Calnex Solutions Ltd

Calnex Paragon CES User Guide

(Version 1.2 July 2011)

This User Guide describes how to set up and use the Paragon to capture and analyse CES traffic flows.

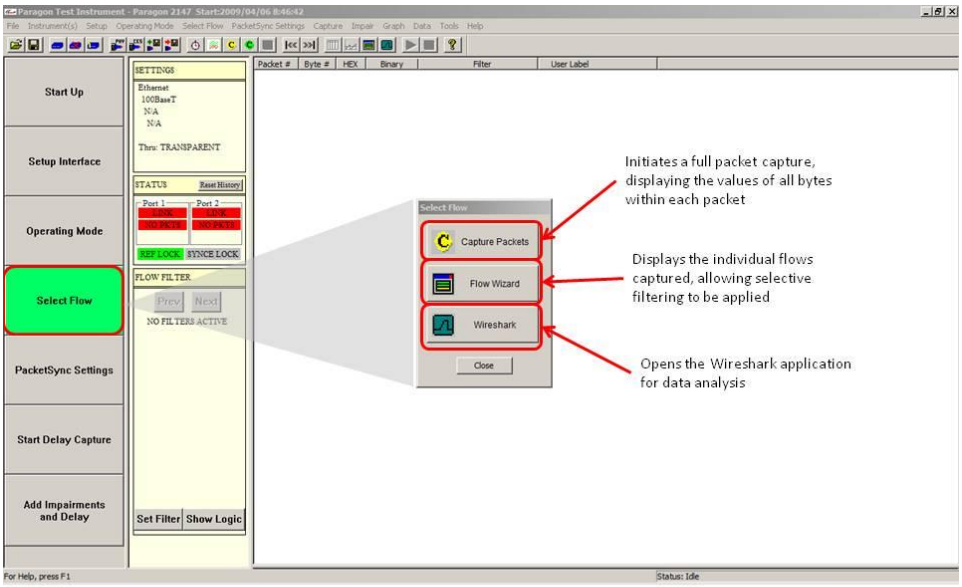
It also describes how to add impairments and delays to chosen flows including the running of ITU-T G.8261 and MEF-18 Test Cases the importing of real live captured data to simulate the same environment in the lab.

It assumes that the user has set the Paragon up to the point where CES is selected in the "Operating mode" menu on page 11 of the separate ***Paragon Start-up guide***

Contents

Setting the Filters to capture/replay on CES flows

1. Click on the **Select Flow** button and the “Select Flow” window will appear

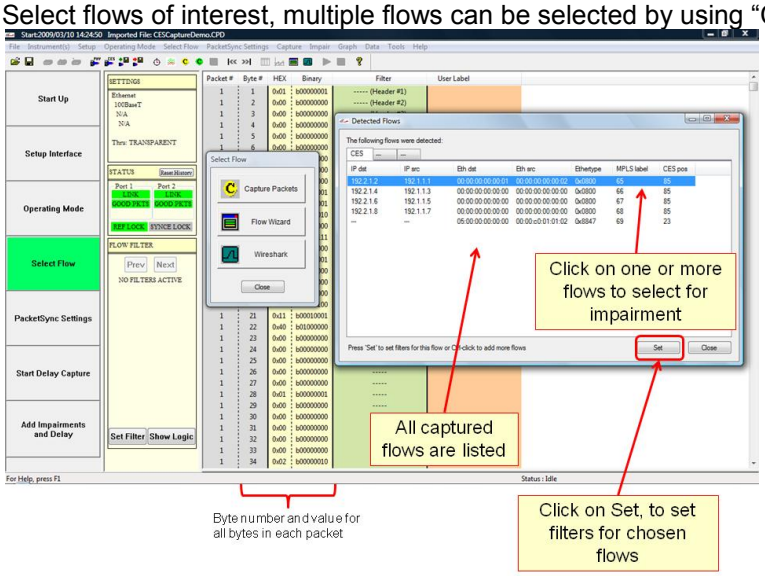


2. Click on Capture Packets

3. After a short time (~10 Seconds) click on Stop Capture

4. Select Flow wizard Flow Wizard

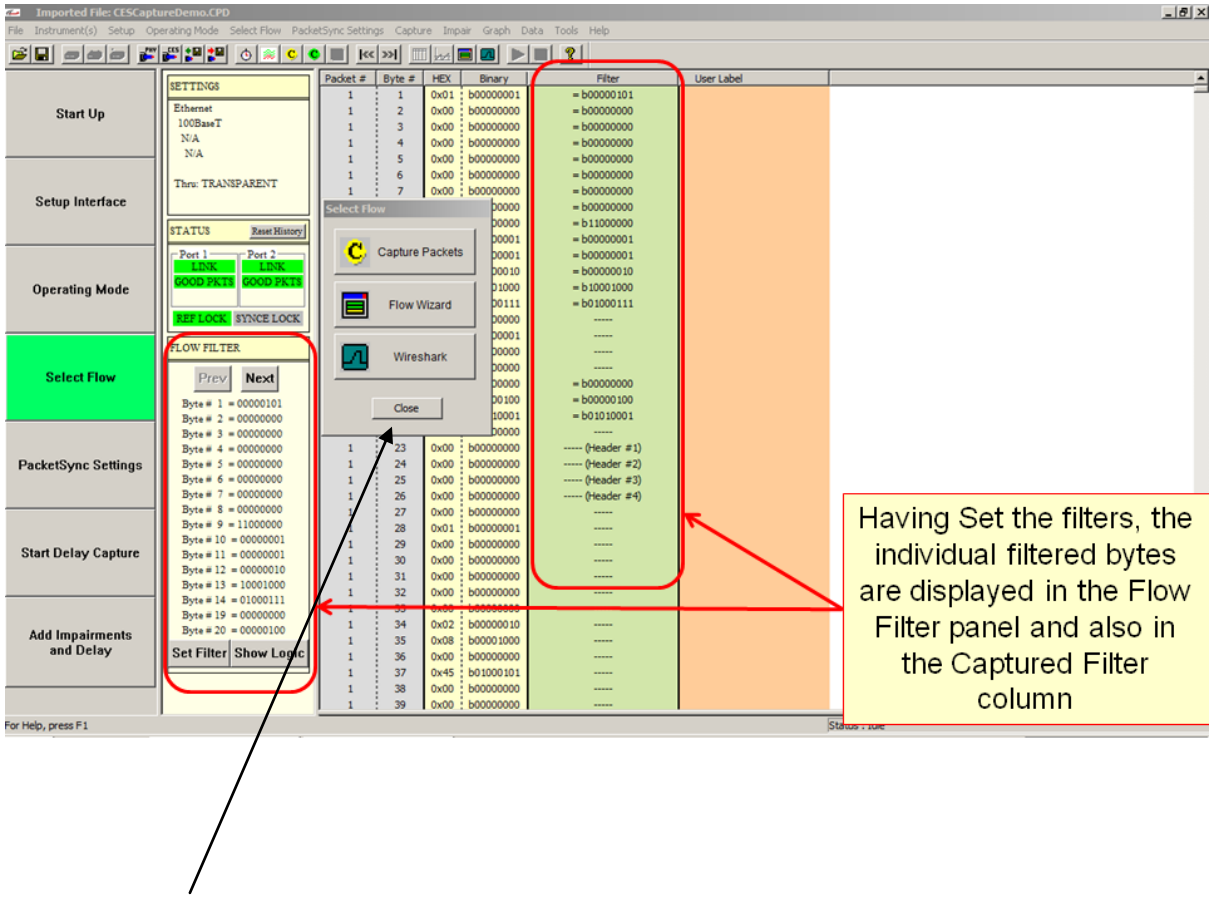
5. Select flows of interest, multiple flows can be selected by using “Ctrl-click”



