Agilent N2X

Ethernet OAM Connectivity Fault Management (CFM) Emulation Software

N5581A

Technical Data Sheet

The most comprehensive and scalable tool to verify the operation, performance and scalability of IEEE 802.1ag CFM implementations for Ethernet.

Agilent Technologies

Key Features

- **Emulate CFM messages over Ethernet**
- **Operates with other N2X emulations, such as xSTP and LACP**
- **Easily emulate thousands of Maintenance Points to characterize CFM scalability**
- **Comprehensive Continuity Check Database with stateful feedback**
- **Integration of Loopback and Link Trace with CCDB**
- **Verify CFM functionality across multiple domain levels**
- **Quantify Link Trace and Loopback latency**

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 delivers unparalleled test realism to verify the ultimate performance, scalability and resilience of carrier grade services and infrastructure.

The N5581A CFM Protocol Emulation software is one component of the N2X Carrier Ethernet test solution, which includes emulation and conformance testing of technologies such as LACP, STP, RSTP, MSTP, BFD, L2oMPLS, VLANs, MEF 9 and MEF 14.

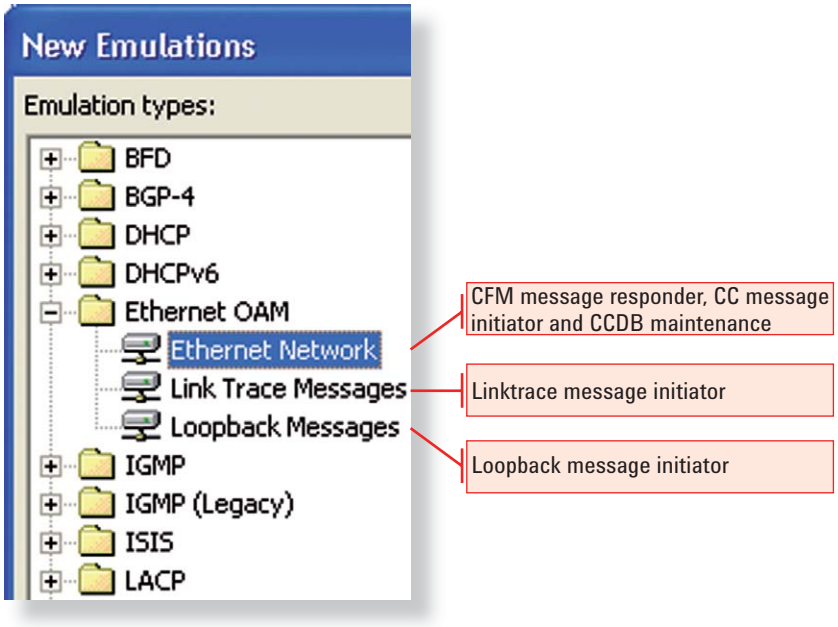

Figure 1 : N2X CFM emulation devices

From a user perspective, the N5581A CFM Protocol Emulation software includes three devices as shown in figure 1:

- An Ethernet Network Device for topology simulation and for Continuity Check Data Base (CCDB) creation and maintenance. It is also responsible for initiating and responding to Continuity Check Messages (CCMs); for Loopback Response (LBR) generation; and for Link Trace Response (LTR) generation
- A Link Trace Message (LTM) initiator device
- A Loopback Message (LBM) initiator device

The LTM and LBM initiator devices are not bound to the N2X simulated topology, thereby allowing the user flexibility to initiate messages to a real Maintenance End Point (MEP) discovered through the Continuity Check protocol or to a manually-defined, possibly non-existent, Maintenance Point (MP).

The Ethernet Network Device simulates one or more Maintenance Intermediate Points (MIPs) connected in series with one or more MEPs connected to the last MIP device. All MPs are able to span multiple maintenance domains (MDs). Simulated MIPs are used for depth in Link Trace verification. Simulated MEPs are used for breadth in Loopback verification. The CFM emulation topology builder allows the creation of large Managed Ethernet Networks while maintaining sufficient flexibility to allow for the simulation of any topology scenario. This emulation concept is shown in figure 2.

