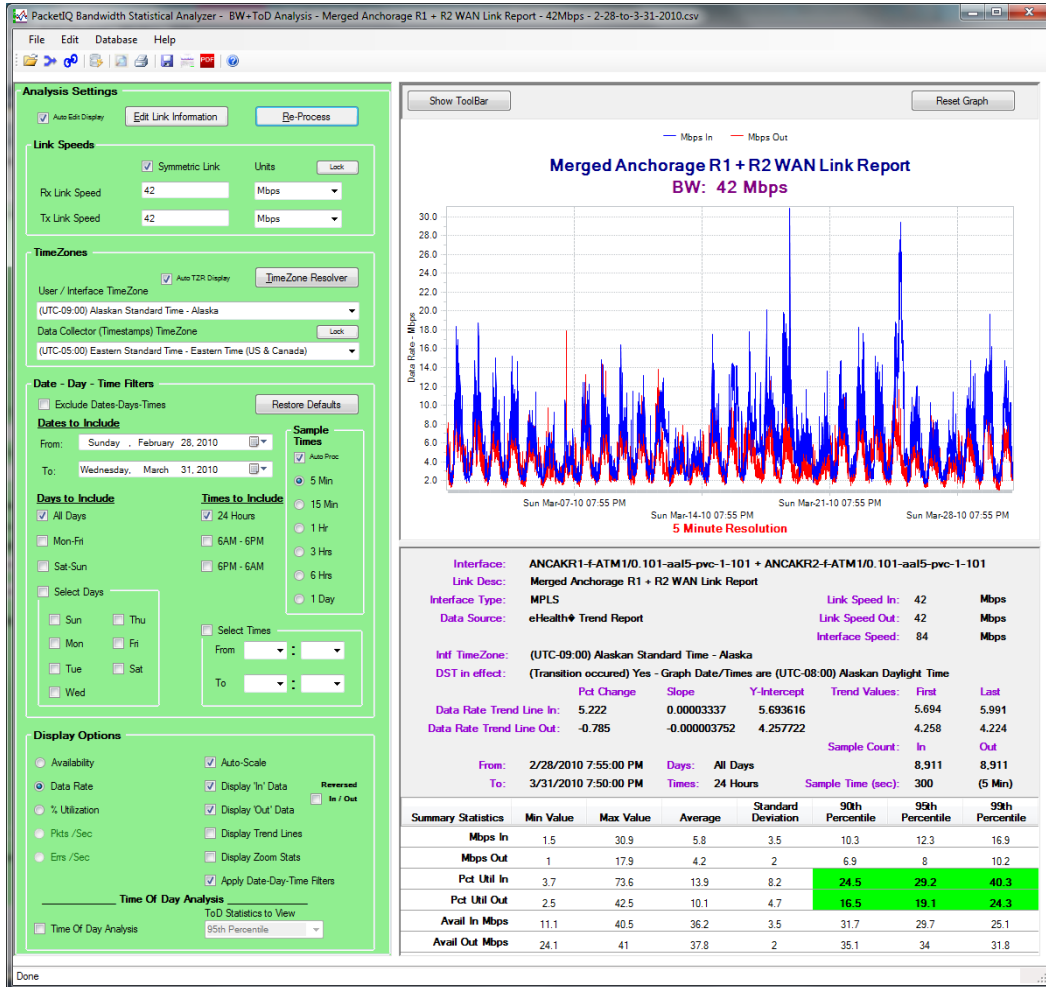PacketIQ

Intelligent Network & Application Performance Management

Bandwidth Statistical Analyzer Overview

v2.x

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Introduction to Advanced Bandwidth Analysis

