

Cisco IOS Software Release 15.1(2)S: New Features for Cisco 7600 Series

Product Overview

Cisco® edge services innovation continues with Cisco IOS® Software Release 15.1(2)S. For customers looking for the best possible return on investment as they transition to the IP Next-Generation Network (IP NGN), the Cisco 7600 Series continues to deliver new services with better manageability for Carrier Ethernet, mobile transport, edge services, video, and converged networks.

Features and Benefits

Table 1 summarizes the new features for the Cisco 7600 Series in Cisco IOS Software Release 15.1(2)S, and the benefits of those features.

Table 1. Features and Benefits

Feature	Benefit
Ethernet Operations, Administration, and Maintenance (EOAM)	
Y.1731 performance monitoring for Cisco 7600 Series	Saves on operating expenses (OpEx), improves service-level agreements (SLAs), and simplifies operations with standardized measurements of frame loss, frame delay, frame delay variation, and availability across Carrier Ethernet and mobile backhaul networks.
Carrier Ethernet and Quality of Service (QoS)	
Dynamic Ethernet service activation	Creates zero-touch provisioning of Layer 2 connections with Ethernet accounting through RADIUS to create new service opportunities for cloud, wholesale, business, and mobile markets.
Switched Port Analyzer (SPAN) on Ethernet virtual circuit (EVC) service instance	Simplifies the transition from switchport to EVC to take greater advantage of the service opportunities and operational benefits of the Cisco IP NGN.
Multiple Spanning Tree (MST) and MST Access Gateway (MST-AG); bridge protocol data unit (BPDU) pseudowire on link aggregation (LAG) Network-to-Network Interface (NNI)	Enhances the resiliency of MST-AG solutions to reduce the likelihood of MST reconvergence and improve SLAs
Resilient Ethernet Protocol (REP) MIB	Improves operations for networks using Cisco REP.
Stateful Switch Over (SSO) support for REP Fast Hello	Enhances REP high availability with SSO support.
IP Source Guard on port channel EVC	Simplifies the transition from switchport to EVC to take greater advantage of the service opportunities and operational benefits of the Cisco IP NGN.
Cisco Intelligent Services Gateway (ISG) Security Control Plane Policing (CoPP) enhancements	Extend CoPP features for Cisco ISG to nonaccess subinterfaces to improve protection against denial-of-service attacks.
Layer 2, Layer 3 and Layer 4 QoS access control list (ACL) classification for EVC on Ethernet Services Plus (ES+)	Uses MAC and Layers 3 and 4 ACLs for traffic classification on EVC interfaces on ES+ line cards. Improves network security and supports more advanced SLAs.
Egress QoS scheduling (shape and queue) for subinterfaces on port channel on ES+	Improves services on port channel. Traffic for services configured on subinterfaces can be shaped to a maximum rate while ensuring that both high- and low-priority traffic are scheduled properly.
Layer 3 QoS Support on Circuit Emulation over Packet (CEoP) shared port adapters (SPAs)	Improve ATM Layer 3 services on physical E1/T1 ATM, Channelized E3/T3, and Synchronous Transport Mode 1 (STM1), and OC-3 carrying logical E1/T1 ATM interfaces.
Mobile and Network Resiliency Enhancements	
Bidirectional Forwarding Detection (BFD) scale improvements for ES+	Improves SLAs while saving on capital expenditures (CapEx) by providing faster failure detection and higher session scale.

