Krafting the Cloud

Building a Free, Open, and Accessible Cloud

By Alex Bissessur

alex.yaml

```yaml
---
apiVersion: v1
kind: Person
metadata:
 name: Alex Bissessur
spec:
  work:
    company: La Sentinelle
    role: Kubernetes Person
    location: Mauritius
  contact:
    website: alexbissessur.dev
    mastodon: moris.social/@AlexB
    github: github.com/xelab04
  interests:
    - Kubernetes
    - Linux
    - Free & Open Source Software
  hobbies:
    - Playing kubectl with Homelab
```


SCC
DEVELOPERS CONFERENCE
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GOLD TIER
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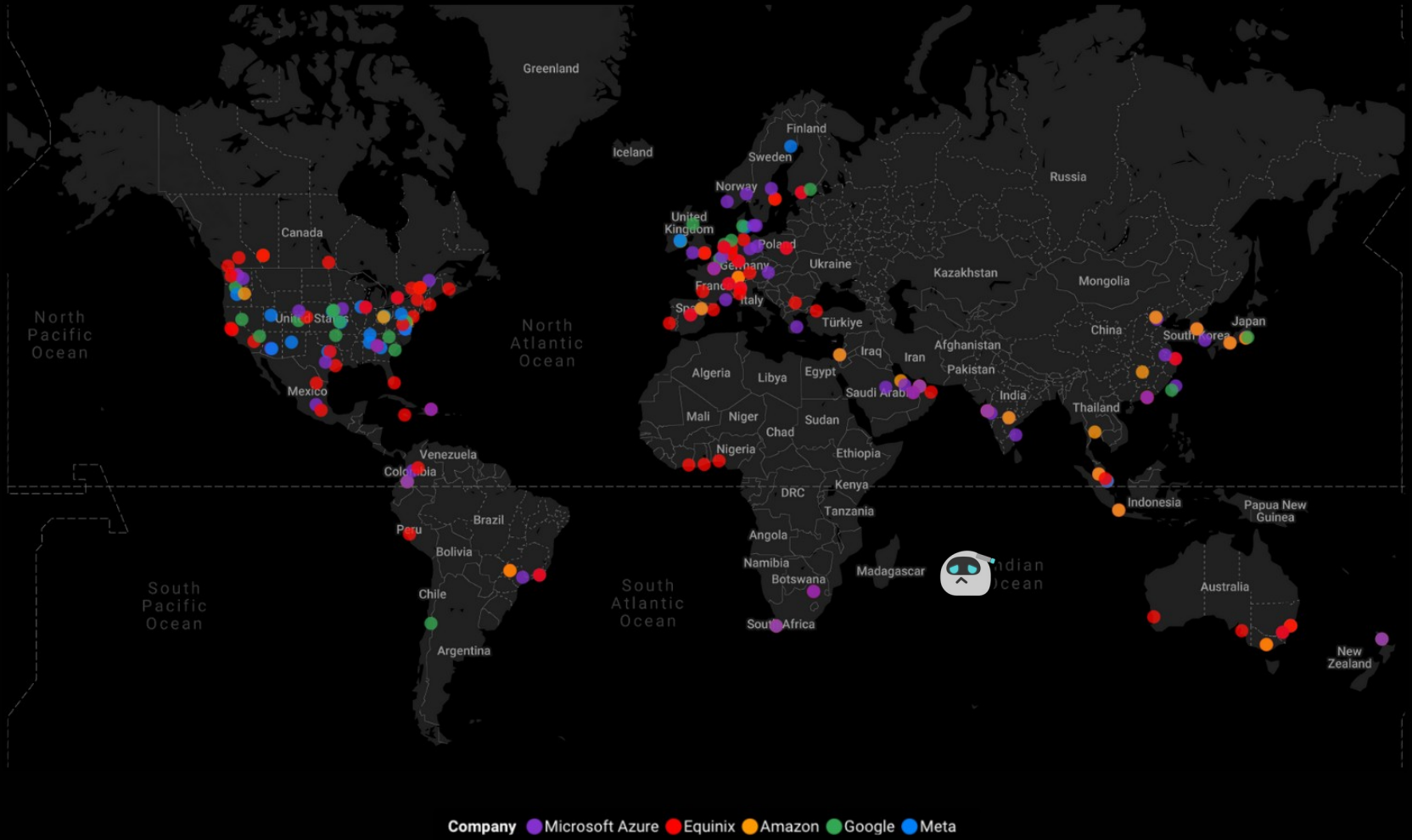
cloud.mu

