Verified Scalability Guide for Cisco APIC, Release 5.2(4) and Cisco Nexus 9000 Series ACI-Mode Switches, Release 15.2(4)

Revised: October 8, 2024

Overview

This guide contains the maximum verified scalability limits for Cisco Application Centric Infrastructure (Cisco ACI) parameters in the following releases:

- Cisco Application Policy Infrastructure Controller (Cisco APIC), Release 5.2(4)
- Cisco Nexus 9000 Series ACI-Mode Switches, Release 15.2(4)

These values are based on a profile where each feature was scaled to the numbers specified in the tables. These numbers do not represent the theoretically possible Cisco ACI fabric scale.

Note The verified scalability limits for Cisco Multi-Site previously included as part of this guide are now listed in the Cisco Nexus Dashboard Orchestrator (NDO) release-specific documents available at the following URL: https://www.cisco.com/c/en/us/support/cloud-systems-management/multi-site-orchestrator/products-device-support-tables-list.html.

The verified scalability limits for Cisco Cloud APIC previously included as part of this guide are now listed in the Cloud APIC release-specific documents available at the following URL: https://www.cisco.com/c/en/us/support/cloud-systems-management/cloud-application-policy-infrastructure-controller/products-tech-notes-list.html.

New and Changed Information

These changes have been made to this document since its initial release:

Date	Changes
October 8, 2024	Updated High Dual Stack profile values in Fabric Topology section.
August 19, 2024	Updated "Per Fabric Scale" values of the IP SLA probes in the Fabric Topology section.
February 2, 2023	Updated "Number of EIGRP neighbors" scale.
May 11, 2022	Added dual-stack scale for "Number of L3 Outs".
April 29, 2022	Updated "Number of External Route Reflectors between Pods" scale. Updated "Number of External EPGs" and "Number of External EPGs per L3 Out" scale with examples for clarity.
April 21, 2022	Added "DHCP relay addresses per BD across all labels" scale.
March 29, 2022	First release of this document.

General Scalability Limits

- **L2 Fabric:** L2 Fabric in this document refers to an ACI fabric that contains only BDs with Scaled L2 Only mode (formerly known as Legacy mode). See **Bridging** > **Bridge Domain Options** > **Scaled L2 Only Mode - Legacy Mode** in APIC *Layer 2 Configuration Guide* for details about Scaled L2 Only mode.
- **L3 Fabric:** The ACI L3 fabric solution provides a feature-rich highly scalable solution for public cloud and large enterprise. With this design, almost all supported features are deployed at the same time and are tested as a solution. The scalability numbers listed in this section are multi-dimensional scalability numbers. The fabric scalability numbers represent the overall number of objects created on the fabric. The per-leaf scale numbers are the objects created and presented on an individual leaf switch. The fabric level scalability numbers represent APIC cluster scalability and the tested upper limits. Some of the per-leaf scalability numbers are subject to hardware restrictions. The per-leaf scalability numbers are the maximum limits tested and supported by leaf switch hardware. This does not necessarily mean that every leaf switch in the fabric was tested with maximum scale numbers.
- **Stretched Fabric:** Stretched fabric allows multiple fabrics (up to 3) distributed in multiple locations to be connected as a single fabric with a single management domain. The scale for the entire stretched fabric remains the same as for a single site fabric. For example a L3 stretched fabric will support up to 400 leaf switches total which is the maximum number of leaf switches supported on a single site fabric. Parameters only relevant to stretched fabric are mentioned in the tables below.
- **Multi-Pod:** Multi-Pod enables provisioning a more fault-tolerant fabric comprised of multiple Pods with isolated control plane protocols. Also, Multi-Pod provides more flexibility with regard to the full mesh cabling between leaf and spine switches. For example, if leaf switches are spread across different floors or different buildings, Multi-Pod enables provisioning multiple Pods per floor or building and providing connectivity between Pods through spine switches.

  Multi-Pod uses a single APIC cluster for all the Pods; all the Pods act as a single fabric. Individual APIC controllers are placed across the Pods but they are all part of a single APIC cluster.
- **Multi-Site**: Multi-Site is the architecture interconnecting and extending the policy domain across multiple APIC cluster domains. As such, Multi-Site could also be named as Multi-Fabric, since interconnects separate Availability Zones (Fabrics) and managed by an independent APIC controller cluster. A Cisco Nexus Dashboard Orchestrator is part of the architecture and is used to communicate with the different APIC domains to simplify the management of the architecture and the definition of inter-site policies.

Leaf Switches and Ports

The maximum number of leaf switches is 400 per Pod and 500 total in Multi-Pod fabric. The maximum number of physical ports is 24,000 per fabric. The maximum number of remote leaf (RL) switches is 128 per fabric, with total number of BDs deployed on all remote leaf switches in the fabric not exceeding 60,000. The total number of BDs on all RLs is equal to the sum of BDs on each RL.

If Remote Leaf Pod Redundancy policy is enabled, we recommended that you disable the `Pre-emption` flag in the APIC for all scaled up RL deployments. In other words, you must wait for BGP CPU utilization to fall under 50% on all spine switches before you initiate pre-emption.

Breakout Ports

The N9K-C9336C-FX2 switch supports up to 34 breakout ports in both 10G or 25G mode.

