

# minikube deep dive

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*Rohit Anand - NEC*



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# Behind the emojis



```
medya@~ $ minikube start
🤗 minikube v1.12.1 on Darwin 10.15.6 (59.6 GB / 18.3 GB used)
🌟 Automatically selected the docker driver. Other choices: hyperkit, virtualbox
👍 Starting control plane node minikube in cluster minikube
🔥 Creating docker container (CPUs=2, Memory=1739MB) ...
🌊 Preparing Kubernetes v1.18.3 on Docker 19.03.2 ...
🔍 Verifying Kubernetes components...
🌟 Enabled addons: default-storageclass, storage-provisioner
👉 Done! kubectl is now configured to use "minikube"
Cancel
```

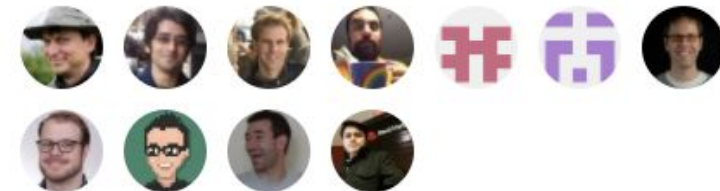
## Maintainers

- Thomas Strömberg
- Medya Ghazizadeh
- Anders Björklund
- Sharif Elgamal
- Priya Wadhwa
- Jose Donizetti

## Honourable mentions

- Dan Lorenc
- Govargo
- Ruben Baez
- Matt Rickard
- Aaron Prindle

## Contributors 527



+ 516 contributors

# What is minikube



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The primary goal of minikube is to make it simple to run Kubernetes locally, for day-to-day development workflows and learning purposes.

- Kubernetes #sig-cluster-lifecycle project
- Inclusive and community-driven (CNCF)
- User-friendly
- Support all Kubernetes features
- Cross-platform
- Reliable
- High Performance
- Developer Focused

# minikube features



- 5 ways to build Images
  - fast build option using “docker-env”
- Access your app:
  - [Loadbalancer & NodePort](#)
- Filesystem mounts
- Feature Gates
- 25+ Addons



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What's New minikube ?

# What's new minikube ?



- Starts 86% faster.
- Uses 20% less CPU.
- Has two new drivers (Docker, Podman)
- Multi-node
- New Commands: Pause/Unpause
- Auto-Select flags (driver, memory, CNI ...)
- 5 New open-source tool graduated from minikube



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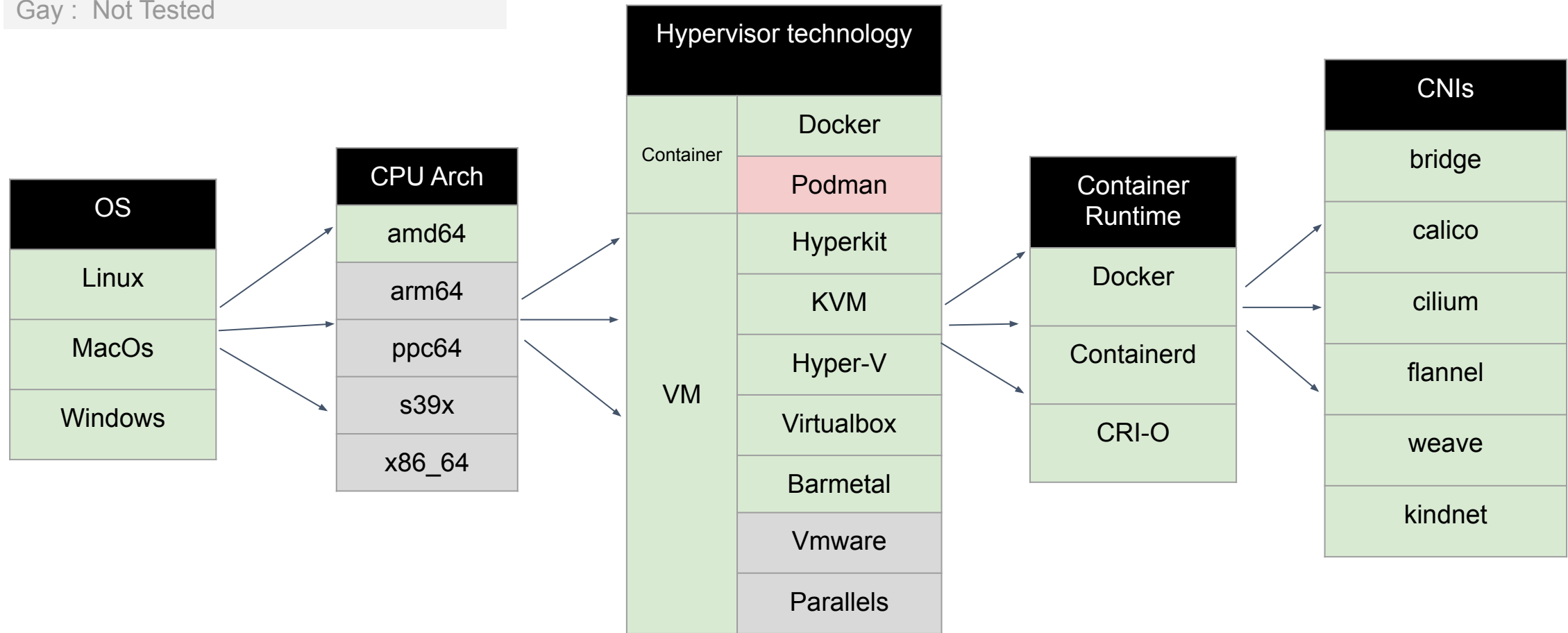
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a deeper look at  
What's new minikube ...