The PacketIQ Bandwidth Statistical Analyzer is designed to provide statistically derived values of network bandwidth usage on Local and Wide Area Network (LAN/WAN) links to support an enhanced and much more accurate level of network capacity and performance management reporting activities.
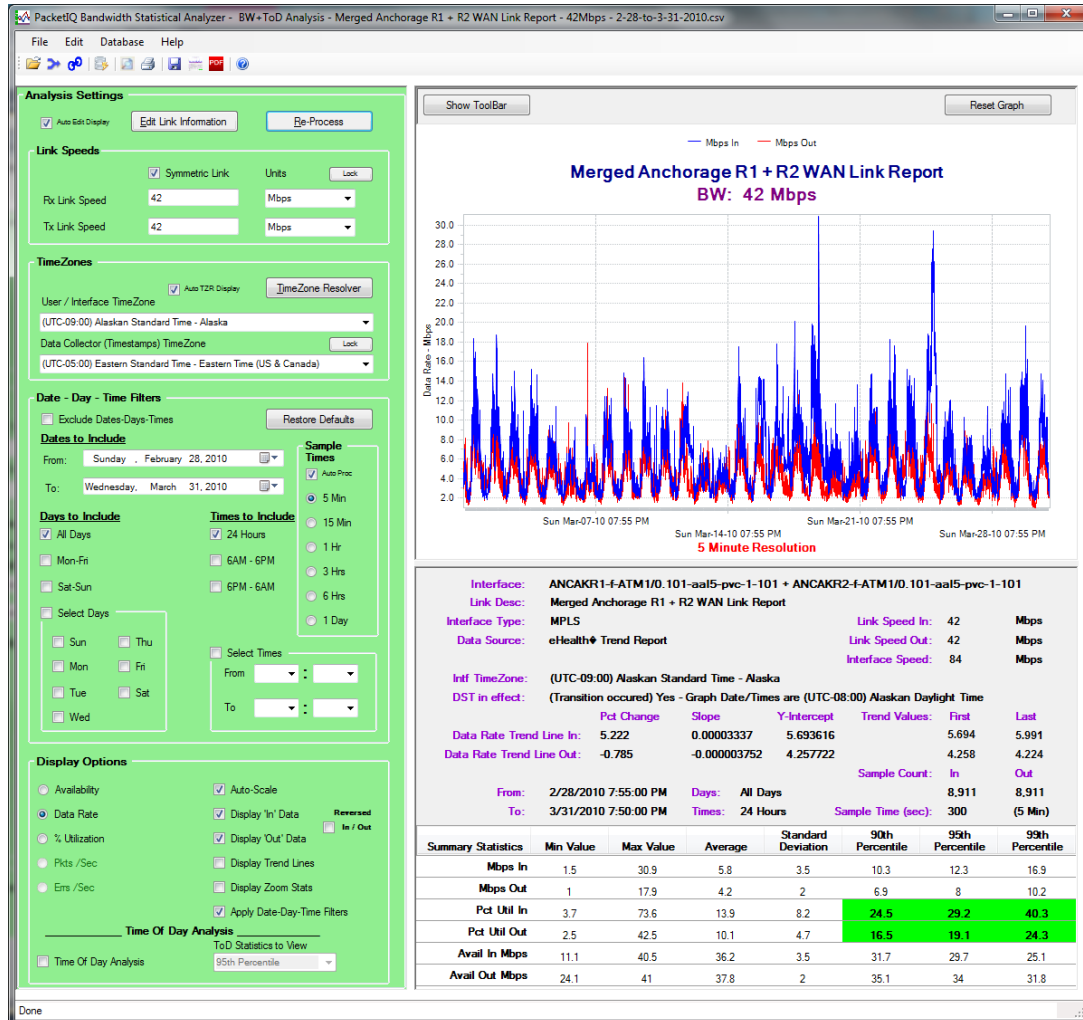
PacketIQ Bandwidth Statistical Analyzer User Interface

The Bandwidth Statistical Analyzer imports and processes bandwidth utilization data from Comma Separated Value (.csv) formatted files which have been exported from a wide variety of commonly used enterprise network management systems.

