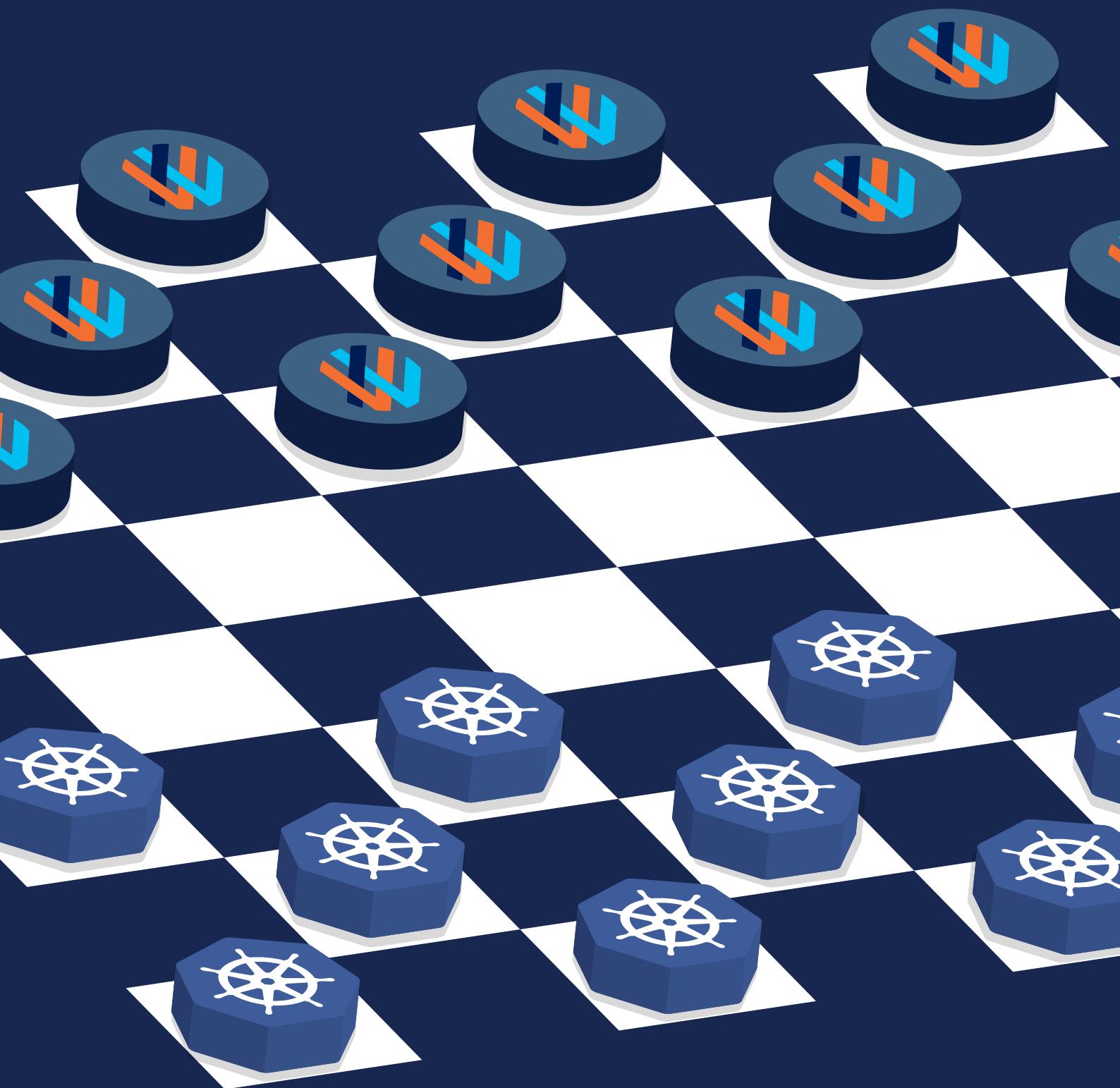
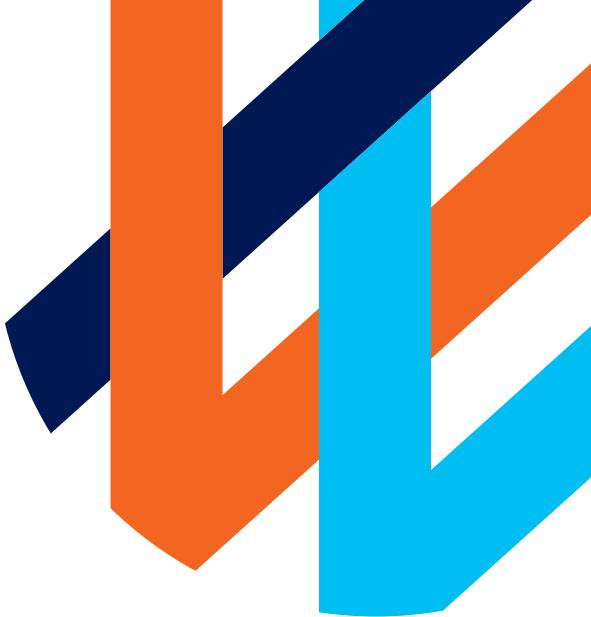


