Release Notes for Catalyst 3650 Series Switch, Cisco IOS XE Denali 16.3.x

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This release note gives an overview of the features for the Cisco IOS XE Denali 16.3.x software on Cisco Catalyst 3650 Series Switches.

Unless otherwise noted, the terms *switch* and *device* refer to a standalone switch and to a switch stack.

Note - For information about unsupported features, see Important Notes, page 11.
- For information about software and hardware restrictions and limitations, see Limitations and Restrictions, page 61.
- For information about open issues with the software and past opens that are resolved, see Caveats, page 63.

Introduction

Cisco Catalyst 3650 Series Switches are the next generation of enterprise class stackable access layer switches that provide full convergence between wired and wireless networks on a single platform. This convergence is built on the resilience of new and improved 160-Gbps StackWise-160. Wired and wireless security and wireless application visibility and control are natively built into the switch.

Cisco Catalyst 3650 Series Switches also support full IEEE 802.3 at Power over Ethernet Plus (PoE+), modular and field replaceable network modules, redundant fans, and power supplies. The Cisco Catalyst 3650 Series Switches enhance productivity by enabling applications such as IP telephony, wireless, and video for a true borderless network experience.

Cisco IOS XE Denali 16.x.x and Cisco IOS XE represent the continuing evolution of the preeminent Cisco IOS operating system. The Cisco IOS XE architecture and well-defined set of APIs extend the Cisco IOS software to improve portability across platforms and extensibility outside the Cisco IOS environment. The Cisco IOS XE software retains the same look and feel of the Cisco IOS software, while providing enhanced future-proofing and improved functionality.

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Whats New in Cisco IOS XE Denali 16.3.2

Software Features in Cisco IOS XE Denali 16.3.2

Feature Name	Description and License Level Information
New in Wired Switching	
Audio Video Bridging (AVB): IEEE 802.1BA	Refers to standard IEEE 802.1 BA - AVB. This feature defines a mechanism whereby endpoints and the network function as a whole to enable high-quality streaming of professional audio and video (AV) over an Ethernet infrastructure. Instead of one-to-one, the network transport enables many-to-many seamless plug-n-play connections for multiple AV endpoints including talkers and listeners. AVB is composed of the following: Generalized Precision Time Protocol (gPTP)—IEEE 802.1AS. Provides a mechanism to synchronize clocks of the bridges and end point devices in an AVB network. Quality of Service (QoS)—IEEE 802.1Qav. Guarantees bandwidth and minimum bounded latency for the time-sensitive audio and video streams. Multiple Stream Reservation Protocol (MSRP)—IEEE 802.1Qat. Provides a mechanism for end stations to reserve network resources that will guarantee the transmission and reception of data streams across a network with the requested bandwidth. Multiple VLAN Registration Protocol (MVRP)—Provides a mechanism for dynamic maintenance of the contents of Dynamic VLAN Registration Entries for each VLAN IDs, and for propagating the information they contain to other Bridges. Hierarchical QoS—Provides a two level parent-child policy. With hierarchical QoS, you can specify QoS behavior at multiple policy levels, which provides a high degree of granularity in traffic management. AVB is supported on the following switch models: • WS-C3650-24PDM • WS-C3650-48FQM (IP Base and IP Services)
Boot Integrity Visibility	Creates a checksum record for each stage of the boot loading activity. You can retrieve and compare the checksum record with a Cisco-certified record, to verify if your software image is genuine. (LAN Base, IP Base, and IP Services)

Feature Name	Description and License Level Information
Federal Information Processing Standard Publication 140-2 (FIPS 140-2) and applicable Common Criteria compliance	Cisco IOS XE Denali 16.3.2 on the Cisco Catalyst 3850 Series Switches is being submitted for certification under FIPS 140-2 and Common Criteria compliance with the US Government, Security Requirements for Network Devices. (For Base Configuration—LAN Base, IP Base, and IP Services) (For IP Security—IP Services)
Media Access Control Security (MACsec): 256-bit AES MACsec (IEEE 802.1AE) host link encryption) with MACsec Key Agreement (MKA) 256-bit AES MACsec (IEEE 802.1AE) inter-network device encryption with MKA Extensible Authentication Protocol - Transport Layer Security (EAP-TLS) method support for MKA	MACsec features are now available with IP Base and IP Services license levels. (IP Base and IP Services)
Multi-Gigabit Ethernet (mGig) Visibility Enhancement: Downshift	Available with mGig interfaces. When downshift is enabled, the system automatically downshifts to a lower port speed if the link quality is poor or if the link is continuously down. (LAN Base, IP Base, and IP Services)
Multiprotocol Label Switching (MPLS) Multicast VPN (MVPN)	MVPN provides the ability to support multicast over a Layer 3 VPN. As enterprises extend the reach of their multicast applications, service providers can accommodate them over their MPLS core network. IP multicast is used to stream video, voice, and data over an MPLS VPN network core. (IP Services)

Feature Name	Description and License Level Information
Programmability: • Network Bootloader • Embedded Event Manager Launching	Network boot loader—Supports booting from a device based or network-based source. With network boot loaders, you can: • Boot an image located on an HTTP or FTP server. • Support IPv4 networks. • Provide off-box event logging to a syslog server. Expanded YANG model coverage—The list of supported leafs (xpaths) in the Native Yang Data Models (ned.yang), Cisco IOS XE Denali 16.3.x is available at: http://www.cisco.com/c/dam/en/us/td/docs/switches/lan/catalyst3850/software/release/16-3/yang_models/IOS-XE1631_NativeYangDataModel.xlsx (LAN Base, IP Base, and IP Services)
Wired Application Visibility and Control (Wired AVC) Flexible NetFlow (FNF)	Support for FNF is now enabled for wired AVC. The feature uses a flow record with an application name as the key, to provide statistics per interface, client, server, and application. The record is similar to the Easy Performance Monitor (EzPM) **application-client-server-stats** traffic monitor, which is available in **application-statistics** and **application-performance** profiles. (IP Base and IP Services)

Whats New in Cisco IOS XE Denali 16.3.1

Software Features in Cisco IOS XE Denali 16.3.1

Feature Name	Description and License Level Information
Auto-Upgrade for Operating System (OS) Mismatch	Enables a switch joining an existing stack to be automatically upgraded to the same version as the existing stack, so that the switch can successfully join the existing stack. Previously, Cisco IOS XE Denali 16.x.x releases supported this feature only on switches running an IOS XE Denali 16.x.x image joining an existing stack with a different Cisco IOS XE Denali 16.x.x image version. Starting with this release, the active switch can resolve a mismatch across Cisco IOS XE Release 3.xE and Cisco IOS XE Denali 16.3.x releases. For this activity to happen automatically, you should have enabled the **software auto-upgrade enable** global configuration command, on the active switch. If not, you can start the process manually by entering the **request platform software package install auto upgrade** privileged EXEC command, on the active switch. See Managing Switch Stacks
In-Place Package Expansion for Software Images	The software image installation process is now optimized: • The space required for installation is reduced—after you have copied the.bin file to flash, only 20MB of additional space is required to complete the installation. • The.bin file is automatically deleted after completion of installation. The installation procedure you have to follow remains the same. See Upgrading the Switch Software, page 23
New in Wired Switching	
Autonomic Networking Infrastructure	Makes network devices intelligent by introducing self-management concepts that simplify network management. See Configuring Autonomic Networking. (IP Base and IP Services)
Bi-directional Forwarding Detection (BFD)	Provides fast forwarding path failure detection times for all media types, encapsulations, topologies, and routing protocols. It also provides a consistent failure detection method for network administrators. See Configuring Bidirectional Forwarding Detection. (IP Services)

Feature Name	Description and License Level Information
Campus Fabric	A virtual topology that can be used to logically connect devices that are a part your physical network, facilitating simple segmentation constructs to build secure boundaries. Fabric Overlay uses alternative forwarding attributes to provide services such as host mobility and enhanced security, which are additional to normal switching and routing capabilities. See Campus Fabric. (IP Services)
Cisco TrustSec: Security Group ACL (SGACL) Monitor Mode	Supports the following commands to ensure that SGACL enforcement does not cause any network disruptions in Cisco TrustSec deployments: • **cts role-based monitor** • **cts role-based permissions** • **show cts role-based permissions** See Security Commands. (IP Base and IP Services)
Cisco TrustSec: SGACL Logging	Supports the following commands to troubleshoot Cisco TrustSec deployments: • **cts role-based enforcement** See Security Commands. (IP Base and IP Services)
Cisco TrustSec: Virtual Routing and Forwarding Aware (VRF-Aware) Security Group Tag (SGT)	Enables a device to communicate with RADIUS servers through VRF interfaces. This feature allows protected access credential (PAC) and Environment-Data to be requested from the authentication device, Cisco Identity Services Engine (Cisco ISE), when Cisco ISE is in a VRF network. See VRF-Aware SGT. (IP Services)
Display of free memory on the CLI	Starting with this release, the amount of free memory is computed more accurately. The output of the following commands (privileged EXEC mode) displays this information: • **show memory platform** • **show platform resources** • **show processes memory platform** • **show platform software status control-processor** • **show platform software process list switch active R0 summary** See Interface and Hardware Commands.

Feature Name	Description and License Level Information
Encapsulated Remote Switched Port Analyzer (ERSPAN)	Enables you to monitor traffic on ports or VLANs and to send monitored traffic to destination ports. See Configuring ERSPAN. (IP Base and IP Services)
Federal Information Processing Standard Publication 140-2 (FIPS 140-2) and the Common Criteria for Information Technology Security Evaluation standard (Common Criteria or CC)	Cisco IOS XE Denali 16.3.1on the Cisco Catalyst 3850 Series Switches is being submitted for certification under FIPS 140-2 and Common Criteria compliance with the US Government, Security Requirements for Network Devices.
IPv4 Multicast over Point-to-Point Generic Routing Encapsulation (GRE) Tunnels	Supports multicasting over a GRE tunnel. See Configuring Multicast Routing over GRE Tunnels. (IP Base and IP Services)
IPv6 Support for VLAN ACLs (VACLs)	Supports filtering of IPv6 traffic by creating IPv6 VACLs and applying them to interfaces. VACLs access control network traffic by filtering all packets that are bridged within a VLAN in the switch or the switch stack. See Configuring IPv6 ACLs. (IP Base and IP Services)
IPv6 ACL Support for HTTP Servers	Supports attachment of IPv6 ACLs to configure a secure HTTP server. **Note** The existing CLIs that specify (only IPv4) ACLs are supported, but are going to be deprecated. Use the new CLIs that support both IPv4 and IPv6 ACLs instead. See Configuring Secure Socket Layer HTTP. (IP Services)
Media Access Control Security (MACsec): 256-bit AES MACsec (IEEE 802.1AE) host link encryption) with MACsec Key Agreement (MKA) 256-bit AES MACsec (IEEE 802.1AE) inter-network device encryption with MKA Extensible Authentication Protocol - Transport Layer Security (EAP-TLS) method support for MKA	Supports the IEEE 802.1x standard-based Layer 2 encryption with MKA on both uplink (switch-to-switch) and downlink (switch-to-host device) ports for 256-bit level encryption using EAP-TLS and Preshared Key (PSK). Supported on Cisco Catalyst 3650 Series Mini Switches and the Cisco Catalyst 3650 Series multigigabit switches. See MACSec Encryption. (IP Services)

Feature Name	Description and License Level Information
Multiprotocol Label Switching (MPLS)	Combines the performance and capabilities of Layer 2 (data link layer) switching with the proven scalability of Layer 3 (network layer) routing. MPLS enables service providers to meet the challenges of explosive growth in network utilization while providing the opportunity to differentiate services without sacrificing the existing network infrastructure. See Multiprotocol Label Switching (MPLS). (IP Services)
Network Edge Authentication Topology (NEAT)	Enables extended secure access in areas outside the wiring closet. It allows you to configure a switch to act as a supplicant to another switch. NEAT utilizes the Client Information Signaling Protocol (CISP) to propagate client MAC addresses and VLAN information between supplicant and authenticator switches. See Configuring IEEE 802.1x Port-Based Authentication. (LAN Base, IP Base, and IP Services)
Next Hop Resolution Protocol (NHRP)	An Address Resolution Protocol (ARP)-like protocol that dynamically maps a nonbroadcast multiaccess (NBMA) network. With NHRP, systems attached to an NBMA network can dynamically learn the NBMA (physical) address of the other systems that are part of that network, allowing these systems to directly communicate. NHRP is a client and server protocol where the hub is the Next Hop Server (NHS) and the spokes are the Next Hop Clients (NHCs). The hub maintains an NHRP database of the public interface addresses of each spoke. Each spoke registers its real address when it boots and queries the NHRP database for real addresses of the destination spokes to build direct tunnels. See Configuring NHRP. (IP Base and IP Services)
Wired Application Visibility and Control (AVC)	Support for AVC has been enabled on wired ports - for standalone switches, as well as a switch stack. See Configuring Application Visibility and Control. For important limitations related to this feature, see Limitations and Restrictions, page 61. (IP Base and IP Services)

Feature Name	Description and License Level Information
Yet Another Next Generation (YANG) data-modeling language	Support for the YANG data-modeling language, which replaces the process of manual configuration with a programmatic and standards-based way of writing configurations to any network device. It supports the automation of configuration for multiple switches across the network using data models. See Configuring YANG Datamodel. The list of supported leafs (xpaths) in the Native Yang Data Models (ned.yang), Cisco IOS XE Denali 16.3.1 is available at: http://www.cisco.com/c/dam/en/us/td/docs/switches/lan/catalyst3850/software/release/16-3/yang_models/IOS-XE1631_NativeYangDataModel.xlsx Any leaf/xpath which does not appear in this list is unsupported and is available for evaluation purposes only and may be removed from the model in the subsequent Cisco IOS XE releases. For important limitations related to this feature, see Limitations and Restrictions, page 61 (LAN Base, IP Base, and IP Services)
New in Wireless Switching	
–B Domain Support	The FCC (USA) rule making on 5 GHz released on April 1, 2014 (FCC 14-30 Report and Order) goes into effect for products that are sold or shipped on or after June 2, 2016. Cisco APs and Cisco WLCs will comply with the new rules by supporting the new regulatory domain, –B, for the US and will create new AP SKUs that are certified under the new rules. Examples of new rules include new 5-GHz band channels permitted for indoor and outdoor use, and transmission (Tx) power level increased for indoor, outdoor, and point-to-point transmissions. Cisco APs and Cisco WLCs that are in the –A domain category can continue to operate and even coexist with –B domain devices without any issues. We recommend that you upgrade Cisco APs and Cisco WLCs to the appropriate software release that supports –B domain. –B Domain Compliant Cisco APs starting with Cisco IOS XE Denali 16.2.2 are: 702i, 702w, 1552 (IoT versions only), 1532, 1572, 1600, 1700, 1810, 1810W, 2600, 2800, 3600, 3700, 3800.
AP2800 802.11 ac Wave 2 and AP3800 802.11 ac Wave 2: Cisco Multi-Gig (mGig) Enabled Ethernet Ports	Enables the current network to carry a higher bandwidth using mGig enabled Ethernet Ports. Speeds that cap at 1Gbps can now go upto 2.5Gpbs and 5Gbps speeds. These speeds can be achieved on the existing CAT5e and above type of LAN cables. **Note** Flexible Radio Assignment and 160 MH Channel width is not supported. (IP Base and IP Services)

Feature Name	Description and License Level Information
AVC Support on 802.11 ac Wave2 APs	Support for Application Visibility and Control (AVC) on the following Access Points (APs): Cisco Aironet 1810w Series APs Cisco Aironet 1830 Series APs Cisco Aironet 1850 Series APs Cisco Aironet 2800 Series APs Cisco Aironet 3800 Series APs You can now also capture AVC statistics for the last 48 hours. Use the **show platform software fed switch active avc statistics byte-count-window hours 48 raw** privilege EXEC command. (IP Base and IP Services)
Fast Locate with Local Mode	Provides reporting of location performance via data packets RSSI through Local Mode radios through CPU cycle stealing when Cisco Hyperlocation radio module is not installed on an AP. This is available on the following APs: Cisco Aironet 700 Series APs Cisco Aironet 1700 Series APs Cisco Aironet 2600 Series APs Cisco Aironet 2700 Series APs Cisco Aironet 3600 Series APs Cisco Aironet 3700 Series APs You can now configure Cisco Hyperlocation for an AP group. Previously, Cisco Hyperlocation configuration was applicable to all APs globally See Cisco Hyperlocation. (IP Base and IP Services)
Cisco Hyperlocation Module with Integrated Bluetooth Low Energy (BLE) Radio	Enables transmission of BLE broadcast messages by using up to 5 BLE transmitters. The Cisco Wireless Controller (Cisco WLC) is used to configure the transmission parameters such as interval for the beacons, UUID, and transmission power, per beacon globally for all the access points. Also, the Cisco WLC can configure major, minor, and transmission power value of each access point, thus providing more beacon granularity. This feature works in conjunction with Cisco Hyperlocation Radio Module and the Cisco Hyperlocation feature. See Cisco Hyperlocation. (IP Base and IP Services)

Feature Name	Description and License Level Information
Radio Frequency (RF) Profiles on Converged Access	Provide control over the data rates and power (TPC) values. These RF profiles allows you to optimize the RF settings for AP groups which operate in different environments or coverage zones. These profiles can be created for both radio bands - 2.4-GHz and 5-GHz See Configuring RF Profiles on CA. For information about important limitations related to this feature, see Limitations and Restrictions, page 61 (IP Base and IP Services)
Wall Plate 802.11 ac Wave 2 AP: Remote LAN	Support for Remote-LAN. This feature is similar to Wireless LAN (WLAN). While WLAN is used for wireless connection, Remote-LAN is used for wired ports. Configuring a Remote-LAN profile on the local Gigabit Ethernet ports enables the traffic from wired devices to connect to the WLAN controller. Cisco 1810W and 1810T series APs come with three local Gigabit Ethernet ports, one uplink Gigabit Ethernet port and one passive pass-through RJ-45 port. See Configuring Remote-LAN. (IP Base and IP Services)
New on the Web User Interface (Web UI)	
Web UI support for BLE Beacons and RF Profiles, Cisco Hyperlocation FastLocate	Features introduced and updated on the Web UI in this release: • BLE Beacons (IP Base and IP Services) • RF Profiles (IP Base and IP Services) • Cisco Hyperlocation Fast Locate (IP Base and IP Services) • Cisco Application Visibility for Wired Devices • Wired Alerts (LAN Base, IP Base, and IP Services) • Support for access points that have Ethernet ports to which the device can securely connect. (IP Base and IP Services)

Important Notes

- Starting with Cisco IOS XE Denali 16.3.x, Secure Shell (SSH) Version 1 is deprecated. Use SSH Version 2 instead.
- A switch stack containing a mix of Cisco Catalyst 3650 Series Switches and Cisco Catalyst 3850 Series Switches is not supported.
- Although visible in the CLI, the following commands are not supported:
  - **collect flow username**
  - **authorize-lsc-ap** (CSCui93659)
- The following features available in Cisco IOS XE Release 3.7.3E, are not supported in Cisco IOS XE Denali 16.3.x:

  - Cisco Plug-In for OpenFlow (OpenFlow 1.0 and 1.3)
- The following feature is available in Cisco IOS XE Release 3.6.3, but is not supported in Cisco IOS XE Denali 16.3.x:
  - Cisco Discovery Protocol (CDP) Bypass
- The following features are not supported in Cisco IOS XE Denali 16.3.x:
  - IP-in-IP (IPIP) Tunneling
  - Mesh, FlexConnect, and OfficeExtend access point deployment
  - Wireless Guest Anchor Controller (Cisco Catalyst 3650 Series Switches switch can be configured as a foreign controller.)
  - DVMRP Tunneling
  - Port Security on EtherChannel
  - 802.1x Configurable username and password for MAB
  - IEEE 802.1X-2010 with 802.1AE support
  - Command Switch Redundancy
  - CNS Config Agent
  - Dynamic Access Ports
  - IPv6 Ready Logo phase II - Host
  - IPv6 IKEv2 / IPSecv3
  - Fallback bridging for non-IP traffic
  - DHCP snooping ASCII circuit ID
  - Protocol Storm Protection
  - Per VLAN Policy & Per Port Policer
  - Packet Based Storm Control
  - Ingress/egress Shared Queues
  - Trust Boundary Configuration
  - Cisco Group Management Protocol (CGMP)
  - Device classifier for ASP
  - IPSLA Media Operation
  - Passive Monitoring
  - Performance Monitor (Phase 1)
  - AAA: TACACS over IPv6 Transport
  - Auto QoS for Video endpoints
  - EX SFP Support (GLC-EX-SMD)
  - IPv6 Strict Host Mode Support
  - IPv6 Static Route support on LAN Base images
  - VACL Logging of access denied
  - RFC5460 DHCPv6 Bulk Leasequery
  - DHCPv6 Relay Source Configuration

- RFC 4293 IP-MIB (IPv6 only)
- RFC 4292 IP-FORWARD-MIB (IPv6 only)
- RFC4292/RFC4293 MIBs for IPv6 traffic
- Layer 2 Tunneling Protocol Enhancements
- UniDirectional Link Routing (UDLR)
- Pragmatic General Multicast (PGM)
- DAI, IPSG Interoperability
- Ingress Strict Priority Queuing (Expedite)
- Weighted Random Early Detect (WRED)
- Improvements in QoS policing rates
- Fast SSID support for guest access WLANs

Supported Hardware

Catalyst 3650 Switch Models

Table 1 Catalyst 3650 Switch Models

Switch Model	Cisco IOS Image	Description
WS-C3650-24TS-L	LAN Base	Stackable 24 10/100/1000 Ethernet downlink ports, four 1-Gigabit SFP (small form-factor pluggable) uplink ports, 250-W power supply
WS-C3650-48TS-L	LAN Base	Stackable 48 10/100/1000 Ethernet downlink ports, four 1-Gigabit SFP uplink ports, 250-W power supply
WS-C3650-24PS-L	LAN Base	Stackable 24 10/100/1000 PoE+[1] downlink ports, four 1-Gigabit SFP uplink ports, 640-W power supply
WS-C3650-48PS-L	LAN Base	Stackable 48 10/100/1000 PoE+ downlink ports, four 1-Gigabit SFP uplink ports, 640-W power supply
WS-C3650-48FS-L	LAN Base	Stackable 48 10/100/1000 Full PoE downlink ports, four 1-Gigabit SFP uplink ports, 1025-W power supply
WS-C3650-24TD-L	LAN Base	Stackable 24 10/100/1000 Ethernet downlink ports, two 1-Gigabit SFP and two 10-Gigabit SFP+ uplink ports, 250-W power supply
WS-C3650-48TD-L	LAN Base	Stackable 48 10/100/1000 Ethernet downlink ports, two 1-Gigabit SFP and two 10-Gigabit SFP+ uplink ports, 250-W power supply

Table 1 Catalyst 3650 Switch Models (continued)

Switch Model	Cisco IOS Image	Description
WS-C3650-24PD-L	LAN Base	Stackable 24 10/100/1000 PoE+ downlink ports, two 1-Gigabit SFP and two 10-Gigabit SFP+ uplink ports, 640-W power supply
WS-C3650-48PD-L	LAN Base	Stackable 48 10/100/1000 PoE+ downlink ports, two 1-Gigabit SFP and two 10-Gigabit SFP+ uplink ports, 640-W power supply
WS-C3650-24PDM-L	LAN Base	Stackable 24 10/100/1000 PoE+ downlink ports, two 1-Gigabit SFP uplink ports, two 10-Gigabit SFP+ uplink ports, Fixed 640-W power supply
WS-C3650-48FD-L	LAN Base	Stackable 48 10/100/1000 Full PoE downlink ports, two 1-Gigabit SFP and two 10-Gigabit SFP+ uplink ports, 1025-W power supply
WS-C3650-48FQ-L	LAN Base	Stackable 48 10/100/1000 Full PoE downlink ports, four 10-Gigabit SFP+ uplink ports, 1025-W power supply
WS-C3650-48FQM-L	LAN Base	Stackable 48 10/100/1000 Full PoE downlink ports, four 10-Gigabit SFP+ uplink ports., Fixed 975-W power supply
WS-C3650-48PQ-L	LAN Base	Stackable 48 10/100/1000 PoE+ downlink ports, four 10-Gigabit SFP+ uplink ports, 640-W power supply
WS-C3650-48TQ-L	LAN Base	Stackable 48 10/100/1000 Ethernet downlink ports, four 10-Gigabit SFP+ uplink ports, 250-W power supply
WS-C3650-8X24UQ-L	LAN Base	Stackable 8 100M/1G/2.5G/5G/10G Cisco UPOE™ downlink ports, 16 10/100/1000 Cisco UPOE™ downlink ports, four 10-Gigabit uplink SPF+ ports, 1100-W power supply
WS-C3650-12X48UZ-L	LAN Base	Stackable 12 100M/1G/2.5G/5G/10G Cisco UPOE™ downlink ports, 36 10/100/1000 Cisco UPOE™ downlink ports, two 40-Gigabit uplink QSFP+ ports, 1100-W power supply
WS-C3650-12X48UR-L	LAN Base	Stackable 12 100M/1G/2.5G/5G/10G Cisco UPOE™ downlink ports, 36 10/100/1000 Cisco UPOE™ downlink ports, eight 10-Gigabit uplink SFP+ ports, 1100-W power supply
WS-C3650-12X48UQ-L	LAN Base	Stackable 12 100M/1G/2.5G/5G/10G Cisco UPOE™ downlink ports, 36 10/100/1000 Cisco UPOE™ downlink ports, four 10-Gigabit uplink SFP+ ports, 1100-W power supply
WS-C3650-24TS-S	IP Base	Stackable 24 10/100/1000 Ethernet downlink ports, four 1-Gigabit SFP uplink ports, 250-W power supply

Table 1 Catalyst 3650 Switch Models (continued)

Switch Model	Cisco IOS Image	Description
WS-C3650-48TS-S	IP Base	Stackable 48 10/100/1000 Ethernet downlink ports, four 1-Gigabit SFP uplink ports, 250-W power supply
WS-C3650-24PS-S	IP Base	Stackable 24 10/100/1000 PoE+ downlink ports, four 1-Gigabit SFP uplink ports, 640-W power supply
WS-C3650-48PS-S	IP Base	Stackable 48 10/100/1000 PoE+ downlink ports, four 1-Gigabit SFP uplink ports, 640-W power supply
WS-C3650-48FS-S	IP Base	Stackable 48 10/100/1000 Full PoE downlink ports, four 1-Gigabit SFP uplink ports, 1025-W power supply
WS-C3650-24TD-S	IP Base	Stackable 24 10/100/1000 Ethernet downlink ports, two 1-Gigabit SFP and two 10-Gigabit SFP+ uplink ports, 250-W power supply
WS-C3650-48TD-S	IP Base	Stackable 48 10/100/1000 Ethernet downlink ports, two 1-Gigabit SFP and two 10-Gigabit SFP+ uplink ports, 250-W power supply
WS-C3650-24PD-S	IP Base	Stackable 24 10/100/1000 PoE+ downlink ports, two 1-Gigabit SFP and two 10-Gigabit SFP+ uplink ports, 640-W power supply
WS-C3650-48PD-S	IP Base	Stackable 48 10/100/1000 PoE+ downlink ports, two 1-Gigabit SFP and two 10-Gigabit SFP+ uplink ports, 640-W power supply
WS-C3650-24PDM-S	IP Base	Stackable 24 10/100/1000 PoE+ downlink ports, two 1-Gigabit SFP uplink ports, two 10-Gigabit SFP+ uplink ports, Fixed 640-W power supply
WS-C3650-48FD-S	IP Base	Stackable 48 10/100/1000 Full PoE downlink ports, two 1-Gigabit SFP and two 10-Gigabit SFP+ uplink ports, 1025-W power supply
WS-C3650-48FQ-S	IP Base	Stackable 48 10/100/1000 Full PoE downlink ports, four 10-Gigabit SFP+ uplink ports, 1025-W power supply
WS-C3650-48FQM-S	IP Base	Stackable 48 10/100/1000 Full PoE downlink ports, four 10-Gigabit SFP+ uplink ports, Fixed 975-W power supply
WS-C3650-48PQ-S	IP Base	Stackable 48 10/100/1000 PoE+ downlink ports, four 10-Gigabit SFP+ uplink ports, 640-W power supply
WS-C3650-48TQ-S	IP Base	Stackable 48 10/100/1000 Ethernet downlink ports, four 10-Gigabit SFP+ uplink ports, 250-W power supply

Table 1 Catalyst 3650 Switch Models (continued)

Switch Model	Cisco IOS Image	Description
WS-C3650-8X24UQ-S	IP Base	Stackable 8 100M/1G/2.5G/5G/10G Cisco UPOE™ downlink ports, 16 10/100/1000 Cisco UPOE™ downlink ports, four 10-Gigabit uplink SPF+ ports, 1100-W power supply
WS-C3650-12X48UZ-S	IP Base	Stackable 12 100M/1G/2.5G/5G/10G Cisco UPOE™ downlink ports, 36 10/100/1000 Cisco UPOE™ downlink ports, two 40-Gigabit uplink QSFP+ ports, 1100-W power supply
WS-C3650-12X48UR-S	IP Base	Stackable 12 100M/1G/2.5G/5G/10G Cisco UPOE™ downlink ports, 36 10/100/1000 Cisco UPOE™ downlink ports, eight 10-Gigabit uplink SFP+ ports, 1100-W power supply
WS-C3650-12X48UQ-S	IP Base	Stackable 12 100M/1G/2.5G/5G/10G Cisco UPOE™ downlink ports, 36 10/100/1000 Cisco UPOE™ downlink ports, four 10-Gigabit uplink SFP+ ports, 1100-W power supply
WS-C3650-24TS-E	IP Services	Stackable 24 10/100/1000 Ethernet downlink ports, four 1-Gigabit SFP uplink ports, 250-W power supply
WS-C3650-48TS-E	IP Services	Stackable 48 10/100/1000 Ethernet downlink ports, four 1-Gigabit SFP uplink ports, 250-W power supply
WS-C3650-24PS-E	IP Services	Stackable 24 10/100/1000 PoE+ downlink ports, four 1-Gigabit SFP uplink ports, 640-W power supply
WS-C3650-48PS-E	IP Services	Stackable 48 10/100/1000 PoE+ downlink ports, four 1-Gigabit SFP uplink ports, 640-W power supply
WS-C3650-48FS-E	IP Services	Stackable 48 10/100/1000 Full PoE downlink ports, four 1-Gigabit SFP uplink ports, 1025-W power supply
WS-C3650-24TD-E	IP Services	Stackable 24 10/100/1000 Ethernet downlink ports, two 1-Gigabit SFP and two 10-Gigabit SFP+ uplink ports, 250-W power supply
WS-C3650-48TD-E	IP Services	Stackable 48 10/100/1000 Ethernet downlink ports, two 1-Gigabit SFP and two 10-Gigabit SFP+ uplink ports, 250-W power supply
WS-C3650-24PD-E	IP Services	Stackable 24 10/100/1000 PoE+ downlink ports, two 1-Gigabit SFP and two 10-Gigabit SFP+ uplink ports, 640-W power supply
WS-C3650-48PD-E	IP Services	Stackable 48 10/100/1000 PoE+ downlink ports, two 1-Gigabit SFP and two 10-Gigabit SFP+ uplink ports, 640-W power supply

Table 1 Catalyst 3650 Switch Models (continued)

Switch Model	Cisco IOS Image	Description
WS-C3650-24PDM-E	IP Services	Stackable 24 10/100/1000 PoE+ downlink ports, two 1-Gigabit SFP uplink ports, two 10-Gigabit SFP+ uplink ports, Fixed 640-W power supply
WS-C3650-48FD-E	IP Services	Stackable 48 10/100/1000 Full PoE downlink ports, two 1-Gigabit SFP and two 10-Gigabit SFP+ uplink ports, 1025-W power supply
WS-C3650-48FQ-E	IP Services	Stackable 48 10/100/1000 Full PoE downlink ports, four 10-Gigabit SFP+ uplink ports, 1025-W power supply
WS-C3650-48FQM-E	IP Services	Stackable 48 10/100/1000 Full PoE downlink ports, four10-Gigabit SFP+ uplink ports, Fixed 975-W power supply
WS-C3650-48PQ-E	IP Services	Stackable 48 10/100/1000 PoE+ downlink ports, four 10-Gigabit SFP+ uplink ports, 640-W power supply
WS-C3650-48TQ-E	IP Services	Stackable 48 10/100/1000 Ethernet downlink ports, four 10-Gigabit SFP+ uplink ports, 250-W power supply
WS-C3650-8X24UQ-E	IP Services	Stackable 8 100M/1G/2.5G/5G/10G Cisco UPOE™ downlink ports, 16 10/100/1000 Cisco UPOE™ downlink ports, four 10-Gigabit uplink SPF+ ports, 1100-W power supply
WS-C3650-12X48UZ-E	IP Services	Stackable 12 100M/1G/2.5G/5G/10G Cisco UPOE™ downlink ports, 36 10/100/1000 Cisco UPOE™ downlink ports, two 40-Gigabit uplink QSFP+ ports, 1100-W power supply
WS-C3650-12X48UR-E	IP Services	Stackable 12 100M/1G/2.5G/5G/10G Cisco UPOE™ downlink ports, 36 10/100/1000 Cisco UPOE™ downlink ports, eight 10-Gigabit uplink SFP+ ports, 1100-W power supply
WS-C3650-12X48UQ-E	IP Services	Stackable 12 100M/1G/2.5G/5G/10G Cisco UPOE™ downlink ports, 36 10/100/1000 Cisco UPOE™ downlink ports, four 10-Gigabit uplink SFP+ ports, 1100-W power supply

1. PoE+ = Power over Ethernet plus (provides up to 30 W per port).

Optics Modules

Catalyst switches support a wide range of optics. Because the list of supported optics is updated on a regular basis, consult the tables at this URL for the latest (SFP) compatibility information:

http://www.cisco.com/en/US/products/hw/modules/ps5455/products_device_support_tables_list.html

Access Points and Connected Mobile Experiences (CMX)

Table 2 lists the supported products of the Cisco Catalyst 3650 Series Switches.

Note Telnet is not supported on Cisco 1800 Series APs

Table 2 Catalyst 3650 Switch Supported Products

Product	Platform Supported
Access Point	Cisco Aironet 700, 702i, 700W, 702W, 1040, 1140, 1260, 1530, 1570, 1600, 1700, 1810W, 1830, 1850, 2600, 2700, 2800, 3500, 3600, 3700, 3800
Mobility Services Engine	3365, Virtual Appliance

Table 3 lists the specific supported Cisco access points.

Table 3 Supported Cisco Access Points

Access Points	
Cisco Aironet 700 Series	AIR-CAP702I-x-K9
Cisco Aironet 700W Series	AIR-CAP702Wx-K9
Cisco Aironet 1040 Series	AIR-AP1041N
	AIR-AP1042N
	AIR-LAP1041N
	AIR-LAP1042N
Cisco Aironet 1140 Series	AIR-AP1141N
	AIR-AP1142N
	AIR-LAP1141N
	AIR-LAP1142N
Cisco Aironet 1260 Series	AIR-LAP1261N
	AIR-LAP1262N
	AIR-AP1261N
	AIR-AP1262N
Cisco Aironet 1530 Series	AIR-CAP1532I-x-K9
	AIR-CAP1532E-x-K9
Cisco Aironet 1570 Series	AIR-AP1572EAC-A-K9
	AIR-AP1572ECx-A-K9
	AIR-AP1572ICx-A-K9
Cisco Aironet 1600 Series	AIR-CAP1602E
	AIR-CAP1602I
Cisco Aironet 1700 Series	AIR-CAP1702I-x-K9

Access Points	
Cisco Aironet 1810W Series	AIR-AP1810w-x-K9
Cisco Aironet 1830 Series	AIR-AP1832I-UXK9
	AIR-AP1832I-UXK9C
	AIR-AP1832I-x-K9
	AIR-AP1832I-x-K9C
Cisco Aironet 2600 Series	AIR-CAP2602E
	AIR-CAP2602I
Cisco Aironet 2700 Series	AIR-CAP2702I-x-K9
	AIR-CAP2702E-x-K9
Cisco Aironet 2800 Series	AIR-AP2802I-x-K9
	AIR-AP2802E-x-K9
Cisco Aironet 1850 Series	AIR-AP1852I-UXK9
	AIR-AP1852I-UXK9C
	AIR-AP1852E-UXK9
	AIR-AP1852E-UXK9C
	AIR-AP1852E-x-K9
	AIR-AP1852E-x-K9C
	AIR-AP1852I-x-K9
	AIR-AP1852I-x-K9C
Cisco Aironet 3500 Series	AIR-CAP3501E
	AIR-CAP3501I
	AIR-CAP3501P
	AIR-CAP3502E
	AIR-CAP3502I
	AIR-CAP3502P
Cisco Aironet 3600 Series Modules Supported: • AIR-RM3000AC-x-K9= • AIR-RM3000M= • AIR-RM3010L-x-K9= with AIR-ANT-LOC-01=	AIR-CAP3602E
	AIR-CAP3602I
Cisco Aironet 3700 Series Modules supported: • AIR-RM3000M= • AIR-RM3010L-x-K9= with AIR-ANT-LOC-01=	AIR-CAP3702I
	AIR-CAP3702E
	AIR-CAP3702P
Cisco Aironet 3800 Series	AIR-AP2802I-x-K9
	AIR-AP2802E-x-K9

Compatibility Matrix

Table 4 lists the software compatibility matrix.

