CLOUD NATIVE
COMPUTING FOUNDATION

ANNUAL SURVEY 2021

The year Kubernetes crossed the chasm

VIEW THE FULL DATA ON GITHUB

Featuring production data and insights from Datadog, New Relic and SlashData:

DATADOG

New Relic.

KEY TAKEAWAYS

1 Container Adoption and Kubernetes has truly gone mainstream – usage has risen across organizations globally, particularly in large businesses.

2 With this de-facto status, Kubernetes is now going "under the hood" similar to Linux, with more organizations leveraging managed services and packaged platforms.

3 CNCF is also starting to see organizations move up the stack – adopting less mature projects to tackle challenges including monitoring and communications.

METHODOLOGY AND DATA SOURCES

Since 2016, the Cloud Native Computing Foundation has used its unique position in the cloud native community to survey the landscape, understand the dynamics and better serve users of open source, cloud native technologies.

For this, our ninth iteration, we set out to create our most ambitious survey yet to enable more individuals to participate than ever before.

Firstly, we separated the survey into two parts focussing on different areas of the cloud native landscape. Part one of the survey, honing in on containers and Kubernetes, was conducted between April and June 2021. Part two, conducted between August and November 2021, covered cloud native technologies such as service mesh, serverless, and storage as well as CNCF's other projects. We also separated responses into regions to better understand how the cloud native landscape is evolving across the globe.

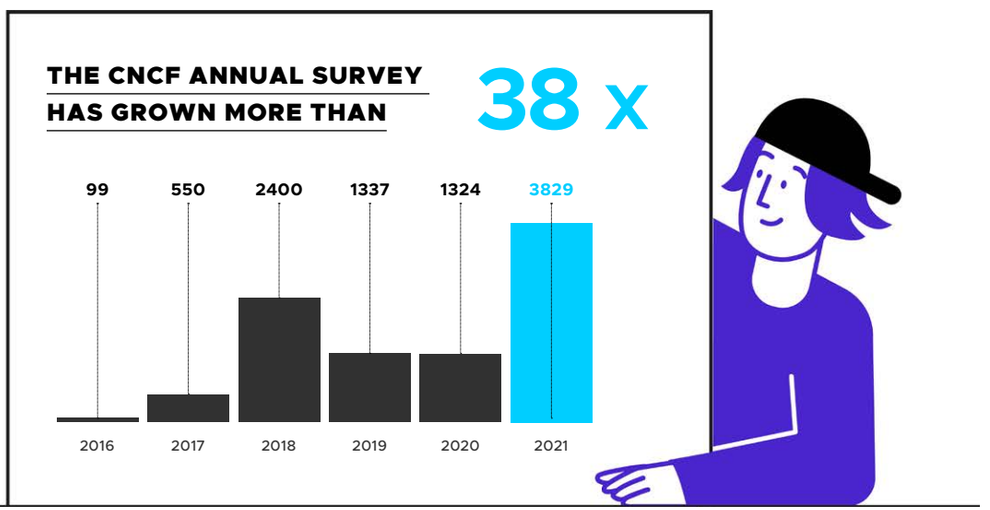
Secondly, we called on the expertise of observability platform providers and CNCF members **Datadog** and **New Relic**, who shared year-on-year production data trends to fully round out our survey and provide a snapshot of key production trends.

And finally, we incorporated our recent **State of Cloud Native Development Report** developed for CNCF by **SlashData**. This analysis is based on the 20th edition of SlashData's Developer Economics survey which ran between November 2020 and February 2021 and reached more than 19,000 developers globally. More than 3800 survey participants answered questions relating to the development of backend services and the technologies they use.

Beneath the topline numbers and key takeaways, a fascinating picture emerges of our community growing in importance and ubiquity. We hope you enjoy reading the report as much as we enjoyed creating it.

GET INVOLVED!

Are you a CNCF member with in-production data and insights, and want to help the community better understand evolving cloud native trends? Apply to take part in our 2022 CNCF Annual Survey and keep #teamcloudnative knowledgeable reach out to: **info@cncf.io**



