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# MAPS™ MC-MLPP(Multi Class Multi Link PPP)

## MC-MLPP Conformance Testing

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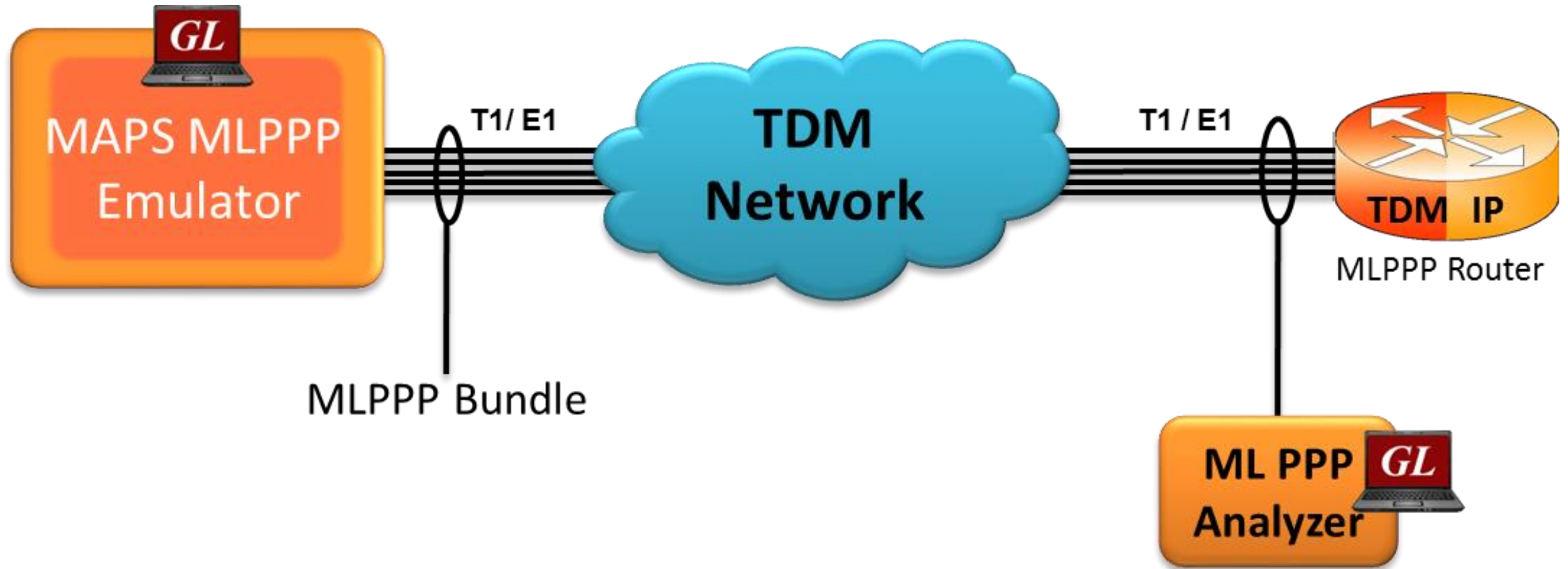
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# MAPS™ MC-MLPP

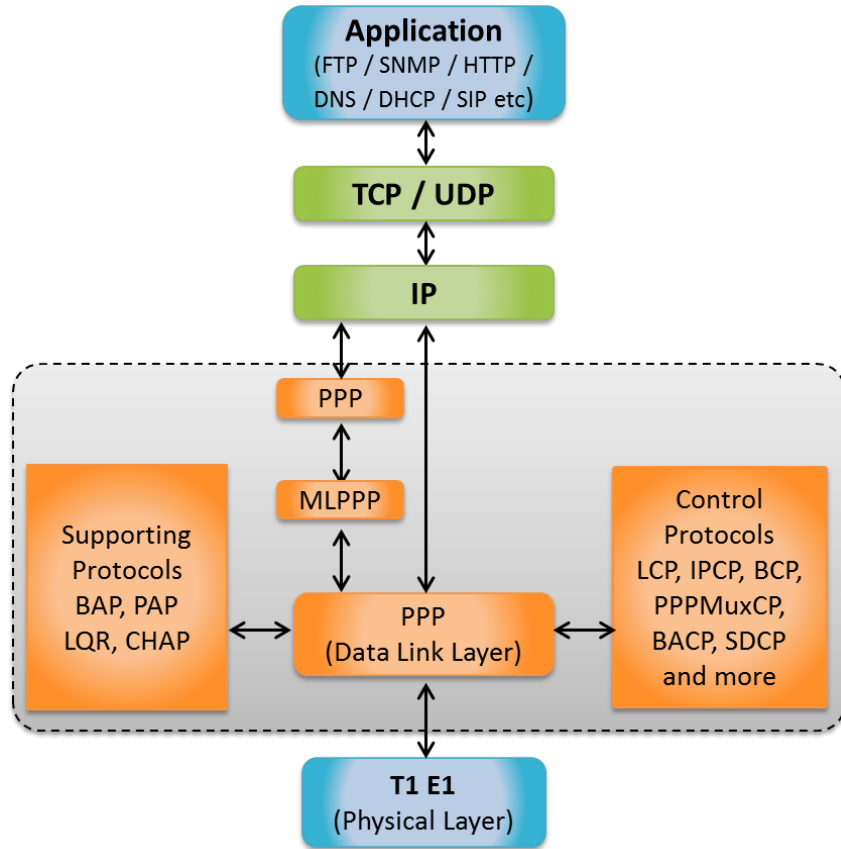
## MC-MLPPP Emulation in the TDM Network



