Cisco IOS XE Software for Cisco ASR 900 Series

The Cisco® ASR 900 Series is a series of full-featured aggregation platforms that run Cisco IOS® XE Software. Cisco IOS XE Software is a result of the continuing evolution of Cisco IOS Software, and provides a modular structure that delivers full Cisco IOS feature functionality. Cisco IOS XE Software helps to prepare your network for future developments and changes. The software's modular structure significantly enhances quality and performance by separating the data plane and control plane. Cisco IOS XE Software on the Cisco ASR 903 (Figure 1) Router continues to evolve and to offer new benefits to help customers manage their networks.

Figure 1. Cisco ASR 903 Router

Software Releases and Options

The Cisco ASR 900 Series is supported in Cisco IOS XE S Software, which is designed to provide modular packaging, feature velocity, and powerful resiliency. The Cisco ASR 903 Router is supported as of Cisco IOS XE Software Release 3.5.0S.

Consolidated Software Packages

Two consolidated software packages contain a superset of all features. The individual feature sets can be enabled once the correct feature licenses are applied to the router. Table 1 describes the two Cisco IOS XE universal consolidated packages supported on the Cisco ASR 903 Router, and the functionality supported in each of these universal images. The functionality is enforced through the appropriate technology package licenses.

Table 1. Universal Cisco IOS XE Software Consolidated Packages for Cisco ASR 903 Router

Cisco IOS XE Consolidated Package	Part Number	Description
Cisco ASR 903 Series RSP1 IOS XE Universal	SASR903R1U	• Provides a consolidated package • Offers only basic feature support without a license • Satisfies export requirements for non-cryptographic software
Cisco ASR 903 Series RSP1 IOS XE - No Payload Encryption	SASR903R1NPEK9	• Provides a consolidated package • Offers only basic feature support without a license, including SSH and SNMPv3 support

Flexible Software Activation

The Cisco ASR 900 Series support the Cisco IOS software activation feature. With this capability, Cisco IOS Software feature sets can be activated with software licenses, supporting a “pay as services grow” model. This model allows service providers to invest in software resources only when their businesses need it. All Cisco ASR 900 Series software licenses are on a per-chassis basis. The Cisco ASR 903 Router offers three Cisco IOS Software licenses:

- **Metro Services license:** Offers advanced quality of service (QoS), Carrier Ethernet Layer 2 features, Synchronous Ethernet (SyncE) and Ethernet operations, administration, and maintenance (OAM) capabilities.
- **Metro IP Services license:** Offers all capabilities of the Metro Services license with the addition of IEEE 1588-2008 Ordinary Clock and Transparent Clock, Bidirectional Forwarding Detection (BFD), Layer 3 features for advanced IP routing protocols, multi-VPN routing, and Layer 3 Multicast and Forwarding Customer Edge (multi-VRF CE) capabilities.
- **Metro Aggregation Services license:** Adds the following capabilities to the Metro IP Services license: Muliprotocol Label Switching Transport Profile (MPLS-TP); MPLS, Ethernet over MPLS (EoMPLS), Circuit Emulation Service over Packet Switched Network (CESoPSN), and Structure Agnostic TDM over Packet (SAToP) pseudowires; Multi-Router Automatic Protection Switching (MR-APS); Multi-chassis Link Aggregation and Control Protocol (mLACP); MPLS traffic engineering (TE); MPLS Fast Reroute (FRR); and MPLS VPN support.

Table 2 lists the main features in the Cisco IOS licenses for the Cisco ASR 903 Router. Availability of features is dependent on software release and implementation schedule.