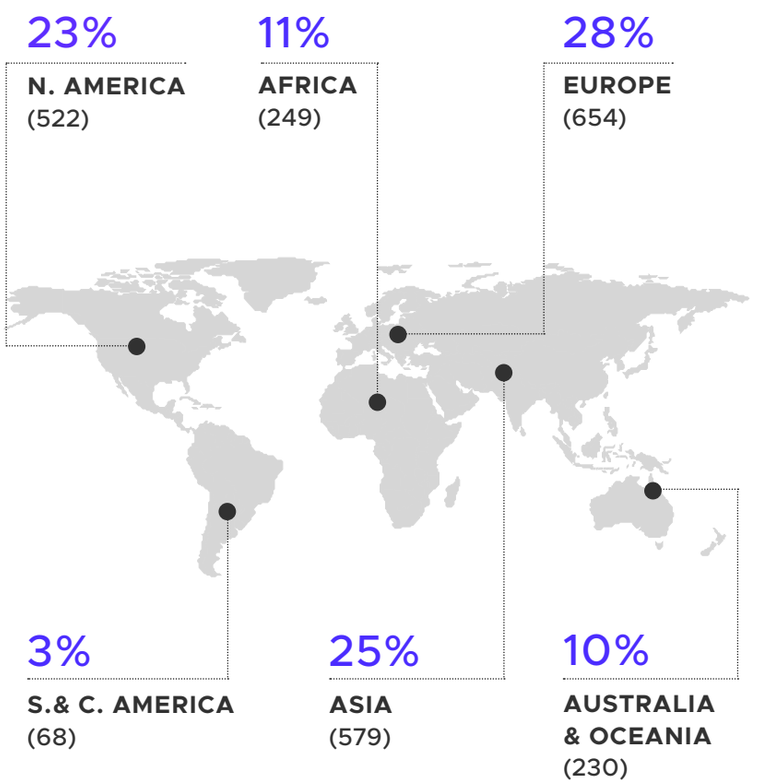
DEMOGRAPHICS

The 2021 report is truly global in scope, drawing responses from six continents and from across the spectrum of industry, from public, private and NGOs, to start-ups to the enterprise sector.

2302
RESPONDENTS

PART 1 / KUBERNETES AND CONTAINERS

REGIONS



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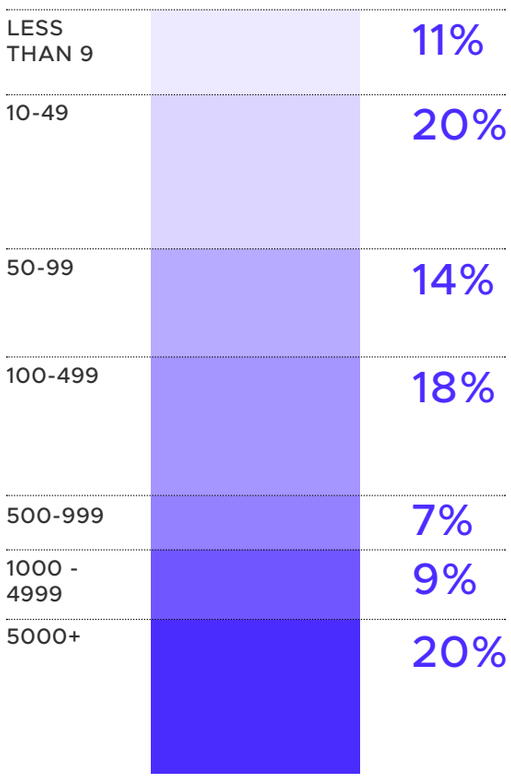
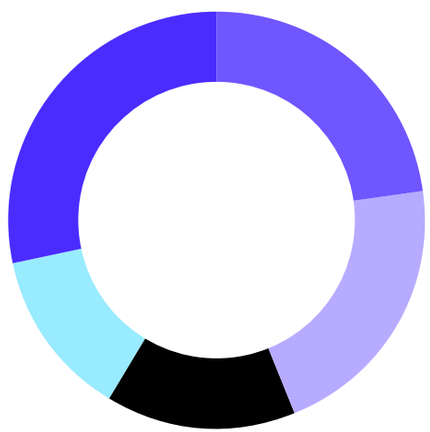


JOB FUNCTION

The most prevalent job functions

*respondents could select more than one function



- **31%** | SRE/DEVOPS ENGINEER
- **25%** | SOFTWARE ARCHITECT
- **23%** | BACKEND DEVELOPER
- **16%** | FULL-STACK DEVELOPER
- **14%** | FRONT-END / APPLICATIONS DEVELOPER

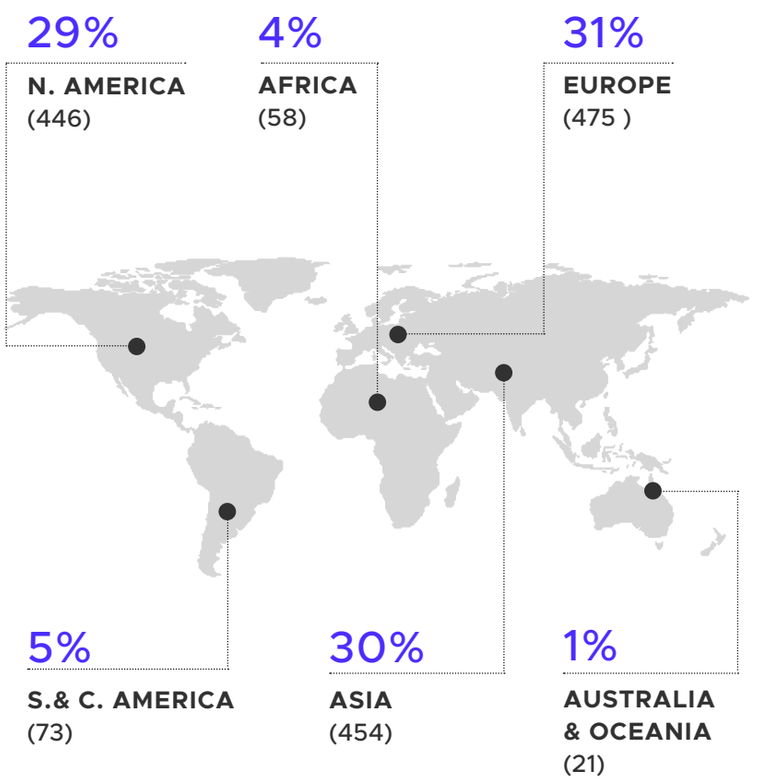
DEMOGRAPHICS

The 2021 report is truly global in scope, drawing responses from six continents and from across the spectrum of industry, from public, private and NGOs, to start-ups to the enterprise sector.

