

CHALLENGES

Application delivery lacks:

- Real-time monitoring of applications and users
- SLA tracking and enforcement
- Elastic scalability, self-service operations, adaptive optimization

SOLUTION

Avi Vantage Platform provides:

- Analytics-driven, elastic application delivery
- Real-time, end-to-end visibility
- Software-based, fully distributed architecture
- OpenStack Nova, Keystone, Neutron, LBaaS integration
- Fully programmable RESTful API

BENEFITS

Avi Vantage with OpenStack delivers:

- Accelerated OpenStack adoption
- Quality end-user experience
- On-demand autoscaling of application performance
- 50% TCO savings
- Faster application rollout and problem resolution

Application Delivery in OpenStack with Avi Networks

OPENSTACK CLOUD ADOPTION LIFECYCLE

Within a few short years, OpenStack has become the de facto choice for open-source cloud orchestration. OpenStack cloud deployment is a three-stage journey from lab experiments to a large-scale production environment (see Figure 1):

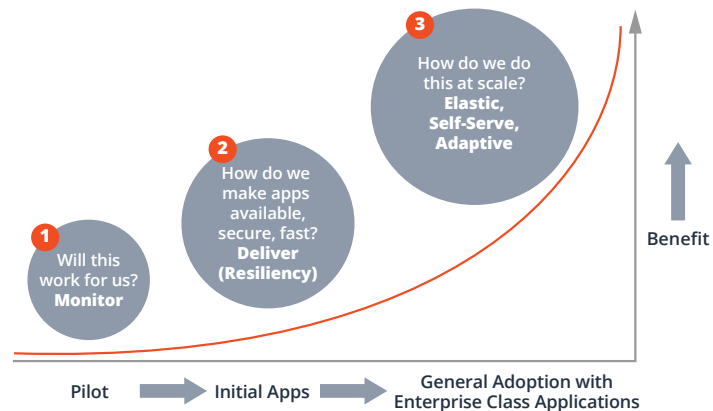


Figure 1: Three Stages of OpenStack Cloud Adoption

- 1. Pilot:** Monitor application performance and end-user experience to ensure that cloud deployment is meeting enterprise needs.
- 2. Initial Applications:** Ensure high availability, security, and performance SLAs of business-critical applications.
- 3. General Adoption:** Achieve operational benefits of cloud at scale. This is the hardest transition and requires elastic scalability, adaptive resource optimization, self service automation, security, and visibility to guarantee SLAs in a large-scale, multi-tenant environment.

INTRODUCING CLOUD APPLICATION DELIVERY PLATFORM FOR OPENSTACK

The Avi Vantage Platform runs natively on virtualized x86 infrastructure within OpenStack and deploys in both traditional networks and SDN environments. The Avi Cloud Connector for OpenStack also enables seamless integration with (see Figure 2):

- Nova – Automatic, real-time scaling through creation of new Avi Service Engine (SE) VMs
- Keystone – Automatic creation of tenants, users, and roles; control and data plane isolation
- Neutron – Automatic network connectivity of Avi SEs
- LBaaS – Load-Balancing-as-a-Service workflow automation

