Release Notes for Cisco NCS 560 Series Routers, Cisco IOS XR Release 7.6.1

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What's New in Cisco IOS XR Release 7.6.1

Feature	Description
Routing	
IGP IP Flexible Algorithm for IS-IS Protocol	With IS-IS protocol extensions supporting Interior Gateway Protocol (IGP) Flexible Algorithm (Flex-Algorithm) on the IP data plane, you can now use the Algorithm to calculate IGP paths in an IP network without running Segment Routing. The IGP Flex-Algorithm allows for user-defined algorithms where the IGP computes paths based on a user-defined combination of metric type and constraints. Earlier, you could calculate IGP only using the Shortest Path First (SPF), which meant that you didn't have any choice except to use the default IGPpath calculated based on a native IGP metric. The following command is introduced: • data-plane ip The following commands are modified: • ipv4 address • ipv6 address • show isis topology
MPLS TE Preference for Tunnels	You can now configure the MPLS TE traffic for equal-cost multipath (ECMP) such that it flows only through TE tunnels. This is useful in scenarios where the hardware has resource constraints that limit the number of mixed ECMP routes. In earlier releases, IS-IS installed multiple ECMPs for a route in the Routing Information Base (RIB) through TE tunnels and physical interfaces by default. This feature introduces the following command: • **mpls traffic-eng tunnel preferred**
32 IS-IS Instances	You can now configure up to 32 IS-IS instances, thus enhancing the ability to isolate resources within your router and on the network. This ability enables you to configure more instances consuming network-wide resources at different rates, giving you more flexibility to manage your networks efficiently. In earlier releases, you could configure up to16 IS-IS instances.

Feature	Description
Modular QoS	
MPLS EXP Marking for EVPN Multi-Homed Services	This feature enables you to differentiate traffic in the MPLS forwarding domain and manage traffic from ingress PE to egress PE based on the MPLS EXP bit of the MPLS header for EVPN multi-home scenarios.
Multicast	
Access Pseudowire in VPLS Bridge Domains	You can configure EVPN in the access node under the same bridge domain as EVPN in the core and create a pseudowire (PW) to the nearest PE that binds the access circuits using EVPN. This PW between the access PE and the single-homed PE ensures that the access nodes can leverage the benefits of EVPN.
Interface and Hardware Component	
Local LAG hashing with PPPoE traffic	Load Balancing for Link Aggregation (LAG) AC and Equal Cost Multipath (ECMP) for PPPoE traffic is now available on Cisco NCS 560 routers and operates in the native and compatible modes. This load balancing is achieved by distributing PPPoE traffic on all available links.
L2VPN and Ethernet Services	
Hierarchical EVPN Access Pseudowire	You can configure EVPN VPWS in the access node under the same bridge domain as EVPN in the core to build a PW to the nearest high-end PE that stitches those access circuits using EVPN. This allows the access nodes to leverage the benefits of EVPN. This feature also allows you to reduce the number of pseudowires (PWs) between the network provider edge (N-PE) devices by replacing PE devices with user provider edge (U-PE) and network provider edge (N-PE) devices.
Flow-Label Support on FAT-PW	This enhancement enables the MPLS OAM pings to work between Cisco devices and the third-party devices. Thus, allowing Flow-Aware Transport (FAT) Pseudowires (PW) to provide the load-balance capability across equal-cost multipath (ECMP) routes by adding a new label, called Flow Label, onto the bottom of the label stack.
Enhancement to the **show ethernet cfm** command to include LTR and LTM statistics	This enhancement adds statistics for Linktrace Messages (LTM) and Linktrace Replies (LTR) in the **show ethernet cfm local meps verbose** command output. Using LTM and LTR count, you can trace the source of network failure and track the path to a unicast destination MAC address.
CFM on EVPN ELAN	This feature introduces CFM support for single-homed EVPN Emulated Local Area Network (ELAN) services. This functionality helps you to monitor the ELAN services of users against their contractual service-level agreements (SLAs), thereby providing high speed Layer 2 and Layer 3 services with high resiliency and less operational complexity to different market segments.

