IP Jackfield™: Constructing a Better Monitoring Network for Media Operations

IP Jackfield™ reintroduces intuitive, hop-by-hop flow access using DMF to mirror specific (S,G) multicast streams anywhere in the network. It's protocol-agnostic, independent of multicast distribution or controllers, and enables rapid port mirroring creation to achieve fine-grained visibility.

The Challenge: Monitoring in IP Media Networks

In a non-IP (or SDI) television broadcast environment, monitoring required one to physically tap each interface between connected processing devices. These connections were exposed to a patch panel called a jackfield, offering easy and fast access to any media flow. While IP adoption brings benefits, moving away from unidirectional, cable-per-flow technologies has complicated monitoring and abstracted visibility.

The Solution: IP Jackfield™

The IP Jackfield™ provides a novel use of Arista DMF to pick off a specific IP multicast (S,G) flow of interest at any point (hop) within the IP network and deliver that flow to appropriate monitoring tools.

Introduction

The landscape of media distribution has shifted from traditional Serial Digital Interface (SDI) environments to widely adopted IP networks, bringing numerous benefits but also introducing complexities in monitoring media flows. Historically, SDI broadcast environments utilized physical patch panels, sometimes referred to as jackfields, allowing broadcast engineers direct and easy access to monitor any specific media flow for debugging and ad-hoc monitoring throughout the on-air chain. The abstraction of monitoring in IP networks, often relying on proxy-based visibility, has made this direct visibility more challenging.

The IP Jackfield™ solution aims to restore this simple, direct visibility model in IP media environments. IP Jackfield™ is an innovative monitoring solution consisting of Arista's DANZ Monitoring Fabric (DMF) integrated with Providius' Network Virtualization & Real Time Telemetry (NVRT) and Broadcast Media Guard (BMG). This solution fortifies media operations by converging IP analysis, and network telemetry.

Key Components:

Arista DMF (DANZ Monitoring Fabric):

DMF forms the packet broker network in the IP Jackfield™ solution. While the use of DMF is not mandatory for the Providius solution, it enables several powerful and unique features:

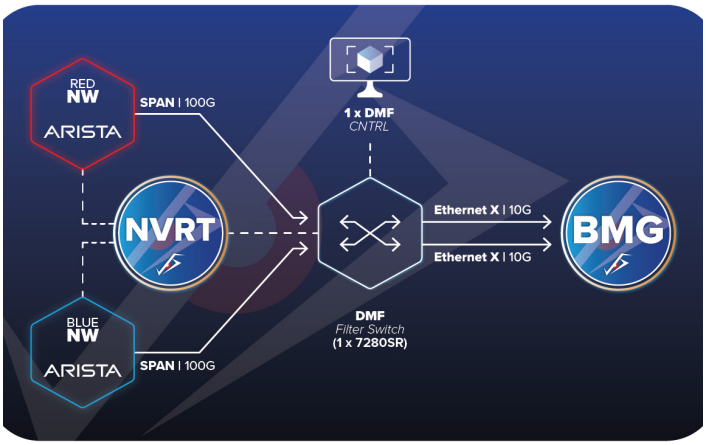
> Allows for the creation of a pool of monitoring devices, any of which can receive a signal from anywhere in the network.

> Allows monitoring packets via mirror session without impacting the production infrastructure.

> DMF switches do not need to participate in PIM or IGMP; they simply take received packets on ingress filter ports and send them to tool ports on the egress side of the packet broker network

> Mirror sessions with ACLs now support selecting specific IP multicast flows from multiple interfaces and forwarding only the desired flows to a single mirror egress port

Providius NVRT (Network Visualization & Real-time Telemetry):