# Main Features

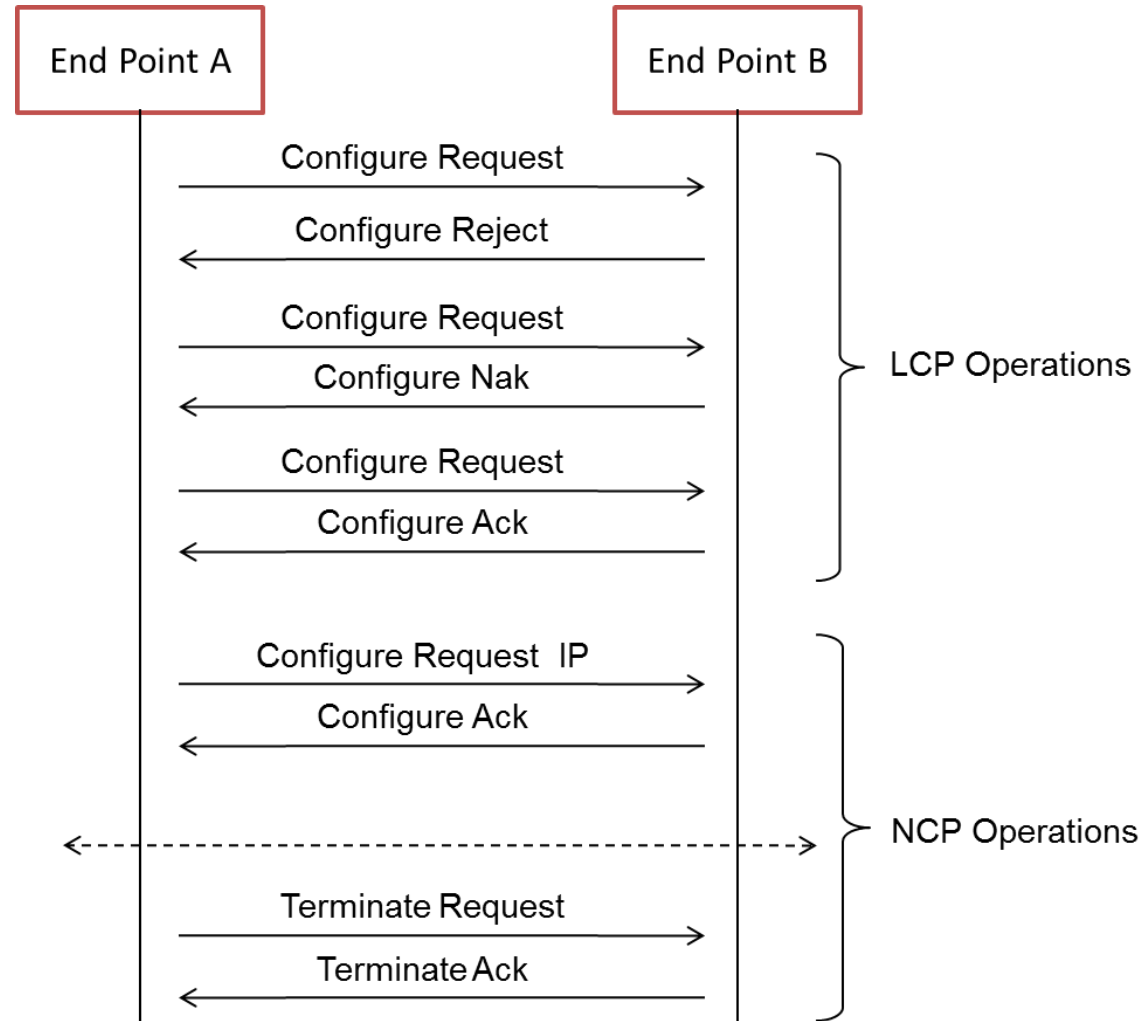
- Performs MC-MLPPP as well as PPP simulation over TDM (T1/E1)
- Supports LCP with the following negotiation options
  - PPP options: MRU (Maximum Receive Unit), ACFC (Address and Control Field Compression), PFC (Protocol Field Compression), and Magic Number
  - MLPPP Options: MRRU (Maximum Received Reconstructed Unit), Short Sequence Number Format, Long sequence header format, Endpoint Discrimination, and Multi-class option
  - Multi-Class Options: Multilink Header Format
- Supports the following NCPs -
  - IPCP - RFC 1332 (PPP Internet Protocol Control Protocol) and RFC 1877 (PPP Internet Protocol Control Protocol Extensions) standard
  - PPPMuxCP – RFC 3153 (PPP Network Control Protocol for PPP Multiplexing) standard
- Supports IP compression negotiation option conforming to RFC 3544
- Supports full or fractional timeslots for PPP Link
- Ideal solution for automated testing using command line scripts
- Supports customization of call flows and message templates using Script editor and Message editor
- Ready to use Conformance scripts for quick testing
- Provides protocol trace with full message decoding, and graphical ladder diagrams of call flow with time stamp
- Provides call statistics with associated captured events and error events during call simulation

# Supported Protocol Standards



Supported Protocols	Standard / Specification Used
Point-to-Point Protocol	RFC1661
Multi-Link PPP	RFC1990
Multi-Class Extension to Multi-Link PPP	RFC2686
IPCP	RFC1332
IPCP Extensions	RFC1877
PPPMuxCP	RFC3153