1527
RESPONDENTS

PART 2 / CLOUD NATIVE TECHNOLOGIES

REGIONS



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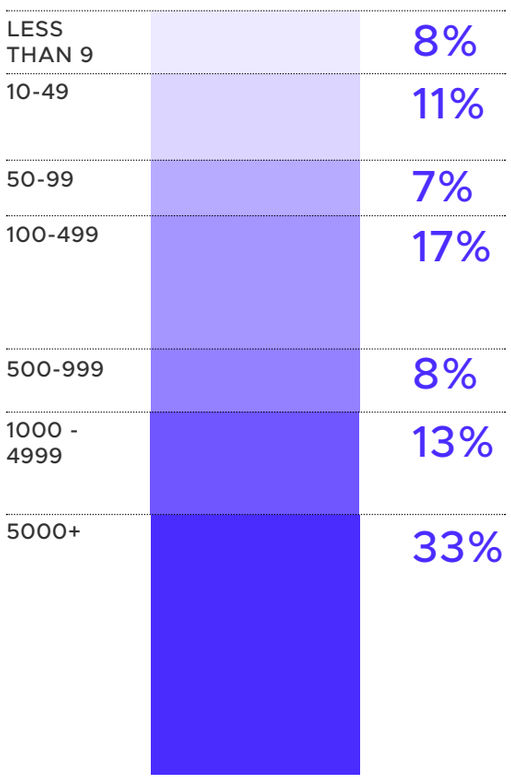

JOB FUNCTION

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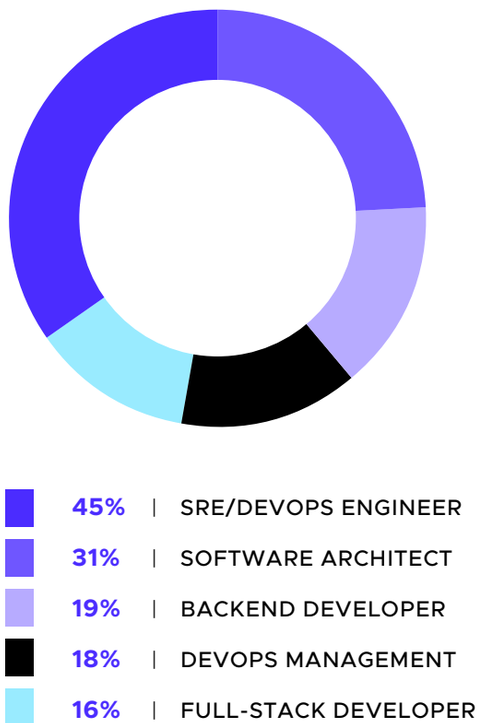
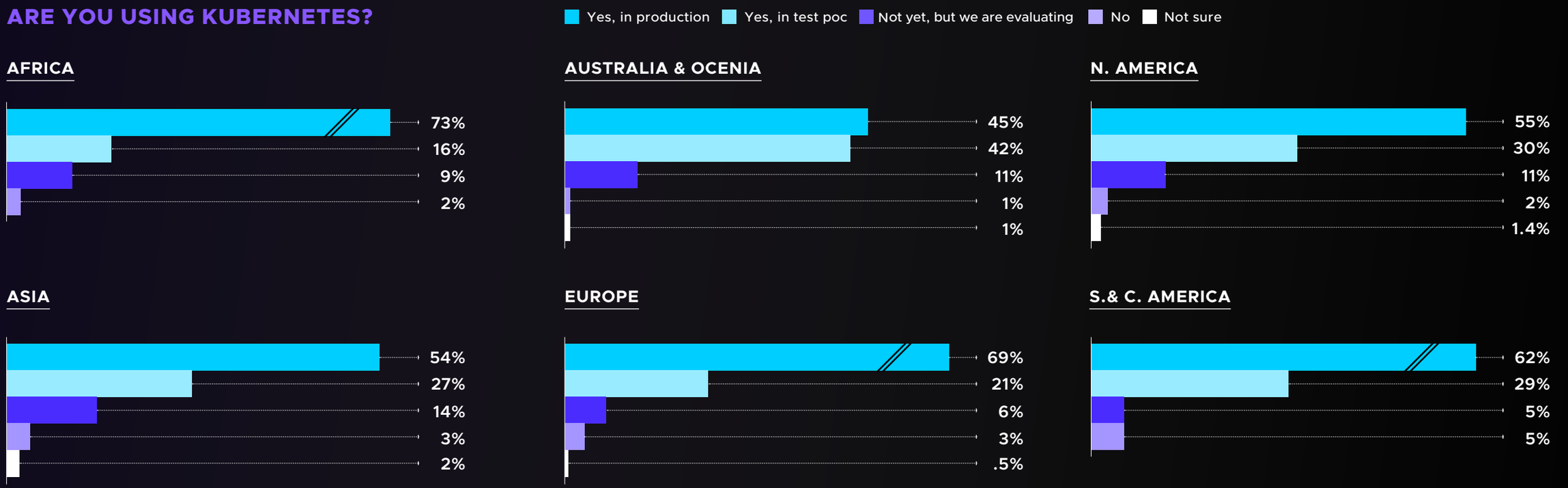


