A cloud-native approach for managing Kubernetes clusters in a hybrid cloud environment

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CERN openlab

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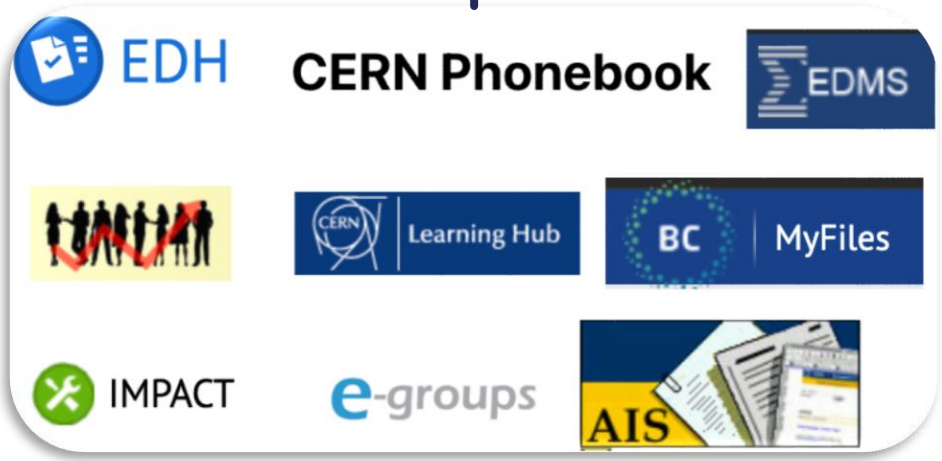
Context

IT-PW-ARW
(Applications and Reusable Workflows**)**

Providing hosting infrastructure based on **Kubernetes** for:

- **SSO** (Single Sign On)
- **CERN critical java applications** for Finance and Administrative Processes (FAP) and engineering (EN) departments such as **EDH** and **EDMS**.



Problem Statement

Current approach

HashiCorp Terraform + CI/CD

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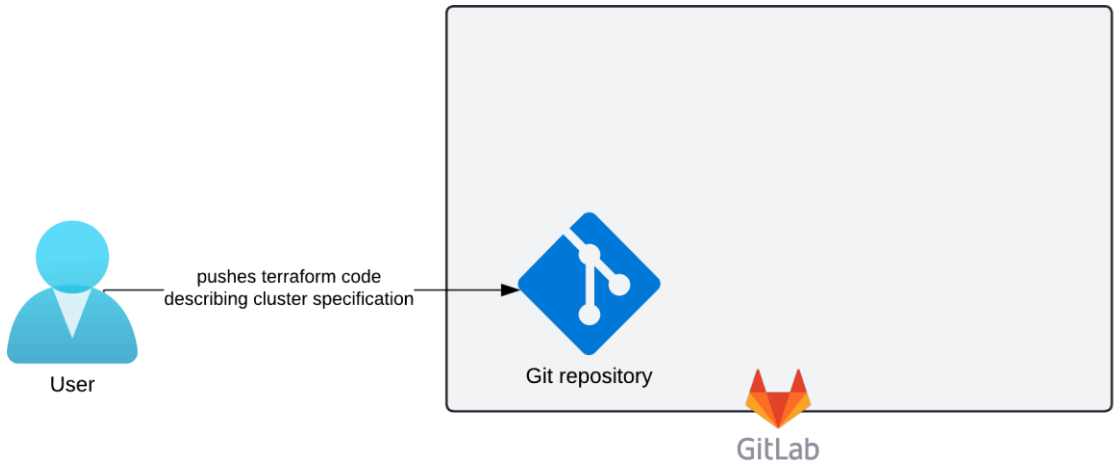

