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VMware Cloud Foundation Better Together with VMware® Avi™ Load Balancer

Plug-and-Play Load Balancing
with a Cloud Operating Model

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VMware Cloud Foundation

VCF makes self-service private cloud easy with a consistent operating, governance and consumption model. It provides quick time to value by enabling self-service consumption and delivery of private cloud resources, providing users and developers with a unified and consistent self-service layer. VCF customers can take advantage of the self-service private cloud with VCF solution to enable advanced use cases, and help drive increased business and IT agility, productivity and efficiency.

VMware Avi Load Balancer

For those who have realized the value of VCF, why not extend the same principles you have come to believe to application delivery too? With its genesis in the Software defined principles and backed by VMware's validated designs, guided by simplified operations along with self-service automation, holistic visibility and overarching security that complements the network security, Avi Load Balancer offers a superior load balancing solution like none other.

Executive Summary

Plug-and-Play Load Balancing with a Cloud Operating Model

As organizations have started to selectively embrace the public cloud for a portion of their business needs, they increasingly realize the advantages of cloud infrastructure and operations. They now require a public cloud-like self-service experience for on-premises environments too.

While public cloud has its place in overall app development and digital initiatives, it is not a fit for everything. Certain apps and workloads may need to reside in on-premises environments due to compliance, integration and cost considerations. Self-service delivery models enable IT organizations to abstract services and provide users what they need, while IT retains the flexibility to move resources on the back end with control and compliance, optimizing the use of strategic corporate infrastructure resources at the same time.

IT needs to transform its operational model as the legacy models of running IT are not sufficient to accommodate the needs of the business. These needs include but are not limited to:

- Self-service through API or portal
- On-demand, anytime, anywhere
- Scalable and expandable when needed
- Pay for what you consume

This needs a change in how people, process and technology are aligned to the goal of supporting the digital transformation outlined in the various strategies. For people this means a shift in mindset in how they provide services. The mindset should focus on becoming a customer-focused, service delivery-oriented organization. This means that people need to be multi-disciplinary and work cross-functionally.

A future-ready IT organization must have clear objectives — with well-thought-out strategies to support its objectives. Its app, data, and cloud strategies must align with higher-level business strategies, initiatives, and outcomes. This is often referred to as the Cloud Operating model.

All of this needs the adoption of a mindset that is focused on delivering resources to the consumers of IT within the business. As a result, processes will need to be re-aligned to accommodate the transition towards a Cloud Operating Model. The focus should be to automate or broker the delivery of IT resources as much as possible and make them accessible through a self-service portal or API.

In this paper, we will learn the benefits of choosing an integrated load balancing solution with the VMware Cloud Foundation (VCF) offering and how it can help you deliver a superior application experience to your customers like no other.

Why Load Balancing is Critical for VCF

Every Application Needs Load Balancing

We live in application driven economy. Enterprises are facing an unprecedented need to provide infrastructure that matches the agility of applications. The network team is under pressure to support remote employees, to deliver container apps and support a much higher velocity of changes and updates to meet time-to-market considerations. Delivering great application experience is synonyms with business growth, better customer satisfaction and workforce productivity. Organizations are realizing the need for a modern, software-defined load balancing solution to enable better application experience. Load balancing is a fundamental building block of as compute, storage, and network. One cannot realize the value of applications and digital transformation without load balancing.

Avi Enables the Cloud Operating Model

VMware Avi Load Balancer is designed to provide flexible deployment and simplified operations through automation and centralized management and as such support the Cloud Operating Model strategy. With a software-defined approach to application delivery infrastructure, Avi Load Balancer decouples the control plane from the data plane and provides consistent application delivery services across clouds and heterogeneous infrastructure, including bare metal servers, virtual machines (VMs), and containers. Unlike the legacy load balancers that are highly overprovisioned and hence wasteful, Avi enables optimal capacity management and highly elastic fabric through automatic zero touch autoscaling features. Yet another disadvantage of the legacy load balancers is the inability to trouble shoot issues in time often resulting in friction among the application and the network teams. Avi makes it easy to troubleshoot complex issues through rich and contextual analytics and stops the blame game. By its virtue of being completely integrated with the VCF ecosystem, you can enjoy the benefits of unified automation workflows, validated designs and visibility for complete peace of mind knowing your applications will be delivered as intended.

