The INFN Cloud platform: state of the art and services implementation

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The National Institute for Nuclear Physics (INFN) has been managing and supporting Italy's largest distributed research and academic infrastructure for decades. In March 2021, INFN introduced "INFN Cloud," a federated cloud infrastructure offering a customizable service portfolio designed to meet the needs of the scientific communities it serves. This portfolio includes standard IaaS solutions as well as more advanced PaaS and SaaS offerings, all tailored to the specific requirements of individual communities. The PaaS services are defined using an Infrastructure as Code approach, combining TOSCA templates to model application stacks, Ansible roles for automated configuration of virtual environments, and Docker containers to package high-level application software and runtimes. The INFN Cloud platform's federation middleware is based on the INDIGO PaaS Orchestration system, which integrates multiple open-source microservices. Among these, the INDIGO PaaS Orchestrator handles high-level deployment requests from users and orchestrates the deployment process across various IaaS platforms.

In this contribution, we will present the recently introduced functionalities and newly developed microservices in the INFN Cloud platform. Due to the obsolescence of certain PaaS components, the development and integration of new microservices became necessary, leveraging modern technologies to replace outdated solutions. For example, the method for collecting information about the resources made available by the federated cloud providers has been significantly refactored by adopting a Neo4j graph database. This enables efficient horizontal scaling to handle high-throughput and large datasets, while offering a REST API interface secured by OpenID Connect/OAuth2 for authentication and authorization. Regarding the PaaS Orchestrator dashboard, an updated version has been released, featuring an improved graphical interface and enhanced functionalities. In particular, the interaction with deployments has been refined, improving the user experience and extending the offered capabilities.

Additionally, new PaaS services have been designed, implemented, and made available to end users, such as the Kubernetes Cluster one that enables the transparent offloading of Kubernetes workloads to remote computation systems. As for SaaS services in the portfolio, we offer an object storage solution based on the Ceph Rados Gateway backend, complemented by a custom web Graphical User Interface developed in-house.

The evolution of the INDIGO PaaS Orchestration system also includes the adoption of modern DevOps practices, like the introduction of automated deployment pipelines and streamlined development workflows to ensure the rapid delivery of new features and improvements.

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