KubeCon CloudNativeCon North America 2026

#KubeCon #CloudNativeCon

10 Years of minikube and the Future of Millions of Users

Medya Ghazizadeh

KubeCon NA 2026 Salt Lake City



$ whoami

Medya Ghazizadeh - medya.dev

13 years experience as software engineer

8.5 years experience at Google, 3 years as Manager
9 Google awards - Among Top CNCF/Kubernetes Contributors

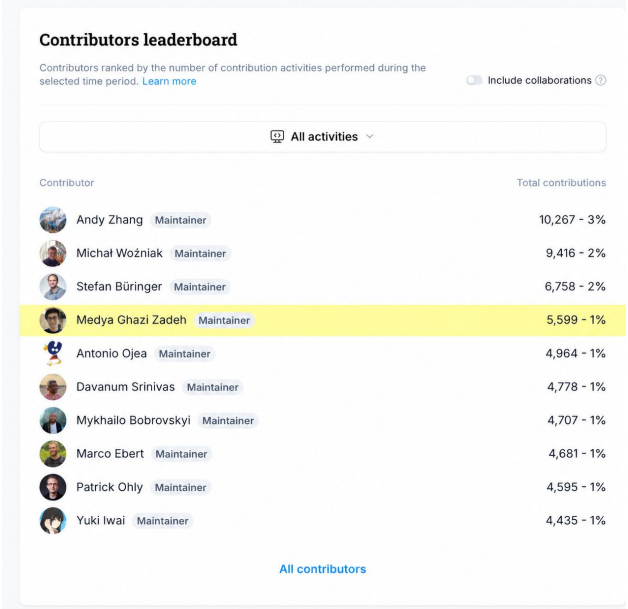
7 years leading minikube

Downloads: 35K → 18M

Author / maintainer of a dozen OSS projects, including gopogh

Open Source History

- Ubuntu Local Groups 2006
- Led **“DePaul Linux Community”** in Chicago - 2011
- Authored K8Guard - First Auditing System for Kubernetes- 2015
- 10 years of Contributions to 36 CNCF projects 2016-Now
- InfoWorld Bossie Award for Best of Open Source Software of the year 2021
- Top 4 CNCF Contributors - 2025
- Top All-time Contributor to Kubernetes - 2025
- Recipient of contributor award of 2026 at KubeCon Maintainers Summit



minikube

build passing | go report retired | downloads 18M

CodersRank Rank

Top 4%



CLOUD NATIVE COMPUTING FOUNDATION

CONTRIBUTOR CARD



medyagh

5.5k | 942 | 1.1k

7.5k contributions to **36** repositories

FIRST CONTRIBUTION

kubernetes/client-go

get containger image size ?

Feb 1, 2017

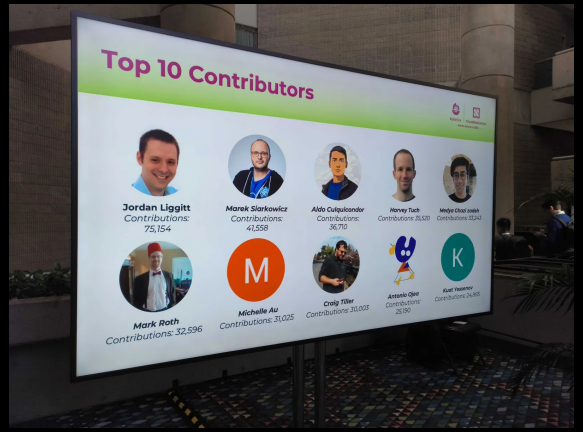
YEARS CONTRIBUTING (10)

2026 | 2025 | 2024 | 2023 | 2022 | 2021 | 2020 +

REPOSITORIES (36)

minikube | minikube-gui | minikube-preloads +33

Share | Get yours



The best open source software of 2021

Feature

Oct 18, 2021 • 16 mins

InfoWorld's 2021 Bossie Awards recognize the year's best open source software for software development, devops, data analytics, and machine learning.

What does open source Mean to me ?



Connecting , Building Together, More Equal Opportunity based on Merit, Freedom of Choice and Do Good

What is minikube?



- Created by Google in 2016
- The most Popular way to start a Certified Kubernetes Cluster locally ! (CNCF Survey)
- Respect Users Freedom of Choice
- Specialized features for local iterative development & embedded use
- Support for International users (13 international languages, support slow/restricted internet)

Some minikube features

Cloud Spanner KubeVirt Ambassador Network policy gVisor Registry aliases Ingress DNS

Localized CLI / LC_ALL NVIDIA GPUs gcp-auth addon Custom TLS certificates Custom addon images Local Path Provisioner Static tokens

kubectl -- <command> --alsologtostderr --extra-config --cni / choose a CNI Static IP --cni=<manifest> ssh -- <command> --container-runtime

Custom ISO Preloaded images ~/.minikube/files/ Corporate CA certificates Structured step events Custom KIC images cp / copy to a node

--kubernetes-version QEMU / ARM64 VMs SSH driver node add pause / unpause --driver Rootless Docker / Podman Auto-pause addon

--no-kubernetes minikube GUI Volume snapshots Apple GPU / AI playground

HA clusters Multi-node Docker Desktop replacement Istio eBPF tools

stop --schedule=5m Multiple clusters --output=json --delete-on-failure GitHub Actions Headlamp Offline use

--cpus=max --memory=max config set cache add Host mounts docker-env image load image save image pull image build podman-env

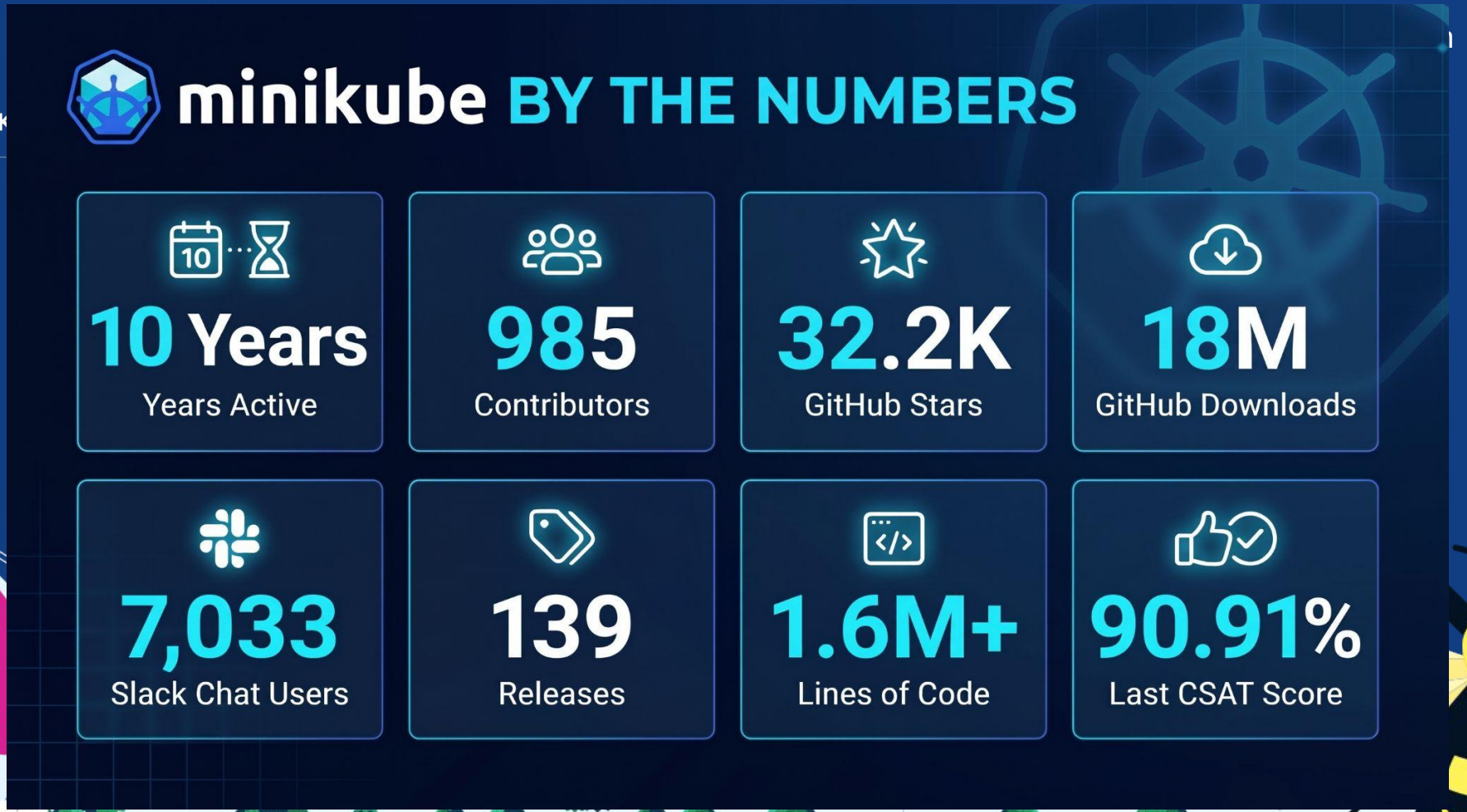
logs --file=logs.txt status --watch logs --problems Audit log / --user --wait-timeout --wait=all / --wait=false --interactive=false license Exit codes