Avi Makes Your VCF Deployment Better

Customers continue to extract tremendous value from the VCF solution keeping in line with the principles of the cloud operating model. But the last mile challenges with application delivery remain. These are compounded by geographically disparate datacenters with wider attack surface and reduced analytics and visibility. This is where the Avi adds tremendous value to the existing VCF customers. In addition to excellent server load balancing capabilities, the Avi enables Global Server Load Balancing with Intelligent Traffic distribution across Data centers and address important use cases such as Disaster Recovery with ease. With the inbuilt WAF, Avi can even provide application protection before traffic reaches the network. Last but not the least, it helps you analyze and optimize the end-to-end application experience proactively while simplifying troubleshooting and automatically building a self-healing infrastructure. Here are a few ways Avi makes your VCF investments better.

Enterprise Scale and Resiliency

As the mandate for application modernization takes effect, it becomes increasingly necessary to load balance applications across geographies and clouds for high availability and address important issues such as disaster recovery and application upkeep. Avi provides global server load balancing (GSLB) services, which provides load balancing of applications across multiple geographically dispersed locations, while providing centralized GSLB configuration, application monitoring, and analytics. That includes centralized provisioning with automated discovery of applications across sites as well as centralized application monitoring, logs, and analytics. In addition, integration with VCF ensures load balancing as a service is available with VCF Cloud Management as well as identity services like LDAP, Radius, DNS servers for better scale and resiliency.

Cloud Experience for DevOps

Infrastructure-induced high latency is one of the top reasons for a suboptimal application experience. Deploying legacy or traditional hardware-based load balancers often lead to high latency leading to sluggish application experience. Avi reduces latency by eliminating hair pining of traffic seen with such external load balancers. It also offloads resource intensive services

including connection management and Access Control List lookups from routers or switches, further accelerating application response times. The Avi integration with VCF can also enable you to proactively optimize resources and troubleshoot with end-to-end visibility which is otherwise impossible with the legacy load balancers that are deployed as point solutions.

Comprehensive Web App Security

In recent years, web application security has become increasingly important, especially as web application attacks are the most common reason for breaches. WAFs have become a critical component of web application security, and guard against web application vulnerabilities while providing the ability to customize the security rules for each application. As WAF is in line with traffic, some functions are conveniently implemented by a load balancer. This is an additional layer of protection at Layer 7 before the traffic reaches your network. The WAF can protect your applications from common threats including Cross-site Scripting (XSS), SQL injection, cookie poisoning, Layer 7 DoS and Web scraping. It is important to know that time to deploy and operational efficiency are extremely critical to a successful security strategy. Avi continuously provides consistent security policies and holistic visibility while reducing complexity and cost, thanks to its unique integration with VCF Networking by NSX,

Avi and VCF Use Cases

Accelerated Transition to a Cloud Operating Model

Avi's software-defined architecture makes it the perfect candidate for an infrastructure-agnostic platform for any application – VMs, bare metal or containers. The abstraction allows for the same APIs, workflows and automation to offer consistent load balancing services regardless of the underlying environments.

Integrated Experience with Full Visibility for VCF

Customers demand better application experience round the clock with complete end to end analytics and automation from Layer 2 through 7. This requires full-stack integration with VCF and a backing of rigorously tested, validated and supported deployment designs. Deploying Avi considerably reduces operational and training efforts, and this integrated experience with VCF ensures load balancers are never an afterthought nor deployed without self-service built-in for DevOps. Avi is software-defined and so is VCF, a synergy in architectures that is unmatched by legacy hardware load balancers, which are outside the VCF stack. Avi integrates with software-defined data center (SDDC) Manager for automated Day 0-2 lifecycle management of load balancing and enables self-service through integrating with VCF Automation (formerly known as Aria Automation).

Disaster Recovery across Multiple Sites with GSLB

Enterprise workloads are often mission critical, hence demanding rigorous business continuity plans. However, DR plans can be quite expensive with a standby site completely idle all the time. This translates to double the licensing cost and complex testing required to make sure this high-availability and failover process works in time of emergency. Avi's software-defined architecture and on-demand auto-scaling of capacity dramatically simplifies the DR solution. Avi Cloud Console monitors and manages a pool of active licenses deployed across multiple sites – on-prem or clouds. With GSLB set up, activating a standby site is as easy as reassigning licenses from one Avi Controller to another, eliminating the need to have idle capacity and unused licenses. Maintaining consistent policies in the Avi Controller and ensuring data plane traffic is not impacted during the switchover, is much more simplified.