# MC-MLPP Call Flow Scenario



# Testbed Configuration

MAPS (Message Automation Protocol Simulation) (MLPPP IETF) - [Testbed Setup - Card1]

Configurations Emulator Reports Editor Debug Tools Windows Help

Config	Value
MLPPP Config	
MLPPP Task Configuration	1
MLPPP Task Configuration 1	
SimulationType	MLPPP
MLPPPTaskConfiguration1	1 TS #1:1
Default Profile	MLPPP_Profiles.xml

LinkConfig

Enter Char

1 TS #1:1

Start Edit

Initialisation Errors Error Events Captured Errc

# Profile Configuration

MAPS (Message Automation Protocol Simulation) (MLPPP IETF) - [Profile Editor - MLPPP\_Profiles]

Configurations Emulator Reports Editor Debug Tools Windows Help

#	Profiles (Edit-F2)	Config	Value	Enable
1	MLPPPProfile01	MLPPPProfile01		<input checked="" type="checkbox"/>
2	MLPPPProfile02	MRU	2000	
3	MLPPPProfile03	Magic Number	77	
4	MLPPPProfile04	Identifier	27	
5	MLPPPProfile05	Stream ID	1	
6	MLPPPProfile06	MAXFAILURE of Peer	5	
7	MLPPPProfile07	IP Address for Peer		
8	MLPPPProfile08	Peer Primary DNS	44.44.44.44	
9	MLPPPProfile09	Peer Primary NBNS	66.66.66.66	
10	MLPPPProfile10	Peer Secondary DNS	88.88.88.88	
		Peer Secondary NBNS	212.121.212.121	
		Local IPHC Parameters		
		TCP Space	11	
		Non TCP Space	11	
		Max Period	11	
		Max Time	5	
		Max Header	11	
		Local Other Parameters		
		IP Address		
		Primary DNS address		
		Primary NBNS Address		
		Secondary DNS Address		
		Secondary NBNS Address		
		Local VJ Parameters		
		Max Slot ID	5	
		Comp Slot ID	1	
		Max Configure of Peer	5	
		MLPPP Options		

Buttons: Add, Insert, Delete, Properties

Bottom status bar: Initialisation Errors, Error Events, Captured Errors, Link Status Up=0 Down=

# Incoming Call Handler Configuration

Incoming Call Handlers Configuration - default

Message Name	Script Name
Configure-Request	TestLoopBackUsingPeerMagicNumber.gls
Configure-Ack	
Configure-Nak	
Configure-Reject	
Terminate-Request	
Terminate-Ack	
Code-Reject	
Protocol-Reject	
Echo-Request	
Echo-Reply	
Discard-Request	

Scripts

- TestLoopBackUsingPeerMagicN...

Sequence  
 Random

Up  
Down

Add Delete Clear Add Delete



# MC-MLPP Call Generation

GL MAPS (Message Automation Protocol Simulation) (MLPPP IETF) - [Call Generation - CallGenDefault]

Configurations Emulator Reports Editor Windows Help

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Events Profile	Result	Total Iterations	Completed Iterations
1	OpenStateTest.gls	MLPPPProfile01		Start	Opened	None	EventProfile.xml ...	Pass	1	1

Add Delete Insert Refresh Start Start All Stop Stop All Abort Abort All

Save Column Width

MAPS DUT

```

sequenceDiagram
    participant MAPS
    participant DUT
    Note over MAPS: 16:30:34.289000
    MAPS->>DUT: Configure-Request
    Note over DUT: 16:30:36.721000
    DUT-->>MAPS: Configure-Ack
    Note over MAPS: 16:30:39.855000
    MAPS->>DUT: Configure-Request
    Note over DUT: 16:30:39.856000
    DUT-->>MAPS: Configure-Ack
    
```

```

===== PPP Link Layer =====
0000 Address Compression Choice = 1111.... No Address Compression
0000 Address = 11111111 Broadcast Address
0001 Ct1 = 00000011 UnSequenced Frame
0002 ProtoCol Field Selection = .....0 ProtocolField Two Octets
0002 Protocol = 11000000 00100001 Link Control
===== Link Control Layer =====
Code Type =
0004 Code = 00000001 Configure-Request
0005 Identifier = 27 (x1B)
0006 Length = 18 (x0012)
Magic-Number =
0008 IE id = 00000101 Magic-Number
0009 Length of Options = 6 (x06)
000A Magic-Number = 110 (x0000006E)
Maximum-Receive-Unit =
000E IE id = 00000001 Maximum-Receive-Unit
000F Length of Options = 4 (x04)
0010 Maximum-Receive-Unit = 1500 (x05DC)
PFC =
0012 IE- Id = 00000111 Protocol -Field-Compression
0013 Length of Options = 2 (x02)
ACFC =
0014 IE- Id = 00001000 Address-and-Control-Field-Compression
0015 Length of Options = 2 (x02)
    
```

Scripts Message Sequence Event Config Script Flow

Error Events Captured Errors Link Status Up=0 Down=0

# MC-MLPP Call Reception

The screenshot displays the MAPS (Message Automation Protocol Simulation) software interface. The title bar reads "MAPS (Message Automation Protocol Simulation) (MLPPP IETF) - [Call Reception]". The menu bar includes "Configurations", "Emulator", "Reports", "Editor", "Windows", and "Help".

