



EPIKS

Epics on K8s for a Control as a Service

Riccardo Gargana

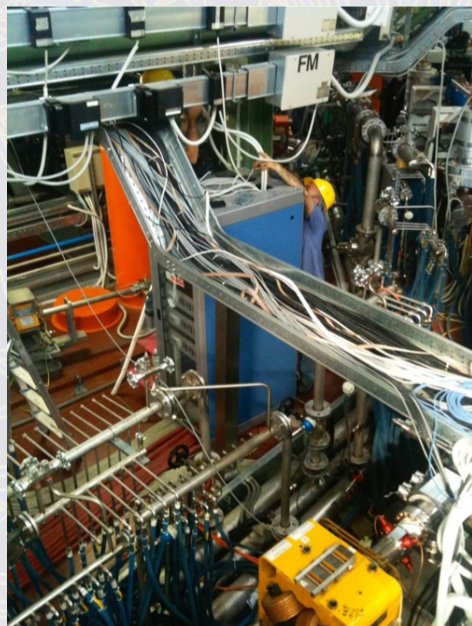
Workshop CCR 2024 - 20-24/05/2024

Control systems for scientific installations



Software

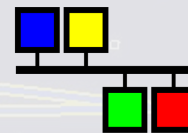
many applications
in a coherent
framework



Plant = many devices

Accelerators
Detectors (slow control)
Telescope arrays
Experimental setups
...

EPICS



TANGO



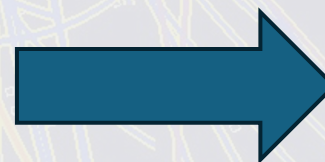
!CHAOS

**Many other custom
solutions...**



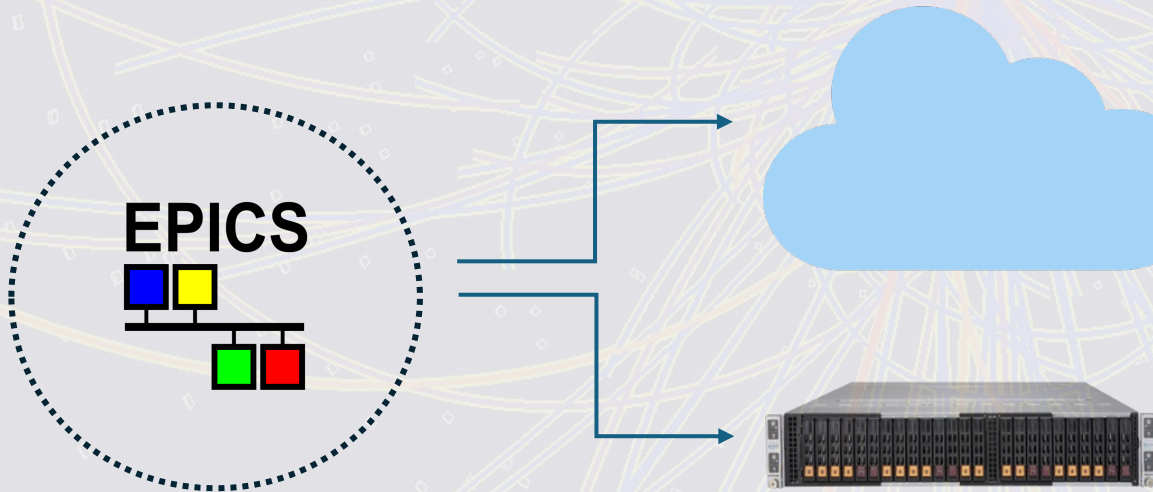
Features

- Actuation
- Monitoring
- User friendly interface
- Data logging & retrieval
- Openness to external apps



Why not to provide a CaaS (Control as a Service)?

- It fully meets the INFN mission;
- There is a large catchment area completely disregarded;
- We have already done a pilot project of it (!CHAOS INFN flagship project, funded by MIUR);
- !CHAOS is running on K8s (Really! Right now!) on some LNF facilities;
- We are using this approach for the SSRIP project in Romania (formerly ELI-NP).



Provisioning K8s on Bare Metal



FOREMAN is a complete lifecycle management tool for physical and virtual servers.

PXE, DHCP and KICKSTAR file



4 X Server con Rocky Linux 9



K8s Cluster configuration



puppet is a software configuration management tool which includes its own declarative language to describe system configuration.

Module using from puppet-forge:

puppetlabs-kubernetes version 8.0.0

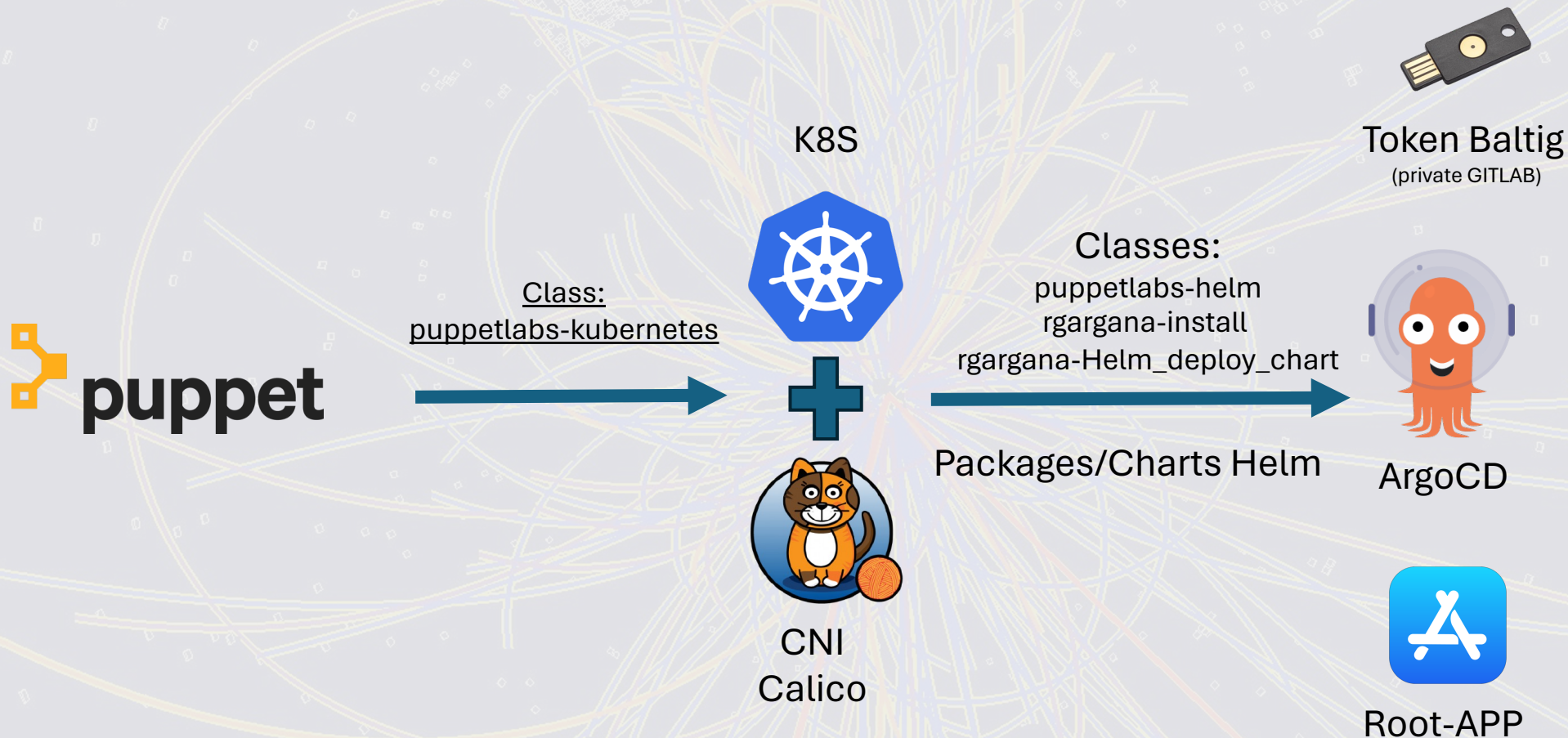
puppetlabs-helm version 4.0.0 (Patched in baltig)

