **WAN Response**: The top URLs by number of bytes served over the WAN.

*Figure 12: Top Sites Chart Showing Response Time Saving by Site*



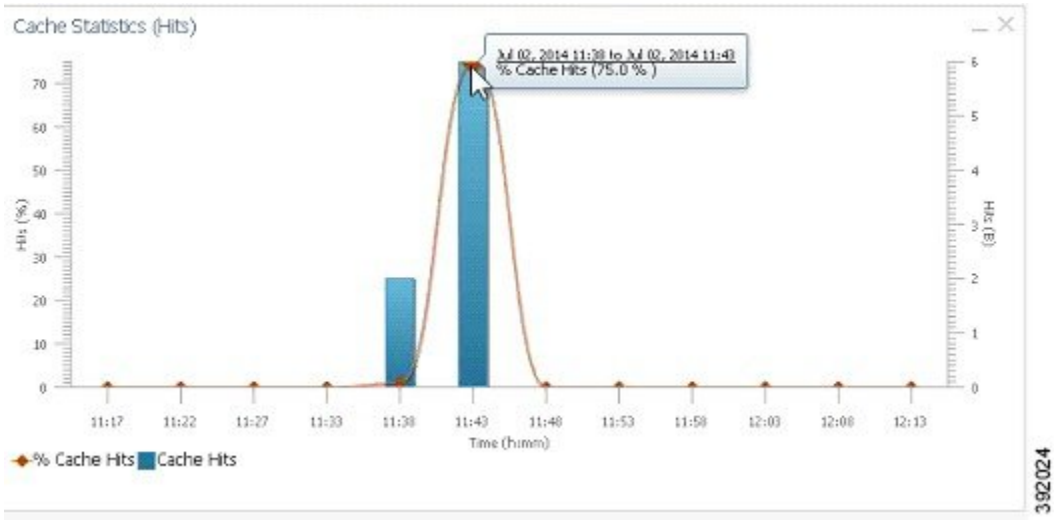
**Note** Information in the Top Sites chart corresponds to the output for the show statistics accelerator http object-cache EXEC command. Top ten sites information is shown as top hosts information, in the Object cache top hosts ordered by: hit count, output section for 0 to 10 hosts. For more information on CLI commands, see the Cisco Wide Area Application Services Command Reference Guide .

## Cache Statistics (Hits)

The **Cache Statistics (Hits)** chart displays information on cache hits or on data served from the cache, in bar chart format. For each type of **Cache Statistics** chart, you can specify a time frame of Last Hour, Last Day, Last Week, Last Month, or set a Custom one.

- The Cache Statistics Hits chart shows the percentage and the number of cache hits (in millions) over a specified time frame.If you hover your mouse over a data point, the total percentage of cache hits for that data point is displayed.If you hover your mouse over a bar, the number of hits, in millions, is displayed.
- The Cache Statistics Data Served from Cache chart shows the percentage and the amount of data served from cache (in MB) over a specified time frame.If you hover your mouse over a data point, the total percentage of cache hits for that data point is displayed. If you hover your mouse over a bar, the total amount, in MB, of data served from the cache, is displayed.

***Figure 13: Example of Cache Statistics Hits Chart Showing a Detailed View of a Data Point***




# Connection Trend Charts

This section contains the following topics:

## Optimized Connections Over Time

The Optimized Connections Over Time chart displays the number of optimized connections over the selected time period. You can show the number of MAPI-reserved connections by checking the **MAPI Reserved Connections** check box. You can view the peak optimized connection values for all the data points in the chart by checking the **Peak Connections** check box. If you have opted to view the peak connections, the chart

shows a combination of Optimized Connections as stacked legends and Peak Connections as overlaid lines for selected application/classifiers. In WAAS-XE devices, the **Optimized Connections Over Time** chart has only the **Peak Connections** option. You can customize the chart by choosing specific applications to be included. The default is all traffic.

The peak connection value is available for the following:

- **Last Hour**: The maximum value (optimized, pass-through connections counters) among the12 data samples available for the last hour.
- **Last Day**: The maximum value (optimized, pass-through connection counters) among the 12 data samples for each hour. For example, if the optimized connection counter values are 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, and 120 for an hour, the peak optimized connection value would be 120.

This chart is available only when a specific Cisco WAAS device is selected and can be added only to the **Connection Trend** report.

## Optimized vs Pass-Through Connections

The Optimized vs Pass-Through Connections chart displays the total number of optimized and pass-through connections on a device or on all devices in a location. You can show the device connection limit, which is the maximum number of connections a device can support, by checking the **Device Connection Limit** check box. This option is available only at the device level. At the Location level, by default, the chart displays only the top five devices series based on the maximum connection limit usage. You can select the devices of your choice from the chart **Settings** page. The chart in the PDF report displays a maximum of 10 series.

You can view the peak pass-through connection values for all the data points in the chart by checking the Peak Connections check box.

**Note** This chart is available only when a specific Cisco WAAS device or location is selected, and can be added only to the Connection Trend report.

**Formula**:

Pass-Through Connections for a Device = Total Pass-Through Connections for all applications

Optimized Connections for a Device = Total Optimized Connections for all applications

Device Connections limit usage % = 100 * Average Optimized connections / Device connection Limit, where

Average Optimized connections = Sum of Optimized Connections / No. of samples

# AppNav Charts

This section contains the following topics:

## Total AppNav Traffic

The Total AppNav Traffic chart displays the total amount of distributed and pass-through traffic processed by the AppNav Cluster or ANC device. The units at the left side depend upon the range.

## AppNav Policies

The AppNav Policies chart displays a graph of the amount of intercepted, distributed, or pass-through traffic processed by the AppNav Cluster (ANC) or ANC device for each policy rule, depending on which tab you select. The units at the left side depend upon the range.

From the **Show Details For** drop-down list, select a policy rule for viewing.

## Top 10 AppNav Policies

The Top 10 AppNav Policies pie chart displays the amount of intercepted, distributed, or pass-through traffic processed by the AppNav Cluster or ANC device for the top nine policy rules with the most traffic, depending on which tab you select. Traffic for all other policy rules is grouped together into a tenth category named Other Traffic (shown only if it totals at least 0.1 percent of all traffic).

From the Show Details For drop-down list, select a policy rule for viewing.

## Top 10 Cisco WAAS Node Group Distribution

The Top 10 Cisco WAAS Node Group Distribution pie chart displays the top nine Cisco WAAS Node Groups to which traffic is distributed. Traffic for all other Cisco WAAS Node Groups is grouped together into a tenth category named **Other Traffic** (shown only if it totals at least 0.1 percent of all traffic).

From the **Show Details** For drop-down list, select a Cisco WAAS Node Group whose individual Cisco WAAS node details you want to view.

## Cisco WAAS Node Group Distribution

The Cisco WAAS Node Group Distribution chart displays a graph of the amount of traffic distributed to each Cisco WAAS Node Group. The units at the left side depend upon the range.

From the **Show Details** For drop-down list, select a Cisco WAAS Node Group whose individual Cisco WAAS node details you want to view.

## Pass-Through Reasons

The Pass-Through Reasons chart displays a graph of the amount of pass-through traffic for each of the pass-through reasons. The units at the left side depend upon the range.

From the Show Details For drop-down list, select a reason whose details you want to view.

## Top 10 Pass-Through Reasons

The Top 10 Pass-Through Reasons pie chart displays the top nine reasons because of which traffic is passed through. Traffic for all other reasons is grouped together into a tenth category named Other Traffic (shown only if it totals at least 0.1 percent of all traffic).

From the Show Details For drop-down list, select a reason whose details you want to view.

# Platform Charts

This section describes these charts:

## CPU Utilization

The CPU Utilization chart displays the percentage of CPU utilization for a device. This chart is available only when a specific Cisco WAAS device is selected. This chart can be added only to the **Monitor > Reports > Reports Central > Resource Utilization** report page.

## Disk Utilization

The **Disk Utilization** chart displays the percentage of disk utilization for a device. This chart is available only when a specific Cisco WAAS device is selected. This chart can be added only to the **Monitor > Reports > Reports Central > Resource Utilization** report page.

# SMB Preposition Chart

The SMB Preposition chart represents the usage of SMB Pre-positioning feature.

This chart is applicable at the device level. It is a combination chart that collects statistics for every 5 minutes from statistics infrastructure and plots the graph to represent the below information based on the statistics collected.

- Data Served from cache (in bytes)
- Percentage of data served from cache.

# Cisco WAAS Table Descriptions

This section describes tables that provide information on system, device, traffic and acceleration, For information on charts that you can choose to include in a dashboard or report, see Cisco WAAS Chart Descriptions, on page 14.

The following statistics details tables are available:

You can sort the tables by clicking any column heading to sort the data in that column. A small triangle appears in the heading to indicate that a column is sorted. Click the triangle to reverse the sort order in the column.

For some values, different formulas are used at the system and device levels, and these formulas are noted in the table descriptions. The terms used in the tables are:

- **Original Inbound**: Traffic that is entering the Cisco WAAS device from the LAN (clients), and needs to be optimized before being sent out on the WAN to a peer Cisco WAAS device.
- **Original Outbound**: Traffic that is exiting the Cisco WAAS device to the LAN (clients) after being received on the WAN from a peer Cisco WAAS device.
- **Optimized Inbound**: Traffic that is entering the Cisco WAAS device from the WAN, and needs to be processed (deoptimized) before being sent out on the LAN to clients.
- **Optimized Outbound**: Traffic that is exiting the Cisco WAAS device to the WAN and a peer WAAS device after being optimized.
- **Pass-Through**: Traffic that is being passed through the Cisco WAAS device and is not optimized.