Feature	Benefit
BFD IP static client group support	Optimize BFD utilization with new tools to effectively group the number of BFD sessions used, especially useful for IP Radio Access Network (RAN) applications to improve network scale and lower costs.
Border Gateway Protocol (BGP) IPv6 client for single-hop BFD	Extends the fast fault detection to BGP IPv6 deployments.
BFD for Routing Information Protocol (RIP) v2 support	Extend the fast fault detection to RIP v2 deployments.
Circuit Emulation Services over User Datagram Protocol (CESoUDP)	Expand the network reach and support more convergence options for VPN, Carrier Ethernet, and mobile backhaul networks.
Connectivity Fault Management (CFM) extension for 1+1 Hot Standby support	Improves operations when connecting with legacy NSN microwave systems.
MIB support for 1588v2 and Synchronous Ethernet (SyncE)	Complete timing solutions with Simple Network Management Protocol (SNMP) management of 1588v2 and SyncE features for successful transformation to 3G and 4G.
Multicast VPN and IPv6	
Loop free alternate Fast Reroute (LFA-FRR) for Intermediate System-to-Intermediate System (IS-IS)	Provides automatic detection and rerouting for sub-50-ms recovery.
Dynamic Host Configuration Protocol (DHCP) v6 relay: Virtual Route Forwarding (VRF) aware	One IPv6 DHCP server can support multiple VPNs instead of dedicating a resource to a VPN. Provides an efficiently managed central service capability to avoid unneeded duplication. Reduces equipment investment and operational costs for IPv6.
BGP Prefix Independent Convergence (PIC) edge and core for IPv6	Provides faster route table convergence at higher scale so that new service opportunities for IPv6 can be delivered with the SLAs that customers expect.
IP over Dense Wavelength-Division Multiplexing (IPoDWDM)	
Virtual transponder for Cisco 7600 Series IPoDWDM line cards	Provides operators with a common and integrated optical network management solution: Cisco Transport Controller (CTC) and Cisco Transport Manager (CTM) for Cisco IPoDWDM and Cisco ONS 15454 Multiservice Transport Platform (MSTP) and Cisco Transport Planner (CTP). Maintains the same operations for IPoDWDM as for existing transponder-based DWDM transport.
Video Monitoring	
Video monitoring for Real Time Transport Protocol (RTP) metrics	Extends the benefits of in-band performance management of video traffic for Cisco Telepresence [®] , Internet Protocol Television (IPTV), cable, and video contribution networks.
Video monitoring metric support on switchport interface	Supports all video monitoring features on switchport interface.
Video monitoring metric support on Point-to-Point over Ethernet (PPPoE) interface	Supports all video monitoring features on PPPoE interface.
Optics	
New Small Form-Factor Pluggables (SFPs)	Cisco's new Gigabit Ethernet (GE) optics simplifies operations and sparing. Consolidates SFP and Gigabit GLC GE PIDs with Digital Optical Monitoring (DOM) support, extended temperature support, and enhanced security.
New low power 10-Gigabit Small Form-Factor Pluggable (XFP)	Cisco's new 10 GE XFP optics with power budgets save energy and reduce operational expenses.

For a complete introduction to the features of Cisco IOS Release 15.1(2)S, visit the IOS 15.1S Release Notes homepage at http://www.cisco.com/en/US/docs/ios/15_1s/release/notes/15_1s_rel_notes.html.

As part of the Cisco IOS Release 15 S Family, Cisco IOS 15.1(2)S includes all the features of Cisco IOS 15.1(1)S, IOS 15.0(1)S and 12.2(33)SRE. Release 15 S offers:

- Faster time to market: three feature releases per year
- Improved quality: production-ready releases sooner
- Broadened operational consistency of features and advanced technologies
- Predictable schedules for new features and rebuilds
- Proactive communication about software selection, support lifecycle, and migration

Cisco IOS 15.1(2)S is a standard-support release. Each Cisco IOS 15 S software release is classified as either a standard-support release or extended-support release. A standard-support release has a sustaining support lifetime of 1 year from first customer shipment (FCS) with two scheduled rebuilds.

Ethernet OAM

ITU-T Y.1731 Performance Monitoring for the Cisco 7600 Series

Y.1731 performance monitoring provides standardized real-time measurements for frame loss, frame delay, and frame delay across Ethernet networks. Service providers can measure critical performance metrics on their networks directly from the Cisco 7600 Series Router, without deploying expensive probes.

When used in conjunction with CFM (IEEE 802.1ag), Y.1731 provides a comprehensive fault management and performance monitoring solution for service providers to save OpEx, improve SLAs, and simplify operations.