Module create purpose:

rgargana-helm_deploy_chart (in baltig)

rgargana-installer (in baltig)

Workflow deploy Infrastructure



ArgoCD



Baltig Token access

Token Baltig
(private GITLAB)



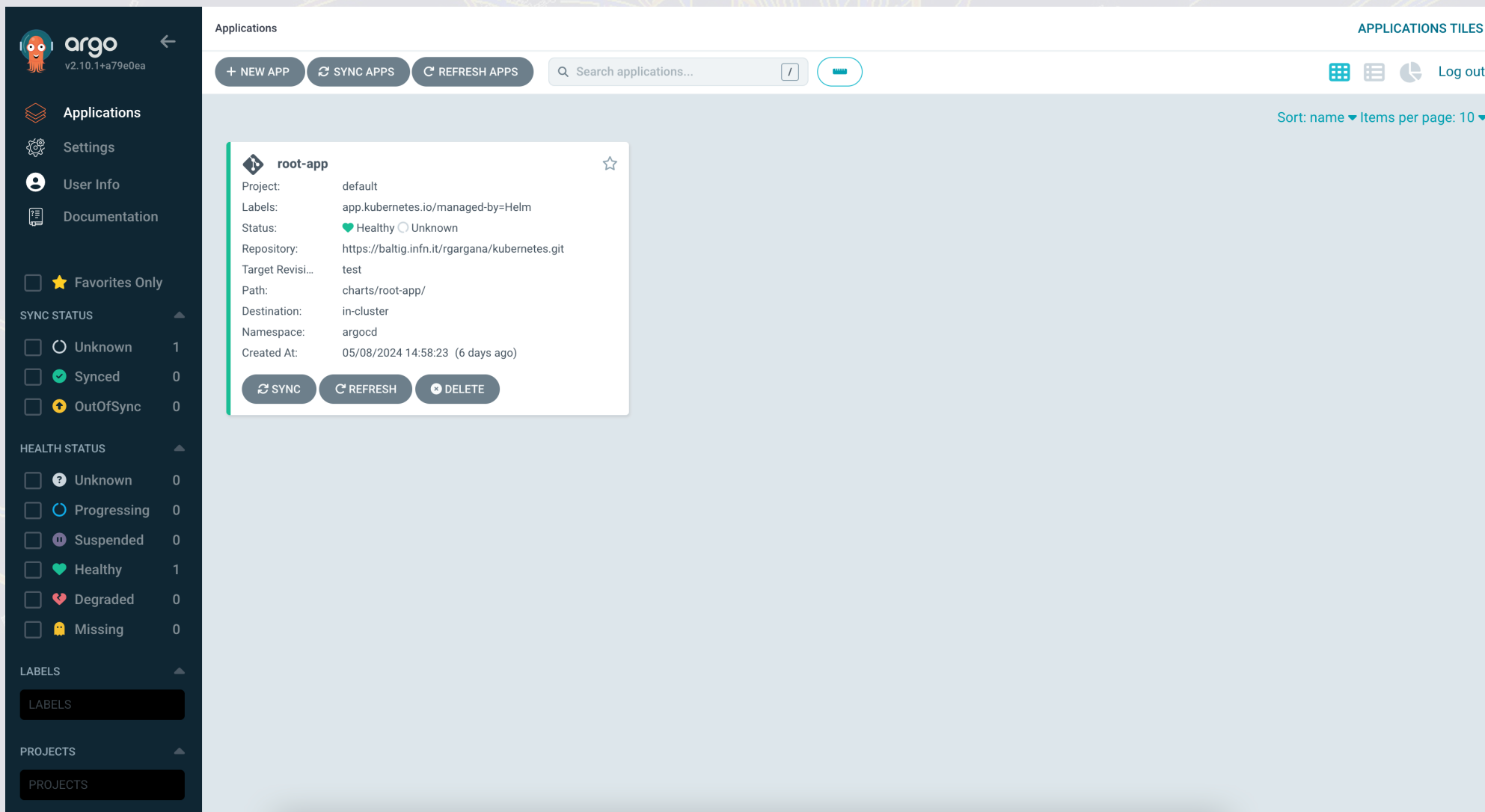
Argo CD is a declarative, GitOps continuous delivery tool for Kubernetes.



Root-APP

Root-APP is ArgoCD application, is used to automatically deploy other services included in the owner's Git/Baltig repository.

