



# Deliver the Next-Generation Intelligent Data Center with Cisco Nexus 7000 Series Switches, Citrix NetScaler Application Delivery Controller, and RISE Technology

## What You Will Learn

The next-generation data center requires tightly integrated layered network services along with data center integration to provide robust application delivery capabilities that accelerate application performance for all users while lowering data center costs by offloading server functions. Integrating the Citrix NetScaler Application Delivery Controller (ADC) with the Cisco Nexus<sup>®</sup> 7000 Series Switches, which include both the Cisco Nexus 7000 platform switches and the Cisco Nexus 7700 platform switches, using Cisco<sup>®</sup> Remote Integrated Services Engine (RISE) technology provides these essential capabilities in a unique and powerful manner.

Cisco RISE provides a generic means of integration that allows a service appliance (physical or virtual) to be seen as a virtual line card within either a Cisco Nexus 7000 or 7700 platform switch. It provides automated attachment, which simplifies service deployment using Cisco Nexus 7000 Series Switches. Cisco RISE establishes a communication path between the network data plane and the service application. This tight integration simplifies service deployments and optimizes application data paths within the data center.<sup>1</sup>

With an implementation based on Cisco RISE, the full suite of Citrix NetScaler functions is available as a centralized resource that can be used across the application infrastructure supported by any Cisco Nexus 7000 Series Switch. Embedded programmable intelligence also enables dynamic reconfiguration of both components - Citrix NetScaler and Cisco Nexus 7000 Series Switches - to both simplify initial deployment and help ensure optimal delivery of an organization's applications and cloud services at all times.

In addition to laying the foundation for significant cost savings and exceptional agility, the net result is that the Citrix NetScaler ADC is now a plug-compatible component of Cisco's blueprint for the next-generation data center.

## The Unified Data Center

The traditional model for data center investment has been infrastructure built in silos, often with dedicated resources for lines of business or individual applications, and designed for peak use requirements. However, this approach is not sustainable for modern organizations. It is not practical to scale in response to rapid growth of both applications and resulting traffic volume. Moreover, inherent inefficiencies, because resources cannot be shared, cause underutilization of individual components, contributing to increasing costs and complexity.

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<sup>1</sup> Use of Citrix NetScaler as an integrated component of the Cisco architecture for the next-generation data center is also based on Citrix NetScaler support for the Cisco Nexus 1110-S Virtual Services Appliance and related Cisco vPath traffic-steering technology.

**Figure 1:** Cisco Unified Data Center



The Cisco Unified Data Center architecture addresses these challenges with its three pillars: Cisco Unified Management, Unified Fabric, and Unified Computing (Figure 1). The Cisco Unified Data Center platform combines computing, storage, network, and management resources to enable and automate IT as a service (ITaaS) by providing:

- Outstanding performance across physical and virtualized resources
- Cost efficiency through elimination of silos and simplification of deployment and operating tasks
- Rapid provisioning of a highly secure, proven infrastructure to support new business initiatives

## Achieving the Vision

Two components instrumental to achieving the benefits of a Cisco Unified Data Center are the Cisco Nexus 7000 Series Switches and the Citrix NetScaler ADC.

## Cisco Nexus 7000 Series Switches

Although the entire family of Cisco Nexus data center-class switches serves as the foundation of the Cisco Unified Fabric, the Cisco Nexus 7000 and 7700 platforms offer comprehensive, modular platform solutions for data center networks while providing aggregation, high density, and end-of-row or top-of-rack server connectivity. Well suited for mission-critical deployments in today's data center, the Cisco Nexus 7000 Series Switches are designed based on three main principles:

- **Infrastructure scalability:** Virtualization, efficient power and cooling, and high density and performance all support efficient data center infrastructure growth.
- **Operation continuity:** The Cisco Nexus design integrates hardware, Cisco Nexus operating system software (Cisco NX-OS Software) features, and management to support zero-downtime environments.
- **Transport flexibility:** You can incrementally and cost-effectively adopt new networking innovations and technologies.



A consistent operating platform used by all Cisco Nexus solutions, Cisco NX-OS, delivers an abundance of features to support workload mobility, transparent interconnection of distributed environments, and other capabilities required of an enterprise cloud network. These include technologies such as Cisco FabricPath, Cisco Overlay Transport Virtualization (OTV), and Cisco Locator/ID Separation Protocol (LISP).