General Scalability Limits

Table 1: Fabric Scale Limits Per Cluster Size

Configurable Options	Default Fabric	Medium Fabric	Large Fabric	
Number of APIC nodes	3	4	5 or 6	7
Number of leaf switches	85	200	300	500
Number of leaf switches per Pod	85	200	200	400
Number of tier-2 leaf switches per Pod in Multi-Tier topology **Note** The total number of leaf switches from all tiers must not exceed the "Number of leaf switches" listed above.	80	100	125	125
Number of Pods	6	6	12	12
Number of tenants	1,000	1,000	3,000	3,000
Number of Layer 3 (L3) contexts (VRFs)	1,000	1,000	3,000	3,000

Table 2: General Scalability Limits Per Fabric

Configurable Options	Scale Limits
Number of spine switches per Pod	6
Number of spine switches in a Multi-Pod fabric	24
Number of FEXs	650 (maximum of 20 FEXs and 576 ports per leaf)
Number of contracts	10,000
Number of contract filters	10,000

Configurable Options	Scale Limits
Number of endpoint groups (EPGs)	15,000 (21,000 for L2 fabric)
Number of EPGs per tenant	General limits: • Single-tenant fabrics: 4,000 • Multi-tenant fabrics: 500 Or one of the following two specific use cases within the same fabric (the EPGs must be deployed on local leaf switches only, not on remote leaf switches): • Use case 1: • Up to 10 tenants that have up to 700 EPGs per tenant, with the EPGs distributed across up to 100 leaf switches • Use case 2: • 1 tenant with up to 1,400 EPGs deployed on up to 100 leaf switches For example, `tenant1` with `EPG1-1400` on `leaf1-100` • 1 tenant with up to 800 EPGs deployed on a different set of up to 20 leaf switches For example, `tenant2` with `EPG1401-2200` on `leaf101-120` • 2 tenants with up to 800 EPGs per tenant deployed on a different set of up 20 leaf switches For example, `tenant3` with `EPG2201-3000` and `tenant4` with `EPG 3001-3800` on `leaf121-140`
Number of bridge domains (BDs)	15,000 (21,000 for L2 fabric)
Number of vCenters	• 200 VDS
Number of Service Chains	1,000
Number of L4 - L7 devices	30 managed or 50 unmanaged physical HA pairs 1,200 virtual HA pairs (1,200 maximum per fabric)
Number of ESXi hosts - VDS	3200
Number of VMs	Depends on server scale
Number of configuration zones per fabric	30

Configurable Options	Scale Limits
L3 EVPN services over fabric WAN - GOLF (with and without OpFlex)	1,000 VRFs 60,000 routes in a fabric
Number of Routes in Overlay-1 VRF	1,000
Floating L3Out	6 anchor nodes 32 non-anchor nodes

Multiple Fabric Options Scalability Limits

Stretched Fabric

Configurable Options	Per Fabric Scale
Number of fabrics that can be a stretched fabric	3
Number of Route Reflectors	6

Multi-Pod

Configurable Options	Per Fabric Scale
Number of Pods	12
Number of leaf switches per Pod	400
Number of leaf switches overall	500
Number of Route Reflectors for L3Out	24
Number of External Route Reflectors between Pods	• **For 1-3 Pods**: Up to 3 external route reflectors We recommend full mesh for external BGP peers instead of using external route reflectors when possible • **For 4 or more Pods**: Up to 4 external route reflectors We recommend using external route reflectors instead of full mesh We recommend that the external route reflectors are distributed across Pods so that in case of any failure there are always at least two Pods with external route reflectors still reachable

Cisco Multi-Site Scalability Limits

Cisco Nexus Dashboard Orchestrator (NDO) does not require a specific version of APIC to be running in all sites. The APIC clusters in each site as well as the NDO itself can be upgraded independently of each other and run in mixed operation mode as long as each fabric is running APIC, Release 3.2(6) or later.

As such, the verified scalability limits for your specific Cisco Nexus Dashboard Orchestrator release are now available at the following URL: https://www.cisco.com/c/en/us/support/cloud-systems-management/multi-site-orchestrator/products-device-support-tables-list.html.

Note Each site managed by the Cisco Nexus Dashboard Orchestrator must still adhere to the scalability limits specific to that site's APIC Release. For a complete list of all *Verified Scalability Guides*, see https://www.cisco.com/c/en/us/support/cloud-systems-management/application-policy-infrastructure-controller-apic/tsd-products-support-series-home.html#Verified_Scalability_Guides

Fabric Topology, SPAN, Tenants, Contexts (VRFs), External EPGs, Bridge Domains, Endpoints, and Contracts Scalability Limits

The table shows the mapping of the "ALE/LSE Type" to the corresponding ToR switches. This information is helpful to determine which ToR switch is affected when we use the terms ALE v1, ALE v2, LSE, or LSE2 in remaining sections.

Note In the table, switches are listed as LSE or LSE2 for scalability purposes only. Check specific feature documentation for the full list of supported devices.

ALE/LSE Type	ACI-Supported ToR switches
ALE v2	• N9K-C9396TX + N9K-M6PQ • N9K-C93128TX + N9K-M6PQ • N9K-C9396PX + N9K-M6PQ • N9K-C9372TX 64K • N9K-C9332PQ • N9K-C9372PX

ALE/LSE Type	ACI-Supported ToR switches
LSE	• N9K-C93108TC-EX • N9K-C93108TC-EX-24 • N9K-C93180YC-EX • N9K-C93180YC-EX-24 • N9K-C93180LC-EX • N9K-C9336C-FX2 • N9K-C93216TC-FX2 • N9K-C93240YC-FX2 • N9K-C93360YC-FX2 • N9K-C9336C-FX2-E
LSE2	• N9K-C93108TC-FX • N9K-C93108TC-FX-24 • N9K-C93180YC-FX • N9K-C93180YC-FX-24 • N9K-C9348GC-FXP • N9K-C93600CD-GX • N9K-C9364C-GX • N9K-C9316D-GX • N9K-C9332D-GX2B • N9K-C93180YC-FX3 • N9K-C93108TC-FX3P • N9K-C9358GY-FXP with 24GB of RAM

Note

- The High Policy, Multicast-Heavy, and High IPv4 EP Scale profiles are not supported on FXP switches.
- Full scale support for High Policy, Multicast-Heavy, and High IPv4 EP Scale profiles requires LSE2 with 32GB of RAM.
- High IPv4 EP Scale—This profile is recommended to be used only for the ACI border leaf (BL) switches in Multi-Domain (ACI-SDA) Integration. It provides enhanced IPv4 EP and LPM scales specifically for these BLs and has specific hardware requirements.