Implementing a Kubernetes Strategy in Your Organization





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Because Kubernetes was designed from the beginning with the idea of software development and operations working together, operations tasks and how they get performed are an integral component of Kubernetes architecture and design. Almost everything in Kubernetes uses declarative constructs that describe how applications are composed, how they interact and how they are managed. This enables a significant increase in the operability and portability of modern software systems. It also allows developers to use [GitOps](#) in their development and operations pipelines which increases the velocity and reliability of feature deployments.

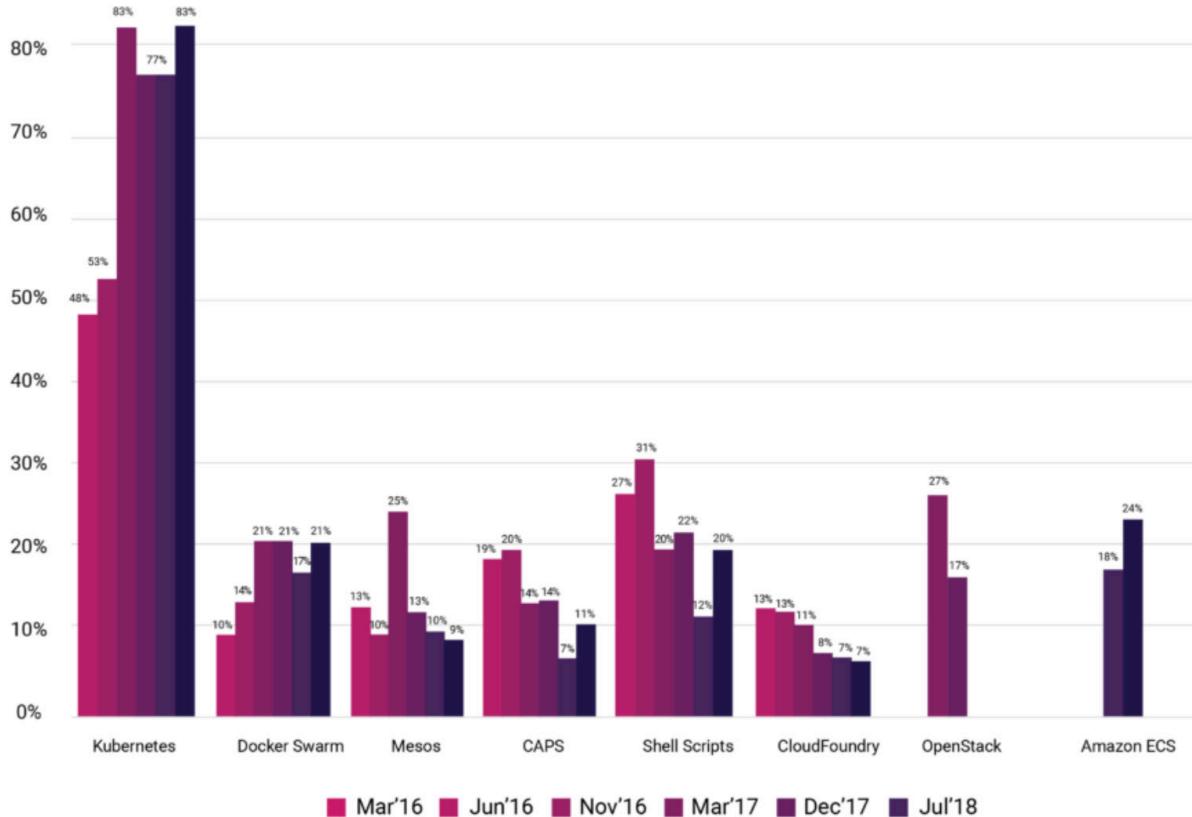
Delivering and building a Kubernetes platform