tunnel / LoadBalancer Proxy / VPN support service / NodePort --feature-gates WSL 2 addons list / enable --registry-mirror --image-repository

Audit policy AWS ECR credentials AMD GPUs YAKD TCP / UDP ingress Traefik CSI driver Inspektor Gadget OpenID Connect Kong

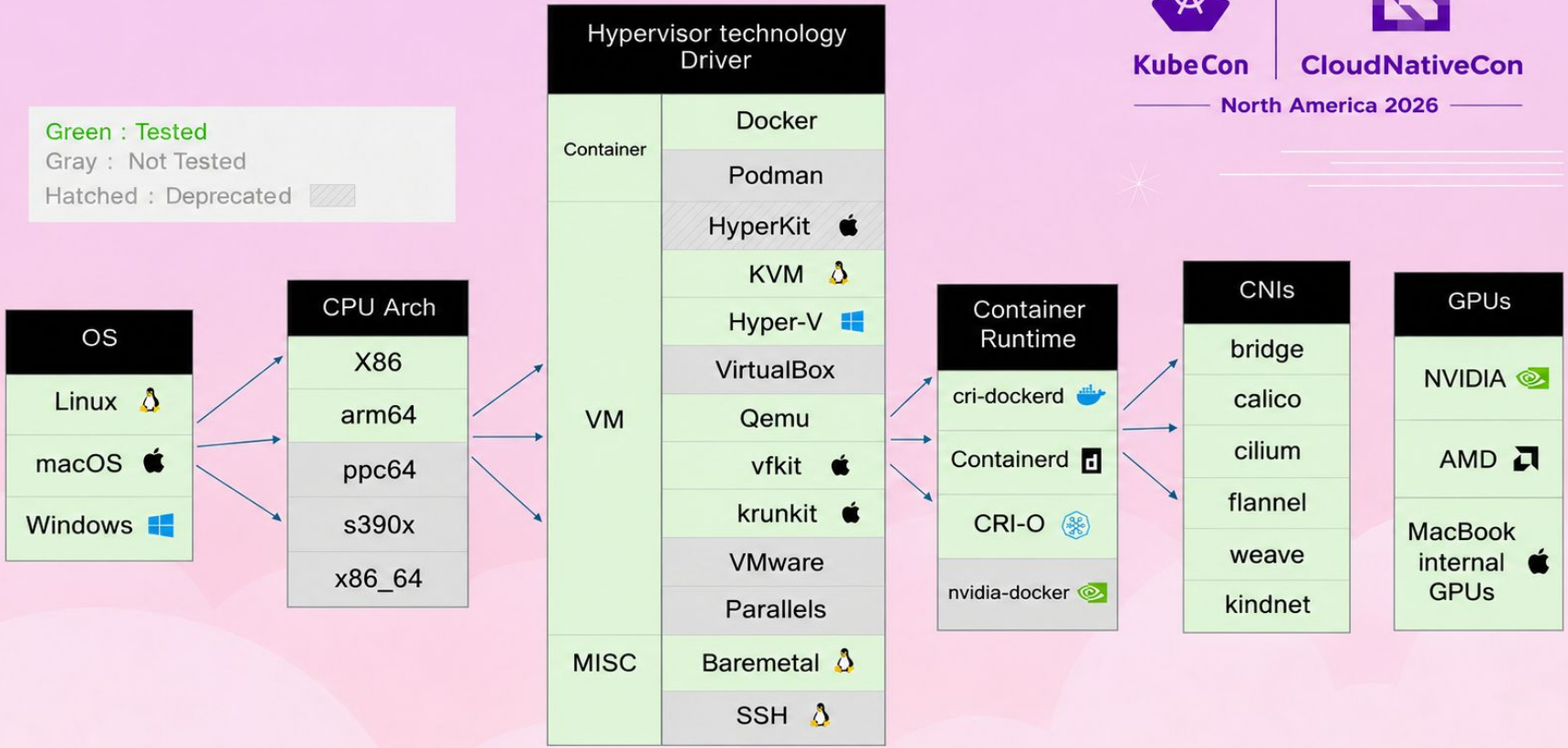
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Checkout minikube tutorials on website


minikube BY THE NUMBERS
10 Years
Years Active
985
Contributors
32.2K
GitHub Stars
18M
GitHub Downloads
7,033
Slack Chat Users
139
Releases
1.6M+
Lines of Code
90.91%
Last CSAT Score

Tech Support Matrix!

Green : Tested
Gray : Not Tested
Hatched : Deprecated



Demo: Deploy AI chatbot Using MacBook's GPU



Scan to Watch on Youtube

First and Only Local Kubernetes Tool that you can Utilize your Macbook internal GPU inside a cluster.
Thanks to Nir Soffer for the Krunkit driver.

Periods of Minikube

10 years. Three eras. An open question.

2016–2019 | 2019–2023 | 2023–mid 2026 | Mid 2026 →

Creation

2–3

full-time team members

Born in the Container Tools team San Francisco

Boom

4–5

full-time maintainers

Exponential growth of users and features and scopes

Downsizing

1

full-time maintainer

Moved to the different org Sunnyvale

The future

?

full-time maintainers

What comes next?

