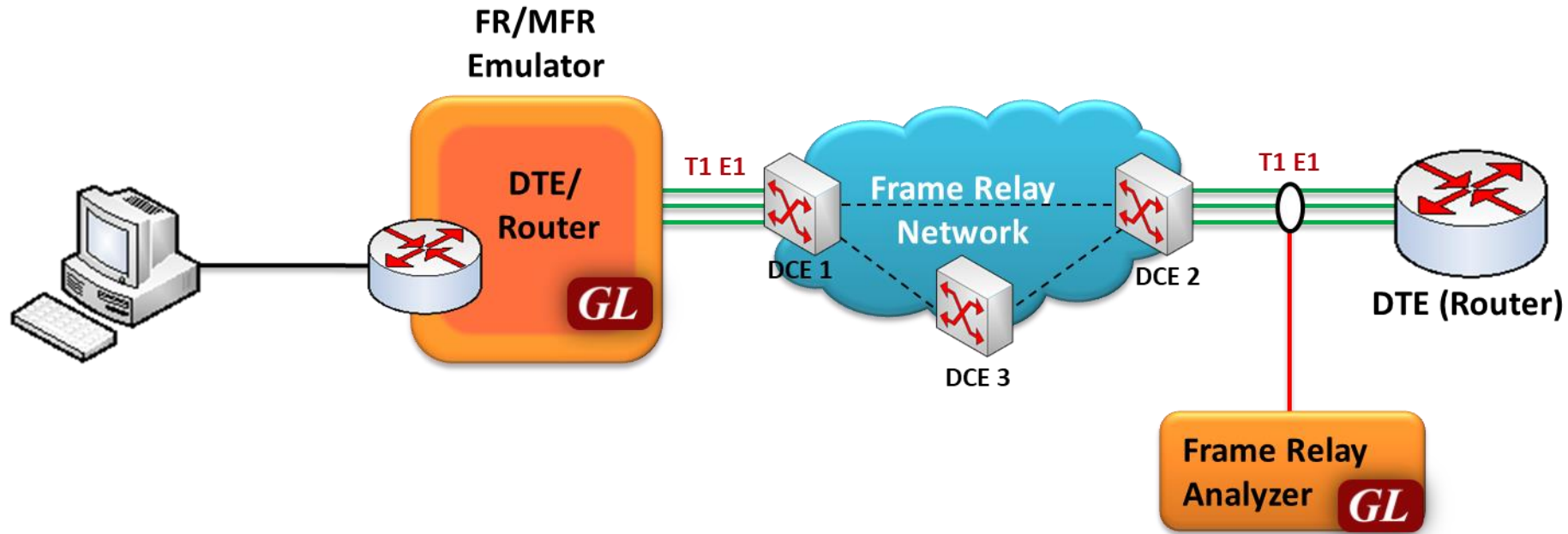

Multi-Link Frame Relay Emulator (MFR)

(FR and MFR Simulation)



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MFR Emulator Working Principle



- Multi-Link Frame Relay Emulation (MFR) software based on client-server architecture over GL's field proven T1 E1 hardware platforms
- The software acts as a Frame Relay (FR)-MFR Data Terminal Equipment (DTE)/Router and generates traffic in compliance with frame relay fragmentation & reassembly models i.e., UNI (DTE-DCE) NNI (DCE peers) & end-to-end fragmentation over multiple virtual circuits

Hardware Platforms



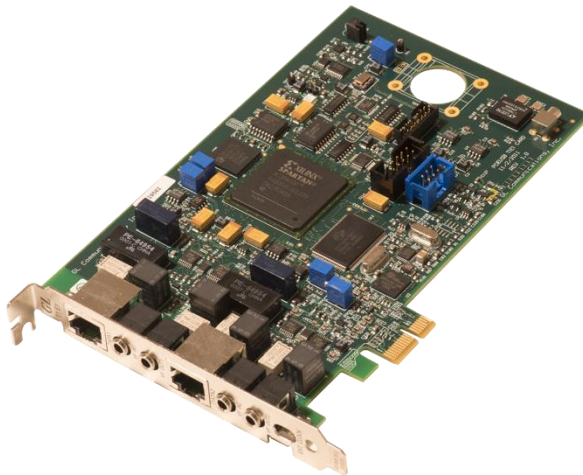
Back Panel

Front Panel

**tProbe™ - Portable USB based T1 E1 VF
FXO FXS and Serial Datacom Analyzer**

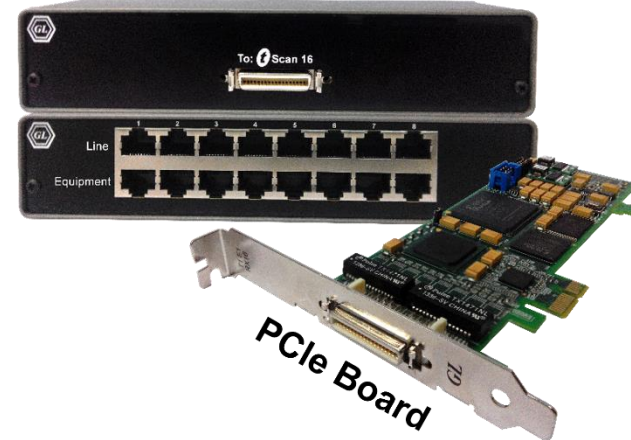


Quad / Octal T1 E1 PCIe Card



Dual T1 E1 Express (PCIe) Board

**tScan16™ with
16-port T1 E1 Breakout Box**



PCIe Board

Connecting to the Server

- **Listen Port:** This is the TCP/IP port on which the server should listen for incoming connection requests from clients. By default, the Listen port for T1 card is set as **17080** and for E1, it is set as **17090**
- **Send / Receive Binary Messages:** Indicates that the server is to communicate with clients using binary messages
- **Send / Receive ASCII Messages:** Indicates that the server is to communicate with clients using ASCII (text-based) messages
- **Send / Receive Version 3 Messages:** Indicates that the server is to communicate with clients using version 3 messages
- **Send / Receive Version 4 Messages:** Indicates that the server is to communicate with clients using version 4 messages
- **Use these settings Until Further Notice:** This option to use the current configuration settings as default settings at analyzer startup
- **Start Server Automatically At analyzer Startup:** It will start the WCS server at analyzer startup by default

