



CNCF SURVEY 2020

Use of containers in production has increased by 300% since 2016



The Cloud Native Computing Foundation (CNCF) Cloud Native Survey takes the pulse of the community to gain a better understanding of where and how cloud native technologies are being adopted. Given the continued growth of the CNCF community, we are well-positioned to discern patterns and highlight changes occurring among users of open source technologies. This is the eighth time CNCF has assessed the cloud native marketplace.

KEY TAKEAWAYS:

- The use of containers in production has increased to 92%, up from 84% last year, and up 300% from our first survey in 2016.
- Kubernetes use in production has increased to 83%, up from 78% last year.
- There has been a 50% increase in the use of all CNCF projects since last year's survey.
- Usage of cloud native tools:
 - 82% of respondents use CI/CD pipelines in production.
 - 30% of respondents use serverless technologies in production.
 - 27% of respondents use a service mesh in production, a 50% increase over last year.
 - 55% of respondents use stateful applications in containers in production.

ABOUT THE SURVEY METHODOLOGY & RESPONDENTS

CNCF surveyed its extended community during May and June 2020 and received 1,324 responses.

Of those respondents, 54% indicated their organization is part of the [CNCF End User Community](#). CNCF's End User Community comprises 140+ top companies and startups committed to accelerating cloud native technologies and improving the deployment experience.

The survey drew responses from the global cloud native community, but particularly Europe and North America: 38% of respondents came from Europe, 33% from North America, 23% from Asia, and 6% from South and Central America, Africa, Australia, and Oceania.

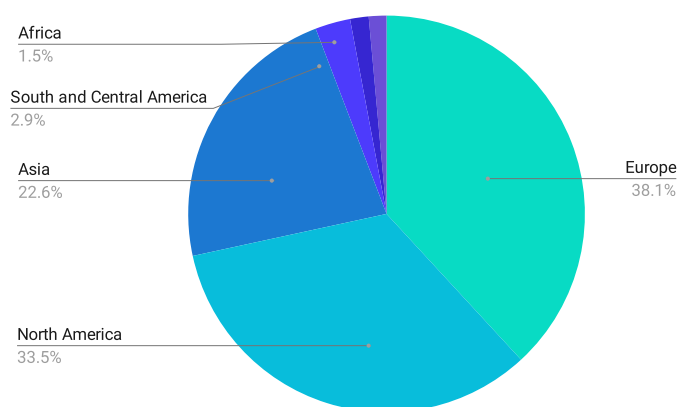
Two-thirds of respondents were from organizations with more than 100 employees, and 30% were from organizations with more than 5,000 employees, showing a strong enterprise representation.

The majority of respondents (56%) came from Software/Technology organizations. Other industries represented include Financial Services (9%), Consulting (6%), and Telecommunications (5%).

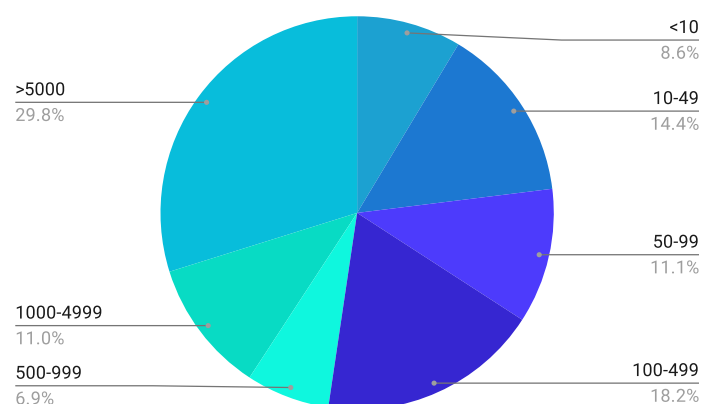
The top job functions were SRE/DevOps engineer (43%), software architect (35%), and backend developer (23%). In terms of job title, 48% were software developers/engineers, followed by manager/director (14%) and SysAdmin (14%).

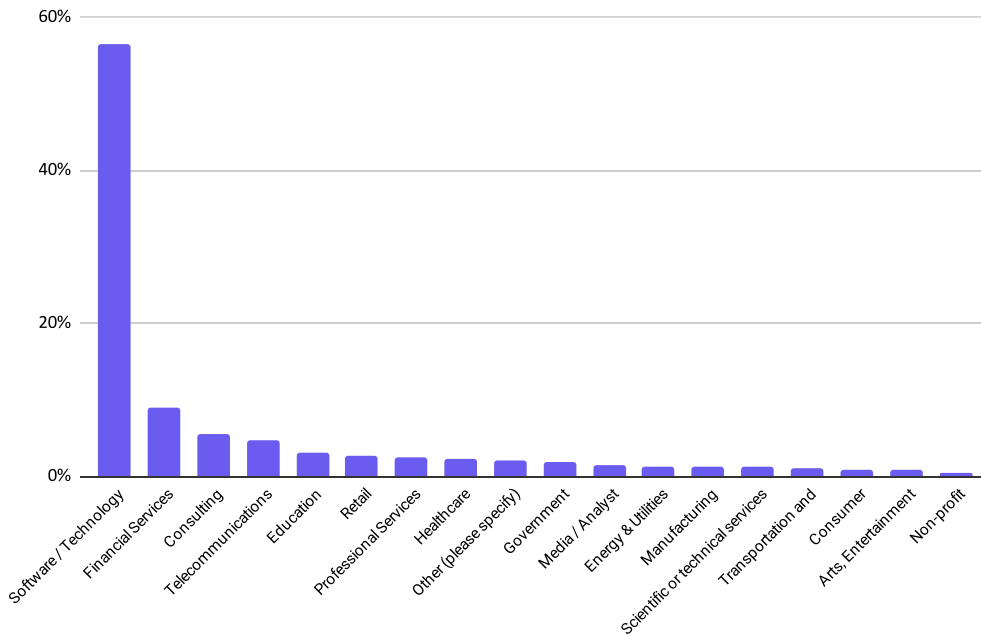
This survey was conducted in English. This report references our [2019 Cloud Native Survey report](#) throughout.

Geographic Location



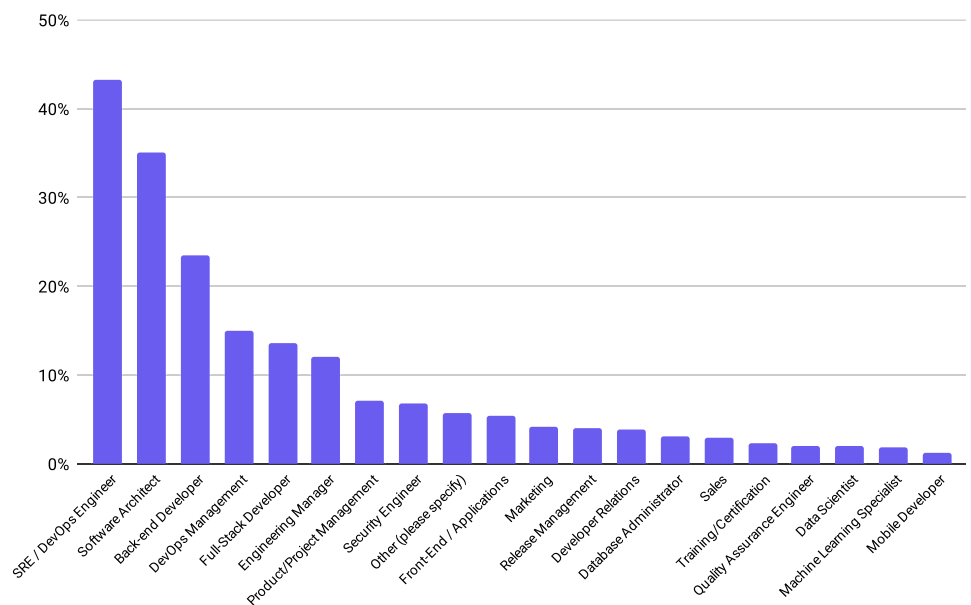
Size of Organization



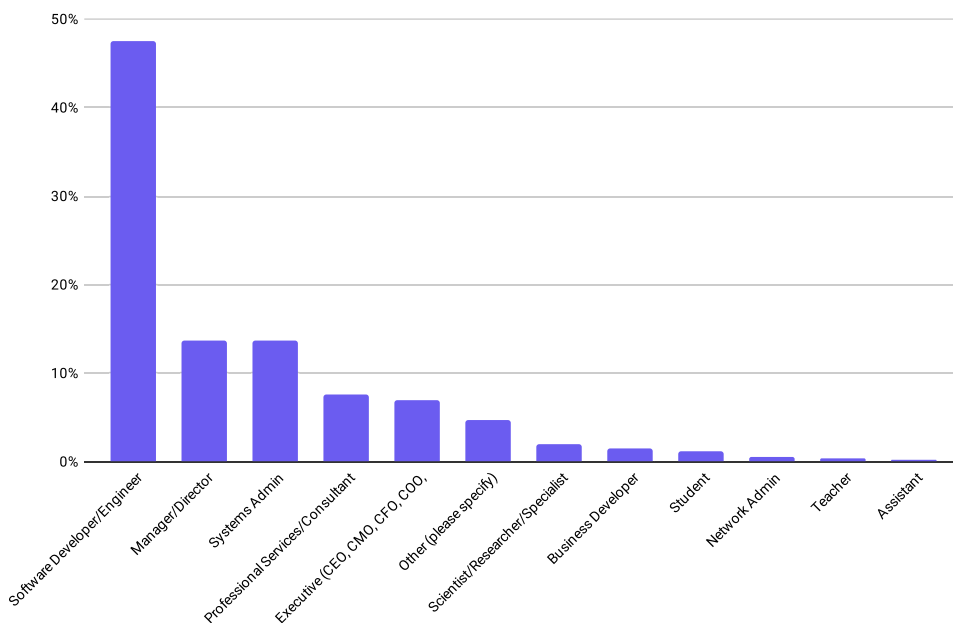


What industry does your company/organization belong to?

What is your job function?
Please select all that apply.



What title most accurately describes your role?



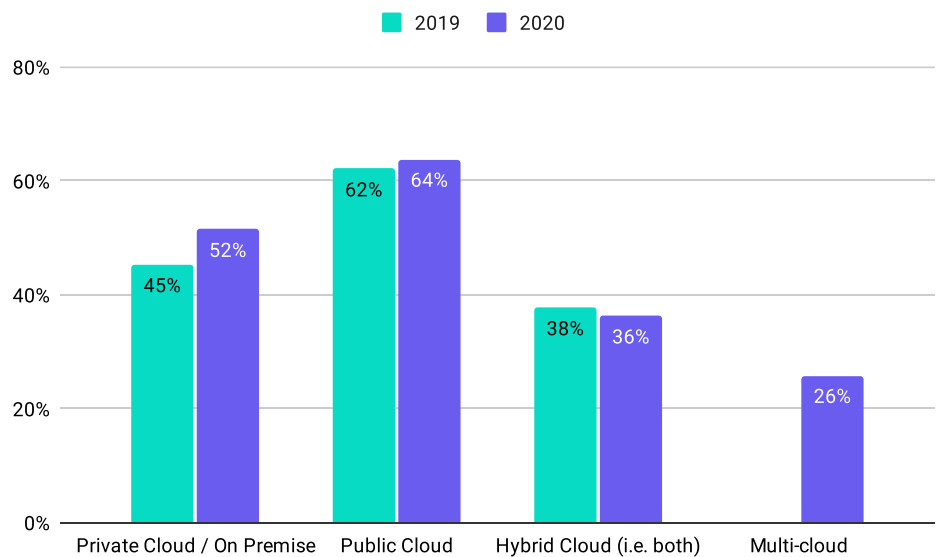
CLOUD

Public cloud remains on top, but private cloud is growing

For the third year, public cloud remains the most popular data center approach. It has increased slightly in usage from last year to 64% from 62%. Private cloud or on-premise usage had the most significant increase to 52% from 45%. Hybrid decreased slightly to 36% from 38% in 2019. Multi-cloud usage was a new option this year and emerged with 26%.

