minikube from cli to gui

Summary of years of maintaining minikube

Medya Ghazizadeh
Twitter :@medya_dev

$ whoami

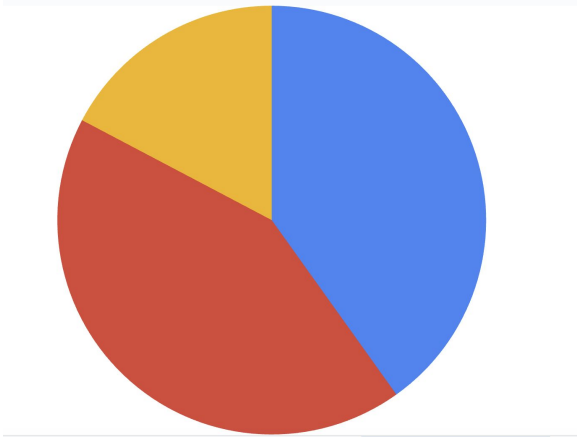
- Medya Ghazizadeh
- Maintaining minikube since 2019
- Released 86 versions of minikube (out of 140 total)
- Sr. Software Engineer/Manager at Google

What is minikube?

Quickly sets up a local Kubernetes cluster on macOS, Linux, and Windows.
With a special focus on application developers and new Kubernetes users.

Survey Data:

- Application Developers 42%
- Learning Kubernetes 40%
- Testing 17.3%

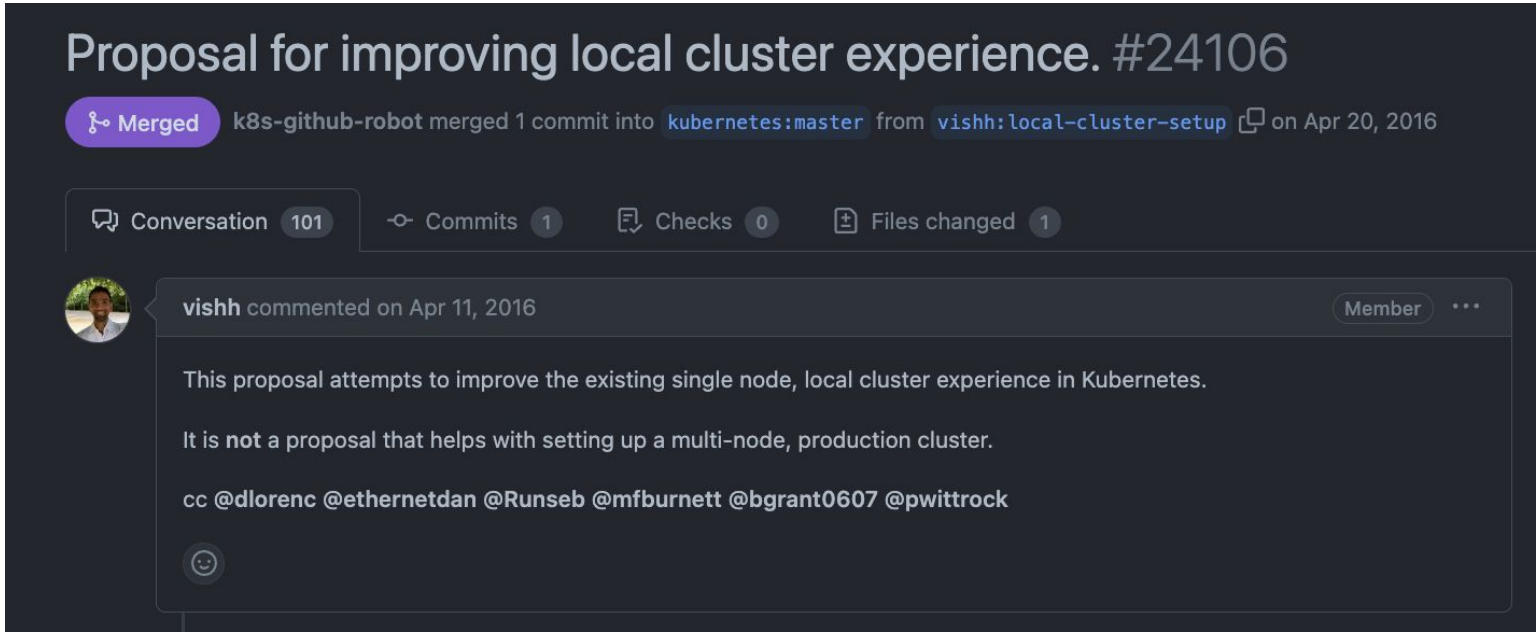


Behind the minikube emojis !

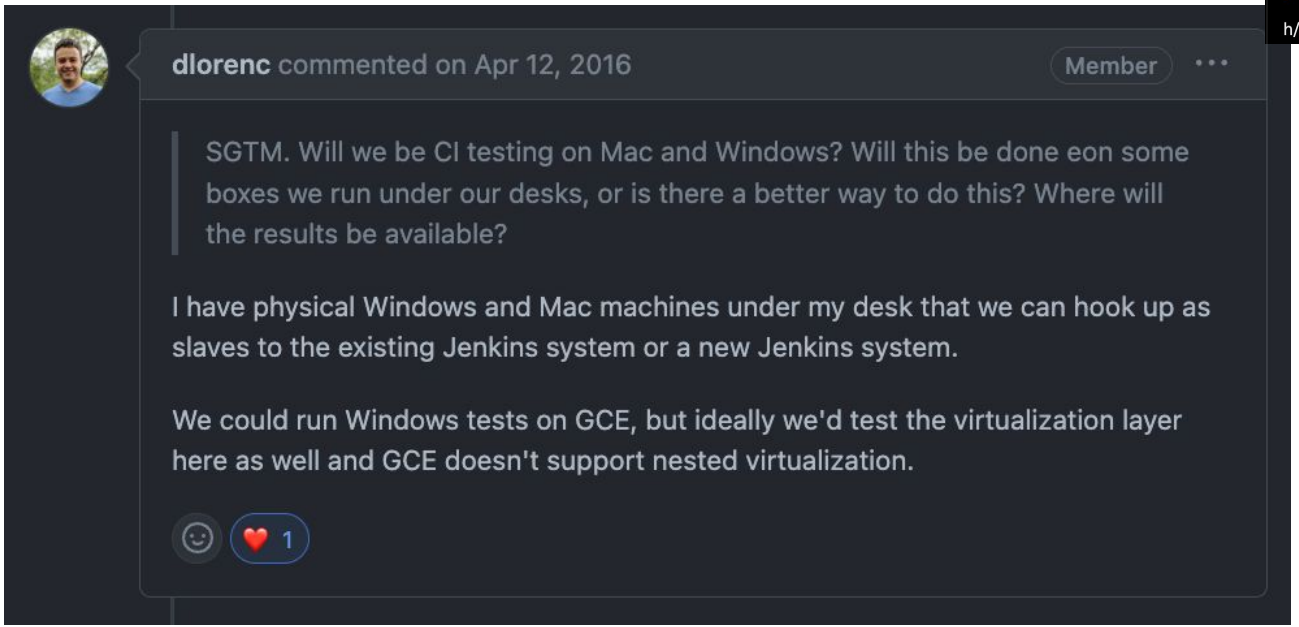
```
$ minikube start
😄  minikube v1.30.1 on Darwin 13.3.1 (arm64)
✨  Using the docker driver based on existing profile
👍  Starting control plane node minikube in cluster minikube
🚜  Pulling base image ...
🏃  Updating the running docker "minikube" container ...
🐳  Preparing Kubernetes v1.26.3 on Docker 23.0.2 ...
🔗  Configuring bridge CNI (Container Networking Interface) ...
🔎  Verifying Kubernetes components...
    ▪ Using image gcr.io/k8s-minikube/storage-provisioner:v5
🌟  Enabled addons: storage-provisioner, default-storageclass
🏄  Done! kubectl is now configured to use "minikube" cluster and "default" namespace by default
```

Other Maintainers Steven Powell, Anders Bjorklund,, Predrag Rogic,
Honorable mention of previous maintainers: Dan Lorenc, Thomas Stromberg and more than 800+ Individual Contributors ! (Thank you)

It all started with a GitHub issue in 2016



Special Needs ! Special Testing



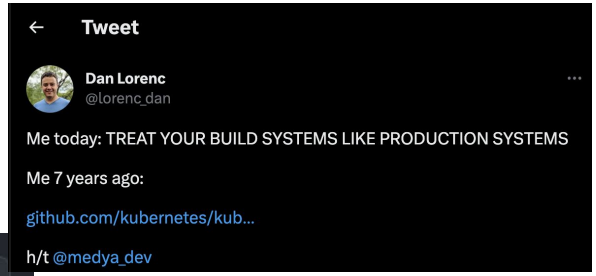
dlorenc commented on Apr 12, 2016 Member

> SGTM. Will we be CI testing on Mac and Windows? Will this be done eon some boxes we run under our desks, or is there a better way to do this? Where will the results be available?

I have physical Windows and Mac machines under my desk that we can hook up as slaves to the existing Jenkins system or a new Jenkins system.

We could run Windows tests on GCE, but ideally we'd test the virtualization layer here as well and GCE doesn't support nested virtualization.

❤️ 1



Tweet

Dan Lorenc
@lorenc_dan

Me today: TREAT YOUR BUILD SYSTEMS LIKE PRODUCTION SYSTEMS

Me 7 years ago:

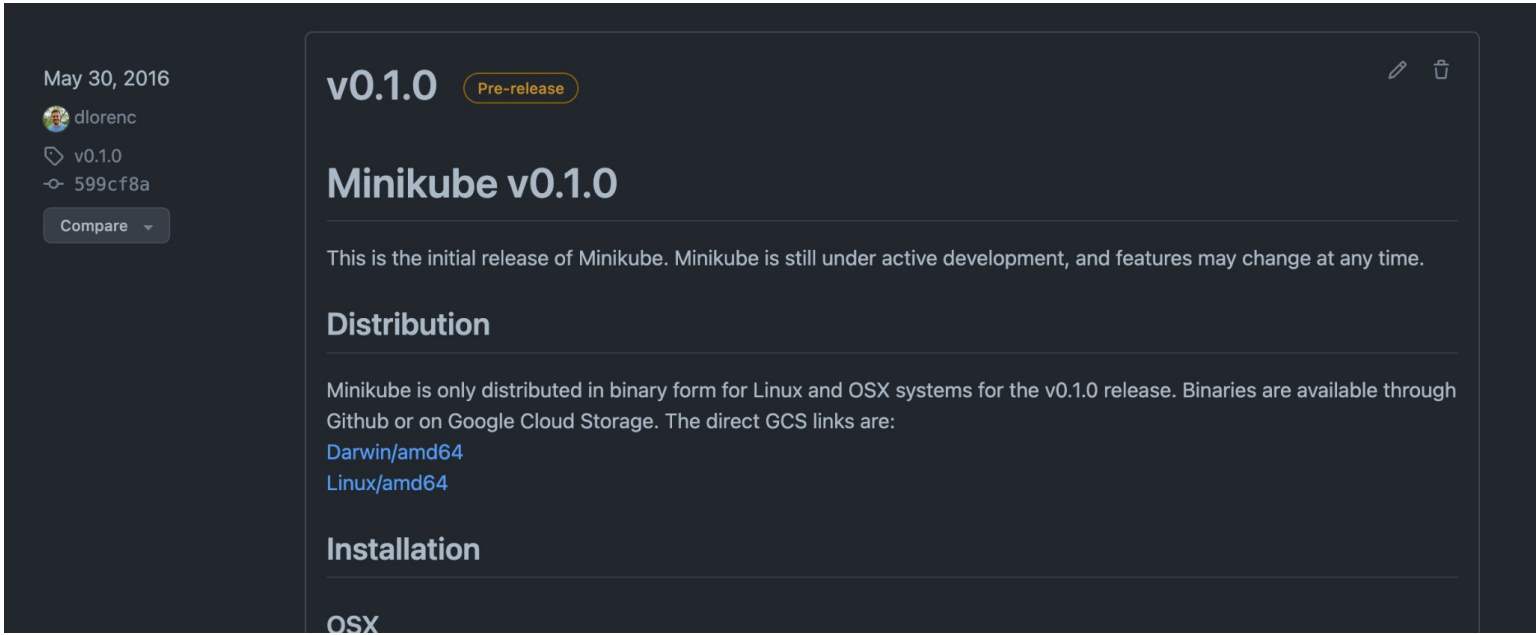
github.com/kubernetes/kub...

h/t @medya_dev

minikube First Test Lab

R.I.P
2016-2020
San Francisco

First Release May 2016 by Dan Lorenc



May 30, 2016

dlorenc

v0.1.0

599cf8a

Compare

v0.1.0 Pre-release

Minikube v0.1.0

This is the initial release of Minikube. Minikube is still under active development, and features may change at any time.