Cisco's Y.1731 performance monitoring complies with international standards per ITU-T Y.1731 2/2008 Section 8.0 (Performance Monitoring) requirements as defined and interpreted by the Metro Ethernet Forum (MEF), primarily through their SOAM PM IA (MEF-17) Draft Specification.

To support one-way delay measurements, IEEE 1588 Precision Time Protocol (PTP) is needed. To provide PTP, the Cisco Timing SPA (SPA-2X1GE-SYNCE) is required on the system, operating in server mode.

Y.1731 PM is available only on the Cisco ES+ Series line cards.

Carrier Ethernet and QoS

Dynamic Ethernet Service Activation

Dynamic Ethernet service activation provides:

- Zero-touch configuration and service activation for Ethernet through RADIUS
- Dynamic changes to Ethernet services (push) through RADIUS
- Automatic Ethernet over Multiprotocol Label Switching (EoMPLS) service configuration
- RADIUS accounting for Ethernet services

With dynamic Ethernet service activation, service policies are automatically applied to Ethernet Flow Points (EFPs) based on the classification of the traffic when it initially arrives on an EFP to turn-up the service. Each aspect of the EVC can be configured in the service policy and activated through RADIUS. Services can also be mapped automatically to different Layer 2 transport types, such as bridge domains or x-connect. MPLS Pseudowire Emulations (PWEs) can be automatically initiated as well. Dynamic Ethernet service activation also provides RADIUS accounting for Ethernet flows for scalable accounting applications.

Dynamic Ethernet service activation creates synergy between the Cisco EVC and ISG infrastructures to automate provisioning and network management, creating new service opportunities for cloud, wholesale, business, and mobile markets.

This feature is available only on Cisco ES+ 3CXL line cards used with Cisco RSP 720 Route Switch Processors.

SPAN on EVC Service Instance

SPAN is a traffic monitoring technology that allows customers to configure the Layer 2 switchport to mirror data passing through any other switchport. Starting with Cisco IOS 15.1(2)S, SPAN functions are available on a per-service-instance basis, which provides more specificity for monitoring on EVCs, and simplifies the transition from switchport to EVC deployments.

This feature is available only on Cisco ES+ series line cards

Port Channel EVC MST and MST-AG; BPDU Pseudowire on LAG NNI

MST-AG is already supported on the Cisco 7600 Series and provides fast recovery for access networks connecting to Virtual Private LAN Services (VPLS), using standard MST in the access network.

Starting with Cisco IOS Release 15.1(2)S, port channel can be used to carry the special control pseudowire that connects the two network Provider Edge (N-PE) systems that act as access gateways, further improving the excellent resiliency of MST-AG solutions.

This feature is available only with Cisco ES20 and ES+ series line cards

REP MIB

REP can provide consistent sub-50 recovery for Ethernet in a ring topology. The Cisco REP MIB provides SNMP access to segment information per node, including port information and interface statistics relevant to REP.

This feature is available with REP on LAN cards, ES20, and ES+ series line cards

SSO Support for REP Fast Hello

SSO support for REP Fast Hello enhances high availability of the Cisco 7600 Series in Layer 2 applications.

This feature is available only with S-Series chassis (7603-S, 7606-S, or 7609-S) or Cisco 7604 chassis using SUP-720, RS-720-1G or RSP-720-10G rout processors.

IP Source Guard on Port Channel EVC

IP Source Guard provides IP and MAC filtering to restrict IP traffic on an untrusted port. Only IP traffic with source IP and MAC address corresponding to valid IP source binding is permitted and all other IP traffic except DHCP is dropped. Beginning with Cisco IOS 12.2(33)SRD, IP Source Guard is available on a per-service-instance basis. With Cisco IOS 15.1(2)S, IP Source Guard on EVC service instances is also supported with port channel. Network transitions from switchport configurations to EVC are now simplified, making it easier to take advantage of new services and operational benefits that come with EVCs.

This feature is available only with ES+ series line cards.