Principles that became practice

What guided my seven years leading minikube

01	**Keep it simple**	XP / YAGNI: build what users need; iterate in small steps.
02	**Protect the user**	Preserve compatibility. Test existing workflows.
03	**Metric Driven Decision**	cstat · time-to-k8s · SlowJam · image benchmarks
04	**Design for human mistakes**	Automated tests & chores · Gopogh · setup-minikube
05	**Listen with empathy**	Surveys · Triage Party · Pull Sheet · inclusive community

Values → engineering decisions → tools the community can use

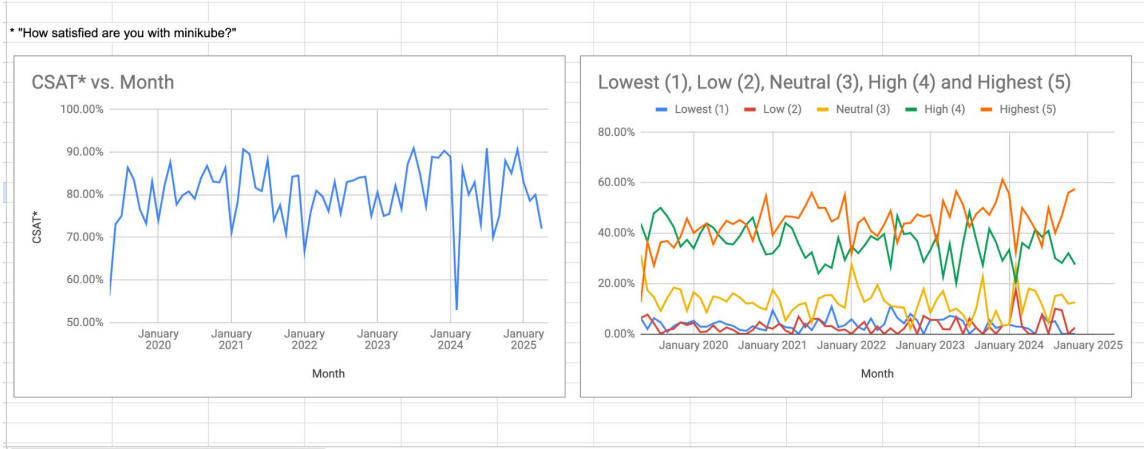
Examples ...

Feedback Venues

- Public Meetings:
  - Office Hours: Biweekly document discussion
  - Triage- Party: Weekly
- Slack
- Github Issues
  - listen to the users, opportunity to learn
- PR Reviews (opposite of github issues)
  - Contributor to listen to maintainer and keep the code high quality and maintainable.
- Surveys
- Mailing List (Deprecated)

Survey: CSAT Score (User Happiness)

Collecting, Organizing and processing Survey was one of the helping factors in minikube's popularity popularity.
Example: Story the time decline in CSAT score, windows users, ended up getting Azure account to test on windows too.



Minikube issues? (or Kubernetes Tech Support?)

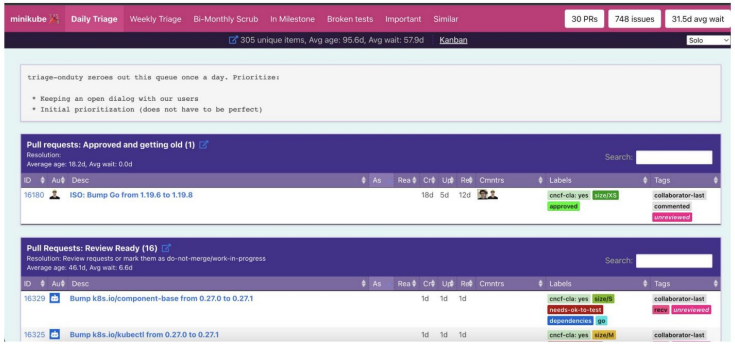
Greater number of minikube issues was
Created by Kubernetes first time users, trying to learn kubernetes.

Needed tooling to filter out types of issues.

Came with with Triage Party to help both minikube
And onboarding news years to Kubernetes

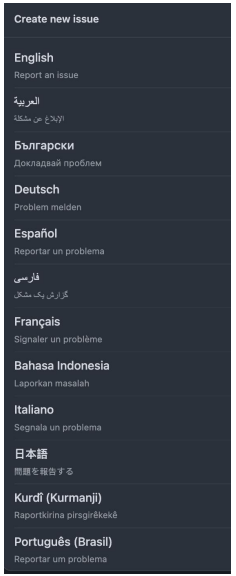
Later adopted by other projects too, to help us triage more issues

Triage Party: Filters that are not possible on GitHub



Make it easier to report/harder to do mistake

- Instructions to provide logs/troubleshooting commands in different languages
- Added feature to automatically collect logs
- Automatically select/config based on common users issues



“Pull Sheet”: Generate contributor leaderboard

Convert github Issues creators to new contributors

Most Influential

Merged PRs reviewed

1. medyagh	100
2. nirs	40
3. Copilot	15
4. afbjorklund	9
5. prezha	8

Most Helpful

Words written in merged PRs

1. nirs	6,503
2. medyagh	5,636
3. Copilot	2,306
4. prezha	947
5. afbjorklund	646

Most Active

Pull requests merged

1. medyagh	138
2. nirs	62
3. afbjorklund	20
4. prezha	16
5. ComradeProgrammer	13

Also recognizes: Most Demanding · Big Movers · Most Difficult to Review

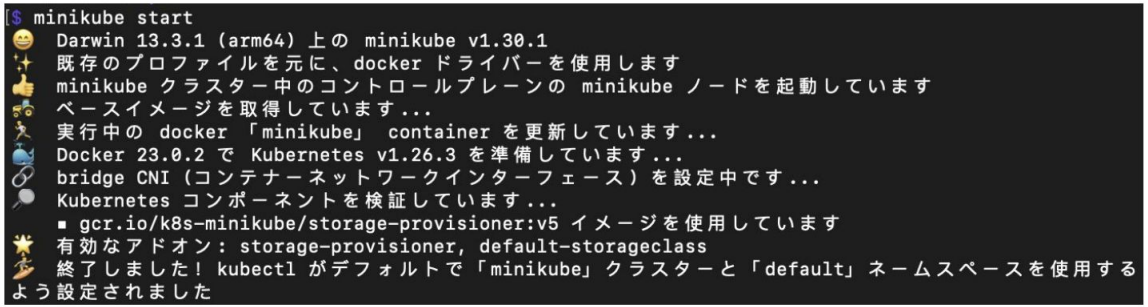
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[2025 leaderboard ↗]

Minikube includes you !

- Freedom of Choice (Technology)
- Support 13 international languages
- Troubleshooting Template in several Languages
- Support mirror for users with restricted access or slow internett
- Support air-gapped offline usage.
- Bring your own ISO/Base Image/Addon

Minikube speaks 13 languages !



Inspired by [“Bring K8s to next Billion Users”](#) Talk by Thomas Stromberg

English, Chinese (Simplified), French, German, Greek, Indonesian, Japanese, Korean, Kurdish, Polish, Portuguese (Brazilian), Russian, Spanish, Ukrainian.

Easily add your language, follow guide on website https://minikube.sigs.k8s.io/docs/contrib/translations/

Overhaul Minikube Website

Website overhaul: from getting started to contributing back

START

Getting started & tutorials

EXPLORE

Handbooks & addons

TROUBLESHOOT

FAQ & practical guides

CONTRIBUTE

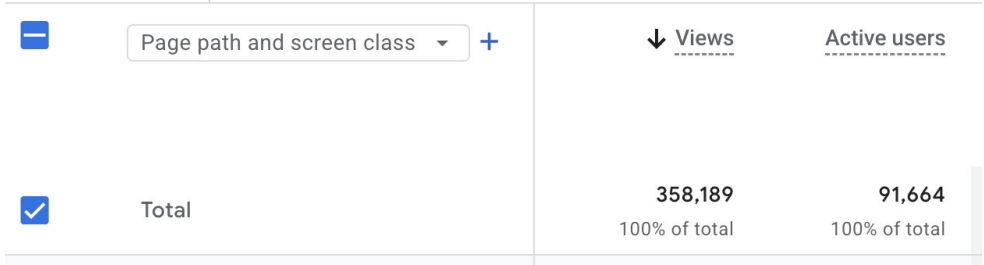
Contributor documentation

358K+

page views

91K+

active users



Website analytics snapshot

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Explore minikube.sigs.k8s.io ↗

Minikube Special Requirements ...

minikube first test lab was a “physical lab”.

San Francisco office · 2016



~8 hours

waiting for tests

> Sometimes, someone had to intervene in person. But still Impressive setup

Why not just use Prow?

In 2016, our tests needed more than a pod.