After importing the bandwidth data, link speeds and time zones can be corrected and filters applied based on specific dates, days of the week, and times of day; the resultant data can be viewed in a variety of formats, including the exclusive **Time of Day Analysis™** view, which provides a 24 hour display of nominal usage levels statistically derived from a multiple day data set.

A zoom-able graph, trend values for capacity planning projections, and a series of standard and statistical values are provided; reports can be printed or saved as an image or PDF file. The result is an unprecedented level of advanced bandwidth analysis capabilities that *allows organizations to accurately measure business day and evening usage levels, confidently schedule data replications, and right-size their network links for optimal performance and cost control*.

Bandwidth Statistical Analyzer Features

The PacketIQ Bandwidth Statistical Analyzer was designed to offer advanced data manipulation, visibility, and statistical analysis not available from standard platforms and tools.

The significant features of the PacketIQ Bandwidth Statistical Analyzer include:

> **DATA IMPORT**
- Bandwidth sample data from one or more switch or router interfaces (time stamped entries of Bits per Second, Bytes, or Percent Utilization In/Out values) can be imported from Comma Separated Value (.csv) formatted files which have been exported from a wide variety of common enterprise network management systems, including:

  - ✓ AT&T® Detailed Network Usage Reports
  - ✓ Cacti
  - ✓ eHealth® Release 6.0 Trend and At-A-Glance Reports
  - ✓ NetQoS® NetVoyant® version 6.1
  - ✓ NetQoS® ReporterAnalyzer™ versions 7.4 & 8.3
  - ✓ PacketIQ Bandwidth Analysis Report v2.0
  - ✓ Sprint™ Compass Performance Reports
  - ✓ Statseeker® versions 2.8.3 & 3.3.4

  As well as:

  - ✓ Directly from a SolarWinds® Orion® Network Performance Monitor v9.5 & 10.5 Database (via SQL queries)

  - ✓ Wireshark® IO Graph Data (specific formats) for advanced analysis of data rates from packet captures

  Note: The product names listed above are trademarks of their respective companies.

- The **Merge** feature allows bandwidth sample data files from two or more switch/router interfaces to be imported and merged in various ways:
  - o Multiple bandwidth data files from the same interface for various time periods can be merged to provide contiguous reports on the same link over multiple weeks/months.

  - o Bandwidth data files from two or more interfaces can be merged based on their timestamps (providing the highest accuracy) to determine the aggregate loading. This is particularly useful for determining the loading effects of a failed link on the remaining link(s) in a load-sharing redundant link configuration.

- A **Multi-Link Analysis** feature allows combining bandwidth data from of a series of sequential WAN links (hops) in the path between a data center and a user location; this data is time-zone corrected and timestamp correlated for each link's bandwidth usage data. The resultant analysis is presented as the amount of bandwidth available to the end-user over the entire path, displayed as a single virtual WAN link.

> **DATA CONVERSION AND FILTERING**
- The timestamps for the imported data samples can be adjusted to compensate for differences in time-zones between where the WAN link terminates and the sample data collector location. This allows a display of bandwidth usage based on the local times at any geographical location in the world, regardless of where the collector is.

- The processed sample data can also be filtered by Date, Day of Week, and Times to only include or exclude specific ranges of data. For example, data can be viewed and statistically processed for just Monday thru Friday, 6 AM thru 6 PM, which would reflect typical workday loading.

- WAN link speeds can be set to allow correcting for and displaying accurate Percent Utilization values. This alleviates issues in which, for example, utilization on a 6 Mbps WAN link is measured from a 100 Mbps router interface that is connected to the WAN vendor's terminating router via an Ethernet interface.

- Supports symmetric and non-symmetric (different Transmit vs Receive) link speeds.

- Link speed data is displayed in selectable standard units – bps, Kbps, Mbps, Gbps, etc. (conversions are possible).