# minikube supports ...

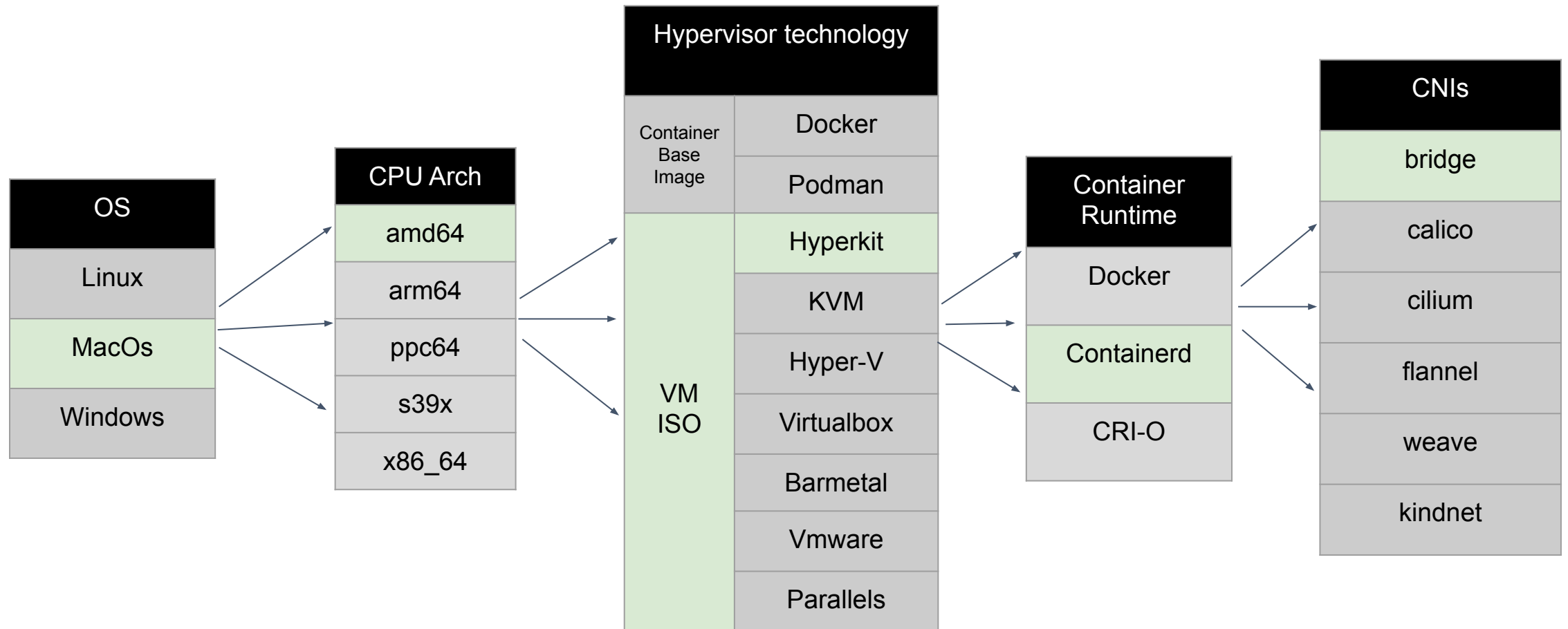
Green : Tested  
Red : Tested but experimental  
Gay : Not Tested





# mac user example

```
medya@~ $ minikube start --driver=hyperkit --container-runtime=containerd
🐼 minikube v1.12.1 on Darwin 10.15.6
🌟 Using the hyperkit driver based on user configuration
📦 Downloading driver docker-machine-driver-hyperkit:
```





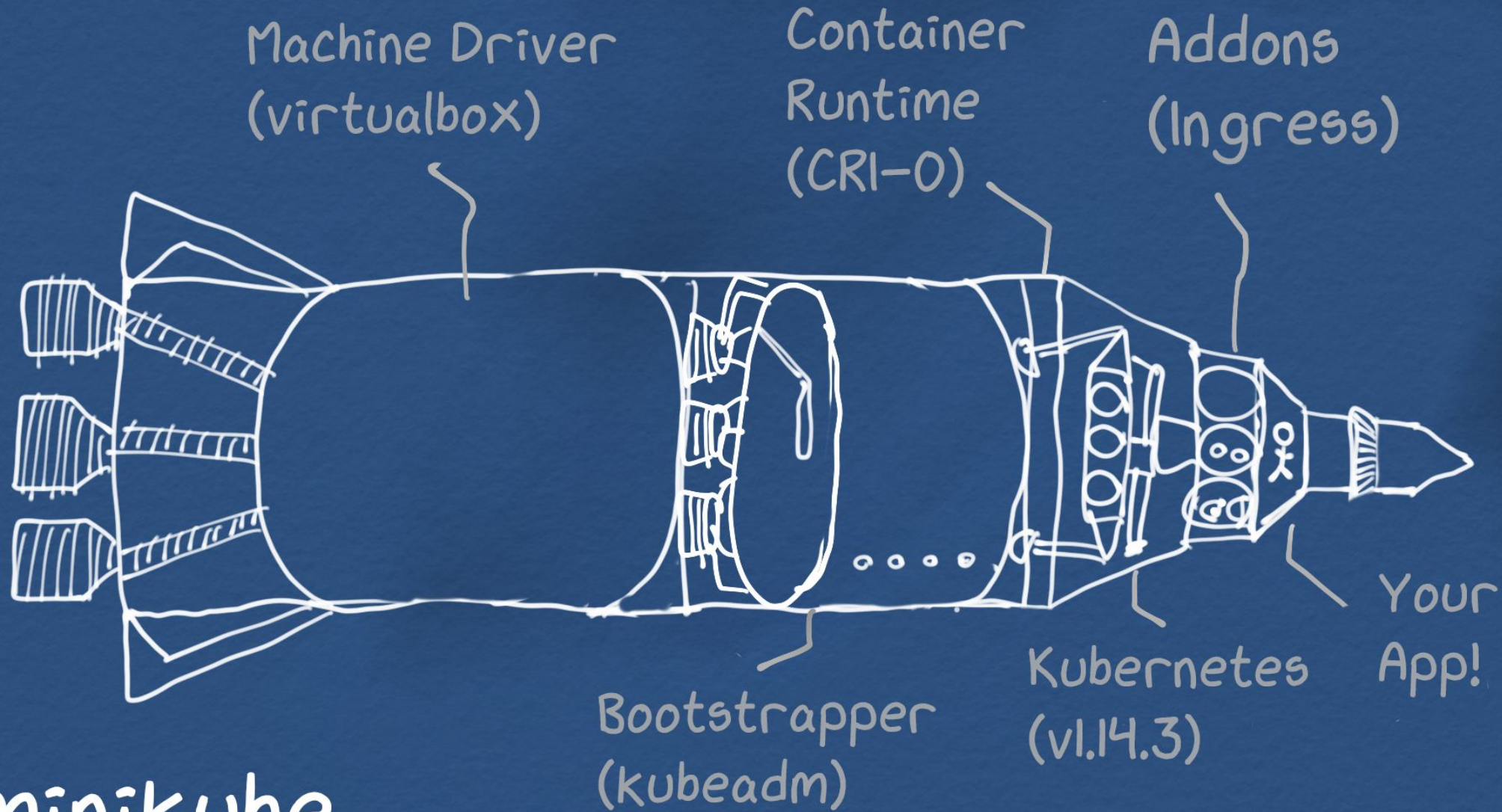
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minikube

