



Spirent TestCenter

Results Framework

Disclaimers about Results Framework

- It seems to allow you to do things that aren't compatible
 - Such as setting the Global Results mode to Jitter and the Analyzer Histogram mode to Inter-arrival time
 - Therefore, follow the suggestions in this presentation
 - Note that release 4.20 included Histogram Cross Checking to help eliviate this problem
- Certain things should disappear depending on the settings but they don't
 - For example, since Advanced Sequencing is not available in Histogram mode, then that tab should not show up in affected results views
- There are too many “Basics”
 - And they mean different things depending on what you are looking at
 - Such as Basic Results Mode, Basic Sequence Tracking, and the Basic Counters Tab in various results views
- With that said, Spirent TestCenter has the most comprehensive and advanced Results Framework around!

Results Framework Topic Overview

- Result Categories
- Real-time Results
- Database Results
- End-of-test Results
- Additional Control Plane Results
- Types of Results
- Global Results Modes
- Analyzer Histogram Modes
- Histogram Settings
- How Latency is Measured

Result Categories

- Spirent TestCenter's four result categories:
 1. **Real-time results**
 - Results that are “subscribed” to and then streamed during a test
 - They are viewed using the Results Browser window in the application
 2. **Database results**
 - The “saved” results are stored in a database formatted file (SQLite .db)
 - They are viewed using the Results Reporter application
 3. **Refreshed results**
 - Those that don't update in real time
 4. **Additional Control Plane results**
 - Such as ARP “View Resolved MAC Addresses” or DHCP/PPP “Session Info”
 - These need to be specifically requested are not present in any of the real-time Results Browser views or Database results

Real-time Results

- Results are subscribed to and then updated at 1 second intervals
- To subscribe, simply open a new Results View
- Once subscribed, results continue to be updated even though you are not looking at them at the time
- Could cause it to generate a lot of management traffic if too many are open
- Select Enable Views to unsubscribe to results in the GUI

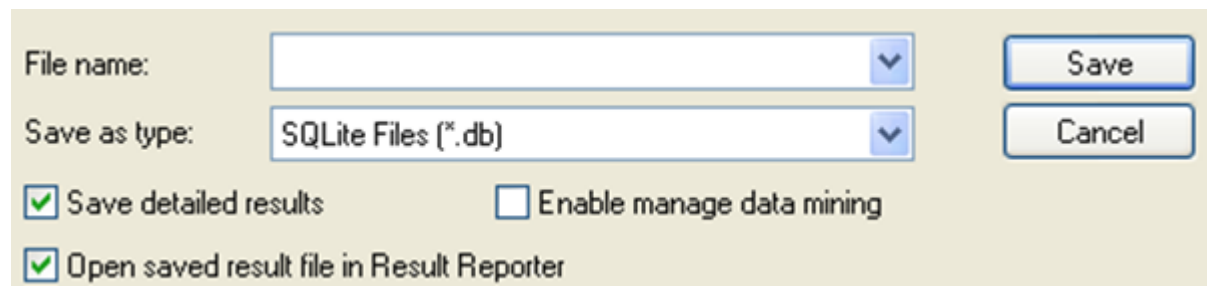
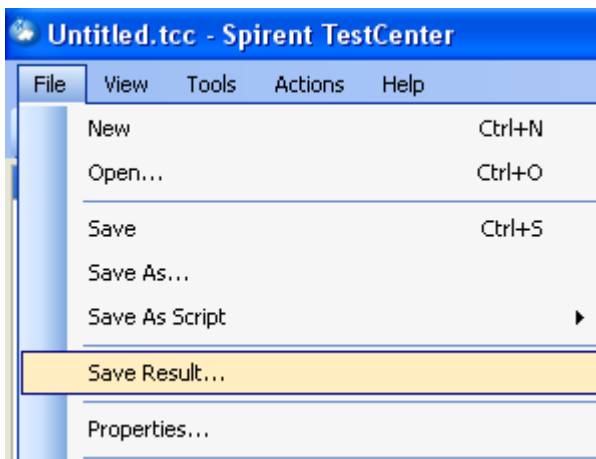
The screenshot displays the SPIRENT GUI interface. On the left, the 'Port Traffic and Counters' section shows a table with columns for Port Name, Total Tx Count (Frames), and Total Rx Count (Frames). The data for Port 1 shows 19,283,564 Tx and 19,283,592 Rx frames, while Port 2 shows 0 Tx and 2,019 Rx frames. A context menu is open over this table, listing options such as 'Create Dynamic/Query View...', 'Create Table View...', 'Create Chart View...', 'Customize View...', 'Clone View...', 'Reset View', 'Save View As Xml File', 'Enable Views...', 'Select View', and 'Select Recent View'. The 'Select View' option is highlighted, and a sub-menu is visible showing 'Port Traffic and Counters', 'Streams', and 'Routing and MPLS'. The 'Streams' option is selected, and another sub-menu is open showing various stream result views: 'Traffic Group Results', 'Filtered Stream Results', 'Interesting Stream Results', 'Stream Threshold Results', 'Detailed Stream Results' (highlighted in red), and 'Stream Block Results'. A red text overlay at the bottom of the 'Detailed Stream Results' sub-menu reads 'Subscribed results are in italics'. The right side of the GUI shows the 'Streams > Detailed Stream Results' section with filters for Tx and Rx ports and a table with columns for Stream ID, Tx Port Name, Rx Port Names, Aggregated Rx Port Count, and Tx Count (Frames). The first row in this table is italicized, indicating it is a subscribed result.

Port Name	Total Tx Count (Frames)	Total Rx Count (Frames)
Port 1	19,283,564	19,283,592
Port 2	0	2,019

Stream ID	Tx Port Name	Rx Port Names	Aggregated Rx Port Count	Tx Count (Frames)
<i>StreamBloc...</i>	Port 1	Port 1	1	<i>19,283,566</i>

Saving Results (i.e., Database Results)

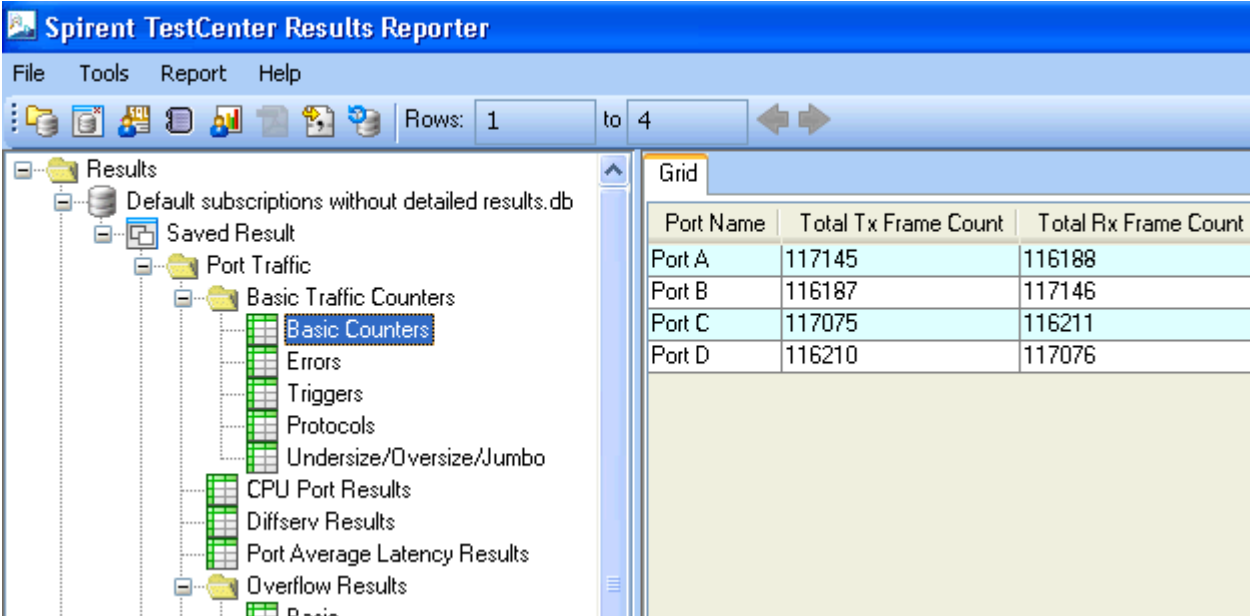
- Creates an SQLite database (.db) file with the most recent results
- You can save with or without “detailed” results (default is without).
- The resulting database file includes configuration information in addition to result information
- You can also choose to have the database opened automatically in the **Results Reporter**



