



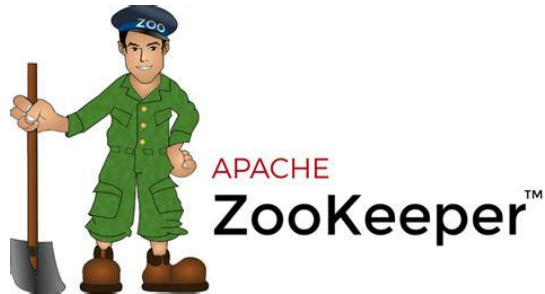
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Migrating Key-Value Data Stores to the Edge

Andrew Jeffery, Heidi Howard, and Richard Mortier

13th July 2023

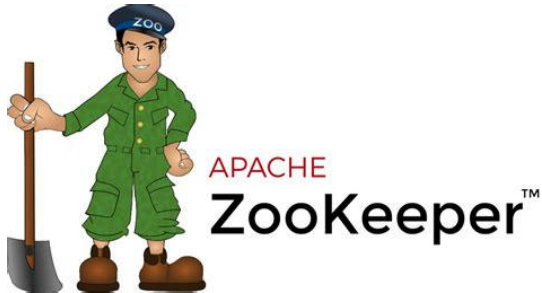
Orchestration platforms and their Key-Value stores



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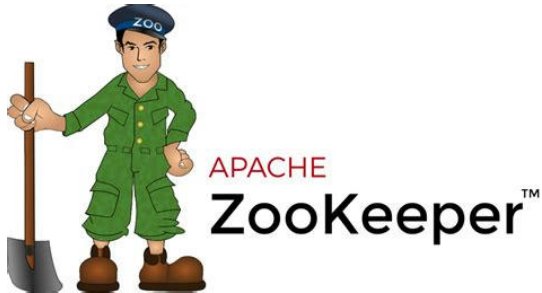
HashiCorp
Nomad



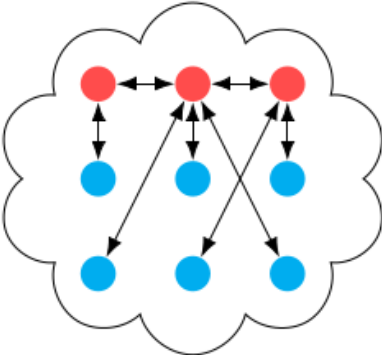
Orchestration platforms and their Key-Value stores