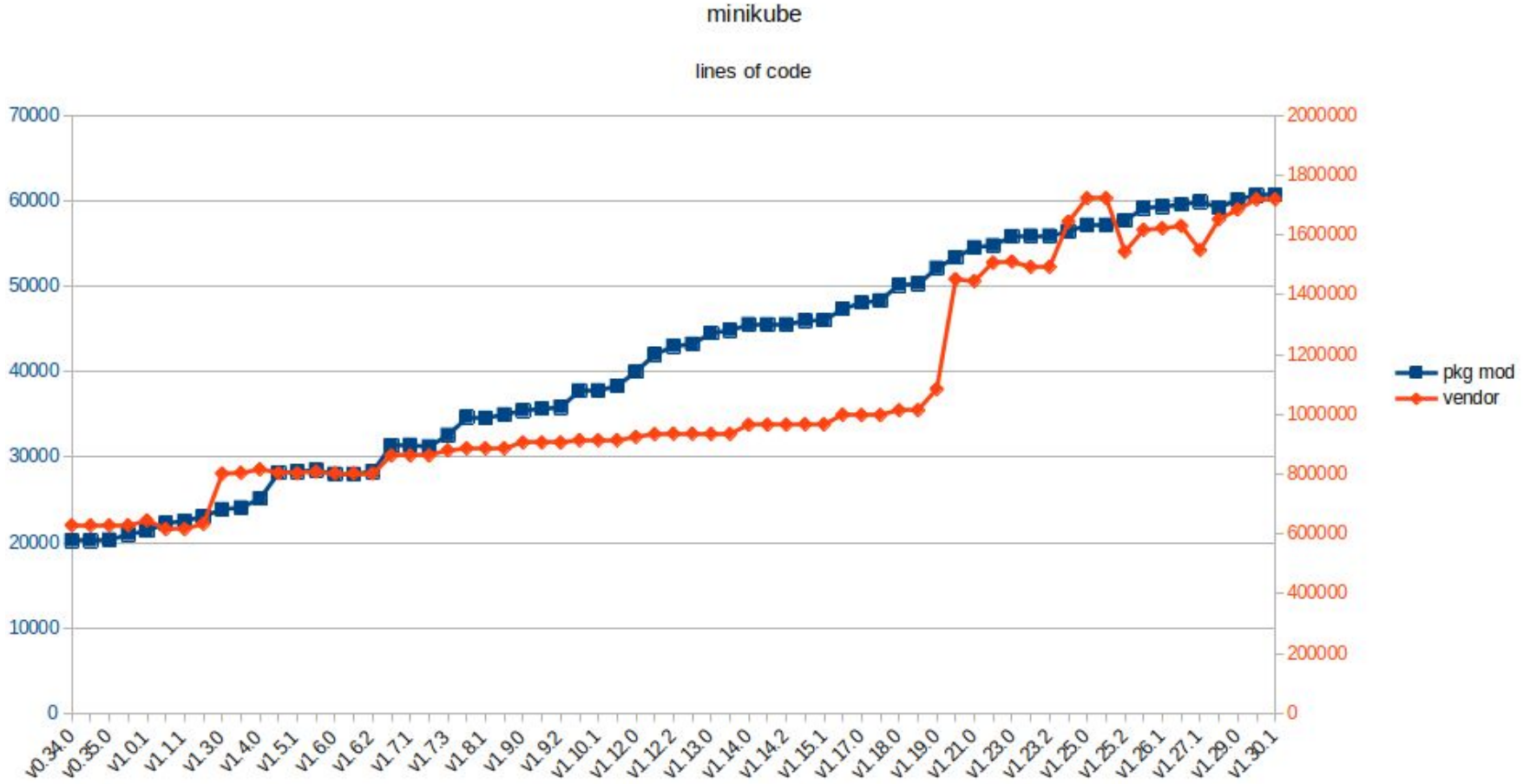
Distribution

Minikube is only distributed in binary form for Linux and OSX systems for the v0.1.0 release. Binaries are available through Github or on Google Cloud Storage. The direct GCS links are:
Darwin/amd64
Linux/amd64

Installation

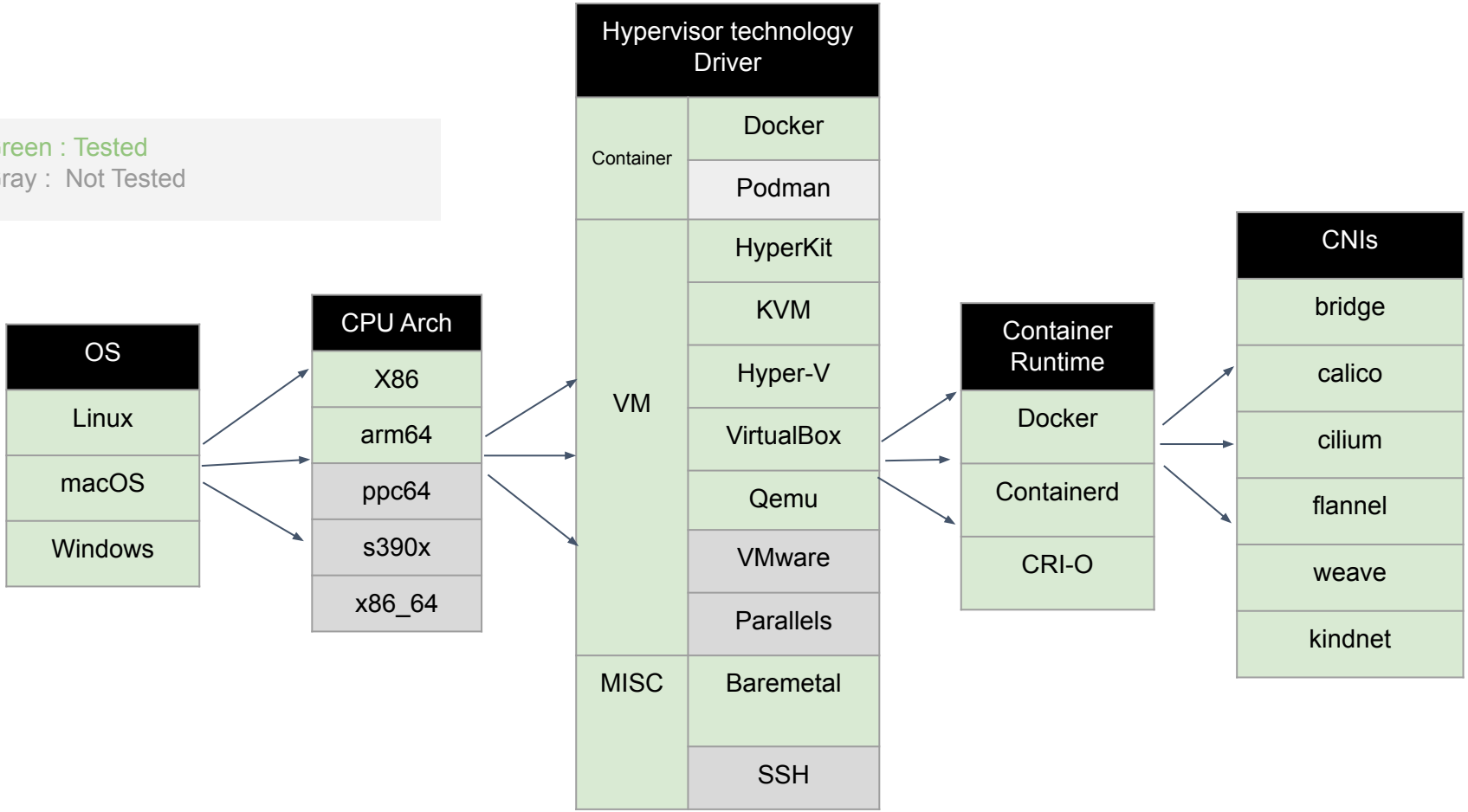
OSX

Fast Forward 2023... 1.8M LOC



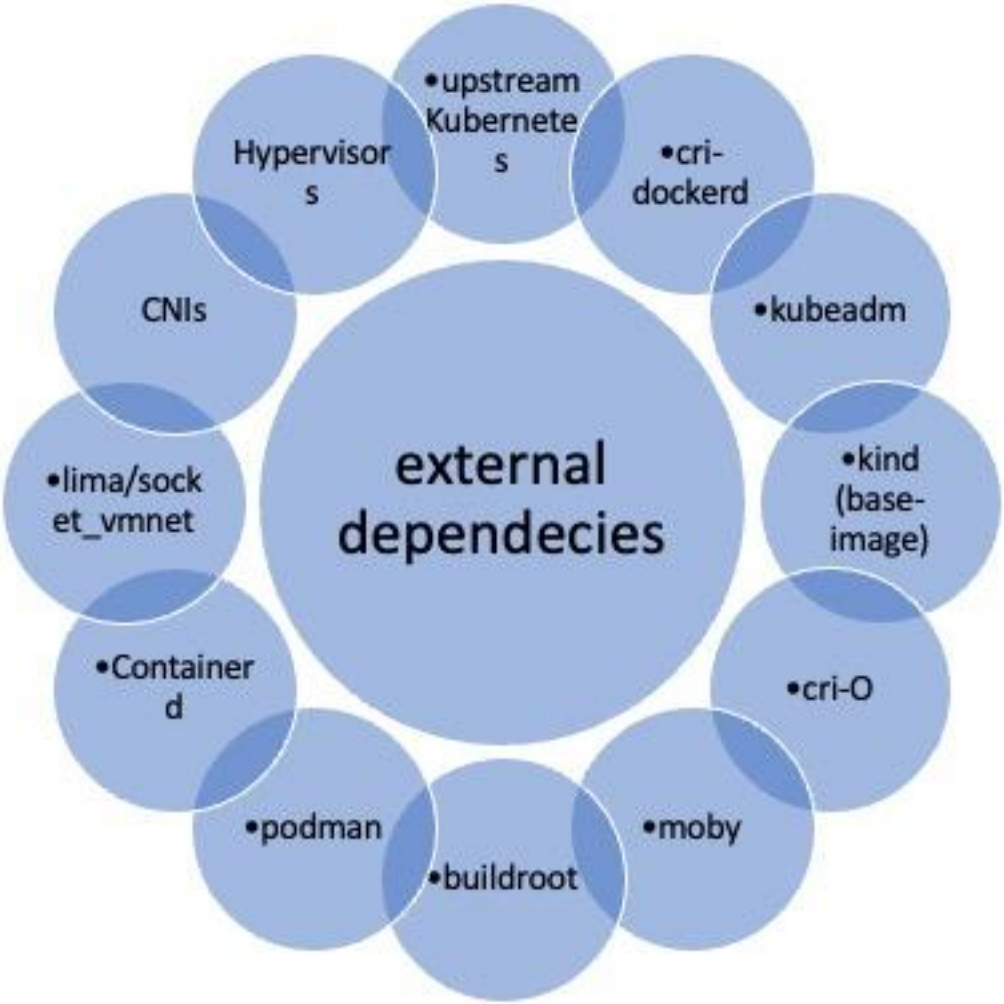
Tech Support Matrix!