In this white paper, we'll discuss several ways to implement Kubernetes in your organization. Some questions we'll address include:

- How and where is Kubernetes being used today?
- Do you manage development on multi-tenant clusters or use multiple clusters?
- What team is responsible for cluster administration?
- What are the tradeoffs of a centralized approach versus a more distributed one?

Kubernetes growth and adoption

The chart below shows the skyrocketing interest in cloud native technologies like Kubernetes. Taken from a survey conducted by the CNCF, the chart displays those who are managing containers with Kubernetes.



What it indicates, is that Kubernetes will be the way we run containers and containerized applications for quite some time. This is further validated by the rising attendance rates at Kubecon attracting close to 10,000 attendees (doubled over last year's attendance),¹ 3,400 participating companies and more than 400 companies who are CNCF members.

The uptake of Kubernetes is truly astonishing with nearly 80% of teams using containers and 70% of those making the shift to Kubernetes are even running it in production.² You could say that we are in the middle of a Kubernetes adoption revolution. Exciting times lay ahead as more and more companies leverage the power of Kubernetes and cloud native to innovate and move their businesses forward.

¹ "Kubernetes turns five: Cloud Native goes mainstream," (May 2019) [451 Research](#), Fellows, William

² [Add it Up: Enterprise Adoption of Kubernetes is Growing](#), (Dec 2018) New Stack, Hecht, Lawrence

Towards a common cloud native platform

Kubernetes is designed for production because of its resilience, failover and self-healing properties. But even more importantly, Kubernetes has a very strong and thriving open source ecosystem with good security. Besides fostering and sustaining an ecosystem of open source, vendor-neutral projects, another goal of the CNCF is to provide the building blocks for a common cloud native platform that enterprises can use within their own organizations.

There are many open source projects available in the CNCF that you can choose from to help you build a platform and to lay the groundwork for your teams to increase velocity. How you go about choosing and implementing those projects though, can be a major challenge for most organizations.

How do you implement a Kubernetes strategy across your organization without suppressing innovation and productivity, since in the end, these are two of the major reasons for making the transition to Kubernetes in the first place?

KEY CHALLENGES TO KUBERNETES ADOPTION

According to several recent surveys conducted by the CNCF, the top challenges³ most organizations face with Kubernetes adoption are:

- Cultural Changes with Development Teams (41%)
- Complexity (40% up from 35%)
- Lack of Training (40%)
- Security (38% down from 43%)
- Monitoring (34% down from 38%)
- Storage (30% down from 41%)
- Networking (30% down from 38%)

Early on in the Kubernetes adoption cycle, the challenges for most companies were security and storage, but now these concerns have shifted toward how to organize and optimize your teams use of Kubernetes for application development.

Getting your developers, DevOps and IT teams to work together to implement Kubernetes correctly is one of the biggest challenges faced. The overall complexity of Kubernetes is high and a lack of skills⁴ can even further hinder adoption in your organization.

³ [CNCF Survey: Use of Cloud Native Technologies in Production Has Grown Over 200%](#)

⁴ [How companies adopt and apply cloud native infrastructure](#)

HOW AND WHERE IS KUBERNETES BEING USED TODAY?

