

Exploring the Industry's Leading Data Center Switching Platform: The Cisco Nexus 9000 Series Switches



Cisco Nexus 9000 Series Switches

Hardware innovation

Three key decisions

Spine Switches

Leaf Switches

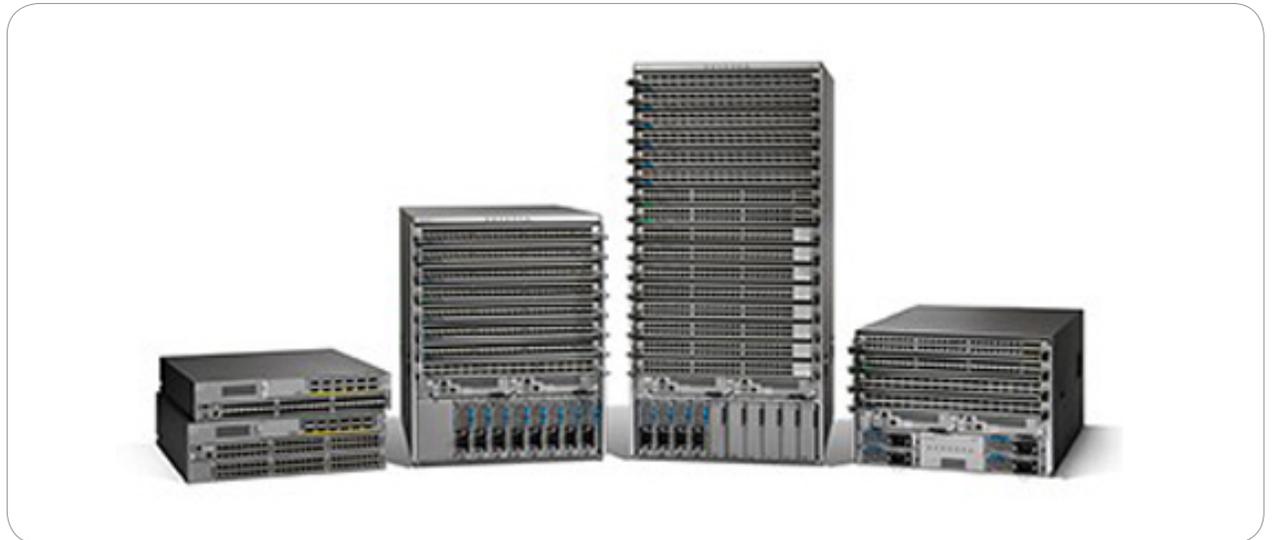
Modular spine line cards

Modular leaf line cards

Additional information

Learn more

Cisco Nexus 9000 Series Switches



The Cisco Nexus 9000 Series Switches

Engineered from the ground up for the automation, performance, and simplicity that your team needs to stay ahead of the ever increasing demands of software developers and applications, the Cisco Nexus® 9000 combines the most programmable network operating systems with the world's highest performing ASICs so your team can deliver amazing experiences faster than your competition.