6. Click Set to set the Filters and then Close to shut the window

7. Click Close to close the “Select Flow” window

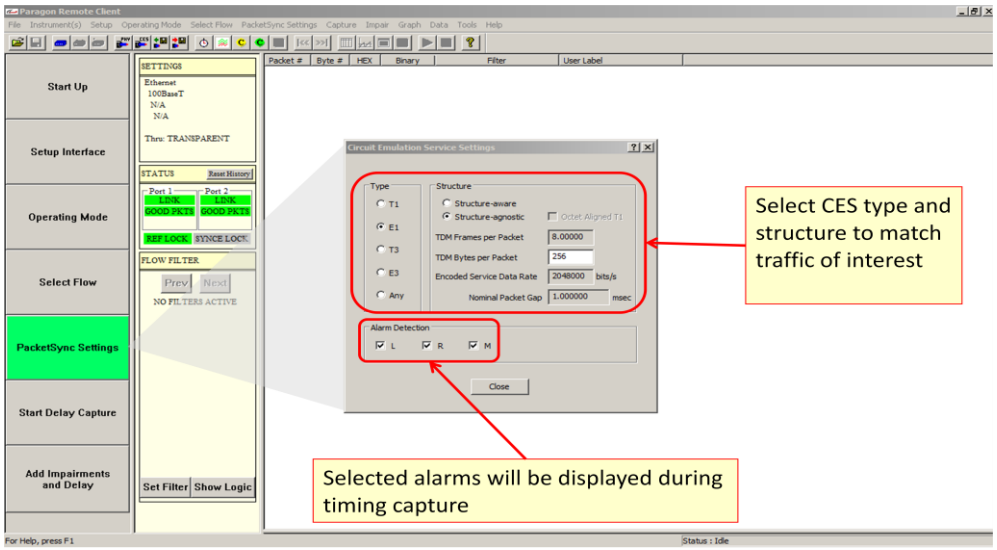
8. The Flow Filter Window will now show that filters have been set.



Click on Close

Settings for CES

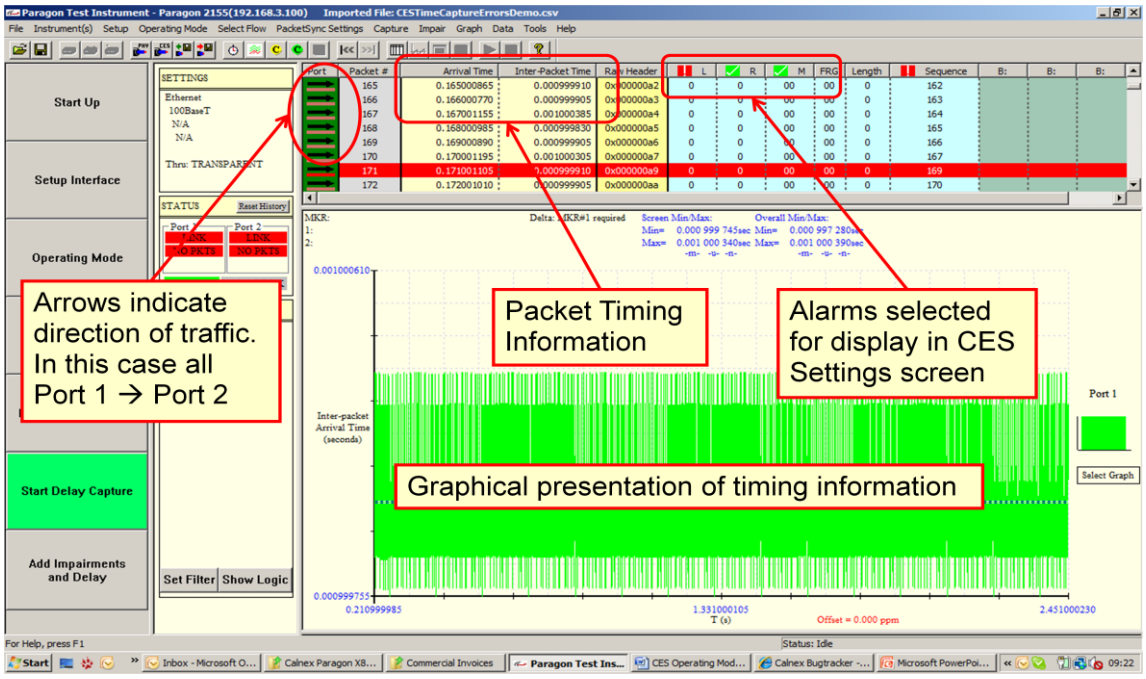
1. Select **PacketSync Settings** on the Work flow interface.



2. Select the appropriate Type and Structure to match your flow of interest. Note: it is essential that the resulting Nominal Packet Gap is the same as your traffic flow, for accurate TIE calculations.
3. Select the alarms you want to be displayed in subsequent timing captures.
4. Click on Close to exit the CES Settings window.

Capturing CES Header and Timing Information

1. Select **Start Delay Capture** on the Work flow interface. The timing information for the flows that were selected using Flow Wizard will be displayed on the table. Each line represents one packet making it easy to identify timing anomalies in the device/system-under-test. Errors or anomalies such as packet corruption and mis-ordered packets are colour coded red. Also use the timing information to check that the filters are set as expected and that the appropriate streams are being captured.



2. The table continues to update in real-time with the captured packets.

3. By Selecting **Select Graph** and then “Auto Graph Refresh” to “On”, the graph will refresh approximately every 10 seconds.

4. Select **Stop Delay Capture** to stop the capture.

5. Various graph options are available. To access the graphs select **Select Graph**

6. Then select Graph Display Mode and select the desired graph

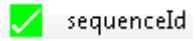
As well as Inter-packet arrival Time vs Time or Packet#, you can also plot the variation in inter-packet arrival time as a Time Interval Error (TIE) graph, measured against either the nominal or measured average arrival times.

Analysing the Delay Capture

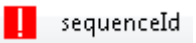
The Paragon has many tools that allow the user to evaluate the Captured data, a brief introduction and explanation of some of these tools can be found below

Analysing for mis-ordered, missing & repeated packets

1. The header and timing table allows the user to quickly determine if there are any mis-ordered, missing or repeated packets. To do this, look at the top of the SequenceID column and check the soft LED icon.



Indicates no error



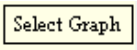
Indicates there is an error

2. To go to the first error use the  icon, and the first/next error will appear at the top of the screen. Errors are identified by the following 1588 message being highlighted in red.

3. To go back to the previous error use the  icon, and the previous error will appear at the top of the screen.

Analysing the captured packets by using the graphs

The Paragon offers various graphing facilities.

1. To Access the graphs select 

2. Then select “Graph Display Mode” which will display 4 options

Menu option	Description
Inter-packet Arrival Time vs Time	Displays the Inter-packet arrival time for each specific packet against Time.
Inter-packet Arrival Time vs Packet #	Displays the Inter-packet arrival time against packet number
Time Interval Error (TIE) vs Nominal	Displays the difference between actual arrival time and calculated arrival time based on the nominal ipg from CES settings.
Time Interval Error (TIE) vs Measured Average	Displays the difference between actual arrival time and calculated arrival time based on the average ipg over the capture period