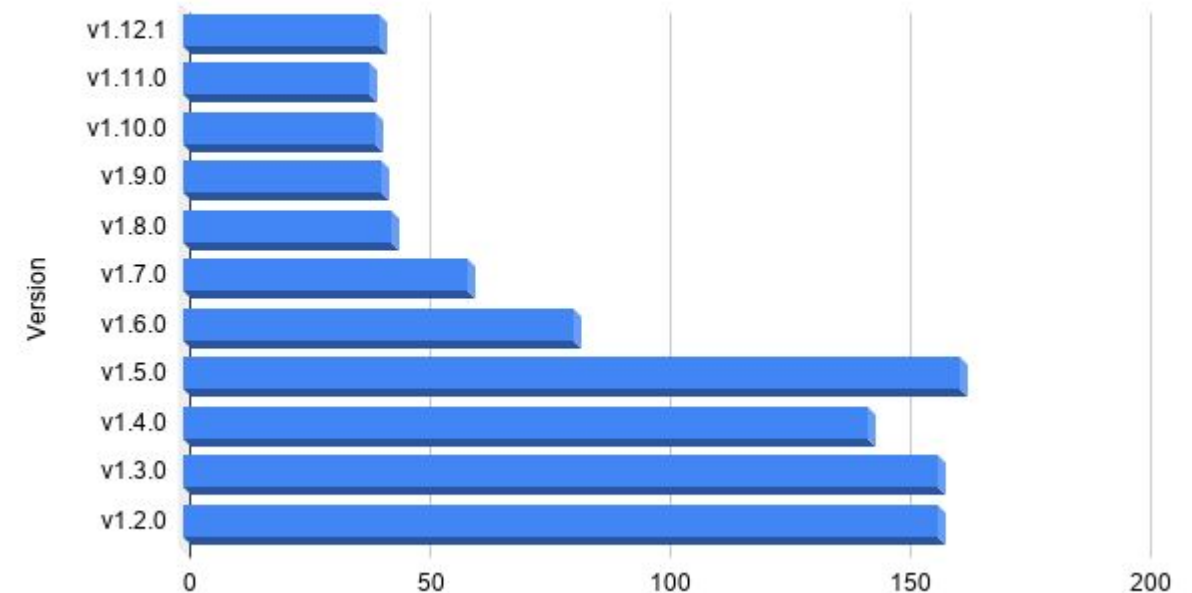
# 86% Faster Start

once upon a time (last year)  
hyperkit driver minikube took **2m35.072s**  
to start. same driver now takes **35s**

and with the new docker driver on linux  
it can be as fast as **21** seconds (%86 faster)

\*\* macbook pro 2.8 GHz Quad-Core Intel Core i7  
\*\* does not include the first time download images time

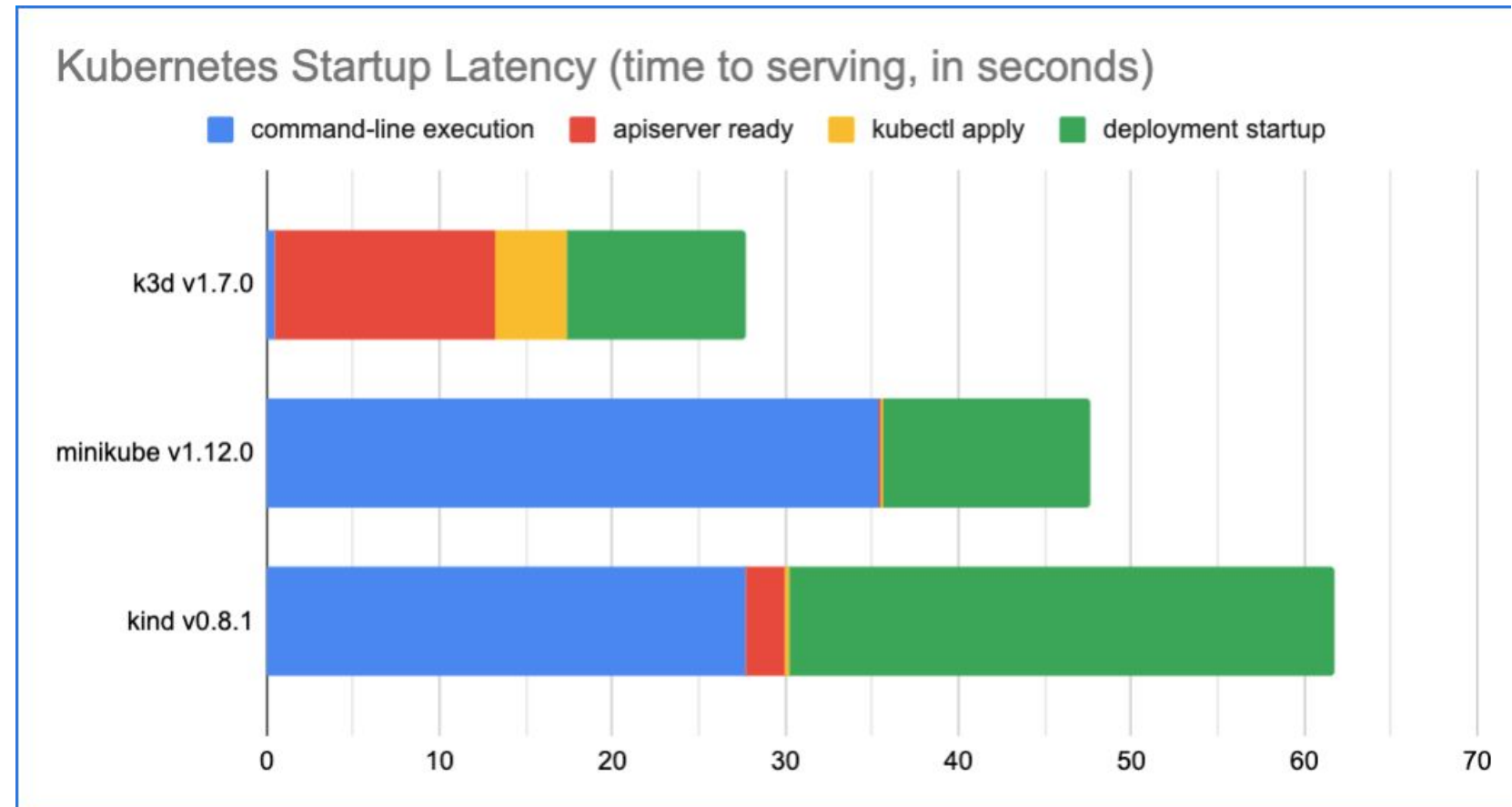
Hyperkit Start time by minikube version



# The Actual time cluster is usable



- Data was aggregated across 113 runs using automated tools.
- k3d forks the kubernetes code, to replace etcd.



Scripts that was used to generate data is available at <https://github.com/tstromberg/time-to-k8s>



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How did minikube go from  
**2m35s minute** to **21 seconds** ?



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**Step 1: Collect metrics**



minikube-pr-bot commented on Jun 3



### kvm2 Driver

Times for minikube: [64.415013512 63.477016749 64.87191736599999]

Average time for minikube: 64.254649209

Times for Minikube (PR 8368): [64.757849563 63.199447897 65.965918705]