ArgoCD Dashboard after deploy

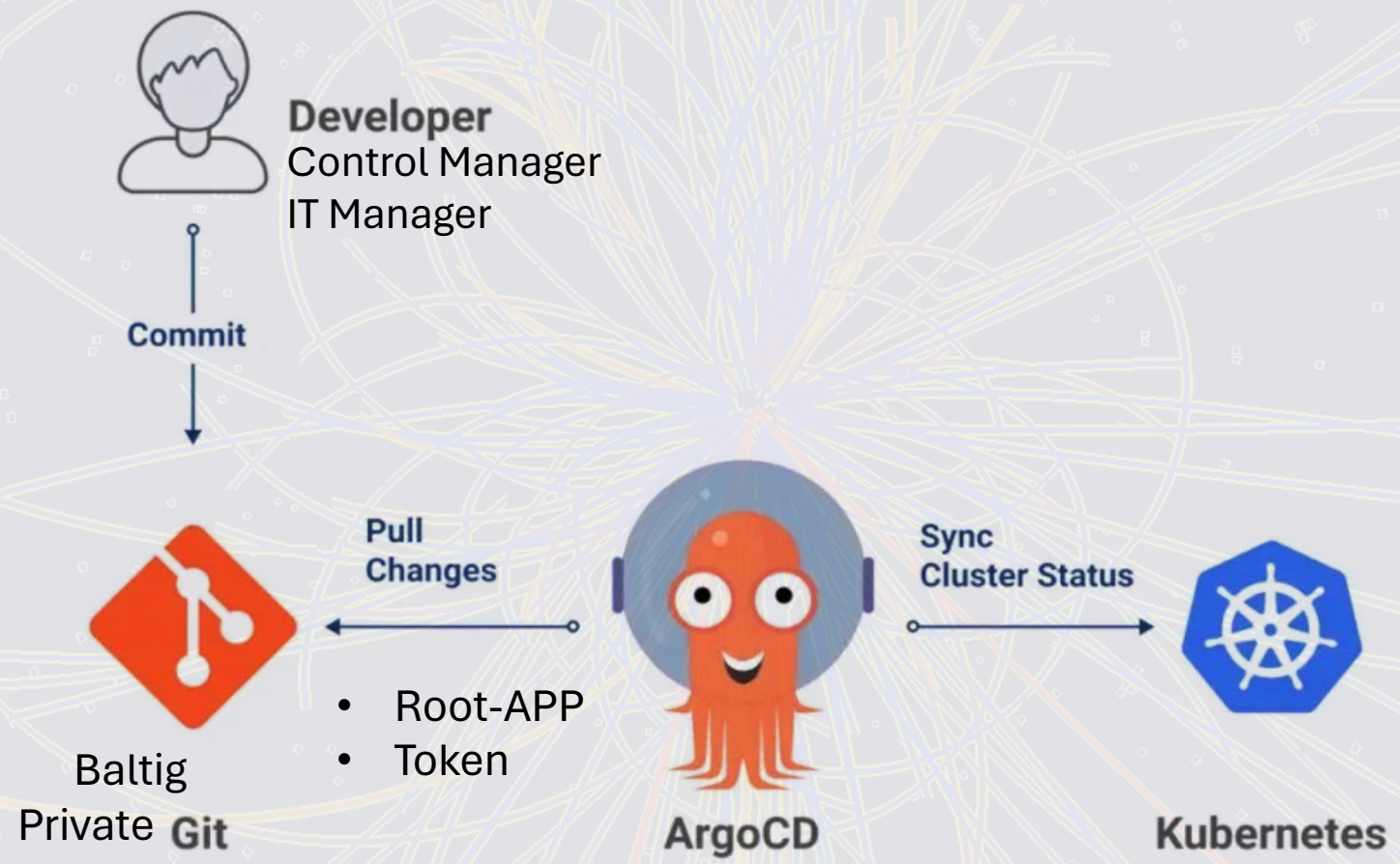


The screenshot displays the ArgoCD dashboard interface. On the left is a dark sidebar with navigation options: Applications, Settings, User Info, and Documentation. Below these are sections for 'Favorites Only', 'SYNC STATUS' (Unknown: 1, Synced: 0, OutOfSync: 0), 'HEALTH STATUS' (Unknown: 0, Progressing: 0, Suspended: 0, Healthy: 1, Degraded: 0, Missing: 0), 'LABELS', and 'PROJECTS'. The main area is titled 'Applications' and features a top bar with '+ NEW APP', 'SYNC APPS', 'REFRESH APPS', a search bar, and a 'Log out' button. A card for 'root-app' is highlighted, showing the following details:

- Project: default
- Labels: app.kubernetes.io/managed-by=Helm
- Status: ♥ Healthy ○ Unknown
- Repository: https://baltig.inf.nl/rgargana/kubernetes.git
- Target Revisi...: test
- Path: charts/root-app/
- Destination: in-cluster
- Namespace: argocd
- Created At: 05/08/2024 14:58:23 (6 days ago)

Below the details are three buttons: SYNC, REFRESH, and DELETE. The top right of the dashboard shows 'APPLICATIONS TILES' and 'Sort: name ▾ Items per page: 10 ▾'.

ArgoCD App-of-App - GitOps Approach



Root-APP deploy


Riccardo Gargana / kubernetes / Repository










main ▾ kubernetes / charts / root-app / templates / + ▾

History Find file Edit ▾ Code ▾



Fix new Typo
root authored 46 minutes ago

a28c9d6a 

Name	Last commit	Last update
..		
 NFS-subdir-external-provisioner.yaml	Remove default storage class to nfs	2 months ago
 argo-cd.yaml	Fix dex on argocd files	1 month ago
 epik8-backend.yaml	fix Typo	2 hours ago
 haproxy-ingress.yaml	Add longhorn ingress. fix creation ns for other services	2 months ago
 longhorn.yaml	Change longhorn app	2 months ago
 metallb.yaml	Add longhorn ingress. fix creation ns for other services	2 months ago
 root-app-kustomize.yaml	Fix new Typo	46 minutes ago
 root-app.yaml	Fix namespace application	2 months ago
 sparc-console.yaml	Change privileg to null	2 months ago