Feature	Description
Configurable Recovery Time for EVPN Core Isolation Group	You can now configure the recovery time for the EVPN core isolation group after the core interfaces recover from a network failure. This functionality is important because post-failure recovery, you can provide sufficient time for the EVPN PE nodes to relearn the MAC addresses and BGP routes received from the remote PEs. There's also time to handle delays in exchanging EVPN routes after recovery. This feature introduces the **core-de-isolation** command under the EVPN Timers configuration mode.
MPLS	
Enhanced Targeted LDP Session Scale Values	With the unidimensional scale parameter value increased to 1999 on the router, you can now configure more targeted LDP sessions to discover extended neighbors.
Programmability	
Accounting Records for NETCONF Operations	Depending on the accounting configuration command you use, every NETCONF operation that the router performs is reported to the local server as syslog messages or remote AAA servers like TACACS+ as accounting messages, or both.
Segment Routing	
Programming Non-Active Candidate Paths of an SR Policy	By programming non-active candidate paths (CPs) in the forwarding plane, you ensure that if the existing active CP is unavailable, the traffic switches quickly to the new CP, thus minimizing loss of traffic flow. In earlier releases, instantiating a non-active CP to the forwarding plane after the unavailability of the active CP could take a few seconds, resulting in potential loss of traffic flow. This feature introduces the following command: • max-install-standby-cpaths
Hardware	

Feature	Description

Optics	**Note** Optics support varies across devices such as routers, line cards, and RPs. To know if an optics is compatible with a specific Cisco device, refer to the Transceiver Module Group (TMG) Compatibility Matrix.
	
	This release introduces the following optics:
	• Cisco 10GBASE SFP+ modules
	  • SFP-10G-AOCxxM
	  • SFP-H10GB-CUxxM
	  • SFP-H10GB-ACUxxM
	  • SFP-10G-ER=
	  • SFP-10G-ZR=
	  • SFP-10G-BXD-I=
	  • SFP-10G-BX40D-I=
	  • SFP-10G-BX40U-I
	• Cisco 2-Channel SFP WDM Transponder
	  • CWDM-SFP-xxxx
	  • DWDM-SFP-xxxx
	• Cisco 100GBASE Quad Small Form-Factor Pluggable (QSFP)
	  • QSFP-100G-AOCxxM
	• Cisco 25GBASE SFP28 (Small Form-Factor Pluggable)
	  • SFP-25G-AOCxM
	  • SFP-H25G-CUxM
	  • SFP-25G-ER-I
	• Cisco Small Form-Factor Pluggable (SFP) Gigabit Interface Converter
	  • SFP-GE-S
	  • GLC-SX-MM-RGD
	  • GLC-LX-SM-RGD
	  • GLC-ZX-SM-RGD
	• Cisco ONS Pluggable Optical Modules
	  • ONS-SC+-10G-SR

Feature	Description
PTP and Synchronous Ethernet (SyncE) 1G Mode on A900-IMA8Z-L interface modules	Based on the IEEE 1588-2008 standard, PTP is a protocol that synchronizes clocks in a network for networked measurement and control systems. With this release, timing support for IEEE 1588-2008 (PTPv2) and SyncE is extended to the A900-IMA8Z-L interface module in 1G Mode. For more information on the interface module slot and 1G mode support combinations on Cisco NCS 560-4 and Cisco NCS 560-7 routers, see Cisco N560-RSP4 and Cisco N560-RSP4-E Route Processor Hardware Installation Guide and Cisco NCS 560-4 Router Hardware Installation Guide.

Restrictions and Limitations on the Cisco NCS 560 Series Router

- The standby RP may get into '`NOT READY`' state intermittently due to some network churn, though the corresponding VM is up and running. But this is a transient state and shows that some data aren't in sync between active and standby due to the network churn. After both active and standby are in sync with respect to all the parameters, then the standby RP comes into '`READY`' state.
- Unlabeled BGP PIC EDGE for global prefixes is not supported.

Cisco IOS XR Caveats Release 7.6.1

Bug ID	Headline
CSCwb13103	IPv6 BFD packets getting control timer expired due to that ISIS OSPF protocols flapped during RPFO

Supported Packages and System Requirements

For more information on system upgrade and package installation process, see Perform System Upgrade and Install Feature Packages.

For a complete list of supported optics, hardware and ordering information, see the Cisco NCS 560 Series Routers Interface Modules Data Sheet and Cisco Network Convergence System 560-4 Router Data Sheet.

To install the Cisco NCS 560 Series Routers, see Cisco N560-RSP4 and Cisco N560-RSP4-E Route Processor Hardware Installation Guide and Cisco NCS 560-4 Router Hardware Installation Guide.

Release 7.6.1 Packages

This following table lists the supported packages and their corresponding file names.