## Citrix NetScaler ADC

A well-suited complement to Cisco's network services portfolio, Citrix NetScaler ADC enables IT transformation and helps customers build highly virtualized, scalable data center and cloud networks.

Deployed in thousands of enterprise, service provider, and public cloud infrastructures globally, Citrix NetScaler ADC combines Layer 4 through 7 load balancing, high-speed data compression, content caching, SSL acceleration, application flow visibility, and a powerful application firewall into a single, easy-to-use platform. Available as a high-performance single-tenant network appliance, a multitenant network appliance, and a software-based virtual appliance, Citrix NetScaler ADC delivers choice of platforms while helping ensure a consistent feature set and uniform, cross-platform policy management.

Revolutionary Citrix TriScale technology adds to the strengths of Citrix NetScaler by providing cloud-like elasticity and scalability for all Citrix NetScaler application delivery services. With Citrix TriScale, organizations of all types, sizes, and levels of cloud maturity can easily:

- Scale up, elastically increasing performance fivefold on demand using the Citrix NetScaler Pay-As-You-Grow model
- Scale in, significantly simplifying the data center and reducing costs by consolidating up to 40 appliances into a single, multitenant Citrix NetScaler platform
- Scale out, dramatically expanding capacity 32-fold with powerful Citrix TriScale clustering

The Citrix NetScaler ADC, when combined with the Cisco Nexus 7000 and 7700 platform switches, results in two best-in-class solutions that independently contribute to delivery of services within a Cisco Unified Data Center. Cisco RISE enables these solutions to automatically work together to overcome the limitations of inline ADC deployments, streamline data center operations, and further optimize delivery for all the organization's applications and cloud services.

## Cisco RISE Technology

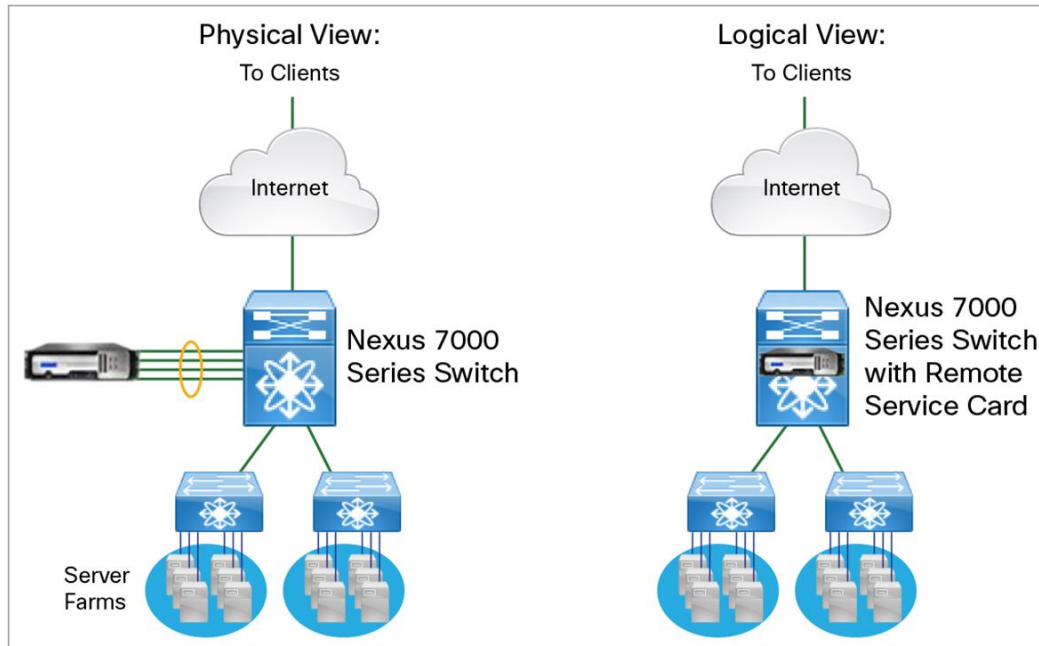
The innovative Cisco RISE technology tightly couples external service appliances, such as the Citrix NetScaler ADC, to Cisco Nexus 7000 Series Switches, enabling more efficient and flexible delivery for layered network services.