Green : Tested
Gray : Not Tested

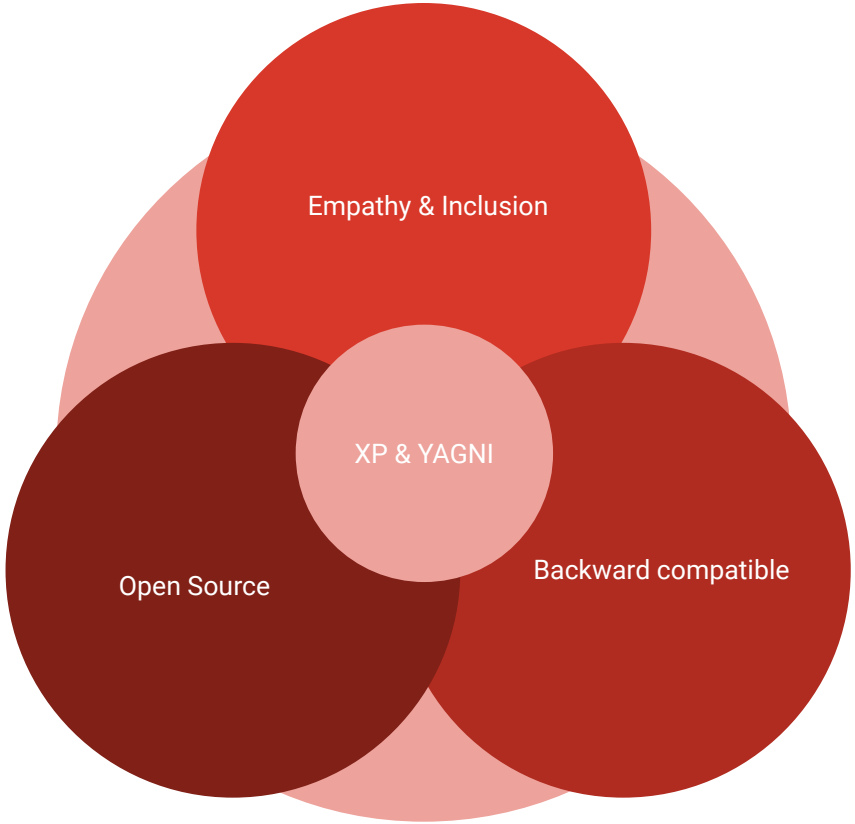


“Minikube mai is not just one project”
It is like a sun with an orbit

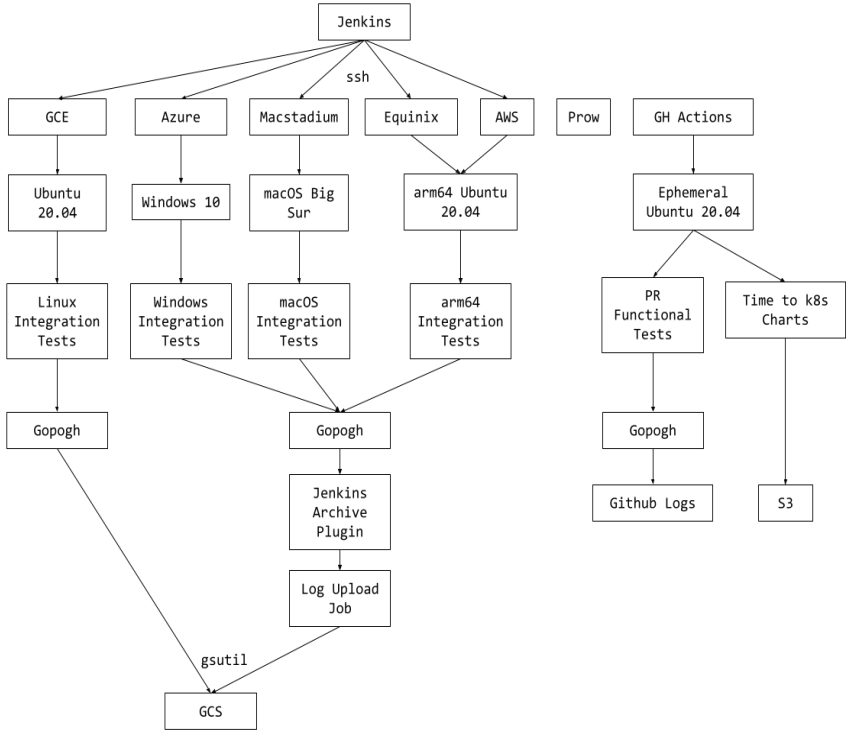
Minikube Maintainence Workstreams
Base Image ISO
•Just Enough Linux for K8S
Machine/Drivers
•Hypervisor Driver
Official Addons
•GCP Auth
•Storage Provisioner
•Auto-Pause
•Gvisor ...
Test Infra Tooling
•Self-hosted Jenkins
•github Actions
•prow
Maintainer Tools
•Gopogh/Flake Rate/CSAT
•Triage Party
•Release Infra
•PR Bots
Benchmarking Tools
•CPU CSAT
•Time-To-K8S
•Dev Loop Stat
•SlowJam
Website
Minikube-gui
Setup-minikube
•Run minikube in CI


external dependecies
•upstream Kubernetes
•cri-dockerd
•kubeadm
•kind (base-image)
•cri-O
•moby
•buildroot
•podman
•Containerd
•lima/socket_vmnet
CNIs
Hypervisors

Minikube Principles



Transform Test Infra



From few computers in the office to

- 46 Self-hosted CI VMs in 5 different clouds (GCP, AWS, Equinix Metal, Azure, Macstadium) + Prow and Github Action
- 296 end to end tests in integration testing suite
- Checkout detailed list of integration tests cases on website

State of minikube idle CPU in 2019

minikube roundtable

"Burning the legs off of developers since 2016"

Minikube v0.23.0 100% CPU usage from kubernetes-dashboard v1.7.0 #2130

Closed bgehman opened this issue on Oct 28, 2017 · 4 comments

VM has 50% resting CPU usage when idle #3207

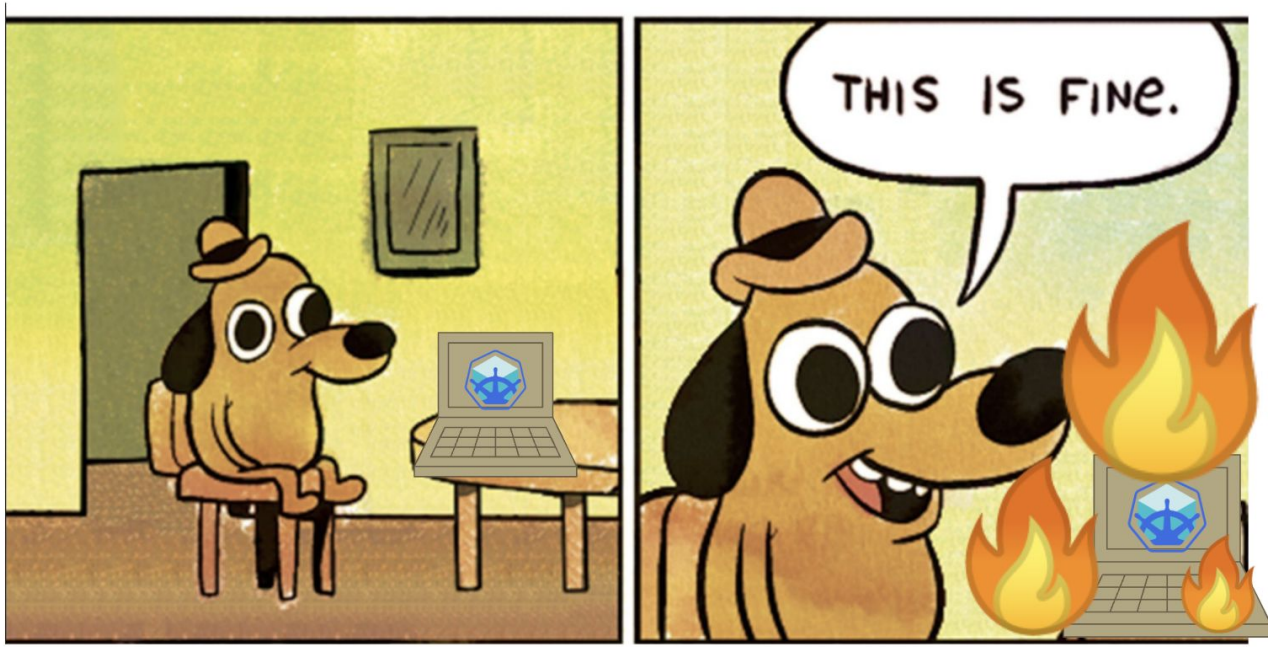
Open samuela opened this issue on Oct 2, 2018 · 46 comments

minikube-darwin-amd64 causing too many CPU wakeups #3291

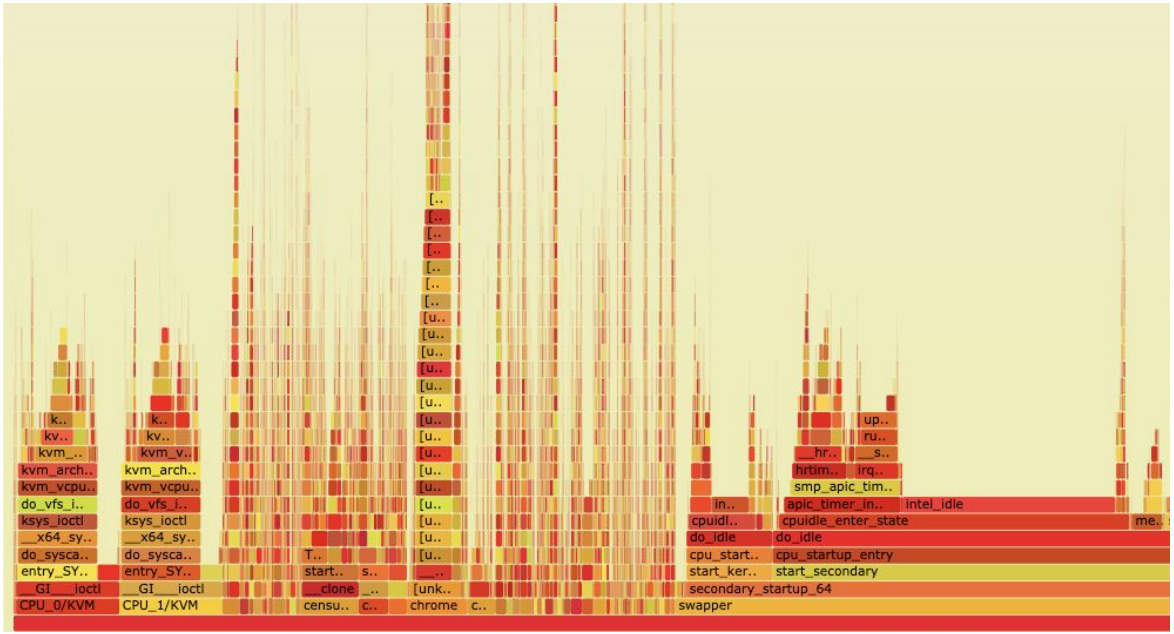
Closed parasyte opened this issue on Nov 1, 2018 · 4 comments

Docker run stuck and consuming 100% CPU #5991

Closed mvgijssel opened this issue on Nov 27, 2019 · 2 comments

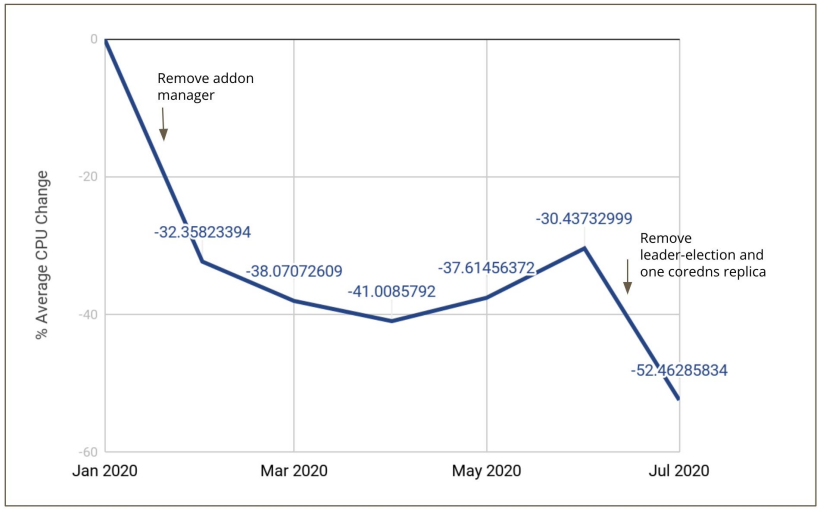


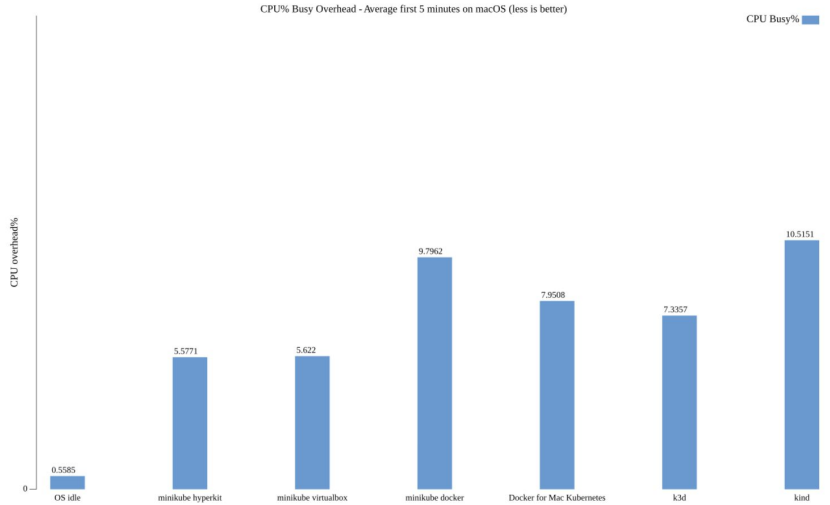
Developed tools to generate CPU flame graph



[cstat](#) (developed by minikube maintainer @tstromberg)
Checkout KubeCon 2020 talk Improving the Performance of Your Kubernetes Cluster - YouTube

