Release Notes for Cisco NCS 6000 Series Routers, IOS XR Release 7.4.1

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The Cisco Network Convergence System (NCS) 6000 series router delivers outstanding network agility, packet optical convergence, and a system scale measured in petabits per second. It also facilitates the build-out of next-generation core to:

- support elastic capacity at the lowest total ownership cost
- deliver high-bandwidth mobile, video, and cloud services

Running the Cisco IOS XR operating system, Cisco's innovative virtualized operating environment, the Cisco NCS 6000 series router advances the concept of distributed routing and virtualization. With Cisco Virtualized IOS XR, the Cisco NCS 6000 series router brings new levels of programmability and virtualization to:

- enhance application service offerings
- increase provisioning speed
- optimize network economics

The Cisco NCS 6000 series router is engineered for environmental efficiency, with the use of adaptable power consumption. The Cisco NCS 6000 series router is powered by the Cisco nPower Network Processor Units (NPU). These technologies aid the Cisco NCS 6000 series router to achieve the lowest carbon footprint in service provider routing.

The Cisco NCS 6008 router, part of the Cisco NCS 6000 series routers, is the next-generation core routing system that provides industry-leading 8 Tbps of full-duplex network bandwidth through single chassis with eight line cards per chassis.

The Cisco NCS 6008 router runs on Cisco IOS XR software with Linux as the underlying host operating system. A Kernel-based Virtual Machine (KVM) hypervisor provides a virtualized environment to independently run system administration and routing functions on separate virtual machines. This provision makes the new system versatile and robust, and provides immense flexibility for future expansion without the need for a complete system overhaul.

A multi-slice architecture of line cards enables the system to be configured in a mixed operating mode, simultaneously supporting traffic at 10 Gbps and 100 Gbps on slice-level granularity.

For a list of software caveats that apply to this Release, see the Caveats section. The caveats are updated for every release and are described at http://www.cisco.com.

What's New in Cisco IOS XR Release 7.4.1

Cisco is continuously enhancing the product with every release and this section covers a brief description of key features and enhancements. It also includes links to detailed documentation, where available.

Feature	Description
IP Addresses and Services	
Virtual IP Address in Network Stack	This feature enables the network stack to support the use of virtual IP addresses by IOS XR or third-party applications that utilize the Linux networking stack. Virtual addresses can now be configured to access a router from the management network using a single virtual IP address.

Feature	Description
Programmability	
CLI to YANG Mapping Tool	This tool provides a quick reference for IOS XR CLIs and a corresponding YANG data model that could be used. New command introduced for this feature: **yang describe**
Transitioning Native Models to Unified Models (UM)	Unified models are CLI-based YANG models that are designed to replace the native schema-based models. UM models are generated directly from the IOS XR CLIs and mirror them in several ways. This results in improved usability and faster adoption of YANG models. You can access the new unified models from the Github repository.
Unique Commit ID for Configuration State	The network orchestrator is a central point of management for the network and typical workflow involves synchronizing the configuration states of the routers it manages. Loading configurations for comparing the states involves unnecessary data and subsequent comparisons are load intensive. This feature synchronizes the configuration states between the orchestrator and the router using a unique commit ID that the router maintains for each configuration commit. The orchestrator retrieves this commit ID from the router using NETCONF Remote Procedure Calls (RPCs) to identify whether the router has the latest configuration.
System Management	
BGP Egress Peer Engineering (EPE) over CSI interfaces	This feature allows a BGP neighbor established over a CSI interface to be allocated a BGP Egress Peer Engineering (EPE) segment.
Explicit Binding SID over CSI Interfaces	This feature allows you to configure an explicit binding SID (BSID) over a CSI interface.
System Security	
Admin Access for NETCONF and gRPC Sessions	This feature allows all authorized users on XR VM to access the admin data on the router through NETCONF or gRPC interface, similar to accessing the CLI. This functionality works by internally mapping the task group of the user on XR VM to a predefined group on System Admin VM. Therefore, the NETCONF and gRPC users can access the admin-related information on the router even if their user profiles do not exist on System Admin VM. Prior to this release, only those users who were authorized on XR VM could access System Admin VM through CLI, by using the **admin** command. Users that were not configured on System Admin VM were denied access through NETCONF or gRPC interface.
Hold-Down Timer for TACACS+	TACACS+ servers provide AAA services to the user. In the event a TACACS+ server becomes unreachable, the router sends the client request to another server, leading to considerable delay in addressing the requests. To prevent this delay, you can set a hold-down timer on the router. The timer gets triggered after the router marks the TACACS+ server as down. During this period, the router does not select the server that is down for processing any client requests. When the timer expires, the router starts using that TACACS+ server for client transactions. This feature improves latency in providing AAA services to the user by limiting the client requests from being sent to unresponsive servers. This feature introduces the **holddown-time** command.

Feature	Description
NETCONF Access Control Model (NACM) for Protocol Operations and Authorization	NACM is defined in AAA subsystem to manage access control for NETCONF Remote Procedure Calls (RPCs). NACM addresses the need to authenticate the user or user groups, authorize whether the user has the required permission to perform the operation. With this feature, you can configure the authorization rules, groups and rule lists containing multiple groups and rules using CLI commands in addition to existing support for YANG data models. This feature also introduces `Cisco-IOS-XR-um-aaa-nacm-cfg.yang` unified data model to configure user access and privileges. You can access this data model from the Github repository.
Telemetry	
Filter Telemetry Data Using Regex Keys in Sensor Paths	Streaming huge telemetry data can create congestion in the network. With this feature, you can use the regular expression (regex) keys in the sensor path configuration on the router. The keys limit the amount of data that can be streamed, thereby ensuring better bandwidth utilization.
In-band Telemetry with Multi-VRF and Bundle VLAN Interfaces	With this feature, in-band telemetry data is sent over the data ports of line cards using the gRPC protocol. This method of data streaming overcomes bandwidth limitations that are otherwise seen when data is sent via the management ports. This feature can be enabled on more than one VRF entity. In addition, data can be transmitted and received from the router to the collector via VLAN IDs configured on the router and the collector.
Virtual Private Network	
PWHE Load Balancing using FAT Label	This feature allows you to generate a flow-aware transport (FAT) label for the traffic going out of the PWHE-L3 interface on the PE device. P routers use the FAT label to load balance the traffic based on the flow but not on the VC label. This feature provides a better traffic distribution across ECMP paths.

Caveats

Caveats describe unexpected behavior in Cisco IOS XR Software releases. Severity-1 caveats are the most critical caveats; severity-2 caveats are less critical.

Caveats Specific to the NCS 6000 Series Routers

Table 1: Cisco NCS 6000 Series Router Specific Bugs

Bug ID	Headline
CSCvy67769	SRTE forwarding counters not shown for CSI interface
CSCvy99157	Yang response of "show install active" showing non xr packages.

Release 7.4.1 Packages

This table lists the Cisco IOS XR Software feature set matrix (packages) and associated filenames available for the Cisco IOS XR Software Release 7.4.1 that is supported on the Cisco NCS 6008 router.

Table 2: Cisco IOS XR Software Release 7.4.1 Packages

Feature Set	Filename	Description
Composite Package		
Cisco IOS XR IP Unicast Routing Core Bundle	ncs6k-mini-x.iso-7.4.1	Contains required core packages, including OS, Admin, Base, Forwarding, Modular Services Card, Routing, SNMP Agent, FPD, and Alarm Correlation.
Optional Individual Packages (packages that are installed individually)		
Cisco IOS XR Manageability Package	ncs6k-mgbl.pkg-7.4.1	Extensible Markup Language (XML) Parser and HTTP server packages.
Cisco IOS XR MPLS Package	ncs6k-mpls.pkg-7.4.1	MPLS Traffic Engineering (MPLS-TE), Label Distribution Protocol (LDP), MPLS Forwarding, MPLS Operations, Administration, and Maintenance (OAM), Link Manager Protocol (LMP), Optical User Network Interface (OUNI), Resource Reservation Protocol (RSVP), and Layer-3 VPN.
Cisco IOS XR Multicast Package	ncs6k-mcast.pkg-7.4.1	Multicast Routing Protocols (PIM, Multicast Source Discovery Protocol [MSDP], Internet Group Management Protocol [IGMP], Auto-RP), Tools (SAP, MTrace), and Infrastructure [(Multicast Routing Information Base [MRIB], Multicast-Unicast RIB [MURIB], Multicast forwarding [MFWD]).
Cisco IOS XR Security Package	ncs6k-k9sec.pkg-7.4.1	Support for Encryption, Decryption, IP Security (IPSec), Secure Shell (SSH), Secure Socket Layer (SSL), and Public-key infrastructure (PKI) (Software based IPSec support—maximum of 500 tunnels)
Cisco IOS XR Lawful Intercept (LI) Package	ncs6k-li.pkg-7.4.1	Supports Lawful Intercept (LI) features.
Cisco IOS XR Documentation Package	ncs6k-doc.pkg-7.4.1	*.man* pages for Cisco IOS XR Software.

Determining Installed Active Packages

To determine active software packages installed on the router, log in to the router and enter the **show install active summary** command in EXEC mode:

```
RP/0/RP0/CPU0:router# show install active
Label : 7.4.1

    Active Packages: 7
```

```
ncs6k-xr-7.4.1 version=7.4.1 [Boot image]
ncs6k-doc-1.0.0.0-r741
ncs6k-li-1.0.0.0-r741
ncs6k-mcast-1.0.0.0-r741
ncs6k-mgbl-1.0.0.0-r741
ncs6k-mpls-1.0.0.0-r741
ncs6k-k9sec-1.0.0.0-r741
```

Supported Packages and System Requirements

This section describes the system requirements for Cisco NCS 6000 Series Routers for Software Release .

