Competitor Analysis: KubeSphere vs. Rancher and OpenShift

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I. Overview

1. Metrics Comparison

1.1 Features Benchmarking

Features	KubeSphere	OpenShift	Rancher
Monitoring	※※※※※	※※※※	※※※
Logging	※※※※※	※※※	※※※
Events	※※※※※	※※※※	※※※
Auditing	※※※※※	※※※※	※※※
Alerting	※※※※	※※※※※	※※※※
Notification	※※※※	※※※	※※※※※
Application Template	※※※※	※※※※※	※※※※
CI/CD Pipeline	※※※※※	※※※※※	※※※
Application Lifecycle Management	※※※※※	※	※
Metering & Billing	※※※※※	※	※
Grayscale Release	※※※※※	※※※	※※※

Traffic Governance	※※※※※	※※※	※※※
Tracing	※※※※※	※※※	※※※
Multicloud Support	※※※※※	※※※	※※※※※
Multi-cluster Management	※※※※	※※※	※※※※※
Edge Computing	※※※※※	※※	※※※※※
Network	※※※※※	※※※※※	※※※※
Storage	※※※※※	※※※※※	※※※※※
Network Policy and Management	※※※※※	※※※※※	※※※
Multi-tenant Management	※※※※	※※※	※※※
Authentication and Authorization	※※※※	※※※※※	※※※※※
Security	※※※※	※※※※※	※※
Windows Container	※	※※※※	※※※※

Support			
Commercial Services and Support	✕✕✕✕✕	✕✕✕✕	✕✕✕✕

1.2 Metrics Details

Product Overview			
Overview	Product name	KubeSphere	OpenShift	Rancher
	Company name	QingCloud Technologies	Red Hat	Rancher Labs
	Parent company	None	IBM	SUSE
	Place of incorporation of parent company	China	United States	Luxembourg
Open Source Status	Open source	Complete open source	OKD only	Open source, plus an **Enterprise Edition**, **Pandaria**, exclusive to China
	GitHub Star/Fork	6.7 K Star/1.1 K Fork	8 K Star/4.6 K Fork	17.4 K Star/2.3 K Fork
Installation and Upgrade	Easy installation	KubeKey, an easy-to-use installation tool, available	**No easy-to-use installation tool**	RancherD, an easy-to-use installation tool, available
	Operating system support	All major Linux operating systems supported	Coupled to Red Hat underlying infrastructure, **RHCOS and RHEL**	All major Linux operating systems supported
	Deployment on physical machines	Supported	Supported	Supported
	Deployment on single node	Supported by all versions	Supported by v4.8 only	Supported by all versions
Certifications	CNCF Kubernetes Conformance Certification	Yes	Yes	Yes
	Trusted Cloud	Yes	Yes	Yes

	Certification			
	Kubernetes-native	**No change to Kubernetes code**	Deep customization	Official Kubernetes distribution, RKE, recommended
Product Features				
Product Details	Version compared	3.1.1	4.8	V2.5.9
Observability	Monitoring	Built-in metrics for **multi-tenant and multi-dimensional** monitoring; built-in **custom monitoring dashboards**	Simple metrics displayed only; Grafana and Prometheus required for displaying complex metrics	Simple metrics displayed only; Grafana and Prometheus required for displaying complex metrics
	Logging	Built-in multi-tenant and multi-dimensional log retrieval system that supports on-disk log collection and provides flexibility to integrate multiple external log receivers	Third-party ELK required for setup; manual configurations required for Kibana to visualize records	Third-party ELK required for setup; manual configurations required for Kibana to visualize records
	Auditing	Built-in visual interface that supports auditing logs retrieval in multiple dimensions of cluster, platform, and application	Auditing logs inspection through OpenShift CLI	Workload-level auditing logs inspection
	Events	Multi-tenant and multi-dimensional event query center available on the console; forwarding to multiple storage backends supported	Unified event query and management	Unified event query and management
	Alerting	Built-in	OpenShift CLI	Several built-in

