Agilent N2X

Multicast Routing Emulation Software

E7886A
Technical Data Sheet

Agilent N2X Multicast Test Solution provides realistic Internet-scale simulation for comprehensive verification and stress testing of edge routers, core routers, and networks that are designed for routing IPv4 and IPv6 multicast traffic.

Agilent Technologies

Key Features

- Stress/verify PIM-SM/SSM, and MSDP protocols
- Simulate multiple PIM-SM and MSDP sessions associated with VLANs
- Simulate PIM-SM/SSM over GRE tunnels to test multicast VPN devices and networks
- Simulate real-world multiprotocol environments and measure multicast protocol-specific parameters
- Integrated Traffic and Multicast Routing for IPv4 and IPv6
- Simulate multiple sources and destinations
- Generate wire-speed (up to 10 Gb/s) unicast and multicast traffic and measure QoS parameters
- Easy-to-use GUI that quickly configures physical interfaces and routing protocols
- Tcl Application Programming Interface speeds the creation of custom test scenarios

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 Multicast Test Solution is ideally suited for integrated control and data plane testing. The solution incorporates emulation of:

- PIM-SM/SSM (Protocol Independent Multicast-Sparse Mode / Source-Specific Multicast) including IPv6 support
- MSDP (Multicast Source Discovery Protocol)

Combine this with wire-speed unicast and multicast traffic generation, and testing multicast-enabled routers becomes an easy task.
The fundamental test scenario involves setting up destination ports through IGMP (E7828A license required), and setting up multicast distribution trees through PIM-SM/SSM. With emulation of the multicast protocols, this test scenario is easily achieved through the GUI.

The PIM-SM/SSM and MSDP protocol modules provide full emulation of the protocol state machine. Also included is support for the PIM-SM Bootstrap Router mechanism (BSR) used for distributing group-to-RP mapping information and Zone Scoping.

The Group Pool concept allows Agilent N2X users to define a range of multicast addresses as a multicast Group Pool with a single group pool containing one or more multicast groups. Various network elements such as multicast sources, multicast receivers, different types of routers (RP, First Hop, Intermediate, Receiver DR) are emulated to aid in creating realistic test scenarios in the laboratory.

Essentially, Agilent N2X gives users the ability to test and measure multicast performance as per the Internet Benchmarking Specifications.

Typical Test Scenario

A typical test scenario is depicted in Figure 1.

- Using the IGMP (E7828A license required) and PIM-SM emulation, a realistic network cloud with multiple hosts, PIM-SM Receiver DR, PIM-SM rendezvous point router and multicast traffic sources are created around the SUT
- To receive multicast traffic, PIM Join messages are sent to the SUT from Port A, and IGMP Membership Reports are sent to the SUT from Port B
- The SUT updates its Tree Information Base (TIB) and Multicast Forwarding Information Base (MFIB) based on the IGMP and PIM Join messages
- Multicast packets destined to the multicast group addresses used in the IGMP and PIM Join messages are transmitted from Port C
- The SUT forwards the multicast traffic based on its MFIB
- With Agilent N2X, performance measurements are made on the traffic forwarded to Ports A and B

Multicast Overview

Generate wire-speed multicast and unicast traffic

The N2X Packets and Protocols application provides an easy way to generate both unicast and multicast traffic at wire-speed of up to 10 Gb/s on multiple interfaces to test performance limits of core, edge and enterprise routers. The GUI guides the user to configure groups, specify source addresses to be associated with each group and direct traffic streams to each group. The traffic is synchronized across multiple ports, thus allowing for real-time measurements of QoS parameters such as throughput, packet loss, and latency. It does so by intelligently correlating input to output traffic streams. Some of the more important test objectives that can be met are:

- Mixed class throughput for determining maximum forwarding rate without packet loss for a mix of unicast and multicast traffic
- Scaled Group Forwarding Matrix Test for measuring multicast throughput without packet loss, as the number of multicast groups is scaled upward
- Measure minimum, maximum, and average multicast forwarding latency at a given transmission rate

