AU: 2024/2025

PROJECT

ARIR86 - Delivery Management, Devops et Pipeline

RS1-RS2-RS3

Créer un Pipeline CI/CD DevOps Localement

GitHub, Jenkins, Maven, SonarQube, Docker, DockerHub, ArgoCD, Helm, Kubernetes, Prometheus, Grafana, Filebeat, OpenSearch, et Kibana

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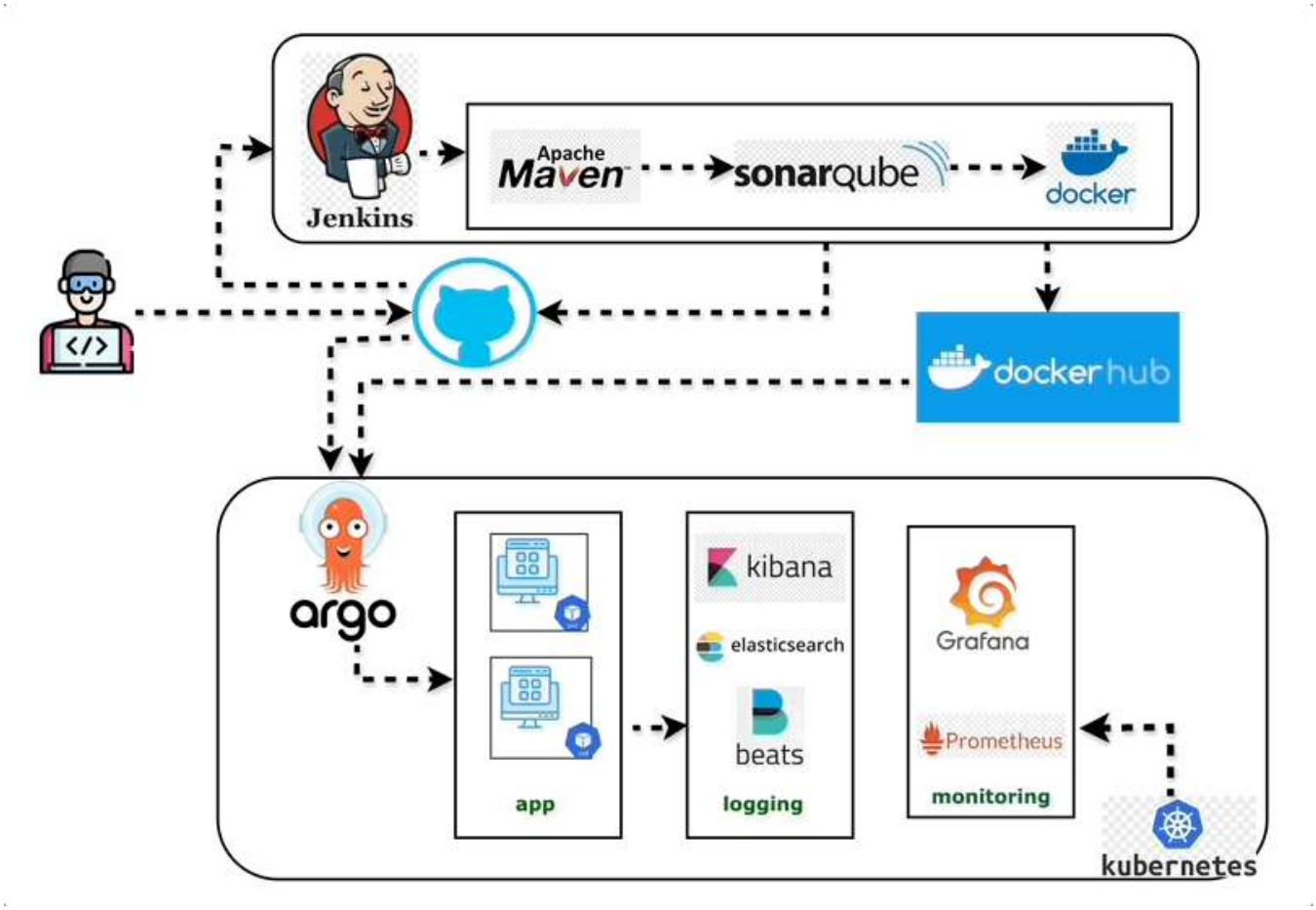


Objectifs généraux :

- Construire un pipeline CI/CD complet dans un environnement local, en intégrant divers outils DevOps pour automatiser les processus de développement et de déploiement des applications.

- Comprendre et utiliser les principaux outils DevOps tels que GitHub, Jenkins, Maven, SonarQube, Docker, DockerHub, ArgoCD, Helm, Kubernetes, Prometheus, Grafana, Filebeat, OpenSearch et Kibana, en les configurant pour qu'ils fonctionnent ensemble de manière transparente au sein d'un pipeline CI/CD.

Présentation du projet

Ce projet implémente un pipeline DevOps CI/CD complet dans un environnement local. La partie CI est implémentée avec Docker et Docker Compose, offrant des environnements isolés pour Jenkins, SonarQube et d'autres outils nécessaires. DockerHub sert de registre de conteneurs pour la gestion des images Docker. Pour l'analyse de la qualité du code et la gestion des builds, Maven et SonarQube sont intégrés à Jenkins, garantissant un processus d'intégration continue fluide et efficace.

La partie CD est gérée par Kubernetes exécuté dans Minikube, permettant une orchestration locale des conteneurs. Le déploiement sur Kubernetes est automatisé grâce à ArgoCD, ce qui facilite les déploiements et les retours en arrière. La surveillance et la journalisation sont assurées par Prometheus, Grafana, Filebeat, OpenSearch et Kibana, tous installés via des charts Helm pour une configuration simplifiée. Cette configuration offre des capacités complètes d'observabilité et de journalisation, idéales pour tester de nouvelles fonctionnalités et des correctifs.

Prérequis :

Avant de commencer ce projet DevOps CI/CD, assurez-vous que les outils suivants sont installés et correctement configurés :

- **Docker** : Pour la conteneurisation.
- **Docker Compose** : Pour gérer des applications multi-conteneurs.
- **DockerHub** : pour stocker et gérer les images Docker.
- **kubectl** : pour interagir avec le cluster Kubernetes.
- **Minikube** : Pour mettre en place un environnement Kubernetes local.
- **Helm** : pour gérer les applications Kubernetes.
- **Git** : Pour le contrôle de version.
- **ArgoCD CLI** : (facultatif) pour gérer les déploiements via la ligne de commande.
- **Compte GitHub** : pour la gestion du référentiel.

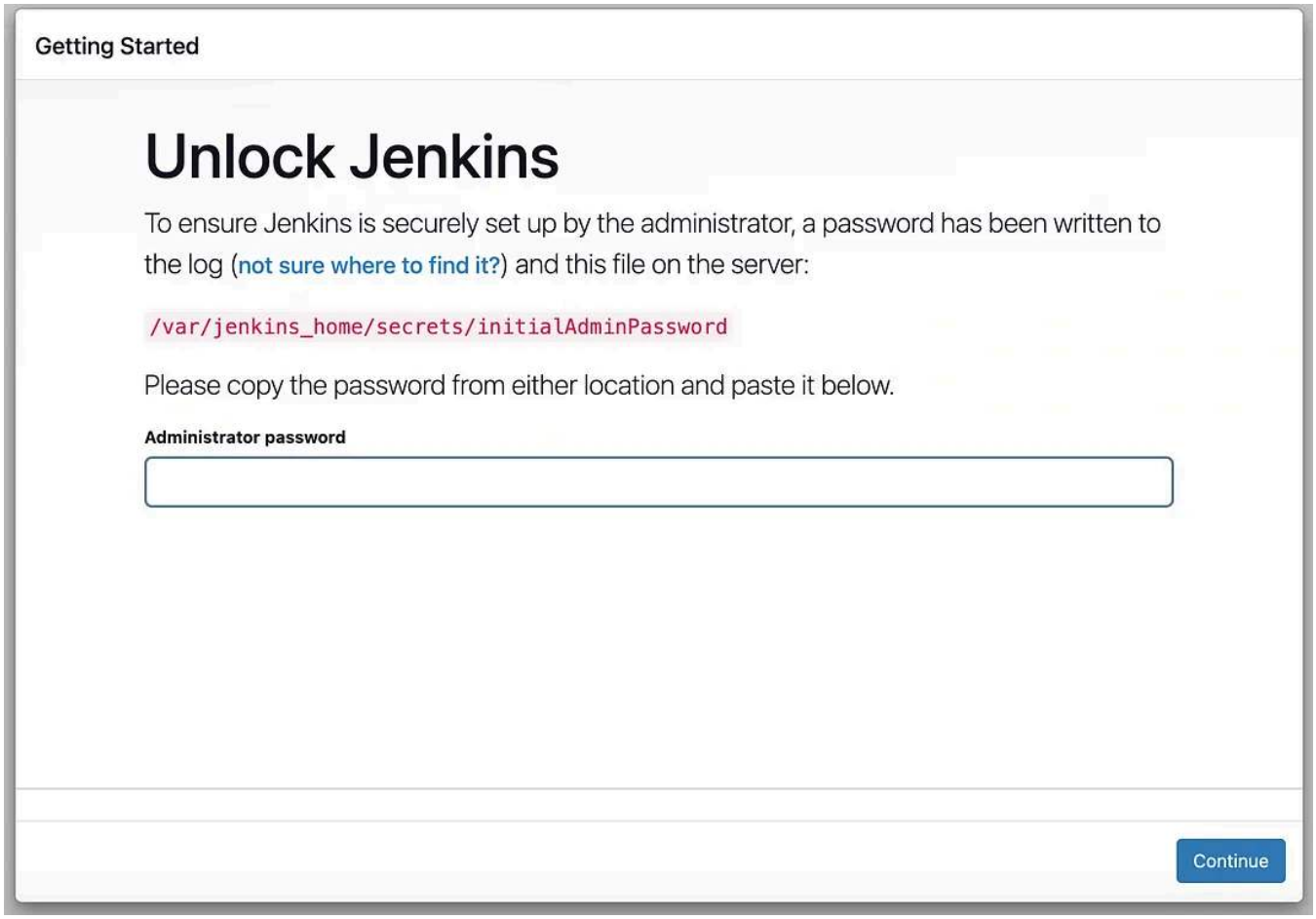
Étapes de mise en œuvre :

0. Installez sur votre VM les outils DevOps via le script dans ce guide:
https://github.com/abdelbaki-bouzaienne/devops-demo-project/blob/main/Preparation-script-devops-tools.md
1. **Fork et clonez le dépôt Git ci-dessous**
https://github.com/abdelbaki-bouzaienne/devops-demo-project

2. **Ouvrez le terminal, accédez au répertoire du projet et utilisez docker-compose pour afficher l'environnement CI :**

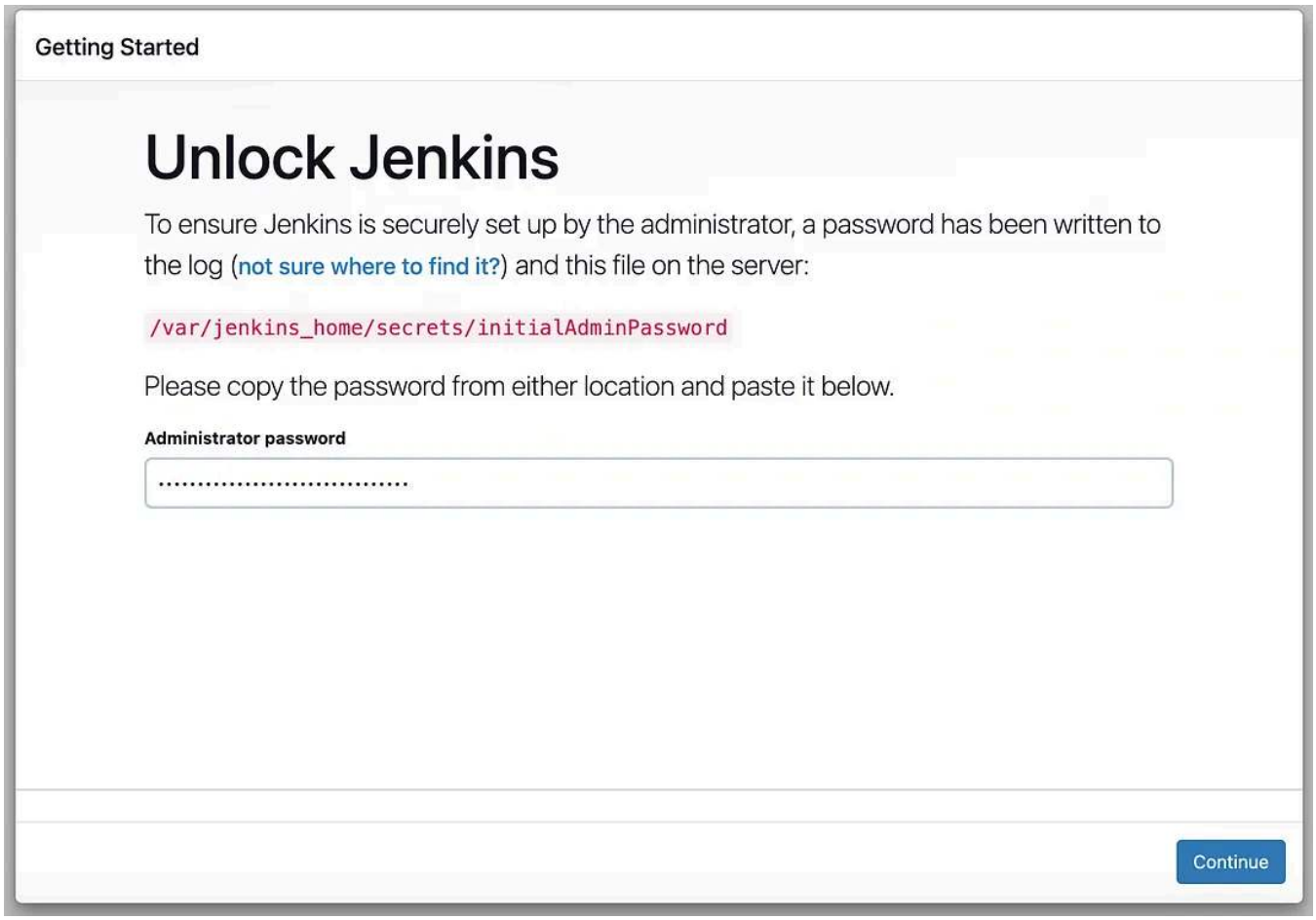
```
cd devops-demo-project/ci
docker-compose up -d
```