Cisco ISG Security CoPP Enhancements

Beginning with Cisco IOS 12.2(33)SRE, ES+ line cards support control plane policing on Cisco ISG access subinterfaces and on main interfaces. This release adds Cisco ISG CoPP for subinterfaces without the access keyword to improve security for more configuration options. CoPP on nonaccess subinterfaces applies only to Address Resolution Protocol (ARP), DHCP, PPPoE, and EOAM protocols.

This feature is available with Cisco ISG only on ES+ 3CXL line cards and RSP-720.

Layer 2, 3, and 4 ACL Classification for EVC on ES+

Two types of ACLs can be used inside Modular QoS command-line interface (MQC) class maps for defining traffic classification of ingress and egress QoS.

- MAC ACLs are typically used in Carrier Ethernet networks providing Layer 2 services. By using named MAC ACLs, traffic can be classified on either destination or source MAC address; classification on both source and destination is not supported. Inside the MAC ACLs, VLAN IDs and CoS values may also be included for more detailed classification.

```
mac access-list extended my-L2-acl
  permit 0000.0000.9e15 ffff.ffff.0000 any
```

```
class-map match-all L2-acl
  match access-group name my-L2-acl
```

- IP ACLs are typically used in IP/MPLS networks providing Layer 3 services. By using either named or numbered standard or extended IP ACLs, traffic can be flexibly classified based on either Layer 3 source or destination IP address information or on Layer 3 protocol port numbers. In addition, the differentiated services code point (DSCP) information can be used.

```
ip access-list extended my-L3-acl
  permit ip 10.1.1.0 0.0.0.225 any dscp ef
```

```
class-map match-all L3-acl
  match access-group name my-L3-acl
```

This feature is available on ES+ line cards only; it is not supported on ES20 or SIP-400 line cards.

Egress QoS Scheduling (Shape and Queue) for Subinterfaces on Port Channel on ES+

The following high-performance port channel features are of value for QoS-supporting Provider Edge Routers:

- Port channel bundling of two or more links into one logical link for either redundancy or link capacity purposes
- Customer traffic spread across all port channel member links based on per-flow load balancing
- Per-customer service hierarchical QoS (HQoS) on the subinterface.

Cisco port channel subinterfaces satisfy the first two requirements, and are now extended to provide the third, egress HQoS per subinterface on a port channel, which allows for the shaping of each customer's service (peak information rate) while helping ensure differential treatment of separate traffic classes inside the shaper using low latency queuing (LLQ) or Class-Based Weighted Fair Queuing (CBWFQ).

The following is a simple configuration example.

```
Interface Gi1/1
  Channel-group 1 mode active

Interface Gi2/1
  Channel-group 1 mode active

Interface Port-channel 1.100
  Encapsulation dot1q 100
```

```
Service-policy out hqos
```

```
Policy-map hqos  
Class class-default  
  Shape average 1000000  
Service-policy llq
```

```
Policy-map llq  
Class voice  
  Police cir percent 10  
  Priority level 1  
Class data  
  Bandwidth percent 30  
Class class-default  
  Random-detect
```

This feature is available on ES+ line cards only; it is not supported on ES20 or SIP-400 line cards.

Layer 3 QoS Support on CEoP SPAs

When configuring ATM permanent virtual circuits (PVCs) for Layer 3 services such as L3VPN, it is important to have the ability to classify packets on egress based on Layer 3 information and implement CBWFQ or LLQ per ATM PVC. This capability is now available on CEoP SPAs to implement ATM-based Layer 3 services over the following interface types:

- Physical E1/T1 ATM interfaces
- Physical clear channel E3/T3 ATM interfaces
- Channelized E3/T3 carrying logical E1/T1 ATM interfaces
- Channelized STM1 and OC-3 carrying logical E1/T1 ATM interfaces

The following is an example of a configuration.

```
interface ATM4/1/0.1/1/3/3.100  
ip address 10.1.1.1 255.255.255.252  
no atm enable-ilmi-trap  
pvc 40/406  
  cbr 128000  
  service-policy out llq
```

```
Policy-map llq  
Class voice  
  Police cir percent 10  
  Priority level 1  
Class data  
  Bandwidth percent 30  
Class class-default  
  Random-detect
```

Mobile and Network Resiliency Enhancements

BFD Scale Improvements for ES+

The Cisco ES+ line cards now offload the generation of the BFD packets from the central route processor, which improves performance and scale substantially. Service providers can improve SLAs with fast detection and save on CapEx at large scale.