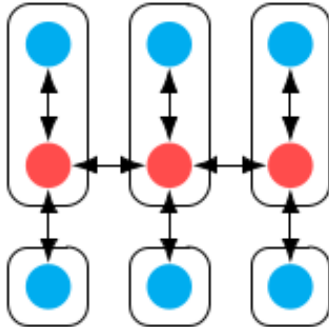
HashiCorp
Nomad



Motivation



K8s
The cloud



K8s
The edge

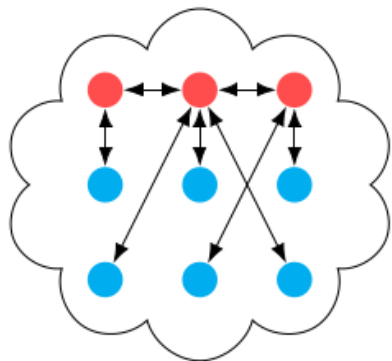


Control plane + *etcd*

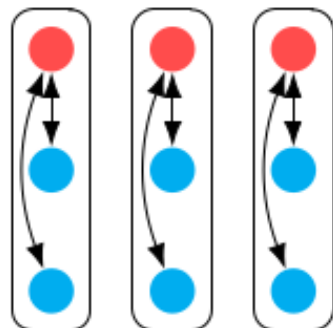


Worker

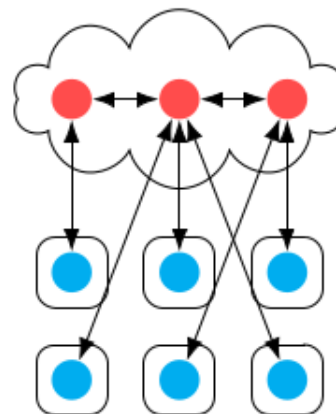
Motivation



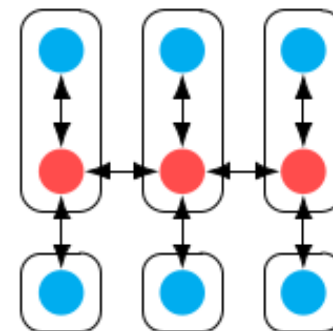
K8s
The cloud



K3s
Single-site
Isolated



KubeEdge
Cloud-centric
Blast radius



K8s
The edge



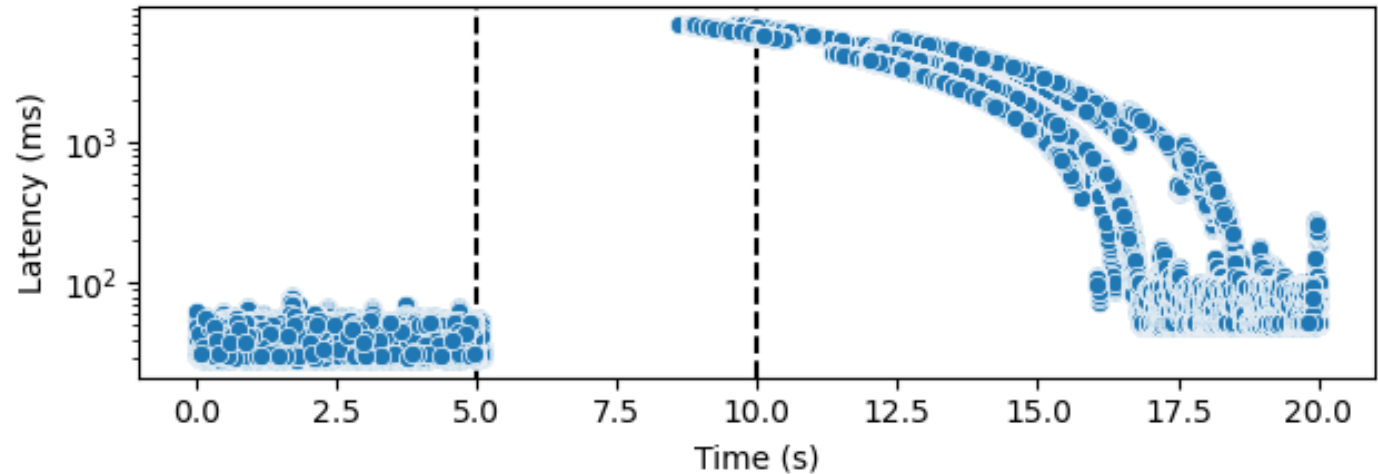
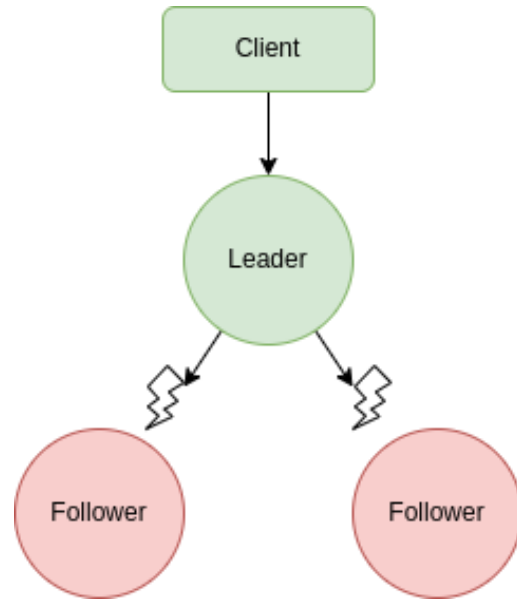
Control plane + *etcd*