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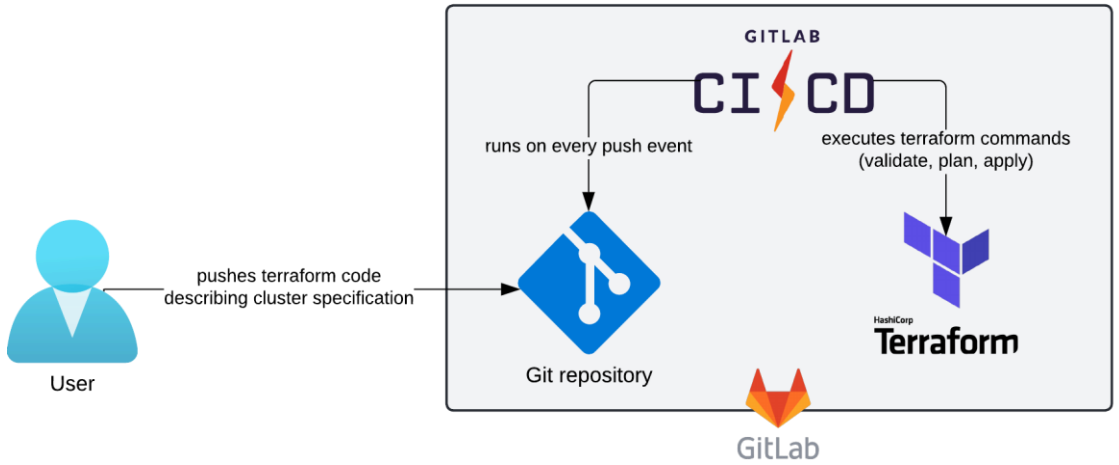

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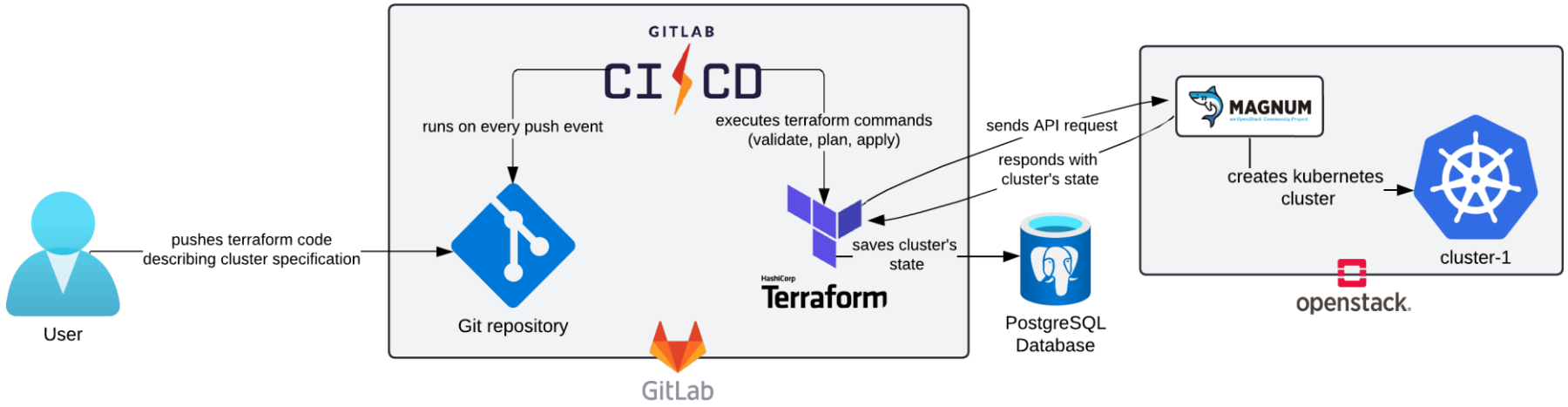

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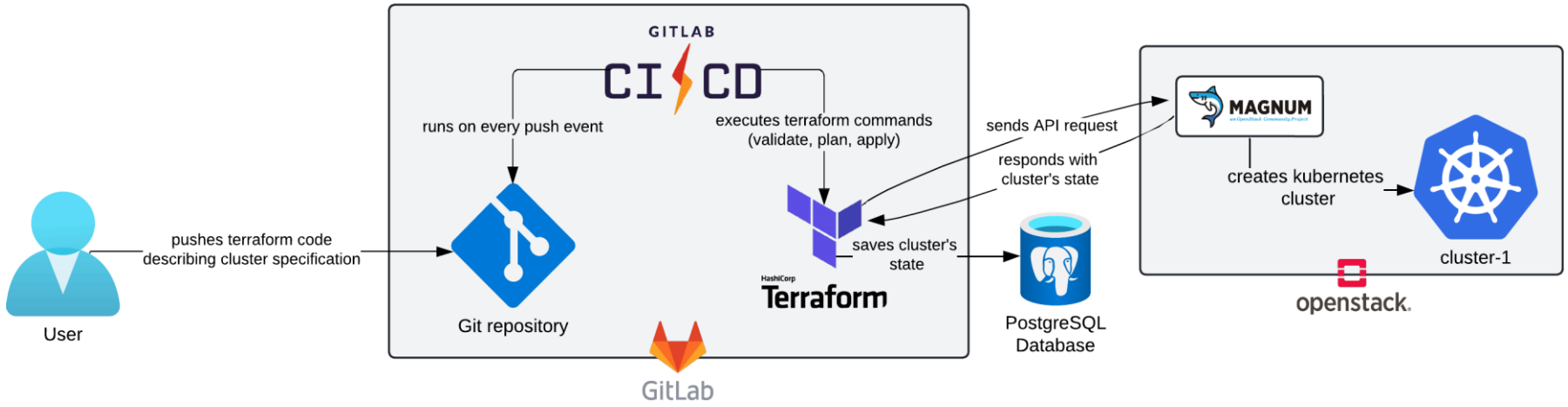
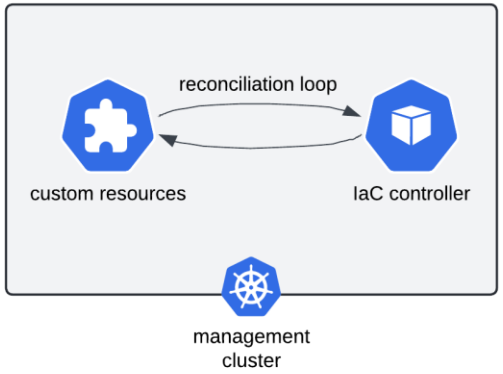