For the purpose of this analysis, hybrid cloud refers to the use of a combination of on-premises and public cloud. Multi-cloud means using workloads across different clouds based on the type of cloud that fits the workload best. The portability that Kubernetes and cloud native tools provide makes it much simpler to switch from one public cloud vendor to another. The addition of multi-cloud as an option this year does not necessarily explain the drop in hybrid unless respondents use a different definition.

Which of the following data center types does your company/organization use?



CODE

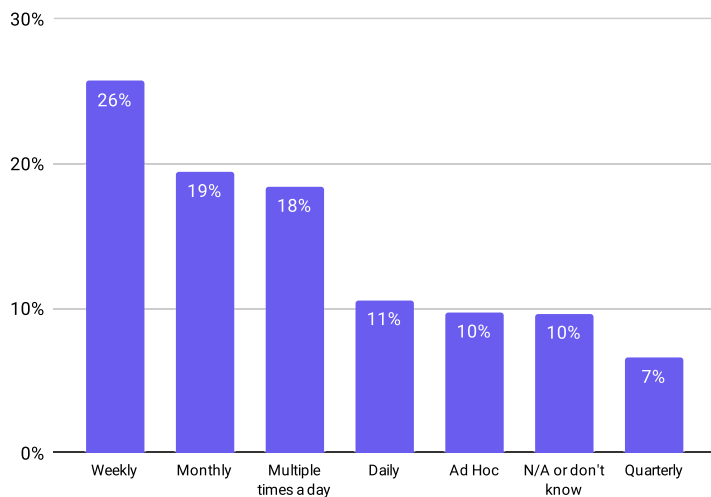
Release cycles continue to speed up, but automation drops

Since 2018, we have asked questions on release cycles, providing insight into how organizations manage their software development cycles. For a third year, we see release cycles continuing to speed up.

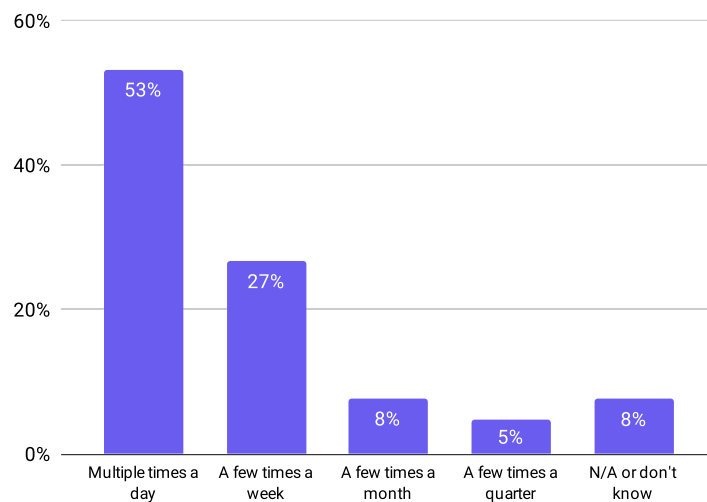
The percentage of those who release software daily, or even multiple times a day, has increased to 29% from 27% last year. Weekly release cycles are still the most common (26%), but more than half of respondents (55%) release weekly or more frequently.

Several factors are driving this trend. As the use of cloud native technologies grows in production, organizations build more advanced infrastructures. Also, the coronavirus pandemic has increased digital consumption, forcing organizations to adapt to keep up with demand.

How often are your release cycles?



How often do you check in code?

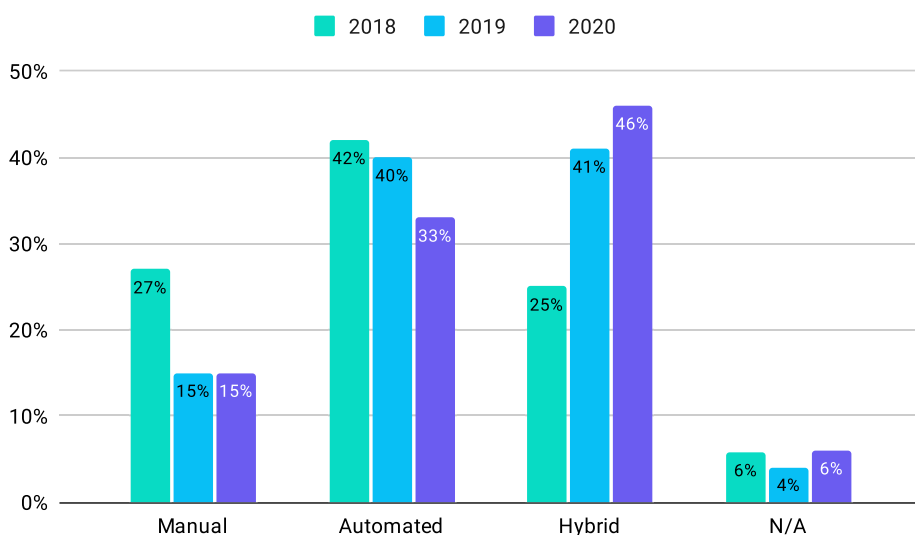


The majority of respondents (53%) check in code multiple times a day, and 80% check in code at least a few times a week. This is in line with last year's results.

Hybrid is the most popular approach for release cycles as chosen by 46% of respondents, up from 41% last year and just 25% in 2018. At the same time, there has been a shift away from fully-automated cycles, which dropped to 33% from 40% in 2019. This is in contrast to last year when hybrid appeared to be gaining ground as application builders shifted away from manual cycles.

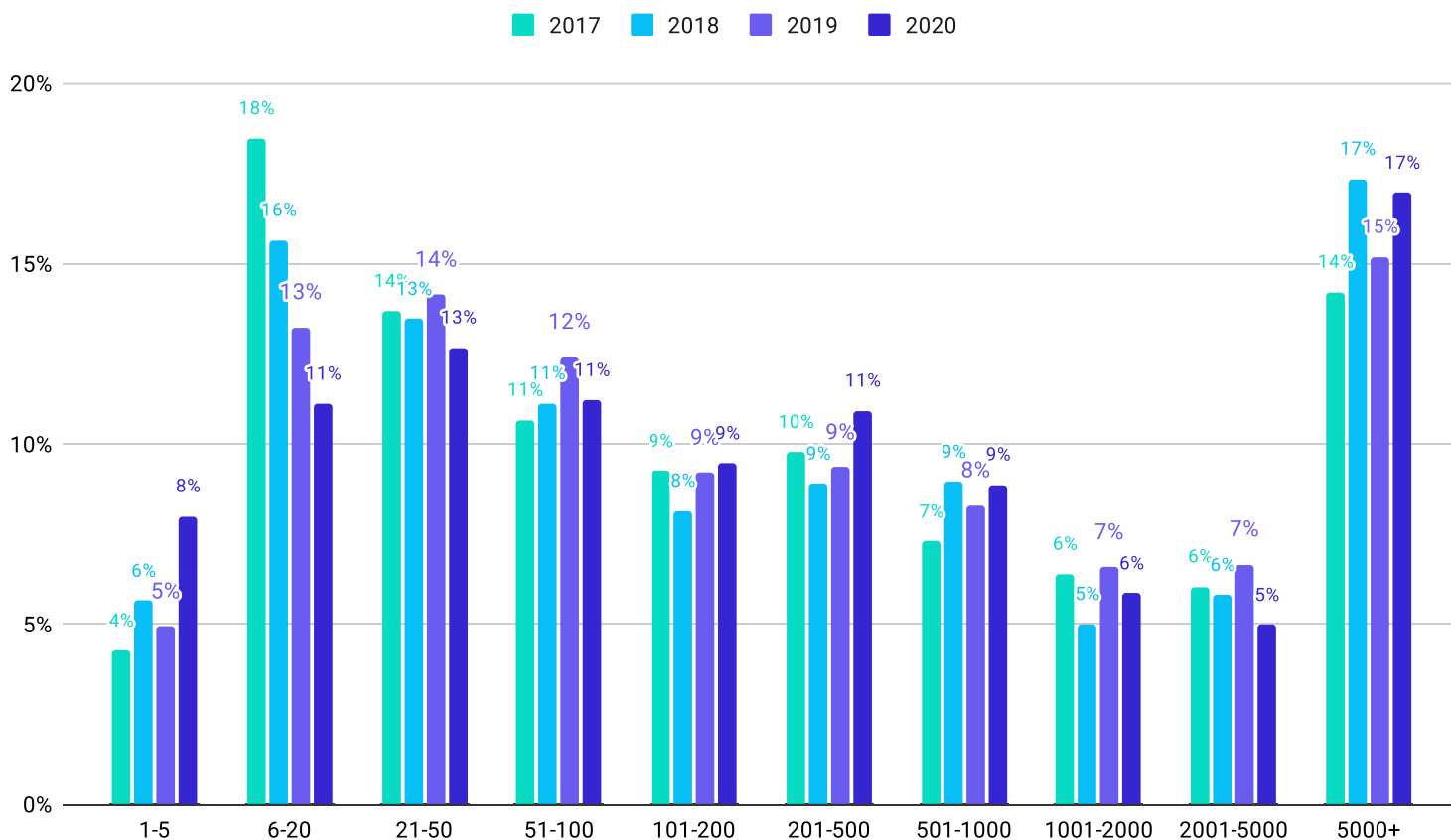
This could mean that many organizations are not ready to jump to fully automated cycles because of the complexity of setting them up, or they wish to retain control over certain aspects of application deployment. It will be interesting to see what happens with this trend in the next survey.

Are release cycles manual or automated?



When it comes to the number of machines that organizations run, including virtual machines and bare metal, we see increases at both ends of the spectrum. Eight percent of respondents use between one and five machines, up from five percent a year ago. This indicates that new adopters have entered the ecosystem. At the same time, those using more than 5,000 machines increased to 17% from 15%. This indicates that those who have been using containers are adding more. Again this year, 81% of respondents use more than 20 machines.

On average, how many machines are in your fleet (including VM, bare metal, etc.)?