Web Application Security for VCF with WAF

Security is only as good as its weakest point. With VCF Networking by NSX offering complete network security from L2-L3, Avi WAF enhances the protection for your workloads by offering excellent L4-7 web app security, built-in to the platform without separate licenses. Avi offers comprehensive security features, such as OWASP Top 10 attack protection, DDoS mitigation, rate limiting, SSL/TLS offload and bot management. This ensures robust web app security and compliance with any

global regulations like GDPR, HIPAA, and PCI-DSS, enabling VCF admins to extend security policies from vSphere to containerized environments.

Container Ingress with Integrated Security

Platform teams responsible for bringing Kubernetes workloads to production-ready status need to stitch together point products or services – often from multiple vendors or open-source projects with zero support. Besides ensuring enterprise-grade features operated at scale, they also must monitor, automate, troubleshoot and secure applications at the speed of application rollouts and changes. Avi offers a comprehensive and consolidated set of Layer 4 to Layer 7 services, including ingress controller, GSLB, IPAM/DNS, web application firewall (WAF), and analytics for any Kubernetes environment including VMware Tanzu, Red Hat OpenShift and native public cloud Kubernetes services.

Avi and VCF Integration Advantages

Unlike the legacy load balancers solutions available in the market that are either hardware based or derivatives of the hardware based solutions, Avi's software defined load balancer brings elastic scale, robust performance and intelligent analytics to every data center and cloud. Customers get enterprise-grade L4-L7 features with self-service automation and rich analytics while solving the significant operational challenges of appliance-based hardware load balancers. Avi offers the following distinct advantages as compared to legacy load balancers:

Single Hybrid Cloud Platform vs. Disjointed Point Products: Reduces operational complexities and delivers hybrid cloud consistency for flexibility and application portability. This also eliminates the need to retrain staff on different products and point solutions.

Controller vs. Instance Manager: Avi's software-defined architecture separates the control and data planes and delivers load balancing and WAF as an elastic fabric that auto-scales based on real time traffic.

Decision Automation vs. Task Scripting: In-built automation coupled with an API based approach makes intelligent decisions, scales, and simplifies hybrid cloud application deployments supported by Closed-loop analytics that helps automate decisions with over 800 unique application metrics.

Optimal Resource Utilization vs. Over-provisioning: Elastic, fabric approach with active-active HA ensures minimal unutilized capacity.

In-built visibility and analytics, v/s bolt-on solutions: Analytics-first architecture with built-in visibility, compared to a bolt-on implementation by legacy load balancers ensures complete end to end L2-7 visibility with VCF integration. Finally, thanks to the VCF and Avi integration by mapping apps to hosts, networks and flows, Avi breaks visibility Silos with holistic L2 to L7 visibility and analytics. This provides contextual Insights for faster Root Cause Analysis thus reducing MTTR and exceeding customer SLA and expectations in the process.

While these advantages make the standalone Avi load balancing solution a forerunner in the load balancing space, it is the plug-and-play integration with VCF that truly makes this solution shine. It is this integration that affords the solution automated deployment of virtual services and service engines. VCF Customers can enjoy enhanced agility consistently using enterprise-wide unified workflow automation with automated contextual bi-directional visibility from network to the applications. Avi with VCF also ensures complete L2-7 security posture while reducing vendor and security fragmentation.

Avi Better Together with VCF Components

In this section, let us take a look at each of the components of the VCF solution and take a deep dive into some of the capabilities that customers can leverage to accelerate the adoption of Cloud Operating model.

VCF SDDC Manager

The cloud operations design for the management domain must feature comprehensive virtual infrastructure provisioning and lifecycle management capabilities. SDDC Manager enhances daily operational efficiency by handling full lifecycle management tasks, including deployment, configuration, patching, and upgrades, streamlining and optimizing the management of the virtual infrastructure.

Avi is the only Load Balancer in the market that delivers true plug-and-play load balancing for VCF workloads through its integration with SDDC-M, which deploys Avi Controllers for each VCF workload. The Controllers deployed communicate directly with the VCF components such as vCenter and NSX-T, integrating seamlessly with the management domain and easing the process for Day 0-2 operations.

