



BUILDING FOR THE ROAD AHEAD

DETROIT 2022

How Adobe Planned For Scale With Argo CD, Cluster API, And VCluster



@cloudtaquero

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About Adobe

Ethos is Adobe's platform for Cloud Native workloads. Origin circa 2017.

- 230 clusters in AWS, Azure & DC across 24 regions
- 18k compute nodes
- 1.8 PB memory
- 500k CPU
- > 2,300,000 pods
- and growing...
- thousands of devs



* Dashboard shows a subset of Adobe's usage...



Goals

Diverse needs from dev and ops

- Provision testing envs per change
- Leverage edge clusters
- Enable self-service from devs
- Sensible management layer for ops
- Track and keep components updated with less impedance
- Supporting Partner Dev Orgs
- Keep an eye on cost as we scale



* Dashboard shows a subset of Adobe's usage...



Migration and Extending CI/CD

Infrastructure build system was a monolithic repo of tightly coupled service applications.



Monolithic release
All changes required review by all knowing maintainer

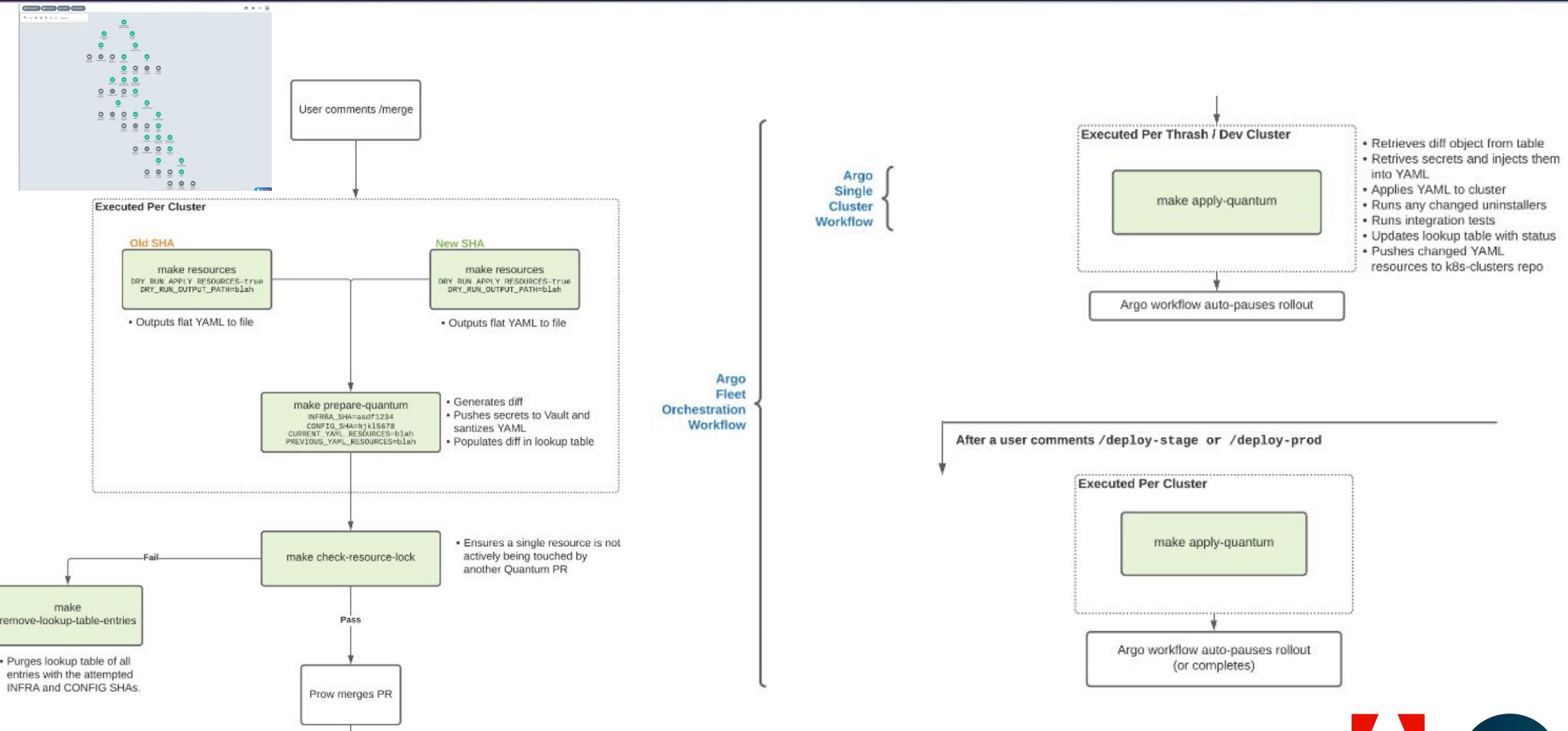
Iterated on existing build system and overlaid Argo Workflows - Workflow of Workflows!



