



Project Description

Kubernetes is the most widely used container orchestration platform, often described as the “Linux of the cloud”. Kubernetes is hosted by the Cloud Native Computing Foundation (CNCF). This report attempts to objectively assess the state of the Kubernetes project and how CNCF has impacted the progress and growth of Kubernetes. Of course, without access to a multiverse to play out alternative scenarios, it is impossible to sort

out correlation and causation. However, this report can at least document correlations.

This is the first of a series of project journey reports CNCF will be publishing focused on the graduated projects.

Project Snapshot

Kubernetes’ first [commit](#) was made on June 6, 2014. Between [joining](#) CNCF on March 10, 2016 and today, Kubernetes has enjoyed:



*Note: These statistics were collected with the [DevStats](#) tool, which CNCF built in collaboration with Kubernetes and other CNCF project communities. For this report, we define “contributor” as somebody who made a review, comment, commit or created a PR or an issue.

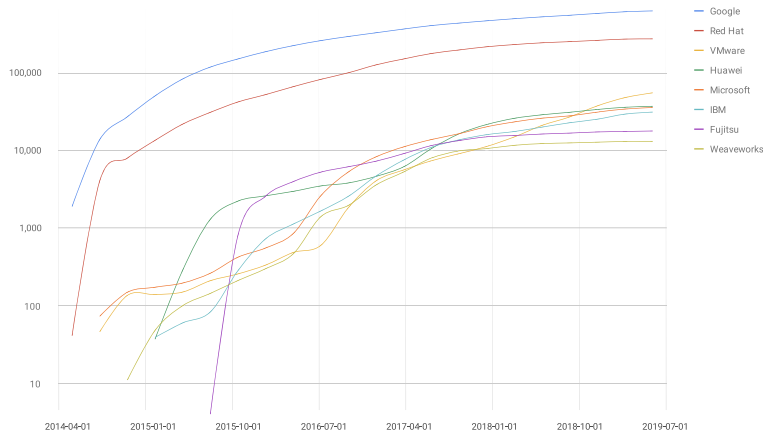
CNCF Premise of Open Source Software Development

A basic premise behind CNCF, our [KubeCon + CloudNativeCon](#) conferences, and open source in general is that most interactions are positive-sum. There is no fixed amount of investment, mindshare, or development contributions that is allocated to specific projects. Just as open source development is based on the idea that, collectively, we are smarter than any one of us, open source foundations work to make the entire community better off. Equally important, a neutral home for a project and community fosters this type of positive-sum thinking and drives growth and diversity that we believe are core elements of a successful open source project.

