Preface

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Audience

This guide is intended primarily for data center administrators with responsibilities and expertise in one or more of the following:

- Virtual machine installation and administration
- Server administration
- Switch and network administration
- Cloud administration

New and Changed Information

The following table provides an overview of the significant changes to the organization and features in this guide up to this current release. The table does not provide an exhaustive list of all changes made to the guide or of the new features up to this release.

Table 1: New Features and Changed Behavior in Cisco APIC Release 3.2(7)

Feature or Change	Description	Where Documented
VRF-scoped node level support for modifying the BGP best path policy.	The 3.2(7) release adds VRF-scoped node level support for modifying the Border Gateway Protocol (BGP) best path policy.	See chapter Routing Protocol Support

Table 2: New Features and Changed Behavior in Cisco APIC Release 3.2(2)

Feature or Change	Description	Where Documented
Validations on incoming configurations to an APIC cluster	Support for validations on incoming configurations to an APIC cluster is added.	See chapter Cisco ACI Forwarding

Table 3: New Features and Changed Behavior in Cisco APIC Release 3.2(1)

Feature or Change	Description	Where Documented
Orphan port support	Support is now available for orphan port-channel or physical ports on remote leaf switches, with a vPC domain.	See chapter Remote Leaf Switches
QoS for L3Outs chapter	QoS for L3Outs is moved to a separate chapter.	See chapter QoS for L3Outs
Layer 3 Routed and Sub-interface Port Channels	Support for Layer 3 port channels is added.	See section Layer 3 Routed and Sub-Interface Port Channels
Remote Leaf switch enhancements	New features and options are supported.	See chapter Remote Leaf Switches
Transit Routing Enhancement	Information is added to configure Transit Routing using the APIC GUI, NX-OS style CLI, or REST API.	See chapter Transit Routing

Table 4: New Features and Changed Behavior in Cisco APIC Release 2.2(4)

Feature or Change	Description	Where Documented
Neighbor Discovery Duplicate Address Detection (DAD)	Support for disabling Discovery Duplicate Address Detection (DAD) is added.	See chapter IPv6 Neighbor Discovery

Table 5: New Features and Changed Behavior in Cisco APIC Release 3.1(2m)

Feature or Change	Description	Where Documented
QoS for L3Outs	In this release, QoS policy enforcement on L3Out ingress traffic is enhanced.	See QoS for L3Outs

Feature or Change	Description	Where Documented
Removed incorrect information: Maximum MTU Increased	**Note** Information on the maximum MTU for Cisco ACI was incorrectly shown with an increase from 9000 to 9216. This information has been corrected.	See chapter Routed Connectivity to External Networks
Neighbor Discovery Router Advertisement on Layer 3 Out	RS/RA packets are used for auto configuration and are configurable on Layer 3 interfaces including routed interface, Layer 3 sub interface, and SVI.	See chapter IPv6 Neighbor Discovery
BGP External Routed Network with Autonomous System Override	The AS override function replaces the AS number from the originating router with the AS number of the sending BGP router in the AS Path of the outbound routes	See chapter Routing Protocol Support

Table 6: New Features and Changed Behavior in Cisco APIC Release 3.1(1i)

Feature or Change	Description	Where Documented
Layer 3 Multicast support with FEX	Multicast sources or receivers connected to FEX ports are supported.	See chapter IP Multicast
Switch Virtual Interface (SVI) Auto State	Allows for the SVI auto state behavior to be enabled. This allows the SVI state to be in the down state when all the ports in the VLAN go down. This feature is available in the APIC Release 2.2(3x) release and going forward with APIC Release 3.1(1). It is not supported in APIC Release 3.0(x).	See chapter Switch Virtual Interface
Remote Leaf Switches	With an ACI fabric deployed, you can extend ACI services and APIC management to remote data centers with Cisco ACI leaf switches that have no local spine switch or APIC attached.	See chapter Remote Leaf Switches