Drawbacks

- Terraform is **not Kubernetes-native**
- **Not effective** for **disaster recovery** (strong dependency on an external CI/CD and a database)

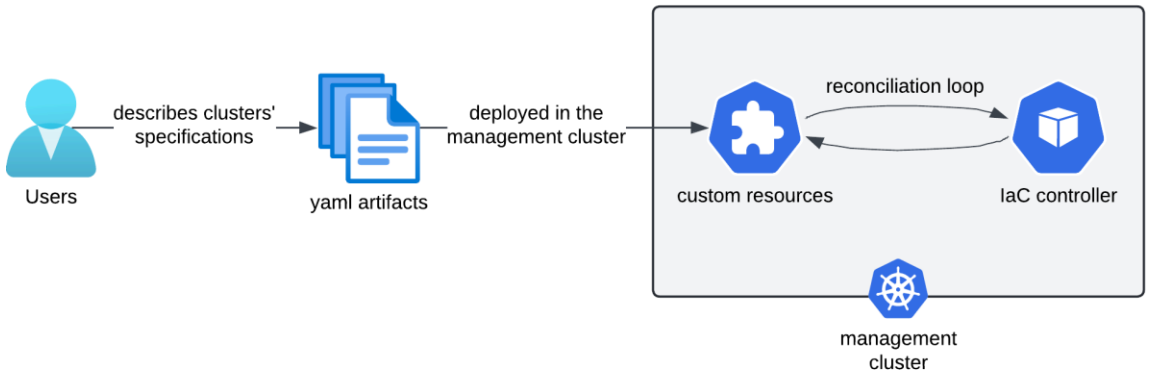
Objective



Propose a unified and cloud native approach for managing Kubernetes clusters on both on-premise (Openstack) and public cloud (Oracle Cloud Infrastructure)