Graph Navigation

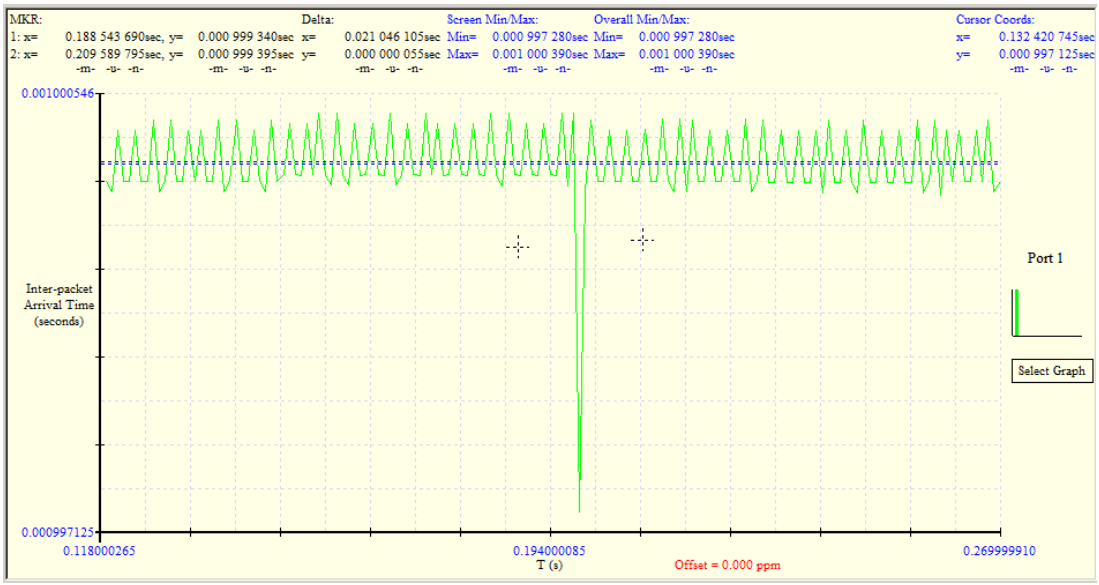
Paragon's zoom and delta features allow a variety of graph navigation actions.

1. To align the tabular view with any point on the graph, position the mouse pointer on the desired point and select Ctrl + left-click. The top packet visible in the tabular view will be the point selected on the graph.

2. To set the time Delta Markers position the mouse cursor at the desired points:

    a. Alt + left click - set Marker #1 and display nearest packet on the table
    b. Alt + right-click - set Marker #2 and display nearest packet on the table

    The xy co-ordinates of each marker and the delta x and y values are displayed in the top left corner of the graph.



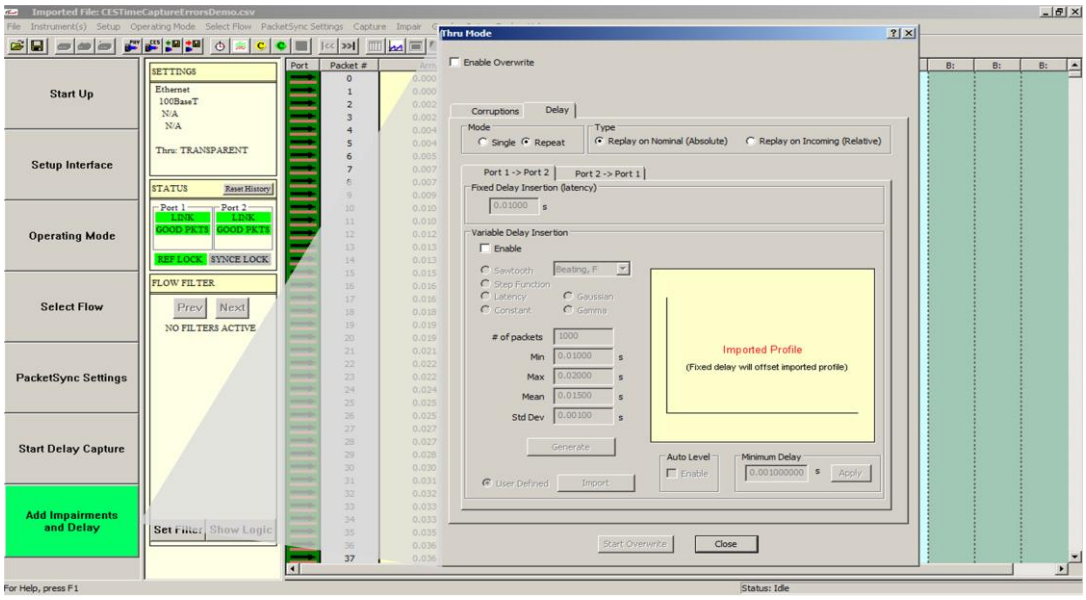
3. To use the zoom feature, place the mouse pointer on the area of interest then left-click to zoom in. Repeat as necessary. Right-click to zoom out. Left and right keyboard arrows will scroll along the X axis.

4. To display a portion of the graphical view, left-click then hold and drag the cursor across the area of interest. When the left-click is released the graph will zoom in to the dragged area.

5. To use the vertical Y axis zoom feature, position the mouse pointer in the region of interest then select Shift + left-click. Repeat as necessary. Right-click to zoom out. Up and down keyboard arrows will scroll along the Y axis.

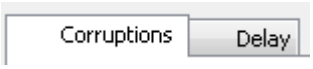
Adding Impairments and Delays

1. Select **Add Impairments and Delay** and the following window will be displayed.This allows a variety of Delays and Corruptions to be selected to replay against the filtered traffic flows.



It is possible to add lost/errored packets at the same time a delay is being applied to the packets.

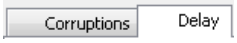
Corruptions or Delays are added by selecting the appropriate tab

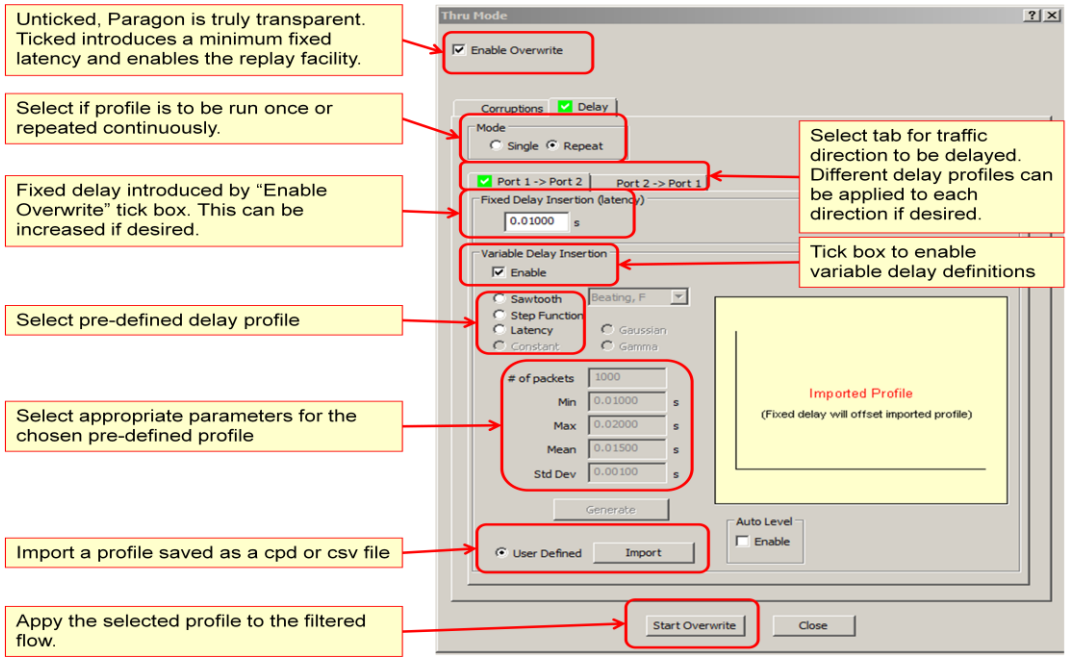


2. To enable the overwrite mode - Ensure the Enable Overwrite box is ticked

Adding Delays

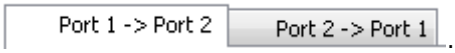
To test for impact of jitter and wander in your device/system-under-test, you can insert various forms of delay into the traffic to manipulate the CES.

1. Click the Delay tab 

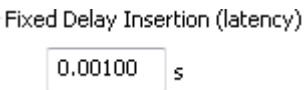


2. Select if you want the delay profile to be repeated or to be run as a single event by selecting the relevant radial button.