Lots of complexity.
Difficult to maintain.
Reimplementing the job of controllers like Argo CD.

Lift and Shift Approach

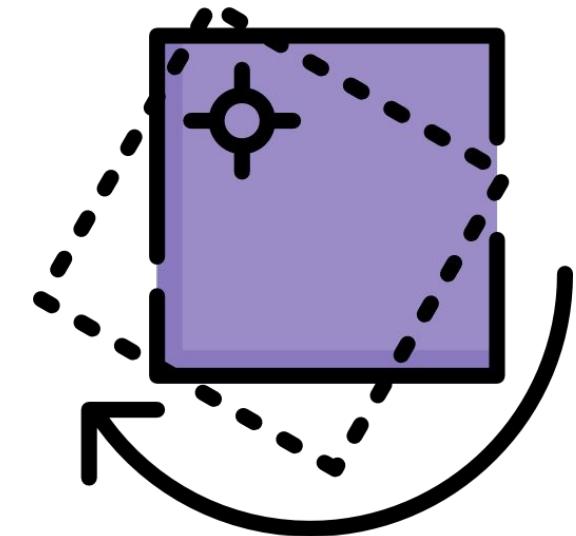
Using Argo Workflows with traditional CI/CD approach



Rethinking What We Could Do

“We’re already doing CI/CD, we can just extend it!”

- Very complex.
- Requires very large, complex, and hard to maintain pipelines.
- Secrets management is very tricky.
- Hard to support the scale we wanted.
- Idempotence is hard.
- Not very self-service
- We couldn’t meet the market demand w/what we had.