We transformed CPU Idle CPU usage

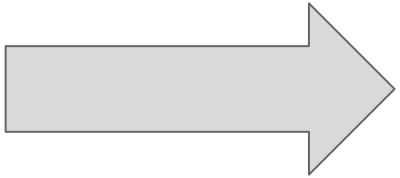




On the left CPU benchmarks after multiple optimization
On the right minikube cpu usage compared to similar tool.
Checkout more benchmarks on [minikube website]
Also checkout minikube auto-pause addon (that pauses when not in use)

Transform minikube start latency (2020)

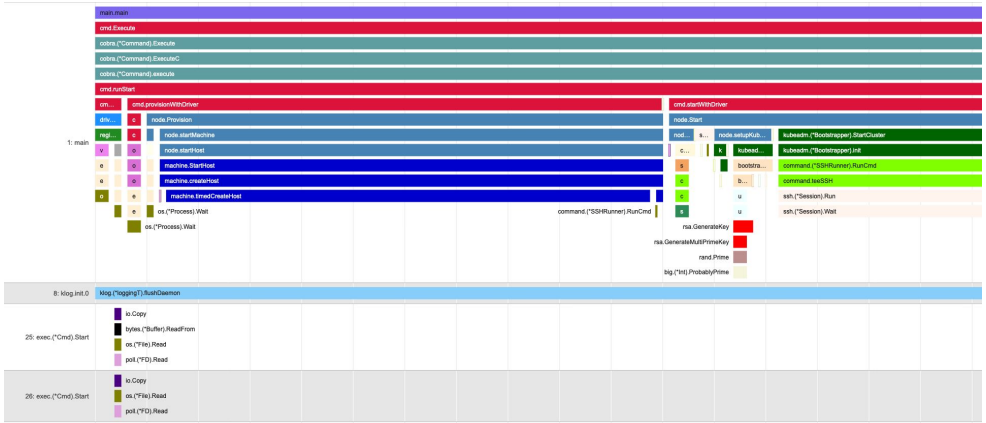
2m35s minute

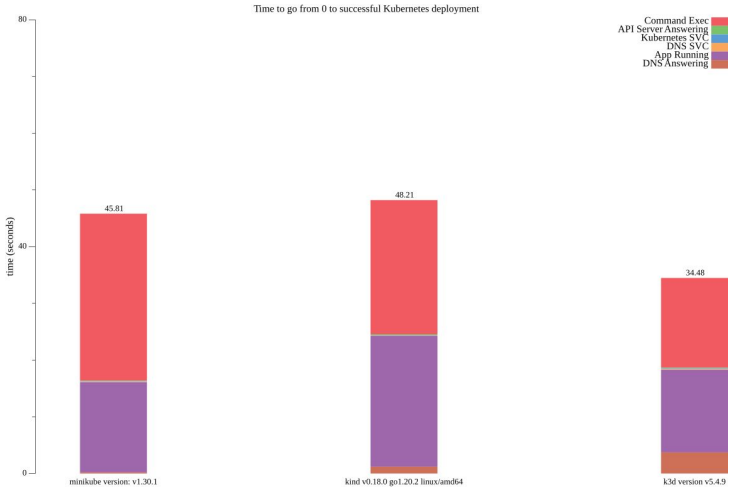


21 seconds (86% faster)

- Introduction of docker driver
- Unified preload images for all drivers
- Massive refactor/overhaul of minikube code base
- Optimizations in Kubernetes config for local developers
- Parallelization

Open sourced SlowJam and Time-To-K8S



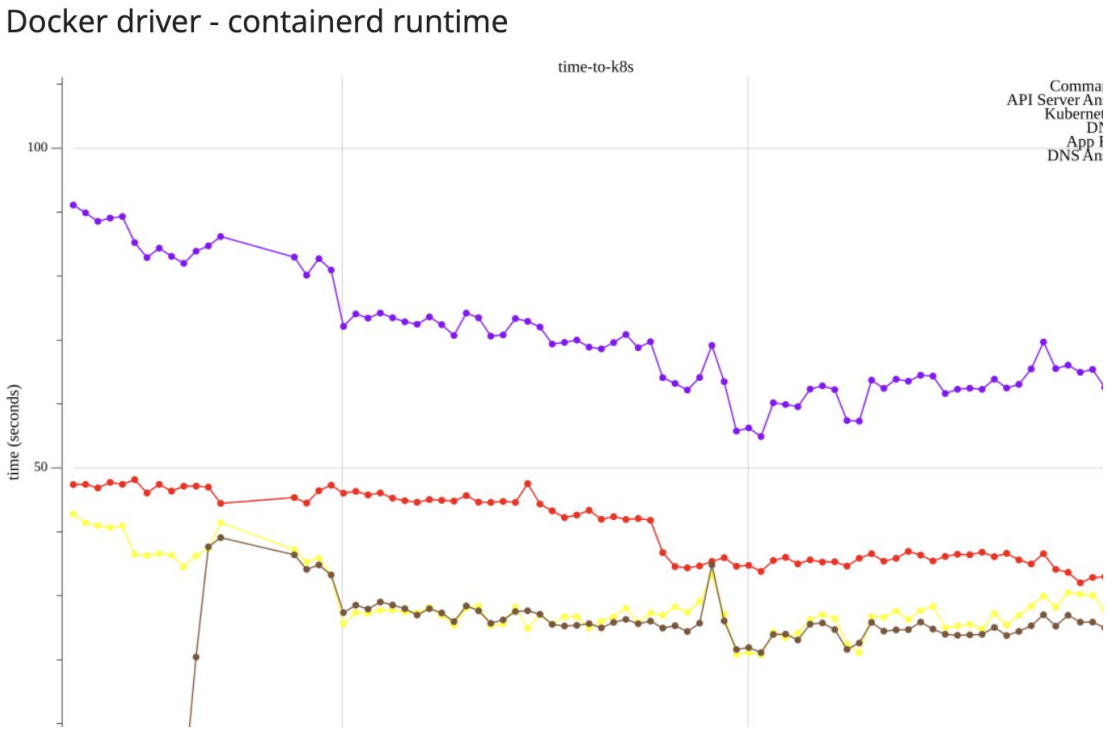


minikube team developed two tools inspect performance metrics

On the left: screenshot of SlowJam

On the right: screenshot of time-to-k8s

Automated Benchmarking



Example of daily benchmarking charts showing minikube start tup time in different categories identified by time-to-k8s over time.

minikube for embedded use 2021

minikube for embedded use 2021

Tons of features for minikube to be used as an embedded use

For example by Skaffold or IDE plugins (such as “cloud code”)

- JSON output
- Schedule-stop
- Step Events
- Audit
- Advanced --wait logic
- --watch flag
- License command
- support CGroups
- Machine readable reason exit codes
- Auto generate docs on exit code

minikube to be used in CI (2021)

gitlab/prow/google cloud build/circleci,...

https://github.com/minikube-ci/examples

Platform	Known to Work?	Status
Prow	Yes ✓	build passing
Google Cloud Build	Yes ✓	cloud build success
Github	Yes ✓	Minikube passing
Azure Pipelines	Yes ✓	Azure Pipelines set up now
Travis CI	Yes ✓	build passing
CircleCI	Yes ✓	FAILED
Gitlab	Yes ✓	Gitlab

Official Github Action (setup-minikube)

- Setup-minikube Github Action maintained by minikube maintainers
- Simply test your PR/app against Kubernetes

Basic Usage

```
steps:
  - name: start minikube
    id: minikube
    uses: medyagh/setup-minikube@latest
```

- See Examples: github.com/marketplace/actions/setup-minikube

Bring K8s for the next billion users

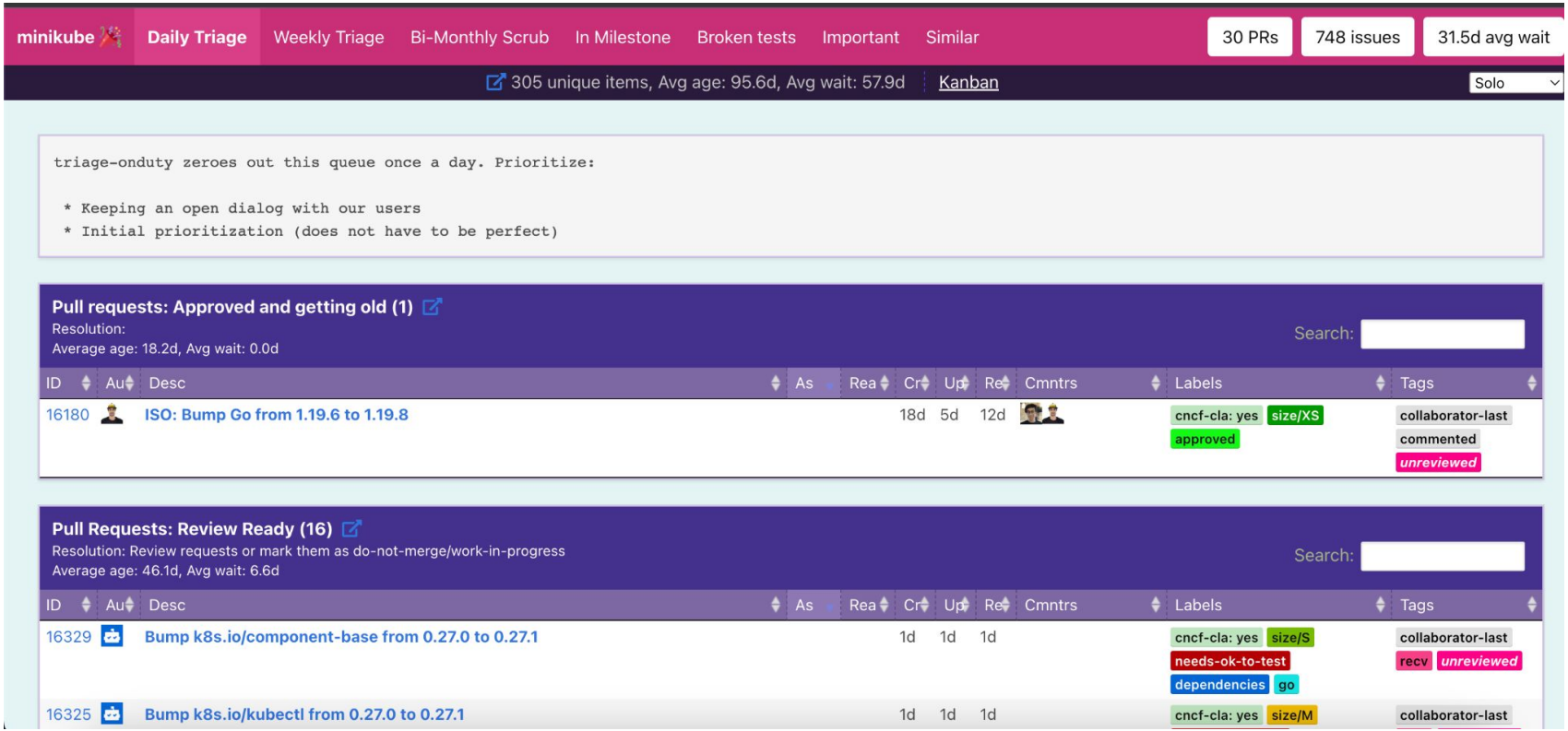
- Checkout talk 2019 KubeCon talk tiled “Minikube: Bringing Kubernetes to the Next Billion Users “
- Talks are available on minikube website (under presentations)

Minikube for non-english languages

```
$ minikube start
😄  Darwin 13.3.1 (arm64) 上の minikube v1.30.1
✨  既存のプロファイルを元に、docker ドライバーを使用します
👍  minikube クラスター中のコントロールプレーンの minikube ノードを起動しています
🚜  ベースイメージを取得しています...
🏃  実行中の docker 「minikube」 container を更新しています...
🐳  Docker 23.0.2 で Kubernetes v1.26.3 を準備しています...
🔗  bridge CNI（コンテナーネットワークインターフェース）を設定中です...
🔎  Kubernetes コンポーネントを検証しています...
    ▪ gcr.io/k8s-minikube/storage-provisioner:v5 イメージを使用しています
🌟  有効なアドオン： storage-provisioner, default-storageclass
🏄  終了しました！ kubectl がデフォルトで「minikube」クラスターと「default」ネームスペースを使用するよう設定されました
```

