

# CLOUD-NATIVE TECHNOLOGY PRIMER FOR VMWARE CLOUD PKS

Understand the Cloud Technology that Powers and Integrates with a Kubernetes-as-a-Service Platform

## VMware Cloud PKS

VMware® Cloud PKS presents Kubernetes as a VMware Cloud Service so you can deploy and orchestrate containerized applications at any time and from any location without the overhead of setting up and managing either Kubernetes or its underlying infrastructure, which are managed for you by VMware. The public beta of VMware Cloud PKS is available through VMware Cloud™ Services.

VMware Cloud PKS embodies two properties that set the stage for the information on the technology related to VMware Cloud PKS described in this paper:

- **Software as a service (SaaS)**, which is an application running on cloud infrastructure that is used over a network, typically the Internet, instead of being downloaded and installed on a local machines. The consumer of the service does not manage or control the underlying cloud infrastructure or the application's capabilities. A SaaS application is also known as a web app. VMware Cloud PKS is a SaaS platform with usage-based billing that lets you deploy your own web app as a containerized application and manage it with Kubernetes. More specifically, VMware Cloud PKS provides Kubernetes as a service, or KaaS.
- **Multicloud**, which is an approach to cloud computing that lets you combine several cloud providers, platforms, or services in one environment or architecture. A multicloud strategy reduces reliance on a single vendor, protects your cloud services from outages, lets you tailor your architecture to your needs, and gives you the flexibility to switch solutions if your needs change. The portability of containers facilitates a multicloud strategy. You can also use both VMware Cloud PKS and VMware PKS at the same time to broaden your multicloud strategy.

## Technology Powering VMware Cloud PKS

Here's a brief explanation of some of the core technology that powers VMware Cloud PKS. If you're familiar with Kubernetes and containers, you skip this section.

### Kubernetes

Kubernetes is an orchestration system that automates the deployment and management of containerized applications. As an application and its services run in containers on a distributed cluster of machines, Kubernetes orchestrates all the moving pieces to optimize the use of computing resources, maintain the desired state, and scale on demand. Kubernetes is also referred to as an orchestration framework or an orchestration engine. VMware Cloud PKS uses native upstream certified compliant Kubernetes.

### Containers

A container is a portable executable format, known as an image, for packaging an application with all its dependencies and instructions on how to run it. When the container image is executed, it runs as a process on a computer or virtual machine with its own isolated, self-described application, file system, and networking.

The use of containers is increasing because they provide a portable, flexible,

## VMWARE CLOUD PKS AT A GLANCE

VMware Cloud PKS delivers Kubernetes as an easy-to-use cloud service that is managed by VMware so you can deploy, orchestrate, and scale containerized applications without the burden of implementing, operating, and maintaining Kubernetes. VMware Cloud PKS uses AWS or, soon, Azure as its underlying infrastructure.

**KEY BENEFITS OF VMWARE CLOUD PKS**

- Control costs with an elastic VMware Smart Cluster™ that dynamically adjusts to changes in demand.
- Run containers on AWS without managing servers or clusters.
- Get seamless integration with AWS compute, storage, analytics, and services, such as AWS Machine Learning.
- Manage globally distributed Kubernetes clusters from a single service endpoint on consistent infrastructure.
- Apply security policies to control access at a granular level in Kubernetes.
- Integrate with Wavefront® by VMware® for monitoring and analytics.

and predictable way of packaging, distributing, modifying, testing, and running applications. Containers speed up software development and deployment.

**Docker**

Docker is a widely used container format. Docker defines a standard format for packaging and porting software, much like ISO containers define a standard for shipping freight. As a runtime instance of a Docker image, a container consists of three parts:

- A Docker image
- An environment in which the image is executed
- A set of instructions for running the image

**Photon OS**

An open-source project from VMware, Project Photon OS is a Linux operating system optimized for running containers. With VMware Cloud PKS, the Docker daemon runs on Photon OS, which is the underlying Linux container host in the Kubernetes clusters.

**Lightwave**

VMware Cloud PKS uses an open-source security platform from VMware called Lightwave. It provides a directory service, a certificate authority, and a secure token service. Lightwave is a critical system component that gives VMware Cloud PKS the ability, through certificates and security protocols, to apply a range of security countermeasures for identity management, authentication, and access control.

