

Stigix Technical White Paper — SD-WAN Multicast Validation & Troubleshooting Guide

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Introduction

Validating IP Multicast across an SD-WAN fabric is traditionally complex because it requires coordinating a traffic generator on one site, a multicast listener on one or more remote branches, and checking multiple routing tables (IGMP, PIM, and Rendezvous Point states) across the network.

Stigix simplifies this entire process into a single button click from a central web dashboard. This White Paper explains in simple, network-oriented terms:

1. **How Stigix coordinates a multicast test** between the **Leader Controller**, the **Sender**, and the **Receivers**.
2. **What happens step-by-step on the network** when you start a stream (both Data Center-to-Branch and Branch-to-Branch).
3. **How to configure Prisma SD-WAN (ION) and transit routers (vynos)** using a validated reference lab (DC1 → BR5).
4. **How to read the results and troubleshoot** multicast drops in seconds.

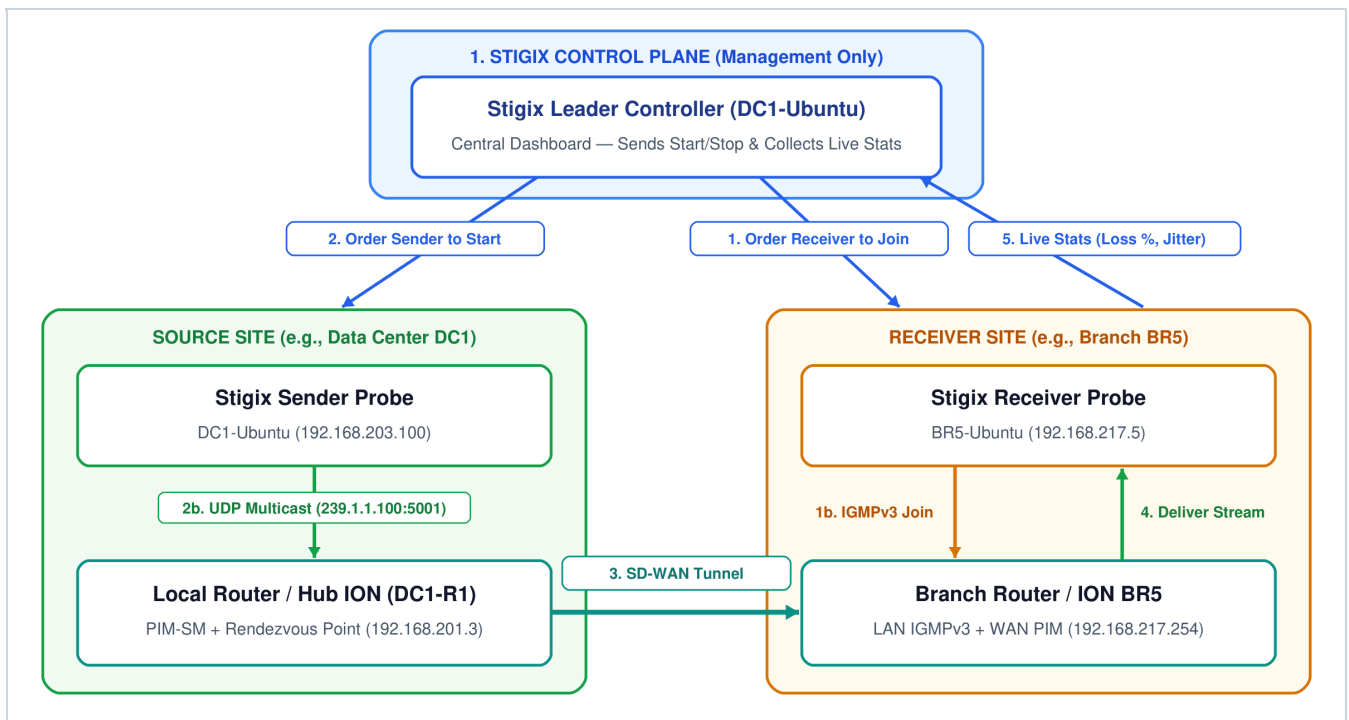
1. How Stigix Works: Leader Controller, Sender, and Receiver

To test multicast across multiple sites without logging into multiple machines via SSH, Stigix separates **Test Management (Control Plane)** from **Multicast Traffic (Data Plane)**.

Every Stigix probe in your network can play one or more of three simple roles:

Role	What It Does	Example in Our Lab
1. Leader Controller	The central web dashboard where you configure the test, click Start / Stop , and view live results from all sites.	DC1-Ubuntu (192.168.203.100)
2. Sender (Source)	The Stigix probe that injects the real UDP Multicast stream onto its local LAN interface toward the local router.	DC1-Ubuntu (or BR8-Ubuntu)
3. Receiver (Listener)	The Stigix probe on a remote site that subscribes to the multicast group (via IGMP) on its local LAN and measures received packets.	BR5-Ubuntu (192.168.217.5)

IMPORTANT: Multicast traffic never passes through the Stigix management tunnel. The management connection between the Leader and the remote branches is only used to send "Start/Stop" orders and collect statistics. The multicast packets themselves are injected directly onto the physical LAN and must traverse your real routers and SD-WAN tunnels.



What Happens When You Click "Start Stream"?

When you click **Start Stream** on the Leader dashboard, Stigix executes a 4-step sequence automatically:

1. Step 1 — The Receivers Subscribe First (IGMP Join):

- The Leader Controller tells all selected **Receiver** probes (e.g., BR5-Ubuntu) to join the multicast group (239.1.1.100:5001).
- Each Receiver immediately sends a standard **IGMPv3 Membership Report** onto its local LAN to tell its local branch router: *"I want to receive multicast group 239.1.1.100"*.
- The branch router (BR5 ION) signals the SD-WAN Rendezvous Point (RP) via **PIM Join** to build the multicast tree.