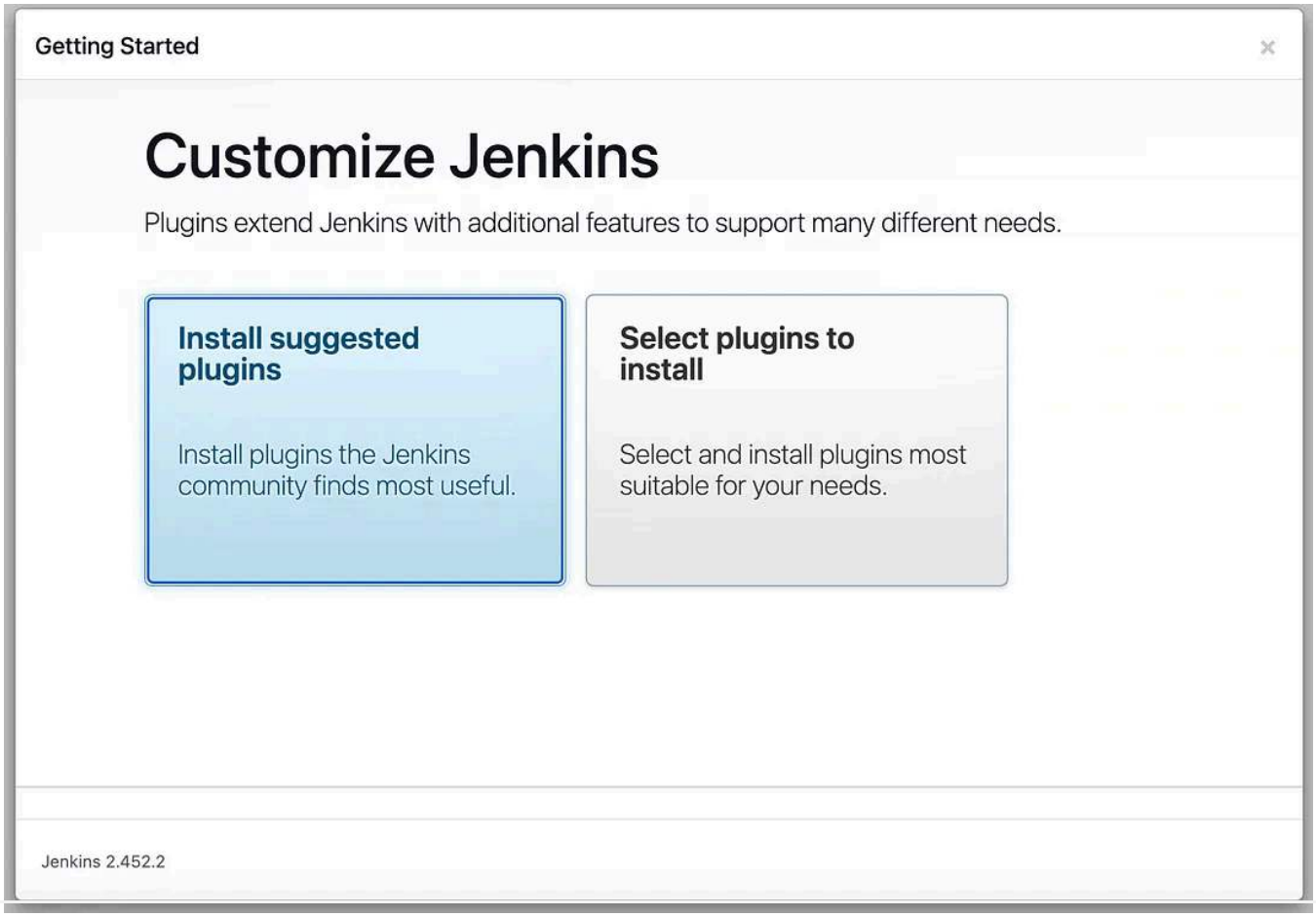
3. **Ouvrez l'URL ci-dessous pour accéder à Jenkins :**
http://localhost:8010/

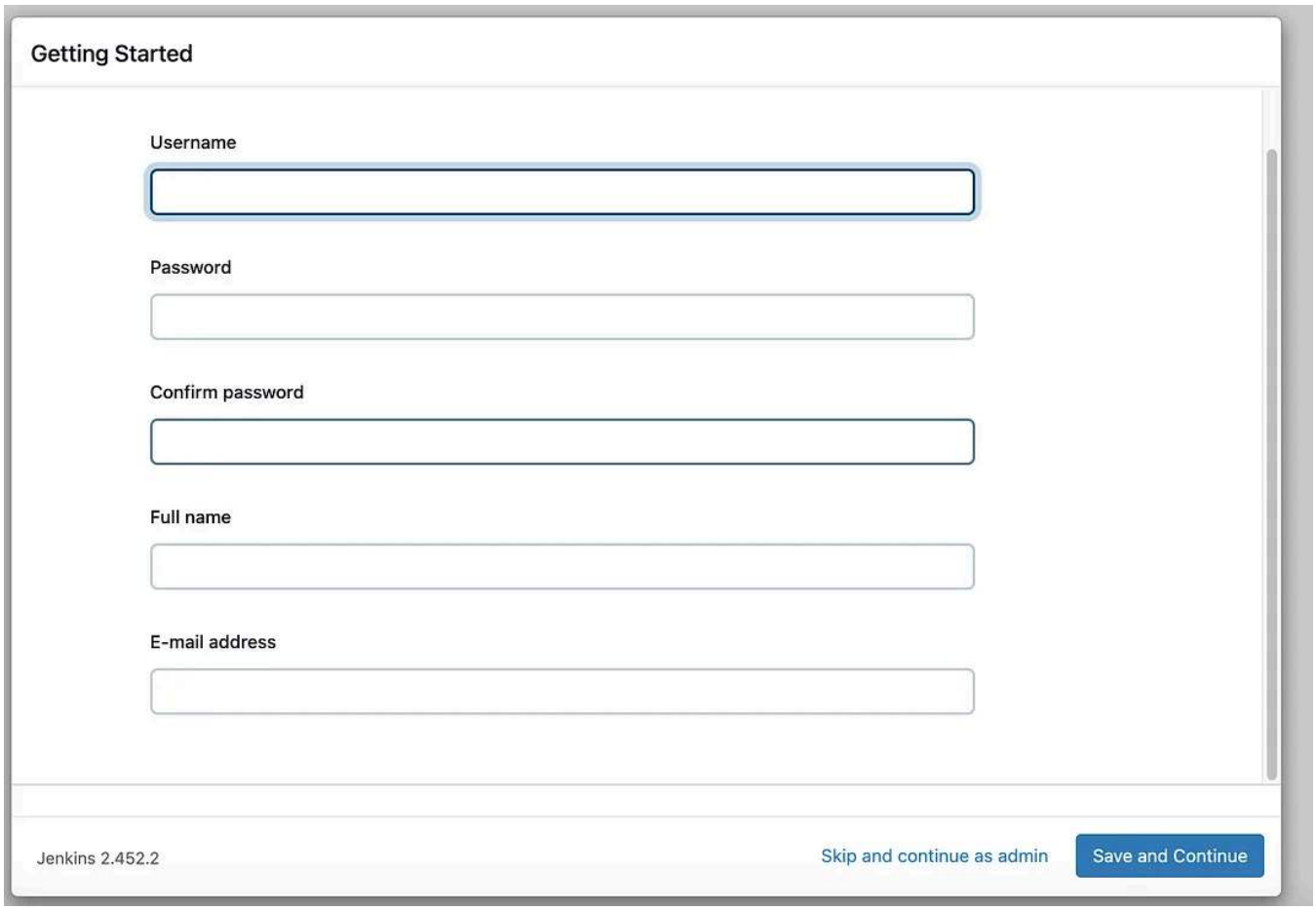


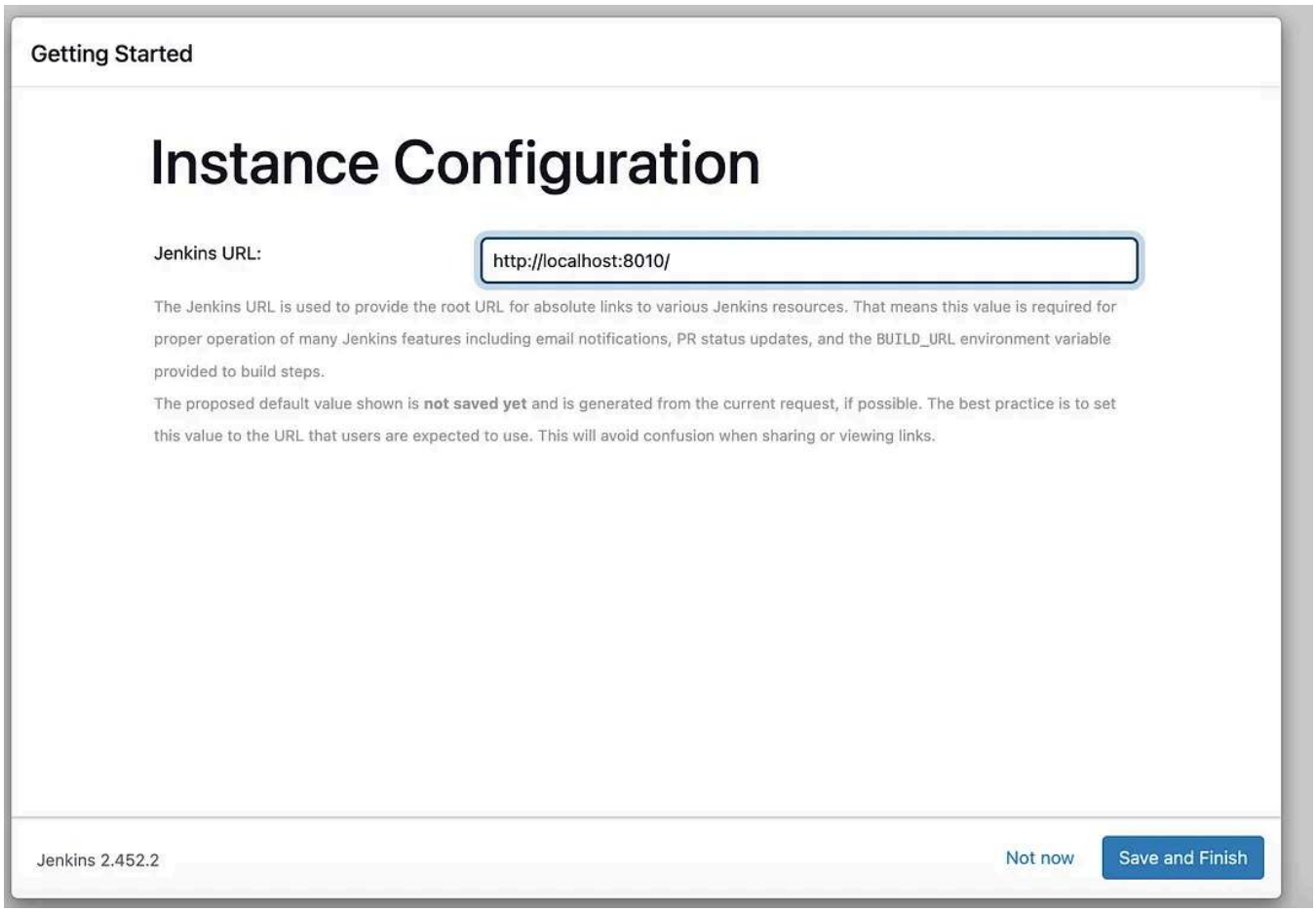
4. **Accédez au mot de passe Jenkins, connectez-vous et installez les plugins suggérés :**

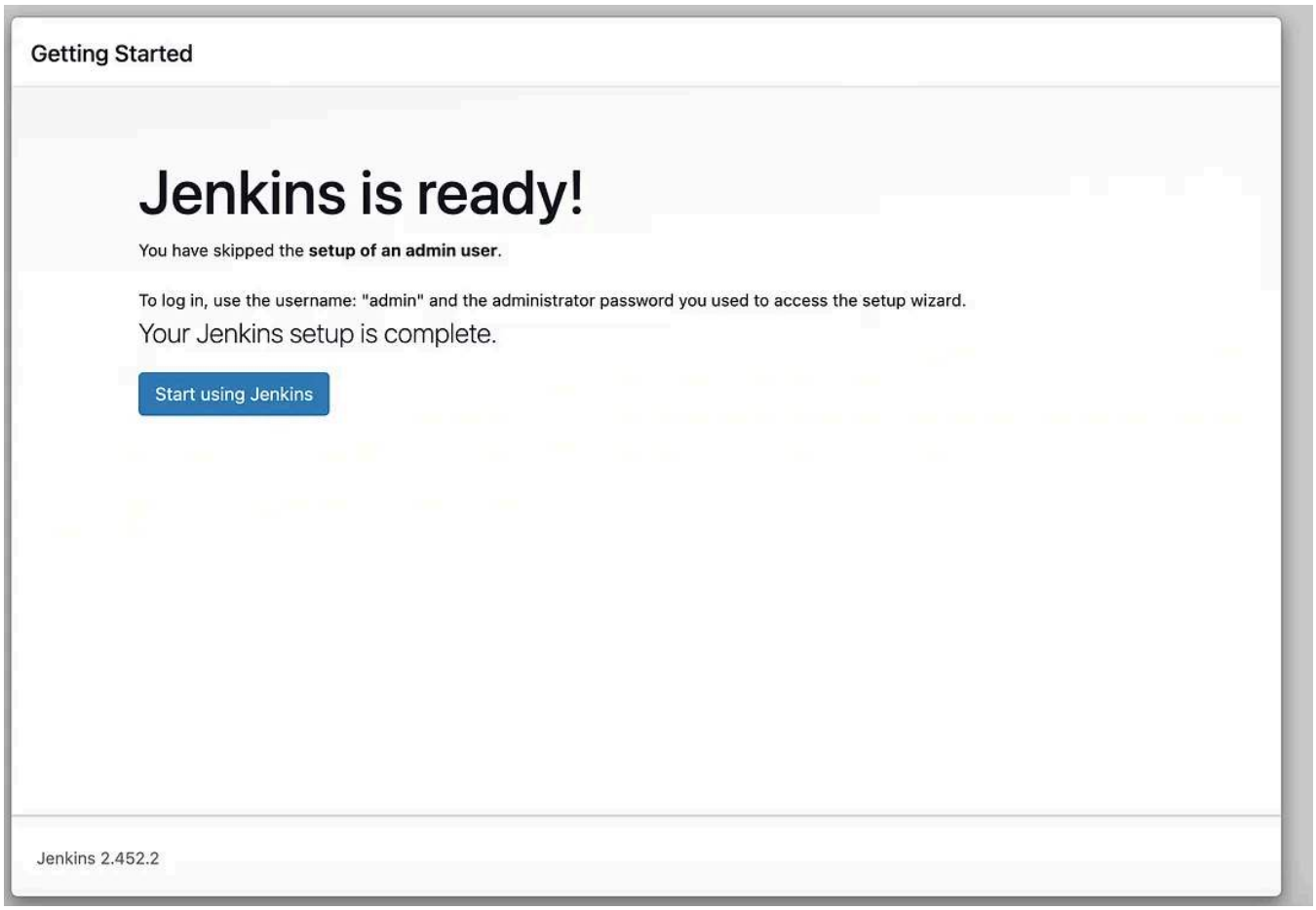
```
docker ps
docker exec -it jenkins bin/bash
cat /var/jenkins_home/secrets/initialAdminPassword
```

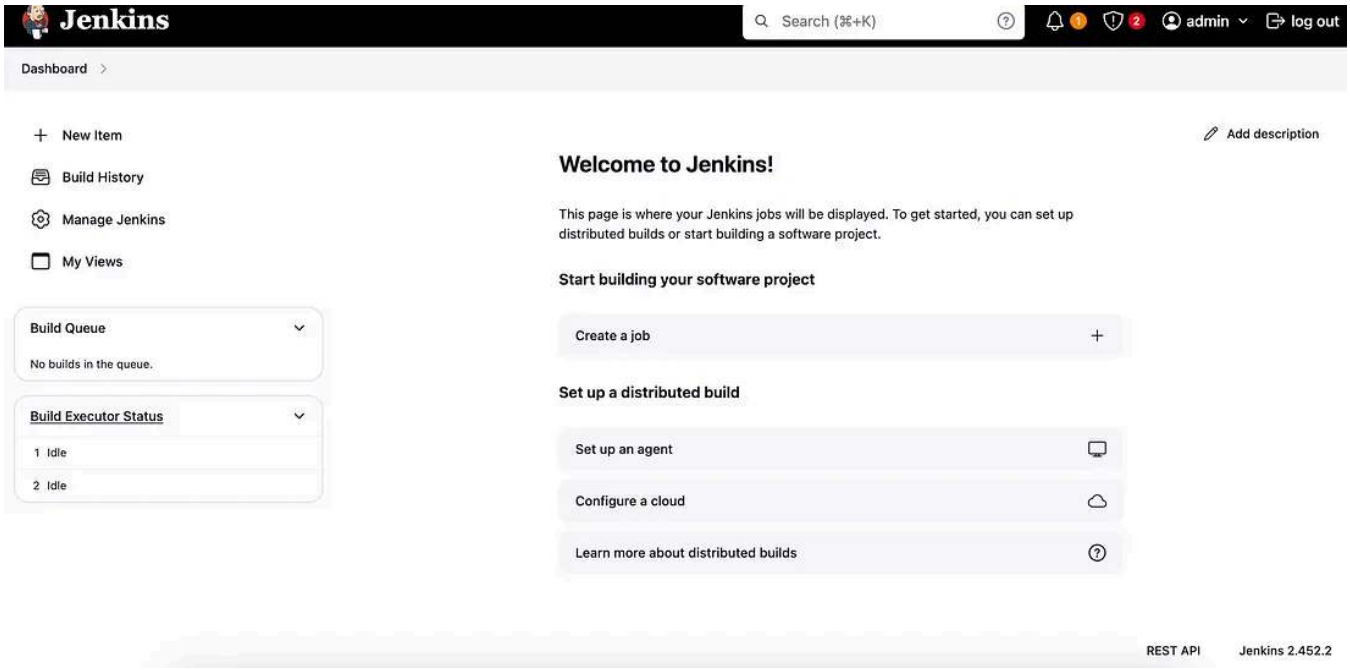

Getting Started
Unlock Jenkins
To ensure Jenkins is securely set up by the administrator, a password has been written to the log (not sure where to find it?) and this file on the server:
/var/jenkins_home/secrets/initialAdminPassword
Please copy the password from either location and paste it below.
Administrator password
Continue