		multi-dimensional alerting rules available; flexible configurations to customize multi-dimensional alerting policies	required to customize alerting rules	alerting rules available; alerting rule configurations on web pages supported
	Notification	Slack, email, and webhook supported		
		Notification Manager, a self-developed open-source tool that supports cloud provider SMS, DingTalk, and WeCom	Pagerduty supported	Pagerduty, Microsoft teams, DingTalk, and WeCom supported
DevOps	Application packaging and publishing	Source-to-Image and Binary-to-Image supported	Source-to-Image and Binary-to-Image supported	Source-to-Image and Binary-to-Image **not supported**
	CI/CD Pipeline	Jenkins pipelines supported with built-in graphical editing panels	Jenkins pipelines supported with built-in visual editing panels (OpenShift Pipeline); GitOps supported with integration of built-in Argo CD and Tekton	Jenkins pipelines supported with built-in graphical editing panels
	Code scanning	Quick integration of SonarQube for static code analysis supported and analysis results available on the UI	Manual configurations required to set up SonarQube for static code analysis	Manual configurations required to set up SonarQube for static code analysis
Application	Application deployment	App Store available to support Helm Chart and application repository configurations	Operator Hub and Helm Chart supported; application repository configurations supported	App Store available to support Helm Chart and application repository configurations

	Application lifecycle management	**Application lifecycle management**, including reviewing, releasing, and suspending	Not supported	Not supported
	Application catalog	17 applications available, including NGINX, Tomcat, and Redis	13 Helm applications and 492 operator applications available by default	34 applications available, including Longhorn and openEBS
Business operations	Metering	Monitoring dashboards available for metering of multi-dimensional resources in clusters and workspaces	Not supported	Not supported
	Billing	Monitoring dashboards available for billing of multi-dimensional resources in clusters and workspaces	Not supported	Not supported
Microservices Governance	Grayscale release	Blue-green deployment, grayscale release, traffic mirroring supported; **no need to learn Istio**	Secondary development based on Istio	**Manual configurations and command lines required to use Istio for implementing grayscale release**
	Traffic governance	Built-in microservices traffic topology maps available to support fine-grained traffic governance policies	Manually configure and integrate the third-party tool Kiali	Manually configure and integrate the third-party tool Kiali

	Tracing	Built-in microservice tracing available with no manual configurations required	Manually configure the Jaeger UI	Manually configure the Jaeger UI
Multicloud and Edge	Multicloud Support	Deep integration with major cloud container services, including AWS EKS, Azure AKS, DigitalOcean Kubernetes, and QKE; importing of hosted clusters running on major cloud container services supported	Deep integration with major cloud container services, including AWS, Azure, IBM Cloud; importing of any Kubernetes cluster or hosted Kubernetes services not supported; underlying operating system coupled to RHCOS and RHEL	Deep integration with major cloud container services, AWS and Azure; importing of hosted clusters running on major cloud container services supported
	Multi-cluster Management	Kubernetes-native and Kubernetes-based container management platform supported; Unified application distribution and scheduling across clusters supported; multi-cluster CI/CD pipelines supported; Tenant management in multiple workspaces across multiple clusters supported	Only support managing OpenShift clusters; Non-standard feature; Red Hat commercial solution, Advanced Cluster Management for Kubernetes, required for managing multiple OpenShift clusters	Management of Kubernetes-native and Kubernetes-based container management platform via UI and API; Security policy configurations across multiple clusters
	Edge computing	Deep integration with KubeEdge; K3s supported;	No feature available and OpenShift	Sponsoring K3s project as the solution for

			commercial solution required	Rancher edge cluster
		Application distribution to edge nodes with unified monitoring and logging available		
Network and Storage	Network	Major CNIs supported, including Calico, Flannel, Weave, and Kube-OVN; OpenELB, a self-developed open-source Load Balancer, available	Built-in OpenShift SDN that supports configuring an overlay network using Open vSwitch (OVS) and supports Layer-3 model; CNI supported, including Flannel, Nuage, and Kuryer	CNI supported, including Calico, Flannel, and Canal
	Storage	NeonSAN, a fully self-developed production-grade distributed block storage, and a distributed file storage system available; Built-in OpenEBS to support dynamic consumption of LocalPV; integration with major distributed storage via CSI, including Ceph, GlusterFS, and NFS; Volume snapshots, capacity management, monitoring, and other O&M features supported;	Custom SDS solution based on Rook Ceph and NooBaa; Integration with major distributed storage via CSI, including Ceph, GlusterFS, and NFS;	Underlying container storage available via Longhorn, the self-developed open-source block storage; Integration with major distributed storage via CSI, including Ceph, GlusterFS, and NFS;
	Network policy and management	Visualization of Kubernetes-native network policy management	Kubernetes-native network policy management and network isolation	Network policy management in native ways such as YAML and CLI;