To get the statistics at the system, location, and device group levels, the **Original Inbound**, **Original Outbound**, **Optimized Inbound**, **Optimized Outbound**, **Pass-through Client**, and **Pass-through Server**

bytes of all devices are added together. The **Reduction %** and **Effective Capacity** values are calculated using added values of all devices.

# Traffic Summary Table

This table is called the Network Traffic Summary, Device Traffic Summary, or Location Traffic Summary, depending on the context, and it displays a summary of traffic.

At the system and location levels, each row in the table displays the total traffic information for each device that is registered to the corresponding Central Manager or is in a particular location. At the device level, each row in the table displays the total traffic information for each application defined on the device. The data is described in the following table.

***Table 4: Traffic Summary Table***

| Table Column | Description and Formulas Used to Calculate Value |
|---|---|
| Device | Displays the device name. (Appears only at the system and location levels.) |
| Application | Displays the application name. (Appears only at the device level.) |
| Original Traffic (Excludes Pass-Through) | Reports the amount of original traffic, excluding pass-through traffic.<br>System: (Original Outbound + Original Inbound) / 2<br>Device / Device Group: Original Inbound + Original Outbound |
| Optimized Traffic (Excludes Pass-Through) | Reports the amount of optimized traffic, excluding pass-through traffic.<br>System: (Optimized Inbound + Optimized Outbound)/2<br>Device/Device Group: Optimized Outbound + Optimized Inbound |
| Pass-Through Traffic | Reports the amount of pass-through traffic. (This value is not applicable for WAAS Express devices.)<br>System: (Pass-through Client + Pass-through Server) / 2<br>Device/Device Group: Pass-through Client + Pass-through Server<br>An asterisk (*) in the column heading indicates that a device whose data is included in this table is configured as a serial peer with another device and optimization is disabled between those two peer devices. The amount of pass-through traffic shown may be more than what is expected because the device passes through traffic coming from its peer. For more information, see Information About Clustering Inline WAEs in Chapter 5, "Configuring Traffic Interception." |
| Reduction (%) | Reports the percentage of bytes saved, considering only optimized traffic.<br>(Original Excl Pass-through – (Optimized)) * 100 / (Original Excl Pass-through) |
| Effective Capacity | Reports the effective bandwidth capacity of the WAN link as a result of optimization, as a multiplier of its base capacity, considering only optimized traffic.<br>1 / (1 – % Reduction Excl Pass-through) |

**Note** The number in the **Pass-Through Traffic** column represents the amount of traffic that is passed through that particular WAE (or, in the case of a location report, all the devices in the location). If the device is part of a serial inline cluster (that is, configured as a nonoptimizing peer with another device), the traffic that is shown as pass-through on one device may have been optimized by another device in the serial cluster. It is useful to know the amount of traffic that is not optimized by either of the devices in the cluster (in other words, passed through the entire cluster).

When the device closer to the LAN is not overloaded, the pass through numbers on that device accurately represent the overall pass-through traffic. But, if that device goes into overload, the second device in the cluster starts optimizing traffic that was passed through by the first one, which needs to be accounted for. In such a scenario, the overall pass-through numbers for the cluster can be obtained as follows. Note that this calculation has to be done even if the first device went into overload in the past and came out of it.

Consider that W1 and W2 are part of a serial cluster, and W1 is toward the LAN (closer to the client if the cluster is in the branch, or closer to the server if the cluster is in the data center) and W2 is toward the WAN. The amount of traffic that is passed through the cluster without optimization by either W1 or W2 can be obtained by the following formula: (W1 pass-through traffic) – (W2 original traffic)

# Network Application Traffic Details Table

The Network Application Traffic Details table is available at the system level and displays the total traffic information for each application. The data is the same as described in the Traffic Summary Table, except there is no Device column in this table.

# HTTP Acceleration Statistics Table

The HTTP Acceleration Statistics table is available at the system and device levels and displays HTTP acceleration details. The data is described in the following table.

***Table 5: HTTP Acceleration Statistics Table***

| Table Column | Description and Formulas Used to Calculate Value |
|---|---|
| Device | Displays the device name. (Appears only at the system level.) |
| Start Time and End Time | Displays the start time and end time for the time period. (Appears only at the device level.) |
| New Connections Handled | Reports the number of HTTP connections handled for the time period. |
| Average Active Connections/Active Connections | Reports the average active number of connections currently being handled by the HTTP accelerator at the system level. At other levels, reports the number of active connections. |
| New Bypassed Connections | Reports the number of connections initially received by the HTTP accelerator and then pushed down to the generic accelerator. |
| Total Time Saved | Reports the amount of time saved due to HTTP optimization. |
| Total Round-Trip Time | Reports the total round-trip time for all connections plus the time for remotely served metadata cache misses. |

| Table Column | Description and Formulas Used to Calculate Value |
|---|---|
| % Time Saved | Reports the percentage of connection time saved for all aggregated samples.<br>Total Time Saved / (Total Time Saved + Total Round Trip Time For All Connections + Total time for all remotely served metadata cache misses) |

# HTTPS Acceleration Statistics Table

The HTTPS Acceleration Statistics table is available at the system and device levels and displays HTTPS acceleration details. The data is described in the following table.

***Table 6: HTTPS Acceleration Statistics Table***

| Table Column | Description and Formulas Used to Calculate Value |
|---|---|
| Device | Displays the device name. (Appears only at the system level.) |
| Start Time and End Time | Displays the start time and end time for the time period. (Appears only at the device level.) |
| New Connections Handled | Reports the number of HTTPS connections handled for the time period. |
| Average Active Connections/Active Connections | Reports the average number of connections currently being handled by the HTTP/SSL accelerator at the system level. At other levels, reports the number of active connections. |
| Total Time Saved | Reports the amount of time saved due to HTTPS optimization. |
| Total Round-Trip Time | Reports the total round-trip time for all connections plus the time for remotely served metadata cache misses. |
| % Time Saved | Reports the percentage of connection time saved for all aggregated samples.<br>Total Time Saved by cache hits / (Total Time Saved by cache hits + Total time for all remotely served metadata cache misses) |

# ICA Acceleration Statistics Table

The ICA Acceleration Statistics table is available at the system and device levels and displays ICA acceleration details. The data is described in the following table.

***Table 7: ICA Acceleration Statistics Table***

| Table Column | Description and Formulas Used to Calculate Value |
|---|---|
| Device | Displays the device name. (Appears only at the system level. WAAS Express devices are not included.) |
| Start Time and End Time | Displays the start time and end time for the time period. (Appears only at the device level.) |

| Table Column | Description and Formulas Used to Calculate Value |
|---|---|
| New Connections Handled | Reports the number of ICA connections handled for the time period. |
| Average Active Connections/Active Connections | Reports the average number of connections currently being handled by the ICA accelerator at the system level. At other levels, reports the number of active connections. |
| Dropped Connections | Reports the number of connections dropped by the ICA accelerator. |
| Bypassed Connections | Reports the number of connections initially received by the ICA accelerator and then pushed down to the generic accelerator. |

# MAPI Acceleration Statistics Table

The MAPI Acceleration Statistics table is available at the system and device levels and displays MAPI acceleration details. The data is described in the following table.

***Table 8: MAPI Acceleration Statistics Table***

| Table Column | Description and Formulas Used to Calculate Value |
|---|---|
| Device | Displays the device name. (Appears only at the system level. WAAS Express devices are not included.) |
| Start Time and End Time | Displays the start time and end time for the time period. (Appears only at the device level.) |
| New Connections Handled | Reports the number of MAPI connections handled for the time period. |
| Average Active Connections/Active Connections | Reports the average number of connections currently being handled by the MAPI accelerator at the system level. At other levels, reports the number of active connections. |
| New Bypassed Connections | Reports the number of connections initially received by the MAPI accelerator and then pushed down to the generic accelerator. |
| New Local Request Count | Reports the number of client requests handled locally by the WAE. |
| Avg. Local Response Time | Reports the average time used for local responses, in microseconds. |
| New Remote Request Count | Reports the number of client requests handled remotely over the WAN. |
| Avg. Remote Response Time | Reports the average time used for remote responses, in microseconds. |
| Average Time Saved | Reports the average connection time saved for all aggregated samples, in microseconds. |

# SMB Acceleration Statistics Table

The SMB Acceleration Statistics table is available at the system and device levels and displays SMB acceleration details. The data is described in the following table.

*Table 9: SMB Acceleration Statistics Table*

| Table Column | Description and Formulas Used to Calculate Value |
|---|---|
| Device | Displays the device name. (Appears only at the system level. Cisco WAAS Express devices are not included.) |
| Start Time and End Time | Displays the start time and end time for the time period. (Appears only at the device level.) |
| New Connections Handled | Reports the number of SMB connections handled for the time period. |
| Average Active Connections/Active Connections | Reports the average number of connections currently being handled by the SMB accelerator at the system level. At other levels, reports the number of active connections. |
| Bypassed Connections | Reports the number of connections initially received by the SMB accelerator and then pushed down to the generic accelerator. |
| Total Time Saved | Reports the amount of time saved due to SMB optimization. |
| Total Round-Trip Time | Reports the total round-trip time for all connections plus the time for remotely served metadata cache misses. |
| % Time Saved | Reports the percentage of connection time saved for all aggregated samples.<br>Total Time Saved by cache hits / (Total Time Saved by cache hits + Total Time for all remotely served metadata cache misses) |

# SSL Acceleration Statistics Table

The SSL Acceleration Statistics table is available at the system and device levels and displays SSL acceleration details. The data is described in the following table.