Kustomize into ArgoCD








Kubernetes native configuration management

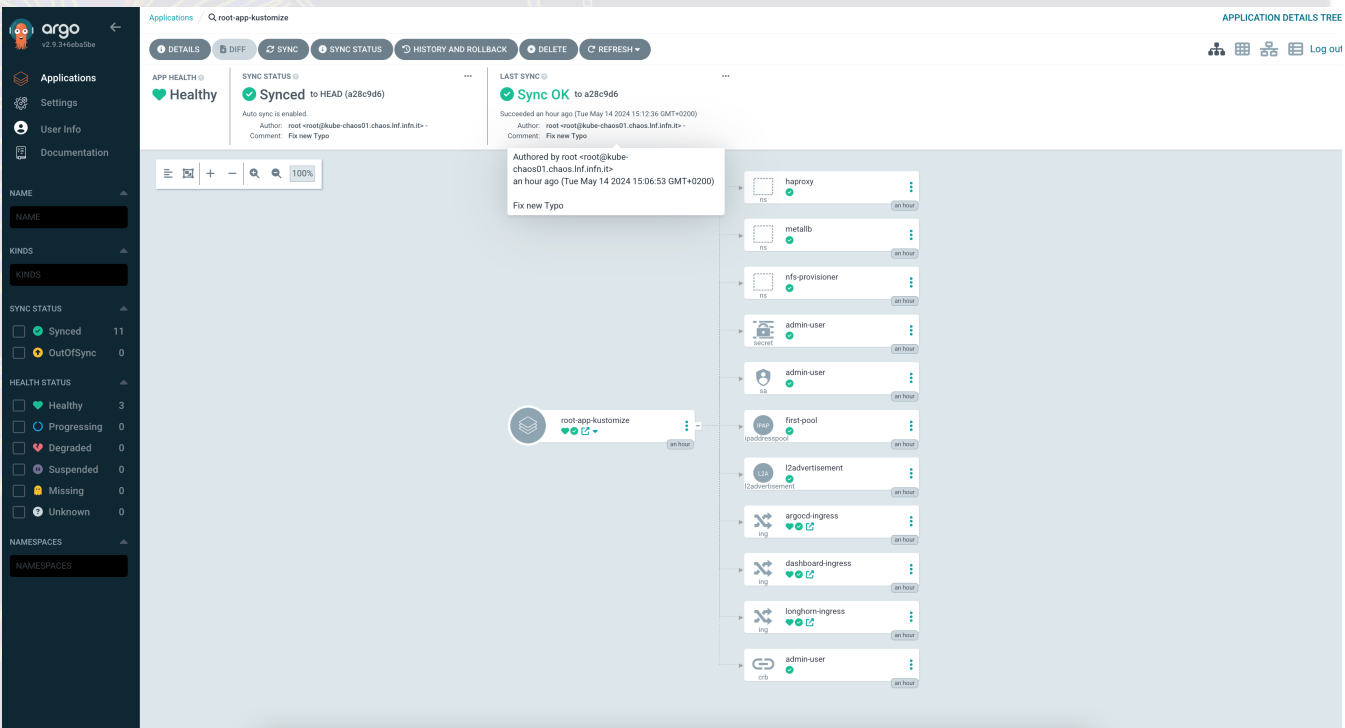
Kustomize introduces a template-free way to customize application configuration that simplifies the use of off-the-shelf applications.

Riccardo Gargana / kubernetes / Repository

main ▾ kubernetes / charts / kustomize / base / + ▾

 **Fix typo longhorn ingress**
root authored 2 months ago

Name	Last commit
..	
 haproxy-ns.yaml	Fix name of file
 ingress-argocd.yaml	Change FQDN service
 ingress-k8s-dashboard.yaml	Change FQDN service
 ingress-longhorn.yaml	Fix typo longhorn ingress
 kustomization.yaml	Add longhorn ingress. fix creation ns for other services
 metallb-config.yaml	Fix code
 nfs-provisioner-ns.yaml	Fix namespace application



The screenshot shows the ArgoCD web interface for the application 'root-app-kustomize'. The interface includes a sidebar with navigation options (Applications, Settings, User Info, Documentation) and a main content area. The main area displays the application's health status as 'Healthy' and its sync status as 'Synced to HEAD (a28c9d6)'. A 'LAST SYNC' section shows a successful sync to 'a28c9d6' from an hour ago. Below this, a list of application components is shown, including 'haproxy', 'metallb', 'nfs-provisioner', 'admin-user', 'first-pool', 'I2advertisement', 'argocd-ingress', 'dashboard-ingress', 'longhorn-ingress', and 'admin-user'. A tooltip is visible over the 'root-app-kustomize' application icon, showing the author 'root' and the commit 'Fix new Typo'.

