Preconfigured Graphs

This document describes all the graphs available in the Statistics:Reports window. These graphs are grouped into the following basic categories, or types of graphs:

- Bandwidth Usage
- Efficiency
- Top-10
- Response Time Measurement
- TCP Connections
- Compression

Class Utilization Graph

The Class Utilization graph shows a history of the class’s average bandwidth consumption in bits per second. This graph answers questions such as, “How much bandwidth does my FTP traffic class typically take?”
Class Utilization with Peaks Graph

The Class Utilization with Peaks graph displays a traffic class’s average and peak bandwidth consumption over time.

Tip: A quick way to display this graph is to go to the Top Ten window and click the graph icon next to the class you want to graph.

Although the average bandwidth utilization over time is also displayed in the Class Utilization graph, the same figures may look different in the Class Utilization with Peaks graph. This is because the graph’s scale changes if there is a sizeable difference between the average and peak figures.

Average bandwidth (without peaks) may show ample capacity, especially when longer time units are measured. By checking the peaks, you can see if a traffic class is frequently hitting a capacity limit.

Dynamic Partition Usage

The Dynamic Partition Usage graph provides three statistics pertaining to a particular dynamic partition:

- The number of active users (that is, the number of active subpartitions)
- The number of subpartitions PacketShaper attempted to create after the partition’s cap was reached.
- Number of dynamic subpartitions that PacketShaper attempted to create but could not because the number of partitions on the PacketShaper unit had reached its limit. The maximum number of partitions on a PacketShaper unit depends on the model. For example, the PacketShaper 4500 can have up to 256 partitions.
Link Utilization Graph

The Link Utilization graph shows the link’s average bandwidth usage in bits per second. If you choose to display the link size when creating the graph, a horizontal line indicates the capacity of the link, as shown below.

This graph answers questions such as “Does the link usage vary a lot? What are my average capacity needs?”

✍ Note: To get the entire picture, you should also view the Link Utilization with Peaks graph (using sufficiently small time intervals).

Link Utilization with Peaks Graph

The Link Utilization with Peaks graph shows the link’s average and peak bandwidth usage in bits per second.
If you choose to display the link size when creating the graph, a horizontal line indicates the capacity of the link. When the link size is displayed (as shown below), the graph can answer questions such as, “How frequently is my link size insufficient? What are my average capacity needs?”

Partition Utilization with Peaks Graph

The Partition Utilization with Peaks graph shows a partition’s average and peak bandwidth usage in bits per second. PacketWise determines the peak rate by looking at the rate recorded for the busiest one-second sub-interval (that is, the sub-interval that had the highest rate).

If you choose to display the partition size when creating the graph, horizontal lines indicate the partition’s minimum and burstable size limits (as shown below). This type of graph can answer questions such as, “I reserved 150 Kbps for this partition — is all that bandwidth really needed?” In the graph below, the partition was changed from non-burstable to burstable during the time period that was graphed. It is easy to see that the excess bandwidth was utilized when the partition was made burstable.
Partition Utilization Graph

The Partition Utilization graph shows a partition’s average bandwidth usage in bits per second. If you choose to display the partition size when creating the graph, horizontal lines indicate the partition’s minimum and burstable size limits (as shown below).

Note: If the selected traffic class does not have a partition, PacketShaper references the partition of the nearest ancestor traffic class.

Bytes Transmitted Graph

The Bytes Transmitted graph compares the number of transmitted bytes to the number of retransmitted bytes for a specific link, partition, or class.
Guaranteed Rate Failures Graph

The Guaranteed Rate Failures graph shows a history of the number of times PacketShaper was unable to provide the bandwidth guaranteed by the class’s policy. If the selected class does not have an associated guaranteed rate, the graph shows zeroes.

Network Efficiency Graph

The Network Efficiency graph shows the amount of wasted TCP traffic by displaying the percentage of bytes that are not retransmits. This graph displays the measurement engine variable tcp-data-bytes as a percentage, which is computed as:

\[(\text{bytes} - \text{tcp-rex-bytes}) / \text{bytes}\]

✍ Note: If the selected class’s traffic is not TCP, then the graph indicates 100%.

The Network Efficiency graph can help you spot bad trends. Tosses and retransmitted packets lower the efficiency percentage. An efficient network, displayed as minor fluctuations from 100%, needs very little intervention. A lower percentage indicates that more of your network capacity is devoted to retransmitting packets. In this case, you may want to reevaluate your current partitions and policies.
If this graph shows an unacceptable increase in rate failures, ask the following questions:

- Is the rate guarantee inappropriate?
- Am I having an unexpected number of flows?
- Is a partition or a lower guarantee workable?
- Is my policy’s admission control set adequately?