*Table 10: SSL Acceleration Statistics Table*

| Table Column | Description |
|---|---|
| Device | Displays the device name. (Appears only at the system level.) |
| Start Time and End Time | Displays the start time and end time for the time period. (Appears only at the device level.) |
| New Connections Handled | Reports the number of SSL connections handled for the time period. |
| Average Active Connections/Active Connections | Reports the average number of connections currently being handled by the SSL accelerator at the system level. At other levels, reports the number of active connections. |
| New HTTPS Connections Handled | Reports the number of HTTPS connections handled by the SSL accelerator. |
| New ICA Connections Handled | Reports the number of ICA connections handled by the ICA accelerator. |
| Dropped Connections | Reports the number of connections dropped by the SSL accelerator. |

| Table Column | Description |
|---|---|
| Bypassed Connections | Reports the number of connections initially received by the SSL accelerator and then pushed down to the generic accelerator. |

# Using Predefined Reports to Monitor WAAS

The Cisco WAAS Central Manager includes a number of predefined reports that you can use to monitor system operation. These reports are available from the Monitor menu. The reports consist of a combination of specific charts and graphs and a statistical table displayed in the lower part of the WAAS Central Manager window.

You can customize these predefined reports by editing them with the **Manage Report** function available in the **Monitor** menu, as described in Viewing and Editing a Report, on page 53.

This section contains the following topics:

## Predefined Reports Available by Cisco WAAS Level

The following table shows predefined reports available at the system, AppNav cluster, location, and device level.

***Table 11: Predefined Reports Available at the System, AppNav Cluster, Location, and Device Level***

| Report Type | Available Reports |
|---|---|
| Optimization | • TCP Summary Report, on page 38 |
| Acceleration (not all reports available for WAAS Express device level) | • HTTP Acceleration Report, on page 38<br>• HTTPS Acceleration Report, on page 38<br>• SSL Acceleration Report, on page 39<br>• MAPI Acceleration Report, on page 39<br>• SMB Acceleration Report, on page 39<br>• Summary Report, on page 40 |
| Caching and Akamai Connected Cache | • Cache Statistics (Hits), on page 27<br>• Throughput Summary for Akamai Connect, on page 24<br>• HTTP: Bandwidth Savings, on page 25<br>• Top Sites, on page 26 |

The following table shows the predefined reports available at specified Cisco WAAS levels.

*Table 12: Predefined Reports Available at Specified Levels*

| Cisco WAAS Level | Report Type | Available Reports |
|---|---|---|
| System level | • Network | • Summary Report, on page 40 |
| System and Device levels | • Network/Peers | • Topology Report, on page 41 |
| Device and Location levels | • Optimization | • Connection Trend Report, on page 41 |
| Device level | • Optimization | • Connections Statistics Report, on page 41 |
| | • Acceleration | • SMB Acceleration Report, on page 39 |
| | • Platform (not available at WAAS Express or AppNav-XE device level) | • Resource Utilization Report, on page 43<br>• Disks Report, on page 43 |
| AppNav Cluster level and Device level for AppNav Controller devices | • AppNav | • AppNav Report, on page 44 |

**Note** In a Cisco WAAS network where there are 1000 or more Cisco WAEs, there may be a delay of up to 90 seconds to redisplay the table when you click a table column to sort a system-level report table. You may experience a similar delay when you click the **Print** icon in the taskbar before you see the report.

# Location-Level Reports

### Before you begin

Location-level reports aggregate data from all the Cisco WAEs present in a particular location. For more information about locations, see Working with Device Locations in the chapter "Using Device Groups and Device Locations."

### Procedure

**Step 1** From the Cisco WAAS Central Manager menu, choose **Locations** > *location-name*.

**Step 2** From the Cisco WAAS Central Manager menu, choose **Monitor** and choose the report from the **Optimization** or **Acceleration** categories.

**Step 3** Considering the following operating guidelines:

- When scheduling any report, you can also select one or more locations; the report will include data from all the devices within the selected locations. For more information, see Scheduling a Report, on page 53.
- The maximum number of devices supported in a location-level report is 25 by default. This number is configurable up to 250 by the **System.monitoring.maxDevicePerLocation** system property. For more information, see Modifying Default System Properties in the chapter "Configuring Other System Settings."

# TCP Summary Report

The Transmission Control Protocol (TCP) Summary report displays a summary of all traffic. The following charts and tables are included:

# HTTP Acceleration Report

The HTTP Acceleration report displays the HTTP acceleration statistics. The following charts and tables are included:

The Cisco WAAS Central Manager provides monitoring information on the following types of caching: **Basic**, **Standard**, **Advanced**, **Bypass**, and **Connected Cache**. Except for the **Top Sites** chart, you can view monitoring information at the device, network, location, or AppNav cluster levels. The following charts are included:

- Akamai Connected Cache Charts, on page 23
  - Cache Statistics (Hits), on page 27
  - Throughput Summary for Akamai Connect, on page 24
  - HTTP: Bandwidth Savings, on page 25
  - Top Sites, on page 26

# HTTPS Acceleration Report

The HTTPS Acceleration report displays the HTTPS acceleration statistics. The following charts and tables are included:

- HTTPS: Estimated Time Savings, on page 18
- HTTPS: Effective WAN Capacity , on page 18
- HTTPS: Connection Details, on page 17
- HTTPS: Response Time Savings, on page 18
- HTTPS: Optimization Count, on page 18
- HTTPS: Optimization Techniques, on page 18
- HTTPS Acceleration Statistics Table, on page 33

# SSL Acceleration Report

The SSL Acceleration report displays the SSL acceleration statistics. The following charts and tables are included:

- SSL: Connection Details, on page 18
- SSL: Effective WAN Capacity, on page 19
- SSL: Acceleration Bypass Reason, on page 18
- SSL Acceleration Statistics Table, on page 35

# MAPI Acceleration Report

The **MAPI Acceleration Report** displays the MAPI acceleration statistics. The following charts and tables are included:

- MAPI: Average Response Time Saved, on page 19
- MAPI: Effective WAN Capacity , on page 20
- MAPI: Connection Details, on page 19
- MAPI: Request Optimization, on page 20
- MAPI: Response Time Optimization, on page 20
- MAPI: Average Accelerated Client Sessions, on page 20
- MAPI: Acceleration Bypass Reason, on page 19
- MAPI Acceleration Statistics Table, on page 34

# SMB Acceleration Report

The SMB Acceleration report displays the SMB acceleration statistics. The following charts and tables are included:

- SMB: Average Response Time Saved, on page 21
- SMB: Effective WAN Capacity, on page 22
- SMB: Connection Details, on page 21
- SMB: Request Optimization, on page 22
- SMB: Response Time Savings, on page 22
- SMB: Client Average Throughput, on page 21
- SMB: Versions Detected, on page 22
- SMB Acceleration Statistics Table, on page 34

# ICA Acceleration Report

The ICA Acceleration report displays the ICA acceleration statistics. The following charts and tables are included:

- ICA: Effective WAN Capacity , on page 23
- ICA: Connection Details, on page 22
- ICA: Client Versions , on page 22
- ICA: Unaccelerated Reasons, on page 23
- ICA Acceleration Statistics Table, on page 33

**Note** The ICA charts in Cisco WAAS Version 5.0 and later are different from those used in Version 4.5. If you are viewing the data from a Cisco WAAS device running Cisco WAAS Version 4.5, the charts appear empty due to the different data that the device is collecting. The ICA data for Cisco WAAS devices running Cisco WAAS Version 4.5 is available in the system-level TCP Summary Report. For more information, see TCP Summary Report, on page 38.

# Summary Report

The Summary Report is a predefined report that can be used to monitor system operation. It is available at the system level. This report displays the following charts and tables by default:

- Traffic Summary, on page 16
- Effective WAN Capacity, on page 15
- Traffic Summary Over Time, on page 16
- Traffic Volume and Reduction, on page 16
- Compression Summary, on page 15
- Compression Summary Over Time, on page 15
- HTTP: Estimated Time Savings, on page 17
- HTTP: Effective WAN Capacity, on page 17
- MAPI: Effective WAN Capacity , on page 20
- SSL: Effective WAN Capacity, on page 19
- MAPI: Average Response Time Saved, on page 19

The Summary Report can be customized to display the charts that you require. Use the Customize taskbar icon to select the charts that you want to be displayed in this report. Only 12 charts can be displayed in the report.

# Topology Report

The Topology report at the system level displays a topology map that shows a graphical representation of all the connections between the WAAS devices.

The topology map uses blue squares to show connections between devices. Use the legend to the right of the grid to associate the device name with the number that appears at the top of the grid. Use the drop-down lists at the top of the window to perform the following tasks:

- Display connections between your various locations instead of between devices.
- Sort the grid by the number of connections instead of by device name.

Click the **View** icon next to the WAE to view a list of peer devices for a specific WAE. The Peer List window appears, which is the same as the device level Topology report.

At the device level, the Topology report lists all the peer devices connected to a specific WAE so that you can see the relationship between devices in your WAAS network. The Peer List window displays information about each peer device involved in optimized connections with this WAE. To go to the system level Topology report, click the **Topology** icon in the taskbar.

If a peer device is not registered with the WAAS Central Manager, the message Unknown, this peer is not being managed by CM is displayed for the name and Unknown is displayed for the IP address.

**Note** The WAAS Central Manager device does not have any peers because it does not participate with any WAEs to optimize traffic. For this reason, the topology feature is not available on the WAAS Central Manager device.