Table 4 Software Compatibility Matrix

Catalyst 3650	Cisco 5700 WLC	Cisco 5508 or WiSM2	MSE/CMX	ISE	ACS	Cisco PI
Denali 16.3.2	03.07.04E 03.06.05E	8.2.0, 8.3.0	CMX 10.2.2	2.1 Patch 1 (Wired and Wireless)	5.4 5.5	PI 3.1 + PI 3.1 latest maintenance release + PI 3.1 latest device pack[1] (Wired and Wireless). See Prime Infrastructure 3.1 on cisco.com.
Denali 16.3.1	03.07.04E 03.06.05E	8.2.0, 8.3.0	CMX 10.2.2	2.0 Patch 3 1.4 Patch 7 1.3 Patch 6 (Wired and Wireless)	5.4 5.5	PI 3.1 + PI 3.1 latest maintenance release + PI 3.1 latest device pack[1] (Wired and Wireless). See Prime Infrastructure 3.1 on cisco.com.
Denali 16.2.2	03.07.02E 03.06.03E[3]	8.1.0, 8.2.0	CMX 10.2.2	1.3 Patch 5 (Wired and Wireless)	5.3 5.4	3.1.0 + Device Pack 1 (Wired and Wireless)
Denali 16.2.1	03.07.03E 03.06.03E[3]	8.1.0, 8.2.0	CMX 10.2.2	1.3 Patch 5 (Wired and Wireless)	5.3 5.4	3.1.0 (Wired) 3.1.0, 3.0.2[2] + Device Pack 4 + PI 3.0 Technology Pack (Wireless)
Denali 16.1.3	03.07.02E 03.06.03E[3]	8.1.0	CMX 10.2.0	1.3 Patch 3 (Wired) 1.4 (Wireless)	5.3 5.4	3.0.2 + Device Pack 5+ PI 3.0 Technology Pack
Denali 16.1.2	03.07.02E 03.06.03E[3]	8.1.0	CMX 10.2.0	1.3 Patch 3 (Wired) 1.4 (Wireless)	5.3 5.4	3.0.2 + Device Pack 4 + PI 3.0 Technology Pack
Denali 16.1.1	03.07.02E 03.06.03E[3]	8.1.0	CMX 10.2.0	1.3 Patch 3 (Wired) 1.4 (Wireless)	5.3 5.4	3.0.2 + PI 3.0 Device Pack 2 + PI 3.0 Technology Pack
03.07.03E 03.07.02E 03.07.01E 03.07.00E	03.07.03E 03.07.02E 03.07.01E 03.07.00E	8.0 8.0 8.0 7.6	8.0 8.0[4]	1.3 1.3	5.2 5.2 5.3	2.2

Table 4 Software Compatibility Matrix

Catalyst 3650	Cisco 5700 WLC	Cisco 5508 or WiSM2	MSE/CMX	ISE	ACS	Cisco PI
03.06.04E 03.06.03E 03.06.02aE 03.06.01E 03.06.00E	03.06.04E 03.06.02aE 03.06.01E 03.06.00E	8.0 8.0 7.6	8.0 8.0	1.3 1.2	5.2 5.2 5.3	2.2 2.2, 2.1.2, or 2.1.1 if MSE is also deployed[5] 2.1.0 if MSE is not deployed
03.03.03SE 03.03.02SE 03.03.01SE 03.03.00SE	03.03.03SE 03.03.02SE 03.03.01SE 03.03.00SE	7.5[6]	7.5	1.2	5.2 5.3	2.0

1. For maintenance release patches, go to Prime Infrastructure Patches. For the latest device pack, go to Prime Infrastructure Device Pack.
2. The Cisco IOS XE Denali 16.2.1 features are not available with 3.0.2, but 3.0.2 is compatible with Cisco IOS XE Denali 16.2.1.
3. Cisco 5700 (with Cisco IOS XE Release 03.06.03E/Cisco IOS XE Release 03.07.02E) inter-operates as a Peer MC with Catalyst 3850 running Cisco IOS XE Denali 16.1.1
4. Because of SHA-2 certificate implementation, MSE 7.6 is not compatible with Cisco IOS XE Release 3.6E and later. Therefore, we recommend that you upgrade to MSE 8.0.
5. If MSE is deployed on your network, we recommend that you upgrade to Cisco Prime Infrastructure 2.1.2.
6. Prime Infrastructure 2.0 enables you to manage Cisco WLC c7.5.102.0 with the features of Cisco WLC 7.4.110.0 and earlier releases. Prime Infrastructure 2.0 does not support any features of Cisco WLC 7.5.102.0 including the new AP platforms.

For more information on the compatibility of wireless software components across releases, see the *Cisco Wireless Solutions Software Compatibility Matrix*.

Web UI System Requirements

Hardware Requirements

Table 5 Minimum Hardware Requirements

Processor Speed	DRAM	Number of Colors	Resolution	Font Size
233 MHz minimum[1]	512 MB[2]	256	1024 x 768	Small

1. We recommend 1 GHz.
2. We recommend 1 GB DRAM.

Software Requirements

- Operating Systems
  - Windows 7
  - Mac OS X 10.9.5
- Browsers

- Google Chrome—Version 38 and later (On Windows)
- Microsoft Internet Explorer—Versions 10 and later (On Windows)
- Mozilla Firefox—Version 33 and later (On Windows and Mac)
- Safari—Version 7 and later (On Mac)

Finding the Software Version and Feature Set

Table 6 shows the mapping of the Cisco IOS XE version number and the Cisco IOS version number.

Table 6 Cisco IOS XE to Cisco IOS Version Number Mapping

Cisco IOS XE Version	Cisco IOSd Version	Cisco Wireless Control Module Version	Access Point Version
Denali 16.3.2	Not applicable	Denali 16.3.2	15.3(3)JPC2
Denali 16.3.1	Not applicable	Denali 16.3.1	15.3(3)JPC
Denali 16.2.2	Not applicable	Denali 16.2.2	15.3(3)JPB1
Denali 16.2.1	Not applicable	Denali 16.2.1	15.3(3)JPB
Denali 16.1.3	Not applicable	Denali 16.1.3	15.3(3)JNP2
Denali 16.1.2	Not applicable	Denali 16.1.2	15.3(3)JNP1
Denali 16.1.1	Not applicable	Denali 16.1.1	15.3(3)JNP
03.07.03E	15.2(3)E3	10.3.130.0	15.3(3)JNB3
03.07.02E	15.2(3)E2	10.3.100.0	15.3(3)JNB1
03.07.01E	15.2(3)E1	10.3.100.0	15.3(3)JNB1
03.07.00E	15.2(3)E	10.3.100.0	15.3(3)JNB
03.06.04E	15.2(2)E4	10.2.140.0	15.3(3)JN8
03.06.03E	15.2(2)E3	10.2.131.0	15.3(3)JN7
03.06.02aE	15.2(2)E2	10.2.120.0	15.3(3)JN4
03.06.01E	15.2(2)E1	10.2.111.0	15.3(3)JN3
03.06.00E	15.2(2)E	10.2.102.0	15.3(3)JN
03.03.05SE	15.0(1)EZ5	10.1.150.0	15.2(4)JB7
03.03.04SE	15.0(1)EZ4	10.1.140.0	15.2(4)JB6
03.03.03SE	15.0(1)EZ3	10.1.130.0	15.2(4)JB5h
03.03.02SE	15.0(1)EZ2	10.1.121.0	15.2(4)JB5
03.03.01SE	15.0(1)EZ1	10.1.110.0	15.2(4)JB2
03.03.00SE	15.0(1)EZ	10.1.100.0	15.2(4)JN

The package files for the Cisco IOS XE software are stored on the system board flash device (flash:).

You can use the **show version** privileged EXEC command to see the software version that is running on your switch.

Note Although the **show version** output always shows the software image running on the switch, the model name shown at the end of this display is the factory configuration and does not change if you upgrade the software license.

You can also use the **dir** *filesystem***:** privileged EXEC command to see the directory names of other software images that you might have stored in flash memory.

Upgrading the Switch Software

This section covers the following scenarios:

- Automatic Boot Loader Upgrade
- Automatic Microcode Upgrade
- Upgrading from Cisco IOS XE 3.xE to Cisco IOS XE Denali 16.1.x,16.2.x, or 16.3.x in Install Mode
- Upgrading from Cisco IOS XE 3.xE to Cisco IOS XE Denali 16.1.x, 16.2.x, or 16.3.x in Bundle Mode
- Upgrading from Cisco IOS XE Denali 16.1.1 to 16.1.x, 16.2.x, or 16.3.x in Install Mode
- Upgrading from Cisco IOS XE Denali 16.3.x to Cisco IOS XE 16.x in Install Mode
- Downgrade from Cisco IOS XE 16.x to Cisco IOS XE 3.xE in Install Mode
- Downgrade from Cisco IOS XE 16.x to Cisco IOS XE 3.xE in Bundle Mode
- WCM Sub Package Software Image Upgrade

Note You cannot use the Web UI to install, upgrade to, or downgrade from Cisco IOS XE Denali 16.1.x, 16.2.x, or 16.3.x.

Table 7 Software Images

Release	Image	File Name
Cisco IOS XE Denali 16.3.2	Universal	cat3k_caa-universalk9.16.03.02.SPA.bin
	Universal without DTLS	cat3k_caa-universalk9ldpe.16.03.02.SPA.bin
Cisco IOS XE Denali 16.3.1a	Universal	cat3k_caa-universalk9.16.03.01a.SPA.bin
	Universal without DTLS	cat3k_caa-universalk9ldpe.16.03.01a.SPA.bin
Cisco IOS XE Denali 16.3.1	Universal	cat3k_caa-universalk9.16.03.01.SPA.bin
	Universal without DTLS	cat3k_caa-universalk9ldpe.16.03.01.SPA.bin

Table 8 Changes in Software Installation CLI Commands

Cisco IOS XE 3.xE	
`Switch#software ?`	
`auto-upgrade`	Initiate auto upgrade for switches running incompatible software
`clean`	Clean unused package files from local media

commit	Commit the provisioned software and cancel the automatic rollback timer
expand	Expand a software bundle to local storage, default location is where the bundle currently resides
install	Install software
rollback	Rollback the committed software
Cisco IOS XE Denali 16.x Commands	
Switch#request platform software package ?	
clean	Clean unnecessary package files from media
copy	Copy package to media
describe	Describe package content
expand	Expand all-in-one package to media
install	Package installation
uninstall	Package uninstall
verify	Verify ISSU software package compatibility

Automatic Boot Loader Upgrade

When you upgrade from any prior IOS 3.xE release to an IOS XE 16.x release for the first time, the boot loader is automatically upgraded and it will take effect on the next reload. For subsequent IOS XE 16.x releases, if the boot loader is updated in those releases, it will be automatically upgraded when you load the new release on the switch. If you go back to an IOS 3.xE release, your boot loader will not be downgraded. The updated boot loader supports all previous IOS 3.xE releases.

Caution Do not power cycle your switch during the upgrade.

Scenario	Automatic Boot Loader Response

If you boot Cisco IOS XE Denali 16.3.2 the first time	The boot loader is upgraded to version 4.26. For example:
	`BOOTLDR: CAT3K_CAA Boot Loader (CAT3K_CAA-HBOOT-M) Version 4.26, RELEASE SOFTWARE (P)`
	During the automatic boot loader upgrade while booting Cisco IOS XE Denali 16.3.2, you will see the following on the console:
	`%IOSXEBOOT-Thu-###: (rp/0): Nov 3 00:10:16 Universal 2016 PLEASE DO NOT POWER CYCLE ### BOOT LOADER UPGRADING`
	`%IOSXEBOOT-loader-boot: (rp/0): upgrade successful`

If you boot Cisco IOS XE Denali 16.3.1 the first time	The boot loader is upgraded to version 3.76. For example:
	`CAT3K_CAA Boot Loader (CAT3K_CAA-HBOOT-M) Version 3.76, RELEASE SOFTWARE (P)`
	During the automatic boot loader upgrade while booting Cisco IOS XE Denali 16.3.1, you will see the following on the console:
	`%IOSXEBOOT-Mon-###: (rp/0): Jul 25 04:26:53 Universal 2016 PLEASE DO NOT POWER CYCLE ### BOOT LOADER UPGRADING`
	`%IOSXEBOOT-loader-boot: (rp/0): upgrade successful`

Scenario	Automatic Boot Loader Response

If you boot Cisco IOS XE Denali 16.2.x for the first time	The boot loader is upgraded to version 3.56. For example:
	`switch: version`
	`BOOTLDR: CAT3K_CAA Boot Loader (CAT3K_CAA-HBOOT-M) Version 3.56, RELEASE SOFTWARE (P)`
	During the automatic boot loader upgrade while booting Cisco IOS XE Denali 16.2.1, you will see the following on the console:
	`%IOSXEBOOT-Thu-###: (rp/0): Mar 24 18:18:10 Universal 2016 PLEASE DO NOT POWER CYCLE ### BOOT LOADER UPGRADING`
	`%IOSXEBOOT-loader-boot: (rp/0): upgrade successful`

If you boot Cisco IOS XE Denali 16.1.x for the first time	The boot loader is upgraded to version 3.2. For example:
	`BOOTLDR: CAT3K_CAA Boot Loader (CAT3K_CAA-HBOOT-M) Version 3.2, RELEASE SOFTWARE (P)`
	During the automatic boot loader upgrade while booting Cisco IOS XE Denali 16.1.x, you will see the following on the console:
	`%IOSXEBOOT-PLEASE-###: (rp/0): DO NOT POWER CYCLE ### BOOT LOADER UPGRADING`
	`%IOSXEBOOT-Nov-Tue: (rp/0): 24 11:04:42 Universal 2015 boot loader upgrade successful`

Automatic Microcode Upgrade

During an IOS image upgrade or downgrade on a PoE or UPoE switch, the microcode is updated to reflect applicable feature enhancements and bug fixes. Do not restart the switch during the upgrade or downgrade process. With the Cisco IOS XE Denali 16.x.x release, it takes approximately an additional 4 minutes to complete the microcode upgrade in addition to the normal reload time. The microcode update occurs only during an image upgrade or downgrade on PoE or UPoE switches. It does not occur during switch reloads or on non-PoE switches.

The following console messages are displayed during microcode upgrade:

```
Front-end Microcode IMG MGR: found 4 microcode images for 1 device.
Image for front-end 0: /tmp/microcode_update/front_end/fe_type_6_0
Image for front-end 0: /tmp/microcode_update/front_end/fe_type_6_1
Image for front-end 0: /tmp/microcode_update/front_end/fe_type_6_2
Image for front-end 0: /tmp/microcode_update/front_end/fe_type_6_3

Front-end Microcode IMG MGR: Preparing to program device microcode...
Front-end Microcode IMG MGR: Preparing to program device[0]...594412 bytes....
Skipped[0].
Front-end Microcode IMG MGR: Preparing to program device[0]...381758 bytes.
Front-end Microcode IMG MGR: Programming device
0...rwRrrrrrrw..0%....................................................................
.
..10%......................................................................20%........
.
.............................................................30%......................
..................................................40%.................................
......................................50%.............................................
```

```
.........................60%..........................................................
............70%.
........................................................................80%...........
...........................................................90%........................
..............................................100%
Front-end Microcode IMG MGR: Preparing to program device[0]...25166 bytes.
Front-end Microcode IMG MGR: Programming device
0...rrrrrrw..0%....10%....20%......30%...40%......50%....60%......70%...80%......90%..
..100%
Front-end Microcode IMG MGR: Microcode programming complete for device 0.
Front-end Microcode IMG MGR: Preparing to program device[0]...86370 bytes....
Skipped[3].
Front-end Microcode IMG MGR: Microcode programming complete in 237 seconds
```

Upgrading from Cisco IOS XE 3.xE to Cisco IOS XE Denali 16.1.x,16.2.x, or 16.3.x in Install Mode

Follow these instructions to upgrade from Cisco IOS XE 3.xE to Cisco IOS XE Denali 16.1.x, 16.2.x, or 16.3.x in Install Mode:

Copy New Image to Stack

When you expand the image, if you point to the source image on your TFTP server, you can skip this section and go to Software Install Image to Flash, page 27.

Step 1 Make sure your tftp server is reachable from IOS via GigabitEthernet0/0.

```
Switch# show run | i tftp
ip tftp source-interface GigabitEthernet0/0
ip tftp blocksize 8192
Switch#
Switch# show run | i ip route vrf
ip route vrf Mgmt-vrf 5.0.0.0 255.0.0.0 5.30.0.1
Switch#
Switch# show run int GigabitEthernet0/0
Building configuration...

Current configuration : 115 bytes
!
interface GigabitEthernet0/0
 vrf forwarding Mgmt-vrf
 ip address 5.30.12.121 255.255.0.0
 negotiation auto
end
Switch#
Switch# ping vrf Mgmt-vrf ip 5.28.11.250
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 5.28.11.250, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/2 ms
```

Step 2 Copy the image from your tftp server to flash.

```
Switch# copy tftp://5.28.11.250/cat3k_caa-universalk9.16.03.01.SPA.bin flash:
Destination filename [cat3k_caa-universalk9.16.03.01.SPA.bin]?
Accessing tftp://5.28.11.250/cat3k_caa-universalk9.16.03.01.SPA.bin...
```

```
Loading cat3k_caa-universalk9.16.03.01.SPA.bin from 5.28.11.250 (via
GigabitEthernet0/0):
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!O!!!!!!!!!!
!!!!!!!!!!!!!!!
[OK - 489159804 bytes]

489159804 bytes copied in 143.802 secs (3401620 bytes/sec)
Switch#
```

Step 3 Use the **dir flash** command to confirm that the image has been successfully copied to flash.

```
Switch# dir flash:*.bin
Directory of flash:/*.bin

   14  -rw-   489159804  Aug 1 2016 20:50:59 +00:00
cat3k_caa-universalk9.16.03.01.SPA.bin


1621966848 bytes total (827838464 bytes free)
Switch#
```

Software Install Image to Flash

Step 4 Use the **software install** command with the ‘new’ and ‘force’ options to expand the target image to flash. You can point to the source image on your TFTP server or in flash if you have it copied to flash.

```
Switch# software install file flash:cat3k_caa-universalk9.16.03.01.SPA.bin new force
Preparing install operation ...
[1]: Copying software from active switch 1 to switches 2,3,4
[1]: Finished copying software to switches 2,3,4
[1 2 3 4]: Starting install operation
[1 2 3 4]: Expanding bundle flash:cat3k_caa-universalk9.16.03.01.SPA.bin
[1 2 3 4]: Copying package files
[1 2 3 4]: Package files copied
[1 2 3 4]: Finished expanding bundle flash:cat3k_caa-universalk9.16.03.01.SPA.bin
[1 2 3 4]: Verifying and copying expanded package files to flash:
[1 2 3 4]: Verified and copied expanded package files to flash:
[1 2 3 4]: Starting compatibility checks
[1 2 3 4]: Bypassing peer package compatibility checks due to 'force' command option
[1 2 3 4]: Finished compatibility checks
[1 2 3 4]: Starting application pre-installation processing
[1 2 3 4]: Finished application pre-installation processing
[1]: Old files list:
    Removed cat3k_caa-base.SPA.03.07.03E.pkg
    Removed cat3k_caa-drivers.SPA.03.07.03E.pkg
    Removed cat3k_caa-infra.SPA.03.07.03E.pkg
    Removed cat3k_caa-iosd-universalk9.SPA.152-3.E3.pkg
    Removed cat3k_caa-platform.SPA.03.07.03E.pkg
    Removed cat3k_caa-wcm.SPA.10.3.130.0.pkg
[2]: Old files list:
    Removed cat3k_caa-base.SPA.03.07.03E.pkg
    Removed cat3k_caa-drivers.SPA.03.07.03E.pkg
    Removed cat3k_caa-infra.SPA.03.07.03E.pkg
    Removed cat3k_caa-iosd-universalk9.SPA.152-3.E3.pkg
    Removed cat3k_caa-platform.SPA.03.07.03E.pkg
    Removed cat3k_caa-wcm.SPA.10.3.130.0.pkg
[3]: Old files list:
    Removed cat3k_caa-base.SPA.03.07.03E.pkg
    Removed cat3k_caa-drivers.SPA.03.07.03E.pkg
    Removed cat3k_caa-infra.SPA.03.07.03E.pkg
    Removed cat3k_caa-iosd-universalk9.SPA.152-3.E3.pkg
    Removed cat3k_caa-platform.SPA.03.07.03E.pkg
    Removed cat3k_caa-wcm.SPA.10.3.130.0.pkg
[4]: Old files list:
    Removed cat3k_caa-base.SPA.03.07.03E.pkg
    Removed cat3k_caa-drivers.SPA.03.07.03E.pkg
    Removed cat3k_caa-infra.SPA.03.07.03E.pkg
    Removed cat3k_caa-iosd-universalk9.SPA.152-3.E3.pkg
    Removed cat3k_caa-platform.SPA.03.07.03E.pkg
    Removed cat3k_caa-wcm.SPA.10.3.130.0.pkg
[1]: New files list:
    Added cat3k_caa-rpbase.16.03.01.SPA.pkg
    Added cat3k_caa-rpcore.16.03.01.SPA.pkg
    Added cat3k_caa-srdriver.16.03.01.SPA.pkg
    Added cat3k_caa-wcm.16.03.01.SPA.pkg
    Added cat3k_caa-webui.16.03.01.SPA.pkg
[2]: New files list:
    Added cat3k_caa-rpbase.16.03.01.SPA.pkg
    Added cat3k_caa-rpcore.16.03.01.SPA.pkg
    Added cat3k_caa-srdriver.16.03.01.SPA.pkg
    Added cat3k_caa-wcm.16.03.01.SPA.pkg
    Added cat3k_caa-webui.16.03.01.SPA.pkg
[3]: New files list:
    Added cat3k_caa-rpbase.16.03.01.SPA.pkg
    Added cat3k_caa-rpcore.16.03.01.SPA.pkg
    Added cat3k_caa-srdriver.16.03.01.SPA.pkg
    Added cat3k_caa-wcm.16.03.01.SPA.pkg
    Added cat3k_caa-webui.16.03.01.SPA.pkg
[4]: New files list:
    Added cat3k_caa-rpbase.16.03.01.SPA.pkg
    Added cat3k_caa-rpcore.16.03.01.SPA.pkg
    Added cat3k_caa-srdriver.16.03.01.SPA.pkg
    Added cat3k_caa-wcm.16.03.01.SPA.pkg
    Added cat3k_caa-webui.16.03.01.SPA.pkg
[1 2 3 4]: Creating pending provisioning file
[1 2 3 4]: Finished installing software.  New software will load on reboot.
[1 2 3 4]: Committing provisioning file

[1 2 3 4]: Do you want to proceed with reload? [yes/no]: yes
[1 2 3 4]: Reloading
Switch#
```

Note Old files listed in the logs should be removed using the **request platform software package clean switch all** command, after reload

Reload

Step 5 If you said ‘Yes’ to the prompt in software install and your switches are configured with auto boot, the stack will automatically boot up with the new image. If not, you can manually boot flash:packages.conf

```
switch: boot flash:packages.conf
```

Note When you boot the new image, it will automatically update the boot loader.