Feature or Change	Description	Where Documented
New Hardware Support for Multipod and GOLF	Multipod and GOLF are supported by all Cisco Nexus 9300 platform ACI-mode switches and all of the Cisco Nexus 9500 platform ACI-mode switch line cards and fabric modules. With Cisco APIC, release 3.1(x) and higher, this includes the N9K-C9364C switch.	See chapters Cisco ACI GOLF and Multipod
Using Shared GOLF Connections Between Multi-Site Sites	Guidelines were added to avoid inter-VRF traffic issues for APIC Sites in a Multi-Site topology, if stretched VRFs share GOLF connections.	See chapter Cisco ACI GOLF
BFD support for spine switch	Support for Bidirectional Forwarding Detection (BFD) on spine switch is added.	See chapter Routing Protocol Support
New examples for L3Out configuration	New GUI, NX-OS style CLI, and REST API examples provide clarity and consistency.	See chapter Routed Connectivity to External Networks
Configuring Transit Routing	Content from the knowledge base article *Cisco APIC and Transit Routing* was incorporated in this guide, including new configuration examples for APIC GUI, NX-OS style CLI, and REST API	See chapter Transit Routing
Chapters reorganized	The chapters of this guide were reorganized into a more logical order and the following chapter names were changed: • *Tenant Outside Networks* is now *Routed Connectivity to External Networks* • *Route Profiles, Route Maps, and IP Prefix Lists* is now *Route Control* • *Shared Layer 3 Outside Connections* is now *Shared Services* • *SVI External Encapsulation Scope* is now *Switch Virtual Interface*	--

Table 7: New Features and Changed Behavior in Cisco APIC Release 3.0(2h)

Feature or Change	Description	Where Documented
Static Route on BD	Support is added to configure a static route in a pervasive bridge domain (BD) to enable routes to virtual services behind firewalls. This feature enables endpoint (EP) reachability to subnets and hosts which are not directly connected to the pervasive BD, using regular EPGs.	See chapter Static Route on a Bridge Domain

NOTE: The APIC Release 2.2(3x) feature is only available in this specific release. It is not supported in APIC Release 3.0(x) or 3.1(x).

Table 8: New Features and Changed Behavior in Cisco APIC for Cisco APIC Release 2.2(3x)

Feature or Change	Description	Where Documented
Switch Virtual Interface (SVI) Auto State	Allows for the SVI auto state behavior to be enabled. This allows the SVI state to be in the down state when all the ports in the VLAN go down. **Note** This feature is available in APIC Release 2.2(3x) release. It is not supported in APIC Release 3.0(x).	See chapter Switch Virtual Interface

Table 9: New Features and Changed Behavior in Cisco APIC for Cisco APIC Release 3.0(1k)

Feature or Change	Description	Where Documented
AS Path Prepend	Allows for the change to the length of the autonomous system path in a BGP route to invoke best-path selection by a remote peer	See chapter Routing Protocol Support
BGP Max Path	Enables you to configure the maximum number of paths that BGP adds to the route table to invoke equal-cost multipath load balancing	See chapter Routing Protocol Support

Table 10: New Features and Changed Behavior in Cisco APIC for Cisco APIC Release 2.3(1e)

Feature or Change	Description	Where Documented
Encapsulation scope for SVI across Layer 3 Outside Networks	With this release you can configure the encapsulation scope for SVI across Layer 3 networks.	See chapter Switch Virtual Interface
Support for Deny prefix	Denying context rules for specific routes is now supported.	See chapter Route Control

Table 11: New Features and Changed Behavior in Cisco APIC for Cisco APIC Release 2.2(2e) and 2.2(2f)

Feature or Change	Description	Where Documented
Per VRF per node BGP timer values	With this release, you can define and associate BGP timers on a per VRF per node basis.	See chapter Routing Protocol Support
Layer 3 Out to Layer 3 Out Inter-VRF Leaking	With this release, shared Layer 3 Outs in different VRFs can communicate with each other using a contract.	See chapter Shared Services
Multiple BGP communities assigned per route prefix	With this release, multiple BGP communities can now be assigned per route prefix using the BGP protocol.	See chapter Routed Connectivity to External Networks and Route Control
Support for EIGRP to BGP transit routing is available	Added support in the Supported Transit Combination Matrix.	See chapter Transit Routing
Communication between shared L3Outs in different VRFs	Added support statement in Scope and Aggregate Controls for Subnets.	See chapter Transit Routing