Table 1: Release 7.6.1 Packages for Cisco NCS 560 Series Router

Composite Package		
Feature Set	**Filename**	**Description**
Cisco IOS XR IP Unicast Routing Core Bundle	ncs560-mini-x-7.6.1.iso	Contains base image contents that includes: • Host operating system • System Admin boot image • IOS XR boot image • BGP packages • OS • Admin • Base • Forwarding • Modular Services Card • Routing • SNMP Agent • Alarm Correlation
Cisco IOS XR Manageability Package	ncs560-mgbl-2.0.0.0-r761.x86_64.rpm	Telemetry, Extensible Markup Language (XML), Parser, and HTTP server packages, NETCONF, YANG Models, gRPC.
Cisco IOS XR OSPF package	ncs560-ospf-2.0.0.0-r761.x86_64.rpm	Supports OSPF
Cisco IOS XR Security Package	ncs560-k9sec-2.0.0.0-r761.x86_64.rpm	Support for Encryption, Decryption, Secure Shell (SSH), Secure Socket Layer (SSL), and Public-key infrastructure (PKI)
Multicast Package	ncs560-mcast-2.0.0.0-r761.x86_64.rpm	Supports Multicast Supports Automatic Multicast Tunneling (AMT), IGMP Multicast Listener Discovery (MLD), Multicast Label Distribution Protocol (MLDP), Multicast Source Discovery Protocol (MSDP) and PIM.

Composite Package		
Feature Set	**Filename**	**Description**
Cisco IOS XR ISIS package	ncs560-isis-2.0.0.0-r761.x86_64.rpm	Supports Intermediate System to Intermediate System (IS-IS).
Cisco IOS XR USB Boot Package	ncs560-usb_boot-7.6.1.zip	Supports Cisco IOS XR USB Boot Package
Cisco IOS XR MPLS Package	ncs560-mpls-1.0.0.0-r761.x86_64.rpm ncs560-mpls-te-rsvp-2.0.0.0-r761.x86_64.rpm	Supports MPLS and MPLS Traffic Engineering (MPLS-TE) RPM. Label Distribution Protocol (LDP), MPLS Forwarding, MPLS Operations, Administration, and Maintenance (OAM), Link Manager Protocol (LMP), Optical User Network Interface (OUNI) and Layer-3 VPN. Cisco IOS XR MPLS-TE and RSVP Package MPLS Traffic Engineering (MPLS-TE) and Resource Reservation Protocol (RSVP).
Cisco IOS XR LI Package	ncs560-li-1.0.0.0-r761.x86_64.rpm	Lawful Intercept
Cisco IOS XR EIGRP Package	ncs560-eigrp-1.0.0.0-r761.x86_64.rpm	(Optional) Includes EIGRP protocol support software

Determine Software Version

Log in to the router and enter the **show version** command.

```
RP/0/RP0/CPU0:R3_PE3_RSP4#show version
Tue Mar 29 16:22:57.094 IST
Cisco IOS XR Software, Version 7.6.1
Copyright (c) 2013-2022 by Cisco Systems, Inc.

Build Information:
 Built By     : ingunawa
 Built On     : Sat Mar 26 19:55:09 PDT 2022
 Built Host   : iox-ucs-052
 Workspace    : /auto/srcarchive17/prod/7.6.1/ncs560/ws
 Version      : 7.6.1
 Location     : /opt/cisco/XR/packages/
 Label        : 7.6.1

cisco NCS-560 () processor
System uptime is 1 day 4 hours 19 minutes
```

