



Introduction to NetApp Kubernetes Service

A New Way to Use Kubernetes on AWS

ABSTRACT

This guide is an introduction to NetApp® Kubernetes Services (NKS). It begins with a broad overview of the benefits of Kubernetes and containerization and then introduces some of the common issues that users encounter when operating Kubernetes clusters in the cloud—issues that NKS can solve. The guide then looks in depth at NKS and how this new service from NetApp can enhance the use of Kubernetes with Amazon Elastic Container Service for Kubernetes. It also explores provisioning and managing persistent storage with NetApp Trident and NetApp Cloud Volumes Service for AWS.

INTRODUCTION

[Kubernetes](#)' market share dwarfs other container orchestration platforms in the cloud, such as Docker Swarm and [Amazon Elastic Container Service](#) (Amazon ECS). New commercial Kubernetes service offerings are making it possible to take advantage of Kubernetes in [hybrid cloud](#) environments, simplifying the job of software developers by allowing them to develop and test new applications by using Docker containers, and allowing [DevOps](#) teams to easily scale those containers out across a cluster of machines in the cloud by using Kubernetes.

Even though Kubernetes makes it easier to deploy and operate container execution at scale, there are still many challenges, including keeping



clusters patched and up to date with the latest releases of Kubernetes; managing hybrid cloud deployments; and ensuring the smooth operation of cluster workloads, such as those that use a microservices architecture. Many of these services are often stateful, and therefore require access to some form of persistent storage, which adds significant complexity to Kubernetes deployment and management.

This guide examines how NetApp Kubernetes Service meets the challenges of deploying and managing Kubernetes on AWS, while at the same time easily provisioning persistent volumes by using NetApp cloud data storage solutions.

Deploying and Managing Kubernetes

Kubernetes helps you take container deployments into production by providing a solution for high availability, horizontal scaling, persistent storage, monitoring, and container management. This solution uses a grid of worker nodes managed by one or more Kubernetes master nodes that form the cluster control plane. The master nodes are responsible for scheduling pods, groups of containers that interoperate closely with each other across the worker nodes in the cluster.

Kubernetes continually monitors the cluster in order to balance the workload evenly across the worker nodes. The cluster reacts to pod failure by restarting the pod, possibly on a different node, and

it can also be instructed to spin up a larger number of pods to deal with an increase in workload. This is the basis for making container applications that run on Docker scalable and fault tolerant.

Kubernetes offers a wide range of built-in storage provisioners that integrate with Amazon Elastic Block Store (Amazon EBS) in the Amazon Web Services (AWS) cloud. Shared storage, such as NFS, can also make use of the same storage from multiple pods concurrently. However, provisioning and managing persistent storage can become more difficult as cluster size increases. Ensuring that the pod storage used by Kubernetes for business-critical data is fault tolerant, highly available, and provides consistent levels of I/O performance is out of scope for Kubernetes.

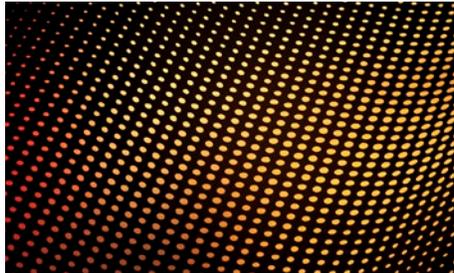
Similarly, Kubernetes administrators must deploy their own platforms and tools to manage the actual workloads deployed to the cluster. Microservice architectures require secure communications between constituent services, with the ability to manage the flow of traffic with dynamic changes to routing information. These facilities are usually provided by a service mesh, such as Istio.

To meet the rising demand for Kubernetes deployment, cloud vendors are releasing their own managed Kubernetes solutions. On AWS, that solution is Amazon Elastic Container Service for Kubernetes ([Amazon EKS](#)).

But what if your Kubernetes clusters extend to other environments?

AMAZON EKS

- Fully managed Kubernetes service on AWS
- Built across Availability Zones to eliminate points of failure
- Encrypted and secure communication between nodes
- Compatible with standard Kubernetes workloads



With NetApp Kubernetes Service (NKS), you have another option for Kubernetes deployment with AWS. You could build a cluster by using [Amazon Elastic Compute Cloud](#) (Amazon EC2) directly, with support for NVIDIA Tesla GPU-enabled worker nodes. That option also gives you greater control of the master nodes and facilitates an easier transition to building clusters on Amazon EC2 directly if you're currently using Amazon EKS. Having the flexibility to deploy Kubernetes in the way that you need it is a significant part of the value offered by NKS, as discussed in the next section of this guide.

NetApp Kubernetes Service

NetApp Kubernetes Service (NKS) is a complete solution for deploying and managing Kubernetes and the workloads that operate on Kubernetes clusters. NKS is now available for use with AWS, providing a consistent interface for deploying Kubernetes in your cloud environment, either by using the managed Kubernetes service, such as Amazon EKS, or directly off of Amazon EC2. This solution gives you a single pane of glass for managing your global deployment of Kubernetes.

NKS offers an innovative and intuitive web-based user interface for deploying and managing Kubernetes clusters. NKS is a fully managed solution that is part of [NetApp Cloud Central](#), so there is nothing to install. New clusters can be deployed to any cloud environment with just a few clicks, dramatically simplifying the process of getting up and running with cloud-based container orchestration.

After you deploy a new cluster, NKS helps you keep your cluster up to date with the latest releases of Kubernetes. In fact, the NKS dashboard provides bell notifications when critical security issues are found that can be resolved by upgrading to the latest version of Kubernetes. It's easy to scale the cluster with new nodes through the NKS dashboard, regardless of the underlying platform used to host the cluster. NKS also offers direct integration with NetApp cloud storage solutions, such as Cloud Volumes Service, which offer robust and high-performance iSCSI and NFS storage solutions for provisioning [persistent storage](#).