Table 12: New Features and Changed Information in this Document

Feature or Change	Description	Where Documented
Document Reorganization	The topics in this guide were collected from *Cisco APIC Basic Configuration Guide, Release 2.x*, *Cisco ACI and Layer 3 Multicast with Cisco ACI*, and the following Knowledge Base articles: • *Cisco APIC and Interleak of External Routes* • *Cisco APIC and Route Maps Using Explicit Prefix List* • *Cisco APIC IP Aging Policy* • *Cisco APIC Layer 3 Outside for Tenant Network* • *Cisco APIC Tenant, VRF, and Bridge Domain Creation with IPv6 Neighbor Discovery* • *Cisco APIC and Common Pervasive Gateway* • *Cisco APIC and HSRP* • *Cisco APIC and IGMP Snoop Layer 2 Multicast Configuration* • Cisco APIC and Route Control Protocol Using Import and Export Controls • *Cisco APIC and BGP External Routed Network and BFD* • *Cisco APIC with EIGRP*	*Cisco APIC Layer 3 Configuration Guide* (this guide)
Name Change	Changed name of "Layer 3 EVPN Services for Fabric WAN" to "Cisco ACI GOLF".	See chapters Cisco ACI GOLF and Multipod

Table 13: New Features and Changed Information in this Document for Cisco APIC Release 2.2(1n)

Feature or Change	Description	Where Documented
HSRP	With this release, you can enable HSRP, a first-hop redundancy protocol (FHRP) that allows a transparent failover of the first-hop IP router. HSRP provides first-hop routing redundancy for IP hosts on Ethernet networks configured with a default router IP address. You use HSRP in a group of routers for selecting an active router and a standby router. In a group of routers, the active router is the router that routes packets, and the standby router is the router that takes over when the active router fails or when preset conditions are met.	See chapter HSRP

Table 14: New Features and Changed Behavior in Cisco APIC for Cisco APIC Release 2.1(1h)

Feature or Change	Description	Where Documented
Distribute EVPN Type-2 Host Routes	Support is added for optimal traffic forwarding in an EVPN topology enables fabric spines to advertise host routes using EVPN type-2 (MAC-IP) routes to the DCIG along with public BD subnets in the form of BGP EVPN type-5 (IP Prefix) routes.	See chapter Cisco ACI GOLF
Route Maps Using Explicit Prefix Lists	Explicit prefix lists for public bridge domain (BD) subnets and external transit networks enable inbound and outbound route controls. Inbound and outbound route control for Layer 3 Out is managed by the route map/profile (rtctrlProfile). The route map/profile policy supports a fully controllable prefix list for Layer 3 Out in the Cisco ACI fabric.	See chapter Route Control

Feature or Change	Description	Where Documented
IP Aging Policy	In this release, you can enable a new aging policy for IPs in an endpoint. The IP aging policy tracks and ages unused IPs on an endpoint. Tracking is performed using the endpoint retention policy configured for the BD to send ARP requests (for IPv4) and neighbor solicitations (for IPv6) at 75% of the local endpoint aging interval. When no response is received from an IP, that IP is aged out.	See chapter IP Aging
IGMP Snoop access group support and IGMP Snoop static group support	Support is added for IGMP snooping, the process of listening to Internet Group Management Protocol (IGMP) network traffic. The feature allows a network switch to listen in on the IGMP conversation between hosts and routers and filter multicast links that do not need them, thus controlling which ports receive specific multicast traffic.	See chapter IGMP Snooping
IP Multicast support for Multipod	Support is added for IP Multicast in a Multipod topology	See chapter IP Multicast

Table 15: New Features and Changed Behavior in Cisco APIC for Cisco APIC Release 2.0(1m)

Feature or Change	Description	Where Documented
Import control policy support for OSPF inbound filtering	Support is added for import and export controls using OSPF as well as BGP.	See chapters Routed Connectivity to External Networks and Route Control
GOLF (Layer 3 EVPN Services Over Fabric WAN)	GOLF is introduced.	See chapter Cisco ACI GOLF
GOLF is Supported with Transit Routing	GOLF L3Outs and Border Leaf BGP/OSPF L3Outs are supported	See chapter Transit Routing
Enhancements for the EIGRP interface policy	Support is added for EIGRP properties such as bandwidth and delay.	See chapter Routing Protocol Support
Layer 3 Multicast	Layer 3 Multicast is introduced.	See chapter IP Multicast
Support for Aggregate Controls for Subnets for Transit Routing	Added a new section for Scope and Aggregate Controls for Subnets.	See chapter Transit Routing

Feature or Change	Description	Where Documented
Support Ethertype, protocol, L4 port, and TCP flag filters	Support for Ethertype, protocol, L4 port, and TCP flag filters is available, and can be used in transit routing controls.	See chapter Transit Routing