For more details, please refer to the E7880A Packets Application Software and the E7881A Packets and Protocols Application Software datasheets.
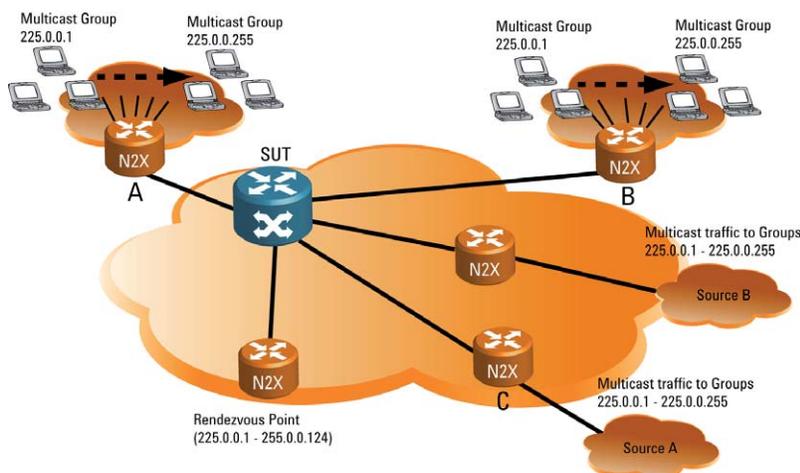

Figure 1: Scalability Test Scenario for PIM

Simulate Multiprotocol Environments

The Agilent N2X supports PIM-SM/SSM, MSDP, as well as unicast routing protocols (BGP, MBGP, OSPF, IS-IS, RIP, etc.). This creates realistic test scenarios and measures the performance of multicast-enabled routers.

Such testing accurately determines the ability of routers to provide multicast services under real-life conditions. Below is a summary of various scenarios that can be simulated for testing multicast-enabled routers and networks:

- Simulate multicast groups and sources, and measure group capacity
- Measure group join/leave (prune) latency
- Measure effect of unicast route flaps on the delivery of multicast services
- Dynamically change the number of multicast membership groups and measure the effect on packet forwarding performance
- Simulate switching between source-independent (*,G) and source-specific (S,G) group memberships and determine impact on forwarding performance
- Determine RPT to SPT switchover times

Verify and stress PIM-SM/SSM, and MSDP protocol implementations

Using the PIM-SM/SSM and MSDP emulations, Agilent N2X can emulate a multicast network with multiple sources and destinations with the added capability of prune flooding. This enables verification and control plane stress testing of PIM-SM/SSM and MSDP. In particular, MSDP emulation enables multicast testing across multiple autonomous systems. PIM-bidir is also supported with the exception of DF election.

For more rigorous scalability testing, the Agilent N2X supports multiple PIM sessions (adjacencies) on an individual test basis.

Verify Multicast VPN networks

The Agilent N2X test system provides a highly scalable and complete solution to verify multicast VPN (mVPN) implementations and deployments. The Multicast Routing Emulation Software includes full support for PIM-SM/SSM over GRE, necessary to simulate multicast VPN (mVPN) Provider and Provider Edge routers. Integrating fully with the IPv4 Routing Emulation Software Solution (E7882), the solution can simulate large numbers of CE routers and associated VPN clients with simultaneous PIM and IGP emulation. N2X can completely surround the system under test and provide highly realistic, controllable and accurate testing. Implemented in patented XML technology, the flexible protocol definitions allow rapid modification, enabling the user to keep pace with emerging mVPN draft standards.

Easy-to-use graphical user interface

A single dialog displays the complete status of the router test system. Physical/link layer status and alarms are highlighted. Traffic stream definitions and statistics are displayed in real-time. The Agilent N2X configuration is easily saved to restore complex network and traffic simulations.

Tcl application programming interface

The Tcl-based API enables the user to create automated test sequences or pre-defined test configurations. It allows Agilent N2X to integrate with other instruments. Tcl scripts can run on the Agilent N2X System Controller, a remote PC, or Unix workstation attached to the Controller via a TCP/IP connection.

PIM Technical Specifications

PIM modes Supported

PIM-SM/SSM

PIM-SM/SSM over GRE (IPv4)

PIM-SM/SSM Messages Supported

Hello

Join/Prune

Register

Register Stop

Assert

C-RP-Adv

BSM (Bootstrap messages)

PIM-SM/SSM over GRE Configurable Parameters

Checksum	Enable/Disable
Local Address	IPv4 only
Remote Address	IPv4 only

MSDP Messages Supported

Source Active

Source Active Request

Source Active Response

Keep Alive

Notification

PIM-SM/SSM Statistics

Hello messages	Received/transmitted
Join/Prune	(*,G), (S,G), (*,*,RP) and (S,G,rpt) received/transmitted
Assert	(*,G) and (S,G) received/transmitted
Register	Received/transmitted
Register Stop	Received/transmitte
Null Register	Received/transmitte
C-RP-Adv	Received/transmitte
BSM (Bootstrap messages)	Received/transmitte