Average time for Minikube (PR 8368): 64.641072055

### Averages Time Per Log

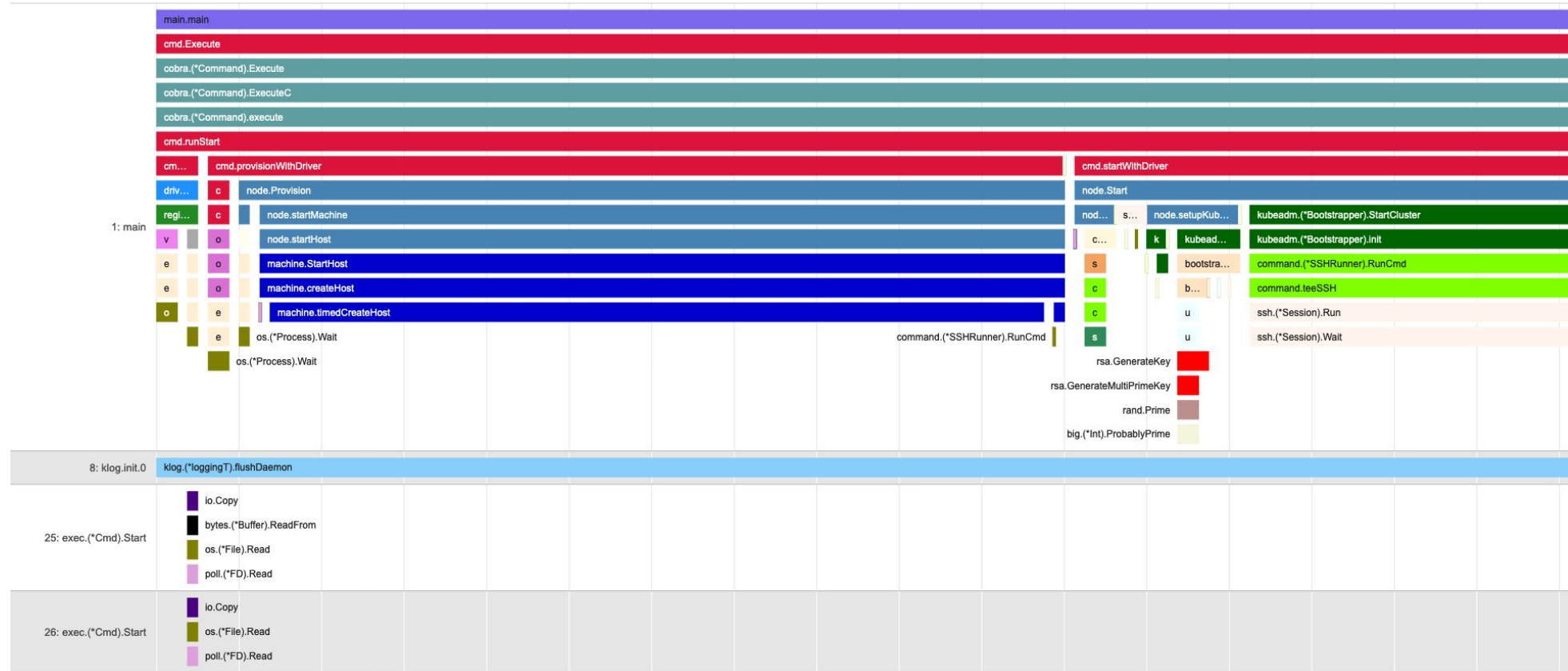
▼ Details

LOG	MINIKUBE	MINIKUBE (PR 8368)
* minikube v1.11.0 on Debian 9.11	0.061998	0.057818
* Using the kvm2 driver based on existing profile	0.022895	0.021530
* Starting control plane node minikube in cluster minikube	0.003324	0.009416
* Creating kvm2 VM (CPUs=2, Memory=3700MB, Disk=20000MB) ...	40.234083	41.291437
* Preparing Kubernetes v1.18.3 on Docker 19.03.8 ...	22.507218	21.196589
* Verifying Kubernetes components...	1.273849	1.321261
* Enabled addons: default-storageclass, storage-provisioner	0.073519	0.667896
* Done! kubectl is now configured to use "minikube"	0.074325	0.070031
	0.003438	0.005094

Github bot to analyze PR's performance difference.

by [Priya Wadhwa](#)

# Slowjam: Visualize stack trace



Slowjam by Thomas Stromberg





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- Big Targets for optimization
  - Creating VM
  - Loading kubernetes Images

# VM-Free Request 2016



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- one of the oldest feature requests of minikube (June, 2016)

# VM-Free Design

## Question

in minikube we create a VM and setup kubernetes inside.  
why can't we just create a container and do exact same thing ?





New Question

How to run Systemd in a container ?

[Answer in Redhat blog](#)

# and it worked !



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Question ! can we have all minikube features ?

Yes. Some with more work.

# It's called Kic for a reason !



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If we could add Docker driver, what stopped us from adding Podman ?



Docker Desktop (on mac and windows) does not give you an accessible IP address for the container

That made These features challenging:

1. Tunnell
2. Service

Jose Donizetti's implemented a solution for docker network limitations.



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KIC and other refactors made minikube more than 1 minute faster but still we had a long way to go ...to become under 35 seconds.

Next Target is preloading images





New question:

can we preload the images for both VM drivers and Container drivers (docker,podman) same way ?

# Preload Images



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1. Pull kubernetes images into the container-runtime
2. Freeze the file-system and lz4 zip them (for smallest size)
3. Upon container creation, spin up a side-container and unzip in Parallel and by the time the main container is running.
4. Save time by doing this in parallel and load the volume to the main container.

For details on generating the preload images checkout:

[github.com/kubernetes/minikube/tree/master/hack/preload-images](https://github.com/kubernetes/minikube/tree/master/hack/preload-images)



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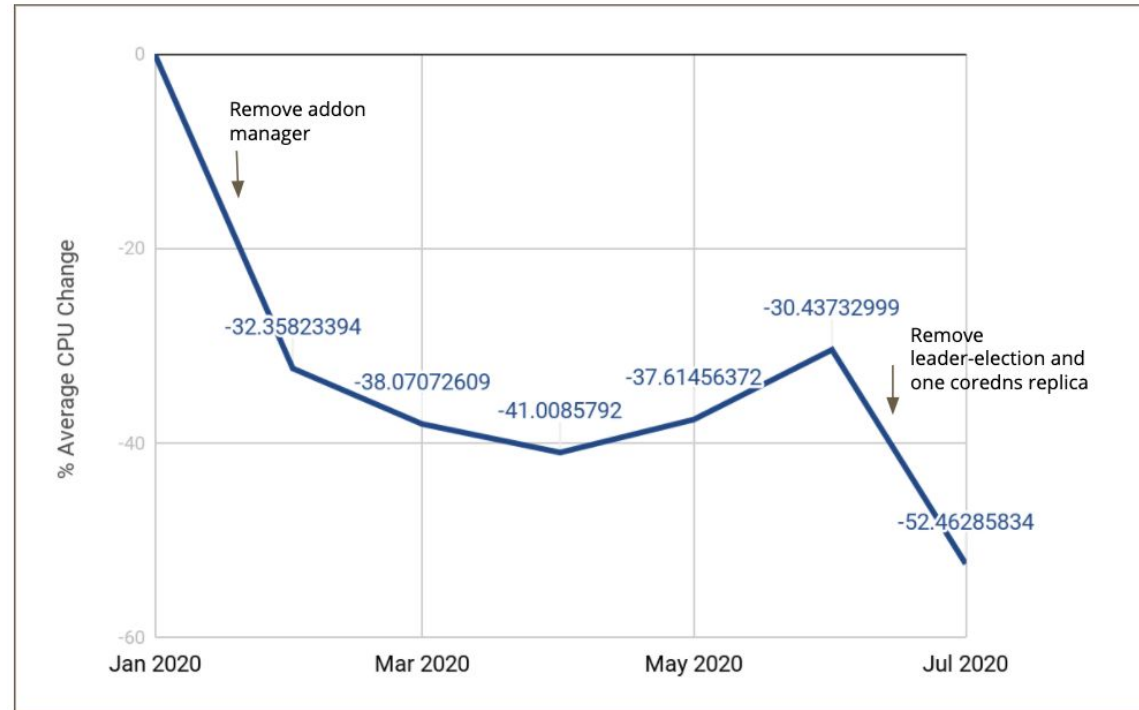
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In addition to VM-Free and Preload, we did tons of other small optimizations in kubernetes that made minikube start %86 faster