|			between different tenants and projects;	
		Network isolation between different tenants (workspaces) and projects (namespaces); Built-in Pod IP pool for visualized management; Visualization of network traffic topology based on Weave		
Multi-tenancy and Security	Multi-tenancy and permission management	Isolation of tenants in workspaces and tenant quota management available to meet business needs; User group management supported; Built-in account roles on top of abstraction of Kubernetes RBAC for different levels, including platform, cluster, and application; custom role permissions supported; Multi-tenant (cluster, workspace, project) isolation supported for all features on the platform	Project-level tenant management supported; User role permission configurations supported via YAML files; Project quota configurations supported via YAML files; Two built-in management roles: administrator and developer;	Management of multiple namespaces via projects; Project quota supported; Adding members and binding roles to members supported on web pages
	Authentication and authorization	Integration with AD and LDAP supported; Identity providers supported,	Built-in OAuth service for integration with multiple identity providers,	Integration with AD, OpenLDAP, and FreeIPA; OAuth and SAML identity providers

		including CAS, OIDC, and iDaaS; Service Account management supported	including LDAP, Keystone, OpenID Connect, and OAuth	supported, such as Keycloak and Okta
	Security	Pod Security Context applied for Pod security policy management; Permission control across multiple clusters supported; Password protection policies supported to prevent brute-force attacks on account passwords	Security Context Constraints applied for Pod security policy management, but OC command lines required for edit	PSP and OPA GateKeeper supported as the consistent management tools for global security policies on the platform
Others	Windows Container Support	Not supported yet	Supported as a Work Node	Supported as a Work Node
Commercial Services and Support	Services and support	Online technical support and services via ticket subscription per number of times and duration of services; the quickest initial response available within 1 hour to provide 2-hour ongoing response; 24/7 support also available	Support available according to severity level; the quickest initial response (for Severity 1) available within 1 hour to provide 2-hour ongoing response; 24/7 support also available	Support available according to severity level; the quickest initial response (for Severity 1) available within 1 hour to provide 1-hour ongoing response; 24/7 support also available
	Cost	$	$$$$$	$$$

Note: The products are listed in alphabetical order.