Worker

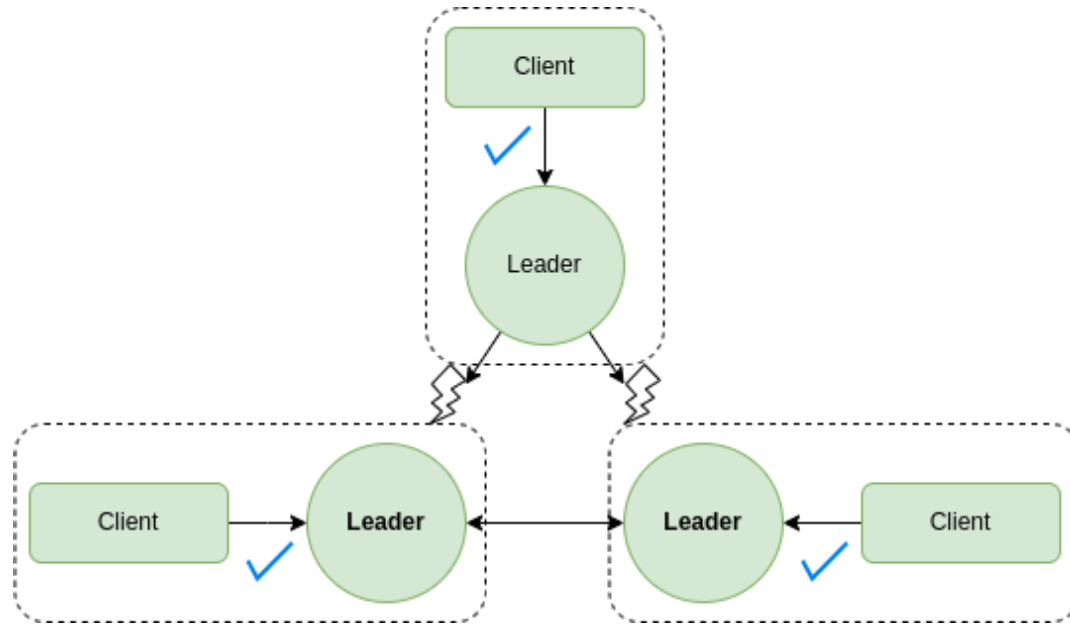


etcd is the problem



3 nodes, leader partitioned between $t=5$ and $t=10$,
10ms link delay, successful requests, 10,000 rps

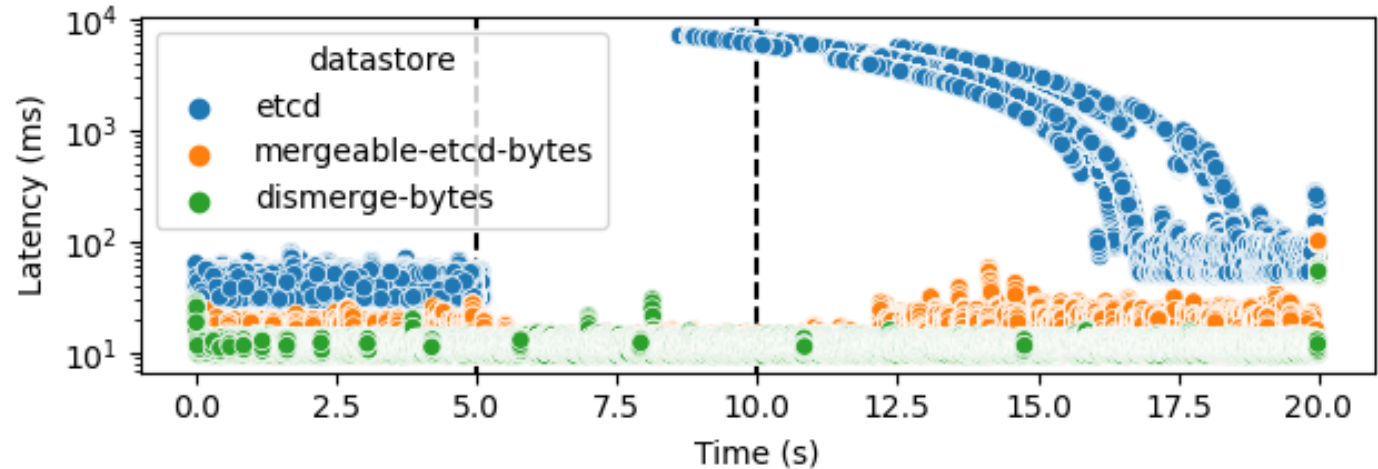
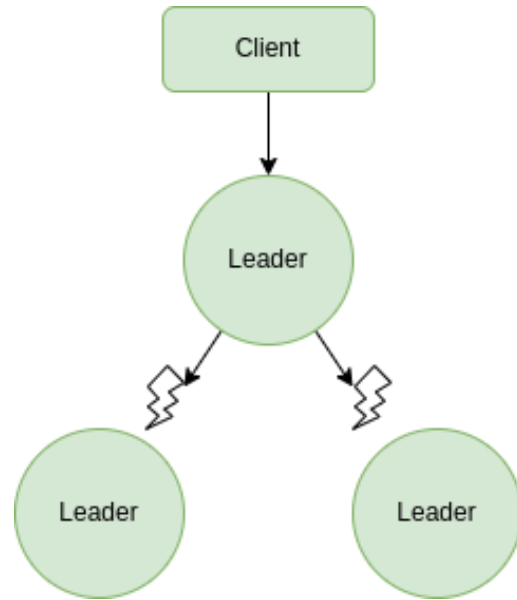
Avoiding coordination with *dismerge*



Bringing datastore nodes closer to clients with
dismerge

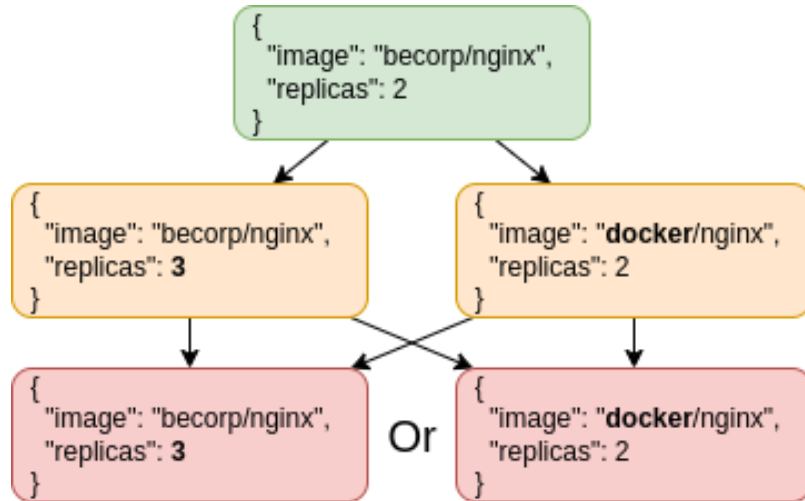
- All nodes are leaders
- Leaders are now local
- Replication is lazy