3. A different delay profile can be added to Port 1 ->Port 2 from that applied to Port2 ->Port 1. This optimizes the utilization of test times for the network. The different profiles are added by selecting the relevant tab (Operation of both tabs are identical.)



4. It is possible to adjust the Fixed Delay of all packets flowing through the Paragon.

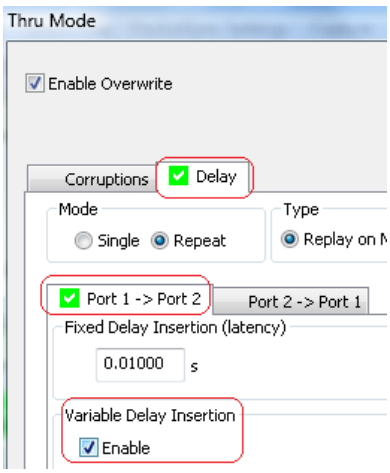


Maximum delay is 2 seconds.

Minimum delay is dependent on Mode and line rate

		Instrument Mode		
		CES	1588	Services
Line Rate	100M	10mS	1mS	1mS
	1G	2mS	0.1mS	0.1mS

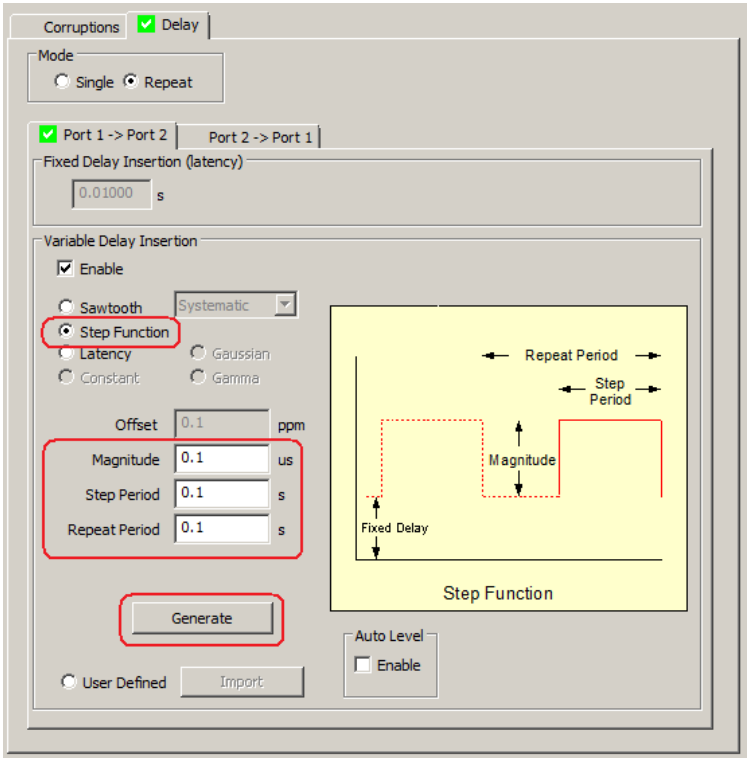
5. Tick the Variable Delay insertion box and a green tick will appear on the Delay tab and also on the Port direction tab(s) indicating that a delay has been enabled and in which direction(s).



6. Different types of delays can be selected by clicking the appropriate radial button .

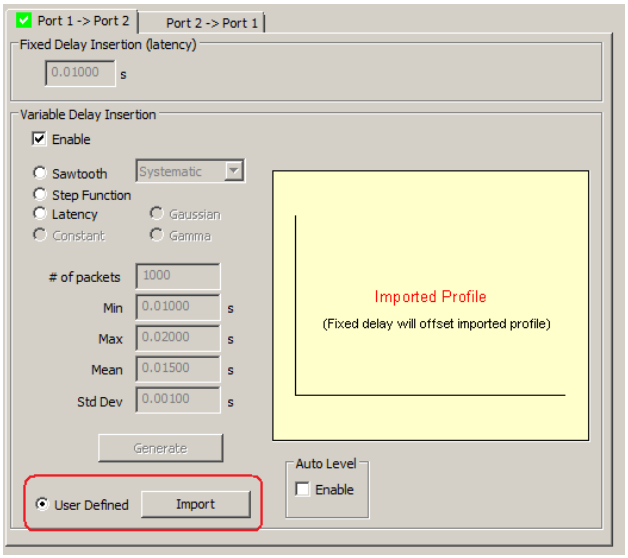
- G.8261 Sawtooth profiles (Beating Delay on faster Stream or on a slower stream)
- Step Function
- Latency
- Constant
- Gamma
- Gaussian
- User Defined (such as files previously captured on the Paragon)

7. For each delay profile selected (except User Defined) a picture will show the parameters that define the profile and these parameters can be entered into the relevant boxes. For example, the Step Function is shown here.

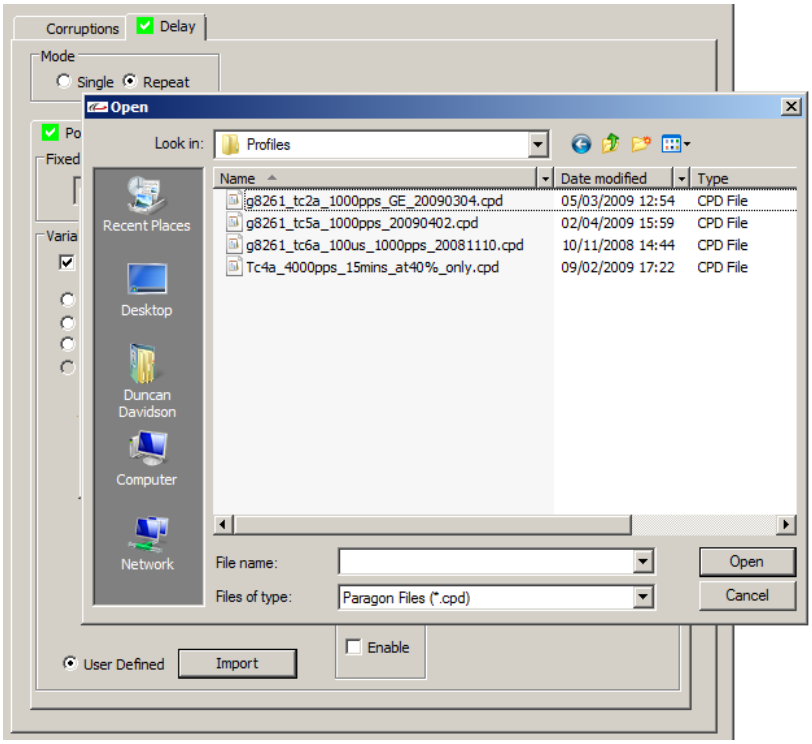


Once you have defined your profile of choice, generate the delay profile by clicking Generate

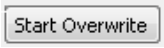
8. User defined profiles: Calnex provides a library of G8261 test profiles that can be imported to stress test your device/system-under-test. Alternatively you can capture data from a live network and import that captured profile for replay in your lab environment. Click the User Defined radial button and then press Import which will open a window to allow the import of a file in .cpd or .csv format.



9. Navigate to the folder where the desired profile is, select it and click Open. The profile will be imported and a status bar will show the progress of the import.



10. For adding the same or different delays in the other direction. Select the other direction tab and follow steps 4 to 9 above.
    When delays are being added in both directions –there will be a green tick shown in each direction tab as shown below.

11. Having generated the desired pre-defined profile, or imported the appropriate captured file or library file, initiate replay by clicking  and the following screen will be shown.