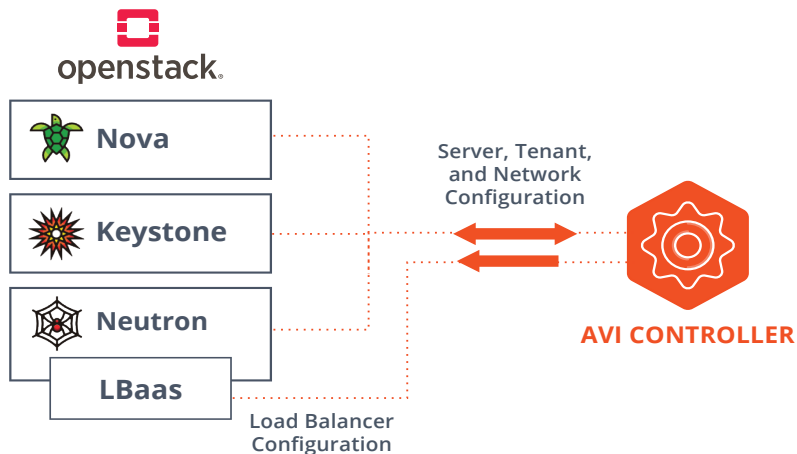


Figure 2. Avi Cloud Connector for OpenStack

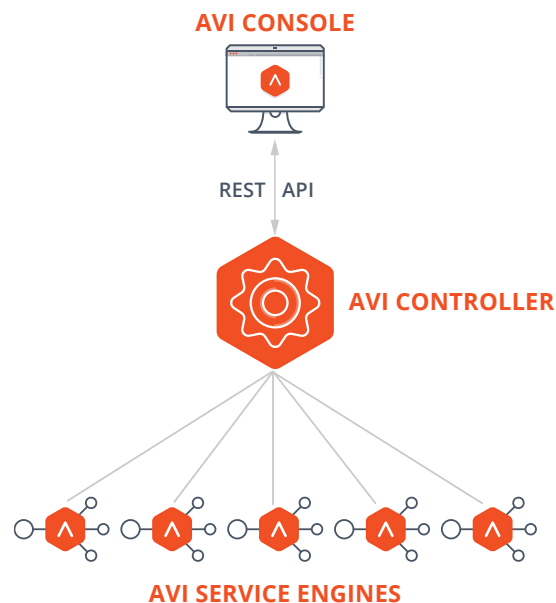


Figure 3. Avi Vantage: Components

Avi Vantage separates the data, control and management planes into individual system components (see Figure 3):

- **Avi Service Engines** provide distributed data-plane services
- **Avi Controller** is the centralized policy and analytics engine
- **Avi Console** offers a rich user interface built on RESTful APIs and Avi App Insights (see later)

DELIVERING ROBUST APPLICATION SERVICES IN OPENSTACK CLOUD

1. Real-Time Monitoring of Application Performance and End-User Experience

Challenge

When tracking SLAs in a cloud environment, existing application and network performance monitoring solutions:

- Rely on a separate monitoring fabric with hardware appliances for traffic mirroring, which is inflexible and complex.
- Require changes to the applications code and installation of agents on servers – not always viable.
- Lack visibility in end-to-end correlation of application performance and end-user experience

Solution

Avi SEs serve as distributed probes in the network, capturing hundreds of application metrics and transaction log data. Avi SEs perform a smart-reduce function on terabits of streaming transactions to achieve a 1000x reduction before sending this data to the Avi Controller. The Avi Controller runs the Big-Analytics engine that correlates this data with server and network infrastructure logs, and Avi App Insights offers real-time, highly granular insights into application performance and end-user experience, without any application changes, server agents, or network taps (see Figure 4).

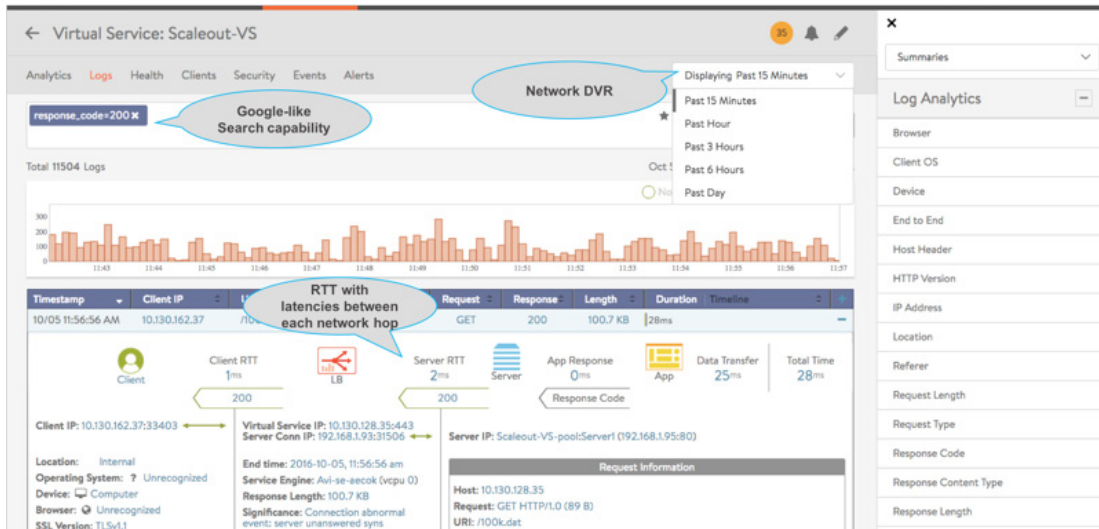


Figure 4. Analytics Dashboard on OpenStack Horizon UI

Avi App Insights help make decisions based on:

Application Health Score: A single, unified health score captures application health summary and detects any performance or resource exhaustion issues in the infrastructure.

End-to-End Timing: Avi measures client and server network latency, application response time, and data transfer time for every transaction. This powerful visualization tool helps benchmark user interactions with applications, flags deviations, and quickly identifies bottlenecks.

Real User Metrics (RUM): Browser-based metrics for details on page load times, image download and display times, and JavaScript execution times provide a real-time view on the end-user experience.

Client Logs: Real-time HTTP session logs and integrated search capabilities analyze traffic patterns and detect problems

Client Insights: A geo-map of end users analyzes application performance by geography and location, providing insights into top resources accessed, top browsers and devices used, and client operating systems.