MSDP Statistics

Keep Alive Messages	Received/transmitted
SA Advertisement	Received/transmitted
SA Advertisement (S,G) pairs	Received/transmitted
SA Request	Received/transmitted
SA Response	Received/transmitted
SA Response (S,G) pairs	Received/transmitted
Notification	Received/transmitted

PIM-SM/SSM Parameters Configurable through Tcl

Timers	• HELLO INTERVAL • T PERIODIC • KEEPALIVE PERIOD • REGISTER SUPPRESSION TIME • REGISTER PROBE TIME
PIM Entity Type	Remote RP, C-RP, C-BSR
Neighbor Address	User-defined <IP Address>
Multicast Groups	User-defined <IP Address>
Multicast Sources	User-defined <IP Address>
Types of Joins or Prunes to be sent	User-defined <(S,G), (*,G)>,<(S,G,rpt), (*,*,RP)>
Hello TLV options	User-defined
Aggregation of Join/Prune	User-defined <enabled/disabled>
Staggered Sending of Joins	User-defined <# of Joins to be sent in a specified time>
Flapping of Join/Prune	User-defined <amount of time to remain joined, amount of time to remain pruned>
Sending of Register Traffic	User-defined <Sources, Groups>

MSDP Parameters Configurable through Tcl

Timers	• SA ADVERTISEMENT • PEER HOLD • KEEP ALIVE • CONNECT RETRY
Peer IP Address	User-defined <IP Address>
Multicast Groups	User-defined <IP Address>
Multicast Sources	User-defined <IP Address>
Rendezvous Point Address	User-defined <IP Address>
Source Active Message Transmission Rate	User-defined
Encapsulated Multicast Packet in Source Active Message	Enable/disable

Applicable Standards

PIM-SM:
draft-ietf-pim-sm-v2-new-08
(obsoletes RFC 2362)
PIM-SSM:
draft-ietf-mboned-ssm232-06.txt
MSDP: RFC 3618
Multicast Benchmarking:
RFC 2432: Terminology for IP
Multicast Benchmarking and
draft-ietf-bmwg-mcastm-13.txt
Bi-directional PIM: draft-ietf-pim-bidir-05
Generic Routing Encapsulation: RFC 2784
Multicast VPN: draft-rosen-vpm-mcast-05.txt

Configuration and Ordering Details

To use the E7886A Multicast Routing
Emulation software, Agilent N2X
hardware and software is required.

Hardware

A N2X system is required with:
- A system controller and two test
  ports (three is recommended).
- Chassis
- Interface cards

Software

To realize the full benefit of the PIM
emulation, an underlying IGP such as
OSPF is needed (recommend E7882A
IPv4 Routing Emulation software and
E7885A IPv6 Routing Emulation). LSP
tunnels can be created and the data
forwarding performance of the labeled
packets traversing those tunnels can
be measured.

The E7828A IGMP Protocol Emulation
Software license is recommended for
scalable and realistic simulation of
IPv4 multicast clients. The E7897A
MLD Protocol Emulation Software
license is recommended for IPv6
multicast testing.

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 Agilent N2X. Dialog-
level, context-sensitive help provides
rapid access to the relevant sections
of the online help. A technology
reference section provides a complete
library of background information
pertaining to router performance
testing.

Acronyms

API	Application Programming Interface
BGP	Border Gateway Protocol
DR	Designated Router
GRE	Generic Routing Encapsulation
GUI	Graphical User Interface
IGMP	Internet Group Management Protocol
IPv4	Internet Protocol Version 4
IS-IS	Intermediate System to Intermediate System
MBGP	Multiprotocol Border Gateway Protocol
MFIB	Multicast Forwarding Information Base
MRIB	Multicast Routing Information Base
MSDP	Multicast Source Discovery Protocol
OSPF	Open Shortest Path First
PIM-SM	Protocol Independent Multicast-Sparse Mode
PIM-SSM	Protocol Independent Multicast - Source-Specific Multicast
RIP	Routing Information Protocol
RPT	Rendezvous Point Tree
S,G	Source Comma Group
*,G	Star Comma Group
SPT	Shortest Path Tree
SUT	System Under Test
Tcl	Tool Command Language
TIB	Tree Information Base

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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.

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:
Agilent Technologies Canada Inc.
2660 Matheson Blvd. E
Mississauga, Ontario
L4W 5M2
1-877-894-4414

Europe:
Agilent Technologies
European Marketing Organisation
P.O. Box 999
1180 AZ Amstelveen
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(31 20) 547-2323

United Kingdom
07004 666666

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