- Detection and native support for 5 Min, 15 Min, 1 Hr, 3 Hr, 6 Hr, and 1 Day sample time data, and the ability to adjust the sample time settings to simulate longer sample time periods. This is useful for demonstrating loss of resolution and statistical data accuracy with longer sample times. Other sample times can be processed as well.

STATISTICAL ANALYSIS

- Statistical values are presented for the data set after time-zone and filtering options are applied, including Minimum, Maximum, Average, Standard Deviation, 90th Percentile, 95th Percentile, and 99th Percentile.

- A Time of Day Analysis™ feature presents bandwidth usage over a 24 hour day (or a filtered range) based on statistically derived values from a multi-day data set. This enables a quick and accurate summarization of nominal utilization levels during a typical day, as opposed to trying to estimate these levels from visually inspecting graph patterns over multiple days.

- Trending values from a Least Squares analysis of the sample data are provided, including Percent Change, Slope, Y-Intercept, and the First/Last Trend values for the sample data period. These values can be applied to forward projections of usage levels.

DATA DISPLAY

- The bandwidth data is displayed on a graph as (user selectable) Percent Utilization, Data Rate, or 'Availability', which is how much bandwidth is available – the reciprocal of usage.

- User-editable information about the link – interface, description, link speeds, etc. – is displayed and included in reports.

- An Auto-Scale function causes the graph to display the highest data value near the top of the graph, adjusting the graph scale accordingly; this offers increased resolution in some conditions. Turning this feature off sets the top of the graph and its scale to the specified link speed rate.

- The 'In' and 'Out' data can be turned off for selective viewing of usage patterns, trend lines, and statistics by un-checking the appropriate checkbox.

- Trend Lines can be displayed over bandwidth usage data in the graph by checking the 'Display Trend Lines' checkbox.

- A Display Zoom Stats checkbox, when enabled and a subset of the graph data is selected (using the 'Zoom' feature), will calculate and display statistical values on just the selected data.

- An Apply Date-Day-Time Filters checkbox allows enabling/disabling of selected display filtering options for quick and easy comparison.

- A 'Reverse In/Out' feature reverses In-Coming and Out-Going data series to view and save bandwidth data from major data center links from the end-user perspective.

ANALYSIS DATA & REPORT SAVE & PRINT

- After bandwidth data has been imported/merged, time-zone and link speed adjusted, filtered, and reviewed, statistical summary data and the original or analysis-altered sample data can be saved to a new Excel®-friendly .csv file. All the analysis settings are preserved, which allows for a quick re- import/review of previously processed data without having to edit the user & display options.

- A screen-shot copy of the graph / information / statistical data can be printed, saved as an image, or saved as a PDF report.

Merge Overview

In cases where a site has two or more redundant WAN links configured in a load-sharing arrangement it is important to ensure that if one of the links fails the other can carry the combined network load without saturating the link and adversely affecting network services.