2. Step 2 — The Sender Starts Injecting Traffic (UDP Multicast):

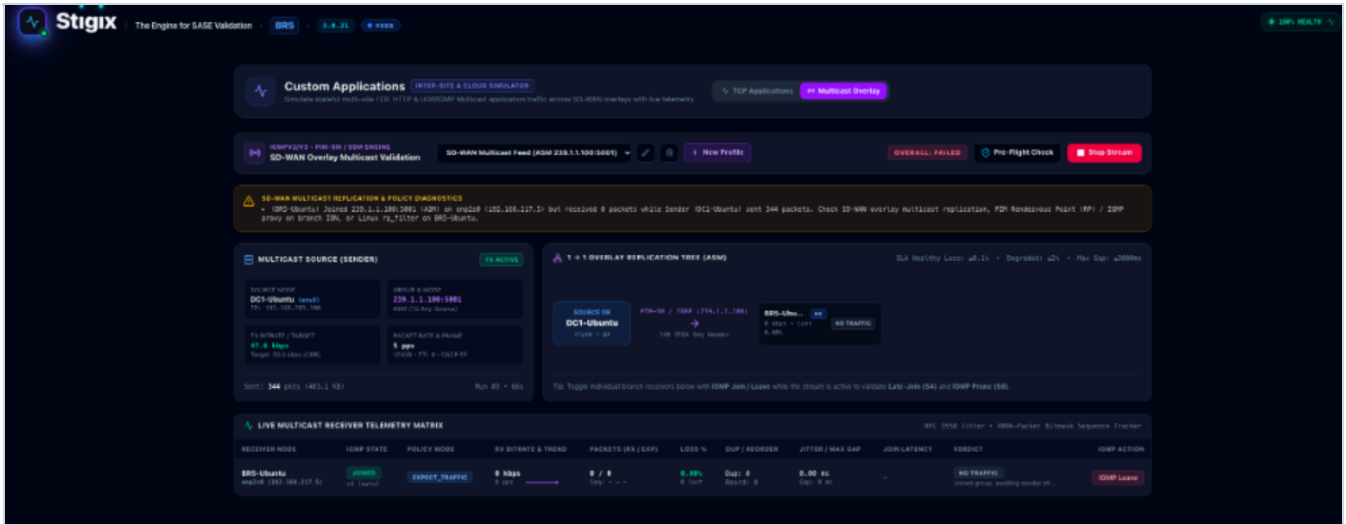
- A fraction of a second later (once the receivers are ready), the Leader Controller tells the **Sender** probe (e.g., DC1-Ubuntu) to start transmitting the UDP multicast stream at the chosen bitrate (for example, 50 kbps with DSCP EF and TTL 8).
- Each packet is numbered sequentially (#1, #2, #3...) and timestamped so receivers can detect any missing, duplicated, or delayed packet.

3. Step 3 — Live Measurement & Dashboard Updates:

- Every 2 seconds, the Leader Controller asks the **Sender** (*"How many packets did you send?"*) and each **Receiver** (*"How many packets did you receive, what is your loss %, and what is your jitter?"*).
- If a Receiver joins while the stream is already running (**Late Join**), it starts counting from the first packet it sees, so it never reports false packet loss for packets sent before it joined.

4. Step 4 — Clean Teardown ("Stop Stream"):

- When you click **Stop Stream**, the Leader Controller **stops the Sender first** so no new packets enter the network, and **then** tells the Receivers to send an **IGMP Leave** to tear down the multicast tree cleanly without false loss alerts.



2. Hub-to-Branch vs. Branch-to-Branch: How the Traffic Flows

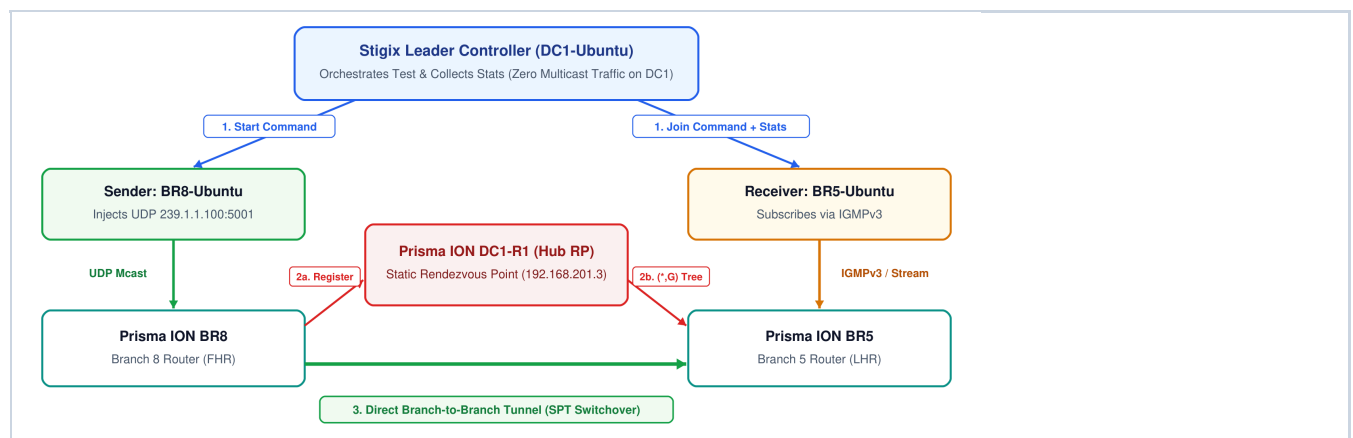
Because the **Leader Controller** role is independent from the **Sender** role, you can run tests from any site to any other site from the exact same DC1 dashboard.

Case A: Data Center to Branch (DC1 Source → BR5 Receiver)

- **Stigix Roles:** DC1-Ubuntu is both the **Leader Controller** and the **Sender**. BR5-Ubuntu is the **Receiver**.
- **Network Path:**
 1. BR5-Ubuntu sends an **IGMPv3 Join** to its local BR5 ION (192.168.217.254).
 2. BR5 ION sends a **PIM Join** over the SD-WAN tunnel to the Hub DC1-R1 ION (which acts as the Rendezvous Point at 192.168.201.3).
 3. DC1-Ubuntu sends the UDP multicast stream on its LAN (192.168.203.100), which reaches DC1-R1 ION and is replicated across the SD-WAN tunnel to BR5.