Recommended settings for most cases depicted above

Viewing Database Results

- Any SQL tool can open and browse the database file
- Spirent TestCenter's Results Reporter application was designed to open, view, and format these files
- The Results Reporter can also be used to save portions of the database in CSV, HTML, XLS, or PDF format

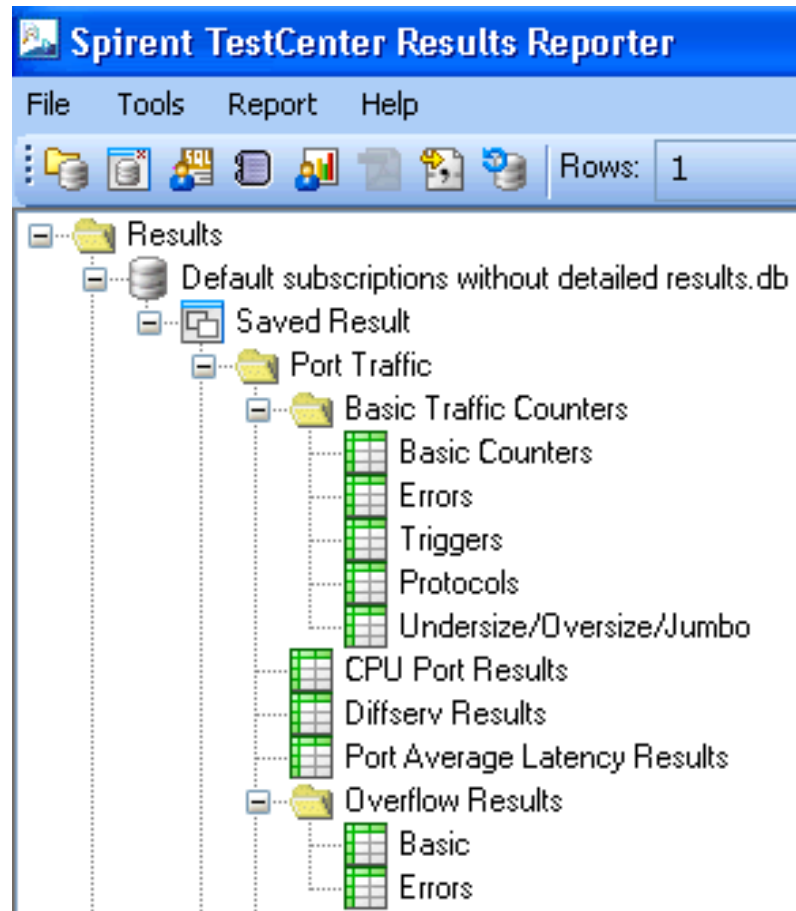


The screenshot shows the Spirent TestCenter Results Reporter application interface. The title bar reads "Spirent TestCenter Results Reporter". The menu bar includes "File", "Tools", "Report", and "Help". Below the menu bar is a toolbar with various icons and a "Rows: 1 to 4" indicator. The main window is divided into two panes. The left pane shows a tree view of the database structure under "Results". The tree view includes "Default subscriptions without detailed results.db", "Saved Result", "Port Traffic", "Basic Traffic Counters", "Basic Counters", "Errors", "Triggers", "Protocols", "Undersize/Oversize/Jumbo", "CPU Port Results", "Diffserv Results", "Port Average Latency Results", "Overflow Results", and "Basic". The right pane displays a data grid with the following data:

Port Name	Total Tx Frame Count	Total Rx Frame Count
Port A	117145	116188
Port B	116187	117146
Port C	117075	116211
Port D	116210	117076

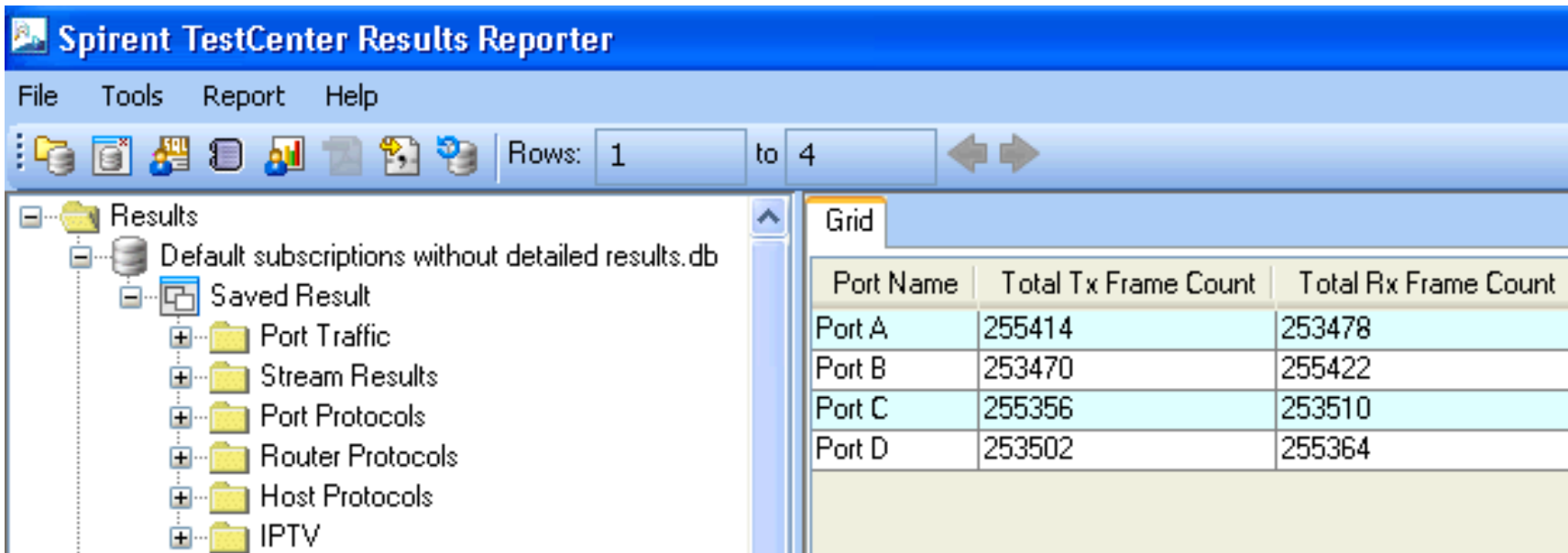
Save Results without Detailed Test Results

- Saves only the Counters pictured even though the hardware has all of the detailed counters



Save Results with Detailed Test Results

- Saves all counters and results views regardless of whether they were subscribed to or not
- The hardware is always “counting” all available statistics regardless of whether they were subscribed to or not
- Also saves the Stream-based results



The screenshot displays the Spirent TestCenter Results Reporter application. The interface includes a menu bar (File, Tools, Report, Help) and a toolbar with various icons. A status bar indicates "Rows: 1 to 4". The main area is divided into a tree view on the left and a data grid on the right.