# Connection Trend Report

The Connection Trend Report displays the connection trends of applications on a device. The following charts are included:

- Optimized Connections Over Time, on page 27

  (included only at the device level)

- Optimized vs Pass-Through Connections, on page 28

# Connections Statistics Report

The Connections Statistics report displays a **Connections Statistics** table for the device. The table displays all the TCP connections handled by the device and corresponds to the **show statistics connection** EXEC mode command in the Cisco WAE and the **show waas connection brief** command in Cisco WAAS Express.

You can choose to display a subset of connections identified by IP address and port by entering values in the **Source/Destination IP Address** and **Source/Destination Port** fields above the table and clicking **Submit**. To see the **Connection Start Time** for the active connections in appropriate time zones, you can select the time zone from the available values of **CM Local Time**, **Device Local Time** and **UTC** from the **Show Connection Start Time** drop-down list.

**Note** In case of a clock or timezone change in the Cisco WAE, the exact time for device timezone is reflected after the configuration synchronization cycles.

The **Connection Statistics** table displays the following information about each connection:

- Source IP address and port.
- Destination IP address and port.
- Peer ID: Hostname of the peer device.
- Applied Policy/Bypass Reason: Displays icons representing the applied optimization policies, including TFO, DRE, LZ, and an application accelerator, respectively. (Hover your mouse over the icon to see its meaning.) If the connection is not optimized, the bypass reason is shown.
- Connection Start Time: Date and time at which the connection was started.
- Open Duration: Number of hours, minutes, and seconds that the connection has been open.
- Total number of original bytes.
- Total number of optimized bytes.
- Percentage of compression.
- Class map name: If no class map exists for the connection, this column contains a dash. To create a class map for this connection, click the radio button at the left of the row and then click the Create Class-Map taskbar icon to display the **Optimization Class-Map** pane. For more information, see the chapterConfiguring Application Acceleration.

**Note** If the WAE is inheriting policies from a device group, the **Create Class-Map** button is dimmed, to prevent a user from unknowingly overriding device group policies. To create a class map, you must first override the device group policy page and then return to the Connection Statistics report.

The data in the **Connections Statistics** table is retrieved from the device once when you view the table for the first time.

From the **Connections Statistics** table, you can perform the following tasks:

- Apply filter settings to display particular connections based on specific criteria, by choosing Quick Filter from the Show drop-list in the taskbar.
- To refresh the table, click the **Refresh** taskbar icon.
- To export the table to a spreadsheet, click the **Export** taskbar icon.
- To view connection details, click the **Details** icon next to the connection entry.

The **Connection Details** window contains connection addresses, port information, policy information, and traffic statistics. It also displays graphs that plot real-time traffic statistics and are refreshed every two seconds.

**Note** In the **Connection Details** window, if the value for **Percentage Compression** is negative, the **Percentage Compression** and **Effective Capacity** values do not appear.

In some cases, the Cisco WAAS Central Manager is not able to fetch the **Connections Statistics** page details at the WAE device level. This happens when the WAE uses internal IP for management purpose with the Cisco WAAS Central Manager and external IP (NAT) for RPC or registration purpose with the Cisco WAAS Central Manager, and if the internal IP not reachable from the Cisco WAAS Central Manager.

# Resource Utilization Report

The Resource Utilization report displays the following charts:

## CPU Utilization

The CPU Utilization chart displays the percentage of CPU utilization for a device. This chart is available only when a specific Cisco WAAS device is selected. This chart can be added only to the **Monitor > Reports > Reports Central > Resource Utilization** report page.

## Disk Utilization

The **Disk Utilization** chart displays the percentage of disk utilization for a device. This chart is available only when a specific Cisco WAAS device is selected. This chart can be added only to the **Monitor > Reports > Reports Central > Resource Utilization** report page.

# Disks Report

The **Disks Report** displays physical and logical disk information.

The report window displays the following information about each disk:

- Physical disk information, including the disk name, serial number, and disk size.
- Present status. The **Present** field will show either **Yes** if the disk is present or **Not Applicable** if the disk is administratively shut down.
- Operational status: NORMAL, REBUILD, BAD, UNKNOWN, or Online.
- Administrative status: ENABLED or DISABLED. When the Administrative Status field shows DISABLED, the Present field will show Not Applicable.
- Current and future disk encryption status.
- RAID level. For RAID-5 devices, the Disk Information window includes the RAID device name, RAID status, and RAID device size.
- Error information, if any errors are detected.

From this window, you can save all disk information details to an Excel spreadsheet by clicking the **Export Table** taskbar icon.

# AppNav Report

The AppNav report displays AppNav flow distribution information. This report is available at the AppNav Cluster level, where it shows statistics for the whole AppNav Cluster, and at the device level for AppNav Controllers (ANCs), where it shows statistics for a single ANC.

The following charts and tables are included:


- Total AppNav Traffic, on page 28
- AppNav Policies, on page 29
- Top 10 AppNav Policies, on page 29
- Top 10 Cisco WAAS Node Group Distribution, on page 29
- Cisco WAAS Node Group Distribution, on page 29
- Pass-Through Reasons, on page 29
- Top 10 Pass-Through Reasons, on page 29


At the **AppNav Cluster** level, the following additional controls appear in the taskbar:

- The **Scope** drop-down list allows you to choose to display data for the whole cluster or for an individual ANC.
- The **AppNav Policy Rule** drop-down list allows you to choose the AppNav policy for which data is displayed (shown for Cisco WAAS appliance AppNav clusters only.)
- The **Context** drop-down list allows you to choose the AppNav context (or all contexts) for which data is displayed (shown for AppNav-XE clusters only.)

**Note** At the **AppNav Cluster** level, the charts may not show data if the configuration on all ANCs in the cluster does not match. To resolve this situation, choose **AppNav Clusters** > *cluster-name* from the Cisco WAAS Central Manager menu and click the **Force Settings on all Devices in a Group** taskbar icon. After about 15 minutes, the AppNav charts will display data.

# Exported Reports

Using the spreadsheet icon in the Central Manager taskbar, you can export chart values to a CSV file.

The following "Exported Report Column Headings" table provides descriptions of report column headings for exported reports. Because there are many report column headings, the table is divided into categories by types of traffic, in alphabetical order. For these heading descriptions, a time specification (for example, milliseconds) is not noted, as the time specification may change depending on the time period specified for the report (for example, hour or week).

***Table 13: Exported Report Column Headings***

| Report Column Heading | Description |
|---|---|
| **Akamai Connected Cache** | |

| Report Column Heading | Description |
|---|---|
| ce_cachetype_hit_count<br>ce_cachetype_hit_miss<br>ce_cachetype_hit_response<br>ce_cachetype_wan_response | For the Akamai Connect Cache Engine, exported reports show the following types of information:<br>Hit Count—The top URLs by number of cache hits.<br>Hit Miss—The number of object cache responses not cached.<br>Hit Response—The number of object cache response bytes for cache-hit transactions.<br>WAN Response—The top URLs by number of bytes served over the WAN.<br>Depending on which cache types are enabled and what traffic is seen, the output may show statistics for any or all of the following cache types:<br>• Connected Cache (example: ce_connect_hit_count)<br>• Bypass (example: ce_bypass_hit_miss)<br>• Standard, (example: ce_standard_hit_response)<br>• Basic (example: ce_basic_wan_response)<br>• Advanced (example: ce_advanced_hit_count)<br>• OTT-youtube (example: ce_ott_hit_miss)<br>• OTT-generic (example: ce_ott-generic_hit_response)<br>• unknown (example: ce_unknown_wan_response) |
| total_aggregate_time_saved | Aggregated amount of time saved due to Akamai Connect caching. |
| **Akamai Connected Cache Top Sites** | |
| Hit Count | The top URLs by number of cache hits. |
| Response Time Savings | The response time saved due to Akamai Connect caching. |
| Site | The names of the top sites being served by the Akamai Cache Engine, in terms of hostname and traffic. |
| Timestamp | The date and time of the information recorded, for each row of the report. |
| WAN Offload | The top URLs by number of bytes served out of the cache, and as a result did not come over the WAN. |
| WAN Response | The top URLs by number of bytes served over the WAN. |

| Report Column Heading | Description |
|---|---|
| **Application, Time, and Time Saved** | |
| timestamp | The date and time of the information recorded, for each row of the report. |
| Application Name | Type of application for the reported data, such as enterprise, backup, replication, file system, email and messaging, file system, storage, web. file transfer, streaming, printing, or remote desktop. |
| time_saved | Total response time saved, for cache hit transactions. The time is incremented on the client side WAE by one RTT whenever an idle fast connection is reused instead of establishing a new WAN connection. |
| total_adjusted_download_time | The total adjusted download time. |
| total_aggregate_time_saved | Aggregated amount of time saved due to Akamai Connect caching. |
| **Cache Control Header and Cache** | |
| httpao_requests_cache_control_denies_cached_resp | Number of requests not to be cached, as specified by a Cache-Control header. |
| httpao_responses_cache_control_prevents_caching | Number of OK (200), Redirected (301), Not Modified (304), and Unauthorized (401) responses not to be cached, as specified by a Cache-Control header. |
| httpao_long_url | Number of responses not cached because the URL is longer than 255 characters. The URL length includes the length of the destination IP address. |
| httpao_total_time_cache_miss<br>httpao_total_time_cache_miss_https | For HTTP/S, total time for HTTP AO cache misses. |
| **Connections: Active, Dropped, Incomplete, Pending** | |
| active connections | Number of WAN side connections currently established and either in use or free for fast connection use. |
| active_https_connections | Number of active HTTPS connections. |
| maximum_active_connections | Maximum value reached by the Current Active Connections counter. Maximum Active Connections is reset if the accelerator is restarted or if statistics are cleared. |
| dropped_connections | Number of connections dropped for any reason other than client/server socket errors or close (for example, out of resources). |