Before you can start defining a Kubernetes strategy, you need to understand how people inside of your organization are using Kubernetes today. From our experience at Weaveworks, we see three different patterns emerge in how clusters get deployed:

1. Cluster per specific app workloads

From customers that we work with, most clusters are deployed to run specific app workloads. The clusters are generally maintained by SREs and DevOps teams. But it is also very common place that Kubernetes is implemented by a platform team to run a specific app or specific workloads tied to a particular business function.

2. Emerging edge computing

Another pattern of installation is the emergence of edge computing. Edge computing is an on-premise network of Kubernetes clusters that are managed on site. This is a common set up for storefronts, and factories. Chick-fil-A is a famous example of edge computing with Kubernetes. They deployed a small Kubernetes cluster in each of their restaurants to help calculate time of delivery and optimize sandwich delivery.⁵

3. Multiple clusters throughout an organization

Another common pattern we see are many individual clusters running throughout an organization. There are different versions of Kubernetes, each running a custom variation of a software stack. In this decentralized approach, each team is running a version of a cluster to meet their own agility, and business requirements.

As we'll discuss later on in this paper, you may also opt for a centralized approach that fits well with a multiple cluster approach across teams

INSTALLING KUBERNETES IS NOW SIMPLE

Things have come a long way since the publication of Kelsey Hightower's infamous, "Kubernetes the Hard Way."⁶ Two years later there are many different options available for installing Kubernetes that makes spinning up a cluster quite simple using any one of these environments:

- On-premise Kubernetes
- Hosted Kubernetes in a public cloud
- Managed and hosted Kubernetes

5 [How Chick-fil-A Uses Kubernetes and GitOps at the Edge](#), December 2018, eWeek by Sean Michael Kerner

6 [Kubernetes the Hard Way](#), Hightower, Kelsey (2016)

Self-managed Kubernetes options	Hosted Kubernetes options
Kubeadm	Google GKE
Kops	Amazon EKS
Rancher RKE	Digital Ocean
Weaveworks EKP	Azure AKS
Roll your own upstream K8S	Oracle, IBM, and others

Installation Options for Kubernetes

Because it's relatively straightforward to install Kubernetes, it's even more critical to streamline Kubernetes adoption and use it throughout your organization.

MULTI-TENANT VS MULTICLUSTER

There are competing philosophies on how to manage Kubernetes for development. Some teams work from one enormous cluster, split into different namespaces shared across Dev, QA and Staging. Other teams choose to spin up clusters as they need them.

DevOps teams may spin up separate clusters for staging and QA, and then of course, there are development environments which also need their own cluster. As you can see, the adhoc multi-cluster approach can get quickly out of hand and you can easily end up with a lot of clusters running all over your organization. Multiple clusters not only adds to overhead and maintenance headaches, but they can also incur extra costs and are potentially insecure if not managed properly.

Shared clusters with namespaces

Kubernetes allows you to split a single cluster into different environments and share them across your team using namespaces. There are many cases, however, where it makes sense to run more than one cluster. But with Kubernetes, multiple clusters don't always have to be the default approach. At Weaveworks, we generally have a separate staging cluster before we promote releases to production, but we do development and QA on a shared cluster split into namespaces.

ENTERPRISE IT – WHO IS RESPONSIBLE FOR KUBERNETES?

While we're on the topic of development versus operations, some may wonder who should own Kubernetes? There are often competing problems to be solved between IT, Ops and DevOps or platform teams.

DevOps and platform team goals

For most platform teams, the important issues are whether Kubernetes fits into a company-wide cloud strategy that will increase engineering feature output velocity and encourage innovation. DevOps and platform teams are tasked with defining a suitable platform and a software stack that can be effectively used across engineering.

Depending on how large and diverse the applications being delivered across an enterprise, both teams may need to tie Kubernetes into their existing infrastructure or legacy applications. Both however want to encourage broader Kubernetes adoption across the organization.

IT goals

The goals of an enterprise wide IT department are somewhat broader. While they also want to empower teams and improve productivity, they need to do it efficiently, cost effectively and securely. For most IT departments, creating shared services that are accessible by multiple teams across an organization is appealing. Most IT departments would rather not see individual clusters spun up all over the place.

IT wants to leverage Kubernetes in order to reduce costs and maintenance as well as manage security risk across an organization. A common platform is easier to monitor and also provides consistency for how containers are built and allows for an easier migration path for software stack upgrades.