Tree View:

- Results
 - Default subscriptions without detailed results.db
 - Saved Result
 - Port Traffic
 - Stream Results
 - Port Protocols
 - Router Protocols
 - Host Protocols
 - IPTV

Data Grid:

Port Name	Total Tx Frame Count	Total Rx Frame Count
Port A	255414	253478
Port B	253470	255422
Port C	255356	253510
Port D	253502	255364

Refreshed Results

- Some results, such as Stream Block results, need to be Refreshed to get their most recent results (i.e., they don't update automatically, therefore, they are not subscribed)
- The reason is some statistic groups need to perform additional calculation to be displayed and so they are not updated in real-time

The screenshot shows the 'Results Browser' window in Spirent TestCenter. The main view is 'Stream Results > Stream Block Results'. The toolbar includes a 'Refresh' button (a green circular arrow icon) which is highlighted by a mouse cursor. Below the toolbar are tabs for 'Basic Counters', 'Errors', 'Basic Sequencing', 'Advanced Sequencing', and 'Histograms'. The 'Basic Counters' tab is active, displaying a table with the following data:

Tx Port Name	Rx Port Names	Stream Block	Tx Frame Count	Rx Frame Count	Tx Octet Count
Port A	Port B	StreamBlo...	255,411	255,411	32,692,608
					32,443,776
					32,685,184
					32,447,872

Overlaid on the bottom left is a 'Spirent TestCenter' dialog box with an information icon and the text: 'Port Average Latency Results view does not update in real time. Click on the Refresh button in view toolbar to retrieve results.' An 'OK' button is at the bottom of the dialog.

Refreshed Results continued

- They apply to Port Pair, Stream Block, Interesting Streams, Port Average Latency Results, Dynamic Result Views, more
- Configured using the Timed Refresh Settings option

The screenshot displays the 'Test Configuration' window in Spirent TestCenter. The left sidebar shows a tree view of the test configuration, with 'Settings' under 'Port 2' highlighted. The main panel shows the 'L2L3 ResultOptions' tab, which is also highlighted. The 'Timed Refresh Settings' section is highlighted, showing the 'Manual' radio button selected and the 'Interval (sec)' set to 10. The 'Clear Result Settings' section is also visible, with four unchecked options.

Additional Control Plane Results

- Some statistics need to be specifically requested (i.e., right-click on an object)
- Those include such things as ARP Resolved MAC Addresses, DHCP/PPP Session Info, or MPLS Label Bindings

The screenshot shows the Spirent TestCenter interface. On the left is a tree view under 'Spirent TestCenter' containing 'Project', 'All Ports', 'All Hosts', 'All Stream Blocks', 'All Traffic Generators', 'All Traffic Analyzers', 'Ports' (with sub-items Port A, B, C, D), and 'Settings'. The main area displays a table of Stream Blocks with columns: Active, Name, Index, Controlled By, Source, and Destination. A context menu is open over the table, listing actions like 'Add Bound Stream Block(s)...', 'Delete', 'Cut', 'Copy', 'Paste', 'Duplicate...', 'ARP/ND', 'L2Learning', 'Edit...', 'Start', and 'Stop'. The 'View Resolved MAC Addresses' option is highlighted with a red box.

Active	Name	Index	Controlled By	Source	Destination
<input checked="" type="checkbox"/>	StreamBlock 1	0	generator	Host 1 (192.168.11.2/24)	Host 2 (192.168.12.2/24)
<input checked="" type="checkbox"/>	StreamBlock 2	2		Host 1 (192.168.11.2/24)	Host 1 (192.168.11.2/24)
<input checked="" type="checkbox"/>	StreamBlock 3	3		Host 3 (192.168.13.2/24)	Host 4 (192.168.14.2/24)
<input checked="" type="checkbox"/>	StreamBlock 4	4		Host 4 (192.168.14.2/24)	Host 3 (192.168.13.2/24)

Control Plane Results continued

- In relation to ARP, will show the actual resolved MAC addresses
- Also shows the Failed ARP Items

Global Arp Cache				
ARP Cache		Failed ARP Items		
Port	Stream\Router\Host	Source IP Address	Gateway IP Address	Resolved MAC Address
Port A	StreamBlock 1 :0	192.168.11.2	192.168.11.1	00:04:96:21:00:00
Port B	StreamBlock 2 :0	192.168.12.2	192.168.12.1	00:04:96:21:00:00
Port C	StreamBlock 3 :0	192.168.13.2	192.168.13.1	00:04:96:21:00:00
Port D	StreamBlock 4 :0	192.168.14.2	192.168.14.1	00:04:96:21:00:00

Types of Result Statistics

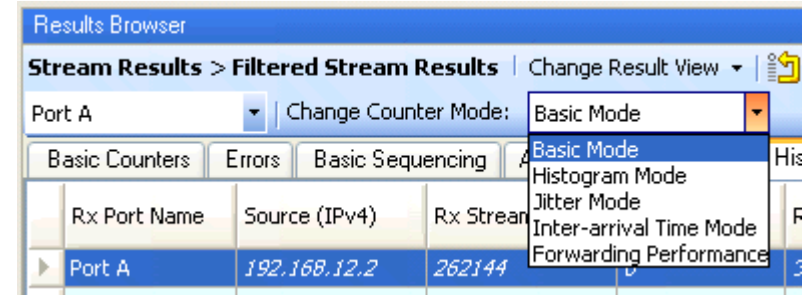
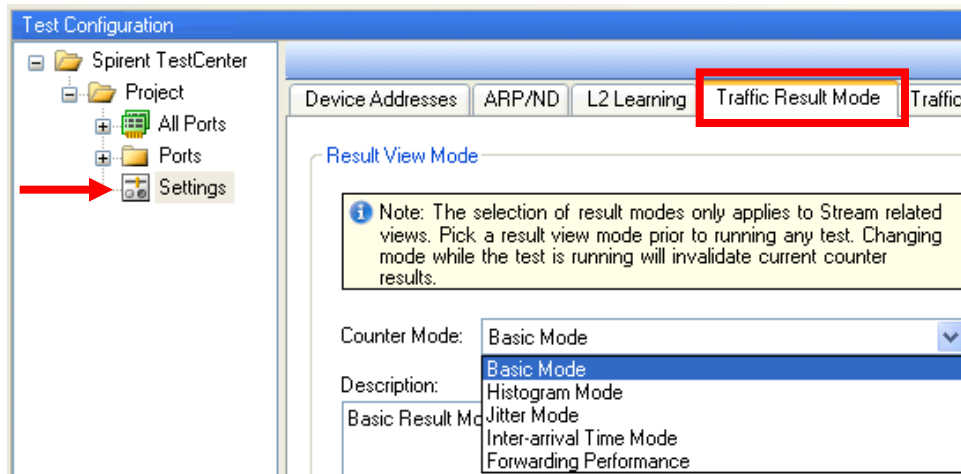
- The Spirent TestCenter platform provides an extensive set of result statistics
 - Port, Stream, and Protocol rates and counts
 - Time-based results such as Latency and Jitter
- However, not all of these statistics are available during a test
 - The different selections available are called **Result Modes** and the desired Result Mode must be selected before you start the test
 - Also, there is a trade off between **Histograms** (i.e., the buckets) and **Advanced Sequencing** both of which use the same memory.

