From Sensors to Servers: Efficient Edge Computing with Akri and WebAssembly

Exploring an Open-Source Toolkit for Wasm and the Edge

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Kubernetes on the Edge

Challenges with Edge Computing

Imagine a bustling ecosystem filled with diverse devices working together:

Thousands of edge sensors publish data, each speaking its own protocol.

Servers need to discover these devices and continually process data to harness valuable insights from the edge.

Open Source Tools for Running Serverless Kubernetes on the Edge

Akri + SpinKube: Toolkit for Serverless WebAssembly Applications on the Edge

Akri

CNCF project for dynamically bridging IoT leaf devices to your edge Kubernetes cluster

SpinKube

Open Source project for efficiently running Wasm applications on Kubernetes

Tiny Edge

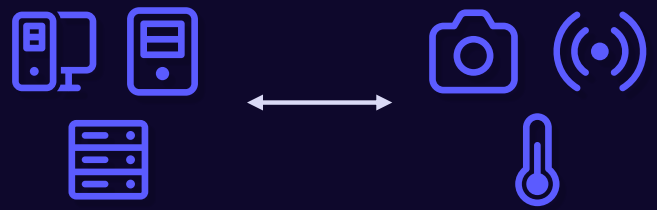
IoT leaf devices (sensors, actuators, etc.) have many challenges:

Different protocols, topologies and authentication requirements.

May have intermittent availability and downtime.

Too small, too old and too locked down to run Kubernetes today.

Manual configuration required to make IoT devices available to Kubernetes workloads.



Kubernetes Nodes

Leaf Devices (Tiny Edge)

What is Akri?

1K GITHUB ★

300+ SLACK MEMBERS

github.com/project-akri/akri

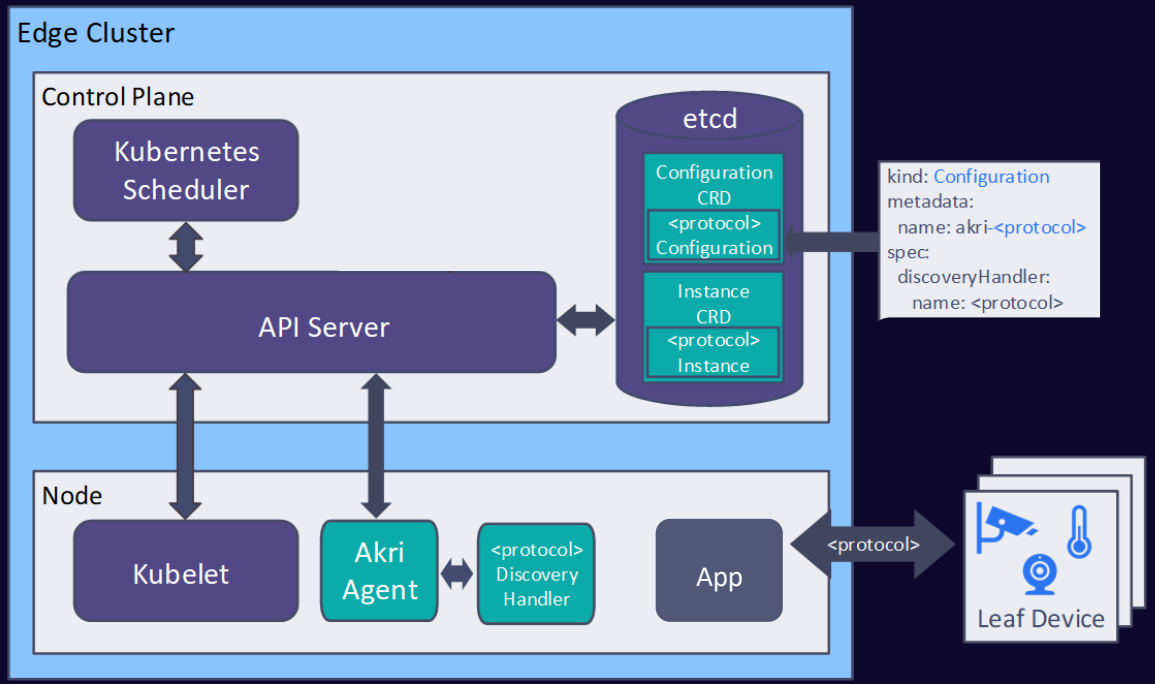
Discovers non-Kubernetes devices exposed on protocols and stores node-attach information