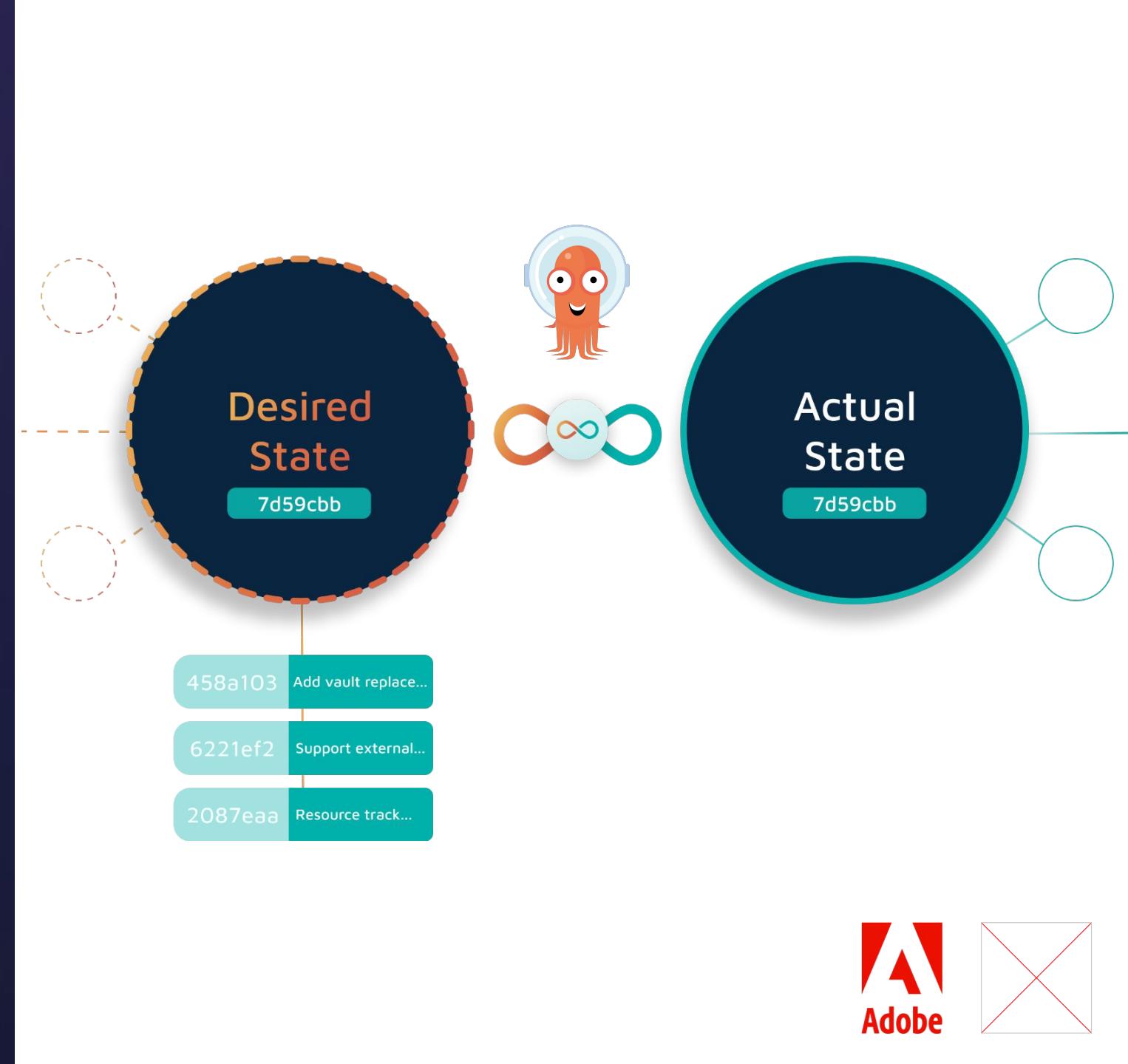


Basically realized we were reimplementing Argo CD...

Moving to a GitOps Model

- Pull request generation
- Makes Idempotence Easy
- Cluster per app
- Test operators against k8s versions

opengitops.dev



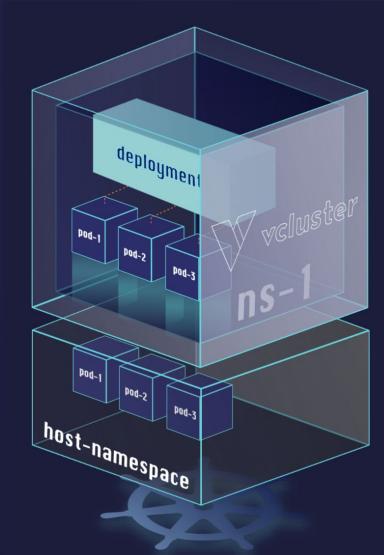
Key Tooling



Cluster API

Operators to provision cluster resources.

- Just YAML
- Any cloud
- Extensible
- Perfect w/Argo CD



vCluster

Virtual clusters that run inside a namespace.