Result Statistics continued

- There are 6 Global Results Modes:
 - Basic
 - Histogram
 - Jitter
 - Inter-arrival Time
 - Forwarding
 - Latency+Jitter
- The Result Mode selected will affect the following Result views:
 - Port Average Latency
 - Filtered Stream Results
 - Detailed Stream Results
 - Stream Block Results
 - Port Pair Results
 - Traffic Group Results

Selecting Results Modes

- The GUI refers to these result modes as either Counter Modes or Traffic Result Modes
- The result modes can be configured in the GUI either from:
 - The **Test Configuration's Settings** node
 - or with the **Results Browser's Change Counter Mode** drop-down (only appears in affected result views)



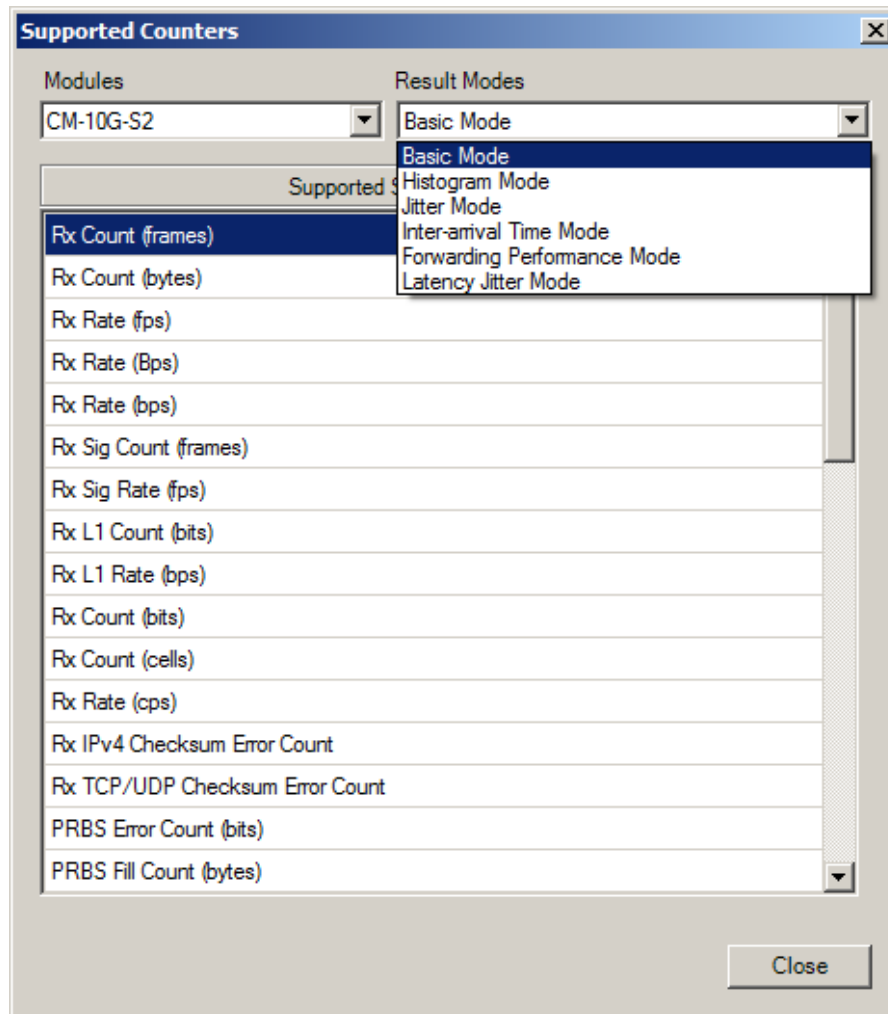
Results Mode's Supported Counters

- Depending on the Module Type and Results Mode selected, certain Statistics may or may not be supported
- Select the Supported Counters... Button to see

The screenshot displays the 'Test Configuration' window. On the left is a tree view of the test setup, including 'Spirent TestCenter', 'All Devices (Hosts, Routers, ...)', 'All Stream Blocks', 'All Traffic Generators', 'All Traffic Analyzers', 'All Ports', and two 'PortConfig' entries. The right pane shows configuration tabs: 'Device Addresses', 'ARP/ND', 'L2 Learning', 'PHY Options', 'Traffic Result Mode' (selected), and 'L2L3 Resu'. Below the tabs, a 'Result View Mode' section contains a note: 'Note: The selection of result modes only applies to Stream related views. You must select a result view mode prior to running a test. Changing this mode while a test is running invalidates the current counter results.' Below the note are two dropdown menus: 'Counter Mode' set to 'Basic Mode' and 'Jitter Mode' set to 'RFC 3393 Absolute Value'. A 'Description:' field contains the text 'Basic traffic counters.' Below this is a checkbox labeled 'Save Only Counters For Result View Mode' with a note: 'Select this checkbox to save only the counters that you specify in Change Counter Mode in the Detailed Streams result view.' The 'Supported Counters...' button is highlighted with a red rectangle. Below it, a list of 'Supported Result Views' is shown: 'Port Average Latency', 'Filtered Stream Results', 'Interesting Stream Results', 'Detailed Stream Results', 'Port Pair Results (Rates are not applicable)', 'Traffic Group Results', and 'Stream Block Results (All Rates and Expected Sequence Number are not available)'.

Supported Counters Continued

- Select the Module Type and then the Result Mode



Results Modes Supported Result Views

- Depending on the Results Mode selected, certain Result Views may or may not be **affected**
- For example, Detailed Stream Results are affected by all Results Modes but Port Counter Results are not even affected

The screenshot displays the 'Test Configuration' window. On the left is a tree view of the test center hierarchy, including 'Spirent TestCenter', 'All Devices (Hosts, Routers, ...)', 'All Stream Blocks', 'All Traffic Generators', 'All Traffic Analyzers', 'All Ports', and two 'PortConfig' entries. The right pane shows the 'Traffic Result Mode' configuration. It includes a note: 'Note: The selection of result modes only applies to Stream related views. You must select a result view mode prior to running a test. Changing this mode while a test is running invalidates the current counter results.' Below the note are dropdown menus for 'Counter Mode' (set to 'Basic Mode') and 'Jitter Mode' (set to 'RFC 3393 Absolute Value'). A 'Description' field contains 'Basic traffic counters.' There is an unchecked checkbox for 'Save Only Counters For Result View Mode' with a sub-note: 'Select this checkbox to save only the counters that you specify in Change Counter Mode in the Detailed Streams result view.' A 'Supported Counters...' button is present. A red box highlights the 'Supported Result Views:' section, which lists: 'Port Average Latency', 'Filtered Stream Results', 'Interesting Stream Results', 'Detailed Stream Results', 'Port Pair Results (Rates are not applicable)', 'Traffic Group Results', and 'Stream Block Results (All Rates and Expected Sequence Number are not available)'.