Fabric Topology

Configurable Options	Per Leaf Scale	Per Fabric Scale
Number of PCs, vPCs	320 (with FEX HIF)	N/A
Number of encapsulations per access port, PC, vPC (non-FEX HIF)	3,000	N/A
Number of encapsulations per FEX HIF, PC, vPC	100	N/A
Number of encapsulations per FEX	1,400	N/A
Number of member links per PC, vPC* *vPC total ports = 32, 16 per leaf	16	N/A
Number of ports x VLANs (global scope and no FEX HIF)	64,000 168,000 (when using legacy BD mode)	N/A
Number of ports x VLANs (FEX HIFs and/or local scope)	ALE v2: 9,000 LSE and LSE2: 10,000	N/A
Number of static port bindings	ALE v2: 30,000 For LSE and LSE2: 60,000	700,000 (200,000 per tenant)
Number of VMACs	For ALE v2: 255 For LSE and LSE2: 510	N/A
STP	All VLANs	N/A
Mis-Cabling Protocol (MCP)	256 VLANs per interface 2,000 logical ports (port x VLAN) per leaf	N/A

Configurable Options	Per Leaf Scale	Per Fabric Scale
Number of endpoints (EPs)	Default (Dual Stack) profile: • ALE v2: • MAC: 12,000 • IPv4: 12,000 or • IPv6: 6,000 or • IPv4: 4,000 IPv6: 4,000 Default profile or High LPM profile: • LSE or LSE2: • MAC: 24,000 • IPv4: 24,000 • IPv6: 12,000 IPv4 scale profile: • LSE and LSE2: • MAC: 48,000 • IPv4: 48,000 • IPv6: Not supported • ALE v2: Not supported High Dual Stack scale profile: • LSE: • MAC: 64,000 • IPv4: 64,000 • IPv6: 24,000 • LSE2: • MAC: 64,000 • IPv4: 64,000 • IPv6: 48,000 • ALE v2: Not supported	16-slot and 8-slot modular spine switches: Max. 450,000 Proxy Database Entries in the fabric, which can be translated into any one of these: • 450,000 MAC-only EPs (each EP with one MAC only) • 225,000 IPv4 EPs (each EP with one MAC and one IPv4) • 150,000 dual-stack EPs (each EP with one MAC, one IPv4, and one IPv6) The formula to calculate in mixed mode is: #MAC + #IPv4 + #IPv6 <= 450,000 NOTE: Four fabric modules are required on all spines in the fabric to support above scale. 4-slot modular spine switches: Max. 360,000 Proxy Database Entries in the fabric, which can be translated into any one of these: • 360,000 MAC-only EPs (each EP with one MAC only) • 180,000 IPv4 EPs (each EP with one MAC and one IPv4) • 120,000 dual-stack EPs (each EP with one MAC, one IPv4, and one IPv6) The formula to calculate in mixed mode is: #MAC + #IPv4 + #IPv6 <= 360,000 NOTE: Four fabric modules are required on all spines in the fabric to support above scale.

Configurable Options	Per Leaf Scale	Per Fabric Scale

Number of endpoints (EPs)
(Continued)
	High Policy profile:
	• LSE2 (except FXP switches):
	  • MAC: 24,000
	  • IPv4: 24,000
	  • IPv6: 12,000
	• LSE:
	  • MAC: 16,000
	  • IPv4: 16,000
	  • IPv6: 8,000
	
	High IPv4 EP Scale profile:
	• LSE2 (with 32GB of RAM):
	  • MAC: 24,000
	  • IPv4 local: 24,000
	  • IPv4 total: 280,000
	  • IPv6: 12,000
	• LSE: Not supported
	
	Multicast Heavy profile:
	• LSE2 (except FXP switches):
	  • MAC: 24,000
	  • IPv4 local: 24,000
	  • IPv4 total: 64,000
	  • IPv6: 4,000
	• LSE: Not supported
		Fixed spine switches:
		Max. 180,000 Proxy Database Entries in the fabric, which can be translated into any one of these:
		• 180,000 MAC-only EPs (each EP with one MAC only)
		• 90,000 IPv4 EPs (each EP with one MAC and one IPv4)
		• 60,000 dual-stack EPs (each EP with one MAC, one IPv4, and one IPv6)
		