dismerge is a solution



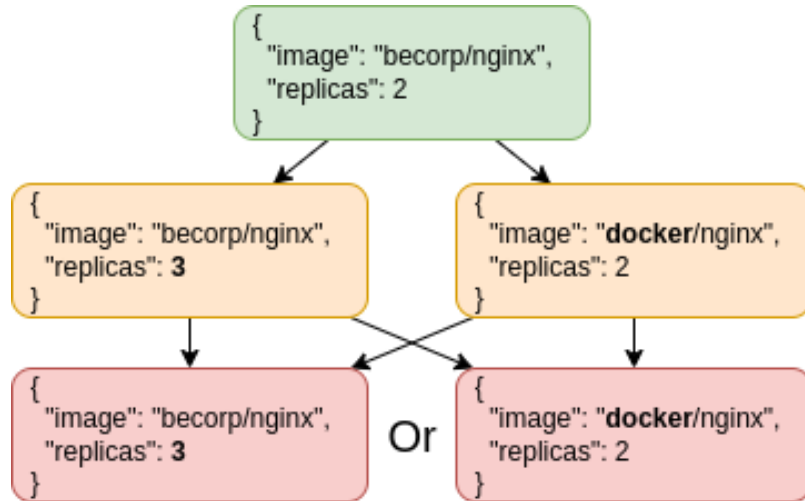
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Handling conflicts with custom datatypes

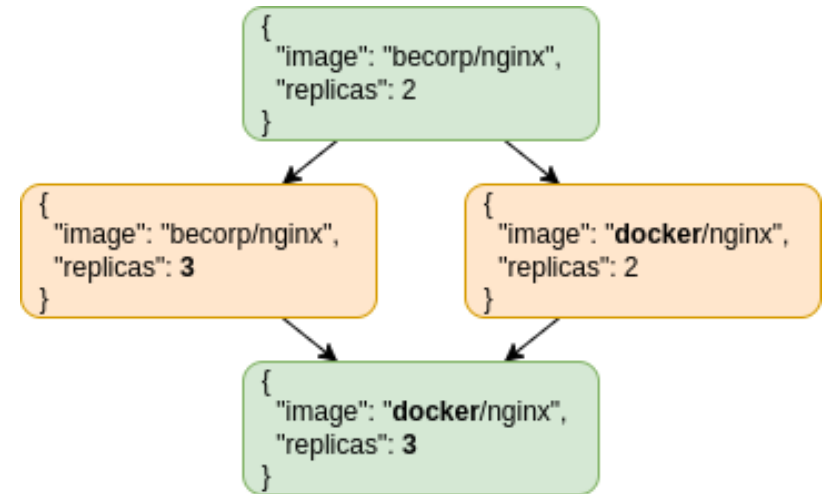


Coarse grained
Using raw values

Handling conflicts with custom datatypes

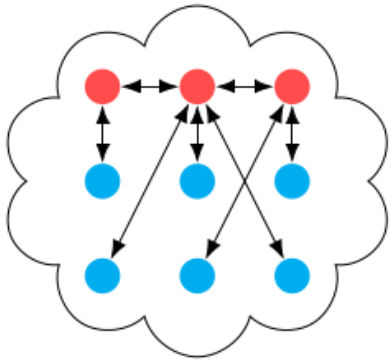


Coarse grained
Using raw values



Fine grained
Introspecting values

Linking back to orchestrators



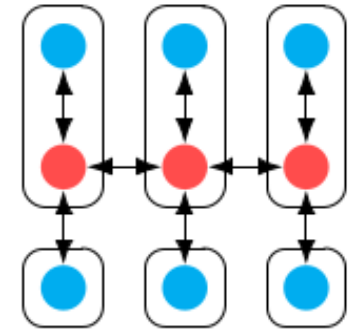
K8s

The cloud

etcd -> *dismerge*

- Local operation
- Availability
- Resiliency

Some modifications
needed to orchestrators
e.g. StatefulSets



K8s

The edge

Conclusion

Orchestration platforms are being *pushed* to, not *designed* for the edge

dismerge places new edge-focused orchestration platforms on strong foundations, providing local operation, availability and resiliency.