Project versus Port Results Settings

- From the **Project > Settings** you can change the “global” Counter Mode (also from affected Results Browser windows as previously discussed)
- From the individual **Ports > Traffic Analyzer** you can change their Histogram Mode and values

The image displays two screenshots of the Spirent TestCenter software interface. The top screenshot shows the 'Test Configuration' window with the 'Traffic Result Mode' tab selected. A note states: 'Note: The selection of result modes only applies to Stream related views. Pick a result view mode prior to running any test. Changing mode while the test is running will invalidate current counter results.' The 'Counter Mode' is set to 'Forwarding Performance'. The bottom screenshot shows the 'Test Configuration' window with the 'Histograms' tab selected. The 'Histogram Mode' is set to 'Latency'. Under 'Bucket Size and Limit Configuration', the 'Predefined Mode' is 'Custom', 'Mode Size' is 0, and 'Uniform Bucket Size' is 0. A 'Reset' button is visible. Below the configuration is a table:

	Bucket Sizes	Limits	Description
1	2	2	x < 2

6 Global Results Modes

- There are 6 Counter Results Modes: Basic, Forwarding, Histogram, Jitter, and Inter-arrival, Latency+Jitter

The screenshot displays the Spirent TestCenter interface. The 'Test Configuration' window is open, showing a tree view on the left with folders like 'Spirent TestCenter', 'Project', 'All Ports', 'Ports', and 'Settings'. The 'Traffic Result Mode' tab is selected in the top right. A note states: 'Note: The selection of result modes only applies to Stream related views. Pick a result view mode prior to running any test. Changing mode while the test is running will invalidate current counter results.' The 'Counter Mode' dropdown is set to 'Basic Mode', and its list is expanded to show 'Basic Mode', 'Histogram Mode', 'Jitter Mode', 'Inter-arrival Time Mode', and 'Forwarding Performance'. Below this, 'Supported Counters' includes 'Rx Frame Count'. At the bottom, the 'Results Browser' shows 'Stream Results > Stream Block Results' with a 'Change Counter Mode' dropdown also set to 'Basic Mode'. A red arrow points from the dropdown menu in the Results Browser to the 'Change Counter Mode' dropdown in the Test Configuration window.

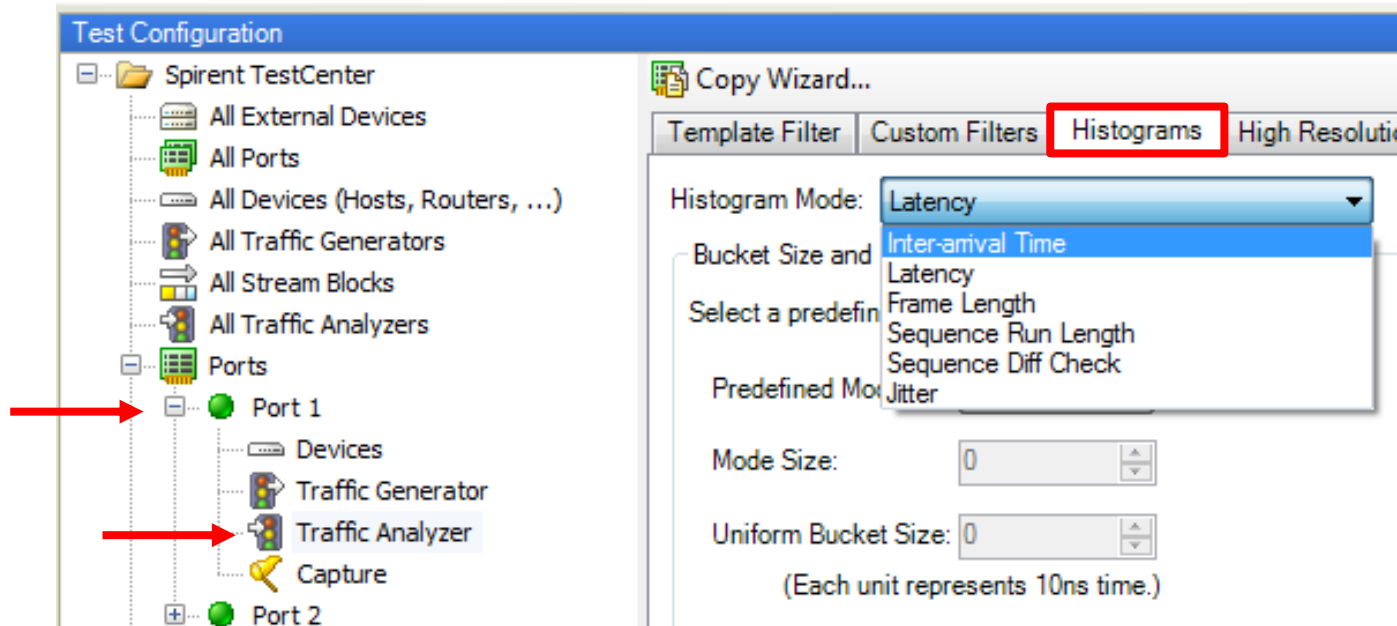
Tx Port Name	Rx Port Name	Tx Frame Count	Rx Frame Count
Port A	Port B	255,411	255,411

6 Global Results Modes continued

- There are 6 Counter Results Modes: Basic, Forwarding, Histogram, Jitter, Inter-arrival, Latency+Jitter
- Basic and Forwarding support **Advanced Sequence Tracking**
 - Which includes additional sequence events such as Dropped, Duplicate, In-order, Reordered, and Late frames
- Histogram, Jitter, and Inter-arrival only support **Basic Sequence Tracking**
 - Only In-sequence and Out-of-sequence events
- However, Histogram, Jitter, and Inter-arrival also support Histograms
 - Buckets that record the distribution of specific events over time
 - Spirent TestCenter supports 16 user configurable buckets per port

6 Traffic Analyzer Histogram Modes

- There are 6 Traffic Analyzer Histogram Modes: Inter-arrival Time, Latency, Frame Length, Sequence Run Length, Sequence Diff Check, Jitter
- These are configurable on a per-port basis



Compatible Results Modes

- You have to be careful though since not all Port Analyzer Histogram Modes are compatible with all of the Global Results Modes.
- **Basic and Forwarding Mode** - none of the Traffic Analyzer Histogram Modes apply (i.e., we support Advanced Sequence Tracking instead)
- **Histogram Mode** - only the following Traffic Analyzer Histogram Modes apply:
 - Latency
 - Frame Length
 - Sequence Run Length
 - Sequence Diff Check
- **Jitter Mode** - only the Jitter Traffic Analyzer Histogram Mode applies
- **Inter-arrival Time Mode** - only the Inter-arrival Traffic Analyzer Histogram Mode applies

Histogram Cross Checking Configuration

- Provides the user with an error configuration if there is a mismatch between the Analyzer Histograms settings and the Histograms Result Mode.

Selections – Result Mode (on the left) and Analyzer Histograms (on the right):

The image shows two configuration panels side-by-side. The left panel, titled 'Result View Mode', has tabs for 'Device Addresses', 'Warranty', 'ARP/ND', 'L2 Learning', 'Traffic Result Mode', and 'L2L3 ResultOpt'. It contains a note about result modes, a 'Counter Mode' dropdown set to 'Histogram Mode (No Jitter)', and a 'Jitter Mode' dropdown set to 'RFC 4689 Absolute Value'. The right panel, titled 'Histograms', has tabs for 'Template Filter', 'Custom Filters', 'Histograms', and 'High Resolution Port Sampling'. It features a 'Histogram Mode' dropdown set to 'Jitter', a 'Bucket Size and Limit Configuration' section with a 'Predefined Mode' dropdown set to 'Custom', a 'Bucket Size Unit' dropdown set to 'ns', a 'Uniform Bucket Width' input field set to '80', and a 'Mode Width' input field set to '0'.

Error Message:

Level	Message
Error	Settings: 'TrafficResult Mode' should be set to Histogram, Jitter, or Inter-Arrival Result Mode. Please ensure that you have selected the correct counters prior to running any tests.