*** IaC:** Infrastructure as Code

Objective



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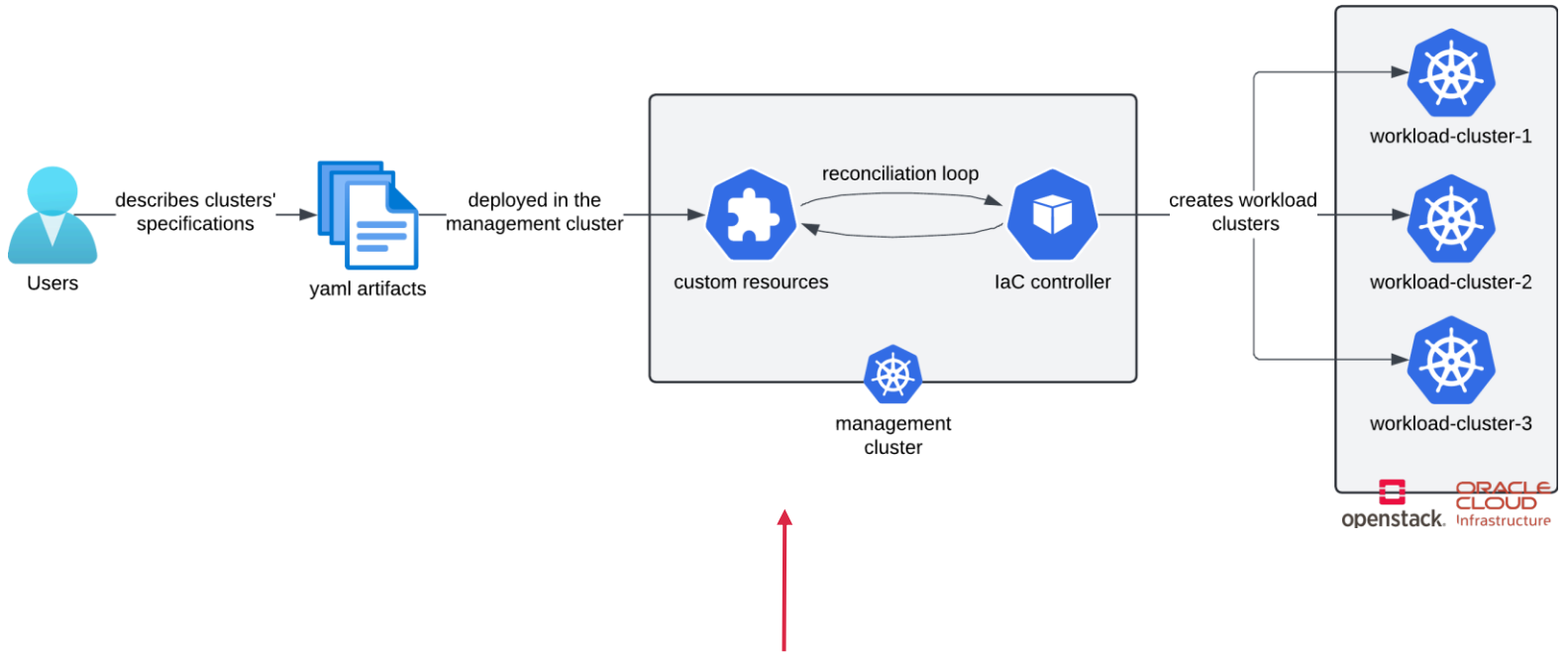

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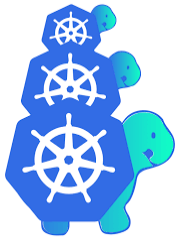
Investigations

Cloud-native IaC tools	Overview	openstack.	ORACLE CLOUD Infrastructure
 ClusterAPI	• **focused on** the lifecycle management of **Kubernetes clusters**		
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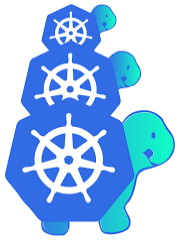 ClusterAPI	• **focused on** the lifecycle management of **Kubernetes clusters**	• Does not support creating Kubernetes clusters through **Magnum** service • It can be used as a backend for **Magnum** instead of **Heat** service • Creating clusters using **Nova** service does not work with CERN Openstack cloud due to networking constraints	
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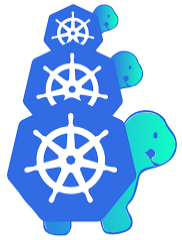
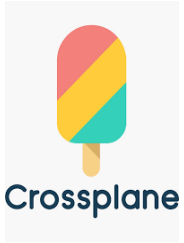
 ClusterAPI	• **focused on** the lifecycle management of **Kubernetes clusters**	• Does not support creating Kubernetes clusters through **Magnum** service • It can be used as a backend for **Magnum** instead of **Heat** service • Creating clusters using **Nova** service does not work with CERN Openstack cloud due to networking constraints	• Supports creating both self-managed and managed clusters
 Crossplane	• a **general purpose** IaC tool • **based on terraform** under the hood • providers are created using a code generation tool called **Upjet** that allows code generation of a crossplane provider from a terraform provider	• Supports creating clusters through **Magnum**	

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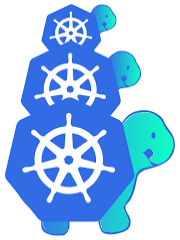 ClusterAPI	• **focused on** the lifecycle management of **Kubernetes clusters**	• Does not support creating Kubernetes clusters through **Magnum** service • It can be used as a backend for **Magnum** instead of **Heat** service • Creating clusters using **Nova** service does not work with CERN Openstack cloud due to networking constraints	• Supports creating both self-managed and managed clusters
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*** IaC:** Infrastructure as Code

Solution

Technology Choice

+

Why ?