**Packet Size Distribution Graph**

The Packet Size Distribution graph is a histogram of packets received on the Inbound or Outbound link, in seven different size buckets. The buckets of packet sizes (in bytes) include: [0-63], [64-127], [128-255], [256-511], [512-1023], [1024-1517], [>=1518]. In the example below, about 340,000 packets were received that were in the "127" bucket (that is, the size range of 64-127 bytes).

![Packet Size Distribution Graph](image)

**Packets Transmitted Graph**

The Packets Transmitted graph compares the number of transmitted packets to the number of retransmitted packets (excluding tossed packets) for a specific link, partition, or class.

![Packets Transmitted Graph](image)
Graphs for Analyzing Top Ten

**Top-10 Classes Graph**

The Top-10 Classes graph is a pie chart showing the relative portions of bandwidth allocated to the ten most active classes associated with the selected class and all its descendents. This graph displays each class’s average bandwidth usage in bits per second and its percentage of the total bandwidth used by the group.

**Top 10 Children Classes Graph**

The Top 10 Children Classes graph is a pie chart showing the relative portions of bandwidth allocated to the ten most active children classes of the selected class. This graph is similar to the Top 10 Classes graph except that this graph displays direct children only, while the Top 10 Class graph shows leaf classes (classes that don’t have any children of their own). In other words, the Top 10 Children Classes graph allows you to graph a class’ children, without grandchildren.

This graph displays each child class’ average bandwidth usage in bits per second and its percentage of the parent class’ total bandwidth usage.
Top-10 Partitions Graph

The Top-10 Partitions graph is a pie chart showing the relative portions of bandwidth allocated to the ten most active partitions associated with the selected class or its descendents. This graph displays each partition’s average bandwidth usage in bits per second and its percentage of the total bandwidth used by the group.

Note: Occasionally, the browser may display the colors incorrectly, causing discrepancies between the pie chart and the legend. To correct the colors, refresh the display by closing and reopening the window.

Average Transaction Size Graph

The Average Transaction Size graph shows the average transaction size of a TCP-based application. This graph type is available only if RTM is available for the selected object.
Network Delay Graph
The Network Delay graph shows the average response times in milliseconds of a traffic class over time. This graph shows only the portion of the transaction time that is attributable to the network, enabling you to analyze network delay. This graph type is available only if RTM is available for the selected object.

Network Delay Distribution
The Network Delay Distribution graph displays the number of transactions whose network delay falls into each of the 14 transaction-time buckets described under the Transaction Delay Distribution graph. The median delay is indicated on the bottom of the graph. This graph type is available only if RTM is available for the selected object.

Normalized Network Delay Graph
The Normalized Network Delay graph shows the transaction delay in the network, normalized by transaction size. This graph type is available only if RTM is available for the selected object.

Note: The Normalized Network Delay graph is based on the normalized-network-delay-avg variable, an experimental measurement variable.
This variable, and its associated graph, may be removed from PacketWise in the future.

Packet Round-Trip Time Graph

The Packet Round-Trip Time graph shows the history of a transaction’s round-trip time (RTT). RTT is the average number of milliseconds spent in transit when a client and server exchange the SYN (synchronize sequence numbers flag) and its corresponding ACK (acknowledge flag). A transaction involving a large amount of data requires the data to be divided into multiple packets. Whereas a transaction’s network delay reflects the total transit time for all required packets, the RTT reflects the time for a single packet to make its way from client to server and another packet to make the return trip. This graph type is available only if RTM is available for the selected object.

The RTT graph provides a good way to track the history of network speed, independent of the size of historical transactions. The RTT from a given client to a given server only varies with network speed; the size of the transaction is irrelevant.
Server Delay

The Server Delay graph shows the average response times in milliseconds of a traffic class over time. This graph shows only the portion of the transaction time that is attributable to the server, enabling you to analyze server delay. This graph type is available only if RTM is available for the selected object.

Server Delay Distribution Graph

The Server Delay Distribution graph displays the number of transactions whose server delay falls into each of the 14 transaction-time buckets described under the Transaction Delay Graph. The median delay is indicated on the bottom of the graph. This graph type is available only if RTM is available for the selected object.

Note that the counts of each type of delay for any one transaction time slot aren’t necessarily associated with the same transactions. For example, one transaction might have:

- .025-second server delay (the 3rd slot)
- .475-second network delay (7th slot)
- .5-second total delay (8th slot)

Service Level Compliance Graph

The Service Level Compliance graph is available for traffic classes with response-time measurements and thresholds. This graph shows two lines, one representing the required percentage of good transactions and the other representing the actual percentage of good transactions. The first line is always flat. The second line varies, depending on performance. This graph type is available only if RTM is available for the selected object.
The Service Level Compliance graph shows how a class measures up to its own performance standard. For example, suppose a class has a Total Delay Threshold set to 400 ms and a Service Level Threshold set to 90 percent. For that class to be performing well, at least 90 percent of the class’s transaction delays in each one-minute interval should be under 400 ms.