# minikube cpu overhead in 2020



Screenshot from related talk:  
[Improving the Performance of Your Kubernetes Cluster](#)  
by Priya Wadhwa, Google

Tuesday, August 18 • 18:30 - 19:05

# minikube vs others



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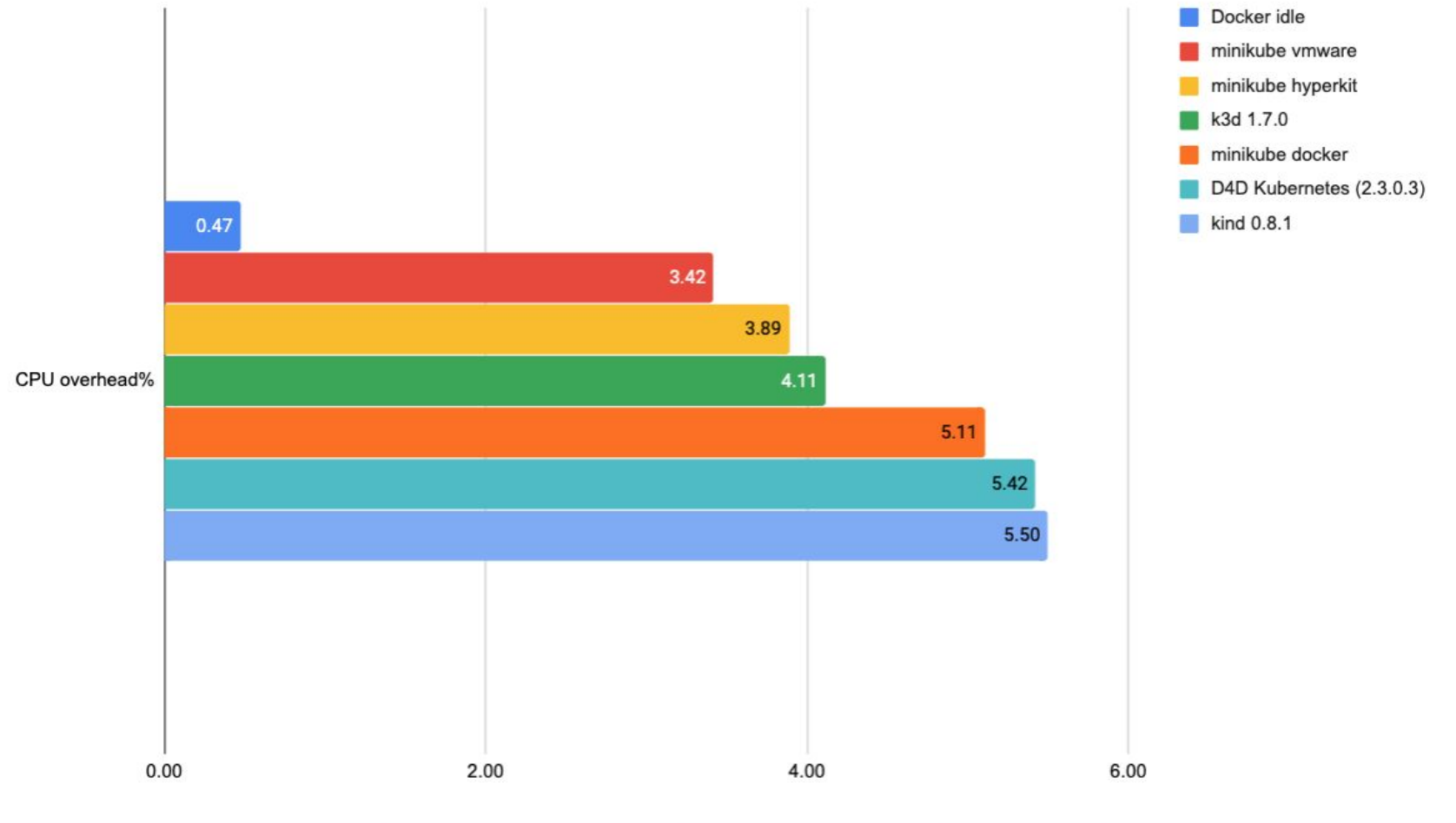


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CPU% Busy Overhead - Average first 5 minutes (MacBook Pro 2018, 6-Core 2.2GHz i7)



Lower is better

# minikube vs others



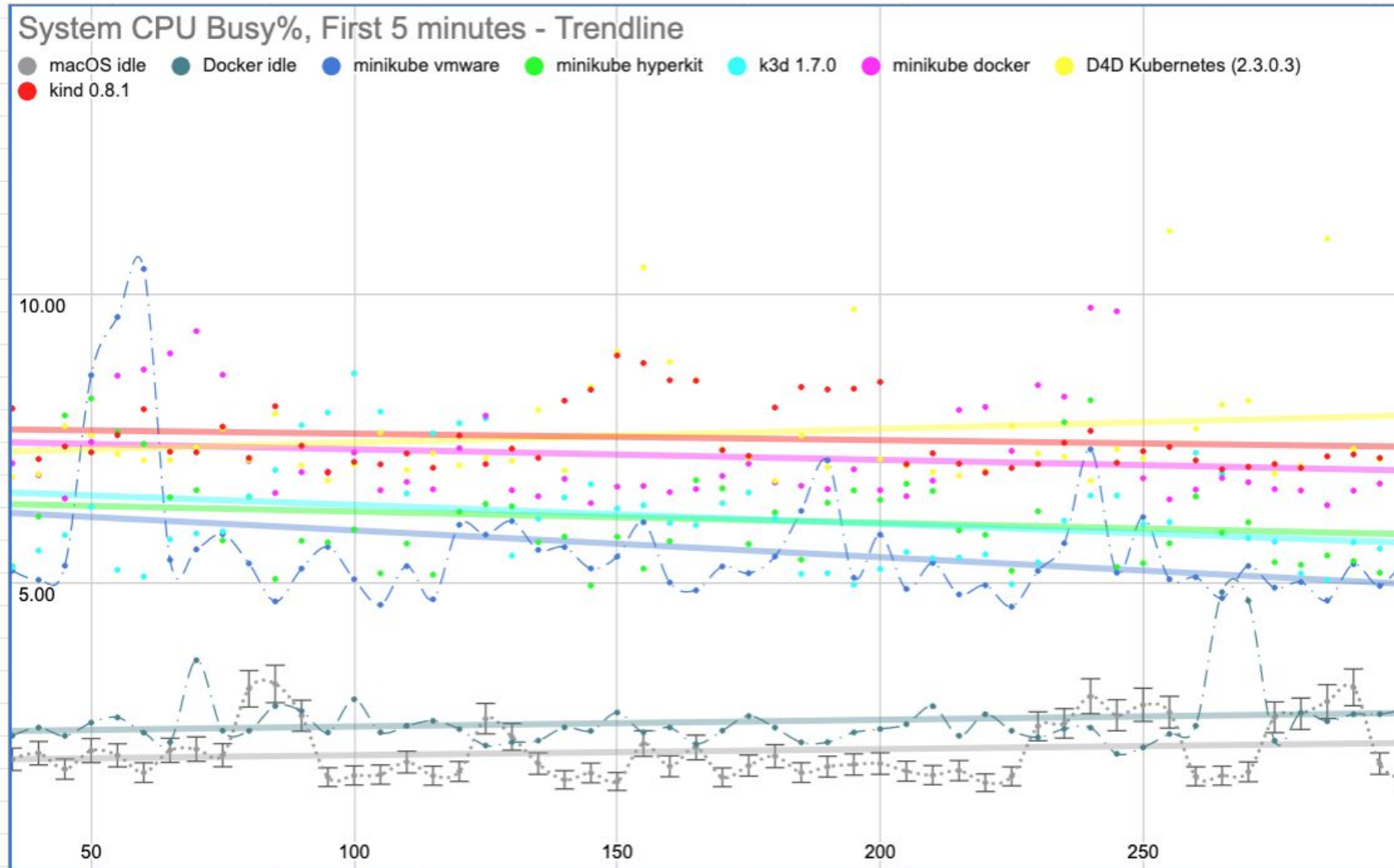
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# Pause Kubernetes, Continue App