Product Features

Emulate CFM messages over Ethernet

Carrier Ethernet services can be implemented over an IEEE 802.3 switched-Ethernet infrastructure. Typically in such a test scenario, the System Under Test (SUT) is a carrier-class Ethernet switch running RSTP/MSTP, and N2X emulates the surrounding switched network, sending and responding to CFM OAM messages.

The SUT may also be an MPLS core network with CFM frames transparently tunneled through the core.

Operates with other N2X emulations, such as xSTP and LACP

The N2X CFM emulation is aware of other N2X emulations that are operating concurrently. For example, the Multiple Spanning Tree Protocol (MSTP) emulation is CFM-aware and blocks CFM messages if a port or Multiple Spanning Tree Instance (MSTI) is in the discarding state.

N2X can also generate and receive CFM messages over Link Aggregation bundles. This is important as it allows a link-trace to be performed following a link failure in the Link Aggregation Group (LAG), in order to confirm that the failover has actually occurred and to measure end-to-end path latency on the standby link.

'On-the-fly' simulation of network faults

The N5581A CFM emulation allows the user to enable and disable Maintenance Points interactively, while the test is running. This includes the ability to suppress Continuity Checks, Loopback Responses and Link Trace Responses. This interactive capability is essential in order to emulate and measure the impact of realistic network faults.

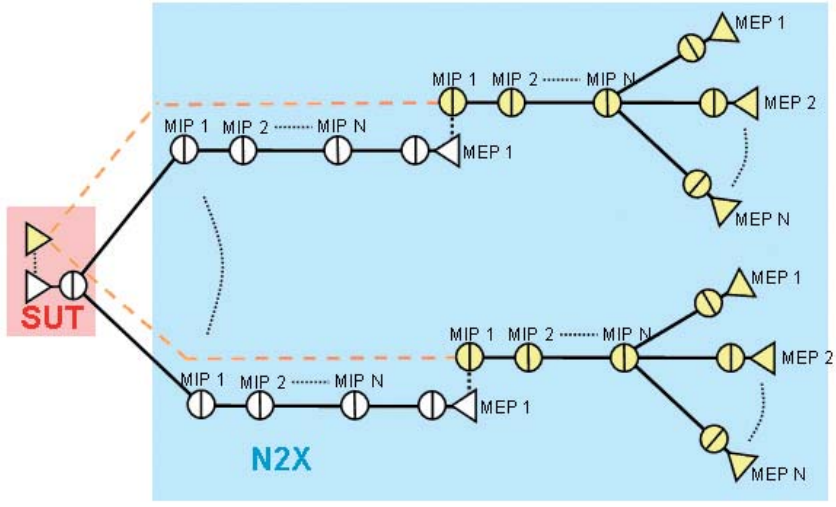

Figure 2: N2X emulates multiple MIPs and MEPs spanning multiple domain levels

Easily emulate thousands of Maintenance Points to characterize CFM scalability

As shown in figure 3, the N5581A emulation architecture allows for rapid and easy creation of realistic scaled topologies. N2X can simulate individual bridges or entire server (sub) layers.

Tests are easily scaled up using multiple interfaces, multiple emulated devices, and multiple CFM emulation instances, to gauge performance under worst-case conditions and to measure the impact of fault management overhead on subscriber traffic, DUT processing capability, and other DUT resources.

The user can visualize the simulated topology either in a tabular manner, or via a pictorial representation, as shown in figure 4.