Step 6 When the new image boots up, you can verify the version of the new image, by checking **show version**

```
Switch# show version
Cisco IOS Software [Denali], Catalyst L3 Switch Software (CAT3K_CAA-UNIVERSALK9-M),
Version 16.3.1, RELEASE SOFTWARE (fc3)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2016 by Cisco Systems, Inc.
```

```
Compiled Tue 02-Aug-16 17:33 by mcpre
```

Step 7 After you have successfully installed the image, you no longer need the .bin image and the file can be deleted from flash of each switch if it was copied to flash.

```
Switch# delete flash:cat3k_caa-universalk9.16.03.01.SPA.bin
Delete filename [cat3k_caa-universalk9.16.03.01.SPA.bin]?
Delete flash:/cat3k_caa-universalk9.16.03.01.SPA.bin? [confirm]
Switch#
```

Upgrading from Cisco IOS XE 3.xE to Cisco IOS XE Denali 16.1.x, 16.2.x, or 16.3.x in Bundle Mode

Follow these instructions to upgrade from Cisco IOS XE 3.xE to Cisco IOS XE Denali 16.1.x, 16.2.x, or 16.3.x in Bundle Mode:

Copy New Image to Stack

You cannot boot Cisco IOS XE Denali 16.1.1 via TFTP for the first time with a Cisco IOS XE 3.xE boot loader. The Cisco IOS XE 3.xE boot loaders have a limitation that they cannot boot an image larger than 400MB via the TFTP server. Since Cisco IOS XE Denali 16.1.x is larger than 400MB, you must boot the image via flash.

Note You cannot boot Cisco IOS XE Denali 16.1.1 via TFTP if you have a Cisco IOS XE 3.xE boot loader. The Cisco IOS XE 3.xE boot loaders have a limitation that they cannot boot an image larger than 400MB via TFTP.

Step 1 Make sure your TFTP server is reachable from IOS via GigabitEthernet0/0.

```
Switch# show run | i tftp
ip tftp source-interface GigabitEthernet0/0
ip tftp blocksize 8192
Switch#
Switch# show run | i ip route vrf
ip route vrf Mgmt-vrf 5.0.0.0 255.0.0.0 5.30.0.1
Switch#
Switch# show run int GigabitEthernet0/0
Building configuration...

Current configuration : 115 bytes
!
interface GigabitEthernet0/0
 vrf forwarding Mgmt-vrf
 ip address 5.30.12.121 255.255.0.0
 negotiation auto
end
Switch#
Switch# ping vrf Mgmt-vrf ip 5.28.11.250
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 5.28.11.250, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/2 ms
```

Step 2 Copy the image from your TFTP server to flash.

```
Switch# copy tftp://5.28.11.250/cat3k_caa-universalk9.16.03.01.SPA.bin flash:
Destination filename [cat3k_caa-universalk9.16.03.01.SPA.bin]?
Accessing tftp://5.28.11.250/cat3k_caa-universalk9.16.03.01.SPA.bin...
Loading cat3k_caa-universalk9.16.02.01.SPA.bin from 5.28.11.250 (via
GigabitEthernet0/0):
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!O!!!!!!!!!!
!!!!!!!!!!!!!!!
[OK - 489159804 bytes]

489159804 bytes copied in 143.802 secs (3401620 bytes/sec)
Switch#
```

Note If you have a stack, you must copy the image to the flash of each switch in your stack.

Step 3 Use the **dir flash** command to confirm that the image has been successfully copied to flash.

```
Switch# dir flash:*.bin
Directory of flash:/*.bin

Directory of flash:/

   14  -rw-   489159804  Aug 1 2016 20:50:59 +00:00
cat3k_caa-universalk9.16.03.01.SPA.bin
1621966848 bytes total (279199744 bytes free)
Switch#
```

Edit the Boot variable

Step 4 Clear the boot variable

```
Switch(config)# no boot system
```

Step 5 Edit the boot variable to point to the new image.

```
Switch(config)# boot system flash:cat3k_caa-universalk9.16.03.01.SPA.bin
```

Step 6 Use the **write memory** command to save the configuration change.

```
Switch#write memory
```

Step 7 Use the **show boot** command to confirm that your boot variable is pointing to the new image

```
Switch# show boot
---------------------------
Switch 1
---------------------------
Current Boot Variables:
BOOT variable = flash:cat3k_caa-universalk9.16.03.01.SPA.bin;

Boot Variables on next reload:
BOOT variable = flash:cat3k_caa-universalk9.16.03.01.SPA.bin;
Allow Dev Key = yes
Manual Boot = yes
Enable Break = yes
Switch#
```

Reload

Step 8 Reload the switch

```
Switch# reload
```

Step 9 If your switches are configured with auto boot, the stack will automatically boot up with the new image that your boot variable is configured to. If not, you can manually boot flash: cat3k_caa-universalk9.16.02.01.SPA.bin

```
switch:boot flash:cat3k_caa-universalk9.16.03.01.SPA.bin
```

Note When you boot the new image, it will automatically update the boot loader.

Step 10 When the new image boots up, you can verify the version of the new image, by checking **show version**

```
Cisco IOS Software [Denali], Catalyst L3 Switch Software (CAT3K_CAA-UNIVERSALK9-M),
Version 16.3.1, RELEASE SOFTWARE (fc3)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2016 by Cisco Systems, Inc.
Compiled Tue 02-Aug-16 17:33 by mcpre
```

Move from Cisco IOS XE Denali 16.x Bundle Mode to Install Mode

Step 11 Ensure you have enough space in flash to expand a new image by cleaning up old installation files. This command will erase your Cisco IOS XE Denali 16.x bin image file, so ensure that you copy it to your Active again.

Note Use the **switch all** option to clean up all switches in your stack.

```
Switch# request platform software package clean switch all file flash:
Running command on switch 1
Cleaning up unnecessary package files
  Scanning boot directory for packages ... done.
  Preparing packages list to delete ...
  done.

Running command on switch 2
Cleaning up unnecessary package files
  Scanning boot directory for packages ... done.
  Preparing packages list to delete ...
  done.

Running command on switch 3
Cleaning up unnecessary package files
  Scanning boot directory for packages ... done.
  Preparing packages list to delete ...
  done.

Running command on switch 4
Cleaning up unnecessary package files
  Scanning boot directory for packages ... done.
  Preparing packages list to delete ...
  done.

The following files will be deleted:
[1]:
/flash/cat3k_caa-base.SPA.03.07.02E.pkg
/flash/cat3k_caa-drivers.SPA.03.07.02E.pkg
/flash/cat3k_caa-infra.SPA.03.07.02E.pkg
/flash/cat3k_caa-iosd-universalk9.SPA.152-3.E2.pkg
```

```
/flash/cat3k_caa-platform.SPA.03.07.02E.pkg
/flash/cat3k_caa-universalk9.16.01.01.SPA.bin
/flash/cat3k_caa-wcm.SPA.10.3.120.0.pkg
/flash/packages.conf
[2]:
/flash/cat3k_caa-base.SPA.03.07.02E.pkg
/flash/cat3k_caa-drivers.SPA.03.07.02E.pkg
/flash/cat3k_caa-infra.SPA.03.07.02E.pkg
/flash/cat3k_caa-iosd-universalk9.SPA.152-3.E2.pkg
/flash/cat3k_caa-platform.SPA.03.07.02E.pkg
/flash/cat3k_caa-universalk9.16.01.01.SPA.bin
/flash/cat3k_caa-wcm.SPA.10.3.120.0.pkg
/flash/packages.conf
[3]:
/flash/cat3k_caa-base.SPA.03.07.02E.pkg
/flash/cat3k_caa-drivers.SPA.03.07.02E.pkg
/flash/cat3k_caa-infra.SPA.03.07.02E.pkg
/flash/cat3k_caa-iosd-universalk9.SPA.152-3.E2.pkg
/flash/cat3k_caa-platform.SPA.03.07.02E.pkg
/flash/cat3k_caa-universalk9.16.01.01.SPA.bin
/flash/cat3k_caa-wcm.SPA.10.3.120.0.pkg
/flash/packages.conf
[4]:
/flash/cat3k_caa-base.SPA.03.07.02E.pkg
/flash/cat3k_caa-drivers.SPA.03.07.02E.pkg
/flash/cat3k_caa-infra.SPA.03.07.02E.pkg
/flash/cat3k_caa-iosd-universalk9.SPA.152-3.E2.pkg
/flash/cat3k_caa-platform.SPA.03.07.02E.pkg
/flash/cat3k_caa-universalk9.16.01.01.SPA.bin
/flash/cat3k_caa-wcm.SPA.10.3.120.0.pkg
/flash/packages.conf

Do you want to proceed? [y/n]y
[1]:
Deleting file flash:cat3k_caa-base.SPA.03.07.02E.pkg ... done.
Deleting file flash:cat3k_caa-drivers.SPA.03.07.02E.pkg ... done.
Deleting file flash:cat3k_caa-infra.SPA.03.07.02E.pkg ... done.
Deleting file flash:cat3k_caa-iosd-universalk9.SPA.152-3.E2.pkg ... done.
Deleting file flash:cat3k_caa-platform.SPA.03.07.02E.pkg ... done.
Deleting file flash:cat3k_caa-universalk9.16.01.01.SPA.bin ... done.
Deleting file flash:cat3k_caa-wcm.SPA.10.3.120.0.pkg ... done.
Deleting file flash:packages.conf ... done.
SUCCESS: Files deleted.
[2]:
Deleting file flash:cat3k_caa-base.SPA.03.07.02E.pkg ... done.
Deleting file flash:cat3k_caa-drivers.SPA.03.07.02E.pkg ... done.
Deleting file flash:cat3k_caa-infra.SPA.03.07.02E.pkg ... done.
Deleting file flash:cat3k_caa-iosd-universalk9.SPA.152-3.E2.pkg ... done.
Deleting file flash:cat3k_caa-platform.SPA.03.07.02E.pkg ... done.
Deleting file flash:cat3k_caa-universalk9.16.01.01.SPA.bin ... done.
Deleting file flash:cat3k_caa-wcm.SPA.10.3.120.0.pkg ... done.
Deleting file flash:packages.conf ... done.
SUCCESS: Files deleted.
[3]:
Deleting file flash:cat3k_caa-base.SPA.03.07.02E.pkg ... done.
Deleting file flash:cat3k_caa-drivers.SPA.03.07.02E.pkg ... done.
Deleting file flash:cat3k_caa-infra.SPA.03.07.02E.pkg ... done.
Deleting file flash:cat3k_caa-iosd-universalk9.SPA.152-3.E2.pkg ... done.
Deleting file flash:cat3k_caa-platform.SPA.03.07.02E.pkg ... done.
Deleting file flash:cat3k_caa-universalk9.16.01.01.SPA.bin ... done.
Deleting file flash:cat3k_caa-wcm.SPA.10.3.120.0.pkg ... done.
Deleting file flash:packages.conf ... done.
SUCCESS: Files deleted.
[4]:
```

```
Deleting file flash:cat3k_caa-base.SPA.03.07.02E.pkg ... done.
Deleting file flash:cat3k_caa-drivers.SPA.03.07.02E.pkg ... done.
Deleting file flash:cat3k_caa-infra.SPA.03.07.02E.pkg ... done.
Deleting file flash:cat3k_caa-iosd-universalk9.SPA.152-3.E2.pkg ... done.
Deleting file flash:cat3k_caa-platform.SPA.03.07.02E.pkg ... done.
Deleting file flash:cat3k_caa-universalk9.16.01.01.SPA.bin ... done.
Deleting file flash:cat3k_caa-wcm.SPA.10.3.120.0.pkg ... done.
Deleting file flash:packages.conf ... done.
SUCCESS: Files deleted.
Switch#
```

Step 12 Copy the image from your tftp server to flash

```
Switch# copy tftp://5.28.11.250/cat3k_caa-universalk9.16.03.01.SPA.bin flash:
Destination filename [cat3k_caa-universalk9.16.03.01.SPA.bin]?
Accessing tftp://5.28.11.250/cat3k_caa-universalk9.16.03.01.SPA.bin...
Loading cat3k_caa-universalk9.16.02.01.SPA.bin from 5.28.11.250 (via
GigabitEthernet0/0):
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!O!!!!!!!!!!
!!!!!!!!!!!!!!!
[OK - 489159804 bytes]

489159804 bytes copied in 143.802 secs (3401620 bytes/sec)
Switch#
```

Step 13 Use the **software expand** command to expand the target image to flash and move from bundle mode to install mode. You can point to the source image on your TFTP server or in flash if you have it copied to flash.

Note Use the **switch all** option to upgrade all switches in your stack
Use the **auto-copy** option to copy the .bin image from flash: to all other switches in your stack

```
Switch# request platform software package expand switch all file
flash:cat3k_caa-universalk9.16.03.01.SPA.bin auto-copy
[1]: Copying flash:cat3k_caa-universalk9.16.03.01.SPA.bin from switch 1 to switch 2 3
4
[2 3 4]: Finished copying to switch 2 3 4
[1 2 3 4]: Expanding file
[1 2 3 4]: Finished expanding all-in-one software package in switch 1 2 3 4
SUCCESS: Finished expanding all-in-one software package.
Switch#
```

Edit the Boot variable

Step 14 Clear the boot variable

```
Switch(config)# no boot system
```

Step 15 Edit the boot variable to point to the new image.

```
Switch(config)# boot system flash:packages.conf
```

Step 16 Use the **write memory** command to save the configuration change.

```
Switch# write memory
```

Step 17 Use the **show boot** command to confirm that your boot variable is pointing to the new image

```
Switch# show boot
---------------------------
```

```
Switch 1
---------------------------
Current Boot Variables:
BOOT variable = flash:packages.conf;

Boot Variables on next reload:
BOOT variable = flash:packages.conf;
Manual Boot = yes
Enable Break = yes
Switch#
```

Reload

Step 18 Reload the switch

```
Switch# reload
```

Step 19 If your switches are configured with auto boot, the stack will automatically boot up with the new image. If not, you can manually boot flash:packages.conf

```
switch:boot flash:packages.conf
```

Step 20 When the new image boots up, you can verify the version of the new image, by checking **`show version`**

```
Switch# show version
Cisco IOS Software [Denali], Catalyst L3 Switch Software (CAT3K_CAA-UNIVERSALK9-M),
Version 16.3.1, RELEASE SOFTWARE (fc3)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2016 by Cisco Systems, Inc.
Compiled Tue 02-Aug-16 17:33 by mcpre
```

Step 21 After you have successfully installed the image, you no longer need the .bin image and the file can be deleted from the flash of each switch if you had copied to flash.

```
Switch# delete flash:cat3k_caa-universalk9.16.03.01.SPA.bin
Delete filename [cat3k_caa-universalk9.16.03.01.SPA.bin]?
Delete flash:/cat3k_caa-universalk9.16.03.01.SPA.bin? [confirm]
Switch#
```

Upgrading from Cisco IOS XE Denali 16.1.1 to 16.1.x, 16.2.x, or 16.3.x in Install Mode

Follow these instructions to upgrade from Cisco IOS XE Denali 16.1.1 to Cisco IOS XE Denali 16.1.x, 16.2.x, or 16.3.x in Install Mode. In order to do a software image upgrade, you must be booted into IOS using the **`boot flash:packages.conf`**.

Clean Up

Step 1 Ensure you have enough space in flash to expand a new image by cleaning up old installation files.

Note Use the switch all option to clean up all switches in your stack.

```
Switch# request platform software package clean switch all file flash:
Running command on switch 1
```

```
Cleaning up unnecessary package files
  Scanning boot directory for packages ... done.
  Preparing packages list to delete ...
    cat3k_caa-rpbase.16.01.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-srdriver.16.01.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-wcm.16.01.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-webui.16.01.01.SPA.pkg
      File is in use, will not delete.
    packages.conf
      File is in use, will not delete.
  done.

SUCCESS: No extra package or provisioning files found on media. Nothing to clean.
Running command on switch 2
Cleaning up unnecessary package files
  Scanning boot directory for packages ... done.
  Preparing packages list to delete ...
    cat3k_caa-rpbase.16.01.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-srdriver.16.01.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-wcm.16.01.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-webui.16.01.01.SPA.pkg
      File is in use, will not delete.
    packages.conf
      File is in use, will not delete.
  done.

SUCCESS: No extra package or provisioning files found on media. Nothing to clean.
Running command on switch 3
Cleaning up unnecessary package files
  Scanning boot directory for packages ... done.
  Preparing packages list to delete ...
    cat3k_caa-rpbase.16.01.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-srdriver.16.01.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-wcm.16.01.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-webui.16.01.01.SPA.pkg
      File is in use, will not delete.
    packages.conf
      File is in use, will not delete.
  done.

SUCCESS: No extra package or provisioning files found on media. Nothing to clean.
Running command on switch 4
Cleaning up unnecessary package files
  Scanning boot directory for packages ... done.
  Preparing packages list to delete ...
    packages.conf
      File is in use, will not delete.
    cat3k_caa-rpbase.16.01.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-srdriver.16.01.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-wcm.16.01.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-webui.16.01.01.SPA.pkg
      File is in use, will not delete.
  done.

SUCCESS: No extra package or provisioning files found on media. Nothing to clean.
Switch#
```

Copy New Image to Stack

Step 2 Copy the new image to flash: (or skip this step if you want to use the new image from your TFTP server).

```
Switch# copy tftp://5.28.11.250/cat3k_caa-universalk9.16.03.01.SPA.bin
flash:cat3k_caa-universalk9.16.03.01.SPA.bin
Destination filename [cat3k_caa-universalk9.16.03.01.SPA.bin]?
Accessing tftp://5.28.11.250/cat3k_caa-universalk9.16.03.01.SPA.bin...
Loading cat3k_caa-universalk9.16.03.01.SPA.bin from 5.28.11.250 (via
GigabitEthernet0/0):
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!
[OK - 489159804 bytes]

489159804 bytes copied in 143.802 secs (3401620 bytes/sec)
Switch#
```

Step 3 Use the **dir flash** command to confirm that the image has been successfully copied to flash.

```
Switch# dir flash:*.bin
Directory of flash:/*.bin

Directory of flash:/

 7759  -rw-   489159804  Aug 1 2016 04:35:43 +00:00
cat3k_caa-universalk9.16.03.01.SPA.bin
1621966848 bytes total (598597632 bytes free)
Switch#
```

Software Install Image to Flash

Step 4 Use the **request platform software package install switch all file flash: new auto-copy** command to install the target image to flash.