Prow in 2016

Test inside a pod

Pod-based testing

01 VM drivers

Nested virtualization

Host VM

Hypervisor

minikube VM

02 Linux ISO

For each PR change

Build the ISO

Store it in a GCS bucket

Test the new image

These requirements shaped minikube's own test infrastructure.

A SMALL SIDE NOTE

Oh, and we maintain our own Linux.

Just enough Linux to run Kubernetes.

~300

MB Linux image

Built with Buildroot

A minimal Linux image with the kernel modules Kubernetes needs.

Small footprint. Real maintenance.

Builds can take hours. Every change needs testing.

[minikube-os ↗]

From the office lab to parallel cloud testing

The overhaul began after I joined minikube in 2019.

Move to the cloud

Physical machines → CI VMs

Moved tests to an internal GCP project; no longer tied to the office lab.

Run tests in parallel

More than one cluster at once

Parallel runs exposed bugs in running multiple minikube clusters simultaneously.

Broaden coverage

Across clouds and platforms

GCP · AWS · Azure
Equinix Metal · MacStadium
Plus Prow & GitHub Actions

BY KUBECON 2023

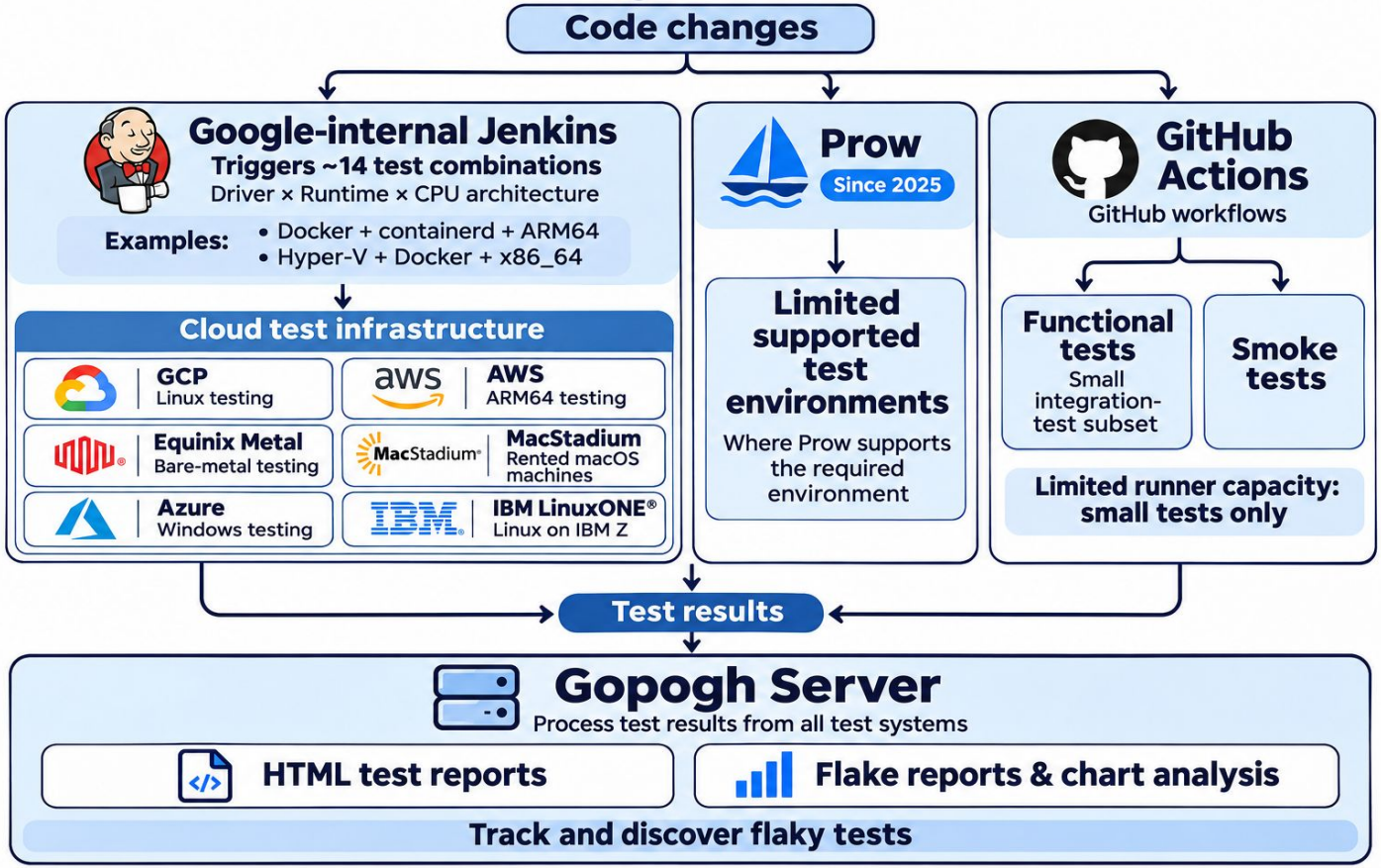
46 self-hosted CI VMs

5 cloud providers

300 end-to-end tests

Source: KubeCon NA 2023 · “Transform Test Infra”

It takes a village to test minikube



minikube tests catch “Kubernetes” regressions

Different OSes, runtimes, kernels, and CNIs expose different failures.

STARTUP SPEED

~1 min

extra startup time

Kubernetes v1.20.3+
Benchmarks caught a kubelet startup regression.

Report: kubeadm #2395 ↗

SINGLE-STACK NETWORKING

IPv4 / IPv6

one stack should be enough

Kubernetes v1.34
KVM integration tests caught a kube-proxy startup failure.

Report #133694 → fix #133695 ↗

KERNEL COMPATIBILITY

5.12.2+

Linux kernel versions

A kernel upgrade exposed kube-proxy crashes when setting a conntrack limit.

Report: minikube #11418 ↗

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Next opportunity: expand minikube testing of Kubernetes pre-releases ↗

Tests ran in parallel. Humans still read logs.

More test coverage created a new bottleneck: understanding failures.

RAW TEST OUTPUT · ILLUSTRATIVE

```
=== RUN   TestStart
=== RUN   TestNetwork
[TestStart] preparing node...
[TestNetwork] waiting for DNS...
[TestStart] pulling images...
--- FAIL: TestNetwork
[TestStart] checking health...
... thousands more lines ...
```

Find the failure

Parallel output is interleaved.

Find the context

Where does each test begin and end?

Decide what it means

A regression—or a familiar flake?

The cost: more time triaging, slower PR review.

Gopogh: from log overload to clear failures

Same test run. Same results. Much easier to investigate.