IMPLEMENTING KUBERNETES – DECENTRALIZED OR CENTRALIZED?

There are a couple of different approaches to take when introducing Kubernetes into your organization: a decentralized self-service model or a more centralized one with a set of shared services and applications.

The trend over time is to create a central services team managed by your DevOps team, or to create a specialized platform team.⁷ With a set of repeatable, shared services that can be drawn from at any time, the chaos of everybody building their own Kubernetes cluster in your organization can be minimized.

⁷ [Gartner Top 10 Trends Impacting Infrastructure & Operations for 2019](#), Costello, Katie (December 2018)

Benefits and tradeoffs

As mentioned earlier, organizations typically don't want to put in place a rigid set of standards that run the risk of suppressing the innovation and velocity that you hope to gain from using Kubernetes in the first place.

	What is it?	Pros	Cons
Decentralized	Teams can roll their own Kubernetes clusters whenever they need to.	<ul style="list-style-type: none">• Maximizes innovation and offers a high degree of autonomy.• Teams can build what they need on demand.	<ul style="list-style-type: none">• Difficult to manage upgrades, tools and security across your organization.• Reduces portability. Hard to manage code across projects.
Centralized	Automate a set of tasks and fully integrated components that are always available across your organization.	<ul style="list-style-type: none">• Can focus on security and compliance.• Simple to move code between projects.• Cost effective.	<ul style="list-style-type: none">• Can be difficult to integrate with the rest of your stack.• Can be too rigid for innovation if not managed properly.

Ultimately, what you want is to strike a balance between having some standards in place, while also providing the ability to spin up a cluster with a vetted and secure full-stack in place so that innovation is unhindered.

BENEFITS OF SHARED CONFIGURATION MANAGEMENT SERVICES

An advantage of offering a shared service in your organization is that you can bring both IT and DevOps together beneath a common platform, satisfying the concerns of each team. With a centralized approach to Kubernetes management, platform components are integrated and kept up to date with the latest releases. This poses less of a risk to the organization. Some components, like setting pod resource limits or RBAC controls are also less complex when they have been preconfigured, allowing them to be more easily adapted by teams.

The benefits of a shared configuration management service is that DevOps and engineering teams can spin up a cluster to run a particular workflow with the tools they need and prefer. Since the tools have been integrated already, IT doesn't need to worry about compatibility or security issues. In addition to this, an automated and standardized approach to configuration management can also allocate the necessary namespaces with the appropriate access controls.