Overview Dashboard ArgoCD

argo
v2.9.3+6eba5be

- Applications
- Settings
- User Info
- Documentation

Favorites Only

SYNC STATUS

- Unknown 0
- Synced 7
- OutOfSync 0

HEALTH STATUS

- Unknown 0
- Progressing 0
- Suspended 0
- Healthy 7
- Degraded 0
- Missing 0

LABELS

LABELS

PROJECTS

PROJECTS

CLUSTERS

CLUSTERS

Applications

APPLICATIONS TILES

Sort: name ▾ Items per page: 10 ▾

<p>argo-cd ★</p> <p>Project: default</p> <p>Labels: argocd.argoproj.io/instance=root-app</p> <p>Status: ♥ Healthy ✔ Synced</p> <p>Repository: https://baltig.infn.it/rgargana/kubernetes.git</p> <p>Target Revis... HEAD</p> <p>Path: charts/argo-cd</p> <p>Destination: in-cluster</p> <p>Namespace: argocd</p> <p>Created At: 03/03/2024 12:21:22 (3 months ago)</p> <p>Last Sync: 04/12/2024 00:24:06 (a month ago)</p> <p> <input type="button" value="REFRESH"/> <input type="button" value="REFRESH"/> <input type="button" value="DELETE"/> </p>	<p>haproxy-ingress ★</p> <p>Project: default</p> <p>Labels: argocd.argoproj.io/instance=root-app</p> <p>Status: ♥ Healthy ✔ Synced</p> <p>Repository: https://haproxy-ingress.github.io/charts</p> <p>Target Revis... 0.14.6</p> <p>Chart: haproxy-ingress</p> <p>Destination: in-cluster</p> <p>Namespace: haproxy</p> <p>Created At: 03/03/2024 12:21:22 (3 months ago)</p> <p>Last Sync: 05/14/2024 15:12:05 (7 days ago)</p> <p> <input type="button" value="REFRESH"/> <input type="button" value="REFRESH"/> <input type="button" value="DELETE"/> </p>	<p>longhorn ★</p> <p>Project: default</p> <p>Labels: argocd.argoproj.io/instance=root-app</p> <p>Status: ♥ Healthy ✔ Synced</p> <p>Repository: https://charts.longhorn.io/</p> <p>Target Revis... v1.6.0</p> <p>Chart: longhorn</p> <p>Destination: in-cluster</p> <p>Namespace: longhorn-system</p> <p>Created At: 03/12/2024 22:20:10 (2 months ago)</p> <p>Last Sync: 03/12/2024 22:20:28 (2 months ago)</p> <p> <input type="button" value="REFRESH"/> <input type="button" value="REFRESH"/> <input type="button" value="DELETE"/> </p>	<p>metallb ★</p> <p>Project: default</p> <p>Labels: argocd.argoproj.io/instance=root-app</p> <p>Status: ♥ Healthy ✔ Synced</p> <p>Repository: https://metallb.github.io/metallb</p> <p>Target Revis... 0.13.12</p> <p>Chart: metallb</p> <p>Destination: in-cluster</p> <p>Namespace: metallb</p> <p>Created At: 03/11/2024 23:46:36 (2 months ago)</p> <p>Last Sync: 05/21/2024 09:46:48 (2 minutes ago)</p> <p> <input type="button" value="REFRESH"/> <input type="button" value="REFRESH"/> <input type="button" value="DELETE"/> </p>
<p>nfs-subdir-external-provisioner ★</p> <p>Project: default</p> <p>Labels: argocd.argoproj.io/instance=root-app</p> <p>Status: ♥ Healthy ✔ Synced</p> <p>Repository: https://kubernetes-sigs.github.io/nfs-subdir-ext...</p> <p>Target Revis... 4.0.18</p> <p>Chart: nfs-subdir-external-provisioner</p> <p>Destination: in-cluster</p> <p>Namespace: nfs-provisioner</p> <p>Created At: 03/12/2024 00:01:22 (2 months ago)</p> <p>Last Sync: 05/14/2024 15:12:05 (7 days ago)</p> <p> <input type="button" value="REFRESH"/> <input type="button" value="REFRESH"/> <input type="button" value="DELETE"/> </p>	<p>root-app ★</p> <p>Project: default</p> <p>Labels: app.kubernetes.io/managed-by=Helm, argocd.arg...</p> <p>Status: ♥ Healthy ✔ Synced</p> <p>Repository: https://baltig.infn.it/rgargana/kubernetes.git</p> <p>Target Revis... HEAD</p> <p>Path: charts/root-app/</p> <p>Destination: in-cluster</p> <p>Namespace: argocd</p> <p>Created At: 03/03/2024 12:09:13 (3 months ago)</p> <p>Last Sync: 05/21/2024 09:19:52 (29 minutes ago)</p> <p> <input type="button" value="REFRESH"/> <input type="button" value="REFRESH"/> <input type="button" value="DELETE"/> </p>	<p>root-app-kustomize ★</p> <p>Project: default</p> <p>Labels: argocd.argoproj.io/instance=root-app</p> <p>Status: ♥ Healthy ✔ Synced</p> <p>Repository: https://baltig.infn.it/rgargana/kubernetes.git</p> <p>Target Revis... HEAD</p> <p>Path: charts/kustomize/base/</p> <p>Destination: in-cluster</p> <p>Namespace: argocd</p> <p>Created At: 05/14/2024 15:11:45 (7 days ago)</p> <p>Last Sync: 05/14/2024 15:12:36 (7 days ago)</p> <p> <input type="button" value="REFRESH"/> <input type="button" value="REFRESH"/> <input type="button" value="DELETE"/> </p>	

Provisioning OKD on vSphere

by Ramon Orrù



Terraform (Infrastructure as code) creates bastion host & service account privileges

Ansible sets up bastion host and compiles install config



OKD installer brings up whole cluster

Installation takes approx. 45 mins

OKD Cluster configuration



Kustomize allows maintaining a cluster configuration efficiently

vSphere storage drivers support PVs dynamic allocation out of the box, even with CSI compliance



ArgoCD enables gitops features and keeps apps in sync

Why OKD?