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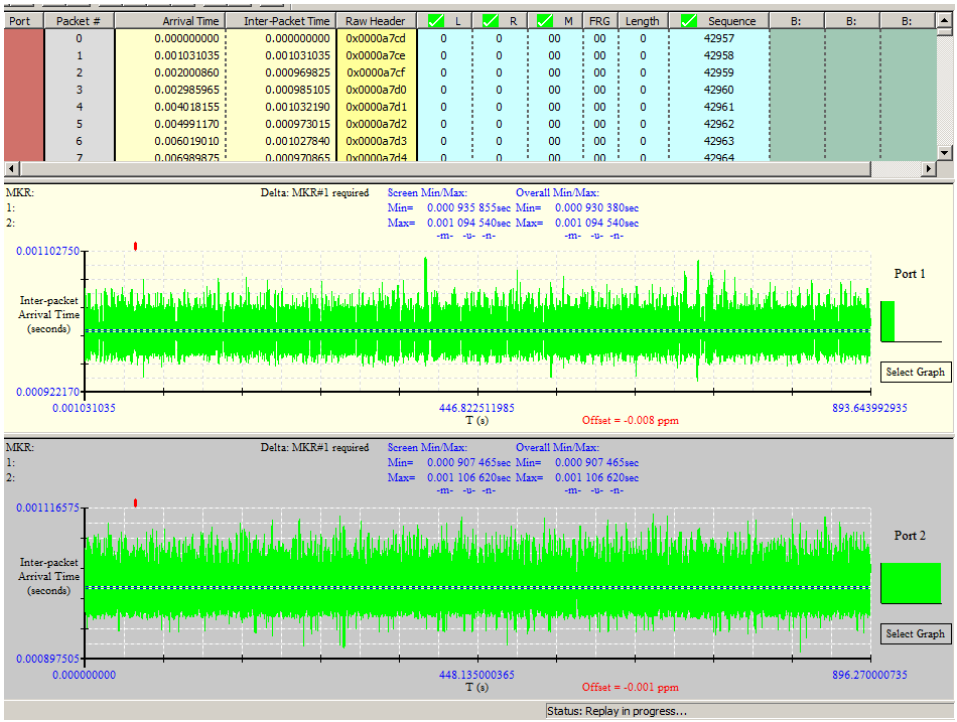


The replayed profile for each direction is displayed. The Header and timing will show the data for the active graph which is shown in white. To change between graphs, click the graph that is required.

Each graph has a red vertical bar above it, this bar shows the progress of the replay of the delay profile.

12. The replay can be stopped by clicking 

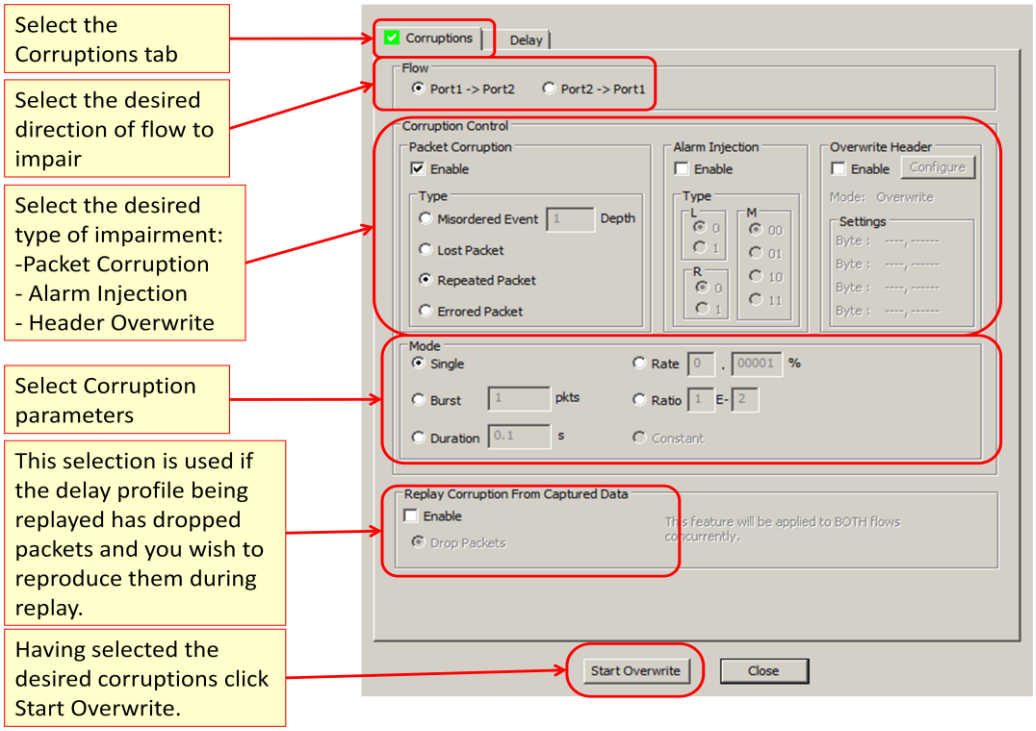
Adding Packet Corruptions and Signal Alarms

You can introduce standard packet corruption events such as taking out a packet to simulate lost packets, repeat a packet by putting it in twice and you can misorder packets by setting the depth of the mis-order to bring the packet back at a specific position.

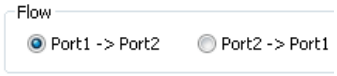
As well as packet corruption events, you can introduce alarms (L local, R remote M modified) to the outgoing signal and you can overwrite header bytes with a defined pattern.

1. Click the Corruptions tab 

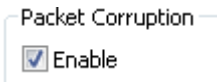
, the following window will appear

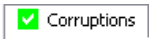


2. Select the direction the Corruptions are to be applied by clicking the appropriate radial button.



3. Check the box to enable Packet corruption



4. A green tick will now be visible on the Corruptions tab indicating corruptions are enabled. 

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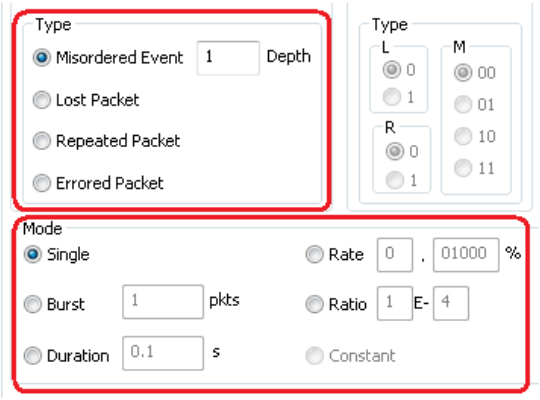
5. The type of corruption is selected by clicking the relevant radial button and then by selecting the required mode and associated parameters.



The table below provides more information on each corruption and mode available.

Type	Mode
Misordered Event (Range 1 – 32)	• Single event • Burst (Range 1 to 10,000) • Duration (Range 0.1S to 10S in steps of 0.1S) • Rate (Range 0.00001 to 99. 99999% in steps of 00001%) • Ratio (Range Mantissa 1 to 9, exponent 1 to 7, both in steps of 1)
Lost Packets	• Single event • Burst (Range 1 to 10,000) • Duration (Range 0.1S to 10S in steps of 0.1S) • Rate (Range 0.00001 to 99. 99999% in steps of 00001%) • Ratio (Range Mantissa 1 to 9, exponent 1 to 7, both in steps of 1) • Constant
Repeated Packets	• Single event • Burst (Range 1 to 10,000) • Duration (Range 0.1S to 10S in steps of 0.1S) • Rate (Range 0.00001 to 99. 99999% in steps of 00001%) • Ratio (Range Mantissa 1 to 9, exponent 1 to 7, both in steps of 1)
Errored Packets	• Single event • Burst (Range 1 to 10,000) • Duration (Range 0.1S to 10S in steps of 0.1S) • Rate (Range 0.00001 to 99. 99999% in steps of 00001%) • Ratio (Range Mantissa 1 to 9, exponent 1 to 7, both in steps of 1) • Constant

6. Click 

to add the corruptions. Corruptions will be applied to the filtered traffic flows only