		The formula to calculate in mixed mode is:
		#MAC + #IPv4 + #IPv6 <= 180,000

Configurable Options	Per Leaf Scale	Per Fabric Scale
Number of Multicast Routes	Default (Dual Stack), IPv4 Scale, High LPM, High Policy or High IPv4 EP scale profiles: 8,000 with (S,G) scale not exceeding 4,000 High Dual Stack profile: • LSE: 512 • LSE2: 32,000 with (S,G) scale not exceeding 16,000 Multicast Heavy profile: • LSE: not supported • LSE2 (with 32GB of RAM): 90,000 with (S,G) scale not exceeding 72,000	128,000
Number of Multicast Routes per VRF	Default (Dual Stack), IPv4 Scale, High LPM, High Policy or High IPv4 EP scale profiles: 8,000 with (S,G) scale not exceeding 4,000 High Dual Stack profile: • LSE: 512 • LSE2: 32,000 with (S,G) scale not exceeding 16,000 Multicast Heavy profile: • LSE: not supported • LSE2 (except FXP switches): 32,000	32,000
IGMP snooping L2 multicast routes • For IGMPv2, route scale is for (*, G) only • For IGMPv3, route scale is for both (S, G) and (*, G) **Note** IGMP snooping entries are created per BD (2 receivers that join the same group from 2 different BDs consume 2 separate entries).	Default (Dual Stack), IPv4, High LPM, High Policy, or High IPv4 EP scale profiles: 8,000 High Dual Stack profile: • LSE: 512 • LSE2: 32,000 Multicast Heavy profile: • LSE: not supported • LSE2: 32,000	32,000
Number of IPs per MAC	4,096	4,096

Configurable Options	Per Leaf Scale	Per Fabric Scale
Number of Host-Based Routing Advertisements	30,000 host routes per border leaf	N/A
SPAN	ALE-based ToR switches: • 4 unidirectional or 2 bidirectional access/tenant sessions • 4 unidirectional or 2 bidirectional fabric sessions LSE-based ToR switches: • 32 unidirectional or 16 bidirectional sessions (fabric, access, or tenant)	N/A
Number of ports per SPAN session **Note** This is also the total number of unique ports (fabric and access) that can be used as SPAN sources across all SPAN sessions combined	ALE-based ToR switches: • All leaf access ports could be in one session. • All leaf fabric ports could be in one session. LSE/LSE2-based ToR switches: • 63 – total number of unique ports (fabric + access) across all types of span sessions	N/A

Configurable Options	Per Leaf Scale	Per Fabric Scale
Number of source EPGs in tenant SPAN sessions **Note** The numbers listed in this row assume that only tenant SPAN is configured. If both, Access and Tenant SPAN are configured, this formula applies for both ingress and egress SPAN: `E + P + E*P + EPP + v6FePP + 0.5*v4FePP <= 230` Where: • `E`— Number of source EPGs in Tenant SPAN • `P`—Number of source Ports in access SPAN without any filters • `EPP`—Number of (Epg,Port) Pairs in access SPAN with EPG filter only (no filter group) • `v4FePP`—Number of (v4 filter entry, Port) Pairs in access SPAN with filter group • `v6FePP`—Number of (v6 Filter entry, Port) Pairs in access SPAN with filter group	ALE-based ToR switches: • 230 ingress direction + 50 egress direction LSE-based ToR switches: • 230 bidirectional • 460 unidirectional (230 ingress + 230 egress)	N/A
Number of SPAN ACL filter TCAM entries SPAN filters are supported on -EX, -FX, and -FX2 TORs only. SPAN filters are not supported in: • Fabric ports • Fabric and tenant SPAN sessions • Spine switches	• IPv4: 480 • IPv6: 240 Total number of TCAM entries is calculated using this formula: (`IPv4-filters`) * (`IPv4-filter-source-groups`) + 2 * (`IPv6-filters`) * (`IPv6-filter-source-groups`) + 2 * (`no-filter-source-groups`)	N/A

Configurable Options	Per Leaf Scale	Per Fabric Scale
Number of L4 Port Ranges	16 (8 source and 8 destination) First 16 port ranges consume a TCAM entry per range. Each additional port range beyond the first 16 consumes a TCAM entry per port in the port range. Filters with distinct source port range and destination port range count as 2 port ranges. You cannot add more than 16 port ranges at once.	N/A
Common pervasive gateway	256 virtual IPs per Bridge Domain	N/A
Number of Data Plane policers at the interface level	ALE: • 64 ingress policers • 64 egress policers LSE and LSE2: • 7 ingress policers • 3 egress policers	N/A
Number of Data Plane policers at EPG and interface level	128 ingress policers	N/A
Number of interfaces with Per-Protocol Per-Interface (PPPI) CoPP	63	N/A
Number of TCAM entries for Per-Protocol Per-Interface (PPPI) CoPP	256 One PPPI CoPP configuration may use more than one TCAM entry. The number of TCAM entries used for each configuration varies in each protocol and leaf platform. Use `vsh_lc -c 'show system internal aclqos pppi copp tcam-usage'` command to check on LSE/LSE2 platforms	N/A
Number of SNMP trap receivers	10	10
IP SLA probes* *With 1 second probe time and 3 seconds of timeout	100	• 1500 (for PBR tracking) • 400 (for static route tracking)

Configurable Options	Per Leaf Scale	Per Fabric Scale
First Hop Security (FHS)* With any combination of BDs/EPGs/EPs within the supported limit	2,000 endpoints 1,000 bridge domains	N/A
Number of Q-in-Q tunnels (both QinQ core and edge combined)	1,980	N/A
Number of TEP-to-TEP atomic counters (tracked by 'dbgAcPathA' object)	N/A	1,600

SR-MPLS

Configurable Options	Per Leaf Scale	Per Fabric Scale
EVPN sessions	4	100
BGP labeled unicast (LU) pairs	16	200
ECMP paths	16	N/A
Infra SR-MPLS L3Outs* * Including both, remote leaf and multi-pod	N/A	100 total, 2 per RL location
VRFs* * Including both, remote leaf and multi-pod	N/A	1,200
External EPGs	N/A	2,000 total, 100 per VRF
Interfaces	N/A	Same as fabric scale
Multi-pod remote leaf pairs	N/A	50 pairs (100 RLs total)

Tenants

Configurable Options	Per Leaf Scale	Per Fabric Scale
Contexts (VRFs) per tenant	ALE: 50 LSE: 128	ALE: 50 LSE: 128

VRFs (Contexts)

All numbers are applicable to dual stack unless explicitly called out.