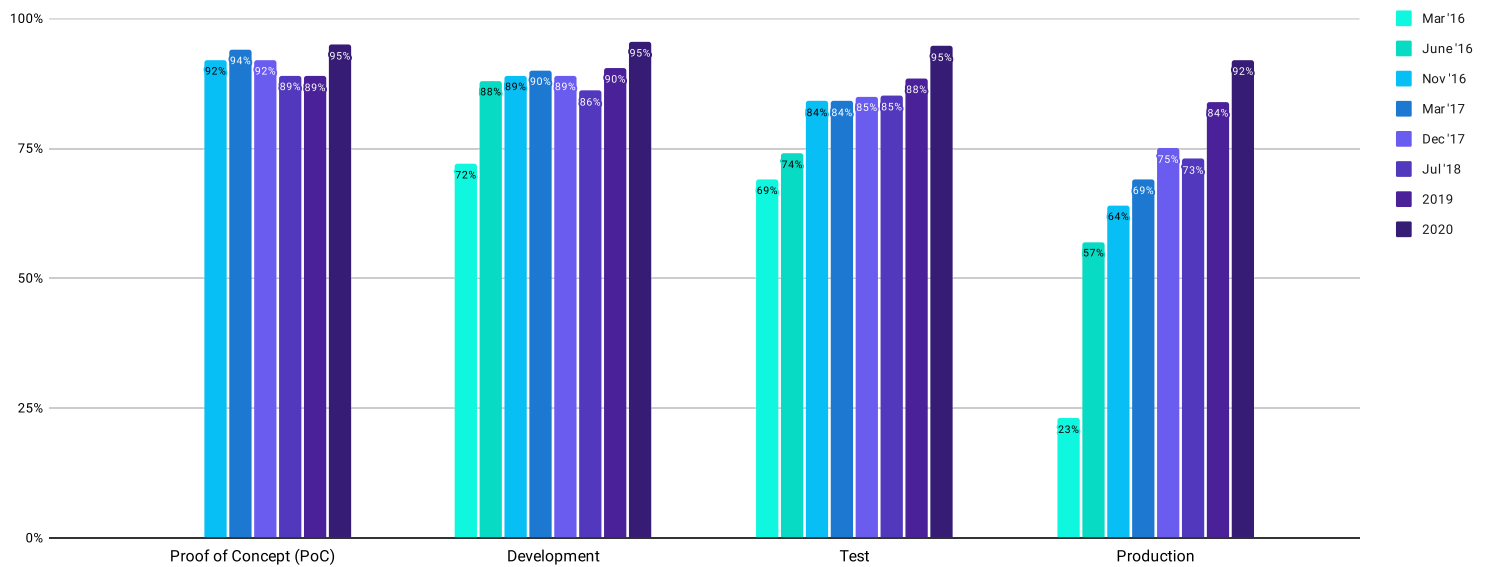
CONTAINERS

Use of containers in production is the norm

This year, 92% of respondents say they use containers in production, an extraordinary 300% increase from just 23% in our first survey in March 2016. This is also up from 84% of respondents in 2019 and 73% in 2018.

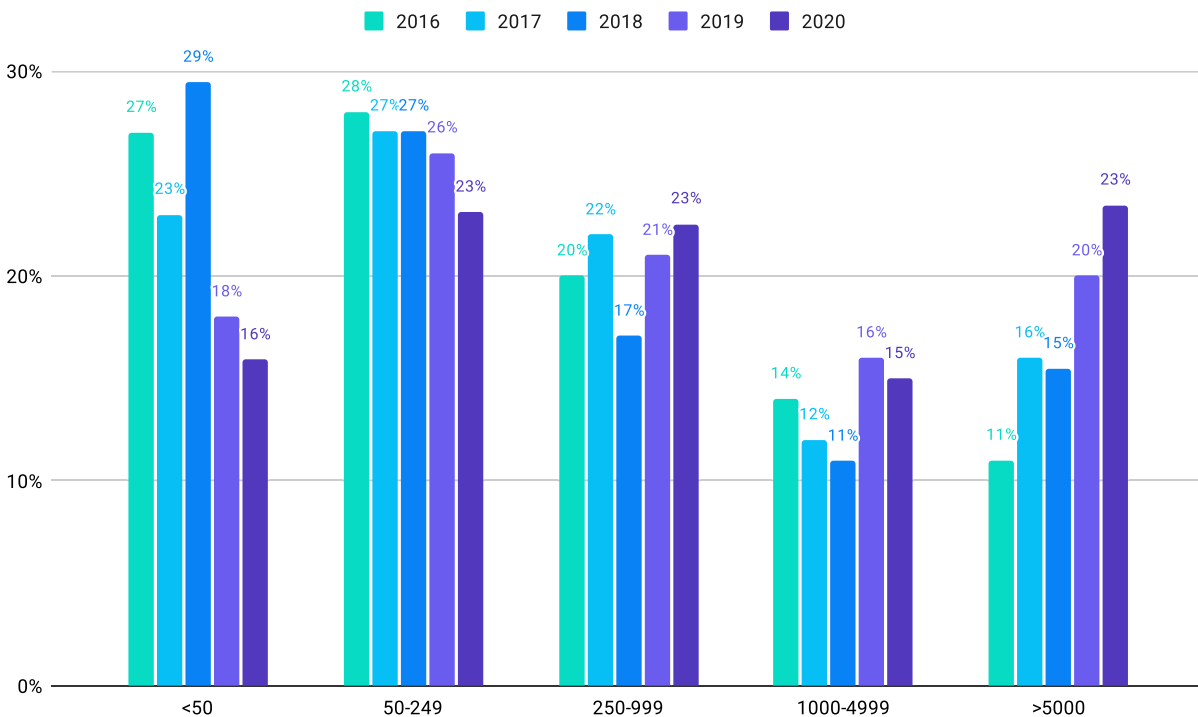
Some 95% of respondents use containers in the proof of concept (PoC), test, and development environments, which is a slight increase in each category from last year. This is the first time since June 2016 that there has been an increase in those using containers in PoC environments. This could mean that organizations are testing new use cases or moving more workloads as they become more comfortable with containers.

Please indicate if your company/organization currently uses, or has future plans to use, containers for any of the below options.



Again, we see steady growth in the number of containers that organizations run. Those using more than 5,000 containers hit 23% in 2020, up 109% from 11% in 2016. 61% now use more than 250 containers, up from 57% in 2019.

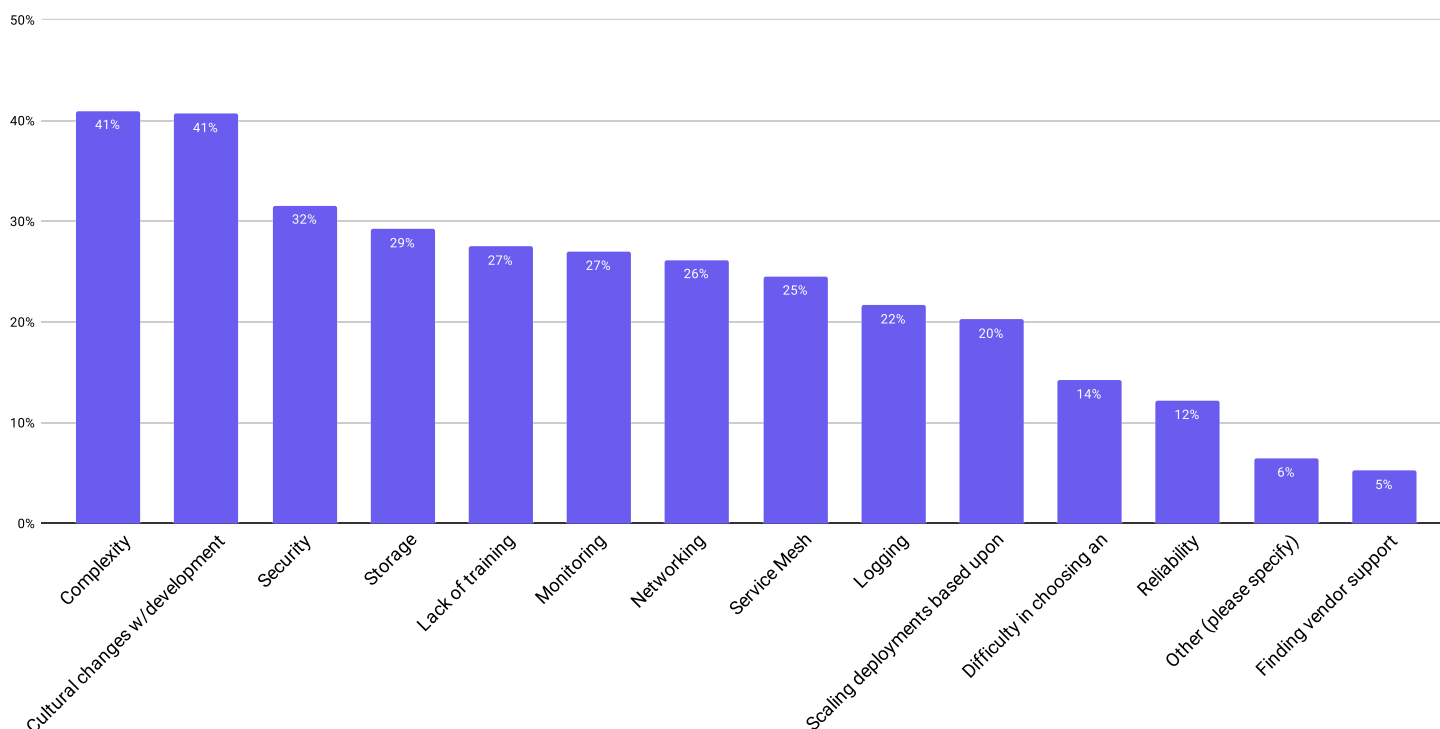
How many containers does your company/organization typically run?



Container Challenges

This year, complexity joined cultural changes with the development team as the top challenges in using and deploying containers. Both were cited by 41% of respondents. Security (32%), which was second last year, slipped to third place, followed by storage (29%), and lack of training and monitoring (both at 27%).

What are your challenges in using/deploying containers? Please select all that apply



KUBERNETES

Kubernetes continues to lead the container charge

This year, 91% of respondents report using Kubernetes, 83% of them in production. This continues a steady increase from 78% last year and 58% in 2018.

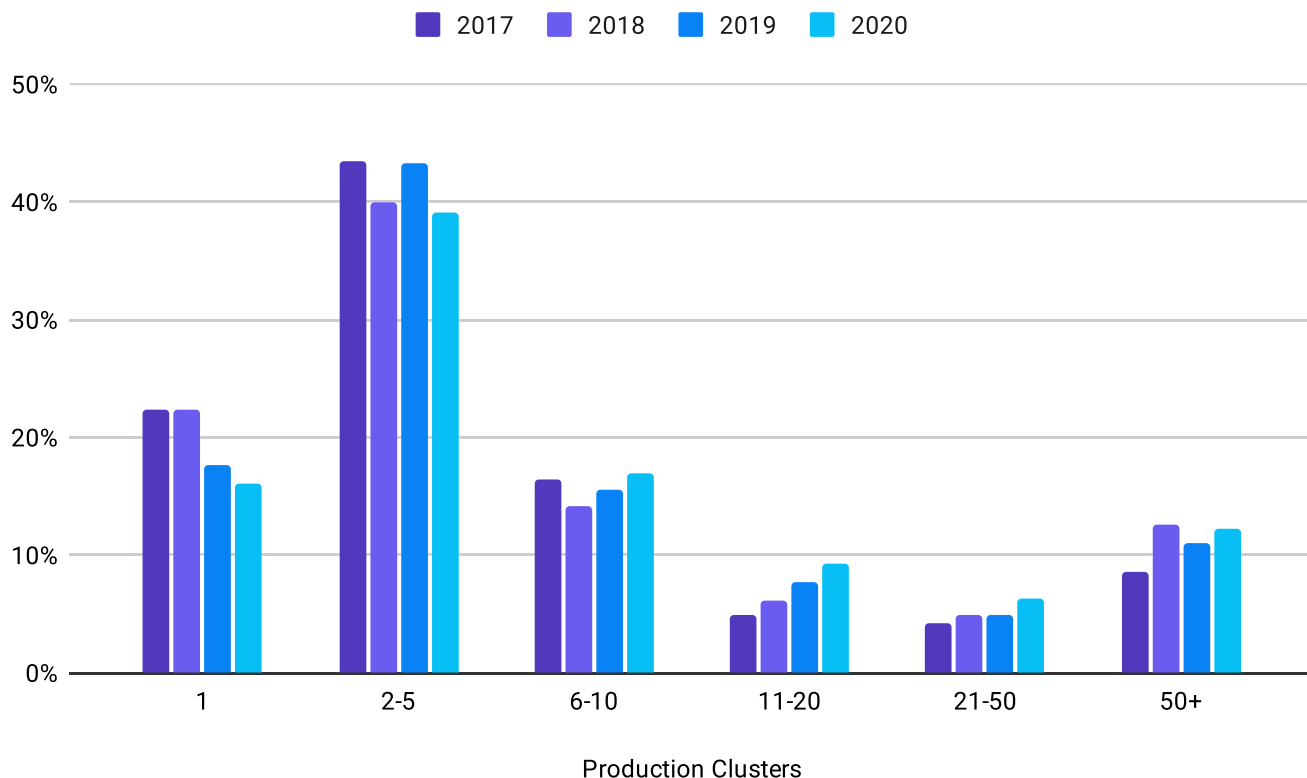
Of those using Kubernetes, two to five remains the most common number of production clusters, with 39% reporting that quantity, down from 43% last year. There was an increase in those using more than 11 production clusters from 24% in 2019 to 28%, and a 56% increase from 2017.

