A Cloud Computing infrastructure for the Competence Centre for the Conservation of Cultural Heritage

A. Alkhansa[1] , A. Bombini[2] , A. Costantini[1], L. dell'Agnello[1], F. Taccetti[2]

[1]Center for Research and Development on Information and Communication Technologies (CNAF), [2]Istituto Nazionale di Fisica Nucleare (INFN)

Abstract. Within the context of the Competence Centre for the Conservation of Cultural Heritage (4CH) project, the design and deployment of a Platform-as-a-Service Cloud infrastructure as a prototype for the first European Competence Centre of Cultural Heritage has begun. On top of this, some services used and developed for the cultural heritage community have been integrated. In this contribution, we summarise the status of the work carried out within the 4CH project activities, the services currently hosted, and the different solutions adopted. We conclude by describing the next step towards the creation of the first European cloud platform (and related services) for cultural heritage

Competence Centre for the Conservation of Cultural Heritage (4CH)

The Competence Centre for the Conservation of Cultural Heritage (4CH) project is an initiative that was approved in January 2021 under the DT-TRANSFORMATIONS-20-2020 call of the European Community's Horizon 2020 framework programme.

Its goal is to design and prepare for an European Competence Centre (CC) for the Conservation of Cultural Heritage which will work proactively for the preservation and conservation of cultural heritage (CH). The Competence Centre will address several topics, such as how cultural heritage is managed, the risks it may be exposed to, the technologies that can be used for its conservation and how it shall be exploited.

Towards the development of a 4CH Cloud Platform

During the 4CH project activities, an important effort has been spent to design a proper architecture aimed at hosting all the elements needed to provide users with the capability of using different software services, made available via a platform in order to let them be able to use resource infrastructures in a seamless and transparent way.

To host the 4CH services for cultural heritage, a cloud-based infrastructure has been implemented as a pilot infrastructure hosted on the OpenStack Cloud at CNAF, the national center of INFN (Italian Institute for Nuclear Physics) dedicated to Research and Development on Information and Communication Technologies. The adopted tools and solutions are aimed at providing distributed computing resources, network, and stora-

ge. Moreover, on top of the 4CH Platform, some ancillary services providing useful functionalities such as reverse proxy, image repository, monitoring and authorization and authentication, already deployed, have been also considered and integrated together into the 4CH Platform-as-a-Service.

Fig. 1
4CH platform
design and
components
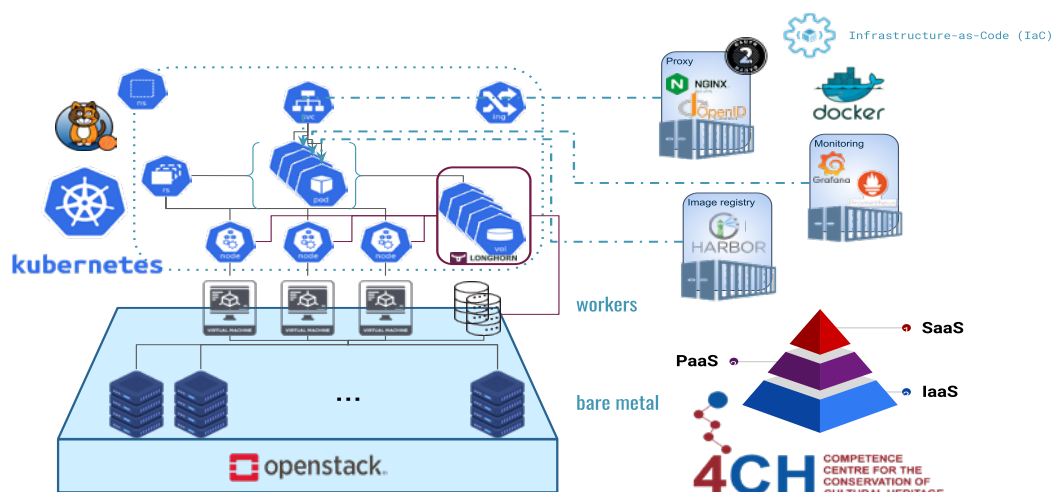
The 4CH platform development adopted the so-called Infrastructure-as-Code (IaC) approach . Following the IaC approach, Kubernetes has been adopted and implemented. The platform was deployed using the Rancher Kubernetes Engine (RKE). On top of the Kubernetes cluster, some components have been deployed to improve the platform functionalities. Network service relies on Calico, while storage service relies on Longhorn.

