A Buyer's Guide to Enterprise Kubernetes Solutions

A Comparison of Pivotal PKS, Platform9 Managed Kubernetes, Rancher, and Red Hat OpenShift

PLATFORM9

In just a few years, Kubernetes has rapidly emerged as the de-facto open source standard for container orchestration. Numerous Kubernetes solutions and products have emerged from startups to established traditional vendors thus making it difficult to compare and contrast the various offerings. This guide identifies 18 technical and operational capabilities to consider while evaluating various vendor offerings and then provides a detailed comparison of the level of completeness of these capabilities for four leading solutions in this market: Pivotal PKS, Red Hat OpenShift, Rancher, and Platform9 Managed Kubernetes.

What are the key features to consider while evaluating an enterprise Kubernetes platform?

1. **Provisioning of Kubernetes Clusters, High Availability and Healing**
   Kubernetes does not offer deployment of highly available clusters out of box and must be configured by the Kubernetes administrator. It is recommended that at least three master nodes are configured behind a load balancing solution with integrated or independent clustered deployment of etcd that stores all the cluster state information. Any high availability solution must also account for failure scenarios and auto-repair and recovery.

2. **Deployment Model(s) Supported**
   The deployment model of a Kubernetes solution defines how it will integrate within your enterprise environment and what level of support service level agreement (SLA) it can provide for day 2 operations. The top three deployment models for Kubernetes solutions are:

   • Traditional on-premises deployment - users download and deploy Kubernetes on their infrastructure on their own or using professional services and support from a vendor

   • Hosted Kubernetes as a service (KaaS) - A vendor will offer Kubernetes as a service on top of infrastructure that's hosted by the provider

   • Hybrid Cloud Kubernetes as a Service - Kubernetes is offered as a service on the infrastructure of your choice, your own infrastructure or public cloud

3. **Prerequisites and Operating System Requirements**
   The prerequisites of an enterprise Kubernetes solution define what infrastructure requirements you need to satisfy before you can get up and running with Kubernetes. Some solutions require an expensive licensing purchase of underlying infrastructure, such as a hypervisor, or an investment in a hosted Kubernetes solution.

4. **Monitoring and Operations Management**
   A production Kubernetes cluster must be monitored at all times to handle any issues and outages without severely affecting cluster and application availability to users. An enterprise Kubernetes solution must provide this capability out of box.

5. **Cluster Upgrades**
   Kubernetes has a large community of contributors and a new version is available every 3 months. An enterprise-class solution will support rolling upgrades of clusters, such that the cluster and the cluster API is always available even while the cluster is being upgraded. Additionally, it will provide the ability to rollback to previous stable version upon failure.

6. **Multi-cluster Management**
   A single Kubernetes cluster can scale horizontally to support large sets of workloads. However, running Kubernetes in production requires being able to run multiple Kubernetes clusters, as you will want to fully isolate your dev/test/staging applications from production applications by deploying them on a separate cluster.

7. **Multi-tenancy, Role-based Access Control and Single Sign-on Support**
   Kubernetes supports multi-tenancy at the cluster level using the namespace abstraction. However, in a multi-cluster environment, you need a higher level multi-tenancy abstraction to supplement Kubernetes multi-tenancy and provide the right level of isolation across different teams of users. It should integrate with Single-Sign On (SSO) solutions most commonly used by enterprises such as Active Directory or ADFS, Okta, and other popular SAML providers.

8. **Load Balancing**
   Kubernetes automatically load balances requests to application services inside of a Kubernetes cluster. However, some services need to be exposed externally for consumption by outside clients. Kubernetes does not provide an out-of-the box load balancing solution for that type of services. An enterprise Kubernetes product should include a robust external load balancing solution, or integrate seamlessly with existing commercial load balancers.

9. **Private Registry Support and Image Management**
   Running containerized applications on Kubernetes clusters requires having access to a container registry where your application images will be stored. A large enterprise organization will typically want a secure private container registry to store their proprietary application images. An enterprise Kubernetes solution should provide image management capability out of box.

10. **Hybrid Cloud Integrations and APIs**
    Every enterprise today wants to build a cloud neutral strategy by investing in multiple cloud solutions. Having multiple private and/or public clouds as part of your cloud strategy ensures that you aren't getting locked into a single provider with no leverage on pricing, to have high availability across your infrastructure overall, and to satisfy your unique business policies.