As Kubernetes grows, so does the ecosystem around it. The project [released version 1.19](#) in late August. During this release cycle between April and August, 382 companies and over 2,464 individuals contributed to Kubernetes, according to the [DevStats dashboard](#).

The Steering Committee launched a new contributor-focused website, [Kubernetes.dev](#), which brings contributor documentation, resources, and project event information into one central location.

In November, the Certified Kubernetes Security Specialist (CKS) certification program just launched, joining the Certified Kubernetes Administrator (CKA) and Certified Kubernetes Application Developer (CKAD) programs.

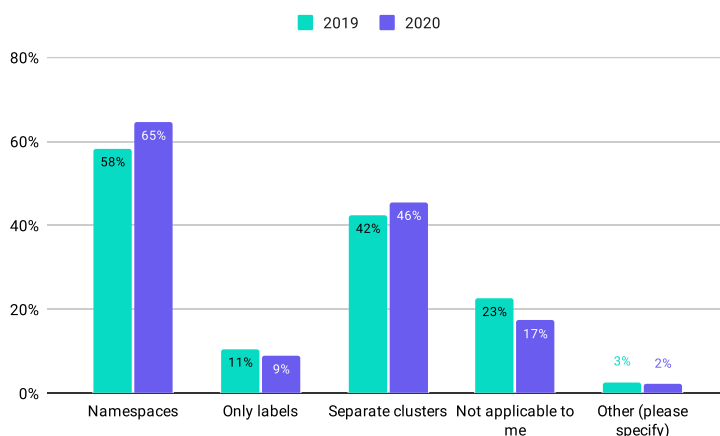
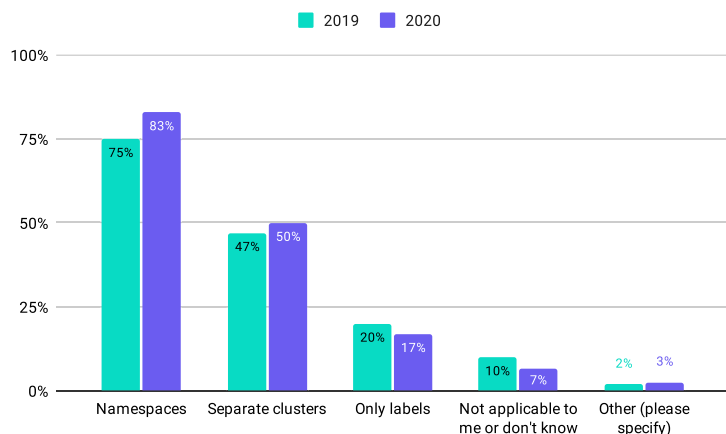
We have also seen exciting new use cases, which are documented in [case studies](#) featuring global brands like Adidas, Amadeus, CapitalOne, IBM, JD.com, Ocado, Zalando, and many others.



We also asked respondents about tools they use to manage various aspects of Kubernetes applications:

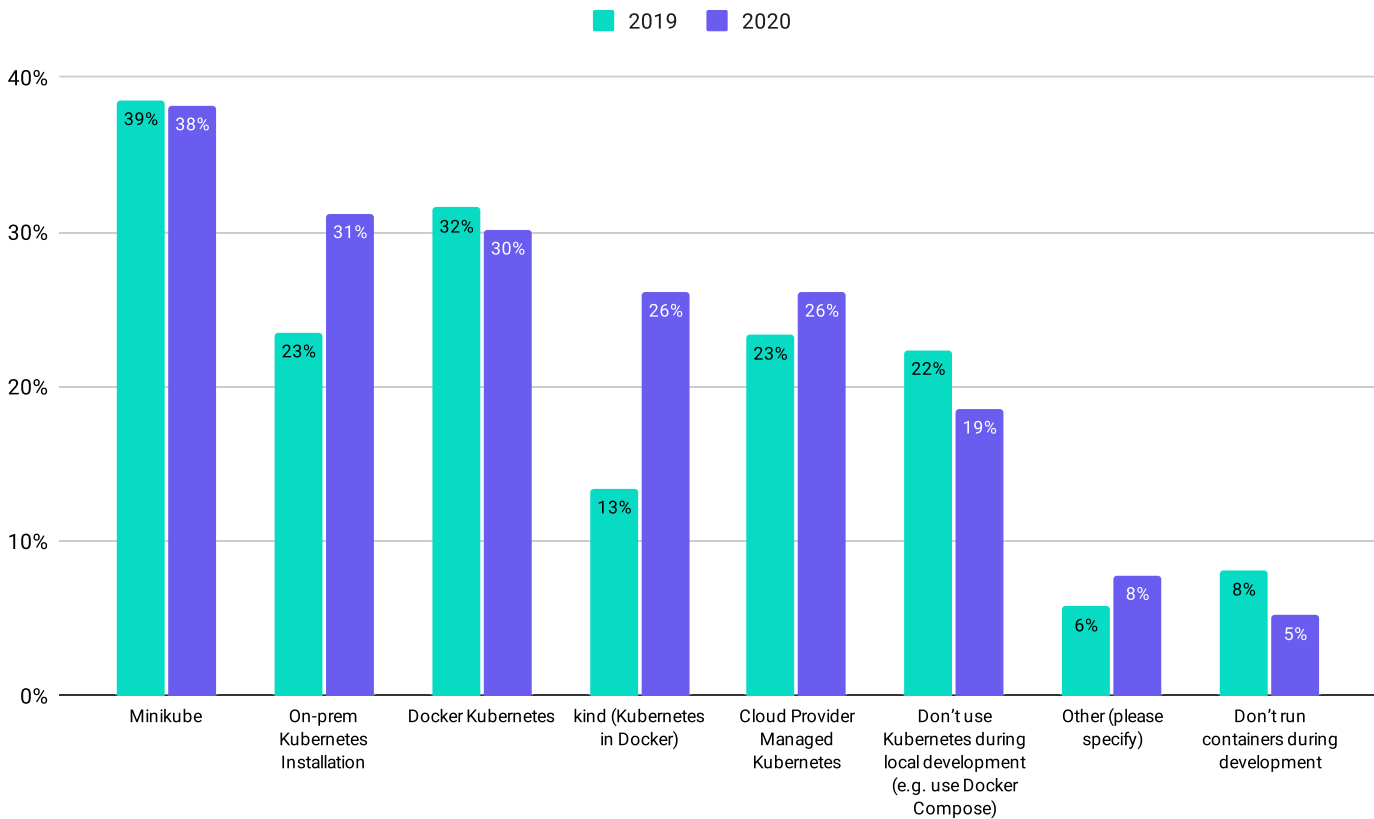
Separating Kubernetes Applications

Namespaces remain the most popular way to separate Kubernetes applications. Those using namespaces increased to 83%, up from 75% in 2019. Those using namespaces in an organization with multiple teams increased to 65%, from 58% in 2019.



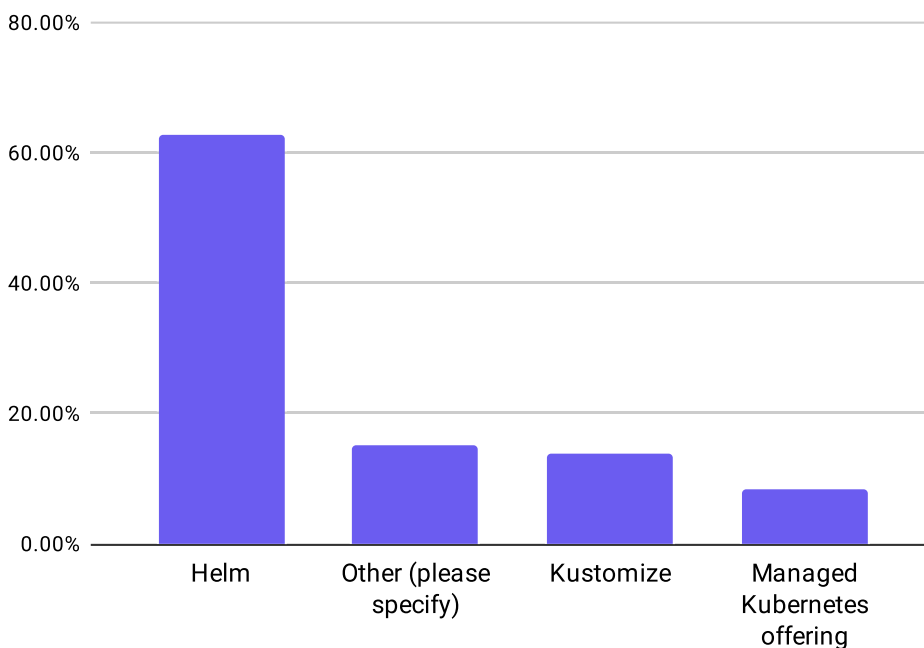
Kubernetes Environments

The top Kubernetes environments are Minikube (37%), on-prem Kubernetes installations (31%), and Docker Kubernetes (29%). On-prem Kubernetes installation increased to 31% from 23% last year.



Packaging Applications

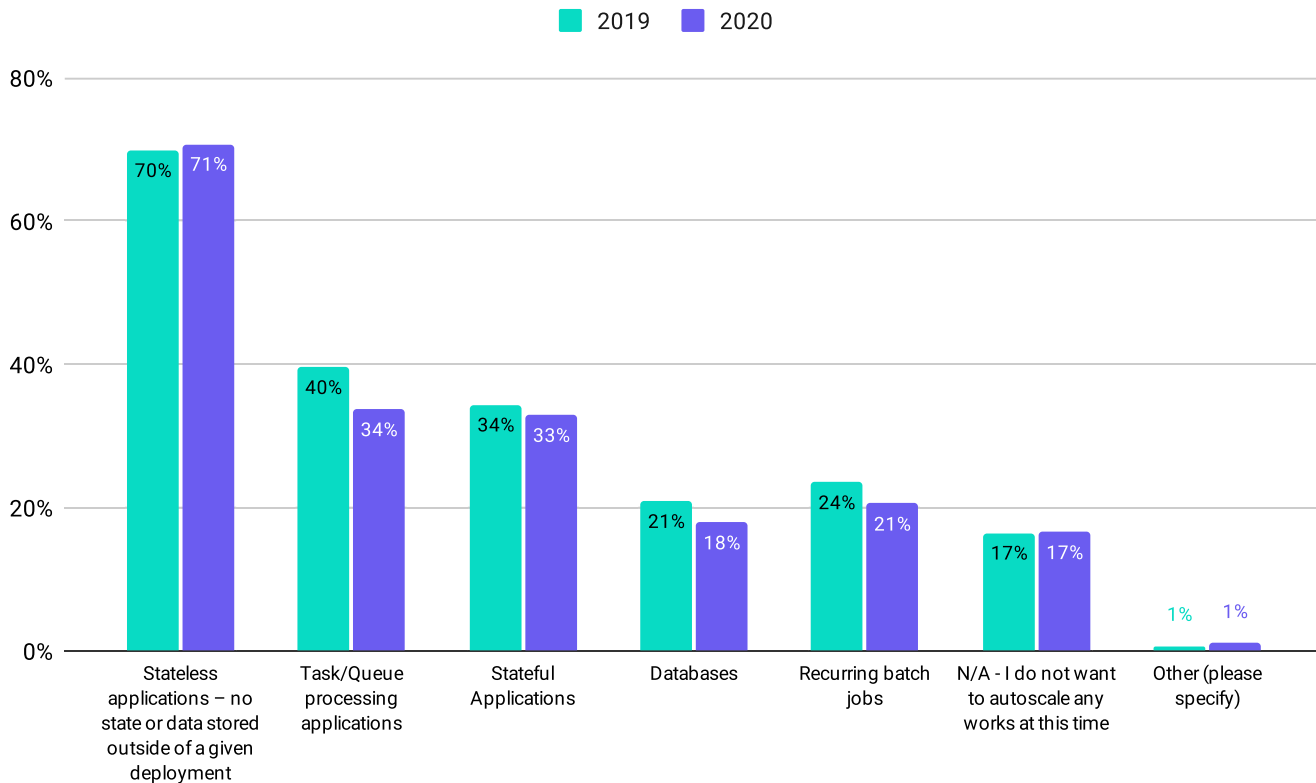
What is your preferred method for packaging Kubernetes applications?