7. To stop the corruptions click 

or 

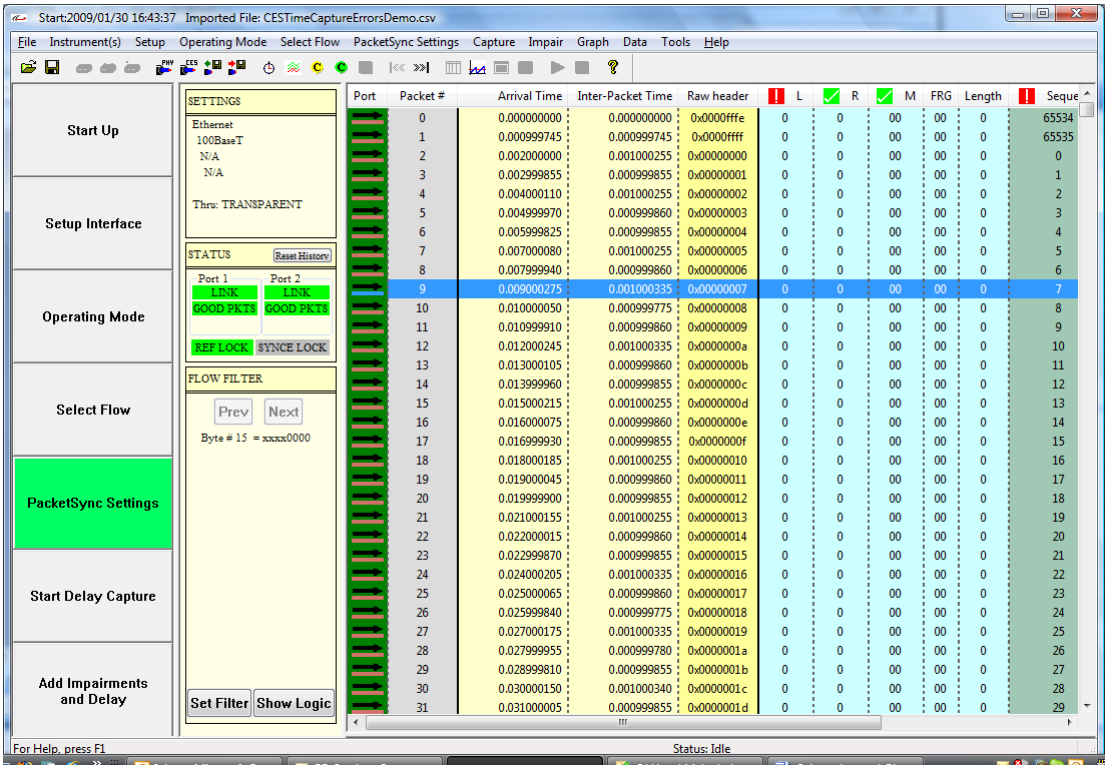
Dropping Packets from a Profile

There are two methods that determine if a packet should be dropped from a profile during replay. Particular packets can be selected to be dropped or replay can be forced to recognise and reproduce sequence number gaps.

- **Selecting packets to be dropped**

This feature allows a captured profile to be altered so that packets are dropped on a replay of the manipulated profile. A series of profiles can be generated from a single profile to allow the investigation of the impact of progressively longer intervals of packet drop out. The user should remember to save profiles created into suitably named files should they be required for future replay. There are undo features to re-enable packets allowing ease of experimentation or margin testing. The traffic to be re-profiled is captured in the normal way, or a pre-existing profile can be imported for manipulation.

Capture or file import will yield the tabular display as shown below.



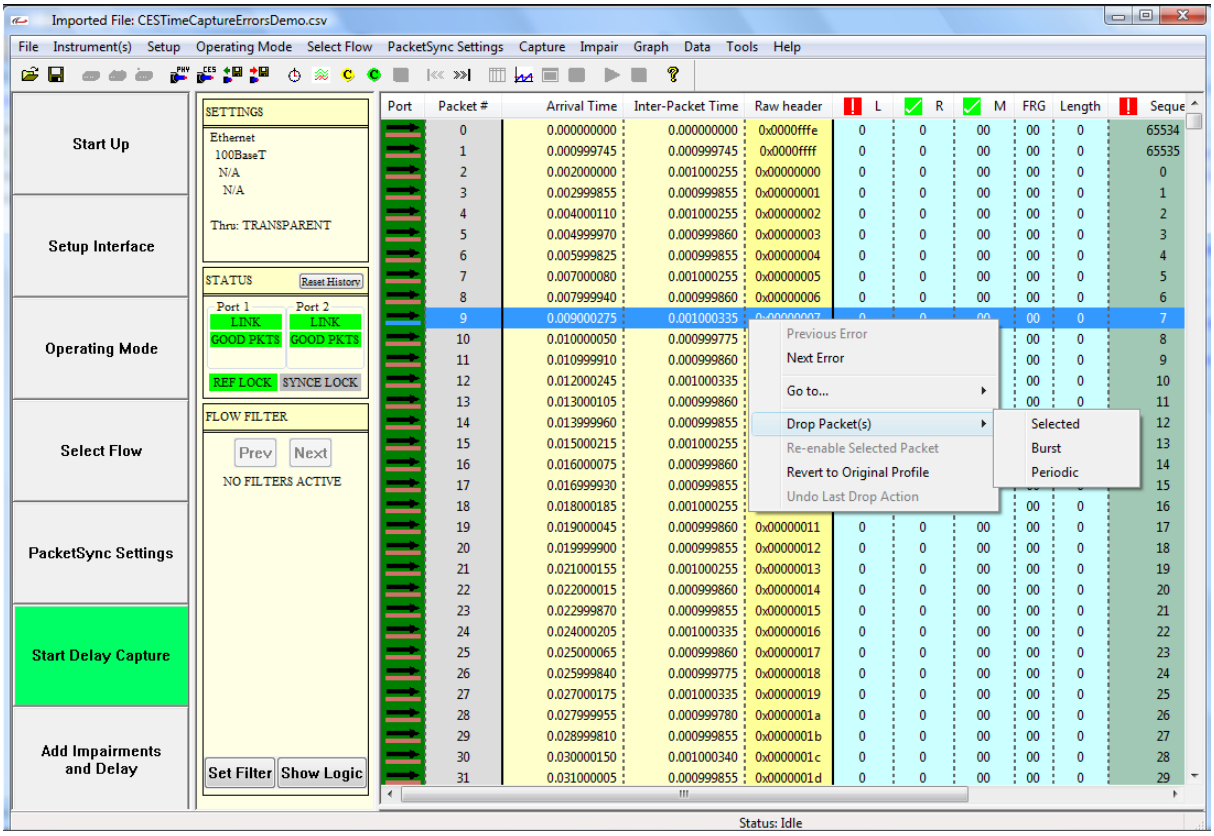
The packets should now be selected to be dropped on replay. There are 3 modes of selection:

1. Select an individual packet to be dropped.
2. Select a burst of packets to be dropped.
3. Select a periodic series of packets to be dropped.

To drop an individual packet:

- Left click on the entry on the table. The entry will highlight in blue as shown for packet 9 in the screen shot above.