A table at the top shows the execution results for a script named "TestLoopBackUsingPeerMagicNumber.gls":

Sr No	Script Name	Call Info	Script Execution	Status	Events	Events...	Results
1	TestLoopBackUsingPeerMagicNumber.gls		Completed		None		Pass

Below the table, there are buttons for "Abort" and "Abort All", and checkboxes for "Show Records" (checked), "Auto Trash", and "Trash".

The main area shows a "Message Sequence" diagram between "DUT" and "MAPS". The sequence includes:

- Configure-Request (DUT to MAPS) at 18:32:49.251000
- Configure-Ack (MAPS to DUT) at 18:32:49.252000
- Configure-Request (DUT to MAPS) at 18:32:49.252000
- Configure-Nak (DUT to MAPS) at 18:32:51.629000 (highlighted in orange)

The right pane displays the raw data for the selected "Configure-Nak" message:

```
===== PPP Link Layer =====  
0000 Address Compression Choice = 1111.... No Address Compression  
0000 Address = 11111111 Broadcast Address  
0001 Ctl = 00000011 UnSequenced Frame  
0002 ProtoCol Field Selection = .....0 ProtocolField Two Octets  
0002 Protocol = 11000000 00100001 Link Control  
===== Link Control Layer =====  
Code Type =  
0004 Code = 00000011 Configure-Nak  
0005 Identifier = 14 (x0E)  
0006 Length = 14 (x000E)  
Magic-Number =  
0008 IE id = 00000101 Magic-Number  
0009 Length of Options = 6 (x06)  
000A Magic-Number = 31698 (x00007BD2)  
Max-Recv-Recnstrctd-Unit =  
000E IE-Id = 00010001 Maximum-Receive-Reconstructed-Unit  
000F Length of Options = 4 (x04)  
0010 Maximum-Receive-Reconstructed-Unit = 1500 (x05DC)
```

At the bottom, there are tabs for "Scripts", "Message Sequence" (selected), "Event Config", and "Script Flow". The status bar shows "Error Events", "Captured Errors", and "Link Status Up=0 Down=0".

# MC-MLPP Call Event Log

Date/Time	Captured Events	Call...	Script Name	Script Id
2014-10-21 16:29:44.761000	Source Port = 44419		Mapslnit.gls	
2014-10-21 16:29:44.761000	Source Port = 44887		Mapslnit.gls	
2014-10-21 16:30:06.312000	ConfigReq Sent		OpenStateTest.gls	CGProtScriptId_77146006-1152-376
2014-10-21 16:30:10.017000	ConfigReq received		OpenStateTest.gls	CGProtScriptId_77146006-1152-376
2014-10-21 16:30:10.018000	ConfigAck Sent		OpenStateTest.gls	CGProtScriptId_77146006-1152-376
2014-10-21 16:30:18.704000	Ack Received		OpenStateTest.gls	CGProtScriptId_77146006-1152-376
2014-10-21 16:30:18.704000	Open state Entered		OpenStateTest.gls	CGProtScriptId_77146006-1152-376
2014-10-21 16:30:34.289000	ConfigReq Sent		OpenStateTest.gls	CGProtScriptId_77173990-1153-376
2014-10-21 16:30:36.721000	Ack Received		OpenStateTest.gls	CGProtScriptId_77173990-1153-376
2014-10-21 16:30:39.855000	ConfigReq received		OpenStateTest.gls	CGProtScriptId_77173990-1153-376
2014-10-21 16:30:39.856000	ConfigAck Sent		OpenStateTest.gls	CGProtScriptId_77173990-1153-376
2014-10-21 16:30:39.856000	Open state Entered		OpenStateTest.gls	CGProtScriptId_77173990-1153-376

Clear    Save Events     Capture Events to file    ...

# Global Configuration

MAPS (Message Automation Protocol Simulation) (MLPPP IETF) - [Global Configuration - Globalprofile]

Configurations Emulator Reports Editor Debug Tools Windows Help

Config	Value
Global Configuration	
Protocol Specific Timers	
TimeSpan in msec	10
RecvTime in msec	100
MLPPPConfigurations	
MAXFAILURE	5
LinkStatus	DOWN
LinkstreamID	1