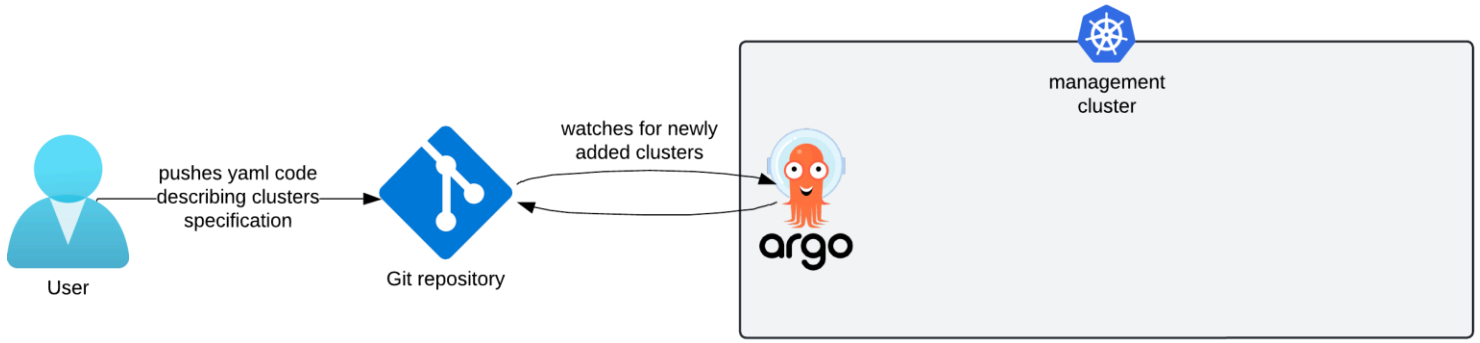
Openstack is the priority because **all our productions clusters are running on OpenStack** at the moment

Why ?

A CD pipeline that runs within Kubernetes to **automate Kubernetes objects deployment from a git repository**

Solution

Proposed approach



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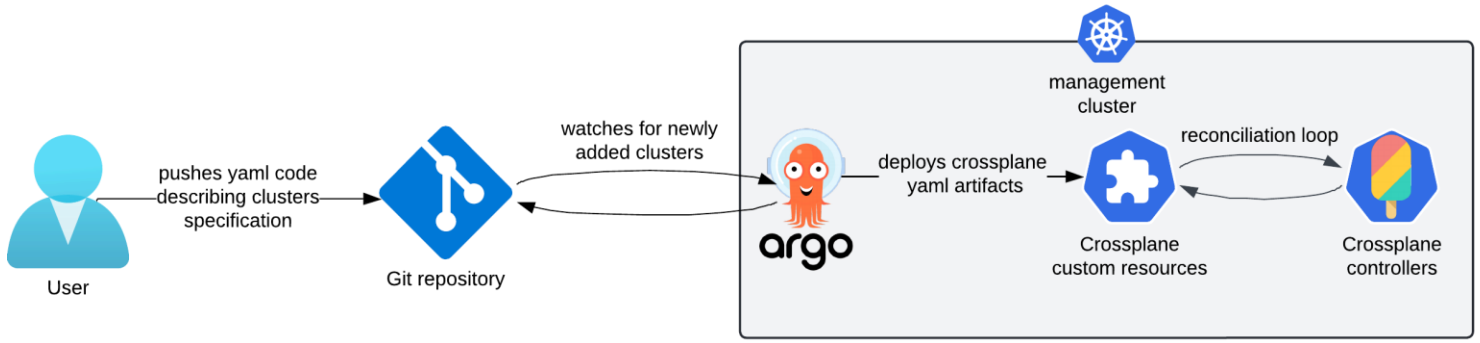