Data Center Locations (Microsoft, Equinix, Amazon, Google, Meta)



What about Local CSPs?

- Overpriced, yes, even accounting for hardware costs
- “Old School” – only VPS’s, no managed db, managed K8s, load balancers, etc
- Manual involvement – involves CSP staff in the loop
- Not **cloud-native-first**

How do we build a cloud?

Requirements for CSPs

- Isolation – different users must stay separate and unable to interact
- Cloud – it must run on someone else’s computer
- Self-managed – I do not provision VMs manually

Introducing Virtual Clusters

- KinD – run Kubernetes in Docker, perfect for testing
- Virtual clusters can be deployed to an existing K8s cluster – Kubernetes in Kubernetes
- Existing options:
  - VCluster, Loft Labs
  - K3k, Rancher/SUSE

K3k and VCluster

- Provision virtual clusters on a host
- Virtual cluster lives in pods, with the API server exposed
- Option to passthrough host resources, such as: storageclass, ingressclass, configmaps, secrets
- Virtual clusters are isolated across different namespaces

KRaft

Pronunciation: /krɑːft/

Origin:

- K for Kubernetes
- Raft, compared to the Kubernetes ship
- Craft, for building and creating

Built with:

- K3k
- Longhorn
- Traefik

How is KRaft Made?

- Kraft is split into ‘microservices’
- Auth service – login, registration
- Cluster service – provision & expose clusters
- Resource service – monitor cluster metrics
- Frontend – static website w/ Nginx
- Postgres DB

KRaft

```
NAME                                      CPU(cores)   MEMORY(bytes)
kraft-auth-7c4646b85c-m76jf               1m           5Mi
# written in Rust
kraft-cluster-manage-6cf9d74c9b-hnrmv     1m           9Mi
# also written in Rust
kraft-db-8566c5b599-4mtrb                 1m           176Mi
# simple MariaDB pod
kraft-frontend-68d8c7698c-z5nck           0m           7Mi
# nginx with static files
kraft-resource-manage-7d7d979fc4-5qlwz    1m           290Mi
# python container, Flask
```

KRaft by Alex

> Create a cluster

> View clusters

> ReadMe.md

> Account

KRaft by Alex

> Account

email: dummy@user.com

username: dummyuser

Sign out

> Password

Password :

New Password :