You can point to the source image on your TFTP server or in flash if you have it copied to flash.

Note Use the **switch all** option to upgrade all switches in your stack
Use the **new** option to upgrade from Cisco IOS XE Denali 16.1.1 to Cisco IOS XE Denali 16.1.x, 16.2.x, or 16.3.x. (There are packaging changes in Cisco IOS XE Denali 16.1.2 and later releases.)
Use the **auto-copy** option to copy the .bin image from flash: to all other switches in your stack

Note When you execute the command, the following message is displayed:

```
Unknown package type 21
```

This is expected and does not affect the upgrade. See CSCux82059

```
Switch# request platform software package install switch all file
flash:cat3k_caa-universalk9.16.03.01.SPA.bin new auto-copy
Expanding image file: flash:cat3k_caa-universalk9.16.03.01.SPA.bin
```

```
[1]: Copying flash:cat3k_caa-universalk9.16.03.01.SPA.bin from switch 1 to switch 2 3
4
[2 3 4]: Finished copying to switch 2 3 4
[1 2 3 4]: Expanding file
[1 2 3 4]: Finished expanding all-in-one software package in switch 1 2 3 4
SUCCESS: Finished expanding all-in-one software package.
[1 2 3 4]: Performing install

Unknown package type 21

Unknown package type 21

Unknown package type 21

Unknown package type 21
  SUCCESS: install Finished
[1]: install package(s) on switch 1
--- Starting list of software package changes ---
Old files list:
  Removed cat3k_caa-rpbase.16.01.01E.SPA.pkg
  Removed cat3k_caa-srdriver.16.01.01E.SPA.pkg
  Removed cat3k_caa-wcm.16.01.01E.SPA.pkg
  Removed cat3k_caa-webui.16.01.01E.SPA.pkg
New files list:
  Added cat3k_caa-rpbase.16.03.01.SPA.pkg
  Added cat3k_caa-rpcore.16.03.01.SPA.pkg
  Added cat3k_caa-srdriver.16.03.01.SPA.pkg
  Added cat3k_caa-wcm.16.03.01.SPA.pkg
  Added cat3k_caa-webui.16.03.01.SPA.pkg
Finished list of software package changes
SUCCESS: Software provisioned.  New software will load on reboot.
[1]: Finished install successful on switch 1
[2]: install package(s) on switch 2
--- Starting list of software package changes ---
Old files list:
  Removed cat3k_caa-rpbase.16.01.01E.SPA.pkg
  Removed cat3k_caa-srdriver.16.01.01E.SPA.pkg
  Removed cat3k_caa-wcm.16.01.01E.SPA.pkg
  Removed cat3k_caa-webui.16.01.01E.SPA.pkg
New files list:
  Added cat3k_caa-rpbase.16.03.01.SPA.pkg
  Added cat3k_caa-rpcore.16.03.01.SPA.pkg
  Added cat3k_caa-srdriver.16.03.01.SPA.pkg
  Added cat3k_caa-wcm.16.03.01.SPA.pkg
  Added cat3k_caa-webui.16.03.01.SPA.pkg
Finished list of software package changes
SUCCESS: Software provisioned.  New software will load on reboot.
[2]: Finished install successful on switch 2
[3]: install package(s) on switch 3
--- Starting list of software package changes ---
Old files list:
  Removed cat3k_caa-rpbase.16.01.01E.SPA.pkg
  Removed cat3k_caa-srdriver.16.01.01E.SPA.pkg
  Removed cat3k_caa-wcm.16.01.01E.SPA.pkg
  Removed cat3k_caa-webui.16.01.01E.SPA.pkg
New files list:
  Added cat3k_caa-rpbase.16.03.01.SPA.pkg
  Added cat3k_caa-rpcore.16.03.01.SPA.pkg
  Added cat3k_caa-srdriver.16.03.01.SPA.pkg
  Added cat3k_caa-wcm.16.03.01.SPA.pkg
  Added cat3k_caa-webui.16.03.01.SPA.pkg
Finished list of software package changes
SUCCESS: Software provisioned.  New software will load on reboot.
[3]: Finished install successful on switch 3
```

```
[4]: install package(s) on switch 4
--- Starting list of software package changes ---
Old files list:
  Removed cat3k_caa-rpbase.16.01.01E.SPA.pkg
  Removed cat3k_caa-srdriver.16.01.01E.SPA.pkg
  Removed cat3k_caa-wcm.16.01.01E.SPA.pkg
  Removed cat3k_caa-webui.16.01.01E.SPA.pkg
New files list:
  Added cat3k_caa-rpbase.16.03.01.SPA.pkg
  Added cat3k_caa-rpcore.16.03.01.SPA.pkg
  Added cat3k_caa-srdriver.16.03.01.SPA.pkg
  Added cat3k_caa-wcm.16.03.01.SPA.pkg
  Added cat3k_caa-webui.16.03.01.SPA.pkg
Finished list of software package changes
SUCCESS: Software provisioned.  New software will load on reboot.
[4]: Finished install successful on switch 4
Checking status of install on [1 2 3 4]
[1 2 3 4]: Finished install in switch 1 2 3 4
SUCCESS: Finished install: Success on [1 2 3 4]
Switch#
```

Note Old files listed in the logs will not be removed from flash.

Step 5 After you have successfully installed the software, verify that the flash partition has five new .pkg files and one updated packages.conf file. See sample output below:

```
Switch# dir flash:*.pkg
Directory of flash:/*.pkg

Directory of flash:/

 7747  -rw-   281076014  Mar 27 2016 22:15:50 +00:00
cat3k_caa-rpbase.16.01.01E.SPA.pkg
 7748  -rw-     7197312  Mar 27 2016 22:15:51 +00:00
cat3k_caa-srdriver.16.01.01E.SPA.pkg
 7749  -rw-   166767220  Mar 27 2016 22:15:51 +00:00  cat3k_caa-wcm.16.01.01E.SPA.pkg
 7750  -rw-    14631548  Mar 27 2016 22:15:51 +00:00
cat3k_caa-webui.16.01.01E.SPA.pkg
31000  -rw-         22173354   Aug 1 2016 04:40:38 -07:00
cat3k_caa-rpbase.16.03.01.SPA.pkg
30996  -rw-        266177140   Aug 1 2016 04:40:36 -07:00
cat3k_caa-rpcore.16.03.01.SPA.pkg
30998  -rw-          9067132   Aug 1 2016 04:40:37 -07:00
cat3k_caa-srdriver.16.03.01.SPA.pkg
30999  -rw-        178403952   Aug 1 2016 04:40:38 -07:00
cat3k_caa-wcm.16.03.01.SPA.pkg
30997  -rw-         13333112   Aug 1 2016 04:40:37 -07:00
cat3k_caa-webui.16.03.01.SPA.pkg
1621966848 bytes total (132620288 bytes free)
Switch#

Switch# dir flash:*.conf
Directory of flash:/*.conf

Directory of flash:/

30994  -rw-             4676   Aug 1 2016 04:42:26 -07:00  packages.conf
30995  -rw-             4667   Aug 1 2016 04:41:40 -07:00
cat3k_caa-universalk9.16.03.01.SPA.conf
1621966848 bytes total (132620288 bytes free)
Switch#
```

Step 6 After you have successfully installed the image, you no longer need the.bin image. If you copied the file to flash, you can delete it from the flash of each switch.

```
Switch# delete flash:cat3k_caa-universalk9.16.03.01.SPA.bin
Delete filename [cat3k_caa-universalk9.16.03.01.SPA.bin]?
Delete flash:/ cat3k_caa-universalk9.16.03.01.SPA.bin? [confirm]
Switch#
```

Reload

Step 7 Reload the switch.

```
Switch# reload
```

Step 8 If the switch is configured with auto boot, then the stack automatically boots up with the new image. If not, you can manually boot flash:packages.conf

```
switch:boot flash:packages.conf
```

Step 9 When the new image boots up, you can verify the version of the new image, by using the **show version** command:

```
Cisco IOS Software [Denali], Catalyst L3 Switch Software (CAT3K_CAA-UNIVERSALK9-M),
Version 16.3.1, RELEASE SOFTWARE (fc3)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2016 by Cisco Systems, Inc.
Compiled Tue 02-Aug-16 17:33 by mcpre
```

Upgrading from Cisco IOS XE Denali 16.3.x to Cisco IOS XE 16.x in Install Mode

Follow these instructions to upgrade from Cisco IOS XE Denali 16.3.x to a future IOS XE 16.x release in Install mode. In order to do a software image upgrade, you must be booted into IOS via “boot flash:packages.conf.”

Clean Up

Step 1 Ensure you have enough space in flash to expand a new image by cleaning up old installation files.

Note Use the **switch all** option to clean up all switches in your stack.

```
Switch# request platform software package clean switch all file flash:
Running command on switch 1
Cleaning up unnecessary package files
  Scanning boot directory for packages ... done.
  Preparing packages list to delete ...
    packages.conf
      File is in use, will not delete.
    cat3k_caa-rpbase.16.03.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-rpcore.16.03.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-srdriver.16.03.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-wcm.16.03.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-webui.16.03.01.SPA.pkg
      File is in use, will not delete.
  done.

SUCCESS: No extra package or provisioning files found on media. Nothing to clean.
Running command on switch 2
Cleaning up unnecessary package files
  Scanning boot directory for packages ... done.
  Preparing packages list to delete ...
    packages.conf
      File is in use, will not delete.
    cat3k_caa-rpbase.16.03.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-rpcore.16.03.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-srdriver.16.03.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-wcm.16.03.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-webui.16.03.01.SPA.pkg
      File is in use, will not delete.
  done.

SUCCESS: No extra package or provisioning files found on media. Nothing to clean.
Running command on switch 3
Cleaning up unnecessary package files
  Scanning boot directory for packages ... done.
  Preparing packages list to delete ...
    packages.conf
      File is in use, will not delete.
    cat3k_caa-rpbase.16.03.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-rpcore.16.03.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-srdriver.16.03.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-wcm.16.03.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-webui.16.03.01.SPA.pkg
      File is in use, will not delete.
  done.

SUCCESS: No extra package or provisioning files found on media. Nothing to clean.
Running command on switch 4
Cleaning up unnecessary package files
  Scanning boot directory for packages ... done.
  Preparing packages list to delete ...
    packages.conf
      File is in use, will not delete.
    cat3k_caa-rpbase.16.03.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-rpcore.16.03.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-srdriver.16.03.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-wcm.16.03.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-webui.16.03.01.SPA.pkg
      File is in use, will not delete.
  done.

SUCCESS: No extra package or provisioning files found on media. Nothing to clean.
```

```
Switch#
```

Copy New Image to Stack

Step 2 Copy the new image to flash: (or skip this step if you want to use the new image from your TFTP server).

```
Switch# copy tftp://5.28.11.250/cat3k_caa-universalk9.16.04.01.SPA.bin
flash:cat3k_caa-universalk9.16.04.01.SPA.bin
Destination filename [cat3k_caa-universalk9.16.04.01.SPA.bin]?
Accessing tftp://5.28.11.250/cat3k_caa-universalk9.16.04.01.SPA.bin...
Loading cat3k_caa-universalk9.16.04.01.SPA.bin from 5.28.11.250 (via
GigabitEthernet0/0):
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!
[OK - 465466221 bytes]

465466221 bytes copied in 118.175 secs (3938788 bytes/sec)
Switch#
```

Step 3 Use the **dir flash** command to confirm that the image has been successfully copied to flash.

```
Switch# dir flash:*.bin
Directory of flash:/*.bin

Directory of flash:/

 7759  -rw-   465466221  Aug 1 2016 04:35:43 +00:00
cat3k_caa-universalk9.16.04.01.SPA.bin
1621966848 bytes total (598597632 bytes free)
Switch#
```

Software Install Image to Flash

Step 4 Use the **request platform software package install switch all file flash: auto-copy** command to install the target image to flash. You can point to the source image on your TFTP server or in flash if you have it copied to flash.

Note Use the **switch all** option to upgrade all switches in your stack
Use the **auto-copy** option to copy the .bin image from flash: to all other switches in your stack

```
Switch# request platform software package install switch all file
flash:cat3k_caa-universalk9.16.04.01.SPA.bin auto-copy
Expanding image file: flash:cat3k_caa-universalk9.16.04.01.SPA.bin
[1]: Copying flash:cat3k_caa-universalk9.16.04.01.SPA.bin from switch 1 to switch 2 3
4
[2 3 4]: Finished copying to switch 2 3 4
[1 2 3 4]: Expanding file
[1 2 3 4]: Finished expanding all-in-one software package in switch 1 2 3 4
SUCCESS: Finished expanding all-in-one software package.
[1 2 3 4]: Performing install
  SUCCESS: install Finished
[1]: install package(s) on switch 1
--- Starting list of software package changes ---
Old files list:
  Removed cat3k_caa-rpbase.16.03.01.SPA.pkg
  Removed cat3k_caa-rpcore.16.03.01.SPA.pkg
  Removed cat3k_caa-srdriver.16.03.01.SPA.pkg
  Removed cat3k_caa-wcm.16.03.01.SPA.pkg
  Removed cat3k_caa-webui.16.03.01.SPA.pkg
New files list:
  Added cat3k_caa-rpbase.16.04.01.SPA.pkg
  Added cat3k_caa-rpcore.16.04.01.SPA.pkg
  Added cat3k_caa-srdriver.16.04.01.SPA.pkg
  Added cat3k_caa-wcm.16.04.01.SPA.pkg
  Added cat3k_caa-webui.16.04.01.SPA.pkg
Finished list of software package changes
SUCCESS: Software provisioned.  New software will load on reboot.
[1]: Finished install successful on switch 1
[2]: install package(s) on switch 2
--- Starting list of software package changes ---
Old files list:
  Removed cat3k_caa-rpbase.16.03.01.SPA.pkg
  Removed cat3k_caa-rpcore.16.03.01.SPA.pkg
  Removed cat3k_caa-srdriver.16.03.01.SPA.pkg
  Removed cat3k_caa-wcm.16.03.01.SPA.pkg
  Removed cat3k_caa-webui.16.03.01.SPA.pkg
New files list:
  Added cat3k_caa-rpbase.16.04.01.SPA.pkg
  Added cat3k_caa-rpcore.16.04.01.SPA.pkg
  Added cat3k_caa-srdriver.16.04.01.SPA.pkg
  Added cat3k_caa-wcm.16.04.01.SPA.pkg
  Added cat3k_caa-webui.16.04.01.SPA.pkg
Finished list of software package changes
SUCCESS: Software provisioned.  New software will load on reboot.
[2]: Finished install successful on switch 2
[3]: install package(s) on switch 3
--- Starting list of software package changes ---
Old files list:
  Removed cat3k_caa-rpbase.16.03.01.SPA.pkg
  Removed cat3k_caa-rpcore.16.03.01.SPA.pkg
  Removed cat3k_caa-srdriver.16.03.01.SPA.pkg
  Removed cat3k_caa-wcm.16.03.01.SPA.pkg
  Removed cat3k_caa-webui.16.03.01.SPA.pkg
New files list:
  Added cat3k_caa-rpbase.16.04.01.SPA.pkg
  Added cat3k_caa-rpcore.16.04.01.SPA.pkg
  Added cat3k_caa-srdriver.16.04.01.SPA.pkg
  Added cat3k_caa-wcm.16.04.01.SPA.pkg
  Added cat3k_caa-webui.16.04.01.SPA.pkg
Finished list of software package changes
SUCCESS: Software provisioned.  New software will load on reboot.
[3]: Finished install successful on switch 3
[4]: install package(s) on switch 4
--- Starting list of software package changes ---
Old files list:
  Removed cat3k_caa-rpbase.16.03.01.SPA.pkg
  Removed cat3k_caa-rpcore.16.03.01.SPA.pkg
  Removed cat3k_caa-srdriver.16.03.01.SPA.pkg
  Removed cat3k_caa-wcm.16.03.01.SPA.pkg
  Removed cat3k_caa-webui.16.03.01.SPA.pkg
New files list:
  Added cat3k_caa-rpbase.16.04.01.SPA.pkg
  Added cat3k_caa-rpcore.16.04.01.SPA.pkg
  Added cat3k_caa-srdriver.16.04.01.SPA.pkg
  Added cat3k_caa-wcm.16.04.01.SPA A.pkg
  Added cat3k_caa-webui.16.04.01.SPA.pkg
Finished list of software package changes
SUCCESS: Software provisioned.  New software will load on reboot.
[4]: Finished install successful on switch 4
Checking status of install on [1 2 3 4]
[1 2 3 4]: Finished install in switch 1 2 3 4
```

```
SUCCESS: Finished install: Success on [1 2 3 4]

Switch#
```

Note Old files listed in the logs will not be removed from flash.

Step 5 After the software has been successfully installed, verify that the flash partition has five new .pkg files and 1 updated packages.conf file. See sample output below.

```
Switch# dir flash:*.pkg
Directory of flash:/*.pkg

Directory of flash:/

 7761  -rw-    21906269  Aug 1 2016 04:45:48 +00:00  cat3k_caa-rpbase.16.03.01.SPA.pkg
 7765  -rw-   253160056  Aug 1 2016 04:45:50 +00:00  cat3k_caa-rpcore.16.03.01.SPA.pkg
 7763  -rw-     7328384  Aug 1 2016 04:45:49 +00:00
cat3k_caa-srdriver.16.03.01.SPA.pkg
 7762  -rw-   165657204  Aug 1 2016 04:45:49 +00:00  cat3k_caa-wcm.16.03.01.SPA.pkg
 7764  -rw-    17408636  Aug 1 2016 04:45:49 +00:00  cat3k_caa-webui.16.03.01.SPA.pkg
 7749  -rw-    21902119  Aug 1 2016 06:09:38 +00:00  cat3k_caa-rpbase.16.04.01.SPA.pkg
 7760  -rw-   253094520  Aug 1 2016 06:09:41 +00:00  cat3k_caa-rpcore.16.04.01.SPA.pkg
 7755  -rw-     7326336  Aug 1 2016 06:09:39 +00:00
cat3k_caa-srdriver.16.04.01.SPA.pkg
 7750  -rw-   165667444  Aug 1 2016 06:09:39 +00:00  cat3k_caa-wcm.16.04.01.SPA.pkg
 7759  -rw-    16829052  Aug 1 2016 06:09:39 +00:00  cat3k_caa-webui.16.04.01.SPA.pkg
1621966848 bytes total (137928704 bytes free)
Switch#
Switch# dir flash:*.conf
Directory of flash:/*.conf

Directory of flash:/

 7766  -rw-        5137  Aug 1 2016 06:10:39 +00:00
cat3k_caa-universalk9.16.04.01.SPA.conf
 7769  -rw-        5125  Aug 1 2016 06:11:19 +00:00  packages.conf
1621966848 bytes total (137928704 bytes free)
Switch#
```

Step 6 After you have successfully installed the image, you do not need the .bin image and the file can be deleted from the flash of EACH switch if you had it copied to flash.

```
Switch# delete flash:cat3k_caa-universalk9.16.04.01.SPA.bin
Delete filename [cat3k_caa-universalk9.16.04.01.SPA.bin]?
Delete flash:/ cat3k_caa-universalk9.16.04.01.SPA.bin? [confirm]
Switch#
```

Reload

Step 7 Reload the switch

```
Switch# reload
```

Step 8 If your switches are configured with auto boot, then the stack will automatically boot up with the new image. If not, you can manually boot flash:packages.conf

```
switch: boot flash:packages.conf
```

Note When you boot the new image, it will automatically update the boot loader.