**Transaction Delay Graph**

The Transaction Delay graph shows a timeline of a traffic class’s average response times in milliseconds. Three colored lines track the total, network, and server delays, so you can determine the source of any significant delays. The horizontal line represents the Total Delay Threshold as a reference point to determine the quality of the response times. This graph type is available only if RTM is available for the selected object.
Transaction Delay Distribution Graph

PacketShaper maintains histograms for network, server, and total delays for each class. The range of response times (0 to 25000+ milliseconds) is divided into 14 unequal transaction-time buckets. Each slot contains the number of transactions that are delayed with the specified number of seconds. For example, in the sample chart, about 140 transactions were delayed .1 seconds, 125 transactions were delayed .25 seconds, and 35 transactions were delayed .5 seconds. As each delay is calculated, PacketShaper updates its corresponding average and increases the count for the appropriate time slot. This graph type is available only if RTM is available for the selected object.

The Transaction Delay Distribution graph displays the number of transactions whose total delay falls into each of the 14 transaction-time buckets. The median delay is indicated on the bottom of the graph.

The transaction-time buckets and their respective counts provide efficient median estimates. A good median approximation is possible by using each time slot’s count and making the assumption that the times within each group are distributed evenly.

Medians are presented to give a better idea of what most users are actually experiencing. Half the transactions’ delays are below the median and half are above. While the average response time can be distorted by one very slow transaction, the median is not. For example, the average of this series (1, 2, 3, 4, 190) is 40, while the median is 3.

Connection Retransmissions Graph

The Connection Retransmissions graph compares the TCP retransmit rate (the percentage of packets that were retransmitted) with the TCP toss rate (the percentage of retransmitted packets that were tossed) of a link, partition, or class. This graph can help identify poorly tuned servers whose retransmissions are wasting bandwidth.
TCP Connections Initiated Graph
The TCP Connections Initiated graph shows the number of TCP connections started in the specified time period.

TCP Health Graph
The TCP Health graph gives you a comprehensive picture of TCP connections for a particular link, partition, or class. It compares the number of TCP connections that were started, aborted, ignored by the server (that is, the server never responded), and refused by the server during the specified time period.

For example, suppose you created classes for each branch office and one of your offices complained about a server problem (such as slow speed, or many disconnects, or hung systems). By comparing TCP Health graphs of the various branch office classes, you can figure out what is causing the server problem at the one branch office.
Graphs for Analyzing Compression

Use these graphs to analyze how much compression your PacketShaper Xpress is doing. You can analyze compression per class, partition, or the entire link.

Class Compression Average Rates Graph

The Class Compression Average Rates graph compares average bandwidth usage for the class, with and without compression. The Postcompression line represents average usage with compression enabled and the Precompression line represents what average usage would have been without compression.

The graph includes compressible (tunneled) traffic only. If you want the graph to include all traffic (compressible and non-compressible), select the Include Non-compressible Traffic in Compression Graphs checkbox when creating the graph.

Class Compression Percent Bytes Saved Graph

The Class Compression Percent Bytes Saved graph shows the percentage of bytes saved for the class, due to compression. The Compression Percent Bytes Saved value is calculated by subtracting precompression bytes (the size without any compression) and postcompression bytes (the size after compression) and dividing this difference by precompression bytes. For example, if a class’ traffic is 400k without compression and is compressed to 100k, the Compression Percent Bytes Saved would be 75%.

Note that only compressible traffic is considered in these calculations.
Class Compression Bytes Transferred Graph

The Class Compression Bytes Transferred graph shows the total number of bytes recorded for the class, with and without compression.

- The *Tunneled Postcompression Bytes* line shows the number of bytes that were compressed for the class.
- The *Tunneled Precompression Bytes* line represents the number of bytes that would have been recorded for the class if compression wasn’t enabled.
- The *Bytes Saved* line shows the number of bytes that didn’t have to traverse the link, due to compression; it’s the difference between tunneled precompression and postcompression bytes.