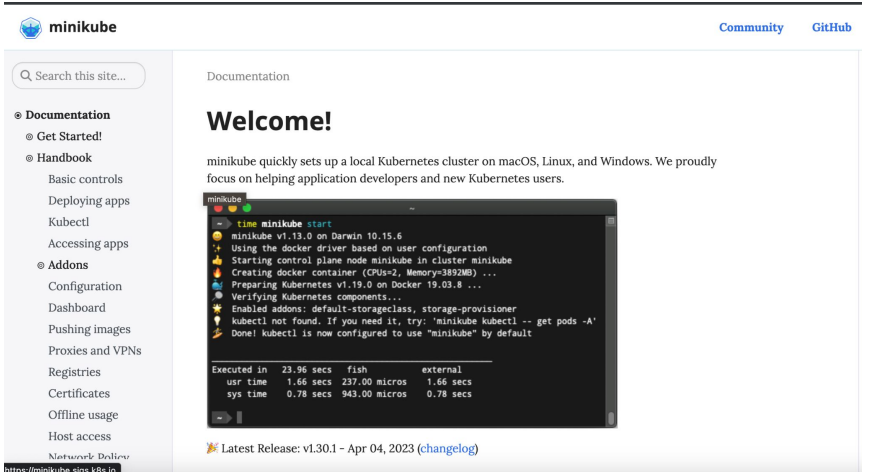
- Supporting French, Spanish, Japanese, Chinese, Korean, Polish, German and russian.
- You can easily contribute your language to minikube (no coding required) Search for “translations” in [minikube website]

Triage Party! (Join every Wed)



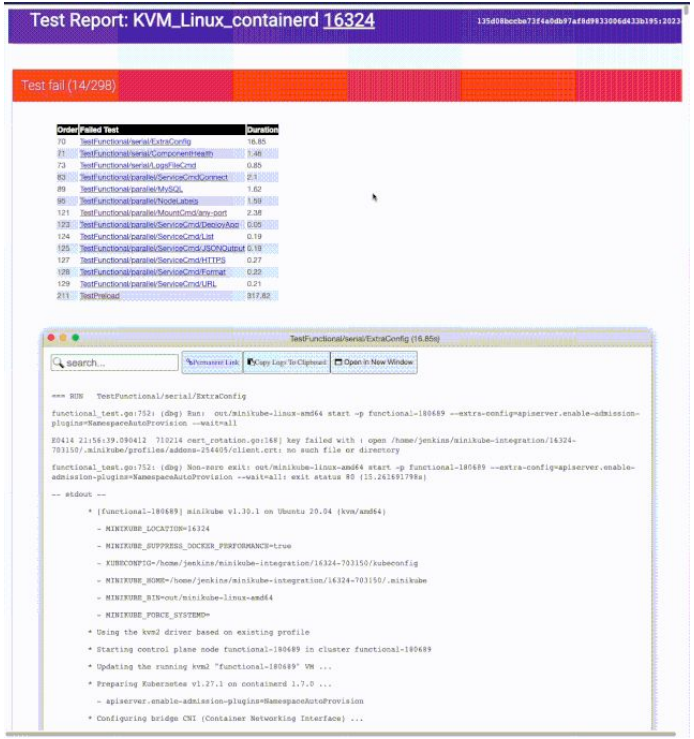
Overhaul of minikube Website (2019-2021)

- minikube website (Since 2019-06-15)
  - https://minikube.sigs.k8s.io/docs/
  - Getting started
  - Tutorials
  - Handbooks
  - Addons
  - FAQ
  - Contributors Guide
- Twitter (Since july 2021)
  - @minikube_dev
- Slack Channel (6K members since 2016)



Investments in Developer Velocity

GOPOGH: Reading dozen 10K lines logs is not fun !

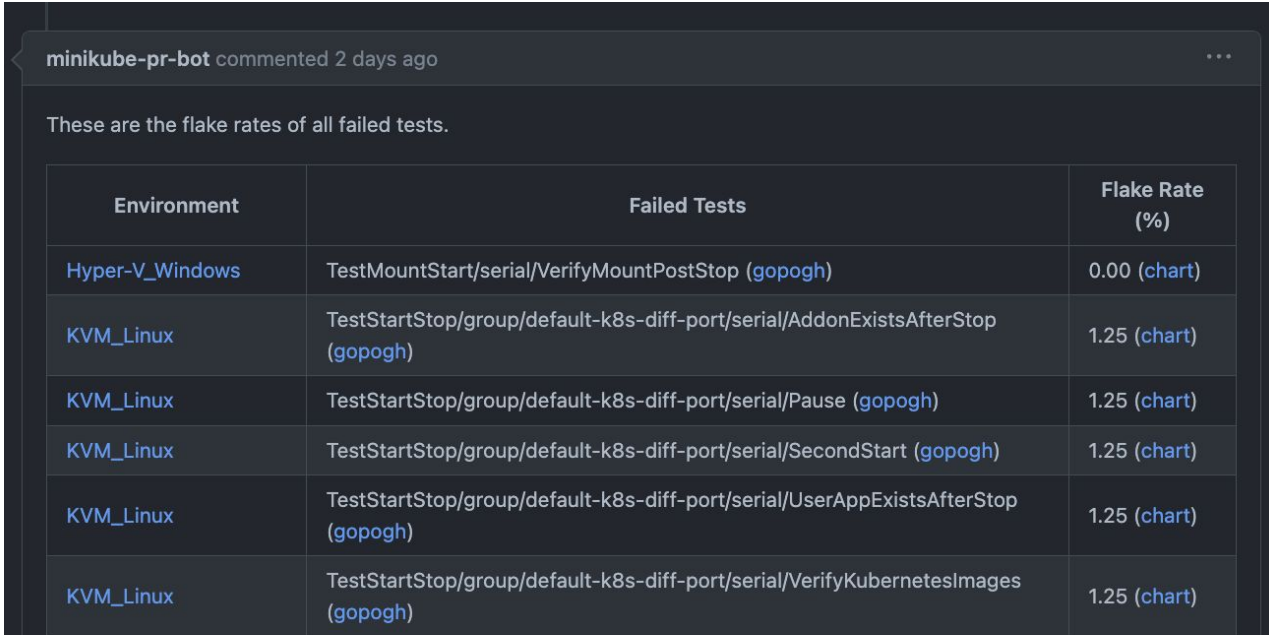


https://github.com/medyagh/gopogh

Chart all the things!

Transform Developer Velocity: Identify Flakes!

minikube bot warns the reviewer the following integration test do NOT fail on a high rate on HEAD

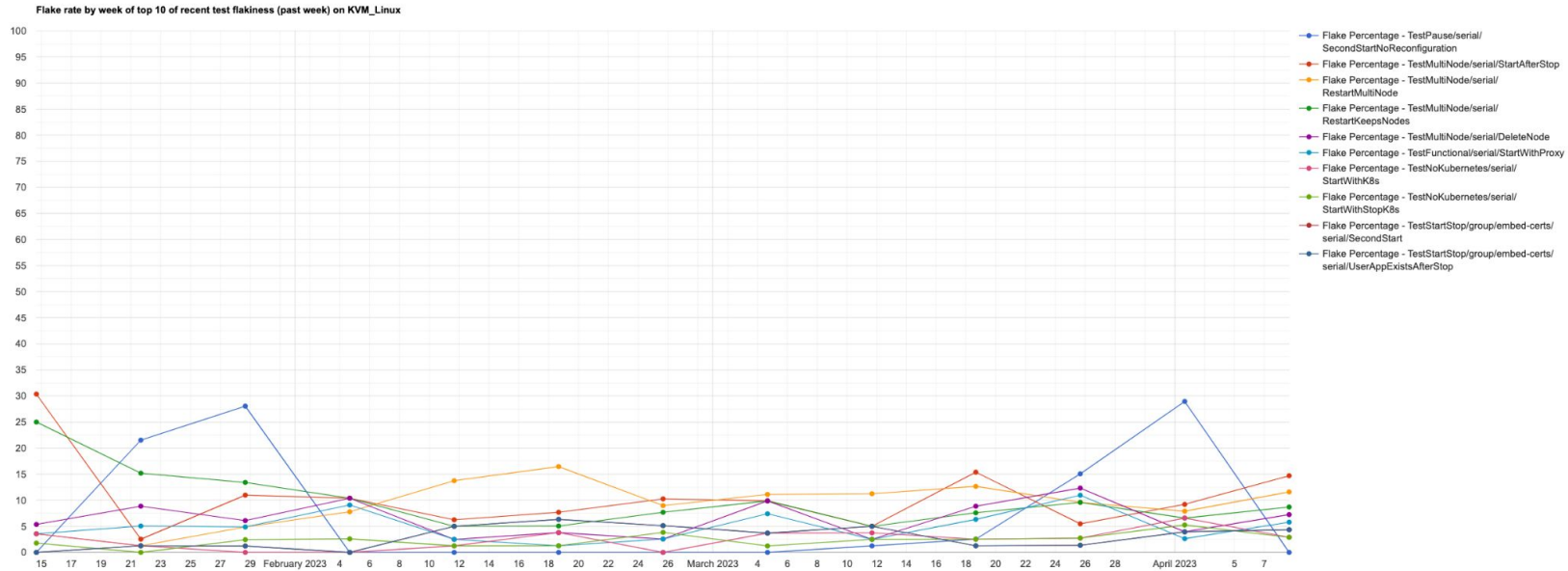


minikube-pr-bot commented 2 days ago

These are the flake rates of all failed tests.

Environment	Failed Tests	Flake Rate (%)
Hyper-V_Windows	TestMountStart/serial/VerifyMountPostStop (gopogh)	0.00 (chart)
KVM_Linux	TestStartStop/group/default-k8s-diff-port/serial/AddonExistsAfterStop (gopogh)	1.25 (chart)
KVM_Linux	TestStartStop/group/default-k8s-diff-port/serial/Pause (gopogh)	1.25 (chart)
KVM_Linux	TestStartStop/group/default-k8s-diff-port/serial/SecondStart (gopogh)	1.25 (chart)
KVM_Linux	TestStartStop/group/default-k8s-diff-port/serial/UserAppExistsAfterStop (gopogh)	1.25 (chart)
KVM_Linux	TestStartStop/group/default-k8s-diff-port/serial/VerifyKubernetesImages (gopogh)	1.25 (chart)

Maintainer Velocity: Flake Charts Example

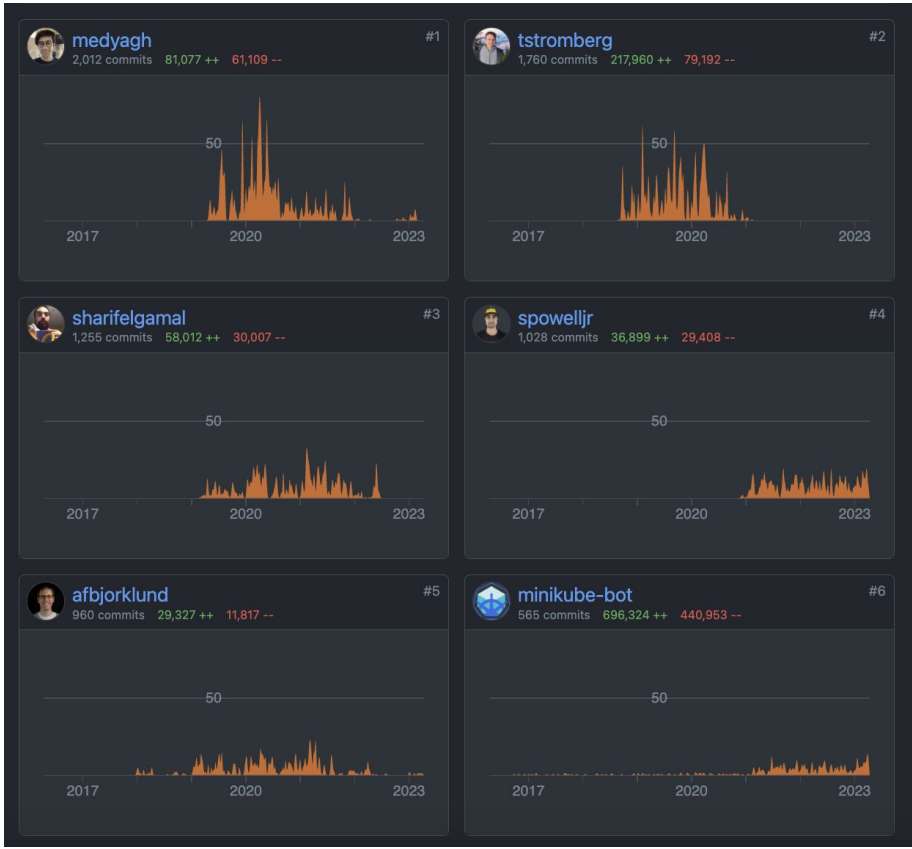


- flake tests charts per environment and per test case are updated in minikube website daily and available for public
  - https://minikube.sigs.k8s.io/docs/contrib/test_flakes/

Developer Velocity: Automated PRs at Midnight

- minikube Bot created more than 500 PRs!
- Pushing code after hours reducing traffic on test infrastructure for human developers
- Build Docker Image and ISO images on PRs (that took 5+ hours)
- Sync Images to Alibaba