Memory Requirements

The minimum memory requirements for a Cisco NCS 6008 router running Cisco IOS XR Software Release consist of the following:

- 48 GB memory on the NCS 6008 Route Processors (NCS6-RP)

- 16 GB memory on 1T line cards

- 32 GB memory on 2T line cards

In order to avoid low memory conditions during system operations, it is recommended that you have 2000MB of free memory available on the Route Processors.

Supported Hardware

The following table lists the supported hardware components on the Cisco NCS 6000 Series Router and the minimum required software release. For more information, see the *Firmware Support* section.

Table 3: Cisco NCS 6008 Router Hardware and Software Compatibility Matrix

Component	Part Number	Support from Release
20-port 100Gbps Lean Core PAYG Line Card	NC6-10/20X100G-L-C	7.1.1
20-port 100Gbps Multi-Service PAYG Line Card	NC6-10/20X100G-M	7.1.1
Second-generation S2 fabric card for the FCC with 32 CXP2 ports for 270GE SR25 CXP2s	NCS-F-FC2	6.3.2
CXP2 - 270GE SR25 transceiver module	ONS-CXP2-SR25	6.3.2
96 ONS-CXP2-SR25 optical modules	NCS-FAB-OPT2	6.3.2
Cisco 100GBASE SR4 QSFP Transceiver Cisco 100GBASE LR4 QSFP Transceiver	QSFP-100G-SR4-S QSFP-100G-LR4-S	6.2.2
20-port 100Gbps Lean Core	NC6-20X100GE-L-C	6.2.2
20-port 100Gbps Multi-Service Core	NC6-20X100GE-M-C	6.2.2

Component	Part Number	Support from Release
Universal Fabric Card	NC6-FC2-U	6.2.1
Cisco NCS 6008 FT, version 2	NC6-FANTRAY-2	6.1.2
CPAK optical transceiver module, 100GBASE-SR4, 100m OM4	CPAK-100G-SR4	6.1.2
S13 fabric card for LCC with16 CXP ports for 100GE SR optics	NC6-FC-MC	5.2.1
S13 fabric card for LCC with16 CXP ports for 100GE SR optics Spare	NC6-FC-MC=	5.2.1
S2 fabric card for the FCC with 32 CXP ports for 100GE SR12 CXPs	NCS-F-FC	5.2.1
S2 fabric card for the FCC with 32 CXP ports for 100GE SR12 CXPs Spare	NCS-F-FC=	5.2.1
FCC shelf controllers	NCS-F-SC	5.2.1
FCC shelf controllers Spare	NCS-F-SC=	5.2.1
FCC shelf controller and switch (SC-SW) card	NCS-F-SCSW	5.2.1
FCC shelf controller and switch (SC-SW) card Spare	NCS-F-SCSW=	5.2.1
Short reach SFP 10GE transceiver module	SFP-10G-SR	5.2.1
Long reach SFP 10GE transceiver module	SFP-10G-LR	5.2.1
Short reach QSFP 40GE optical module (SC-SW card only)	QSFP-40G-SR4	5.2.1
Long reach QSFP 40GE optical module (SC-SW card only)	QSFP-40G-LR4	5.2.1
96 CXP-100G-SR12 optical module	NCS-FAB-OPT	5.2.1
2X100GE MS PAYG Card with CPAK	NC6-2-10x100G-M-K	5.2.1
2X100GE LSR PAYG Card with CPAK	NC6-2-10x100G-L-K	5.2.1
30x10GE MS PAYG Card with SFPP	NC6-30x10G-M-S	5.2.1
30x10GE LSR PAYG Card with SFPP	NC6-30x10G-L-S	5.2.1
Craft Panel	NCS-CRFT	5.2.1
60-port 10Gbps SFP+ Lean Core Line card	NC6-60X10GE-L-S	5.0.1

Component	Part Number	Support from Release
60-port 10Gbps SFP+ Multi-Service Core Line card	NC6-60X10GE-M-S	5.0.1
Cisco 10GBASE-SR SFP+ Module for MMF	SFP-10G-SR	5.0.1
Cisco 10GBASE-SR SFP+ Module for MMF, extended temperature range	SFP-10G-SR-X	5.0.1
Cisco 10GBASE-LR SFP+ Module for SMF	SFP-10G-LR	5.0.1
Cisco multirate 10GBASE-LR, 10GBASE-LW and OTU2e SFP+ Module for SMF, extended temperature range	SFP-10G-LR-X	5.0.1
Cisco 10GBASE-ER SFP+ Module for SMF	SFP-10G-ER	5.0.1
Cisco 10GBASE-ZR SFP+ Module for SMF	SFP-10G-ZR	5.0.1
NCS 6008 - 8-Slot Chassis	NCS-6008	5.0.0
NCS 6008 Fabric Card	NC6-FC	5.0.0
NCS 6008 Route Processor	NC6-RP	5.0.0
NCS 6008 Chassis Fan Tray	NC6-FANTRAY	5.0.0
NCS AC Power Tray	NCS-AC-PWRTRAY	5.0.0
NCS DC Power Tray	NCS-DC-PWRTRAY	5.0.0
NCS PDU Bracket	NCS-PDU-BRKT	5.0.0
NCS 6008 3-to-1 Phase DELTA PDU	NCS-PDU-DELTA	5.0.0
NCS 6008 3-to-1 Phase WYE PDU	NCS-PDU-WYE	5.0.0
NCS 100x10GE Patch Panel Short Reach	NCS-PP-100X10-SR	5.0.0
NCS 6000 10x100G Multi-Service CPAK	NC6-10X100G-M-K	5.0.0
NCS 6000 10x100G Multi-Service CXP	NC6-10X100G-M-P	5.0.0
NCS 6000 10x100G LSR CPAK	NC6-10X100G-L-K	5.0.0
NCS 6000 10x100G LSR CXP	NC6-10X100G-L-P	5.0.0
NCS Craft Panel Display Kit	NCS-CRFT	5.0.0
NCS 6008 Chassis Front Doors	NC6-DOOR-F	5.0.0
NCS 6008 Chassis Rear Doors	NC6-DOOR-R	5.0.0
NCS 6008 Chassis Drill Template	NC6-DRILLTEMP	5.0.0

Component	Part Number	Support from Release
NCS 6008 Chassis Front-Bottom Grille	NC6-GRILLE-FB	5.0.0
NCS 6008 Chassis Front-Top Grille	NC6-GRILLE-FT	5.0.0
NCS 6008 Chassis Rear Grille	NC6-GRILLE-R	5.0.0
NCS 6008 Power Control Module	NC6-PCM	5.0.0
NCS 6008 Chassis Trough	NC6-TROUGH	5.0.0
NCS 6008 Chassis Trough Wide	NC6-TROUGH-W	5.0.0
NCS 6008 & NCS Fabric Chassis Lift Dolly	NCS-LIFT	5.0.0
10X10G-LR Cisco CPAK module for SMF	CPAK-10X10G-LR	5.0.0
CPAK-100G-LR4 Transceiver module, 10 km SMF	CPAK-100G-LR4	5.0.0
CXP-100G-SR10 transceiver Module	CXP-100G-SR10	5.0.0