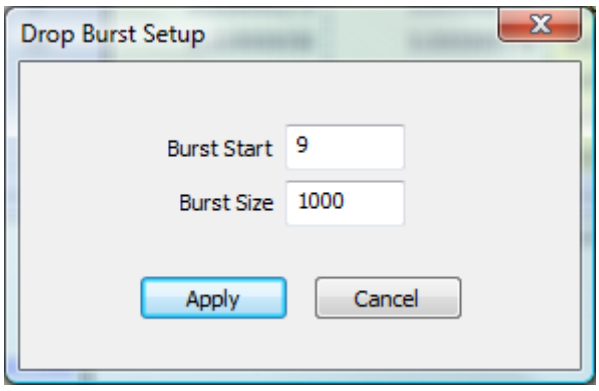
- Click the right button on the mouse and a pop-up menu appears, select Drop Packet(s) -> Selected as shown below



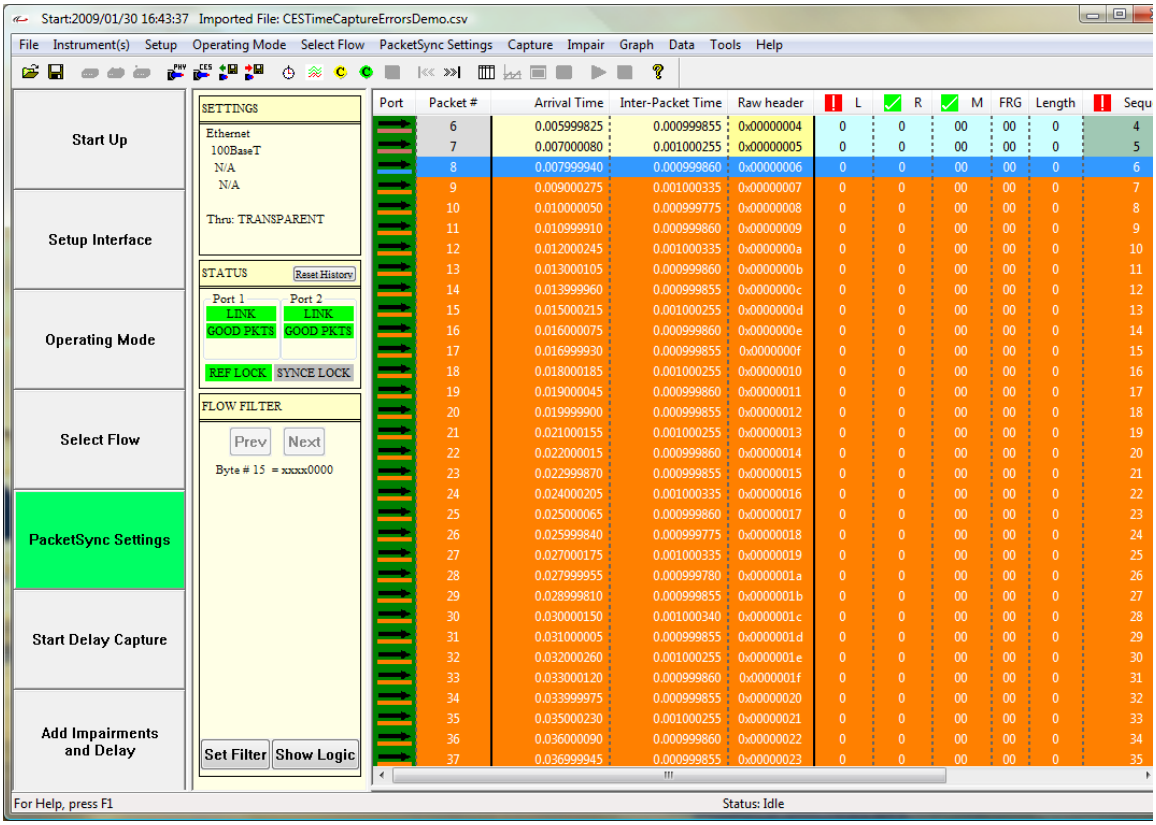
- This will mark the packet to be dropped. This is confirmed by the background colour for the line turning orange.

To drop a burst of packets repeat the first step above then:

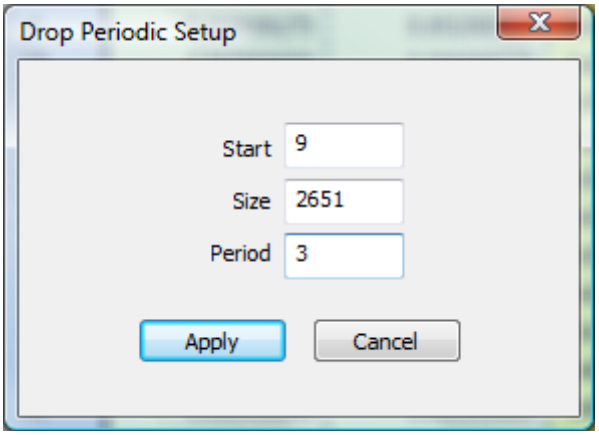
- Select Drop Packet(s) -> Burst. This will bring up the pop-up window shown below.
- Set the Burst Size required



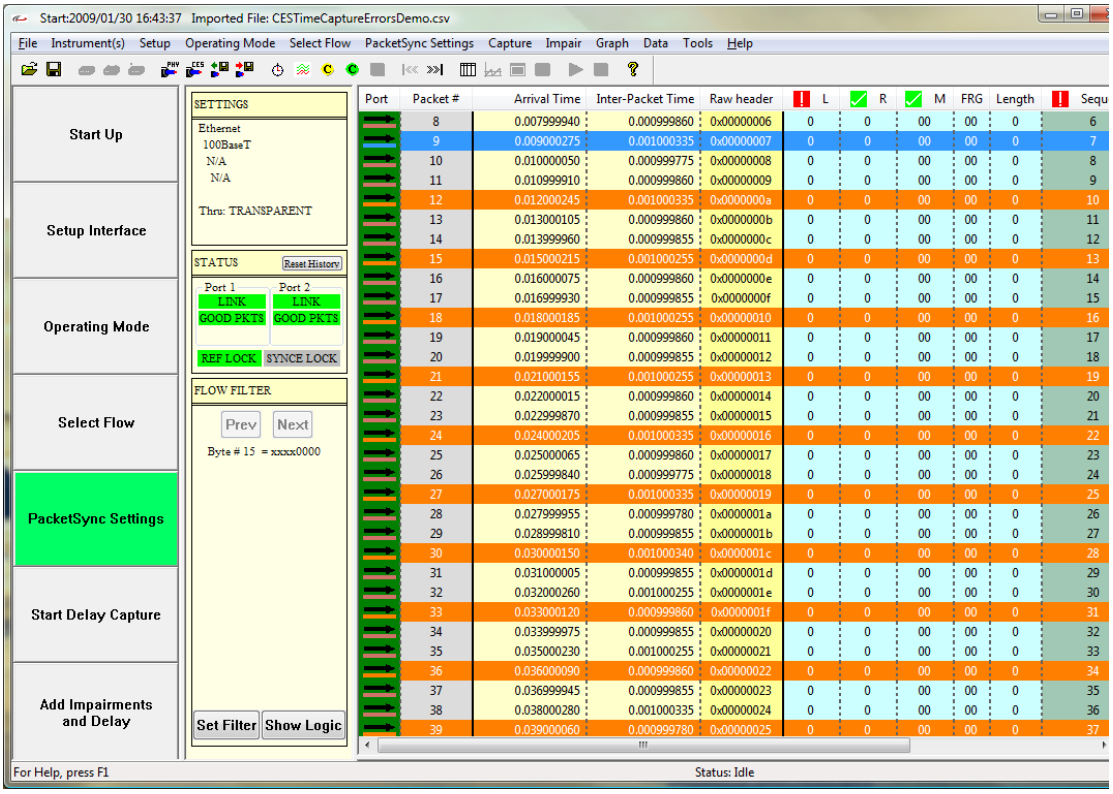
Again the table will be updated to indicate the packets to be dropped with a background of orange.