Robot in
Top 6 contributors!



docker desktop alternative? --no-kubernetes (2022)

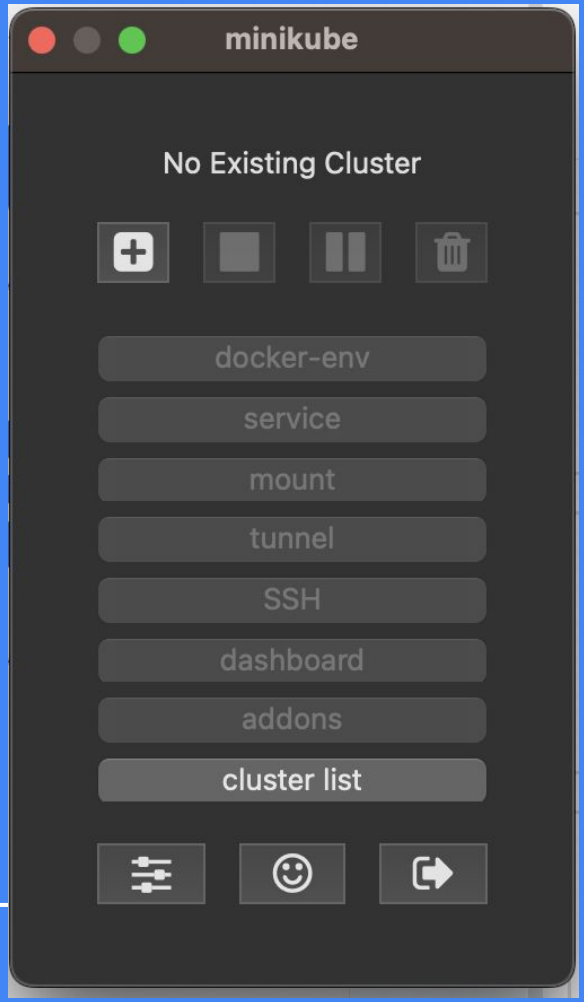
- In 2022 minikube surveys showed significant interest of users using minikube as a free docker desktop replacement. (see site tutorial)
- Users asked for starting minikube without kubernetes!!!
  - And we delivered minikube start --no-kubernetes
- More info see website (search for docker desktop)

2022: The year arm64!

- Delivering Docker arm64 was done earlier in 2021
- 2022 we delivered QEMU driver for macOS M1 (arm64)

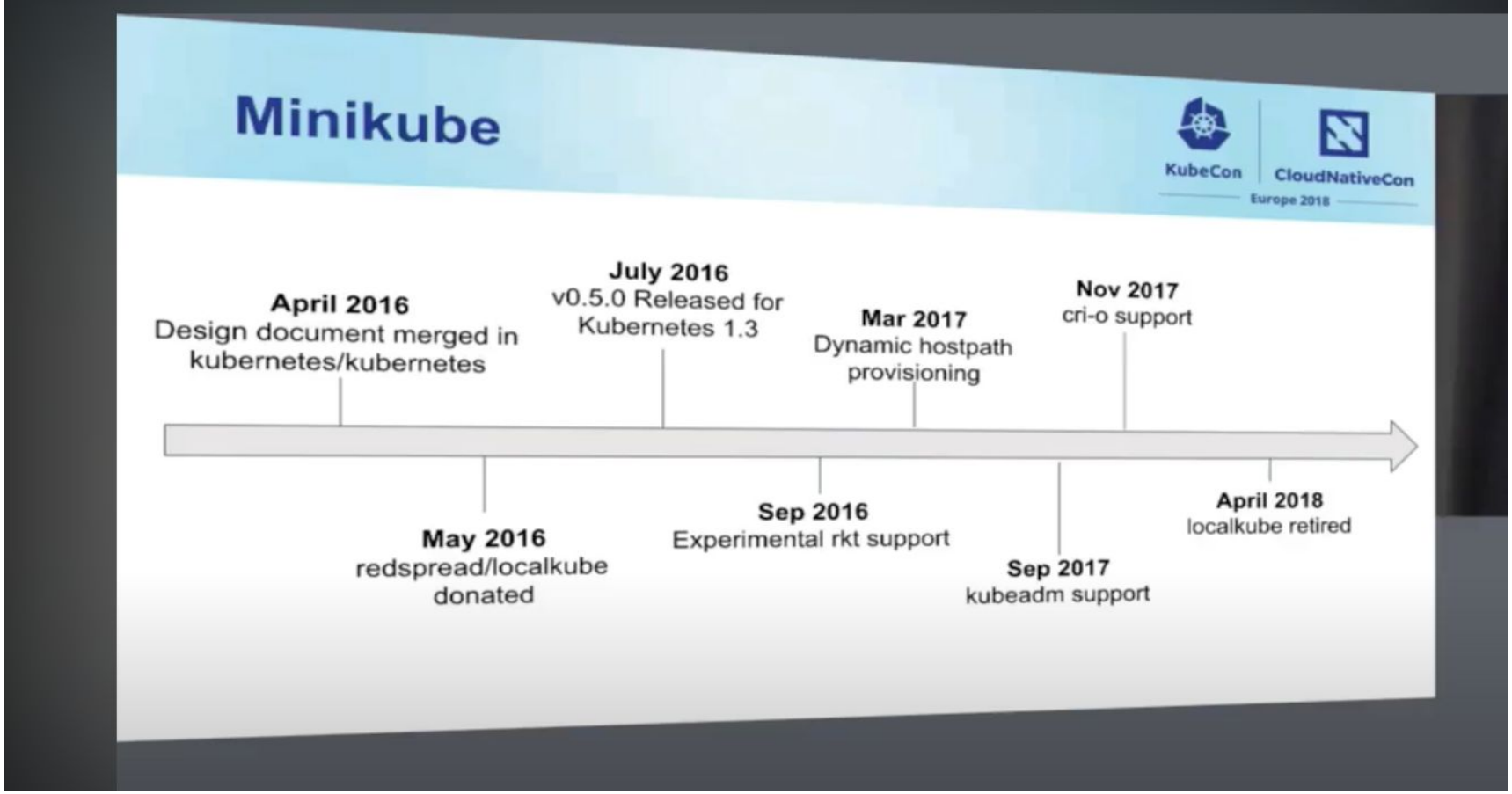
And now present to you! minikube-gui !