Firmware Support

To check the firmware code running on the Cisco NCS 6000 Series Router, run the **show fpd package** command in admin mode.

```
RP/0/RP0/CPU0:router(admin)#show fpd package


================================ ==================================================
                                            Field Programmable Device Package
                                 ==================================================
                                 Req    SW      Min Req   Min Req
Card Type             FPD Description            Reload Ver     SW Ver  Board Ver
==================  ==========================  ======  =======  ========  =========
------------------------------------------------------------------------------
NC6-10X100G-L-K       Backup-BIOS(A)             YES    14.09   14.00      0.0
                      Backup-CCC-PwrOn(A)        NO      1.39    1.31      0.0
                      Backup-EthSwitch(A)        YES     1.33    1.32      0.0
                      BAO-DB-FPGA(A)             NO      1.06    1.06      0.0
                      BAO-MB-FPGA(A)             NO      1.06    1.06      0.0
                      CCC-Bootloader(A)          YES     2.12    2.07      0.0
                      CCC-FPGA(A)                YES     2.12    2.12      0.0
                      CCC-Power-On(A)            NO      1.41    1.41      0.0
                      Ethernet-Switch(A)         YES     1.33    1.33      0.0
                      LTC2978_540867_ISP(A)      YES     1.00    1.00      0.0
                      PLX-8748(A)                YES     0.05    0.05      0.1
                      Primary-BIOS(A)            YES    14.09   14.09      0.0
                      S2-GN2411(A)               YES     5.86    5.86      2.0
                      S2-GN2411(A)               YES     7.58    7.58      0.0
                      S3-GN2411(A)               YES     5.86    5.86      2.0
                      S3-GN2411(A)               YES     7.58    7.58      0.0
                      S4-GN2411(A)               YES     5.86    5.86      2.0
                      S4-GN2411(A)               YES     7.58    7.58      0.0
                      SB Backup Key(A)           NO      1.00    1.00      0.0
                      SB Certificates(A)         NO      1.00    1.00      0.0
                      SB Primary Key(A)          NO      1.00    1.00      0.0
                      SMART-iSATA(A)             NO      7.05    7.05      0.0
                      SMART-SATA(A)              NO      7.05    7.05      0.0
------------------------------------------------------------------------------
```

```
NC6-10X100G-L-P      Backup-BIOS(A)              YES    14.09    14.00    0.0
                     Backup-CCC-PwrOn(A)         NO      1.39     1.31    0.0
                     Backup-EthSwitch(A)         YES     1.33     1.32    0.0
                     BAO-DB-FPGA(A)              NO      1.06     1.06    0.0
                     BAO-MB-FPGA(A)              NO      1.06     1.06    0.0
                     CCC-Bootloader(A)           YES     2.12     2.07    0.0
                     CCC-FPGA(A)                 YES     2.12     2.12    0.0
                     CCC-Power-On(A)             NO      1.41     1.41    0.0
                     Ethernet-Switch(A)          YES     1.33     1.33    0.0
                     LTC2978_540869_ISP(A)       YES     1.00     1.00    0.0
                     PLX-8748(A)                 YES     0.05     0.05    0.1
                     Primary-BIOS(A)             YES    14.09    14.09    0.0
                     S2-GN2411(A)                YES     5.86     5.86    2.0
                     S2-GN2411(A)                YES     7.58     7.58    0.0
                     S3-GN2411(A)                YES     5.86     5.86    2.0
                     S3-GN2411(A)                YES     7.58     7.58    0.0
                     S4-GN2411(A)                YES     5.86     5.86    2.0
                     S4-GN2411(A)                YES     7.58     7.58    0.0
                     SB Backup Key(A)            NO      1.00     1.00    0.0
                     SB Certificates(A)          NO      1.00     1.00    0.0
                     SB Primary Key(A)           NO      1.00     1.00    0.0
                     Slice-0-GN2411(A)           YES     5.86     5.86    2.0
                     Slice-0-GN2411(A)           YES     7.58     7.58    0.0
                     Slice-1-GN2411(A)           YES     5.86     5.86    2.0
                     Slice-1-GN2411(A)           YES     7.58     7.58    0.0
                     Slice-2-GN2411(A)           YES     5.86     5.86    2.0
                     Slice-2-GN2411(A)           YES     7.58     7.58    0.0
                     Slice-3-GN2411(A)           YES     5.86     5.86    2.0
                     Slice-3-GN2411(A)           YES     7.58     7.58    0.0
                     Slice-4-GN2411(A)           YES     5.86     5.86    2.0
                     Slice-4-GN2411(A)           YES     7.58     7.58    0.0
                     SMART-iSATA(A)              NO      7.05     7.05    0.0
                     SMART-SATA(A)               NO      7.05     7.05    0.0
--------------------------------------------------------------------------------
NC6-10X100G-M-K      Backup-BIOS(A)              YES    14.09    14.00    0.0
                     Backup-CCC-PwrOn(A)         NO      1.39     1.31    0.0
                     Backup-EthSwitch(A)         YES     1.33     1.32    0.0
                     BAO-DB-FPGA(A)              NO      1.06     1.06    0.0
                     BAO-MB-FPGA(A)              NO      1.06     1.06    0.0
                     CCC-Bootloader(A)           YES     2.12     2.07    0.0
                     CCC-FPGA(A)                 YES     2.12     2.12    0.0
                     CCC-Power-On(A)             NO      1.41     1.41    0.0
                     Ethernet-Switch(A)          YES     1.33     1.33    0.0
                     PLX-8748(A)                 YES     0.05     0.05    0.1
                     Primary-BIOS(A)             YES    14.09    14.09    0.0
                     S2-GN2411(A)                YES     5.86     5.86    2.0
                     S2-GN2411(A)                YES     7.58     7.58    0.0
                     S3-GN2411(A)                YES     5.86     5.86    2.0
                     S3-GN2411(A)                YES     7.58     7.58    0.0
                     S4-GN2411(A)                YES     5.86     5.86    2.0
                     S4-GN2411(A)                YES     7.58     7.58    0.0
                     SB Backup Key(A)            NO      1.00     1.00    0.0
                     SB Certificates(A)          NO      1.00     1.00    0.0
                     SB Primary Key(A)           NO      1.00     1.00    0.0
                     SMART-iSATA(A)              NO      7.05     7.05    0.0
                     SMART-SATA(A)               NO      7.05     7.05    0.0
--------------------------------------------------------------------------------
NC6-10X100G-M-P      Backup-BIOS(A)              YES    14.09    14.00    0.0
                     Backup-CCC-PwrOn(A)         NO      1.39     1.31    0.0
                     Backup-EthSwitch(A)         YES     1.33     1.32    0.0
                     BAO-DB-FPGA(A)              NO      1.06     1.06    0.0
                     BAO-MB-FPGA(A)              NO      1.06     1.06    0.0
                     CCC-Bootloader(A)           YES     2.12     2.07    0.0
                     CCC-FPGA(A)                 YES     2.12     2.12    0.0
```

```
                     CCC-Power-On(A)        NO    1.41    1.41    0.0
                     Ethernet-Switch(A)     YES   1.33    1.33    0.0
                     PLX-8748(A)            YES   0.05    0.05    0.1
                     Primary-BIOS(A)        YES  14.09   14.09    0.0
                     S2-GN2411(A)           YES   5.86    5.86    2.0
                     S2-GN2411(A)           YES   7.58    7.58    0.0
                     S3-GN2411(A)           YES   5.86    5.86    2.0
                     S3-GN2411(A)           YES   7.58    7.58    0.0
                     S4-GN2411(A)           YES   5.86    5.86    2.0
                     S4-GN2411(A)           YES   7.58    7.58    0.0
                     SB Backup Key(A)       NO    1.00    1.00    0.0
                     SB Certificates(A)     NO    1.00    1.00    0.0
                     SB Primary Key(A)      NO    1.00    1.00    0.0
                     Slice-0-GN2411(A)      YES   5.86    5.86    2.0
                     Slice-0-GN2411(A)      YES   7.58    7.58    0.0
                     Slice-1-GN2411(A)      YES   5.86    5.86    2.0
                     Slice-1-GN2411(A)      YES   7.58    7.58    0.0
                     Slice-2-GN2411(A)      YES   5.86    5.86    2.0
                     Slice-2-GN2411(A)      YES   7.58    7.58    0.0
                     Slice-3-GN2411(A)      YES   5.86    5.86    2.0
                     Slice-3-GN2411(A)      YES   7.58    7.58    0.0
                     Slice-4-GN2411(A)      YES   5.86    5.86    2.0
                     Slice-4-GN2411(A)      YES   7.58    7.58    0.0
                     SMART-iSATA(A)         NO    7.05    7.05    0.0
                     SMART-SATA(A)          NO    7.05    7.05    0.0
--------------------------------------------------------------------------------
NC6-2/10X100G-L-K    Backup-BIOS(A)         YES  14.09   14.00    0.0
                     Backup-CCC-PwrOn(A)    NO    1.39    1.31    0.0
                     Backup-EthSwitch(A)    YES   1.33    1.32    0.0
                     BAO-DB-FPGA(A)         NO    1.06    1.06    0.0
                     BAO-MB-FPGA(A)         NO    1.06    1.06    0.0
                     CCC-Bootloader(A)      YES   2.12    2.07    0.0
                     CCC-FPGA(A)            YES   2.12    2.12    0.0
                     CCC-Power-On(A)        NO    1.41    1.41    0.0
                     Ethernet-Switch(A)     YES   1.33    1.33    0.0
                     PLX-8748(A)            YES   0.05    0.05    0.1
                     Primary-BIOS(A)        YES  14.09   14.09    0.0
                     S2-GN2411(A)           YES   5.86    5.86    2.0
                     S2-GN2411(A)           YES   7.58    7.58    0.0
                     S3-GN2411(A)           YES   5.86    5.86    2.0
                     S3-GN2411(A)           YES   7.58    7.58    0.0
                     S4-GN2411(A)           YES   5.86    5.86    2.0
                     S4-GN2411(A)           YES   7.58    7.58    0.0
                     SB Backup Key(A)       NO    1.00    1.00    0.0
                     SB Certificates(A)     NO    1.00    1.00    0.0
                     SB Primary Key(A)      NO    1.00    1.00    0.0
                     SMART-iSATA(A)         NO    7.05    7.05    0.0
                     SMART-SATA(A)          NO    7.05    7.05    0.0
--------------------------------------------------------------------------------
NC6-2/10X100G-M-K    Backup-BIOS(A)         YES  14.09   14.00    0.0
                     Backup-CCC-PwrOn(A)    NO    1.39    1.31    0.0
                     Backup-EthSwitch(A)    YES   1.33    1.32    0.0
                     BAO-DB-FPGA(A)         NO    1.06    1.06    0.0
                     BAO-MB-FPGA(A)         NO    1.06    1.06    0.0
                     CCC-Bootloader(A)      YES   2.12    2.07    0.0
                     CCC-FPGA(A)            YES   2.12    2.12    0.0
                     CCC-Power-On(A)        NO    1.41    1.41    0.0
                     Ethernet-Switch(A)     YES   1.33    1.33    0.0
                     PLX-8748(A)            YES   0.05    0.05    0.1
                     Primary-BIOS(A)        YES  14.09   14.09    0.0
                     S2-GN2411(A)           YES   5.86    5.86    2.0
                     S2-GN2411(A)           YES   7.58    7.58    0.0
                     S3-GN2411(A)           YES   5.86    5.86    2.0
                     S3-GN2411(A)           YES   7.58    7.58    0.0
```