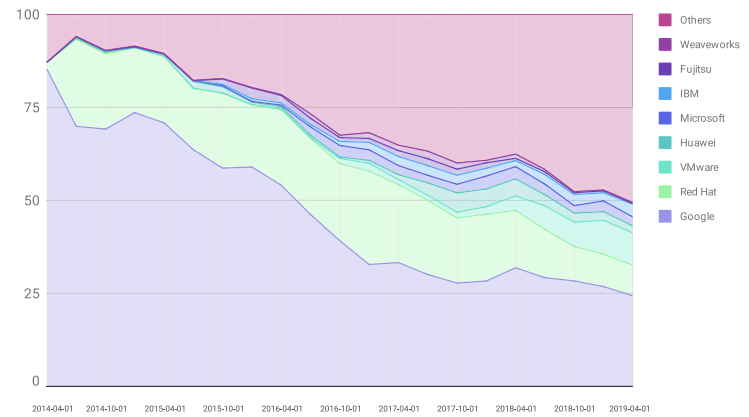
Code Diversity

Today, no single company dominates contributions to Kubernetes. The top two contributing companies are Google and Red Hat. These two accounted for 83% of contributions before Kubernetes joined CNCF three years ago. Today, they account for 35% of contributions. Even as their percentage of all contributions has declined, the gross number of contributions from those two companies has continued to increase. This indicates a healthy dynamic where the project originators continue to contribute high volumes of code but have also encouraged other organizations to contribute a greater percentage of code over time, sharing stewardship and growing the community. At inception, the number of actively contributing companies started at ~15. Today the number of actively contributing companies tallies ~350, an increase of over 2,000%. Over 2,000 companies have contributed code to Kubernetes since the inception of the project. Kubernetes has also enjoyed a healthy expansion of individual contributors over the project life. At its beginning, Kubernetes had roughly 20 actively contributing developers. When CNCF accepted Kubernetes as its first project, there were roughly 400. Today it has over 3,000 active contributors, representing a contributor increase of over 14,000% since inception and 7x since acceptance.

Contributions by Company

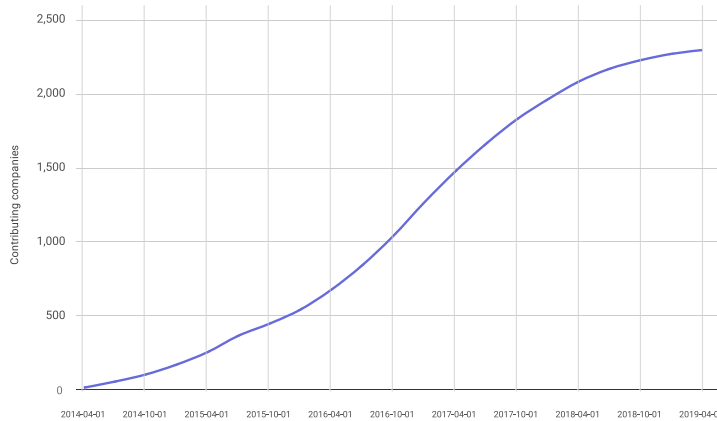


Cumulative volume of contributions by company since Kubernetes project launch

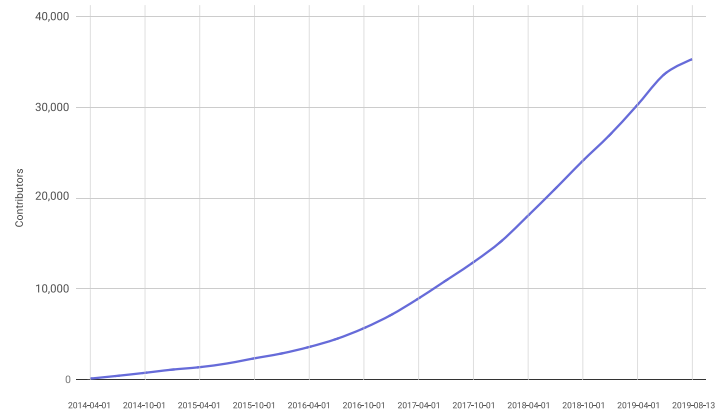


Percentage breakdown of contributions by company since Kubernetes project launch

Growth: Contributing Companies and Contributors



Cumulative growth of number of contributing companies



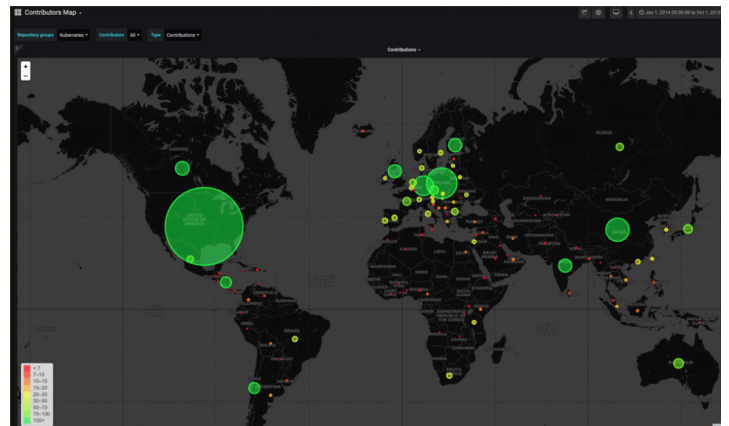
Cumulative growth of contributors

Geographic Diversity of Contributors

Contributors to Kubernetes have come from dozens of countries with geographic diversity of contributions expanding over time. Over the life of the project, 11 countries have averaged 10 contributors or more and 17 have averaged 5 or more. The four graphics show the number of contributions over time and the percentage of contributors over time, broken down by country.