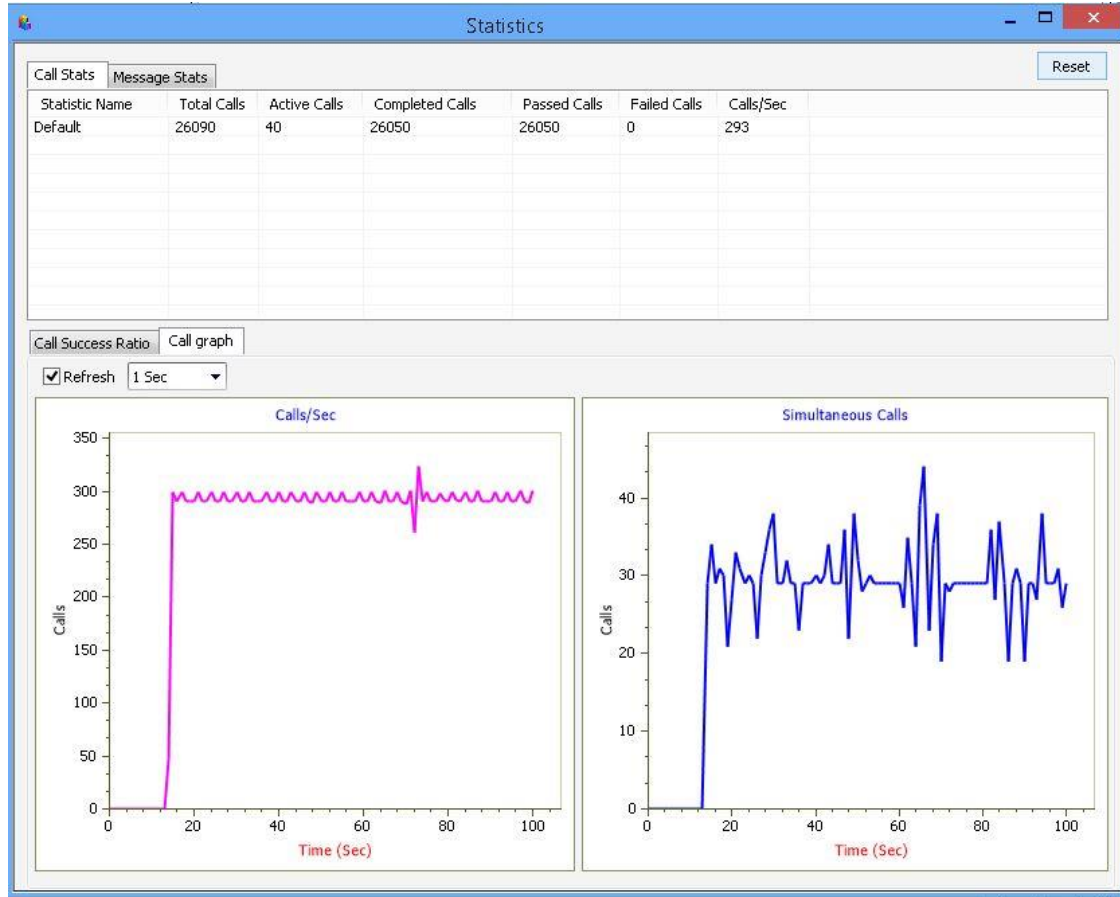
Enable

Apply Edit

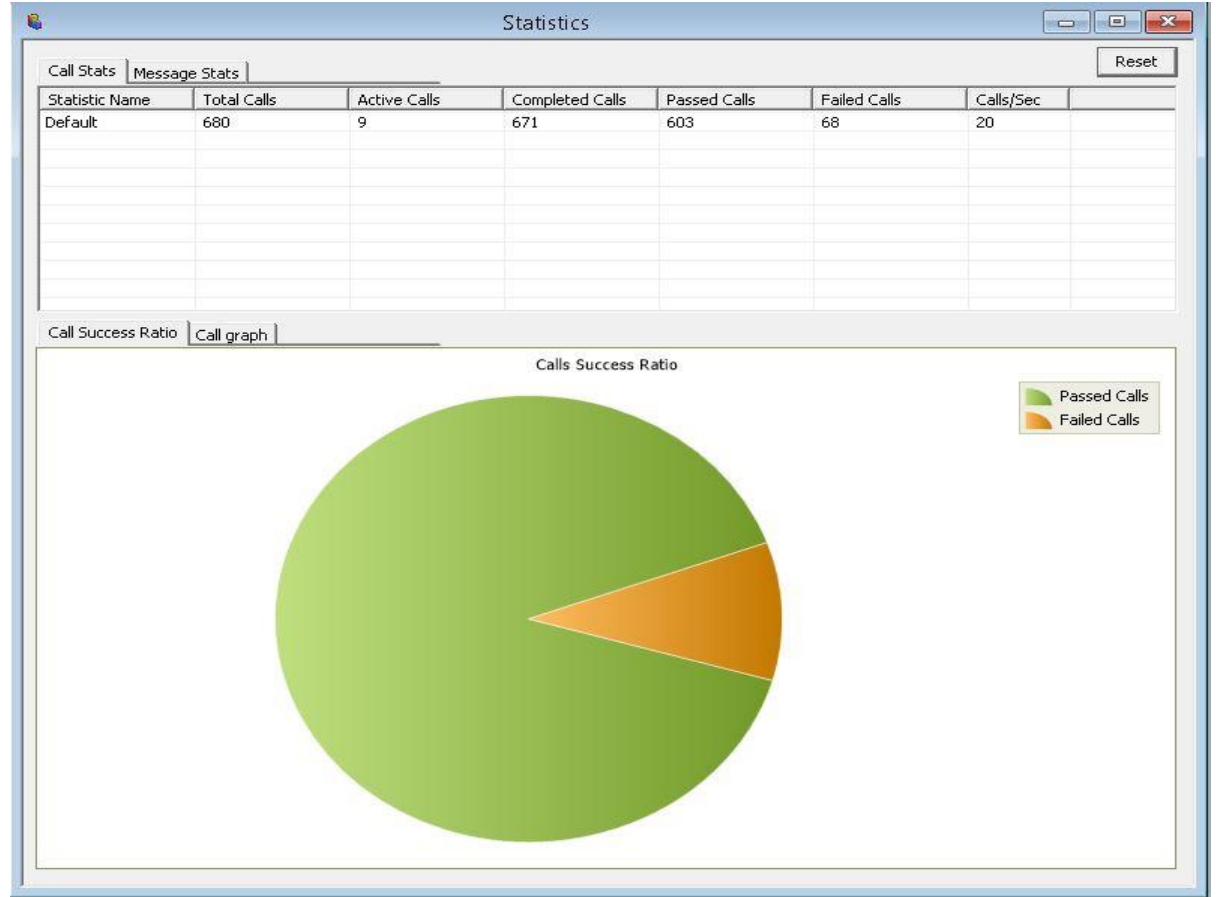
Initialisation Errors Error Events Captu