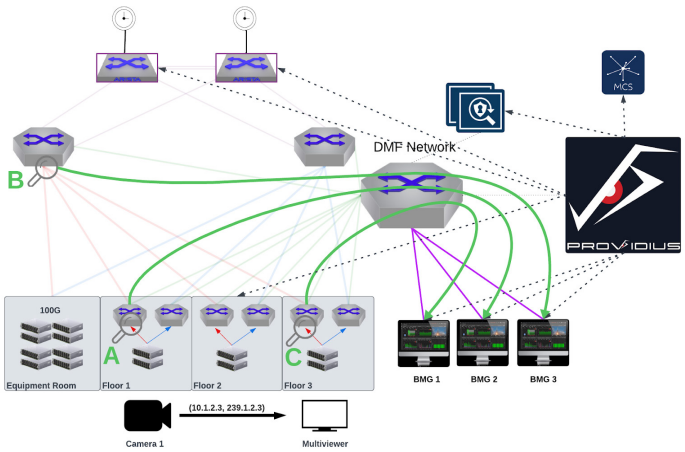


Providius' NVRT is used for real-time visibility and IP multicast path tracing of the entire media network. It orchestrates the monitoring points of interest through its integration with the Arista DMF Controller via a REST API. NVRT provides insight into network connectivity, PTP operations, and monitors performance metrics such as bandwidth, packet loss, and device health. It subscribes to data from each switch, harvesting MFIB and IGMP Snooping tables to build a map of where a particular (S,G) multicast flow is traversing. For communication with Arista switches, NVRT uses eAPI over gNMI to send commands such as creating SPAN ports and filtered ACLs. It can also directly subscribe to real-time telemetry like snooping paths and MFIB data via gNMI.

Providius BMG (Broadcast Media Guard):

Providius' BMG evaluates the timing, structure, and contents of an IP multicast flow. BMG ensures optimal video quality by monitoring for frame loss, frozen frames, packet jitter, and packet timing, in addition to performing format detection and standard compliance checks of the frame stream. BMG can decode many different flavours of video/audio. BMG devices can connect with 10G, 25G, or 100G interfaces.

How it Works (Simplified Flow):



1. Monitoring Point Selection: A Providius NVRT operator specifies the desired IP multicast flow (e.g., "Camera #1" or a multicast address like ("10.1.2.3 "," 239.1.2.3 ")) and the specific points ("A", "B "," C ") in the network where monitoring is needed.

2. SPAN Port Creation: NVRT integrates with the Arista DMF Controller via REST API and communicates with individual Arista switches in the production fabric using gNMI/eAPI. It creates SPAN ports on each Arista switch in the media network, directing traffic to the DMF packet broker network. The NVRT operator specifies the actual SPAN egress port on each Arista switch.

3. Flow Delivery to Tools: The DMF packet broker network receives the mirrored traffic and feeds the selected IP multicast flows of interest into the Providius BMG tools for analysis.

4. Real-time Analysis & Visualization: BMG evaluates the media flow for quality and compliance, while NVRT provides real-time network visualization, path tracing, and telemetry, displaying the harvested data.

Key Advantages and Benefits:

• **Comprehensive Flow Monitoring:** The IP Jackfield™ allows you to monitor flows at any point in the network (represented by "green connections" in diagrams).

• **Protocol Independence:** The traffic being monitored is not dependent on multicast protocols.

• **Independent Operation:** It operates independent of multicast distribution or Broadcast Controller.

• **Efficient Tool Utilization:** Enables efficient use of monitoring tools by creating a pool of available resources. Without this, signal analysis is prone to errors from unintended traffic inspection, demands costly additional probes, and complicates troubleshooting by depending on both network routing and broadcast control systems.

• **Rapid Monitoring Deployment:** With a single "submit" from an NVRT operator, SPAN ports are created and traffic is redirected to the Providius BMG for immediate analysis.

• **Scalability:** The scale of the IP Jackfield™ is limited only by the scale of the DMF fabric, from a single switch to the largest chassis and multi-switch DMF fabrics.

• **Non-intrusive Monitoring:** Provides monitoring without impacting the production via the creation of mirror sessions.

• **Broadcast-Centric Naming:** While it operates with multicast addresses (S,G), Providius NVRT can collect user-friendly flow names (mnemonics) like "Camera #1's video flow" from Broadcast Controllers or potentially from Arista MCS (if the media system already uses MCS), simplifying the monitoring process for operators. Alternatively, these names can be ingested via a CSV file.

• **Vendor Agnostic:** The IP Jackfield™ works effectively with any Arista media switch fabric and any broadcast controller vendor

Flexibility and Considerations:

• IP Jackfield™ supplements legacy network wide monitoring with an essence of traditional broadcast monitoring.

• Arista MCS is not a requirement for the IP Jackfield™ to function, but it offers an alternative for translating technical multicast addresses into user-friendly names.

• DMF Service Nodes are not required for flow filtering, as filtering can happen directly on the DMF filter switch. However, a DMF Service Node could be optional for end-to-end latency analysis, and a DMF Recorder Node could capture packets (Providius CRIO also provides packet capture capabilities).

Conclusion

The IP Jackfield™ solution, leveraging the powerful capabilities of Arista DMF and Providius NVRT/BMG, provides a robust, scalable, and efficient way to achieve deep, direct visibility into IP media networks. By restoring the intuitive monitoring experience of traditional jackfields in an IP environment, it empowers broadcast engineers to quickly identify and troubleshoot media flows, ensuring optimal performance and quality in modern media operations.

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