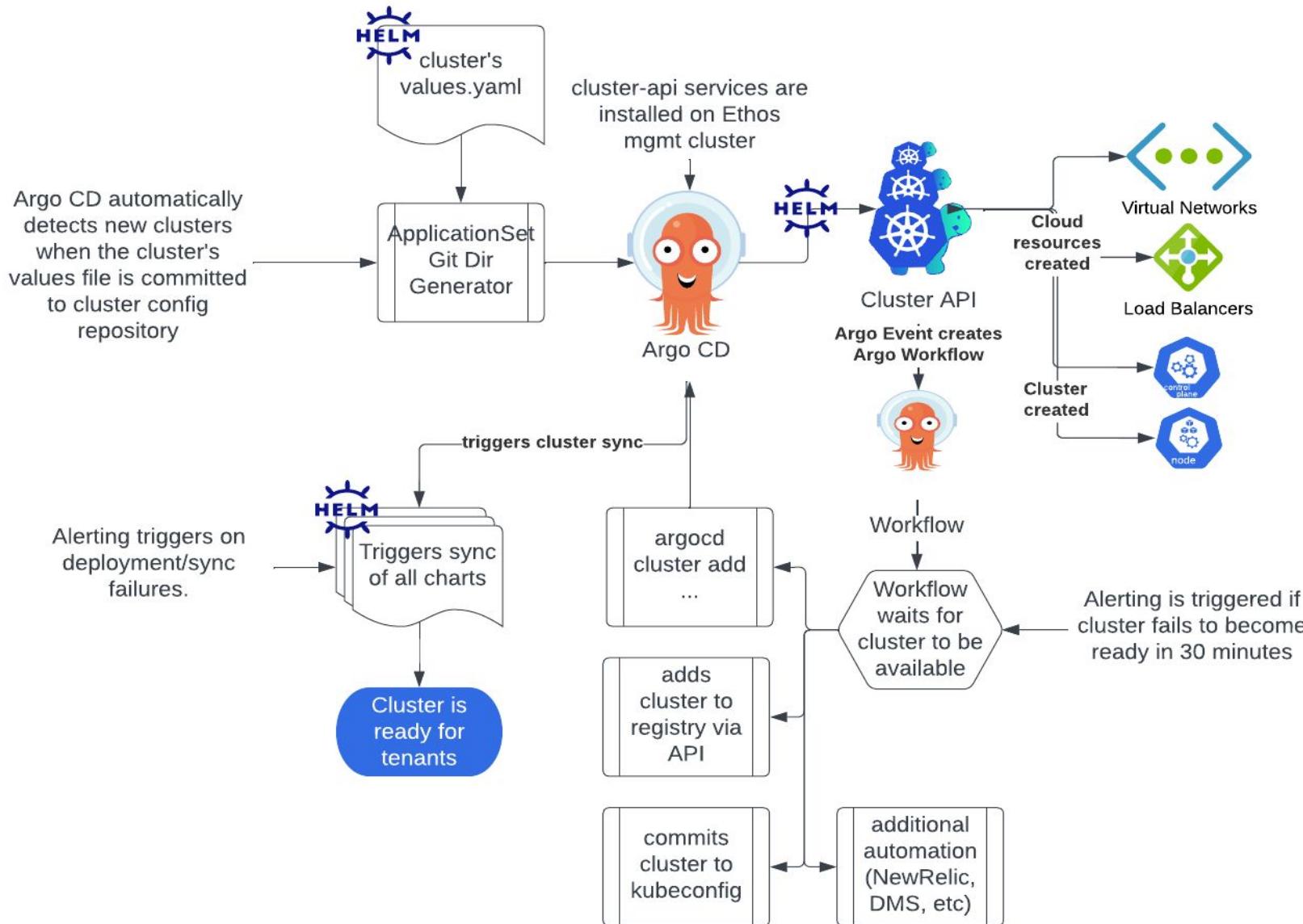
- Host cluster security is enforced
- Quotas
- Rapid provisioning



Argo Stack

- Argo CD for GitOps,
- Argo Workflows for workflows,
- Argo Rollouts for progressive delivery.

Architecture



"one of the most limiting aspects of the agility and stability of Ethos is the rate at which we can deploy and build clusters. This new approach changes the game for us and allows us to shift away from the clusters as pets model. It ensures cluster consistency with the repo and distributes deployment ownership to the experts."

Marci Moon @Adobe

Pull Request Environments

Problems:

- Dev clusters are expensive
- Testing against operators needs discrete envs
- “Clean” envs inside of namespaces are hard
- Multi-tenancy is even harder

Solution:

- Create vcluster(s) on each PR
- Test against CRD/operators
- Isolation against intrusive changes
- Ease burden of etcd and API servers
- Lower cost!



Mike Tougeron, Lead Cloud Engineer
Ethos @ Adobe

via GitOpsCon '22 coming soon to CNCF channel on Youtube



Scaling w/ Argo CD and GitOps

- Performance
- Security
- Organization

[codefresh.io/blog/
scaling-argo-cd-securely-in-2022](https://codefresh.io/blog/scaling-argo-cd-securely-in-2022)