Start GL Server

Listen Port

17080

<Default>

Restore Default

Start GL Server

Exit

☐ Server is Invisible

Messaging

☒ Send / Receive Binary Messages

☐ Send / Receive ASCII Messages

Version

☐ Send / Receive Version 3 Messages

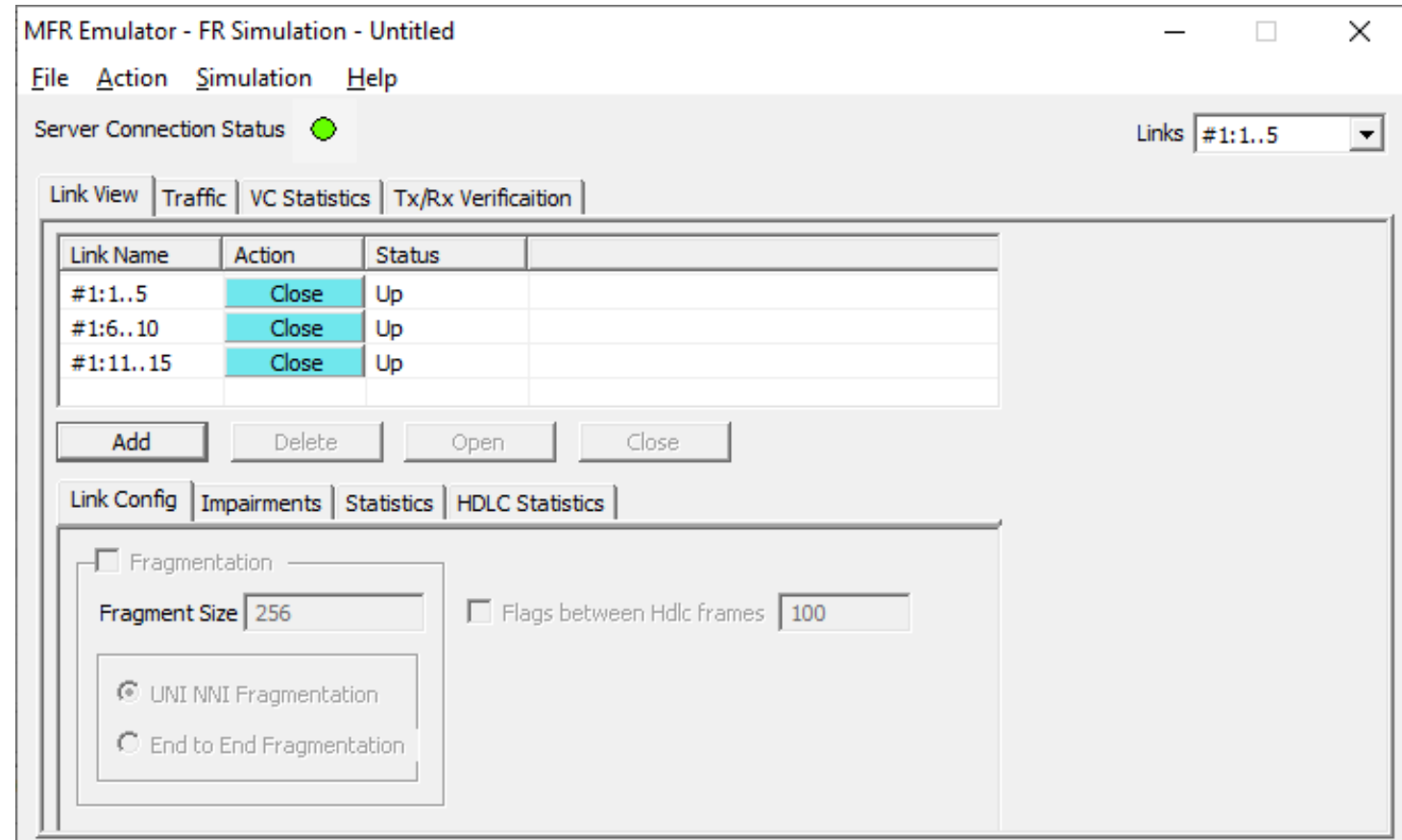
☒ Send / Receive Version 4 Messages

☒ Use These Settings until Further Notice

☒ Start Server Automatically At Analyzer Start-Up

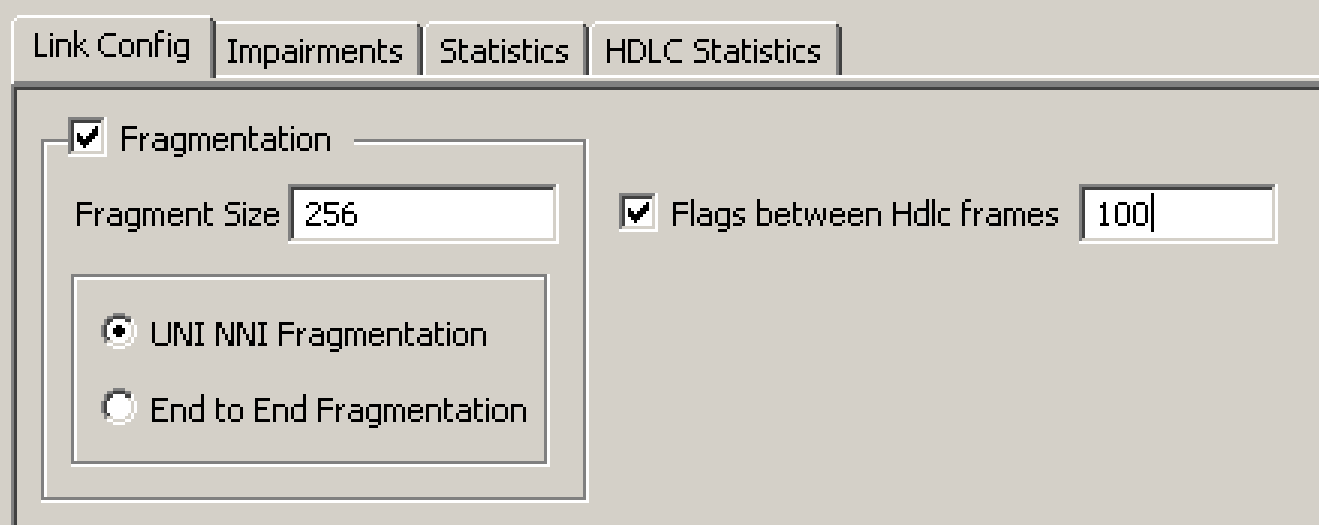
Simulating Frame Relay Links

- Various links (of any bandwidth varying from 64Kbps to n*64Kpbs or sub channels) can be added in FR Simulation
- Two or more than two timeslots can be grouped to constitute a Hyper-channel



Link Configuration

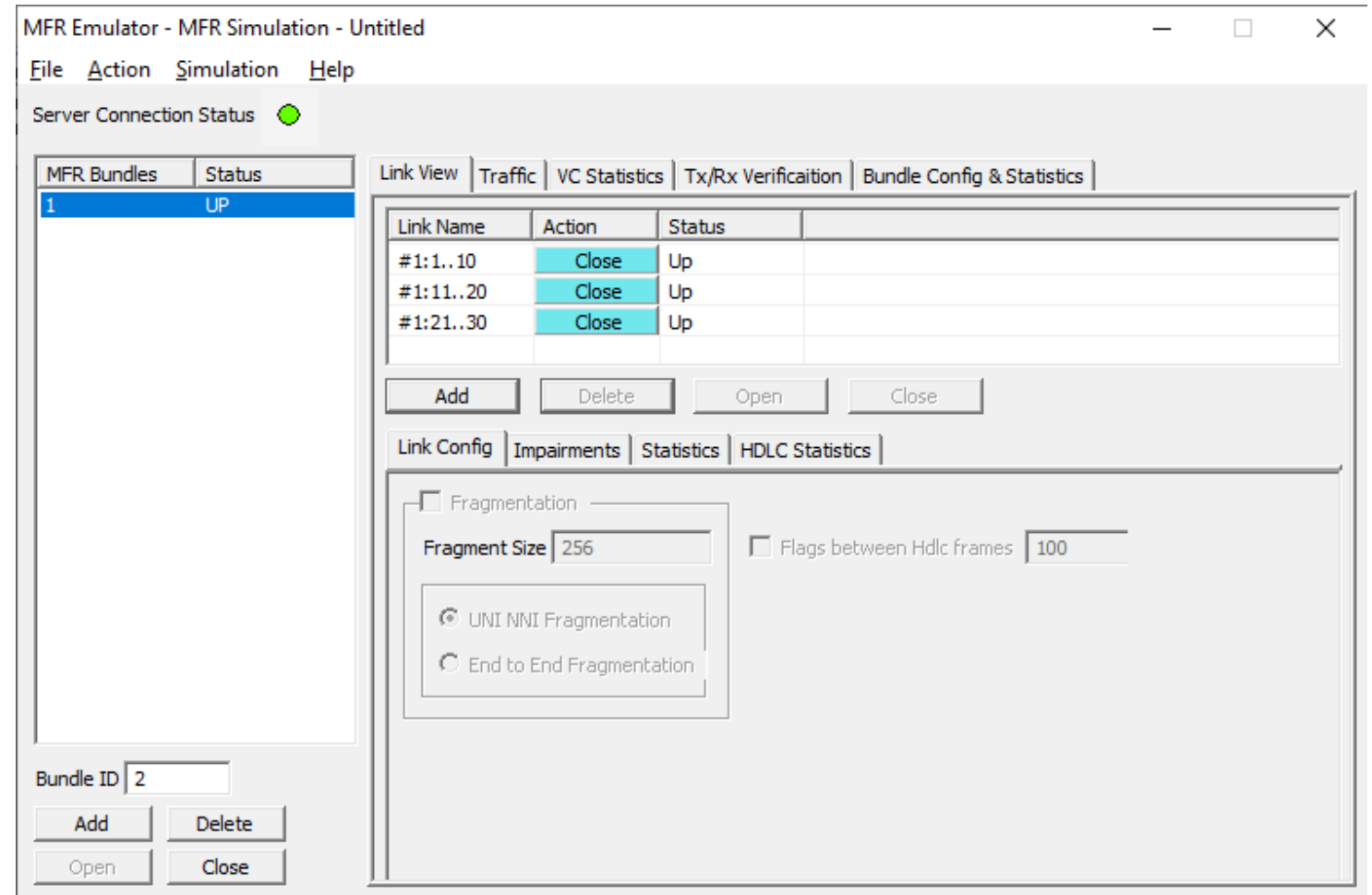
- Provides Frame Fragmentation configuration adhering to FRF.12 standard for traffic generation on selected FR links
- Supports two types of fragmentation: UNI NNI Fragmentation and End-to-End Fragmentation on a FR link
- Allows to configure the bandwidth using flags



The screenshot shows a software window titled "Link Configuration" with four tabs: "Link Config", "Impairments", "Statistics", and "HDLC Statistics". The "Link Config" tab is active. Inside the tab, there is a "Fragmentation" section with a checked checkbox. Below it, a "Fragment Size" is set to "256". There are two radio button options: "UNI NNI Fragmentation" (which is selected) and "End to End Fragmentation". To the right of the fragmentation options, there is a checkbox for "Flags between Hdlc frames" which is also checked, and a text box next to it containing the value "100".