BEFORE · RAW LOG

42,129 lines

```
=== RUN   TestDownloadOnly
=== RUN   TestDownloadOnly/v1.16.0
=== RUN   .../v1.16.0/json-events
    ...
=== RUN   .../v1.16.0/preload-exists
=== RUN   .../v1.16.0/cached-images
```

Raw excerpt · long test names shortened



AFTER · GOPOGH REPORT

9 failures / 279 tests

Selected failures	Duration
calico / Start	553.27s
custom-weave / Start	519.15s
false / DNS	373.56s

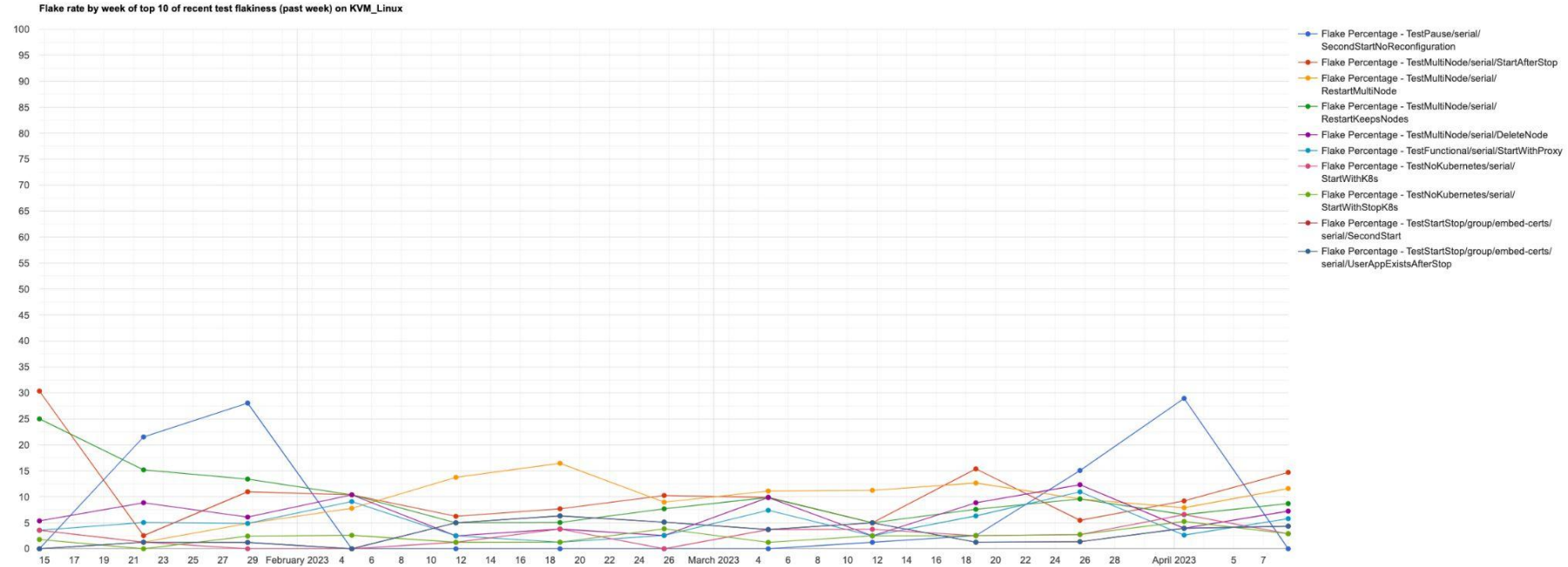
TestNetworkPlugins/group/… · 3 of 9 failures

Spot the failure → open its logs → share the exact test

Real run: Docker/Linux · 21 Feb 2022 · Open raw log ↗

Open HTML report ↗

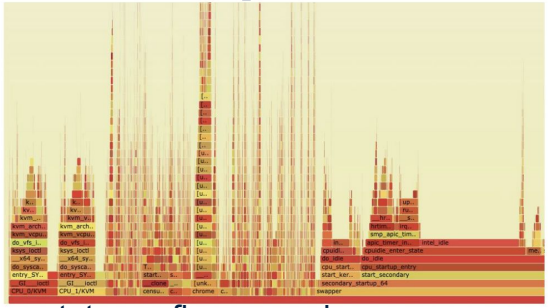
Gopogh Server: Is this failure new?



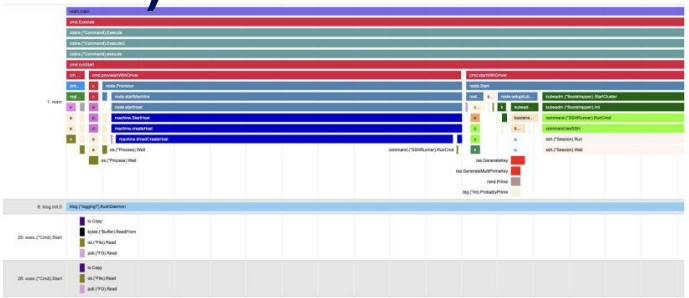
KVM/Linux · Weekly flake rates · Historical example from KubeCon 2023
Compare today's failure with recurring patterns before investigating.

How did “minkube start” went from 3 minutes to 13 seconds ?

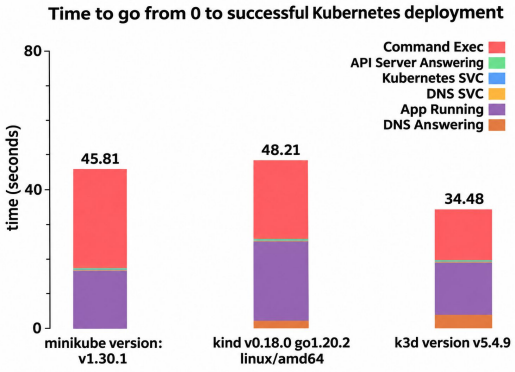
Benchmarking tools open sourced by minikube team (All Benchmarks published to website)



cstat: cpu flame graphs



SlowJam: latency profiler for Go functions



time-to-k8s

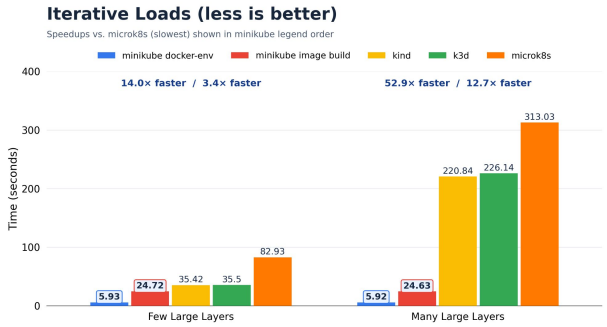
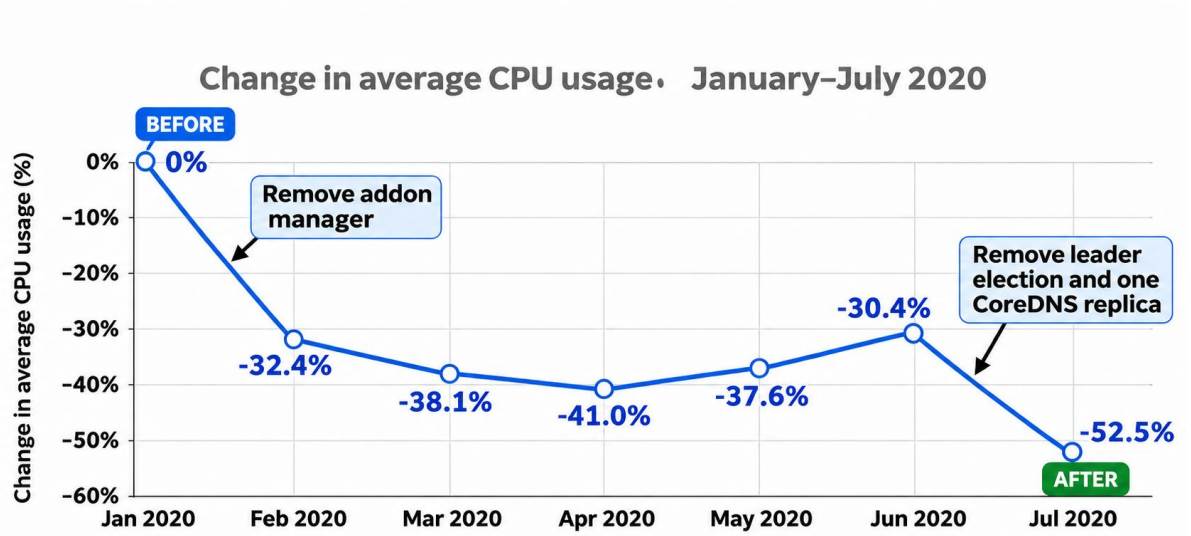