https://github.com/medyagh/gopogh/

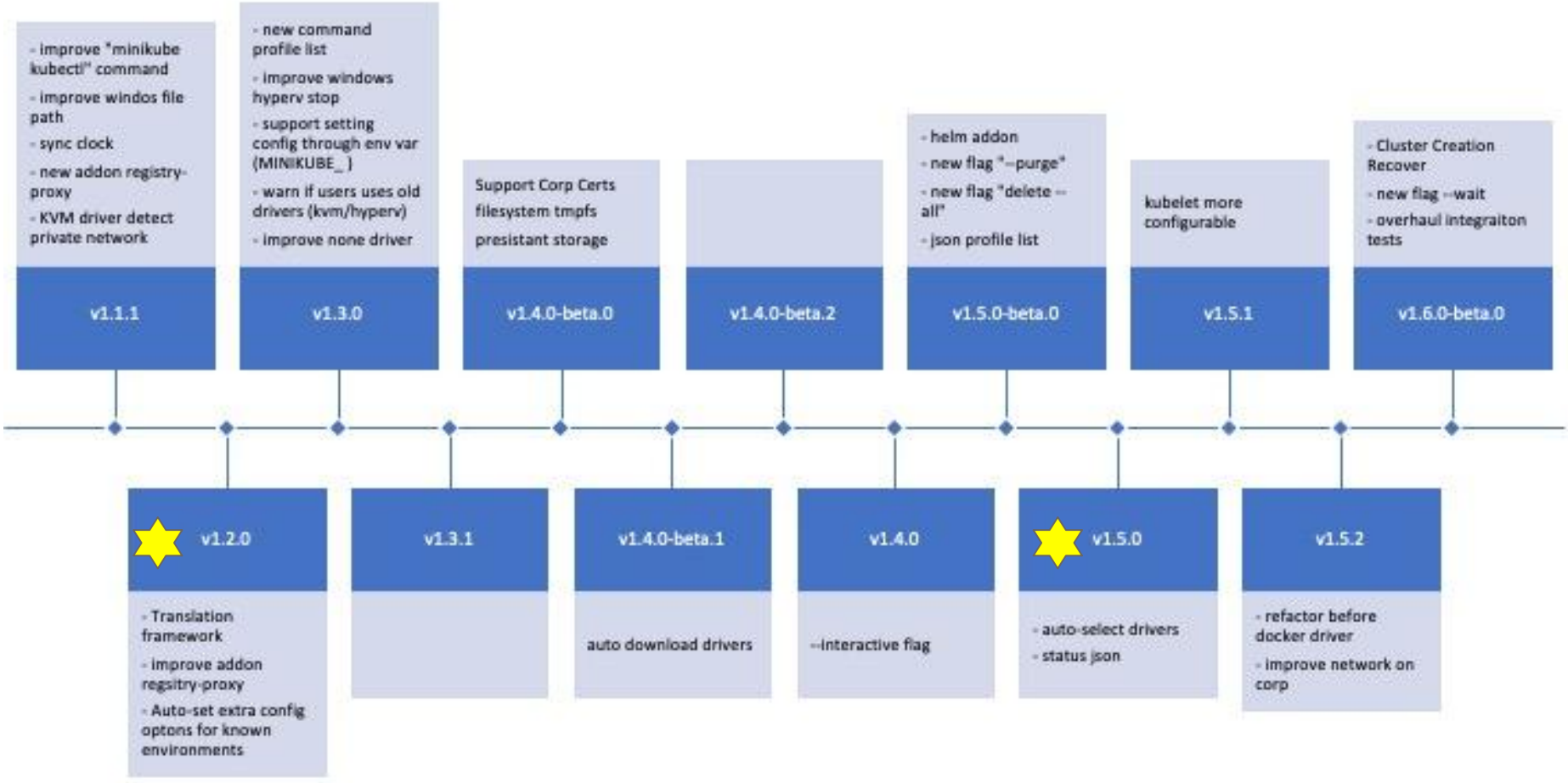


Appendix

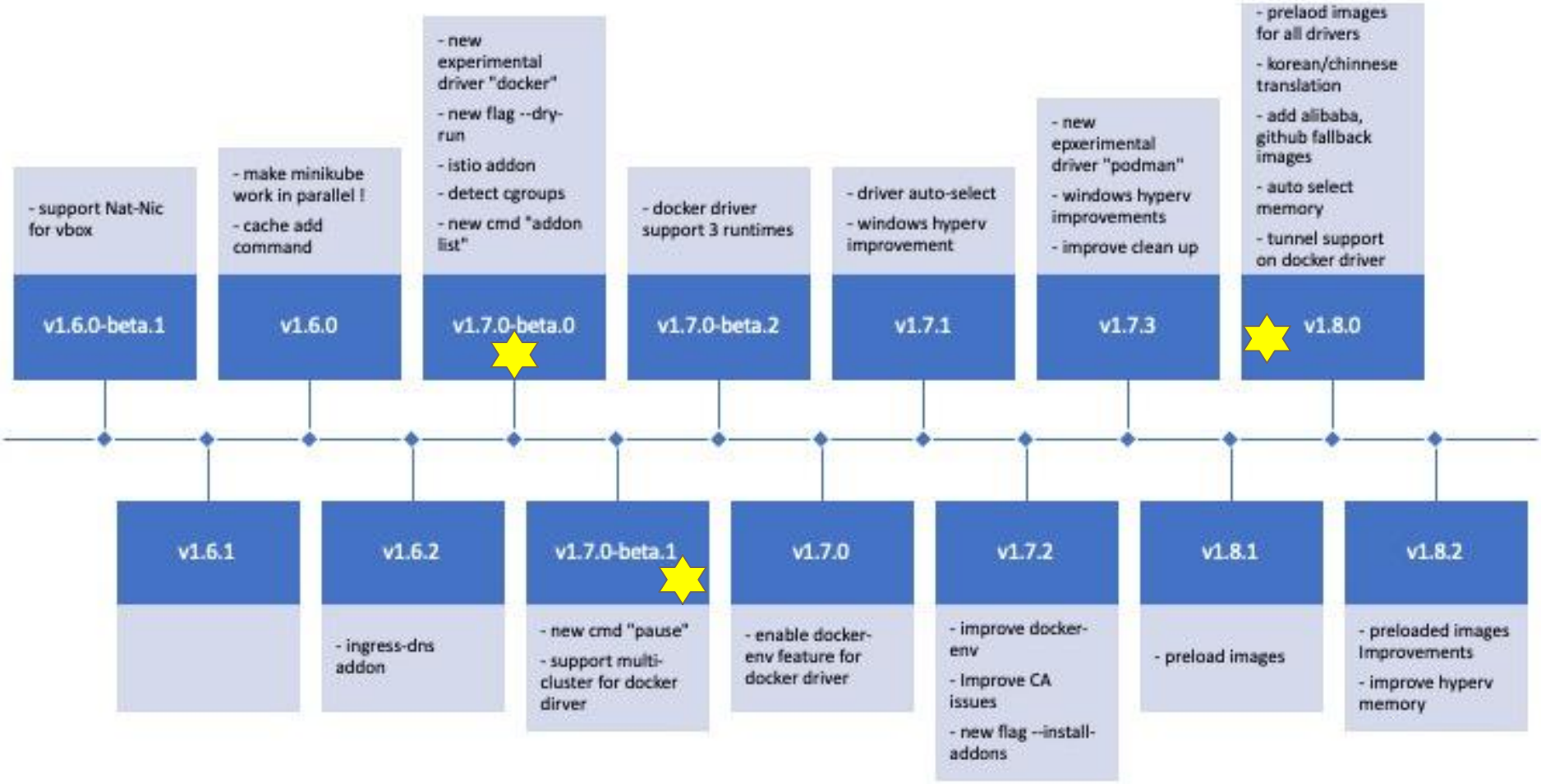
Release Timeline



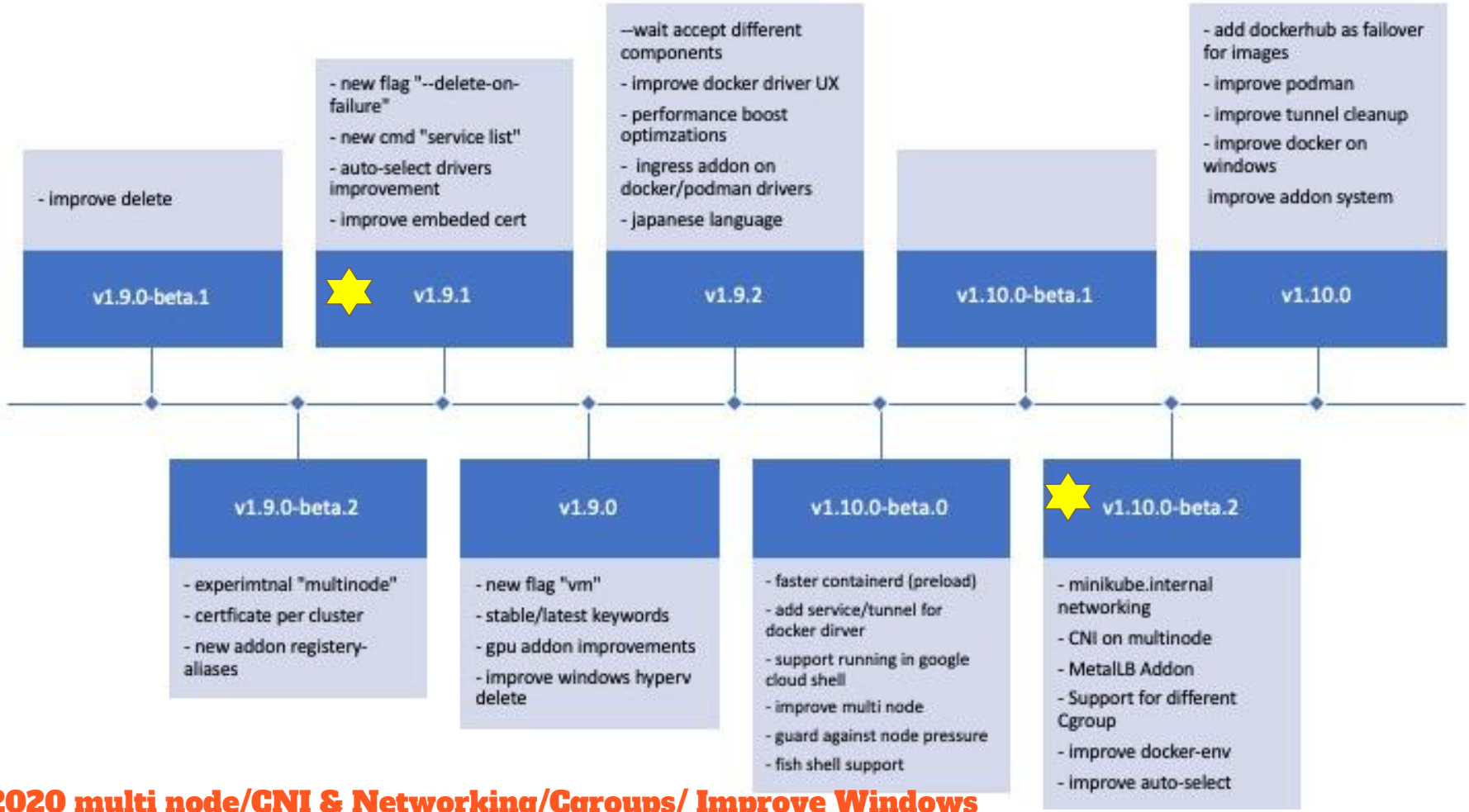
2016-2018 Dan Lorenc Time



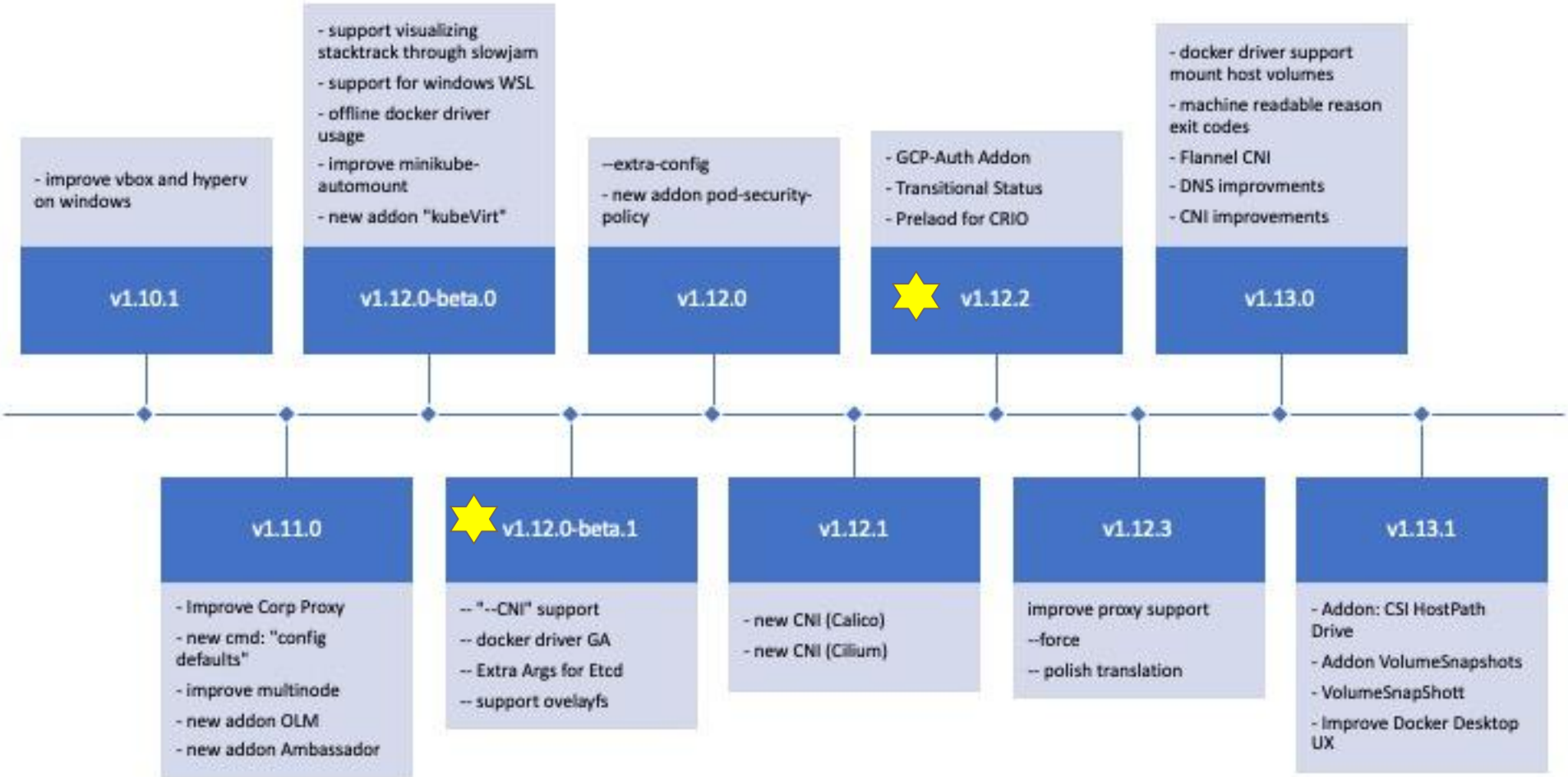
2019-2020 Translations/Auto-select options/ Refactor technical debt



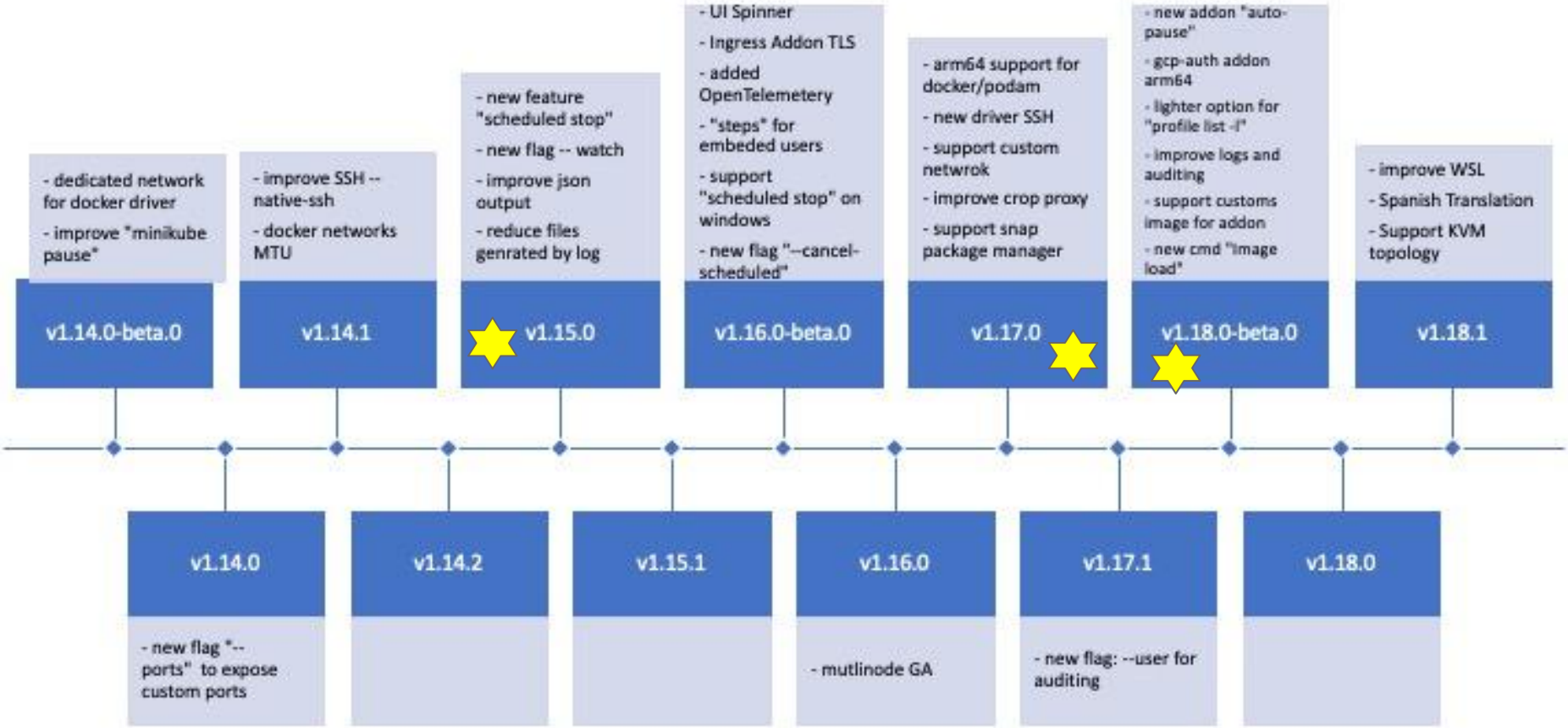
2019-2020- docker driver/unified preload/pause cmd



