



## **Release Notes for Cisco IOS XRv 9000 Router, Release 6.0.2**

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## Cisco IOS XRv 9000 Router Overview

The Cisco IOS XRv 9000 Router is based on Cisco IOS XR software, so it inherits and shares the wide breadth of routing functionality available on other IOS XR platforms. The IOS XR features available on the Cisco IOS XRv 9000 Router are discussed in *Supported Cisco IOS XR Technologies* section.

When the Cisco IOS XRv 9000 Router virtual IOS XR software is deployed as a VM, the Cisco IOS XR software functions just as if it were deployed on a traditional Cisco IOS XR hardware platform. The Cisco IOS XRv 9000 Router combines Route Processor, Line Card, and virtualized forwarding capabilities into a single, centralized forwarding instance. The Cisco IOS XRv 9000 Router has a fully featured, high speed virtual x86 data plane.

Cisco IOS XRv 9000 Router supports the same look and feel as Cisco ASR 9000 Series Aggregation Services Routers and North-bound APIs. Cisco IOS XRv 9000 Router does not support hardware specific configurations. The configuration commands for control plane and data plane features follow the same syntax as the Cisco ASR 9000 Series Aggregation Services Routers. See [Cisco ASR 9000 Series Aggregation Services Routers command references](#) for more information on configuration commands.

## Cisco IOS XRv 9000 Router Licensing Model

The Cisco IOS XRv 9000 Router supports activation using Cisco Smart Licensing. By default the Cisco IOS XRv 9000 Router (without license) is rate limited to 200 Kbps.

For more information on licensing model supported on Cisco IOS XRv 9000 Router, see the *Cisco IOS XRv 9000 Router Smart Licensing* chapter in the [Cisco IOS XRv 9000 Router Installation and Configuration Guide](#).

See [Cisco Smart Software Licensing Overview](#) for more information on Cisco Smart Licensing.

## License Ordering Information

The Cisco IOS XRv 9000 Router offers a flexible licensing scheme, with multiple tiers to choose from, such as Scale, and Throughput. This table lists details of Cisco IOS XRv 9000 Router's pool of software licenses or entitlements, arranged according to licensing PIDs.



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**Note** The XRv9000 router only consumes and reports VPE licenses. VRR licenses are not consumed or reported.

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**Table 1: Cisco IOS XRv 9000 Router UCS M5 Based vRR Appliance PIDS**

License PID	Description
R-XRV9000-66-RR	Cisco IOS XRv 9000 software, VRR profile
S-XRV-ROUTE-T4	Preloaded Software Image: IOS XRv 9000 vRR scale upgrade license from 20M up to 70M
XRV9000-APLN-ROUT	IOS XRv 9000 M5 Appliance with preloaded IOS XR functionality with 20 million route scale

## Supported MIBs

The following MIBs are supported in this release:

- ENTITY-MIB
- ENTITY-STATE-MIB
- CISCO-ENTITY-ASSET-MIB
- BGP4-MIB
- CISCO-AAA-SERVER-MIB
- CISCO-ACL-MIB
- CISCO-BGP4-MIB
- CISCO-BULK-FILE-MIB
- CISCO-CDP-MIB
- CISCO-CLASS-BASED-QOS-MIB
- CISCO-CONFIG-COPY-MIB
- CISCO-CONFIG-MAN-MIB
- CISCO-CONTEXT-MAPPING-MIB
- CISCO-FTP-CLIENT-MIB
- CISCO-IF-EXTENSION-MIB
- CISCO-PING-MIB
- CISCO-PROCESS-MIB
- CISCO-SYSLOG-MIB
- CISCO-SYSTEM-MIB
- CISCO-TCP-MIB
- CISCO-VLAN-IFTABLE-RELATIONSHIP-MIB
- ETHERLIKE-MIB
- EVENT-MIB
- EXPRESSION-MIB
- IETF-TCP-MIB
- IETF-UDP-MIB
- IF-MIB
- IP-FORWARD-MIB
- IP-MIB