Image build benchmark

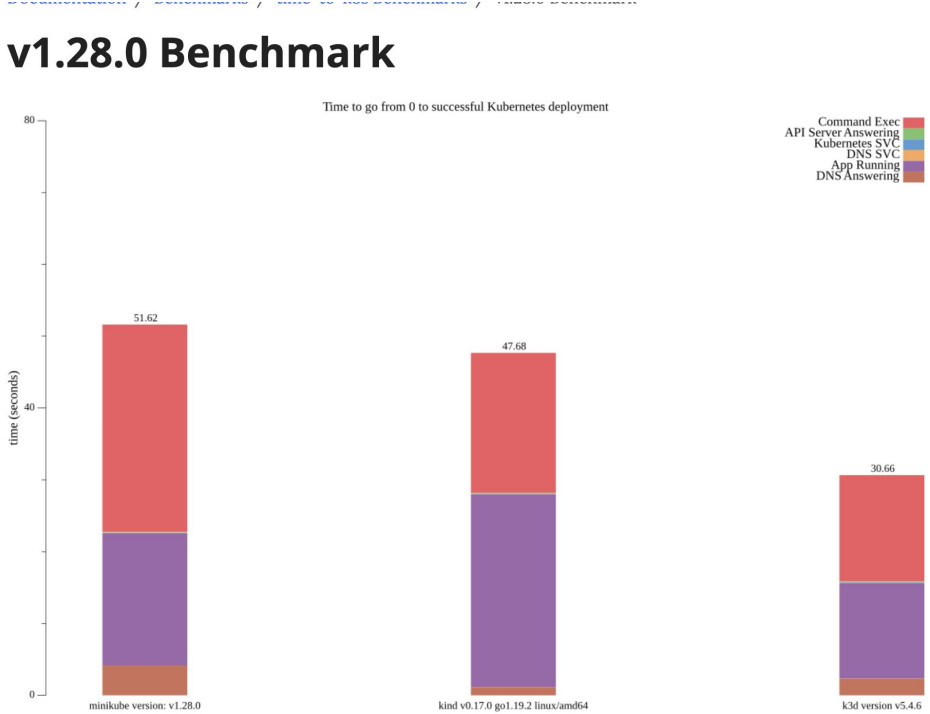
Why So Much Benchmarking?

- To do data-driven technical Surgeries.
- To Avoid“Biases” and misperceptions.

Track minikube CPU usage by Code Change



Time-to-k8s measure how fast cluster is “usable”

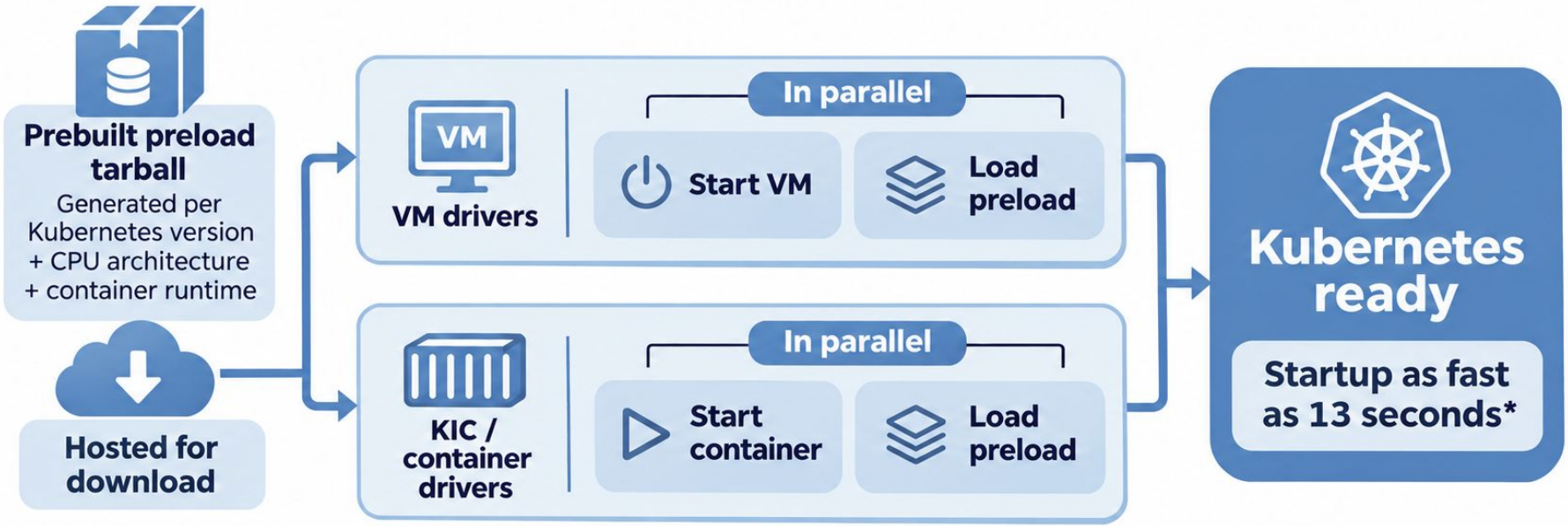


Automated benchmark published for each minikube version on the [minikube website]