Table 16: New Features and Changed Behavior in Cisco APIC for Cisco APIC Release 1.3(1g)

Feature or Change	Description	Where Documented
Route Summarization	Removed object model CLI procedure. Added route summarization procedures for the GUI and NX-OS CLI interfaces.	See chapter Routing Protocol Support
-	Removed object model CLI procedures and added NX-OS style CLI procedures.	• NX-OS style CLI topics in chapter See chapter Transit Routing *IPv6 and Neighbor Discovery* • NX-OS style CLI topics in *Route Controls* • NX-OS style CLI topics in *BGP External Routed Networks with BFD* in *Routing Protocol Support* • See chapter Routing Protocol Support

Table 17: New Features and Changed Behavior in Cisco APIC for Cisco APIC Release 1.2(x)

Feature or Change	Description	Where Documented
Set attributes for all routes received and redistributed from OSPF	Support is added to set attributes for all routes received such as community, local prefix, MED. Set attributes for all routes redistributed such as tags, local prefix, community.	See chapter Routing Protocol Support

Feature or Change	Description	Where Documented
Route Summarization for OSPF, BGP, and EIGRP	Route summarization enables route tables by replacing many specific addresses with an single address. For example, 10.1.1.0/24, 10.1.2.0/24, and 10.1.3.0/24 is replaced with 10.1.0.0/16. Route summarization policies enable routes to be shared efficiently among border leaf switches and their neighbor leaf switches. BGP, OSPF, or EIGRP route summarization policies are applied to a bridge domain or transit subnet. For OSPF, inter-area and external route summarization are supported.	See chapter Routing Protocol Support
Common Pervasive Gateway	Two ACI fabrics can be configured with an IPv4 common gateway on a per bridge-domain basis. Doing so enables moving one or more virtual machine (VM) or conventional hosts across the fabrics while the host retains its IP address. VM-host moves across fabrics can be done automatically by the VM hypervisor. The ACI fabrics can be co-located, or provisioned across multiple sites. The Layer 2 connection between the ACI fabrics can be a local link, or can be across a bridged network.	See chapter Common Pervasive Gateway
Set BGP attributes for routes based on incoming communities	Set BGP attributes is enabled for routes based on incoming communities such as community, local preference, MED.	See chapter Routing Protocol Support
Bidirectional Forwarding Detection (BFD): Global configuration for GUI, NX-OS CLI, and REST API Interface configuration for GUI, NX-OS CLI, and REST API Consumer protocol configuration for GUI, NX-OS CLI, and REST API	Support for BFD is introduced, providing sub-second failure detection times in the forwarding path between ACI fabric border leaf switches configured to support peering router connections.	See chapter Routing Protocol Support
Maximum prefix limit	Support is added for BGP maximum prefix limit.	See chapter Routing Protocol Support

Feature or Change	Description	Where Documented
BGP enhancements to set attributes for action rule profiles and peer connectivity profiles	Support is added for the BGP attributes Dynamic Neighbors, Route Dampening, weight attribute and remove-private-as.	See chapter Routing Protocol Support
IPv6 support and interface policy enhancements	IPv6 is supported with EIGRP. Interface policies are enhanced. In addition to existing interface policy parameters, bandwidth and delay can be controlled on the interface through the eigrpIfPol attribute. Added the NX-OS-style CLI procedure.	See chapter Routing Protocol Support
Interleak of external routes	Support is added for setting attributes (such as community, preference, or metric) to enable interleak of routes from OSPF to BGP.	See chapter Interleak Redistribution for MP-BGP
Transit Routing Support	Support is added for transit routing through the fabric.	See chapter Transit Routing

Table 18: New Features and Changed Behavior in Cisco APIC, Release 1.1(x)

Feature or Change	Description	Where Documented
IPv6 support, Direct BGP support, and eBGP support	Introduced IPv6 support, direct BGP support, and eBGP support.	See chapter Routing Protocol Support
Tenant Layer 3 outside networks	Documentation is added for tenant Layer 3 outside networks.	See chapter Routed Connectivity to External Networks

Document Conventions

Command descriptions use the following conventions:

Convention	Description
bold	Bold text indicates the commands and keywords that you enter literally as shown.
Italic	Italic text indicates arguments for which the user supplies the values.
[x]	Square brackets enclose an optional element (keyword or argument).
[x | y]	Square brackets enclosing keywords or arguments separated by a vertical bar indicate an optional choice.