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                       S4-GN2411(A)              YES     5.86      5.86      2.0
                       S4-GN2411(A)              YES     7.58      7.58      0.0
                       SB Backup Key(A)          NO      1.00      1.00      0.0
                       SB Certificates(A)        NO      1.00      1.00      0.0
                       SB Primary Key(A)         NO      1.00      1.00      0.0
                       SMART-iSATA(A)            NO      7.05      7.05      0.0
                       SMART-SATA(A)             NO      7.05      7.05      0.0
-------------------------------------------------------------------------------
NC6-20X100GE-L-C       Backup-BIOS(A)            YES     1.08      1.08      0.1
                       Backup-CCC-PwrOn(A)       NO      1.11      1.10      0.0
                       Backup-EthSwitch(A)       YES     1.00      1.00      0.0
                       Backup-EthSwitch(A)       YES     1.14      1.14      0.2
                       Backup-SolDBfpga(A)       NO      1.04      1.04      0.0
                       Backup-SolMBfpga(A)       NO      1.04      1.04      0.0
                       CCC-Bootloader(A)         YES     1.08      1.08      0.0
                       CCC-FPGA(A)               YES     1.08      1.08      0.0
                       CCC-Power-On(A)           NO      1.11      1.11      0.0
                       Ethernet-Switch(A)        YES     1.00      1.00      0.0
                       Ethernet-Switch(A)        YES     1.14      1.14      0.2
                       PLX-8749(A)               YES     0.06      0.06      0.1
                       Primary-BIOS(A)           YES     1.08      1.08      0.1
                       SB Backup Key(A)          NO      1.00      1.00      0.0
                       SB Certificates(A)        NO      1.00      1.00      0.0
                       SB Primary Key(A)         NO      1.00      1.00      0.0
                       SOL-DB-FPGA(A)            NO      1.04      1.04      0.0
                       SOL-MB-FPGA(A)            NO      1.04      1.04      0.0
-------------------------------------------------------------------------------
NC6-20X100GE-M-C       Backup-BIOS(A)            YES     1.08      1.08      0.1
                       Backup-CCC-PwrOn(A)       NO      1.11      1.10      0.0
                       Backup-EthSwitch(A)       YES     1.00      1.00      0.0
                       Backup-EthSwitch(A)       YES     1.14      1.14      0.2
                       Backup-SolDBfpga(A)       NO      1.04      1.04      0.0
                       Backup-SolMBfpga(A)       NO      1.04      1.04      0.0
                       CCC-Bootloader(A)         YES     1.08      1.08      0.0
                       CCC-FPGA(A)               YES     1.08      1.08      0.0
                       CCC-Power-On(A)           NO      1.11      1.11      0.0
                       Ethernet-Switch(A)        YES     1.00      1.00      0.0
                       Ethernet-Switch(A)        YES     1.14      1.14      0.2
                       PLX-8749(A)               YES     0.06      0.06      0.1
                       Primary-BIOS(A)           YES     1.08      1.08      0.1
                       SB Backup Key(A)          NO      1.00      1.00      0.0
                       SB Certificates(A)        NO      1.00      1.00      0.0
                       SB Primary Key(A)         NO      1.00      1.00      0.0
                       SOL-DB-FPGA(A)            NO      1.04      1.04      0.0
                       SOL-MB-FPGA(A)            NO      1.04      1.04      0.0
-------------------------------------------------------------------------------
NC6-30/60X10G-L-S      Backup-BIOS(A)            YES    14.09     14.00      0.0
                       Backup-CCC-PwrOn(A)       NO      1.39      1.31      0.0
                       Backup-EthSwitch(A)       YES     1.33      1.32      0.0
                       BAO-DB-FPGA(A)            NO      0.29      0.29      0.0
                       BAO-MB-FPGA(A)            NO      0.29      0.29      0.0
                       CCC-Bootloader(A)         YES     2.12      2.07      0.0
                       CCC-FPGA(A)               YES     2.12      2.12      0.0
                       CCC-Power-On(A)           NO      1.41      1.41      0.0
                       Ethernet-Switch(A)        YES     1.33      1.33      0.0
                       Modena-0-PHY(A)           YES     0.13      0.13      0.0
                       Modena-1-PHY(A)           YES     0.13      0.13      0.0
                       Modena-10-PHY(A)          YES     0.13      0.13      0.0
                       Modena-11-PHY(A)          YES     0.13      0.13      0.0
                       Modena-12-PHY(A)          YES     0.13      0.13      0.0
                       Modena-13-PHY(A)          YES     0.13      0.13      0.0
                       Modena-14-PHY(A)          YES     0.13      0.13      0.0
                       Modena-15-PHY(A)          YES     0.13      0.13      0.0
                       Modena-2-PHY(A)           YES     0.13      0.13      0.0
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                       Modena-3-PHY(A)          YES    0.13    0.13     0.0
                       Modena-4-PHY(A)          YES    0.13    0.13     0.0
                       Modena-5-PHY(A)          YES    0.13    0.13     0.0
                       Modena-6-PHY(A)          YES    0.13    0.13     0.0
                       Modena-7-PHY(A)          YES    0.13    0.13     0.0
                       Modena-8-PHY(A)          YES    0.13    0.13     0.0
                       Modena-9-PHY(A)          YES    0.13    0.13     0.0
                       PLX-8748(A)              YES    0.05    0.05     0.1
                       Primary-BIOS(A)          YES   14.09   14.09     0.0
                       S2-GN2411(A)             YES    5.86    5.86     2.0
                       S2-GN2411(A)             YES    7.58    7.58     0.0
                       S3-GN2411(A)             YES    5.86    5.86     2.0
                       S3-GN2411(A)             YES    7.58    7.58     0.0
                       S4-GN2411(A)             YES    5.86    5.86     2.0
                       S4-GN2411(A)             YES    7.58    7.58     0.0
                       SB Backup Key(A)         NO     1.00    1.00     0.0
                       SB Certificates(A)       NO     1.00    1.00     0.0
                       SB Primary Key(A)        NO     1.00    1.00     0.0
                       Slice-0-GN2411(A)        YES    5.86    5.86     2.0
                       Slice-0-GN2411(A)        YES    7.58    7.58     0.0
                       Slice-1-GN2411(A)        YES    5.86    5.86     2.0
                       Slice-1-GN2411(A)        YES    7.58    7.58     0.0
                       Slice-2-GN2411(A)        YES    5.86    5.86     2.0
                       Slice-2-GN2411(A)        YES    7.58    7.58     0.0
                       Slice-3-GN2411(A)        YES    5.86    5.86     2.0
                       Slice-3-GN2411(A)        YES    7.58    7.58     0.0
                       Slice-4-GN2411(A)        YES    5.86    5.86     2.0
                       Slice-4-GN2411(A)        YES    7.58    7.58     0.0
                       SMART-iSATA(A)           NO     7.05    7.05     0.0
                       SMART-SATA(A)            NO     7.05    7.05     0.0
-------------------------------------------------------------------------------
NC6-30/60X10G-M-S      Backup-BIOS(A)           YES   14.09   14.00     0.0
                       Backup-CCC-PwrOn(A)      NO     1.39    1.31     0.0
                       Backup-EthSwitch(A)      YES    1.33    1.32     0.0
                       BAO-DB-FPGA(A)           NO     0.29    0.29     0.0
                       BAO-MB-FPGA(A)           NO     0.29    0.29     0.0
                       CCC-Bootloader(A)        YES    2.12    2.07     0.0
                       CCC-FPGA(A)              YES    2.12    2.12     0.0
                       CCC-Power-On(A)          NO     1.41    1.41     0.0
                       Ethernet-Switch(A)       YES    1.33    1.33     0.0
                       Modena-0-PHY(A)          YES    0.13    0.13     0.0
                       Modena-1-PHY(A)          YES    0.13    0.13     0.0
                       Modena-10-PHY(A)         YES    0.13    0.13     0.0
                       Modena-11-PHY(A)         YES    0.13    0.13     0.0
                       Modena-12-PHY(A)         YES    0.13    0.13     0.0
                       Modena-13-PHY(A)         YES    0.13    0.13     0.0
                       Modena-14-PHY(A)         YES    0.13    0.13     0.0
                       Modena-15-PHY(A)         YES    0.13    0.13     0.0
                       Modena-2-PHY(A)          YES    0.13    0.13     0.0
                       Modena-3-PHY(A)          YES    0.13    0.13     0.0
                       Modena-4-PHY(A)          YES    0.13    0.13     0.0
                       Modena-5-PHY(A)          YES    0.13    0.13     0.0
                       Modena-6-PHY(A)          YES    0.13    0.13     0.0
                       Modena-7-PHY(A)          YES    0.13    0.13     0.0
                       Modena-8-PHY(A)          YES    0.13    0.13     0.0
                       Modena-9-PHY(A)          YES    0.13    0.13     0.0
                       PLX-8748(A)              YES    0.05    0.05     0.1
                       Primary-BIOS(A)          YES   14.09   14.09     0.0
                       S2-GN2411(A)             YES    5.86    5.86     2.0
                       S2-GN2411(A)             YES    7.58    7.58     0.0
                       S3-GN2411(A)             YES    5.86    5.86     2.0
                       S3-GN2411(A)             YES    7.58    7.58     0.0
                       SB Backup Key(A)         NO     1.00    1.00     0.0
                       SB Certificates(A)       NO     1.00    1.00     0.0
```

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                      SB Primary Key(A)        NO     1.00     1.00     0.0
                      SMART-iSATA(A)           NO     7.05     7.05     0.0
                      SMART-SATA(A)            NO     7.05     7.05     0.0
-------------------------------------------------------------------------------
NC6-4-10X100G-M-K     Backup-BIOS(A)           YES   14.09    14.00     0.0
                      Backup-CCC-PwrOn(A)      NO     1.39     1.31     0.0
                      Backup-EthSwitch(A)      YES    1.33     1.32     0.0
                      BAO-DB-FPGA(A)           NO     1.06     1.06     0.0
                      BAO-MB-FPGA(A)           NO     1.06     1.06     0.0
                      CCC-Bootloader(A)        YES    2.12     2.07     0.0
                      CCC-FPGA(A)              YES    2.12     2.12     0.0
                      CCC-Power-On(A)          NO     1.41     1.41     0.0
                      Ethernet-Switch(A)       YES    1.33     1.33     0.0
                      PLX-8748(A)              YES    0.05     0.05     0.1
                      Primary-BIOS(A)          YES   14.09    14.09     0.0
                      S2-GN2411(A)             YES    5.86     5.86     2.0
                      S2-GN2411(A)             YES    7.58     7.58     0.0
                      S3-GN2411(A)             YES    5.86     5.86     2.0
                      S3-GN2411(A)             YES    7.58     7.58     0.0
                      S4-GN2411(A)             YES    5.86     5.86     2.0
                      S4-GN2411(A)             YES    7.58     7.58     0.0
                      SB Backup Key(A)         NO     1.00     1.00     0.0
                      SB Certificates(A)       NO     1.00     1.00     0.0
                      SB Primary Key(A)        NO     1.00     1.00     0.0
                      SMART-iSATA(A)           NO     7.05     7.05     0.0
                      SMART-SATA(A)            NO     7.05     7.05     0.0
-------------------------------------------------------------------------------
NC6-6-10X100G-L-K     Backup-BIOS(A)           YES   14.09    14.00     0.0
                      Backup-CCC-PwrOn(A)      NO     1.39     1.31     0.0