To select a periodic dropping of packets repeat the above but select Drop Packet(s) -> Periodic. This brings up the dialogue shown below

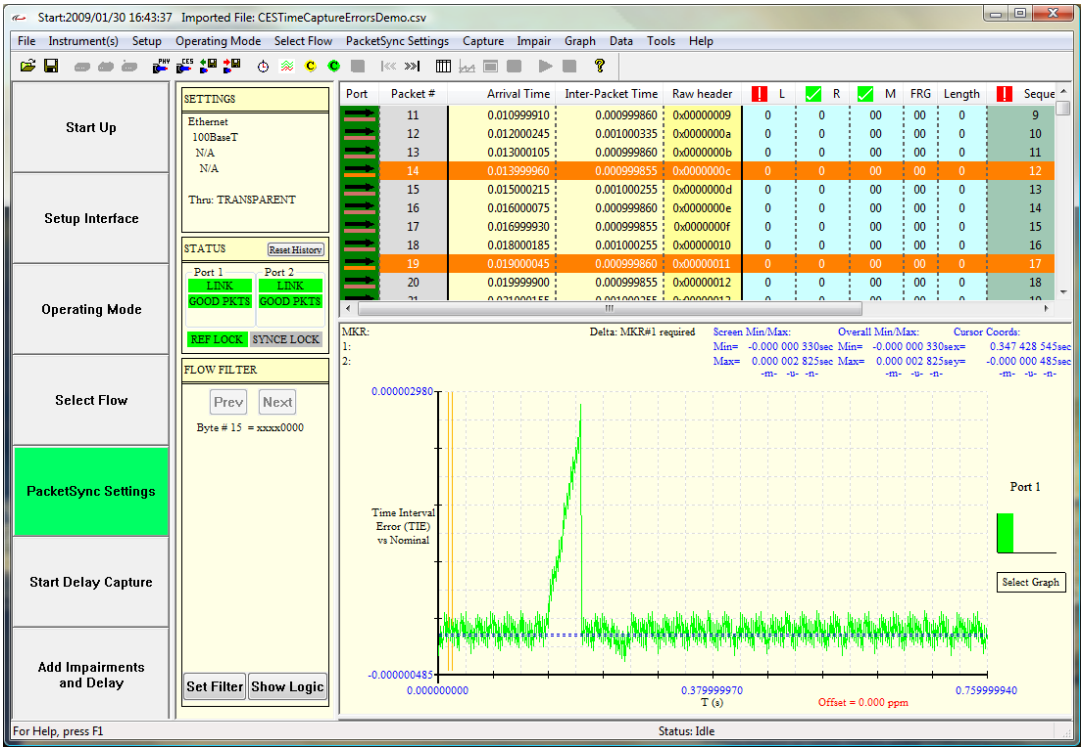


This allows the repeat interval to be set by setting the Period field. The Size field is used to set the range of packets over which the repeat applies. So with Period set to 3 the following table display will result.



The various modes of selection packets can be repeated to allow the desired pattern to be built up.

Additionally the timing graph will be marked to show where packets are going to be dropped during the replay. Vertical orange bars appear at the appropriate places on the graph as shown below where 2 packets have been selected.

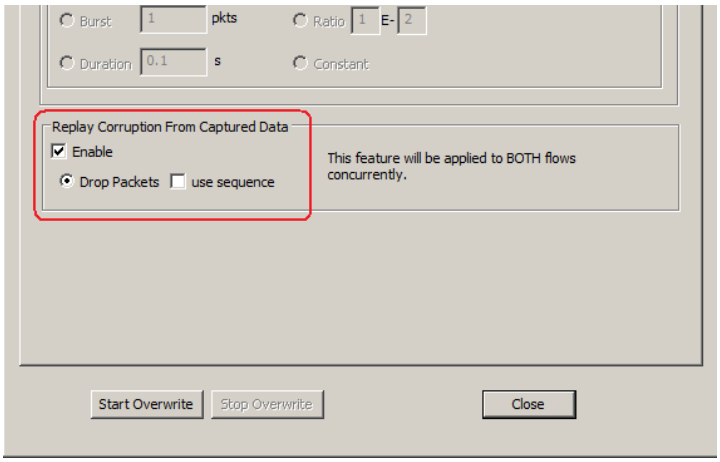


There are 3 additional undo controls worth noting. These are accessed by right clicking the mouse in the table display area.

- Undo Last Drop Action. This allows for a single level of resetting.
- Re-enable Selected Packet will allow one packet to be unselected and replayed correctly. This applies regardless of the method of causing the drop, individual, burst or periodic.
- Revert to Original Profile will reset all the packets selected to be dropped since the file was loaded or captured.

When a profile of dropped packets has been created, it can be saved using File -> Export for later use.

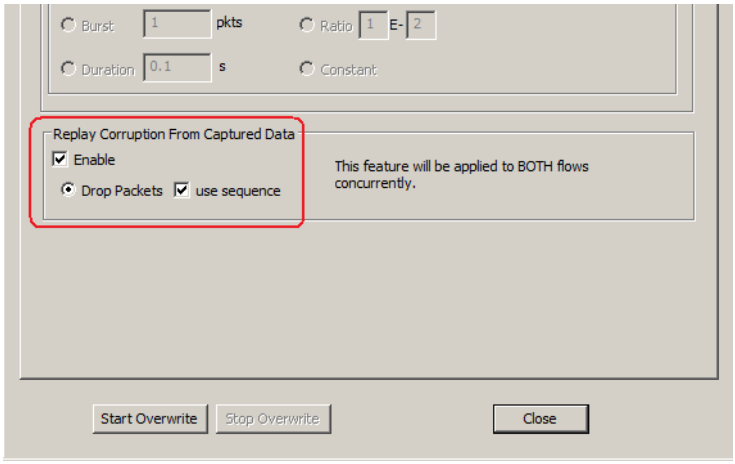
Having selected the packets to be dropped, ensure that the Replay Corruption From Captured Data >Drop Packets boxes are selected. If these are un-checked, all packets will be replayed as normal.



- **Reproducing Sequence Number Gaps**

This feature allows you to replay a captured profile that had missing packets, by recognising and reproducing the sequence number gaps.

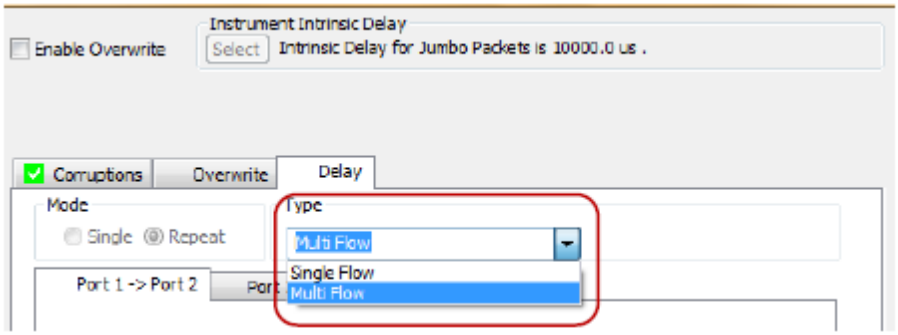
- Import the file in the normal way.
- Select Replay Corruption From Captured Data > use sequence. If these are un-checked, all packets will be replayed as normal, and sequence gaps will be ignored.



Adding Impairments and Delays to Multiple Flows

This feature allows a PDV profile to be replayed onto multiple flows. Each point from the profile is applied to a period of time (e.g. for a profile for a 1000 packets per second flow, each point is applied to a 1msec interval). There is therefore no limit to the number of flows and/or packets that can be impacted during each period.

It is accessed using the Add Impairments and Delay button. On the pop-up window the Delay tab will show a selection for single or multiple flows as shown on the screen shot below.



The selection of Single Flow maintains the existing method of applying the delay profile on a packet by packet basis with the delay changing after each packet.

If Multi Flow is selected, the delay will be applied for the interval represented in the profile file e.g. if the rate is 1000 packets per second then the delay will be applied to all packets received in the 1ms interval. The next delay in the profile will then be applied to all the packets in the next 1ms interval and so on.

The files which can be replayed in this manner are the captured profiles for a Circuit Emulated Services session and the generated delays such as Step and Sawtooth.

As an example, if the instrument filters are set to allow 50 CES streams each at 1000 packets per second and the timing replay profile is generated at 1000 packets per second then each delay in the profile will be applied to one packet in each of the 50 streams. As indicated previously, there is no limit to the number of streams which may be delayed.

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