1.3 Summary

1.3.1 KubeSphere

KubeSphere is more productized and easier to install than Rancher and OpenShift despite the fact that KubeSphere is a late starter. KubeSphere is designed to integrate open-source projects and components in the cloud-native ecosystem into a unified container platform product, ensuring consistent user experience in all features and interoperability and minimizing user barriers.
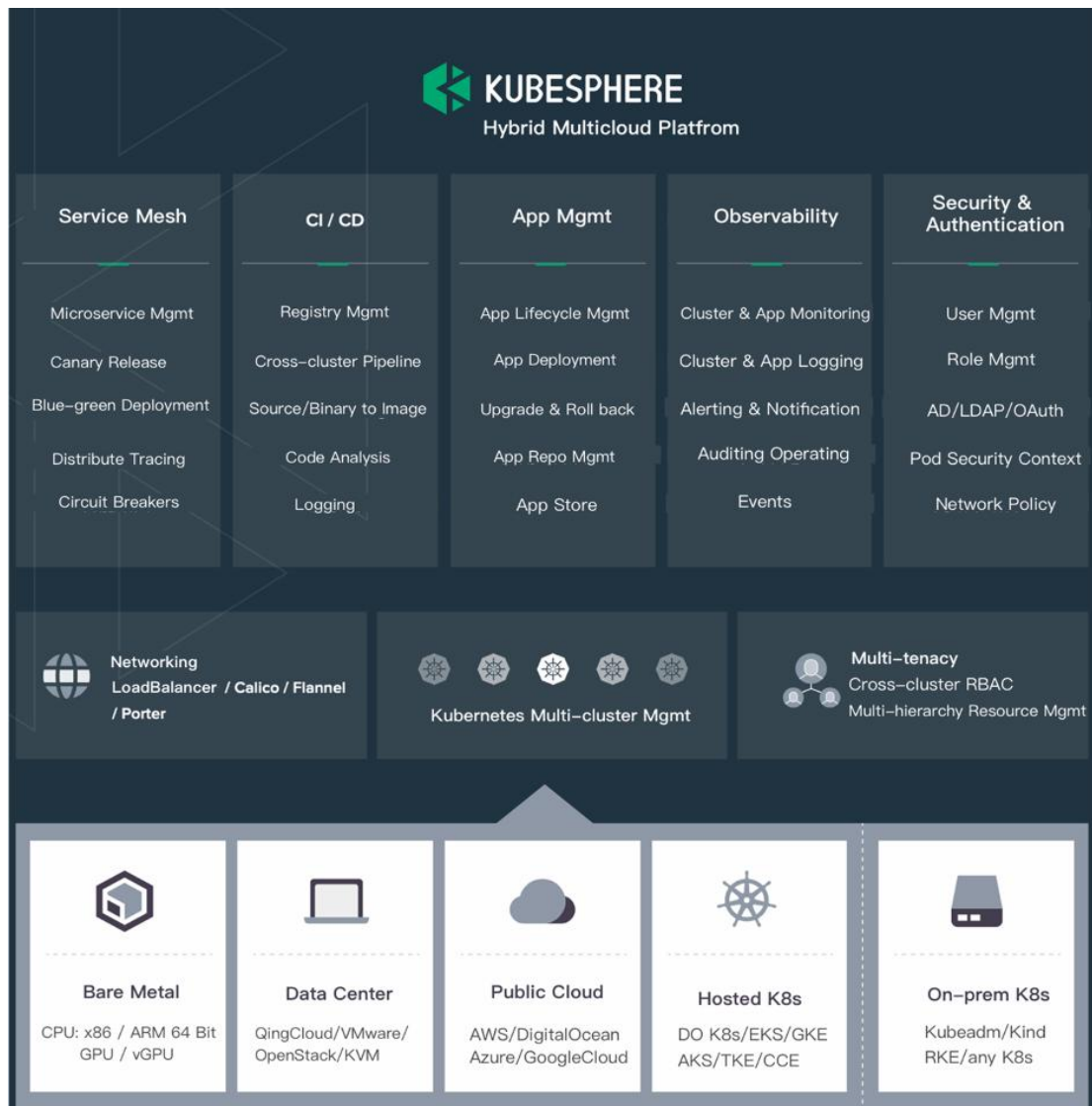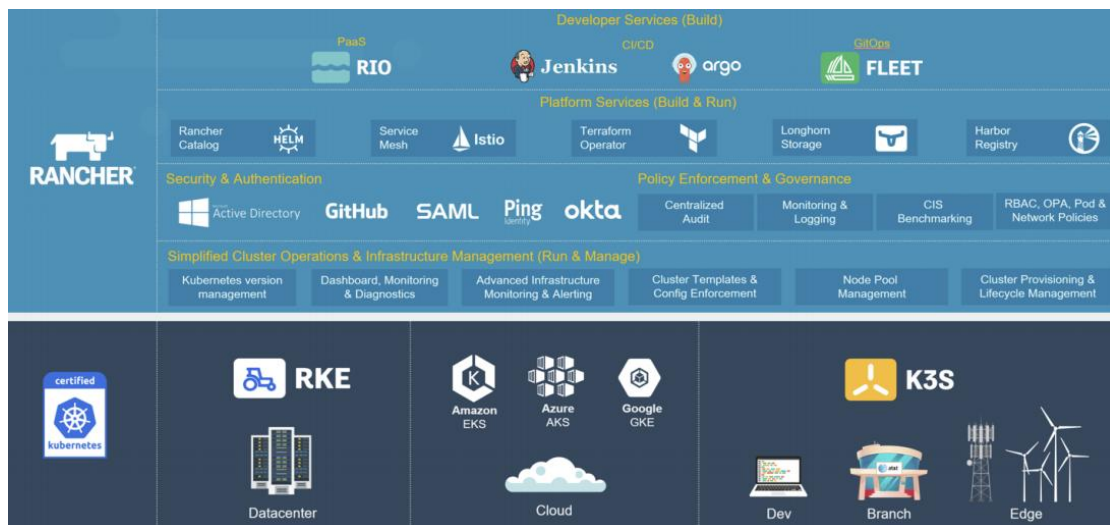