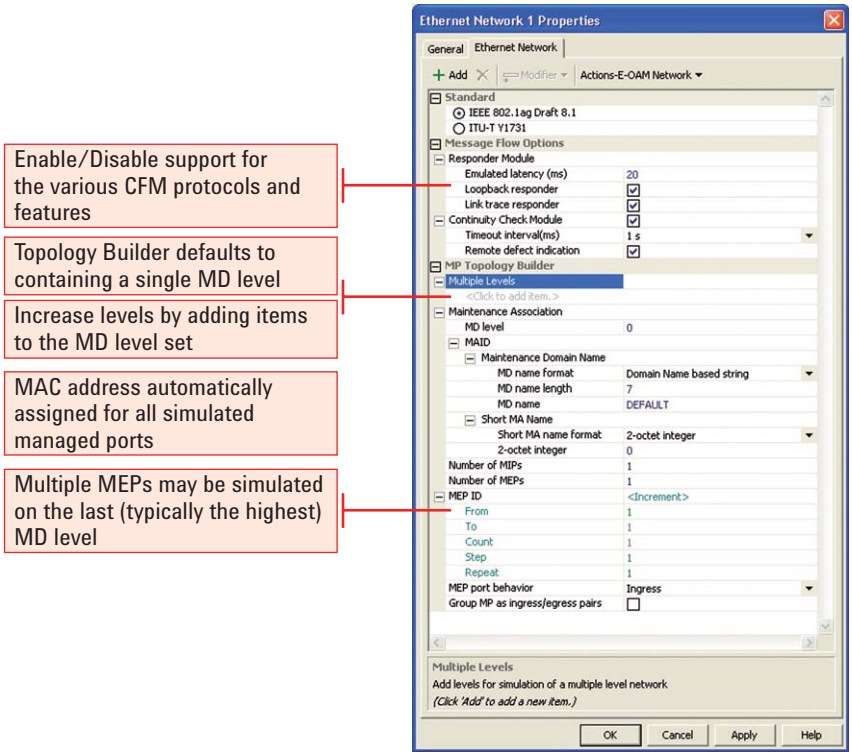

Figure 3: Rapidly and easily create scaled topologies

Comprehensive Continuity Check Database with stateful feedback

For each test port, N2X builds a comprehensive Continuity Check Database (CCDB) and maintains state (START/OK/FAILED) for each connectivity on that port. Connectivities are either manually entered or discovered through the reception of CCMs. Failure to receive a CCM for an expected connectivity within the configured time-out period triggers the generation of Remote Defect Indicator (RDI) in all subsequent CCMs that are transmitted. All Continuity Check information is viewable in the CCDB in columns that can be individually hidden or shown and used for event sorting. Statistics are maintained by the CCDB on detected errors.

In a typical test scenario, N2X surrounds the SUT with thousands of emulated MPs. The user can then examine the SUT's CCDB to ensure that the SUT was aware of the relevant MPs and their associated states.

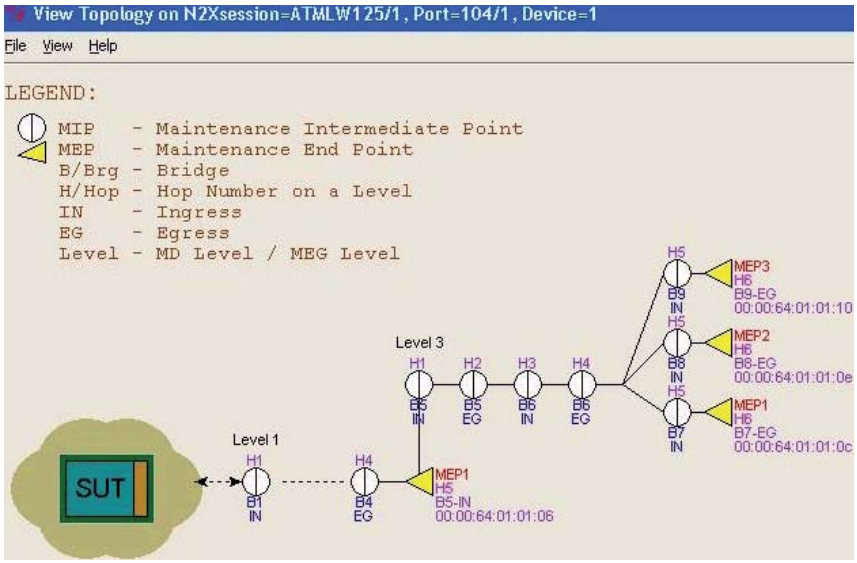

Figure 4: Pictorial representation of a simulated Ethernet OAM topology as displayed by N2X emulation.

Integration of Loopback and Link Trace with CCDB

The Maintenance Point destination for Loopback and LTMs may be manually specified or rapidly selected from MEPs in the CCDB. Selection of MEPs from the CCDB easily allows large numbers of realistic connectivity checks to be undertaken to characterize CFM scaled performance.

Verify CFM functionality across multiple domain levels

A Managed Ethernet Network may be simulated across multiple domain levels (Customer, Provider, and Operator). The simulated topology is easy to configure, and can be readily expanded across multiple Maintenance Domain Levels to ensure test realism.

