# **Lightweight, standalone** and **composable** Che workspaces with Kubernetes Operators

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# First, what is Che about ?

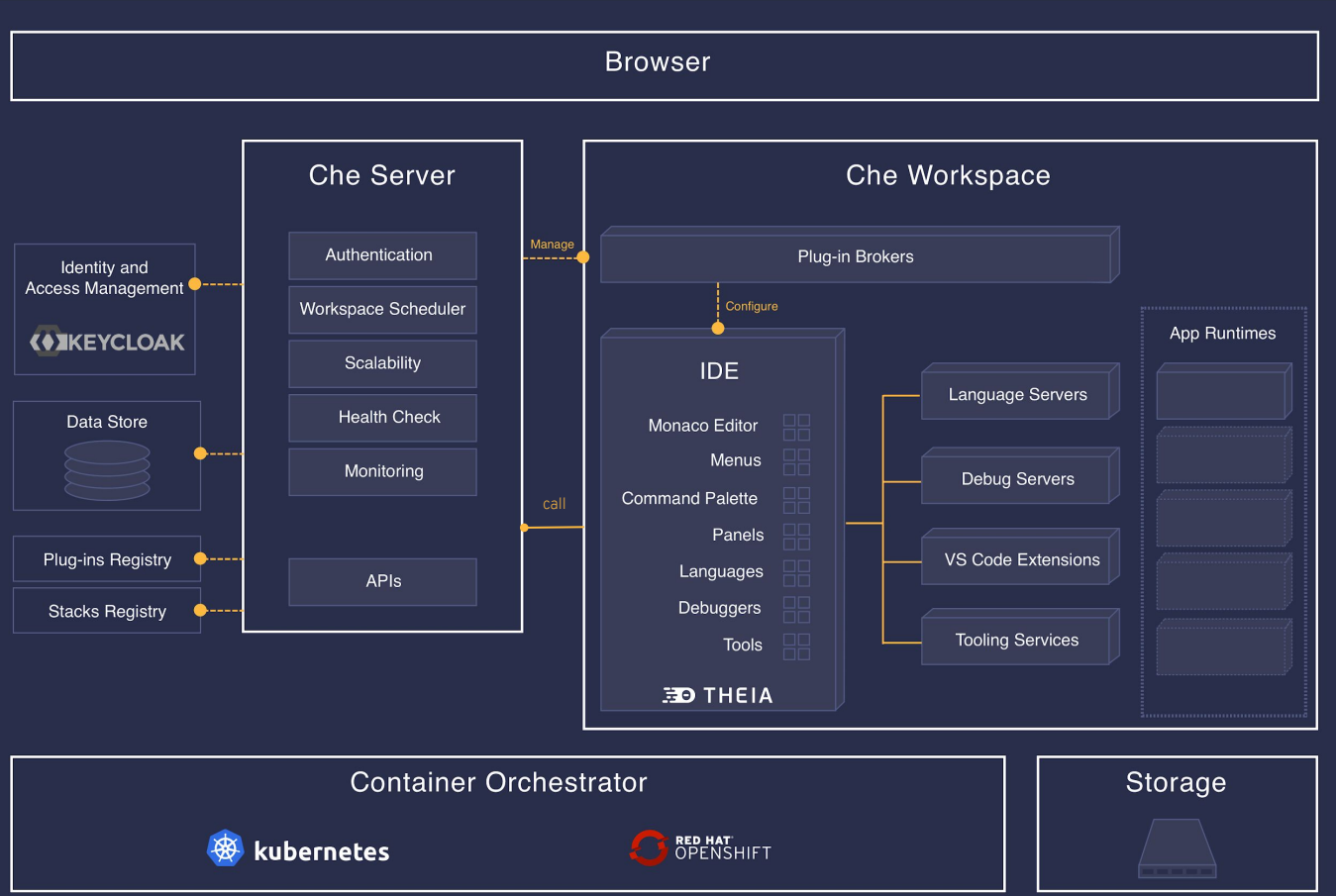
# “First open-source Kubernetes-native IDE…”

(Che 7 Announcement)

# …for developer teams

(Che home page @ eclipse.org)