KubeSphere Functional Architecture

1.3.2 OpenShift

OpenShift products are comprehensive in terms of functionality with the advantage of Red Hat's long-standing technical, ecological, and customer experience in Linux and Kubernetes. However, OpenShift leads to higher vendor binding possibilities. For example, RHCOS and RHEL are required for installing the Master node operating system. Besides, several features, such as multi-cluster and edge computing, are not supported in the open-source edition and need to be obtained through a subscription to commercial licenses and commercial solutions. Since it also provides the most expensive commercial subscription services, OpenShift is suitable for enterprises that depend heavily on Red Hat's commercial software solutions or large enterprises that have very high demands for cloud-native security.
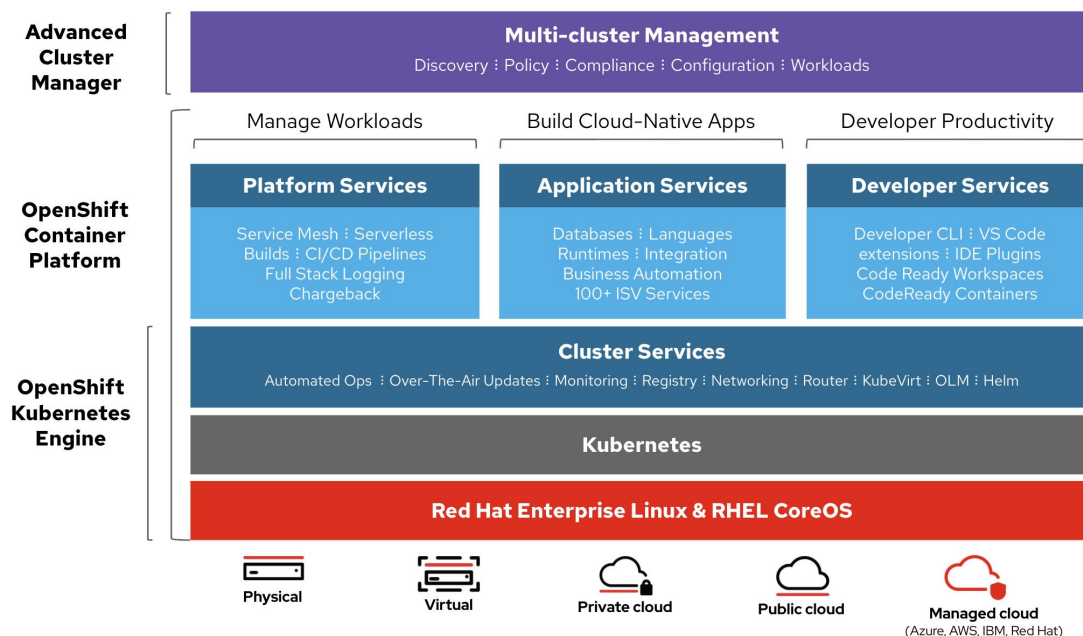
OpenShift Functional Architecture

1.3.3 Rancher

Rancher products are very lightweight with the advantage of extension and support of underlying components such as the open-source projects K3s and Longhorn. However, its overall product design philosophy is more Kubernetes-native, and most of its cores require the installation of third-party open-source components to piece together features with different projects and user interfaces. To handle different scenarios, users need to have an in-depth understanding of the concepts and use of Kubernetes and cloud-native ecological projects. Since its products bring a high learning curve, Rancher is suitable for Kubernetes cluster O&M personnel who have a basic understanding of cloud-native technology.