- IPV6-MIB
- IPV6-FORWARD-MIB
- ISIS-MIB
- MPLS-L3VPN-STD-MIB
- MPLS-LDP-GENERIC-STD-MIB
- MPLS-LDP-STD-MIB
- MPLS-LSR-STD-MI
- NOTIFICATION-LOG-MIB
- OSPF-MIB
- OSPF-TRAP-MIB
- OSPFV3-MIB
- RFC1213-MIB
- RFC2011-MIB
- RFC2465-MIB
- SNMP-COMMUNITY-MIB
- SNMP-FRAMEWORK-MIB
- SNMP-NOTIFICATION-MIB
- SNMP-TARGET-MIB
- SNMP-USB-MIB
- SNMPv2-MIB
- SNMP-VACM-MIB
- TCP-MIB
- UDP-MIB
- CISCO-IETF-BFD-MIB
- CISCO-IP-TAP-MIB
- CISCO-TAP2-MIB
- RADIUS-ACC-CLIENT-MIB
- RADIUS-AUTH-CLIENT-MIB
- SNMP-TARGET-MIB

# New Features Supported in Release 6.0.2

There are no new features supported in this release.

## System Requirements

### Hypervisors

A hypervisor enables multiple operating systems to share a single hardware host machine. While each operating system appears to have the dedicated use of the host's processor, memory, and other resources; the hypervisor controls and allocates only needed resources to each operating system and ensures that the operating systems (VMs) do not disrupt each other.

Installation of the Cisco IOS XRv 9000 Router is supported on selected Type 1 (native, bare metal) hypervisors. Installation is not supported on Type 2 (hosted) hypervisors, such as VMware Fusion, VMware Player, or Virtual Box. The following table lists release specific supported hypervisor versions.

**Table 2: Support Matrix for Hypervisor Versions**

Cisco IOS XR Version	VMWare ESXi	Kernel Based Virtual Machine (KVM)
	version 6.5, 6.7, and later	Linux KVM based on <ul style="list-style-type: none"><li>• Red Hat Enterprise Linux 7, 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7, and 8.0</li><li>• Ubuntu 14.04.03 LTS</li><li>• CentOS 7, 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, and 7.7</li><li>• Openstack 10</li></ul>

### Virtual Machines

Cisco IOS XRv 9000 Router virtual machines must meet the following requirements:

**Table 3: VM Requirement for VMware Environment**

Parameters	Supported
VMware ESXi	Version 6.5, 6.7, 7.0 and later
Virtual CPU cores	1 socket with a minimum of 2 cores <b>Note</b> For production environment minimum of 4 cores is recommended.
Virtual Machine memory size	
Virtual Machine hard disk size	

Parameters	Supported
Virtual Interfaces	E1000 VMXNET3 for traffic interfaces only
Physical NICs	<p>For pass-through:</p> <ul style="list-style-type: none"> <li>• Intel i350 Quad Port 1Gb Adapter</li> <li>• Intel Dual Port 10 GbE Ethernet X520 Server Adapter</li> <li>• Intel 4 port 10GE Fortville</li> </ul> <p><b>Note</b> PCI passthrough only. SRIOV is not supported.</p> <p><b>Note</b> • Intel Forville has a lower forwarding capability (for high throughput applications in vPE profiles) when compared with Intel 82599 10GE Controller.</p> <p>Cisco UCS Virtual Interface Card (VIC) 1225</p> <p><b>Note</b> If you are configuring LLDP on Cisco IOS XRv 9000, then you must first disable LLDP in the Cisco UCS VIC 1225 via Cisco Integrated Management Controller (CIMC).</p>
Number of interfaces	<p>Minimum of 4 NICs where:</p> <ul style="list-style-type: none"> <li>• 1 for management</li> <li>• 2 are reserved</li> <li>• 1 for traffic</li> </ul> <p>Maximum of 11 NICs where:</p> <ul style="list-style-type: none"> <li>• 1 for management</li> <li>• 2 are reserved</li> <li>• 8 for traffic</li> </ul>
Default video, SCSI controller set	<p>Required</p> <p>SCSI controller not required for IDE disk.</p>
Virtual CD/DVD drive installed	Virtual CD/DVD is required when installing the Cisco IOS XRv 9000 Router on the VM using ISO template.
IDE hard disk	<p>Single IDE hard disk</p> <p><b>Note</b> Multiple hard disk drives on a VM are not supported.</p>



**Note** The maximum traffic performance with pass-through NIC interfaces in ESXi is lower than the performance that can be achieved in KVM environments. This is because it is not possible to configure 1G huge-pages in the ESXi hypervisor (as of VMware ESXi 6.0).