| Report Column Heading | Description |
|---|---|
| incomplete_connect | Number of SSL CONNECT requests with an incomplete message. |
| pending_connections | Number of connections pending to be accepted. |
| **Connections: Handled, Optimized, Prepositioned** | |
| handled_connections | Number of connections handled since the accelerator was started or its statistics were last reset; incremented when a connection is accepted or re-used; never decremented. |
| handled_https_connections | Number of HTTPS connections handled since the accelerator was started or its statistics were last reset; incremented when a connection is accepted or re-used; never decremented. |
| optimized_connections | Number of connections previously and currently optimized by the accelerator. |
| total_optimized_connections_https | For HTTPS, the total number of optimized connections. |
| Optimized Single Sided Connections | Number of optimized connections using single-sided mode. |
| preposition connections | Number of prepositioned connections. |
| Opt TCP Only Connections | Number of current active connections using TFO optimization only. |
| optimized TCP Plus Connections | Number of current active connections using DRE/LZ compression/optimization or handled by an accelerator. |
| **Connections: Idle, Reused, Timeout** | |
| idle | Number of Current Active Connections that are idle and available for reuse as a fast connection. Incremented when an in-use active connection becomes idle and is available for reuse as a fast connection; decremented an available idle active connection is reused or its idle timeout (5 secs) is reached. |
| reused | Number of times a client-side idle active WAN connection was able to be reused instead of establishing a new WAN connection. |
| reuse_failed | Number of times a client-side idle active WAN connection was attempted to be re-used but the reuse failed. |

| Report Column Heading | Description |
|---|---|
| max_reused | Maximum number of times a single connection was reused. This is the “best case” of number of reuses on a single connection. |
| reused_peer | Number of times a peer WAAS device connection was reused instead of establishing a new connection. |
| http_time_saved_fast_reuse | Time saved by fast connection reuse. |
| ao_syn_hndling_timeouts | Number of SYN (synchronize/start) timeouts because the AO accelerator was temporarily busy. |
| **Connections: Handoffs, Pass Through, Piped Through** | |
| handoff_failed | Number of connections attempted to be handed off but the handoff failed. |
| ssl_handoff | Number of connections handed off to the SSL accelerator as a result of SSL CONNECT requests received by the HTTP accelerator. |
| total_handoff | Total number of connections handed off. |
| PT Config Connections | Number of pass-through connections offloaded due to missing policy configurations. |
| PT Intermediate Connections | Number of pass-through connections due to an intermediate WAAS node. |
| PT Other Connections | Number of pass-through connections offloaded due to other reasons. |
| PT No Peer Connections | Number of pass-through connections offloaded due to the absence of a peer WAAS node. |
| pipe_through_connections | Number of connections bypassed by the SSL accelerator due to, for example, SSL cipher negotiated on the flow is not supported on the WAAS device, or the destination domain did not match domains to be accelerated. |
| pipe_through_uncompressed | The number of connections bypassed |
| **DRE and LZ Compression** | |
| httpao_dre_hints_flush<br>httpao_dre_hints_flush_https | For HTTP/S, number of DRE hints by SMB accelerator to flush data. |
| httpao_dre_hints_skip_bytes<br>httpao_dre_hints_skip_bytes_https | For HTTP/S, number of DRE hints by SMB accelerator to skip the header bytes. |

| Report Column Heading | Description |
|---|---|
| httpao_dre_hints_skip_lz<br>httpao_dre_hints_skip_lz_https | Number of DRE hints by SMB accelerator to skip LZ compression. |
| httpao_accept_encoding_removed<br>httpao_accept_encoding_removed_https | Number of HTTP/S requests with Accept-Encoding removed from the HTTP/S header (preventing the server from compressing HTTP/S data and allowing the WAE to apply its own compression). |
| **Locally Served and Remotely Served** | |
| httpao_locally_served_if_not_modified<br>httpao_locally_served_if_not_modified_https | Number of locally served HTTP/S Not Modified (304) responses. |
| httpao_locally_served_redirect<br>httpao_locally_served_redirect_https | Number of locally served HTTP Redirect (301) responses. |
| httpao_locally_served_unauthorized<br>httpao_locally_served_unauthorized_https | Number of locally served HTTP/S Unauthorized (401) responses. |
| httpao_remotely_served_if_not_modified | Number of remotely served Not Modified (304) responses (cache misses). |
| httpao_remotely_served_redirect | Number of remotely served Redirect (301) responses (cache misses). |
| httpao_remotely_served_unauthorized | Number of remotely served Unauthorized (401) responses (cache misses). |
| **Round Trip Time (RTT)** | |
| setup_rtt | The initial RTT time, in milliseconds. |
| rtt | Round trip time saved for all WAN connections that have been established. |
| http_if_not_modified_cache_saved_rtt<br>http_if_not_modified_cache_saved_rtt_https | For HTTP/S, round trip time saved by caching and locally serving Not Modified (304) responses, in milliseconds. |
| http_redirect_cache_saved_rtt<br>http_redirect_cache_saved_rtt_https | For HTTP/S, round trip time saved by caching and locally serving Redirected (301) responses. |
| http_unauth_cache_saved_rtt<br>http_unauth_cache_saved_rtt_https | For HTTP/S, round trip time saved by caching and locally serving Unauthorized (401) responses. |
| total_rtt_saved_all_caches_https | Total round trip time saved for all response types. |
| httpao_sharepoint_saved_rtt<br>httpao_sharepoint_saved_rtt_https | For HTTP/S, total response time saved for HTTP AO in accessing SharePoint objects by enabling SharePoint optimization. |

| Report Column Heading | Description |
|---|---|
| **Session** | |
| httpao_move_session_to_v1_on_request | The number of HTTP AO transactions moved to the NTLM Version 1 Security Model on request, for this session. |
| httpao_move_session_to_v1_on_response | The number of HTTP AO transactions moved to the NTLM Version 1 Security Model on response, for this session. |
| httpao_pipelined session | Number of HTTP AO pipelined transactions during the session. |
| httpao_session_auth_required | Number of HTTP AO Unauthorized (401) responses for the session. |
| httpao_sharepoint_session_hit_count<br>httpao_sharepoint_session_hit_count_https | Number of HTTP/S sessions using the SharePoint optimization feature to access objects from the SharePoint server. |
| **Sharepoint** | |
| httpao_sharepoint_saved_rtt<br>httpao_sharepoint_saved_rtt_https | For HTTP/S, total response time saved for HTTP AO in accessing SharePoint objects by enabling SharePoint optimization. |
| httpao_total_time_sharepoint_miss<br>httpao_total_time_sharepoint_miss_https | For HTTP/S, total time lost in accessing SharePoint data that is not already stored in cache. |
| httpao_sharepoint_session_hit_count<br>httpao_sharepoint_session_hit_count_https | Number of HTTP/S sessions using the SharePoint optimization feature to access objects from the SharePoint server. |
| **Throughput** | |
| Original Throughput In(bits/sec) | Original input throughput, in bits per second. |
| Optimized Throughput Out(bits/sec) | Optimized output throughput, in bits per second. |
| Original Throughput Out(bits/sec) | Original output throughput, in bits per second. |
| Optimized Throughput In(bits/sec) | Optimized input throughput, in bits per second. |
| Original Peak Throughput In(bits/sec) | Original peak input throughput, in bits per second. |
| Optimized Peak Throughput Out(bits/sec) | Optimized peak output throughput, in bits per second. |
| Original Peak Throughput Out(bits/sec) | Original peak output throughput, in bits per second. |
| Optimized Peak Throughput In(bits/sec) | Optimized peak input throughput, in bits per second. |
| **Transactions** | |

| Report Column Heading | Description |
|---|---|
| httpao_handled_transaction | Number of HTTP AO handled transactions. |

# Managing Reports

The Cisco WAAS Central Manager allows you to edit any of the predefined reports and to create custom reports. Additionally, you can schedule reports to be generated periodically such as hourly, daily, weekly, or monthly. When a scheduled report is generated, a link to the report is e-mailed to notify the recipients.

This section contains the following topics:

## Creating a Custom Report

This section contains the following topics:

### Creating a New Custom Report

#### Before you begin

A report consists of up to eight charts and tables. The system and device dashboard displays are examples of predefined reports, along with the other reports available in the Monitor menu.

Reports can be created only at the system level, not at the device level.