Simulating MFR Bundle

- Allows to create a virtual interface referred as 'bundle' interface
- An MFR bundle can consist of multiple physical links of the same type or physical links of different types
- Data sent through this channel will be distributed among all the links
- It is used to derive larger bandwidth pipe by aggregating smaller bandwidth pipes e.g. from multiple T1s or E1s



Impairments

- Enable the user to intentionally introduce errors in data transmission.
- Impairments can be applied at different levels, i.e.
 - Impair all packets sent over a Physical Link
 - Impair frames on a particular Virtual Channel [VC may be on a physical link or on the MFR bundle]
 - Impair frames on a particular Aggregated Virtual Channel
 - Impair all packets on the MFR bundle

DELETE FRAME
INSERT FRAME
DELETE BYTES
INSERT BYTES
DUPLICATE FRAME
CRC
FRAME
AND
OR
XOR

Link Config Impairments Statistics HDLC Statistics

☒ Enable

Impairment Type: DELETE FRAME

Options

Frame count: 1

Byte Offset: 1

Skip Before Impair: 1

Impairment Duration

☐ Repeat 1

☒ Continuous

Activate

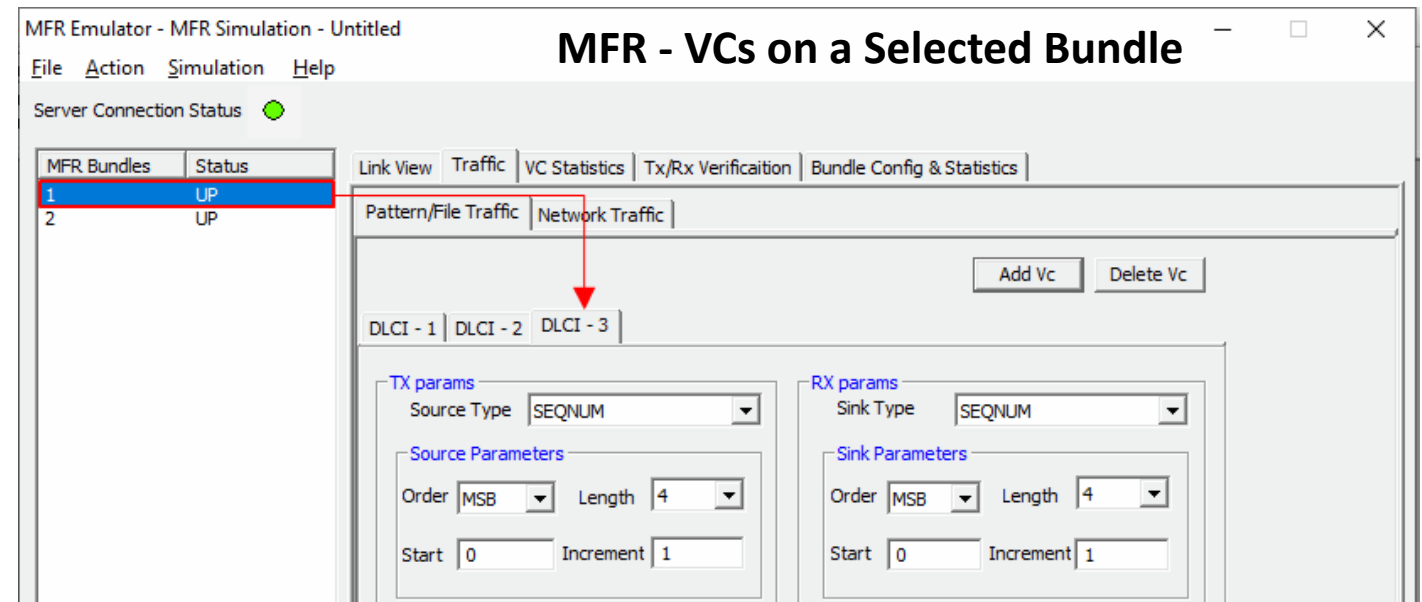
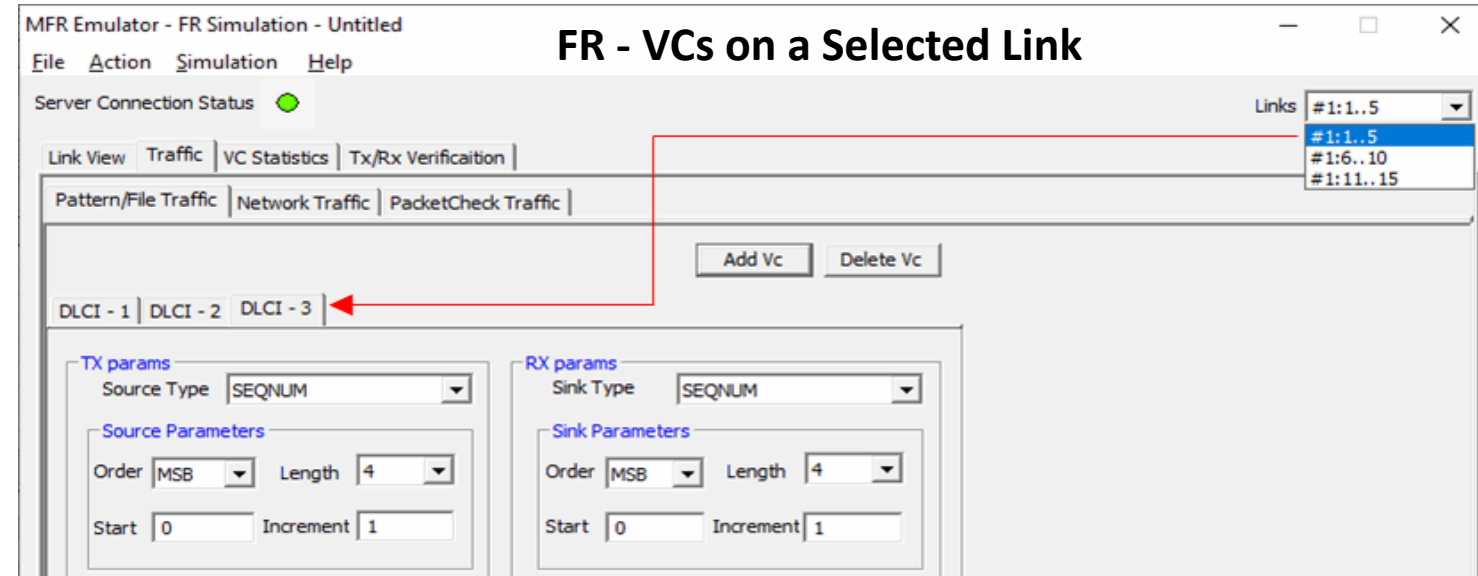
Delay