Case B: Branch to Branch (BR8 Source → BR5 Receiver)

What happens if you stay on the DC1 dashboard, but select **BR8-Ubuntu as the Sender** and **BR5-Ubuntu as the Receiver**?



1. **DC1 Only Gives the Orders:** DC1-Ubuntu tells BR5-Ubuntu to listen and BR8-Ubuntu to transmit. DC1-Ubuntu does not generate or receive any multicast traffic itself.

2. **Initial Meeting at the Hub RP (*, G):**

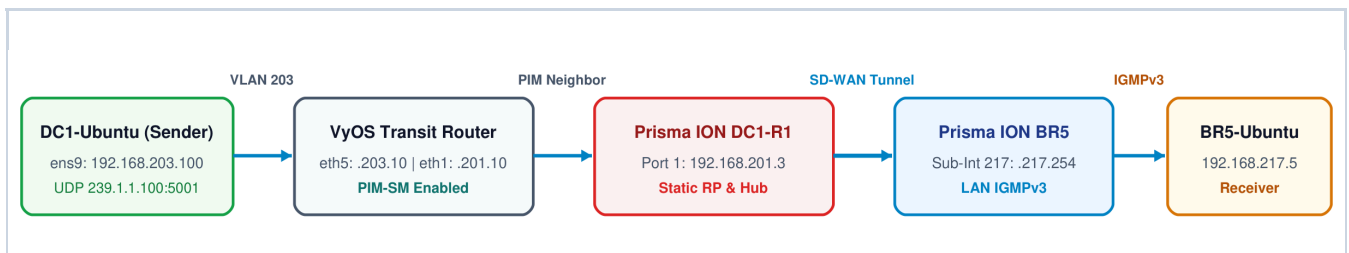
- BR5 ION asks the Rendezvous Point (DC1-R1) for group 239.1.1.100.
- BR8 ION receives the multicast stream from BR8-Ubuntu on its LAN and registers the stream with the Rendezvous Point (DC1-R1). The very first packets flow through DC1-R1 to reach BR5.

3. **Automatic Switch to Direct Branch-to-Branch Tunnel (SPT Switchover):**

- Because **SPT Switchover** is enabled on Prisma SD-WAN, as soon as BR5 ION receives the first packet, it sees that the real source is BR8.
- BR5 ION immediately builds a direct multicast path (S, G) over the dynamic branch-to-branch VPN tunnel between BR8 and BR5, **bypassing the Data Center (DC1)** to reduce latency and save Hub bandwidth.

3. Step-by-Step Configuration Guide (DC1 → BR5)

Below is the complete configuration used in our lab to validate multicast between DC1 (192.168.203.100) and BR5 (192.168.217.5).



3.1 Step 1 — Configure the Multicast Test Profile in Stigix

In the Stigix Web Dashboard (**Custom Apps** → **Multicast Overlay**), create your test profile:

Edit Multicast Profile: SD-WAN Multicast Feed

PROFILE ID: mc-sdwan-feed PROFILE NAME: SD-WAN Multicast Feed

ADDRESSING MODE: ASM (*G → 239.0.0.0/8) MULTICAST GROUP IP: 239.1.1.100 UDP PORT: 5001

SENDER NODE (SOURCE DR): DC1-Ubuntu (192.168.203.100) RATE MODE & BITRATE (Kbps): CBR 50 PAYLOAD / TTL / DSCP: 1200 8 EF

Source LAN IP: 192.168.203.100

PARTICIPATING RECEIVER NODES (1 → N REPLICATION) Use EXPECT_NONE to test Multicast Policy / Zone Deny (S7)

Known Stigix Targets (click to add as Receiver with its LAN IP):

- + DC1-Ubuntu (192.168.203.100) SENDER
- + BR8-Ubuntu (192.168.219.1)
- + BR2-Ubuntu (192.168.206.10)
- + BR1-Ubuntu (192.168.207.10)
- + HetznerCloud (142.132.193.157)
- + NucVillersOKNow (192.168.1.163)
- + DC2-Ubuntu (192.168.212.100)
- + HomelabMacbookAir (192.168.10.141)
- ✓ BR5-Ubuntu (192.168.217.5)
- + DC7-Ubuntu (192.168.205.10)

-- Select a Stigix Target to add as Receiver -- EXPECT_TRAFFIC (Normal)