Getting Started
Customize Jenkins
Plugins extend Jenkins with additional features to support many different needs.
Install suggested plugins
Install plugins the Jenkins community finds most useful.
Select plugins to install
Select and install plugins most suitable for your needs.
Jenkins 2.452.2

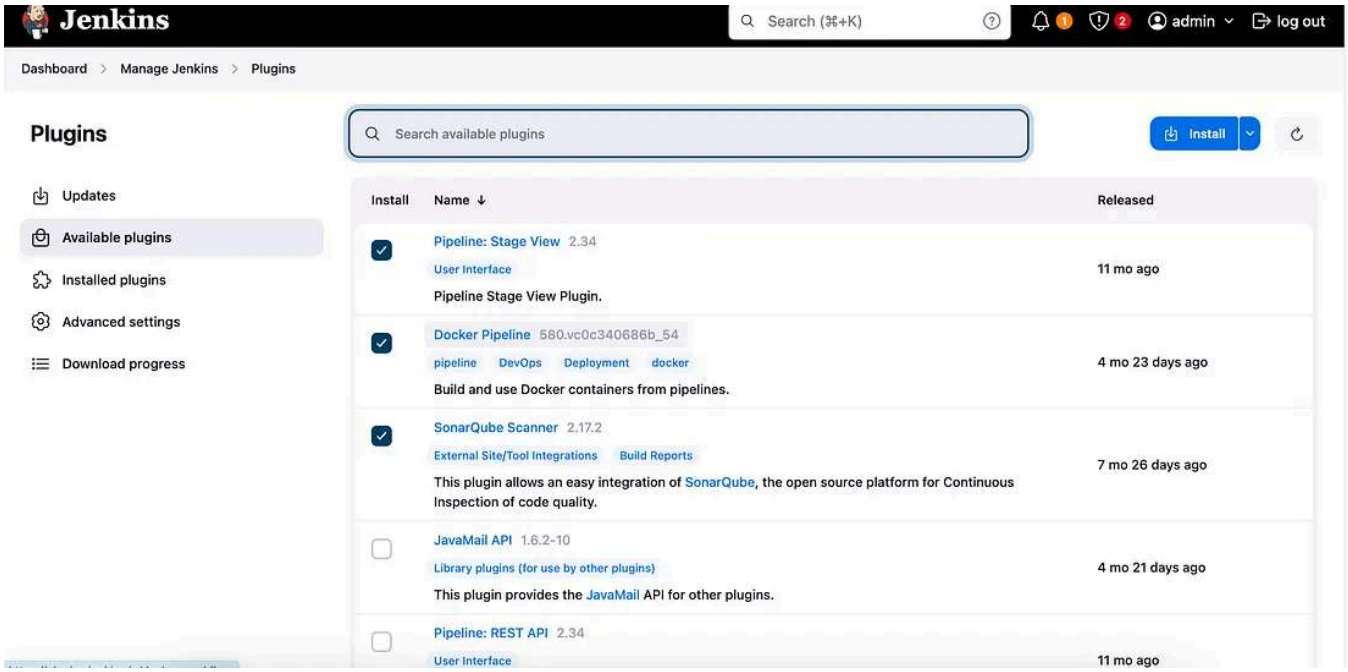

Getting Started
Username
Password
Confirm password
Full name
E-mail address
Jenkins 2.452.2
Skip and continue as admin
Save and Continue

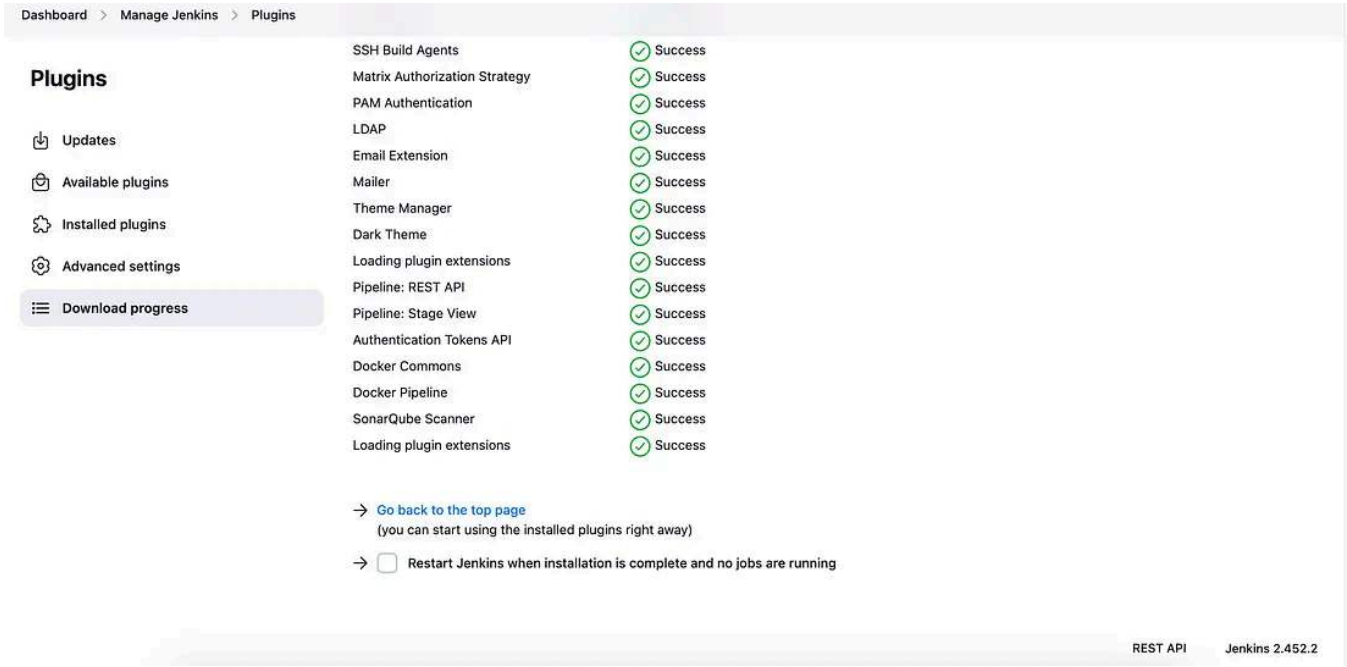

Getting Started
Instance Configuration
Jenkins URL:
http://localhost:8010/
The Jenkins URL is used to provide the root URL for absolute links to various Jenkins resources. That means this value is required for proper operation of many Jenkins features including email notifications, PR status updates, and the BUILD_URL environment variable provided to build steps.
The proposed default value shown is not saved yet and is generated from the current request, if possible. The best practice is to set this value to the URL that users are expected to use. This will avoid confusion when sharing or viewing links.
Jenkins 2.452.2
Not now
Save and Finish





5. **Installez les plugins suggérés ci-dessous et redémarrez le conteneur Jenkins :**