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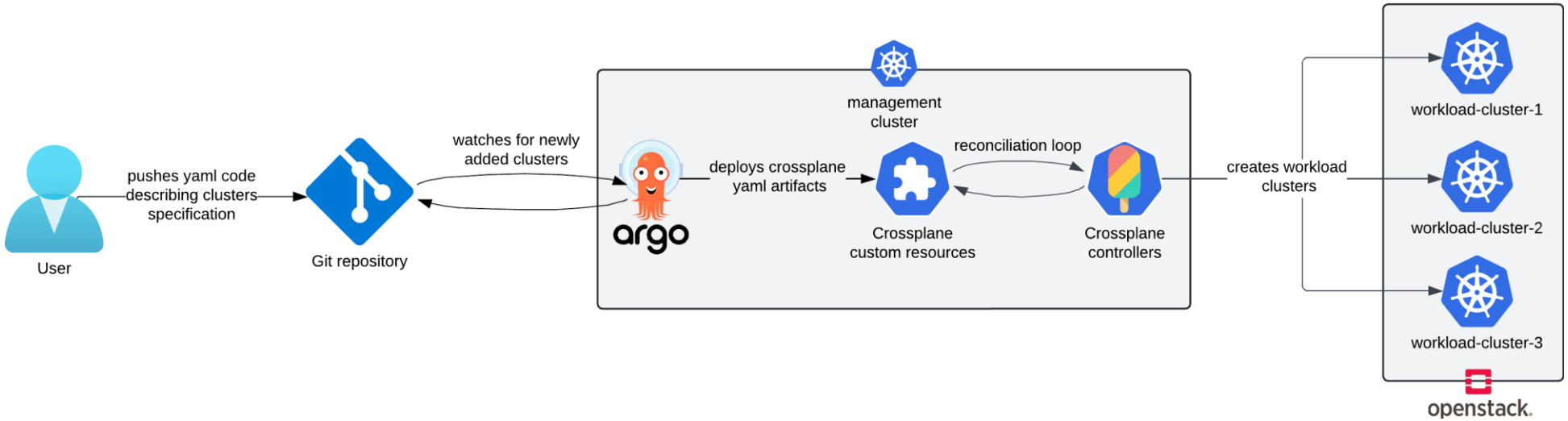

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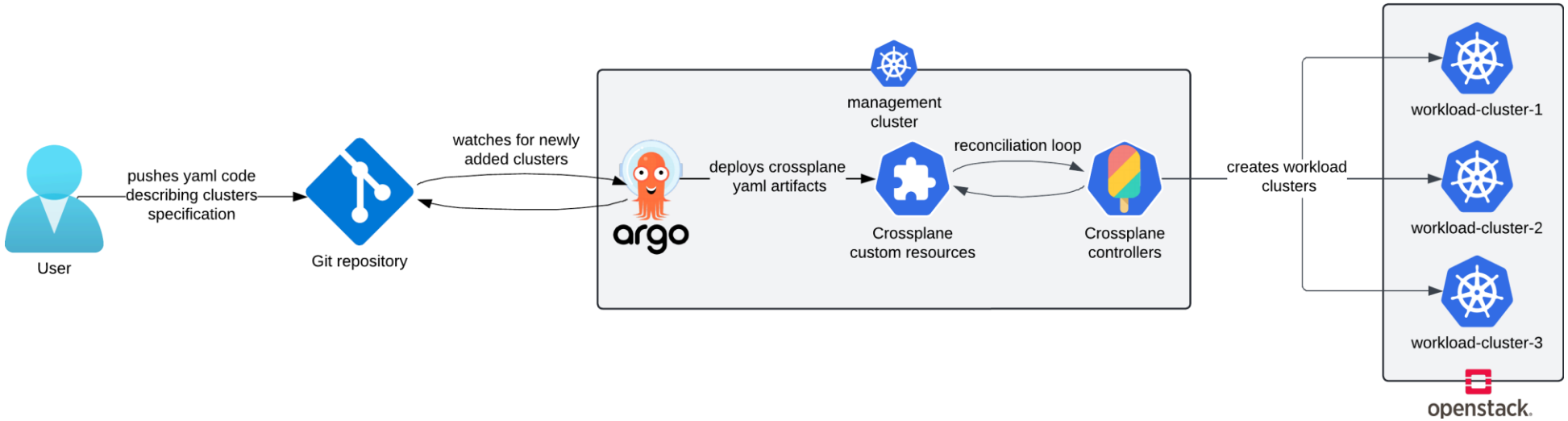

Advantages

- A **unified approach** for deploying applications and infrastructure
- **Faster recovery** of Kubernetes clusters (It takes only few steps)

Current vs Proposed Approach

Approach	Declarative	Version control	Requirements	Maintenance
HashiCorp Terraform Current GitLab CI/CD	Yes	Yes	• Gitlab repository • Gitlab CI/CD • PostgreSQL database	Not Straightforward (HCL - HashiCorp Configuration Language)
Crossplane Proposed argo	Yes	Yes	A Kubernetes cluster with ArgoCD installed	Easy (Kubernetes Object)

Conclusion & Perspectives

- Relying on a cloud-native IaC tool allows for both Kubernetes oriented infrastructure deployment and effective disaster recovery
- We will pass the feedback to Oracle to highlight the missing provider for Crossplane
- Integrating ClusterAPI with CERN Openstack could be possible but requires collaborative efforts between multiple teams

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Thank you!

Questions ?

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