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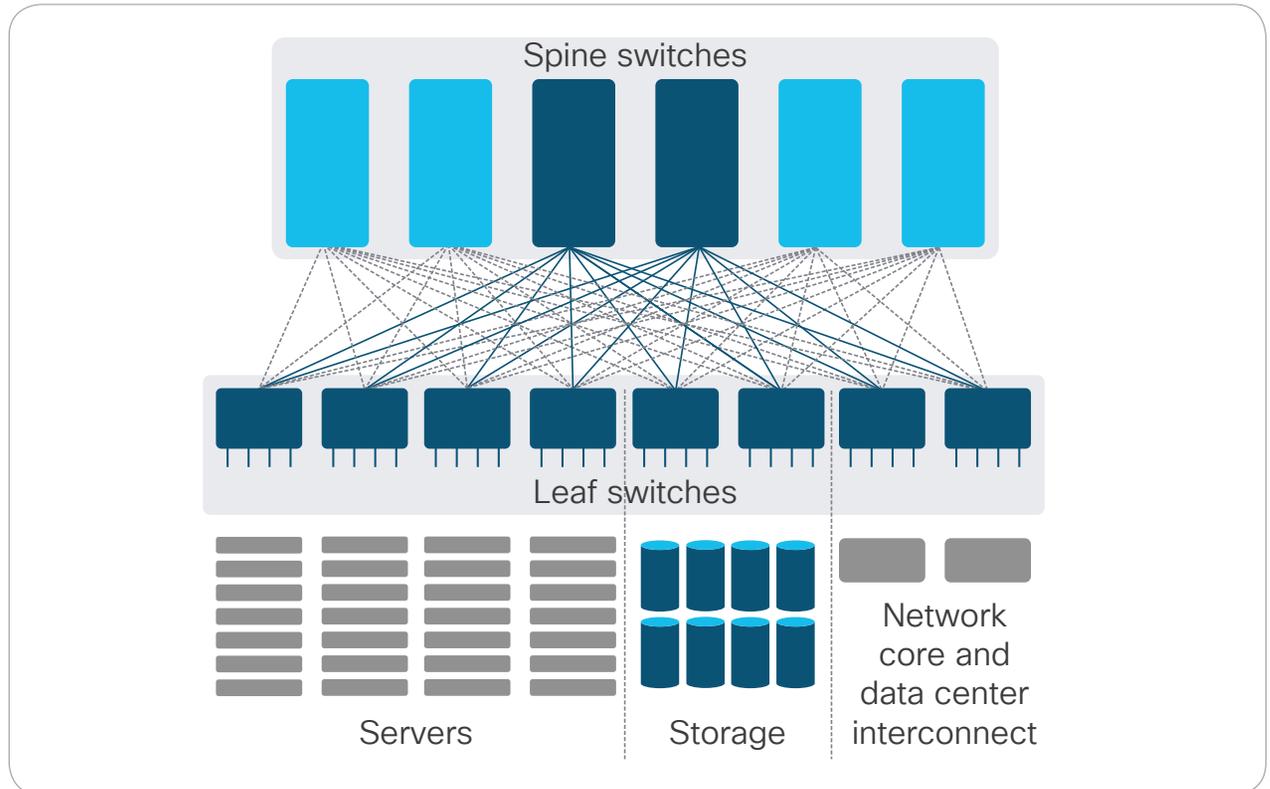
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Optimize your Architecture

Data center networks around the world are shifting to spine-and-leaf^{1,2} architecture to simplify scaling bandwidth, deliver consistently lower latency and reduce overall costs.

Unlike traditional 3-tier networks, every leaf (access) switch connects to every spine (aggregation) switch – and every spine switch only connects to the leaf switches. Every connection to the data center network is made through a leaf switch. To increase overall bandwidth, all you need to do is add another spine switch. To add access ports, simply add another leaf switch. Every leaf is only two hops away from every other leaf for consistently low latency. And every link is always active, so your network delivers the maximum bandwidth with the fewest switches.

¹ ACI mode is designed for spine-and-leaf only and requires the Cisco Application Policy Infrastructure Controller (APIC).

² While this guide focuses on the spine-and-leaf architecture, the Nexus 9000 and 3000 can be configured for either spine-and-leaf or traditional 2-tier and 3-tier architectures in NX-OS mode.

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All networking platforms depend upon their network processors and the other microchips on which they run. That's why we have some of the world's best Application-Specific Integrated Circuit (ASIC) designers. We are committed to driving the industry forward when we see that customer needs aren't being met by merchant silicon. A great example of this are the Cloud Scale ASICs.



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Which network operating system is right for you?

Which leaf switches do you need?

What is the best spine switch to standardize on?

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Your organization's data center architecture is unique. When you consider your combination of network administrators, applications, software developers, users, computing, storage, and public cloud usage, no other organization is an exact match for your needs. That's the reason we've built such broad capabilities into the Cisco Nexus 9000 portfolio. As you consider how it could best meet the needs of your organization, there are three key decisions you'll need to make.

Which network operating system is right for you?

Both Cisco [ACI](#)¹ and [NX-OS](#)² have their benefits. You will need to pick one as your spine-and-leaf operating system.

Cisco ACI¹

The ACI¹ network operating system dramatically simplifies SDN and delivers end-to-end policy automation by taking advantage of Cisco's Cloud Scale ASICs that connect physical and logical networks.

NX-OS²

The industry's most programmable network operating system with open APIs. With over 50,000 customers, NX-OS is the world's industry-leading network operating system for data centers.

Which one is right for you?

It really comes down to your people. ACI¹ makes automation dramatically easier. Your people won't have to learn tools like Ansible, Puppet, or Chef. They'll have a single-pane of glass for managing physical and virtual networks, and they'll be able to deploy and maintain applications faster and easier.

