



Grant Agreement N°: 101016673

Topic: ICT-40-2020



**The European Cloud Computing Hub
to grow a sustainable and comprehensive ecosystem**

D3.1: Cloud computing standardization and open source initiatives - version 1

Revision:v1.0

Work package	WP3
Task	Task 3.1
Due date	30/09/2021
Submission date	15/10/2021
Deliverable lead	ATOS
Version	1.0

Abstract

This report includes and overview of the most relevant OSS and SDOs initiatives across the EU community as well as within the EU projects included in the first round of the EU Survey.

Keywords: Cloud, Edge, Open-source, Standards

Document Revision History

Version	Date	Description of change	List of contributor(s)
V0.1	15/04/2021	TOC	Clara Pezuela
V0.2	17/05/2021	Refined TOC	Enric Pages
V0.3	20/06/2021	Initial contributions	All
V0.5	13/07/2021	Open source initiatives	Enric Pages
V0.7	20/08/2021	Standarisation initiatives	Leire Orue-Echevarria
V0.8	27/09/2021	Final contributions	All
V0.9	30/09/2021	Quality review process	Tecnalía, Martel
V1.0	01/10/2021	Final version	Enric Pages

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* *R: Document, report (excluding the periodic and final reports)*

DEM: Demonstrator, pilot, prototype, plan designs

DEC: Websites, patents filing, press & media actions, videos, etc.

OTHER: Software, technical diagram, etc

EXECUTIVE SUMMARY

HUB4CLOUD is a Coordination and Support Action (CSA) funded under topic ICT-40-2020 Cloud Computing: towards a smart cloud computing continuum. HUB4CLOUD runs coordination and support activities to assist growing the impact and relevance of Cloud Computing research, innovation and policy driven efforts while ensuring close coordination and networking among stakeholders in the cloud computing, including key players such as the various ECC projects.

This is supported by the 1) the Strategic Coordination Board (SCB) that will regularly coordinate to align on strategic direction and overall cross-programme objectives, priorities and common activities); 2) a set of dedicated community building and stakeholders engagement tools and services (H-CLOUD Forum animation, expert groups, webinars, liaisons, etc) fostering the growth of a sustainable forum of stakeholders, representing research, industry and users that range across all HUB4CLOUD tasks and activities.

The pre-standardisation/standardisation and open-source activities have been addressed via a dedicated set of activities under the lead of Task 3.1 that helps to promote contributions from ECC projects as appropriate, engaging the relevant (pre-)standardisation bodies and open-source communities, including specific activities aiming to boost the progress of innovative secure, trustworthy and environmentally sustainable CC infrastructures and solutions, by facilitating technology transfer and know-how exchange, while mapping ECC efforts into open-source, pre-standardisation and standardisation activities.



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ABBREVIATIONS

CC	Cloud Computing
CNCF	Cloud Native Computing Foundation
OSS	Open Source Software
SDOs	Standards Developing Organisations

1 INTRODUCTION

This section introduces the general purpose of the deliverable focusing on standardisation and open-source activities under the lead of Task 3.1.

1.1 Overview and Objectives

Contributions and engagement in open-source, pre-standardisation and standardisation activities within the context of H2020 projects often suffers from the lack of visibility on directly relevant initiatives, but also from fragmented efforts. This report aims to help the ECC projects by analysing their planned open-source / (pre-) standardisation efforts and strategies, identify good practices and come up with guidelines on how to effectively monitor, steer and inject into relevant cloud computing initiatives.

The pre-standarisation/standarisation and open-source activities have been addressed via a dedicated set of activities that helps promote contributions from ECC projects as appropriate, engaging the relevant (pre-)standardisation bodies and open-source communities, including specific activities that aim to boost the progress of innovative secure, trustworthy and environmentally sustainable CC infrastructures and solutions, by facilitating technology transfer and know-how exchange, while mapping ECC efforts into open-source, pre-standardisation and standardisation activities.

1.2 Relation to other HUB4CLOUD activities

Information has been collected by directly liaising with the scientific / technical coordinators and innovation / exploitation managers of ongoing ICT-15 and ICT-40 projects. Two dedicated surveys will be run and, in close collaboration with Tasks 1.1, 1.2, 2.1 and 2.3, and dedicated webinars.

1.3 Target Audience

The target audience of this document are technicians and business stakeholders interested in open-source and standardisation activities and initiatives relevant for the European community. The primary target is to help H2020 and Horizon Europe projects to identify contributions on those activities while facilitates technology transfer as well as the know-how exchange between them.