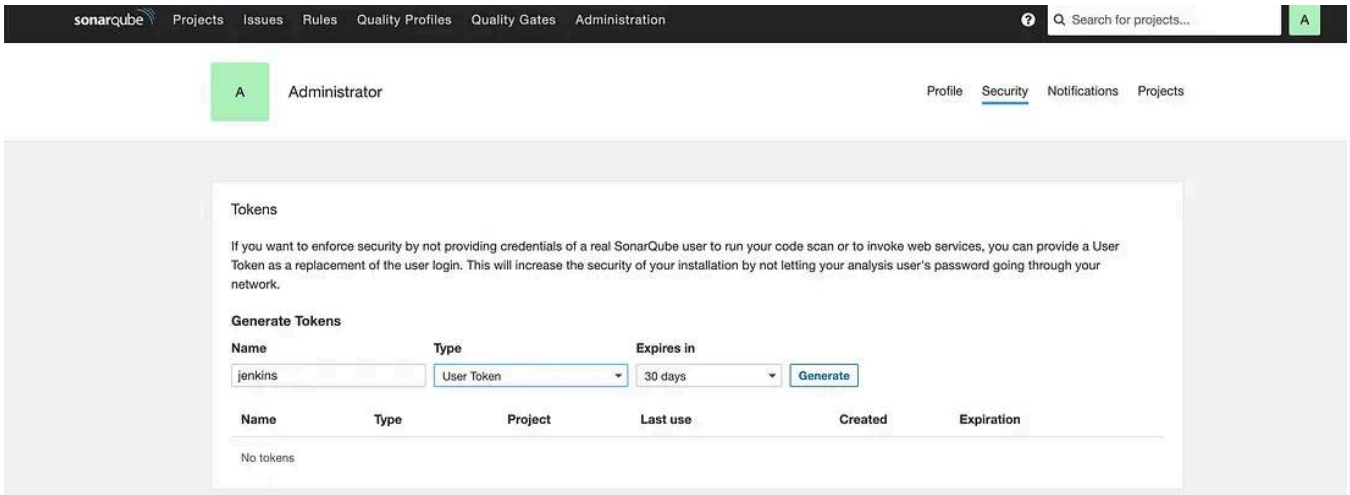


6. **Ouvrez SonarQube en utilisant l'URL ci-dessous et créez un jeton :**

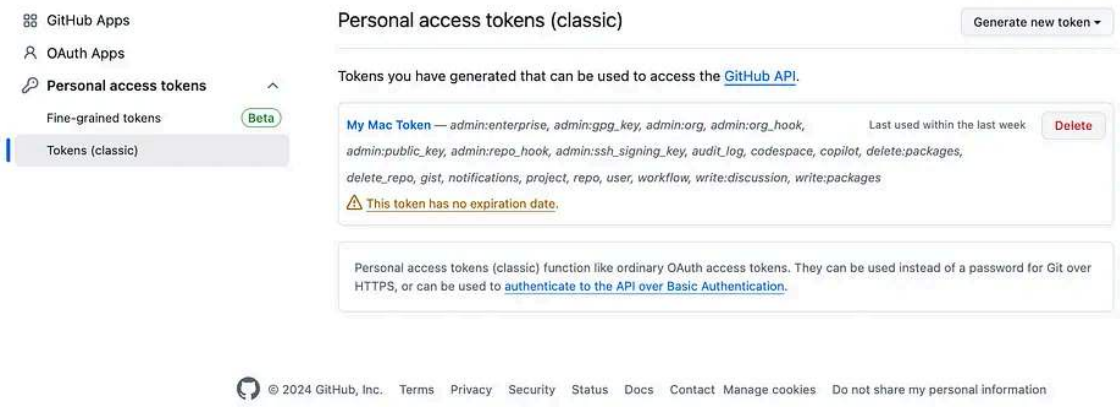
http://localcalhost:9000

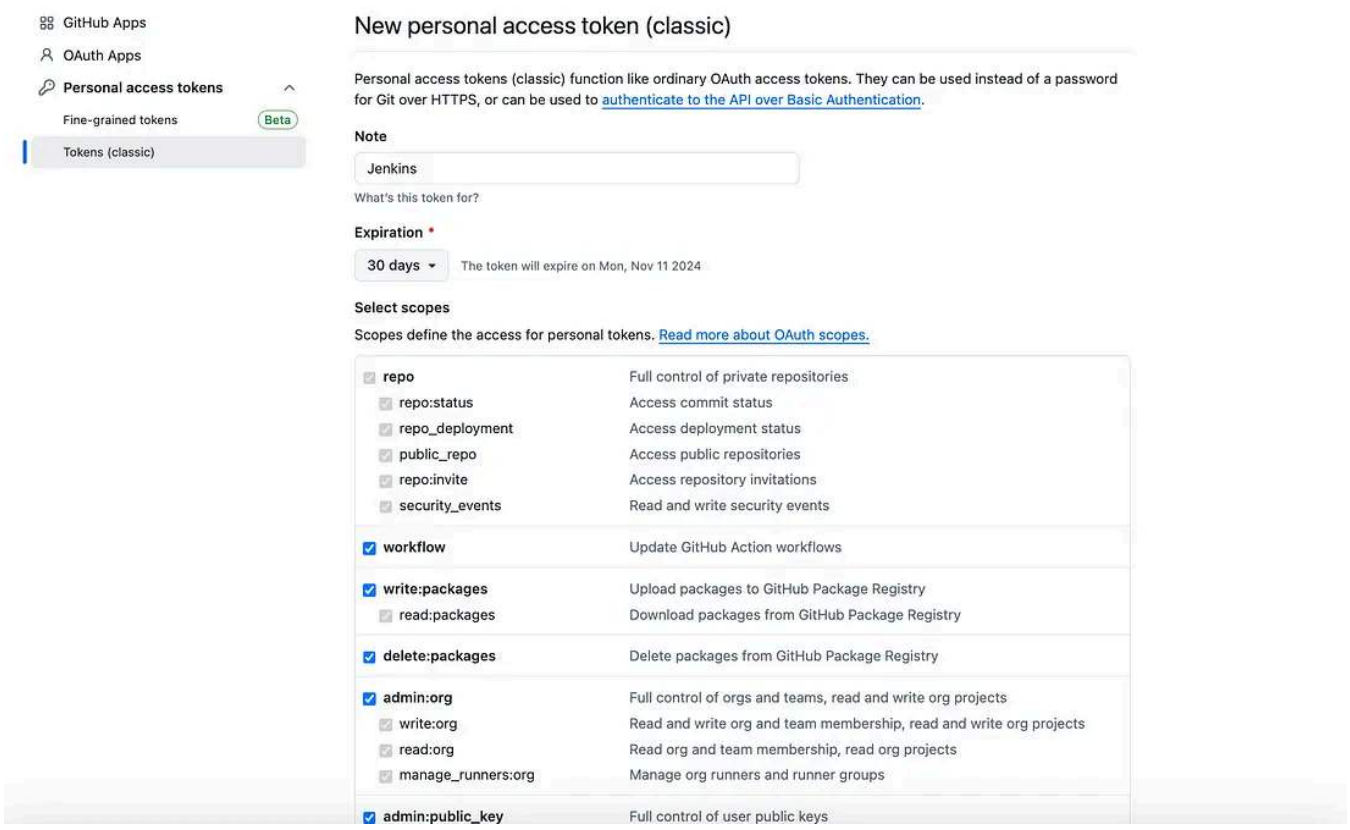
nom d'utilisateur : admin

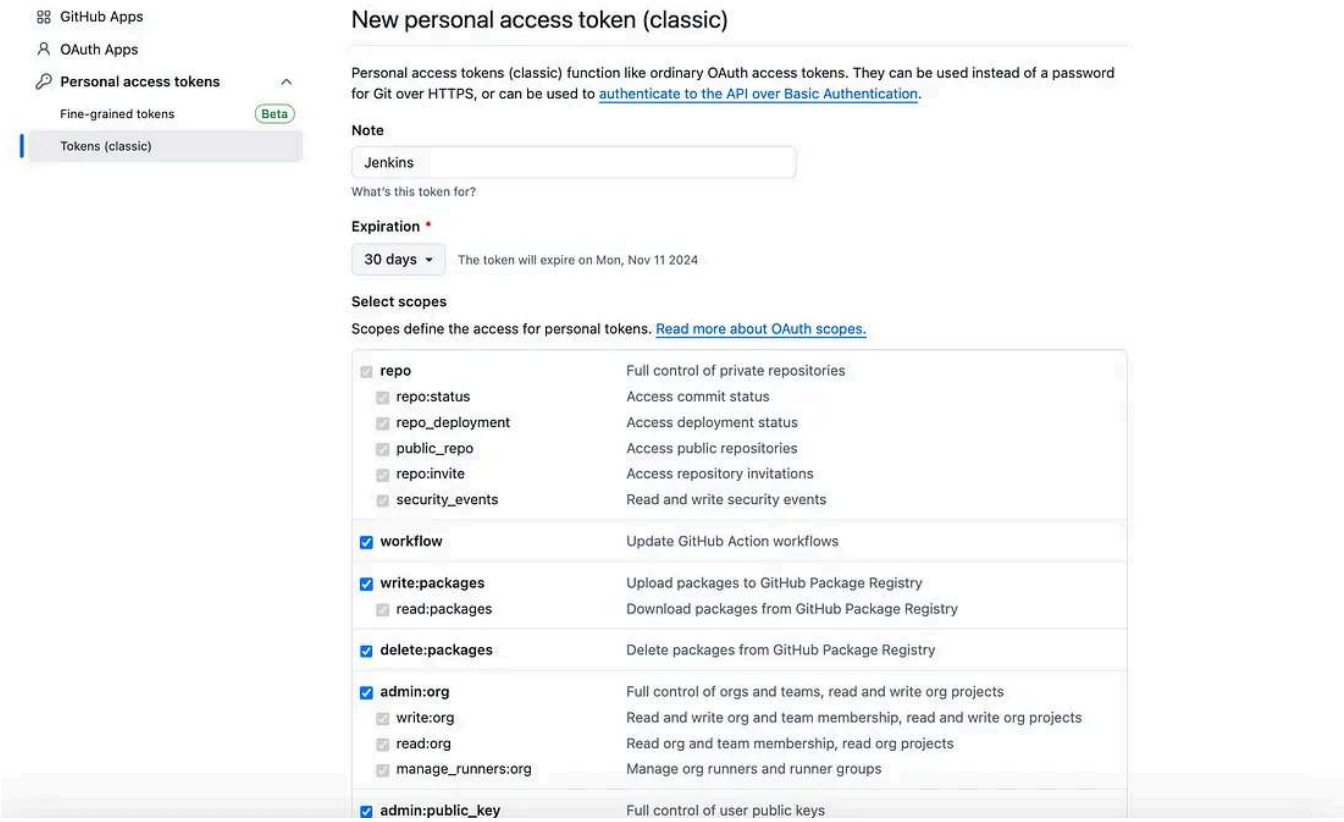
mot de passe : admin



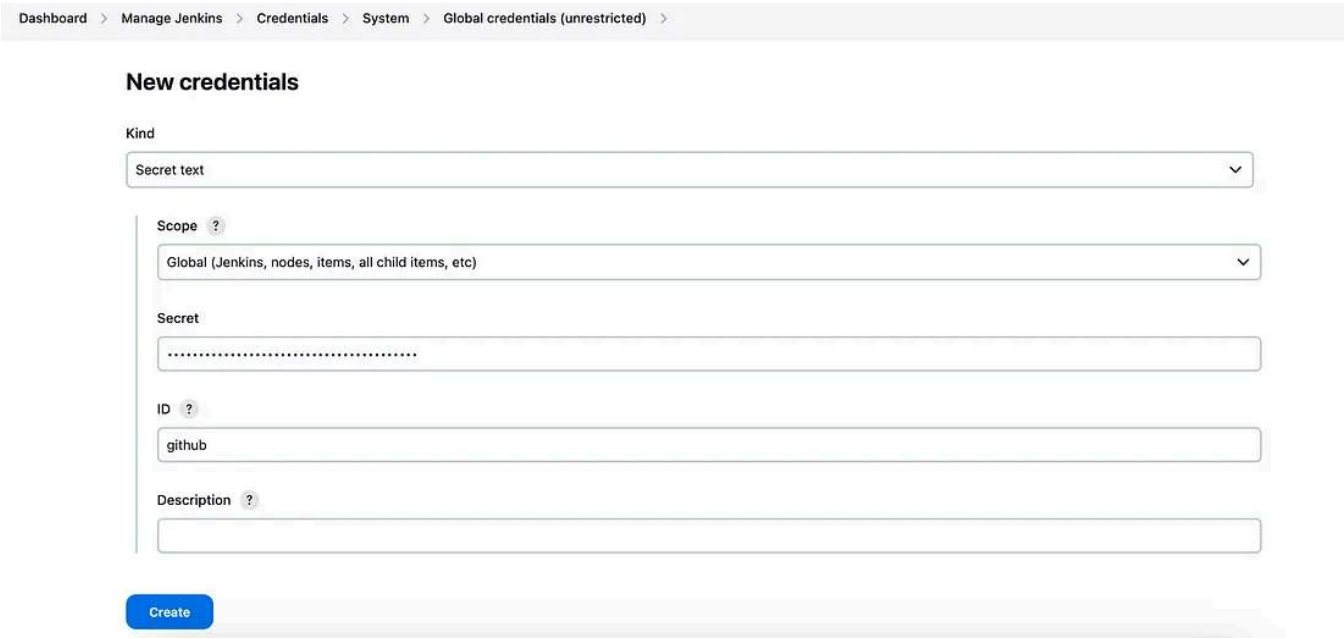
7. Connectez-vous à votre compte GitHub et générez un jeton d'accès personnel :

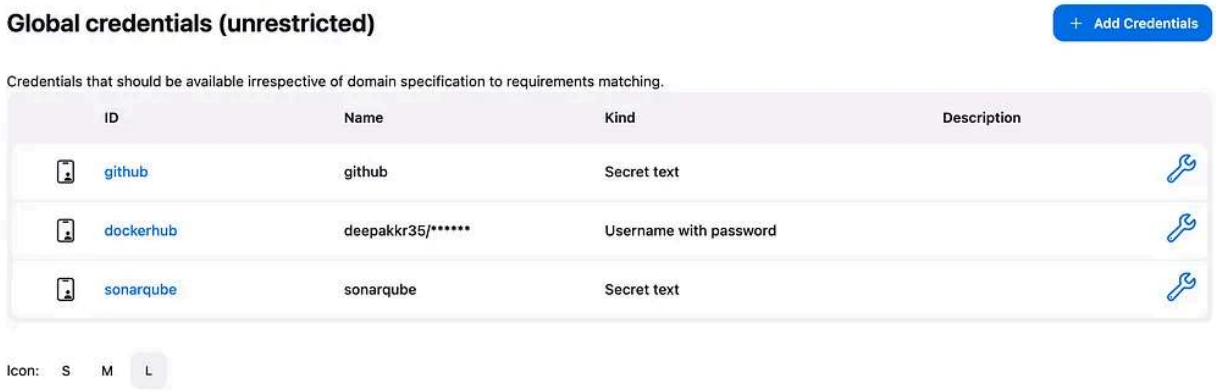




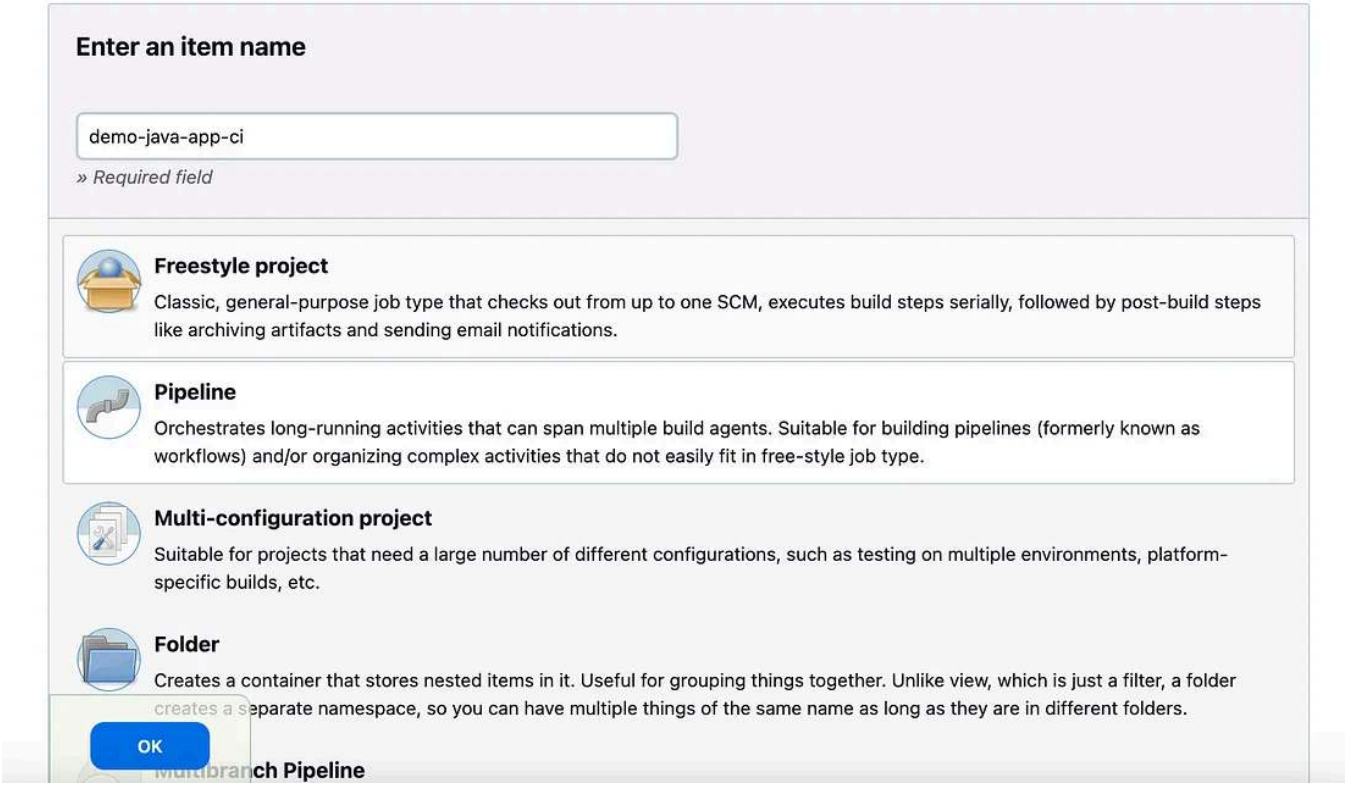


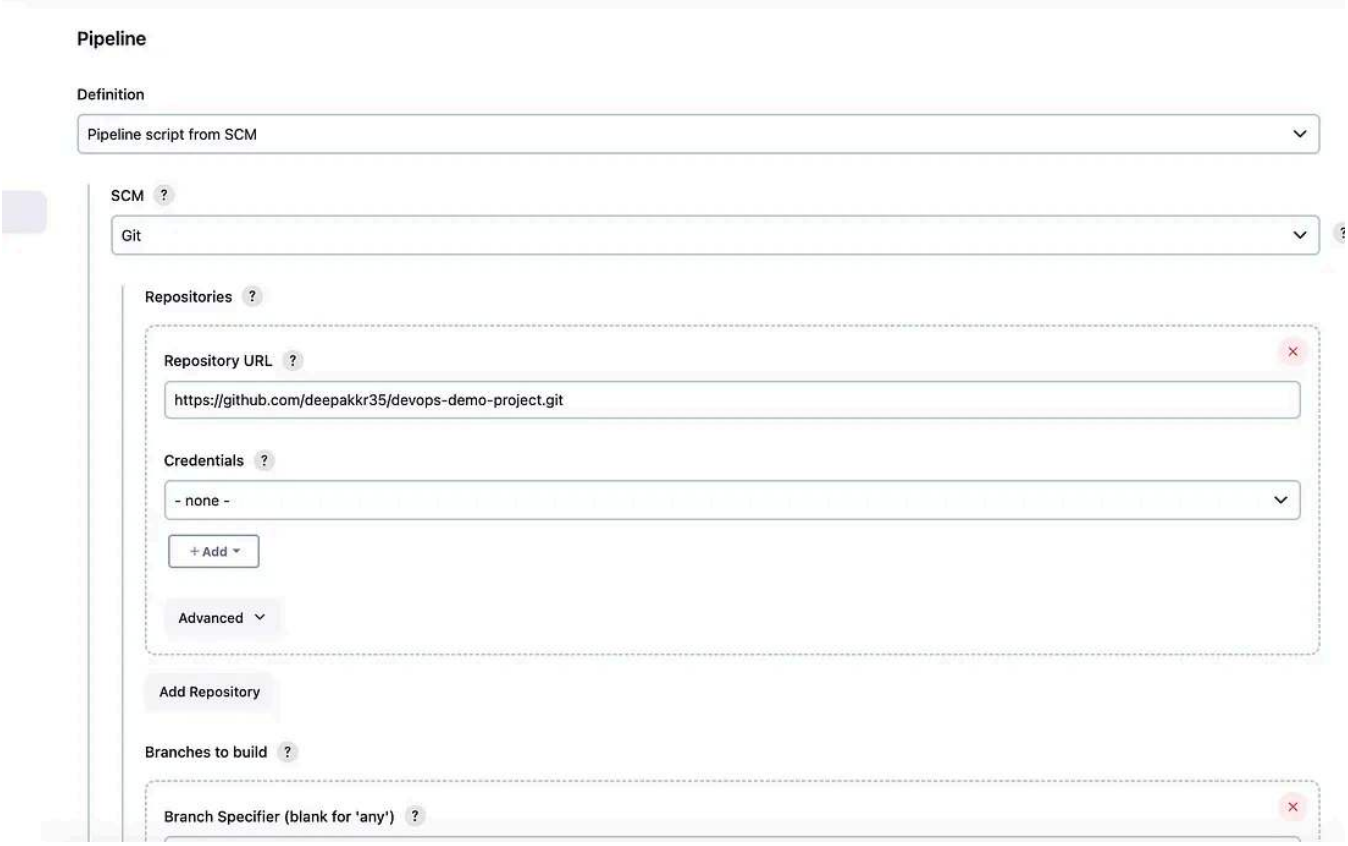
8. Add credentials for GitHub and SonarQube using secret text and DockerHub using username with password:

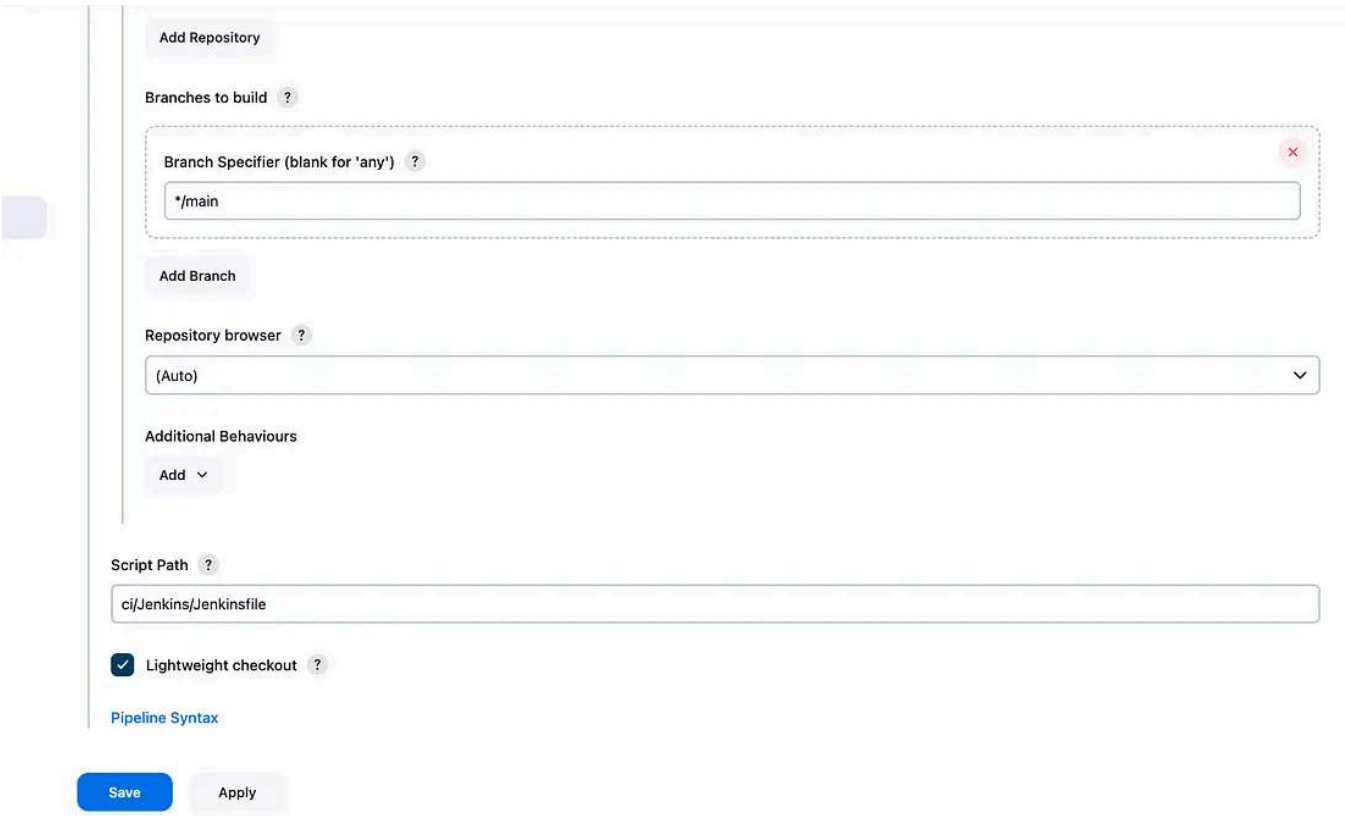




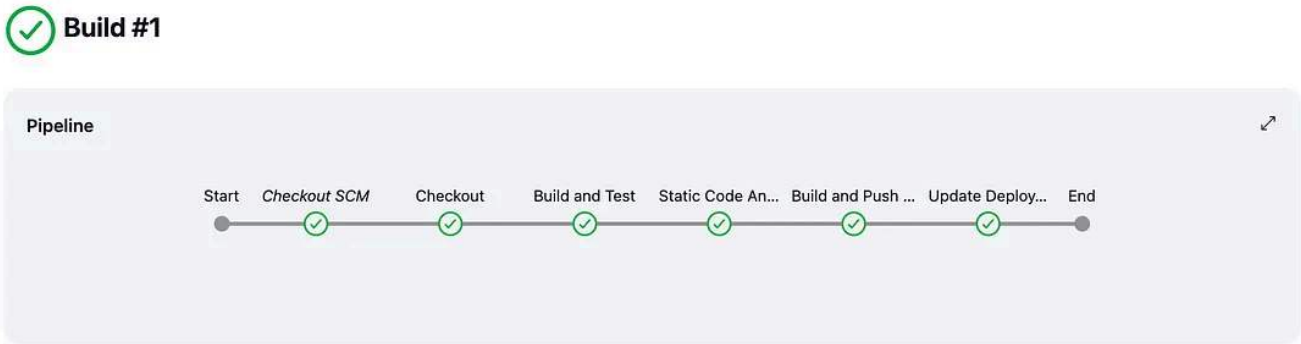
9. Login to Jenkins and create new item:

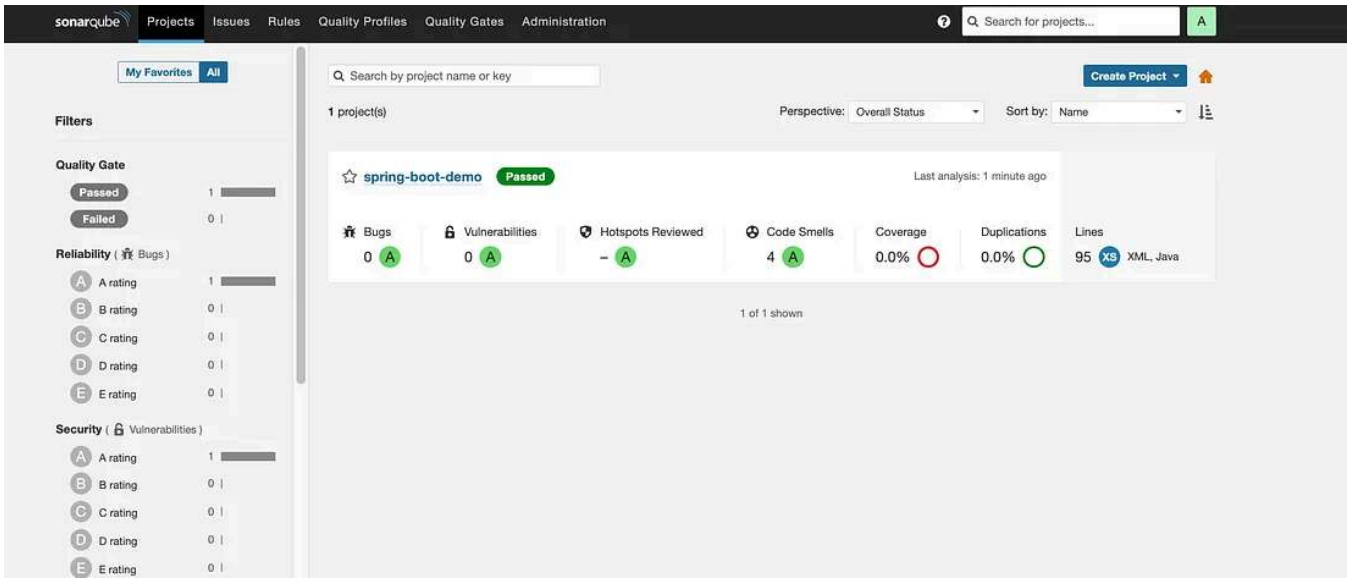

Enter an item name
demo-java-app-ci
» Required field
Freestyle project
Classic, general-purpose job type that checks out from up to one SCM, executes build steps serially, followed by post-build steps like archiving artifacts and sending email notifications.
Pipeline
Orchestrates long-running activities that can span multiple build agents. Suitable for building pipelines (formerly known as workflows) and/or organizing complex activities that do not easily fit in free-style job type.
Multi-configuration project
Suitable for projects that need a large number of different configurations, such as testing on multiple environments, platform-specific builds, etc.
Folder
Creates a container that stores nested items in it. Useful for grouping things together. Unlike view, which is just a filter, a folder creates a separate namespace, so you can have multiple things of the same name as long as they are in different folders.
OK
Multibranch Pipeline


Pipeline
Definition
Pipeline script from SCM
SCM
Git
Repositories
Repository URL
https://github.com/deepakkr35/devops-demo-project.git
Credentials
- none -
+ Add
Advanced
Add Repository
Branches to build
Branch Specifier (blank for 'any')

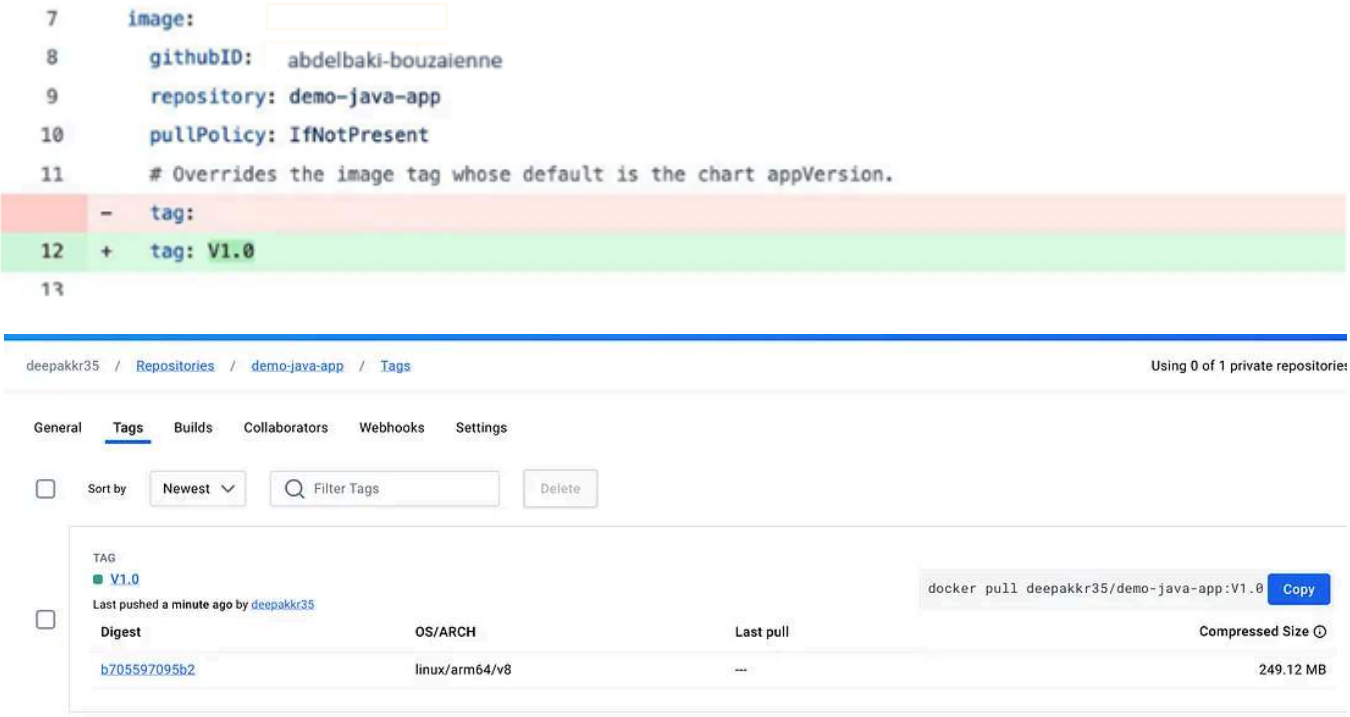


10. **Build the pipeline with V1.0 parameter:**





11. Docker image will be created and GitHub helm/app/values.yaml will be updated with appropriate tag:



12. **Start Kubernets cluster (Minikube) in docker driver mode:**

```
minikube start --driver=docker --cpus 4 --memory 10240
```

```
😄 minikube v1.33.1 on Darwin 14.6.1 (arm64)
✨ Using the docker driver based on user configuration
📌 Using Docker Desktop driver with root privileges
👍 Starting "minikube" primary control-plane node in "minikube" cluster
🚜 Pulling base image v0.0.44 ...
🔥 Creating docker container (CPUs=4, Memory=10240MB) ...
🐳 Preparing Kubernetes v1.30.0 on Docker 26.1.1 ...
    ▪ Generating certificates and keys ...
    ▪ Booting up control plane ...
    ▪ Configuring RBAC rules ...
🔗 Configuring bridge CNI (Container Networking Interface) ...
🔎 Verifying Kubernetes components...
    ▪ Using image gcr.io/k8s-minikube/storage-provisioner:v5
🌟 Enabled addons: storage-provisioner, default-storageclass
🏄 Done! kubectl is now configured to use "minikube" cluster and "default" namespace by default
```

13. **Create namespaces for installing application, logging and monitoring:**

```
kubectl create ns app
kubectl create ns logging
kubectl create ns monitoring
```

14. **Edit app namespace and add following label for ArgoCD:**

```
kubectl edit ns app
```

```
labels:
  kubernetes.io/metadata.name: app
  argocd.argoproj.io/managed-by: argocd
```

15. **Install Graphana and Promotheus in monitoring namespce using Helm:** (port-forward is required to access UI, as minikube is running in Docker driver mode)

```
(voir sur teams)
```

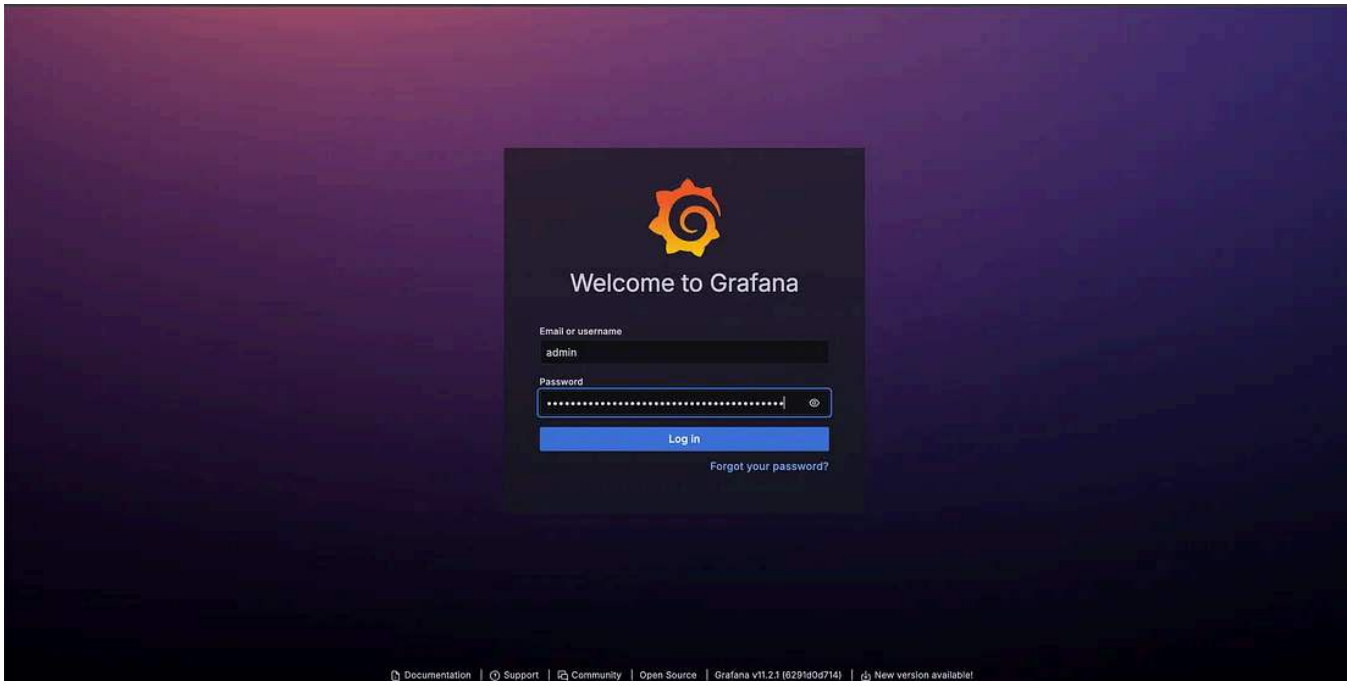
```
helm repo add prometheus-community https://prometheus-community.github.io/helm-charts

helm install prometheus prometheus-community/prometheus -n monitoring
kubectl port-forward service/prometheus-server 9030:80 -n monitoring
```

http://localhost:9030/

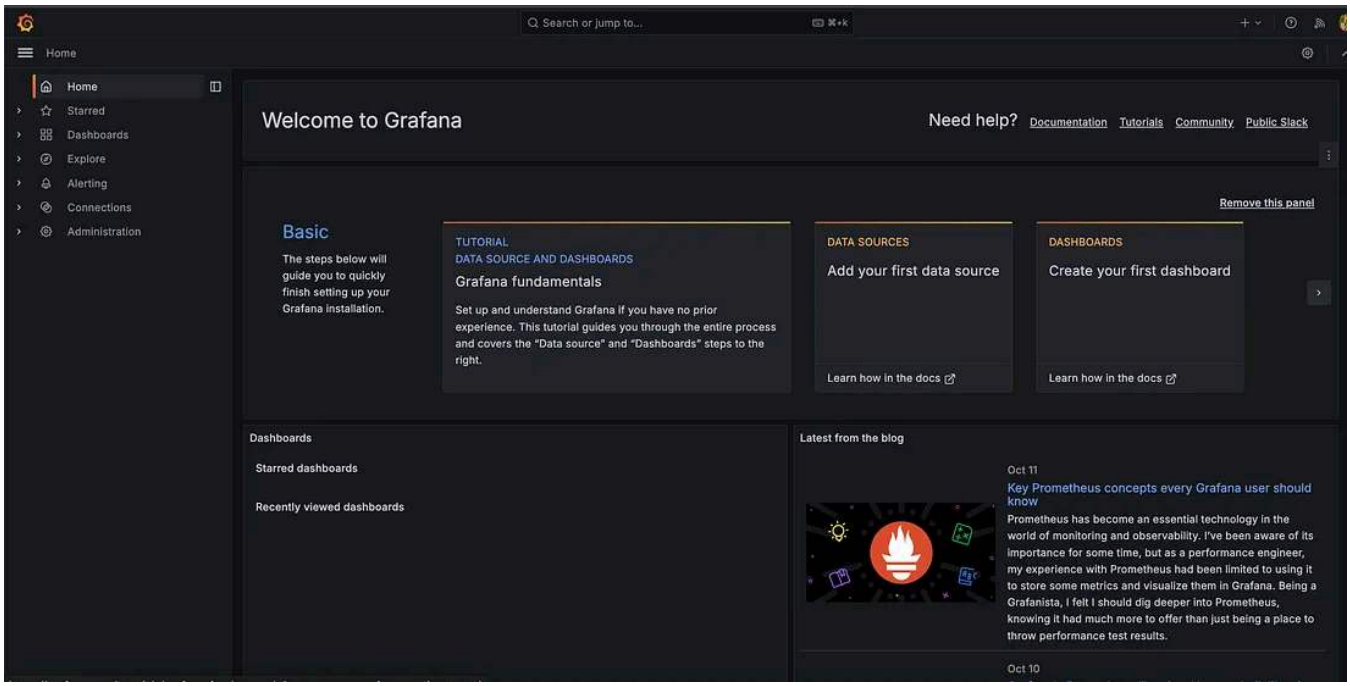
(voir sur teams)