KUBERNETES HAS CROSSED THE ADOPTION CHASM TO BECOME A MAINSTREAM GLOBAL TECHNOLOGY

According to CNCF's respondents, 96% of organizations are either using or evaluating Kubernetes – a record high since our surveys began in 2016. Particularly interesting is the regional adoption of Kubernetes in production, with emerging technology hub Africa (73%) jumping ahead of other more established tech centers including Europe (69%) and North America (55%). Additionally, 93% of respondents are currently using, or planning to use, containers in production, echoing 92% in our **2020 survey**.

96% OF ORGANIZATIONS ARE EITHER USING OR EVALUATING KUBERNETES

ARE YOU USING KUBERNETES?



KUBERNETES HAS CROSSED THE ADOPTION CHASM

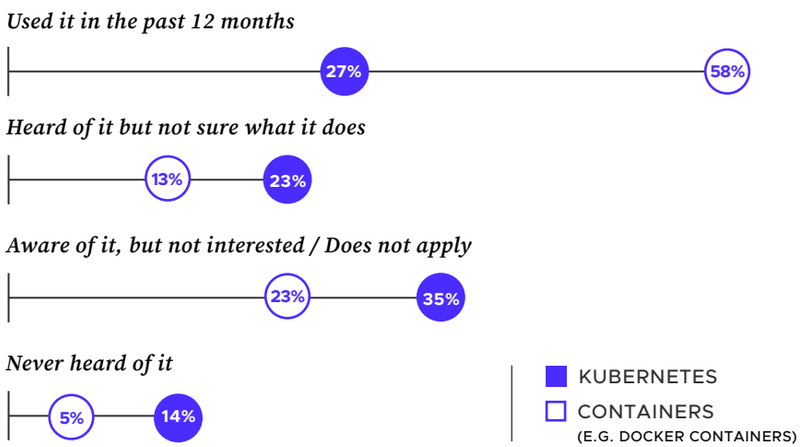
According to the most recent State of Cloud Native Development Report, developed for CNCF by SlashData, Kubernetes has demonstrated impressive growth over the past 12 months with 5.6 million developers using Kubernetes today.

This represents a 67% increase from a year ago when, adjusting for a change in the question methodology, there were 3.9 million Kubernetes developers worldwide. This group now represents 31% of all backend developers, an increase of 4 percentage points in the last year.

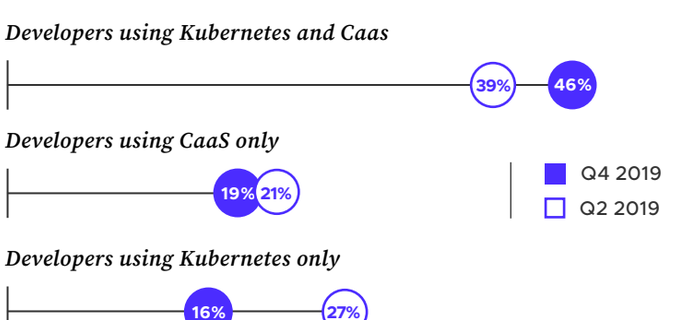
Kubernetes' ubiquity is also supported by strong evidence from New Relic, which saw a 37% year-on-year increase in Kubernetes adoption based on accounts and a 49% year-on-year increase in overall container adoption. Based on these statistics and New Relic's O11y Trends Report, they believe the rise in adoption of Kubernetes and container-based platforms has increased the need for observability maturity amongst organizations looking to gain visibility into their complex application architectures.

An interesting trend CNCF has seen develop is the correlation between Kubernetes and large organizations: respondents from organizations larger than 5,000 FTEs are far more likely to use Kubernetes than those working at smaller organizations. This is reinforced by findings from SlashData, who found Kubernetes usage skyrockets in large companies. Additionally, Datadog reported that larger companies (500-1000 and 1000+) are using Kubernetes more than smaller ones (<500).