BR5-Ubuntu LAN IP: 192.168.217.5 EXPECT_TRAFFIC Remove

Cancel Save Changes

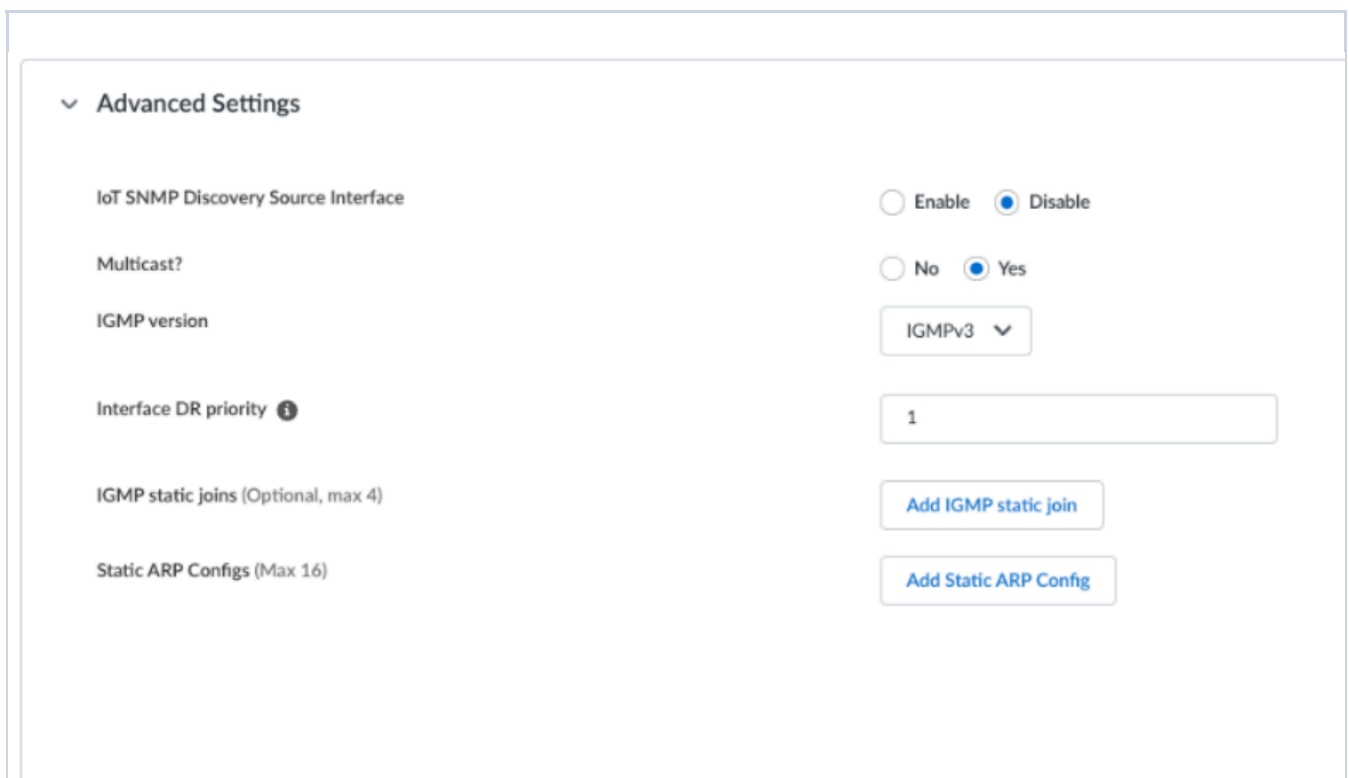
- **Mode:** ASM (*,G - 239.0.0.0/8) (uses the SD-WAN Rendezvous Point).
- **Group & Port:** 239.1.1.100 on UDP port 5001.
- **Sender Node:** DC1-Ubuntu (192.168.203.100).
- **Rate:** CBR at 50 kbps (1200 bytes per packet, ~5 packets/second).
- **TTL & DSCP:** TTL = 8 (must be greater than the number of routers on the path) and DSCP = EF (Real-Time Voice/Video priority).
- **Receiver Node:** BR5-Ubuntu (192.168.217.5) with expectation set to **EXPECT_TRAFFIC**.

3.2 Step 2 — Configure the Prisma SD-WAN Branch ION (BR5)

On the branch router (BR5), two settings are required so it listens to the local Receiver and requests the stream from the Hub:

A. Enable Multicast & IGMPv3 on the Branch LAN Interface

Go to **Interfaces** → **Port 3** → **Sub-Interface (217)** (192.168.217.254/24) → **Advanced Settings**, set **Multicast** to **yes**, and select **IGMPv3**:



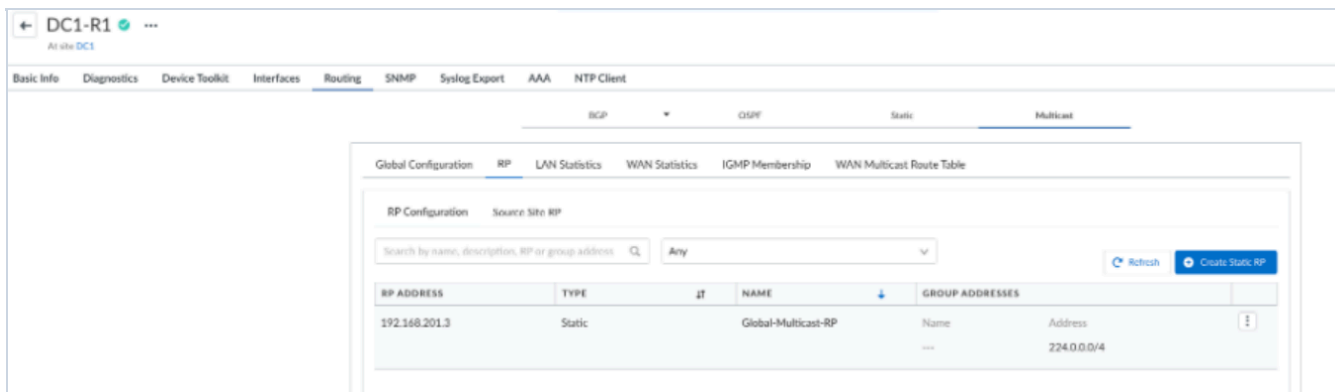
The screenshot shows the 'Advanced Settings' section of a configuration page. It includes the following settings:

- IoT SNMP Discovery Source Interface:** Radio buttons for 'Enable' and 'Disable', with 'Disable' selected.
- Multicast?:** Radio buttons for 'No' and 'Yes', with 'Yes' selected.
- IGMP version:** A dropdown menu showing 'IGMPv3'.
- Interface DR priority:** A text input field containing the value '1'.
- IGMP static joins (Optional, max 4):** A button labeled 'Add IGMP static join'.
- Static ARP Configs (Max 16):** A button labeled 'Add Static ARP Config'.

TIP: Why IGMPv3? Modern Linux servers (Ubuntu 22.04 / 24.04) use **IGMPv3** by default when subscribing to a multicast group. Selecting **IGMPv3** on the Prisma SD-WAN LAN interface ensures the router immediately recognizes the subscription.