# Che 7 Architecture



# Demo

Let’s discover Che

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# Demo content

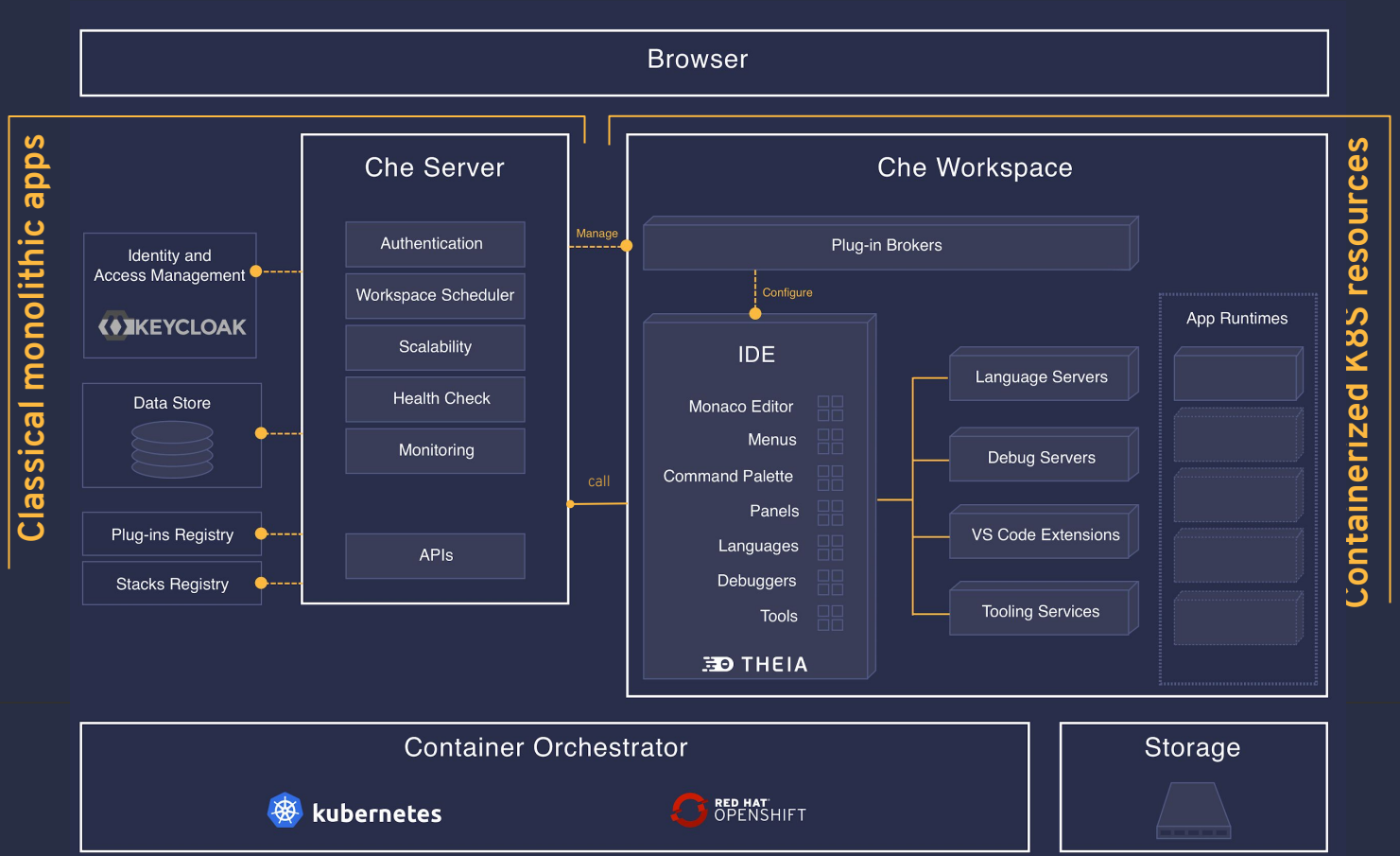
- On OpenShift : for the ease, but would be the same on other Kubernetes envs.
- Create  a workspace from the Dashboard and play 2 minutes inside it to showcase the power
- Show when we really arrive *inside* the workspace (!= from the Dashoard)
- Show that the workspace is only containerizedkubernetes resources + external access through services
- Switch to show the Che server => ressources used !...