Determine Firmware Support

Log in to the router and enter the **show hw-module fpd** command to know the release image.

```
RP/0/RP0/CPU0:R3_PE3_RSP4#show fpd package
Thu Mar 31 16:35:04.767 IST

================================ ============================================
                                        Field Programmable Device Package
                                 ============================================
                                          Req      SW       Min Req   Min Req
Card Type            FPD Description      Reload   Ver      SW Ver    Board Ver
================== ========================== ====== ======= ======== =========
------------------------------------------------------------------------------
A900-IMA8CS1Z-CC     IMFPGA                  YES     1.113     1.113     0.0
------------------------------------------------------------------------------
A900-IMA8CS1Z-M      IMFPGA                  YES     1.113     1.113     0.0
------------------------------------------------------------------------------
A900-IMA8Z           IMFPGA                  YES    17.05     17.05      0.0
------------------------------------------------------------------------------
A900-IMA8Z-CC        IMFPGA                  YES    17.05     17.05      0.0
------------------------------------------------------------------------------
A900-IMA8Z-L         IMFPGA                  YES     1.49      1.49      0.0
------------------------------------------------------------------------------
A900-PWR1200-A       DCA-PriMCU(A)           NO      0.11      0.11      0.0
                     DCA-SecMCU(A)           NO      1.04      1.04      0.0
------------------------------------------------------------------------------
A900-PWR1200-D       LIT-PriMCU(A)           NO      2.04      0.04      0.0
                     LIT-SecMCU(A)           NO      1.23      1.23      0.0
------------------------------------------------------------------------------
A907-FAN-E           PSOC(A)                 NO      1.65      1.65      0.0
                     PSOC(A)                 NO      1.66      1.66      0.4
------------------------------------------------------------------------------
N560-4-FAN-H         PSOC(A)                 NO    177.02    177.02      0.0
------------------------------------------------------------------------------
N560-4-FAN-H-CC      PSOC(A)                 NO    177.02    177.02      0.0
------------------------------------------------------------------------------
N560-4-PWR-FAN       PSOC(A)                 NO    177.08    177.08      0.0
------------------------------------------------------------------------------
N560-4-PWR-FAN-CC    PSOC(A)                 NO    177.08    177.08      0.0
------------------------------------------------------------------------------
N560-4-RSP4          ADM(A)                  NO      1.06      1.06      0.0
                     IOFPGA(A)               YES     0.67      0.67      0.0
                     PRIMARY-BIOS(A)         YES     0.21      0.21      0.0
                     SATA(A)                 NO      2.10      2.10      0.0
                     SATA_MAR(A)             NO      1.30      1.30      0.0
------------------------------------------------------------------------------
N560-4-RSP4-CC       ADM(A)                  NO      1.06      1.06      0.0
                     IOFPGA(A)               YES     0.67      0.67      0.0
                     PRIMARY-BIOS(A)         YES     0.21      0.21      0.0
                     SATA(A)                 NO      2.10      2.10      0.0
                     SATA_MAR(A)             NO      1.30      1.30      0.0
------------------------------------------------------------------------------
N560-4-RSP4E         ADM(A)                  NO      1.06      1.06      0.0
                     IOFPGA(A)               YES     0.67      0.67      0.0
                     PRIMARY-BIOS(A)         YES     0.21      0.21      0.0
                     SATA(A)                 NO      2.10      2.10      0.0
                     SATA_MAR(A)             NO      1.30      1.30      0.0
------------------------------------------------------------------------------
N560-4-RSP4E-CC      ADM(A)                  NO      1.06      1.06      0.0
                     IOFPGA(A)               YES     0.67      0.67      0.0
                     PRIMARY-BIOS(A)         YES     0.21      0.21      0.0
                     SATA(A)                 NO      2.10      2.10      0.0
                     SATA_MAR(A)             NO      1.30      1.30      0.0
------------------------------------------------------------------------------
N560-FAN-H           PSOC(A)                 NO      2.02      2.02      0.0
------------------------------------------------------------------------------
N560-IMA-8Q/4L       IMFPGA                  YES     1.27      1.27      0.0
```

```
--------------------------------------------------------------------------------
N560-IMA1W           CFP2-D-DCO                NO     38.27397  38.27397   0.0
                     CFP2-DE-DCO               NO     38.27397  38.27397   0.0
                     CFP2-DET-DCO              NO     38.27397  38.27397   0.0
                     CFP2-DETS-DCO             NO     38.27397  38.27397   0.0
                     CFP2-DS-DCO               NO     38.27397  38.27397   0.0
                     CFP2-DS100-DCO            NO     38.27397  38.27397   0.0
                     IMFPGA                    YES     1.28      1.28      0.0
--------------------------------------------------------------------------------
N560-IMA2C           IMFPGA                    YES     5.07      5.07      0.0
--------------------------------------------------------------------------------
N560-IMA2C-CC        IMFPGA                    YES     5.07      5.07      0.0
--------------------------------------------------------------------------------
N560-IMA2C-DD        IMFPGA                    YES     1.28      1.28      0.0
                     QDD_100_FW_P0             NO    161.10    161.10     0.0
                     QDD_100_FW_P1             NO    161.10    161.10     0.0
--------------------------------------------------------------------------------
N560-IMA2C-L         IMFPGA                    YES     1.28      1.28      0.0
--------------------------------------------------------------------------------
N560-PWR1200-D-E     QCS-PriMCU(A)             NO      1.82      1.82      0.0
                     QCS-SecMCU(A)             NO      1.84      1.84      0.0
--------------------------------------------------------------------------------
N560-RSP4            ADM(A)                    NO      1.06      1.06      0.0
                     IOFPGA(A)                 YES     0.67      0.67      0.0
                     PRIMARY-BIOS(A)           YES     0.21      0.21      0.0
                     SATA(A)                   NO      2.10      2.10      0.0
                     SATA_MAR(A)               NO      1.30      1.30      0.0
--------------------------------------------------------------------------------
N560-RSP4-E          ADM(A)                    NO      1.06      1.06      0.0
                     IOFPGA(A)                 YES     0.67      0.67      0.0
                     PRIMARY-BIOS(A)           YES     0.21      0.21      0.0
                     SATA(A)                   NO      2.10      2.10      0.0
                     SATA_MAR(A)               NO      1.30      1.30      0.0
--------------------------------------------------------------------------------
NCS4200-1T16G-PS     IMFPGA                    YES     1.113     1.113     0.0
--------------------------------------------------------------------------------
NCS4200-2H-PQ        IMFPGA                    YES     5.07      5.07      0.0
--------------------------------------------------------------------------------
NCS4200-8T-PS        IMFPGA                    YES    17.05     17.05      0.0
```