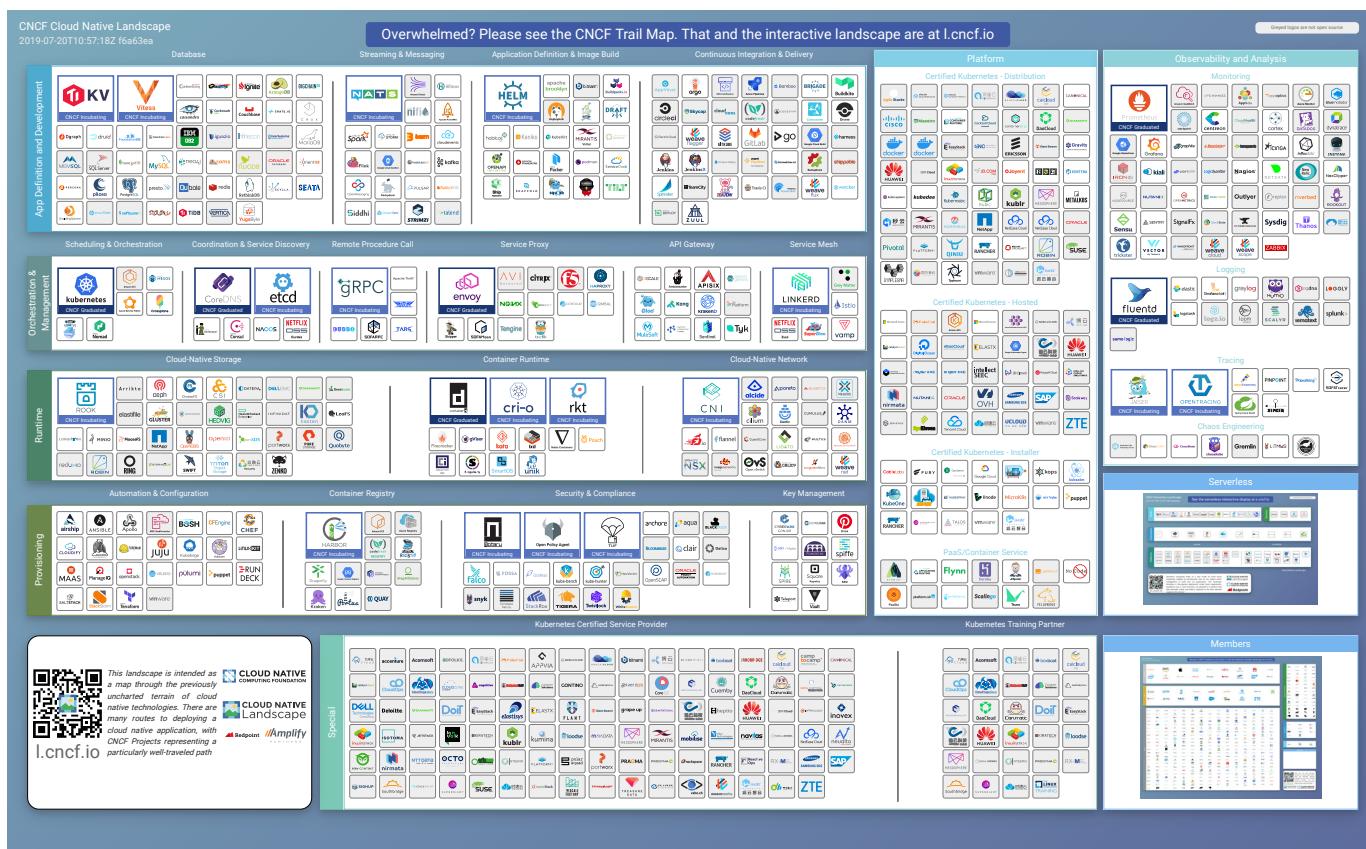
Better security and compliance

The most significant advantage to a centralized approach is that IT can control RBAC settings and also implement a unified approach to authentication using Active Directory or other enterprise wide network authentication registries. This allows you to set who sees what, when and who has the permissions to set up roles. Related to this are other policies that you can set, such as a standard pod network policy, as well as standard third-party image scanning software for containers and other cluster artefacts that can be used for deployment pipelines. Also providing shared services allows you to more easily manage compliance and other regulatory commitments.

More flexible DevOps stacks

One difficulty of a centralized approach is delivering your shared services on top of the rest of the DevOps stack. DevOps teams will want some freedom in choosing the tools that they like to work with on a daily basis. While you will not necessarily include every single project in a centralized approach, you will want to provide your DevOps team with a choice.