                      Backup-EthSwitch(A)      YES    1.33     1.32     0.0
                      BAO-DB-FPGA(A)           NO     1.06     1.06     0.0
                      BAO-MB-FPGA(A)           NO     1.06     1.06     0.0
                      CCC-Bootloader(A)        YES    2.12     2.07     0.0
                      CCC-FPGA(A)              YES    2.12     2.12     0.0
                      CCC-Power-On(A)          NO     1.41     1.41     0.0
                      Ethernet-Switch(A)       YES    1.33     1.33     0.0
                      PLX-8748(A)              YES    0.05     0.05     0.1
                      Primary-BIOS(A)          YES   14.09    14.09     0.0
                      S2-GN2411(A)             YES    5.86     5.86     2.0
                      S2-GN2411(A)             YES    7.58     7.58     0.0
                      S3-GN2411(A)             YES    5.86     5.86     2.0
                      S3-GN2411(A)             YES    7.58     7.58     0.0
                      S4-GN2411(A)             YES    5.86     5.86     2.0
                      S4-GN2411(A)             YES    7.58     7.58     0.0
                      SB Backup Key(A)         NO     1.00     1.00     0.0
                      SB Certificates(A)       NO     1.00     1.00     0.0
                      SB Primary Key(A)        NO     1.00     1.00     0.0
                      SMART-iSATA(A)           NO     7.05     7.05     0.0
                      SMART-SATA(A)            NO     7.05     7.05     0.0
-------------------------------------------------------------------------------
NC6-60X10GE-L-S       Backup-BIOS(A)           YES   14.09    14.00     0.0
                      Backup-CCC-PwrOn(A)      NO     1.39     1.31     0.0
                      Backup-EthSwitch(A)      YES    1.33     1.32     0.0
                      BAO-DB-FPGA(A)           NO     0.29     0.29     0.0
                      BAO-MB-FPGA(A)           NO     0.29     0.29     0.0
                      CCC-Bootloader(A)        YES    2.12     2.07     0.0
                      CCC-FPGA(A)              YES    2.12     2.12     0.0
                      CCC-Power-On(A)          NO     1.41     1.41     0.0
                      Ethernet-Switch(A)       YES    1.33     1.33     0.0
                      Modena-0-PHY(A)          YES    0.13     0.13     0.0
                      Modena-1-PHY(A)          YES    0.13     0.13     0.0
                      Modena-10-PHY(A)         YES    0.13     0.13     0.0
                      Modena-11-PHY(A)         YES    0.13     0.13     0.0
                      Modena-12-PHY(A)         YES    0.13     0.13     0.0
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                 Modena-13-PHY(A)            YES    0.13    0.13    0.0
                 Modena-14-PHY(A)            YES    0.13    0.13    0.0
                 Modena-15-PHY(A)            YES    0.13    0.13    0.0
                 Modena-2-PHY(A)             YES    0.13    0.13    0.0
                 Modena-3-PHY(A)             YES    0.13    0.13    0.0
                 Modena-4-PHY(A)             YES    0.13    0.13    0.0
                 Modena-5-PHY(A)             YES    0.13    0.13    0.0
                 Modena-6-PHY(A)             YES    0.13    0.13    0.0
                 Modena-7-PHY(A)             YES    0.13    0.13    0.0
                 Modena-8-PHY(A)             YES    0.13    0.13    0.0
                 Modena-9-PHY(A)             YES    0.13    0.13    0.0
                 PLX-8748(A)                 YES    0.05    0.05    0.1
                 Primary-BIOS(A)             YES   14.09   14.09    0.0
                 S2-GN2411(A)                YES    5.86    5.86    2.0
                 S2-GN2411(A)                YES    7.58    7.58    0.0
                 S3-GN2411(A)                YES    5.86    5.86    2.0
                 S3-GN2411(A)                YES    7.58    7.58    0.0
                 S4-GN2411(A)                YES    5.86    5.86    2.0
                 S4-GN2411(A)                YES    7.58    7.58    0.0
                 SB Backup Key(A)            NO     1.00    1.00    0.0
                 SB Certificates(A)          NO     1.00    1.00    0.0
                 SB Primary Key(A)           NO     1.00    1.00    0.0
                 Slice-0-GN2411(A)           YES    5.86    5.86    2.0
                 Slice-0-GN2411(A)           YES    7.58    7.58    0.0
                 Slice-1-GN2411(A)           YES    5.86    5.86    2.0
                 Slice-1-GN2411(A)           YES    7.58    7.58    0.0
                 Slice-2-GN2411(A)           YES    5.86    5.86    2.0
                 Slice-2-GN2411(A)           YES    7.58    7.58    0.0
                 Slice-3-GN2411(A)           YES    5.86    5.86    2.0
                 Slice-3-GN2411(A)           YES    7.58    7.58    0.0
                 Slice-4-GN2411(A)           YES    5.86    5.86    2.0
                 Slice-4-GN2411(A)           YES    7.58    7.58    0.0
                 SMART-iSATA(A)              NO     7.05    7.05    0.0
                 SMART-SATA(A)               NO     7.05    7.05    0.0
--------------------------------------------------------------------------------
NC6-60X10GE-M-S  Backup-BIOS(A)              YES   14.09   14.00    0.0
                 Backup-CCC-PwrOn(A)         NO     1.39    1.31    0.0
                 Backup-EthSwitch(A)         YES    1.33    1.32    0.0
                 BAO-DB-FPGA(A)              NO     0.29    0.29    0.0
                 BAO-MB-FPGA(A)              NO     0.29    0.29    0.0
                 CCC-Bootloader(A)           YES    2.12    2.07    0.0
                 CCC-FPGA(A)                 YES    2.12    2.12    0.0
                 CCC-Power-On(A)             NO     1.41    1.41    0.0
                 Ethernet-Switch(A)          YES    1.33    1.33    0.0
                 LTC2978_540870_DB_ISP(A)    YES    1.00    1.00    0.0
                 LTC2978_540870_MB_ISP(A)    YES    1.00    1.00    0.0
                 Modena-0-PHY(A)             YES    0.13    0.13    0.0
                 Modena-1-PHY(A)             YES    0.13    0.13    0.0
                 Modena-10-PHY(A)            YES    0.13    0.13    0.0
                 Modena-11-PHY(A)            YES    0.13    0.13    0.0
                 Modena-12-PHY(A)            YES    0.13    0.13    0.0
                 Modena-13-PHY(A)            YES    0.13    0.13    0.0
                 Modena-14-PHY(A)            YES    0.13    0.13    0.0
                 Modena-15-PHY(A)            YES    0.13    0.13    0.0
                 Modena-2-PHY(A)             YES    0.13    0.13    0.0
                 Modena-3-PHY(A)             YES    0.13    0.13    0.0
                 Modena-4-PHY(A)             YES    0.13    0.13    0.0
                 Modena-5-PHY(A)             YES    0.13    0.13    0.0
                 Modena-6-PHY(A)             YES    0.13    0.13    0.0
                 Modena-7-PHY(A)             YES    0.13    0.13    0.0
                 Modena-8-PHY(A)             YES    0.13    0.13    0.0
                 Modena-9-PHY(A)             YES    0.13    0.13    0.0
                 PLX-8748(A)                 YES    0.05    0.05    0.1
                 Primary-BIOS(A)             YES   14.09   14.09    0.0
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                    S2-GN2411(A)              YES     5.86      5.86      2.0
                    S2-GN2411(A)              YES     7.58      7.58      0.0
                    S3-GN2411(A)              YES     5.86      5.86      2.0
                    S3-GN2411(A)              YES     7.58      7.58      0.0
                    SB Backup Key(A)          NO      1.00      1.00      0.0
                    SB Certificates(A)        NO      1.00      1.00      0.0
                    SB Primary Key(A)         NO      1.00      1.00      0.0
                    SMART-iSATA(A)            NO      7.05      7.05      0.0
                    SMART-SATA(A)             NO      7.05      7.05      0.0
--------------------------------------------------------------------------------
NC6-FANTRAY         Fantray-FPGA(A)           NO      2.01      2.01      0.0
--------------------------------------------------------------------------------
NC6-FANTRAY-2       Fantray-FPGA(A)           NO      3.05      3.05      0.0
--------------------------------------------------------------------------------
NC6-FC              CCC-FPGA(A)               YES     1.29      1.29      0.0
                    CCC-Power-On(A)           NO      1.39      1.39      0.0
                    LTC2978_420830_ISP(A)     YES     1.00      1.00      0.0
                    PLX-8713(A)               YES     1.03      1.03      0.1
                    SB Certificates(A)        NO      1.00      1.00      0.0
--------------------------------------------------------------------------------
NC6-FC-MC           Back-CRE-FPGA-MB(A)       YES     1.00      1.00      0.0
                    CCC-FPGA(A)               YES     1.29      1.29      0.0
                    CCC-Power-On(A)           NO      1.39      1.39      0.0
                    CRE-FPGA-MB(A)            YES     1.00      1.00      0.0
                    GN2411-BUS-0(A)           YES     5.86      5.86      2.0
                    GN2411-BUS-0(A)           YES     7.58      7.58      0.0
                    GN2411-BUS-1(A)           YES     5.86      5.86      2.0
                    GN2411-BUS-1(A)           YES     7.58      7.58      0.0
                    GN2411-BUS-2(A)           YES     5.86      5.86      2.0
                    GN2411-BUS-2(A)           YES     7.58      7.58      0.0
                    LTC2978_420833_ISP(A)     YES     1.00      1.00      0.0
                    PLX-8713(A)               YES     1.03      1.03      0.1
                    SB Certificates(A)        NO      1.00      1.00      0.0
--------------------------------------------------------------------------------
NC6-FC2-U           CCC-FPGA(A)               YES     2.11      2.11      0.0
                    CCC-Power-On(A)           NO      1.39      1.39      0.0
                    LTC2980_LTC3882_420845_IS( YES    1.00      1.00      0.0
                    PLX-8713(A)               YES     1.05      1.05      0.0
                    SB Certificates(A)        NO      1.00      1.00      0.0
--------------------------------------------------------------------------------
NC6-RP              Backup-BIOS(A)            YES     14.09     14.00     0.0
                    Backup-CCC-PwrOn(A)       NO      1.42      1.32      0.0
                    Backup-EthSwitch(A)       YES     1.33      1.32      0.2
                    Backup-EthSwitch(A)       YES     1.33      1.32      0.1
                    CCC-Bootloader(A)         YES     2.07      2.03      0.0
                    CCC-FPGA(A)               YES     2.07      2.07      0.0
                    CCC-Power-On(A)           NO      1.42      1.42      0.0
                    CPU Backup_Key(A)         NO      1.00      1.00      0.0
                    CPU Primary_Key(A)        NO      1.00      1.00      0.0
                    CPU-Complex-BOOT(A)       YES     4.08      4.04      0.1
                    CPU-Complex-BOOT(A)       YES     0.01      0.01      0.0
                    CPU-Complex-FPGA(A)       YES     4.08      4.08      0.1
                    CPU-Complex-FPGA(A)       YES     0.01      0.01      0.0
                    Ethernet-Switch(A)        YES     1.33      1.33      0.2
                    Ethernet-Switch(A)        YES     1.33      1.33      0.1
                    LTC2978_1E0800_DB_ISP(A)  YES     1.00      1.00      0.0
                    LTC2978_1E0800_MB_ISP(A)  YES     1.00      1.00      0.0
                    PLX-8748(A)               YES     0.05      0.05      0.0
                    Primary-BIOS(A)           YES     14.09     14.09     0.0
                    SB Backup Key(A)          NO      1.00      1.00      0.0
                    SB Certificates(A)        NO      1.00      1.00      0.0
                    SB Primary Key(A)         NO      1.00      1.00      0.0
                    SMART-iSATA(A)            NO      7.05      7.05      0.0
                    SMART-SATA(A)             NO      7.05      7.05      0.0
```