Hub and Spoke

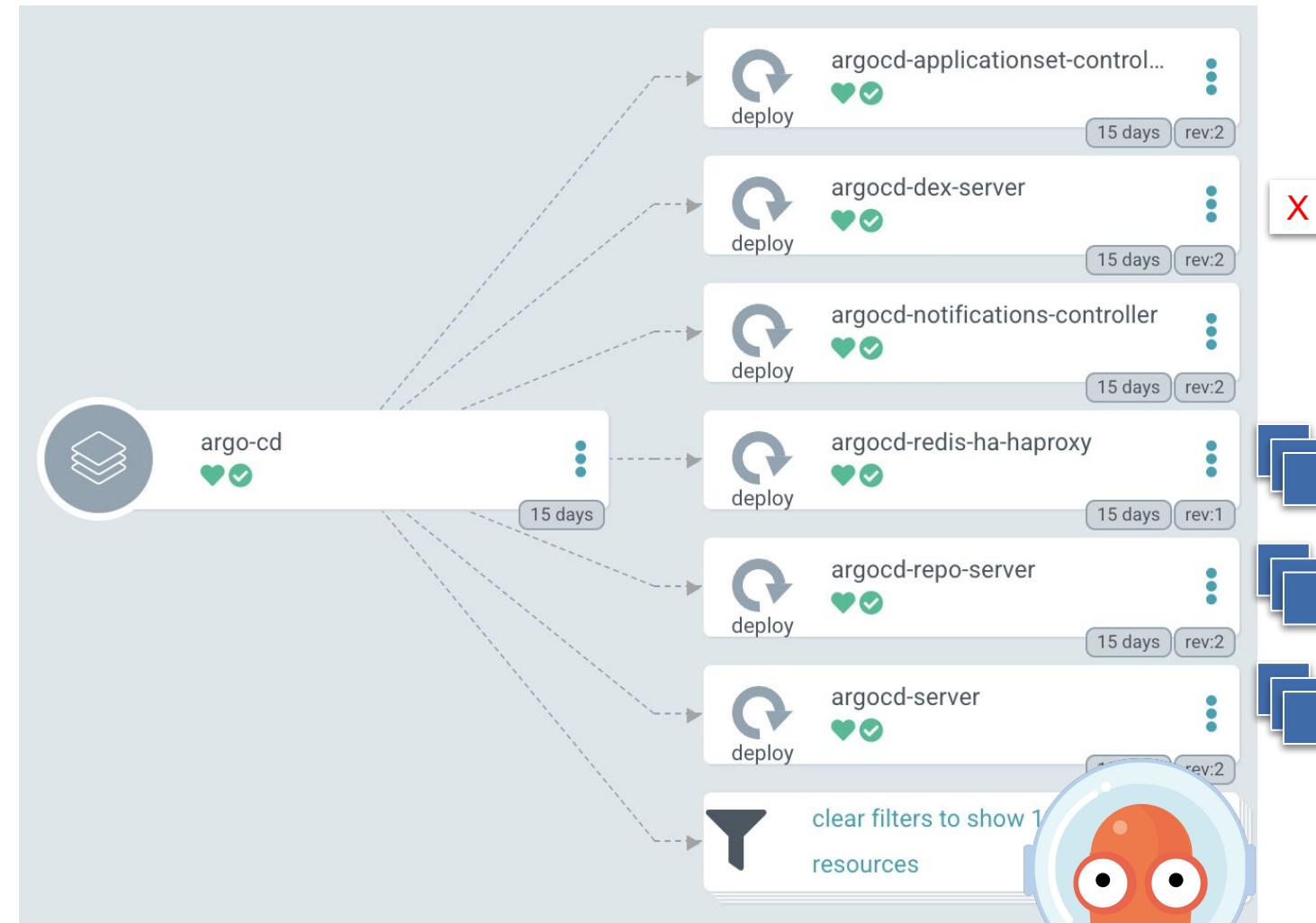


Per Cluster

Benchmarking Argo CD

- What capacity can I expect?
- When do I need to start tuning?
- Using Argo CD HA
- Argo CD has tons of dials!

argo-cd.readthedocs.io/en/stable/operator-manual/high_availability



Deployments that scale

[Code](#)[Issues](#) 1.7k[Pull requests](#) 170[Discussions](#)[Actions](#)[Projects](#) 2[Wiki](#)[Security](#) 19[Issues](#)[master](#) ▾