Configurable Options	Per Leaf Scale	Per Fabric Scale
Number of Contexts (VRFs)	ALE: 400 LSE and LSE2: 800	3,000

Configurable Options	Per Leaf Scale	Per Fabric Scale
Maximum ECMP (equal cost multipath) for BGP best path	64	N/A
Maximum ECMP (equal cost multipath) for OSPF best path	64	N/A
Maximum ECMP (equal cost multipath) for Static Route best path	64	N/A
Number of isolated EPGs	400	400
Border Leafs per L3 Out	N/A	12
Number of vzAny Provided Contracts	Shared services: Not supported Non-shared services: 70 per Context (VRF)	N/A
Number of vzAny Consumed Contracts	Shared services: 16 per Context (VRF) Non-shared services: 70 per Context (VRF)	N/A
Number of Graphs Instances per device cluster	N/A	500
L3 Out per context (VRF)	N/A	400

Number of BFD neighbors	• Up to 256 sessions using these minimum BFD timers:
	  • `minTx:50`
	  • `minRx:50`
	  • `multiplier:3`
	• 257-2000 sessions using these minimum BFD timers:
	  • `minTx:300`
	  • `minRx:300`
	  • `multiplier:3`
		N/A

Number of BGP neighbors	2,000 with up to 70,000 external prefixes with a single path	20,000

Configurable Options	Per Leaf Scale	Per Fabric Scale

Number of OSPF neighbors	• Up to 700 with up to 10,000 external prefixes using these timers:
	  • `Hello` timer of `10` seconds
	  • `Dead` timer of `40` seconds
	  • No more than 300 OSPF neighbors per VRF
	• 701-2000 with up to 35,000 external prefixe using these timers:
	  • `Hello` timer of `40` seconds
	  • `Dead` timer of `160` seconds
	  • No more than 300 OSPF neighbors per VRF
		12,000

Number of EIGRP neighbors	32	N/A
Number of subnets for Route Summarization	1,000	N/A
Number of static routes to a single SVI/VRF	5,000	N/A
Number of static routes on a single leaf switch	10,000	N/A

Configurable Options	Per Leaf Scale	Per Fabric Scale

Number of IP Longest Prefix Matches (LPM) entries
Note The total of `(# of IPv4 prefixes) + 2*(# of IPv6 prefixes)` must not exceed the scale listed for IPv4 alone
	Default (Dual Stack) profile:
	• ALE v2:
	  • IPv4: 10,000 or
	  • IPv6: 6,000 or
	  • IPv4: 4,000, IPv6: 4000
	  • IPv6 wide prefixes (> /64): 1,000
	• For LSE or LSE2:
	  • IPv4: 20,000 or
	  • IPv6: 10,000
	  • IPv6 wide prefixes (>= /84): 1,000
	  NOTE: For LSE2 and FX2 models there's no restriction on wide prefixes.
	IPv4 scale profile:
	• For LSE or LSE2:
	  • IPv4: 38,000
	  • IPv6: Not supported
	• ALE v2: Not supported
	High Dual Stack scale profile:
	• LSE or LSE2:
	  • IPv4: 38,000 or
	  • IPv6: 19,000
	  • IPv6 wide prefixes (>= /84): 1,000
	  NOTE: For LSE2 and FX2 models there's no restriction on wide prefixes.
	• ALE v2: Not supported
		N/A

Configurable Options	Per Leaf Scale	Per Fabric Scale
Number of IP Longest Prefix Matches (LPM) entries (Continued) **Note** The total of `(# of IPv4 prefixes) + 2*(# of IPv6 prefixes)` must not exceed the scale listed for IPv4 alone	High LPM Scale profile – • LSE or LSE2: • IPv4: 128,000 or • IPv6: 64,000 • IPv6 wide prefixes (>= /84): 1,000 NOTE: For LSE2 and FX2 models there's no restriction on wide prefixes. • ALE v2: Not supported High Policy profile: • LSE2 (except FXP switches): • IPv4: 20,000 or • IPv6: 10,000 • LSE: • IPv4: 8,000 • IPv6: 4,000 High IPv4 EP Scale profile: • LSE2 (except FXP switches): • IPv4: 40,000 • IPv6: 20,000 • LSE: Not supported Multicast Heavy profile: • LSE2 (except FXP switches): • IPv4: 20,000 • IPv6: 10,000 • LSE: Not supported	N/A

Configurable Options	Per Leaf Scale	Per Fabric Scale
Average number of paths (ECMP) per prefix at maximum LPM scale Across all prefixes, the average number of equal cost next-hops (ECMP) must not exceed the specified number. Some prefixes may have a higher number of paths as long as it's compensated by other prefixes that have a lower number of paths.	Default (Dual Stack), High Policy and Multicast Heavy profiles: • IPv4: 32 • IPv6: 12 IPv4 scale profile: • IPv4: 16 • IPv6: NA High Dual Stack scale profile: • IPv4: 16 • IPv6: 6 High LPM scale profile: • IPv4: 4 • IPv6: 1	N/A
Number of Secondary addresses per logical interface	1	1
Number of L3 interfaces per Context	• 1,000 SVIs • 16 Routed interfaces • 100 sub-interfaces with or without port-channel	N/A
Number of L3 interfaces	• 1,000 SVIs • 16 Routed interfaces • 1,000 sub-interfaces with or without port-channel	N/A
Number of ARP entries for L3 Outs	7,500	N/A
Shared L3 Out	• IPv4 Prefixes: 2,000 or • IPv6 Prefixes: 1,000	• IPv4 Prefixes: 6,000 or • IPv6 Prefixes: 3,000
Number of L3 Outs	400 For LSE and LSE2: 800	2,400 (single-stack) 1,800 (dual-stack)