## Fundamentals

Cisco RISE integrates Citrix NetScaler as a service module within the Cisco Nexus 7000 or 7700 platform switch, even though it remains a physically separate device.

Architecturally, this virtual service module arrangement is enabled by embedded intelligent services that securely integrate the control planes of the Citrix NetScaler ADC and Cisco Nexus 7000 Series Switches. Physically, the two devices can be attached either in direct mode, through a single interface, PortChannel, or virtual PortChannel (vPC), or indirect mode, through a switched (Layer 2) network. In either case, Cisco RISE establishes a secured Ethernet-based connection for control-plane interactions over a management VLAN. Cisco RISE then enables data-plane VLANs to allow the Citrix NetScaler ADC to process application-data traffic (Figure 2).

**Figure 2:** RISE Allows a Physical ADC Appliance to Be Deployed As the Logical Equivalent of an Embedded Module with Backplane Connectivity



Functionally, Cisco RISE enables streamlined deployment for the initial configuration plus ongoing management of Citrix NetScaler ADC by integrating the ADC as a service module within Cisco Nexus 7000 Series Switches.

## Core Functions

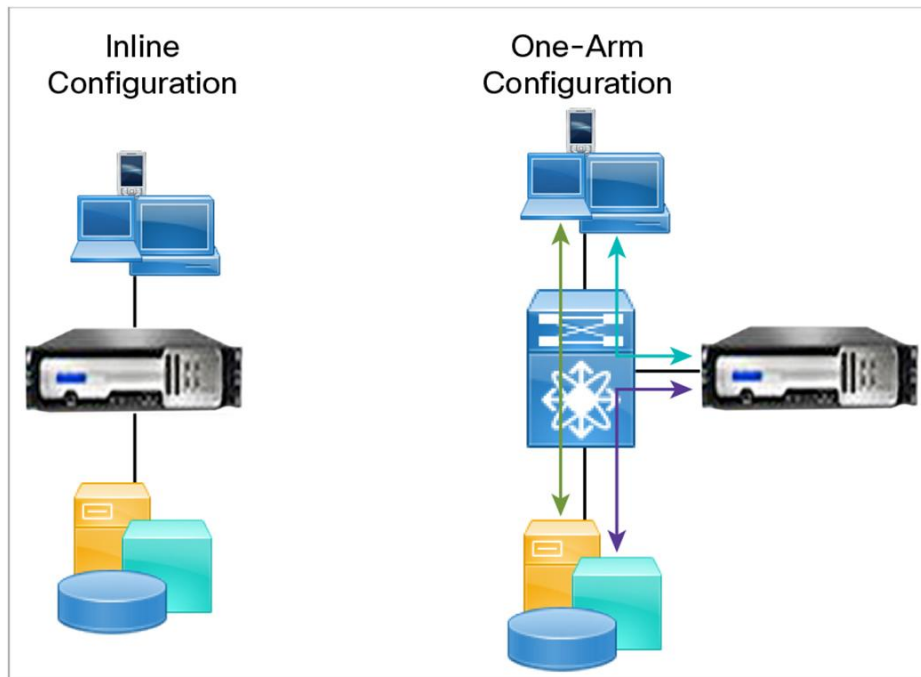
With Cisco RISE, each device can retrieve and program the hardware and software tables of the other (for example, the forwarding tables, routing tables, and access control lists [ACLs]). This capability enables dynamic reconfiguration of the network fabric to more effectively account for mobile workloads and additional, dynamically provisioned application servers (among other possibilities), thereby allowing the modification of application traffic.

Two use cases that demonstrate the power of this core capability involve automatic policy-based routing (APBR) and route health injection (RHI).

## APBR Scenario

Traditional, inline deployment of ADCs is problematic in the data center. Because of the capacity mismatch - Gbps for ADCs and terabits per second (Tbps) for data center switches - ADCs deployed in this manner can become a bottleneck. The typical workaround is to deploy the ADC in a one-arm configuration, in which it is out of band. This configuration both keeps it from becoming a bottleneck and boosts its effective service capacity by eliminating the need to process traffic for which it is not applicable (Figure 3).