**Table 4: VM Requirement for KVM Environment**

Parameters	Supported
KVM versions	<ul style="list-style-type: none"><li>• Linux KVM based on Red Hat Enterprise Linux 7, 7.1, 7.2, 7.3 and 7.4</li><li>• Ubuntu 14.04.03 LTS Server 64 Bits</li><li>• Openstack Release 5 (Icehouse), Openstack Juno/Icehouse (RHEL 7), Kilo (RHEL 7.1), Liberty (RHEL 7.2), Openstack 10 (Newton)</li><li>• CentOS 7, 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, and 7.7</li></ul>
Virtual CPU cores	1 socket with minimum of 2 cores.
Virtual Machine memory size	
Virtual Machine hard disk size	
Virtual Interfaces	E1000, VirtIO and VMXNET3 for traffic interfaces only
Physical NICs	<p>For pass-through:</p> <ul style="list-style-type: none"><li>• Intel i350 Quad Port 1Gb Adapter</li><li>• Intel Dual Port 10 GbE Ethernet X520 Server Adapter</li><li>• Intel 4 port 10GE Fortville</li></ul> <p><b>Note</b> PCI passthrough only. SRIOV is not support.</p> <p><b>Note</b> • Intel Forville has a lower forwarding capability (for high throughput applications in vPE profiles) when compared with Intel 82599 10GE Controller.</p> <p>Cisco UCS Virtual Interface Card (VIC) 1225</p> <p><b>Note</b> If you are configuring LLDP on Cisco IOS XRv 9000, then you must first disable LLDP in the Cisco UCS VIC 1225 via Cisco Integrated Management Controller (CIMC).</p>

Parameters	Supported
Number of interfaces	Minimum of 4 NICs where: <ul style="list-style-type: none"> <li>• 1 is for management</li> <li>• 2 are reserved</li> <li>• 1 is for traffic</li> </ul> Maximum of 11 NICs where: <ul style="list-style-type: none"> <li>• 1 is for management</li> <li>• 2 are reserved</li> <li>• 8 is for traffic</li> </ul>
Virtual CD/DVD drive installed	Virtual CD/DVD drive is required for ISO installation




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**Note** In the Cisco IOS XRv 9000 Router, some CPU cores are dedicated to the control plane while others are dedicated to the data plane. Each data plane's core runs a single thread that performs packet forwarding. To achieve maximum performance, these threads constantly look for data packets to process. As a result, the OS records that these cores run at 100% utilization. This is expected behavior and not an indication that packet forwarding has reached its threshold limit.

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## Server

The server must support:

- Intel Westmere or later CPU versions with clock frequency of 2.0GHz for instances with Gigabit or paravirtualized interfaces
- Intel Ivy Bridge or later CPU versions for instances with 10Gb or higher interfaces
- Intel CPU must support the **sse4\_2** capability flag. This can be checked in KVM by looking for the **sse4\_2** flag in the flags section of `/proc/cpuinfo`. For example:

```
cat /proc/cpuinfo | grep sse4_2
flags       : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36 clflush mmx fxsr
sse sse2 ss syscall nx pdpe1gb rdtscp lm constant_tsc arch_perfmon nopl xtopology tsc_reliable nonstop_tsc
aperfmpperf pni pclmulqdq vmx ssse3 fma cx16 pcid sse4_1 sse4_2 x2apic movbe popcnt aes xsave avx f16c
rdrand hypervisor lahf_lm ida arat epb pln pts dtherm tpr_shadow vnmi ept vpid fsgsbase smep
```




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**Note** To use passthrough interfaces in KVM, you must set the option **intel\_iommu=on** command in the grub configuration.

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## Supported Cisco IOS XR Technologies

Cisco IOS XRv 9000 Router supports selected Cisco IOS XR technologies.

This table lists the major Cisco IOS XR technologies Cisco IOS XRv 9000 supports. Not all features in a given technology may be supported. To verify support for specific features, use [Cisco Feature Navigator](#).