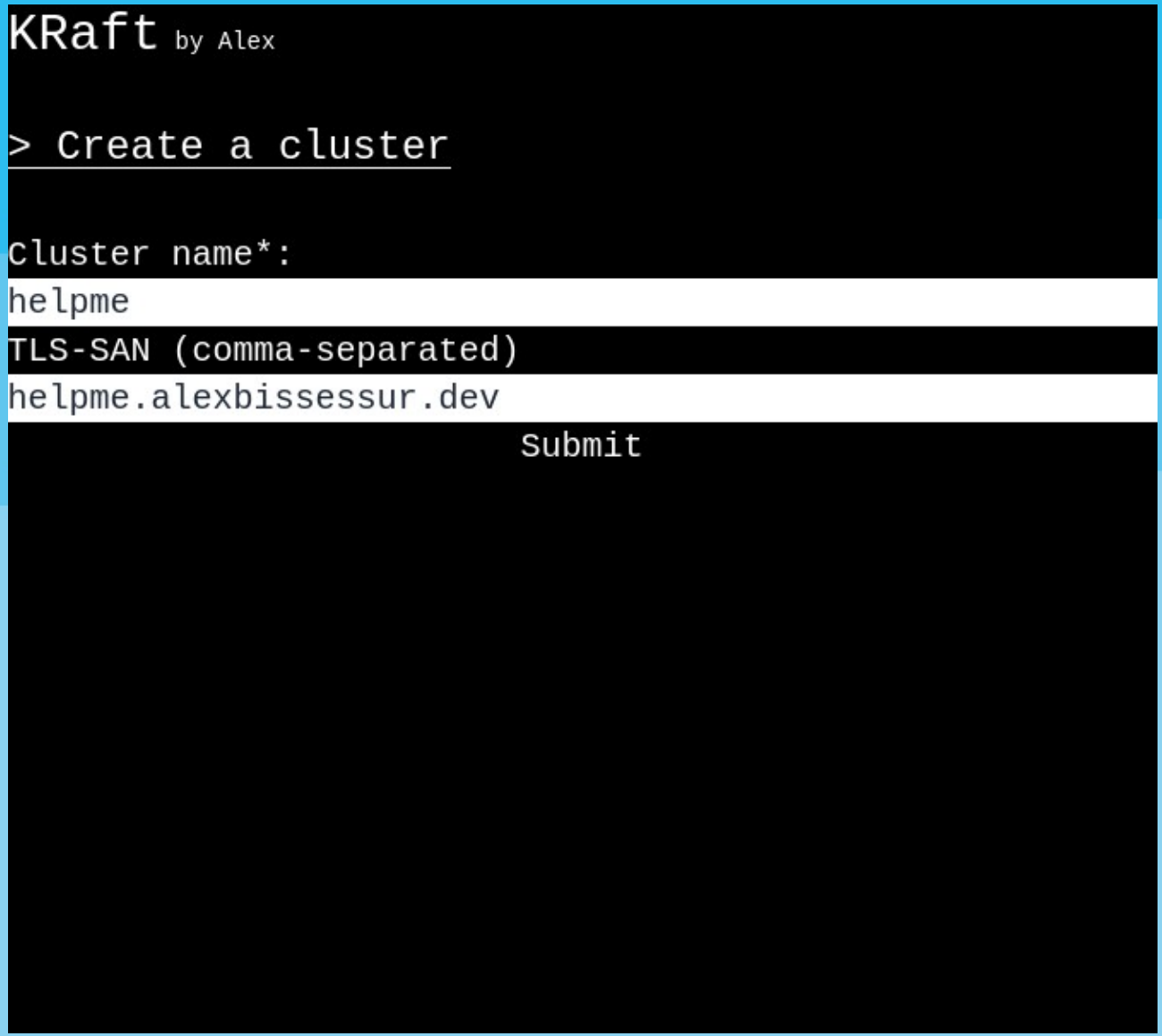
Confirm Password :

Submit

> Delete Account

WARNING: This deletes all your clusters, all your data, and your entire account. There is no turning back.

Delete


KRaft by Alex
> Create a cluster
Cluster name*:
helpme
TLS-SAN (comma-separated)
helpme.alexbissessur.dev
Submit

KRaft by Alex

> View Clusters

Cluster	Endpoint	Actions
3-test	bigeneric-commissure	Expand
3-cnmu	sloppily-skijorings	Expand