CLOUD NATIVE TECHNOLOGY USAGE AND AWARENESS



OVERLAP OF KUBERNETES AND CAAS USERS %



State of Cloud Native Development, SlashData

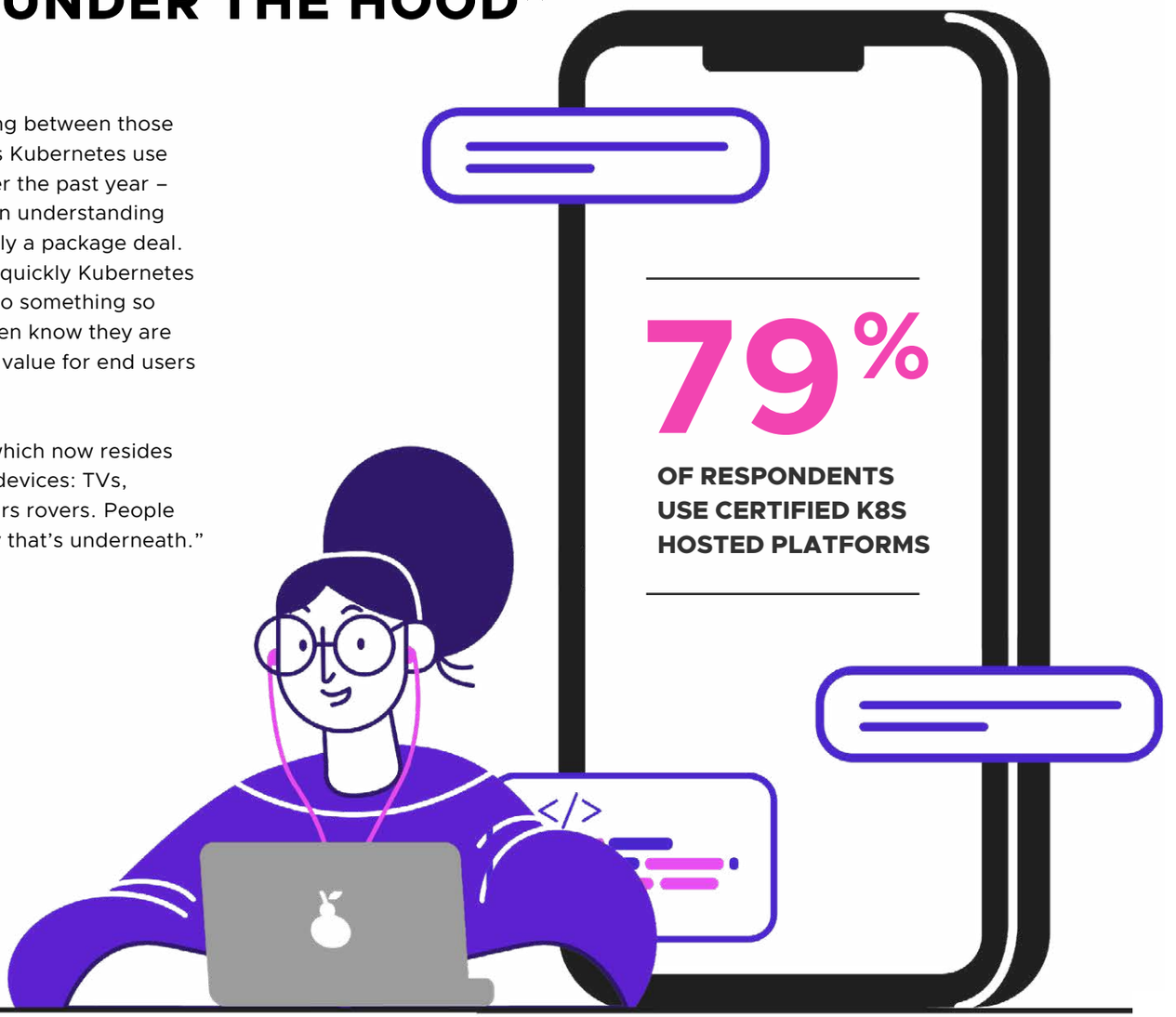
WITH ITS MAINSTREAM STATUS SOLIDIFIED, KUBERNETES IS STARTING TO GO "UNDER THE HOOD"

Both containers generally and Kubernetes specifically seem to be becoming less visible as the technology evolves. It appears that organizations are using serverless and managed services more intensively than in the past and users now don't necessarily need to know about the underlying container technology.

"The discrepancies we've been seeing between those reporting container use (93%) versus Kubernetes use (96%) has been growing steadily over the past year – there appears to be a growing void in understanding that these technologies are essentially a package deal. What's fascinating about this is how quickly Kubernetes has grown from a niche technology to something so utterly ubiquitous that folks don't even know they are using technologies built on it, as the value for end users has moved up the stack.

It's similar to the ubiquity of Linux, which now resides inside so many other platforms and devices: TVs, phones, fridges, and even on the Mars rovers. People tend not to realize all the technology that's underneath."

Chris Aniszczyk, CTO, CNCF



Kubernetes has grown from a niche technology to something utterly ubiquitous

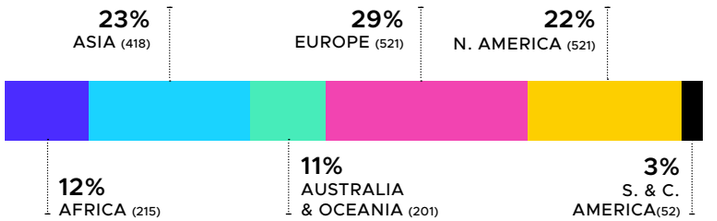
Chris Aniszczyk
CTO, CNCF

KUBERNETES IS STARTING TO GO "UNDER THE HOOD" 1 / 3

CNCF saw this trend reflected in part one of our survey results: 79% of respondents use Certified Kubernetes Hosted platforms. Of those, the most popular are Amazon Elastic Container Service for Kubernetes (39%), Azure Kubernetes Service (23%), and Azure (AKS) Engine (17%).