Helm is still the most popular tool for packaging Kubernetes applications and is used by 63% of respondents.

Autoscaling Workloads

Again this year, the majority (71%) of respondents plan to autoscale their stateless applications, followed by 34% for task/queue processing applications, and 33% of stateful applications.



The majority (72%) do not use autoscaling capabilities because they do not want to autoscale workloads.

CNCF PROJECTS

Project usage has increased by 50%

CNCF is now home to more than 70 projects, including 13 graduated and 21 incubating projects.

As the number of projects grows, so has the usage. There has been a 50% increase in the use of all CNCF projects since the 2019 survey.

Kubernetes (83%), Prometheus (69%), and Helm (67%) are the most used graduated projects in production. Since last year's survey, there has been a 25% increase in the use of graduated projects.

etcd (62%), CNI (40%), and gRPC (35%) are the most used incubating projects in production. Since 2019, there has been a 45% increase in the use of incubating projects.

Sandbox projects have jumped in usage by 238%. The most used sandbox projects in production are Flux (8%), OpenEBS (8%), and Network Service Mesh (7%). The top three projects being evaluated by respondents are OpenTelemetry (20%), Service Mesh Interface (14%), and OpenMetrics (14%).

CLOUD NATIVE TOOLS

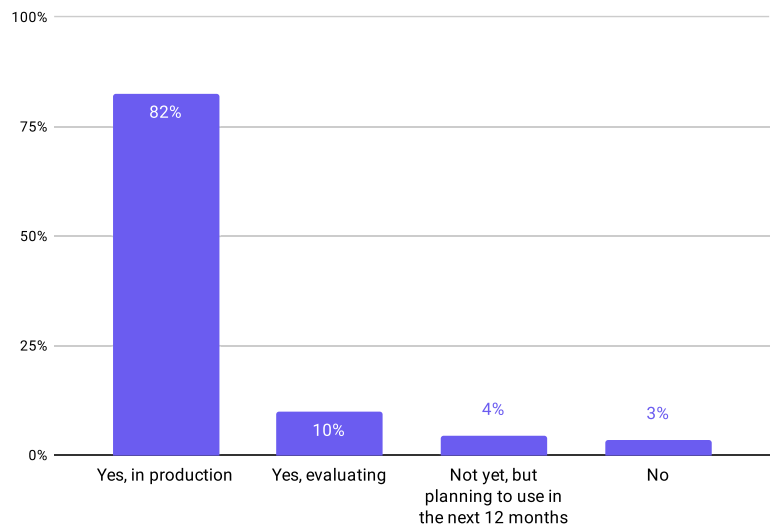
CI/CD and storage tools are used broadly while serverless tools, service meshes, and service proxies are growing

Continuous integration and continuous delivery (CI/CD)

CI/CD pipelines are critical for automating the building, testing, and deployment of applications. As an essential aspect of DevOps, CI/CD is used widely in production.

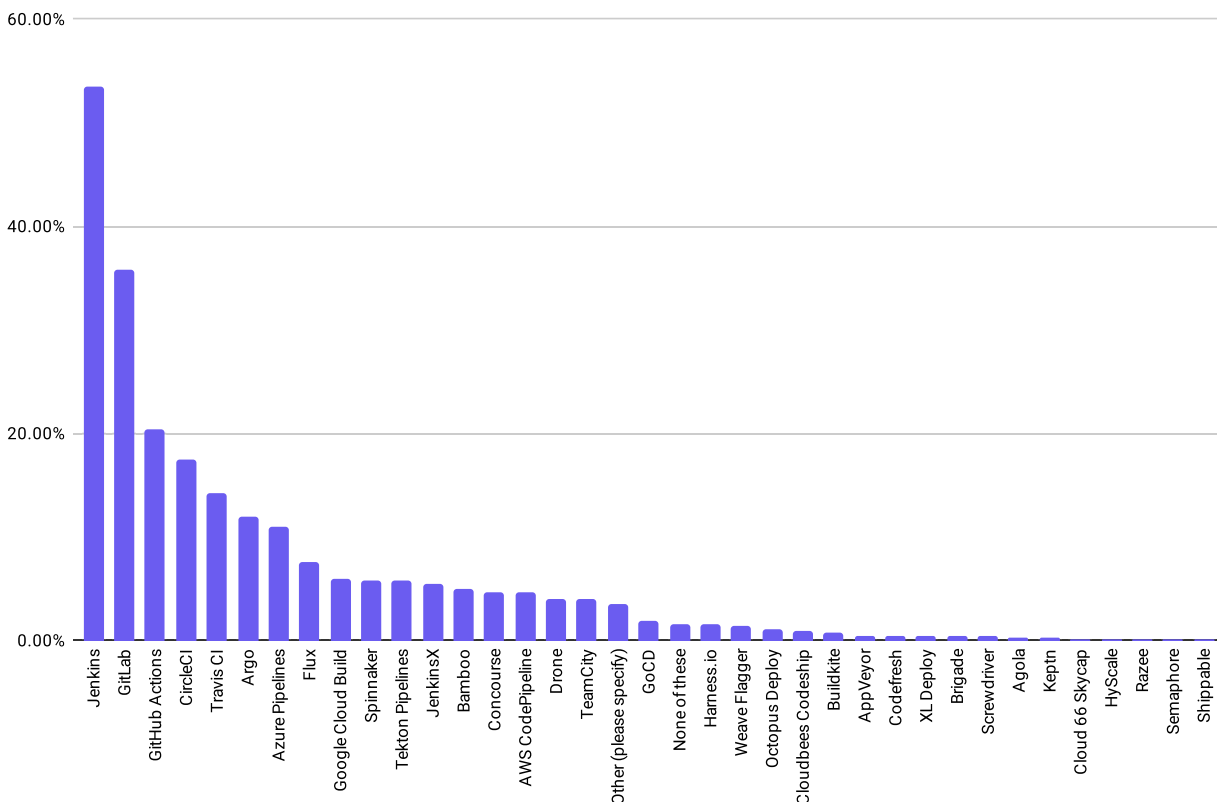
Some 82% of respondents use CI/CD pipelines in production, with 10% evaluating and 4% planning to run CI/CD in the next 12 months.

Do you run Continuous Integration / Continuous Development (CI/CD) pipelines?

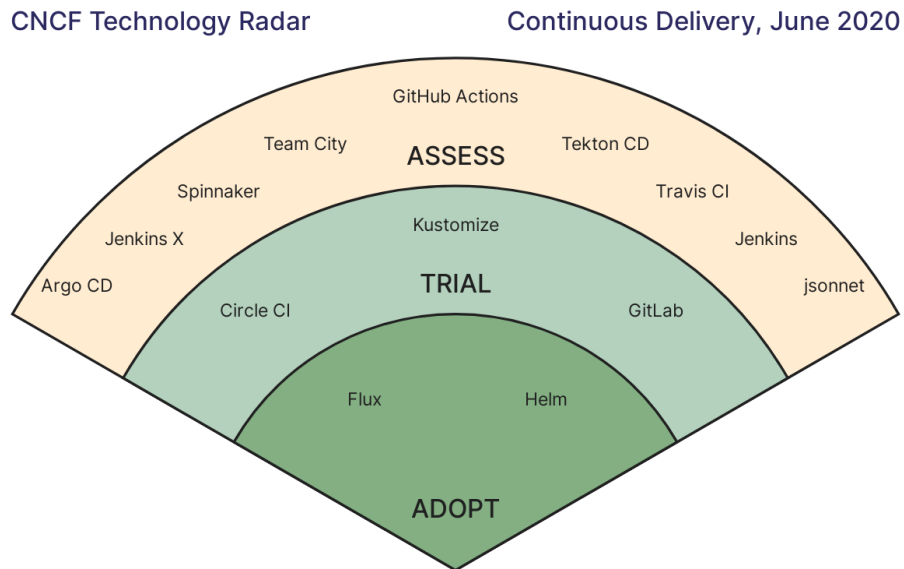


The three most used CI/CD tools are Jenkins (53%), GitLab (36%), and GitHub Actions (20%).

What tools do you use to manage your CI/CD pipeline? Please select all that apply.



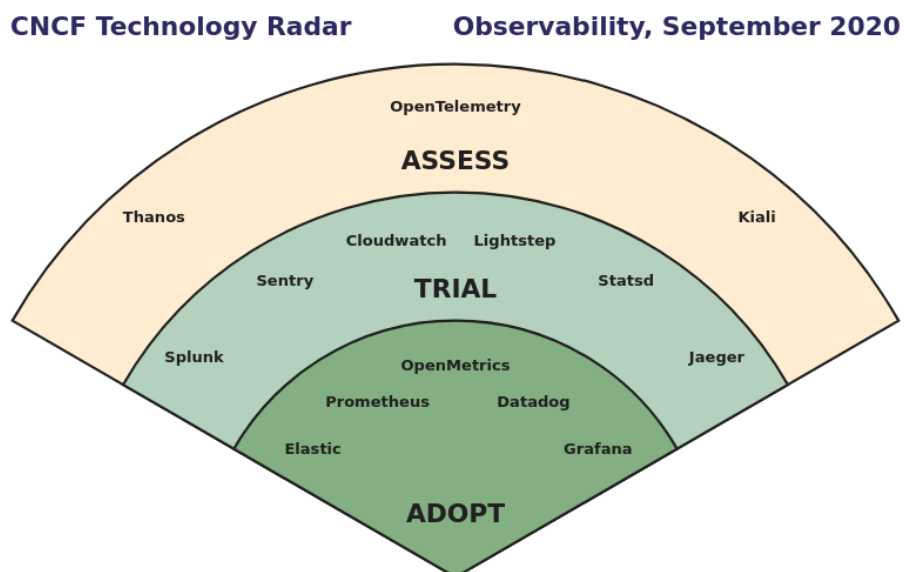
Continuous delivery was also the topic of CNCF's first End User Technology Radar, a guide for evaluating cloud native technologies based on the experiences of the CNCF End User Community. The Radar found that Flux and Helm are the most widely adopted tools for CD, and few or none of the respondents recommended against using them.



Monitoring, Logging, and Tracing

Monitoring, logging, and tracing are often confused as interchangeable tools for observing and analyzing IT environments, but each serves a unique purpose. Observability requires looking at data from different views to answer questions. Different tools have strengths in different techniques and integrations, which means monitoring, logging, and tracing tools can be incredibly powerful when used together.