Cluster Name

3-cnmu

API Server Endpoint

sloppily-skijorings

Kubeconfig

Download

KRaft by Alex

> View Clusters

Cluster	Endpoint
3-test	bigeneric-commi
3-cnmu	sloppily-skijor

Cluster Name

3-cnmu

API Server Endpoint

sloppily-skijorings

Kubeconfig

Download

Delete Cluster

Delete

Cluster Logs

Server Agents refresh copy

```
time="2026-01-05T11:13:51Z" level=info msg="Updated coredns NodeHosts
entry for scorch"
{"level":"info","ts":"2026-01-
05T11:13:54.758942Z","caller":"traceutil/
trace.go:171","msg":"trace[1847929247]
transaction","detail":"{read_only:false; response_revision:8058412;
number_of_response:1;
}","duration":"232.810052ms","start":"2026-01-
05T11:13:54.526114Z","end":"2026-01-05T11:13:54.758924Z","steps":
["trace[1847929247] 'process raft request'  (duration:
232.70677ms)"],"step_count":1}
{"level":"info","ts":"2026-01-
```

k3k-rs

- Kube-rs is the crate for interacting with Kubernetes resources from Rust
- Using K3k CRDs properly meant implementing them as Rust structs
- K3k-rs is an offshoot project
  - CRDs reimplemented
  - Convenience functions to manage K3k-related resources

List k3k clusters

```rust
let client = Client::try_default().await?;
let list: Vec<cluster::Cluster> = cluster::list::namespaced(&client, "k3k-namespace").await?;
```

```rust
let client = Client::try_default().await?;

let cluster_schema = k3k_rs::cluster::Cluster {
    metadata: kube::core::ObjectMeta {
        name: Some("test-cluster".to_string()),
        namespace: Some("k3k-namespace".to_string()),
        ..Default::default()
    },
    spec: ClusterSpec {
        // servers: 1, (default)
        // agents: 0, (default)
        // mode: "shared".to_string(), (default)
        // persistence: Some(PersistenceSpec {
        //     r#type: Some("dynamic".to_string()),
        //     storage_class_name: None,
        //     storage_request_size: Some("1G".to_string()),
        // }),
        expose: Some(ExposeSpec {
            LoadBalancer: Some(ExposeLoadBalancer {
                etcd_port: Some(2379),
                server_port: Some(443),
            }),
            NodePort: None,
            Ingress: None,
        }),
        ..Default::default()
    },
    status: None,
};

cluster::create(&client, namespace, &cluster_schema).await?;
```

You’re writing yaml in Rust, how hard can it be?

Keeping Workloads Safe

- Users interact with only their virtual API
- Clusters are
  - separated by namespace
  - isolated through network policies
  - secured with pod security admission level
- Each cluster has its own CoreDNS

Social Benefits

- Platform for workshops and local CNCG
- People can learn K8s without a server rack in their living room
- Free hosting for:
  - community projects
  - personal websites
- It can run anywhere, so anyone can host it for their community

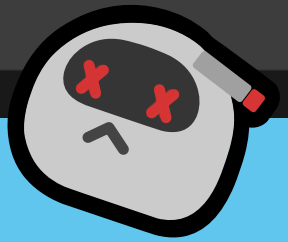
```
📦[bazzite@dump Downloads]$ export
KUBECONFIG=/home/bazzite/Downloads/4-help
📦[bazzite@dump Downloads]$ kubectl get
nodes
NAME        STATUS   ROLES    AGE
VERSION
northstar   Ready    agent    100m
v1.33.5-k3s1
ronin       Ready    agent    100m
v1.33.5-k3s1
scorch      Ready    agent    100m
v1.33.5-k3s1
```
22:56

It's aliiiive :o 22:57

WAIT IT WORKS!!!! 22:57

Haha, so surprised xD 22:57

Ah, yes.
HTTP 200 Success
Yet UI shows "An error occurred somewhere between here and the server."
Good start 21:12



Now 0:01

listen 0:01

it might not be covered by a TLS cert 0:01

Buuut 0:01

http://testing.kraftcloud.dev 0:01

I did get a thing to be hosted and it just freaking worked first try 0:01

I am impressed 0:01

(Also it only loads via curl, because you have hsts on that domain) 0:02

Work In Progress

- Ingresses are across the cluster – can cause conflicts
- Improvements needed on k3k-rs CRD structure
- K3k does not run in restricted mode
- Need to figure out backups
- Portability with Helm charts to install anywhere

Thank You!