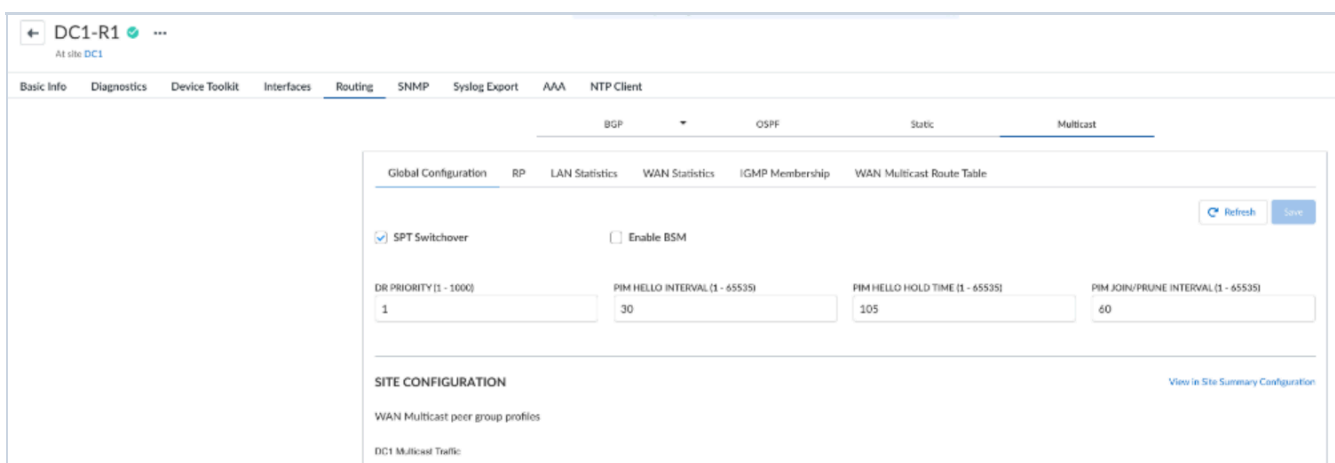
B. Point the Branch to the Rendezvous Point (RP)

Go to **Routing** → **Multicast** → **RP** and configure the Static RP address (192.168.201.3, which is DC1-R1's LAN IP) for the multicast range 224.0.0.0/4:



3.3 Step 3 — Configure the Prisma SD-WAN Hub ION (DC1-R1)

On the Data Center Hub router (DC1-R1), enable **Global Multicast**, **SPT Switchover**, and the **WAN Multicast Peer Group Profile**, and define the same Static RP (192.168.201.3 for 224.0.0.0/4):



Also ensure that DC1-R1's LAN interface (Port 1, 192.168.201.3/24) has **Multicast (yes)** and **PIM** enabled so it can receive multicast streams from the Data Center LAN.

3.4 Step 4 — Don't Forget Transit Routers in the Data Center (vynos Example)

In many Data Centers, the server generating the multicast stream (DC1-Ubuntu in 192.168.203.0/24) is not on the exact same subnet as the SD-WAN Hub (DC1-R1 in 192.168.201.0/24), with a core switch or router (vynoslandc1) sitting in between.

WARNING: Unicast routing (BGP/OSPF) does not forward multicast packets! Even if DC1-Ubuntu can ping DC1-R1, the transit router (vynoslandc1) will silently drop multicast packets unless **PIM-SM** is enabled on both its incoming (eth5) and outgoing (eth1) interfaces.

Configuration required on the vynoslandc1 router:

```
configure
set protocols pim interface eth5
set protocols pim interface eth1
set protocols pim rp address 192.168.201.3 group '224.0.0.0/4'
```

```
commit
save
```

Once applied, vyoslandc1 establishes a PIM neighbor session with DC1-R1 (192.168.201.3) and forwards the stream (192.168.203.100, 239.1.1.100) from eth5 to eth1:

```
vyos@vyoslandc1:~$ show ip pim neighbor
Interface Neighbor      Uptime    Holdtime  DR Pri
eth1      192.168.201.3  00:00:42  00:01:33  1

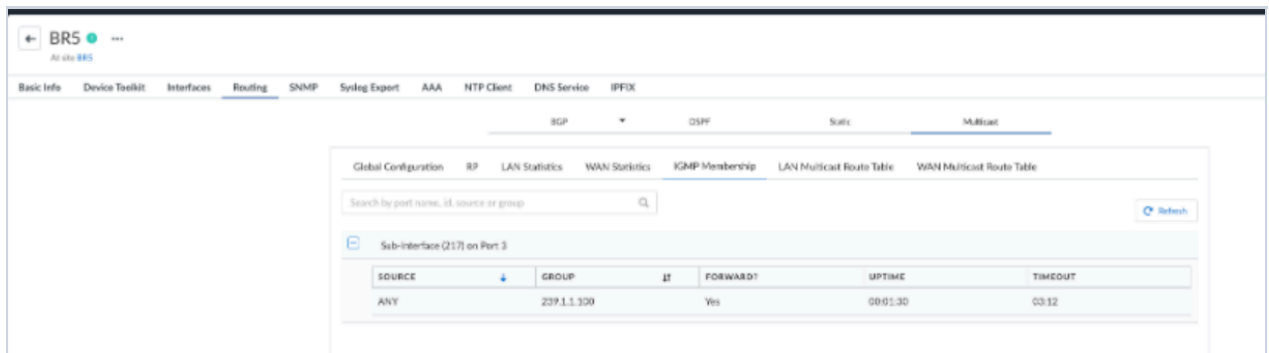
vyos@vyoslandc1:~$ show ip multicast route
Source      Group      Flags  Proto  Input  Output  TTL  Uptime
192.168.203.100  239.1.1.100  SFT    PIM    eth5   eth1    1    00:01:13
```