250 msec Apply

Sync All Links

Pattern/File Traffic

- The source of the traffic is either a file or a repetitive pattern as defined by the user
- Traffic type can be used for end-to-end testing of the link
- The verification process will provide results such as how many frames are received and out of which how many have been matched successfully with configured pattern, similarly, how many frames modified etc.
- BERT test can also be conducted using various pre-defined patterns or a user defined pattern file



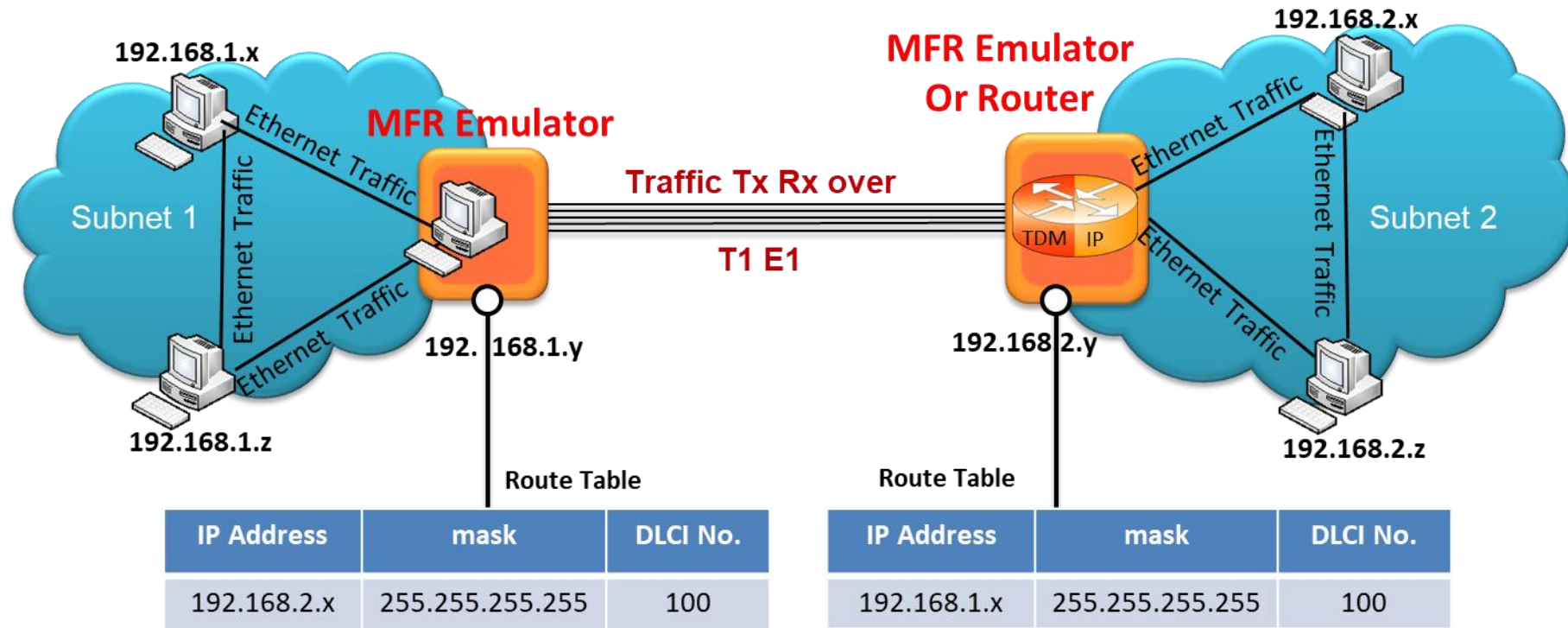
TxRx Verification

Link View Traffic VC Statistics Tx/Rx Verification Bundle Config & Statistics							
Reset							
VC	Tx Cnt	Rx Cnt	Matched Cnt	Modified Cnt	Inserted Cnt	Deleted Cnt	Bert Status
1	1592	1395	1286	2	0	2	N/A
2	1590	1395	1286	5	0	5	N/A
3	1590	1394	1284	3	0	3	N/A
Total	4772	4184	3856	10	0	10	

- The results of the verification for each of the added VCs are available in Tx/Rx Verification
- The statistics include:
 - The number of VCs created
 - The number of frames transmitted successfully
 - The number of frames received successfully
 - If a received frame is verified successfully, then it will be included in "Matched" Frame Count
 - If a received frame does not match, it will be included in the "Modified" Frame Count
 - If the frame is lost then it will be included in "Deleted" Frame Count
 - If extra frames have been received which were not expected then they will be included in Inserted Frame Count