External EPGs

Configurable Options	Per Leaf Scale	Per Fabric Scale
Number of External EPGs	800	ALE: 2,400 LSE: 4,000 The listed scale is calculated as a product of (Number of external EPGs)*(Number of border leaf switches for the L3Out) For example, this combination adds up to a total of 2,000 external EPGs in the fabric (250 external EPGs * 2 border leaf switches * 4 L3Outs): • 250 External EPGs in `L3Out1` on `leaf1` and `leaf2` • 250 External EPGs in `L3Out2` on `leaf1` and `leaf2`. • 250 External EPGs in `L3Out3` on `leaf3` and `leaf4` • 250 External EPGs in `L3Out4` on `leaf3` and `leaf4`
Number of External EPGs per L3Out	250	600 The listed scale is calculated as a product of (Number of external EPGs per L3Out)*(Number of border leaf switches for the L3Out) For examples, 150 external EPGs on `L3Out1` that is deployed on `leaf1`, `leaf2`, `leaf3`, and `leaf4` adds up to a total of 600
Number of LPM Prefixes for External EPG Classification **Note** Maximum combined number of IPv4/IPv6 host and LPM prefixes for External EPG Classification must not exceed 64,000	ALE: 1,000 IPv4 LSE: refer to LPM scale section.	N/A

Configurable Options	Per Leaf Scale	Per Fabric Scale

Number of host prefixes for External EPG Classification
Note Maximum combined number of IPv4/IPv6 host and LPM prefixes for External EPG Classification must not exceed 64,000
	ALE: 1,000
	Default Profile:
	• LSE and LSE2:
	  • IPv4 (/32): 16,000
	  • IPv6 (/128): 12,000
	  Combined number of host prefixes and endpoints can't exceed 12,000.
	IPv4 Scale profile:
	• LSE and LSE2:
	  • IPv4 (/32): 16,000
	  Combined number of host prefixes, multicast groups, and endpoints can't exceed 56,000.
	  • IPv6 (/128): 0
		N/A

Configurable Options	Per Leaf Scale	Per Fabric Scale
Number of host prefixes for External EPG Classification (Continued) **Note** Maximum combined number of IPv4/IPv6 host and LPM prefixes for External EPG Classification must not exceed 64,000	High Dual Stack Profile: • LSE: • IPv4 (/32): 64,000 Combined number of host prefixes, multicast groups, and endpoints can't exceed 64,000. • IPv6 (/128): 24,000 Combined number of host prefixes and endpoints can't exceed 24,000. • LSE2: • IPv4 (/32): 64,000 Combined number of host prefixes, multicast groups, and endpoints can't exceed 64,000. • IPv6 (/128): 48,000 Combined number of host prefixes and endpoints can't exceed 48,000. High LPM Profile: • LSE and LSE2: • IPv4 (/32): 24,000 Combined number of host prefixes, multicast groups, and endpoints can't exceed 24,000. • IPv6 (/128): 12,000 Combined number of host prefixes and endpoints can't exceed 12,000.	N/A

Configurable Options	Per Leaf Scale	Per Fabric Scale
Number of host prefixes for External EPG Classification **Note** Maximum combined number of IPv4/IPv6 host and LPM prefixes for External EPG Classification must not exceed 64,000 (Continued)	High Policy profile: • LSE: • IPv4 (/32): 16,000 Combined number of host prefixes, multicast groups, and endpoints can't exceed 24,000 • IPv6 (/128): 8,000 Combined number of host prefixes and endpoints can't exceed 8,000. • LSE2 (except FXP switches): • IPv4 (/32): 16,000 • IPv6 (/128): 12,000 Combined number of host prefixes and endpoints can't exceed 12,000.	N/A

Configurable Options	Per Leaf Scale	Per Fabric Scale
Number of host prefixes for External EPG Classification **Note** Maximum combined number of IPv4/IPv6 host and LPM prefixes for External EPG Classification must not exceed 64,000 (Continued)	High IPv4 EP Scale profile: • LSE2 (except FXP switches): • IPv4 (/32): 16,000 • IPv6 (/128): 12,000 Combined number of host prefixes and endpoints can't exceed 12,000. • LSE: Not supported Multicast Heavy profile: • LSE2 (except FXP switches): • IPv4 (/32): 16,000 Combined number of host prefixes, multicast groups, and endpoints can't exceed 154,000. • IPv6 (/128): 4,000 Combined number of host prefixes and endpoints can't exceed 4,000. • LSE: Not supported	N/A

Bridge Domains

Configurable Options	Per Leaf Scale	Per Fabric Scale
Number of BDs	1,980 Legacy mode: 3,500 On ALE ToR switches with multicast optimized mode: 50	15,000
Number of BDs with Unicast Routing per Context (VRF)	ALE: 256 LSE: 1,000	1750
Number of subnets per BD	1,000, cannot be for all BDs.	1,000 per BD
Number of EPGs per BD	3,960	4,000
Number of L2 Outs per BD	1	1