  ... though the Che server only manages:

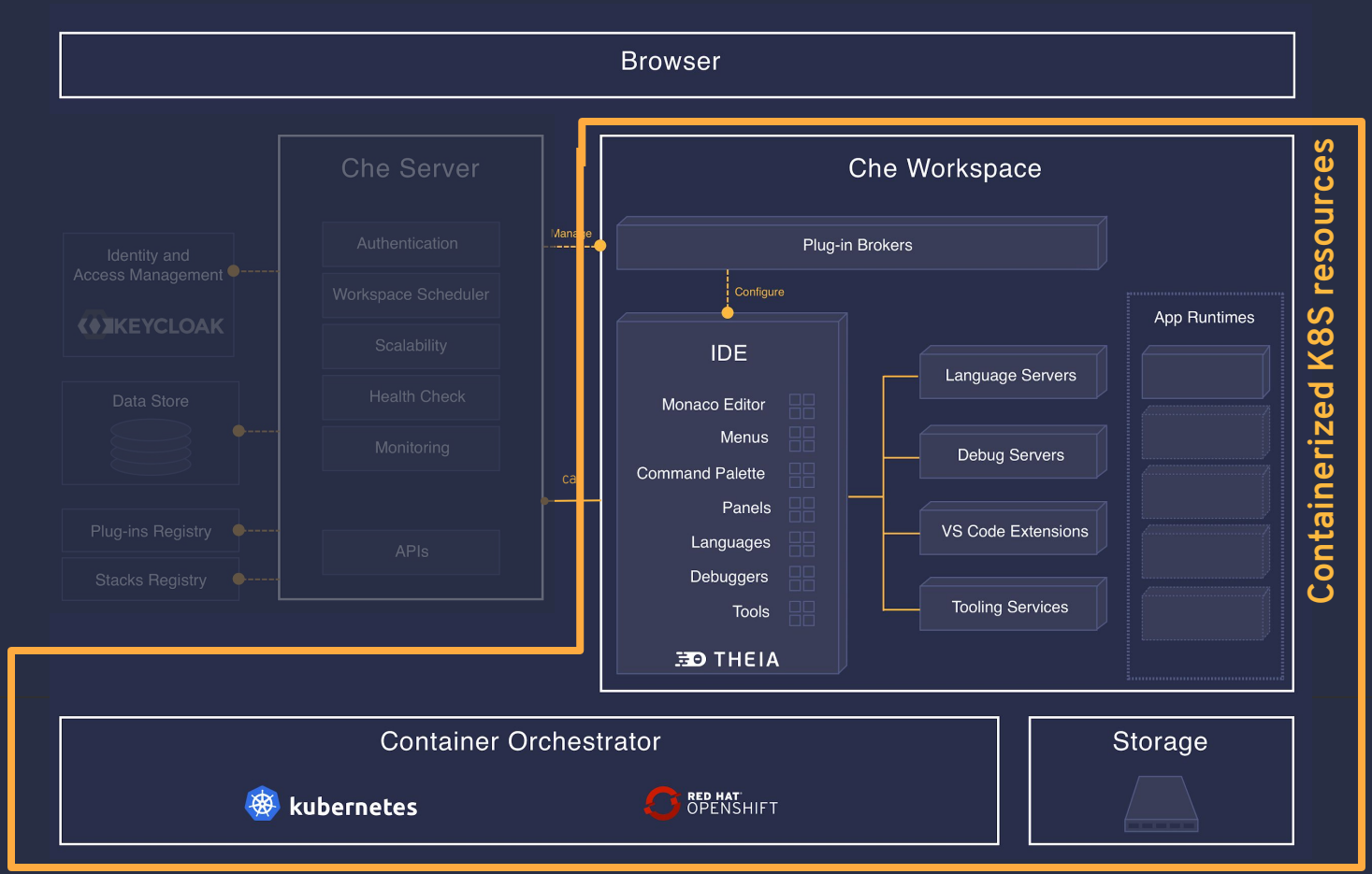
  - Workspace lifecyle
  - Authentication and identity management
  - Creates and manages workspace underlying K8S resources