4. Validating & Troubleshooting Multicast in Prisma SD-WAN and Stigix

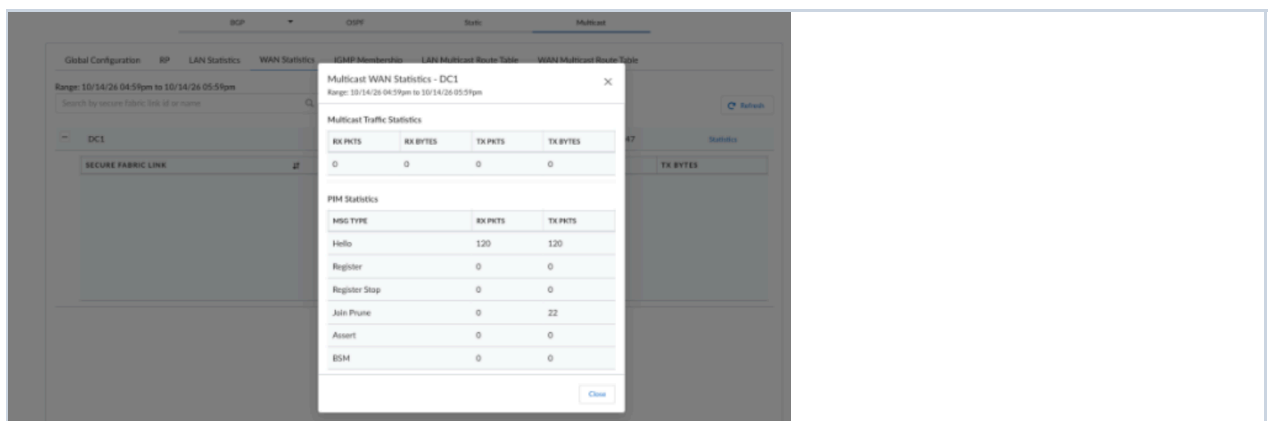
4.1 Checking Prisma SD-WAN Tables (From Branch to Hub)

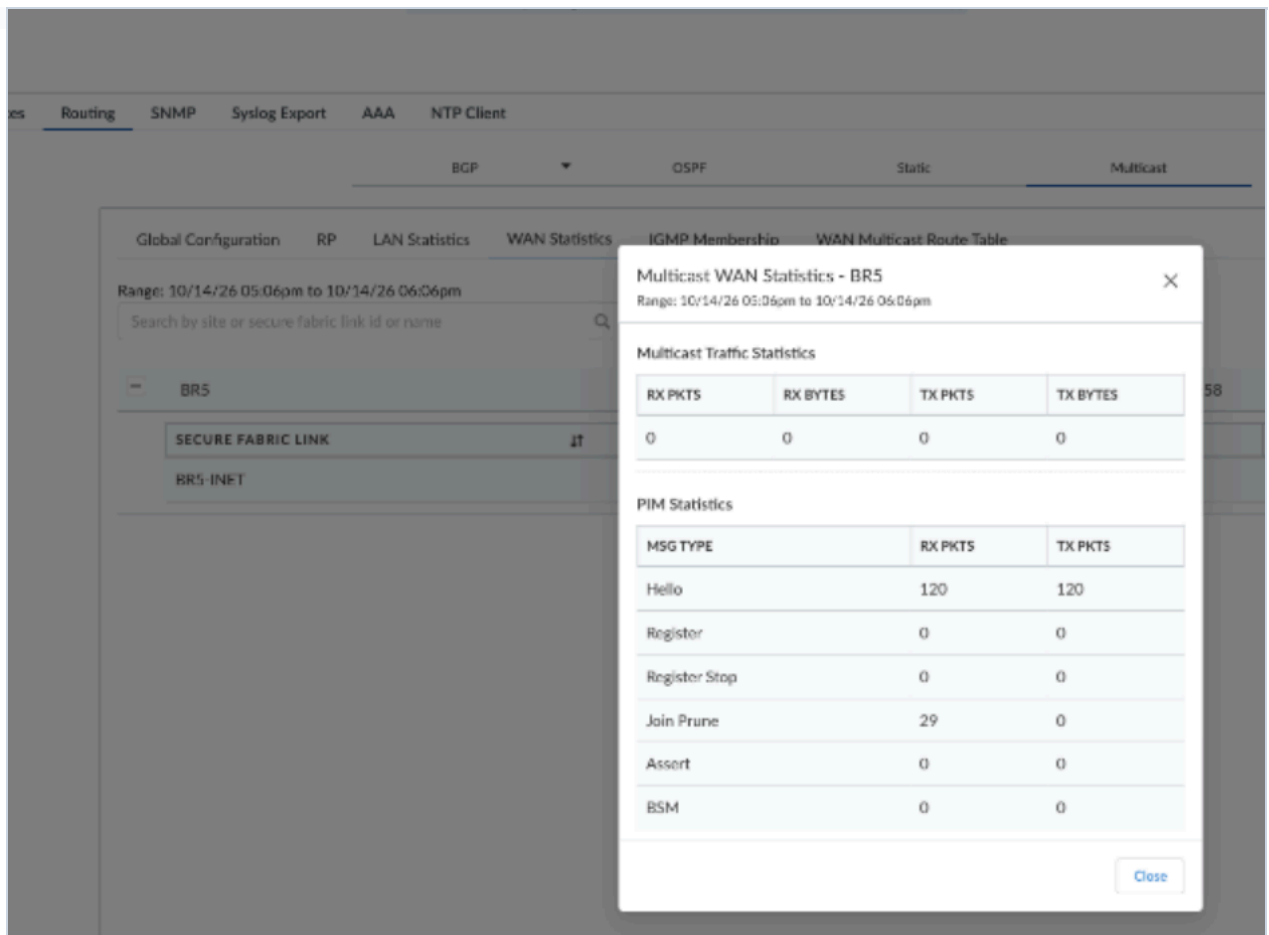
When a stream is running, you can verify the 3 stages of the multicast tree directly in the Prisma SD-WAN UI:

1. On BR5 — Did the branch router hear the local server's IGMP Join? Check **Routing** → **Multicast** → **IGMP**. You should see **GROUP: 239.1.1.100 on Sub-Interface (217) on Port 3 with FORWARD?: Yes**:



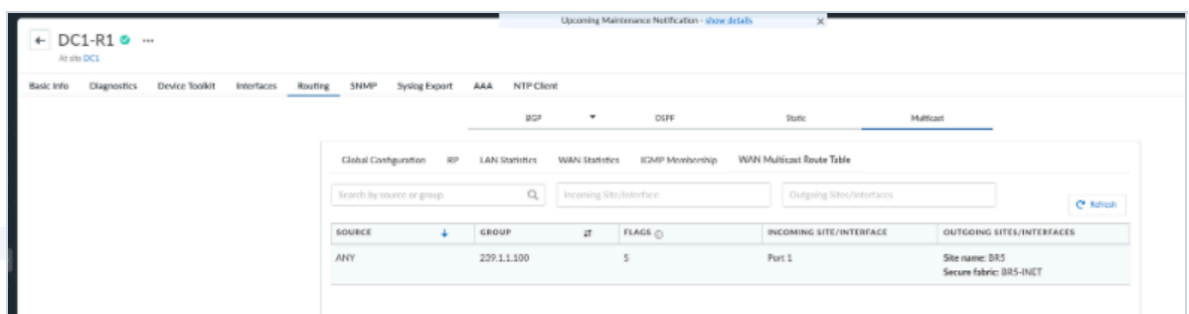
2. On BR5 & DC1-R1 — Did the branch request the stream over the SD-WAN WAN tunnel? Check **Routing** → **Multicast** → **WAN Statistics**. You should see **Join Prune TX PKTS** incrementing on BR5 and **Join Prune RX PKTS** incrementing on DC1-R1:



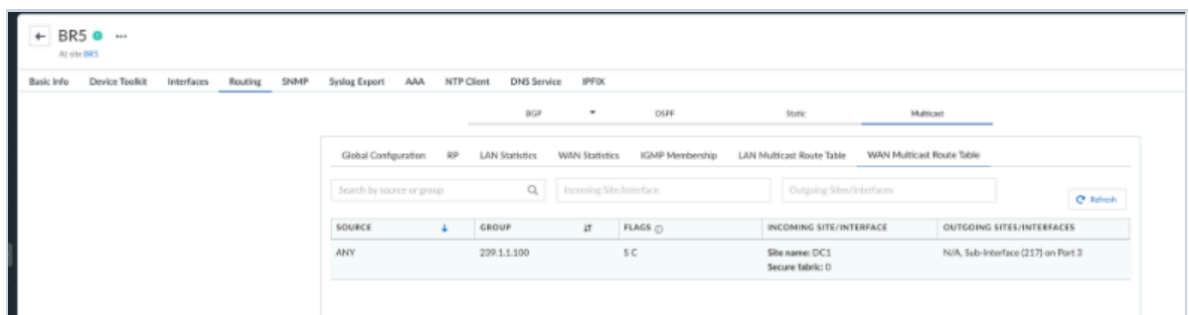


3. On DC1-R1 & BR5 — Is the WAN Multicast Route installed end-to-end? Check **Routing → Multicast → WAN Multicast Route**.

- On **DC1-R1**, INCOMING is Port 1 (DC LAN) and OUTGOING is Site name: BR5, Secure fabric: BR5-INET:



- On **BR5**, INCOMING is Site name: DC1 and OUTGOING is Sub-Interface (217) on Port 3:

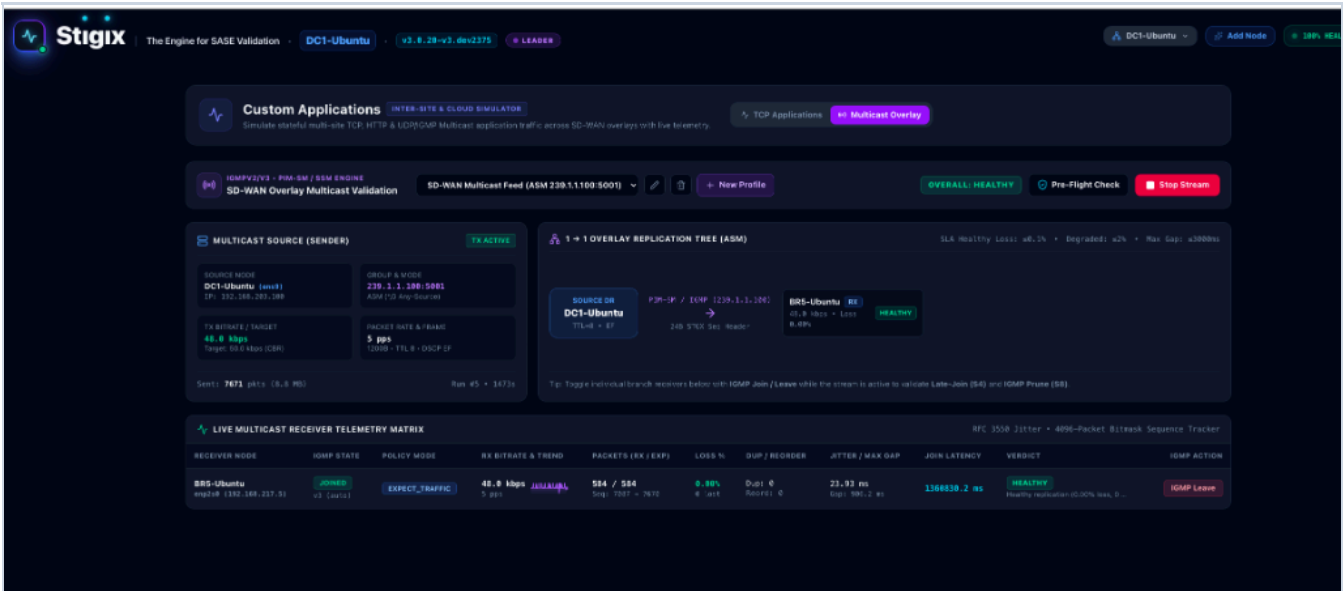


4.2 Reading the Stigix Dashboard Verdicts

Stigix translates raw packet counters into three visual states so you immediately know the health of your multicast overlay:

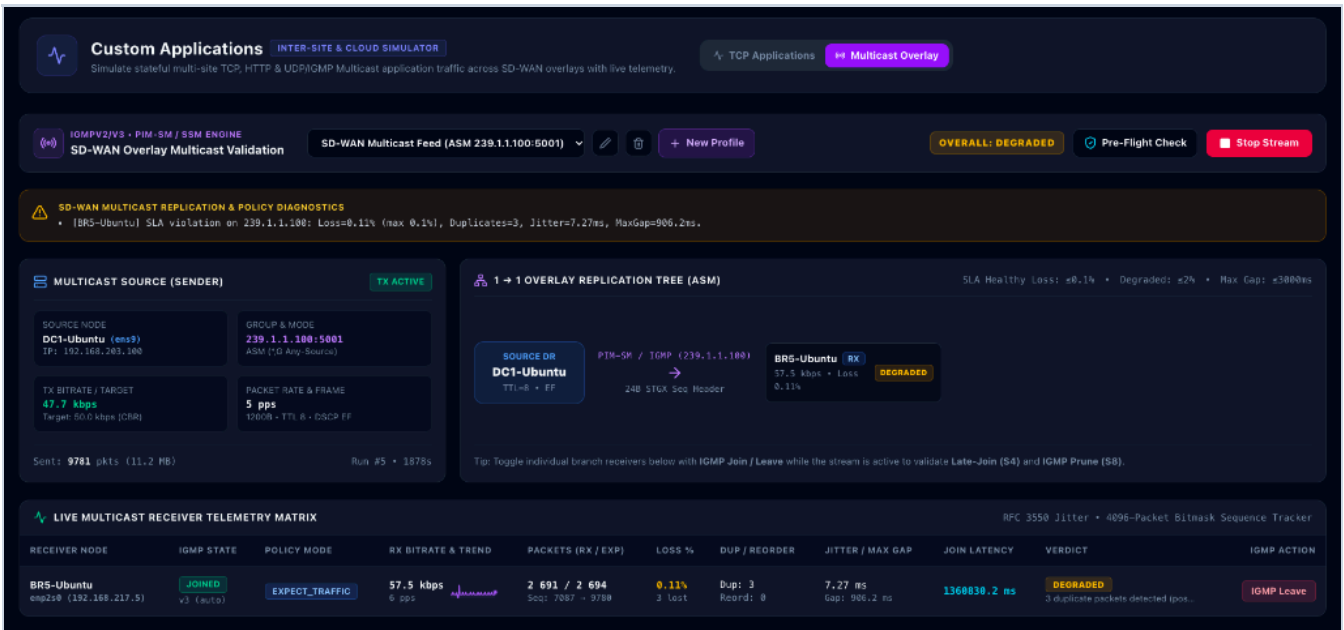
1. OVERALL: HEALTHY — End-to-End Replication Validated

All packets sent by DC1-Ubuntu (584 SENT) arrive at BR5-Ubuntu (584/584 PKTS, 0.00% loss, 50 kbps bitrate, 23.93 ms jitter):



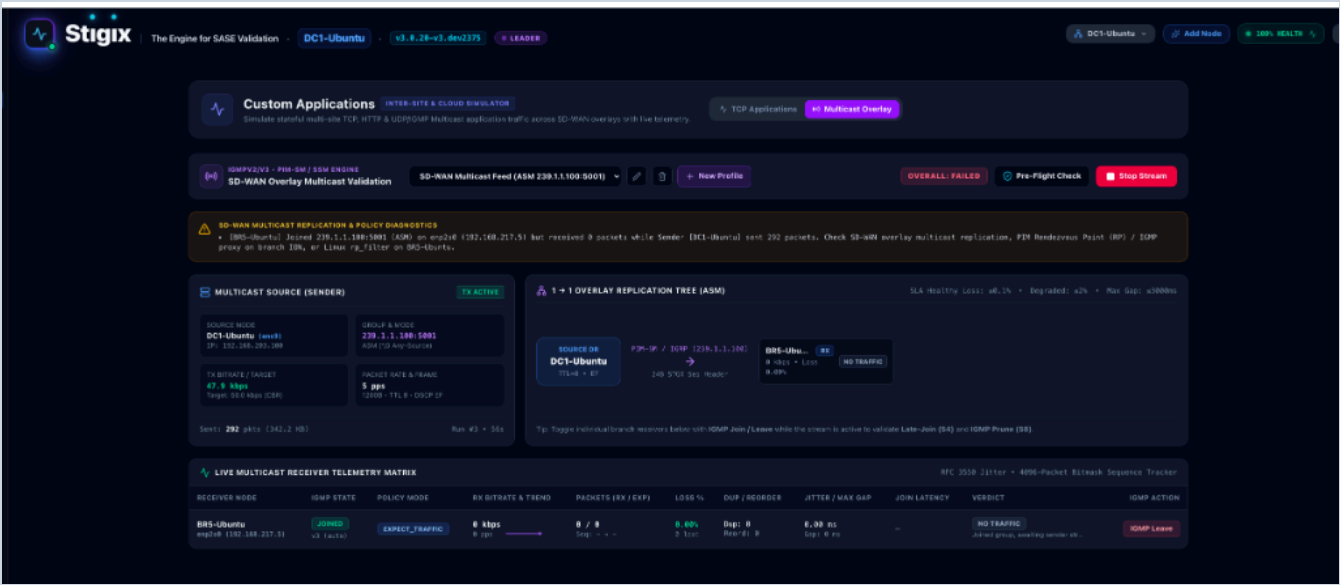
2. OVERALL: DEGRADED — Packet Loss or Mid-Stream Interruption Detected

The stream reaches the branch, but packet loss exceeds the SLA threshold (e.g., 24.16% loss or a 5571 ms interruption gap during a routing change):



3. OVERALL: NO_TRAFFIC / FAILED — Multicast Tree Blocked

The Sender is transmitting (28 SENT), and the Receiver is subscribed (JOINED (v3)), but 0 packets arrive at the branch (0/0 PKTS). Stigix automatically displays a **Diagnostics & SD-WAN Hints** banner listing the exact causes to check (RP reachability, PIM-SM on transit routers, IGMP version mismatch, or TTL):



Revision History

Date	Version	Author	Description
2026-10-14	1.0	Stigix Engineering	Simplified, network-engineer-friendly White Paper covering Control Plane vs. Data Plane operation, Hub-to-Branch & Branch-to-Branch flows, Prisma SD-WAN + VyOS setup, and visual troubleshooting.