11. **Enterprise Grade User Experience**
    Enterprise grade user experience is all about having a polished user interface that enables enterprises to manage their hybrid environments though a single UI. This delivers complete visibility simplifying communications across the environment. This UI should allow operations that span multiple clusters: for example, globally searching for workloads of a specific type or tagged with a specific label across all clusters running on different regions, data centers and cloud providers.

12. **Application Lifecycle Management - Application Catalog**
    Application catalog provides easy one-click deployment for a set of pre-packaged applications on top of Kubernetes. It also provides end users a vehicle to build and publish their own applications via the catalog for others in their team or their organization to deploy in a one click manner. The application catalog enables organizations to standardize on a set of application deployment recipes or blueprints, avoiding sprawl of configurations.

13. **Production Grade Service Level Agreements (SLA)**
    As more and more organizations are running their business on Kubernetes, IT must ensure that it can support the SLAs that the business requires. IT must ensure that Kubernetes is available to developers and the business to support key initiatives. Most organizations require 99.9% uptime.

14. **Ease of Setup, Installation, Continuous Use, Management, and Maintenance**
    A successful Kubernetes platform must be easy to implement and maintain so organizations can leverage containers continuously. This alone is a major barrier that many organizations do not overcome.

15. **Networking Support and Integrations**
    Networking integration is a critical component of running Kubernetes clusters in production and at scale. An enterprise will typically want Kubernetes to integrate with a Software-Defined-Networking (SDN) solution of their choice that they currently standardize on or a container native solution such as calico or weave that gives them more options around isolation.

16. **Storage Support and Integrations**

Similar to networking, integration with enterprise grade storage is an essential component of running Kubernetes clusters in production. Kubernetes provides an abstraction called Persistent Volumes to hold data persisted by stateful applications. It is important for a Enterprise Kubernetes product to map PVs to an actual highly-available storage technology. Enterprises will typically want their Kubernetes deployment to integrate with storage solutions that they have already deployed such as NetApp, Pure, SolidFire, etc. or they may want to integrate with a container native storage technology such as Portworx.

17. **Self Service Provisioning**

Developers must have self-service access to one or more Kubernetes clusters with right levels of isolation in place so only members with right privileges can access production workloads.

18. **Built-in CI/CD Support**

One of the most critical workloads run by the developers is Continuous Integration / Continuous Delivery. A robust CI / CD pipeline is critical to ensure agile development and rapid delivery of new software releases to customers.

Comparison Scorecard

FEATURES	PLATFORM9 MANAGED KUBERNETES	RANCHER	RED HAT OPEN SHIFT	PIVOTAL PKS
Provisioning of Kubernetes Clusters	● (full)	● (full)	● (full)	● (full)
High Availability and Healing	◕ (3/4)	◑ (1/2)	◕ (3/4)	◕ (3/4)
Deployment Model(s) Supported	◑ (1/2)	◑ (1/2)	● (full)	◔ (1/4)
Prerequisites and Operating System Requirements	● (full)	● (full)	◑ (1/2)	◔ (1/4)
Monitoring and Operations Management	● (full)	◕ (3/4)	◑ (1/2)	◔ (1/4)
Cluster Upgrades	● (full)	● (full)	● (full)	◕ (3/4)
Multi-cluster Management	● (full)	● (full)	◔ (1/4)	◑ (1/2)
Multi-tenancy, Role-based Access Control, and Single Sign-on Support	● (full)	◕ (3/4)	◑ (1/2)	◑ (1/2)
Load Balancing	● (full)	◑ (1/2)	◕ (3/4)	◑ (1/2)
Private Registry Support and Image Management	◔ (1/4)	◑ (1/2)	◕ (3/4)	● (full)
Hybrid Cloud Integrations and APIs	● (full)	◕ (3/4)	◑ (1/2)	◑ (1/2)
Enterprise Grade User Experience	● (full)	● (full)	◕ (3/4)	◔ (1/4)
Application Lifecycle Management - Application Catalog	◕ (3/4)	◕ (3/4)	● (full)	◔ (1/4)
Production Grade Service Level Agreement	● (full)	◕ (3/4)	◕ (3/4)	◕ (3/4)
Ease of Setup, Installation, Continuous Use, Management, and Maintenance	● (full)	● (full)	◔ (1/4)	◔ (1/4)
Networking Support and Integrations	◕ (3/4)	◕ (3/4)	● (full)	◕ (3/4)
Storage Support and Integrations	◕ (3/4)	◑ (1/2)	◕ (3/4)	◕ (3/4)
Self Service Provisioning	● (full)	● (full)	◑ (1/2)	○ (empty)
Built-in CI/CD Support	◑ (1/2)	● (full)	◕ (3/4)	○ (empty)