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² While this guide focuses on the spine-and-leaf architecture, the Nexus 9000 and 3000 can be configured for either spine-and-leaf or traditional 2-tier and 3-tier architectures in NX-OS mode.

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Which network operating system is right for you?

Which leaf switches do you need?

What is the best spine switch to standardize on?

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Which leaf switches do you need?

You will likely need many different leaf switches to meet your computing, storage, and core networking needs. If you are new to the Cisco Nexus 9000 Series Switches, we recommend that you focus on switches with Cloud Scale ASICs.



Cloud Scale ASICs

Built on next-generation process technology (16 nm), our Cloud Scale ASICs deliver significant advantages over merchant silicon:

- Fundamentally faster due to 16nm processes
- Substantially more features in hardware
- Higher performing buffers
- Line rate encryption and analytics

Cisco ACI¹ technology

As the industry moves toward Software-Defined Networking (SDN) and infrastructure as code, there is no industry standard for combining physical and virtual networks. We invented Cisco ACI1 to connect physical and virtual networks for deploying policy-based automation end-to-end.

FCoE and Fibre Channel

While all Cisco Nexus 9000 leaf switches support Fibre Channel-over-Ethernet (FCoE), only the N9K-93180YC-FX can be configured for Fibre Channel ports to connect to your SAN.)

What is the best spine switch to standardize on?

Unlike leaf switches, you will want to pick a single spine switch to standardize on. Key considerations include:

Total spine bandwidth

In most cases, you will start with two spine switches and have the option to expand to up to 6 spines.³

Leaf uplinks

You'll want to make sure your spine is compatible with all your leaves' uplinks. You'll need a modular spine if want to have both QSFP28 and QSFP+ uplinks.

Operating system

You'll want to make sure your operating system supports all of your spine and leaf switches.

¹ ACI mode is designed for spine-and-leaf only and requires the Cisco Application Policy Infrastructure Controller (APIC).

³ We strongly recommend you start with at least two spine switches. You will also likely be limited to six spine switches because that is the most common number of uplinks for leaf switches. The range shown here is the total maximum system bandwidth for two to six spine switches.

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Spine Switches

Modular spine switches

**Total spine bandwidth: 120–360
Tbps³ maximum**

[N9K-C9516-FM-E2](#)

- 16-slot chassis
- Cisco ACI^{TM1} and Cisco[®] NX-OS² modes
- Up to 576 40/100G or 2,304 10G ports

**Total spine bandwidth: 60–180
Tbps³ maximum**

[N9K-C9508-FM-E](#)

- 8-slot chassis
- Cisco ACI¹ and NX-OS² modes
- Up to 288 40/100G or 1,152 10G Ports

Total spine bandwidth: 30–90 Tbps³ maximum

[N9K-C9504-FM-E](#)

- 4-slot chassis
- Cisco ACI¹ and NX-OS² modes
- Up to 144 40/100G or 576 10G Ports

Fixed configuration spine switches

Total spine bandwidth: 24–72 Tbps³ maximum
[N9K-9364C](#)



- Cisco ACI¹ and NX-OS² modes
- 64 ports 40/100G QSPF28 ports
- 2 fixed 1/10G SFP+ ports
- 16 ports of MACsec line rate encryption

Total spine bandwidth: 14–42 Tbps³ maximum
[N9K-9336C-FX2](#)



- Cisco ACI¹ and NX-OS² modes
- 36 x 1/10/25/40/100-Gbps QSFP28 ports
- All ports support MACsec line rate encryption

[N9K-9236C](#)

- NX-OS² only
- 36 line-rate 10/25/40/100G QSPF285 ports

Total spine bandwidth: 6–18 Tbps³ maximum
[N9K-9336PQ](#)

- Cisco ACI¹ only
- 36 line-rate 40 GBE QSFP+ ports
- 16 ports of MACsec line rate encryption

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³ We strongly recommend you start with at least two spine switches. You will also likely be limited to six spine switches because that is the most common number of uplinks for leaf switches. The range shown here is the total maximum system bandwidth for two to six spine switches.

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Fixed configuration leaf switches

For NX-OS² fixed copper access, you'll need to use the Cisco ACI enabled leaf switches.