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--------------------------------------------------------------------------------
NCS-CRFT             Craft-FCC(A)             NO       1.06      1.06      0.1
                     Craft-LCC(A)             NO       1.06      1.06      0.1
--------------------------------------------------------------------------------
NCS-F-FANTRAY        Fantray-FPGA(A)          NO       2.01      2.01      0.0
--------------------------------------------------------------------------------
NCS-F-FC             Back-CRE-FPGA-DC(A)      YES      1.00      1.00      0.0
                     Back-CRE-FPGA-MB(A)      YES      1.00      1.00      0.0
                     CCC-FPGA(A)              YES      1.29      1.29      0.0
                     CCC-Power-On(A)          NO       1.39      1.39      0.0
                     CRE-FPGA-DC(A)           YES      1.00      1.00      0.0
                     CRE-FPGA-MB(A)           YES      1.00      1.00      0.0
                     GN2411-BUS-0(A)          YES      5.86      5.86      2.0
                     GN2411-BUS-0(A)          YES      7.58      7.58      0.0
                     GN2411-BUS-1(A)          YES      5.86      5.86      2.0
                     GN2411-BUS-1(A)          YES      7.58      7.58      0.0
                     GN2411-BUS-2(A)          YES      5.86      5.86      2.0
                     GN2411-BUS-2(A)          YES      7.58      7.58      0.0
                     GN2411-BUS-3(A)          YES      5.86      5.86      2.0
                     GN2411-BUS-3(A)          YES      7.58      7.58      0.0
                     GN2411-BUS-4(A)          YES      5.86      5.86      2.0
                     GN2411-BUS-4(A)          YES      7.58      7.58      0.0
                     LTC2978_420834_ISP(A)    YES      1.00      1.00      0.0
                     PLX-8713(A)              YES      1.04      1.04      0.1
                     SB Certificates(A)       NO       1.00      1.00      0.0
--------------------------------------------------------------------------------
NCS-F-FC2            Back-CRE2-FPGA-DC(A)     YES      1.00      1.00      0.0
                     CCC-FPGA(A)              YES      1.10      1.10      0.0
                     CCC-Power-On(A)          NO       1.05      1.05      0.0
                     CRE2-FPGA-DC(A)          YES      1.03      1.03      0.0
                     LTC2980_LTC3882_42094B_IS( YES    1.00      1.00      0.0
                     PLX-8713(A)              YES      1.05      1.05      0.1
                     SB Certificates(A)       NO       1.00      1.00      0.0
--------------------------------------------------------------------------------
NCS-F-SC             Backup-BIOS(A)           YES     14.09     14.00      0.0
                     Backup-CCC-PwrOn(A)      NO       1.41      1.38      0.0
                     Backup-EthSwitch(A)      YES      1.33      1.33      0.0
                     CCC-Bootloader(A)        YES      2.03      2.01      0.0
                     CCC-FPGA(A)              YES      2.03      2.03      0.0
                     CCC-Power-On(A)          NO       1.41      1.41      0.0
                     CPU Backup_Key(A)        NO       1.00      1.00      0.0
                     CPU Primary_Key(A)       NO       1.00      1.00      0.0
                     CPU-Complex-BOOT(A)      YES      4.08      4.04      0.1
                     CPU-Complex-BOOT(A)      YES      0.01      0.01      0.0
                     CPU-Complex-FPGA(A)      YES      4.08      4.08      0.1
                     CPU-Complex-FPGA(A)      YES      0.01      0.01      0.0
                     Ethernet-Switch(A)       YES      1.33      1.33      0.0
                     LTC2978_1F0804_MB_ISP(A) YES      1.00      1.00      0.0
                     PLX-8625(A)              YES      0.02      0.02      0.0
                     Primary-BIOS(A)          YES     14.09     14.09      0.0
                     SB Backup Key(A)         NO       1.00      1.00      0.0
                     SB Certificates(A)       NO       1.00      1.00      0.0
                     SB Primary Key(A)        NO       1.00      1.00      0.0
                     SMART-iSATA(A)           NO       7.05      7.05      0.0
                     SMART-SATA(A)            NO       7.05      7.05      0.0
--------------------------------------------------------------------------------
NCS-F-SCSW           Backup-BIOS(A)           YES     14.09     14.00      0.0
                     Backup-CCC-PwrOn(A)      NO       1.41      1.38      0.0
                     Backup-EthSwitch(A)      YES      1.33      1.33      0.0
                     CCC-Bootloader(A)        YES      2.03      2.01      0.0
                     CCC-FPGA(A)              YES      2.03      2.03      0.0
                     CCC-Power-On(A)          NO       1.41      1.41      0.0
                     CPU Backup_Key(A)        NO       1.00      1.00      0.0
                     CPU Primary_Key(A)       NO       1.00      1.00      0.0
```

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                        CPU-Complex-BOOT(A)        YES     4.08     4.04     0.1
                        CPU-Complex-BOOT(A)        YES     0.01     0.01     0.0
                        CPU-Complex-FPGA(A)        YES     4.08     4.08     0.1
                        CPU-Complex-FPGA(A)        YES     0.01     0.01     0.0
                        Ethernet-Switch(A)         YES     1.33     1.33     0.0
                        PLX-8625(A)                YES     0.02     0.02     0.0
                        Primary-BIOS(A)            YES    14.09    14.09     0.0
                        SB Backup Key(A)           NO      1.00     1.00     0.0
                        SB Certificates(A)         NO      1.00     1.00     0.0
                        SB Primary Key(A)          NO      1.00     1.00     0.0
                        SMART-iSATA(A)             NO      7.05     7.05     0.0
                        SMART-SATA(A)              NO      7.05     7.05     0.0
--------------------------------------------------------------------------------
NCS-F-SCSW (SW)         CCC-FPGA(A)                YES     1.03     1.03     0.0
                        CCC-Power-On(A)            NO      1.39     1.39     0.0
                        LTC2978_1F0806_ISP(A)      YES     1.00     1.00     0.0
                        PLX-8614(A)                YES     0.03     0.03     0.0
                        SB Certificates(A)         NO      1.00     1.00     0.0
--------------------------------------------------------------------------------
P-L-20X40G-QSFP         Backup-BIOS(A)             YES    14.09    14.00     0.0
                        Backup-CCC-PwrOn(A)        NO      1.39     1.31     0.0
                        Backup-EthSwitch(A)        YES     1.33     1.32     0.0
                        BAO-DB-FPGA(A)             NO      0.29     0.29     0.0
                        BAO-MB-FPGA(A)             NO      0.29     0.29     0.0
                        CCC-Bootloader(A)          YES     2.12     2.07     0.0
                        CCC-FPGA(A)                YES     2.12     2.12     0.0
                        CCC-Power-On(A)            NO      1.41     1.41     0.0
                        Ethernet-Switch(A)         YES     1.33     1.33     0.0
                        PLX-8748(A)                YES     0.05     0.05     0.1
                        Primary-BIOS(A)            YES    14.09    14.09     0.0
                        S2-GN2411(A)               YES     5.86     5.86     2.0
                        S2-GN2411(A)               YES     7.58     7.58     0.0
                        S3-GN2411(A)               YES     5.86     5.86     2.0
                        S3-GN2411(A)               YES     7.58     7.58     0.0
                        S4-GN2411(A)               YES     5.86     5.86     2.0
                        S4-GN2411(A)               YES     7.58     7.58     0.0
                        SB Backup Key(A)           NO      1.00     1.00     0.0
                        SB Certificates(A)         NO      1.00     1.00     0.0
                        SB Primary Key(A)          NO      1.00     1.00     0.0
                        Slice-0-GN2411(A)          YES     5.86     5.86     2.0
                        Slice-0-GN2411(A)          YES     7.58     7.58     0.0
                        Slice-1-GN2411(A)          YES     5.86     5.86     2.0
                        Slice-1-GN2411(A)          YES     7.58     7.58     0.0
                        Slice-2-GN2411(A)          YES     5.86     5.86     2.0
                        Slice-2-GN2411(A)          YES     7.58     7.58     0.0
                        Slice-3-GN2411(A)          YES     5.86     5.86     2.0
                        Slice-3-GN2411(A)          YES     7.58     7.58     0.0
                        Slice-4-GN2411(A)          YES     5.86     5.86     2.0
                        Slice-4-GN2411(A)          YES     7.58     7.58     0.0
                        SMART-iSATA(A)             NO      7.05     7.05     0.0
                        SMART-SATA(A)              NO      7.05     7.05     0.0
--------------------------------------------------------------------------------
PROTO-1XPAT-QSFP        Backup-BIOS(A)             YES    14.09    14.00     0.0
                        Backup-CCC-PwrOn(A)        NO      1.39     1.31     0.0
                        Backup-EthSwitch(A)        YES     1.33     1.32     0.0
                        BAO-MB-FPGA(A)             NO      0.29     0.29     0.0
                        CCC-Bootloader(A)          YES     2.12     2.07     0.0
                        CCC-FPGA(A)                YES     2.12     2.12     0.0
                        CCC-Power-On(A)            NO      1.41     1.41     0.0
                        Ethernet-Switch(A)         YES     1.33     1.33     0.0
                        PLX-8748(A)                YES     0.05     0.05     0.1
                        Primary-BIOS(A)            YES    14.09    14.09     0.0
                        SB Backup Key(A)           NO      1.00     1.00     0.0
                        SB Certificates(A)         NO      1.00     1.00     0.0
```

