Avi Networks: Integration With Cisco ACI

APPLICATION CENTRIC INFRASTRUCTURE

The Cisco Application Centric Infrastructure (ACI) is a distributed overlay network that is built on multipath leaf and spine switching nodes. Endpoint devices, such as servers and firewalls, are connected to leaf nodes. The Cisco Application Policy Infrastructure Controller (APIC) provides a single point of control and a repository of policy data for Cisco ACI. It communicates with Cisco ACI spine and leaf nodes to create isolated tenant networks, set up network paths, and insert network services, such as Layer 4 to 7 and security functions between endpoint devices.

With Cisco APIC, IT admins can store all network and service-policy data in one central location. They can apply policies quickly to the ACI fabric to provide communication paths and network functions as required, without having to touch individual network nodes. When IT admins declare their policies, Cisco APIC automatically figures out how to implement them. This operation model enables IT to quickly roll out network services by freeing IT admins from repetitive tasks and allowing them to manage networks at scale.

CHALLENGES WITH LAYER 4–7 SERVICE INSERTION

In traditional networks, when an application requires a firewall service, load balancing service, or both, IT admins need to configure multiple network switches to attach and steer traffic to them. This task is often time-consuming – taking days – and is error prone.

Cisco APIC allows IT admins to insert Layer 4–7 services or application delivery services based on policies expressed in a service graph by configuring the ACI fabric automatically. With this approach, IT admins can complete the task in minutes instead of days.

However, three challenges arise from today's complex application delivery services and operational requirements:

- To monitor and guarantee SLAs, IT needs actionable information, such as end-to-end timing information and visibility into application workloads and data.
- To cope with the dynamic nature of workloads, IT needs the ability to scale out the capacity of application delivery services in real time. Adding extra capacity still means manually adding a new service appliance – virtual or physical – with many steps.
- To assist implementing business logic, and to accelerate and secure application delivery, IT needs access to an easy-to-use, purpose-built GUI to define sophisticated application delivery policies and analyze application visibility data.

Unlike other application delivery products, the Avi Vantage Platform is an application delivery controller (ADC) that integrates with Cisco APIC to directly address the three challenges through its unique controller-based architecture.

ABOUT THIS DOCUMENT

This white paper details how Cisco ACI and the Avi Vantage Platforms enable IT teams to quickly roll out network infrastructure and application delivery services in the data center based on centralized policies. Together, Cisco ACI and Avi Vantage deliver seamless L4-L7 service insertion, application visibility for accelerated troubleshooting, service fabric automation, and simplified L4-L7 policy creation.

The Avi Vantage Platform from Avi Networks is a software-only solution that provides real-time analytics, application visibility, and elastic application delivery services - such as SSL termination, load balancing, and content acceleration.

By separating the control plane from data plane, Avi Vantage simplifies operations and maximizes the elasticity of data planes (Avi Service Engines). The Avi Controller acts as a centralized policy repository and distributes policies across Avi Service Engines that perform ADC functions while collecting extensive inline metrics for application visibility (See Figure 1). Avi Controller can automatically add and remove Avi SEs to and from data planes to adapt to workloads.