1.4 Structure of the Document

The outline of this document is as follows: The first chapter introduces the document and its objectives. The second chapter describes the methodology and work plan followed during the project lifetime. The third chapter presents the open-source and standardisation activities relevant for EU related to the Cloud Computing research topics. The consultation process used during the EU Survey is described in section 4. The results gathered during the consultation process have been presented in section 5. Finally, the last section contains the preliminary conclusions, recommendations, and guidelines.

2 FOLLOWED METHODOLOGY AND WORKING PLAN

The methodology used for this report was first of all a comprehensive review of the considerable established literature as well as the most recent published reports by the identified SDOs and OSS initiatives in order to reflect an initial state of the art for both communities; standards, and open-source initiatives related with Cloud Computing. Afterwards, additional information has been collected through the HUB4CLOUD EU Survey, which is an online survey-management system built for the creation and publishing of globally accessible forms, where several H2020 EU projects funded under ICT-16-2018, ICT-15-2019 and ICT-40-2020 have been selected to participate.

The methodology applied is an incremental iterative process which has been conducted through two major iterations of interviews and open surveys with scientific coordinators and innovation / exploitation managers of the running EU funded projects. HUB4CLOUD is willing to provide a collaborative framework for facilitating contributions to pre-normative, open-source and standardisation activities, while encouraging the development of new business models and dedicated skill-building programmes.

After every major cycle an analysis of the surveys and reports have been planned to produce two editions (M09 & M18) of a map of standards and open-source bodies/communities related to cloud computing initiatives in Europe.

In addition to the aforementioned sources of information, additional feedback has been gathered continuously from HUB4CLOUD Advisory Board (AB) and Strategic Coordination Board (SCB) as well as through workshops and webinars with stakeholders.

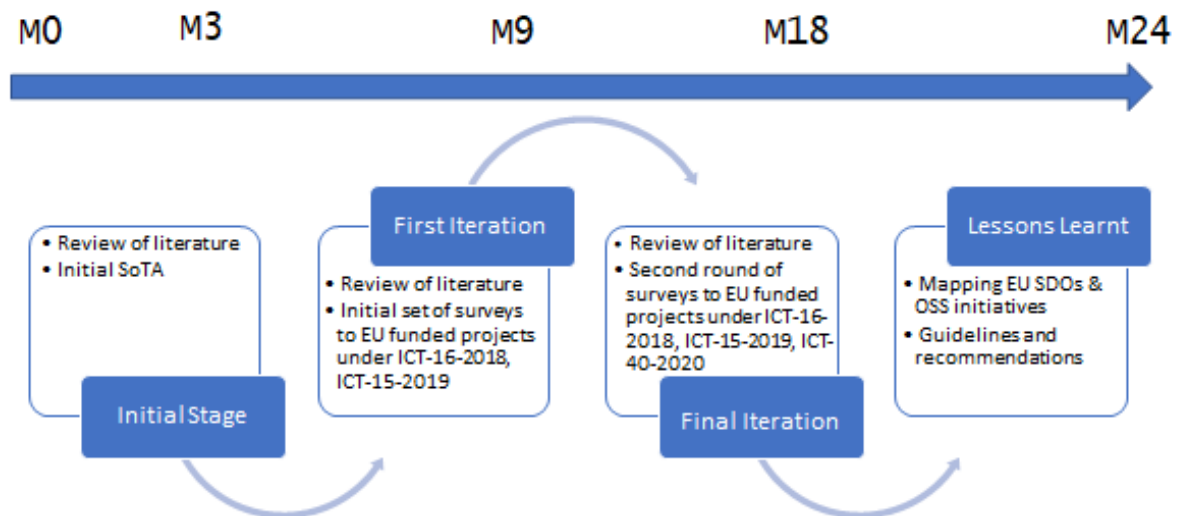


Figure 1. *Please edit the caption*

Methodology followed for the open source

The European Commission approved the new Open Source Software Strategy 2020-2023.

The key objectives of the new strategy are to enable the Commission to:

- Progress towards digital autonomy of Europe's own, independent digital approach.
- Implement the European Commission Digital Strategy.
- Encourage sharing and reuse of software and applications, as well as data, information and knowledge.