Managing Persistent Storage

The integration of NKS with Cloud Volumes Service is achieved through the NetApp Trident Kubernetes storage provisioner, which is automatically deployed to new clusters created with NKS. Trident is NetApp's open-source and fully supported solution for integrating NetApp storage solutions with

NETAPP KUBERNETES SERVICE

- Fully managed solution
- Fully integrated with Amazon EKS
- Web-based user interface
- Regular and managed updates for Kubernetes
- Easy scaling
- Works directly with NetApp Cloud Volumes Service
- Federate clusters for large-scale deployments

any Kubernetes cluster. Native Kubernetes manifests are used to achieve this integration, which means that users don't need to adopt new processes or procedures to use this storage.

[NetApp Cloud Volumes Service](#) is an enterprise-grade solution for data storage in the cloud, providing a fully managed solution for robust and very high-performance NFS storage in AWS. Cloud Volumes Service comes with NetApp's high-quality data management features such as instant, space-efficient snapshots, data cloning, and high availability that is resilient against Availability Zone failures. Having access to this kind of storage solution directly from your Kubernetes cluster makes it much easier to provision reliable, flexible, and high-performance persistent volumes.

An example of the flexibility of NetApp cloud storage solutions is the use of data cloning to quickly create clones of existing storage volumes. This process gives you immediate access to temporary, writable copies of existing file share volumes. NKS users on AWS can take advantage of cloning from directly within their Kubernetes clusters by using native Kubernetes manifests, because the NetApp Trident storage provisioner can be instructed to create a clone of an existing persistent volume, rather than dynamically provisioning a new one, using a metadata annotation.

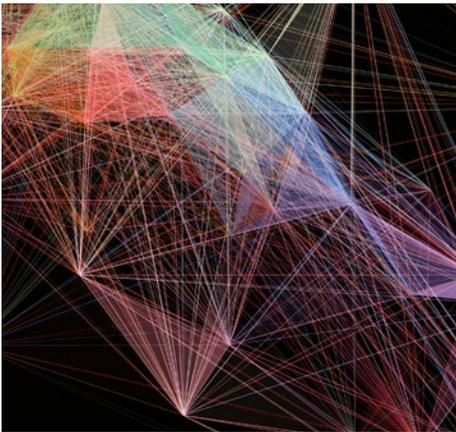
Cluster Management

After deploying a set of clusters, potentially across different AWS regions, NKS allows you federate a number of those clusters together. In that way you can use DNS services in the cloud to route incoming requests to any of the back-end clusters that are part of the federation. Federating gives you access to almost unlimited scalability around the globe, as well as superior guarantees of availability and uptime, all with just a few clicks.



The main NKS control plane dashboard also directly supports creating an Istio service mesh across multiple Kubernetes clusters. Istio offers service discovery, routing and traffic management, security, and graphical monitoring for the microservices that you deploy to Kubernetes, helping to resolve a wide variety of management issues that surface when a large number of services require reliable and secure communication with each other. NKS automatically handles the deployment of the Istio management services and the Envoy sidecar proxy.

The Istio management services, such as Pilot and Citadel, allow microservices to talk to each other reliably and securely. Routing information can be changed at runtime without the need to restart services, with calls from one microservice to another intelligently load balanced across the cluster and retried on failure. Istio uses a built-in certificate authority to ensure that all traffic between services is automatically and transparently encrypted, freeing application developers from having to implement these features themselves.



In addition to Istio, the NKS dashboard can also be used to deploy other prepackaged solutions into your cluster from a curated list of tested software options. This list includes solutions such as Prometheus, Helm, Redis, PostgreSQL, and RabbitMQ, to mention just a few. These solutions

give you ready access to powerful Kubernetes resources that you can deploy straight into your clusters.

NKS also brings structure to the overall management of Kubernetes clusters by allowing each cluster to be created in a specific workspace. NKS users are grouped into teams, and each team manages a set of workspaces. Multiple workspaces exist in an organization, and NKS allows you to create multiple organizations. This arrangement enables you to start with a small deployment of Kubernetes and scale out to manage multiple tenants, each with many workspaces, all under a single NKS account, as you grow.

Conclusion

NKS is an all-encompassing solution for deploying Kubernetes to the cloud that goes beyond simply managing the Kubernetes control plane. Using the Kubernetes dashboard, users can deploy new clusters to AWS and other environments by using a consistent interface, and then optionally federate the clusters together and manage them by using a single service mesh. By handling the deployment of the cluster, providing solutions for the management of cluster workloads, and giving easy access to robust persistent data storage, NKS deals with all aspects of production Kubernetes deployment.

NKS automatically deploys new clusters with NetApp Trident, which simplifies integration with NetApp on-premises and cloud storage solutions, across cloud environments. This means that you can use NetApp cloud data services to deploy Kubernetes and provision persistent storage by using the same solution. NetApp cloud data solutions, such as Cloud Volumes Service, give you the benefits of the NetApp storage technology stack in AWS, for use with Kubernetes or independently for other enterprise workloads.

Visit [NetApp](#) online to learn more about streamlining all aspects of production Kubernetes deployment and application lifecycle management by using [NetApp Kubernetes Service](#) and [Cloud Volumes Service for AWS](#). [NetApp Kubernetes Service](#) and [NetApp Cloud Volumes Service for AWS](#) are available at the [AWS Marketplace](#).