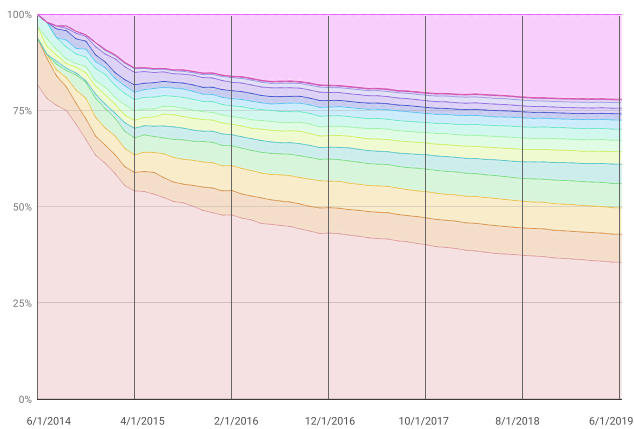


Number of contributions per country over time – 6/2014 – 6/2019

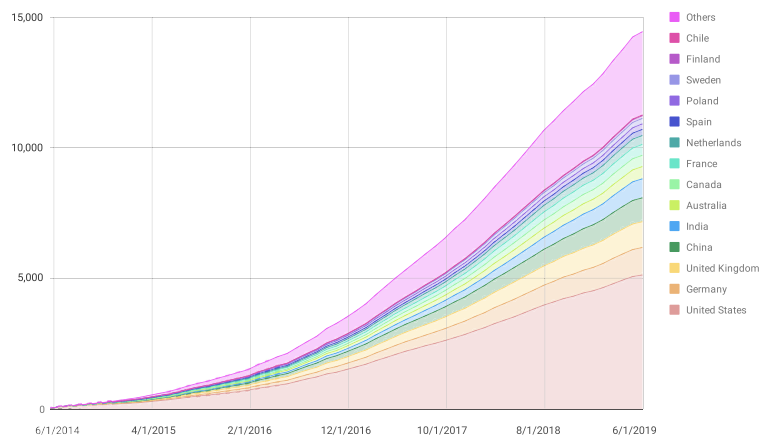


Number of contributors per country over time - 6/2014 - 7/2019

Contributions by Country



Change in percentage of contributors by country

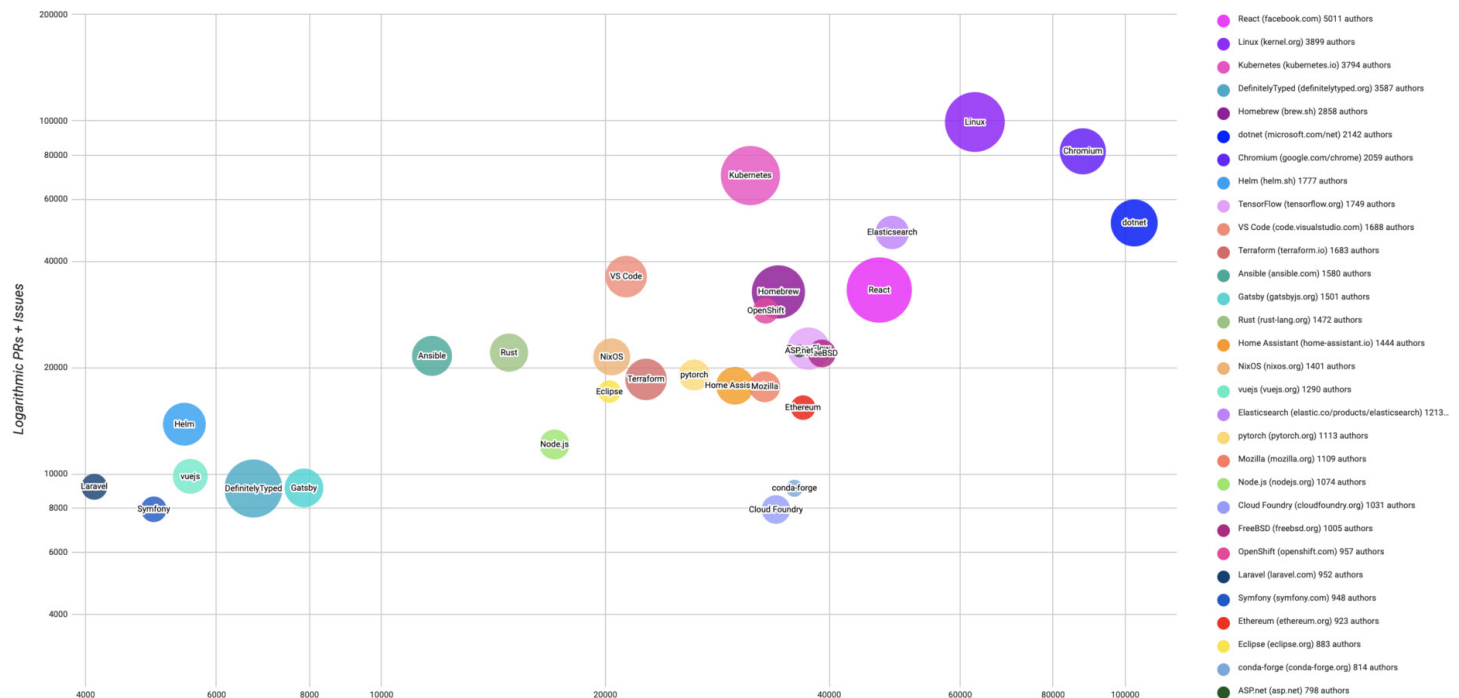


Cumulative growth of contributors by country

Development Velocity

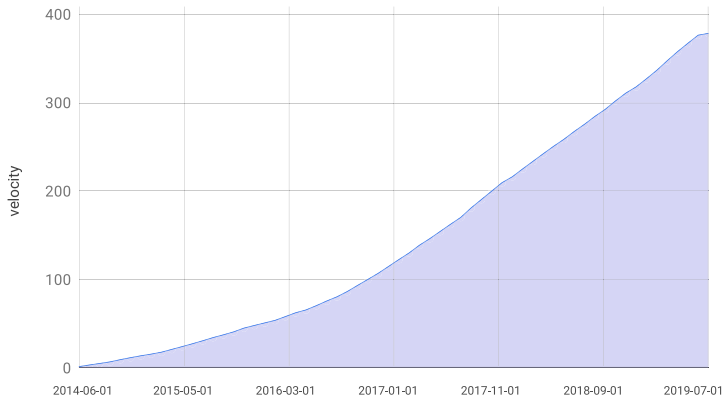
Kubernetes is one of the fastest growing open source software projects in history. The charts below show the developer velocity tracked across three metrics: number of authors, number of pull requests and issues, and number of code commits. The bubbles' area is proportional to the number of authors, the y-axis (height) is the total number of pull requests and issues, and the x-axis is the number of commits. A greater bubble circumference plus a position in the upper right quadrant indicates high velocity, evidence of a diverse, engaged, and vibrant community fostered by a neutral home. Kubernetes velocity metrics continue to accelerate, including number of pull requests and number of contributors.

