

White Paper

Efficient Multicast Communication in IP Networks: Exploring the Power of Protocol Independent Multicast (PIM)

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PIM (Protocol Independent Multicast) is a multicast routing protocol used to efficiently deliver multicast data in IP networks.

Advantages of the PIM protocol

Protocol Independence:

PIM is a protocol-independent multicast routing protocol that can work in conjunction with different unicast routing protocols such as OSPF, BGP, etc. This flexibility allows PIM to operate in various network environments.

Scalability:

PIM supports scalability and efficient delivery of multicast data in large networks. It uses a distributed routing selection algorithm that can dynamically adapt to network changes.

Efficiency:

PIM achieves optimal delivery of multicast data by forwarding it only to the interfaces that need it. It establishes a tree-like structure to build the best multicast path, thereby saving bandwidth and resources.

Adaptability:

PIM has adaptive features that allow it to adjust routing based on network status and topology changes. It can detect and avoid multicast loops while ensuring the correct delivery of data.

Cross-Network Support:

PIM supports multicast in different IP networks such as IPv4 and IPv6 and can run on various network devices such as routers and switches.

Commonly used PIM routing topologies

Sparse Mode (SM):

Sparse Mode is the default mode of PIM and is commonly used in scenarios where multicast traffic is sparse and receivers are located in different parts of the network. In SM, routers only forward multicast traffic when there is an explicit request from receivers. The topology typically consists of a Rendezvous Point (RP) that acts as a root for the multicast distribution tree. Routers maintain a shared tree from the RP to receivers, and if needed, they can create Shortest Path Trees (SPTs) from the RP to specific sources.

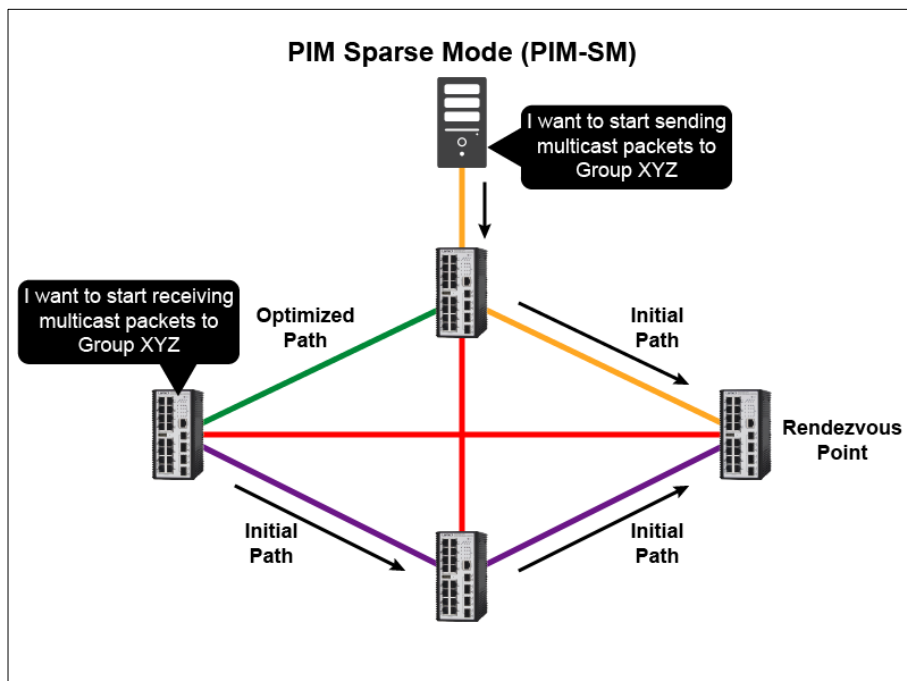


Figure 1 – PIM Sparse Mode (PIM-SM)

Dense Mode (DM):

Dense Mode is suitable for scenarios where multicast traffic is dense and receivers are located in close proximity. In DM, routers flood multicast traffic throughout the network, and prunes are used to stop forwarding at points where there are no interested receivers. DM uses Reverse Path Forwarding (RPF) checks to avoid loops and build the multicast distribution tree. It is efficient in small, dense networks but may not scale well in larger networks.