Table 2. Feature Sets in Cisco ASR 903 Router Licenses

Metro Services	Metro IP Services	Metro Aggregation Services
	All features in Metro Services plus	**All features in Metro IP Services Plus**
QoS, with deep buffers and hierarchical QoS (HQOS)	IP routing (RIP, OSPF, EIGRP, BGP, IS-IS)	MPLS (LDP and VPN)
Layer 2: 802.1d, 802.1q	PIM (SM, DM, SSM), SSM mapping	MPLS TE and FRR
Ethernet Virtual Circuit (EVC)	BFD	MPLS OAM
Ethernet OAM (802.1ag, 802.3ah)	Multi-VRF CE (VRF lite) with service awareness (ARP, ping, SNMP, syslog, trace-route, FTP, TFTP)	MPLS-TP
Multiple Spanning Tree (MST) and Resilient Ethernet Protocol (REP)	IEEE 1588-2008 Ordinary Clock and Transparent Clock	Pseudowire emulation (EoMPLS, CESoPSN, and SAToP)
Synchronous Ethernet		VPLS and HVPLS
IPv4 and IPv6 host connectivity		Pseudowire redundancy
		MR-APS and mLACP

Additional Feature Licenses

In addition to the preceding Cisco IOS feature-set licenses, two additional licenses are used to enable new software functionality for the Cisco ASR 903 Router in addition to the feature-set capabilities.

- **ATM license:** Allows service providers to enable ATM functionality on TDM interfaces when required. One license is required for each Cisco ASR 903 Router that needs ATM functionality to be enabled in the system. This includes support for ATM pseudowires over MPLS (ATMoMPLS), ATM local switching, ATM interworking, and local ATM termination. This license requires the system to have at least one T1/E1, OC-3/STM-1, or OC-12/STM-4 card installed.
- **IEEE 1588-2008 BC/MC license:** Allows service providers to enable IEEE 1588-2008 Boundary Clock (BC) or Master Clock (MC), or both, when required. One license is required for each chassis that needs IEEE 1588-2008 BC or MC functionality to be enabled in the system.

Cisco IOS XE Software Release Schedule

The Cisco IOS XE software delivery schedule allows customers to qualify releases more quickly and have a definitive release schedule for new software images. This schedule is summarized in the following highlights.

- **Time-based releases**: Releases are planned for delivery three times a year (every four months). New software features and hardware are introduced in each release. Releases have fewer incremental features included when compared with traditional Cisco IOS Software releases, reducing customer qualification time.
- **Two release support durations**: Each Cisco IOS XE Software release is classified as either a Standard Support or Extended Support release. A Standard Support release has a total engineering support lifetime of one year, with two scheduled rebuilds. The Extended Support release provides a total engineering support lifetime of two years, with four scheduled rebuilds. For more information about the Cisco IOS XE Software end-of-life policy and associated support milestones for specific Cisco IOS XE Software releases, visit http://www.cisco.com.
- **Rebuilds scheduled at regular intervals**: Rebuilds are created only for bug fixes, and no new features are included in a rebuild image. For Standard Support releases, the first rebuild image is released two months after the parent image's first customer shipment (FCS). The second rebuild image is released four months after the parent image's FCS. The Extended Support release provides four scheduled rebuilds. The first two of these rebuilds are released at two-month intervals after FCS of the affected Cisco IOS XE Software release, and the second two rebuilds are released at four-month intervals thereafter. Releases to correct critical problems (such as those identified by the Cisco Product Security Incident Response Team) are introduced as needed.

Part Numbers for License Options and Activation Keys

Table 3 lists part numbers for the Cisco ASR 903 Router software feature options.

Table 3. Cisco ASR 903 Router Software Options

Part Number	Product Name
Feature Set License Options	
SLASR903-M	ASR 903 Metro Services
SLASR903-I	ASR 903 Metro IP Services
SLASR903-A	ASR 903 Metro Aggregation Services