**Figure 3:** Inline and One-Arm Configurations



However, one-arm configurations have their own challenges. To help ensure that return traffic is not dropped by the originating client, they require either the use of source Network Address Translation (NAT), an approach in which the application server has no visibility of the actual client, or manually configured policy-based routes (PBRs) that redirect traffic through the ADC to effectively reverse the inbound path and preserve all of the proper addressing. PBR configuration requires switch updates with each service rollout, which is a tedious process prone to human error.

Cisco RISE integration solves this dilemma by providing a third option: automated policy-based routes. With the Cisco RISE APBR feature, the Citrix NetScaler ADC can simply obtain the Cisco Nexus Series Switch parameters it needs to automatically implement the required policy-based routes dynamically as new services are provisioned. This approach helps tremendously because servers that support application services are constantly added and removed. Cisco RISE APBR significantly simplifies application scaling by automating the addition and deletion of routes as additional application resources are brought online.

## RHI Scenario

Traditionally, when a virtual IP address is distributed on Citrix NetScaler through multiple data centers, static routes are used to optimize traffic flow. When this shared service is added, removed, or becomes unavailable in the event that the application fails to respond, the associated static route must be added or removed on the Cisco Nexus 7000 Series Switch. This manual process becomes more costly to manage as the number of shared virtual IP services grows, as well as when shared services expand to additional data centers.

Cisco RISE eliminates the need for manual intervention when shared services are deployed, thereby significantly simplifying deployments and reducing the cost of operating and maintaining the system. Using its extensive health-checking capabilities, Citrix NetScaler monitors the status of downstream resources. Using this information, it can then use the RHI Advertise function within Cisco RISE to notify the Cisco Nexus 7000 Series Switches to update the appropriate routing tables, allowing clients to always get the best available service.



## Additional Capabilities and Technical Benefits

Other technical capabilities and advantages of Citrix NetScaler and Cisco RISE integration with Cisco Nexus 7000 Series data center switches include:

**Simplified provisioning:** Autodiscovery and bootstrap capabilities reduce administrator involvement for direct-mode implementations from 30 steps to 8 steps: creating the port channel, allowing the control and data VLANs, and enabling desired Cisco RISE features on the Cisco Nexus 7000 Series Switch. After this provisioning is completed, all configuration on Citrix NetScaler occurs automatically (configuration of VLANs, PortChannels, management IP, etc.), eliminating the need to physically connect a serial cable to configure the device through a console cable.

**Data-path optimization:** APBR and RHI are just two examples of the possible use cases with the cross-device visibility and programming enabled by Cisco RISE. Administrators can use Cisco RISE capabilities to configure a broad range of other similar features to further automate and optimize delivery of network services in a dynamic data center.

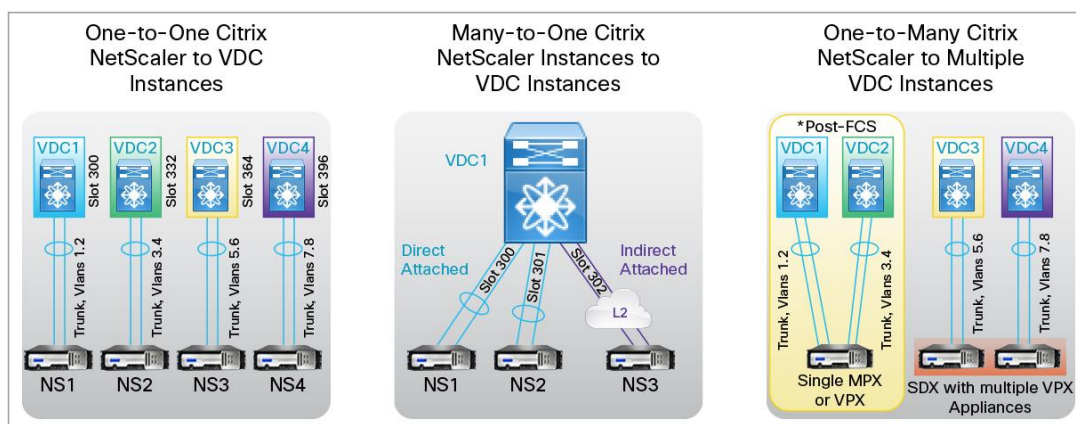
**vPC-attach mode:** In direct-attach mode, Cisco RISE enables the Citrix NetScaler device to be dual-attached to the Cisco Nexus 7000 Series Switches using vPC. This interconnection doubles the ADC bandwidth potential without requiring additional cabling. Cisco RISE centralizes provisioning and provides bootstrap and autodiscovery processes, eliminating the need for duplicate Layer 2 configurations on Citrix NetScaler and manual verification of configuration synchronization between the switch and the ADC device.