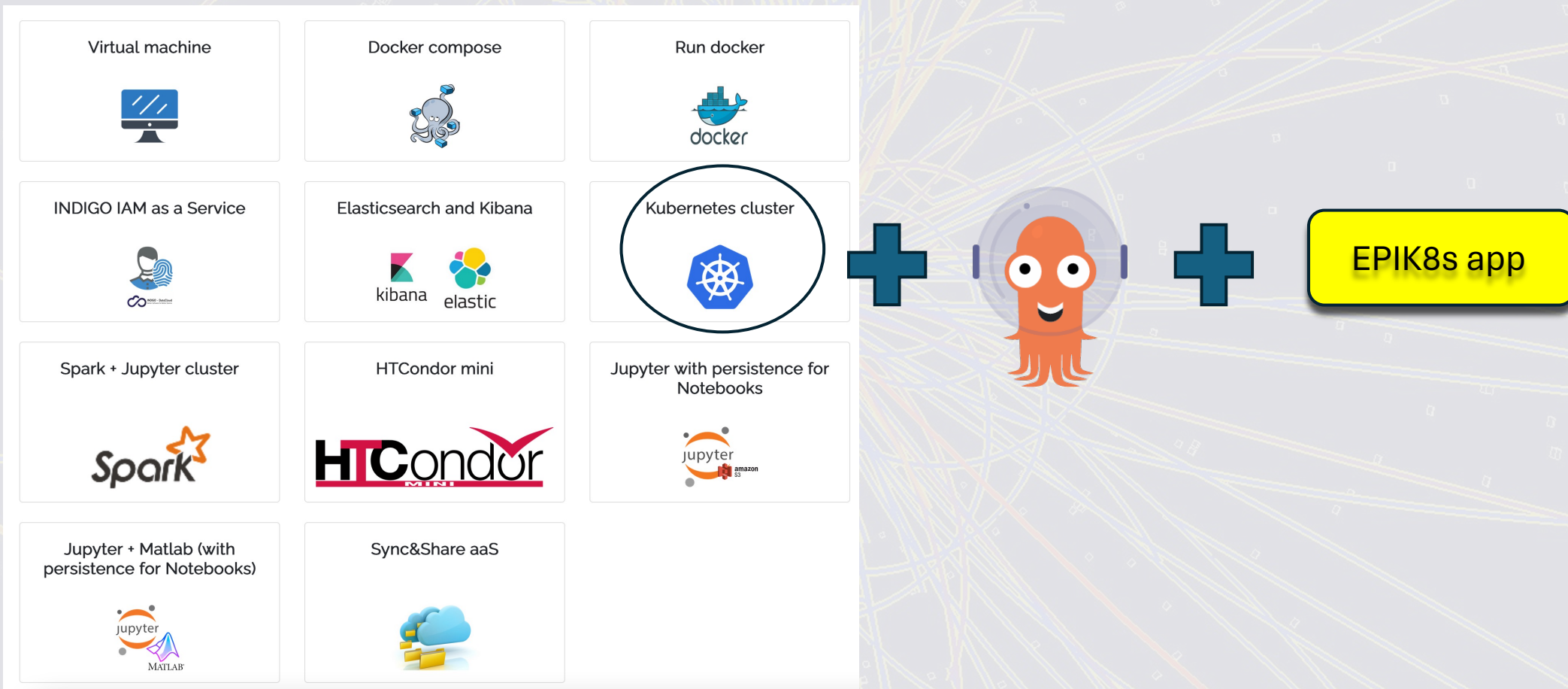
+

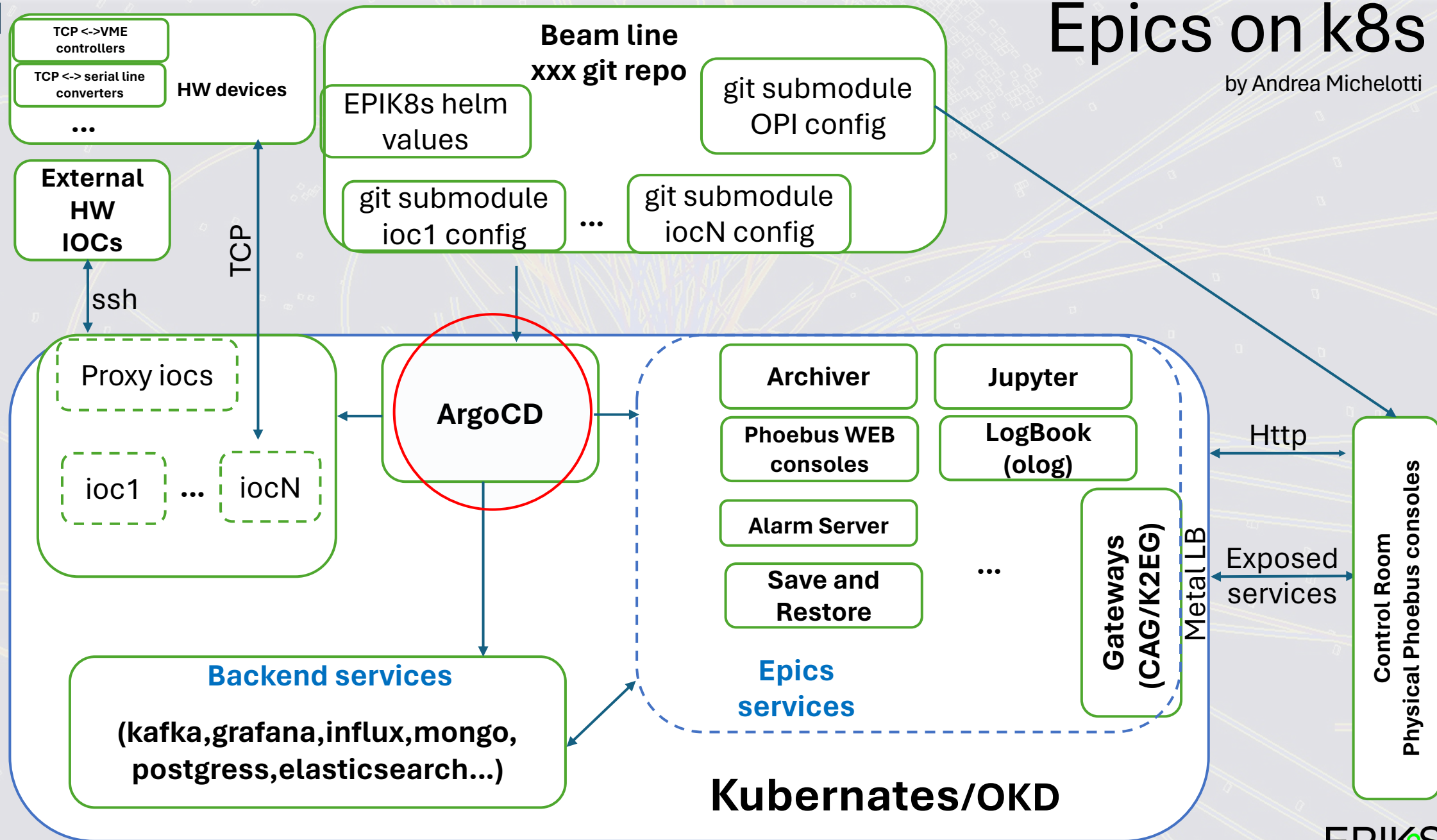
- IPI/UPI automated installer
- OTA updates
- CNI drivers
- CSI drivers
- Complete dashboard
- Ingress
- Monitoring platform
- Log ingestion
- Alerting
- Registry
- Auth connectors
- Operators marketplace
- KubeVirt (VMs)