# MC-MLPP Call Ratio Statistics

## Call Graph

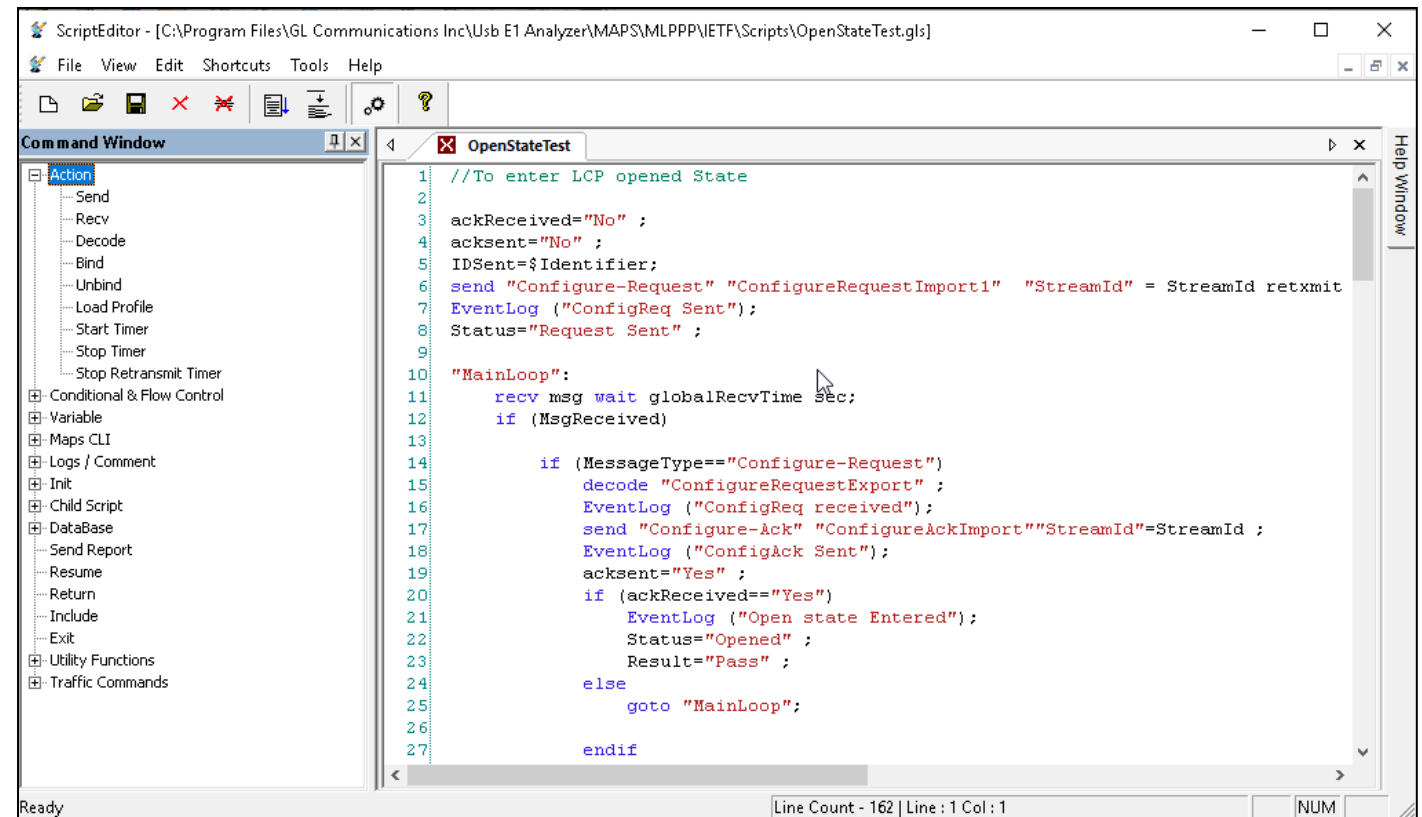


## Call Stats



# Customizations - Call Flow (Scripts)

- Scripts are written in our proprietary \*.gls scripting language. They represent generic state machines intended provide protocol/signaling logic for a call and establish bearer traffic
- Each instance of a script corresponds to a single transaction/call, i.e., if you place 500 calls in parallel you will have 500 script instances running at once. If you place 500 calls in series the same script will execute and terminate 500 times
- It is possible to create your own scripts, but almost never necessary! We attempt to provide all necessary scripts out of the box