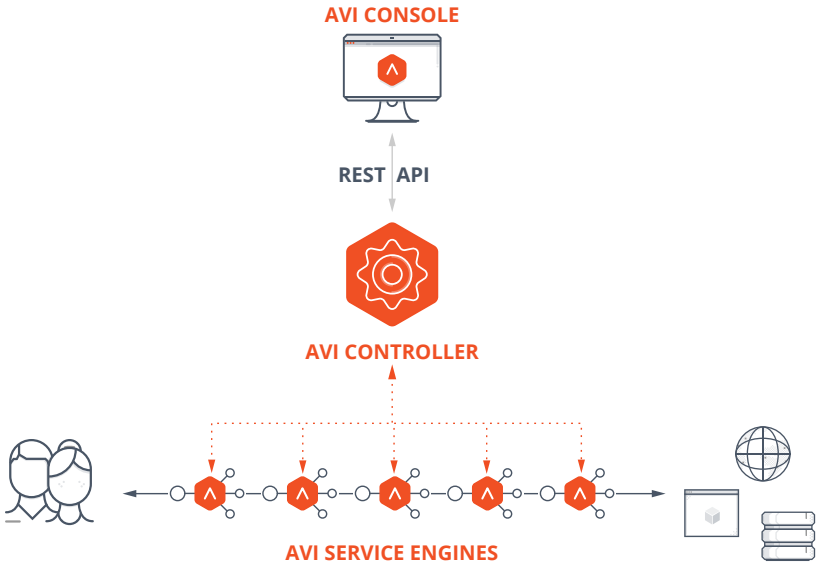

Figure 1: Avi Networks ADC components

AVI VANTAGE: INTEGRATION WITH CISCO APIC

Together, Cisco APIC and Avi Vantage enable IT to roll out highly elastic application delivery services quickly, tailored to business and application needs. The Avi Controller builds a dynamic service fabric by making its Avi SEs available to Cisco ACI on demand. Cisco APIC programs the ACI fabric and communicates with the Avi Controller through the REST APIs provided by Avi Networks (See Figure 2).

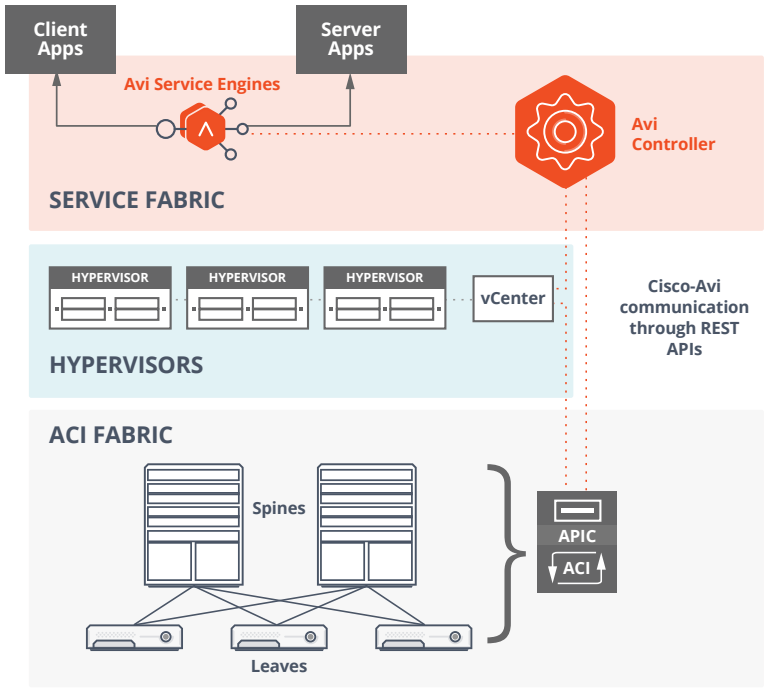

Figure 2: Cisco ACI and Avi Vantage integration

The benefits of the joint solution include the following:

- **L4–L7 service insertion:** Cisco APIC allows quick insertion of Avi Vantage services by configuring the ACI fabric based on policies to steer traffic accordingly.
- **Application visibility:** Avi Vantage delivers powerful inline analytics that complements Cisco APIC's network visibility with end-to-end (user-to-app) timing information as well as visibility into application data (See Figure 3). This is actionable information that quickly narrows down the root cause of problems affecting SLAs. With the combined solution, IT admins can very quickly pinpoint the source of any service degradation issue.