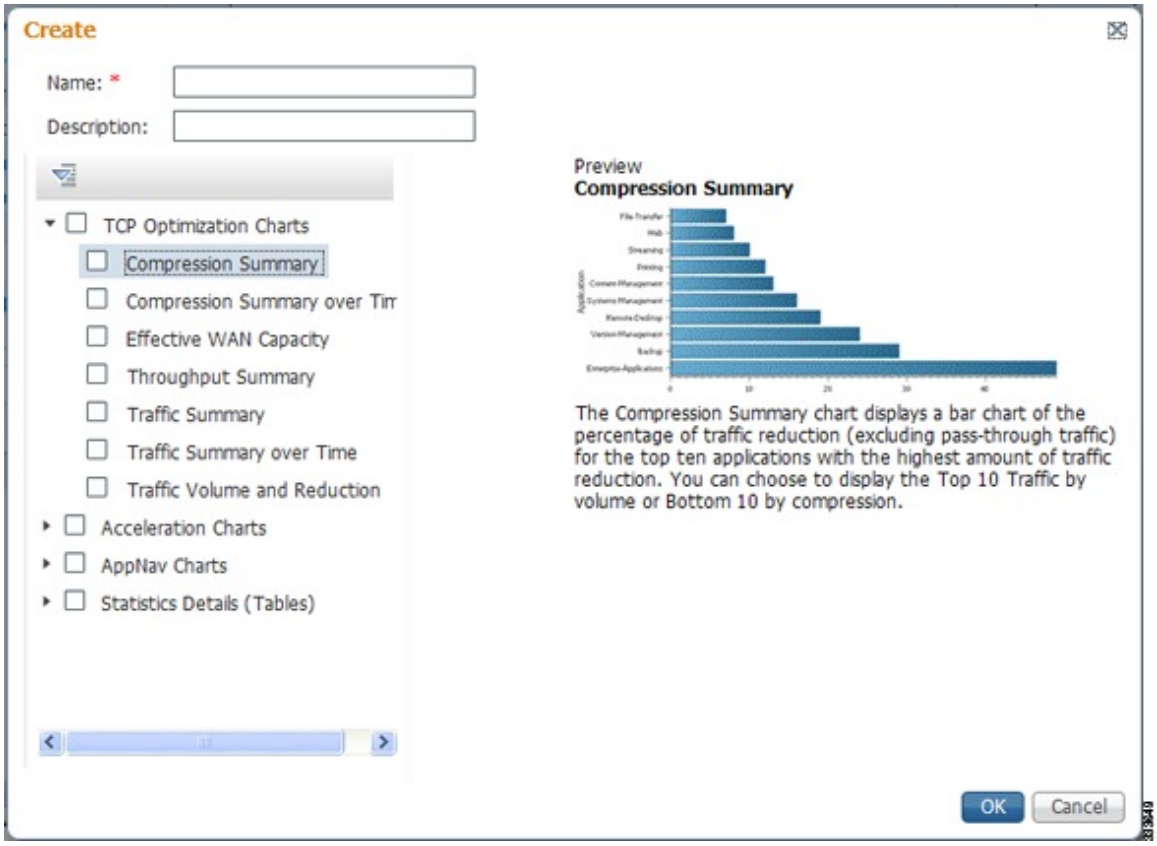
#### Procedure

**Step 1** From the Cisco WAAS Central Manager menu, choose **Monitor > Reports > Reports Central**.

**Step 2** Click the **Create** taskbar icon.

The **Create Report** pane appears.

*Figure 14: Create Report Pane*




**Step 3** In the **Name** field, enter a name for the report. The maximum is 64 characters. Only numerals, letters, spaces, periods, hyphens, and underscores are allowed.

**Step 4** (Optional) In the **Description** field, enter a description of the report.

**Step 5** In the list at the left side of the pane, check the check box next to each chart and table that you want to be displayed in the report. For more information, see Cisco WAAS Chart Descriptions, on page 14.

Expand the categories by clicking the small triangle next to the category name. See a preview and description of a chart by clicking the chart name. Tables are listed in the last category, Statistics Details.

**Step 6** Click **OK**.

**Step 7** (Optional) Customize any of the chart settings as follows:

a) To display the report, click the report name in the **Report Templates** table.

b) You can customize report settings, such as the time frame and the time zone, as described in Customizing a Dashboard or Report, on page 10.

c) To customize the chart settings, click the **Edit** icon in the upper left of a chart. For more information, see Configuring Chart Settings, on page 13.

d) Click **OK**.

Repeat the steps for each chart you want to customize.

## Creating a New Custom Report from an Existing Report

### Procedure

**Step 1** From the Cisco WAAS Central Manager menu, choose **Monitor** > **Reports** > **Reports Central**.

**Step 2** Check the box next to the report that you want to copy.

**Step 3** Click the **Copy** taskbar icon.

The **Copy Report** window appears.

**Step 4** In the **Name** field, enter a name for the report.

**Step 5** (Optional) In the **Description** field, enter a description of the report.

**Step 6** Click **OK**.

The report is added to the **Reports** table.

# Viewing and Editing a Report

### Procedure

**Step 1** From the WAAS Central Manager menu, choose **Monitor** > **Reports** > **Reports Central**.

**Step 2** Click the name of the report that you want to view or edit.

You can filter the list by choosing **Quick Filter** from the **Show** drop-down list and entering filter criteria.

**Step 3** To change any of the charts or tables in the report, use the standard chart editing methods, as described in Customizing a Dashboard or Report, on page 10.

**Step 4** Click **Save** to save the report, or click Save As to save the report under a different name.

### What to do next

To delete a report from the **Reports** table, check the check box next to the corresponding report and click the **Delete** taskbar icon.

Admin users can view, edit, and delete reports created by all users and can view and edit predefined reports. Nonadmin users can view, edit, and delete only reports created by themselves, and can view and edit predefined reports.

# Scheduling a Report

### Before you begin

You can schedule reports to be generated once or periodically, such as daily, weekly, or monthly. When a scheduled report is generated, a copy of the report can be emailed.

**Note** You cannot delete a scheduled custom report after you have scheduled it and it is in pending status. You can delete a report only after it has been generated.

### Procedure

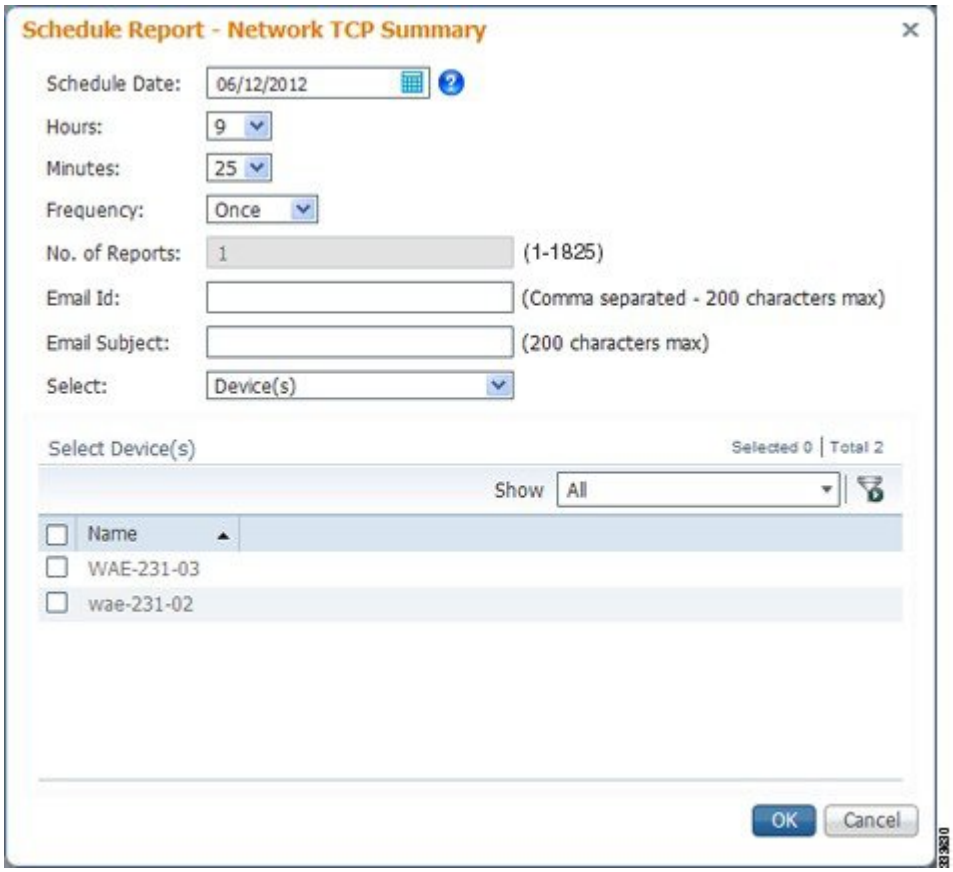
**Step 1** From the Cisco WAAS Central Manager menu, choose **Monitor > Reports > Reports Central**.

**Step 2** Check the check box next to the report that you want to schedule.

**Step 3** Click the **Schedule** icon in the taskbar.

The **Schedule Report** window appears.

***Figure 15: Scheduling a Report***




**Step 4** In the **Schedule Date** field, enter the schedule date in the format **DD/MM/YYYY**, or click the calendar icon to display a calendar from which to choose the date.

**Step 5** From the **Hours** drop-down list, choose the hours. The time represents the local time at the Cisco WAAS Central Manager.

**Step 6** From the **Minutes** drop-down list, choose the minutes. The time represents the local time at the Cisco WAAS Central Manager.

**Step 7** In the **Frequency** drop-down list, choose the report frequency (**Once**, **Hourly**, **Daily**, **Weekly**, or **Monthly**). You can now schedule reports for multiple devices for Akamai Connect Reports. This is available only if you schedule a **Monthly** report.

- Select the **Aggregate** box to receive an aggregate report of all devices called **statistics.csv**. These files are stored in the **ftpconfig.properties** file in the FTP server that needs to be configured before.
- Deselect the **Aggregate** box to receive individual reports for all devices. This report is called **devicename_ddmmyyyy.csv**.

**Step 8** In the **No. of Reports** field, enter the number of times a reoccurring report is to be generated. You can schedule it to be generated for up to 1825 times. After being generated the specified number of times, the report is no longer generated.

**Step 9** Select the **Email PDF** or **Email CSV** check box to receive the report in the format of your choice.

**Step 10** In the **Email Id** field (enabled only when the **Email PDF** or **Email CSV** check box is checked), enter the email addresses of the report recipients, separated by commas.