Detailed Comparison Table

PRODUCT	PLATFORM9 MANAGED KUBERNETES	RANCHER	RED HAT OPEN SHIFT	PIVOTAL PKS
Provisioning of Kubernetes Clusters	Fully automated provisioning of clusters	Fully automated provisioning of clusters	Fully automated provisioning of clusters	Fully automated provisioning of clusters
High Availability and Healing	» Built-in support for highly available clusters out of the box » Clusters of 1/3/5 masters are supported for quorum » Built-in etcd high availability support » Supports full repair or recovery of etcd upon failure	» Leverages native Kubernetes features to deliver HA and healing	» Supports a highly available cluster deployment » The default HAProxy load balancer can be used to create a multi-master and multi-etcd cluster environment - with etcd nodes either forming their own cluster or deployed on the same node as the master	» Includes Cloud Foundry Ops Manager Provides BOSH which is a vital component within PKS » BOSH monitors the health of clusters and enables self-healing to optimize capacity Unhealthy nodes are automatically detected and resurrected without downtime
Deployment Model(s) Supported	One deployment model offered: » SaaS-managed offering - ideally suited for enterprise hybrid clouds, includes support, upgrades, remote management, etc.	» Traditional deployment and support model with software downloaded and installed » Support for on-prem and public cloud deployments	Three deployment models offered: » Hosted Public Cloud Offering - trial environment only » OpenShift Dedicated - Single-tenant, high-availability OpenShift clusters hosted on Amazon Web Services Delivered as a hosted service » OpenShift Container Platform - Enterprise offering available for large customers with on-prem and/or hybrid infrastructure	One deployment model offered across three platforms. The product files are downloaded for Pivotal Ops Manager and PKS and the end-user performs the install. VMware vSphere, AWS, and GCP supported
Prerequisites and Operating System Requirements	Supports all popular enterprise Linux distributions - Red Hat, CentOS, Ubuntu	Supports all popular enterprise Linux distributions - Red Hat, CentOS, Ubuntu	» Supports Red Hat Linux only » RHEL subscription is required and included as part of the OpenShift bundled product subscription	PKS has an extensive list of prerequisites: » It can not be installed on any linux systems » Requires VMware vSphere Enterprise Plus Edition or vSphere with Operations Management Enterprise Plus minimum

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Monitoring and Operations Management	» 24 x 7 live monitoring » 99.9% guaranteed SLA » Proactive repair » Automated email notifications for any issues » Automated support ticket creation and triaging of issues	» Performs health checks on all Kubernetes clusters, and presents resource consumption statistics » Sends cluster-level alerts for Kubernetes system components (e.g., etcd, DNS, etc.) -Customizable resource alerts such as CPU, memory etc. » Traditional support ticketing process for issues » Automatically deploys and configures Prometheus for monitoring	» Diagnostic tools via command line for health statistics » Environmental health check information » Prometheus available but requires lot of manual configuration for storage, alerting etc	» Does not provide any out of the box live monitoring for your k8s clusters, Prometheus support, etc. » Traditional support ticketing system
Cluster Upgrades	» Fully automated cluster upgrades delivered seamlessly, with no interruption to the environment » Zero-downtime upgrade	» Providers an easy built in cluster upgrade experience » Upgrade one cluster at a time or multiple clusters simultaneously	Administrators need to manually initiate upgrades to clusters upon installing new version of OpenShift	» Patching and upgrades of Kubernetes nodes can be managed from the PKS platform in a centralized fashion, without impact to running applications via BOSH » Customers are guaranteed to always have the latest Kubernetes version available to them » PKS maintainst compatibility to Google Container Engine (GKE)
Multi-cluster Management	» Built in multi-cluster support. Create any number of clusters » Admins can manage multiple clusters across different regions, data centers and clouds	» Provides unified management of multiple clusters » Build clusters on public cloud providers like GKE, EKS, AKS or on data centers » Able to discover existing clusters pre-created	» A typical deployment creates a single Kubernetes cluster that is designed to scale up to 2000 nodes » All users of that deployment are expected to share that single cluster and achieve isolation via a combination of Kubernetes name-spaces, and OpenShift multi-tenancy » Multiple clusters achieved through multiple OpenShift deployments	» Supports multi-cluster management. Create one or more clusters using PKS CLI, then list the clusters, view cluster details and delete clusters using the CLI
PRODUCT	PLATFORM9 MANAGED KUBERNETES	RANCHER	RED HAT OPEN SHIFT	PIVOTAL PKS

