

White Paper

Ensuring Seamless Multicast Streaming with VRRP Aware PIM

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Introduction

In industrial networking environments, high availability and real-time communication are critical to maintaining operational efficiency and safety. Applications such as railway systems, factory automation, smart grids, and oil & gas facilities rely heavily on multicast communication to distribute real-time data, status updates, and control signals. Any disruption in multicast traffic during network failover can lead to significant operational issues — from production line downtime to safety risks and communication failures.

A common challenge arises when Virtual Router Redundancy Protocol (VRRP) is used to provide high availability in multicast networks. Protocol Independent Multicast (PIM), which handles multicast traffic distribution, does not rely on the routing table to determine forwarding paths. As a result, PIM cannot recognize the virtual IP (VIP) assigned by VRRP. When a VRRP failover occurs, the new Master router loses the existing PIM state and must re-establish the multicast tree by sending new PIM join requests. This process can take several seconds, resulting in dropped data, control signal delays, and even critical system failures.

To illustrate the impact, consider an intelligent transportation system (ITS) where real-time video streaming from traffic cameras is transmitted via multicast to a central control center. If the primary VRRP Master router fails, a backup router will take over. Without VRRP Aware PIM, the new Master will need to reinitiate PIM join requests, causing the video stream to drop for several seconds — a critical failure when real-time monitoring and response are essential.

With VRRP Aware PIM, the new Master router immediately inherits the multicast state and PIM join information during failover. This ensures that multicast traffic continues seamlessly without having to rebuild the PIM tree, maintaining real-time data flow and operational continuity.

This capability is particularly valuable in industrial settings where real-time visibility and control are critical. In railway applications, uninterrupted multicast transmission supports real-time passenger information and surveillance. In factory automation, synchronized robotic control relies on multicast updates to maintain production precision. Similarly, in smart grid infrastructure and oil & gas facilities, real-time multicast-based monitoring of equipment status and environmental conditions is essential for operational stability and safety.

What is VRRP Aware PIM?

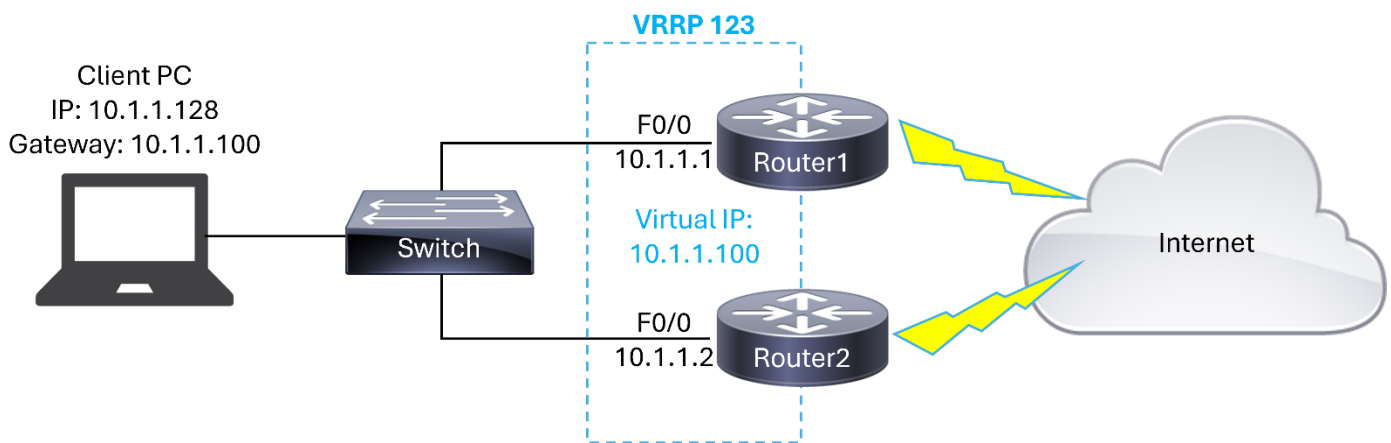
VRRP aware PIM is a feature that integrates Virtual Router Redundancy Protocol (VRRP) with Protocol Independent Multicast (PIM) to improve multicast routing in networks with redundant routers. Below is a detailed explanation of what it is and how it works.