Step 9 When the new image boots up, you can verify the version of the new image, using the **show version** command:

```
Switch# show version
Cisco IOS Software, Catalyst L3 Switch Software (CAT3K_CAA-UNIVERSALK9-M), Version
Denali 16.4.1, RELEASE SOFTWARE (fc1)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2016 by Cisco Systems, Inc.
Compiled Thu 1-Aug-16 22:49 by mcpre
```

Downgrade from Cisco IOS XE 16.x to Cisco IOS XE 3.xE in Install Mode

Follow these instructions to downgrade from Cisco IOS XE 16.x to older Cisco IOS XE 3.xE releases in Install Mode.

Clean Up

Step 1 Ensure you have enough space in flash to expand a new image by cleaning up old installation files.

Note Use the **switch all** option to clean up all switches in your stack.

```
Switch#request platform software package clean switch all file flash:
Running command on switch 1
Cleaning up unnecessary package files
  Scanning boot directory for packages ... done.
Preparing packages list to delete ...
    cat3k_caa-rpbase.16.03.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-rpcore.16.03.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-srdriver.16.03.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-wcm.16.03.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-webui.16.03.01.SPA.pkg
      File is in use, will not delete.
    packages.conf
      File is in use, will not delete.
  done.

Running command on switch 2
Cleaning up unnecessary package files
  Scanning boot directory for packages ... done.
Preparing packages list to delete ...
    cat3k_caa-rpbase.16.03.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-rpcore.16.03.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-srdriver.16.03.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-wcm.16.03.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-webui.16.03.01.SPA.pkg
      File is in use, will not delete.
    packages.conf
      File is in use, will not delete.
  done.

Running command on switch 3
Cleaning up unnecessary package files
  Scanning boot directory for packages ... done.
Preparing packages list to delete ...
    cat3k_caa-rpbase.16.03.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-rpcore.16.03.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-srdriver.16.03.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-wcm.16.03.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-webui.16.03.01.SPA.pkg
      File is in use, will not delete.
    packages.conf
      File is in use, will not delete.
  done.

Running command on switch 4
Cleaning up unnecessary package files
  Scanning boot directory for packages ... done.
Preparing packages list to delete ...
    cat3k_caa-rpbase.16.03.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-rpcore.16.03.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-srdriver.16.03.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-wcm.16.03.01.SPA.pkg
      File is in use, will not delete.
    cat3k_caa-webui.16.03.01.SPA.pkg
      File is in use, will not delete.
    packages.conf
      File is in use, will not delete.
  done.

The following files will be deleted:
[1]:
/flash/cat3k_caa-rpbase.16.02.01.SPA.pkg
/flash/cat3k_caa-srdriver.16.02.01.SPA.pkg
/flash/cat3k_caa-universalk9.16.01.01.SPA.bin
/flash/cat3k_caa-universalk9.16.01.01.SPA.conf
/flash/cat3k_caa-wcm.16.02.01.SPA.pkg
/flash/cat3k_caa-webui.16.02.01.SPA.pkg
/flash/packages.conf.00-
[2]:
/flash/cat3k_caa-rpbase.16.02.01.SPA.pkg
/flash/cat3k_caa-srdriver.16.02.01.SPA.pkg
/flash/cat3k_caa-universalk9.16.01.01.SPA.bin
/flash/cat3k_caa-universalk9.16.01.01.SPA.conf
/flash/cat3k_caa-wcm.16.02.01.SPA.pkg
/flash/cat3k_caa-webui.16.02.01.SPA.pkg
/flash/packages.conf.00-
[3]:
/flash/cat3k_caa-rpbase.16.02.01.SPA.pkg
/flash/cat3k_caa-srdriver.16.02.01.SPA.pkg
/flash/cat3k_caa-universalk9.16.01.01.SPA.bin
/flash/cat3k_caa-universalk9.16.01.01.SPA.conf
/flash/cat3k_caa-wcm.16.02.01.SPA.pkg
/flash/cat3k_caa-webui.16.02.01.SPA.pkg
/flash/packages.conf.00-
[4]:
```

```
/flash/cat3k_caa-rpbase.16.02.01.SPA.pkg
/flash/cat3k_caa-srdriver.16.02.01.SPA.pkg
/flash/cat3k_caa-universalk9.16.01.01.SPA.bin
/flash/cat3k_caa-universalk9.16.01.01.SPA.conf
/flash/cat3k_caa-wcm.16.02.01.SPA.pkg
/flash/cat3k_caa-webui.16.02.01.SPA.pkg
/flash/packages.conf.00-

Do you want to proceed? [y/n]y
[1]:
Deleting file flash:cat3k_caa-rpbase.16.02.01.SPA.pkg ... done.
Deleting file flash:cat3k_caa-srdriver.16.02.01.SPA.pkg ... done.
Deleting file flash:cat3k_caa-universalk9.16.01.01.SPA.bin ... done.
Deleting file flash:cat3k_caa-universalk9.16.01.01.SPA.conf ... done.
Deleting file flash:cat3k_caa-wcm.16.02.01.SPA.pkg ... done.
Deleting file flash:cat3k_caa-webui.16.02.01.SPA.pkg ... done.
Deleting file flash:packages.conf.00- ... done.
SUCCESS: Files deleted.
[2]:
Deleting file flash:cat3k_caa-rpbase.16.02.01.SPA.pkg ... done.
Deleting file flash:cat3k_caa-srdriver.16.02.01.SPA.pkg ... done.
Deleting file flash:cat3k_caa-universalk9.16.01.01.SPA.bin ... done.
Deleting file flash:cat3k_caa-universalk9.16.01.01.SPA.conf ... done.
Deleting file flash:cat3k_caa-wcm.16.02.01.SPA.pkg ... done.
Deleting file flash:cat3k_caa-webui.16.02.01.SPA.pkg ... done.
Deleting file flash:packages.conf.00- ... done.
SUCCESS: Files deleted.
[3]:
Deleting file flash:cat3k_caa-rpbase.16.02.01.SPA.pkg ... done.
Deleting file flash:cat3k_caa-srdriver.16.02.01.SPA.pkg ... done.
Deleting file flash:cat3k_caa-universalk9.16.01.01.SPA.bin ... done.
Deleting file flash:cat3k_caa-universalk9.16.01.01.SPA.conf ... done.
Deleting file flash:cat3k_caa-wcm.16.02.01.SPA.pkg ... done.
Deleting file flash:cat3k_caa-webui.16.02.01.SPA.pkg ... done.
Deleting file flash:packages.conf.00- ... done.
SUCCESS: Files deleted.
[4]:
Deleting file flash:cat3k_caa-rpbase.16.02.01.SPA.pkg ... done.
Deleting file flash:cat3k_caa-srdriver.16.02.01.SPA.pkg ... done.
Deleting file flash:cat3k_caa-universalk9.16.01.01.SPA.bin ... done.
Deleting file flash:cat3k_caa-universalk9.16.01.01.SPA.conf ... done.
Deleting file flash:cat3k_caa-wcm.16.02.01.SPA.pkg ... done.
Deleting file flash:cat3k_caa-webui.16.02.01.SPA.pkg ... done.
Deleting file flash:packages.conf.00- ... done.
SUCCESS: Files deleted.
Switch#
```

Copy New Image to Stack

Step 2 Copy the target Cisco IOS XE 3.xE image to flash: (you can skip this step if you want to use the image from your TFTP server).

```
Switch# copy tftp://5.28.11.250/cat3k_caa-universalk9.SPA.03.07.02.E.152-3.E2.bin
flash:
cat3k_caa-universalk9.SPA.03.07.02.E.152-3.E2.bin
Destination filename [cat3k_caa-universalk9.SPA.03.07.02.E.152-3.E2.bin]?
Accessing tftp://5.28.11.250/cat3k_caa-universalk9.SPA.03.07.02.E.152-3.E2.bin...
Loading cat3k_caa-universalk9.SPA.03.07.02.E.152-3.E2.bin from 5.28.11.250 (via
GigabitEthernet0/0):
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!O!!!!!!!!!!
!!!!!!!!!!!!!!!
```

```
[OK - 311154824 bytes]

311154824 bytes copied in 68.781 secs (4523849 bytes/sec)
Switch#
```

Step 3 Use the **dir flash** command to confirm that the image has been successfully copied to flash.

```
Switch# dir flash:*.bin
Directory of flash:/*.bin

Directory of flash:/

47718  -rw-   311154824  Nov 25 2015 18:17:21 +00:00
cat3k_caa-universalk9.SPA.03.07.02.E.152-3.E2.bin

3458338816 bytes total (2468995072 bytes free)
Switch#
```

Downgrade Software Image

Step 4 Use the **request platform software package install** command with the **new** option to downgrade your stack. You can point to the source image on your tftpserver or in flash if you have it copied to flash.

Note Use the **switch all** option is needed to upgrade all switches in your stack.
Use the **auto-copy** option to copy the .bin image from flash: to all other switches in your stack.

```
Switch#request platform software package install switch all file flash:cat3k_caa-
universalk9.SPA.03.07.02.E.152-3.E2.bin new auto-copy
Expanding image file: flash:cat3k_caa-universalk9.SPA.03.07.02.E.152-3.E2.bin
[4]: Copying flash:cat3k_caa-universalk9.SPA.03.07.02.E.152-3.E2.bin from switch 4 to
switch 1 2 3
[1 2 3]: Finished copying to switch 1 2 3
[1 2 3 4]: Expanding file
[1 2 3 4]: Finished expanding all-in-one software package in switch 1 2 3 4
SUCCESS: Finished expanding all-in-one software package.
[1 2 3 4]: Performing install
  SUCCESS: install Finished
[1]: install package(s) on switch 1
--- Starting list of software package changes ---
Old files list:
  Removed cat3k_caa-rpbase.16.03.01.SPA.pkg
  Removed cat3k_caa-rpcore.16.03.01.SPA.pkg
  Removed cat3k_caa-srdriver.16.03.01.SPA.pkg
  Removed cat3k_caa-wcm.16.03.01.SPA.pkg
  Removed cat3k_caa-webui.16.03.01.SPA.pkg
New files list:
  Added cat3k_caa-base.SPA.03.07.02E.pkg
  Added cat3k_caa-drivers.SPA.03.07.02E.pkg
  Added cat3k_caa-infra.SPA.03.07.02E.pkg
  Added cat3k_caa-iosd-universalk9.SPA.152-3.E2.pkg
  Added cat3k_caa-platform.SPA.03.07.02E.pkg
  Added cat3k_caa-wcm.SPA.10.3.120.0.pkg
Finished list of software package changes
SUCCESS: Software provisioned.  New software will load on reboot.
[1]: Finished install successful on switch 1
[2]: install package(s) on switch 2
--- Starting list of software package changes ---
Old files list:
  Removed cat3k_caa-rpbase.16.03.01.SPA.pkg
  Removed cat3k_caa-rpcore.16.03.01.SPA.pkg
  Removed cat3k_caa-srdriver.16.03.01.SPA.pkg
  Removed cat3k_caa-wcm.16.03.01.SPA.pkg
  Removed cat3k_caa-webui.16.03.01.SPA.pkg
New files list:
  Added cat3k_caa-base.SPA.03.07.02E.pkg
  Added cat3k_caa-drivers.SPA.03.07.02E.pkg
  Added cat3k_caa-infra.SPA.03.07.02E.pkg
  Added cat3k_caa-iosd-universalk9.SPA.152-3.E2.pkg
  Added cat3k_caa-platform.SPA.03.07.02E.pkg
  Added cat3k_caa-wcm.SPA.10.3.120.0.pkg
Finished list of software package changes
SUCCESS: Software provisioned.  New software will load on reboot.
[2]: Finished install successful on switch 2
[3]: install package(s) on switch 3
--- Starting list of software package changes ---
Old files list:
  Removed cat3k_caa-rpbase.16.03.01.SPA.pkg
  Removed cat3k_caa-rpcore.16.03.01.SPA.pkg
  Removed cat3k_caa-srdriver.16.03.01.SPA.pkg
  Removed cat3k_caa-wcm.16.03.01.SPA.pkg
  Removed cat3k_caa-webui.16.03.01.SPA.pkg
New files list:
  Added cat3k_caa-base.SPA.03.07.02E.pkg
  Added cat3k_caa-drivers.SPA.03.07.02E.pkg
  Added cat3k_caa-infra.SPA.03.07.02E.pkg
  Added cat3k_caa-iosd-universalk9.SPA.152-3.E2.pkg
  Added cat3k_caa-platform.SPA.03.07.02E.pkg
  Added cat3k_caa-wcm.SPA.10.3.120.0.pkg
Finished list of software package changes
SUCCESS: Software provisioned.  New software will load on reboot.
[3]: Finished install successful on switch 3
[4]: install package(s) on switch 4
--- Starting list of software package changes ---
Old files list:
  Removed cat3k_caa-rpbase.16.03.01.SPA.pkg
  Removed cat3k_caa-rpcore.16.03.01.SPA.pkg
  Removed cat3k_caa-srdriver.16.03.01.SPA.pkg
  Removed cat3k_caa-wcm.16.03.01.SPA.pkg
  Removed cat3k_caa-webui.16.03.01.SPA.pkg
New files list:
  Added cat3k_caa-base.SPA.03.07.02E.pkg
  Added cat3k_caa-drivers.SPA.03.07.02E.pkg
  Added cat3k_caa-infra.SPA.03.07.02E.pkg
  Added cat3k_caa-iosd-universalk9.SPA.152-3.E2.pkg
  Added cat3k_caa-platform.SPA.03.07.02E.pkg
  Added cat3k_caa-wcm.SPA.10.3.120.0.pkg
Finished list of software package changes
SUCCESS: Software provisioned.  New software will load on reboot.
[4]: Finished install successful on switch 4
Checking status of install on [1 2 3 4]
[1 2 3 4]: Finished install in switch 1 2 3 4
SUCCESS: Finished install: Success on [1 2 3 4]
```

Note The old files listed in the logs should be removed using the **`software clean`** command, after reload

Step 5 After you have successfully installed the image, you no longer need the .bin image and the file can be deleted from flash of each switch if you copied it to flash.

```
Switch# delete flash: cat3k_caa-universalk9.SPA.03.07.02.E.152-3.E2.bin
Delete filename [cat3k_caa-universalk9.SPA.03.07.02.E.152-3.E2.bin]?
Delete flash:/ cat3k_caa-universalk9.SPA.03.07.02.E.152-3.E2.bin? [confirm]
Switch#
```

Reload

Step 6 Reload the switch

```
Switch# reload
```

Step 7 If your switches are configured with auto boot, then the stack will automatically boot up with the new image. If not, you can manually boot flash:packages.conf

```
Switch: boot flash:packages.conf
```

Note When you downgrade to a Cisco IOS XE 3.xE image, your boot loader will not automatically downgrade. It will remain updated. The new boot loader can support booting both Cisco IOS XE 3.xE releases as well as Cisco IOS XE Denali16.x releases.

Downgrade from Cisco IOS XE 16.x to Cisco IOS XE 3.xE in Bundle Mode

Follow these instructions to downgrade from Cisco IOS XE 16.x in Bundle mode to an older Cisco IOS XE 3.xE releases in Bundle mode.

Copy New Image to Stack

Step 1 Make sure your TFTP server is reachable from IOS via GigabitEthernet0/0.

```
Switch# show run | i tftp
ip tftp source-interface GigabitEthernet0/0
ip tftp blocksize 8192
Switch#
Switch# show run | i ip route vrf
ip route vrf Mgmt-vrf 5.0.0.0 255.0.0.0 5.30.0.1
Switch#
Switch#show run int GigabitEthernet0/0
Building configuration...

Current configuration : 115 bytes
!
interface GigabitEthernet0/0
 vrf forwarding Mgmt-vrf
 ip address 5.30.12.121 255.255.0.0
 negotiation auto
end
Switch#
Switch# ping vrf Mgmt-vrf ip 5.28.11.250
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 5.28.11.250, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/2 ms
```

Step 2 Copy the image from your TFTP server to flash.

```
Switch# copy tftp://5.28.11.250/cat3k_caa-universalk9.SPA.03.07.02.E.152-3.E2.bin
flash:
cat3k_caa-universalk9.SPA.03.07.02.E.152-3.E2.bin
```

```
Destination filename [cat3k_caa-universalk9.SPA.03.07.02.E.152-3.E2.bin]?
Accessing tftp://5.28.11.250/cat3k_caa-universalk9.SPA.03.07.02.E.152-3.E2.bin...
Loading cat3k_caa-universalk9.SPA.03.07.02.E.152-3.E2.bin from 5.28.11.250 (via
GigabitEthernet0/0):
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!O!!!!!!!!!!
!
!!!!!!!!!!!!!!
[OK - 311154824 bytes]

311154824 bytes copied in 68.781 secs (4523849 bytes/sec)
Switch#
```

Note If you have a stack, you must copy the image to the flash of each switch in your stack.

Step 3 Use the **dir flash** command to confirm that the image has been successfully copied to flash.

```
Switch# dir flash:*.bin
Directory of flash:/*.bin

Directory of flash:/

47718  -rw-   311154824  Nov 25 2015 18:17:21 +00:00
cat3k_caa-universalk9.SPA.03.07.02.E.152-3.E2.bin

3458338816 bytes total (2468995072 bytes free)
Switch#
```

Edit the Boot variable

Step 4 Clear the boot variable

```
Switch(config)# no boot system
```

Step 5 Edit the boot variable to point to the new image.

```
Switch(config)# boot system flash:cat3k_caa-universalk9.SPA.03.07.02.E.152-3.E2.bin
```

Step 6 Use the **write memory** command to save the configuration change.

```
Switch# write memory
```

Step 7 Use the **show boot** command to confirm that your boot variable is pointing to the new image

```
Switch# show boot
---------------------------
Switch 1
---------------------------
Current Boot Variables:
BOOT variable = flash:cat3k_caa-universalk9.SPA.03.07.02.E.152-3.E2.bin;

Boot Variables on next reload:
BOOT variable = flash:cat3k_caa-universalk9.SPA.03.07.02.E.152-3.E2.bin;
Allow Dev Key = yes
Manual Boot = yes
Enable Break = yes
Switch#
```

Reload

Step 8 Reload the switch

```
switch# reload
```

Step 9 If your switches are configured with auto boot, the stack will automatically boot up with the new image. If not, you can manually boot flash:cat3k_caa-universalk9.SPA.03.07.02.E.152-3.E2.bin

```
switch:boot flash:cat3k_caa-universalk9.SPA.03.07.02.E.152-3.E2.bin
```

Note When you downgrade to a Cisco IOS XE 3.xE image, your boot loader will remain updated, and will automatically be downgraded. The new boot loader can support booting both Cisco IOS XE 3.x releases as well as Cisco IOS XE Denali 16.x releases.

