Contribution ID: **150** Type: **Oral Presentation**

Deploying the INDIGO PaaS Orchestration System Components on a Kubernetes-Based Infrastructure Using ArgoCD

Thursday, 19 March 2026 16:30 (30 minutes)

The National Institute for Nuclear Physics (INFN) manages the INFN Cloud, a federated cloud platform offering a customizable portfolio of IaaS, PaaS, and SaaS services tailored to the needs of the scientific communities it supports. The PaaS services are defined through an Infrastructure as Code approach, combining TOSCA templates to model application stacks, Ansible roles for automated configuration, Docker containers for packaging software and runtimes, and Helm charts for deploying applications on Kubernetes clusters. This approach allows the platform to provide flexible, reproducible, and consistent environments for a wide range of scientific workloads.

The platform's federation middleware is based on the INDIGO PaaS Orchestration system, which integrates several open-source microservices. Among these, the INDIGO PaaS Orchestrator is responsible for managing high-level deployment requests from users and coordinating the provisioning process across multiple federated IaaS platforms, ensuring efficient utilization of distributed resources and streamlined application delivery. Over the past year, development efforts have focused on replacing legacy components with new, modular services to extend system functionalities and mitigate security vulnerabilities. To achieve long-term maintainability, Python was adopted as the primary programming language, chosen for its readability, ease of maintenance, and compatibility with modern development practices, ensuring that the system can be efficiently updated and extended in the future.

This contribution presents the activity aimed at deploying the microservices composing the INDIGO PaaS Orchestration system on a Kubernetes-based infrastructure using ArgoCD. The migration is expected to improve resource management, simplify service deployment, and enable continuous integration and delivery through ArgoCD's GitOps approach.
Kubernetes plays a central role by providing resilience, self-healing capabilities, load balancing, and automated recovery, ensuring high availability and fault tolerance for critical orchestration services. ArgoCD manages and synchronizes microservice deployments directly from Git repositories, guaranteeing configuration consistency, version control, and traceability of all changes.
The ultimate objective is to achieve a more resilient, maintainable, and automated deployment environment, fully aligned with modern cloud-native and DevOps best practices.

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Session Classification: Infrastructure Clouds and Virtualisations - III

Track Classification: Track 8: Infrastructure Clouds and Virtualizations