2. Delivering Application Resiliency – Availability, Security, Acceleration

Challenge

Virtual (and physical) appliances are deployed as shared devices across multiple tenants, providing no data-plane or control-plane isolation. However, deploying one appliance per tenant is economically or operationally cost-prohibitive. Like legacy appliances, open-source load-balancing solutions offer only best-effort services to tenant applications and cannot provide SLA guarantees. With solutions such as HAProxy, the solution itself is not natively highly available.

Solution

Application Availability: Avi Vantage is a fully featured load balancer with a policy-based L4-L7 rules engine. Supported L4-L7 protocols include SPDY/HTTP 2, a comprehensive suite of load-balancing algorithms including patented Avi ServerSaver™, session persistence, server monitoring, and content switching/rewrite features.

Application Security: High-performance SSL termination capabilities support Elliptic Curve Cryptography (ECC)-based Perfect Forward Secrecy (PFS), Strict Transport Security, SSL server re-encryption, DDoS mitigation, access control, client tracking, protocol validation, and connection and throughput-based rate-control features.

Application Acceleration: A full TCP proxy, with an optimized TCP stack, supports TCP and HTTP connection multiplexing, compression and content-caching. With SPDY/HTTP 2 support, mobile users benefit from accelerated application performance, even with legacy applications.

Multi-Tenancy: Avi Controller runs in the OpenStack administrator context and manages the Avi Service Engines in each of the tenant contexts. Avi Controller enforces strict control-plane and data-plane isolation to guarantee SLAs for each tenant.

- **Data-plane isolation:** Each tenant gets individual SEs, which are auto-provisioned based on the tenant's policies. Each tenant can independently scale application delivery and analytics services without affecting performance of other tenants
- **Control-plane isolation:** Each tenant gets complete policy control over and visibility into its applications. Within each tenant, role based access control further limits the access of different users.

3. Guarantees at Scale: Elastic, Self-Serve, and Adaptive Solution

Challenge

Traditional appliances require long wait times for installation and configuration, since each device needs to be individually configured, managed, and troubleshoot in cases of failures. Moreover, taking the outputs of application visibility and applying the necessary changes to application delivery is still a manual process, making solutions error prone, unreliable, and expensive, especially at large scale.

Solution

Closed-Loop Application Delivery: Avi Vantage constantly analyzes the end-to-end application environment and uses the analytical insights to dynamically adapt application delivery services (see Figure 5).

Auto Placement and Migration: As applications are added, Avi Controller automatically places virtual services (VIPs) on the SEs based on application SLAs and infrastructure resource utilization. As more applications are added and their load changes, Avi Controller automatically rebalances the workload by migrating the VIPs to more optimal locations.

Autoscaling: The Avi Controller continuously monitors performance and resource utilization, and automatically adds new SEs to increase performance. Autoscaling allows both individual application performance (VIP throughput) and overall system performance to scale linearly with new SEs. AutoScaling simplifies capacity planning and eliminates overprovisioning of application delivery services.

Single Point of Control & Management: The Avi Controller is the single point of control, management, and integration for any number of tenants, applications, and users, allowing practically unlimited scalability for OpenStack cloud. The Avi Controller itself is a multi-node, active-active cluster, eliminating any single point of failure.

N-way active redundancy: Avi provides not just Active-Standby or Active-Active High Availability, but also N-Way Active redundancy to ensure availability not only at server or rack level, but also at a data center level.

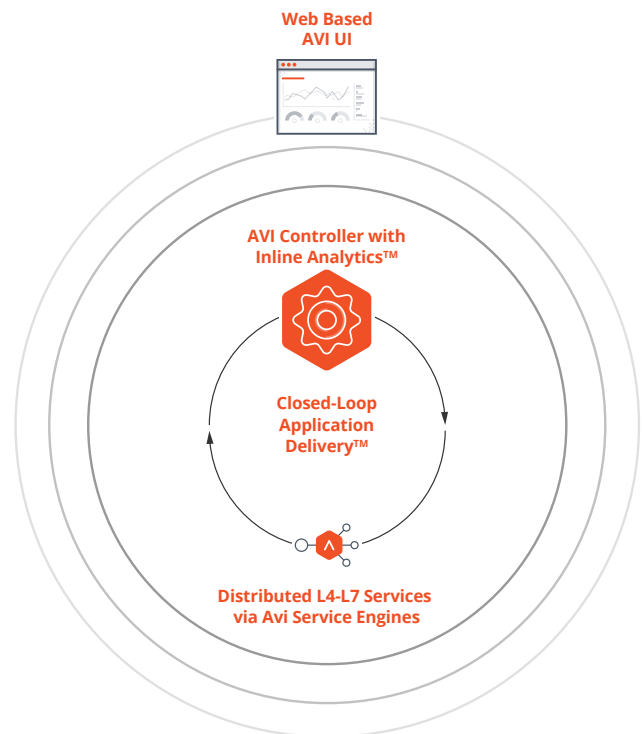


Figure 5. Closed-Loop Application Delivery