= **okd**

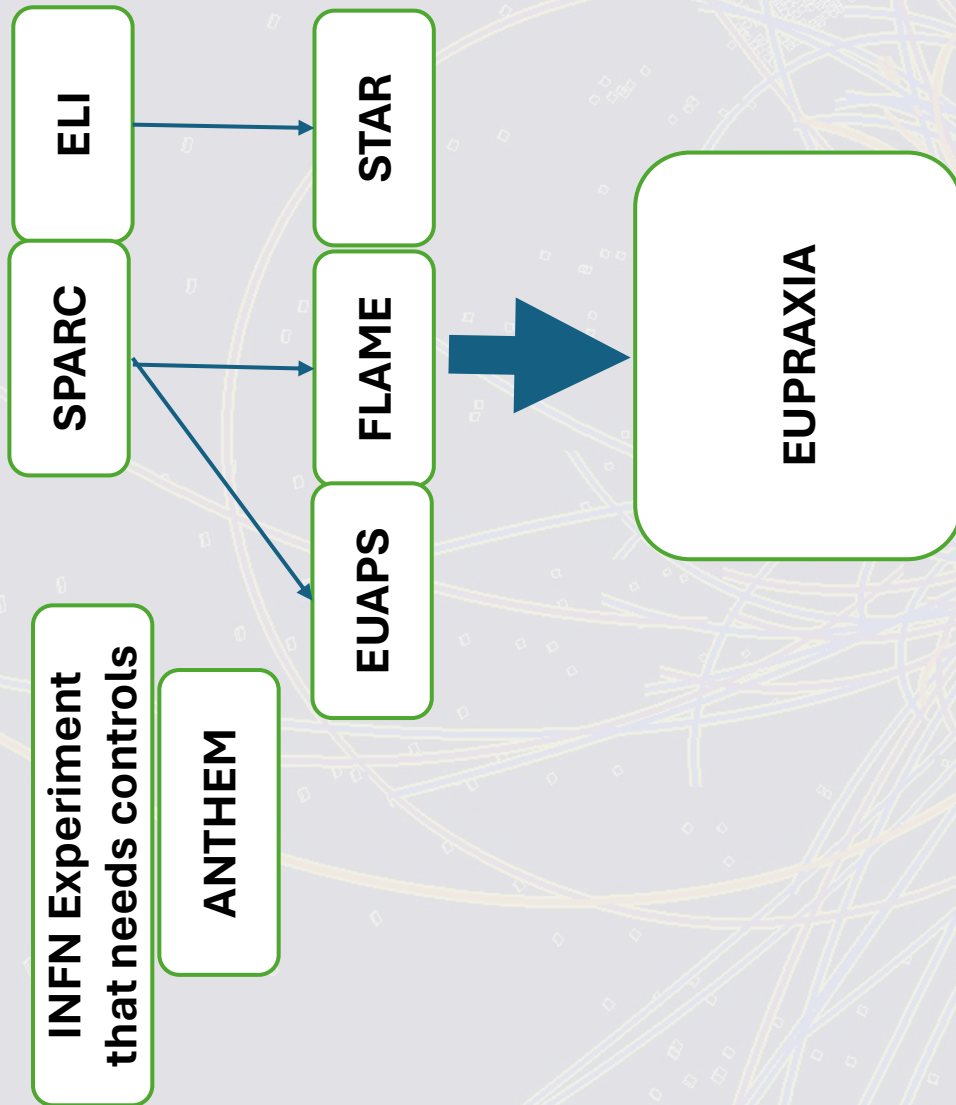
Out of the box

K8s in INFN Cloud + ArgoCD





EPIK8s a common platform for INFN experiments that needs EPICS controls



With standardized workflows and tools provided by a predefined platform, a database of controls, interfaces, and common procedures will be established. This platform will gradually become more comprehensive and refined, simplifying the installation of full-featured EPICS controls in our experiments.

THIS IS THE MISSION OF "RETE EPICS INFN"
epics@lists.infn.it

ArgoCD control application lifecycle dashboard (LNF SPARC facility)

Applications

+ NEW APP SYNC APPS REFRESH APPS Search applications... [7] -

APPLICATIONS TITLE

Log out

sparc-archiver-service

Project: default

Labels: app.kubernetes.io/instance=sparc-deploy-all, beamline=sparc, revision=level, rootapp=epi...

Status: ✔ Healthy ✔ Synced

Repository: https://baltig.infn.it/epics-containers/epics-archiver-chart.git

Target Revision: devel

Path: .

Destination: in-cluster

Namespace: sparc

Created At: 04/10/2024 11:08:57 (a month ago)

Last Sync: 05/04/2024 23:14:30 (12 days ago)

↻ SYNC 🔄 REFRESH 🗑️ DELETE

sparc-bdsparcac1bpm001-loc

Project: default

Labels: app.kubernetes.io/instance=sparc-deploy-all, beamline=sparc, iochost=bdsparcac1bpm00...

Status: ✔ Healthy ✔ Synced

Repository: https://baltig.infn.it/epics-containers/ioc-launcher-chart.git

Target Revision: devel

Path: .

Destination: in-cluster

Namespace: sparc

Created At: 05/03/2024 00:17:49 (14 days ago)

Last Sync: 05/04/2024 23:31:28 (12 days ago)

↻ SYNC 🔄 REFRESH 🗑️ DELETE

sparc-bdsparcac2bpm001-loc

Project: default

Labels: app.kubernetes.io/instance=sparc-deploy-all, beamline=sparc, iochost=bdsparcac2bpm00...

Status: ⚠ Missing ✔ OutOfSync

Repository: https://baltig.infn.it/epics-containers/ioc-launcher-chart.git

Target Revision: devel

Path: .

Destination: in-cluster

Namespace: sparc

Created At: 05/16/2024 12:43:21 (15 minutes ago)

↻ SYNC 🔄 REFRESH 🗑️ DELETE

sparc-bdsparcac3bpm001-loc

Project: default

Labels: app.kubernetes.io/instance=sparc-deploy-all, beamline=sparc, iochost=bdsparcac3bpm00...

Status: ✔ Healthy ✔ Synced

Repository: https://baltig.infn.it/epics-containers/ioc-launcher-chart.git

Target Revision: devel

Path: .

Destination: in-cluster

Namespace: sparc

Created At: 05/03/2024 00:20:09 (14 days ago)

Last Sync: 05/04/2024 23:34:37 (12 days ago)

↻ SYNC 🔄 REFRESH 🗑️ DELETE

sparc-bdsparcdg1bpm001-loc

Project: default

Labels: app.kubernetes.io/instance=sparc-deploy-all, beamline=sparc, iochost=bdsparcdg1bpm00...

Status: ✔ Healthy ✔ Synced

Repository: https://baltig.infn.it/epics-containers/ioc-launcher-chart.git

Target Revision: devel

Path: .

Destination: in-cluster

Namespace: sparc

Created At: 05/03/2024 00:20:20 (14 days ago)

Last Sync: 05/04/2024 23:34:35 (12 days ago)

↻ SYNC 🔄 REFRESH 🗑️ DELETE

sparc-bdsparcdg1bpm002-loc

Project: default

Labels: app.kubernetes.io/instance=sparc-deploy-all, beamline=sparc, iochost=bdsparcdg1bpm00...

Status: ✔ Healthy ✔ Synced

Repository: https://baltig.infn.it/epics-containers/ioc-launcher-chart.git

Target Revision: devel

Path: .

Destination: in-cluster

Namespace: sparc

Created At: 05/03/2024 00:21:29 (14 days ago)

Last Sync: 05/04/2024 23:34:35 (12 days ago)

↻ SYNC 🔄 REFRESH 🗑️ DELETE

sparc-bdsparcdg1bpm003-loc

Project: default

Labels: app.kubernetes.io/instance=sparc-deploy-all, beamline=sparc, iochost=bdsparcdg1bpm00...

Status: ✔ Healthy ✔ Synced

Repository: https://baltig.infn.it/epics-containers/ioc-launcher-chart.git

Target Revision: devel

Path: .

Destination: in-cluster

Namespace: sparc

Created At: 05/03/2024 00:21:29 (14 days ago)

Last Sync: 05/04/2024 23:34:37 (12 days ago)

↻ SYNC 🔄 REFRESH 🗑️ DELETE

sparc-bdsparcplxbpm001-loc

Project: default

Labels: app.kubernetes.io/instance=sparc-deploy-all, beamline=sparc, iochost=bdsparcplxbpm00...

Status: ✔ Healthy ✔ Synced

Repository: https://baltig.infn.it/epics-containers/ioc-launcher-chart.git

Target Revision: devel

Path: .