42 branches

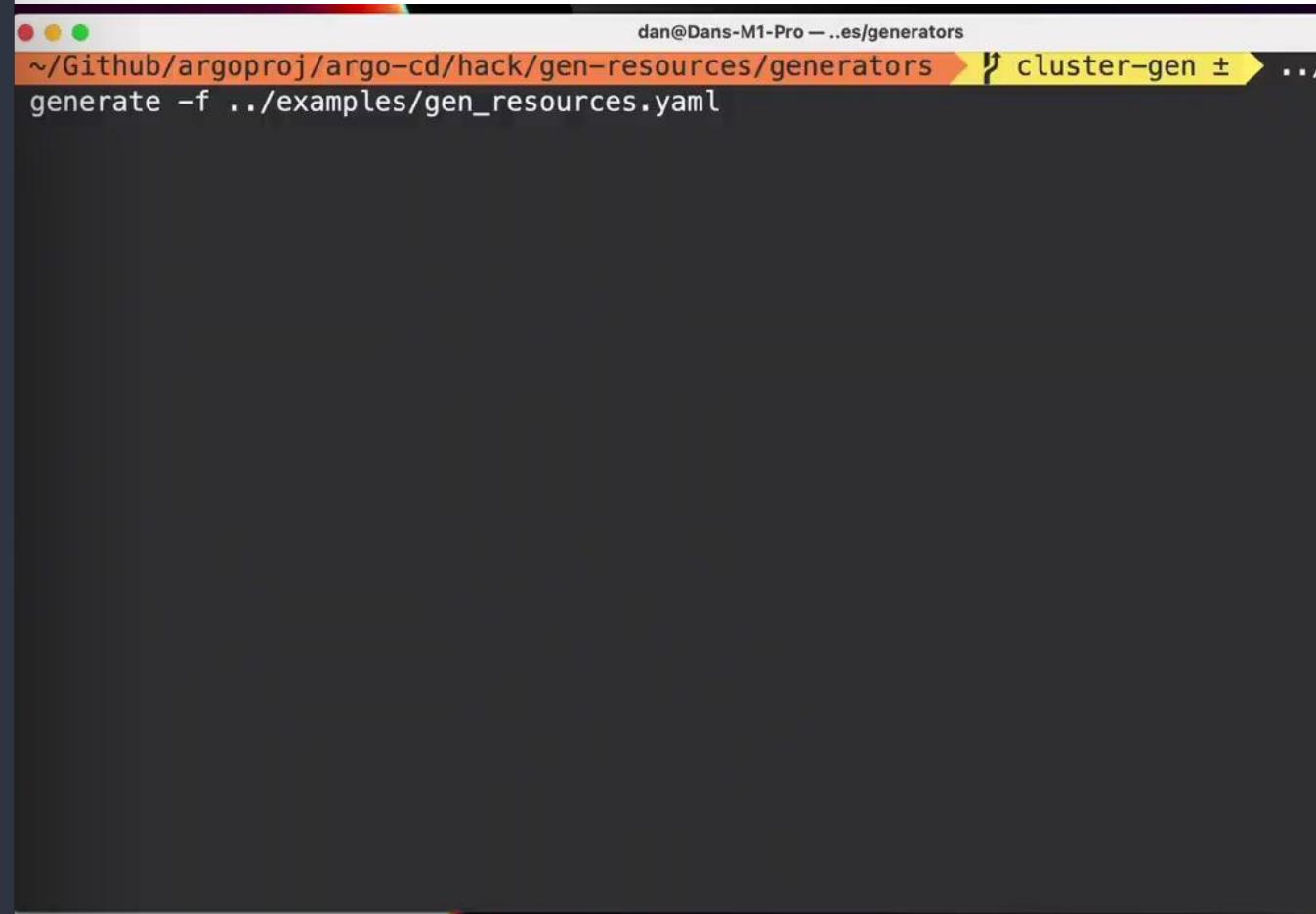
239 tags

[Go to file](#)[Add file](#) ▾[Code](#) ▾

ufUNnxagpM	docs: fix 'bellow' typos (#11038) ...	✓ 309654c 3 days ago	🕒 4,683 commits
.github	chore: upgrade actions/checkout to v3, i.e. Node.js 16 (#10947)	7 days ago	
applicationset	chore: improve error logs (#10944)	8 days ago	
assets	docs: message is no longer truncated (#10962)	9 days ago	
cmd	test: simplify bcrypt test (#11013)	4 days ago	
cmpserver	docs: remove unused plugin config fields (#10304)	18 days ago	
common	feat: add notifications API (#10279)	2 months ago	
controller	chore: wrap errors with message (#10592) (#10986)	6 days ago	
docs	docs: fix 'bellow' typos (#11038)	3 days ago	
examples	fix: typo in dashboard (#5015)	2 years ago	
hack	fix: upgrade Helm to avoid disk use issue (#8773) (#10937)	8 days ago	
manifests	chore: increase liveness timeout (#10730)	4 days ago	
notification_controller/controller	feat: Migrate argocd notifications to argocd (#7744)	11 months ago	
notifications_catalog	chore: update notifications version (#8267)	9 months ago	

Modeling for Performance

```
application:  
  samples: 7500  
  source:  
    strategy: Random  
destination:  
  strategy: Random  
  
cluster:  
  samples: 200  
  namespacePrefix: vcluster  
  valuesFilePath: /Users/argocd/.kube/util/values.yaml  
  destinationNamespace: argocd  
  clusterNamePrefix: test  
  
repository:  
  samples: 1500  
  
project:  
  samples: 1500  
  
namespace: argocd
```



A screenshot of a macOS terminal window titled "dan@Dans-M1-Pro — ..es/generators". The command being run is "generate -f ../examples/gen_resources.yaml". The terminal has a dark theme with orange highlights for the path and command.