The ES+ line cards now support 2000 BFD sessions per system and can achieve 50 ms hello timers. Further enhancements are forthcoming in future releases.

This feature is available only on ES+ series line cards.

BFD IP Static Client Group Support

This feature creates an active parent BFD session to monitor passive child BFD sessions within a group. The parent provides active monitoring for each child in the group. Presence of the static routes tracked through active and passive BFD static configurations depend upon monitoring on the parent BFD session. The hierarchical model optimizes BFD utilization to maximize network efficiency, especially in IP-RAN networks.

BGP IPv6 Client for Single-Hop BFD

The client extends the fast fault detection of BFD to BGP IPv6 deployments.

This feature is available only with SUP-720 and RSP-720 processors.

BFD for RIP v2 Support

This support extends fast fault detection to RIP v2 deployments.

This feature is available only with SUP-720 and RSP-720 processors.

CESoUDP

The Cisco 7600 Series Router already supports CESoPSN to allow customers to transport TDM pseudowires over a MPLS core network per RFC 5086. With Cisco IOS 15.1(2)S, Cisco now supports the option to transport the CESoPSN pseudowires directly over an IP network by using the CESoPSN over UDP IP encapsulation as described in RFC 5086.

This feature extends circuit emulation service support to a general-purpose IP network. Customers benefit with more options for circuit emulation with a simple solution to carry pseudowires over an IP network directly.

This feature is available only with SIP-400 line cards on the Customer Edge-facing side.

CFM Extension for 1+1 Hot Standby Support

Extends Cisco IOS Continuity Check Messages (CFM) to support NSN Microwave 1+1 Hot Standby (HSBY) protocol, extending Cisco's solution offering with NSN, especially in the mobile backhaul applications.

MIB Support for 1588v2 and SyncE

SNMP management of the 1588v2 and SyncE features is now available for complete network timing solutions on Ethernet.

Multicast VPN and IPv6

LFA-FRR for IS-IS

LFA-FRR provides automatic detection and rerouting for alternative paths in networks using IS-IS routing protocols. Open Shortest Path First (OSPF) protocol is planned for future releases. LFA is prefix independent, so convergence on the alternative path is determined in a fixed time.

VRF-Aware DHCPv6 Relay

To facilitate managed central services in MPLS- and VPN-based NGNs, DHCPv6 is now MPLS-aware, so a single resource can be used to serve multiple VPNs instead of dedicating a resource to a VPN. This reduces equipment investment and operational costs.

Because DHCPv6 (relay and server) is now VRF-aware on the Cisco 7600 Series Router, simply providing the VRF context allows the lookup to happen in the specific VRF table for packet transmission to the right destination. VRF-specific capability within DHCPv6 helps provide a highly efficient, managed central service capability, eliminating the need for the service to be replicated on a per-VPN basis.

BGP PIC Edge and Core for IPv6

PIC edge and core simplifies route advertisement processing to scale BGP routing table convergence. PIC edge and core now support IPv6 to provide faster route table convergence at higher scale so that new service opportunities for IPv6 can be delivered with the SLAs that customers expect.

IPoDWDM

Virtual Transponder for Cisco 7600 Series IPoDWDM Line Cards

The purpose of a virtual transponder is to help ensure that the transport management system can continue to manage the DWDM layer as it does today, even when the DWDM transponder is physically integrated into a router line card. DWDM interfaces on the router will appear to the transport management system as transponders housed in separate chassis.