**Step 11** In the **Email Subject** field, enter the subject of the email message.

**Step 12** From the **Select** drop-down list, choose an option (**Device(s)**, **DeviceGroup**, **Cluster**, or **Location**) to display a list of the chosen entities.

**Step 13** In the **Select** entity area, choose the devices that are to be included in the statistics for the report. Check the check box next to each device, device group, cluster, or location that you want to include.

To locate an entity in a long list, choose **Quick Filter** from the **Show** drop-down list and enter the complete or partial entity name in the field above the list. The search is case-sensitive.

**Step 14** Click **OK**.

**Step 15** Configure the email server settings for e-mail notification when reports are generated. For more information, see Configuring the Email Notification Server in the chapter "Configuring Other System Settings."

**Note** In a Cisco WAAS network where there are 1000 or more WAEs, a scheduled report might take up to 4 minutes to generate. And if you schedule more than one report at the same time, the reports will be generated with a delay of up to 20 minutes, depending on the number of reports and devices.

# Viewing or Deleting a Scheduled Report

**Procedure**

**Step 1** From the Cisco WAAS Central Manager menu, choose **Monitor > Reports > Reports Central**.

The lower section of the **Reports** window lists the completed and pending scheduled reports, depending on the tab you choose. (You can use the **Show filter** above the table to filter the reports that are displayed.)

**Step 2** (Optional) To view a completed report instance in the **Completed Reports** tab, click the **Completed** link in the **Status** column.

**Note** For each completed instance of a scheduled report, the **Frequency** column shows **Once** and the **Completed Time** shows the date and time that the report was generated.

**Step 3** (Optional) If you want to view a list of pending reports, click the **Pending Reports** tab.

**Step 4** (Optional) If you want to delete a report in either the **Completed Reports** or **Pending Reports** tabs, check the box next to one or more report instances that you want to delete and click the **Delete** taskbar icon.

Consider the following operating guidelines:

- Cisco WAAS stores the 10 most recently completed or failed report instances for each custom report. This number is configurable by the **System.monitoring.maxReports** system property. For more information, see Modifying Default System Properties in the chapter "Configuring Other System Settings."
- Admin users can view reports scheduled by all users or the name of the report creator. Nonadmin users can view only reports scheduled by themselves.
- Any changes to predefined report settings are stored separately for individual users. That is, if one user changes a predefined scheduled report, only that user sees the changes, and other users (including admin users) continue to see the report with default settings.
- Reports scheduled by an external user are deleted if the maximum limit of days without a login passes and the user is deleted. For more information, see the **cdm.remoteuser.deletionDaysLimit** system configuration property in Modifying Default System Properties in the chapter "Configuring Other System Settings.

**Note** You cannot delete a scheduled custom report after you have scheduled it and it is in pending status. You can delete a report only after it has been generated.

# Configuring Flow Monitoring

Flow-monitoring applications collect traffic data that is used for application trend studies, network planning, and vendor-deployment impact studies. This section describes how to configure the flow monitoring feature on the Cisco WAE, and includes the following topics:

## Configuring Flowing Monitoring with NetQoS

This section contains the following topics:

### About Flow Monitoring with NetQoS

The NetQoS monitoring application can interoperate with the Cisco WAAS software to provide flow monitoring. To integrate this application with the Cisco WAAS software, configure the NetQoS FlowAgent module on the WAE devices. The NetQoS FlowAgent module on the WAE collects important metrics of packet flows, which are then sent across the network to the NetQoS SuperAgent. This monitoring agent analyzes the data and generates reports. For this feature to work, additional configuration is required on the NetQoS FlowAgent. (See the Example: Using NetQoS for Flow Monitoring, on page 58.)

The monitoring agent comprises two modules: the console (or host) and the collector. The WAE initiates two types of connections to these two monitoring agent modules: a temporary connection to the console and a persistent connection to the collector.

## Configuration Considerations for Flow Monitoring with NetQoS

Consider the following when you configure flow monitoring with NetQoS:

- Configure the console IP address on the WAE by entering the **flow monitor tcpstat-v1 host** global configuration mode command in either the WAE CLI or through the Cisco WAAS Central Manager GUI. This temporary connection is referred to as the control connection.
- The control connection uses TCP port 7878. Its purpose is to obtain the IP address and port number of the collector to which the WAE is assigned.
- The WAE also pulls the configuration information regarding which servers are to be monitored over the control connection. After the WAE obtains the IP address and port number of the collector, the WAE opens a persistent connection to the collector. Collected summary data for the servers that are being monitored is sent over this persistent connection.
- You can place the console (or host) module and the collector module on a single device or on separate devices. These connections are independent of one another. Failure of one connection does not cause the failure of the other connection.
- You can view the state of these connections and various operation statistics display with the **show statistics flow monitor tcpstat-v1** EXEC mode command. Connection errors and data transfer errors trigger alarms on the WAE and in the Central Manager GUI. For information on flow monitoring alarms, see Troubleshooting Flow Monitoring Information, on page 64.
- To display debug information, use the **debug flow monitor tcpstat-v1** EXEC mode command.

## Configuring Flow Monitoring with NetQoS Using the Cisco WAAS Central Manager

**Procedure**

**Step 1** To create a new device group for configuring flow monitoring on multiple devices, choose **Device Groups** > *device-group-name* > **Create New Device Group**.

a) When you create a device group, check the **Automatically assign all newly activated devices to this group** check box to enable this option.

b) Add your existing WAE devices to this new device group.

**Step 2** In the **Device Group** listing window, click the **Edit** icon next to the name of the flow monitoring configuration device group that you want to configure.

**Step 3** Choose **Configure** > **Monitoring** > **Flow Monitor**. The **Flow Monitor Settings for Device Group** window appears.

**Step 4** In the **Destination IP Address** field, enter the IP address of the monitoring agent console.

This configuration allows the WAE to establish a temporary connection (a control connection) to the console for the purpose of obtaining the IP address of the collector device. You must configure the collector IP address information from the console device. (See the configuration documentation for the NetQoS flow monitoring application software.)

**Step 5** Check the **Enable Flow Monitor** check box.

**Step 6** To apply the settings to the devices in this device group, click **Submit**.

## Configuring Flow Monitoring with NetQoS Using the CLI

### Procedure

**Step 1** Register the WAE with the IP address of the monitoring agent console.

```
WAE(config)# flow monitor tcpstat-v1 host 10.1.2.3
```

This configuration allows the WAE to establish a temporary connection (a control connection) to the console (or host) for the purpose of obtaining the IP address of the collector device. You must configure the collector IP address information from the console device. (See the configuration documentation for the NetQoS flow monitoring application software.)

**Step 2** Enable flow monitoring on the WAE appliance.

```
WAE(config)# flow monitor tcpstat-v1 enable
```

**Step 3** To check the configuration, run the **show running-config** EXEC command.

## Example: Using NetQoS for Flow Monitoring

### Before you begin

NetQoS integrates with the WAAS software by running the NetQoS FlowAgent on WAE devices. FlowAgent is a software module developed by NetQoS that resides on a WAE appliance. The FlowAgent collects metrics about the packet flows, which are then sent across the network to a NetQoS SuperAgent. The SuperAgent measures the round-trip times, server response times, and data transfer times, and then analyzes the data and generates reports.

**Note** When you use flow monitoring with the NetQoS SuperAgent, the flow monitor on the WAE captures optimized traffic only.

### Procedure

**Step 1** From the WAE CLI or Cisco WAAS Central Manager GUI, enter the **SuperAgent Master Console IP** address in the **Destination IP Address** field on your WAE appliances.

If you are configuring multiple Cisco WAAS devices through a device group, wait for the configuration to propagate to all the devices in the device list.

**Step 2** From the **NetQoS SuperAgent** console, assign a WAE to a SuperAgent Aggregator (known as the collector in Cisco WAAS terminology) and configure the NetQoS networks, servers, and applications entities.

# Configuring Flow Monitoring with NetFlow v9

This section contains the following topics:

## About Flow Monitoring with NetFlow v9

NetFlow v9 is a template-based protocol developed by Cisco Systems to collect IP traffic information. The NetFlow v9 record format consists of a packet header followed by a template flowset of data flowset. A template flowset contains a description of the fields to be sent through in the data flowset. A data flowset is a collection of the data records containing flow information that is put into an export packet.

Cisco WAAS Version 5.3.1 and later provide the following features for Netflow v9:

- Unlike NetFlow v5, which used a fixed format, NetFlow v9 utilizes a template format. All Cisco WAAS optimization engines can use this template format to export data to collectors such as Cisco Prime and Solarwinds.
- The template format allows new features to be quickly added to NetFlow v9.
- Templates are verified every few minutes for changes, and sent out hourly to provide collectors with field information for data records.
- NetFlow v9 uses Cisco WAAS transaction log information and adds an exporter code to allow data to be sent to external devices.
- NetFlow v9 can be used on all Cisco WAAS optimization engines; it is not used with Cisco WAAS AppNav.
- By default, all Cisco WAAS class maps are monitored. If you would like to have specific class maps to not be monitored, see Disabling NetFlow v9 Monitoring , on page 60.

## Configuration Considerations for Flow Monitoring with NetFlow v9

To configure NetFlow v9 on your WAEs from the CLI, configure four monitoring areas:

- **Flow Record**: Contains the DNA-specific or WAAS-specific flow information or both that you want to send to the collector.
- **Flow Exporter**: Contains the destination details for the exported information, and the format for this information.
- **Flow Monitor**: Specifies which flow records are going to which flow exporter.
- **Class Map**: For Cisco WAAS v5.3.1 and later, monitors are enabled globally on all class map policies by default. If you do not want a particular device monitored, manually disable monitoring for that device.