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                        SB Primary Key(A)          NO    1.00    1.00    0.0
                        SMART-iSATA(A)             NO    7.05    7.05    0.0
                        SMART-SATA(A)              NO    7.05    7.05    0.0
-------------------------------------------------------------------------------
PROTO-1XPAT-SFP         Backup-BIOS(A)             YES  14.09   14.00    0.0
                        Backup-CCC-PwrOn(A)        NO    1.39    1.31    0.0
                        Backup-EthSwitch(A)        YES   1.33    1.32    0.0
                        BAO-MB-FPGA(A)             NO    0.29    0.29    0.0
                        CCC-Bootloader(A)          YES   2.12    2.07    0.0
                        CCC-FPGA(A)                YES   2.12    2.12    0.0
                        CCC-Power-On(A)            NO    1.41    1.41    0.0
                        Ethernet-Switch(A)         YES   1.33    1.33    0.0
                        PLX-8748(A)                YES   0.05    0.05    0.1
                        Primary-BIOS(A)            YES  14.09   14.09    0.0
                        SB Backup Key(A)           NO    1.00    1.00    0.0
                        SB Certificates(A)         NO    1.00    1.00    0.0
                        SB Primary Key(A)          NO    1.00    1.00    0.0
                        SMART-iSATA(A)             NO    7.05    7.05    0.0
                        SMART-SATA(A)              NO    7.05    7.05    0.0
-------------------------------------------------------------------------------
PROTO-2XPAT-SFP         Backup-BIOS(A)             YES  14.09   14.00    0.0
                        Backup-CCC-PwrOn(A)        NO    1.39    1.31    0.0
                        Backup-EthSwitch(A)        YES   1.33    1.32    0.0
                        BAO-MB-FPGA(A)             NO    0.29    0.29    0.0
                        CCC-Bootloader(A)          YES   2.12    2.07    0.0
                        CCC-FPGA(A)                YES   2.12    2.12    0.0
                        CCC-Power-On(A)            NO    1.41    1.41    0.0
                        Ethernet-Switch(A)         YES   1.33    1.33    0.0
                        Modena-0-PHY(A)            YES   0.13    0.13    0.0
                        Modena-1-PHY(A)            YES   0.13    0.13    0.0
                        Modena-2-PHY(A)            YES   0.13    0.13    0.0
                        Modena-3-PHY(A)            YES   0.13    0.13    0.0
                        Modena-4-PHY(A)            YES   0.13    0.13    0.0
                        Modena-5-PHY(A)            YES   0.13    0.13    0.0
                        Modena-6-PHY(A)            YES   0.13    0.13    0.0
                        Modena-7-PHY(A)            YES   0.13    0.13    0.0
                        PLX-8748(A)                YES   0.05    0.05    0.1
                        Primary-BIOS(A)            YES  14.09   14.09    0.0
                        SB Backup Key(A)           NO    1.00    1.00    0.0
                        SB Certificates(A)         NO    1.00    1.00    0.0
                        SB Primary Key(A)          NO    1.00    1.00    0.0
                        SMART-iSATA(A)             NO    7.05    7.05    0.0
                        SMART-SATA(A)              NO    7.05    7.05    0.0
-------------------------------------------------------------------------------
PROTO-2XPAT-SFP-L       Backup-BIOS(A)             YES  14.09   14.00    0.0
                        Backup-CCC-PwrOn(A)        NO    1.39    1.31    0.0
                        Backup-EthSwitch(A)        YES   1.33    1.32    0.0
                        BAO-MB-FPGA(A)             NO    0.29    0.29    0.0
                        CCC-Bootloader(A)          YES   2.12    2.07    0.0
                        CCC-FPGA(A)                YES   2.12    2.12    0.0
                        CCC-Power-On(A)            NO    1.41    1.41    0.0
                        Ethernet-Switch(A)         YES   1.33    1.33    0.0
                        PLX-8748(A)                YES   0.05    0.05    0.1
                        Primary-BIOS(A)            YES  14.09   14.09    0.0
                        SB Backup Key(A)           NO    1.00    1.00    0.0
                        SB Certificates(A)         NO    1.00    1.00    0.0
                        SB Primary Key(A)          NO    1.00    1.00    0.0
                        SMART-iSATA(A)             NO    7.05    7.05    0.0
                        SMART-SATA(A)              NO    7.05    7.05    0.0
-------------------------------------------------------------------------------
PROTO-CXP-1XPITA        Backup-BIOS(A)             YES  14.09   14.00    0.0
                        Backup-CCC-PwrOn(A)        NO    1.39    1.31    0.0
                        Backup-EthSwitch(A)        YES   1.33    1.32    0.0
                        BAO-MB-FPGA(A)             NO    1.06    1.06    0.0
```

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                        CCC-Bootloader(A)        YES     2.12    2.07    0.0
                        CCC-FPGA(A)              YES     2.12    2.12    0.0
                        CCC-Power-On(A)          NO      1.41    1.41    0.0
                        Ethernet-Switch(A)       YES     1.33    1.33    0.0
                        PLX-8748(A)              YES     0.05    0.05    0.1
                        Primary-BIOS(A)          YES    14.09   14.09    0.0
                        SB Backup Key(A)         NO      1.00    1.00    0.0
                        SB Certificates(A)       NO      1.00    1.00    0.0
                        SB Primary Key(A)        NO      1.00    1.00    0.0
                        Slice-1-GN2411(A)        YES     5.86    5.86    2.0
                        Slice-1-GN2411(A)        YES     7.58    7.58    0.0
                        SMART-iSATA(A)           NO      7.05    7.05    0.0
                        SMART-SATA(A)            NO      7.05    7.05    0.0
-----------------------------------------------------------------------------
PROTO-CXP-2XPITA        Backup-BIOS(A)           YES    14.09   14.00    0.0
                        Backup-CCC-PwrOn(A)      NO      1.39    1.31    0.0
                        Backup-EthSwitch(A)      YES     1.33    1.32    0.0
                        BAO-MB-FPGA(A)           NO      1.06    1.06    0.0
                        CCC-Bootloader(A)        YES     2.12    2.07    0.0
                        CCC-FPGA(A)              YES     2.12    2.12    0.0
                        CCC-Power-On(A)          NO      1.41    1.41    0.0
                        Ethernet-Switch(A)       YES     1.33    1.33    0.0
                        PLX-8748(A)              YES     0.05    0.05    0.1
                        Primary-BIOS(A)          YES    14.09   14.09    0.0
                        SB Backup Key(A)         NO      1.00    1.00    0.0
                        SB Certificates(A)       NO      1.00    1.00    0.0
                        SB Primary Key(A)        NO      1.00    1.00    0.0
                        Slice-0-GN2411(A)        YES     5.86    5.86    2.0
                        Slice-0-GN2411(A)        YES     7.58    7.58    0.0
                        Slice-1-GN2411(A)        YES     5.86    5.86    2.0
                        Slice-1-GN2411(A)        YES     7.58    7.58    0.0
                        SMART-iSATA(A)           NO      7.05    7.05    0.0
                        SMART-SATA(A)            NO      7.05    7.05    0.0
-----------------------------------------------------------------------------
PROTO-F-SC              Backup-BIOS(A)           YES    14.09   14.00    0.0
                        Backup-CCC-PwrOn(A)      NO      1.41    1.38    0.0
                        Backup-EthSwitch(A)      YES     1.33    1.33    0.0
                        CCC-Bootloader(A)        YES     2.03    2.01    0.0
                        CCC-FPGA(A)              YES     2.03    2.03    0.0
                        CCC-Power-On(A)          NO      1.41    1.41    0.0
                        CPU Backup_Key(A)        NO      1.00    1.00    0.0
                        CPU Primary_Key(A)       NO      1.00    1.00    0.0
                        CPU-Complex-BOOT(A)      YES     4.08    4.04    0.1
                        CPU-Complex-BOOT(A)      YES     0.01    0.01    0.0
                        CPU-Complex-FPGA(A)      YES     4.08    4.08    0.1
                        CPU-Complex-FPGA(A)      YES     0.01    0.01    0.0
                        Ethernet-Switch(A)       YES     1.33    1.33    0.0
                        PLX-8625(A)              YES     0.02    0.02    0.0
                        Primary-BIOS(A)          YES    14.09   14.09    0.0
                        SB Backup Key(A)         NO      1.00    1.00    0.0
                        SB Certificates(A)       NO      1.00    1.00    0.0
                        SB Primary Key(A)        NO      1.00    1.00    0.0
                        SMART-iSATA(A)           NO      7.05    7.05    0.0
                        SMART-SATA(A)            NO      7.05    7.05    0.0
-----------------------------------------------------------------------------
PROTO-NC6K-ATV          Backup-BIOS(A)           YES    14.09   14.00    0.0
                        Backup-CCC-PwrOn(A)      NO      1.39    1.31    0.0
                        Backup-EthSwitch(A)      YES     1.33    1.32    0.0
                        BAO-MB-FPGA(A)           NO      1.00    1.00    0.0
                        CCC-Bootloader(A)        YES     2.12    2.07    0.0
                        CCC-FPGA(A)              YES     2.12    2.12    0.0
                        CCC-Power-On(A)          NO      1.41    1.41    0.0
                        Ethernet-Switch(A)       YES     1.33    1.33    0.0
                        Primary-BIOS(A)          YES    14.09   14.09    0.0
```

```
                   SB Backup Key(A)              NO      1.00    1.00    0.0
                   SB Certificates(A)            NO      1.00    1.00    0.0
                   SB Primary Key(A)             NO      1.00    1.00    0.0
                   Slice-1-GN2411(A)             YES     5.86    5.86    2.0
                   Slice-1-GN2411(A)             YES     7.58    7.58    0.0
--------------------------------------------------------------------------------
PWR-2KW-DC-V2      DT-PriMCU(A)                  NO      6.03    6.03    0.12
                   DT-Sec54vMCU(A)               NO      6.02    6.02    0.12
                   DT-Sec5vMCU(A)                NO      6.03    6.03    0.12
                   EM-PriMCU(A)                  NO      3.12    3.12    0.21
                   EM-Sec54vMCU(A)               NO      3.19    3.19    0.21
                   EM-Sec5vMCU(A)                NO      3.19    3.19    0.21
--------------------------------------------------------------------------------
PWR-3KW-AC-V2      DT-PriMCU(A)                  NO      6.02    6.02    1.0
                   DT-Sec54vMCU(A)               NO      6.02    6.02    1.0
                   DT-Sec5vMCU(A)                NO      6.04    6.04    1.0
                   EM-Sec54vMCU(A)               NO      3.12    3.12    0.21
                   EM-Sec5vMCU(A)                NO      3.18    3.18    0.21
```