The Bandwidth Statistical Analyzer's Merge capability makes it possible to accurately combine and determine the total bandwidth usage from multiple links **on a timestamp-by-timestamp basis**, resulting in an accurate assessment of what the true loading would have been over time if one link were to fail. This allows a much more accurate failure-mode analysis than is possible by simply combining percentile or other usage summary values.
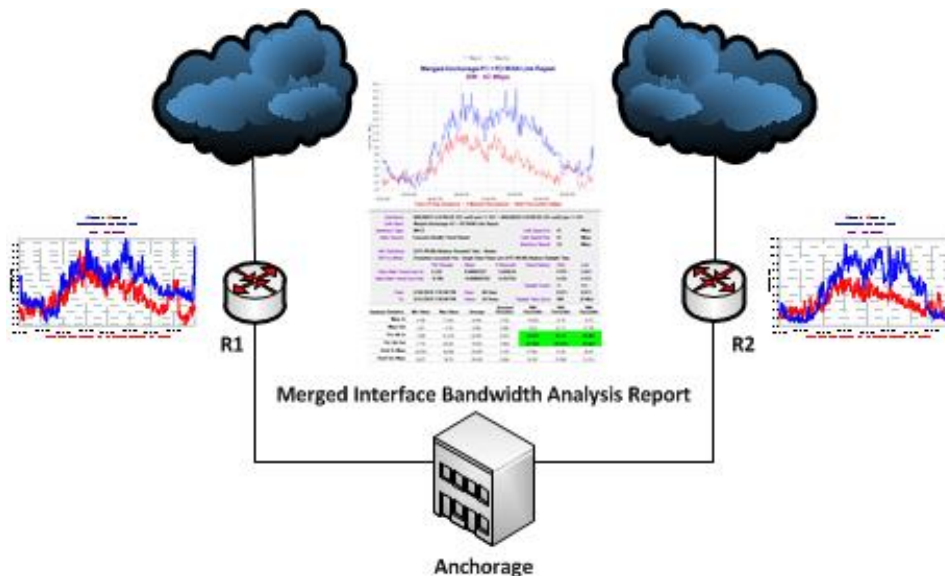
Merging Two WAN Links into One Bandwidth Report

The Merge capability is also useful for determining the effects of combining network loads from multiple WAN links that are not in a load-sharing configuration so that redundant and therefore unnecessary links can be eliminated to realize a cost savings, or for accurately projecting new load levels from re-homing traffic for data center migrations, a merger between companies, or similar consolidation efforts.

Multi-Link Analysis Overview

In larger Enterprise environments, the network traffic flowing between a specific user group and their application servers in a remote data center may traverse multiple WAN links – and multiple time zones. Each regional/global WAN link in the path is likely providing services to other remote locations, with loading patterns unique to their user communities and time zones.

If one or more of the links in the path experiences excessive utilization over certain time periods (which may not be in the same time zone as the target user group), the effects of that high utilization on available bandwidth to the remote users – the time of day, and the extent that the intermediate link loading affects business day operations – may not be apparent or easily determined.
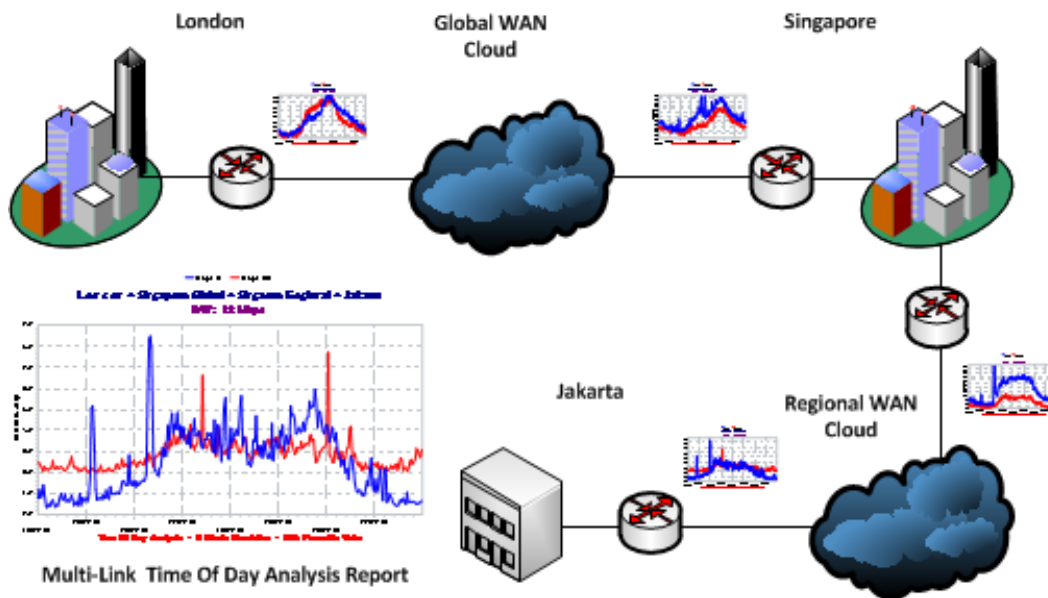
Combining Multiple WAN Link Reports into a Multi-Link Analysis Report

