Agilent N2X

Optical Signaling Emulation Software

E7889A
Technical Data Sheet

Agilent N2X Optical Signaling Emulation software provides realistic Internet-scale GMPLS and OIF UNI protocol emulation.

Agilent Technologies

Key Features

- **Simulate large and complex topologies including GMPLS, UNI and MPLS capable nodes**
- **Stress and verify GMPLS, UNI, LMP, RSVP-TE signaling implementations**
- **Measure network performance under real world conditions**
- **Powerful scripting environment for rapid creation of scaling and stress tests**
- **Flexible - allows users to define and test proprietary objects**
- **Simultaneous verification of control and data plane performance**

Product Overview

Agilent N2X is the industry's most comprehensive test solution for testing the development and deployment of network services for converging network infrastructures. Service providers, network equipment manufacturers (NEMs), and component manufacturers can verify service attributes of entire networks end-to-end, while also isolating problems down to individual networking devices and subsystems.

Agilent N2X incorporates the strength of the RouterTester 900 to deliver unparalleled test realism to verify the ultimate performance, scalability and resilience of carrier grade services and infrastructure.

Agilent N2X Optical Signaling Emulation software is the industry's first test solution that emulates realistic GMPLS-capable networks and enables developers to effectively verify the conformance, interoperability, and scalability of their GMPLS, UNI, LMP and RSVP-TE implementations. This software enables the simulation of ingress, egress and interior label switch routers (LSRs).

Each simulated LSR has the ability to request large numbers of diverse label switched paths (LSPs) and terminate many incoming LSPs. Full control of the message contents, including ERO, allows users to simulate diverse topologies.

GMPLS allows control of both electrical and optical switching fabrics, including time-division multiplexing (TDM), lambda switching and fiber switching. To deal with these new switching capabilities a new series of generalized label is defined. The generalized label identifies a timeslot, wavelength, waveband, or port. Hierarchy may also be applied to a network, for example a packet switch capable (PSC) LSR may have channelized interfaces, hence making it both PSC and TDM capable.

The Optical Signaling Emulation software provides an automated label manager that supports the management of SONET/SDH (TDM), and Port/Wavelength (FSC/LSC) labels. Multiple instances of the GMPLS or MPLS protocol software may be used to simulate hierarchy.

Product Features

GMPLS RSVP Signaling

The E7889A Optical Signaling Emulation software includes RSVP-TE with GMPLS extensions including GMPLS Extensions for SONET and SDH Control.

GMPLS OSPF Routing

Use the OSPF component of the IPv4 Routing Emulation software to configure a virtual GMPLS topology. OSPF routing protocol includes OSPF-TE with GMPLS extensions.

UNI 1.0 Release 2 - RSVP Signaling

UNI 1.0 signaling support allows emulation of UNI-N or UNI-C devices using RSVP signaling.

Verification of GMPLS/UNI signaling and forwarding function

The Optical Signaling Emulation software provides the ability to build a complex set of LSP descriptors to describe various LSP properties. Many instances of each LSP descriptor can be opened to setup a complex topology

When emulating an egress node, the protocol software can be configured to automatically accept or reject LSP setup requests.

Generate wire speed labeled test traffic to verify correct routing of LSP's, and use accurate test traffic time stamping to verify LSP setup performance.

LMP Support

Use the integrated LMP protocol software to provide control channel maintenance for either GMPLS or UNI and link property correlation.

Simulating real world, multiprotocol environment

In real networks, GMPLS RSVP must inter-work with other routing and signaling protocols. In traffic engineering applications, an IGP such as OSPF or IS-IS will construct a routing topology. An IP or MPLS network may be overlayed or integrated with a GMPLS core network.

As a result, simultaneous simulation of OSPF or IS-IS with GMPLS RSVP and GMPLS OSPF is needed to simulate real world conditions.

GMPLS extensions to OSPF allow quick creation of complex topologies. MPLS can be used to generate LSP hierarchy.

Stress and verify the GMPLS/ UNI RSVP implementations

Optical transport networks carry huge amounts of critical data. Before deployment, control plane protocol implementations must be proven reliable under real world conditions. As a result, stress testing is critical in establishing if GMPLS/MPLS/UNI-capable devices or networks will be able to sustain the conditions expected in a live network.