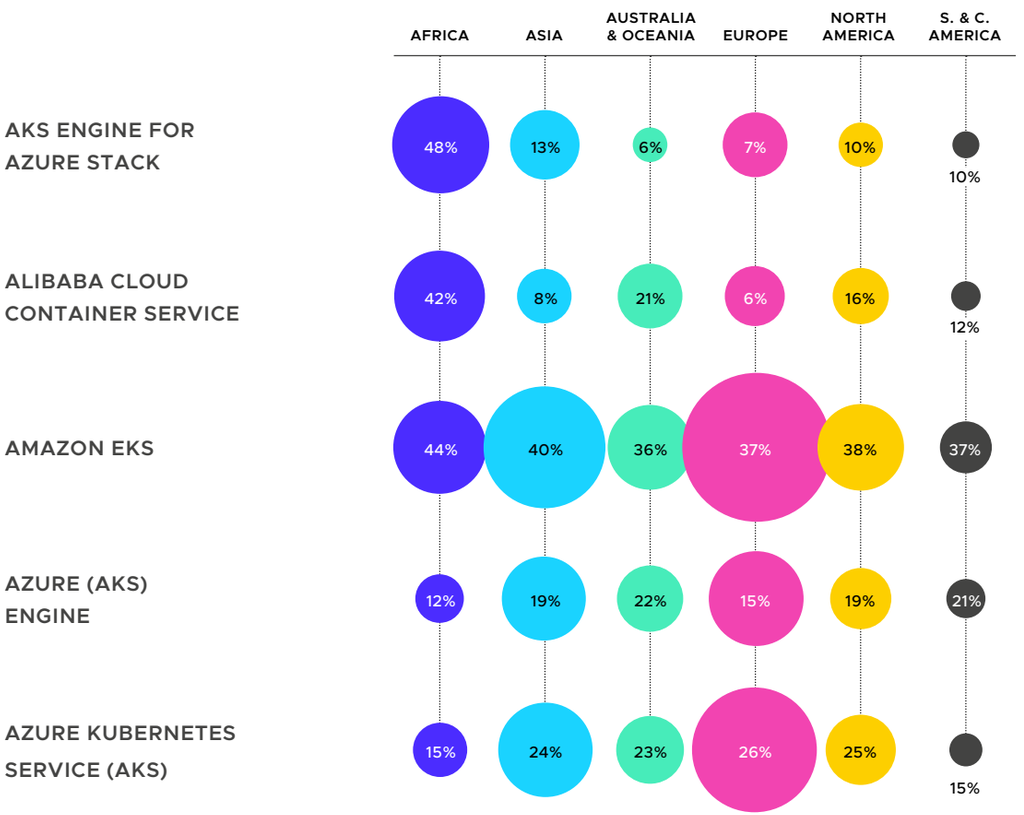
1809
RESPONDENTS

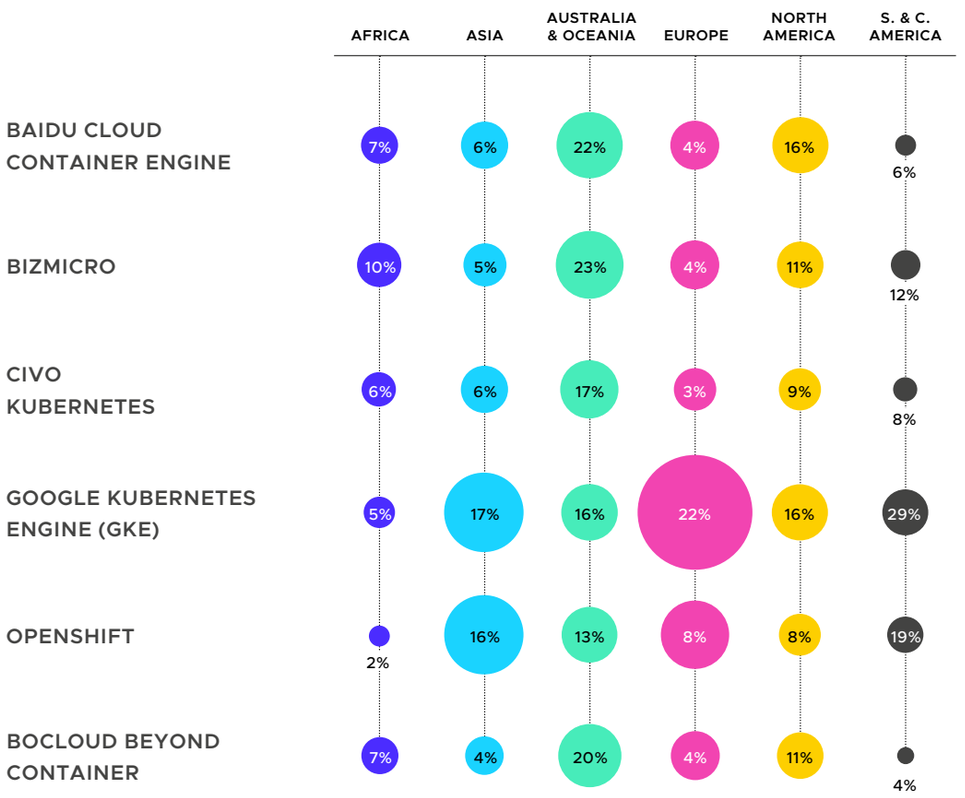
respondents could select more than one platform



DOES YOUR ORGANIZATION USE ANY CERTIFIED KUBERNETES INSTALLERS?