## Procedure for Configuring Flow Monitoring with NetFlow v9

### Procedure

**Step 1** Use the following command to create a flow record to configure which fields to collect as part of Netflow export:

```
WAE(config)# flow record Record name
WAE(config)# collect waas
```

*Table 14: Collection Parameters*

| Collection Parameter | Description |
|---|---|
| **application-name** | Collects application name for the flow. |
| **bytes** | Collects byte counts for the flow. |
| **class-name** | Collects class name for the flow. |
| **connection mode** | Collects connection mode for the flow. |
| **dre in** | Collects DRE details for the flow. |
| **lz in** | Collects LZ details for the flow. |
| **flow-direction** | Collects direction for the flow. |
| **packets** | Collects packet counts for the flow. |

**Step 2** Use the following command to create the flow exporter, which includes the destination IP address and port for the Netflow:

```
WAE(config)# flow exporter ExporterName
WAE(config-flow_exporter)# destination 2.2.2.2
WAE(config-flow_exporter)# description DescriptiveName
WAE(config-flow_exporter)# export-protocol IPFIX
WAE(config-flow_exporter)# transport udp 12000
WAE(config-flow_exporter)# exit
```

**Step 3** Use the following command to create the flow monitor and associate the flow record with the flow exporter:

```
WAE(config)# flow monitor MonitorName
WAE(config-flow_monitor)# description DescriptiveName
WAE(config-flow_monitor)# exporter ExporterName
WAE(config-flow_monitor)# record RecordName
WAE(config-flow_monitor)# enable
```

## Disabling NetFlow v9 Monitoring

If flow monitoring is configured, it is enabled for all class-maps by default. Use the following command to disable monitoring for a particular class:

```
WAE(config)# policy-map type waas PmapName
WAE(config)# class ClassName
WAE(config)# {no} flow-monitor enable
```

## NetFlow v9 Exported Fields

In NetFlow v9, there are several fields that can be provided to the NetFlow collector. The following table provides some examples of these fields:

*Table 15: NetFlow v9 Exported Fields*

| Exported Field | Description and Corresponding Number Value |
|---|---|
| Segment ID | The segment of the optimized flow that the values are from: 1, 2, 4, 8, or 16. A value of 1 is the unoptimized side on the Edge WAE, and a value of 16 is a pass-through flow. |
| Source IP | Source IP address. |
| Destination IP | Destination IP address. |
| NextHop | IP address of next-hop router. |
| Input Interface | SNMP index of input interface. |
| Output Interface | SNMP index of output interface. |
| Source Port | TCP/UDP source port number or equivalent. |
| Destination Port | TCP/UDP destination port number of equivalent. |
| TCP Flags | Cumulative OR of TCP flags. |
| Packets | Packets in the flow. |
| Bytes | Unused bytes. |
| Start Time | System uptime at start of flow. |
| End Time | System uptime when the last packet of the flow is received. |
| Protocol | IP protocol type, for example, TCP=6, UDP=17. |
| Type of Service | Type of service. |
| Source ASN | Autonomous System Number of the source, either origin or peer. |
| Destination ASN | Autonomous System Number of the destination, either origin or peer. |
| Source Mask | Source address of the prefix mask, in bits. |
| Destination Mask | Destination address of the prefix mask, in bits. |
| Application Name | Name of the application traffic on the connection. |
| Class Name | Class name. |
| Connection Mode | Current connection mode. Value of 1 (TFO), 3 (TFO + DRE), 5 (TFO + LZ) or 7 (TFO + DRE + LZ). |
| Pass-Through Reason | Reason the traffic was not optimized. |
| Bytes Received | Number of bytes received. |
| Bytes Sent | Number of bytes sent. |

| | |
|---|---|
| Packets Received | Number of packets received. |
| Packets Sent | Number of packets sent. |
| DRE In Bytes | Number of DRE bytes before compression. |
| DRE Out Bytes | Number of DRE bytes after compression. |
| DRE Encode Latency | Amount of latency incurred during DRE encode operation against an optimized connection. |
| DRE Decode Latency | Amount of latency incurred during DRE decode operation against an optimized connection. |
| LZ In Bytes | Number of LZ bytes before compression. |
| LZ Out Bytes | Number of LZ bytes after decompression. |
| LZ Encode Latency | The amount of latency (transmission delay) associated with the LZ compressed message operation. |
| LZ Decode Latency | The amount of latency (transmission delay) associated with the LZ decompressed message operation. |
| Original Bytes | Number of unoptimized bytes. |
| Optimized Bytes | Number of optimized bytes. |

## NetFlow v9 Pass-Through Reasons

Pass-Through reasons are sent to the collector. The following table shows pass-through numbers and associated reasons.

***Table 16: Pass-Through Number and Pass-Through Reason***

| Pass-Through Number | Pass-Through Reason |
|---|---|
| 0 | PE_CONN_UNKNOWN |
| 1 | PE_CONN_PT_APP_CONFIG |
| 2 | PE_CONN_PT_GLB_CONFIG |
| 3 | PE_CONN_PT_OVERLOAD |
| 4 | PE_CONN_PT_CPU_OVERLOAD |
| 5 | PE_CONN_PT_IN_PROGRESS |
| 6 | PE_CONN_PT_PE_INT_ERROR |
| 7 | PE_CONN_PT_DYN_BYPASS |
| 8 | PE_CONN_INT_CLIENT |

| Pass-Through Number | Pass-Through Reason |
|---|---|
| 9 | PE_CONN_INT_SERVER |
| 10 | PE_CONN_ACCEL_OPTIMIZED |
| 11 | PE_CONN_ACCEL_NON_OPTIMIZED |
| 12 | PE_CONN_APP_DYN_MITCH_OPTIMIZED |
| 13 | PE_CONN_APP_DYN_MITCH_NON_OPTIMIZED |
| 14 | PE_CONN_OPT_TCP_PLUS |
| 15 | PE_CONN_ORIG_TCP_PLUS |
| 16 | PE_CONN_OPT_PREPOSITION |
| 17 | PE_CONN_ORIG_PREPOSITION |
| 18 | PE_CONN_OPT_TCP_ONLY |
| 19 | PE_CONN_ORIGIN_TCP_ONLY |
| 20 | PE_CONN_PT_NO_PEER |
| 21 | PE_CONN_PT_RJCT_CAPABILITIES |
| 22 | PE_CONN_PT_RJCT_RESOURCES |
| 23 | PE_CONN_PT_NO_LICENSE |
| 24 | PE_CONN_PT_ASYMMETRIC |
| 25 | PE_CONN_PT_INTERMEDIATE |
| 26 | PE_CONN_PT_FB_INT_ERROR |
| 27 | PE_CONN_PT_AD_INT_ERROR |
| 28 | PE_CONN_PT_SQ_INT_ERROR |
| 29 | PE_CONN_PT_APP_OVERRIDE |
| 30 | PE_CONN_PT_SVR_BLACKLIST |
| 31 | PE_CONN_PT_AD_VER_MISMATCH |
| 32 | PE_CONN_PT_AD_AO_INCOMPAT |
| 33 | PE_CONN_PT_AD_AOIM_PROGRESS |
| 34 | PE_CONN_PT_DIRM_VER_MISMATCH |
| 35 | PE_CONN_PT_DIRM_INT_ERROR |
| 36 | PE_CONN_PT_PEER_OVERRIDE |

| Pass-Through Number | Pass-Through Reason |
|---|---|
| 37 | PE_CONN_PT_AD_OPT_PARSE_FAIL |
| 38 | PE_CONN_PT_AD_SERIAL_MODE_PEER |
| 39 | PE_CONN_PT_INTERCEPTION_ACL |
| 40 | PE_CONN_PT_WCCP_SHUTDOWN_ACTIVE |
| 41 | PE_CONN_PT_AD_IP_FRAG |

# Troubleshooting Flow Monitoring Information

This section has the following topics:

## Alarms for Flow Monitoring

The following table shows the four different alarms that may be raised when errors occur with flow monitoring.

***Table 17: Alarms for Flow Monitoring***

| Name | Severity | Description |
|---|---|---|
| CONTROL_CONN | Major | Indicates a problem with the control connection. |
| COLLECTOR_CONN | Major | Indicates a problem with the collector connection. |
| SUMMARY_COLLECTION | Minor | Indicates a problem with the collection of packet summary information.<br>Summary packets may be dropped because the buffer queue limit has been reached or because of a TFO (Transport File Optimization) error, such as not being able to allocate memory.<br>Summary packet collection may also be dependent on the available WAN bandwidth. |
| DATA_UPDATE | Minor | Indicates a problem with the ability of the WAE to send updates to the collector agent. |

## Commands Used to Troubleshoot Flow Monitoring

The following table shows the commands used to troubleshoot flow monitoring.

*Table 18: Commands Used to Troubleshoot Flow Monitoring*

| Command Type | Command |
|---|---|
| **show** commands | **show flow record** *RecordName*<br>**show flow record** *RecordName* **template**<br>**show flow** *ExporterName* **exporter**<br>**show flow monitor** |
| **show statistics** commands | **show statistics flow monitor** *MonitorName*<br>**show statistics flow exporter** *ExporterName* |
| **clear statistics** commands | **clear statistics flow monitor** *MonitorName*<br>**clear statistics flow exporter** *ExporterName* |
| **tcpdump** commands | **tcpdump** |