minikube

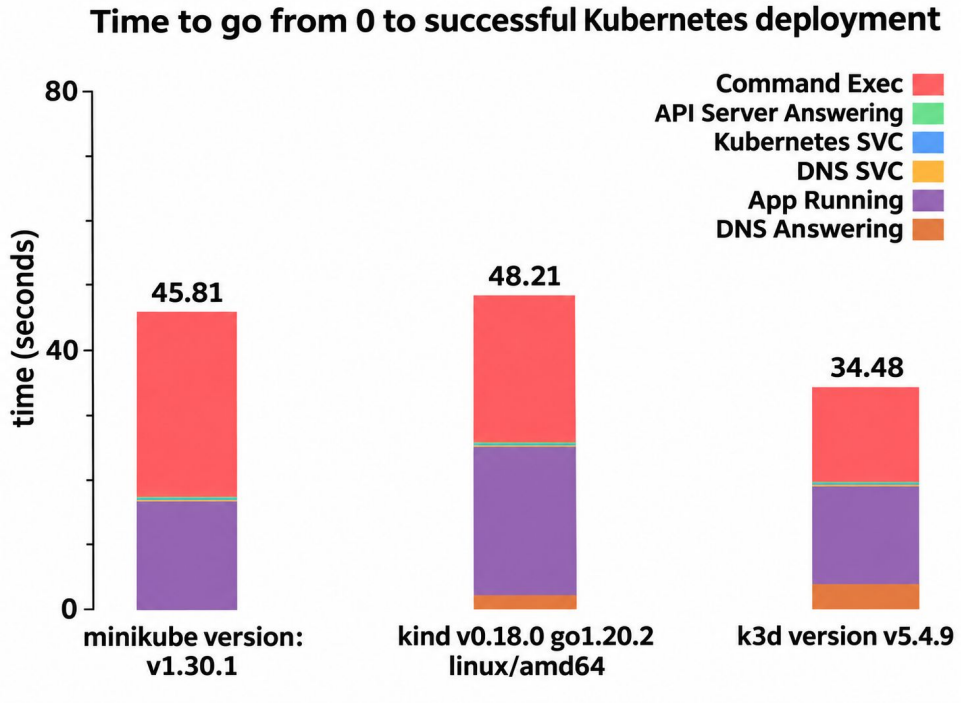
Preloads: minikube's secret sauce

Fast startup across VM and container drivers



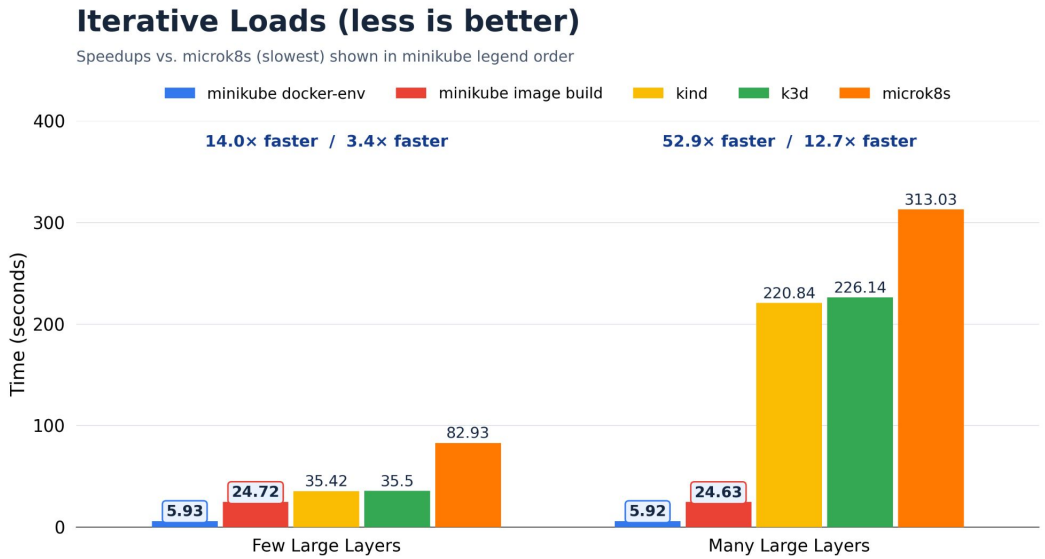
*Startup time varies by environment and cache state.

Time-to-k8s “Verified”



Automated benchmark published for each minikube version on the [minikube website]

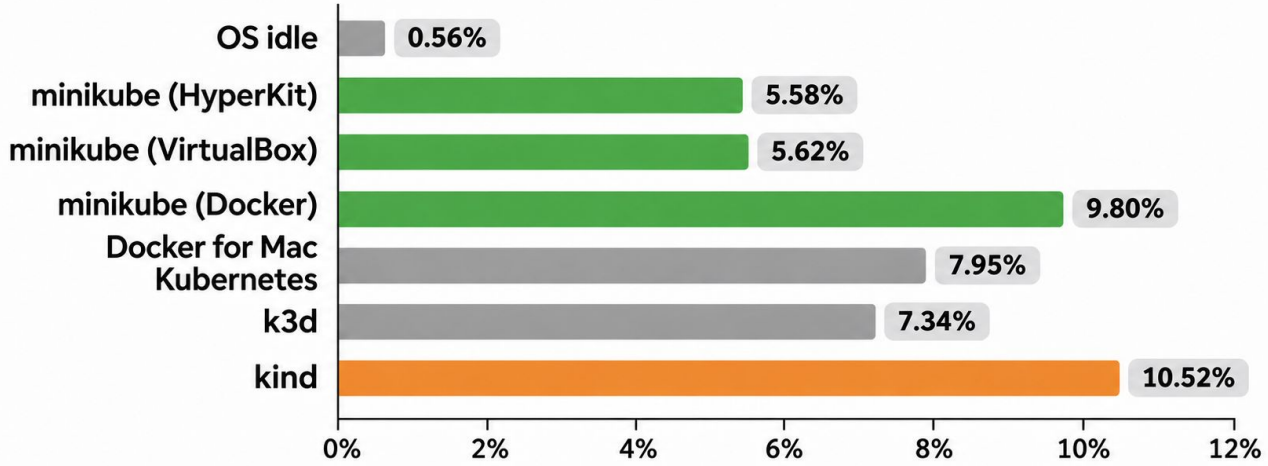
Building images on minikube is 52x faster !



All benchmarking data/tools available on [miniukube website]

CPU usage: minikube vs Others

Average CPU busy % over the first 5 minutes on macOS • Lower is better

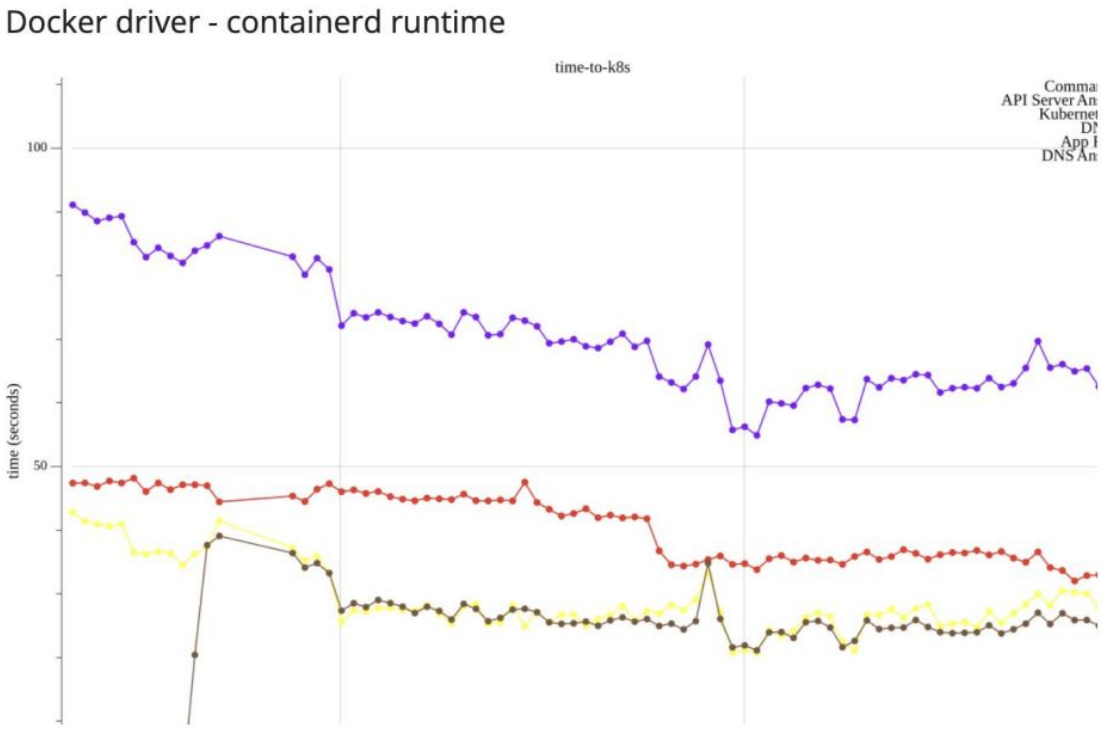


minikube (Docker): 6.8% lower CPU usage than kind in this benchmark

Historical benchmark shown in the original slide; not a current performance claim.

Continuous Automated Benchmarking

Benchmarks run periodically
Per Release
And sometimes Per PR
And published to
minikube website



Minikube is more than one project

An ecosystem of projects, infrastructure, and maintainer tools

Platform

minikube-os

Linux base image / ISO for Kubernetes

minikube-preloads

Preloaded Kubernetes images for faster cluster startup

User experience

setup-minikube

Run minikube in CI

minikube-gui + website

Interface and documentation

Official addons

GCP auth · storage provisioner
Auto-pause · gVisor

Engineering tools

Test infrastructure

Jenkins · GitHub Actions · Prow

Maintainer tools

Gopogh · flakes · CSAT
Triage Party · releases · PR bots

Benchmarking tools

cstat · time-to-k8s · SlowJam
Dev-loop stats

machine-drivers | Hypervisor drivers | Deprecated as of 2025

2025: stepping up as the team downsized to 1

With the team reduced to just me, I absorbed additional responsibilities and took on new work across code, infrastructure, and community.