Step 10 When the new image boots up, you can verify the version of the new image, by checking **show version**

```
Switch# show version
Cisco IOS Software, IOS-XE Software, Catalyst L3 Switch Software
(CAT3K_CAA-UNIVERSALK9-M), Version 03.07.02E RELEASE SOFTWARE (fc1)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2015 by Cisco Systems, Inc.
Compiled Tue 21-Jul-15 12:51 by prod_rel_team
```

Move from Cisco IOS XE 3.xE Bundle Mode to Install Mode

Step 11 Ensure you have enough space in flash to expand a new image by cleaning up old installation files. This command will erase your Cisco IOS XE 3.xE bin image file, so ensure that you copy it to your Active again.

```
Switch# software clean file flash:
Preparing clean operation ...
[1 2 3 4]: Cleaning up unnecessary package files
[1 2 3 4]: Preparing packages list to delete ...
[1]: Files that will be deleted:
    cat3k_caa-rpbase.16.03.01.SPA.pkg
    cat3k_caa-rpcore.16.03.01.SPA.pkg
    cat3k_caa-srdriver.16.03.01.SPA.pkg
    cat3k_caa-universalk9.16.03.01.SPA.bin
    cat3k_caa-wcm.16.03.01.SPA.pkg
    cat3k_caa-webui.16.03.01.SPA.pkg
    packages.conf
[2]: Files that will be deleted:
    cat3k_caa-rpbase.16.03.01.SPA.pkg
    cat3k_caa-rpcore.16.03.01.SPA.pkg
    cat3k_caa-srdriver.16.03.01.SPA.pkg
    cat3k_caa-universalk9.16.03.01.SPA.bin
    cat3k_caa-wcm.16.03.01.SPA.pkg
    cat3k_caa-webui.16.03.01.SPA.pkg
    packages.conf
[3]: Files that will be deleted:
    cat3k_caa-rpbase.16.03.01.SPA.pkg
    cat3k_caa-rpcore.16.03.01.SPA.pkg
    cat3k_caa-srdriver.16.03.01.SPA.pkg
    cat3k_caa-universalk9.16.03.01.SPA.bin
    cat3k_caa-wcm.16.03.01.SPA.pkg
    cat3k_caa-webui.16.03.01.SPA.pkg
    packages.conf
[4]: Files that will be deleted:
    cat3k_caa-rpbase.16.03.01.SPA.pkg
```

```
        cat3k_caa-rpcore.16.03.01.SPA.pkg
        cat3k_caa-srdriver.16.03.01.SPA.pkg
        cat3k_caa-universalk9.16.03.01.SPA.bin
        cat3k_caa-wcm.16.03.01.SPA.pkg
        cat3k_caa-webui.16.03.01.SPA.pkg
        packages.conf

[1 2 3 4]: Do you want to proceed with the deletion? [yes/no]: yes
[1 2 3 4]: Clean up completed
Switch#
```

Step 12 Copy the image from your TFTP server to flash

```
Switch# copy tftp://5.28.11.250/cat3k_caa-universalk9.SPA.03.07.02.E.152-3.E2.bin
flash:
cat3k_caa-universalk9.SPA.03.07.02.E.152-3.E2.bin
Destination filename [cat3k_caa-universalk9.SPA.03.07.02.E.152-3.E2.bin]?
Accessing tftp://5.28.11.250/cat3k_caa-universalk9.SPA.03.07.02.E.152-3.E2.bin...
Loading cat3k_caa-universalk9.SPA.03.07.02.E.152-3.E2.bin from 5.28.11.250 (via
GigabitEthernet0/0):
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!O!!!!!!!!!!
!
!!!!!!!!!!!!!!
[OK - 311154824 bytes]

311154824 bytes copied in 68.781 secs (4523849 bytes/sec)
Switch#
```

Step 13 Use the **software expand** command to expand the target image to flash and move from bundle mode to install mode. You can point to the source image on your TFTP server or in flash if you have it copied to flash.

```
Switch# software expand file flash:cat3k_caa-universalk9.SPA.03.07.02.E.152-3.E2.bin
Preparing expand operation ...
[1]: Copying software from active switch 1 to switches 2,3,4
[1]: Finished copying software to switches 2,3,4
[1 2 3 4]: Expanding bundle flash:cat3k_caa-universalk9.SPA.03.07.02.E.152-3.E2.bin
[1 2 3 4]: Copying package files
[1 2 3 4]: Package files copied
[1 2 3 4]: Finished expanding bundle
flash:cat3k_caa-universalk9.SPA.03.07.02.E.152-3.E2.bin
Switch#
```

Edit the Boot variable

Step 14 Clear the boot variable

```
Switch(config)# no boot system
```

Step 15 Edit the boot variable to point to the new image.

```
Switch(config)# boot system flash:packages.conf
```

Step 16 Use the **write memory** command to save the configuration change.

```
Switch# write memory
```

Step 17 Use the **show boot** command to confirm that your boot variable is pointing to the new image

```
Switch# show boot
---------------------------
Switch 1
---------------------------
```

```
Current Boot Variables:
BOOT variable = flash:packages.conf;

Boot Variables on next reload:
BOOT variable = flash:packages.conf;
Manual Boot = yes
Enable Break = yes
Switch#
```

Reload

Step 18 Reload the switch

```
Switch#reload
```

Step 19 If your switches are configured with auto boot, the stack will automatically boot up with the new image. If not, you can manually boot flash:packages.conf

```
switch:boot flash:packages.conf
```

Step 20 When the new image boots up, you can verify the version of the new image, by checking **show version**

```
Switch# show version
Cisco IOS Software, IOS-XE Software, Catalyst L3 Switch Software
(CAT3K_CAA-UNIVERSALK9-M), Version 03.07.02E RELEASE SOFTWARE (fc1)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2015 by Cisco Systems, Inc.
Compiled Tue 21-Jul-15 12:51 by prod_rel_team
```

Step 21 After you have successfully installed the image, you no longer need the .bin image and the file can be deleted from the flash of each switch if you had copied to flash.

```
Switch# delete flash:cat3k_caa-universalk9.SPA.03.07.02.E.152-3.E2.bin
Delete filename [cat3k_caa-universalk9.SPA.03.07.02.E.152-3.E2.bin]?
Delete flash:/cat3k_caa-universalk9.SPA.03.07.02.E.152-3.E2.bin? [confirm]
Switch#
```

WCM Sub Package Software Image Upgrade

The sub-package upgrade steps are similar to the bundle package upgrade, except that you only install one sub-package and not all packages. In order to perform a sub-package software image upgrade, you must be booted into IOS using **boot flash:packages.conf**.

Step 1 Copy new sub-package image to flash. For example, **cat3k_caa-wcm.16.02.01.SPA.pkg for WCM module** for the WCM module.

Step 2 Use the **request platform software package install switch <switch id> file flash:<image>** command to upgrade your switch.

```
switch# request platform software package install switch 1 file flash:
    cat3k_caa-wcm.16.02.01.SPA.pkg
[1]: install package(s) on switch 1
--- Starting list of software package changes ---
Old files list:
  Removed cat3k_caa-wcm.16.01.01.SPA.pkg
New files list:
  Added cat3k_caa-wcm.16.02.01.SPA.pkg
Finished list of software package changes
SUCCESS: Software provisioned.  New software will load on reboot.
```

```
[1]: Finished install successful on switch 1
```

Step 3 When you upgrade the WCM sub-package, and you have AP(s) connected and joined to the controller, you can pre-download the newly upgraded AP images to APs before restarting the APs. The pre-download steps are as follows:

Step	Command	Purpose
1.	**# show ap join stats summary.**	Shows all APs connected to the controller, includes joined and not joined APs.
2.	**# show ap image**	Only joined AP(s) can perform the image pre-downloading process.
3.	**# ap image predownload**	While pre-downloading the AP image(s), use **#show ap image** to monitor the pre-downloading status. Go to the next step after image pre-downloading is completed.
4.	**# ap image swap**	Swaps the backup AP image with the bootup AP image on AP device.
5.	**# ap imate reset**	Restarts all the APs that have connected to the controller.
6.	**# reload**	Restart the controller.

Upgrading RTU Licenses

In Cisco IOS XE Denali 16.1.1, right-to-use (RTU) licensing has been modified to allow stack members to join a stack without having the same license level as the rest of the existing stack. The mismatched switch will not be put into Lic-Mismatch state. Even though the switch with the mismatched license is allowed to join the stack, the following syslog message is displayed periodically reminding you to fix the RTU license level:

```
%STACK_RTU_LICENSE-6-IOSD_LIC_MISMATCH:Switch 5 R0/0: stack_mgr: Switch #5:
Current IOSd runs on lanbase license while RTU active license is ipservices.
Please configure RTU license to current IOSd license.
```

For more information, see CSCux27336.

The EXEC mode **Right to Use License** command allows you to activate or deactivate feature set licenses or Adder AP Count Licenses. This command provides options to activate or deactivate any license supported on the platform.

```
license right-to-use  [activate|deactivate]  [ lanbase | ipbase | ipservices |
ap-count]  {evaluation  | <count> } [ all | slot  <switch id>] {acceptEULA}
```

The EXEC mode **Right to Use License** command has been provided to activate or deactive feature set licenses or Adder AP Count Licenses. This command provides options to activate or deactivate any license supported on the platform.

```
license right-to-use  [activate|deactivate]  [ lanbase | ipbase | ipservices |
ap-count]  {evaluation  | <count> } [ all | slot  <switch id>] {acceptEULA}
```

Ugrading an IP Base SKU to IP Services License

Step	Command	Purpose
1	license right-to-use activate ipservices slot <switch id>	Activate IP Services license. Pass the switch id. EULA will be prompted, accept the EULA by typing ‘yes’.
2	show license right-to-use summary	Check the reboot license level is ipservices.
3	reload	Reboot the switch to boot with ipservices.

Evaluating IP Services License on IP Base SKU

Step	Command	Purpose
1	license right-to-use activate ipservices evaluation slot <switch id>	Activate IP Services evaluation license. Pass the switch id. EULA will be prompted, accept the EULA by typing ‘yes’.
2	show license right-to-use summary	Check the reboot license level is ipservices eval.
3	reload	Reboot the switch to boot with ipservices eval.

Upgrading an LAN Base SKU to IP Services License Without Prompting EULA

Step	Command	Purpose
1	license right-to-use activate ipservices slot <switch id> acceptEULA	Activate IP Services license. Pass the switch id. EULA will be accepted automatically without being prompted.
2	show license right-to-use summary	Check the reboot license level is ipservices.
3	Reload	Reboot the switch to boot with ipservices.

Deactivating Evaluation IP Services License on IP Base SKU

Step	Command	Purpose
1	license right-to-use deactivate ipservices evaluation slot <switch id>	Deactivates IP Services evaluation license.
2	show license right-to-use summary	Check the reboot license level is ipbase.
3	Reload	Reboot the switch to boot with ipbase.

Upgrading LAN Base Stack to IP Base Stack

Step	Command	Purpose
1	license right-to-use activate ipbase all	Activate IP Base license on all the switches in the stack. EULA will be prompted, accept the EULA by typing 'yes'.
2	show license right-to-use	Check the reboot license level is ipbase for all the switches.
3	Reload	Reboot the switch to boot with ipbase.

Changing the License Level of License Mismatch Switch from Active's Console

If the license mismatch switch has a lower license level than other switches in the stack, and the stack is running at IP Services and the mismatch switch is booted with IP Base license.

Step	Command	Purpose
1	show switch	Get the switch number in license mismatch state.
2	show license right-to-use mismatch	Check the license level of the license mismatch switch.
3	license right-to-use activate ipservices slot <switch-id>	Activate IP Services license on all the mismatch switches in the stack. EULA will be prompted, accept the EULA by typing 'yes'.
4	Reload slot <switch-id>	Reboot the license mismatch switch to boot with ipservices and join the stack.

If the license mismatch switch has a higher license level than other switches in the stack, and the stack is running at IP Base and the mismatch switch is booted with IP Services license.

Step	Command	Purpose
1	show switch	Get the switch number in license mismatch state.
2	show license right-to-use mismatch	Check the license level of the license mismatch switch.
3	license right-to-use activate ipbase slot <switch-id>	Activate IP Base license on the license mismatch switch. EULA will be prompted, accept the EULA by typing 'yes'.

Adding Adder AP Count Licenses

Step	Command	Purpose
1	license right-to-use activate apcount <count> slot <switch id>	Pass the number of AP count licenses to add as count. Pass the switch-id on which the Adder AP count licenses are to be added. EULA is prompted, accept it by typing 'yes'.
2	Show license right-to-use slot <switch-id>	Check the adder AP count licenses are incremented on the given switch.
3	Show license right-to-use summary	Check the total Adder AP count licenses are incremented and the Total available AP count are incremented.

Decrementing Adder AP Count licenses

Step	Command	Purpose
1	license right-to-use deactivate apcount <count> slot <switch id>	Pass the number of AP count licenses to be removed as count. Pass the switch-id on which the Adder AP count licenses are to be removed.
2	Show license right-to-use slot <switch-id>	Check the adder AP count licenses are decremented on the given switch.
3	Show license right-to-use summary	Check the total Adder AP count licenses are reduced by count and the Total available AP Count are reduced.

Activating Evaluation AP Count License on the Stack

Step	Command	Purpose
1	license right-to-use activate apcount evaluation	Activated evaluation AP Count licenses on the stack. EULA will be prompted, accept it.
2	Show license right-to-use summary	Check the license type evaluation with maximum supported AP Count is displayed. Base and adder AP Count licenses are not seen.
3	Show license right-to-use	To check the base and adder apcount licenses, if any.

Deactivating Evaluation AP Count License

Step	Command	Purpose
1	license right-to-use deactivate apcount evaluation	Deactivates evaluation AP Count licenses on the stack.
2	Show license right-to-use summary	Base and Adder AP Count licenses are displayed. Total available AP Count is sum of Base and Adder AP Count.

Feature Sets

The Catalyst 3650 switch supports three different feature sets:

- LAN Base feature set—Provides basic Layer 2+ features, including access control lists (ACLs) and quality of service (QoS), and up to 255 VLANs.
- IP Base feature set—Provides Layer 2+ and basic Layer 3 features (enterprise-class intelligent services). These features include access control lists (ACLs), quality of service (QoS),static routing, EIGRP stub routing, IP multicast routing, Routing Information Protocol (RIP), basic IPv6 management, the Open Shortest Path First (OSPF) Protocol (for routed access only), and support for wireless controller functionality. The license supports up to 4094 VLANs.
- IP Services feature set—Provides a richer set of enterprise-class intelligent services and full IPv6 support. It includes all IP Base features plus full Layer 3 routing (IP unicast routing, IP multicast routing, and fallback bridging for only IP traffic). The IP Services feature set includes protocols such as the Enhanced Interior Gateway Routing Protocol (EIGRP), the Open Shortest Path First (OSPF) Protocol, and support for wireless controller functionality. The license supports up to 4094 VLANs.

Note A separate access point count license is required to use the switch as a wireless controller.

For more information about the features, see the product data sheet at this URL:

http://www.cisco.com/en/US/products/ps13133/products_data_sheets_list.html

Interoperability with Other Client Devices

This section describes the interoperability of this version of the switch software release with other client devices.

Table 9 Test Bed Configuration for Interoperability

Hardware/Software Parameter	Hardware/Software Configuration Type
Release	16.3.1
Controller	Cisco 3850 Controller
Access points	3802, 3502, 3602, 2602, 1702, 2702, 3702, 702W, 1852
Radio	802.11ac, 802.11a, 802.11g, 802.11n2, 802.11n5

Table 9 Test Bed Configuration for Interoperability

Security	Open, WEP, PSK (WPA and WPA2), 802.1X (WPA-TKIP and WPA2-AES) (LEAP, PEAP, EAP-FAST, EAP-TLS)
RADIUS	ACS 5.3, ISE 1.2
Types of tests	Connectivity, traffic, and roaming between two access points

Table 10 lists the client types on which the tests were conducted. The clients included laptops, handheld devices, and phones.

Table 10 Client Types

Client Type and Name	Version
Laptop	
Intel 5100/5300	v14.3.2.1
Intel 6200	15.15.0.1
Intel 6300	15.16.0.2
Intel 6205	15.16.0.2
Intel 1000/1030	v14.3.0.6
Intel 7260	18.33.0.2
Intel 7265	18.40.0.9
Intel 3160	18.33.0.2
Broadcom 4360	6.30.163.2005
Linksys AE6000 (USB)	5.1.2.0
Netgear A6200 (USB)	6.30.145.30
Netgear A6210(USB)	5.1.18.0
D-Link DWA-182 (USB)	6.30.145.30
Engenius EUB 1200AC(USB)	1026.5.1118.2013
Asus AC56(USB)	1027.7.515.2015
Dell 1395/1397/Broadcom 4312HMG(L)	5.30.21.0
Dell 1501 (Broadcom BCM4313)	v5.60.48.35/v5.60.350.11
Dell 1505/1510/Broadcom 4321MCAG/4322HM	5.60.18.8
Dell 1515(Atheros)	8.0.0.239
Dell 1520/Broadcom 43224HMS	5.60.48.18
Dell 1530 (Broadcom BCM4359)	5.100.235.12
Dell 1540	6.30.223.215
Cisco CB21	1.3.0.532
Atheros HB92/HB97	8.0.0.320
Atheros HB95	7.7.0.358

Table 10 Client Types

MacBook Pro	OSX 10.11.5
MacBook Air old	OSX 10.11.5
MacBook Air new	OSX 10.11.5
Macbook Pro with Retina Display	OSX 10.11.5
Macbook New 2015	OSX 10.11.5
Tablets	
Apple iPad2	iOS 9.3.1(13E238)
Apple iPad3	iOS 9.3.1(13E238)
Apple iPad mini with Retina display	iOS 9.3.1(13E238)
Apple iPad Air	iOS 9.3.1(13E238)
Apple iPad Air 2	iOS 9.3.1(13E238)
Samsung Galaxy Tab Pro SM-T320	Android 4.4.2
Samsung Galaxy Tab 10.1- 2014 SM-P600	Android 4.4.2
Samsung Galaxy Note 3 – SM-N900	Android 5.0
Microsoft Surface Pro 3	Windows 8.1 Driver: 15.68.3073.151
Microsoft Surface Pro 2	Windows 8.1 Driver: 14.69.24039.134
Google Nexus 9	Android 6.0
Google Nexus 7 2nd Gen	Android 5.0
Phones	
Cisco 7921G	1.4.5.3.LOADS
Cisco 7925G	1.4.5.3.LOADS
Cisco 8861	Sip88xx.10-2-1-16
Apple iPhone 4S	iOS 9.2(13C75)
Apple iPhone 5	iOS 9.3.1(13E238)
Apple iPhone 5s	iOS 9.3.1(13E238)
Apple iPhone 5c	iOS 9.3.1(13E238)
Apple iPhone 6	iOS 9.3.1(13E238)
Apple iPhone 6 Plus	iOS 9.3.1(13E238)
Apple iPhone SE	iOS 9.3.1(13E238)
HTC One	Android 5.0
OnePlusOne	Android 4.3
Samsung Galaxy S4 – GT-I9500	Android 5.0.1
Sony Xperia Z Ultra	Android 4.4.2
Nokia Lumia 1520	Windows Phone 8.1
Google Nexus 5	Android 5.1

Table 10 Client Types

Nexus 6	Android 5.1.1
Samsung Galaxy S5-SM-G900A	Android 4.4.2
Huawei Ascend P7	Android 4.4.2
Samsung Galaxy S III	Android 4.4.2
Google Nexus 9	Android 6.0
Samsung Galaxy Nexus GTI9200	Android 4.4.2
Samsung Galaxy Mega SM900	Android 4.4.2
Samsung Galaxy S6	Android 6.0.1
Samsung Galaxy S5	Android 5.0.1
Xiaomi Mi 4i	Android 5.1.1
Samsung Galaxy S7	Android 6.0.1

Scaling Guidelines

Table 11 Scaling Guidelines

System Feature	Maximum Limit
Number of HTTP session redirections system-wide	Up to 100 clients per second (wired/wireless)
Number of HTTPS session redirections system-wide	Up to 5 clients per second (wireless) Up to 20 clients per second (wired)

Limitations and Restrictions

- Limitations for YANG data modeling—A maximum of 20 simultaneous NETCONF sessions are supported.
- Limitations for RF Profiles—Configuration with Cisco Prime Infrastructure is not supported. You must use the CLI to configure the feature.
- Limitations for Wired AVC:
  - NBAR2 (QOS and Protocol-discovery) configuration is allowed only on wired physical ports. It is not supported on virtual interfaces, for example, VLAN, port channel nor other logical interfaces.
  - NBAR2 based match criteria ‘match protocol’ is allowed only with marking or policing actions. NBAR2 match criteria will not be allowed in a policy that has queuing features configured.
  - ‘Match Protocol’: up to 256 concurrent different protocols in all policies.
  - NBAR2 attributes based QOS is not supported (‘match protocol attribute’).
  - NBAR2 and Netflow cannot be configured together at the same time on the same interface.
  - Only IPv4 unicast (TCP/UDP) is supported.
  - AVC is not supported on management port (Gig 0/0)

  - NBAR2 attachment should be done only on physical access ports. Uplink can be attached as long as it is a single uplink and is not part of a port channel.
  - Performance—Each switch member is able to handle 500 connections per second (CPS) at less than 50% CPU utilization. Above this rate, AVC service is not guaranteed.
  - Scale—Able to handle up to 5000 bi-directional flows per 24 access ports.
- Restrictions for QoS:
  - When configuring QoS queuing policy, the sum of the queuing buffer should not exceed 100%.
  - For QoS policies, only switched virtual interfaces (SVI) are supported for logical interfaces.
  - QoS policies are not supported for port-channel interfaces, tunnel interfaces, and other logical interfaces.
- Starting with Cisco IOS XE Denali 16.3.1, Centralized Management Mode (CMM) is no longer supported.
- MSE 8.x is not supported with Cisco IOS XE Denali 16.x.x.
- WIPs is not supported with Cisco IOS XE Denali 16.x.x since the CMX WIPs solution is not available.
- You cannot configure NetFlow export using the Ethernet Management port (g0/0).
- The maximum committed information rate (CIR) for voice traffic on a wireless port is 132 Mb/sec.
- Flex Links are not supported. We recommend that you use spanning tree protocol (STP) as the alternative.
- Outdoor access points are supported only when they are in Local mode.
- Restrictions for Cisco TrustSec:
  - Dynamic SGACL download is limited to 6KB per destination group tag (DGT).
  - Cisco TrustSec 802.1x is not supported.
  - Cisco TrustSec Critical Auth is not supported.
  - Cisco TrustSec can be configured only on physical interfaces, not on logical interfaces.
  - Cisco TrustSec for IPv6 is not supported.
  - Cisco TrustSec cannot be configured on a pure bridging domain with IPSG feature enabled. You must either enable IP routing or disable the IPSG feature in the bridging domain.
- When a logging discriminator is configured and applied to a device, memory leak is seen under heavy syslog or debug output. The rate of the leak is dependent on the quantity of logs produced. In extreme cases, the device may crash. As a workaround, disable the logging discriminator on the device.