Devices are registered as Kubernetes extended resources that can be requested by Pods

Standardizes method for storing and passing in secrets for authentication

Easily extend Akri to discover more devices by creating a new Discovery Handler (in any language)

Akri Architecture



Consuming Akri Resources

```
apiVersion: v1
kind: Pod
metadata:
  name: app
  namespace: default
spec:
  containers:
  - name: app
    image: app:latest
    resources:
      requests:
        akri.sh/mqtt-sound-sensor: 1
      limits:
        akri.sh/mqtt-sound-sensor: 1
```

Request IoT devices just as you would CPU and memory.

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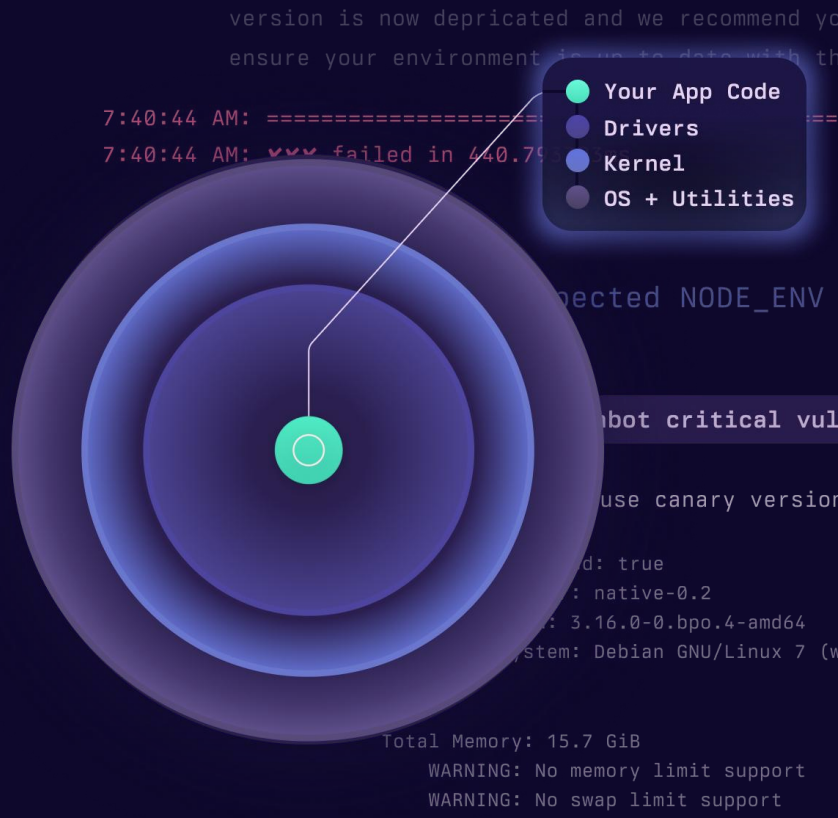
PAIN POINT