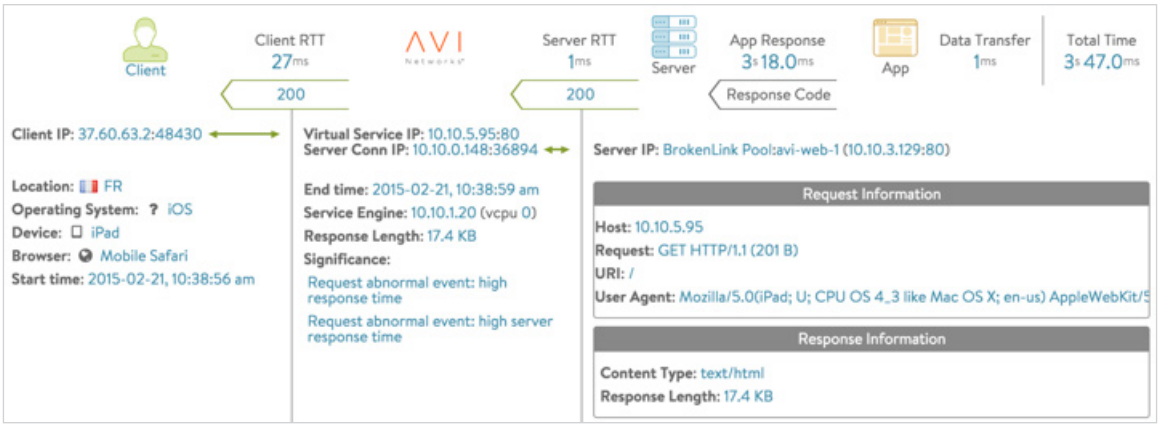

Figure 3: End-to-end timing and application visibility information

- **Service fabric automation:** Avi Vantage automates the service fabric provisioning to provide an elastic application delivery service, thus complementing Cisco APIC's automated ACI fabric provisioning using centralized policies. The Avi Controller can increase data plane capacity in real time by creating an Avi SE and making it available to the Cisco ACI dynamically without any human intervention.
- **Simplified L4–L7 policy creation:** Unlike other solutions, the Avi Vantage Platform's integration with Cisco APIC allows IT admins to create complex application-delivery policies directly from the Avi console. This integrated approach reduces the number of function node types and simplifies configuration tasks.

HOW IT WORKS

In the Cisco ACI policy model, endpoint groups (EPGs) represent a set of terminal objects or communication endpoints, such as clients and servers. Objects in the same EPG can communicate with each other freely, but objects in different EPGs must have a contract for communication. The contract defines traffic filtering rules and can include a service graph to offer network functions, such as Layer 4–7 services.

Service Graph

A service graph defines a list of functions and specifies that the path from one EPG to another EPG must pass through the functions. Avi Vantage provides inline analytics, application visibility, SSL termination, load balancing, and content acceleration services. IT admins can enable all of these features by including function nodes called ADCTier1 and ADCTier2 in a service graph. This two-node approach allows a virtual service to scale out in real time (See Figure 4).

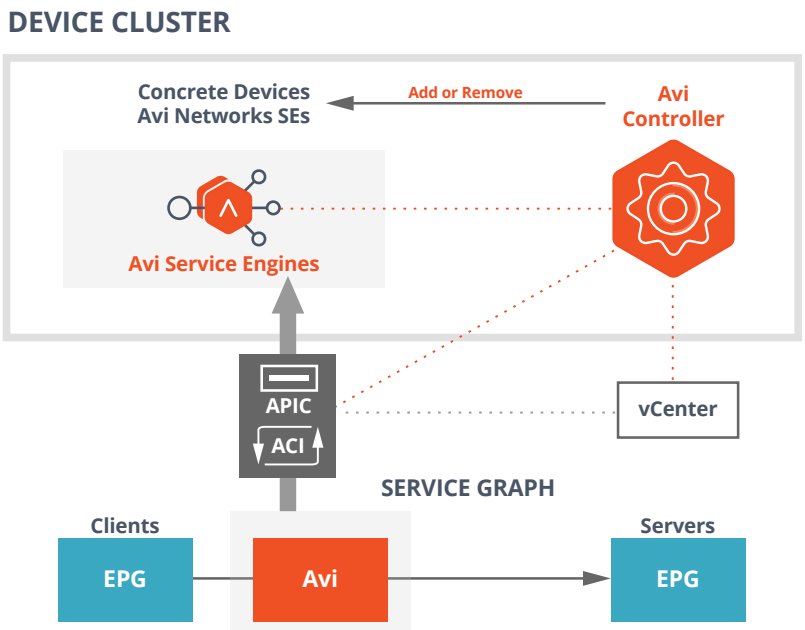

Figure 4: Service Graph Rendering

Cisco APIC translates a service graph into a network path by associating it with concrete devices, allocating necessary bridge domains, and configuring IP addresses on the interfaces of the devices (Figure 4). Also, Cisco APIC performs network stitching within ACI fabric to enable data path flows. In this model, Avi SEs represent concrete devices, and Avi Controller acts as a single management point that interacts with Cisco APIC.