- Contribute to the knowledge society by sharing the Commission's source code;
- Build a world-class public service;

The objective of this analysis is to identify the relevant open-source initiatives related with Cloud Computing and Edge paradigms which are in line with the OSS strategy principles defined by the EU commission. The methodology used has been:

- Desktop research analysis of the considerable established literature and community events.
- Surveys to a set of identified projects related to Cloud/Edge topics from different perspectives

Methodology followed for the standards

On 27th September 2012, the Communication from the Commission to the European Parliament and other European Institutions with the title "Unleashing the Potential of Cloud Computing in Europe" [1] already identified in its Key Action 3 the necessity to "*cut through the jungle of technical standards so that cloud users enjoy interoperability, data portability and reversibility*". The result of this Key Action was the launching of two initiatives, which are detailed next:

1. Cloud Certification Schemes Metaframework (CCSM) [2]: The European Commission with the support of the European Union Agency for Network and Information Security (ENISA) and other relevant bodies worked towards a list of Cloud Computing Schemes (CCSL) and a Cloud Certification Schemes Metaframework (CCSM), with the definition of 27 security objectives.
2. Cloud Standardization Coordination (CSC) initiative, led by ETSI which had as main goal a mapping of standards in critical areas such as security, interoperability, data portability and reversibility. It had two phases. Phase I of the CSC took place in 2013 and primarily addressed the Cloud Computing standards roadmap. In December 2013 the results were publicly presented in a workshop organized by the EC. Phase II was launched to address issues left open after CSC Phase 1, with the objective to provide a detailed report before the end of 2015. This Phase investigated some specific aspects of the Cloud Computing Standardization landscape, in particular from the point of view of Users (e.g. SMEs, Administrations). The result was also another report.

In spite of the above efforts, there are still numerous standards in the field of cloud computing; that however can make sense, taking into consideration the complexity of the cloud computing architecture and supply chain.

The objective of this analysis is to identify the most relevant standards coming from different standard bodies, international and European ones. As in similar tasks, the methodology used has been:

- Desktop research analysis: for the desktop research analysis several sources have been analysed based on the knowledge of the project partners.
- Surveys to a set of identified projects, to understand the use of standards in their research projects, the effort devoted to standardization as well as the intention to extend existing standards.

The main sources for the desktop research analysis at hand have been:

- standict.eu and its European Observatory
- the study SMART 20216 /0029 performed by TECNALIA,
- additional desktop research made throughout the different standardization committees of ISO/IEC, especially JTC 1/SC 38 (Distributed Application Platforms and Services) and JTC 1/SC 27 (Information security, cybersecurity and privacy protection), ENISA, and OASIS.

In the case of the European Observatory of standict.eu the following search criteria has been used:

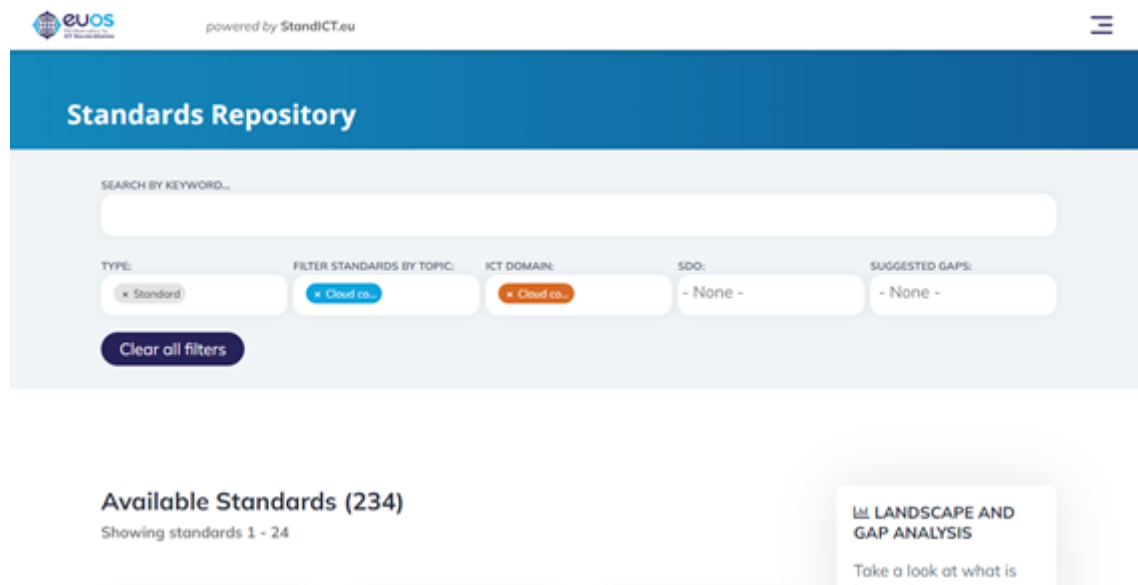


Figure 2. Standict.eu European Standards Observatory

The search obtains 24 standards out of the 234 in the database related to cloud computing. However, a closer filtering of the results yields that several of them are double and both recommendations and standards in draft status are considered as standards. Those are discarded for our analysis.