Optical Signaling Emulation software can be used to stress devices or networks. A large number of LSP requests can be initiated, responded to or torn down when simulating an edge LSRs. For interior LSRs, virtual topologies can be constructed using OSPF. LSPs consistent with these virtual topologies can then be initiated, accepted, rejected or torn down.

Adding or withdrawing OSPF LSAs can simulate dynamic changes in a GMPLS network.

Developers can verify the connection setup time, restoration response time and explore other performance bounds of their devices and networks.

Generate wire speed traffic

The Agilent N2X's multi-port traffic generation capabilities allow users to send IP, MPLS, or PRBS traffic over the GMPLS tunnels to verify connectivity and performance. Test full integration of the IP and Optical layers by forwarding MPLS label-prefixed packets at wire-speed over any type of GMPLS or MPLS label switched path.

A full range of N2X interfaces allows developers to simulate networks that include MPLS and GMPLS devices with any type of GMPLS or MPLS switching capability. Verify the performance and reliability of integrated next generation MPLS-GMPLS intelligent networks.

Generic Routing Encapsulation (GRE) Support

In addition to standard IP encapsulation, generic routing encapsulation is supported where RSVP and LMP packets are encapsulated in IP/GRE/IP.

Define proprietary RSVP-TE objects

Define generic objects beyond those listed in the various IETF documents. Such objects may be used in RSVP messages by some equipment vendors for proprietary purposes. This feature allows the flexibility to test proprietary objects added to the PATH messages.

Powerful Scripting Environment

Create repeatable regression tests using the integrated Tcl API and QuickTest environment .

Statistic

Statistics are collected on transmit and receive ports for the different message types, allowing users to quickly pinpoint problems such as message loss or retransmission.

Remote Access

The Optical Signaling Emulation software can be controlled via the local system controller, or can be controlled remotely from any PC attached to a corporate LAN.

Optical Signaling Technical Specifications

This section describes the features of the Optical Signaling Emulation software that are accessible using the GUI and Tcl/TK scripting environment. Simple point and click actions enable the user to dynamically change the environment being tested.

GMPLS (RSVP) Emulation

RSVP Emulation Parameters	• Refresh Period - The interval between PATH (head-end) or RESV (tail-end) automatic refreshes • L- Timer Constant - The multiplier used to compute the Lifetime Timer expiry
Hello Signaling	• Refresh Interval • Hello Timer Constant • Exclude Restart Cap object
RSVP Refresh Reduction	• Reliable Messaging • Initial time out • Exponential backoff • Retry limit • SREFRESH • Maximum Latency Bundle • Maximum Latency
UNI Signaling	UNI TNA (transport network address)
Messages Supported	PATH RESV PATH TEAR RESV TEAR HELLO SREFRESH BUNDLE ACK

PATH Message Fields

Common Header	Automatically derived from the objects present
Message ID ACK/ Message ID NACK	ACKed if ACK_Desired flag is set in Message ID. NACKed if PATH state is non-existent
Message ID	Unique to each RSVP message, except for refresh messages
Session	Including the Extended Tunnel ID
RSVP Hop	May be automatically derived from the Label Manager or manually specified
Time Values	Downstream refresh interval
Explicit Route	May be assigned to be a list of virtual LSRs. IP, Label, and Interface ERO sub-objects are supported. Also provides the capability to define generic sub-objects
Label Request	Protocol and ranges may be specified, including IP, SONET/SDH, Wavelength and Port
Protection	User defined 32 bit
Label Set	List or range of labels that the downstream node must choose from
Session Attributes	Including Setup and Hold priorities, Flag Bits and Name fields
Admin Status	Contain info regarding the status of the LSP. This object is used by the Ingress/Egress nodes to initiate graceful deletion
Policy Data	User defined, 32 bit value
Sender Template	LSP-Ids may be specified on a per/tunnel basis
Sender TSPEC	CoS, integrated services and SONET/SDH are supported. Also provides for user defined TSPEC
ADSPEC	CoS and integrated services models are supported
Suggested Label	May be used if acceptable to the downstream node. A value (or stack) derived automatically from the Label Manger. SONET/SDH, Generalized labels, Waveband and generic labels are supported
Upstream Label	To support bi-directional LSPs. A value (or stack) derived automatically from the Label Manger. SONET/SDH, Generalized labels, Waveband and generic labels are supported
Extension Object	Provides the ability to added proprietary objects