Cisco ACI¹ and NX-OS² modes with line rate encryption⁴

Fiber access with MACsec and 100G uplinks

[N9K-9336C-FX2](#)

- 36 x 1/10/25/40/100-Gbps QSFP28 ports
- Configure each port for access or uplinks



[N9K-93240YC-FX2](#)

- 48 x 1/10/25-Gbps ports
- 12 x 40/100-Gbps QSFP28 uplinks



[N9K-93180C-FX](#)

- 48 x 10/25-Gbps or 8/16/32-Gbps Fibre Channel QSFP28 ports
- 6 x 40/100-Gbps QSFP28 uplinks



Copper access with MACsec and 100G uplinks

[N9K-93108TC-FX](#)

- 48 x 10GBASE-T ports
- 6 x 40/100-Gbps QSFP28 uplinks



[N9K-9348GC-FXP](#)

- 48 x 100M/1G BASE-T ports
- 4 x 1/10/25-Gbps SFP28 uplinks and 2 x 40/100-Gbps QSFP28 uplinks



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² While this guide focuses on the spine-and-leaf architecture, the Nexus 9000 and 3000 can be configured for either spine-and-leaf or traditional 2-tier and 3-tier architectures in NX-OS mode.

⁴ If you are considering using the Nexus 9500 as a leaf switch, the N9K-X9788TC-FX offers line rate encryption in NX-OS mode.

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Cisco ACI¹ and NX-OS² modes

Fiber access with 100G uplinks

[N9K-93180LC-EX](#)

- 24 x 40/50-Gbps QSFP28 ports
- 6 x 40/100-Gbps QSFP28 uplinks

[N9K-93180YC-EX](#)

- 48 x 10/25-Gbps QSFP28 ports
- 6 x 40/100-Gbps QSFP28 uplinks

Fiber access with 40G uplinks

[N9K-9332PQ](#)

- 32 x 40-Gbps QSFP+ ports
- Configure each port for access or uplinks

[N9K-9396PX](#)

- 48 x 1/10-Gbps SFP+ ports
- 12 x 40-Gbps QSFP+ uplinks

[N9K-9372PX-E](#)

- 48 x 1/10-Gbps SFP+ ports
- 6 x 40-Gbps QSFP+ uplinks

Copper access with 100G uplinks

[N9K-93108TC-EX](#)

- 48 x 1/10GBASE-T ports
- 6 x 40/100-Gbps QSFP28 uplinks

Copper access with 40G uplinks

[N9K-93120TX](#)

- 96 x 1/10GBASE-T ports
- 6 x 40-Gbps QSFP+ uplinks



[N9K-9396TX](#)

- 48 x 1/10GBASE-T ports
- 12 x 40-Gbps QSFP+ uplinks



[N9K-9372TX-E](#)

- 48 x 1/10GBASE-T ports
- 6 x 40-Gbps QSFP+ uplinks

Fiber access with 100G uplinks

[N9K-92304QC](#)

- 56 x 40-Gbps QSFP+ ports
- 8 x 100-Gbps QSFP28 uplinks



[N9K-9236C](#)

- 36 x 1/10/25/40/50/100G QSFP28 ports
- All ports can be configured for access or uplink



[N9K-92300YC](#)

- 48 x 10/25-Gbps SFP+ ports
- 18 x 100-Gbps QSFP28 uplinks



[N9K-92160YC-X](#)

- 48 x 10/25-Gbps SFP+ ports
- 6 x QSFP28 ports (4 of the QSFP+ ports are 100Gbps capable)



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Cisco AC and NX-OS² modes

NX-OS² mode only

Modular leaf line cards

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Modular spine line cards

Cisco AC¹ and NX-OS² modes

1/10/25/40/ 50/100G QSFP28 uplinks

Line rate encryption (+170 byte packets) Uplinks

[N9K-X9736C-FX](#)

- 36 uplinks
- 3.6 Tbps
- 160 MB buffer capacity



Line rate for all packets (no encryption)

[N9K-X9732C-EX](#)

- 32 uplinks
- 3.6 Tbps
- 160 MB buffer capacity



NX-OS² mode only

Line rate encryption (+170 byte packets)

[N9K-X9732C-FX](#)

- 32 uplinks
- 3.6 Tbps
- 160 MB buffer capacity



Line rate for +250 byte packets

[N9K-X9432C-S](#)

- 32 uplinks
- 32 MB buffer capacity

Deep buffers

[N9K-X9636C-R](#)