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Multi-tenancy, Role-based Access Control, and Single Sign-on Support	» Support for multi-region management. Built in multi-tenancy support » Kubernetes RBAC is fully supported » Full support for Single-Sign On (SSO). Integrate with a SAML-based provider that your organization uses such as Okta, ADFS, Ping Identity, etc.	» Provides centralized authentication (GitHub, AD/LDAP, SAML, etc.) across RKE or cloud Kubernetes services » Allows admins to define Kubernetes RBAC policies and network and pod security policies centrally and apply them across any cluster	» Delivers multi-tenancy through projects, called Kubernetes namespaces » Kubernetes RBAC is utilized to define granular access policies for users » There is no cross cluster multi-tenancy	» Supports multi-tenancy in a limited form » On VMware vSphere with NSX-T, PKS uses VMware NSX-T to isolate different clusters using NSX security policies » Kubernetes clusters can be deployed into different vSphere clusters and configured to use different datastores » Multi-tenancy is not available when deployed without NSX-T or on public clouds
Load Balancing	» Out of the box support for cluster and service level load balancing with MetalLB load balancer » Can integrate with customer specific load balancers(AVI and others)	» Leverages native Kubernetes features to deliver load balancing	» Out of the box support for cluster and service level load balancing with default HAProxy load balancer	» When deployed on vSphere with NSX-T, PKS can leverage load balancing feature from NSX-T to provide cluster and service level load balancing » When deployed on public clouds like GCP or AWS, PKS leverages the cloud native load balancing capability
Private Registry Support and Image Management	» Does not provide out of the box support for private registries » Registries and secrets required to authenticate with the registries need to be managed by the customer separately	» Does not provide out of the box support for private registry deployment. Users have to deploy their own public or private registries » Does support storing of secrets required to pull images from private registries	The internal integrated Docker registry can be deployed in the OpenShift environment to locally manage images. OpenShift does not handle DockerHub well with their private registries. Because of complex security requirements and configs specific to openshift, a user is prevented from pulling a docker image. A user would have to build image streams, secrets management, and built to image in a lot of cases, unlike pure kubernetes which is much less complex.	» IncludesProject Harbor which is an open source enterprise container registry. Harbor simplifies image management with distribution, replication and security mechanisms » The Harbor registry uses a logical construct called Project » This is used to group users and repositories to enable fine-grained access control

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Hybrid Cloud Integrations and APIs	» Includes the most native integration with all major private data center/private cloud offerings and major public cloud providers » Integrates natively with VMware vSphere, Linux/KVM, OpenStack » Clusters on public clouds are created with the public cloud's IaaS layer to provide a native Kubernetes cluster experience	» Automates cluster creation on bare metal servers, VMware, or any IaaS cloud » Clusters on IaaS clouds are created with cloud specific version of Kubernetes (EKS for Amazon AWS cloud, AKS for Azure cloud, etc.) » Rancher is subject to any limitations the cloud providers expose around versioning, update, HA, etc.	» Provides a managed deployment on AWS » A joint collaboration has been announced with Microsoft to support OpenShift deployment on Azure	» Supports on-premises and public cloud based deployments » On-premises requires vSphere or vSphere with NSX-T » Does not support pure bare metal deployment, or Linux/KVM virtualized environment
Enterprise Grade User Experience	» Provides and enterprise class UI and user experience » The clarity UI provides a single pane of glass across bare metal, virtualized and containerized workloads » Unify all your data centers, private clouds, and public clouds under single UI	» Includes an intuitive UI that makes it easy for users to deploy services on Kubernetes and get complete visibility » Common configuration options directly from the UI for defining scheduling rules, health checks, ingress controllers, secrets, storage and other key configuration choices are offered	» Provides a native UI that enables management of your Kubernetes resources and the catalog » This is a web console only and does allow for customization	» Lags behind significantly in this category » There is no UI for PKS. All Kubernetes operations such as cluster creation and management happen purely via CLI » PKS does enable the Kubernetes dashboard
Application Lifecycle Management - Application Catalog	» Built in support for Application catalog that's populated with public Helm chart applications » Administrators can provide users access to applications that are private to the organization » Support for managed apps	» Built in support for Application catalog that's populated with public Helm chart applications » 'Rancher certified' applications provided in the catalog that are tested and certified by Rancher	» An extensive application catalog and PaaS layer helps with building and deploying apps » The service catalog is based on Open Service Broker API » It ships with two service brokers, one to enables applications from their built in app template library, the other is an ansible broker » The templated applications support - Rails (Ruby), Django (Python), Node.js, CakePHP (PHP), and Dancer (Perl) » The Ansible broker supports integration w/ Ansible Playbook Bundles (APB) » The service catalog offers Prometheus, EFK, Jenkins etc.	» Does not ship with a built-in Kubernetes application catalog » It is able to deploy Helm charts