Containers + Kubernetes = heavy

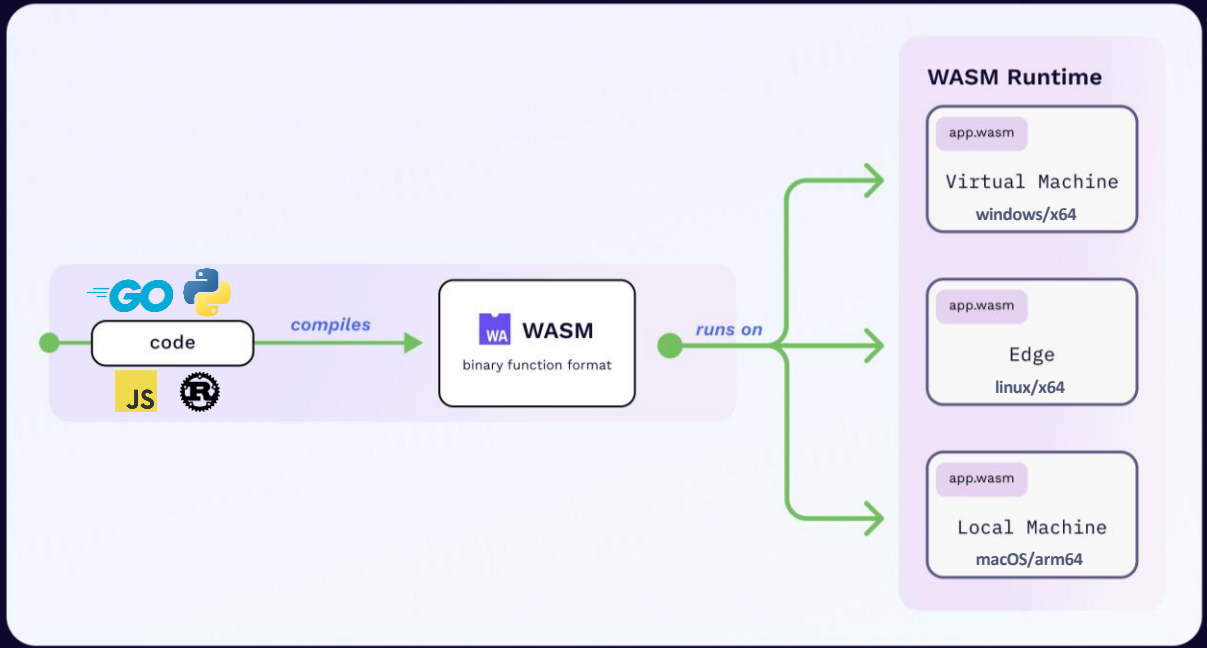


Containers are bloated with operational dependencies dependencies

They are slow to scale up and down

More than 80 percent of container spend is wasted on idle resources - Datadog 2024 State of Cloud Costs

WebAssembly



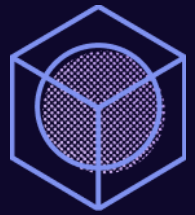
Why WebAssembly?

Portable

You can swap out the underlying node OS and architecture (x64/arm, linux/windows) without having to produce separate pipelines and deploy artifacts.

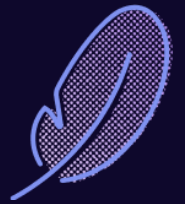
Small package sizes

A hello-world WebAssembly application written in Rust is a 284kB OCI Artifact.



Sandboxed

WebAssembly components are sandboxed and are by default denied access to resources on the system.