Part Number	Product Name
Feature Set Product Activation Keys	
SLASR903-M=	ASR 903 Metro Services Paper PAK
L-SLASR903-M=	ASR 903 Metro Services E-Delivery PAK
SLASR903-I=	ASR 903 Metro IP Services Paper PAK
L-SLASR903-I=	ASR 903 Metro IP Services E-Delivery PAK
SLASR903-A=	ASR 903 Metro Aggregation Services Paper PAK
L-SLASR903-A=	ASR 903 Metro Aggregation Services E-Delivery PAK
Feature Set Upgrade Product Activation Keys	
SLASR903-M-I=	ASR 903 Metro to Metro IP Paper PAK
SLASR903-M-A=	ASR 903 Metro to Metro Aggregation Paper PAK
SLASR903-I-A=	ASR 903 Metro IP to Metro Aggregation Paper PAK
L-SLASR903-M-I=	ASR 903 Metro to Metro IP E-Delivery PAK
L-SLASR903-M-A=	ASR 903 Metro to Metro Aggregation E-Delivery PAK
L-SLASR903-I-A=	ASR 903 Metro IP to Metro Aggregation E-Delivery PAK
Feature Licenses	
FLSASR903-ATM	ASR 903 ATM License
FLSASR903-1588	ASR 903 IEEE 1588-2008 BC/MC License
Feature Licenses Product Activation Keys	
FLSASR903-ATM=	ASR 903 ATM License Paper PAK
L-FLSASR903-ATM=	ASR 903 ATM License E-Delivery PAK
FLSASR903-1588=	ASR 903 IEEE 1588-2008 BC/MC License Paper PAK
L-FLSASR903-1588=	ASR 903 IEEE 1588-2008 BC/MC License E-Delivery PAK

Major Features

Table 4 lists the features supported by Cisco IOS XE in the Cisco ASR 903 Router. Availability of features is dependent on software release and implementation schedule.

Table 4. Cisco ASR 903 Router Software Features

Features
Ethernet Services
• Ethernet Flow Point (EFP) with support for: ◦ 802.1q ◦ Selective QinQ ◦ Inner and Outer VLAN classification ◦ VLAN local significance ◦ One VLAN tag ingress push ◦ Pop one VLAN tag ◦ Pop two VLAN tags ◦ Trunk-EFP construct for configuration simplification • IEEE 802.1s Multiple Spanning Tree (MST) • Resilient Ethernet Protocol (REP) • ITU G.8032 • 802.3ad/802.1ax Link Aggregation Control Protocol (LACP) • Multi-chassis Link Aggregation Control Protocol (mLACP) • Layer 2 Protocol Tunneling (L2PT) • Virtual Private LAN Service (VPLS), Hierarchical VPLS (HVPLS), Virtual Private Wire Service (VPWS), Ethernet over MPLS (EoMPLS) • Static Multicast MAC addresses