Log in to the router and enter the **show hw-module fpd** command to know the current version.

```
RP/0/RP0/CPU0:R3_PE3_RSP4#show hw-module fpd
Tue Mar 29 16:23:02.242 IST

Auto-upgrade:Disabled

                                                                 FPD Versions
                                                                 ==============
Location   Card type              HWver FPD device       ATR Status    Running   Programd
--------------------------------------------------------------------------------------
0/4        A900-IMA8CS1Z-M        0.0   IMFPGA              CURRENT     1.113     1.113
0/6        A900-IMA8CS1Z-M        0.0   IMFPGA              CURRENT     1.113     1.113
0/7        N560-IMA2C             0.0   IMFPGA              CURRENT     5.07      5.07
0/9        N560-IMA-8Q/4L         0.0   IMFPGA              CURRENT     1.27      1.27
0/10       A900-IMA8Z-L           0.0   IMFPGA              CURRENT     1.49      1.49
0/11       A900-IMA8Z             0.0   IMFPGA              CURRENT    17.05     17.05
0/RP0      N560-RSP4-E            0.0   ADM                 CURRENT     1.06      1.06
0/RP0      N560-RSP4-E            0.0   IOFPGA              CURRENT     0.67      0.67
0/RP0      N560-RSP4-E            0.0   PRIMARY-BIOS        CURRENT     0.21      0.21
0/RP0      N560-RSP4-E            0.0   SATA                CURRENT     2.10      2.10
0/RP1      N560-RSP4-E            0.0   ADM                 CURRENT     1.06      1.06
0/RP1      N560-RSP4-E            0.0   IOFPGA              CURRENT     0.67      0.67
0/RP1      N560-RSP4-E            0.0   PRIMARY-BIOS        CURRENT     0.21      0.21
0/RP1      N560-RSP4-E            0.0   SATA                CURRENT     2.10      2.10
0/FT0      A907-FAN-E             1.0   PSOC                CURRENT     1.65      1.65
```

Important Notes

Supported Transceiver Modules

For more information on the supported transceiver modules, see Transceiver Module Group (TMG) Compatibility Matrix. In the **Begin your Search** search box, enter the keyword NCS560 and click **Enter**.

Upgrading Cisco IOS XR Software

Cisco IOS XR Software is installed and activated from modular packages, allowing specific features or software patches to be installed, upgraded, or downgraded without affecting unrelated processes. Software packages can be upgraded or downgraded on all supported card types, or on a single card (node).

The upgrade document for Cisco NCS 560 router is available along with the software image in *NCS560_Upgrade_MOP_7.6.1.tar* file.

Use user-class Option 'xr-config' Instead Of 'exr-config' To Provision ZTP

In Cisco IOS XR Release 7.3.1 and earlier, the system accepts the device sending **user-class = "exr-config"**; however starting Cisco IOS XR Release 7.3.2 and later, you must use only **user-class = "xr-config"**.

In Cisco IOS XR Release 7.3.2 and later, use:

```
host cisco-rp0 {
   hardware ethernet e4:c7:22:be:10:ba;
   fixed-address 172.30.12.54;
   if exists user-class and option user-class = "iPXE" {
      filename = "http://172.30.0.22/boot.ipxe";
   } elsif exists user-class and option user-class = "xr-config" {
      filename = "http://172.30.0.22/scripts/cisco-rp0_ztp.sh";
   }
}
```

Additional References

Supported MIBs

The Cisco NCS 5500 MIB support list is also applicable to the Cisco NCS 560 Series Routers. For the list of supported MIBs, see the Cisco NCS5500 MIB Support List.