Top 30 Projects



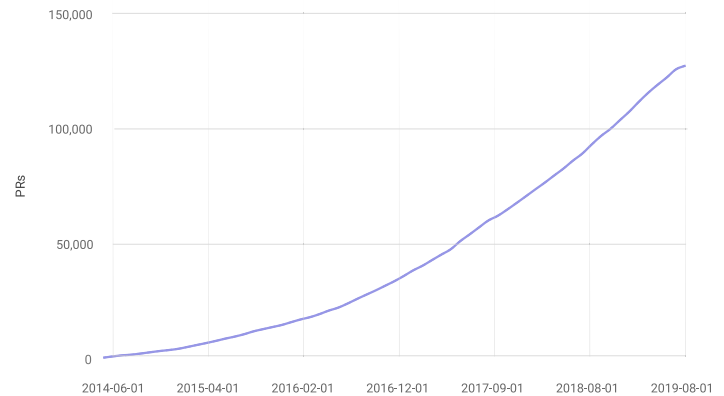
Bubble Chart of the 30 highest velocity open source projects as of June 2019

Velocity Monthly



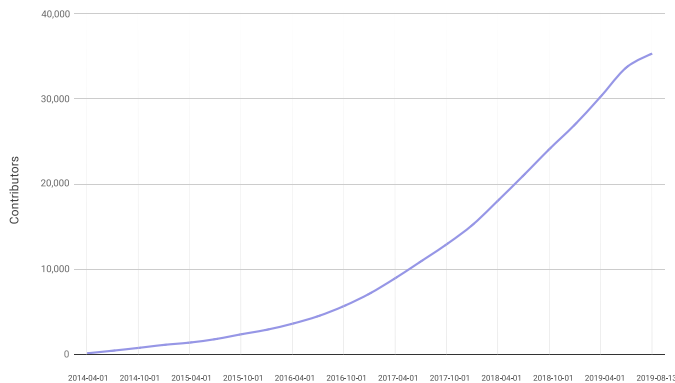
Velocity increases over time

Kubernetes Pull Requests



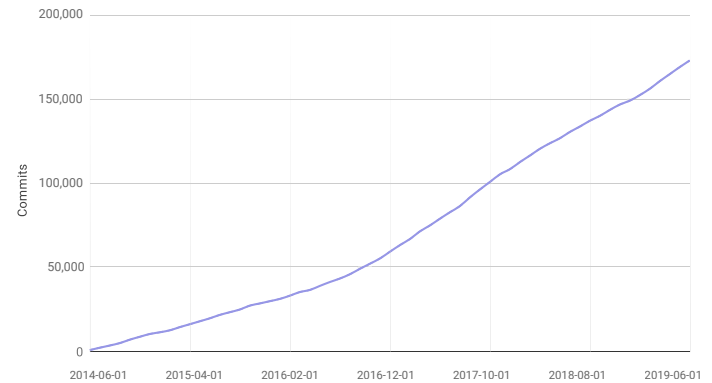
Cumulative growth of Kubernetes pull requests over time