# If only we had Lightweight, Standalone Workspaces As first-class K8S citizens ?

# Split Che Architecture



# Split Che Architecture



# Extend Kubernetes with workspaces ?

## Currently

- **Workspace drives the creation of standard Kubernetes objects**

## Go one step further

- **Make workspaces themselves become Kubernetes objects**

**Now Possible** since Kubernetes has become **extensible** with **Custom Resources**, and finally **Operators**

# A word on Kubernetes Operators

**Custom Resource Definitions (CRD)**

- Allow new types K8S custom resources (CR): Metadata, Spec,Status

**Controllers**

- Contain logic to reconcile expected and observed state of the CR on CRUD events

**Operators**

- Bundle CRDs and controller in a single unit along with metadata and permissions

# What we currently have

**Workspace Data** → Che-server specific model

- Workspace structure → Devfile
- Workspace runtime desired state → Che server-specific model
- Workspace runtime effective state → Che server-specific model

All stored in Che own dedicated database

**Workspace Management logic**

- From inside a single dedicated server
- In-house **management** of K8S objects
- Sync with the internal workspace runtime status

# What we could have

**Workspace Data** → ~~Che-server-specific model~~ K8S Custom Resource (CR) with:

- Workspace structure → Devfile (already K8S-compatible syntax)
- Workspace runtime desired state → ~~Che-server-specific model~~ CR Spec fields
- Workspace runtime effective state → ~~Che-server-specific model~~ CR Status fields

All stored ~~in Che own dedicated database~~ as standard K8S objects in the cluster Etcd instance

**Workspace Management logic**

- ~~From inside a single dedicated server~~ In K8S-compliant CRD controller
- ~~In-house **management** of K8S objects~~ Typical CRUD K8S resource reconciliation
- ~~Sync with the internal workspace runtime status~~ Runtime state is in the workspace CR

# We have it in fact… in early development

## Che Workspace Operator

- ➥ Simple K8S Deployment with
  - Small GO application
  - Embedded plugin registry (apache server + yaml files)

## Open-source POC hosted in the `che-incubator` GitHub repository

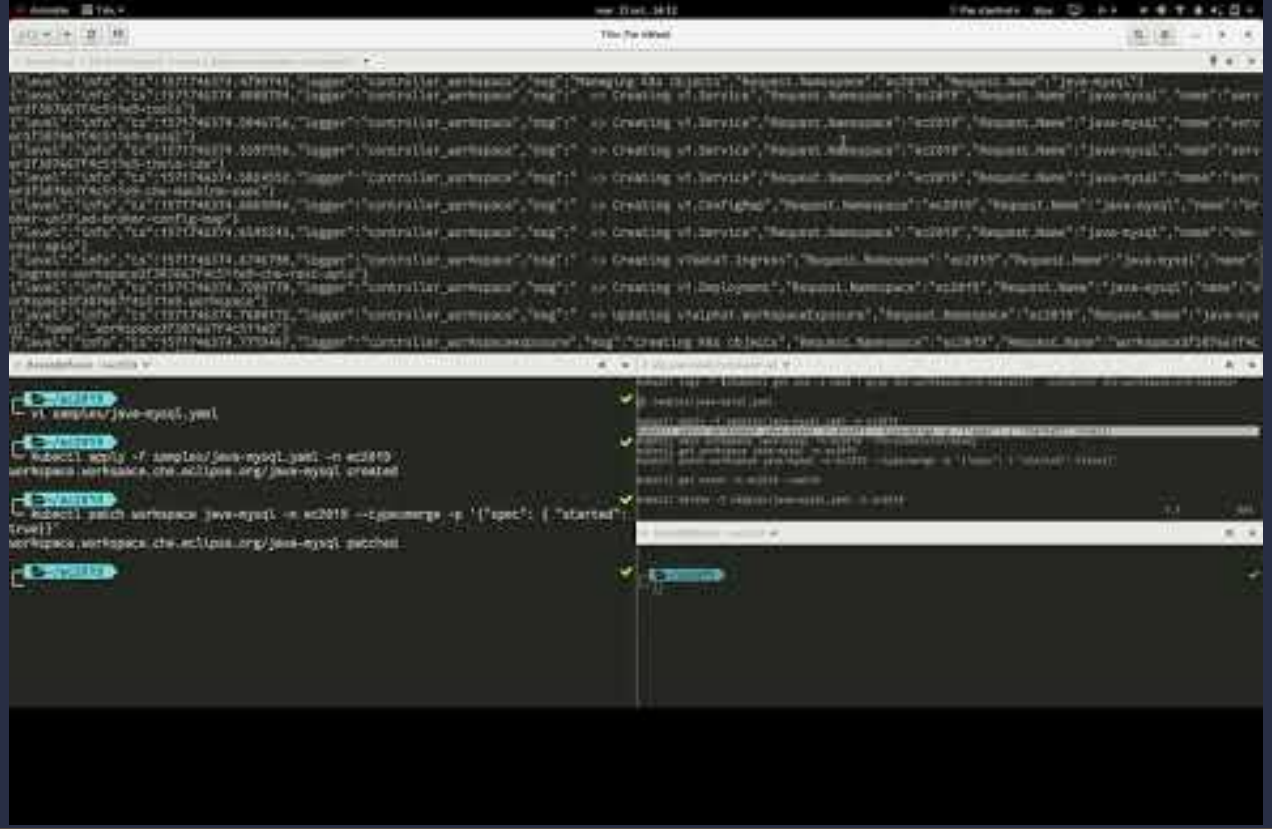
- ➥ Needs cleaning, documentation, decent testing,
- ➥ But concept and main implementation skeleton are there.