**Table 5: Cisco IOS XR Technologies Supported on the Cisco IOS XRv 9000 Router**

<b>Feature</b>	<b>See the Following Documentation</b>	<b>Introduced in Release</b>
<ul style="list-style-type: none"> <li>• 6PE, 6VPE</li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">Cisco ASR 9000 Series Aggregation Services Router MPLS Layer 3 VPN Configuration Guide</a></li> <li>• <a href="#">Cisco ASR 9000 Series Aggregation Services Router VPN and Ethernet Services Command Reference</a></li> </ul>	Release 5.4.0
<ul style="list-style-type: none"> <li>• Bi-directional Policing and Marking</li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">Cisco ASR 9000 Series Aggregation Services Router Modular Quality of Service Configuration Guide</a></li> <li>• <a href="#">Cisco ASR 9000 Series Aggregation Services Router Modular Quality of Service Command Reference</a></li> </ul>	Release 5.4.0
<ul style="list-style-type: none"> <li>• Bi-directional Forwarding Detection</li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">Cisco ASR 9000 Series Aggregation Services Router Routing Configuration Guide</a></li> <li>• <a href="#">Cisco ASR 9000 Series Aggregation Services Router Routing Command Reference</a></li> </ul>	Release 5.4.0
Customize Installation using Golden ISO	<a href="#">Customize Installation using Golden ISO</a>	Release 7.3.1
Cisco IOS XRv 9000 Router Deployment on AWS	<ul style="list-style-type: none"> <li>• <a href="#">Cisco IOS XRv 9000 Router Installation and Configuration Guide</a></li> </ul>	Release 6.3.1
Create User Profiles and Assign Privileges	<a href="#">System Setup and Software Installation Guide for Cisco ASR 9000 Series Routers</a>	Release 7.1.1
<ul style="list-style-type: none"> <li>• Early Fast Discard</li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">Early Fast discard</a></li> </ul>	Release 5.4.0
<ul style="list-style-type: none"> <li>• IPv4 Routing</li> <li>• IPv6 Routing</li> <li>• OSPF</li> <li>• ISIS</li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">Cisco ASR 9000 Series Aggregation Services Router Routing Configuration Guide</a></li> <li>• <a href="#">Cisco ASR 9000 Series Aggregation Services Router Routing Command Reference</a></li> </ul>	Release 5.4.0
<ul style="list-style-type: none"> <li>• IPv4 and IPv6 ACL</li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">Cisco ASR 9000 Series Aggregation Services Router IP Addresses and Services Configuration Guide</a></li> <li>• <a href="#">Access List Commands</a></li> </ul>	Release 5.4.0

Feature	See the Following Documentation	Introduced in Release
<ul style="list-style-type: none"> <li>• IPv4 L3VPN</li> <li>• 6PE, 6VPE</li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">Cisco ASR 9000 Series Aggregation Services Router MPLS Layer 3 VPN Configuration Guide</a></li> <li>• <a href="#">Cisco ASR 9000 Series Aggregation Services Router VPN and Ethernet Services Command Reference</a></li> </ul>	Release 5.4.0
<ul style="list-style-type: none"> <li>• Lawful Intercept</li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">Implementing Lawful Intercept</a></li> <li>• <a href="#">Cisco ASR 9000 Series Aggregation Services Router System Security Command Reference</a></li> </ul>	Release 5.4.0
<ul style="list-style-type: none"> <li>• LDP</li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">Cisco ASR 9000 Series Aggregation Services Router MPLS Configuration Guide</a></li> <li>• <a href="#">Cisco ASR 9000 Series Aggregation Services Router MPLS Command Reference</a></li> </ul>	Release 5.4.0
<ul style="list-style-type: none"> <li>• LPTS</li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">Cisco ASR 9000 Series Aggregation Services Router IP Addresses and Services Configuration Guide</a></li> <li>• <a href="#">LPTS Commands</a></li> </ul>	Release 5.4.0
<ul style="list-style-type: none"> <li>• MPLS</li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">Cisco ASR 9000 Series Aggregation Services Router MPLS Configuration Guide</a></li> <li>• <a href="#">Cisco ASR 9000 Series Aggregation Services Router MPLS Command Reference</a></li> </ul>	Release 5.4.0
<ul style="list-style-type: none"> <li>• MP-BGP, EBGp PE-CE</li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">Cisco ASR 9000 Series Aggregation Services Router Routing Configuration Guide</a></li> <li>• <a href="#">Cisco ASR 9000 Series Aggregation Services Router Routing Command Reference</a></li> </ul>	Release 5.4.0
<ul style="list-style-type: none"> <li>• Netconf Yang support</li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">System Management Configuration Guide for Cisco ASR 9000 Series Routers</a></li> <li>• <a href="#">Network Time Protocol (NTP) Commands</a></li> </ul>	Release 5.4.0
<ul style="list-style-type: none"> <li>• Smart Licensing</li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">Cisco ASR 9000 Series Aggregation Services Router System Management Configuration Guide</a></li> <li>• <a href="#">Cisco ASR 9000 Series Aggregation Services Router System Management Command Reference</a></li> </ul>	Release 5.4.0