The Bandwidth Statistical Analyzer's Multi-Link Analysis capability makes it possible to accurately determine the effective available bandwidth across multiple links between a data center and a remote user group – specific to that user group's local time zone. Sample data for each link in the path is combined using the Multi-Link Group feature, and timestamps for each sample data set are correlated automatically to reflect the time zone of the target user group.

A 'virtual' Bandwidth Report is generated that reflects the smallest link size in the series of links and how much bandwidth is used/available for that virtual link. Coupled with the Time of Day Analysis™ feature, it is easy to visualize how much bandwidth is available to the remote user group over a 24 hour day, and provide statistical values to support performance and capacity planning efforts.

Time of Day Analysis™

Enabling the **Time of Day Analysis** feature provides a graphical view and statistics of bandwidth usage over a 24-hour period statistically derived (90th, 95th, or 99th Percentiles) from all of the values in a multi-day sample data set. This is the most accurate method of analyzing business day traffic patterns and levels – especially compared with trying to determine daily usage patterns by studying the daily spikes in typical graphs. This is an exclusive feature of the PacketIQ Bandwidth Statistical Analyzer not available *anywhere* else.

The Time of Day Analysis feature is very useful for accurately determining true business day usage levels for performance analysis and capacity planning / management, and/or confidently scheduling data replications / backups for off-peak hours and making sure existing backups aren't and won't run into business day periods.

Interface:	ANCAK01R-f-ATM1/0.101-aal5-pvc-1-101 + ANCAK02R-f-ATM1/0.101-aal5-pvc-1-101						
Link Desc:	Anchorage R1 + R2 Merged WAN Links						
Interface Type:	MPLS			Link Speed In:	42	Mbps	
Data Source:	eHealth♦ Trend Report			Link Speed Out:	42	Mbps	
				Interface Speed:	84	Mbps	
Intf TimeZone:	(UTC-09:00) Alaskan Standard Time - Alaska						
DST in effect:	(Transition occured) Yes - Graph Date/Times are (UTC-08:00) Alaskan Daylight Time						

	Pct Change	Slope	Y-Intercept	Trend Values:	First	Last
Data Rate Trend Line In:	5.222	0.00003337	5.693616		5.694	5.991
Data Rate Trend Line Out:	-0.785	-0.000003752	4.257722		4.258	4.224
				Sample Count:	In	Out
From:	2/28/2010 7:55:00 PM	Days: All Days			8,911	8,911
To:	3/31/2010 7:50:00 PM	Times: 24 Hours	Sample Time (sec):	300	(5 Min)	

Summary Statistics	Min Value	Max Value	Average	Standard Deviation	90th Percentile	95th Percentile	99th Percentile
Mbps In	3.106	17.461	9.445	3.743	14.039	14.75	16.75
Mbps Out	3.24	11.03	6.562	2.084	9.633	10.111	10.788
Pct Util In	7.395	41.574	22.487	8.912	33.427	35.12	39.881
Pct Util Out	7.714	26.261	15.623	4.962	22.935	24.074	25.687
Avail In Mbps	24.539	38.894	32.555	3.743	27.961	27.25	25.25
Avail Out Mbps	30.97	38.76	35.438	2.084	32.367	31.889	31.212

Time of Day Analysis Report

About PacketIQ

PacketIQ Inc. provides advanced network and application performance analysis, modeling, troubleshooting, and capacity management services. PacketIQ Inc. has developed a suite of innovative applications and processes to enable delivery of superior analysis services, and markets these solutions to clients and consulting professionals.

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