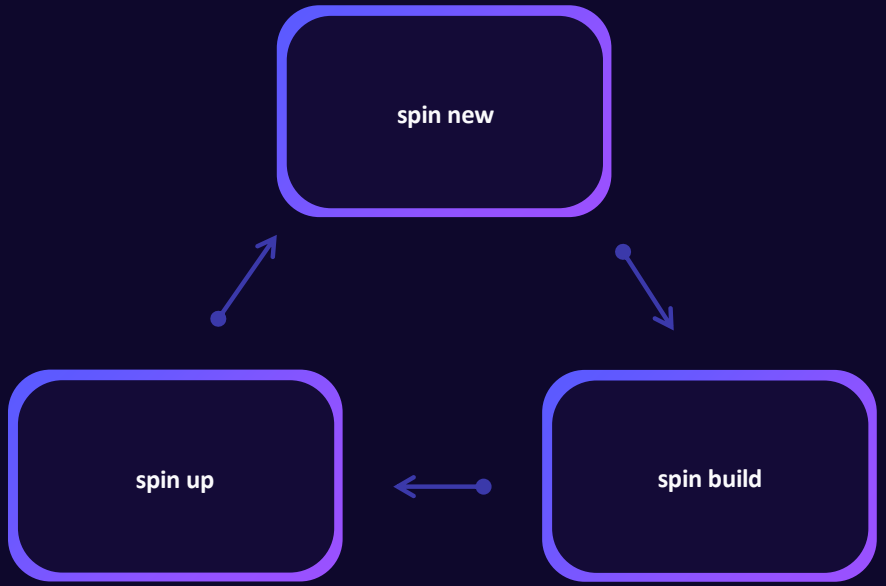
Startup time

A Spin WebAssembly component component will start in < 1ms

SPIN

Spin is an open source project, built with open standards like WASI, Wagi and the WebAssembly Component Model.

Developer tool for building and running event-driven serverless WebAssembly applications