Virtual transponder support for the Cisco 7600 Series delivers an end-to-end management solution for the Cisco 7600 Series IPoDWDM wavelengths deployed over a Cisco ONS 15454 MSTP DWDM network using CTC and CTM. The solution allows management of the Layer 1 parameters of a Cisco 7600 Series IPoDWDM line card from CTC and CTM, including configuration of DWDM parameters (for example, wavelength) and monitoring IPoDWDM port and end-to-end transport status (for example, optical power and OTN alarms).

Virtual transponder is already supported by the Cisco Carrier Routing System (CRS) and Cisco ONS 15454 MSTP and CTP. The addition of this capability on the Cisco 7600 Series provides operators with a common and integrated optical network management solution for Cisco IPoDWDM and Cisco ONS 15454 MSTP and CTP.

This feature is available only on Cisco 7600 Series Ethernet Services Plus Extended Combination (76-ES+XC), 10 GE Extended Transport (76-ES+XT-2TG and 76-ES+XT-4TG) and 10 GE Transport (76-ES+T-2TG and 76-ES+T-4TG) line cards.

IPoDWDM support requires the purchase of the 76-ES+OTN-LIC license.

Video Monitoring Enhancements

Inline Video Monitoring for RTP Metrics

The inline RTP video metrics allow video content and service providers to monitor real-time video quality of multicast and broadcast channels or unicast (video on demand [VoD]) channels on any router port of ES+ line cards at line rate. The metrics available are video loss, jitter, latency and reordered packets. With the distinctive inline RTP video monitoring capability, an external video monitoring appliance or probe is not required. Video monitoring supports multiple video transports, including MPTS, SPTS, MPEG transport stream (MPEG-TS), and uncompressed video (Society of Motion Picture and Television Engineers [SMPTE] standards) and is deployable in these applications: Cisco Telepresence, IPTV, cable video, and video contribution networks.

Video Monitoring Metric Support on Switchport Interface

This release extends the support of all video monitoring metrics to switchport interfaces. All video monitoring metrics can be configured on ingress or egress direction on switchport interfaces and still maintain line rate performance without affecting existing services provisioned on a port.

Video Monitoring Metric Support on PPPoE Interface

This release extends the support of all video monitoring metrics to PPPoE interfaces. All video monitoring metrics can be configured on ingress or egress direction on PPPoE interfaces and still maintain line rate performance without affecting existing services provisioned on a port.

All Cisco video monitoring features are available only on ES+ series line cards. Video monitoring can be configured on any port and still maintain line rate performance without affecting existing services provisioned on a port.

For video monitoring, the purchase of the 76-ES+VIDEO-LIC license is required.

Optics

Catskills SFPs

Cisco is simplifying its GLC and SFP GE offerings with additional DOM, extended temperature, and new security support. In the initial phase available with Cisco IOS 15.1(2)S, the Cisco 7600 Series will support the following two Product IDs (PIDs) on all ES+ 1 GE interfaces (Table 2).

Table 2. New SFP Support

PID	Description	Feature Support	Cisco 7600 Line Card Support
GLC-SX-MMD(=)	Short reach multimode	DOM: Yes External temperature: Yes ACT 1T: Yes Secure label: Yes	All ES+ 1 GE interfaces
GLC-LH-SMD(=)	10 km single mode	DOM: Yes External temperature: Yes ACT 1T: Yes Secure label: Yes	All ES+ 1 GE interfaces

Low power XFPs

To reduce power consumption with high-density 10 GE interface support, new low-power XFPs are now supported. The two new low-power XFPs provide 10 km and 40 km reach (Table 3).

Table 3. New Low Power XFPs

PID	Description	Supported Line Cards
XFP10GER-192IR-L(=)	Low-power multirate XFP supporting 10 GB ASE-ER and OC-192 IR	All ES+ 10 G interface
XFP10GLR-192SR-L(=)	Low-power multirate XFP supporting 10 GB ASE-LR and OC-192 SR	All ES+ 10 G interface

Ordering Information

Table 4 lists ordering information. To place an order, visit the [Cisco Ordering Home Page](#). To download software, visit the [Cisco Software Center](#).