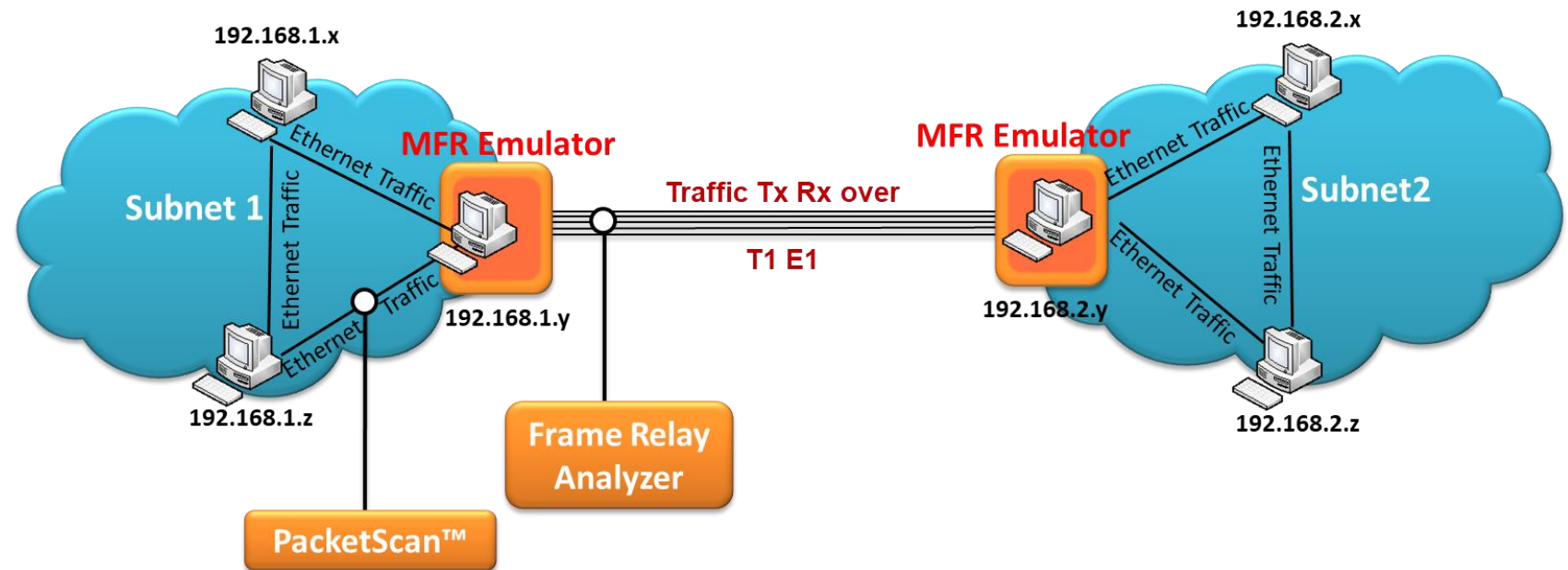
Network Traffic - MFR Emulator as a Router

- Allows user to setup routing table by configuring IP Address and Mask
- Once configured, the emulator forwards the IP packets which match routing criteria over MFR links
- Emulator responds to all ARP requests whose IP addresses present in routing table
- The image shows two networks, **Subnet1** and **Subnet2**, connected through T1 E1 lines using MFR Emulator that is configured to work as router

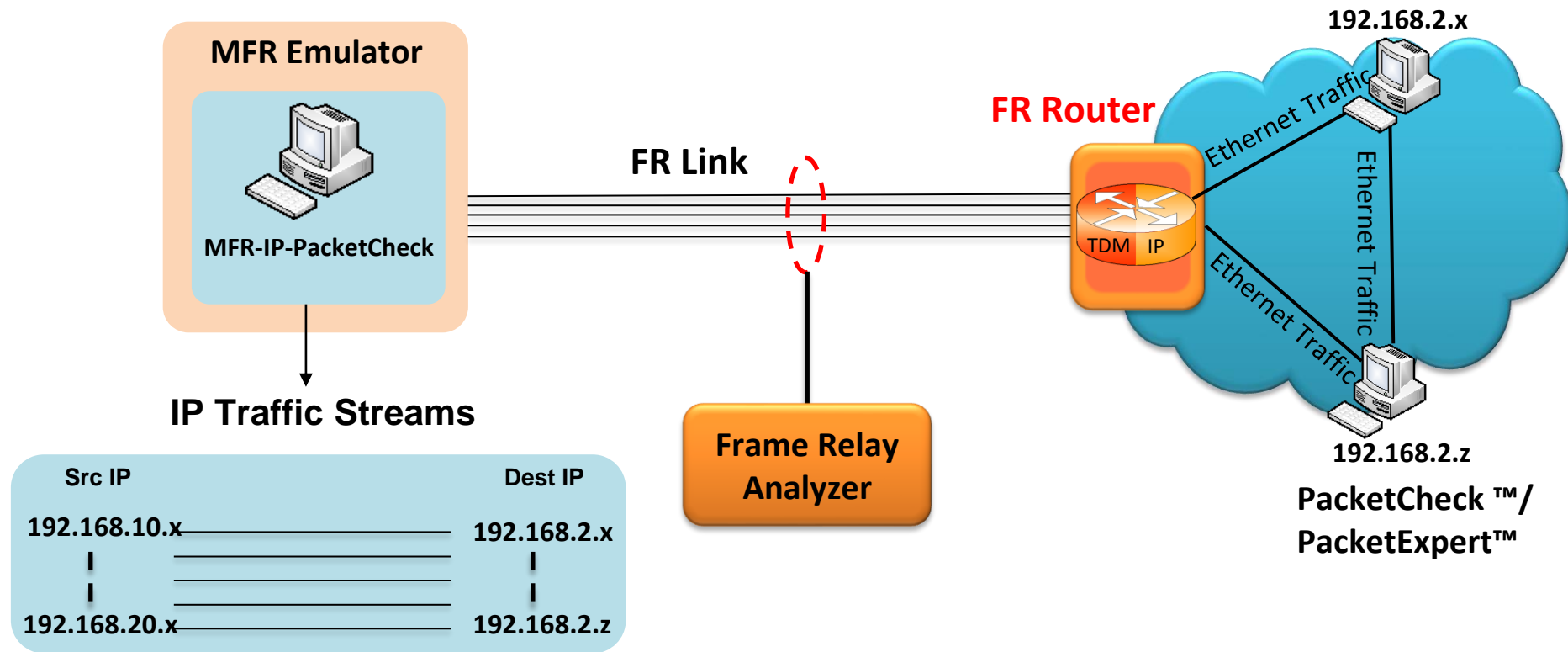


Network Traffic - MFR Emulator as a Bridge

- When the MFR Emulator is configured to act as bridge between two networks, all ARP and traffic received from the network is encapsulated as bridged IP and streamed over T1 E1 links
- The Emulator on another network removes bridging header, converts to Ethernet and streams to the destination