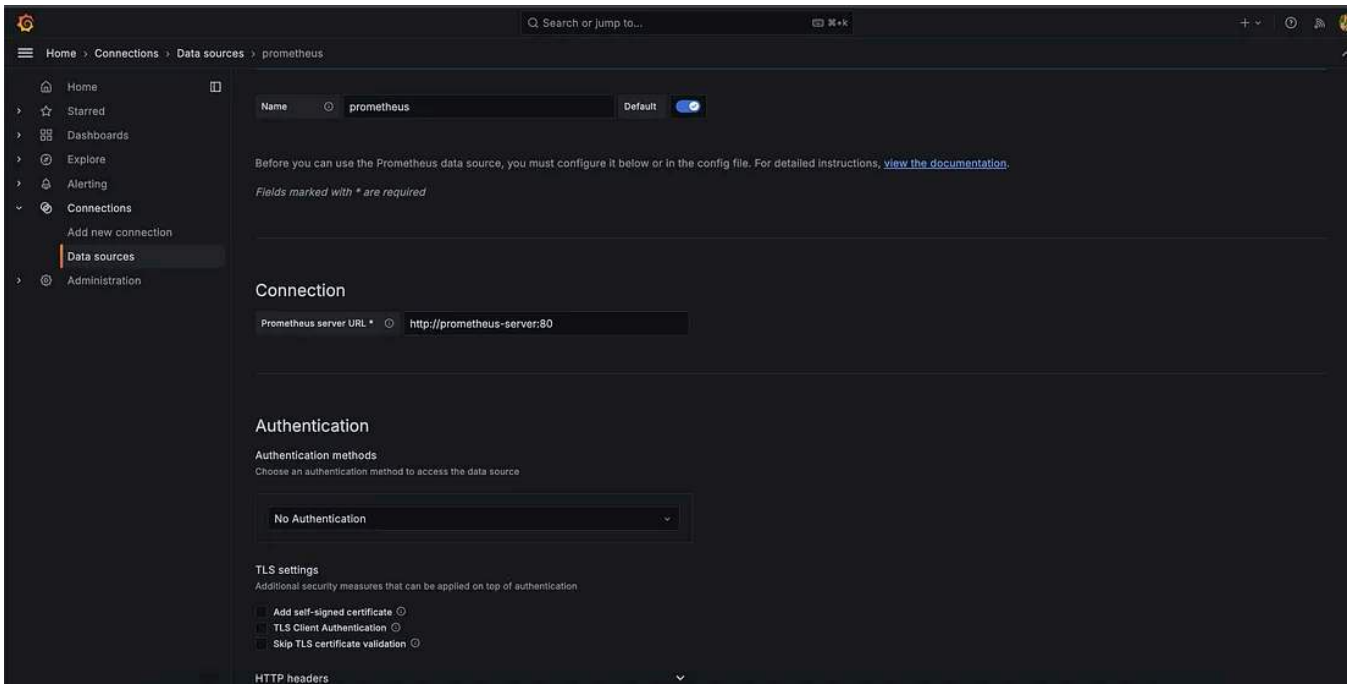
```
helm repo add grafana https://grafana.github.io/helm-charts
helm install grafana grafana/grafana -n monitoring

kubectl get secret --namespace monitoring grafana -o jsonpath="{.data.admin-password}" | base64
--decode ; echo

kubectl port-forward service/grafana 9040:80 -n monitoring
```

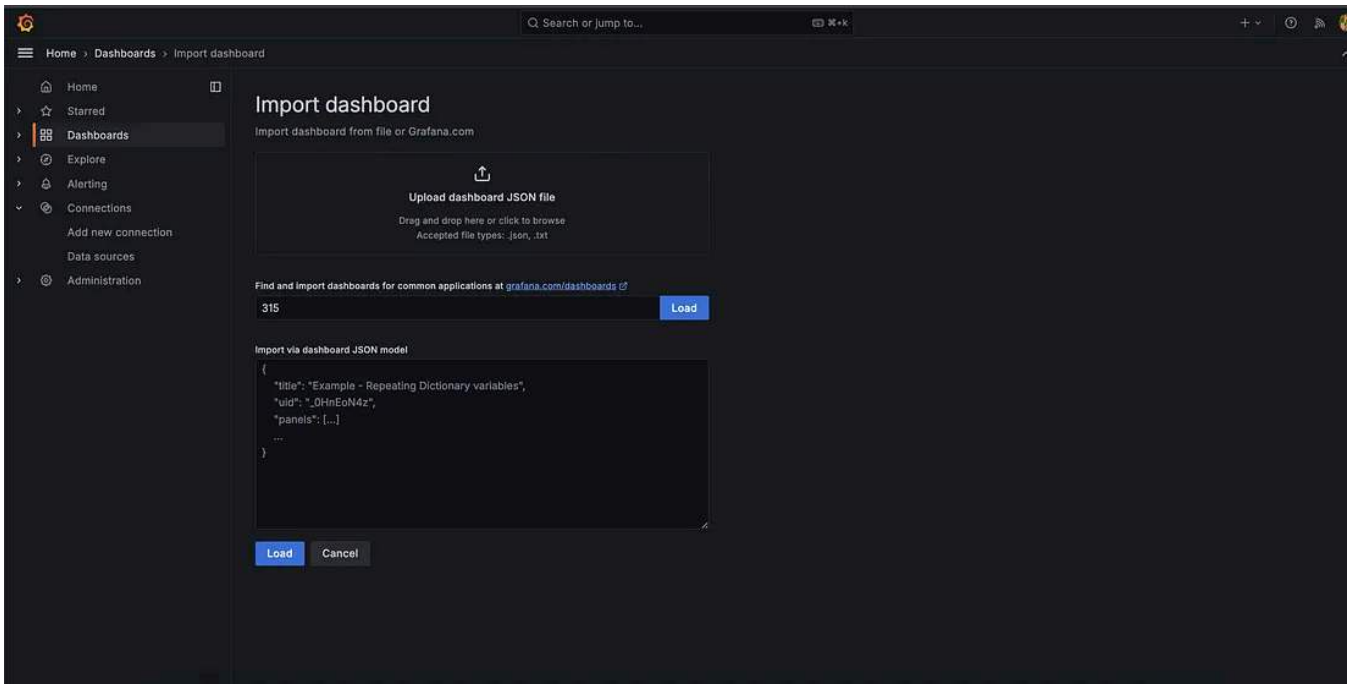
http://localhost:9040/

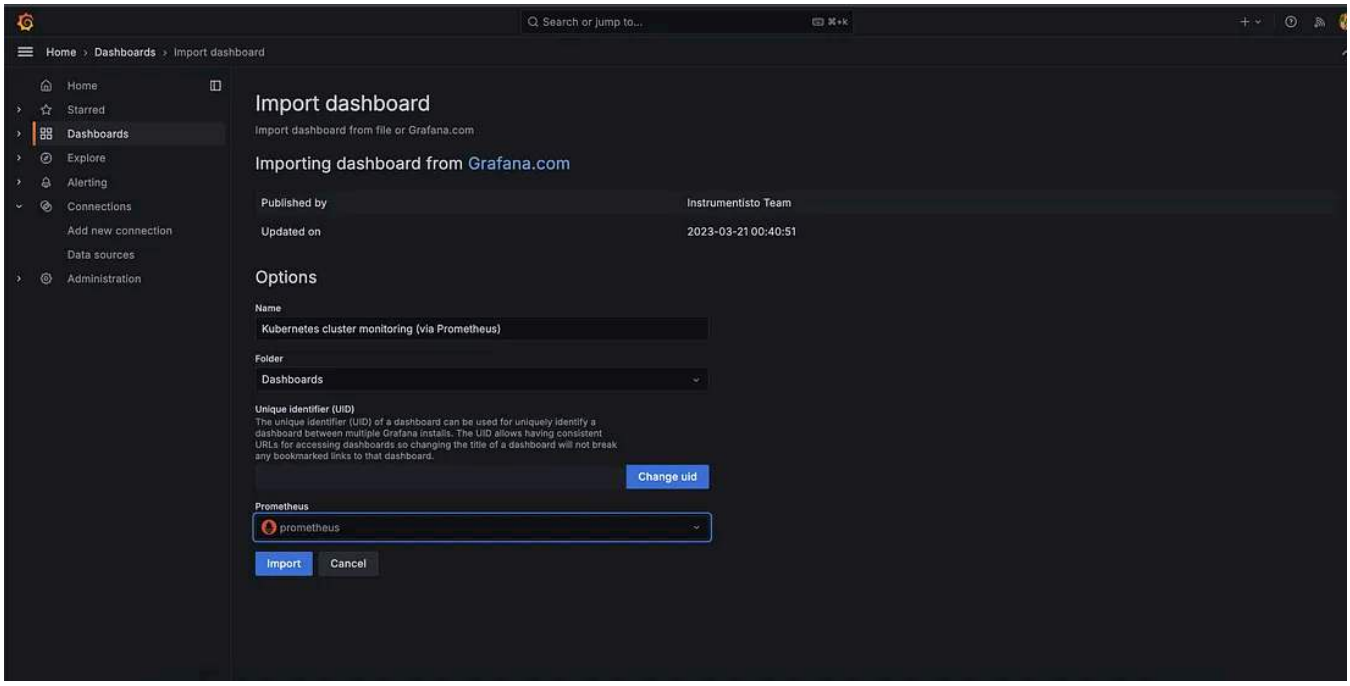


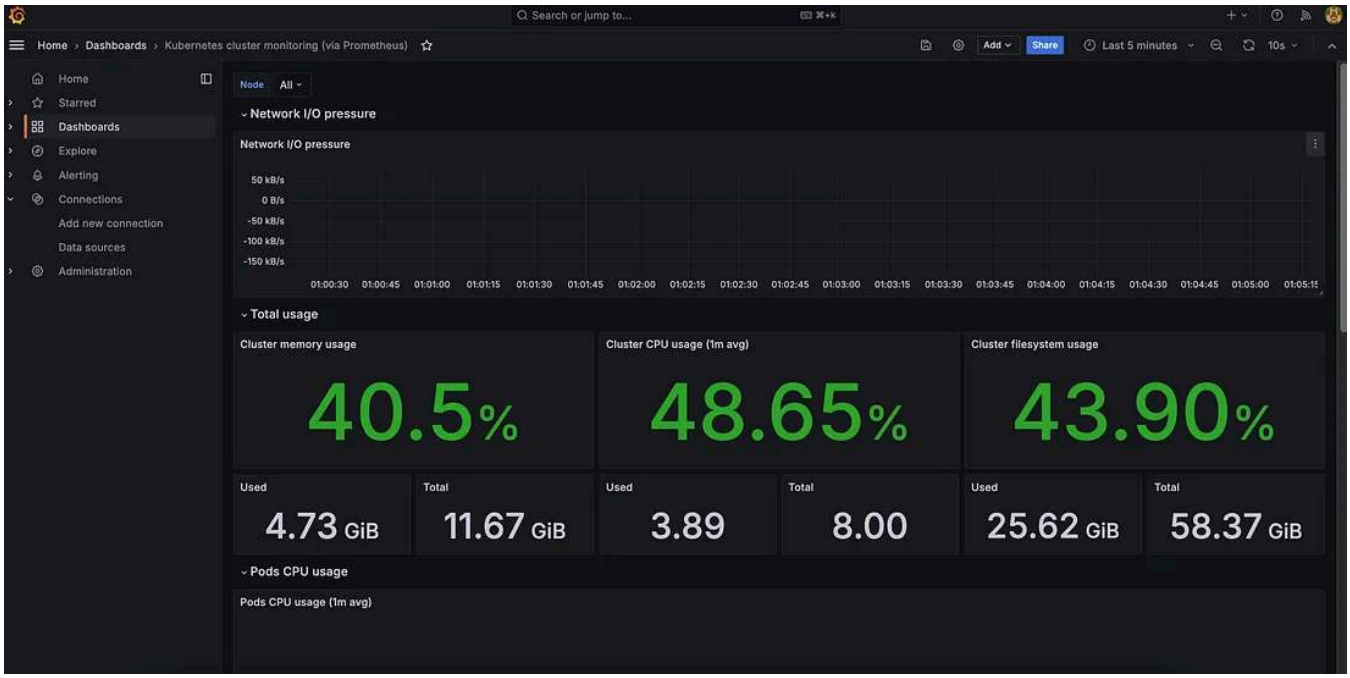
16. **Configure Graphana to use Promoetheus as data source and import required dashhboards:**






Search or jump to...
Home › Dashboards › Import dashboard
Home
Starred
Dashboards
Explore
Alerting
Connections
Add new connection
Data sources
Administration
Import dashboard
Import dashboard from file or Grafana.com
Upload dashboard JSON file
Drag and drop here or click to browse
Accepted file types: .json, .txt
Find and import dashboards for common applications at grafana.com/dashboards
315
Load
Import via dashboard JSON model
{
"title": "Example - Repeating Dictionary variables",
"uid": "_0HnEoN4z",
"panels": [...]
...
}
Load
Cancel


Search or jump to...
Home › Dashboards › Import dashboard
Home
Starred
Dashboards
Explore
Alerting
Connections
Add new connection
Data sources
Administration
Import dashboard
Import dashboard from file or Grafana.com
Importing dashboard from Grafana.com
Published by
Instrumentisto Team
Updated on
2023-03-21 00:40:51
Options
Name
Kubernetes cluster monitoring (via Prometheus)
Folder
Dashboards
Unique identifier (UID)
The unique identifier (UID) of a dashboard can be used for uniquely identify a dashboard between multiple Grafana installs. The UID allows having consistent URLs for accessing dashboards so changing the title of a dashboard will not break any bookmarked links to that dashboard.
Change uid
Prometheus
prometheus
Import
Cancel



17. Install Elasticsearch, Kibana and Filebeat in logging namespace using Helm and port forward to access Elasticsearch and Kibana UIs:

```
(Voir sur teams)
```

```
cd devops-demo-project/helm
helm install elasticsearch ./logging/elasticsearch
helm install kibana ./logging/kibana
helm install filebeat ./logging/filebeat

kubectl port-forward service/es-master-service 9010:9200 -n logging
kubectl port-forward service/kibana-service 9020:5601 -n logging
```