Dynamic Service Fabric

At the heart of the service graph integration is the capability of the Avi Controller to add concrete devices to the device cluster on-demand by interacting with the vCenter, discover network resources, let a user configure ADC policies via Avi Controller, and communicate the information with Cisco APIC, which provisions the ACI fabric to steer traffic through services. In this model, ADC policies, such as SSL termination and load-balancing policies, exist on the Avi Controller, whereas network policies exist on the APIC controller.

Deployment Workflow

To enable Cisco APIC to insert Avi Vantage services, IT admins need to follow these steps:

1. Deploy Avi Controller. This deployment requires APIC and vCenter access credential information to allow Avi Controller to communicate with Cisco APIC through REST API (See Figure 5).

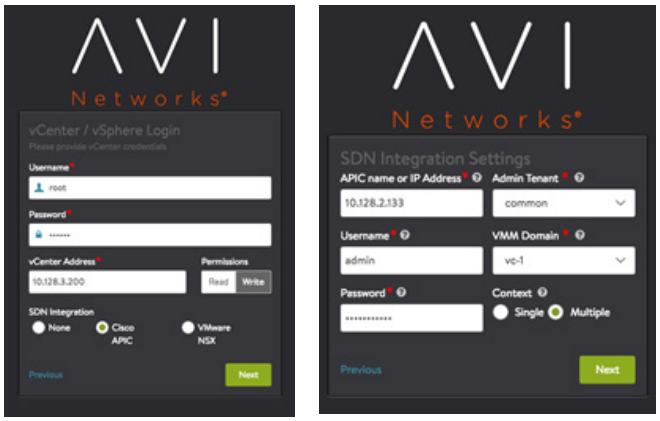

Figure 5: Configuring APIC and vCenter access information

2. Create a service graph using the Avi Vantage function node (See Figure 6).

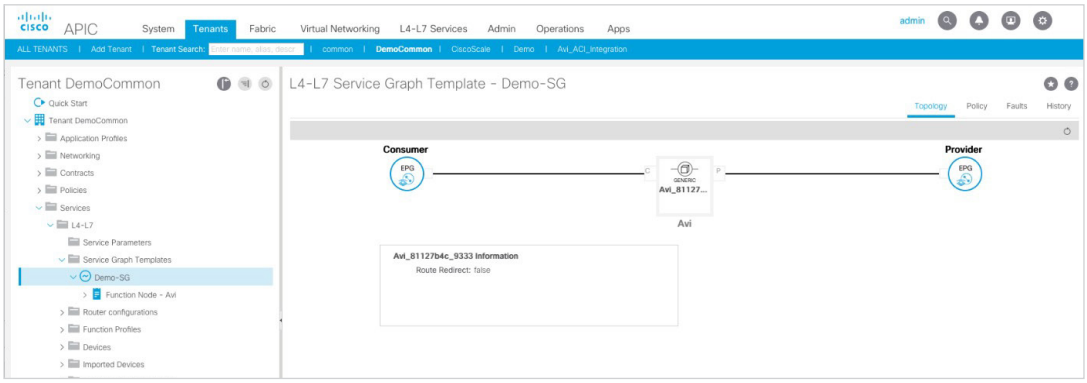

Figure 6: Service Graph, using the Avi Vantage Logical Device

3. Create a contract with a subject.

4. Associate the service graph with contract subject created in the previous step (See Figure 7).

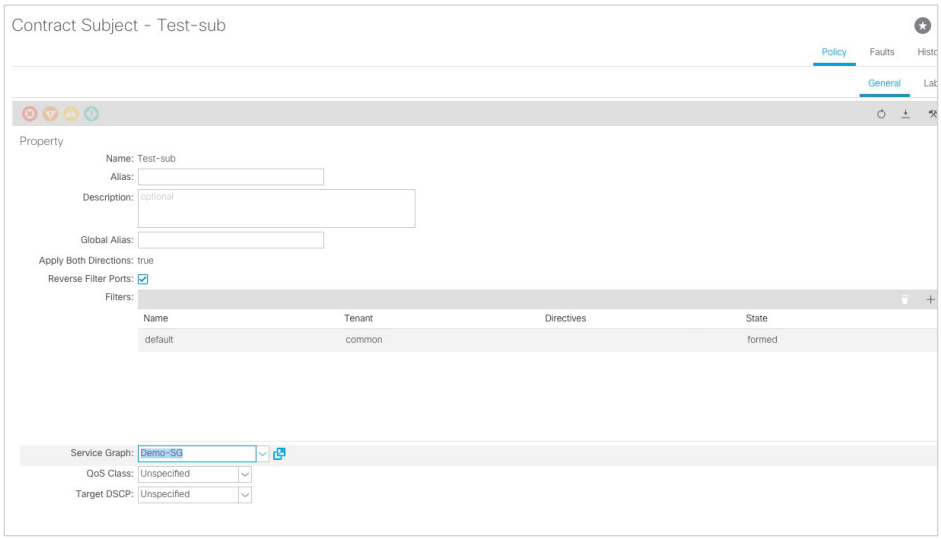

Figure 7: Service Graph association