Kubernetes Contributors



Cumulative growth of Kubernetes contributors over time

Kubernetes Commits



Cumulative growth of Kubernetes code commits over time

Education, Events and Sponsorship

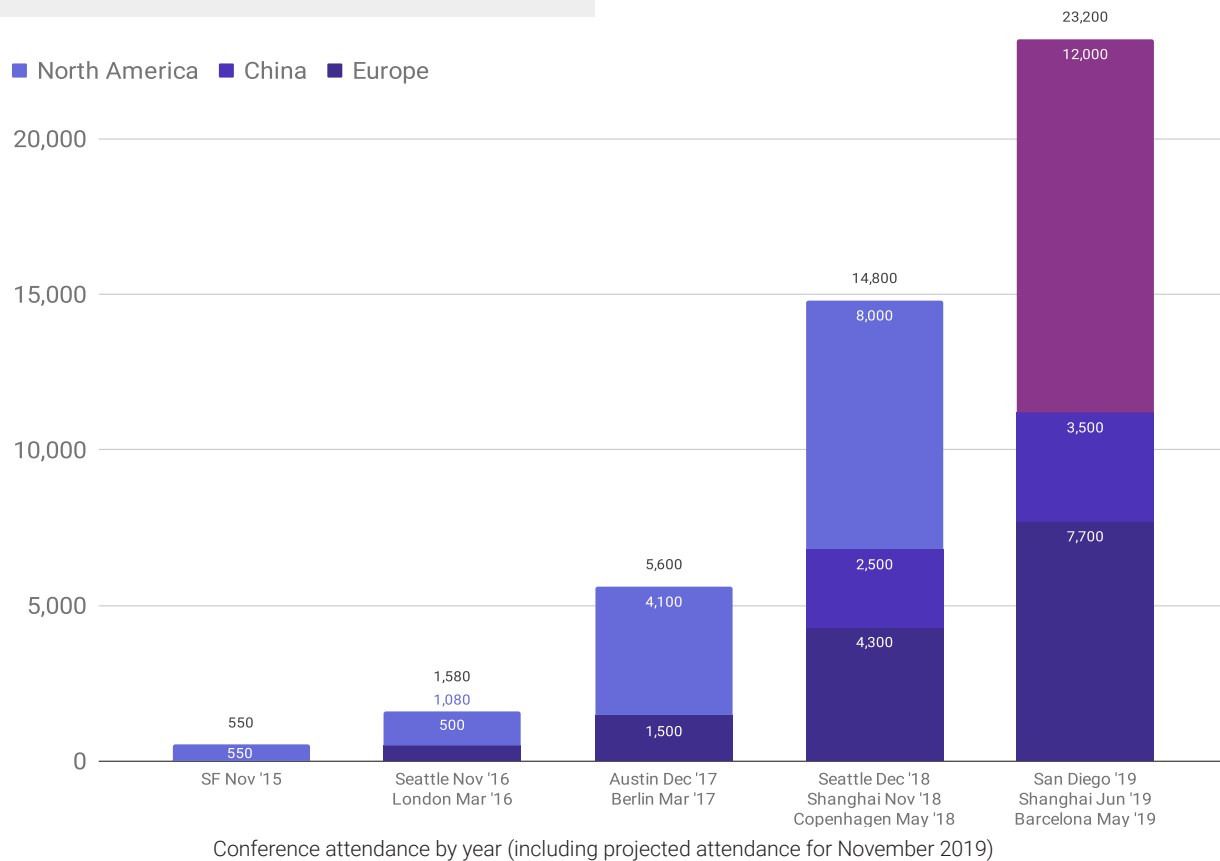
Growth of community participation in education, events and sponsorship are reliable proxies for the health of a project. Kubernetes is enjoying continued growth on all three of those metrics.

Events

In the last 12 months, more than 21,000 people attended Kubernetes-related CNCF events around the world. Demand for events continues to strengthen. KubeCon + CloudNativeCon attendance has been roughly doubling every year. To meet rising demand and ensure broader geographic access, Kubernetes added China events in 2018. Since 2015, the number of sponsoring organizations for KubeCon+CloudNativeCon NA and EU has grown more than 5x. Sponsor revenues underwrite all CNCF events. Profits from Kubernetes events are deployed back into the community to support a variety of programs including education and certification, sponsorship of smaller events and meetups, and documentation efforts. CNCF and its members have also sponsored event scholarships to better enable underrepresented groups to attend Kubernetes events. CNCF's diversity program has provided full scholarships (including travel funding as well as registration) to more than 300 recipients from traditionally underrepresented and/or marginalized groups, to attend KubeCon + CloudNativeCon since 2016.