For the Authentication / Authorization workflow, the 4CH cloud platform relies on INDIGO-IAM service. INDIGO-IAM implements (i) the OAuth2.0 standard authorization framework with the OpenID Connect (OIDC) layer, (ii) the User-Group model to manage the authorization procedure.

Grafana and Prometheus have been deployed to monitor both the Kubernetes cluster and the different services running on top of it.

Finally, an image repository service based on Harbor has been deployed. A graphic schema of the 4CH Cloud Platform is shown in Figure 1.

Service integration and federation

To cope with the different web-based (even commercial) applications that may arise from the different 4CH project partners and related communities, a set of principles and policies have been considered to define the requirements related to the application deployment, method and resource exposure and authorization and authentication mechanisms.

In particular, an important effort has been spent to define requirements for service inte-

gration, referring to applications that can be integrated in the 4CH Platform and made available to the community via the 4CH dashboard.

On the other hand, applications that cannot be integrated in the 4CH cloud platform can be hosted outside of it, and can be made available to the community via the CHNet web portal.

By adopting this approach, Cultural Heritage applications that have specific needs (e.g. application which cannot be virtualized, in-house application with particular dependencies, commercial software etc.) can in any case be made available to the final user via the CHNet web portal adopting the authentication and authorization mechanism provided by the 4CH Platform and reach the Cultural Heritage Network communities through the Platform.

Note that a single application, comprising multiple independent services, may be deployed in a mixture of federation and integration deployments.

Next Steps

The present document describes and highlights the 4CH pilot infrastructure and its related Platform components and tools aimed at hosting and integrating the different services oriented to the Cultural Heritage community developed by the 4CH project partners.

At the time being, some services provided by and for the Cultural Heritage community within the activities of the 4CH project have been ported and hosted in the 4CH Cloud Platform.

Those services and processes are part of a lively ecosystem of activities that are expected to evolve within the 4CH project to accommodate further needs and requirements that may not be raised so far.

The interaction and feedback collected from service providers and user communities will also contribute to improve the project developments as well as to define the features of the future European Competence Centre for Cultural Heritage.

Acknowledgments

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Authors:

Ahmad Alkhansa ahmad.alkhansa@cnaf.infn.it

Research Fellow at INFN-CNAF that specializes in the orchestration of containerized workloads. His activities include designing and implementing distributed systems for hosting web applications. He is involved in the provisioning and configuration of the infrastructure dedicated to the 4CH european project, and ensuring the availability of the services deployed on top of it.

Alessandro Bombini alessandro.bombini@fi.infn.it

Researcher at INFN-CHNet, Florence section, is responsible for the research and development of digital infrastructure and web services for the Digital Heritage Laboratory (DHLab), within the European projects EOSCPillar (https://www.eosc-pillar.eu/), A-RIADNEplus (https://ariadne-infrastructure.eu/), and 4CH (https://4ch-project.eu/).

Alessandro Costantini alessandro.costantini@cnaf.infn.it

Alessandro Costantini graduated in Chemistry in 2005, in 2009 he holds a Ph.D. in Chemistry working on Clouds environments and in 2013 he holds a Ph.D. in Mathematics and Computer Science. Since 2022 he is the coordinator of the Distributed Systems group at the INFN National Centre for research in ICT technologies (CNAF) where he enriched his expertise becoming a Cloud technologies expert and participating in different Cloud-related projects. At present, he is coordinating the activity related to the Cultural Heritage Cloud Platform within the 4CH european project.

Luca dell'Agnello luca.dellagnello@cnaf.infn.it

Director of Technology at CNAF, INFN. He was a Network expert for GARR network (1997-2002), Data management and Storage Group Leader at INFN-CNAF (the Italian Tier1 in LHC Computing Grid) from 2005 to 2011, and GARR Technical and Scientific Committee member from May 2009. He is also INFN Tier1 manager since October 1st, 2011, and Director of CNAF since July 15, 2021.

Francesco Taccetti francesco.taccetti@fi.infn.it

First Technologist at INFN, expert in accelerators physics and applied physics on Cultural Heritage. He is national responsible for the INFN-CHNet, the INFN network devoted to the application of nuclear techniques to the Cultural Heritage. He is Principal Investigator for the INFN in the European projects and MIUR-financed projects, such as 4CH, ORMA, A-RIADNEplus, MACHINA, E-RIHS, and authored more than 80 papers published in international journals.