Feature	See the Following Documentation	Introduced in Release
<ul style="list-style-type: none"> <li>• SNMP support</li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">Cisco ASR 9000 Series Aggregation Services Router System Management Configuration Guide</a></li> <li>• <a href="#">Cisco ASR 9000 Series Aggregation Services Router System Management Command Reference</a></li> </ul>	Release 5.4.0
<ul style="list-style-type: none"> <li>• Strict Unicast IPv4 and IPv6 Reverse Path Forwarding (uRPF)</li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">Cisco ASR 9000 Series Aggregation Services Router IP Addresses and Services Configuration Guide</a></li> <li>• <a href="#">IP Addresses and Services Command Reference for Cisco ASR 9000 Series Routers</a></li> </ul>	Release 5.4.0
<ul style="list-style-type: none"> <li>• The Two-Way Active Measurement Protocol (TWAMP)</li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">System Monitoring Configuration Guide for Cisco ASR 9000 Series Routers</a></li> <li>• <a href="#">Cisco ASR 9000 Series Aggregation Services Router System Monitoring Command Reference</a></li> </ul>	Release 6.0.1
gNMI Bundling of Telemetry Updates	<a href="#">Cisco IOS XRv 9000 Router Installation and Configuration Guide</a>	Release 7.8.1
ORR Support for FlexAlgo	<a href="#">Cisco IOS XRv 9000 Router Installation and Configuration Guide</a>	Release 7.5.1
Generic Route Encapsulation using IPv6	<a href="#">MPLS Layer 3 VPN Configuration Guide</a>	Release 7.3.3
<ul style="list-style-type: none"> <li>• Running High Availability (HA) redundancy application for AWS</li> <li>• QoS on IPv4 Release GRE Tunnels</li> <li>• Increase in BFD scale limit and BFD sessions</li> </ul>	<a href="#">Cisco IOS XRv 9000 Router Installation and Configuration Guide</a>	Release 7.3.3

Feature	See the Following Documentation	Introduced in Release
<ul style="list-style-type: none"> <li>• Enhanced Networking Features with Elastic Network Adapter (ENA) on Amazon EC2 M5 Instances</li> <li>• Updated DPDK Driver Version</li> <li>• Enhanced router performance and scales</li> <li>• ACL Based Forwarding (ABF)</li> <li>• Redirect IPV4 and IPV6 traffic using PBR</li> <li>• Support for IPv6 over SR-MPLS through a GRE Tunnel towards an IPv6 Next Hop device</li> <li>• BFD on GRE Tunnel Interface</li> </ul>	<a href="#">Release Notes for Cisco IOS XRv 9000 Routers, IOS XR Release 7.3.3</a>	Release 7.3.3
<ul style="list-style-type: none"> <li>• SR-PCE: Single PCE scale enhancement</li> <li>• SR-PCE: Stateful North-Bound API for Tree-SID</li> </ul>	<a href="#">Release Notes for Cisco IOS XRv 9000 Routers, IOS XR Release 7.5.1</a>	Release 7.5.1

## Caveats

Caveats describe unexpected behavior in Cisco IOS XR Software release.

## Related Documentation

### Production Software Maintenance Updates (SMUs)

A production SMU is a SMU that is formally requested, developed, tested, and released. Production SMUs are intended for use in a live network environment and are formally supported by the Cisco TAC and the relevant development teams. Software bugs identified through software recommendations or Bug Search Tools are not a basis for production SMU requests.

For information on production SMU types, refer the [Production SMU Types](#) section of the [IOS XR Software Maintenance Updates \(SMUs\)](#) guide.

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### **Cisco Bug Search Tool**

[Cisco Bug Search Tool](#) (BST) is a web-based tool that acts as a gateway to the Cisco bug tracking system that maintains a comprehensive list of defects and vulnerabilities in Cisco products and software. BST provides you with detailed defect information about your products and software.

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