Destination: in-cluster

Namespace: sparc

Created At: 05/03/2024 00:21:39 (14 days ago)

Last Sync: 05/04/2024 23:34:35 (12 days ago)

↻ SYNC 🔄 REFRESH 🗑️ DELETE

sparc-bdsparcplxbpm002-loc

Project: default

Labels: app.kubernetes.io/instance=sparc-deploy-all, beamline=sparc, iochost=bdsparcplxbpm00...

Status: ✔ Healthy ✔ Synced

Repository: https://baltig.infn.it/epics-containers/ioc-launcher-chart.git

Target Revision: devel

Path: .

Destination: in-cluster

Namespace: sparc

Created At: 05/03/2024 00:21:51 (14 days ago)

Last Sync: 05/04/2024 23:34:35 (12 days ago)

↻ SYNC 🔄 REFRESH 🗑️ DELETE

sparc-bdsparcplxbpm003-loc

Project: default

Labels: app.kubernetes.io/instance=sparc-deploy-all, beamline=sparc, iochost=bdsparcplxbpm00...

Status: ✔ Healthy ✔ Synced

Repository: https://baltig.infn.it/epics-containers/ioc-launcher-chart.git

Target Revision: devel

Path: .

Destination: in-cluster

Namespace: sparc

Created At: 04/30/2024 11:14:16 (16 days ago)

Last Sync: 05/04/2024 23:34:19 (12 days ago)

↻ SYNC 🔄 REFRESH 🗑️ DELETE

sparc-bdsparcplxbpm004-loc

Project: default

Labels: app.kubernetes.io/instance=sparc-deploy-all, beamline=sparc, iochost=bdsparcplxbpm00...

Status: ✔ Healthy ✔ Synced

Repository: https://baltig.infn.it/epics-containers/ioc-launcher-chart.git

Target Revision: devel

Path: .

Destination: in-cluster

Namespace: sparc

Created At: 04/30/2024 11:14:16 (16 days ago)

Last Sync: 05/04/2024 23:34:35 (12 days ago)

↻ SYNC 🔄 REFRESH 🗑️ DELETE

sparc-bdsparcplxbpm005-loc

Project: default

Labels: app.kubernetes.io/instance=sparc-deploy-all, beamline=sparc, iochost=bdsparcplxbpm00...

Status: ✔ Healthy ✔ Synced

Repository: https://baltig.infn.it/epics-containers/ioc-launcher-chart.git

Target Revision: devel

Path: .

Destination: in-cluster

Namespace: sparc

Created At: 04/30/2024 11:14:16 (16 days ago)

Last Sync: 05/04/2024 23:34:38 (12 days ago)

↻ SYNC 🔄 REFRESH 🗑️ DELETE

sparc-bdsparcplxbpm006-loc

Project: default

Labels: app.kubernetes.io/instance=sparc-deploy-all, beamline=sparc, iochost=bdsparcplxbpm00...

Status: ✔ Healthy ✔ Synced

Repository: https://baltig.infn.it/epics-containers/ioc-launcher-chart.git

Target Revision: devel

Path: .

Destination: in-cluster

Namespace: sparc

Created At: 04/30/2024 11:14:16 (16 days ago)

Last Sync: 05/04/2024 23:34:37 (12 days ago)

↻ SYNC 🔄 REFRESH 🗑️ DELETE

sparc-bdsparcplxbpm007-loc

Project: default

Labels: app.kubernetes.io/instance=sparc-deploy-all, beamline=sparc, iochost=bdsparcplxbpm00...

Status: ⏸ Progressing ✔ Synced

Repository: https://baltig.infn.it/epics-containers/ioc-launcher-chart.git

Target Revision: devel

Path: .

Destination: in-cluster

Namespace: sparc

Created At: 05/07/2024 21:46:28 (9 days ago)

Last Sync: 05/07/2024 21:46:29 (9 days ago)

↻ SYNC 🔄 REFRESH 🗑️ DELETE

sparc-bdsparcptbpm001-loc

Project: default

Labels: app.kubernetes.io/instance=sparc-deploy-all, beamline=sparc, iochost=bdsparcptbpm00...

Status: ✔ Healthy ✔ Synced

Repository: https://baltig.infn.it/epics-containers/ioc-launcher-chart.git

Target Revision: devel

Path: .

Destination: in-cluster

Namespace: sparc

Created At: 04/30/2024 10:52:43 (16 days ago)

Last Sync: 05/04/2024 23:34:38 (12 days ago)

↻ SYNC 🔄 REFRESH 🗑️ DELETE

sparc-bdsparcutbpm001-loc

Project: default

Labels: app.kubernetes.io/instance=sparc-deploy-all, beamline=sparc, iochost=bdsparcutbpm00...

Status: ✔ Healthy ✔ Synced

Repository: https://baltig.infn.it/epics-containers/ioc-launcher-chart.git

Target Revision: devel

Path: .

Destination: in-cluster

Namespace: sparc

Created At: 04/30/2024 11:46:17 (16 days ago)

Last Sync: 05/04/2024 23:34:35 (12 days ago)

↻ SYNC 🔄 REFRESH 🗑️ DELETE

sparc-cagateway-service

Project: default

Labels: app.kubernetes.io/instance=sparc-deploy-all, beamline=sparc, revision=level, rootapp=epi...

Status: ✔ Healthy ✔ Synced

Repository: https://baltig.infn.it/epics-containers/ca-gateway-chart.git

Target Revision: devel

Path: .

sparc-channelfinder-service

Project: default

Labels: app.kubernetes.io/instance=sparc-deploy-all, beamline=sparc, revision=level, rootapp=epi...

Status: ✔ Healthy ✔ Synced

Repository: https://baltig.infn.it/epics-containers/channelfinder-chart.git

Target Revision: devel

Path: .

sparc-console-service

Project: default

Labels: app.kubernetes.io/instance=sparc-deploy-all, beamline=sparc, revision=level, rootapp=epi...

Status: ✔ Healthy ✔ Synced

Repository: https://baltig.infn.it/epics-containers/epics-console-chart.git

Target Revision: devel

Path: .

sparc-deploy-all

Project: default

Labels: app.kubernetes.io/instance=sparc-start-epik8-deploy, deploy=sparc

Status: ✔ Healthy ✔ Synced

Repository: https://baltig.infn.it/epics-containers/epik8-chart.git

Target Revision: HEAD

Path: .

Collaborative environment



IT Architect



Control System Manager

Acknowledgement

Alessandro Stecchi

Andrea Michelotti

Claudio Bisegni

Ramon Orrù

Maurizio Montis

Mauro Giacchini

Francesco Piero Lorenzo Prelz

.... apologies for my memory