- 36 uplinks
- 24 GB buffer capacity



[N9K-X9636C-RX](#)

- 36 uplinks
- 16 GB buffer capacity

Line rate for all packets (no encryption)

[N9K-X9736C-EX](#)

- 36 uplinks
- 3.6 Tbps
- 160 MB buffer capacity

NX-OS² mode only

40 GPS QSFP + uplinks

Line rate for all packets

[N9K-X9636PQ](#)

- 36 uplinks
- 36 MB buffer capacity
- 4-slot and 8-slot chassis only

Line rate for +200 byte packets

[N9K-X9432PQ](#)

- 32 uplinks
- 24 MB buffer capacity

Deep buffers

[N9K-X9636Q-R](#)

- 36 uplinks
- 24 GB buffer capacity

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Modular leaf line cards for the
Cisco Nexus 9500

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Modular leaf line cards

Modular leaf line cards for the Cisco Nexus 9500

NX-OS² mode only

There is also the option to use the Nexus 9500 as a leaf switch. This is usually only needed for data centers with tens of thousands of servers.

Fiber access, 100G uplinks

[N9K-X97160YC-FX](#)

- 48 x 1/10/25-Gbps SFP+ ports
- 4-port 100-Gbps QSFP28 uplink

Fiber access, 40G uplinks

[N9K-X9536PQ](#)

- 36 x 40-Gbps QSFP+ ports
- 1.5:1 oversubscription
- All ports can be configured for access or uplinks

[N9K-X9564PX](#)

- 48 x 1/10-Gbps SFP+ ports
- 4 x 40 Gigabit Ethernet QSFP+ uplinks

[N9K-X9464PX](#)

- 48 x 1/10-Gbps SFP+ ports
- 4 x 40 Gigabit Ethernet QSFP+ uplinks

Copper access, 100G uplinks

[N9K-X9788TC-FX](#)

- 48-port 1 and 10GBASE-T
- 4-port 40/100-Gbps QSFP28 uplinks
- Line rate encryption

Copper access, 40G uplinks

[N9K-X9564TX](#)

- 48-port 1 and 10GBASE-T
Line rate for all packets
- 4-port 40-Gbps QSFP+ uplinks

[N9K-X9464TX2](#)

- 48-port 1 and 10GBASE-T
- Line rate for +200 byte packets
- 4-port 40-Gbps QSFP+ uplinks

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1. Cisco ACI mode is designed for spine-and-leaf only and requires the Cisco Application Policy Infrastructure Controller (APIC).
2. While this guide focuses on the spine-and-leaf architecture, the Cisco Nexus 9000 and 3000 can be configured for either spine-and-leaf or traditional 2-tier and 3-tier architectures in NX-OS mode.
3. We strongly recommend you start with at least two spine switches. You will also likely be limited to six spine switches because that is the most common number of uplinks for leaf switches. The range shown here is the total maximum system bandwidth for two to six spine switches.
4. If you are considering using the Cisco Nexus 9500 as a leaf switch, the N9K-X9788TC-FX offers line rate encryption in NX-OS mode.

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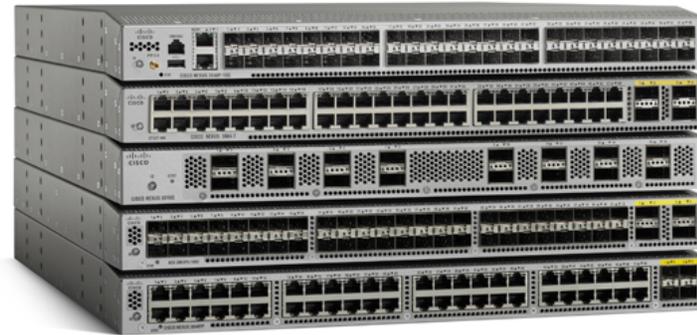
Learn more

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Do you need really fast switches?

Switches with a latency of less than 250–750 nanoseconds?

If you do, then the Cisco Nexus 3000 Series Switches are your ideal leaf switches, and, like the Cisco Nexus 9000, they run NX-OS²



Contact an Account Manager for more information.

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² While this guide focuses on the spine-and-leaf architecture, the Nexus 9000 and 3000 can be configured for either spine-and-leaf or traditional 2-tier and 3-tier architectures in NX-OS mode.

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