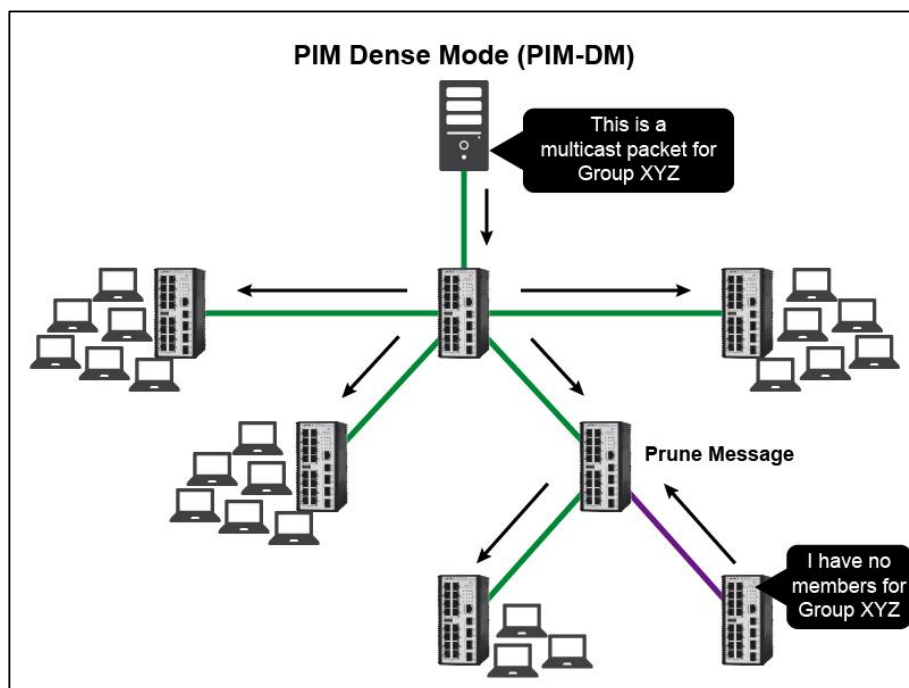


Figure 2 – PIM Dense Mode (PIM-DM)

Source Specific Multicast (SSM):

Source Specific Multicast (SSM) is a variation of PIM that provides a simpler and more secure multicast solution. In SSM, receivers explicitly specify the source IP address from which they want to receive multicast traffic. This eliminates the need for an RP and shared trees. The topology in SSM consists of a source sending multicast traffic directly to interested receivers, creating a source-specific tree.

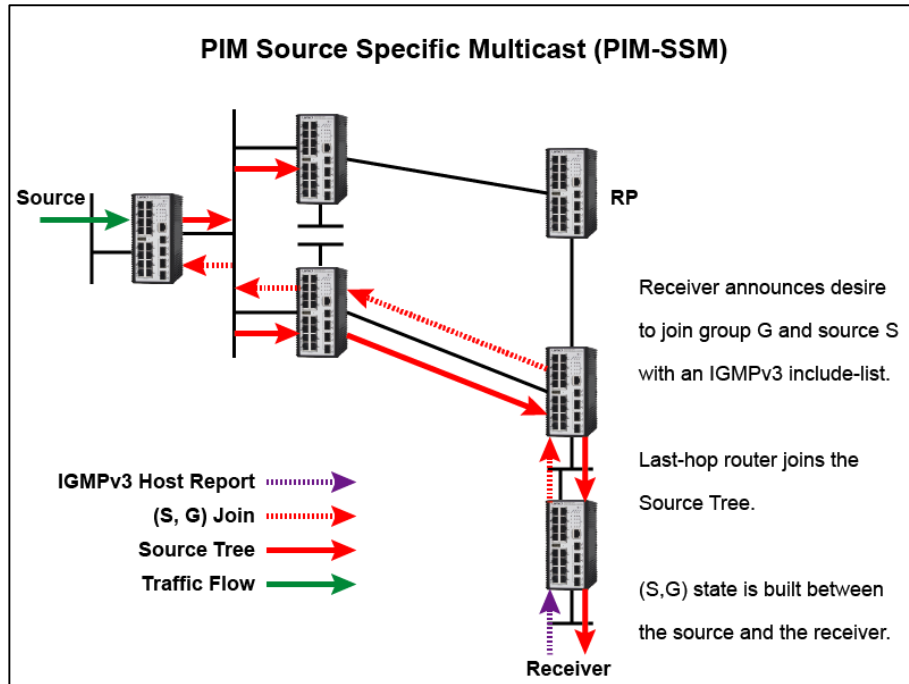


Figure 3 – PIM Source Specific Multicast (PIM-SSM)

Bootstrap Router (BSR):

Bootstrap Router (BSR) is an extension of PIM that provides a mechanism for automatic discovery and distribution of the Rendezvous Point (RP) information in a multicast network. The BSR protocol allows routers to dynamically learn about the active RPs in the network, eliminating the need for manual RP configuration. PIM-BSR is used in conjunction with PIM sparse mode (PIM-SM) and PIM dense mode (PIM-DM) to automate the discovery and distribution of RP information in the network.