RESV Message Fields

Common Header	Automatically derived from the objects present
Message ID ACK/ Message ID NACK	ACKed if ACK_Desired flag is set in Message ID. NACKed if PATH state is non-existent
Message ID	Unique to each RSVP message, except for refresh messages
Session	Including the Extended Tunnel ID
RSVP Hop	Automatically derived from the Label Manager or manually specified
Time Values	Upstream refresh interval
RESV-Confirm	IP Address
Scope	IP Address
Admin Status	Contain info regarding the status of the LSP. This object is used by the Ingress/Egress nodes to initiate graceful deletion
Style	Fixed Filter (FF) and Shared Explicit (SE) are supported

FLOWSPEC	CoS, integrated services and SONET/SDH are supported. Derived from in coming PATH can be overwritten.
FILTERSPEC	Derived from the incoming PATH message
Label	A value (or stack) derived automatically from the Label Manger. SONET/SDH, Generalized labels, Waveband and generic labels are supported

HELLO Message Fields

Common Header	Automatically derived from the objects present, depending of the C-type it can be HELLO REQUEST or HELLO ACK
Hello	Source & Destination instances - 32 bit fields
Restart Cap	Provides support for incoming messages only
SREFRESH Message	Automatically generated if SREFRESH capability enabled
Bundle Message	Automatically generated if Message Bundling capability enabled
ACK Message	Automatically generated if Refresh Reduction capability enabled

LMP Emulation

LMP Emulation Parameters	• Local Node ID • Remote Node ID • Tester IP Control Channel IP Address • SUT IP Control Channel IP Address • Tester Control Channel ID • Hello interval/ dead interval • Negotiable parameters Yes/No
Messages Supported	CONFIG CONFIG ACK CONGFIG NACK HELLO

CONFIG Message Fields

Common Header	Automatically derived from the objects present
Local CCID	Identifies the control channel of the sender
Message ID	For reliable messaging
Local Node ID	Identities the node that originated the LMP packet
CONFIG	Configuration Parameters such Hello intervals

CONFIGACK Message Fields

Match Criteria	These messages are automatically generated to acknowledge receipt of the CONFIG message and indicate agreement on all parameters
Common Header	Automatically derived from the objects present
Local CCID	Identifies the control channel of the sender
Local Node ID	Identities the node that originated the LMP packet
Remote CCID	Obtained from the CONFIG message being acknowledged
Message ID ACK	Obtained from the CONFIG message being acknowledged
Remote Node ID	Obtained from the CONFIG message being acknowledged

CONFIGACK Message Fields

Match Criteria	These messages are automatically generated to acknowledge receipt of the CONFIG message and indicate disagreement on non-negotiable parameters or propose other values for negotiable parameters. Parameters where agreement was reached are not included in this message
Common Header	Automatically derived from the objects present
Local CCID	Identifies the control channel of the sender
Local Node ID	Identities the node that originated the LMP packet
Remote CCID	Obtained from the CONFIG message being acknowledged
Message ID ACK	Obtained from the CONFIG message being acknowledged
Remote Node ID	Obtained from the CONFIG message being acknowledged
Error Code	Parameter(s) that is invalid in the CONFIG message are indicated via the appropriate ERROR CODE. Multiple bits may be set in the ERROR CODE
CONFIG	Negotiable parameters with acceptable values are included. If the message includes non-negotiable parameters it'll be copied from the CONFIG objects received in the CONFIG message

Hello Message Fields

Common Header	Automatically derived from the objects present
Local CCID	Identifies the control channel of the sender
Hello	Periodically transmitted at least once every Hello interval

GRE Tunneling

GRE Tunneling Parameters	• GRE Tester IP Address • GRE SUT IP Address • Checksum

Analysis

Protocol statistics can be displayed to aid in debugging protocol inter-working problems.