## Same user experience inside the Workspace

# Demo

```
> kubectl apply -f workspace.yaml
```

# > kubectl apply -f workspace.yaml



# Demo Content

- Kubectl -apply workspace , start, stop, wait for availability, list workspaces
- Play a bit inside such a started workspace and show it provides the same experience
- Go to the operator POD In Openshift => Show resource consumption : 10 times less

# Lightweight, standalone and … composable

Workspaces CRs become **components**, building blocks

- ➥ Can be viewed, created, managed by any process running on Kubernetes.
- ➥ Inherit K8S ecosystem goodies available for any K8S resource
  - Monitoring,
  - Event aggregating,
  - OpenApi schema validation, etc …

Example of integration

- ➥ The current OpenShift console web application.

# Demo

Manage workspaces in the OpenShift console

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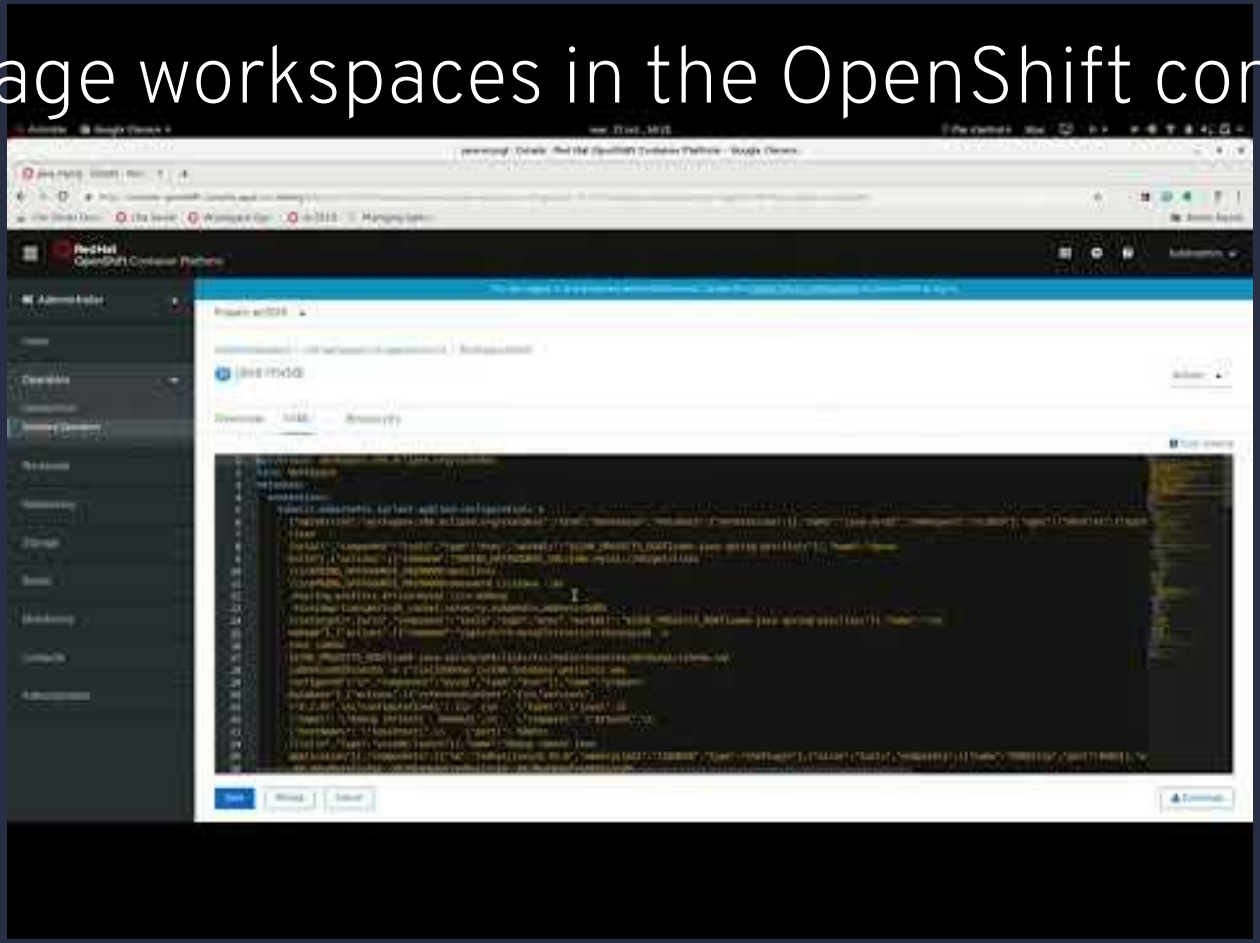

# No more external components ?

## No more dedicated Database ?

- **Delegated to Kubernetes** infrastructure
- Everything is stored in K8S (ETCD) thanks to the Custom Resource

## No more Che server: where is the API ?

- All the required info is in the CR ⇒ API == read the CR
- That can be made in a tiny workspace sidecar (Quarkus App)

## No more dedicated identity management ? ...

# Lost authentication ?...
# ... Delegate to Kubernetes

# Delegate authentication to K8S

**Problem**

➥ Many different and incompatible implementations of identity management

**Solution**

➥ Switch controllers that manage a Custom Resource (cf. Ingress class)

➥ Decompose Custom resources

- **Workspace** == containers, basic services
- **Workspace Exposure** == how the workspace is exposed on the network

➥ Provide several controllers

- **Main controller** for the workspace custom resource
- **Configurable exposure controller**, according to exposure class

