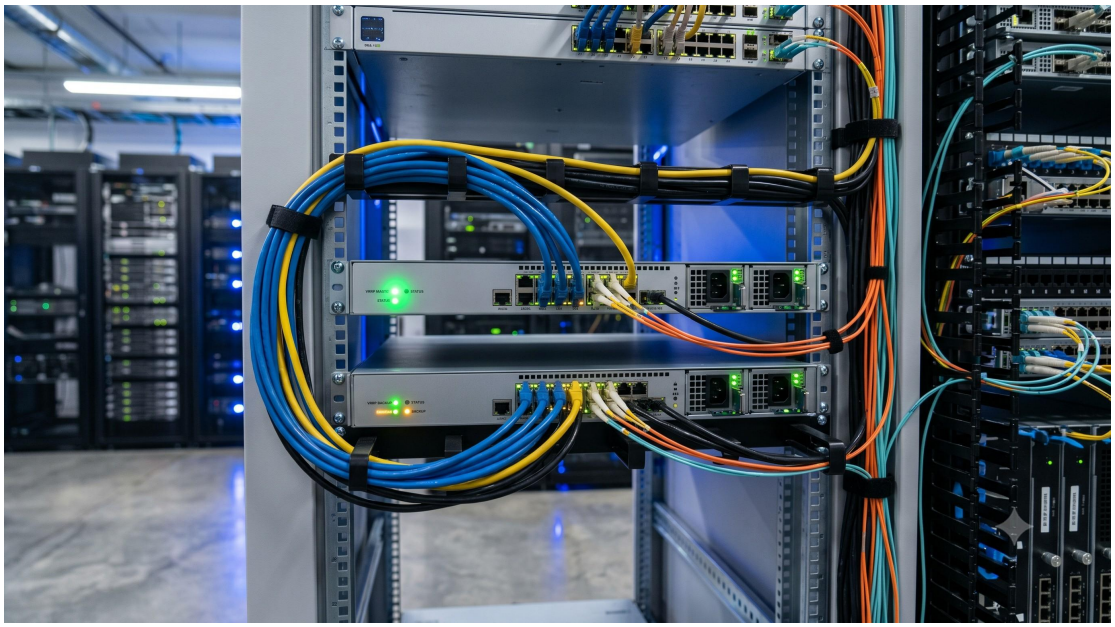
VRRP Virtual Router Redundancy Protocol - Official Technical Overview & Hardware Datasheet

PRODUCT OVERVIEW & VRRP IMPLEMENTATION SUMMARY

The Virtual Router Redundancy Protocol (VRRP) eliminates the single point of failure inherent in static default gateway configurations. By enabling a dynamic, election-based failover mechanism across two or more physical routers, VRRP provides transparent, high-availability Layer 3 gateway services for hosts without requiring host-side protocol modifications. This document details the hardware-assisted VRRP implementation across our carrier-grade routing platforms, including deterministic failover timing, session state preservation, and seamless traffic steering.



HARDWARE ARCHITECTURE & VRRP ACCELERATION SILICON

Our forwarding engines integrate VRRP state machine processing directly into the hardware abstraction layer, offloading advertisement generation, priority calculation, and preemption logic from the control plane CPU. Key silicon-level attributes include:

- Sub-50ms failover detection via dedicated dead-interval timers processed in hardware
- Session state mirroring across redundant routing engines (active/standby and active/active topologies)
- Hardware-based VRRP advertisement authentication (MD5, SHA-1, SHA-256)
- Per-VRID (Virtual Router Identifier) packet tracking and statistics collection without CPU intervention

KEY FEATURES & ROUTING LOGIC

- Deterministic Failover: VRRP master election based on priority values (1-254). Preemptive mode prevents instability via configurable minimum advertisement hold-down timers.
- Virtual MAC Management: Automatic assignment of 00-00-5E-00-01-{VRID} virtual MAC address. Option to use physical interface MAC for legacy environment compatibility.
- Multiple VRID Support: Up to 255 virtual router instances per physical

interface, enabling per-VLAN or per-subnet redundancy domains.

- Tracking & Interface Monitoring: Object tracking linkage to upstream interface health, next-hop reachability, or arbitrary IP SLA probes. Triggers automatic priority decrement upon tracked object failure.

- IPv4 and IPv6 Dual-Stack: Full compliance with RFC 5798 (VRRPv3) for IPv4/IPv6. IPv6 link-local addressing support with EUI-64 format integration.

- Authentication Methods: Simple text password, MD5 HMAC, IP Authentication Header (AH). Hardware-accelerated hash computation minimizes latency impact.

COMPLIANCE & STANDARDS

- RFC 3768: VRRPv2 (IPv4)

- RFC 5798: VRRPv3 (IPv4/IPv6)

- IEEE 802.1Q VLAN tag preservation across VRRP instances

- MEF 19: Ethernet Services OAM requirements for redundancy

- GR-1089-CORE: NEBS Level 3 compliance for carrier environments

- RoHS 3 (Directive 2015/863/EU) and REACH compliant

TECHNICAL SPECIFICATIONS

Parameter	**Specification**

Form Factor	1RU / 2RU / 4RU (carrier-grade chassis options)
Switching Capacity	Up to 2.56 Tbps (non-blocking fabric)
Power Supply	Dual hot-swappable redundant AC (100-240V) or DC (-48V) options
VRRP Failover Time	Hardware-accelerated sub-50ms (typical, 25ms with tuned timers)
Maximum VRIDs per Interface	255
VRRP Advertisement Interval	100ms to 255 seconds (configurable, 1ms granularity)
Session State Capacity	16,000 concurrent VRRP sessions (hardware-dependent)
Authentication Offload	MD5, SHA-1, SHA-256 (hardware-accelerated)
Operating Temperature	0 ° C to 50 ° C (32 ° F to 122 ° F) commercial / -40°C to 65°C industrial
MTBF	420,000 hours (Telcordia SR-332 Issue 4, GB)



ORDERING SKU INFORMATION

Base Platforms with VRRP Hardware Acceleration:

- VRRP-L3-1RU: 1RU appliance, 4x 10GE SFP+, 48x 1GE RJ45, dual PSU

- VRRP-L3-2RU: 2RU modular chassis, up to 6 line cards, redundant fabric

- VRRP-CG-4RU: Carrier-grade 4RU chassis, NEBS Level 3, DC power option

Software Feature License Tiers:

- VRRP-STD: Standard VRRPv2/v3, 16 VRIDs, priority tracking

- VRRP-ADV: Advanced object tracking, 64 VRIDs, IPv6 dual-stack

- VRRP-CARRIER: Full hardware acceleration, sub-50ms failover, telemetry export

Note: All VRRP functionality is included in the base operating system image.

Hardware acceleration requires VRRP-CARRIER license on select SKUs.

Lifecycle Assurance: Mean Time Between Failures (MTBF) exceeds 420,000 hours (calculated per Telcordia SR-332, Issue 4). Standard 5-year hardware warranty with 24/7 advance replacement SLA.