GMPLS/Optical UNI Emulation

Open Tunnels	Total Number of tunnels open
Lifetime Timer Expiry	Number of times a Lifetime Timer expires
Rate of Tunnels Establishment	Rate of LSP open attempts per second

Inbound Statistics

PATH Messages (cumulative count, rate)	Number of PATH messages
PATH-ERR Messages (cumulative count)	Number of PATH-ERR messages
PATH-TEAR Messages (cumulative count)	Number of PATH-TEAR messages
RESV Messages (cumulative count, rate)	Number of RESV messages
RESV-ERR Messages (cumulative count)	Number of RESV-ERR messages
RESV-TEAR Messages (cumulative count)	Number of RESV-TEAR messages
HELLO Messages (cumulative count, rate)	Number of HELLO messages
Message ID ACK Messages (cumulative count)	Number of ACK messages
Message ID NACK Messages (cumulative count)	Number of NACK messages
Messages retransmitted (cumulative count)	Number of messages retransmitted
SREFRESH Messages (cumulative count)	Number of SREFRESH Messages
Bundle Messages (cumulative count)	Number of Bundle Messages
Message received out of order (cumulative count)	Number of messages received out of order

Inbound Statistics

LMP Duration	Emulation running duration

Inbound Statistics

CONFIG Messages (cumulative count)	Number of CONFIG messages
HELLO Messages (cumulative count)	Number of HELLO messages
Hello Dead timeout count	Number of Hello Dead timeout count
CONFIGACK Messages (cumulative count)	Number of CONFIG ACK messages
CONFIGNACK Messages (cumulative count)	Number of CONFIGNACK messages
LMP Restart flag (cumulative count)	Number of Restart flags sent/received

Capture and Decode

The live capture viewer allows real time decoding of RSVP messages. Alternatively a 64MB capture and decoder can be used to analyze in-band message flows.

Additional N2X Features

Online Help

An extensive online help provides complete descriptions and detailed usage instructions. Dialog-level context-sensitive help provide rapid access to the relevant sections of the online help. A technology reference section provides a complete library of background information.

Applicable Standards

- Resource ReSerVation Protocol, Version 1 Functional Specification (RFC 2205)
- RSVP-TE: Extensions to RSVP for LSP Tunnels, (RFC 3209)
- Generalized MPLS - Signaling Functional Description, (RFC 3471)
- Generalized MPLS Signaling -RSVP-TE Extensions, (RFC 3473)
- GMPLS Extensions for SONET and SDH Control (RFC 3946). Support provided for standard concatenation down to STS-1
- RSVP Refresh Overhead Reduction Extensions - (RFC 2961). Excluding multicast extensions
- OIF User Network Interface (UNI) 1.0 Signalling Specifications, Release 2: Common Part
- OIF RSVP Extensions for User Network Interface (UNI) 1.0 Signalling. Release 2
- Link Management Protocol (LMP), (RFC 4204). Control channel maintenance and link property correlation procedures
- GMPLS UNI RSVP-TE Support for the Overlay Model (RFC 4208)

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Agilent N2X

Agilent's N2X multi-service tester combines leading-edge services with carrier grade infrastructure testing and emulation. The N2X solution set allows network equipment manufacturers and service providers to more comprehensively test new services end-to-end, resulting in higher quality of service and lower network operating costs.

Warranty and Support

Hardware Warranty

All N2X hardware is warranted against defects in materials and workmanship for a period of 1 year from the date of shipment.

Software Warranty

All N2X software is warranted for a period of 90 days. The applications are warranted to execute and install properly from the media provided.
This warranty only covers physical defects in the media, whereby the media is replaced at no charge during the warranty period.

Software Updates

With the purchase of any new system controller, Agilent will provide 1 year of complimentary software updates. At the end of the first year, you can enroll into the Software and Support Agreement (SSA) contract for continuing software product enhancements.

Support

Technical support is available throughout the support life of the product. Support is available to verify that the equipment works properly, to help with product operation, and to provide basic measurement assistance for the use of the specified capabilities, at no extra cost, upon request.

Ordering Information

To order and configure the test system consult your local Agilent field engineer.

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