MD1230 Family
IP Multicast Emulation
Outline

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   ➢ Multiflow Monitoring and Capture/Decode
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   ➢ IGMP/MLD
   ➢ IGAP (Option 14)
   ➢ MLDA (Option 22)
   ➢ PIM-SMv2 (Option 21)
1. What is Multicast Distribution?

- **Multicast**: Sends same data simultaneously to multiple specified hosts

**Streaming Movie Content Example**

Unicast send same package three times

Multicast send same package only once over each link

At multicast, the router copies the required number of streams.

- IPTV
- Video meeting, etc.

Lighter server and network loads
2. Multicast Protocols

- Host side multicast protocols: IGMP, IGAP, MLD, MLDA
- Network side multicast protocol: PIM-SM
3. Multicast Functions of MD1230 Family

MD1230 Family Multicast Functions

- Multicast Stream Generation
- Multiflow Monitoring Function and Capture/Decode
- Emulation
3. Multicast Functions of MD1230 Family

- Multicast Stream Generation

Generates multiple channel streams (multiple multicast addresses)
3. Multicast Functions of MD1230 Family

- Multiflow Monitoring and Capture/Decode

  Monitors each channel flow (each multicast address)

  Decodes captured packets (multicast protocol)
3. Multicast Functions of MD1230 Family

In addition to IGMP/IGAP, added *MLD*/MLDA and *PIM-SMv2* Protocol Option for IPv6. IPv6 Multicast Network Performance Test achieved by emulating virtual network and virtual host.

* IPv6 evaluation requires IPv6 Expansion (Option-12)
4. Overview of MD1230 Family Multicast Protocols

✧ **Host side multicast protocols**
  - (1) IGMP/IGMPv3 (Internet Group Management Protocol) [IPv4]
  - (2) MLD/MLDv2 (Multicast Listener Discovery Protocol) [IPv6]
  - (3) MLDA (Multicast Listener Discovery Authentication Protocol) [IPv6]
  - (4) IGAP (IGMP for User Authentication Protocol) [IPv4]

✧ **Network side multicast protocol**
  - (5) PIM-SMv2 [IPv4/IPv6]

* Not supported by MU120131A/32A.
**Multicast Emulation**

- IGMP, IGAP, MLD, MLDA
  Emulates multiple virtual hosts belonging to multicast group to support environment for sending/receiving multicast packets with MD1230
- PIM-SMv2
  Emulates virtual network with hosts belonging to multicast group to support environment for sending/receiving multicast packets with MD1230
Host Side Multicast Protocols

IGMP, MLD, IGAP, MLDA
MD1230B IGMP/IGAP/MLD/MLDA Features

✧ Standards Support
  ➢ IGMP: RFC1112 Host Extensions for IP Multicasting (IGMPv1)
    RFC2236 Internet Group Management Protocol, Version 2 (IGMPv2)
    RFC2113 IP Router Alert Option
  ➢ IGAP: IETF Draft (draft-andou-igmp-auth-01.txt)
  ➢ MLD: RFC2710 Multicast Listener Discovery (MLD) for IPv6
    RFC2711 IPv6 Router Alert Option
  ➢ MLDA: IETF Draft (draft-hayashi-mlda-01.txt)
    IETF Draft (draft-vida-mld-v2-07.txt)

✧ Emulate Multiple Hosts
✧ Send Report Message
✧ Respond Query Message
✧ Password Authentication (IGAP, MLDA)
✧ Change Host Status (Start Listening/Stopping Flap Test)
(1) IGMP/IGMPv3, (2) MLD/MLDv2
Multicast Network

IPv4: IGMP
IPv6: MLD

Multiflow Monitoring and Capture/Decode Function

IP Multicast Network

Multicast Stream A (224.1.1.1)
Multicast Stream B (224.1.1.2)

Virtual Host (Zapping)

Discover What's Possible™
MD1230-14/21/22-E-L-1
Multicast Stream Generation

- Multicast Stream Generation

- CH1
- CH2
- CH3
- CH4
- CH5
- CH6

Multicast Stream Generation

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Flow Monitoring

Contents
CH1... 224.1.1.1
CH2... 224.1.1.2
CH3... 224.1.1.3
CH4... 224.1.1.4
CH5... 224.1.1.5
CH6... 224.1.1.6

Multicast Group

Monitoring
• Traffic rate
• Latency
• Packet loss

…
Capture/Decode Function

Ethereal/Wireshark Protocol Analysis and Troubleshooting

(Example: Channel Switching Time, ...)