PacketCheck™ Traffic



- Allows IP traffic generation and reception over FR links
- Multiple IP traffic streams can be generated and processed over multiple VCs created within the FR links
- VCs can be configured to encapsulate the IP packets with desired custom headers to emulate various protocols
- MFR-IP-PacketCheck traffic is used to generate and receive IP packet streams to and from a FR router
- FR Router shall be tested for routing the received packets to the proper destination

PacketCheck Traffic Configuration

- Allows to create multiple VCs and multiple Routes on the FR links
- Each Route will have its own route criteria and an assigned VC (created in VC configuration)
- Packets that pass through the defined criteria of a route, will be transmitted on the VC assigned to that route

The screenshot shows the 'MFR Emulator - FR Simulation - 2 streams' window. The 'Traffic' tab is selected and highlighted with a red box. Below it, the 'PacketCheck Traffic' sub-tab is active. The 'Vc Configuration' section contains a table with two rows of VC settings. The 'Route Configuration' section contains a table with two rows of route settings. At the bottom, there are buttons for 'Add Vc', 'Delete Vc', 'Load PacketCheck Config', 'Add Route', 'Delete Route', and 'Stop Traffic'. A 'Links' dropdown menu is set to '#1:0..23'.

Server Connection Status ● Links #1:0..23

Link View **Traffic** VC Statistics Tx/Rx Verification

Pattern/File Traffic Network Traffic PacketCheck Traffic

Vc Configuration

Link Name	DLCI	Tx Prefix Header	Tx Skip Bytes	Rx Prefix Header	Rx Skip Bytes	Bandwidth(%)
#1:0..23	123	0300800080c20007	0		8	100
#2:0..23	123	0300800080c20007	0		8	100

Add Vc Delete Vc

Route Configuration

Src MAC Address	Src MAC Mask	Dest MAC Address	Dest MAC Mask	Src IP Address	Src IP Mask	Dest IP Address
ab-cd-ef-12-34-56	FF-FF-FF-FF-FF-FF	78-9a-bc-de-f1-23	FF-FF-FF-FF-FF-FF	192.168.12.92	255.255.252.0	192.168.12.83
78-9a-bc-de-f1-23	FF-FF-FF-FF-FF-FF	ab-cd-ef-12-34-56	FF-FF-FF-FF-FF-FF	192.168.12.83	255.255.252.0	192.168.12.92

< >

Load PacketCheck Config Add Route Delete Route

Stop Traffic MFR-IP-PacketCheck

Linked Statistics

- Provides important statistics information for the selected link such as the Number of frames transmitted, Received frames, Octets Transmitted, and Octets Received

The screenshot displays the MFR Emulator - FR Simulation - MFRTest application window. The 'Server Connection Status' is indicated by a green dot. The 'Link View' tab is active, showing a table with the following data:

Link Name	Action	Status
#1:0..23	Close	Up

Below the table are buttons for 'Add', 'Delete', 'Open', and 'Close'. The 'Statistics' tab is selected, showing the following statistics:

Statistic	Value
Number of Frames Transmitted	2545226
Number of Frames Received	2435479
Number of Octets Transmitted	3848381712
Number of Octets Received	3633952713

A 'Reset' button is located next to the 'Number of Frames Transmitted' field.

HDLC Statistics

- Errors that occur during transmission / reception like the Tx Under/Over Runs, Rx Under/Over Runs, number of FR packets with bad FCS, and number of packets with Frame Errors is recorded in the HDLC Statistics fields