# Demo

Switch to OpenShift integrated authentication

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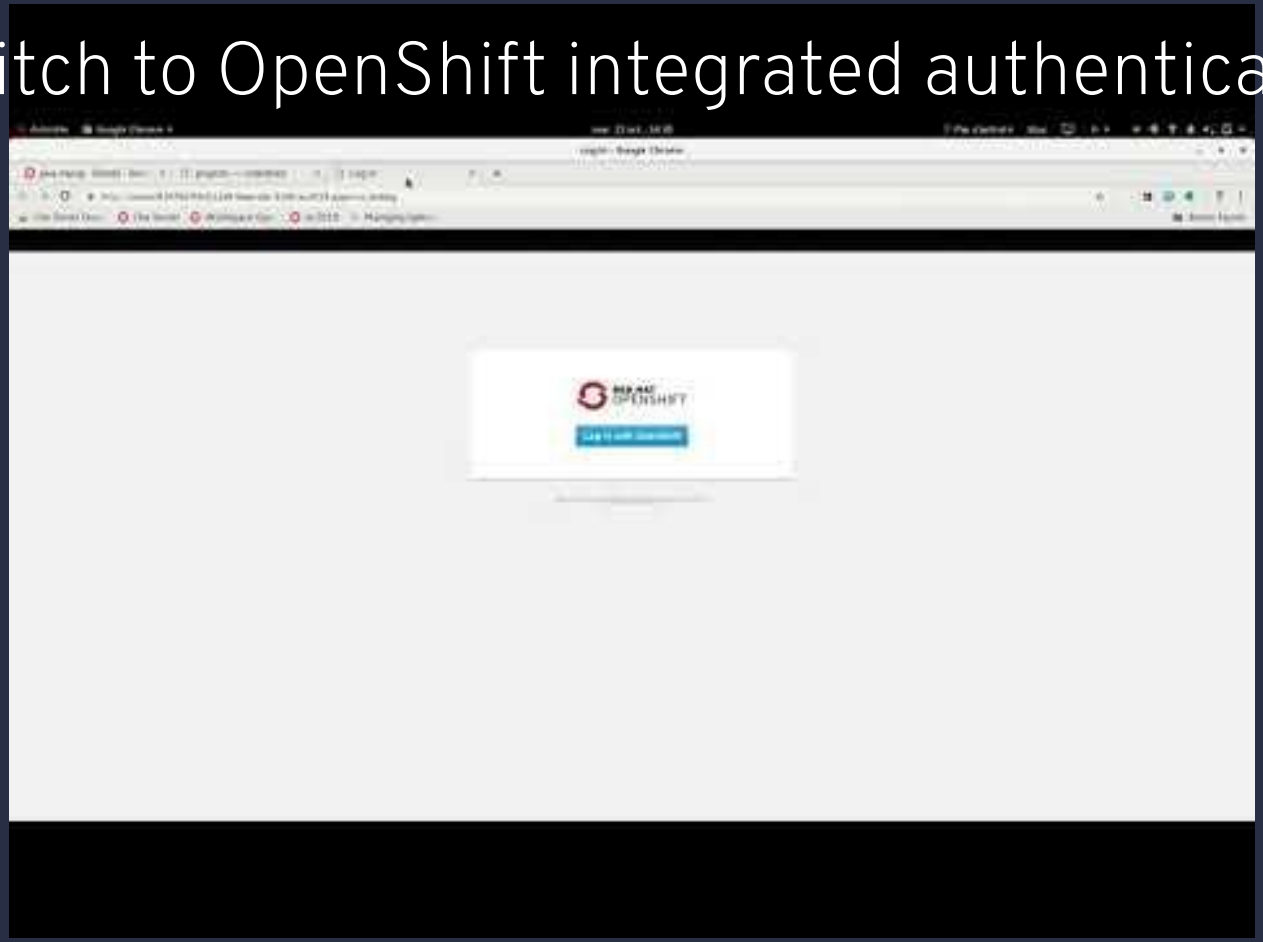

# Demo: Use OpenShift integrated authentication

- Restart the workspace with the openshift-oauth
- Show that it now requires authentication

# Why not make it even more extensible

Same design principle could be applied to other areas

## Authorization

- ➥ Delegate to RBAC, ABAC, ...

## Network access

- ➥ K8S Ingresses, Openshift Routes, ISTIO (to trace workspace internals ?)

## Even deployment mode

- ➥ KNative for scale-to-zero workspaces ?

# Finally,
# all that fuss for what ?

# Why would we continue this way ?

- Because we like kubectl ?
- Only to allow quick setup of personal, standalone Che workspace ?
- For the fun ?
- To be trendy ?

## NOT ONLY

There are **important stakes** behind this new way of creating Che workspaces

And obviously **benefits for the overall Che solution**

# Big enabler for the future of Che overall

**No external central components required, apart from Kubernetes ones**

- Makes it easy to **integrate** and to **manage**
- Allows **saving resources**

**Use Kubernetes design-patterns from the ground**

- Enables **Massive Scalability**
- Opens the **Kubernetes ecosystem** to Che
- Unlocks **Devfile Extensibility** through **custom components**

# Why would we continue this way ?

**In order to**

Enable the **widest spread of Che workspaces**

Throughout **all sorts of Kubernetes infrastructures** and flavors and

Inside **all sorts of software contexts** running on Kubernetes

**While**

Reducing their overall **management and maintenance burden**

**And**

Improving **scalability and performance**

That would be worth it to make Che even more Kube-native

# Questions ?

# Thank You