The screenshot shows the ScriptEditor application window. The title bar reads "ScriptEditor - [C:\Program Files\GL Communications Inc\Usb E1 Analyzer\MAPS\MLPPP\IETF\Scripts\OpenStateTest.gls]". The menu bar includes "File", "View", "Edit", "Shortcuts", "Tools", and "Help". The toolbar contains icons for file operations and editing. On the left, a "Command Window" pane shows a tree view of actions: Send, Recv, Decode, Bind, Unbind, Load Profile, Start Timer, Stop Timer, Stop Retransmit Timer, Conditional & Flow Control, Variable, Maps CLI, Logs / Comment, Init, Child Script, DataBase, Send Report, Resume, Return, Include, Exit, Utility Functions, and Traffic Commands. The main editor area displays the following script code:

```
1 //To enter LCP opened State
2
3 ackReceived="No" ;
4 acksent="No" ;
5 IDSent=$Identifier;
6 send "Configure-Request" "ConfigureRequestImport1" "StreamId" = StreamId retxmit
7 EventLog ("ConfigReq Sent");
8 Status="Request Sent" ;
9
10 "MainLoop":
11     recv msg wait globalRecvTime sec;
12     if (MsgReceived)
13
14         if (MessageType=="Configure-Request")
15             decode "ConfigureRequestExport" ;
16             EventLog ("ConfigReq received");
17             send "Configure-Ack" "ConfigureAckImport""StreamId"=StreamId ;
18             EventLog ("ConfigAck Sent");
19             acksent="Yes" ;
20             if (ackReceived=="Yes")
21                 EventLog ("Open state Entered");
22                 Status="Opened" ;
23                 Result="Pass" ;
24             else
25                 goto "MainLoop";
26
27     endif
```

The status bar at the bottom indicates "Line Count - 162 | Line : 1 Col : 1" and "NUM".

# Customizations - Protocol Messages

- When the script sends a message it does so by loading a hdl file template from disk
- These message templates provide the actual structure of the message, the script simply populates it with values contained in its variables
- These messages are customizable by the user, header fields can be altered and removed. Binary-based messages are edited in our provided message editor

The screenshot shows the 'Message Editor - Configure-Request' window. The interface includes a menu bar (File, View, Direction, Tools, Help), a toolbar with icons for file operations and help, and a main workspace. On the left, a 'Frame No' table shows frame 1. The main workspace is divided into two panes. The top pane shows a tree view of the protocol structure: PPP Link (Address Compression Choice, Address, Ctl, Protocol Field Selection, Protocol), Link Control (Code Type, Code). The bottom pane shows a hex dump of the message structure:

```
===== PPP Link Layer ===== =
0000 Address Compression Choice = 1111... No Address Compression
0000 Address = 11111111 Broadcast Address
0001 Ctl = 00000011 UnSequenced Frame
0002 Protocol Field Selection = .....0 ProtocolField Two Octets
0002 Protocol = 11000000 00100001 Link Control
===== Link Control Layer ===== =
Code Type =
0004 Code = 00000001 Configure-Request
0005 Identifier = 1 (x01)
0006 Length = 18 (x0012)
Magic-Number =
0008 IE id = 00000101 Magic-Number
0009 Length of Options = 6 (x06)
000A Magic-Number = 0 (x00000000)
Maximum-Receive-Unit =
000E IE iD = 00000001 Maximum-Receive-Unit
000F Length of Options = 4 (x04)
0010 Maximum-Receive-Unit = 0 (x0000)
```

The status bar at the bottom indicates 'Ready' and a 'NUM' button.

# Customizations - User Events

MAPS (Message Automation Protocol Simulation) [Call Generation - CallGenDefault]

Configurations Emulator Reports Editor Windows Help

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Events ...	Result	Total Iterations	Completed Iterations
1	Isup_Call.gls	Card1TS01	1.1.1.2.2.2.1	Abort	File Sent	Retrieve		Pass	1	0
2	Call.gls	Card1TS02		Start		None				0
3	Call.gls	Card1TS03		Start		None				0
4	Call.gls	Card1TS04		Start		None				0
5	Call.gls	Card1TS05		Start		None				0
6	Call.gls	Card1TS06		Start		None				0
7	Call.gls	Card1TS07		Start		None				0
8	Call.gls	Card1TS08		Start		None		Unknown	1	0

Add Delete Insert Refresh Start Start All Stop Stop All Abort Abort All

View Executing Line

Script Contents

```
"Hold":  
  CallHoldInitiated = 1;  
  (ISUPScriptId) goto "Hold";  
  resume;  
  
"Retrieve":  
  CallHoldInitiated = 0;  
  (ISUPScriptId) goto "Retrieve";  
  resume;  
  
"Suspend":  
  SuspendInitiated = 1;  
  (ISUPScriptId) goto "Suspend Call";  
  resume;
```

