Cisco Application Centric Infrastructure

This chapter contains the following sections:

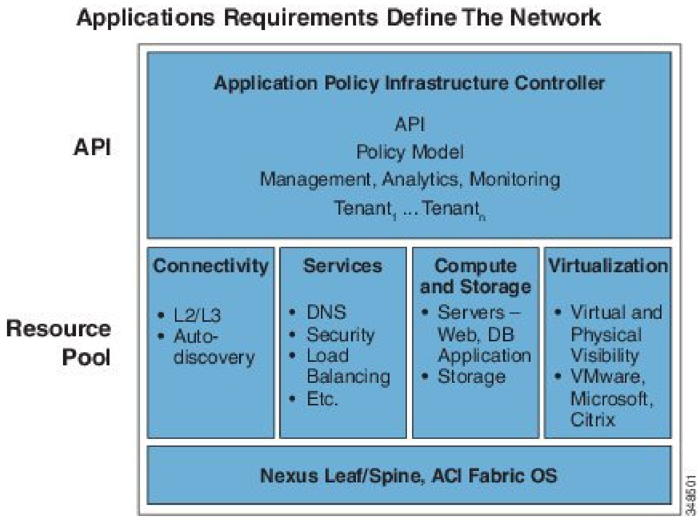
About the Cisco Application Centric Infrastructure

The Cisco Application Centric Infrastructure (ACI) allows application requirements to define the network. This architecture simplifies, optimizes, and accelerates the entire application deployment life cycle.

About the Cisco Application Policy Infrastructure Controller

The Cisco Application Policy Infrastructure Controller (APIC) API enables applications to directly connect with a secure, shared, high-performance resource pool that includes network, compute, and storage capabilities. The following figure provides an overview of the APIC.

Figure 1: APIC Overview

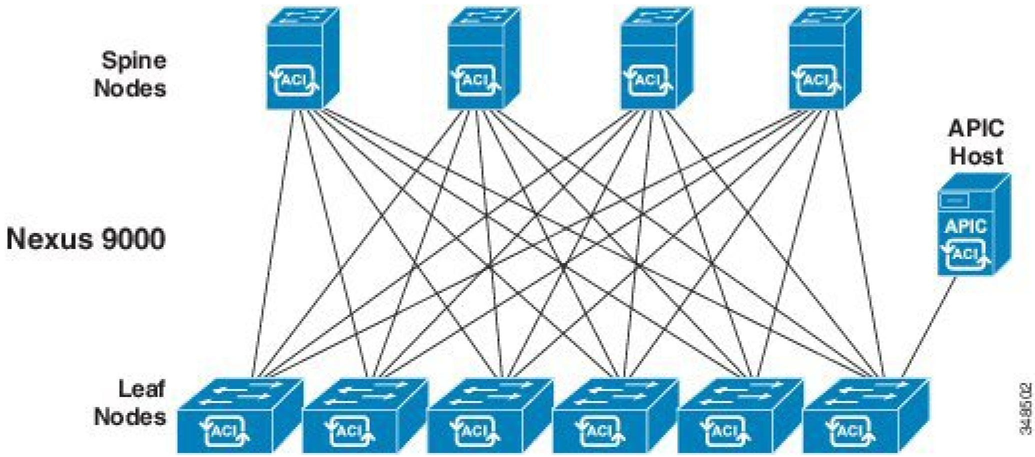


The APIC manages the scalable ACI multi-tenant fabric. The APIC provides a unified point of automation and management, policy programming, application deployment, and health monitoring for the fabric. The APIC, which is implemented as a replicated synchronized clustered controller, optimizes performance, supports any application anywhere, and provides unified operation of the physical and virtual infrastructure. The APIC enables network administrators to easily define the optimal network for applications. Data center operators can clearly see how applications consume network resources, easily isolate and troubleshoot application and infrastructure problems, and monitor and profile resource usage patterns.

Cisco Application Centric Infrastructure Fabric Overview

The Cisco Application Centric Infrastructure Fabric (ACI) fabric includes Cisco Nexus 9000 Series switches with the APIC to run in the leaf/spine ACI fabric mode. These switches form a “fat-tree” network by connecting each leaf node to each spine node; all other devices connect to the leaf nodes. The APIC manages the ACI fabric. The recommended minimum configuration for the APIC is a cluster of three replicated hosts. The APIC fabric management functions do not operate in the data path of the fabric. The following figure shows an overview of the leaf/spin ACI fabric.