Table 4. Ordering Information

Product Name	Part Number
Cisco 7600-RSP720 IOS ADVANCED ENTERPRISE SERVICES SSH	S764AEK9-15102S
Cisco 7600-RSP720 IOS ADVANCED IP SERVICES	S764AIS-15102S
Cisco 7600-RSP720 IOS ADVANCED IP SERVICES SSH	S764AIK9-15102S
Cisco 7600-RSP720 IOS IP SERVICES	S764IS-15102S
Cisco 7600-RSP720 IOS IP SERVICES SSH	S764ISK9-15102S
Cisco 7600-SUP32 IOS ADVANCED ENTERPRISE SERVICES SSH	S732AEK9-15102S
Cisco 7600-SUP32 IOS ADVANCED IP SERVICES	S732AIS-15102S
Cisco 7600-SUP32 IOS ADVANCED IP SERVICES SSH	S732AIK9-15102S
Cisco 7600-SUP32 IOS IP SERVICES	S732IS-15102S
Cisco 7600-SUP32 IOS IP SERVICES SSH	S732ISK9-15102S
Cisco 7600-SUP720 IOS ADVANCED ENTERPRISE SERVICES SSH	S763AEK9-15102S
Cisco 7600-SUP720 IOS ADVANCED IP SERVICES	S763AI-15102S
Cisco 7600-SUP720 IOS ADVANCED IP SERVICES SSH	S763AIK9-15102S
Cisco 7600-SUP720 IOS IP SERVICES	S763IS-15102S
Cisco 7600-SUP720 IOS IP SERVICES SSH	S763ISK9-15102S
Cisco 7600-SUP32 IOS FIELD PROGRAMMABLE DEVICE IMAGE	S732FPD-15102S
Cisco 7600-RSP720 IOS FIELD PROGRAMMABLE DEVICE IMAGE	S764FPD-15102S
Cisco 7600-RSP720 IOS FIELD PROGRAMMABLE DEVICE IMAGE	S76GFPD-15102S

Cisco Services

Cisco Services span all phases of the network lifecycle, build on Cisco's extensive expertise, and help service providers mitigate risk, lower costs, and accelerate time to market for new services.

The Cisco Lifecycle Services approach defines the activities needed to help ensure service excellence at each phase of the network lifecycle: preparation, planning, design, implementation, operation, and optimization. Among the many Cisco Services offerings, Cisco Release Management and Support Services can be particularly helpful in a transition to Cisco IOS Software Release 15.1(2)S. These services are adapted to the service provider's specific needs. Test engineering expertise and Cisco laboratory environments provide service verification, supporting adherence to end-customer SLAs. Services include validation of features, scale, and multivendor solutions, resulting in higher availability, increased capacity, less risk, and shorter deployment times.

In addition, Cisco Upgrade and Refresh Services are helpful when moving to a new software release or for any product, technology, or service migration. These services work with the service provider's specific attributes and provide a cost-effective methodology for preparing, planning, designing, and implementing a Cisco IP NGN transition for increased business agility, high availability, security, and subscriber acquisition and retention. Cisco's experience, automation tools, and cumulative migration expertise help make the network transition predictable, with faster adoption of new services.

By using the extensive tools, best practices, and experts offered through Cisco Services, service providers can mitigate risks, bring new services to market faster, lower costs, improve the customer experience through service assurance, and increase the value of their investments. With a collaborative delivery methodology that joins the forces of Cisco, our highly skilled network of partners, and our customers, Cisco helps service providers achieve outstanding results.

For More Information

Contact your local account representative or visit the following websites.

- To learn more about the Cisco 7600 Series Router, visit www.cisco.com/go/7600.
- For more information about Cisco Services, visit the [Services Routing and Switching](#) webpage or the [Cisco Services for Service Provider](#) webpage.
- For more information about Cisco IOS Software releases, visit www.cisco.com/go/ios.
- For information on Cisco transceivers, visit www.cisco.com/en/US/partner/docs/interfaces_modules/transceiver_modules/compatibility/matrix/OL_6974.html.



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