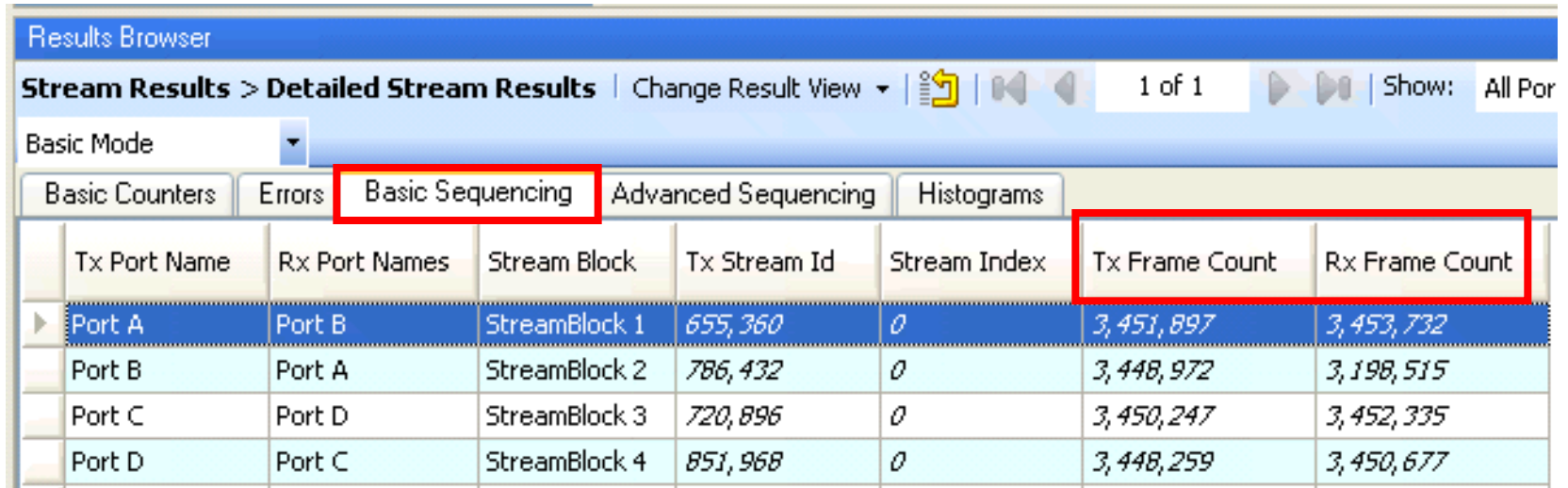
Basic Counters tab

- The Basic Counters tab displays the following, for each of the following Results Browser modes, regardless of the Port Analyzer setting.
 - Basic - Short Term Ave & Ave/Min/Max **Latency**
 - Forwarding Performance - Short Term Ave & Ave/Min/Max **Inter-arrival time**
 - Histogram - Short Term Ave & Ave/Min/Max **Latency**
 - Jitter - Min/Max **Latency**, Short Term Ave & Ave/Min/Max **Jitter**
 - Inter-arrival - Min/Max **Latency**, Short Term Ave & Ave/Min/Max **Inter-arrival time**

Tx Port Name	Rx Port Names	Stream Block	Tx Stream Id	Short Term Avg Latency (us)	Avg Latency (us)	Min Latency (us)	Max Latency (us)
Port A	Port B	StreamBlock 1	655,360	15.17	15.46	14.8	17.09
Port B	Port A	StreamBlock 2	786,432	16.29	16.29	15.09	17.49
Port C	Port D	StreamBlock 3	720,896	16.03	16.04	14.84	17.3
Port D	Port C	StreamBlock 4	851,968	16.33	16.31	15.09	17.53

Basic Sequencing tab

- For all results modes:



Results Browser

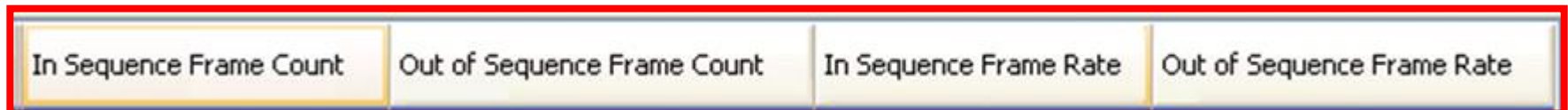
Stream Results > Detailed Stream Results | Change Result View | 1 of 1 | Show: All Por

Basic Mode

Basic Counters | Errors | **Basic Sequencing** | Advanced Sequencing | Histograms

Tx Port Name	Rx Port Names	Stream Block	Tx Stream Id	Stream Index	Tx Frame Count	Rx Frame Count
Port A	Port B	StreamBlock 1	655,360	0	3,451,897	3,453,732
Port B	Port A	StreamBlock 2	786,432	0	3,448,972	3,198,515
Port C	Port D	StreamBlock 3	720,896	0	3,450,247	3,452,335
Port D	Port C	StreamBlock 4	851,968	0	3,448,259	3,450,677

- Also for Histogram, Jitter, and Inter-arrival modes:



In Sequence Frame Count | Out of Sequence Frame Count | In Sequence Frame Rate | Out of Sequence Frame Rate

Advanced Sequencing tab

- For Basic and Forwarding results modes:

Results Browser

Stream Results > Detailed Stream Results | Change Result View | 1 of 1 | Show: All Ports | Change Counter Mode:

Basic Mode

Basic Counters | Errors | Basic Sequencing | **Advanced Sequencing** | Histograms

	Tx Port Name	Rx Port Names	Stream Block	Tx Stream Id	Stream Index	Tx Frame Count	Rx Frame Count	Dropped Frame Count	In-order Frame Count
▶	Port A	Port B	StreamBlock 1	655,360	0	5,960,344	5,962,178	0	5,962,178
	Port B	Port A	StreamBlock 2	786,432	0	5,957,418	5,706,961	0	5,706,961
	Port C	Port D	StreamBlock 3	720,896	0	5,958,693	5,960,782	0	5,960,782
	Port D	Port C	StreamBlock 4	851,968	0	5,956,705	5,959,123	0	5,959,124

Reordered Frame Count | Duplicate Frame Count | Late Frame Count | Dropped Frame Rate | In-order Frame Rate | Reordered Frame Rate | Duplicate Frame Rate | Late Frame Rate

- For Histogram, Jitter, and Inter-arrival results modes:

Results Browser

Stream Results > Detailed Stream Results | Change Result View | 1 of 1 | Show: All Por

Histogram Mode

Basic Counters | Errors | Basic Sequencing | **Advanced Sequencing** | Histograms

	Tx Port Name	Rx Port Names	Stream Block	Tx Stream Id	Stream Index	Tx Frame Count	Rx Frame Count
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Histogram tab

- Buckets Sizes depend on a Port's setting
- If each Port's Histogram mode and/or Bucket Sizes are different, then used Filtered Stream Results

The screenshot displays the Spirent TestCenter interface. On the left, a tree view shows the project structure with 'Port A' selected. A red arrow points to 'Port A' in the tree. The main window is titled 'Test Configuration' and has tabs for 'Template Filter', 'Custom Filters', 'Histograms', 'QoS Settings', and 'Advanced'. The 'Histograms' tab is active and shows 'Histogram Mode' set to 'Latency'. Below this, the 'Bucket Size and Limit Configuration' section includes a 'Predefined Mode' dropdown set to 'Custom', 'Mode Size' and 'Uniform Bucket Size' input fields, and a 'Reset' button. A table at the bottom of this section shows bucket sizes and limits:

	Bucket Sizes	Limits	Description
1	2	2	$x < 2$
2	4	6	$2 \leq x < 6$

The bottom section of the interface is the 'Results Browser', showing 'Stream Results > Detailed Stream Results'. It has tabs for 'Basic Counters', 'Errors', 'Basic Sequencing', 'Advanced Sequencing', and 'Histograms'. The 'Histograms' tab is active. Below the tabs is a table with the following data:

	Tx Port Name	Rx Port Names	Stream Block	Tx Stream Id	Stream Index	Tx Frame Count	Rx Frame Count	$x < 2$	$2 \leq x < 6$	$6 \leq x < 14$	$14 \leq x < 30$
▶	Port A	Port B	StreamBlock 1	655,360	0	10,614,060	10,615,894	0	0	0	0
	Port B	Port A	StreamBlock 2	786,432	0	10,611,135	10,360,677	0	0	0	0


Port Histogram Settings

Test Configuration

- Spirent TestCenter
 - Project
 - All Ports
 - All Hosts
 - All Multicast Groups
 - All Stream Blocks
 - All Traffic Generators
 - All Traffic Analyzers
 - Ports
 - Port //1/1
 - Hosts
 - Traffic Generator
 - Traffic Analyzer
 - Capture
 - Port //1/2
 - Hosts
 - Traffic Generator
 - Traffic Analyzer
 - Capture
 - Port //1/3
 - Port //1/4
 - Settings


Copy to Ports...