Configurable Options	Per Leaf Scale	Per Fabric Scale
Number of BDs with Custom MAC Address	1,000 On ALE ToR switches with multicast optimized mode: 50	1,000 On ALE ToR switches with multicast optimized mode: 50
Number of EPGs + L3 Outs per Multicast Group	128	128
Number of BDs with L3 Multicast enabled	1,750	1,750
Number of VRFs with L3 Multicast enabled	64	300
Number of L3 Outs per BD	ALE: 4 LSE: 16	N/A
Number of static routes behind pervasive BD (EP reachability)	N/A	450
DHCP relay addresses per BD across all labels	16	N/A
Number of external EPGs per L2 out	1	1
Number of PIM Neighbors	1,000	1,000
Number of PIM Neighbors per VRF	64	64
Number of L3Out physical interfaces with PIM enabled	32	N/A

Endpoint Groups (Under App Profiles)

Configurable Options	Per Leaf Scale	Per Fabric Scale
Number of EPGs	Normally 3,960; if legacy mode 3,500	15,000
Maximum amount of encapsulations per EPG	1 Static leaf binding, plus 10 Dynamic VMM	N/A
Maximum Path encap binding per EPG	Equals to number of ports on the leaf	N/A
Maximum amount of encapsulations per EPG per port with static binding	One (path or leaf binding)	N/A
Number of domains (physical, L2, L3)	100	N/A
Number of VMM domains	N/A	• 200 VDS

Configurable Options	Per Leaf Scale	Per Fabric Scale
Number of native encapsulations	• One per port, if a VLAN is used as a native VLAN. • Total number of ports, if there is a different native VLAN per port.	Applicable to each leaf independently
Number of 802.1p encapsulations	• 1, if path binding then equals the number of ports. • If there is a different native VLAN per port, then it equals the number of ports.	Applicable to each leaf independently
Can encapsulation be tagged and untagged?	No	N/A
Number of Static endpoints per EPG	Maximum endpoints	N/A
Number of Subnets for inter-context access per tenant	4,000	N/A
Number of Taboo Contracts per EPG	2	N/A
IP-based EPG (bare metal)	4,000	N/A
MAC-based EPG (bare metal)	4,000	N/A

Contracts

Configurable Options	Per Leaf Scale	Per Fabric Scale
Security TCAM size	Default scale profile: • ALE v2: 40,000 • LSE and LSE2: 64,000 IPv4 scale profile: • ALE v2: N/A • LSE and LSE2: 64,000 High Dual Stack scale profile: • ALE v2: N/A • LSE: 8,000 • LSE2: 128,000 High LPM scale profile: • ALE v2: N/A • LSE and LSE2: 8,000 High Policy profile: • LSE2 (with 32GB of RAM): 256,000 • LSE2 (with 24GB of RAM): 140,000 • LSE: 100,000 High IPv4 EP Scale profile: • LSE2 (except FXP switches): 64,000 • LSE: Not supported Multicast Heavy profile: • LSE2 (except FXP switches): 64,000 • LSE: Not supported	N/A

Configurable Options	Per Leaf Scale	Per Fabric Scale
Software policy scale with Policy Table Compression enabled (Number of `actrlRule` Managed Objects)	Dual stack profile: • LSE and LSE2 (except EX switches): 80,000 High Dual Stack profile: • LSE: Not supported • LSE2: 140,000 High Policy profile: • LSE2 (with 32 GB of RAM) : 256,000 • LSE2 (with 24 GB of RAM) : 140,000 • LSE (except EX switches): 100,000	N/A
Approximate TCAM calculator given contracts and their use by EPGs	Number of entries in a contract X Number of Consumer EPGs X Number of Provider EPGs X 2	N/A
Number of consumers (or providers) of a contract that has more than 1 provider (or consumer)	100	100
Number of consumers (or providers) of a contract that has a single provider (or consumer)	1,000	1,000
Scale guideline for the number of Consumers and Providers for the same contract	N/A	Number of consumer EPGs * number of provider EPGs * number of filters in the contract <= 50,000
Number of rules for consumer/provider relationships with in-band EPG	400	N/A
Number of rules for consumer/provider relationships with out-of-band EPG	400	N/A

Endpoint Security Groups (ESG)

Configurable Options	Scale
Number of ESGs per Fabric	10,000
Number of ESGs per VRF	4,000
Number of ESGs per Tenant	4,000
Number of L2 MAC Selectors per Leaf	5,000

Configurable Options	Scale
Number of L3 IP Selectors per Leaf	5,000

FCoE NPV

Configurable Options	Per Leaf Scale
Number of VSANs	32
Number of VFCs configured on physical ports and FEX ports	151
Number of VFCs on port-channel (PC), including SAN port-channel	7
Number of VFCs on virtual port-channel (vPC) interfaces, including FEX HIF vPC	151
Number of FDISC per port	255
Number of FDISC per leaf	1,000

FC NPV

Configurable Options	Per Leaf Scale
Number of FC NP Uplink interfaces	48
Number of VSANs	32
Number of FDISC per port	255
Number of FDISC per leaf	1,000
Number of SAN port-channel, including VFC port-channel	7
Number of members in a SAN port-channel	16

VMM Scalability Limits

VMware

Configurable Options	Per Leaf Scale	Per Fabric Scale
Number of vCenters (VDS)	N/A	200 (Verified with a load of 10 events/minute for each vCenter)
Datacenters in a vCenter	N/A	15
Total Number of VMM domain (vCenter, Datacenter) instances.	N/A	• 200 VDS

Configurable Options	Per Leaf Scale	Per Fabric Scale
Number of EPGs per vCenter/vDS	N/A	5,000
Number of EPGs to VMware domains/vDS	N/A	5,000
Number of endpoints per VDS	10,000	10,000
Number of endpoints per vCenter	10,000	10,000
Support RBAC for VDS	N/A	Yes
Number of Microsegment EPGs with vDS	400	N/A
Number of VM Attribute Tags per vCenter	N/A	vCenter version 6.0: 500 vCenter version 6.5: 1,000