EXPANDED PROJECT OWNERSHIP

Maintaining minikube and reviewing contributions

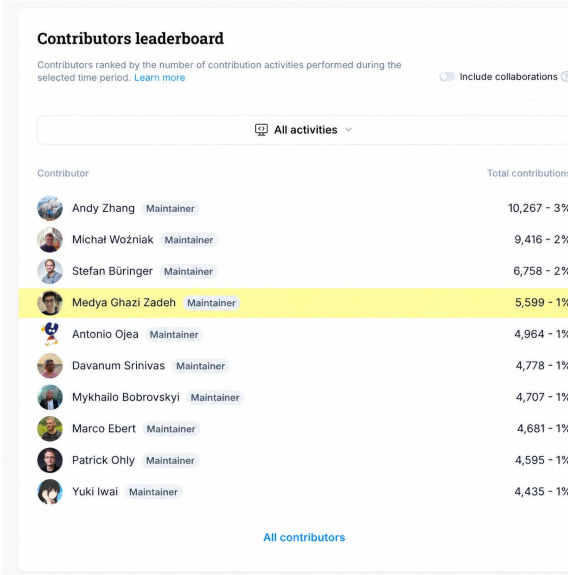
INFRASTRUCTURE

Internal Multi-cloud Infra + Designing new Prow based infra

COMMUNITY

Office hours, issue triage, and contributor support

[#4 on the CNCF contributor leaderboard]



Reducing minikube's reliance on Google

June 2025: began moving toward community-operated infrastructure

SPECIAL REQUIREMENTS

Not yet provided by SIG Infra / SIG Testing

In 2025: storage buckets for PR test ISOs and preload images.

→

MIGRATION EFFORT

600+

PRs / artifacts

Re-engineering builds, storage, and release flows

→

SEPARATE PROJECTS

minikube-os ↗

Linux ISO builds

minikube-preloads ↗

Kubernetes image bundles

One full-time maintainer • independent reviews • volunteer availability

Migration work and dependencies: issue #20887 ↗

Year 2026

Unfortunate year of war

A Story for another day ! ...

Vision The next decade for minikube ...

01

SHARED OWNERSHIP

Grow the maintainer bench

02

OPEN INFRASTRUCTURE

Remove reliance on Google

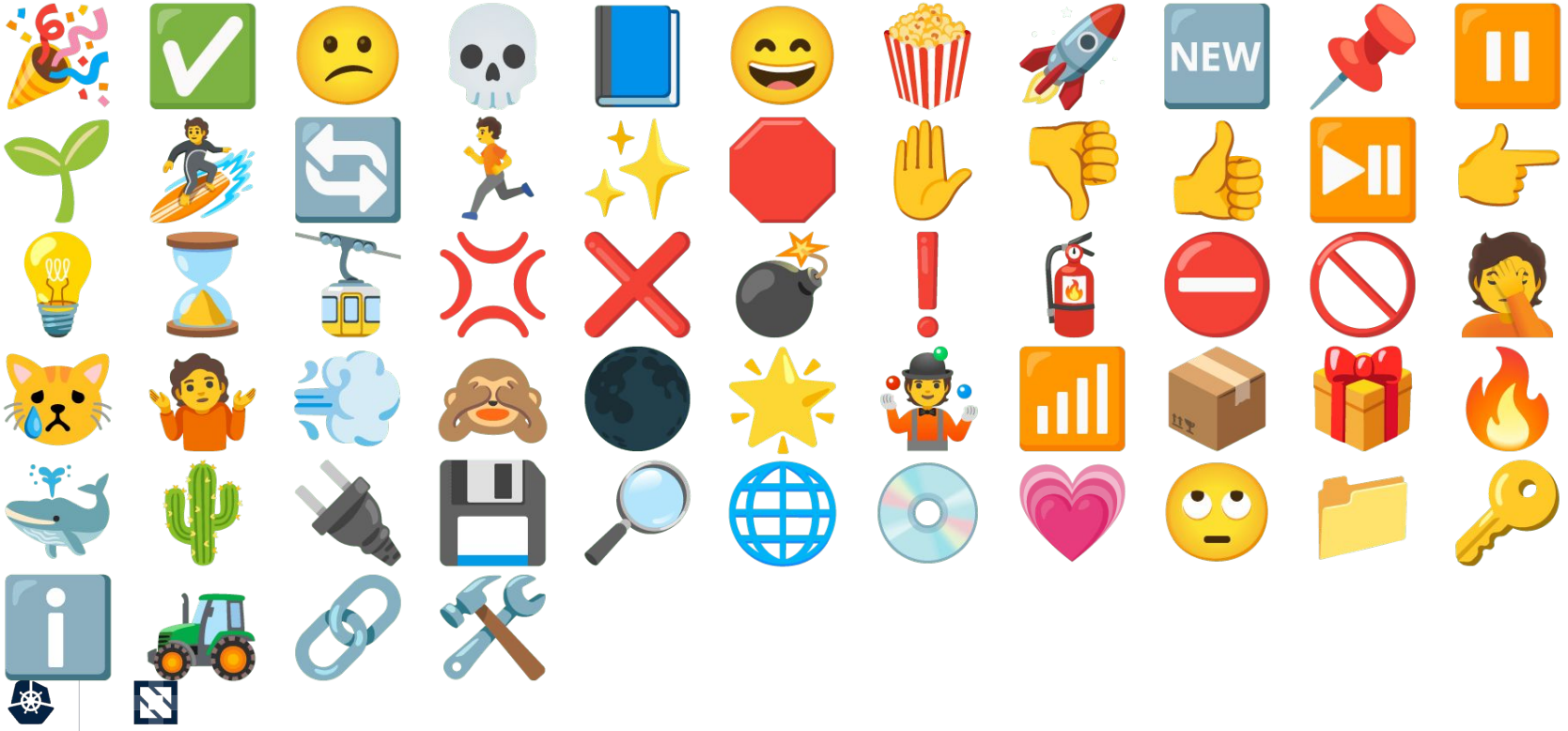
03

Get Organizational Support

Get representation in decision making committees to advocate for minikube needs

The Next decade of Minikube ...

All of Minikube Emojis



Behind Minikube Emojis

🎉 Happy 🔟th birthday, minikube! 🎂

Jiaming Tang
Predrag Rogic
Anders Björklund
Thomas Strömberg
Jose Donizetti Brito Junior
Sharif El Gamal
Nir Soffer
Yanshu Zhao
Ruben Baez
Dan Lorenc
Aaron Prindle
Tara Hernandez
Steven Powell
Bob Sira
Jeff Maury
Akihiro Suda
Priya Wadhwa
Divy Singhvi
Mateusz Loskot
Sylvester

💙 Thank you to all 980+ contributors who made minikube possible.

Let’s keep in touch.

Open to new opportunities

Medya Ghazizadeh

WEBSITE medya.dev

EMAIL medya@medya.dev

TWITTER @medya_dev

Scan to connect

KubeCon CloudNativeCon North America 2026

Thank you for being part of minikube’s story.

Links

- minikube website https://minikube.sigs.k8s.io/docs/
- ChatBot on Macbook Demo: https://www.youtube.com/watch?v=y-xUXaJK9RU&t=1s
- Gopogh github.com/medyagh/gopogh
- Setup-Minikube (github action) github.com/medyagh/setup-minikube
- minikube benchmarking https://minikube.sigs.k8s.io/docs/benchmarks/
- minikube-preloads https://github.com/kubernetes-sigs/minikube-preload
- Slowjam github.com/google/slowjam
- Triage Party github.com/google/triage-party
- Time To K8s github.com/tstromberg/time-to-k8s
- minikube-CI github.com/minikube-ci/examples
- Pull Sheet github.com/google/pullsheet
- minikube-gui https://github.com/kubernetes-sigs/minikube-gui
- minikube-os https://github.com/kubernetes-sigs/minikube-os/