Template Filter | Custom Filters | **Histograms** | QoS Settings | Advanced

Histogram Mode: 

Bucket Size and Limit Configuration

Select a predefined bucket size distribution mode:

Predefined Mode: 

Mode Size:

Uniform Bucket Size:

(Each unit represents 10ns time.)

Change Bucket Size:

	Bucket Sizes	Limits	Description
1	2	2	$x < 2$
2	4	6	$2 \leq x < 6$
3	8	14	$6 \leq x < 14$
4	16	30	$14 \leq x < 30$
5	32	62	$30 \leq x < 62$
6	64	126	$62 \leq x < 126$
7	128	254	$126 \leq x < 254$
8	256	510	$254 \leq x < 510$
9	512	1,022	$510 \leq x < 1,022$
10	1,024	2,046	$1,022 \leq x < 2,046$
11	2,048	4,094	$2,046 \leq x < 4,094$
12	4,096	8,190	$4,094 \leq x < 8,190$
13	8,192	16,382	$8,190 \leq x < 16,382$

- Inter-arrival Time
- Latency**
- Frame Length
- Sequence Run Length
- Sequence Diff Check
- Jitter

- Centered**
- Left
- Right
- Custom

Histogram Enhancements

- Enhanced graphics to aide in visualization
- New “Automatic” mode to build intelligent histograms
 - Only applies to the Latency Histogram Mode
- Selectable Bucket size: ns, us, msec or sec

The screenshot shows the 'Copy Wizard...' dialog box in the Spirent TestCenter. The 'Histograms' tab is selected, and the 'Histogram Mode' is set to 'Latency'. The 'Bucket Size and Limit Configuration' section includes the following settings:

- Predefined Mode: Centered
- Bucket Size Unit: ns
- Uniform Bucket Width: 80
- Mode Width: 10240
- Center Point: 5680

A histogram visualization shows a bell-shaped distribution of green bars. A vertical line marks the 'Center Point' at 5680. The width of the central bar is labeled 'Mode Width: Width of Center Bucket', and the width of a single bar is labeled 'Uniform Bucket Width'. The vertical axis is labeled 'Packets'. A red dashed box highlights the 'Automatic' option in the 'Predefined Mode' dropdown menu.

Change Bucket Size: (Each unit represents ns.) Reset

	Bucket Sizes (ns)	Limits (ns)	Description
1	80	80	$x < 80$
2	80	160	$80 \leq x < 160$
3	80	240	$160 \leq x < 240$

Latency Histogram: Automatic Mode

- Note that you use the Resample button in the Detailed Stream Results View to configure the buckets.

Test Configuration

Spirent TestCenter

- All Devices (Hosts, Routers, ...)
- All Stream Blocks
- All Traffic Generators
- All Traffic Analyzers
- All Ports
 - PortConfig1 //1/1 (offline)
 - Devices
 - Traffic Generator
 - Traffic Analyzer
 - Capture
 - PortConfig2 //1/1 (offline)
- Settings

Copy Wizard...

Template Filter Custom Filters Histograms High Resolution Port Sampling High Resolution Stream

Histogram Mode: Latency

Bucket Size and Limit Configuration

Select a predefined bucket size distribution mode:

Predefined Mode: Automatic

Bucket Size Unit: ns

Uniform Bucket Width: 80

Mode Width: 0

(*Use the Resample button in the Detailed Stream Results View to configure the buckets.)

Change Bucket Size: (Each unit represents ns.) Reset

	Bucket Sizes (ns)	Limits (ns)	Description
1	80	80	$x < 80$
2	80	160	$80 \leq x < 160$
3	80	240	$160 \leq x < 240$
4	80	320	$240 \leq x < 320$
5	80	400	$320 \leq x < 400$
6	80	480	$400 \leq x < 480$

Streams > Detailed Stream Results Change Result View 1 of 0 Select Tx Ports: All Ports

All Ports Change Counter Mode: Histogram Mode (No) Resample

Basic Counters Errors Basic Sequencing Advanced Sequencing Histograms

Name/ID	Tx Port Name	Rx Port Names	Tx Count (Frames)	Rx Count (Frames)	Bucket 1	Bucket 2	Bucket 3	...
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Port Histogram Settings By Histogram Mode

Template Filter Custom Filters **Histograms** QoS Settings Advanced

Histogram Mode:

Bucket Size and Limit Configuration

Select a predefined bucket size distribution mode:

Predefined Mode:

Mode Size:

Uniform Bucket Size:

(Each unit represents 10ns time.)

Template Filter Custom Filters **Histograms** QoS Settings Advanced

Histogram Mode:

Bucket Size and Limit Configuration

Select a predefined bucket size distribution mode:

Predefined Mode:

Mode Size:

Uniform Bucket Size:

(Each unit represents 10ns time.)

Template Filter Custom Filters **Histograms** QoS Settings Advanced

Histogram Mode:

Bucket Size and Limit Configuration

Select a predefined bucket size distribution mode:

Predefined Mode:

Mode Size:

Uniform Bucket Size:

(Each unit represents 1 byte.)

Template Filter Custom Filters **Histograms** QoS Settings Advanced

Histogram Mode:

Bucket Size and Limit Configuration

Select a predefined bucket size distribution mode:

Predefined Mode:

Mode Size:

Uniform Bucket Size:

(Each unit represents 1 frame.)

Bucket Size and Limit Configuration

Select a predefined bucket size distribution mode:

Predefined Mode:

Mode Size:

Uniform Bucket Size:

(Each unit represents 10ns time.)

Template Filter Custom Filters **Histograms** QoS Settings Advanced

Histogram Mode:

Bucket Size and Limit Configuration

Select a predefined bucket size distribution mode:

Predefined Mode:

Mode Size:

Uniform Bucket Size:

(Each unit represents delta.)

Template Filter Custom Filters **Histograms** QoS Settings Advanced

Histogram Mode:

Bucket Size and Limit Configuration

Select a predefined bucket size distribution mode:

Predefined Mode:

Mode Size:

Uniform Bucket Size:

(Each unit represents 10ns time.)