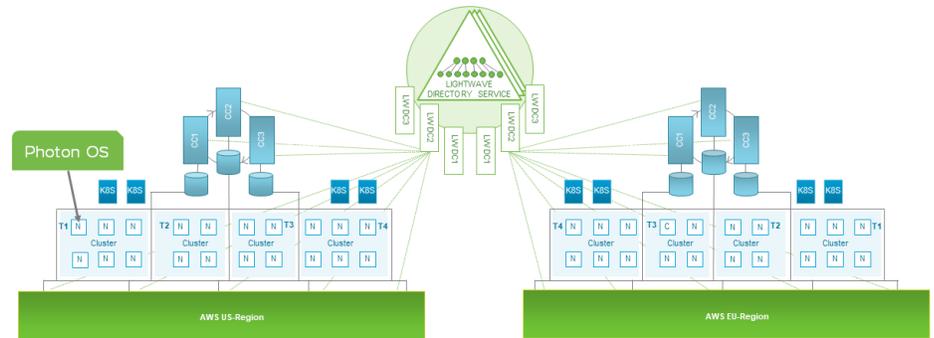


Figure 1: Lightwave, an open-source security platform from VMware, is a distributed system that works behind the scenes of VMware Cloud PKS to authenticate users, control access, and manage certificates. In Kubernetes clusters on VMware Cloud PKS, Photon OS is the Linux container host.

**Integrations with Other Technology**

Here’s a brief description of other cloud-native technology that you can integrate with VMware Cloud PKS to extend its power or to fulfill your own unique requirements. You should, as a best practice, integrate other technology with VMware Cloud PKS as a service in the cloud.

**AWS Web Services**

VMware Cloud PKS gives you turnkey access to public cloud services and application building blocks, such as the following:

- Amazon Machine Learning
- AWS Lambda

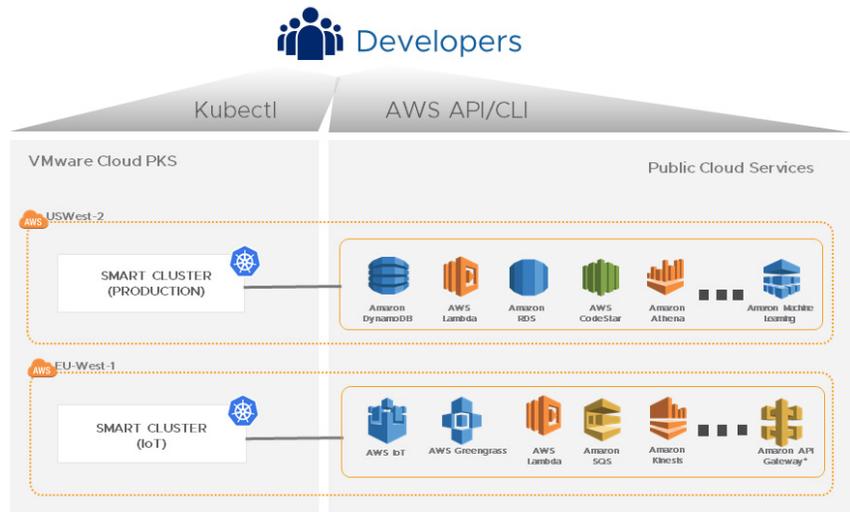


Figure 2: VMware Cloud PKS gives you turnkey access to public cloud services and application building blocks like Amazon Machine Learning, AWS Lambda, AWS Greengrass, and AWS IoT.

- AWS Greengrass
- AWS IoT

VMware Cloud PKS also gives you turnkey access to services that are part of VMware Cloud, such as Wavefront® by VMware®.

As you use VMware Cloud PKS to build and deploy cloud-native applications and 12-factor apps in the VMware Cloud, you can tap into these services to, for example, analyze data from the Internet of things or create machine learning applications.

### Wavefront

VMware Cloud PKS can be integrated with Wavefront by VMware to efficiently monitor containers at enterprise scale. Wavefront delivers monitoring and analytics throughout a cloud-native stack for always-on metrics as a service. When integrated with VMware Cloud PKS, Wavefront gives developers and DevOps real-time visibility into the operations and performance of containerized workloads and Kubernetes clusters.