3 OVERVIEW OF CLOUD STANDARDS AND OPEN SOURCE INITIATIVES

This section provides an overview of existing CC (pre-)standardisation and open-source initiatives.

3.1 Overview of Open-Source Initiatives

The methodology used by the Linux Foundation in its 2016 *Guide to the Open Cloud*, proposes a breakdown of Open Cloud Computing projects in different categories representing the different elements of Cloud Computing paradigm: IaaS, PaaS, Virtualization systems, container management and automation, DevOps, software defined networks and storage among others.

This section does not aim to provide an exhaustive list or mapping of all the technology enablers that could fit in each of the categories proposed by the Linux Foundation, nevertheless this section is focused on the open-source communities that can cover several categories under the same umbrella.

Open Source Initiatives	Website
Cloud Native Computing Foundation (CNCF)	https://www.cncf.io
<p>CNCF serves as the vendor-neutral home for many of the fastest-growing projects providing foundations for the development of cloud computing applications, fostering the collaboration between the industry's top developers, end users and vendors. Projects parts of CNCF include Kubernetes, Prometheus and Envoy.</p>	
OpenInfra Foundation (OpenStack)	https://openinfra.dev/
<p>With over 100,000 members in 187 countries, the OpenInfra Foundation helps open source communities build the tools infrastructure operators need for Data Center Clouds, 5G, Edge, Containers, CI/CD and beyond. The projects and tools ecosystem offered aims to support the development and adoption of production infrastructure with open source components across the computing continuum.</p> <p>Several projects are confirmed: AIRSHIP allowing the lifecycle management and provisioning of cloud in declarative way, KATA Containers for an increased containers security and workload isolation, STARLING X offering a cloud infrastructure software stack for the edge for high-performance and ultra-low latency applications, last but not least, OPENSTACK offering one of the most popular open source programmable infrastructure for the management of clouds across VMs, containers, pods and bare metal resources.</p>	
Kubernetes Communities	https://kubernetes.io/community/
<p>Kubernetes, also known as K8s, is an open-source system for automating deployment, scaling, and management of containerised applications. Kubernetes was originally developed and designed by engineers at Google in 2014 and donated to the Cloud Native Computing Foundation in 2015, the technology has been open-sourced in 2014 in order to provide to the community a platform to develop a way to take out workloads from proprietary infrastructure and enable cloud to run anywhere.</p> <p>Nowadays several open-source technology enablers related with Cloud Computing adopted K8s, including major players in the field like OpenStack or RedHat. The community is composed by more than 52K contributors, 24 Special Interest Groups (SIGs) and around 9 Working Groups</p>	

(WGs), all in all it is translated in one the biggest open source communities with more than 100K issues/pull requests in their source code repository.

The Kubernetes project community is distributed around the world, over the past year, the number of international contributors has grown, as have initiatives to support localizations of the project. The Kubernetes Certified Service Provider (KCSP) program ensure that European providers gets support, consulting, professional services and training required to embrace Kubernetes.

FIWARE

<https://www.fiware.org/>

FIWARE has been growing as an open community committed to promote the adoption and growth of the FIWARE platform as a de-facto standard to developed innovative cloud-based services and applications in multiple sectors, leading to the recent creation of the FIWARE Foundation.

OW2

<https://www.ow2.org/>

OW2 is an independent, global, non-profit, open-source community which fosters open source project to facilitate the development, deployment and management of distributed applications. It focuses on open source middleware and related development and management tools. The mission of OW2 is to a) promote the development of open-source middleware, generic business applications, cloud computing platform and b) foster a vibrant community and business ecosystem. OW2 includes 56 projects in the repository and around 30 corporate members.

Open Nebula

<https://opennebula.io/>

OpenNebula is an open source cloud computing platform to build and manage enterprise clouds covering deployments of containers, virtual machines and Kubernetes clusters. It brings with multi-cloud architecture composed of Edge clusters, that can run any workload on any resource anywhere truly enabling hybrid and multi-cloud architectures across the computing continuum. OpenNebula offers on one hand support to transition from centralized cloud to distributed edge-like cloud environments while on the other hand is able to address peaks of demand and need for extra computing power by dynamically growing the underlying physical infrastructure.