Scale of circle denotes volume of respondents and platform combined



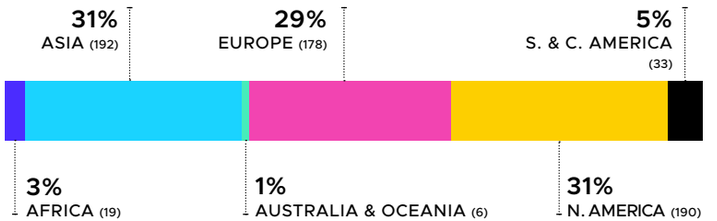


KUBERNETES IS STARTING TO GO "UNDER THE HOOD" 2 / 3

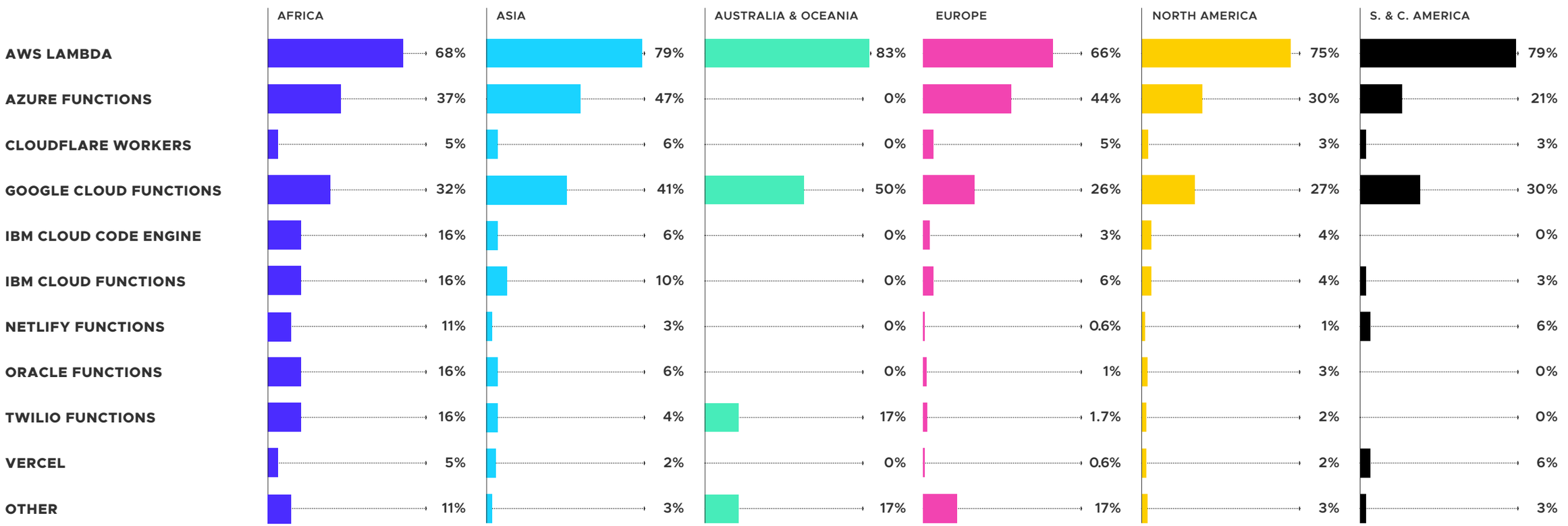
Meanwhile, part two of our survey revealed 39% of respondents are using serverless technology (similar to 2020), and of those who are, hosted platforms (75%) are the most popular – a 24% increase on last year, with AWS Lambda (74%) and Azure Functions (39%) the front-running choices.

618
RESPONDENTS

respondents could select more than one platform



IF YOUR ORGANIZATION IS USING SERVERLESS VIA A 'HOSTED PLATFORM', WHICH HOSTED SERVERLESS PLATFORMS DO YOU USE?



KUBERNETES IS STARTING TO GO "UNDER THE HOOD" 3 / 3

Datadog's **2021 Container Report** showed nearly 90 percent of Kubernetes users leverage cloud-managed services, up from nearly 70% in 2020. Meanwhile, nearly 40% of containerized companies using Amazon ECS use Fargate, up from around 35% in 2020, suggesting serverless containers are on the rise.

In addition, Datadog's **2021 State of Serverless Report**, which examined millions of functions run by thousands of companies to understand the real-world applications of serverless technologies, found that **Lambda functions are invoked 3.5 times more often than two years ago**. According to the report, AWS Lambda is the most mature and widely used function-as-a-service offering, but Datadog has also seen impressive growth in adoption of Azure Functions and Google Cloud Functions.