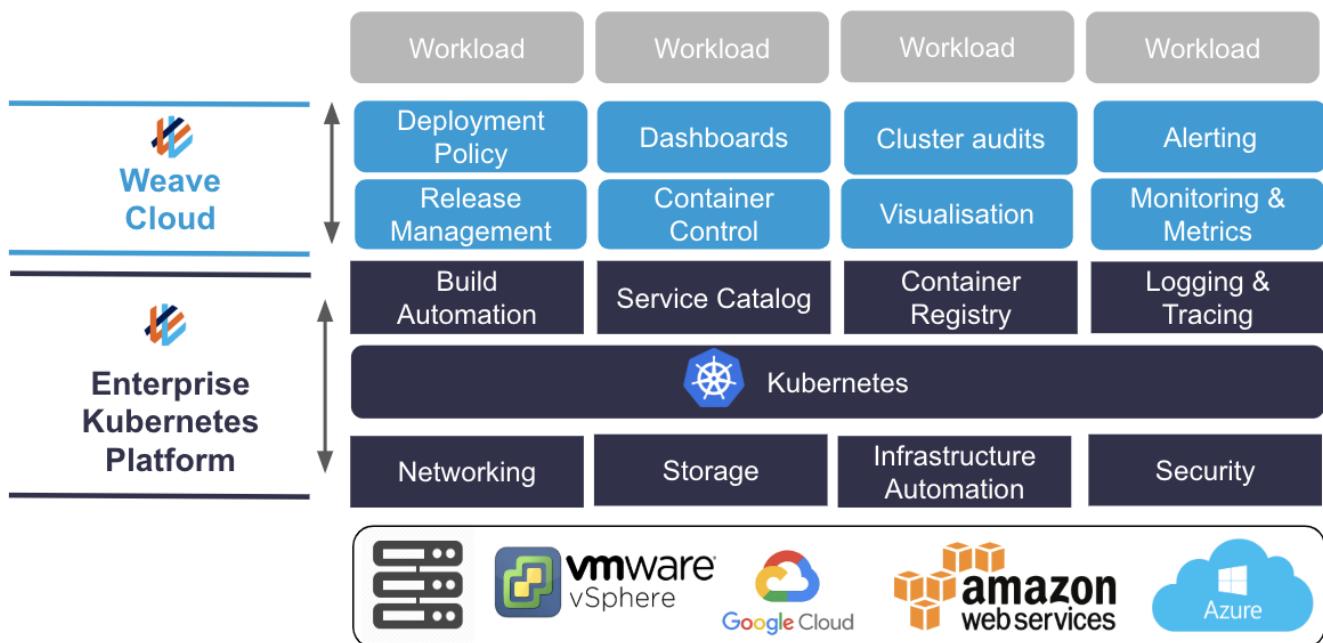
Below is a sample of the CNCF projects that DevOps will want to draw from to build a platform.⁸



8 From CNCF Cloud Native Landscape

BUILD A CLOUD NATIVE PLATFORM WITH GITOFS AND ENTERPRISE KUBERNETES PLATFORM

Our Enterprise Kubernetes Platform reduces complexity through configuration management, automation and operations tooling. With GitOps configuration management, teams can define a standard installation of Kubernetes and automate the deployment of new nodes following their predefined template. It also simplifies additional cluster installation, since Kubernetes is already preconfigured and any applications running on top of it are also predefined.



GITOFS CONFIGURATION MANAGEMENT AUTOMATION

With GitOps at the center of your operational model, teams can install and manage production ready Kubernetes on-premise, in a public cloud such as AWS and even onto pre-created OpenStack nodes. GitOps can be used to initiate a cluster patch or a minor version upgrade or add and remove cluster nodes all without having to rebuild your entire cluster from the ground up.

With your entire cluster configuration stored in Git and managed through GitOps, you can reproduce an entire cluster in a repeatable and predictable way. This brings advantages when you are building test environments and pipelines, and producing clusters for different teams with the same base configuration, or improving your disaster recovery capability.

KEY FEATURES OF THE WEAVEWORKS ENTERPRISE KUBERNETES PLATFORM

- Reliable, stable and upstream version of Kubernetes
- Unified cluster-API based installer for Kubernetes
- Critical cluster add-ons for all major cloud platforms and on-premise versions
- Node and cluster lifecycle management based on GitOps workflows
- Inclusive cluster observability components:
 - Flexible monitoring and logging configuration
 - Prometheus, the best monitoring choice for Kubernetes

Choice of add-ons:

- Network authentication protocol (Kerberos)
- Safe automatic node reboots (Kured)
- Continuous and auditable deployment (Weave Flux)
- Diff alerting on running and desired state (Kubediff)
- Integration ready for third party metrics, logging and other tooling choices

Find out more about the [**Enterprise Kubernetes Platform**](#)

HAVE QUESTIONS ON WHAT YOU NEED TO CREATE A CLOUD NATIVE PLATFORM?

The Weaveworks team can help you navigate the vast landscape of cloud native technologies – OSS and paid. Together we can create a cloud native reference architecture that fits your business needs. You can benefit from a Weaveworks' validated design or you can design, review and select technology options with our help.

[**Contact us for a demo**](#) of the Enterprise Kubernetes Platform.