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Production Grade Service Level Agreement	» Platform9 contractually promises 99.9% cluster uptime and high availability » Provides self healing, problem resolution through the service	» Provides a traditional enterprise class support model » Troubleshooting is handled via support tickets » Customers drive the manual upgrades and any issues require support team engagement	» Provides a traditional enterprise class support model » Troubleshooting is handled via support tickets » Customers drive the manual upgrades and any issues require support team engagement	» Provides a traditional enterprise class support model » Troubleshooting is handled via support tickets » Customers drive the manual upgrades and any issues require support team engagement
Ease of Setup, Installation, Continuous Use, Management, and Maintenance	» Platform9's SaaS managed gets Kubernetes up and running in minutes » Create a simple Kubernetes cluster using on-prem servers, VMs or public cloud resources in minutes » Manage clusters with one-click UI-based upgrades and troubleshooting	» Simple setup, run a single docker command on a linux machine and you are up and running » Provides an intuitive UI to help with rest of the setup and Kubernetes cluster creation	» Installing and configuring OpenShift is a manual process which is ansible-based Several ansible playbooks are required during the installation	» The installation of PKS is manual and requires Pivotal Ops Managed to be configured for on-prem and public cloud use » Any problems require logging a support ticket

Networking Support and Integrations	» Provides full CNI support
	
	» Integrates OOB with Flannel, Calico, Weave and OpenContrail
	
	» Other CNI compatible integrations possible on customer request
		» Rancher provides CNI support
		
		» Out of the box support provided for canal, calico, flannel
			» OpenShift provides CNI support and can integrate with any CNI based SDN
			
			» By default OpenShift SDN is deployed, which configures an overlay network using Open vSwitch (OVS) and supports 3 modes:
			
			  1. Flat network model with ovs-subnet plugin where every pod can communicate with every other pod
			
			  2. Project level isolation for pods
			
			  3. Services using ovs-multitenant plugin, and which enables administrators to configure their own isolation policies using Network Policy objects with ovs-network policy plug-in
			
			» Out of the box third party CNI plugins supported: Flannel, Nuage and Kuryer
				» Supports integration with VMware NSX-T for advance networking on VMware.
				
				» It also support flannel, calico, nuage, OVN and kube-router

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Storage Support and Integrations	» Supports integration with any flexvolume drivers » Integrates with any cinder supported storage backend. - Supports integration with all popular storage backends such as NetApp, Pure Storage, etc.	» Rancher supports flexvolume driver level integration with storage providers	» Supports integration with network based persistent storage using the Kubernetes persistent volume framework » Supports a wide variety of persistent storage endpoints such as NFS, GlusterFS, OpenStack Cinder, FlexVolume, VMware vSphere etc	» Requires k8s vSphere cloud provider so that vSphere persistent storage and data services are exposed at container volume level » Cluster admins can create storage classes that can map to a specific underlying vSphere datastore or a VSAN datastore with desired configuration, or by referencing a vSphere storage policy name » For deployment on public clouds, PKS integrates with cloud specific persistent storage offerings
Self Service Provisioning	» Complete self-service provisioning enabled via Platform9's clarity UI » Users log into the UI as part of a specific Tenant (eg dev/test/production) and are able to access clusters provided they have been granted access » Quick deployment of pods, deployments and services via a wizard	Provides a complete self-service provisioning UI for end users and admins to create workloads on top of Kubernetes	Provides a self-service UI that is separate from the default Kubernetes dashboard UI to enable self-service for developers and administrators	» Does not include a UI for Kubernetes, which means there is no self service capabilities for Administrators to manage their k8s clusters » End-users cannot log in and deploy or manage their workloads » The Kubernetes dashboard UI can be used out-of-the box for cluster creation