Testing Plan

	Small	Med	Large	X-Large	XXL	XXXL
Apps	100	1,000	2,500	5,000	7,500	10,000
Clusters	8	21	50	97	144	190
Repos	10	500	1,250	2,500	3,750	5,000
Projects	10	110	250	500	750	1,000
Sims	10	100	100	100	100	100
Objects	700	7,000	17,500	35,000	52,500	70,000
Apps per cluster	13	48	50	52	52	53
Obj per cluster	88	333	350	361	365	368

Tested using Argo CD HA w/default settings.
GKE - e2-standard-4 nodes 4 vCPU x 16GB

Argo CD Performance Scales Very Well



Rule of thumb

Conservatively, expect at least

- ~1.5k apps,
- ~ 14k objects,
- ~50 clusters,
- ~200 devs,

whichever comes first.

With tweaking, you can go far beyond.



argo



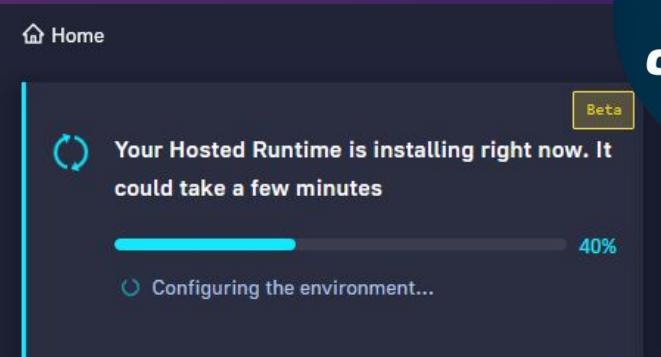
argo



argo

Security

- Argo CD is thoroughly tested for security, w/ improvements in 2.3, 2.4, 2.5...
- Multi-tenancy
- Users can add repos and execute arbitrary manifest generation.
- Networking considerations
- How Codefresh tackled hosted Argo CD



Conway's Law

“ The structure of software will mirror the structure of the organization that built it.



When to Use a Control Plane for Argo

- Manage and track versions
- Single UI for all Apps/Clusters
- Better security isolation
- Removes pain of multiple instances...
- Better resiliency



Other Considerations

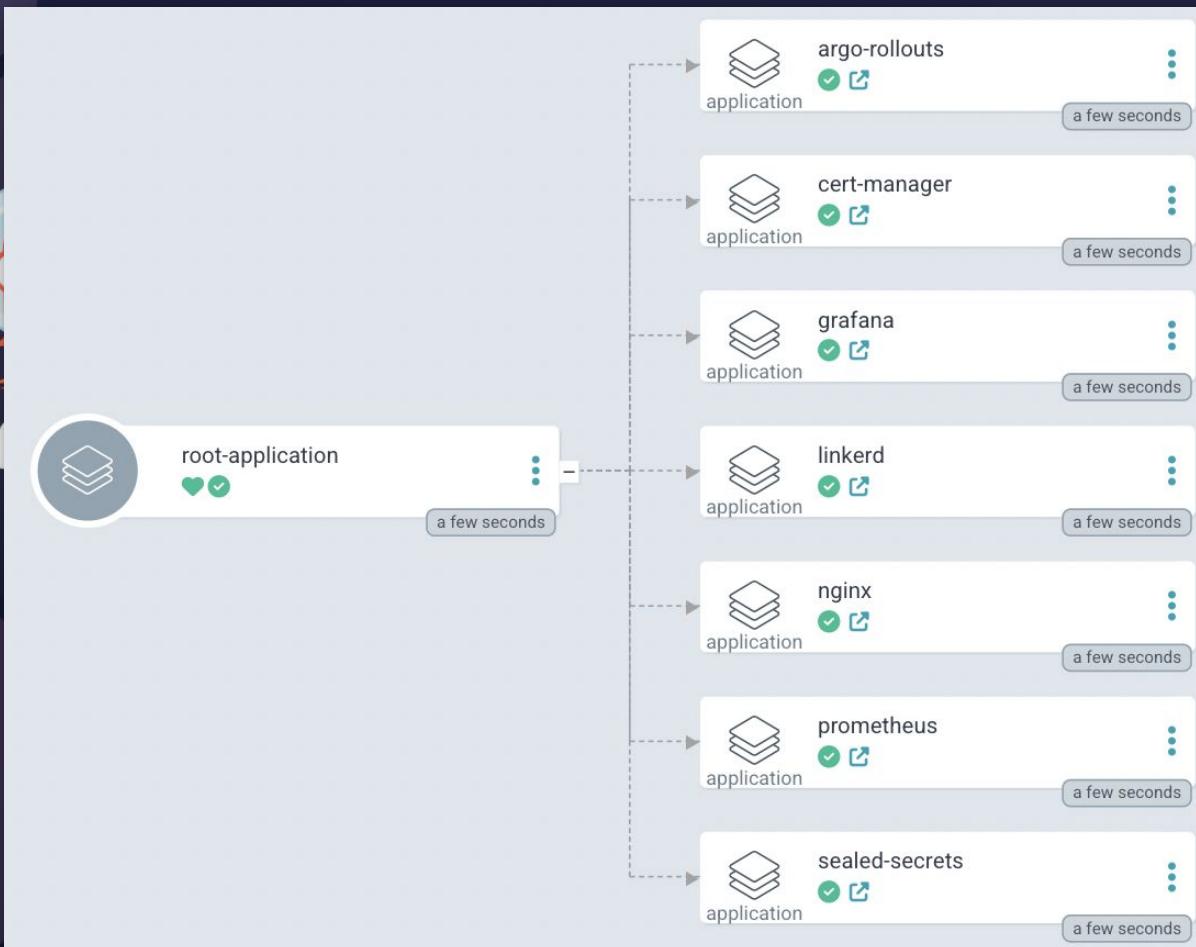
- Two-Repo Model
- CODEOWNERS files for permissions
- Team Training
 - Codefresh GitOps Certification levels 1 + 2
<https://learning.codefresh.io>