Predefined Analyzer Mode: Custom

- An example using the RFC 2544 seven recommended frame sizes
- Bucket 1 = undersize
- Even buckets hone in on a specific frame size (i.e., the 7)
- Bucket 15 is for frames over 1518 and up to 1522
- Bucket 16 = oversize

Template Filter Custom Filters Histograms High Resolution Port Sampling

Histogram Mode: Frame Length

Bucket Size and Limit Configuration

Select a predefined bucket size distribution mode:

Predefined Mode: Custom

Mode Size: 1024

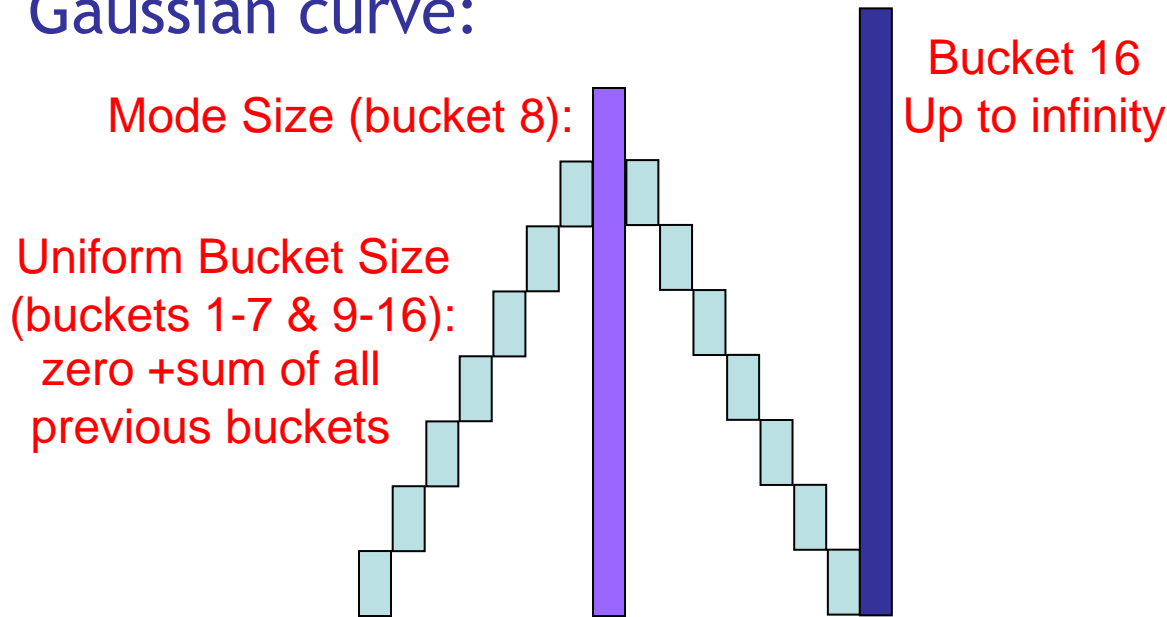
Uniform Bucket Size: 8
(Each unit represents 1 byte.)

Change Bucket Size: Reset

	Bucket Sizes	Limits	Description
1	64	64	$x < 64$
2	1	65	$64 \leq x < 65$
3	63	128	$65 \leq x < 128$
4	1	129	$128 \leq x < 129$
5	127	256	$129 \leq x < 256$
6	1	257	$256 \leq x < 257$
7	255	512	$257 \leq x < 512$
8	1	513	$512 \leq x < 513$
9	511	1,024	$513 \leq x < 1,024$
10	1	1,025	$1,024 \leq x < 1,025$
11	255	1,280	$1,025 \leq x < 1,280$
12	1	1,281	$1,280 \leq x < 1,281$
13	237	1,518	$1,281 \leq x < 1,518$
14	1	1,519	$1,518 \leq x < 1,519$
15	4	1,523	$1,519 \leq x < 1,523$
16	4,294,965,772		$x \geq 1,523$

Predefined Analyzer Mode: Centered

- Really the graph should look something like this instead of a Gaussian curve:



	Bucket Sizes	Limits	Description
1	8	8	$x < 8$
2	8	16	$8 \leq x < 16$
3	8	24	$16 \leq x < 24$
4	8	32	$24 \leq x < 32$
5	8	40	$32 \leq x < 40$
6	8	48	$40 \leq x < 48$
7	8	56	$48 \leq x < 56$
8	1,024	1,080	$56 \leq x < 1,080$
9	8	1,088	$1,080 \leq x < 1,088$
10	8	1,096	$1,088 \leq x < 1,096$
11	8	1,104	$1,096 \leq x < 1,104$
12	8	1,112	$1,104 \leq x < 1,112$
13	8	1,120	$1,112 \leq x < 1,120$
14	8	1,128	$1,120 \leq x < 1,128$
15	8	1,136	$1,128 \leq x < 1,136$
16	4,294,966,159		$x \geq 1,136$

- But how do you specify another center area other than using the uniform bucket size?

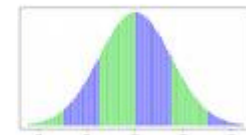
- Answer: You can't today 😞

Predefined Mode:

Mode Size:

Uniform Bucket Size:

(Each unit represents 10ns time.)



Not this!

How Latency is Measured in the Different Modes

- For just Latency, it can either be start or end of frame (Rx minus Tx time stamp).
 - This is user configurable on both the Tx and Rx side.
- There is a difference in the way hardware measures Jitter and Inter-arrival Time.
- For Jitter, it is the difference in delay of two frames
 - Requires 4 parameters to calculate - transmit and arrival times for two frames (the delta of the deltas)
- Inter-arrival time, uses just the delta time between frames
 - Fails when packet loss occurs because the two frames are most likely farther apart

Calculating Jitter versus Inter-arrival Time

- Jitter is a calculation unique to Spirent TestCenter
- It requires a specific hardware design whereas you can hold two values in memory and then perform a calculation on them in real time, separately for potentially 64,000 individual streams, and at up to 15 million frames per second!
- Jitter = the delay of the previous frame minus the delay of the current
 - Only measured for frames in sequence
 - Does not matter that the t3 frame was lost below
- Inter-arrival Time = the time between receiving the last bit of the previous frame and the first bit of the current frame
 - So in the example sequence below, you would have a greater inter-arrival time between t2 and t4 than you did between t1 and t2
 - It is also affected by the rate and burstyness which Jitter is not

t1	t2	t3	t4	t5	t6	t7	t8	t9	t10
x	x		x	x			x	x	x

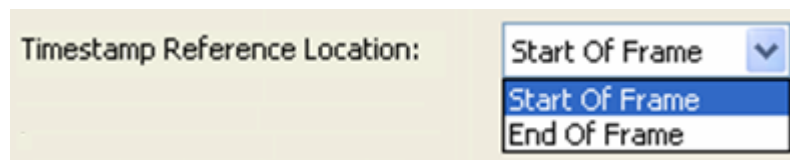
Latency Timestamp Reference Location

- It is possible to set the Latency Timestamp Reference Location different of each side
- However, for most test cases, both sides should be set to Start of Frame which is the default

The image shows two screenshots from the Spirent TestCenter software. The left screenshot displays the 'Test Configuration' window with a tree view on the left. The 'Traffic Analyzer' icon is highlighted with a red box. The main pane shows the 'Advanced' tab with 'Default Settings' and 'Threshold Settings'. The 'Timestamp Reference Location' is set to 'Start Of Frame'. The right screenshot is a 'Generator Advanced Configuration' dialog box. The 'Generator' label in the title bar is highlighted with a red box. The 'Default' section shows 'Timestamp Reference Location' set to 'Start Of Frame' and 'Frame length random seed' set to 'Start Of Frame'. The 'Threshold Settings' section shows 'Jumbo Threshold' at 1518, 'Oversize Threshold' at 9018, and 'Undersize Threshold' at 64. 'OK' and 'Cancel' buttons are at the bottom.

Why are there different Latency Timestamp Reference Locations?

- In summary; so we can measure/display Store-and-Forward latency in real time, separately for potentially 64,000 individual streams, and at up to 15 million frames per second!
- To do this you would set Generator side to End-of-Frame and the Analyzer side to Start-of-Frame
- This essentially would subtract out the frame bit time as per RFC 2544 for measuring Store-and-Forward latency
- However, prior to Spirent TestCenter this was always done post test in software
- Now it can be done by the hardware, and displayed, in real time!





Thank You

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