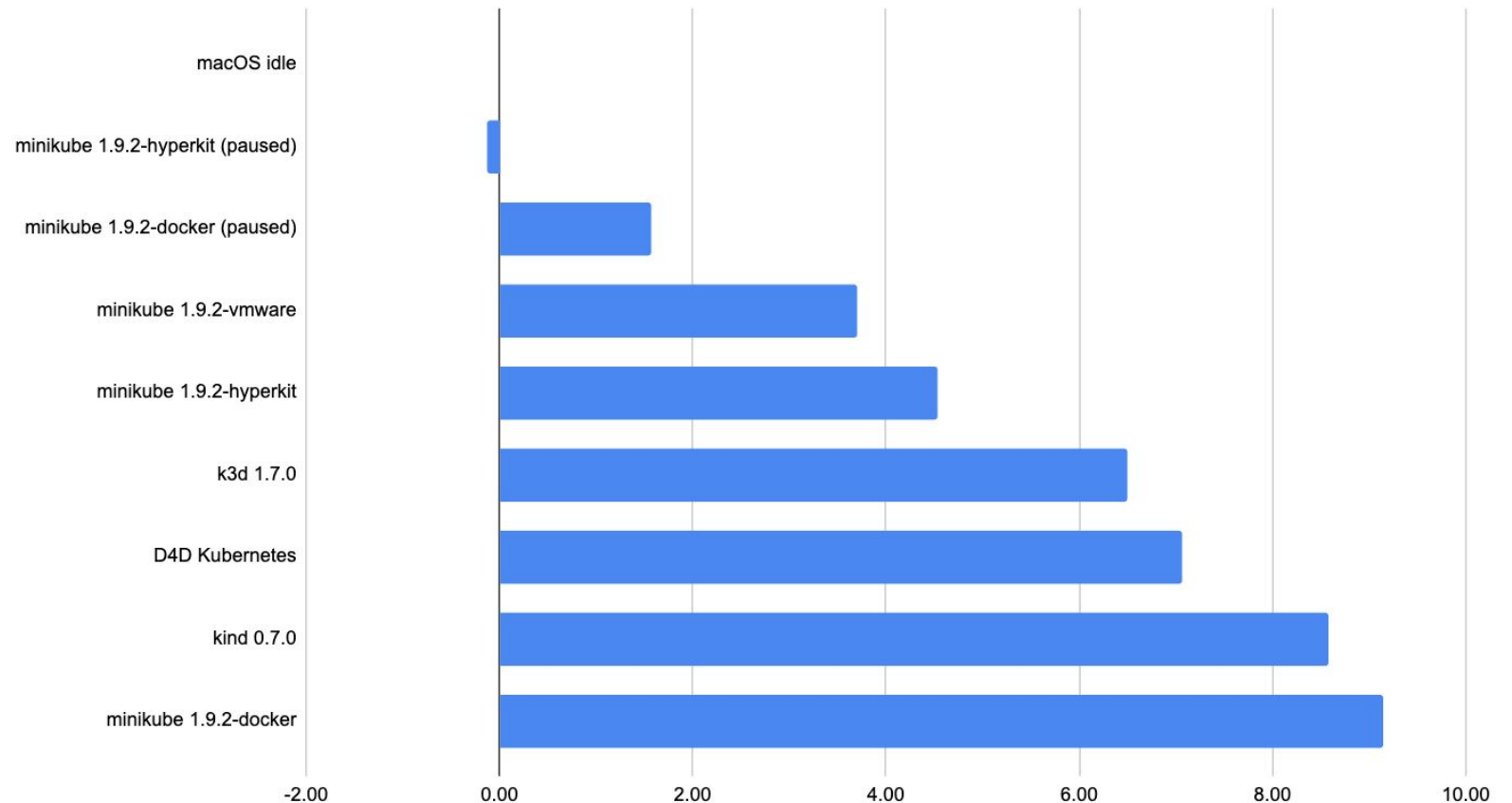


Try pause command today !

```
$ minikube pause  
$ minikube unpause
```

- Kubernetes's apiserver is the main cause high CPU of local kubernetes experience
- "minikube pause" will pause kubernetes
- a paused minikube CPU load is close to zero !
- during a paused minikube your deployed app continues to be running and accessible !
- minikube service and tunnel command works fine even on a paused kubernetes

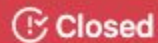
System CPU% Busy Overhead - Average over first 7 minutes



# Multi-node ready to use !



## Add multi-node support #94



Closed

vishh opened this issue on May 19, 2016 · 60 comments



vishh commented on May 19, 2016

Member



To provide a complete kubernetes experience, user might want to play & experience with features like scheduling and daemon set, etc. If minikube can emulate multiple kubernetes nodes, users can then use most of the kubernetes features.

This is probably not necessary in the first few versions of minikube. Once the single node setup is stable, we can look at emulating multiple nodes.

Up votes from users on this issue can be used as a signal to start working on this feature.



535



33



40



7



# Auto-select options



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minikube has many many flags and options to set, which is great for advanced users.

“minikube start” should do the right thing without any flags.

# Auto-select options



- Auto-select driver
  - checks your system for all available options and picks best driver based on their health.
- Auto-select memory-size:
  - picks the best memory size for your cluster based on how much ram you have.
- Auto-Select CNl networks
  - based on on if you selected options (single or multinode,...)



minikube addons enable gcp-auth



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Demo Time

How to add a new language  
to minikube ?