Multicast Protocol Support
IGMP/MLD Host Emulation

DUT: IP Multicast Network and Network Equipment

Contents Server

Router

L3 L2 L1 L0

(192.168.4.0/24)

(192.168.1.0/24)

Flow Monitor

Host

Zapping
- Change channels
- Increase/Decrease hosts
- Increase/Decrease channels

IGMP/MLD Host Emulation

DUT: IP Multicast Network and Network Equipment

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Host Emulation... (Change Channels)
Host Emulation... (Increase/Decrease Hosts)

Channel Zapping

Add Hosts

Host 1 -> Host 2 -> Host 3, ...

(Add) (Add)
Host Emulation... (Increase/Decrease Channels)

![Image of Host Emulation interface]

- Add Channel
  - CH1
  - CH2
  - CH3, ...

(Add)

(Add)
Applications

Switching Time Measurement
Measures time from channel switching until video streamed

Switching Time

IGMP (Membership Report)

Multicast Stream

Host

Router (Network Side)

Ethereal/Wireshark

Capture

Applications

Switching Time Measurement
Measures time from channel switching until video streamed

Switching Time

IGMP (Membership Report)

Multicast Stream

Host

Router (Network Side)

Ethereal/Wireshark

Capture
Applications

Delay Time Measurement
Measures delay time under high load conditions caused by Zapping

Multiflow Counter
Delay Time Occurrence (Time Domain)
Delay Time Distribution (Packet Jitter)
Variation
Applications

- **QoS Assurance**
  Checks impact of packet loss on quality of service (QoS)

![Packet Loss Occurrence](image)
(3) IGAP Protocol (Option-14)
**IGMP Protocol**

.camel-case**IGMP for User Authentication Protocol (IGAP)**

- IETF Draft standard derived from IGMP multicast protocol
  - Proposed by Nortel, NTT
- Adds user authentication
  - Supports control of hosts joining multicast groups
  - Better control of video streaming systems
    - Charging for movies
    - Managing members
IGAP Application

Option-14

IGAP Analysis

Through Mode

IGAP Packet Transmit

- Check IGAP sequence
- Analyze IGAP
- Troubleshooting

IGAP Emulation

- Check IGAP sequence
- Check interconnection
- Perform abnormality tests

- Check IGAP function
- Measure performance during multicasting

Group A

Group B

Group C

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IGAP Analysis

➢ Application
  ✓ Supports both external tapping modules and pass-through mode operation

- Check IGAP sequence
- Analyze IGAP
  - Capture IGAP frames
  - Decode IGAP frames
- Troubleshooting
IGAP Analysis

- Capture and Decode

- Top window shows data for up to 40 ports

- Bottom window provides IGAP protocol decode for analysis

List of captured packets

Protocol analysis
IGAP Analysis

Efficient Troubleshooting

- Filter Setting
- Trigger Setting

Trigger and filter functions help *get only important data*
Solve auto-negotiation problems *quickly and efficiently*
IGAP Packet Transmit

- Transmit Test Features
  - Transmit IGAP packets
    - Check IGAP sequences
    - Check interconnection
    - Perform abnormality tests
  - Sequences of up to 256 patterns
  - Simultaneous transmit and capture

![Diagram showing DUT transmitting IGAP packets to MD1230B](image-url)
IGAP Packet Transmit

- IGAP Packet Edit
  - Transmit up to 256 pattern streams
  - Use easy sequencing, such as Next, Jump, ...

Checkbox enables/disables each pattern
IGAP Packet Transmit

➢ IGAP Packet Edit

Choose Type in pull-down menu.