Convention	Description
{x | y}	Braces enclosing keywords or arguments separated by a vertical bar indicate a required choice.
[x {y | z}]	Nested set of square brackets or braces indicate optional or required choices within optional or required elements. Braces and a vertical bar within square brackets indicate a required choice within an optional element.
`variable`	Indicates a variable for which you supply values, in context where italics cannot be used.
string	A nonquoted set of characters. Do not use quotation marks around the string or the string will include the quotation marks.

Examples use the following conventions:

Convention	Description
`screen font`	Terminal sessions and information the switch displays are in screen font.
`boldface screen font`	Information you must enter is in boldface screen font.
italic screen font	Arguments for which you supply values are in italic screen font.
< >	Nonprinting characters, such as passwords, are in angle brackets.
[ ]	Default responses to system prompts are in square brackets.
!, #	An exclamation point (!) or a pound sign (#) at the beginning of a line of code indicates a comment line.

This document uses the following conventions:

Note Means *reader take note*. Notes contain helpful suggestions or references to material not covered in the manual.

Caution Means *reader be careful*. In this situation, you might do something that could result in equipment damage or loss of data.

Warning IMPORTANT SAFETY INSTRUCTIONS

This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device.

SAVE THESE INSTRUCTIONS

Related Documentation

Cisco Cloud APIC Documentation

The Cisco Cloud APIC documentation is available at the following URL: https://www.cisco.com/c/en/us/support/cloud-systems-management/cloud-application-policy-infrastructure-controller/tsd-products-support-series-home.html

Cisco Application Policy Infrastructure Controller (APIC) Documentation

The following companion guides provide documentation for Cisco APIC:

- *Cisco APIC Getting Started Guide*
- *Cisco APIC Basic Configuration Guide*
- *Cisco ACI Fundamentals*
- *Cisco APIC Layer 2 Networking Configuration Guide*
- *Cisco APIC Layer 3 Networking Configuration Guide*
- *Cisco APIC NX-OS Style Command-Line Interface Configuration Guide*
- *Cisco APIC REST API Configuration Guide*
- *Cisco APIC Layer 4 to Layer 7 Services Deployment Guide*
- *Cisco ACI Virtualization Guide*
- *Cisco Application Centric Infrastructure Best Practices Guide*

All these documents are available at the following URL: http://www.cisco.com/c/en/us/support/cloud-systems-management/application-policy-infrastructure-controller-apic/tsd-products-support-series-home.html

Cisco Application Centric Infrastructure (ACI) Documentation

The broader Cisco ACI documentation is available at the following URL: http://www.cisco.com/c/en/us/support/cloud-systems-management/application-policy-infrastructure-controller-apic/tsd-products-support-series-home.html.

Cisco Application Centric Infrastructure (ACI) Simulator Documentation

The Cisco ACI Simulator documentation is available at http://www.cisco.com/c/en/us/support/cloud-systems-management/application-centric-infrastructure-simulator/tsd-products-support-series-home.html.

Cisco Nexus 9000 Series Switches Documentation

The Cisco Nexus 9000 Series Switches documentation is available at http://www.cisco.com/c/en/us/support/switches/nexus-9000-series-switches/tsd-products-support-series-home.html.

Cisco Application Virtual Switch Documentation

The Cisco Application Virtual Switch (AVS) documentation is available at http://www.cisco.com/c/en/us/support/switches/application-virtual-switch/tsd-products-support-series-home.html.

Cisco ACI Virtual Edge Documentation

The Cisco Application Virtual Edge documentation is available at https://www.cisco.com/c/en/us/support/cloud-systems-management/application-policy-infrastructure-controller-apic/tsd-products-support-series-home.html.

Cisco ACI Virtual Pod Documentation

The Cisco Application Virtual Pod (vPod) documentation is available at https://www.cisco.com/c/en/us/support/cloud-systems-management/application-policy-infrastructure-controller-apic/tsd-products-support-series-home.html.

Cisco Application Centric Infrastructure (ACI) Integration with OpenStack Documentation

Cisco ACI integration with OpenStack documentation is available at http://www.cisco.com/c/en/us/support/cloud-systems-management/application-policy-infrastructure-controller-apic/tsd-products-support-series-home.html.

Documentation Feedback

To provide technical feedback on this document, or to report an error or omission, please send your comments to apic-docfeedback@cisco.com. We appreciate your feedback.