Understanding the components of VRRP Aware PIM.

VRRP (Virtual Router Redundancy Protocol)

VRRP provides redundancy for routers by allowing multiple routers to share a single virtual IP address. One router acts as the master, handling network traffic, while the others are backups, ready to take over if the master fails. This ensures continuous network availability.

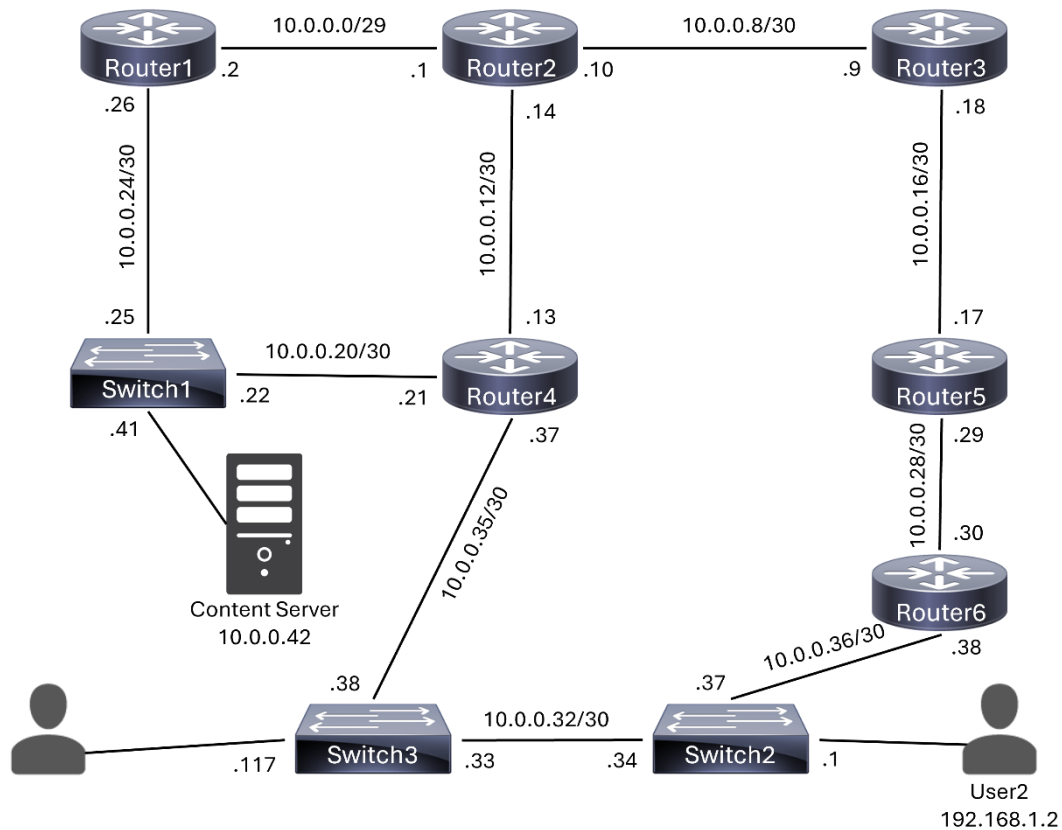
VRRP application:



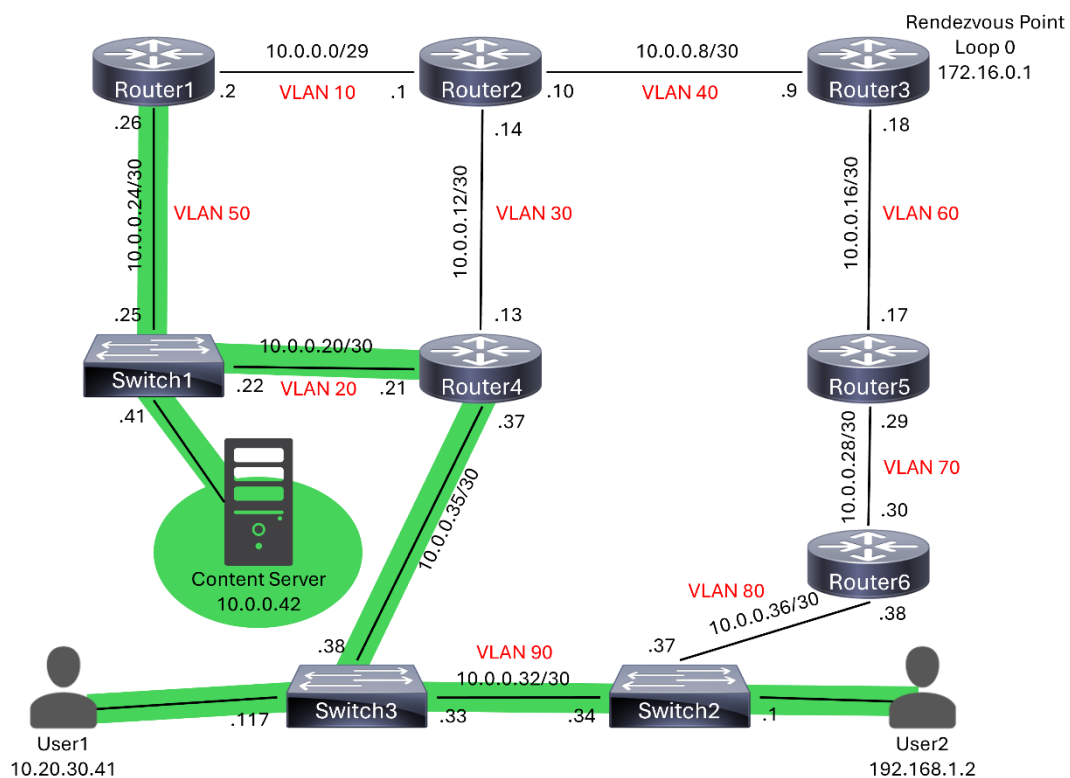
PIM (Protocol Independent Multicast)

PIM is a protocol used to route multicast traffic, which allows a sender to efficiently send data to multiple receivers. In a PIM-enabled network, a Designated Router (DR) is elected on each network segment to forward multicast traffic. The DR will forward the PIM join message from the receiver to the RP (rendezvous point).

PIM application with DR:



User 1 wants to send Multicast stream to user 2 by PIM routing protocol.



Multicast stream will be routed via Designated Router to user 2.

In a typical setup without VRRP aware PIM, the PIM DR and the VRRP master might not be the same router. This misalignment can cause inefficient routing or even loss of multicast traffic, especially during a failover when the master router changes.

What VRRP Aware PIM Does

VRRP aware PIM solves this problem by making PIM "aware" of the VRRP state, ensuring that multicast routing aligns with VRRP's redundancy mechanism. Here's how it works:

Synchronization of Roles

VRRP aware PIM ensures that the PIM DR is always the same router as the VRRP master. It achieves this by dynamically adjusting the PIM DR priority based on the VRRP state. When a router becomes the VRRP master, its PIM DR priority is increased, making it the preferred choice for the DR role.

Benefits

Consistency: Multicast traffic follows the same path as unicast traffic, aligning with the VRRP master router.

Reliability: Prevents issues like duplicate multicast packets or traffic loss (blackholing) during failovers.

Efficiency: Reduces disruptions and ensures rapid recovery of multicast services in redundant networks.

Why It Matters

VRRP aware PIM is particularly valuable in environments where multicast traffic (e.g., video streaming, financial data feeds) must be delivered reliably and without interruption. By integrating VRRP's redundancy with PIM's multicast routing, it provides a seamless and robust solution for network resilience.

In summary, VRRP aware PIM enhances multicast routing by ensuring that the PIM Designated Router aligns with the VRRP master router, leveraging VRRP's failover capabilities to maintain consistent and reliable multicast delivery.

Lantech OS3/OS4/OS5 models support VRRP aware PIM

The VRRP-aware PIM function requires the optional L3 Lite or L3 license.

Learn more about flagship OS5 switches:

<https://www.lantechcom.tw/global/eng/software-OS5.html>

Learn more about OS3/OS4 switches:

https://www.lantechcom.tw/global/eng/software-OS3_OS4.html

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