Post contract creation, deploy a virtual service with required ADC policies using Avi console. Link the service graph contract when creating the Avi virtual service. Deployed ACI service graph contracts will be available via the dropdown in the form of <contract name>:<graph name> (See Figure 8). The analytics and monitoring service is enabled per virtual service automatically.

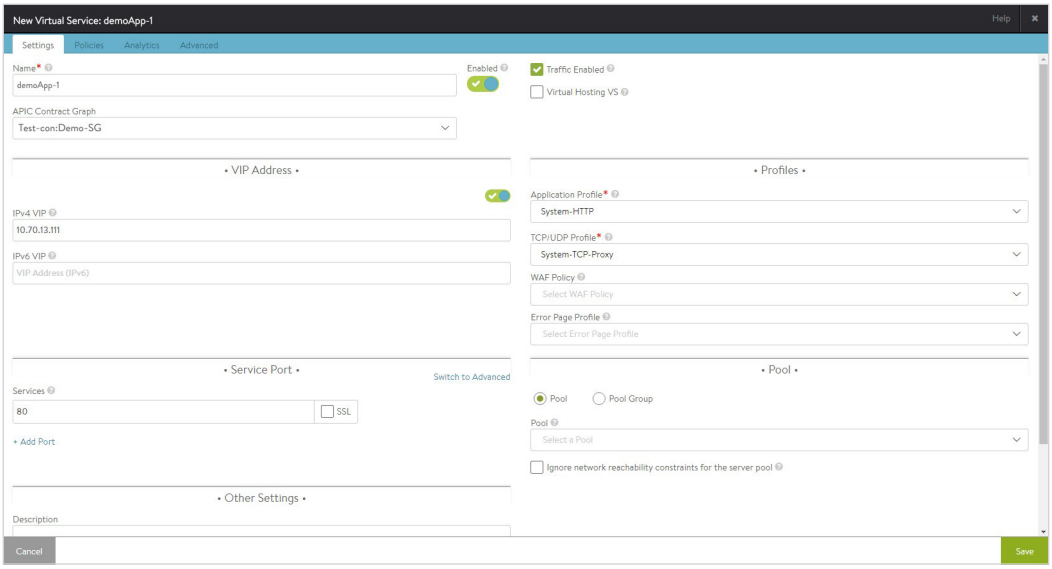

Figure 8: Creating a Virtual Service on Avi UI

SUMMARY

The joint solution from Cisco and Avi Networks enables IT teams to quickly roll out network infrastructure and application delivery services in the data center based on centralized policies. Cisco APIC stores the network policies to insert Avi Networks ADC services and automatically provisions the ACI fabric accordingly.

Avi Controller stores application-delivery policies and provisions the network services fabric dynamically by creating and configuring Avi SEs as needed. Avi SEs not only perform application delivery functions but also collect real-time telemetry data that's fed back to the Avi Controller to provide actionable insights like the end-to-end timing charts. Combined with Cisco APIC's network visibility, the end-to-end timing information helps identify the root cause of issues impacting application performance within minutes.