What this means for Adobe

```
apiVersion: apps/v1
kind: StatefulSet
metadata:
  name: argocd-application-controller
spec:
  replicas: 2
  template:
    spec:
      containers:
        - name: argocd-application-controller
          env:
            - name: ARGOCD_CONTROLLER_REPLICAS
              value: "2"
```

- If every PR generates a cluster...
- We'll need to replicate the Argo CD App Controller
- For thousands, we may need additional instances

What this means for Adobe



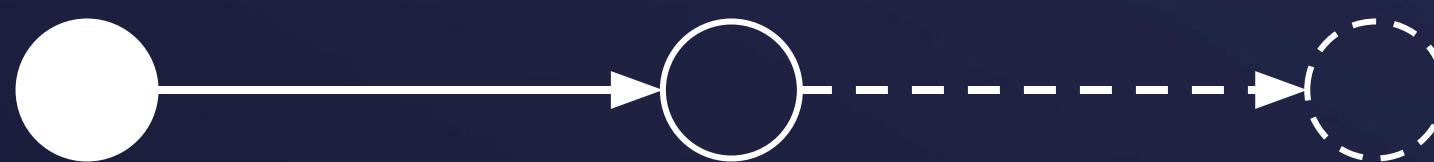
- If every PR generates a cluster...
- We also need to watch object counts per app, and split them up

What this means for Adobe

- Supporting Partner Orgs
- Split up Argo instances for better isolation
- Consider Control Plane



What this means for Adobe



Adobe is the best KubeCon quadrilogy of all time



[Secure Multi-Tenant GitOps Application & Infra Rollouts at Adobe](#)

[Cgroup V2 Before You Jump In](#)

[Multi-Tenancy for Argo Workflows and Argo CD](#)

[How Adobe Planned for Scale with Argo CD, Cluster API, and vCluster](#)



Resources

- Scaling Argo
https://argo-cd.readthedocs.io/en/stable/operator-manual/high_availability/
- Best Practices for Multi Tenancy
<https://blog.argoproj.io/best-practices-for-multi-tenancy-in-argo-cd-273e25a047b0>
- Scaling Securely in 2022 <https://codefresh.io/blog/scaling-argo-cd-securely-in-2022/>
- The Adobe Cinematic Universe KubeCon Quadrillogy
 - Secure Multi-Tenant GitOps Application... <https://sched.co/182Hy>
 - Cgroups V2: Before You Jump In... <https://sched.co/182J2>
 - Multi-Tenancy for Argo Workflows... <https://sched.co/182Fw>
 - How Adobe Planned For Scale With Argo... <https://sched.co/182Dx>

Questions?



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