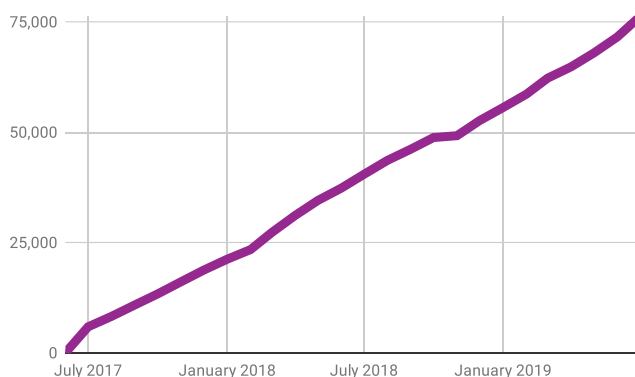


KubeCon + CloudNativeCon Attendance

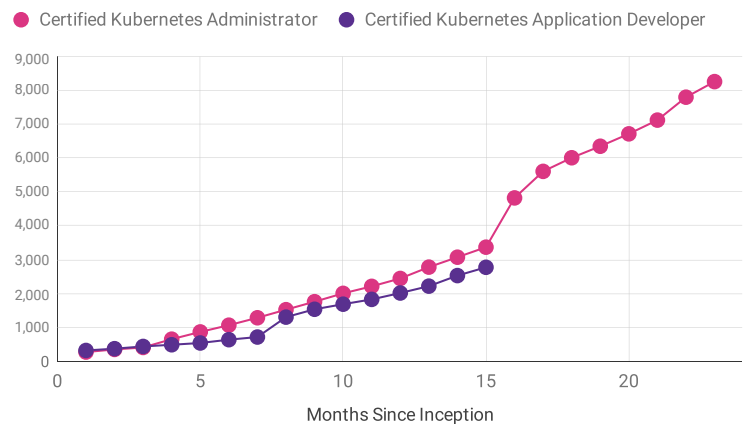


Education

A core mission of CNCF is Kubernetes education. In July 2017, CNCF and the Linux Foundation announced a free Massively Open Online Course (MOOC) [“Introduction to Kubernetes”](#). The course was launched in partnership with edX.org. As of this report, 68,000 people have taken the course with registrants from 159 countries. Also in 2017, CNCF created the [Certified Kubernetes Administrator \(CKA\)](#) program. This program was created to help develop and grow the Kubernetes ecosystem by preparing more people to work with Kubernetes. As of this report, more than 8,200 people have registered for the CKA certification process. In May 2018, CNCF launched the Certified Kubernetes Application Developer (CKAD) program to teach developers best practices for app development on Kubernetes. To date, more than 2,700 people have registered for the certification. In May 2018, CNCF launched the [Kubernetes Training Partners \(KTP\)](#) program with six partners certified to offer customized Kubernetes training to organizations. As of this report, the KTP program has grown to 29 training partners.



Number edX completions / certificates issued



Number of CKA/CKAD courses purchased

Marketing Growth and Programs

Website, Publications and Webinars

In June 2017, CNCF began to facilitate design and content for kubernetes.io. From that date through the date of this report, site traffic has grown from 1.8 million monthly page views to over 5.3 million monthly pageviews. In 2018, CNCF took over management of the [@kubernetesio](https://twitter.com/kubernetesio) Twitter account. Since then, total engagements have increased from 7,200 to 200,000. The number of Twitter followers has grown by 300%. As of the summer of 2019, webinars covering major Kubernetes releases were attracting more than 800 attendees. Thanks in part to these marketing efforts, public awareness of and interest in Kubernetes have grown quickly. Google Trends data for Kubernetes shows a greater than 9x increase in awareness since the project was contributed to the CNCF in March 2016.