Features
• IGMP snooping on Ethernet Flow Point • Link Pass Through • Pseudowire redundancy • Hot Standby Pseudowire • Multi-segment Pseudowire
TDM and ATM services
• Clear Channel and Channelized T1 and E1 ports on the 16 port T1/E1 interface module • RAW socket transport on the 14-port Serial Interface Module • Channelized OC-3/STM-1 mode on the 4 port OC-3/STM-1 Interface Module • Packet over SONET (PoS) mode using PPP over SONET/SDH on the 4 port OC-3/STM-1 Interface Module - RFC 2615 • HDLC • Point to Point Protocol (PPP) - RFC 1661 • Multilink PPP (ML-PPP), with maximum 16 T1 or E1 links per ML-PPP bundle - RFC 1990 • PPP Challenge Handshake Authentication Protocol (CHAP) - RFC 1994 • Pseudowire setup and maintenance using the Label Distribution Protocol (LDP) - RFC 4447 • Structure-Agnostic Time Division Multiplexing (TDM) over Packet (SAToP) - RFC 4553 • Encapsulation methods for transport of ATM over MPLS networks for AAL 0 and AAL 5 - RFC 4717 • Pseudowire Emulation Edge-to-Edge (PWE3) ATM Transparent Cell Transport Service - RFC 4816 • Circuit Emulation Service over Packet Switched Network (CESoPSN) - RFC 5086 • DS0 channels on the OC-3, STM-1 and T1/E1 Interfaces only for CESoPSN services • Single Router Automated Protection switching (SR-APS) for CESoPSN, SATOP, HDLC, PPP and ML-PPP on STM-1 and OC-3 interfaces • Multi Router Automated Protection switching (MR-APS) for CESoPSN, SATOP, HDLC, PPP and ML-PPP on STM-1 and OC-3 interfaces • Access Circuit Redundancy (ACR) for CESoPSN and SATOP • Pseudowire redundancy • Hot Standby Pseudowire • Multi-Segment Pseudowire • IETF ATM PWE3 over MPLS • ATM N:1 (N = 1) virtual channel connection (VCC) cell mode and ATM N:1 (N = 1) virtual path (VP) Cell Relay Mode • ATM cell packing • ATM IMA v1.0, 1.1 on the 16 port T1/E1 and on the 4 port OC-3/STM-1 interface module • ATM AAL0 (for AAL2 voice and data) • ATM Class of Service (CoS) features constant bit rate (CBR) and unspecified bit rate (UBR) and per virtual circuit queuing • Egress Quality of Service (QoS) on ML-PPP, PPP, PoS and HDLC interfaces
Layer 3 and MPLS Services
• Hot Standby Router Protocol (HSRP) • Virtual Router Redundancy Protocol (VRRP) • Layer 3 routing on Routed interfaces and Bridge Domain Interfaces (BDI) • Cisco Express Forwarding (CEF) load sharing of Equal Cost Paths (ECMP) • Open Shortest Path First (OSPF) • Border Gateway Protocol (BGP) • BGP 4-byte Autonomous System number (ASN) • BGP TCP Path MTU Discovery • BGP Prefix-Independent Convergence (PIC) Edge and Core for IPv4 and MPLS VPN • Intermediate System-to-Intermediate System (IS-IS) • Bidirectional Forwarding Detection (BFD) for OSPF, IS-IS, BGP, and static routes • BFD over Ethernet, Routed port, HDLC and PPP interfaces • BFD for HSRP group client • Multi Protocol Label Switching (MPLS) • LDP with Label Edge Router (LER) and Label Switch Router (LSR) • MPLS L3VPN • MPLS Transport Profile (MPLS-TP) for Ethernet, TDM and ATM Pseudo Wires • MPLS Traffic Engineering Fast Re-Route (TE-FRR) • IP Loop Free Alternate Fast Re-Route (LFA FRR) • Remote Loop Free Alternate Fast Re-Route (R-LFA FRR)

Features
• Internet Group Management Protocol (IGMP) version 1 - RFC 1112 • IPv4 and IPv6 multicast • Protocol Independent Multicast sparse mode (PIM-SM), PIM Source Specific Multicast (PIM SSM), PIM SSM mapping • IGMPv2 - RFC 2236 • IGMPv3 - RFC 3376 • IGMP group limiting • Multicast Listener Discovery (MLD) • Multicast VPN (MVPN) based on IETF Rosen Draft
IPv6
• Hardware based IPv6 data forwarding • Addressing and discovery • Manual IPv6 interface addressing • ICMPv6 (RFC 4443) • IPv4 and IPv6 dual stack • IPv6 static routing • OSPF for IPv6 (RFC 5340) • DHCPv6 with relay function • BFD for OSPF, IS-IS, BGP and IPv6 static routes • IPv6 Provider Edge (6PE) • IPv6 VPN Provider Edge (6VPE)
QoS
• Modular QoS CLI (MQC) • Hierarchical QoS (HQoS) • Port shaper and Low Latency Queuing (LLQ) in the presence of an EFP • IEEE 802.1p Class of Service (COS) based QoS • Classification based on inner and outer CoS • IP Precedence Type of Service (ToS) based QoS • Differentiated Services Code Point (DSCP) based QoS • Egress marking of COS, ToS, DSCP and MPLS EXP QoS fields • Classification using Access Control List (ACL) • 2-rate 3-color (2R3C) ingress Policing • Differentiated Services Code Point (DSCP) traffic shaping • Class-Based Weighted Fair Queuing (CBWFQ) • Priority Queuing with up to 2 priority queues • Weighted Random Early Detect (WRED) • Egress shaping per queue • Egress policing per queue • Resource Reservation Protocol (RSVP) Call Admission Protocol (CAC)
Timing
• IEEE 1588-2008 Ordinary Clock over Ethernet, IP and MPLS • IEEE 1588-2008 end-to-end Transparent Clock over Ethernet, IP and MPLS • IEEE 1588-2008 Boundary Clock over Ethernet, IP and MPLS • IEEE 1588-2008 precision time protocol (PTP) telecom profile for frequency synchronization - ITU-T G.8265.1/Y.1365.1 • Hybrid clocking • T1/E1 line timing • OC-3/STM-1 Line Timing • Global navigation satellite system (GNSS) ports; Time of Day (ToD), 10MHz, 1 Pulse Per Second (1PPS) • Building Integrated Timing Supply (BITS) • ITU-T SyncE with Ethernet Synchronization Messaging Channel (ESMC) • Synchronization Status Messages (SSM)
OAM
• IEEE 802.1ag Connectivity Fault Management (CFM) over EFP • IEEE 802.3ah Link OAM