- Increased operational visibility
- Automated SE deployments in VCF workload domains.
- Efficient lifecycle management and Day 2 operations with automation tools suite.
- Convenient password rotation and certificate management through a simple GUI.
- Upgrade checks.

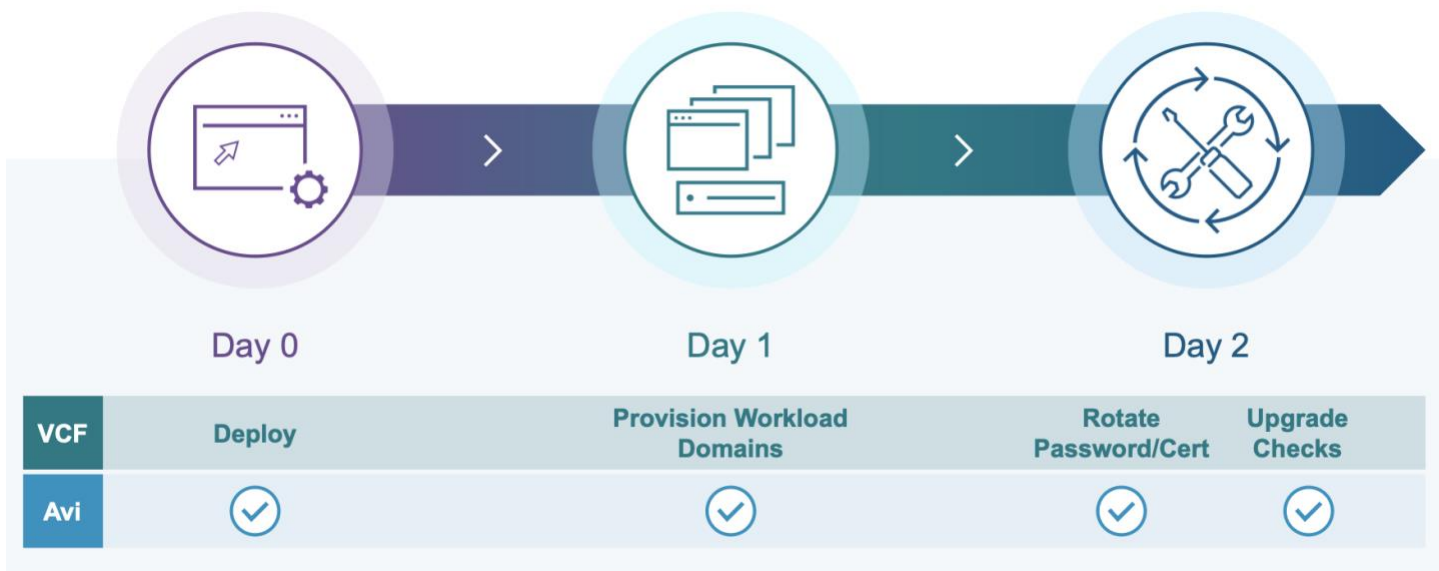


Figure 1 Avi Integration with VCF SDDC Manager Simplifies Operations across LB Lifecycle

To simplify operations and lifecycle management for large and complex systems, it's important to be able to automate steps across initial deployment (day 0), automated configuration and provisioning (day 1) and automated lifecycle management (day 2 and beyond).

By relying on Avi's unique integration with SDDC-M, you can implement centralized load balancing (LB) for your application workloads within VCF and can configure enterprise grade load-balancing, GSLB, application security, and container ingress services. With the joint solution, you can not only manage load balancers centrally across any environment but also create new virtual services in minutes. This solution also helps you scale load balancing capacity dynamically based on traffic patterns and troubleshoot application issues without TCP dumps/log exports.

Day 0 automation through VCF provides automated deployment of private cloud infrastructure and management components to stand up and deploy infrastructure quickly. Day 1 automation provides configuration of these systems with provisioning of workload domains on demand – purpose built and scalable for traditional and container apps. Day 2 and beyond is where most IT shops face difficulties in managing software updates and patching for large scale software systems. VCF provides automation for full lifecycle management including patching/upgrades, monitoring, scaling, and infrastructure management.