Kubernetes.io Page Views Per Week



Documentation, Localization, and IT Support

Continuous additions to, and improvements of project documentation are essential for the growth of any open source project. Similarly, localization of that documentation into different languages enhances growth by making the project more accessible to a wider audience. In early 2018, CNCF staff helped create a [Kubernetes docs contributor's guide](#) to clarify the documentation process and enhance documentation velocity as well as grow the pool of contributors to the Kubernetes code base. To increase participation, CNCF also helped develop a [non-technical contributor's guide](#) to Kubernetes. Over the course of 2018, documentation contributions approximately doubled to 5,800 issues/PRs opened and closed. CNCF staff helped the community establish guidelines and standards for a scalable and efficient [localization](#) and branching strategy. This included supplying a technology solution that allowed for rapid and cost effective deployment of localization workflows and localized documentation. CNCF funded and managed the migration of docs and site framework from Jekyll to Hugo, which now offers built-in multilingual support. In 2018, CNCF also launched kubernetes.cn, a replica of kubernetes.io content hosted inside the Great Firewall. As of this report, there are seven active localizations (Chinese, Korean, Japanese, French, German, Italian, Spanish) and an additional language (Portuguese) in development. CNCF is ready to support any other localization efforts that the Kubernetes community wishes to mount.



Kubernetes “Crossing the Chasm”

Another key indicator of success of an open source software project is adoption of the project by businesses and the growth of a viable business ecosystem. This ecosystem should help end user organizations adopt Kubernetes in production and should help broad project adoption cross the chasm from “early adopters” to “early majority”. The number of “end user” members of the CNCF, the vast majority of which are also using Kubernetes in production, has tripled in the past 18 months, increasing from 33 to 99. This growth in end user members indicates broader production adoption and mainstream acceptance. According to the open source analysis firm [Redmonk](#), Kubernetes is being used for container orchestration by more than 71% of Fortune 100 companies. In recognition of this progress, CNCF “graduated” Kubernetes in March 2018, the first project to graduate from CNCF.

Conformance and Certification Programs

In November 2017, CNCF launched the [Certified Kubernetes program](#) to define and facilitate a consistent experience across Kubernetes distributions. The software conformance program ensures that every vendor’s version of Kubernetes supports the required APIs. At program launch there were 32 conformant distributions. As of this report there were over 90 Certified Kubernetes offerings. All of the largest public clouds and major software enterprise companies have joined the conformance program and support its efforts.

In September 2017, CNCF launched the [Kubernetes Certified Service Provider \(KCSP\)](#) Program to build a network of trusted service providers to assist organizations wishing to adopt Kubernetes. At launch, 22 KCSPs were certified. As of this report, 101 KCSPs have been certified.

Additional Specific Program Efforts

CNCF generally avoids hiring engineers because we don’t want to compete with our members. We have made an exception to fund test development in order to try to address some of the technical debt resulting from the accrual of features in the stable API that lack corresponding conformance tests. Additionally, in 2019 CNCF underwrote an extensive [security audit](#) of Kubernetes.

Conformance Test Development

In 2018, CNCF began funding conformance test development for Kubernetes through an external test development firm. All tests submitted as PRs are approved through the normal SIG-Testing review process. Submitted tests must receive approval from SIG-Architecture. Additionally, after [consultation](#) with CNCF staff, SIG-Architecture instituted a new [requirement](#) that new features in Kubernetes must have conformance tests before becoming part of the [stable API](#). To determine which Kubernetes APIs are used the most but lack conformance tests, CNCF-funded contractors have developed [APISnoop to capture API usage data](#). Data collected by APISnoop will be used to prioritize conformance test development.

Project Security Audit

Lastly, to provide better assurance to end users that Kubernetes is secure, CNCF underwrote a comprehensive \$250,000 security audit of the project. The audit was orchestrated by the [Kubernetes Security Audit WG](#) in 2019.

Conclusion

CNCF is committed to fostering and sustaining an ecosystem of open source, vendor-neutral projects by democratizing state-of-the-art patterns to make technology accessible for everyone. We hope this report provides a useful portrait of how CNCF is fostering and sustaining the growth of Kubernetes.

“Because there’s now an organization that supports Kubernetes, does that build confidence? The answer is a resounding yes.” — Naveen Gattu, Senior Software Engineer on the Community Team at VSCO, a CNCF End User.