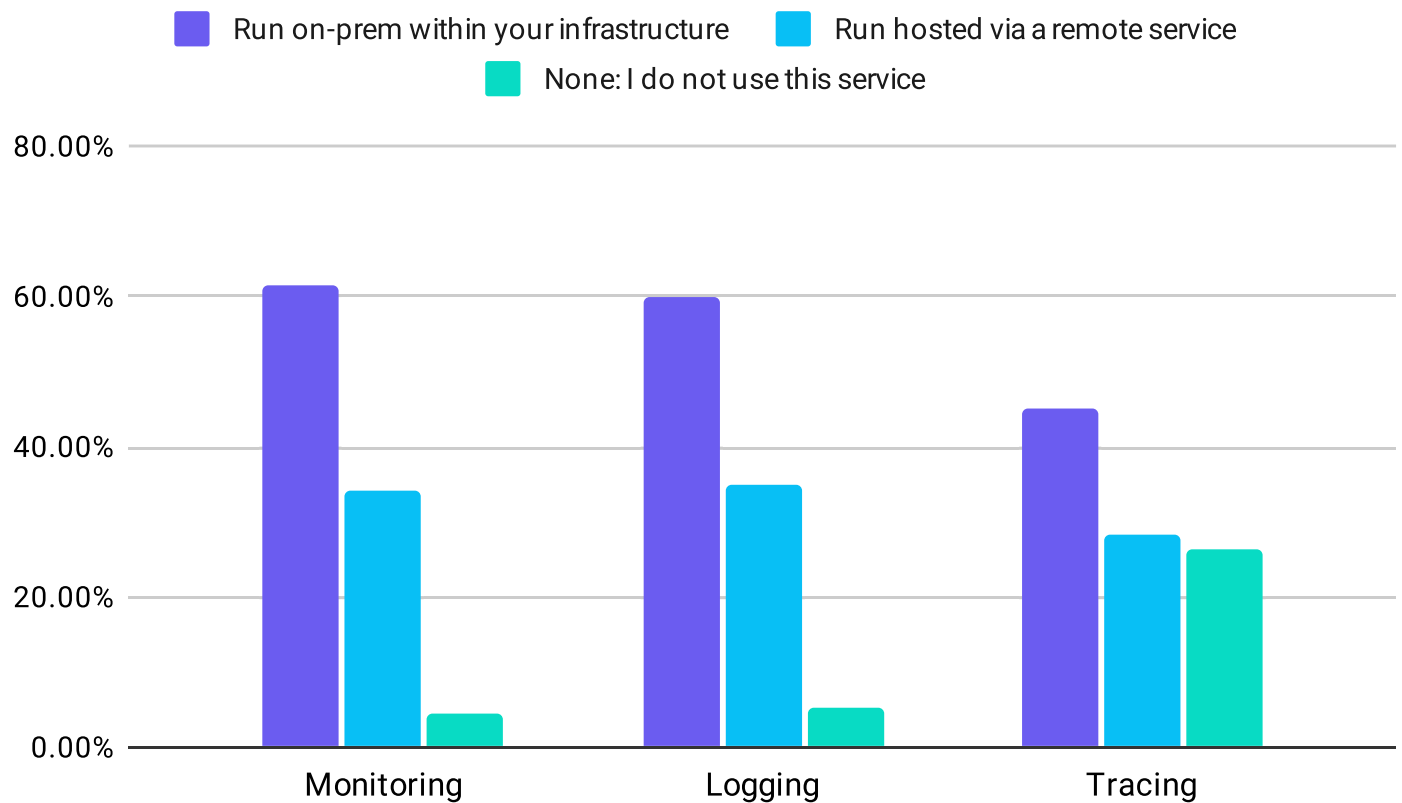
CNCF's second [End User Technology Radar](#), which focused on observability, found that many organizations feel the same way. Half of the companies use five or more tools, and a third had experience with 10+ tools. It also found that the most popular observability tools are open source. The five tools that received the most total votes by participating organizations – Prometheus, Grafana, Elastic, Jaeger, and OpenTelemetry – are all open source.



According to the Cloud Native Survey, 95% of respondents use monitoring, 95% use logging, and 74% use tracing.

It is much more common for those who are using these tools to run them on-premise within their infrastructure, rather than hosted via a remote service.

For your monitoring, logging and tracing solutions, do you require the system to:

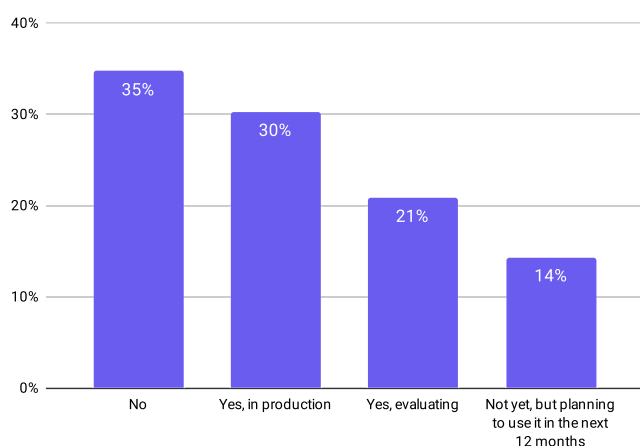


SERVERLESS

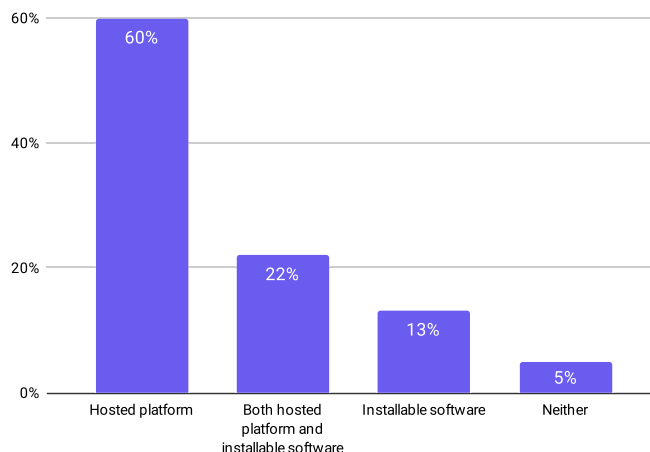
Serverless computing, where computing loads run using a service layer (or “function”) to configure and deploy cloud environments dynamically, has taken off these last few years. We fully expect this growth to continue.

Just under a third (30%) of respondents use serverless technologies in production. Another 21% are evaluating serverless, and 14% plan to use it in the next 12 months.

Is your organization using serverless technology?



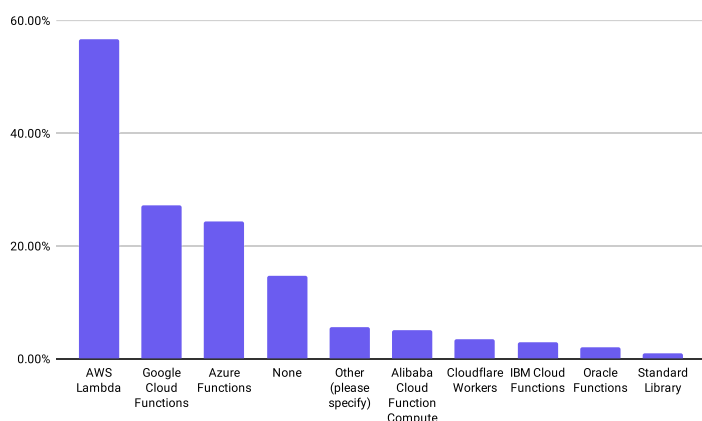
How is your organization using serverless technology?



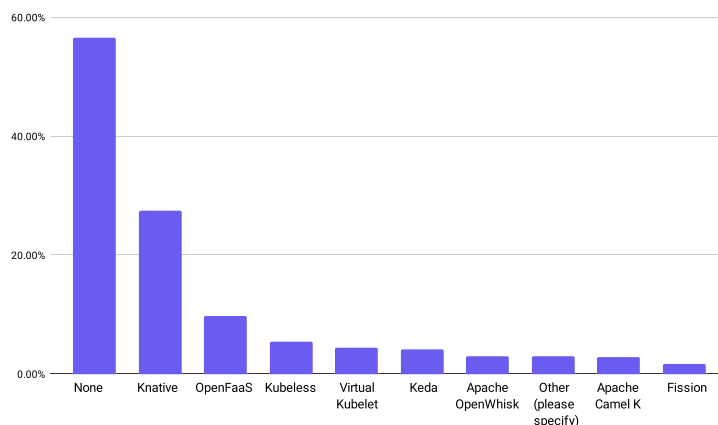
The majority of those using serverless technology (60%) use a hosted platform; 13% use installable software, and 22% use both.

The top hosted serverless platforms are AWS Lambda (57%), Google Cloud Functions (27%), and Azure Functions (24%). The top installable serverless solutions are Knative (27%), OpenFaaS (10%), and Kubeless (5%). In both cases, the top three were the same as in 2019.

If your organization is using serverless via a “hosted platform”, which hosted serverless platform do they use?



If your organization is using serverless via a “installable software”, which hosted installable software do they use?



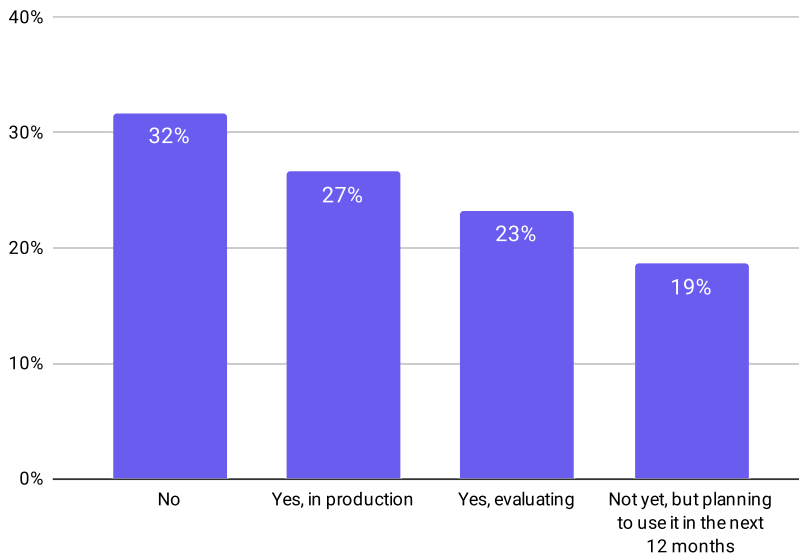
Service Mesh

A service mesh is a dedicated infrastructure layer for making communications between services fast, secure, and reliable.

Last year, 18% of respondents were using a service mesh in production. Another 47% were evaluating the use of a service mesh. This result led us to expect that service mesh usage will grow over the next few years.