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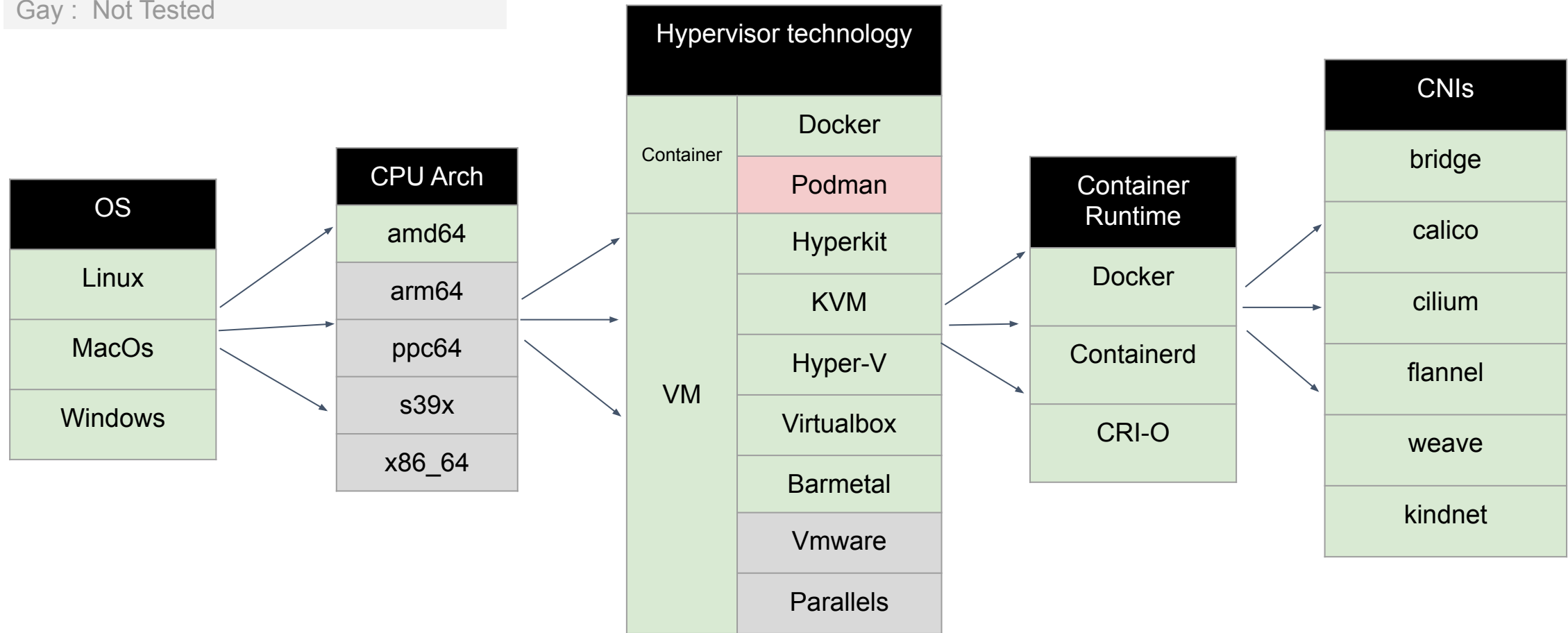
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How do you we not break things when supporting so many different platforms/drivers/options ?

Each time we break a thing, we write an integration test for it

# remember this slide ?

Green : Tested  
Red : Tested but experimental  
Gay : Not Tested



Test pass (191/200)



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### Some checks were not successful

[Hide all checks](#)

21 successful, 3 failing, 8 pending, and 3 neutral checks

Docker\_windows — Commit completed with 70 failures in 1020 minutes (0)

[Details](#)

continuous-integration/travis-ci/pr — The Travis CI build failed

[Details](#)

Docker\_Windows *Pending* — Jenkins

[Details](#)

Docker\_macOS *Pending* — Jenkins

[Details](#)

Hyper-V\_Windows *Pending* — Jenkins

[Details](#)

HyperKit\_macOS *Pending* — Jenkins

[Details](#)



### This branch has no conflicts with the base branch

Merging can be performed automatically.

Merge pull request



You can also [open this in GitHub Desktop](#) or view [command line instructions](#).

When we do so much testing and have so much log ! we need a tool to help us read the integration logs

- Gopogh converts go lang test logs to HTML.
- See [Before](#) , [After](#)
- Github repo: [github.com/medyagh/gopogh](https://github.com/medyagh/gopogh)



# Testing minikube



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- Unit Test
- Integration Test
  - 200 integration tests
- Conformance Test
- ISO / Base Image Test
- Stress Test

# Testing Infra



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- Google Cloud
- Microsoft Azure
- Jenkins
- Github actions

# minikube flags for ci



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```
minikube --wait=all --delete-on-failure --interactive  
false
```

# setup-minikube github action



```
name: CI
on:
  - pull_request
jobs:
  job1:
    runs-on: ubuntu-latest
    name: job1
    steps:
      - name: start minikube
        id: minikube
        uses: medyagh/setup-minikube@master
      # now you can run kubectl to see the pods in the cluster
      - name: kubectl
        run: kubectl get pods -A
```

[Full Example Here](https://github.com/marketplace/actions/setup-minikube)

<https://github.com/marketplace/actions/setup-minikube>

# minikube speaks yours language



<b>English</b> Report an issue
عربي بلغ عن خطأ
<b>Español</b> Reportar un problema
فارسی مشکلی را گزارش کن
<b>Bahasa Indonesia</b> Laporkan masalah
<b>Kurdî</b> Girêftek gozarîş bike
<b>Português</b> Comunicar um problema
<b>中文 (Chinese)</b> 报告问题
<b>Report a security vulnerability</b> Please review our security policy for more details

Don't see your issue here? [Open a blank issue.](#)

## minikube speaks french:

```
LC_ALL=fr out/minikube start
😄 minikube v1.9.2 sur Darwin 10.14.5
🌟 Choix automatique du driver hyperkit. Autres choix: docker
👍 Démarrage du noeud de plan de contrôle minikube dans le cluster minikube
🔥 Création de VM hyperkit (CPUs=2, Mémoire=4000MB, Disque=20000MB)...
🐳 Préparation de Kubernetes v1.18.0 sur Docker 19.03.8...
🌟 Installation des addons: default-storageclass, storage-provisioner
🏁 Terminé ! kubectl est maintenant configuré pour utiliser "minikube".
```



sharifelgamal commented on Jun 4

Member 🗨️ ⋮

由于某些原因，下载iso失败，这很奇怪，因为<https://kubernetes.oss-cn-hangzhou.aliyuncs.com/minikube/iso/minikube-v1.9.0.iso>有效

您可以在浏览器中手动点击该网址吗？

# Triage Party Multiplayer-Game



The screenshot shows the GitHub issues page for minikube, filtered to show issues that are "Important soon, but no updates in 40 days" and "Important longterm, but no updates in 110 days". The page displays a list of issues with columns for ID, description, reactions, and labels. The issues are sorted by priority and include various labels such as "help wanted", "kind/feature", "kind/flake", and "kind/bug".

ID	Desc	Reactions	Labels	Tags
7638	wato prune docker images on minikube start	2 🙋 3mo 6wk 2mo	co/docke-driver help wanted kind/feature priority/important-soon	assigned assignee-updated commented member-last contributor-last
8359	minikube ssh: Unexpected handling of stdin input	1mo 1mo 1mo	kind/bug kind/flake priority/important-soon	commented member-last contributor-last
8310	Test flake: TestMultiNode/serial/AddNode on docker linux	2mo 6wk	co/docke-driver cu/multinode kind/flake priority/important-soon	commented
8200	Fix validateMountCmd functional test on windows	2mo 2mo	co/docke-driver kind/feature priority/important-soon	commented
8219	Support DOCKER_HOST user override from within minikube pod container	2mo 6wk 6wk	co/docke-driver kind/feature priority/important-soon	commented
8154	create a preload-false test	2mo 1mo	kind/feature kind/bug priority/important-soon	commented
7922	docker driver falling test: TestFunctional/parallel/StatusCmd	3mo 7wk 7wk	co/docke-driver kind/flake priority/important-soon	collaborator-last commented pr-merged
7878	Unit test FAIL: k8s.io/minikube/pkg/addons Error getting primary control plane: remove config.json: no such file or directory	3mo 1mo 2mo	kind/flake priority/important-soon	commented contributor-last collaborator-last
7807	TestFunctional/parallel/ComponentHealth on docker: connect: connection refused Error:]]	3mo 7wk 7wk	co/docke-driver kind/flake priority/important-soon	commented pr-merged
3110	Make minikube (and kvm2) installable with "apt-get"	6 🙋 2y 3mo 5mo	kind/feature lifecycle/frozen out/linux packaging packaging/apt priority/important-soon sig/release	assigned assignee-updated commented contributor-last
2704	none: Add support for non-systemd Linux distributions	6 🙋 2y 3mo 3mo	co/uboot co/uboot co/none-driver good first issue help wanted kind/feature lifecycle/frozen out/linux priority/important-soon	commented contributor-last pr-merged pr-reviewed-with-comment

Every Wednesday we have a Triage Party !

Come play [Read more: https://minikube.sigs.k8s.io/docs/contrib/triage/](https://minikube.sigs.k8s.io/docs/contrib/triage/)

- Tools

- setup-minikube github action  
[github.com/marketplace/actions/setup-minikube](https://github.com/marketplace/actions/setup-minikube)
- slowjam  
<https://github.com/google/slowjam>
- triage party  
<https://github.com/google/triage-party>
- gopogh  
<https://github.com/medyagh/gopogh>
- gcp-webhook  
<https://github.com/GoogleContainerTools/gcp-auth-webhook>

- Slack

- <https://kubernetes.slack.com/messages/C1F5CT6Q1>

# Surveys: Listened and Done !



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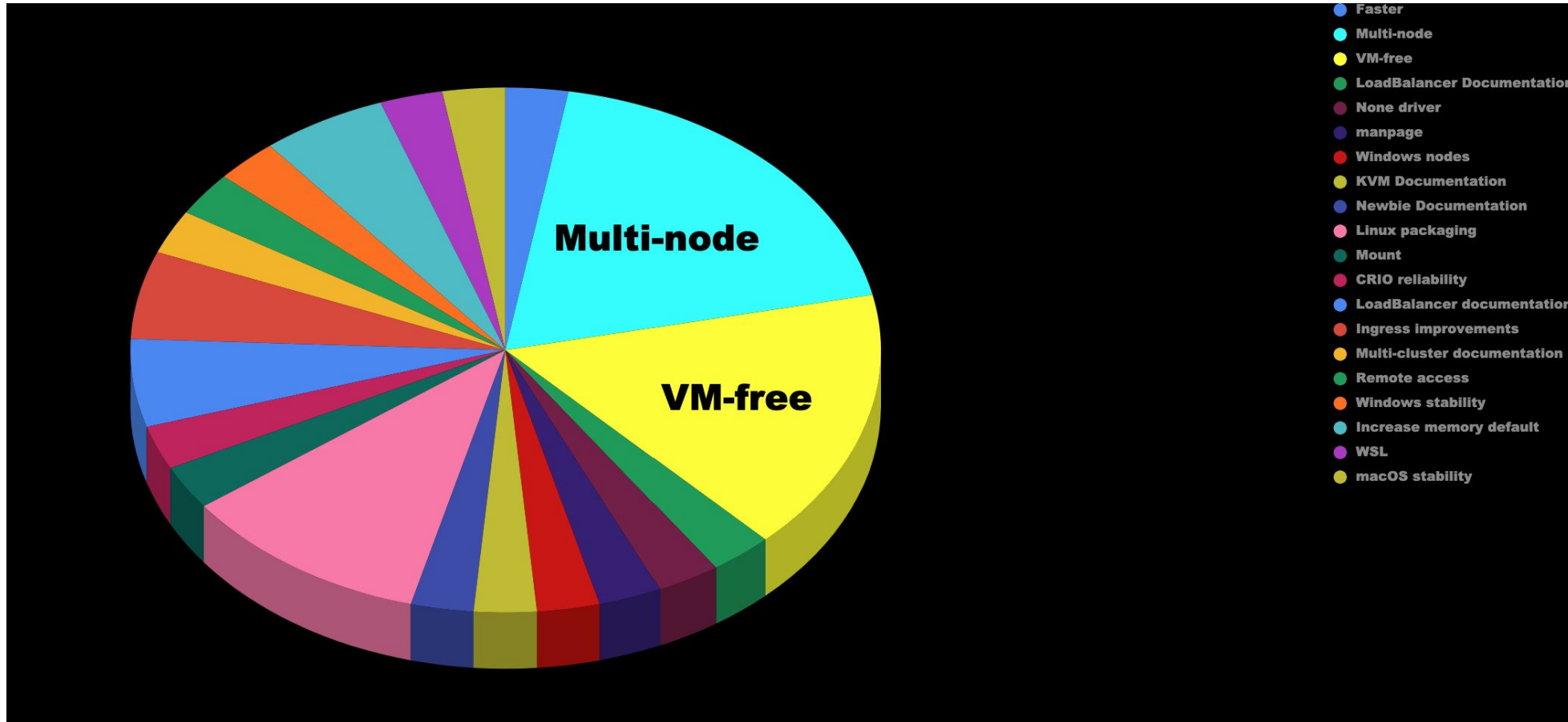


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2020 Q1 Survey  
1500 responses and counting ...





# What is coming next?



- gui
- scheduled stop and start
- auto-pause
- chromebook support
  
- for full list see [public road map](https://minikube.sigs.k8s.io/docs/contrib/roadmap/)  
<https://minikube.sigs.k8s.io/docs/contrib/roadmap/>



**New, Simplified, Searchable**

**<https://minikube.sigs.k8s.io>**

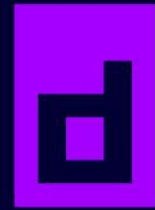


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KEEP CLOUD NATIVE

CONNECTED