MFR Emulator - FR Simulation - Untitled

File Action Simulation Help

Server Connection Status ●

Link View Traffic VC Statistics Tx/Rx Verification

Link Name	Action	Status
#1:0..23	Close	Up
#2:0..23	Close	Up

Add Delete Open Close

Link Config Impairments Statistics HDLC Statistics


Tx Under/Over Runs

Rx Under/Over Runs

CRC Error Frames

Frame Error Frames

VC Statistics

Server Connection Status  Links #1:1..31

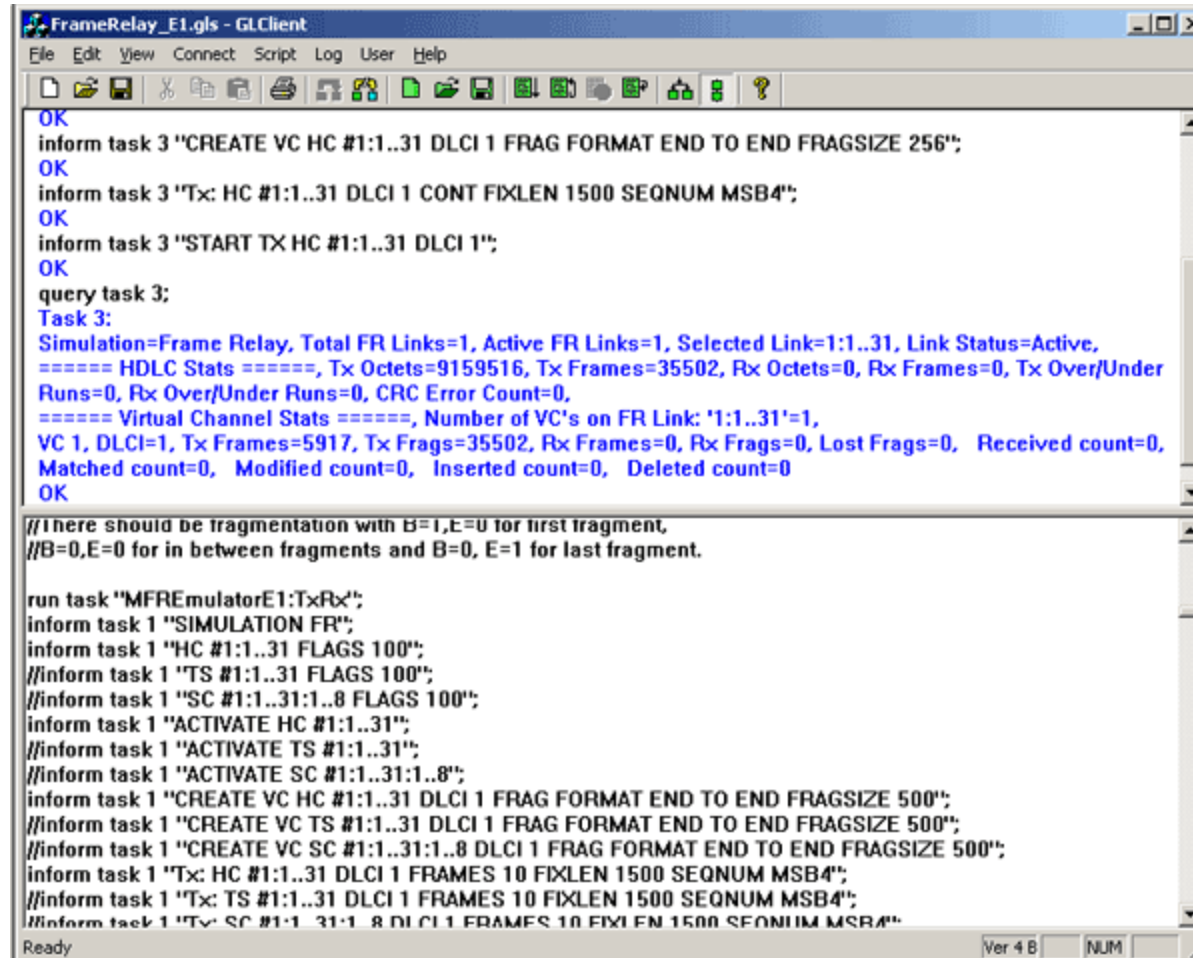
Link View Traffic **VC Statistics** Tx/Rx Verification

Reset

VC	Tx Frames	Tx Frags	Tx Octets	Rx Frames	Rx Frags	Rx Octets	Lost Frags
200	3346	0	5019000	3414	0	5121000	0
300	3345	0	230845	3415	0	235838	0
400	3345	0	5017500	3415	0	5122500	0
500	3344	0	5016000	3413	0	5119500	0
600	3344	0	5016000	3413	0	5119500	0
Total	16724	0	20299345	17070	0	20718338	0

- The statistics for each of the added VCs are available and these include number of Transmitted and received frames, Fragments, Octets, and Lost fragments

MFR Simulation in Command Line Interface



```
FrameRelay_E1.gls - GLClient
File Edit View Connect Script Log User Help

OK
inform task 3 "CREATE VC HC #1:1..31 DLCI 1 FRAG FORMAT END TO END FRAGSIZE 256";
OK
inform task 3 "Tx: HC #1:1..31 DLCI 1 CONT FIXLEN 1500 SEQNUM MSB4";
OK
inform task 3 "START TX HC #1:1..31 DLCI 1";
OK
query task 3:
Task 3:
Simulation=Frame Relay, Total FR Links=1, Active FR Links=1, Selected Link=1:1..31, Link Status=Active,
===== HDLC Stats =====, Tx Octets=9159516, Tx Frames=35502, Rx Octets=0, Rx Frames=0, Tx Over/Under
Runs=0, Rx Over/Under Runs=0, CRC Error Count=0,
===== Virtual Channel Stats =====, Number of VC's on FR Link: '1:1..31'=1,
VC 1, DLCI=1, Tx Frames=5917, Tx Frags=35502, Rx Frames=0, Rx Frags=0, Lost Frags=0, Received count=0,
Matched count=0, Modified count=0, Inserted count=0, Deleted count=0
OK

//There should be fragmentation with B=1,E=0 for first fragment,
//B=0,E=0 for in between fragments and B=0, E=1 for last fragment.

run task "MFRemulatorE1:TxRx";
inform task 1 "SIMULATION FR";
inform task 1 "HC #1:1..31 FLAGS 100";
//inform task 1 "TS #1:1..31 FLAGS 100";
//inform task 1 "SC #1:1..31:1..8 FLAGS 100";
inform task 1 "ACTIVATE HC #1:1..31";
//inform task 1 "ACTIVATE TS #1:1..31";
//inform task 1 "ACTIVATE SC #1:1..31:1..8";
inform task 1 "CREATE VC HC #1:1..31 DLCI 1 FRAG FORMAT END TO END FRAGSIZE 500";
//inform task 1 "CREATE VC TS #1:1..31 DLCI 1 FRAG FORMAT END TO END FRAGSIZE 500";
//inform task 1 "CREATE VC SC #1:1..31:1..8 DLCI 1 FRAG FORMAT END TO END FRAGSIZE 500";
inform task 1 "Tx: HC #1:1..31 DLCI 1 FRAMES 10 FIXLEN 1500 SEQNUM MSB4";
//inform task 1 "Tx: TS #1:1..31 DLCI 1 FRAMES 10 FIXLEN 1500 SEQNUM MSB4";
//inform task 1 "Tx: SC #1:1..31:1..8 DLCI 1 FRAMES 10 FIXLEN 1500 SEQNUM MSB4";

Ready Ver 4 B NUM
```

Thank you