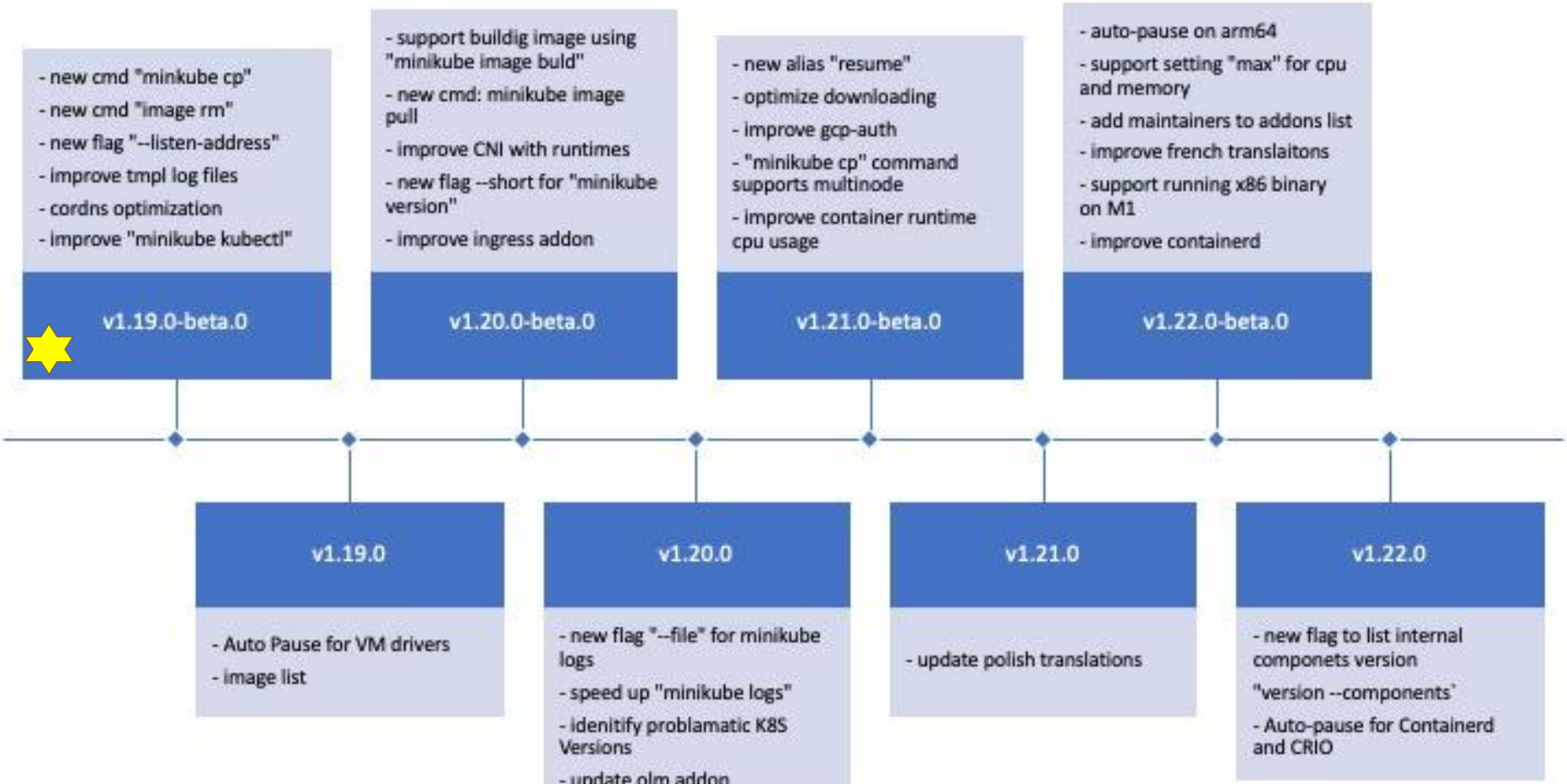
2020 multi node/CNI & Networking/Cgroups/ Improve Windows



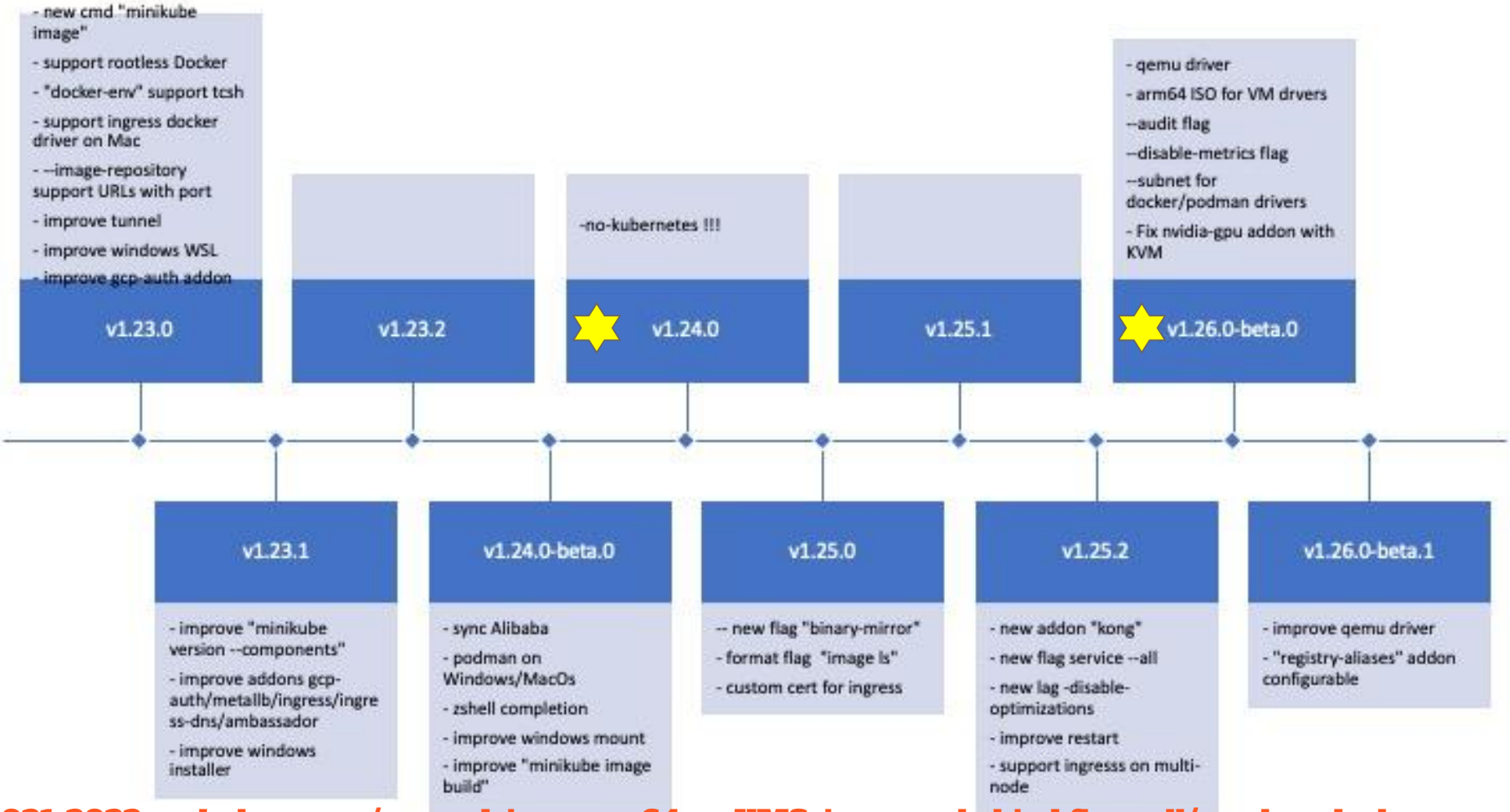
2020 Docker Driver GA/more CNIs/New Addons!



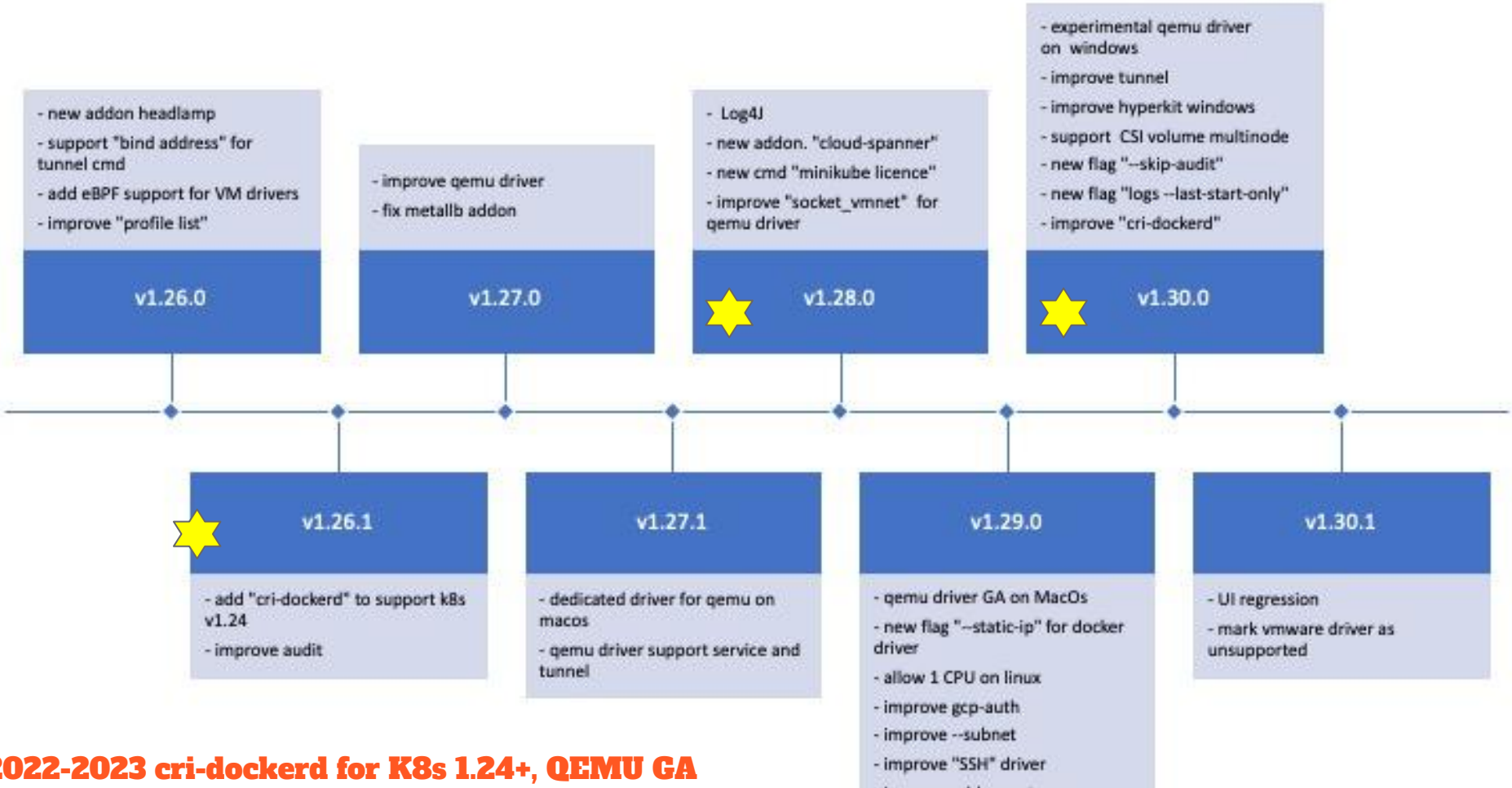
2020- 2021 Embedded use/Arm64 Docker Driver/ Auto Pause/ Multinode GA/Audit



2021 optimizations ,new cmds “image/cp”, Autopause



2021-2022 no-kubernetes/qemu driver, arm64 on VMS, improve behind firewall/rootless docker.



2022-2023 cri-dockerd for K8s 1.24+, QEMU GA

Link to all the minikube github repos

- Minikube GUI
  - github.com/kubernetes-sigs/minikube-gui
- Machine Drivers
  - github.com/machine-drivers/machine
- Setup-Minikube Github Action
  - github.com/marketplace/actions/setup-minikube
- Slowjam
  - github.com/google/slowjam
- Triage Party
  - github.com/google/triage-party
- Gopogh
  - github.com/medyagh/gopogh
- Time To K8s
  - github.com/tstromberg/time-to-k8s
- Minikube-CI
  - github.com/minikube-ci/examples
- Pull Sheet
  - github.com/google/pullsheet
- CSTAT
  - github.com/tstromberg/cstat
- GCP AUTH Addon
  - https://github.com/GoogleContainerTools/gcp-auth-webhook