Rancher Functional Architecture

2. Technical Architecture

2.1 Architecture Overview

2.1.1 KubeSphere

KubeSphere separates front end and back end to implement a cloud-native design. Functional components on the back end can integrate external systems through REST API. KubeSphere has no underlying infrastructure dependencies and can run on any Kubernetes clusters, private clouds, public clouds, VMs, or bare metals. In addition, it can be deployed on any Kubernetes distributions.
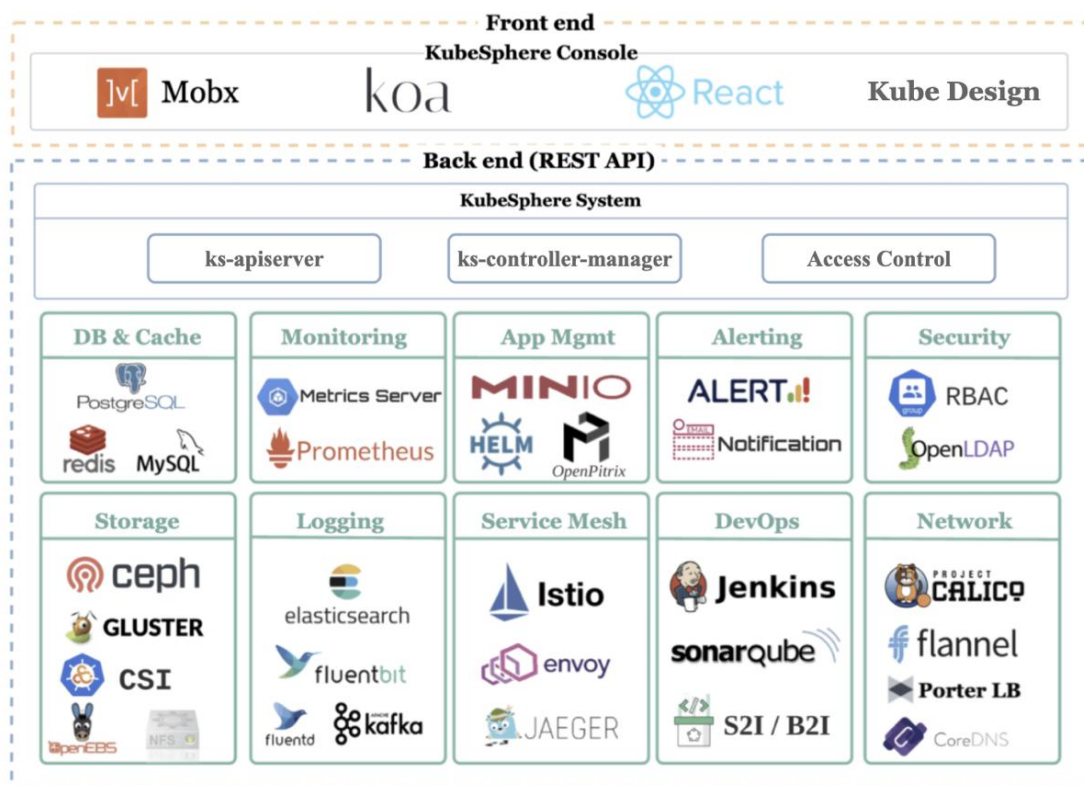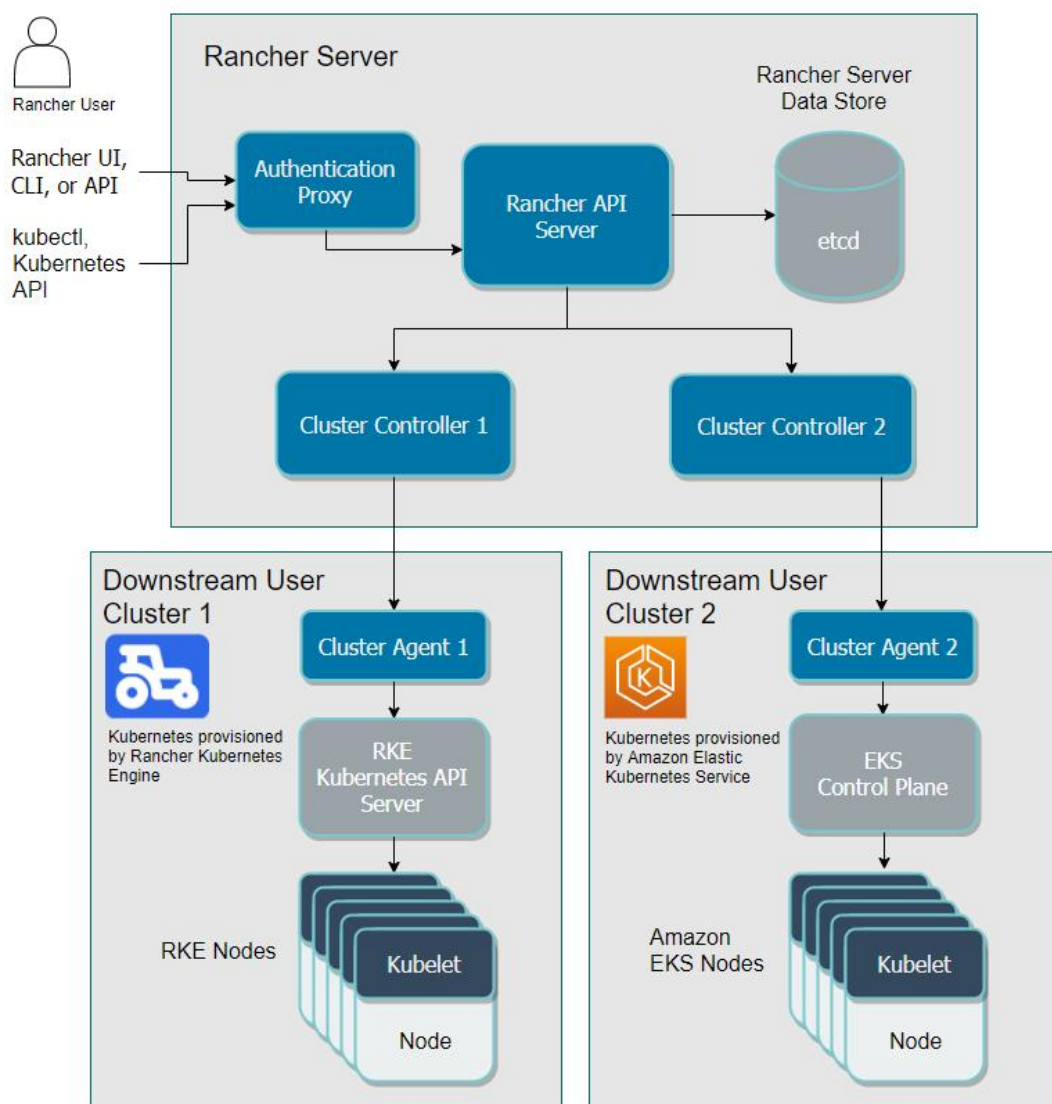

KubeSphere Technical Architecture

2.1.2 OpenShift

2.1.3 Rancher

The Rancher Server consists of Authentication Proxy, Rancher API Server, Cluster Controller, etcd node, and Cluster Agent. All the components are deployed in the Rancher Server except for the Cluster Agent.

Rancher Server Technical Architecture

2.2 Architecture Characteristics

2.2.1 KubeSphere

Compared with the technical architecture of other products on the market, KubeSphere's technical architecture is more integrated with and native to Kubernetes. KubeSphere is deployed as an application on Kubernetes to manage resources and applications on Kubernetes, reflecting the concept of "in Kubernetes for Kubernetes".

For more information, see: [KubeSphere architecture introduction](#).

2.2.2 OpenShift

OpenShift's underlying operating system is bound to Red Hat products, RHCOS and RHEL. This practice reduces overall maintenance costs but decreases the flexibility to extend product solutions.

For more information, see: [OCP 4.8 document](#).

2.2.3 Rancher

Rancher Server manages the RKE cluster deployed by Rancher. The architecture is loosely coupled with Kubernetes but may cause performance bottlenecks. In addition, stability issues may also arise because the ability of Kubernetes scheduling system is not leveraged.

For more information, see: [Rancher architecture introduction](#).