**ADC offload:** Cisco RISE integration frees Citrix NetScaler resources from having to manage ADC flows to help ensure that they are routed back through Citrix NetScaler. Cisco RISE eliminates the need for source NAT in one-arm configurations while helping ensure client visibility at the application layer. This feature enables more customers to adopt one-arm configurations, which allows better sizing and scaling of Citrix NetScaler, while preserving client visibility at the application layer.

**Enhanced application availability:** Real-time route updates between Citrix NetScaler and the Cisco Nexus 7000 Series Switch eliminate route black-holing when application failures occur. By enabling Citrix NetScaler to deliver route health updates to the Cisco Nexus 7000 Series Switch through Cisco RISE, the solution allows customers to more easily deploy shared services within and across data centers at a significantly reduced cost of operation with greater availability than ever before.

**Integrated multitenancy support:** Cisco RISE integration spans multitenancy features on both platforms: virtual device contexts (VDCs) on Cisco Nexus 7000 Series Switches, and the capability to run up to 40 independent Citrix NetScaler instances on a Citrix NetScaler SDX appliance. This feature provides comprehensive flexibility to support multitenant scenarios, including the capability to set up Cisco Nexus VDCs and Citrix NetScaler instances in one-to-many, many-to-one, and a countless variety of many-to-many configurations (Figure 4).

**Figure 4:** Cisco Nexus VDCs and Citrix NetScaler Configurations



## Delivering the Next-Generation Data Center Fabric

Next-generation virtual data centers require layered network services to provide robust application delivery capabilities for optimizing, securing, and controlling the delivery of enterprise applications and cloud services. Moreover, these capabilities must be available in a manner that is consistent with the principles of such a data center environment, as conveyed by the Cisco Unified Data Center architecture and its definition of a unified fabric featuring unified network services. Not only must these services be able to account for mobile workloads, dynamically provisioned servers, and elastic scalability of resources, but they also must exhibit these characteristics themselves. Using Cisco RISE technology to integrate Citrix NetScaler with Cisco Nexus 7000 Series Switches delivers on these objectives by transforming the Citrix NetScaler ADC into an integrated component<sup>1</sup> of Cisco's vision for next-generation data center services.

Compelling technical and business-oriented advantages of Citrix NetScaler integration, enabled with Cisco RISE, with Cisco Nexus 7000 Series Switches include:

- Reduced total cost of ownership (TCO) through simplified deployment, automated operation, and better sharing and utilization of centralized application delivery resources
- Investment protection afforded by the capability to use existing ADC appliances as fully capable, virtualization-aware components of a next-generation data center fabric
- Accelerated speed of application deployment and overall business agility enabled by used of a policy-based network that can respond in real time to changing application requirements and newly provisioned resources
- Enhanced business resilience and scalability of application delivery services through the zero-service-loss architecture of the Cisco Nexus 7000 Series, enabling capacity and capability to be added without any downtime
- Significant reduction in capital expenditures (CapEx) and operating expenses (OpEx), thereby promoting business continuity and cost reduction

## Conclusion

Cisco RISE technology, a new feature in the Nexus 7000 Series Switch Platform, provides greater flexibility and performance advantages when deploying NetScaler ADC appliances. By providing the same functional and logical capabilities as an embedded ADC module connected to the backplane of the Nexus 7000, customers can realize simplified provisioning, data-path optimization, improved ADC off-load and enhanced application availability, among other tangible benefits.

## For More Information

<http://cisco.com/go/nexus7000>

<http://www.citrix.com/products/netscaler-application-delivery-controller/overview.html>



## About Citrix

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