SlashData also reported a similar trend: 33% of developers using orchestration technologies are currently using Amazon ECS, making it the most widely adopted solution. However, GKE has been closing in on this lead with a substantial 4 percentage point growth in the last 12 months. Meanwhile, Amazon EKS is used by 30% of orchestration developers, and AWS Lambda continues to be the most popular serverless solution with 53% of serverless developers using it.

90%

OF K8s USERS LEVERAGE CLOUD-MANAGED SERVICES

EVIDENCE SUGGESTS ORGANIZATIONS ARE STARTING TO MOVE UP THE STACK

With Kubernetes maturing to a mainstream technology, more organizations appear to be slowly moving up the cloud native stack, leveraging Kubernetes APIs and interfaces.

This is particularly apparent with runtime containers (CRI-O, containerd), service mesh (Envoy, Linkerd), and monitoring tools (Prometheus). However, just as Kubernetes has begun disappearing under the hood, awareness of wider cloud native technologies also seems to be dropping. This is highlighted by the responses CNCF received when contrasted with production data from Datadog and New Relic – which paint a more accurate picture of cloud native adoption.

In the CNCF survey data we saw the use of our graduated projects in production and evaluation remain steady year-on-year. There were minor decreases in more mature graduated projects used in production which we attribute to the broader global responses from our growing community – Fluentd saw a slight drop in production usage of 13%, followed by Envoy (-10%), and Prometheus (-6%). containerd saw the most significant rise in usage of 28%. However, this conflicts a bit with production data from observability companies which show an increase in mature projects such as Kubernetes and Prometheus.

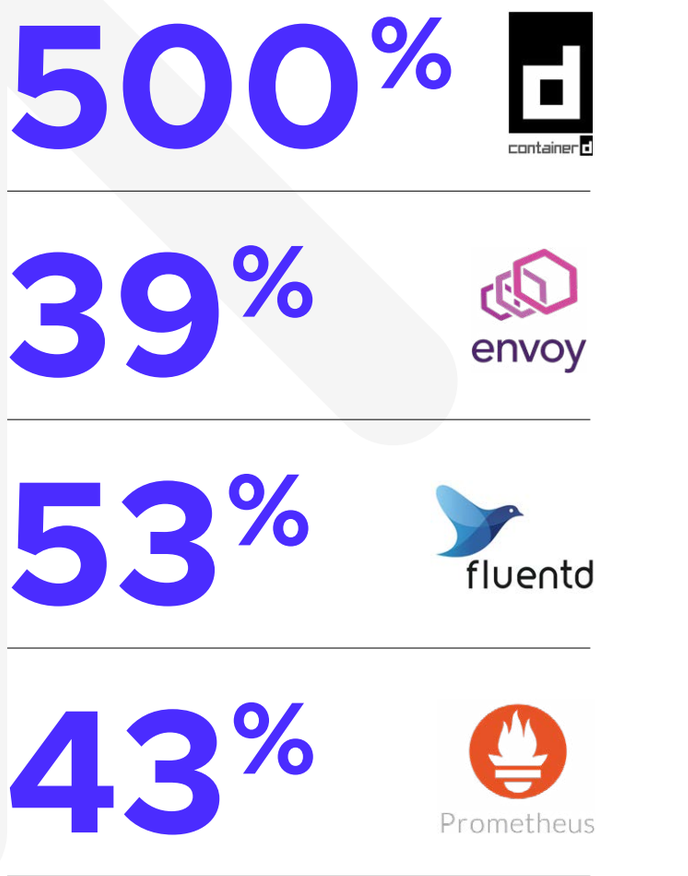
Furthermore, there is strong interest in up-and-coming incubating projects with a healthy increase in production usage. Most notable is the 115% year-on-year increase in Argo's in-production use. Container runtime CRI-O also saw in-production rise 51% year-on-year.

New Relic reported a 43% overall increase in Prometheus adoption for the last six months of 2021, based on accounts. Concurrently, FluentD adoption grew by 53% over the past year based on data ingestion. These trends show more and more organizations are looking to tap into open source technologies to advance their observability practice and capabilities.

Datadog reported the proportion of containerized companies that use containerd quickly grew 500% from 2020 to 2021. Likewise containerized companies that use Envoy grew 39% from January 2020 to January 2021.

This is an emerging trend, and it will be particularly interesting to contrast the results of CNCF's upcoming 2022 survey with what we are seeing today as the cloud native landscape continues to evolve.

CLOUD NATIVE PROJECT ADOPTION IS GROWING YEAR-ON-YEAR



THANK YOU

A huge thank you to everyone who participated in our survey and the support we received from Datadog and New Relic. As always, the full raw data from CNCF's survey is available on GitHub.

In the future, we look to incorporate more production data from our members to compliment survey data to get a more accurate picture of cloud native adoption. If you're interested in working with CNCF to give a more accurate picture of adoption of cloud native projects, please reach out to info@cncf.io

VIEW THE FULL DATA ON GITHUB

You can also view the findings from past surveys here:

CNCF SURVEY 2020: Use of containers in production has increased by 300% since 2016

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

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