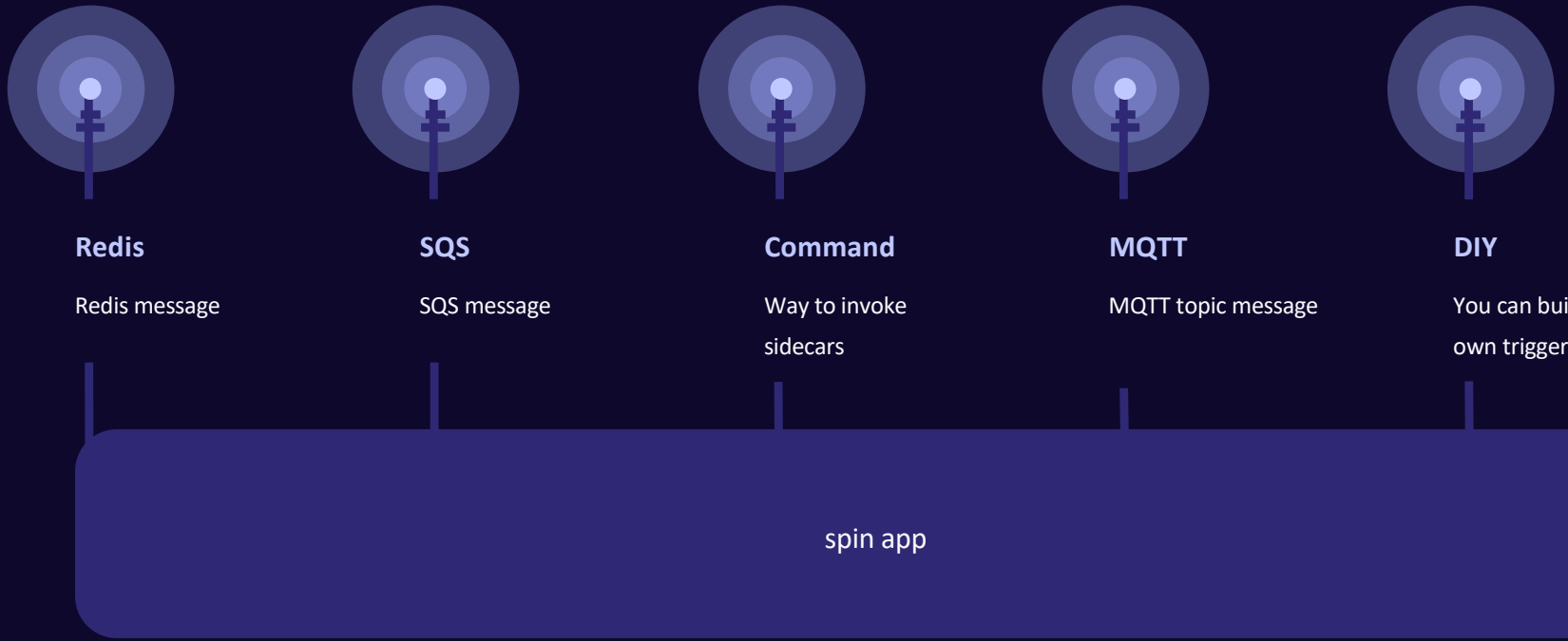


5K GITHUB ★

80+ CONTRIBUTORS

github.com/fermyon/spin

Spin Triggers - Beyond HTTP



Oh, the places Spin goes

SPIN	SPIN	FERMYON CLOUD	SpinKube
Local	Edge	Nomad	Kubernetes
OS + Arch Agnostic	RaspberryPi	Fermyon Cloud	AKS, EKS, GKE, RKE
Development	Edge	Orchestrator Agnostic	

SpinKube

68 followers · https://spinkube.dev · @SpinKube@mastodon.social

Follow

Popular repositories

spin-operator — Public

Spin Operator is a Kubernetes operator that empowers platform engineers to deploy Spin applications as custom resources to their Kubernetes clusters

Go · 96 · 11

containerd-shim-spin — Public

A ContainerD shim for running Spin Applications.

Rust · 35 · 7

runtime-class-manager — Public

A Kubernetes operator to manage Runtime Classes

Go · 14 · 5

spin-plugin-kube — Public

A Spin plugin for interacting with Kubernetes.

Go · 11 · 1

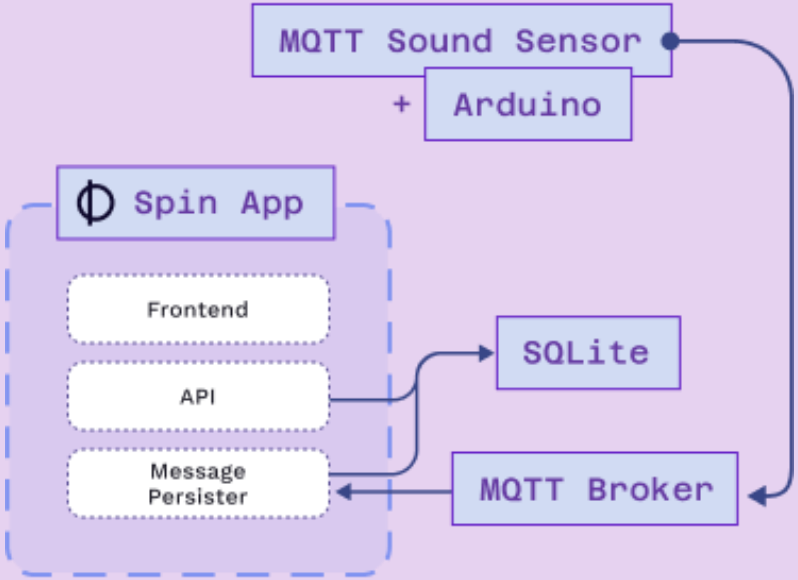
View as: Public

You are viewing the README and pinned repositories as a public user.

You can create a README file visible to anyone.

People

Demo: Measuring Crowd Engagement with an MQTT-based IoT App



https://www.fermyon.com/blog/mqtt_trigger_spinkube

Running SpinApps on K8s

Demo Time

Continue to Make Some Noise! for Wasm on Kubernetes

Check out the SpinKube booth volume demo at the Fermyon, Microsoft, Ampere, and Akamai booths.

Dive deeper into the demo at the Microsoft booth demo (11/13, 2-3PM) and SUSE booth demo (11/14, 2:45-3:30PM).

Visit the Akri booth at the Project Pavilion on Thursday 11/14 from 10:30AM-12PM.

Join **#spinkube** in Cloud Native Computing Foundation and **#akri** in Kubernetes on Slack!

Resources

SpinKube Docs

spinkube.dev

Akri

docs.akri.sh

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@yujinkim-msft