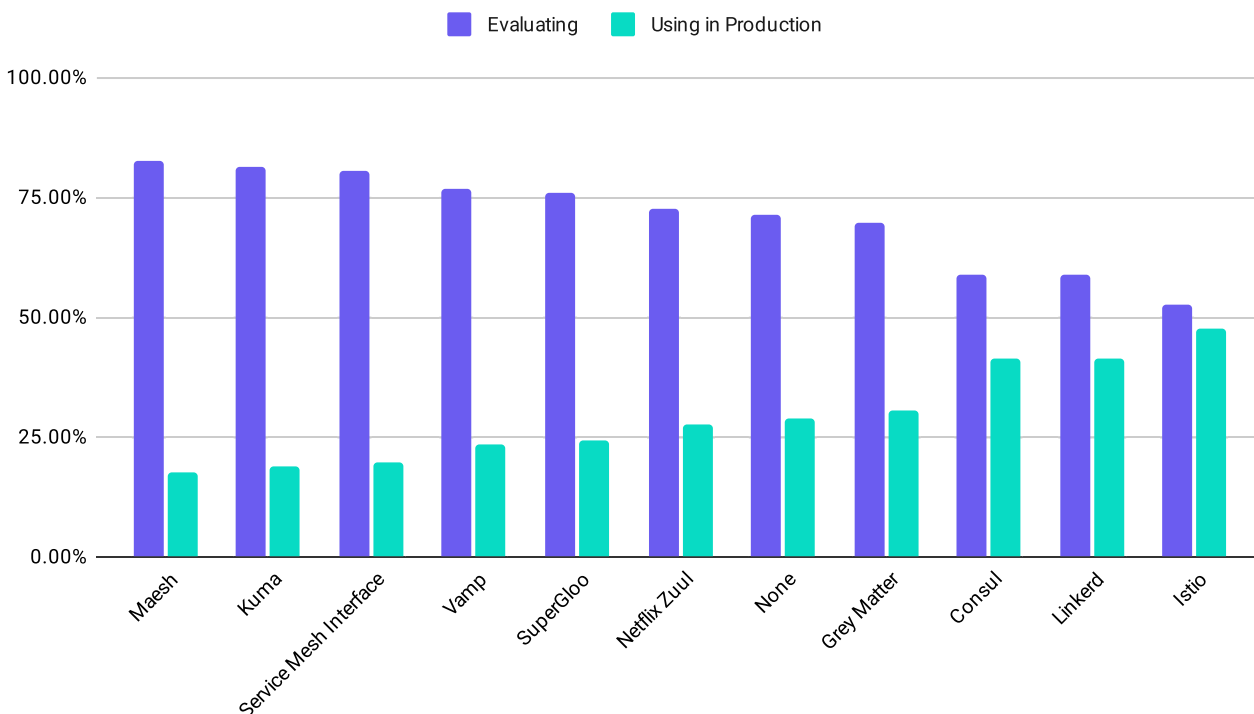
This year, use in production has grown to 27%, a 50% increase over last year. We expect this growth to continue with 23% evaluating a service mesh, and another 19% planning to use one in the next 12 months.

Is your organization using a service mesh?



Of those using a service mesh in production, 47% use Istio, followed closely by Linkerd and Consul, both at 41%. The top three are the same as last year, but Linkerd has closed the gap on Consul, with the two tied for second.

Please indicate if your company/organization is evaluating, or currently using in production, any of these service mesh projects / products.

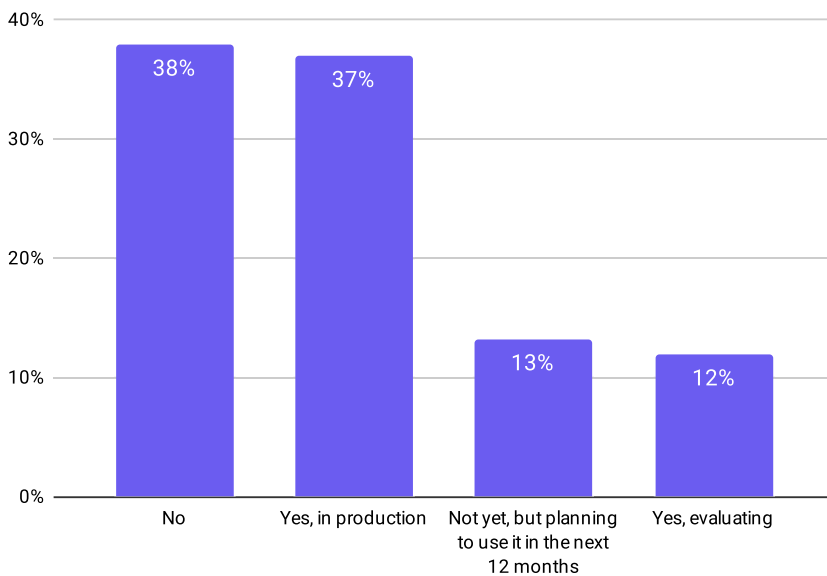


Service Proxy

A service proxy manages interactions among microservices to ensure peak application performance. It can be used to streamline digital transformations and to ease the operation of cloud native architectures.

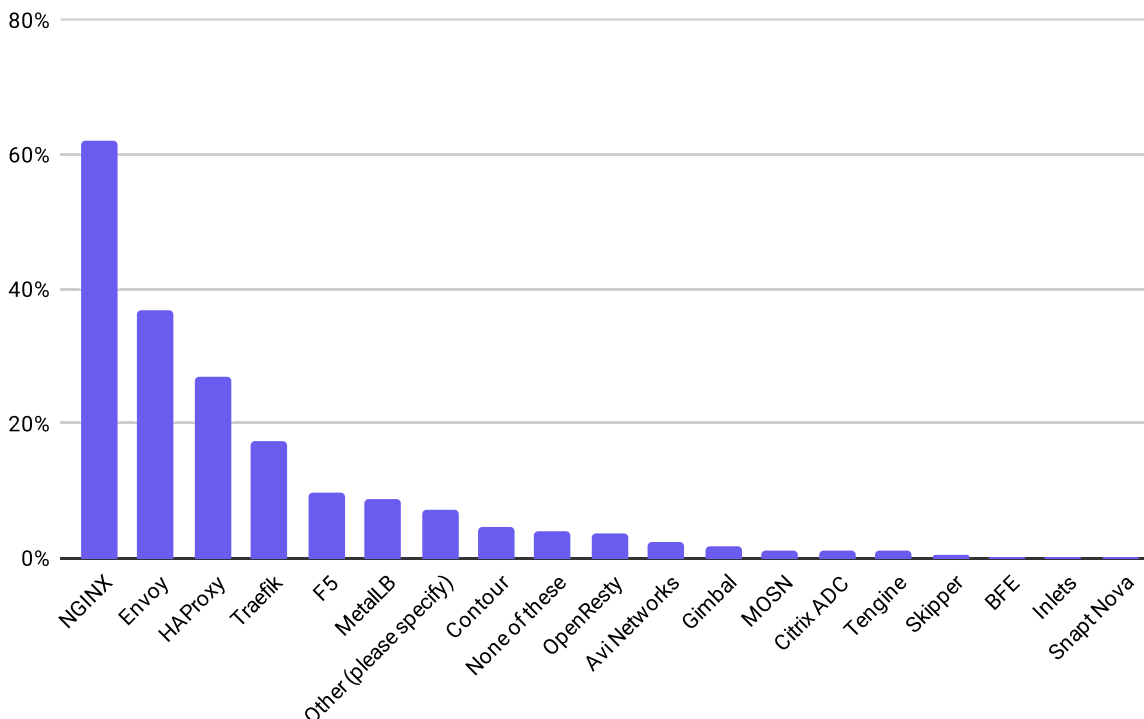
This year, 37% of respondents use a service proxy in production. Another 12% are evaluating a service proxy, and 13% plan to use one in the next 12 months.

Do you use a service proxy?



The top ingress providers for 2020 are NGINX (62%), Envoy (37%), and HAProxy (27%).

What ingress provider(s) (i.e., service proxy) are you using? Please select all that apply.



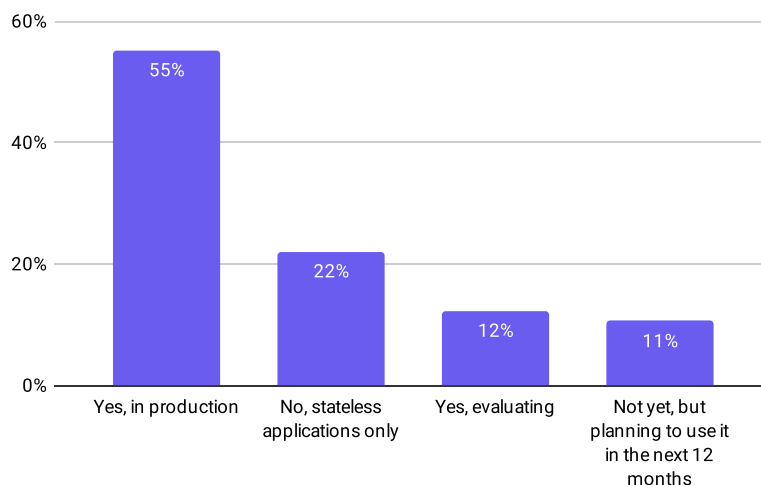
If we adjust for new responses added, Envoy has increased by 116% in use as an ingress provider for 2020.

Storage

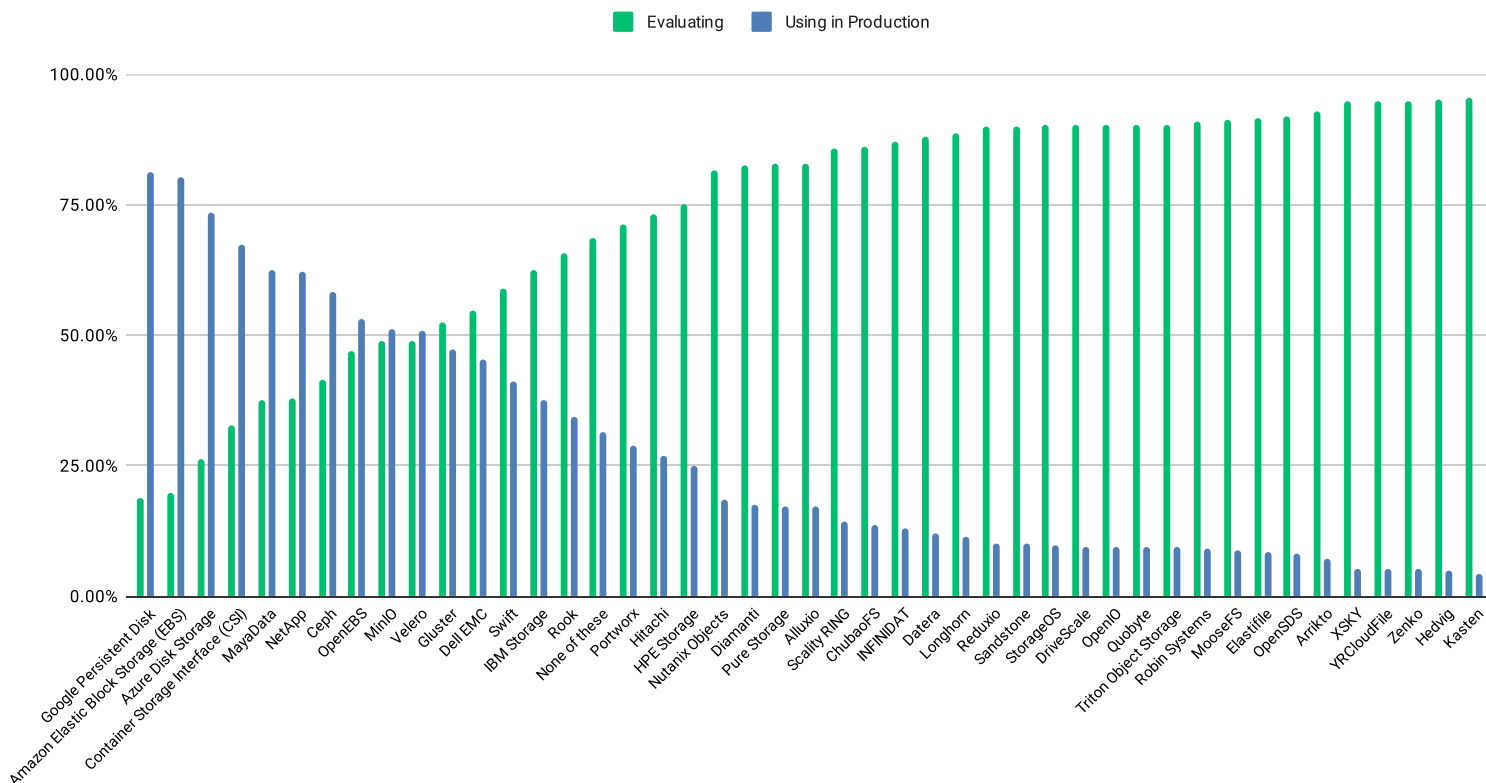
Cloud native storage has exploded in recent years, expanding to include different storage offerings, including centralized, distributed, sharded, and hyper-converged. A special interest group (SIG) focused on storage was launched by the CNCF community to clarify these different options and identify the top attributes to consider when choosing a storage solution. This summer, the SIG released an updated CNCF Storage Landscape Whitepaper for the community to use as a guide.