Features
• MPLS OAM • ITU-T Y.1731 Fault Management (FM) over EFP • ITU-T Y. 1731 Performance Management (PM) over EFP for Delay Measurement (DM) and Synthetic Loss Measurement (SLM) • Ethernet Local Management Interface (E-LMI), as a provider edge (PE) device • CFM extensions for microwave adaptive code modulation (ACM) actual air bandwidth exchange
Security
• Authentication, authorization, and accounting (AAA) with TACACS+ and RADIUS • Secure Shell (SSH) Protocol v2 • MAC limiting per bridge domain (BD) • Storm control for Port Mode • Layer 3 Access Control Lists (ACL) for IPv4 and IPv6 • IPv4 unicast reverse path forwarding (uRPF) strict mode • MAC security • Dynamic Arp Inspection (DAI) • DHCP Snooping with option 82 insertion • DHCP Option 82 Configurable Circuit ID & Remote ID
Manageability
• Simple Network Management Protocol (SNMP) • MIBs • Dying Gasp message • Embedded Event Manager (EEM) • Cisco Discovery Protocol (CDP) • 802.1ab Link Layer Discovery Protocol (LLDP) • Port Level Local SPAN (SPAN) • Port Level Remote SPAN (RSPAN) • Generic Online Diagnostics (GOLD) • Onboard Failure Logging (OBFL) • Cisco IOS Command Line Interface (CLI) • Cisco Prime™ Network: fault, provisioning and performance management • Cisco® Network Virtualization (nV) technology Satellite mode for Ethernet interfaces

Warranty Information

Find warranty information on Cisco.com at the Product Warranties page.

Service and Support

Cisco offers a wide range of services programs to accelerate customer success. These innovative services programs are delivered through a unique combination of people, processes, tools, and partners, resulting in high levels of customer satisfaction. Cisco Services help you protect your network investment, optimize network operations, and prepare your network for new applications to extend network intelligence and the power of your business. For more information about Cisco Services, refer to Cisco Technical Support Services or Cisco Advanced Services.

Cisco is committed to minimizing your total cost of ownership. Cisco offers a portfolio of technical support services to help ensure that Cisco products operate efficiently, remain highly available, and benefit from the most up-to-date system software. The services and support programs described in Table 5 are available as part of the Cisco Carrier Ethernet Switching Service and Support solution and are available directly from Cisco and through resellers.

Table 5. Service and Support

Advanced Services	Features	Benefits
Cisco Total Implementation Solutions (TIS), available directly from Cisco Cisco Packaged TIS, available through resellers	• Project management • Site survey, configuration, and deployment • Installation, text, and cutover • Training • Major moves, adds, and changes • Design review and product staging	• Supplement existing staff • Help ensure functions meet needs • Mitigate risk
Cisco SP Base Support and Service Provider-Based Onsite Support, available directly from Cisco Cisco Packaged Service Provider- Based Support, available through resellers	• 24-hour access to software updates • Web access to technical repositories • Telephone support through the Cisco Technical Assistance Center (TAC) • Advance Replacement of hardware parts	• Facilitate proactive or expedited problem resolution • Lower total cost of ownership by taking advantage of Cisco expertise and knowledge • Minimize network downtime

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