Quantify Link Trace and Loopback latency

Fundamental CFM metrics are Link Trace and Loopback latency. N2X measures the average, minimum and maximum values of key parameters and presents them to the user. This enables verification that the DUT can respond rapidly and accurately under normal conditions and also under load, as well as validation of the DUT's own reporting of round-trip frame latency.

Perform Negative Testing via flexible XML PDU builder

Essential to interoperability testing is the establishment of DUT behaviour in the event of an unexpected or malformed PDU. N2X's flexible XML-based PDU builder allows the user (via the GUI) to easily create and transmit a non-conforming CFM frame. For automated testing of over 170 single-point test cases such as this, please refer to the datasheet for the comprehensive N2X N5518A CFM conformance test suite.

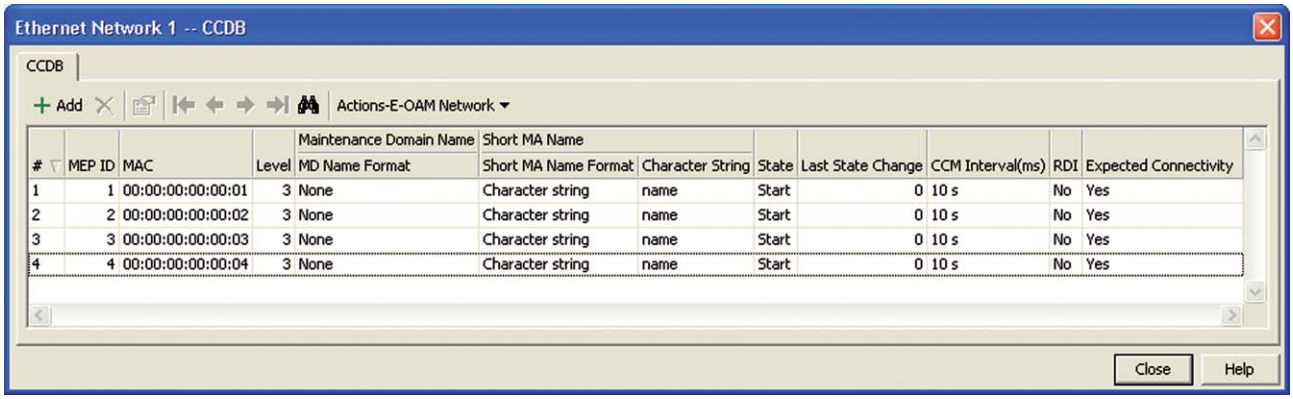

Figure 5: Configure and display CCDB parameters interactively

Technical Specifications.

This section lists the protocol-specific parameters that are configurable through the GUI or the Tcl scripting environment.

Configuration Parameters

Ethernet Network Device

Emulated Maintenance Point Topology
- Number of Maintenance Associations
- Maintenance Domain Level (per MA)
- Maintenance Association ID (per MA)
  - Short MA name (Primary VID, Character String, 2-octet, RFC 2685 VPN ID)
  - MD Name (None, String, MAC Address + 2 Octets, Character String)
- Emulate Server (sub) layers (per MA)
- Number of MIPs (per MA)
- Number of MEPs (last MA)
- Maintenance End Point ID (per MA)
- Maintenance Point Latency emulation (msec)
- Enable/Disable Emulated Link

CCDB – Expected Remote MEPs
- Maintenance End Point ID
- MAC address
- Maintenance Domain Level
- Maintenance Association ID
  - Short MA name (Primary VID, Character String, 2-octet, RFC 2685 VPN ID)
  - MD Name (None, String, MAC Address + 2 Octets, Character String)
- Expected Connectivity

Continuity Check Messages
- Enable/Disable
- Interval: 100ms, 1sec, 10sec, 1min, 10min
- RDI Flag

Loopback Replies
- Enable/Disable
- Emulated Latency

Link Trace Replies
- Enable/Disable
- Emulated Latency

Message Initiator Device

Loopback Messages
- Enable/Disable Loopback message
- Destination MAC address
- Maintenance Domain Level
- Enable/Disable Optional TLVs