Avi is the only product in the market with a jointly created and validated solution that automates the deployment of the VCF management infrastructure, the lifecycle of the load balancers, which reside in the same space as the VCF workloads, and the required load balancing and security services to provide an unmatched experience for the application teams.

VCF Networking by NSX

Faster infrastructure provisioning is required to support the on-demand nature of container applications. While other vendors may provide solutions, managing these heterogeneous systems are a huge threat to the simplicity and agility expected out of that infrastructure. However, not with the NSX and Avi integration. In addition to Automated Network Configuration for Avi Lifecycle, the integration facilitates holistic contextual Visibility as well consistent and stronger security posture.

The combination of Avi and NSX enables Avi Controller to be the single point of management. As developers and network admins configure app and load balancing instances, Avi Controller automatically spins up the distributed load balancers (Avi Service Engines), places the virtual IPs (VIPs) on the Service Engines, and places the network interfaces in the right overlay or underlay network, without manual intervention. Avi also publishes rules and dynamically manages security for the load balanced resources. As application traffic increases, Avi Controller scales out the resources by creating additional Service Engines and scale-in when traffic recedes.

Below are the highlights of the NSX-T and Avi integration:



Enhanced Agility

- Automated discovery of NSX-T inventory & infrastructure objects by Avi
- Automated config of Virtual Service: virtual IP allocation, registration in DNS, NSX-T routing tables
- Automated Service Engine connection to logical network segment
- Eliminate inefficient hair pinning of E-W traffic for better performance & latency
 - Automated Elasticity and Scale-out
 - New SEs auto configured with right network attributes
 - Automated NSX-T IP route updates
 - No config updates needed when you add/remove app servers in a NSgroup



Faster Troubleshooting

- Discover and troubleshoot network connectivity issues faster with full L2-L7 visibility, and network, servers and apps correlation by VCF Networks Operations* (formerly vRNI) integration
- Holistic contextual L1-L7 visibility with NSX-T (L2-L4) with Avi (L4-L7)
- Stop the blame game- Determine if it is a network or server or application problem?
- Corelate Avi, NSX-T and vCenter events, operational status and metrics with single pane of glass
- Network mapped to flows and applications
- Visibility for virtual services, pools, service engines, controller nodes, paths, topology, traffic patterns, packet drops, retransmission count, RTT, latency & more



Stronger Security Posture

- Consistent security posture with your existing vDefend Distributed Firewall (DFW) policies
- Simplified and automated configuration
 - User configured DFW rules using auto created NSgroups and service objects
- Better security posture with network security complemented by Application security (WAF, bot management, DDoS and API protection) with Avi

VCF Compute by vSphere

This integration enables the Avi Controller to interact with the vCenter Server and provide lifecycle management for the Service Engines. Avi enables the automated discovery of vSphere objects, and vCenter automated Service Engines are enhanced with automated object creation and deployment. Application elasticity and scale-out is also automated with Avi.

Below are the highlights of the vCenter and Avi integration:

Enhanced Agility

- Automated discovery of vSphere object
 - ESXi hosts, Datastore, and networks can be discovered by Avi
- Automated Service Engine life cycle with vCenter
 - OVA creation and upload
 - ESXi hosts placement with anti-affinity rules for higher resiliency
 - Automated config of virtual NICs of SEs to connect to right networks
- Automated Elasticity and Scale-out with vCenter and NSX-T
 - New SEs added or removed automatically without any manual configuration

Faster Troubleshooting

- Compute usage visibility in Avi with vCenter integration for faster troubleshooting
 - Application Servers, Service Engines Instances and ESXi hosts performance statistics (e.g., CPU and memory usage)

VCF Cloud Management (formerly Aria or vRealize)

VCF Cloud Management is a platform that unifies applications, infrastructure, and services across private, hybrid, and public clouds in a single platform with a common data model. With VCF Cloud Management, you can gain consistent operations of hybrid clouds with VMware's industry leading products and services for cloud management. Organizations can embrace a cloud operating model to drive innovation and support digital transformation initiatives.

VCF Cloud Management integration means automated workflows for application deployment and changes. The operational support for application availability and optimization is automated through Avi and VCF Automation (formerly Aria Automation). Advanced analytics mean closed loop automation can provide application resiliency and elasticity.