Minimum Firmware Requirement

The following table provides the procedures and resources for minimum firmware requirements:

After completing an Return Material Authorization (RMA), upgrade the firmware as per the matrix in this link, which also links to PDF copies of the IOS XR Firmware Upgrade Guides	http://www.cisco.com/web/Cisco_IOS_XR_Software/index.html
For the upgrade procedure, see the *Performing System Upgrade and Installing Feature Packages* chapter of the *Cisco NCS 6008 System Setup and Software Installation Guide*	http://www.cisco.com/en/US/products/ps13132/tsd_products_support_series_home.html

Other Important Information

- To uniquely identify a line card as a Cisco device, all Cisco IOS XR supported platforms are shipped with a non-tamper-able Trust Anchor Module (TAM) in the hardware. The Cisco Trust Anchor module (TAm) helps verify that Cisco hardware is authentic and provides additional security services. This feature is supported from Cisco IOS XR Release 7.1.x on Cisco NCS 6000 platform.

- From Release 6.0, the onePK toolkit is not supported.

- Country-specific laws, regulations, and licenses—In certain countries, use of these products may be prohibited and subject to laws, regulations, or licenses, including requirements applicable to the use of the products under telecommunications and other laws and regulations; customers must comply with all such applicable laws in the countries in which they intend to use the products.

- BFD limitation—If the current PPS (packets per second) is more than 7000 packets per line card (LC) then on upgrading the Cisco IOS XR software to release 5.2.5 or later the BFD sessions may shut down. You can avoid this scenario by adjusting the PPS per LC so that the load on a LC does not exceed more than 7000 PPS.

    To know the current load (PPS value), use **show bfd summary** command. Use the **bfd address-family ipv4 minimum-interval** command to configure BFD timer.

- Field replacable unit (FRU) removal—For all card removal and replacement (including fabric cards, line cards, fan controller, and RP) follow the instructions provided by Cisco to avoid impact to traffic. See the *Cisco Network Convergence System 6000 Series Routers Hardware Installation Guide* for procedures.

- Exceeding Cisco testing—If you intend to test beyond the combined maximum configuration tested and published by Cisco, contact your Cisco Technical Support representative to discuss how to engineer a large-scale configuration for your purpose.

Related Documentation

The most current Cisco NCS 6000 Series Router software documentation is located at this URL:

http://www.cisco.com/c/en/us/support/routers/network-convergence-system-6000-series-router/tsd-products-support-series-home.html

The document containing Cisco IOS XR System Error Messages (SEM) is located at this URL:

https://www.cisco.com/c/en/us/td/docs/ios_xr_sw/error/message/ios-xr-sem-guide.html

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.

Communications, Services, and Additional Information

- To receive timely, relevant information from Cisco, sign up at Cisco Profile Manager.

- To get the business impact you're looking for with the technologies that matter, visit Cisco Services.

- To submit a service request, visit Cisco Support.

- To discover and browse secure, validated enterprise-class apps, products, solutions and services, visit Cisco Marketplace.

- To obtain general networking, training, and certification titles, visit Cisco Press.

- To find warranty information for a specific product or product family, access Cisco Warranty Finder.

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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