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Built-in CI/CD Support	» Provides Spinnaker and Jenkins via the Helm application catalog	» Includes integrated CI/CD, making it easy for teams using Kubernetes, to quickly integrate it with their development, testing and release management process » Users can easily point Rancher at any git repo and it will automatically run builds on Kubernetes, deploy test environments, and move product	» Pipelines and Build Strategies simplifies the creation and automation of dev/test and production pipelines » Ships out of the box with a Jenkins build strategy and client plugin to create a Jenkins pipeline. However, the setup to create and configure production pipelines is manual and time consuming. » The pipeline build configuration creates a Jenkins master pod (if one doesn't exist) and then automatically creates slave pods to scale jobs & assign different pods for jobs with different runtimes	Does not ship with a CI/CD tool by default

Platform9 Managed Kubernetes

Platform9 Managed Kubernetes is the industry's only SaaS-based continuously managed Kubernetes service that provides:

» Guaranteed 99.9% uptime SLA

» Remote Monitoring and Healing

» Remote Upgrading and Instant Security Patching

» Central management across on-prem data centers, public clouds, and at the Edge.

» Upstream open source Kubernetes
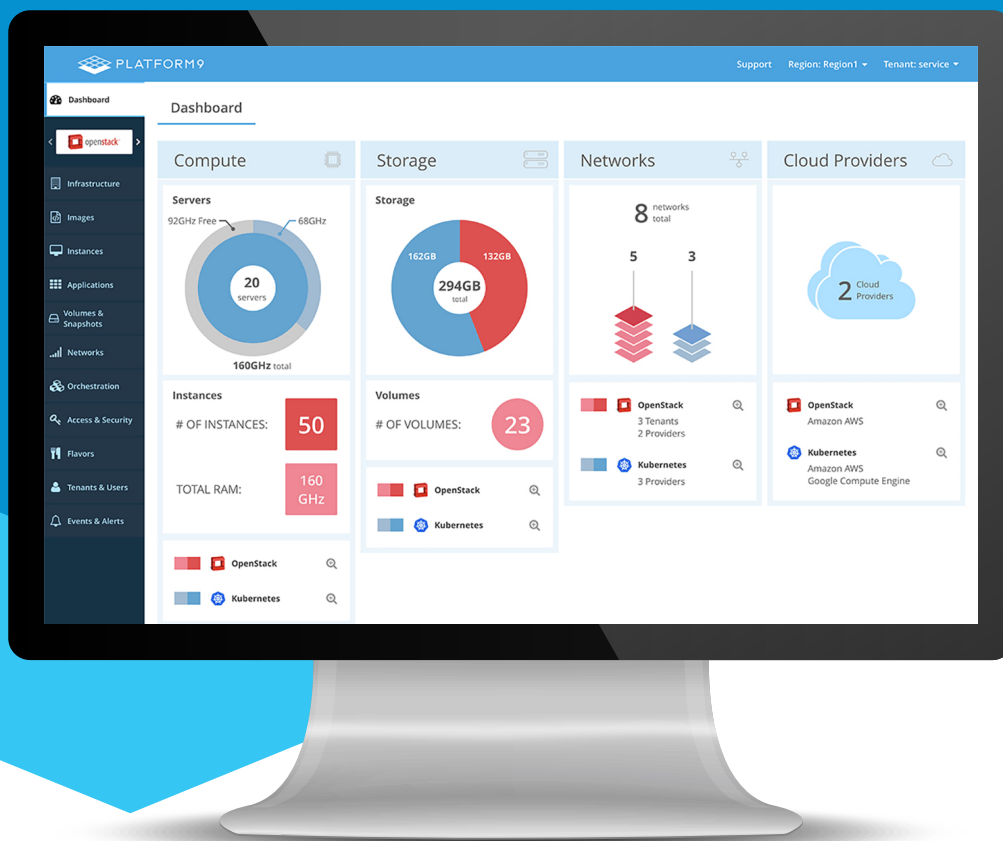
To learn more, please visit

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