Caveats

Caveats describe unexpected behavior in Cisco IOS releases. Caveats listed as open in a prior release are carried forward to the next release as either open or resolved.

Cisco Bug Search Tool

The Bug Search Tool (BST), which is the online successor to Bug Toolkit, is designed to improve the effectiveness in network risk management and device troubleshooting. The BST allows partners and customers to search for software bugs based on product, release, and keyword, and aggregates key data such as bug details, product, and version. The tool has a provision to filter bugs based on credentials to provide external and internal bug views for the search input.

To view the details of a caveat:

1. Access the BST (use your Cisco user ID and password) at https://tools.cisco.com/bugsearch/.
2. Enter the bug ID in the **Search For:** field.

Open Caveats in Cisco IOS XE Denali 16.3.x

The following are the open caveats in Cisco IOS XE Denali 16.3.x. Click on the identifier to view the details of a caveat in the BST.

Identifier	Description
CSCvc05657	Traffic over MKA EAP-TLS link between L2 trunk ports does not pass
CSCvb98211	DYNAMIC mac address not learned with multi-host open access-session on 9 mem stack
CSCvc02056	[16.3.2] CGM Tracebacks while inter MSD roaming
CSCvc00396	Switchover in G12/G24 stack causes two ports to block control plane traffic
CSCvb95657	Auto-QoS configured wlan, policy validation fails after performing "sh/no sh" on wlan multiple times
CSCvb86530	3650 version 16.3.1 Displays traceback when host releases IP address from external DHCP Server
CSCuz76184	During REP ring failure, duplicate packets may be seen for a short time
CSCuv76000	Missing load-balancing details in "show int < port > etherchannel "
CSCvb84760	Port-channel shows down/down but still passing traffic on 16.3.1/switch 3650
CSCva34131	REP: Multicast convergence needs to be optimized
CSCvb88066	UDLD packets are not processed after the reload

Identifier	Description
CSCva97702	C3650 QoS Class-map, DSCP counters issue
CSCva17837	RSS memory leak in platform_mgr
CSCva22373	Impacting stack-mgr events should be printed as a syslog
CSCuy21301	Port coming directly under chassis in CAT3850 s/w version 03.06.03.E
CSCvb53858	Power Supply SN incomplete (only 10 characters)
CSCuz54670	WS-C3850-24XS: Local port still up when TX fiber removed from 10G SFP
CSCvb65304	Output drops and Output errors increment simultaneously in show interfaces
CSCux02676	IGMP input memory leaks seen on Mcast RVR join/leave, 10 gr continuously
CSCux65260	16.2: Inter-LWA clients go to web_pending after mc-ma roam
CSCuy39207	PI3.1 voice diagnostics SNMP GET not working
CSCva19060	from fresh boot of foreign, wired guest clients do not get ip address
CSCva11018	WebUI doesn't have option to enable/disable mgmt-via-wireless
CSCuy21545	STP and LLDP packets are dropping over L2PT dot1q tunnel
CSCuz67181	DHCP IP assignment failing with relay information option vpn enabled
CSCuz78396	Multicast one packet drop seen with igmp
CSCva17647	16.3: Reauthentication not getting resumed after aaa becomes available
CSCva22592	When many ACLs are configured, %PARSE_RC-4-PRC_NON_COMPLIANCE error, config is not applied
CSCva35658	WebUI: port config loss on device upon port flap from webui
CSCva45109	WebUI : WS-C3850-12XS sw even numbers port not shown in day 0 profile
CSCva46857	WebUI day 0 : WS-C3850-48XS-E sw does not display port Te1/0/1-Te1/0/48
CSCva46936	Traffic across 3k-4k L3EC with different SAP cipher sequence fail
CSCva60288	(*.G) progation doesnt happen after unconfig/config lisp on RP
CSCvb06108	Sanity: ping failed after roaming from ap1800 (MC) to ap 2800 (MA)
CSCvb22258	ACL and template definition is not found in FED
CSCvb28676	show monitor capture test buffer cmd does not stop at term length
CSCvb39125	netconf-yang: SSH "remote closed connection"
CSCvb50951	Unicast convergence results are inconsistent when trigger in different node
CSCvb54210	~30 sec traffic loss observed with SSO on a port-channel w. multiple links (A,S,M)
CSCvb65984	CPU hog traceback msg: platform_writeVB & ngwc_flash_setmonvar, when confg "boot ipxe timeout"
CSCvb70028	Unable to Access internal-webauth login page when client associated with AIR-AP2802I-B-K9 AP
CSCvb70427	1632SF-standby reload wi/ config sync failure with router lisp config, after fabric configured.
CSCvb71551	Tracebacks observed on 3650 device with 16.3.2 build when Open auth clients start to roam
CSCvb75533	Netconf/GetConf: "ip igmp snooping last-member-query-interval", wrong logging buffered, MKA issues

Identifier	Description
CSCvb75803	Netconf: Energywise activitycheck leaf not available under the interface through netconf-yang
CSCvb89106	webui swichview issue : port no. 49-50 as downlink port
CSCvb90280	Tengig Port in Etherchannel goes down after bootup
CSCvb95781	iPXE : During HTTP/TFTP exceptions - fallback to device mode boot may not work
CSCvb96470	16.3.2: Port goes to not connect on doing "no switchport"

Resolved Caveats in Cisco IOS XE Denali 16.3.2

Identifier	Description
CSCvb56482	Autoinstall/ PnP fails - from 16.3.1/ 16.3.1a to 16.3.2; wrkaround: use router as DHCP server.
CSCuz33679	Cat3850: REP LSL PDU counter up on shut down interface
CSCva17300	REP Multicast Traffic does not resume after neighbor switch reloaded
CSCva17341	REP Multicast packet loss for 10+seconds during re-convergence
CSCva54058	REP, what will happen when BPA or EPA is lost, TAC SR#680354116
CSCva61031	SVI Ping fails after HA-SSO during REP Topology change
CSCva79145	REP packet drop after 3rd SSO on one of the nodes
CSCvb81117	Cat3850: REP LSL PDU counter incrementing when link is in down state (remote end)
CSCux14425	ACL matching IP option is not working with "no ip unreachables"
CSCva08676	after deleting flex link config, LED of backup port still shows amber
CSCva46457	c3850 stack crash with static mac-address map'd to multiple port-channel
CSCva65105	Cat3650 Stack: specific vlan down when swithcover
CSCva10757	Invalid MAC learning in private VLAN for static MAC addresses
CSCva51684	Ping to SVI fails after breaking link in REP Ring on 3850
CSCuz28295	TCN generate late and mac learn issue on 3650 stack after RSTP TCN
CSCuz98374	3850 incorrectly set more-fragment flag for double fragmentation
CSCuz88403	3850stack stops forward traffic via GRE tunnel after master turning off
CSCuz83883	IPv6 neighbor discovery packet processing behavior
CSCuz11169	High memory utilization observed on catalyst 3650/3850
CSCva69776	PEAP clients cannot get authenticated with NPS server on 16.3.1
CSCuv75864	"octeon_wdt: WDT device closed unexpectedly " error msgs on reload
CSCus49022	Active switch crashes on changing STP mode from RSTP to PVST w/ 128vlans
CSCuu38981	crash observed on high rates of roam @ fman_qos_mark_aom_free
CSCuy19562	3850/3650 intercepts telnet/ssh connections for unknown destinations

Identifier	Description
CSCva71996	CLNS ping failing to 3850
CSCvb17094	Disable Tunnel IPIP CLI as feature not supported on NG3K
CSCvb49347	NGWC ipsec vpn only support "IPv4 GRE" tunnel mode
CSCuw38877	Static IGMP join-group on VLAN interface is not reachable
CSCva25392	forward trap is generated when shutdown by storm control
CSCuz65463	Storm-control is not working after Cat3850 reload
CSCuz05771	3850 Last reload reason: "Power Failure" when reloaded due to OOM
CSCuw69829	WebUI: Not able to contain rogue AP's using webUI
CSCva33039	"show env rps" display wrong RPS state
CSCuz60623	"snmp-server enable traps transceiver all" is recorded twice.
CSCuz71966	"speed auto 10 100" disappeared from show run after reload
CSCuw41152	'%NGWC_PLATFORM_FEP-1-FRU_PS_SIGNAL_FAULTY' message is not output
CSCup05919	3850 - Power given, but State Machine Power Good wait timer timed out
CSCuz50876	3850 Denali 16.1.1 - Bootflash is missing from system-report
CSCva15754	AC power supply still display OK state even if RPS is providing power
CSCva00967	After OIR USB flash on C3850, no trap and syslog output
CSCva13231	CRC/Corrupted packets after a link failure with MACSEC and 802.1q (3850)
CSCva43372	Interoperability - remote side CRC error
CSCva25015	Mode button functionality not working Intermittently
CSCuz08086	PD's not getting PoE on multiple interfaces in 3850 stack
CSCuy97043	Remove invalid data cefcModuleAdminStatus MIB from 3850/3650 switch platform
CSCva69778	Wrong temperature syslog OVERTEMP severity level in 3850
CSCuy70475	Latency increases with low priority background traffic
CSCuz05208	Wireless mobility client data tx via macsec uplink 3850 foreign is drop
CSCuz94565	fqdn acl bypass not taking effect intermittently
CSCva13738	ISR4k dose not send SOLICIT msg in DHCPv6-PD over PPPoE
CSCux98943	Padding for PPPoE over ATM should not be added for accounting
CSCuz17963	plogd tracelogs getting generated causing high cpu in plogd process
CSCuz33638	%IOSXE-4-PLATFORM: R0/0: kernel: EXT2-fs warning:
CSCuz30182	ASR1013: Fails to detect power supply at startup
CSCva90588	Xchassis keeps reloading after installing an RP2 with an old CPLD
CSCuz88340	AN: ULA is configured on ANI & same ANI used for multiple neighbors
CSCva36556	Smart call home crash with debugs enabled
CSCva08096	hostname cannot be retrieved
CSCuz65251	All the UP interfaces displayed as DOWN after wr erase and reload

Identifier	Description
CSCux60876	Memory corruption due to DHCP
CSCva32903	Tracebacks seen while testing DHCP functionality
CSCuz39061	"logging filter ...tcl" config crashes the router
CSCux99594	EEM Policies May Not Be Able To Send Email
CSCuz81292	IPv6 neighbor discovery packet processing behavior
CSCuv24653	ENH: Specify SSL/TLS Version for HTTP secure-server Feature
CSCuz69005	AP unable to join due to pending destroy IFID state
CSCuz12475	Polaris: fman_rp crash occurs with bgp_pic profile
CSCuu77403	%LINK-4-TOOBIG Messages Seen on ISR 3945 with L2TPv3
CSCur47235	When one vrf deletes with "no vrf definition", ip vrf receive is removed
CSCva15526	PW down after clear mpls ldp neighbor followed by RSP SSO
CSCva17339	LDP session stuck in established with no TCP connection
CSCuz95908	Memory leak due to path querry with Null outgoing interface
CSCva44687	ASR 1K Running IOS-XE 3.16S w/ MPLS Crashes on 'clear ip route *'
CSCva64489	1810w - Invalid Number of supported Power Levels: 0
CSCux09478	sh proc mem platform sorted output is incorrect with low free memory
CSCva56329	DMI - AAA authentication/authorization timeout does not try fallback
CSCuz41275	Crash seen with SMD tracing in verbose mode
CSCuy34177	Need 5508 to support sleeping client as single Anchor with NGWC
CSCuz58624	CGM Traceback observed impacting client connectivity
CSCuy16530	Crash after member link re-added to port-channel and clear counters CMD
CSCuu13476	Cisco IOS & IOS XE Software OpenSSH TCP Denial of Service Vulnerability
CSCuu11760	NG3k-QOS: Need to block priority percent command in policy-map
CSCuv92031	Track SNMP Transceiver Sensor Implementation
CSCuw12882	Improper Reporting of FEPs on 3650 with 3.06.01E and others
CSCuw90273	Cannot telnet/ssh(Sessions max out)
CSCuy37943	perpetual POE on per port is working as global command
CSCuz01059	Implement SXP path length override option to limit the SXP database size
CSCuz10706	Infinity: Image name will need to be changed to not have Cisco reference
CSCuz39384	CSCuz10706Upgrade MCU in Amur without changing other silent roll packages
CSCuz39783	Polaris 16.3 :"session port shut-down and session cleared"via COA failed
CSCuz42283	Remove the build path from %IOSXE-3-PLATFORM: R0/0: kernel: logs
CSCuz96994	MAG to MAG, Host to remote MAG ping fail with ISR4000 PMIPv6
CSCva00632	Switch not forwarding traffic after applying the policy-map
CSCva06274	Polaris 163:CPP crash with SGT caching and SGACL interop
CSCva07535	AWS : CSR Crashed after copying config file using kron-policy

Identifier	Description
CSCva12002	Polaris:DACL entries in ACL LE present for unauth sessions
CSCva20123	ERSPAN pkts not received at destination after source sw reload
CSCva27128	AAA Proxy authentication fail with group TACACS-SERVER, local
CSCva32407	RLDP config does not get saved on reboot or upgrade
CSCva62445	ip tcp adjust-mss is not supported on 3850/3650; it should be removed
CSCva63982	1832 error :Invalid Power Level Index 7. Should be in [1,5]
CSCva69559	Theon system noisy after booting IOS
CSCva72088	3802 AP on CA, link-encryption DS/US stats show 0
CSCva92486	polaris : Getting SOA response for unconfigured SOA record/domain
CSCva98140	Secure Fabric, issuing "show fabric host-pool" is crashing box on C3850
CSCvb05894	Backout CSCux99594 EEM Policies May Not Be Able To Send Email
CSCvb56934	commit to 3.7.x and 16.3.x Zero RX counters on te1/1/3 port on bootup

Resolved Caveats in Cisco IOS XE Denali 16.3.1a

The following are the resolved caveats in Cisco IOS XE Denali 16.3.1a. Click on the identifier to view the details of a caveat in the BST.

Identifier	Description
CSCvb29204	BenignCertain on IOS and IOS-XE
CSCvb01730	Leapsec 3.10.7: deadlock test causes wdog timeout - rtr crashes
CSCvb19326	NTP leap second addition is not working during leap second event
CSCvb04298	NTP-PTP: Invalid PTP time during NTP leap second insertion/deletion

Resolved Caveats in Cisco IOS XE Denali 16.3.1

The following is the list of Cisco IOS XE Denali 16.1.x and Cisco IOS XE Denali 16.2.x caveats that are resolved in Cisco IOS XE Denali 16.3.1. Click on the identifier to view the details of a caveat in the BST.

Identifier	Description
CSCuw98808	Empty VLAN ACL sequence with no match causes STP issues
CSCul84467	C3850:Stack:Port-Channel:active mem switch power shut causes traffic loss
CSCuw94814	IEEE8023-LAG-MIB does not work use CISCO-LAG-MIB
CSCuw56706	LACP with 16 ports: after switchover, ports in H state change to D state
CSCuw38877	Static IGMP join-group on VLAN interface is not reachable
CSCux25383	Passwords still encrypted after encryption key is removed
CSCuw69672	WebUI: ACL - "any" option for mask not disabled when it is not supported

Identifier	Description
CSCux23861	WebUI: Few scenarios - refreshing issue related to AP with 11AC module
CSCux62751	Memory leak seen @ dup_classmap_runtime
CSCux35552	Error on editing RogueRule on user configured SSID
CSCuz20613	IOS-XE : Shell license bypass via LXC (2)
CSCuy06768	Secure LDAP with wired 1k dot1x sessions may reload the system
CSCux35423	TACACS mgmt over wireless not working
CSCux22276	vlan pooling-static ip client is not passing traffic for wireless dot1x
CSCuv47300	CTS: In loopback interface, config of IP SGT map should not be allowed
CSCux89701	CFD QMUL: session comes up after port-security violation
CSCux26381	Match based on username fails for dot1x client with Native Profile WLAN
CSCuy04948	Reauth timer running for unauthorized case
CSCuy21768	Session fails authz after few vlans in group brought down and up
CSCux77357	stuck Session with 0 Mac 0 IP not removed from admission cache output
CSCuy32871	WS-C3850-48XS:'sh inventory FRU' lists fan even after removal/failure
CSCuz11169	High memory utilization observed on catalyst 3650/3850
CSCuw94595	Tracebacks on bootup at "epm_vlan_name_insert_or_delete" w/200+ VLANs
CSCuu38981	crash observed on high rates of roam @ fman_qos_mark_aom_free
CSCuz88340	AN: ULA is configured on ANI & same ANI used for multiple neighbors
CSCuy75068	System traceback while Smart Call Home debugs turned on
CSCuz65251	All the UP interfaces displayed as DOWN after wr erase and reload
CSCuy34177	Need 5508 to support sleeping client as single Anchor with NGWC
CSCuy79779	AP flaps for 30 minutes upon changing AP mode after SSO
CSCuy39207	PI3.1 voice diagnostics SNMP GET not working

Troubleshooting

For the most up-to-date, detailed troubleshooting information, see the Cisco TAC website at this URL:

http://www.cisco.com/en/US/support/index.html

Choose **Product Support** > **Switches**. Then choose your product and click **Troubleshoot and Alerts** to find information for the problem that you are experiencing.

Related Documentation

- Cisco IOS XE Denali 16.x.x documentation at this URL:

  http://www.cisco.com/c/en/us/products/ios-nx-os-software/ios-xe/index.html

- Catalyst 3650 switch documentation at this URL:

  http://www.cisco.com/go/cat3650_docs

- Error Message Decoder at this URL:

  https://www.cisco.com/cgi-bin/Support/Errordecoder/index.cgi

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly *What's New in Cisco Product Documentation*, which also lists all new and revised Cisco technical documentation, at:

http://www.cisco.com/c/en/us/td/docs/general/whatsnew/whatsnew.html

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