The graph includes compressible (tunneled) traffic only. If you want the graph to include all traffic (compressible and non-compressible), select the *Include Non-compressible Traffic in Compression Graphs* checkbox when creating the graph. This graph has an additional line:

- The *Non-compressible Bytes* line shows the number of bytes that PacketWise did not attempt to compress, either because they didn’t belong to a compressible service or because they weren’t compressible.
Partition Compression Average Rates Graph

The Partition Compression Average Rates graph compares average bandwidth usage for the partition, with and without compression. The Postcompression line represents average usage with compression enabled and the Precompression line represents what average usage would have been without compression.

Options

The graph includes compressible (tunneled) traffic only. If you want the graph to include all traffic (compressible and non-compressible), select the Include Non-compressible Traffic in Compression Graphs checkbox when creating the graph.

If you select the Include Link and Partition Sizes in Rate Graphs checkbox when creating the graph, horizontal lines appear to indicate the partition’s minimum (Partition Size) and burstable (Partition Burst Limit) size limits.

Partition Compression Percent Bytes Saved Graph

The Partition Compression Percent Bytes Saved graph shows the percentage of bytes saved for the partition, due to compression. The Compression Percent Bytes Saved value is calculated by subtracting precompression bytes (the size without any compression) and postcompression bytes (the size after compression) and dividing this difference by precompression bytes. For example, if a partition’s traffic is 200k without compression and is compressed to 100k, the Compression Percent Bytes Saved would be 50%.

Note that only compressible traffic is considered in these calculations.
Partition Compression Bytes Transferred Graph

The Partition Compression Bytes Transferred graph shows the total number of bytes recorded for the partition, with and without compression.

- The *Tunneled Postcompression Bytes* line shows the number of bytes that were compressed for the partition.
- The *Tunneled Precompression Bytes* line represents the number of bytes that would have been recorded for the partition if compression wasn’t enabled.
- The *Bytes Saved* line shows the number of bytes that didn’t have to traverse the link, due to compression; it’s the difference between tunneled precompression and postcompression bytes.

The graph includes compressible (tunneled) traffic only. If you want the graph to include all traffic (compressible and non-compressible), select the *Include Non-compressible Traffic in Compression Graphs* checkbox when creating the graph. This graph has an additional line:

- The *Non-compressible Bytes* line shows the number of bytes that PacketWise did not attempt to compress, either because they didn’t belong to a compressible service or because they weren’t compressible.
Link Compression Average Rates Graph

The Link Compression Average Rates graph compares average bandwidth usage on the link, with and without compression. The Postcompression line represents average usage with compression enabled and the Precompression line represents what average usage would have been without compression.

Options

The graph includes compressible (tunneled) traffic only. If you want the graph to include all traffic (compressible and non-compressible), select the Include Non-compressible Traffic in Compression Graphs checkbox when creating the graph.

If you select the Include Link and Partition Sizes in Rate Graphs checkbox when creating the graph, a horizontal line appears to indicate the link size.

Link Compression Peak Rates Graph

The Link Compression Peak Rates graph compares peak bandwidth usage on the link, with and without compression. The Postcompression line represents peak usage with compression enabled and the Precompression line represents what peak usage would have been without compression.

Options

The graph includes compressible (tunneled) traffic only. If you want the graph to include all traffic (compressible and non-compressible), select the Include Non-compressible Traffic in Compression Graphs checkbox when creating the graph.

If you select the Include Link and Partition Sizes in Rate Graphs checkbox when creating the graph, a horizontal line appears to indicate the link size.
**Link Compression Percent Bytes Saved Graph**

The Link Compression Percent Bytes Saved graph shows the percentage of bytes saved on the link, due to compression. The Link Compression Percent Bytes Saved value is calculated by subtracting precompression bytes (the size without any compression) and postcompression bytes (the size after compression) and dividing this difference by precompression bytes. For example, if a link’s traffic would have been 700k without compression and is 300k after being compressed, the Compression Percent Bytes Saved would be approximately 57%.

Note that only compressible traffic is considered in these calculations.

**Link Compression Bytes Transferred Graph**

The Link Compression Bytes Transferred graph shows the total number of bytes recorded on the link, with and without compression.

- The **Tunneled Postcompression Bytes** line shows the number of bytes that were compressed on the link.
- The **Tunneled Precompression Bytes** line represents the number of bytes that would have passed through the link if compression wasn’t enabled.
- The **Bytes Saved** line shows the number of bytes that didn’t have to traverse the link, due to compression; it’s the difference between precompression and postcompression bytes.

The graph includes compressible (tunneled) traffic only. If you want the graph to include all traffic (compressible and non-compressible), select the **Include Non-compressible Traffic in Compression Graphs** checkbox when creating the graph. This graph has an additional line:
• The Non-compressible Bytes line shows the number of bytes that PacketWise did not attempt to compress, either because they didn’t belong to a compressible service or because they weren’t compressible.