Displays packet graphically

Check various systems by editing User Account and Message fields.
IGAP Packet Transmit

Example

Transmit IGAP test sequence

Check IGAP response sequence

Transmit abnormal IGAP sequence

Check IGAP response under abnormal conditions
IGAP Emulation

Simple Operation

- Start/Stop
- Set Group IP Address in IGAP Report Packet.
IGAP Emulation

➢ IGAP Report Options

Set any User Account data and Message data in IGAP Report packet to test system response to various conditions.
Perform Join and Leave Flap tests by setting timings for sending Join and Leave request frames. Check grouping function for IGAP multicasting.
IGAP Emulation

Logging

Check IGAP sequence during emulation using each sequence shown in Log field.

Details for each sequence packet are displayed in a separate window.
IGAP Emulation

- Performance Test During Emulation
  - Emulate IGAP multicast
  - Performance test during multicasting
    - Flap test: Join and Leave
    - Load testing and latency measurements

Check real performance of DUT on IGAP multicast network.
(4) MLDA Protocol (Option-22)
**MLDA Protocol**

**Option-22**

**Supported Functions**

- MLDA Password authentication
- Repeated Join/Leave message generation
  - Supports Join/Leave message interval timer
  - Supports phased loading for Join/Leave message
- MLDA Packet generation (TxStream Expansion)
MLDA Protocol Emulation Features

- Standards Support
  - MLDA:
    - IETF Draft (draft-hayashi-mlda-01.txt)
    - IETF Draft (draft-vida-mld-v2-07.txt)
- Virtual Host and Multicast Group Emulation
  - 2000 hosts or groups max.
- Support:
  - Send report
  - Respond query
  - Password authentication
  - Host status change (Listening Start/Stop and Flapping)
- Independently Run Other Host Multicast Protocols (IGAP, IGMP and MLD)
MLDA Applications

- **MLDA Password Authentication**
  - MD1230 generates MLDA password message

- **Measure Router Performance using MLDA Protocol**
  - MD1230 measures multicast packet forwarding performance (Throughput, Latency, etc.) using TxStream and Counter functions
MD1230 independently emulates MLDA, MLD, IGMP, and IGAP protocols

- The MLDA protocol adds authentication to MLD
- Check router behavior using host multicast protocols

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<th>Option Name</th>
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</table>

![Diagram of multicast protocols](image-url)
Network Side Multicast Protocol

PIM-SMv2
(5) PIM-SMv2 Protocol (Option-21)
PIM-SMv2 Protocol

Supported Functions

- Emulates routers at host side, including hosts and networks
- Emulates routers at server side, including server and network
- Repeat transmission of Join/Prune message (settable interval timer)
- Transmit packets encapsulated by PIM Register Message (TxStream Expansion)

Note: The MD1230 cannot emulate Rendezvous Point (RP).
PIM-SMv2 Features

✔ Standards Support
  PIM-SMv2: IETF Draft (draft-ietf-pim-sm-v2-new-08.txt)
  IETF Draft (draft-ietf-pim-bidir-05.txt)
  IETF Draft (draft-ietf-pim-sm-bsr-03.txt)

✔ PIM Router Emulation
✔ PIM-SM Packet Exchange with Neighboring Router and Store Information
✔ Transmit Join/Prune Message about Multicast Groups
  Alternate Join/Prune message transmission and PIM (*, G)
  Join/Prune to PIM (S, G) Join/Prune message switching

✔ 2000 Multicast Group Emulation
✔ Automatic RP Address Detection (BSR: draft-ietf-pim-sm-bsr-03.txt)
✔ IPv4 and IPv6\(^1\) Support

\(^1\) Requires IPv6 Expansion (Option-12)
PIM-SMv2 Applications

- **PIM-SMv2 Load Test**
  - Measure Performance at Emulated Server Side, Host Side, or Both
    - Measure multicast forwarding performance (Throughput, Latency, etc.), using transmitting multicast frames from server side.
PIM-SMv2 Screens

- Supports IPv4, IPv6, and both networks
- Multicast address sets number of addresses
- Supports wild card setting
- Supports automatic RP address detection (BSR only)

Independently supports other protocols

Supports joining of up to eight multicast addresses (selectable)
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