Microsoft SCVMM

Configurable Options	Per Leaf Scale (On-Demand Mode)	Per Leaf Scale (Pre-Provision Mode)	Per Fabric Scale
Number of controllers per SCVMM domain	N/A	N/A	5
Number of SCVMM domains	N/A	N/A	25
EPGs per Microsoft VMM domain	N/A	N/A	3,000
EPGs per all Microsoft VMM domains	N/A	N/A	9,000
EP/VNICs per HyperV host	N/A	N/A	100
EP/VNICs per SCVMM	3,000	10,000	10,000
Number of Hyper-V hosts	64	N/A	N/A
Number of logical switch per host	N/A	N/A	1
Number of uplinks per logical switch	N/A	N/A	4
Microsoft micro-segmentation	1,000	Not Supported	N/A

Microsoft Windows Azure Pack

Configurable Options	Per Fabric Scale
Number of Windows Azure Pack subscriptions	1,000

Configurable Options	Per Fabric Scale
Number of plans per Windows Azure Pack instance	150
Number of users per plan	200
Number of subscriptions per user	3
VM networks per Windows Azure Pack user	100
VM networks per Windows Azure Pack instance	3,000
Number of tenant shared services/providers	40
Number of consumers of shared services	40
Number of VIPs (Citrix)	50
Number of VIPs (F5)	50

Layer 4 - Layer 7 Scalability Limits

Configurable Options (L4-L7 Configurations)	Per Fabric Scale
Number of L4-L7 logical device clusters	1,200
Number of graph instances	1,000
Number of device clusters per tenant	30
Number of interfaces per device cluster	Any
Number of graph instances per device cluster	500
Deployment scenario for ASA (transparent or routed)	Yes
Deployment scenario for Citrix - One arm with SNAT/etc.	Yes
Deployment scenario for F5 - One arm with SNAT/etc.	Yes

AD, TACACS, RBAC Scalability Limits

Configurable Options	Per Fabric Scale
Number of ACS/AD/LDAP authorization domains	4 tested (16 maximum /server type)
Number of login domains	15 (can go beyond).
Number of security domains/APIC	15 (can go beyond).

Configurable Options	Per Fabric Scale
Number of security domains in which the tenant resides	4 (can go beyond).
Number of priorities	4 tested (16 per domain)
Number of shell profiles that can be returned.	4 tested (32 domains total)
Number of users	8,000 local / 8,000 remote
Number of simultaneous logins	500 connections / NGNIX simultaneous REST logins

Cisco Mini ACI Fabric and Virtual APICs Scalability Limits

Property	Maximum Scale
Number of spine switches	2
Number of leaf switches	4
Number of Pods	1
Number of tenants	25
Number of VRFs	25
Number of bridge domains (BDs)	1,000
Number of endpoint groups (EPGs)	1,000
Number of endpoints	20,000
Number of contracts	2,000
Number of service graph instances	20
Number of L4-L7 logical device clusters	3 Physical or 10 Virtual
Number of multicast groups	200
Number of BGP+OSPF sessions	25
GOLF VRF, Route Scale	N/A

Cisco ACI and UCSM Scalability

The following table shows verified scalability numbers for Cisco Unified Computing System with Cisco ACI `ExternalSwitch` app.

Configurable Options	Scale
Number of UCSMs per APIC cluster	12

Configurable Options	Scale
Number of VMM Domains per UCSM	4
Number of VLANs + PVLAN per UCSM	4,000
Number of vNIC Templates per UCSM	16

QoS Scalability Limits

The following table shows QoS scale limits. The same numbers apply for topologies with or without remote leafs as well as with COS preservation and MPOD policy enabled.

QoS Mode	QoS Scale
Custom QoS Policy with DSCP	7
Custom QoS Policy with DSCP and Dot1P	7
Custom QoS Policy with Dot1P	38
Custom QoS Policy via a Contract	38

PTP Scalability Limits

The following table shows Precision Time Protocol (PTP) scale limits.

Configurable Options	Scale (IEEE 1588 Default Profile)	Scale (AES67, SMPTE-2059-2)	Scale (Telecom Profile G.8275.1)
Number of leaf switches connected to a single spine with PTP globally enabled	128	40	N/A
Number of ACI switches connected to the same tier-1 leaf switch (multi-tier topology) with PTP globally enabled	16	16	N/A
Number of access ports with PTP enabled on a leaf switch	25 **Note** For improved performance on 1G interfaces with N9K-C93108TC-FX3P switches, the maximum number of 1G interfaces should not exceed 10 out of 25	25 **Note** For improved performance on 1G interfaces with N9K-C93108TC-FX3P switches, the maximum number of 1G interfaces should not exceed 10 out of 25	24

Configurable Options	Scale (IEEE 1588 Default Profile)	Scale (AES67, SMPTE-2059-2)	Scale (Telecom Profile G.8275.1)
Number of PTP peers per access port	PTP Mode Multicast (Dynamic/Master): 2 peers PTP Mode Unicast Master: 1 peer	PTP Mode Multicast (Dynamic/Master): 2 peers PTP Mode Unicast Master: 1 peer	1
Number of PTP peers per leaf switch	26	26	25

NetFlow Scale

Configurable Options	Scale
Exporters per leaf switch	2
NetFlow monitor policies under BDs per leaf switch	100
NetFlow monitor policies under L3Outs per leaf switch	120
Number of records per collect interval	20,000

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