### Code Stream

VMware Code Stream™, which is part of VMware Cloud™, provides continuous integration and continuous delivery as a service to accelerate software delivery. CI/CD readies an application or part of an application for production by packaging and validating it. You can integrate Code Stream with VMware Cloud PKS.

By establishing release pipelines and displaying analytics in a release dashboard, Code Stream helps you improve software testing, speed up troubleshooting, and release software earlier and more frequently.

### CloudBees

CloudBees Core provides a continuous integration and continuous delivery engine by extending the open-source Jenkins automation server to improve security and compliance, rapidly add developers to its system, and include best practices. CloudBees Core, which is built with Docker and Kubernetes in mind, can be integrated with VMware Cloud PKS.

## THE BENEFITS OF MICROSERVICES

Coupled with containers, microservices are increasingly becoming the architectural pattern of choice for developing a new application. The architecture breaks up the functions of an application into a set of small, discrete, decentralized, goal-oriented processes, each of which can be independently developed, tested, deployed, replaced, and scaled.

- Increase modularity
- Make an application easier to develop and test
- Parallelize development: A team can develop and deploy a service independently of other teams working on other services
- Support continuous code refactoring to heighten the benefits of microservices over time
- Drive a model of continuous integration and continuous deployment
- Improve scalability
- Simplify component upgrades

## LEARN MORE ABOUT VMWARE CLOUD PKS

To learn how VMware can help you deploy, manage, and secure cloud-native applications on VMware Cloud PKS, visit: [cloud.vmware.com](http://cloud.vmware.com)

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## Istio

Istio creates a service mesh at the application layer above virtual IP addresses and ports to manage the interactions of the microservices. A service mesh might deliver service discovery, forwarding, monitoring, and service-to-service authentication. Service discovery is the automatic detection of services.

Istio intercepts network communications among the microservices that make up a containerized application deployed on Kubernetes to manage and help secure the microservices as they interact. Istio lets you oversee the interactions of microservices at a microscopic level.

## Fluentd, Fluent Bit, and Elasticsearch

Fluentd is an open-source data collector for unified logging. Fluent Bit is a lightweight data forwarder for Fluentd. Fluentd is used to create a unified logging layer to collect and process data. Fluent Bit is for forwarding data from the edge to Fluentd aggregators. Fluentd and Fluent Bit can be integrated with VMware Cloud PKS to collect logging data and push it to an output destination, such as Elasticsearch, which is a distributed search and analytics engine that lets data engineers query unstructured, structured, and time-series data.

## Jaeger

Jaeger is a distributed tracing system that was released as open-source software by Uber Technologies. Jaeger can monitor microservice-based architectures. Use cases include distributed transaction monitoring, root cause analysis, service dependency analysis, and performance optimization. Jaeger, which is hosted by the CNCF, can be integrated with VMware Cloud PKS.

## Prometheus and Grafana

Prometheus is an open-source monitoring system for Kubernetes that can be integrated with VMware Cloud PKS. Prometheus excels at monitoring multi-dimensional data, including time-series data. Prometheus is hosted by the Cloud Native Computing Foundation, of which VMware is a member.

Grafana is an open-source metrics dashboard commonly used with Prometheus to display data. Prometheus and Grafana can be integrated with VMware Cloud PKS.

## Helm Chart

Istio, Prometheus, and Grafana are typically packaged as a Helm Chart and deployed on Kubernetes by using the Helm tool. A Helm Chart is package of Kubernetes resources that are pre-configured, customized, and reproducible; you can then manage a chart with the Helm tool. The charts help improve the portability of Kubernetes applications. A single chart can contain an entire web application, including databases, caches, HTTP servers, and other resources.

## Conclusion

All the VMware Cloud PKS-related technology covered in this primer—containers, Kubernetes, microservices, monitoring systems, and open-source software—converges into a powerful recipe for digital transformation: You can optimize the use of your computing resources and your software development practices to extend your enterprise's adaptability, productivity, innovation, competitive advantage, and global reach.