Figure 2: ACI Fabric Overview

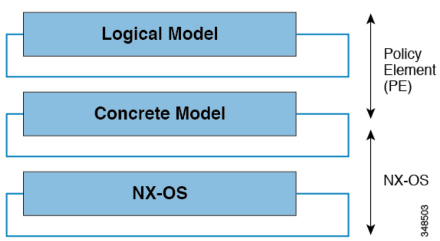


The ACI fabric provides consistent low-latency forwarding across high-bandwidth links (40 Gbps and 100-Gbps). Traffic with the source and destination on the same leaf switch is handled locally, and all other traffic travels from the ingress leaf to the egress leaf through a spine switch. Although this architecture appears as two hops from a physical perspective, it is actually a single Layer 3 hop because the fabric operates as a single Layer 3 switch.

The ACI fabric object-oriented operating system (OS) runs on each Cisco Nexus 9000 Series node. It enables programming of objects for each configurable element of the system.

The ACI fabric OS renders policies from the APIC into a concrete model that runs in the physical infrastructure. The concrete model is analogous to compiled software; it is the form of the model that the switch operating system can execute. The figure below shows the relationship of the logical model to the concrete model and the switch OS.

Figure 3: Logical Model Rendered into a Concrete Model



All the switch nodes contain a complete copy of the concrete model. When an administrator creates a policy in the APIC that represents a configuration, the APIC updates the logical model. The APIC then performs the intermediate step of creating a fully elaborated policy that it pushes into all the switch nodes where the concrete model is updated.

Note The Cisco Nexus 9000 Series switches can only execute the concrete model. Each switch has a copy of the concrete model. If the APIC goes offline, the fabric k.jpg functioning but modifications to the fabric policies are not possible.

The APIC is responsible for fabric activation, switch firmware management, network policy configuration, and instantiation. While the APIC acts as the centralized policy and network management engine for the fabric, it is completely removed from the data path, including the forwarding topology. Therefore, the fabric can still forward traffic even when communication with the APIC is lost.

The Cisco Nexus 9000 Series switches offer modular and fixed 1-, 10-, 40-, and 100-Gigabit Ethernet switch configurations that operate in either Cisco NX-OS stand-alone mode for compatibility and consistency with the current Cisco Nexus switches or in ACI mode to take full advantage of the APIC's application policy-driven services and infrastructure automation features.

Determining How the Fabric Behaves

The ACI fabric allows customers to automate and orchestrate scalable, high performance network, compute and storage resources for cloud deployments. Key players who define how the ACI fabric behaves include the following:

- IT planners, network engineers, and security engineers
- Developers who access the system via the APIC APIs
- Application and network administrators

The Representational State Transfer (REST) architecture is a key development method that supports cloud computing. The ACI API is REST-based. The World Wide Web represents the largest implementation of a system that conforms to the REST architectural style.

Cloud computing differs from conventional computing in scale and approach. Conventional environments include software and maintenance requirements with their associated skill sets that consume substantial operating expenses. Cloud applications use system designs that are supported by a very large scale infrastructure that is deployed along a rapidly declining cost curve. In this infrastructure type, the system administrator, development teams, and network professionals collaborate to provide a much higher valued contribution.

In conventional settings, network access for compute resources and endpoints is managed through virtual LANs (VLANs) or rigid overlays, such as Multiprotocol Label Switching (MPLS), that force traffic through rigidly defined network services, such as load balancers and firewalls. The APIC is designed for programmability and centralized management. By abstracting the network, the ACI fabric enables operators to dynamically provision resources in the network instead of in a static fashion. The result is that the time to deployment (time to market) can be reduced from months or weeks to minutes. Changes to the configuration of virtual or physical switches, adapters, policies, and other hardware and software components can be made in minutes with API calls.

The transformation from conventional practices to cloud computing methods increases the demand for flexible and scalable services from data centers. These changes call for a large pool of highly skilled personnel to enable this transformation. The APIC is designed for programmability and centralized management. A key feature of the APIC is the web API called REST. The APIC REST API accepts and returns HTTP or HTTPS messages that contain JavaScript Object Notation (JSON) or Extensible Markup Language (XML) documents. Today, many web developers use RESTful methods. Adopting web APIs across the network enables enterprises to easily open up and combine services with other internal or external providers. This process transforms the network from a complex mixture of static resources to a dynamic exchange of services on offer.