These are just a few examples of PIM routing topologies. PIM offers flexibility and can be configured in various ways depending on network requirements and multicast traffic patterns. The choice of topology depends on factors such as the density of multicast traffic, receiver distribution, and desired control over multicast paths.

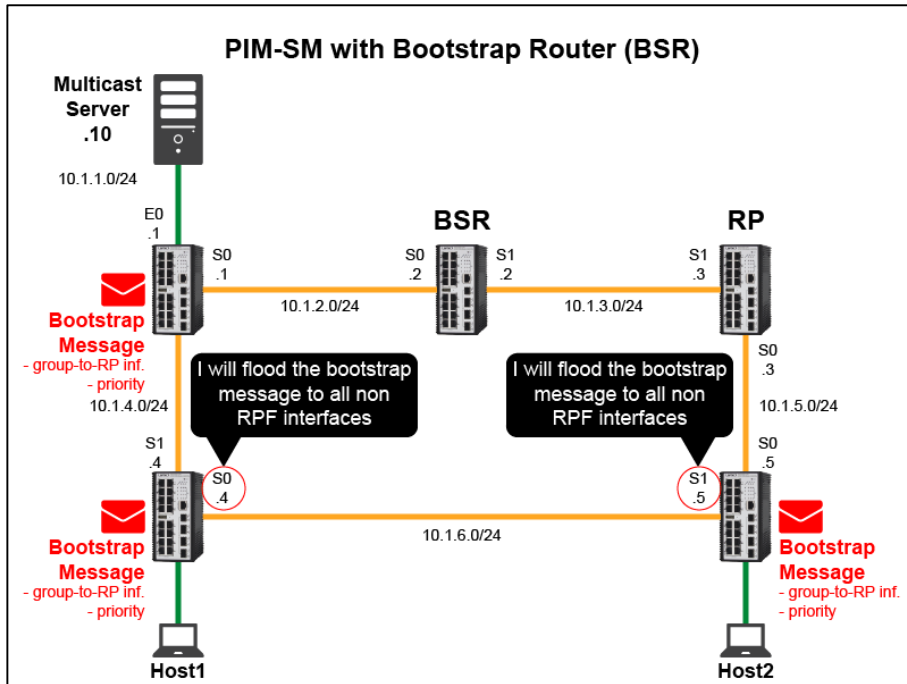


Figure 4 – PIM-SM with Bootstrap Router (BSR)

Summary

In summary, the PIM protocol offers numerous advantages that make it a vital component for implementing efficient multicast communication in IP networks. Its protocol independence allows seamless integration with various unicast routing protocols. PIM's scalability ensures effective delivery of multicast data in large networks while optimizing bandwidth usage. With its efficient forwarding mechanisms and adaptable routing algorithms, PIM achieves high efficiency in multicast data distribution. Furthermore, PIM's cross-network support enables multicast communication across different IP networks, making it versatile and widely applicable. Overall, PIM's combination of protocol independence, scalability, efficiency, adaptability, and cross-network support solidifies its significance in enabling effective multicast communication in IP networks.

Lantech's OS3 and OS4 Ethernet switches offer support for PIM (in L3 and L3Lite license), enabling efficient multicast communication in IP networks. With PIM capabilities, Lantech's switches provide the flexibility to distribute multicast traffic seamlessly, ensuring optimized bandwidth usage and effective delivery to interested receivers across the network.

Learn more about [Lantech's OS3 and OS4 Ethernet switches](#)

About Lantech

Lantech Communications Global, Inc. is an IRIS, IEC 62443-4-1 & ITxPT certified manufacturer of Ethernet products focused on the transportation markets, bus, train, trackside, ITS, smart city and many more applications. Our range of onboard EN50155 & E-Marked Ethernet switches & wireless/ LTE routers offer cutting edge design and functionality. We continue to work with our key customers in creating further enhancements & developments in on board passenger information, video security, trackside data communications by providing rugged 10GbE, PoE managed Ethernet switches, LTE/Wi-Fi routers in line with ITxPT and E-Marked certifications for various applications and critical solutions.