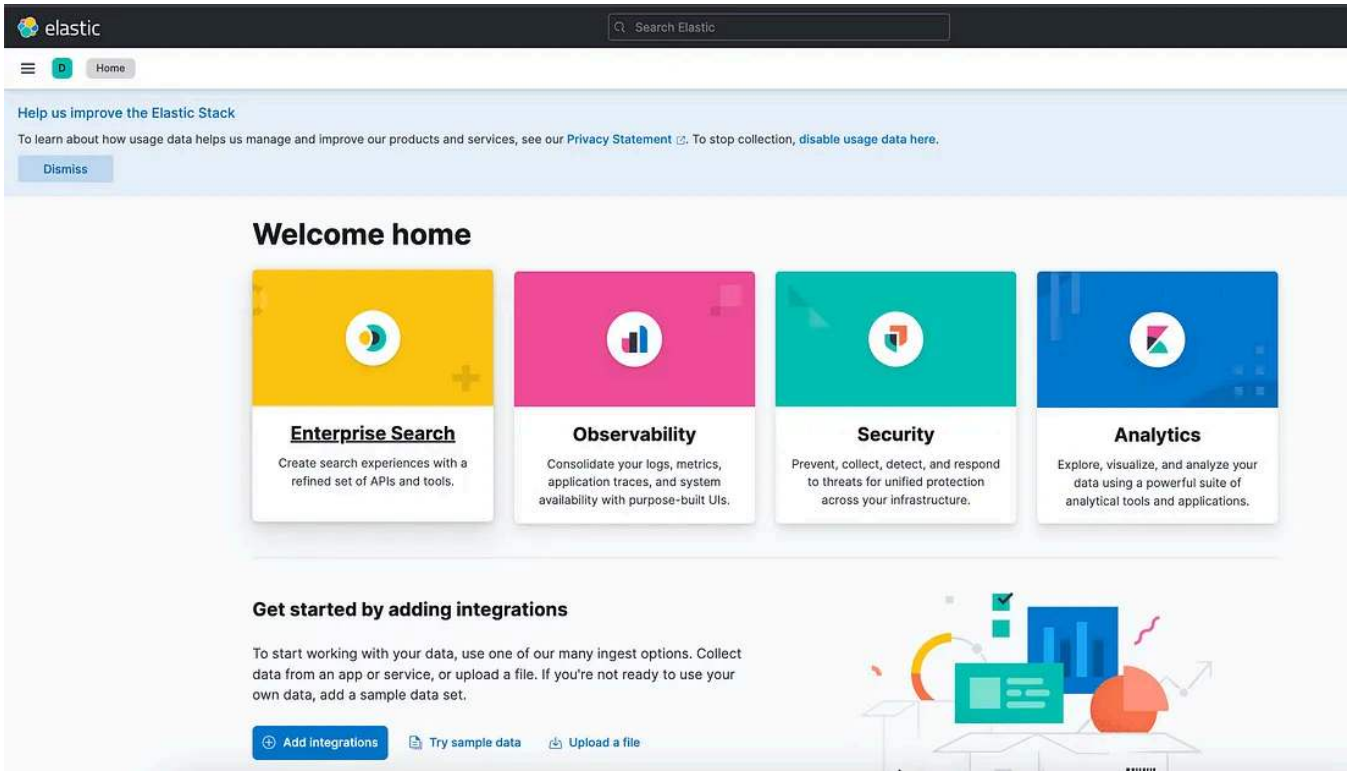
http://localhost:9010/

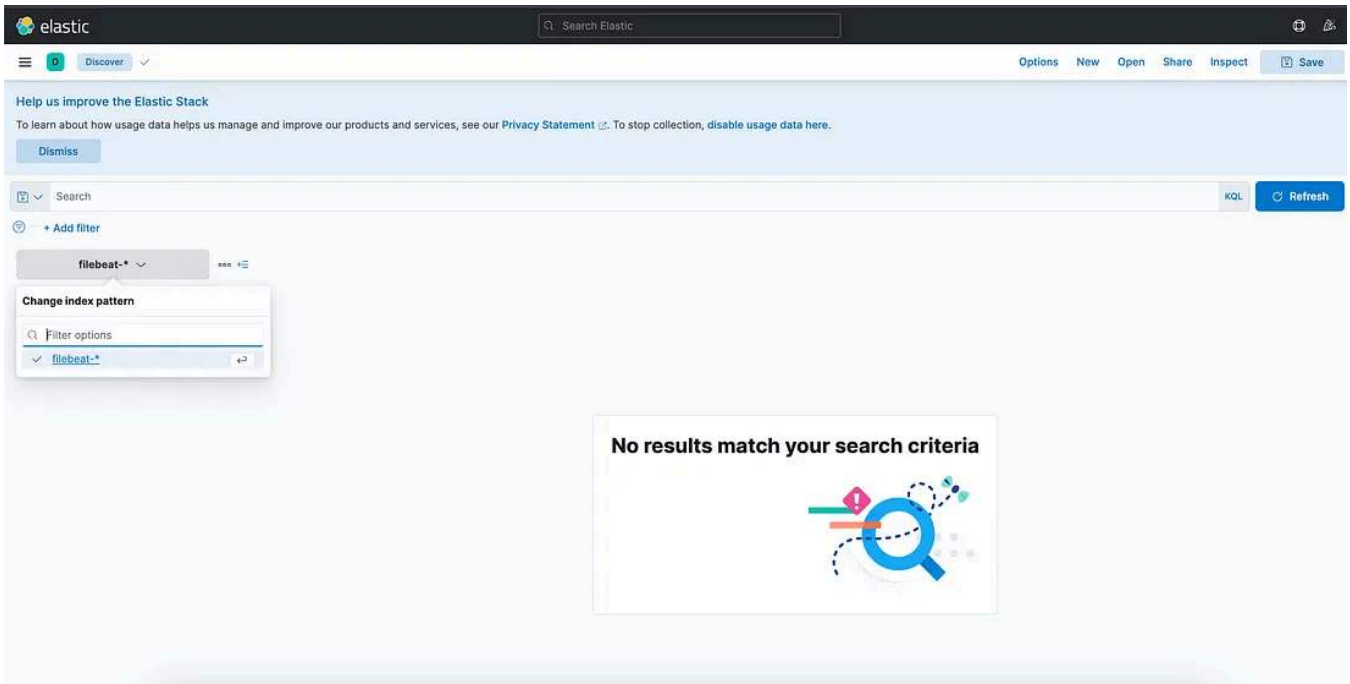
localhost:9010

Pretty-print


```
{
  "name" : "es-6b48497db7-gmgsf",
  "cluster_name" : "docker-cluster",
  "cluster_uuid" : "XkQAwLSsSYGT5iM9XpdDgg",
  "version" : {
    "number" : "7.16.2",
    "build_flavor" : "default",
    "build_type" : "docker",
    "build_hash" : "2b937c44140b6559905130a8650c64dbd0879cfb",
    "build_date" : "2021-12-18T19:42:46.604893745Z",
    "build_snapshot" : false,
    "lucene_version" : "8.10.1",
    "minimum_wire_compatibility_version" : "6.8.0",
    "minimum_index_compatibility_version" : "6.0.0-beta1"
  },
  "tagline" : "You Know, for Search"
}
```


http://localhost:9020/





18. Install ArgoCD in Kubernetes cluster: (voir teams)

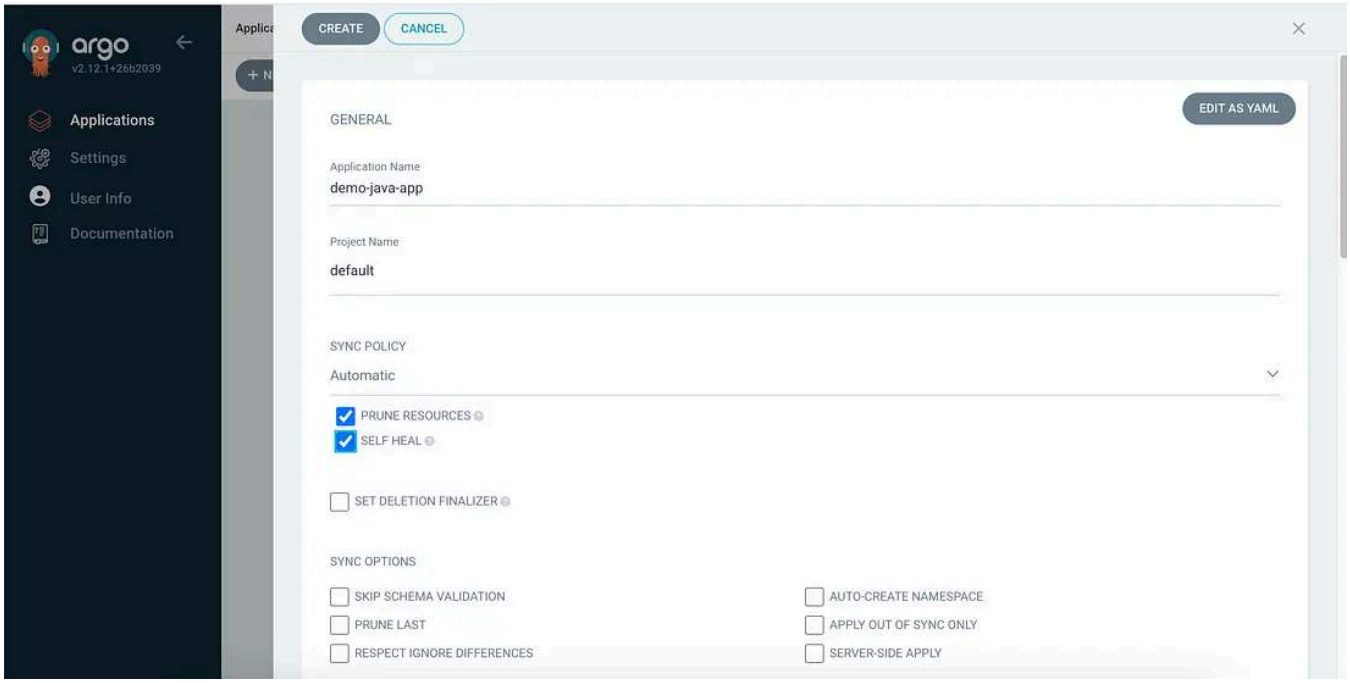
```
cd devops-demo-project/cd/argocd
curl -sL https://github.com/operator-framework/operator-lifecycle-manager/releases/download/v0.28.0/install.sh | bash
-s v0.28.0
kubectl get csv -n operators
kubectl create ns argocd
kubectl apply -f argocd-basic.yaml
echo $(kubectl get secret example-argocd-cluster -n argocd -o jsonpath="{.data.admin\.password}" | base64 —decode)
minikube service example-argocd-server -n argocd
```

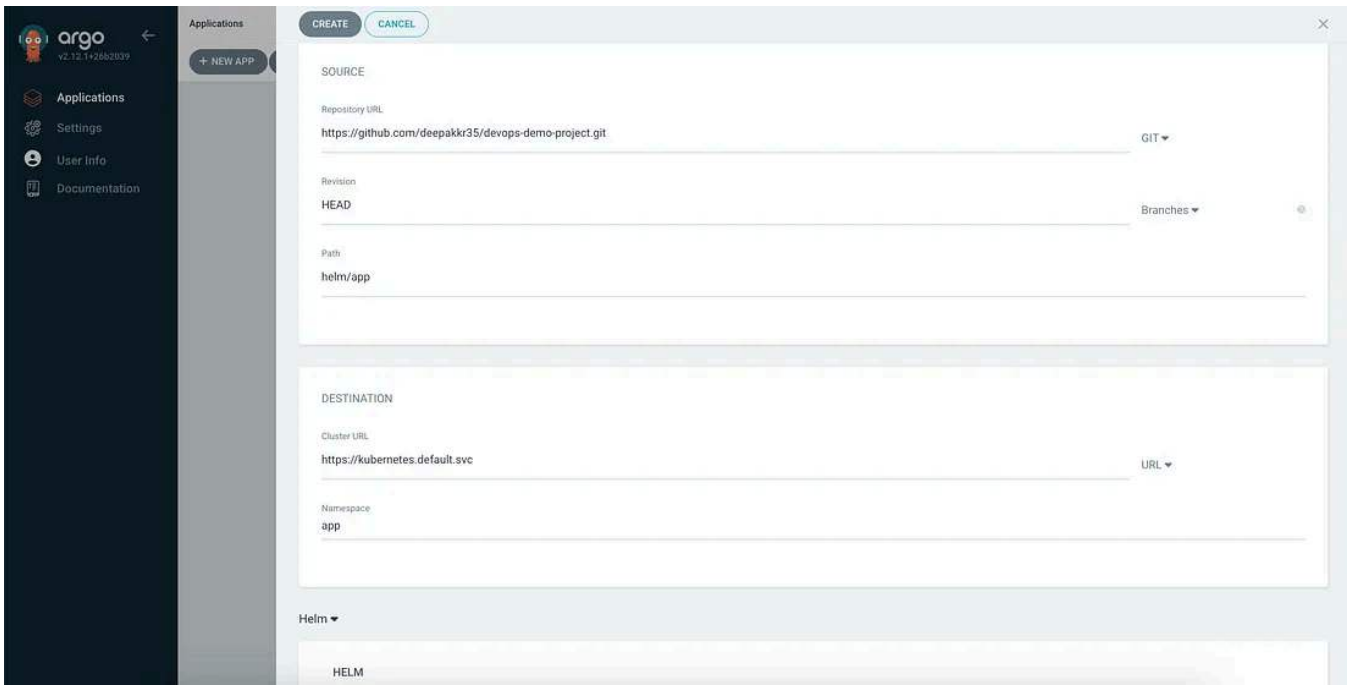
```
|-----------|-----------------------|-------------|-------------|
| NAMESPACE |         NAME          | TARGET PORT |     URL     |
|-----------|-----------------------|-------------|-------------|
| argocd    | example-argocd-server |             | No node port |
|-----------|-----------------------|-------------|-------------|
😿  service argocd/example-argocd-server has no node port
❗  Services [argocd/example-argocd-server] have type "ClusterIP" not meant to be exposed, however for local development minikube allows you to access this !
🏃  Starting tunnel for service example-argocd-server.
|-----------|-----------------------|-------------|-----------------------|
| NAMESPACE |         NAME          | TARGET PORT |          URL          |
|-----------|-----------------------|-------------|-----------------------|
| argocd    | example-argocd-server |             | http://127.0.0.1:49176 |
|           |                       |             | http://127.0.0.1:49177 |
|-----------|-----------------------|-------------|-----------------------|
[argocd example-argocd-server  http://127.0.0.1:49176
http://127.0.0.1:49177]
❗  Because you are using a Docker driver on darwin, the terminal needs to be open to run it.
```

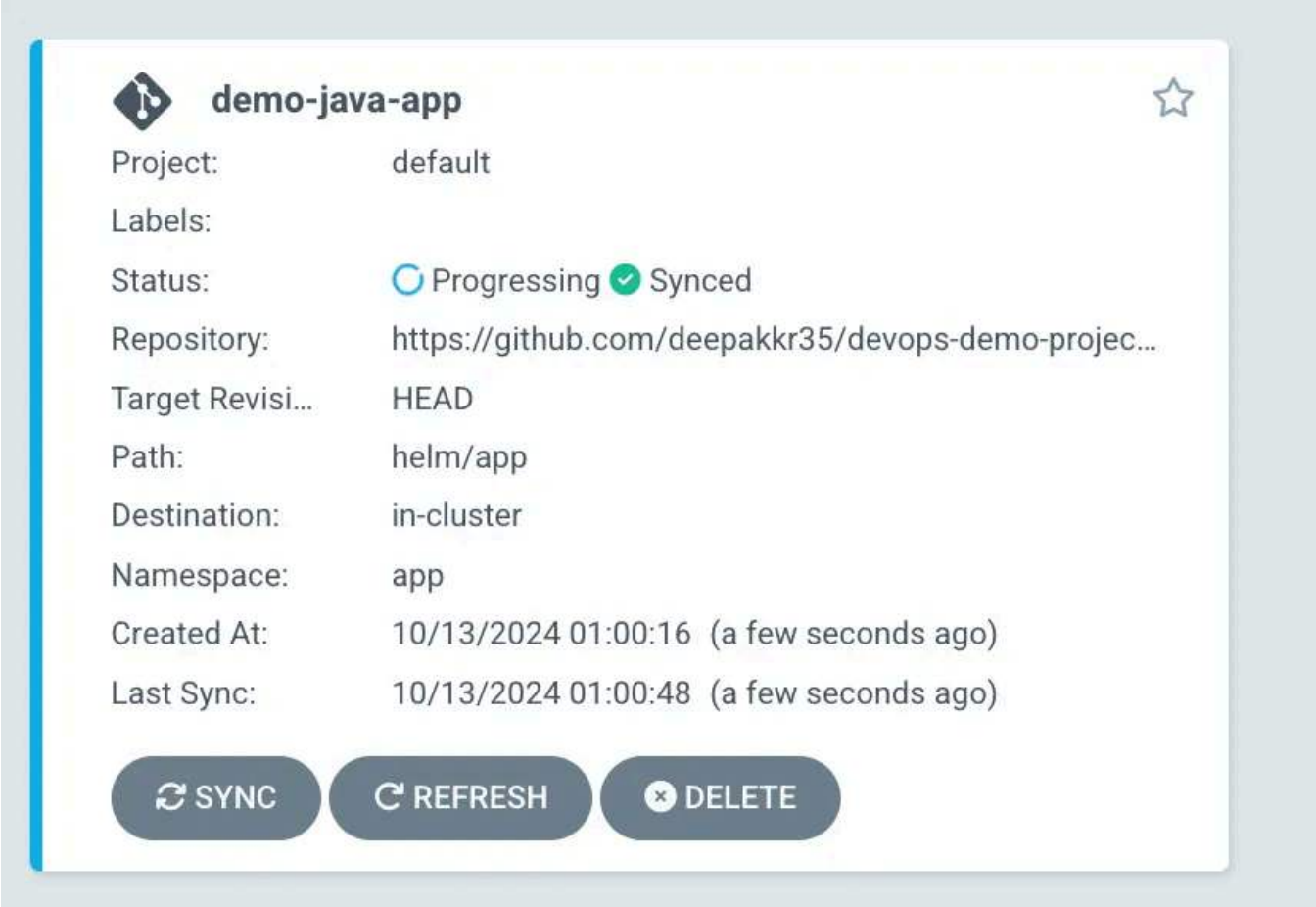
19. Open ArgoCD URL and create application to deploy, using password retrieved earlier:

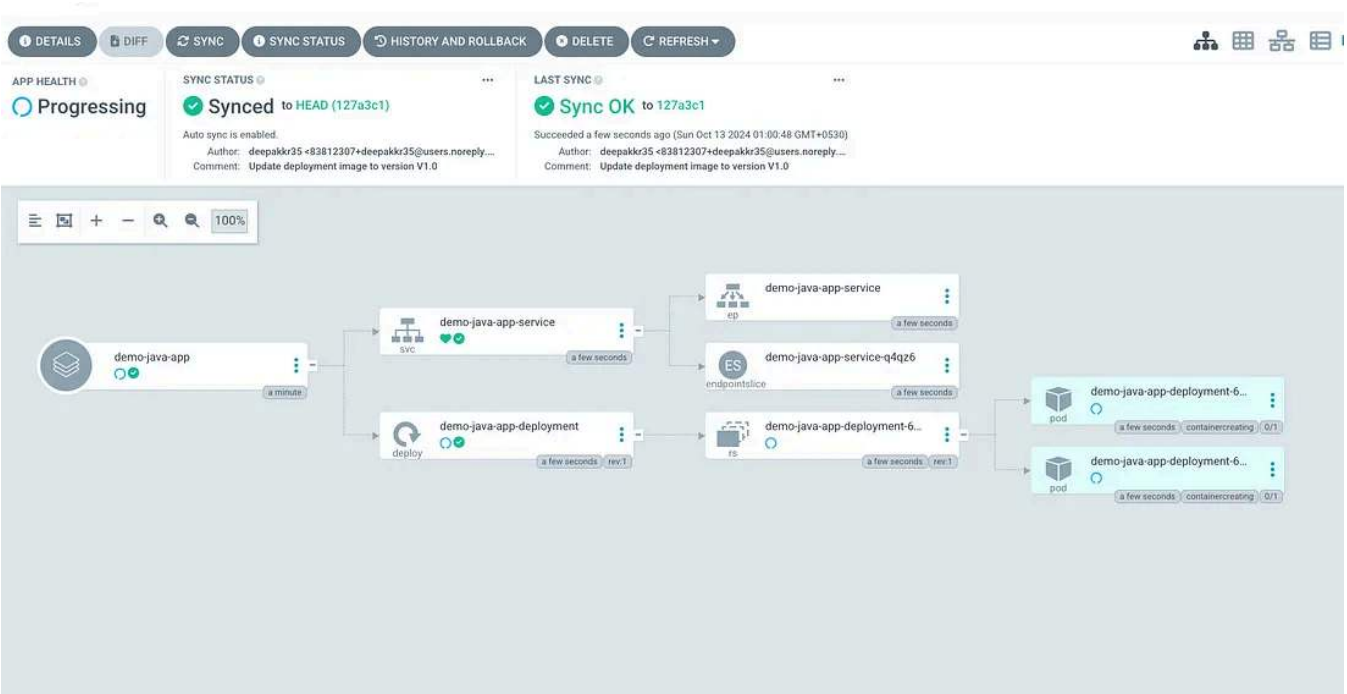

Let's get stuff deployed!


argo
Username
admin
Password
SIGN IN


argo
v2.12.1+26b2039
Applications
Settings
User Info
Documentation
CREATE
CANCEL
EDIT AS YAML
GENERAL
Application Name
demo-java-app
Project Name
default
SYNC POLICY
Automatic
PRUNE RESOURCES
SELF HEAL
SET DELETION FINALIZER
SYNC OPTIONS
SKIP SCHEMA VALIDATION
PRUNE LAST
RESPECT IGNORE DIFFERENCES
AUTO-CREATE NAMESPACE
APPLY OUT OF SYNC ONLY
SERVER-SIDE APPLY


argo
v2.12.1+26b2039
Applications
Settings
User Info
Documentation
+ NEW APP
CREATE
CANCEL
SOURCE
Repository URL
https://github.com/deepakkr35/devops-demo-project.git
GIT
Revision
HEAD
Branches
Path
helm/app
DESTINATION
Cluster URL
https://kubernetes.default.svc
URL
Namespace
app
Helm
HELM

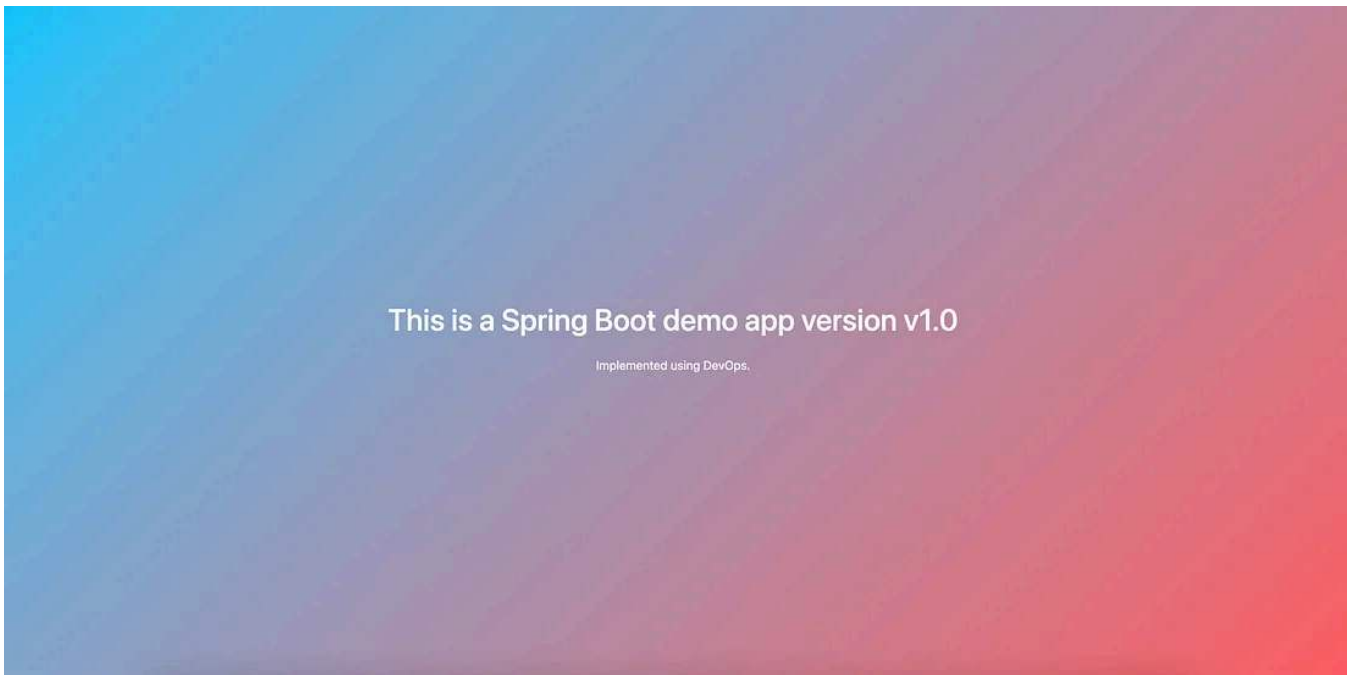




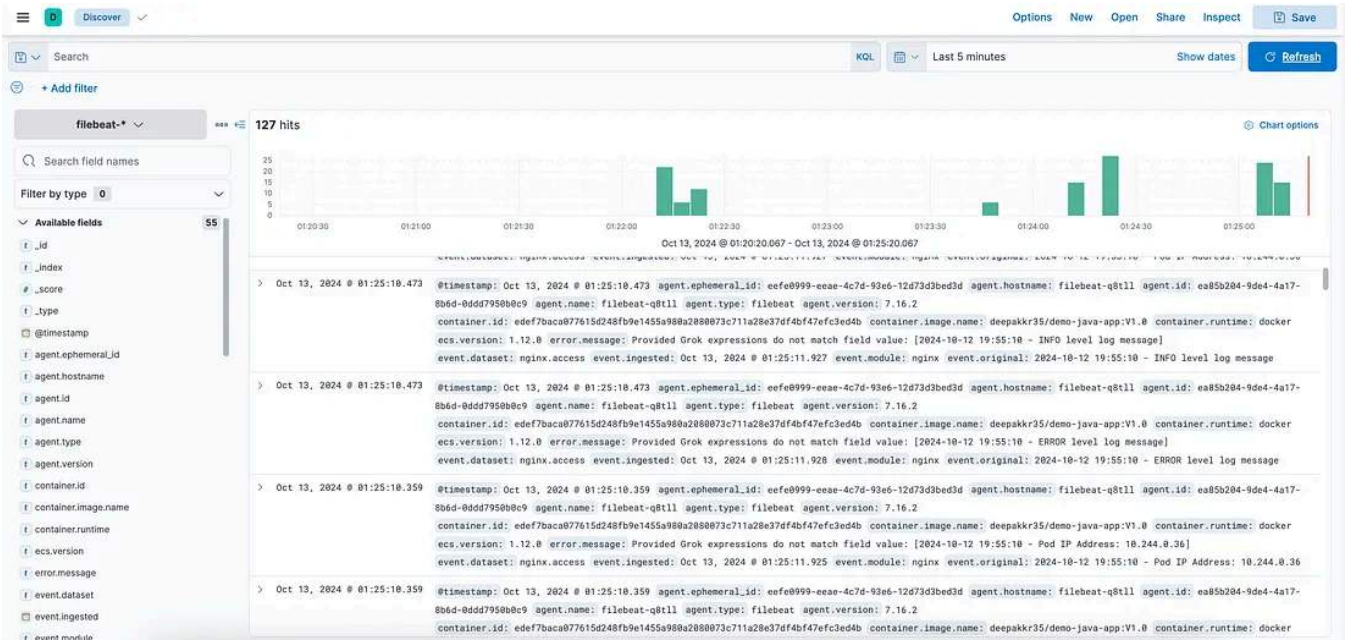
20. **port-forward app to access through UI:**

```
kubectl port-forward service/demo-java-app-service 8080:80 -n app
```

http://localhost:8080/



21. **Check application logs rolling in Kibana:**



22. **Make code changes and commit (for testing CI/CD pipeline):**

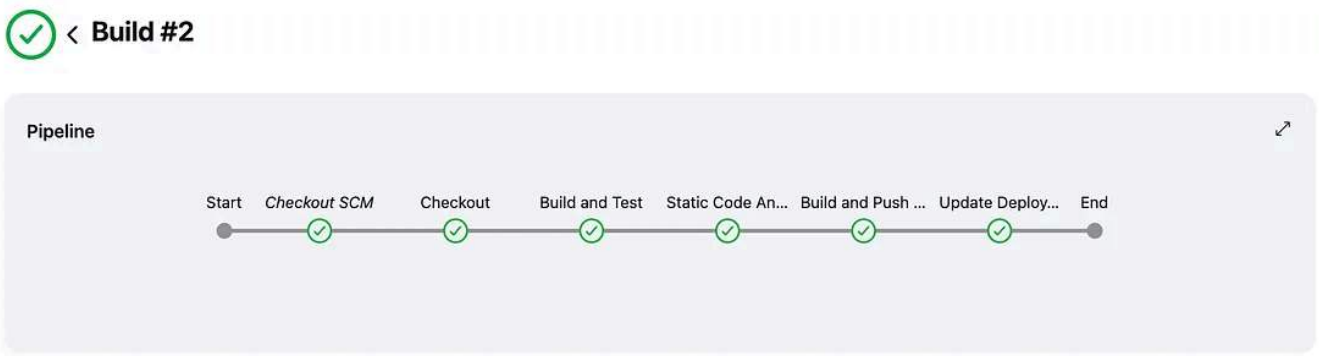
demo-java-app/src/main/java/com/deepak/demo/DemoApplication.java

```
model.addAttribute( s: "title",  o: "This is a Spring Boot demo app version v2.0");
```

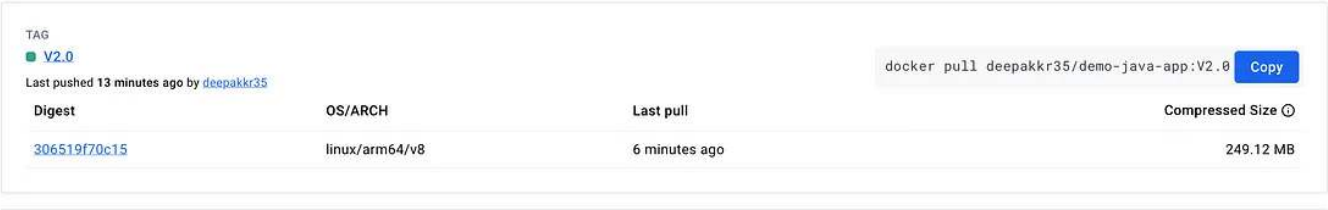
demo-java-app/src/main/resources/templates/index.html

```
    background: linear-gradient(135deg, #6e45e2, #88d3ce);
```

23. **Build pipeline in Jenkins:**



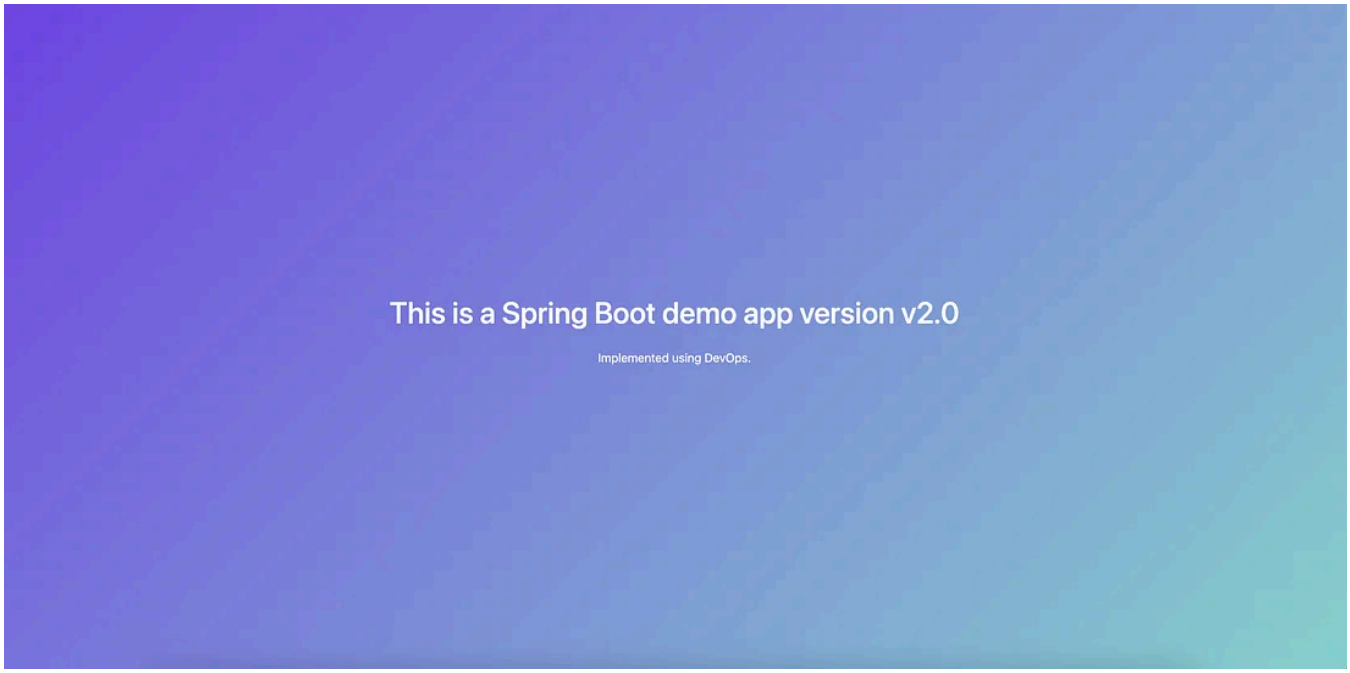
24. **Once CI pipeline is complete, Dockerhub and GitHub will be update:**




```
@@ -9,7 +9,7 @@ image:
9        repository: demo-java-app
10       pullPolicy: IfNotPresent
11       # Overrides the image tag whose default is the chart appVersion.
-        tag: V1.0
12 +     tag: V2.0
13
14     appName: demo-java-app
```

25. **ArgoCD will deploy application changes:**

26. **Access updated application:**



27. **Optional step** (Cleanup of resources)

```
cd devops-demo-project/ci
docker-compose down

minikube stop
minikube delete
```

DevOps | Jenkins | Docker | Argo Cd | Ci Cd Pipeline