Link Trace Messages
- Enable/Disable Link Trace message
- Destination MAC address
- Maintenance Domain Level
- Enable/Disable Optional TLVs

Message Flow
- Burst Size
- Burst Delay
- Renew period (msec)
- Response timeout (msec)

Statistics

Receive
- Total CFM packets
- Total Link Trace Message packets
- Total Link Trace Reply packets
- Total Loopback Message packets
- Total Loopback Reply packets
- Total Continuity Check Message packets

Transmit
- Total CFM packets
- Total Link Trace Message packets
- Total Link Trace Reply packets
- Total Loopback Message packets
- Total Loopback Reply packets
- Total Continuity Check Message packets

Other
- Loss of Continuity Events
- Number of CCM received from non-existent MEP ID
- Unexpected CC Period

Emulation Status (per-instance)

Ethernet Network Device

CCDB
- Number of Remote MEPs
- Number of Remote MEPs in START State
- Number of Remote MEPs in OK state
- Number of Remote MEPs in FAILED state
- Remote Maintenance End Point ID
- Remote MAC address
- Remote Maintenance Domain Level
- Remote Maintenance Association ID
  - Short MA name (Primary VID, Character String, 2-octet, RFC 2685 VPN ID)
  - MD Name (None, String, MAC Address + 2 Octets, Character String)
- Remote MEP State
- Remote MEP last state change
- Remote MEP Continuity Check interval
- Remote MEP RDI State

Emulated Maintenance Point Topology
- Maintenance Point Type (MIP / MEP)
- MP Behavior (Ingress / Egress)
- Maintenance Domain Level
- Hop Number (per level)
- Bridge Number (per level)
- MAC Address
- MEP ID
- Admin State

Loopback Message Device

	• Loopback round trip latency (Min, Max, Average) • Number of MEPs in Loopback Idle State • Number of MEPs in Loopback Waiting State • Number of MEPs in Loopback Received State • Number of MEPs in Loopback Failed State
MEP Loopback Reply	• Source MAC Address • LBM transaction ID

Link Trace Message Device

	• Link Trace round trip latency (Min, Max, Average) • Number of MPs in the trace path • Number of MEPs in Link Trace Idle State • Number of MEPs in Link Trace Waiting State • Number of MEPs in Link Trace Received State • Number of MEPs in Link Trace Failed State
MPs Link Trace Reply List	• Source MAC Address • LTM Transaction ID • Reply TTL

Emulation Status (per-port)

CCDB (Per Remote MEP)	• Remote MEP State • Remote MEP Last state change • Remote MEP CCM Interval

Alarms

- Remote Defect Indicator (RDI) Flag

Applicable Standards

- IEEE 802.1ag Draft 8.1 Connectivity Fault Management (Jun 2007)

Configuration and Ordering Details

Hardware

To use the N5581A E-OAM Connectivity Fault Management (CFM) Emulation software, the following Agilent N2X hardware and software are required.

A N2X system is required with:

- System controller
- Chassis
- One or more Ethernet Test Cards

The N5581A E-OAM CFM Emulation software is supported on all N2X XR, XR-2, XS and XS-2 Ethernet test cards.

The N5581A software is NOT supported on N2X XP or XP-2 test cards.

Software

Required software packages:

- E7881B Packets and Protocols Application Software

Optional software packages:

- N5718A CFM Conformance Test Suite Software

Your local Agilent field engineer can provide more details on how to order and configure a test system.

Online Help

An extensive online help system provides complete descriptions and detailed usage instructions for every component of N2X. Dialog-level, context-sensitive help provides rapid access to the relevant sections of the online help

Related Products

Agilent Network Tester

The Agilent Network Tester N4192A is a highly scalable and flexible solution for performance testing of Layer 4-7 devices. As a companion to N2X, the NetworkTester provides real-world, stateful application layer traffic generation over PPP sessions, enabling developers to verify the end-user experience and performance of applications running over a broadband network. It also supports 802.1x, IPsec and IPsecv6 access protocols.

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www.agilent.com/find/n2x

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.

Sales, Service and Support

United States:
Agilent Technologies
Test and Measurement Call Center
P.O. Box 4026
Englewood, CO 80155-4026
1-800-452-4844

Canada:
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2660 Matheson Blvd. E
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