Scripts Message Sequence Event Config Script Flow

Error Events Captured Errors Link Status Up=1 Down=0

Control moves to "Retrieve" section, after selecting the "Retrieve" User Event



# Customizations - Statistics and Reports

MOS, R-Factor

Packet Loss

Packets Discarded

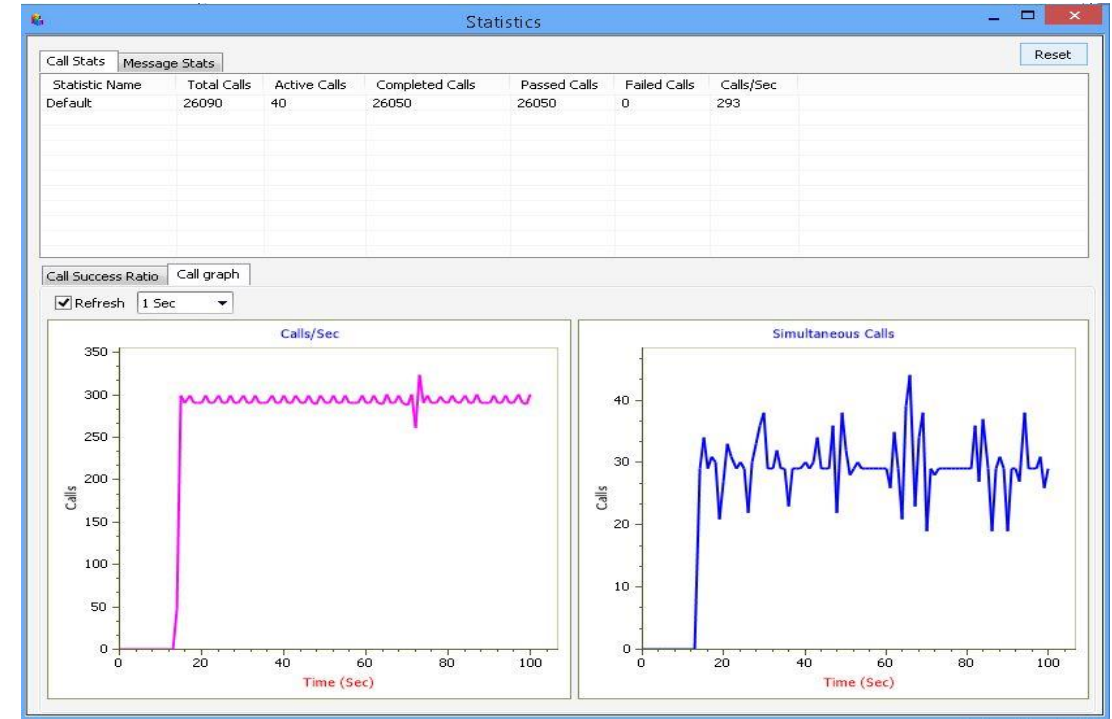
Duplicate Packets

Out-Of-Sequence

Packets

Jitter Statistics

Name	Values
Active RTP Sessions	1987
Completed RTP Sessions	1548093
Sessions With Zero Receive Traffic	0
MOS Score Stats	0
Sessions with Mos ( 5.0 - 4.0 )	612618 [39%]
Sessions with Mos ( 4.0 - 3.0 )	852971 [55%]
Sessions with Mos ( 3.0 - 2.0 )	73446 [4%]
Sessions with Mos ( < 2.0 )	9058 [0%]
Total RTP Packet Sent	4485008797
Total RTP Packet Received	4481760863
Packet-Loss Stats	0
Total PacketLoss	4072 [0%]
Sessions with Zero Packet-Loss	1534967 [99%]
Sessions with Packet-Loss(<1%)	13126 [0%]
Sessions with Packet-Loss(1% - 5%)	0 [0%]
Sessions with Packet-Loss(5% - 10%)	0 [0%]
Sessions with Packet-Loss(>10%)	0 [0%]
Packet-Discarded Stats	0
Total PacketDiscarded	3738934 [0%]
Sessions with Zero Packet-Discard	1464299 [94%]
Sessions with Packet-Discard(<1%)	41479 [2%]
Sessions with Packet-Discard(1% - 5%)	37232 [2%]
Sessions with Packet-Discard(5% - 10%)	4843 [0%]
Sessions with Packet-Discard(>10%)	240 [0%]
Packet-Duplicate Stats	0
Total Duplicate Packet	0 [0%]
Sessions with Zero Duplicate Packets	1539942 [99%]
Sessions with Duplicate Packets(<1%)	0 [0%]
Sessions with Duplicate Packets(1% - 5%)	0 [0%]
Sessions with Duplicate Packets(5% - 10%)	0 [0%]
Sessions with Duplicate Packets(>10%)	0 [0%]
Packet-Out Of Sequence Stats	0 [0%]
Total Out Of Sequence Packet	0 [0%]
Sessions with Zero OOS Packets	1539942 [99%]
Sessions with OOS Packets(<1%)	0 [0%]
Sessions with OOS Packets(1% - 5%)	0 [0%]
Sessions with OOS Packets(5% - 10%)	0 [0%]
Sessions with OOS Packets(>10%)	0 [0%]
Jitter Stats	0
Sessions with Jitter( < 1 msec)	1450779 [93%]
Sessions with Jitter( < 5 msec)	93031 [6%]
Sessions With Jitter( < 10 msec)	4841 [0%]
Sessions With Jitter(>= 10 msec)	350 [0%]



Call Stats provide a running tabular log of system level stats, tracked stats include: Total Calls, Active Calls, Completed Calls, Passed Calls, Failed Calls, Instantaneous Calls/Sec

# MAPS MLPPP Conformance Suite

MAPS™ MLPPP conformance scripts are suitable for conformance tests and functional tests, where test objects can be accurately, reliably and comfortably validated for compliance with IETF standard.

Supported Conformance Tests are:

- PPP Conformance Test Scripts
  - Link Establishment Phase
  - Link Maintenance Phase
  - Link Terminating Phase
  - Generalized Test
  - NCP Negotiation Phase
  - MLPPP Conformance Test Scripts
    - Link Establishment Phase
    - Link Maintenance Phase
    - Link Terminating Phase
    - MLPPP Generalized Test
    - MLPPP Bundle Test Scripts
      - PPP Links for MLPPP Bundle
      - MLPPP Short Sequence Test
      - MLPPP Initialize Sequence Number Test
      - MLPPP Control Field Test
      - NCP over MLPPP/PPP
      - Bundle Echo Test
- Multi-Class MLPPP Test Scripts
- PPP MUX CP Test Scripts

**Thank you**