Avi enables developers to satisfy their load balancing needs at the click of a button thanks to integrating natively with VCF Auto to provide a seamless solution. By linking Avi objects inside VCF Auto using a simple drag-and-drop method, it is now easier than ever to satisfy end-user self-service goals and automate your load balancing as a service solution.

Below are the highlights of the VCF Cloud Management and Avi integration:

Enhanced Agility

- Automated workflow tasks with VCF Automation integration
 - Avi as first-class native resource can now be linked inside VCF Automation through simple drag-and-drop, leading to reduced operational burden.
 - Provide end users increased agility by automating Avi through VCF Automation.
 - VCF Automation service broker forms are designed to use VCF Operations (formerly Aria Operations or vROps) to populate fields with external data, enhancing the self-service experience for deploying Avi through VCF Automation.
 - Achieve greater flexibility with VCF Automation extensibility and VCF Operations actions.

Troubleshoot Faster

- End to end visibility and monitoring across geos, on-prem & clouds with VCF Operations integration for better operations
 - Continuous monitoring, object relationship visualization and unified alert reporting of all Avi resources, metrics and properties for faster troubleshooting
 - One-stop view of health and availability with pre-built dashboards for virtual services, virtual services configs, Avi
- Discover and troubleshoot network connectivity issues faster with full L2-L7 visibility, and network, servers and apps correlation by VCF Network Operations (formerly vRNI) integration
- Centralized Avi events, client request and server response log insights with VCF Operations log management (formerly Aria or vRealize Log Insight) integration

VMware Tanzu

Containerized applications are increasingly deployed in Kubernetes clusters and moved from test and dev labs to production environments. The need to provide reliable and secure application services is essential to application availability and responsiveness on-premises and across any cloud. Avi Load Balancer together with VMware Tanzu brings the shortest path to production-ready Kubernetes clusters and consolidates L4-7 container networking services including local and global traffic management, web application firewall (WAF), and container ingress on a single scalable platform.

VMware Tanzu provides an enterprise-ready Kubernetes runtime and cluster management solution with the promise of the fastest application experience. Avi also supports Tanzu Application Service (formerly Pivotal Cloud Foundry). When deployed together with Avi's container ingress capabilities, you enjoy the following benefits:

Integrated Solution

A comprehensive set of services including load balancing, ingress controller, application security such as WAF, GSLB, DNS, and IPAM capabilities are offered on a single platform.

Operational Simplicity

A single solution with central orchestration of policy, lifecycle management, API endpoint, and ease of troubleshooting lowers operational costs by more than 50%.

Rich Observability

End-to-end visibility across multiple clusters and sets brings real-time telemetry and application insights across all components in a production Kubernetes deployment.

Cloud-native automation with elasticity

Elastic autoscaling based on closed-loop analytics and decision automation provides a resilient and secure backbone to scale out containerized applications.

Below are the highlight of the VMware Tanzu and Avi integration:

Enhanced Agility

- Include AKO (Avi Kubernetes Operator) in your cluster's lifecycle
 - Create new clusters with automated AKO configurations
- Leverage Avi for Tanzu/K8s control plane API
- Leverage Avi for Kubernetes workloads
 - AKO configures Avi based on K8s API calls
 - Avi assigns IP automatically for your external Load Balancer
 - Register automatically your FQDN for your container applications
- Automated Elasticity and Scale-out
 - New SEs auto configured with right network attributes
 - No config updates needed when you add/remove pods to your application

Stronger Security

- Comprehensive unified ingress app security for micro-services apps to reduce complexity, vendor and security posture fragmentation with Avi
 - WAF, bot management, DDoS protection, API protection
- Consistent security posture for your traditional and container apps) by Avi

Summary

Avi Load Balancer is a key component of the VCF ecosystem, enabling the benefits that businesses want to achieve from cloud architectures. Operational support of clouds is complicated, and Avi with VCF simplifies the operations and expertise required to manage the cloud and its applications. Application delivery in the cloud requires a change in how people, processes and technology are aligned and the combination of Avi and VCF provides a solution that works better together to improve and simplify this alignment.

Through enhanced automation, improved security and application visibility, Avi provides plug-and-play load balancing for VCF, helping adopt the mindset required to embrace the Cloud Operating model that businesses are trying to achieve.