Containers were originally built to be stateless in order to keep them flexible and portable. However, only 22% use only stateless applications. Demonstrating the popularity of cloud native storage, 55% use stateful applications in production, 12% are evaluating them, and 11% plan to use them in the next 12 months.

Do you run stateful applications in containers?



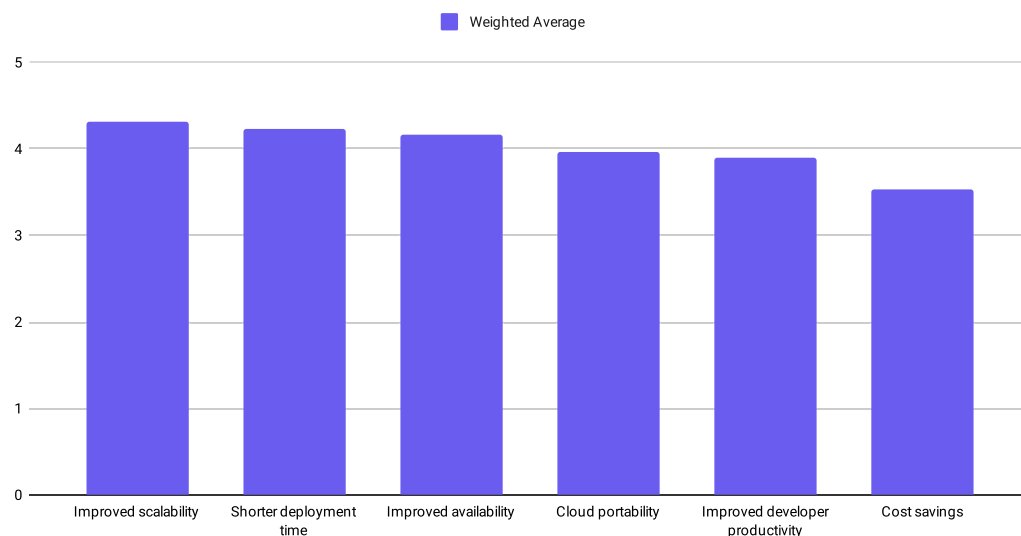
The top three cloud native storage projects in production are Google Persistent Disk (81%), Amazon Elastic Block Storage (EBS) (80%), and Azure Disk Storage (74%).



Cloud Native Benefits

For those using containers and cloud native projects in production, 51% ranked the top benefits as improved scalability and shorter deployment time, while 44% selected improved availability. Last year, shorter deployment time was ranked as the top benefit, followed by improved scalability, then improved availability.

If you are using containers and cloud native projects like Kubernetes and Prometheus in production, rate the following benefits on a scale of 1 to 5 where 5 is the biggest benefit and 1 is no benefit.



CNCF

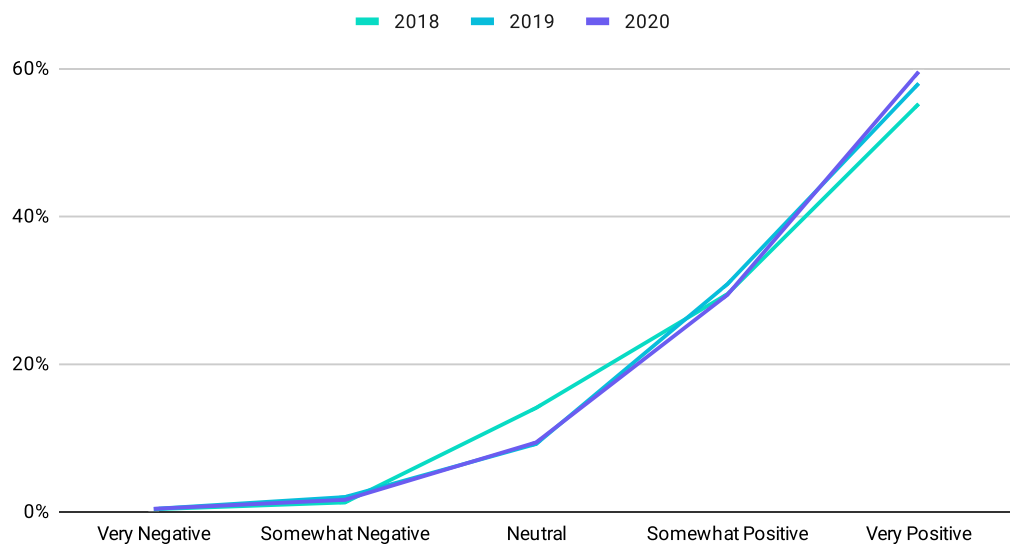
A vendor-neutral home for cloud native projects

When asked about CNCF, respondents remained overwhelmingly positive. About 95% indicated they would be likely to recommend CNCF technologies, up from 94% in 2019.

Additionally, 89% of respondents have a positive opinion of CNCF. This sentiment remains steady since last year and is up from about 85% positive in 2018.

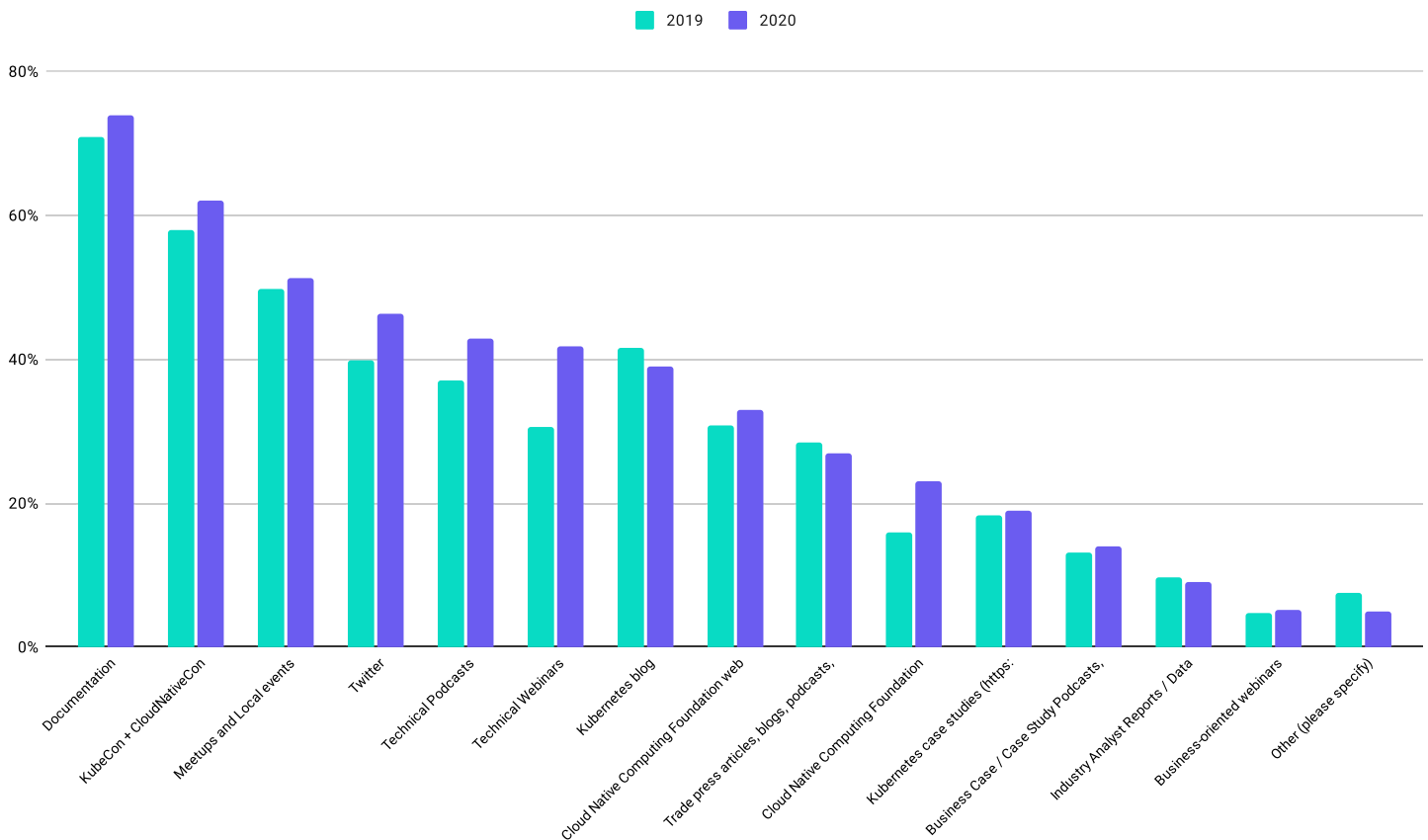
What are your perceptions of CNCF?

When asked to choose a phrase to describe CNCF, a "vendor-neutral home for cloud native projects" was the most selected response at 29%, up from 23%.



Want to learn more?

Are you interested in learning more about cloud native technologies? Here are some of the ways our community keeps informed.



Documentation

For a second year, most respondents (74%) indicated that they learn about cloud native technologies from project documentation. Graduated and incubating CNCF projects host extensive documentation on their websites – a full list can be found [here](#).

Events

Next is events, with 62% of respondents selecting KubeCon + CloudNativeCon events as the best way to learn about cloud native technologies. As events have shifted virtual, this makes them more accessible to technologists across the globe. Our first-ever virtual KubeCon + CloudNativeCon Europe attracted 18,700+ registrants with a 70% attendance rate. This is an increase of more than 10,000 over last year's KubeCon + CloudNativeCon Europe in Barcelona.

Some 51% selected meetups and local events. This summer, we announced that we combined CNCF Meetup Groups and Kubernetes Community Days to create Cloud Native Community Groups (CNCG). CNCGs provide an easy way to host a community meetup or cloud native event, and a great way to connect with other community members interested in all things cloud native, all over the world.

Twitter

In 2020, more respondents are learning about cloud native technologies via Twitter (46% vs. 40% in 2019). Be sure to follow [@CloudNativeFdn](#) for the latest CNCF, community, and project news.

Webinars

More respondents also indicated that they learn about cloud native technologies from webinars – technical webinars increased to 43% from 31% in 2019, and CNCF webinars increased to 23% from 16%. CNCF webinars are hosted by CNCF Ambassadors, members, and project maintainers and dive deep into the latest topics influencing the community. You can view and register to attend upcoming CNCF webinars [here](#), as well as watch recordings of past webinars.

Thank you!

A huge thank you to everyone who participated in our survey! As always, the raw data from this survey is available on GitHub.

You can also view the findings from past surveys here:

[CNCf Cloud Native Survey China 2019](#)

[CNCf Survey 2019: Deployments are getting larger as cloud native adoption becomes mainstream](#)

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

[March 2018: China is Going Native with Cloud](#)

[December 2017: Cloud Native Technologies Are Scaling Production Applications](#)

[June 2017: Survey Shows Kubernetes Leading as Orchestration Platform](#)

[January 2017: Kubernetes moves out of testing and into production](#)

[June 2016: Container Survey](#)

[March 2016: Container survey results](#)