OpenNebula has been used and partly evolved in the las years thanks to EC funds and their involvement in European research projects and initiatives such as HelixNebula for building a European scientific cloud computing infrastructure.

RedHat

<https://www.redhat.com/>

RedHat is one of the major open source companies in the world. It is distinguished one of the most used Linux distributions, but it also offers many solutions for cloud (hybrid cloud, cloud-native deployment, containerisation, etc). American by birth, by now RedHat is strongly established globally, especially in Europe.

RedHat sees edge computing as an opportunity to extend the open hybrid cloud to the data sources and end users. RedHat offers a broad portfolio of solutions providing the connectivity, integration, and infrastructure enablers needed to offer infrastructure, application and developer services related to the cloud.

As part of their catalogue of solutions the more relevant for the cloud paradigm are the Red Hat Enterprise Linux® as an operating system, Red Hat® OpenShift® for containerized workloads, Red Hat OpenStack® Platform for virtual machines and high-performance computing workloads, Red Hat OpenShift Data Foundation provides a persistence storage, Red Hat Ceph Storage for

object storage for modern workload, Red Hat Application Services providing cloud-native capabilities for developers, among other technology enablers for messaging and platform automation.

Open Source MANO (OSM) Project

<https://osm.etsi.org/>

OSM is developing an open-source Management and Orchestration (MANO) stack aligned with ETSI NFV Information Models. As a community-led project, OSM delivers a production-quality MANO stack that meets operators' requirements for commercial NFV deployments.

3.2 Overview of Standards Initiatives

The table below summarizes the standards analysed classified by topic.

Topic	Standards analysed			
Virtualization	DMTF OVF	ISO/IEC 17203		
Architecture	ISO/IEC 17889			
Dataflow	ISO/IEC 19944	ISO/IEC 22624		
Security	ISO/IEC 2700x	EUCS	ISO/IEC 19086-4	
Interoperability and portability	ISO / IEC 19941	OASIS CAMP	OASIS TOSCA	
SLA	ISO/IEC 19086-1	ISO/IEC 19086-2	ISO/IEC 19086-3	
Storage	ISO/IEC 17826			

All standards below are detailed in the same way:

- Identification of the standard: ID and name
- Link: source of the standard
- Goal and brief description of the standard: brief explanation of the objective of the standard
- Main topics addressed (privacy, security, interoperability, portability, vocabulary, architecture, terms, ...): classification of the standard
- Cloud specific (Y/N): whether it is a generic IT standard or a cloud specific one. In principle, for this iteration, with rare exceptions, the focus has been cloud specific.
- Year published: year in which the standard has been published and / or late revised.

Identification of the standard	DMTF Open Virtualization Format (OVF) Specification ISO / IEC 17203:2017
Link	https://www.dmtf.org/sites/default/files/standards/documents/DSP_0243_2.0.0.pdf https://www.iso.org/standard/72081.html
Goal and brief description of the standard	The open virtualization format (OVF) describes the format to package and distribute the software that has to be run on virtual machines. It is not tied to any hypervisor. OVF v2.0 is the last version. The OVF descriptor is an XML file that describes the packaged virtual machine.
Main topics addressed (privacy, security, interoperability, portability, vocabulary, architecture, terms, ...)	Virtualization of hardware (disks, networks, resources, communication and so on)
Cloud specific (Y/N)	Y
Year published	2012

Identification of the standard	ISO / IEC 17789: 2014 - Information technology — Cloud computing — Reference architecture
Link	https://www.iso.org/standard/60545.html
Goal and brief description of the standard	This standard specifies the cloud computing reference architecture (CCRA). It also includes roles, activities, functional components, and relationships. The CCRA is aimed to be vendor-independent and presents the cloud system from four points of view: functional, user, implementation and deployment. However, this standard only focuses on the functional and user viewpoints. The other two are deemed to be out of the scope of the standard as they are inherent to the vendors.

Main topics addressed (privacy, security, interoperability, portability, vocabulary, architecture, terms, ...)	Architecture
Cloud specific (Y/N)	Y
Year published	2014, confirmed on 2021

Identification of the standard	ISO / IEC ISO/IEC 19944:2017 - Information technology — Cloud computing — Cloud services and devices: Data flow, data categories and data use
Link	https://www.iso.org/standard/66674.html
Goal and brief description of the standard	<p>This standard extends 17889 to describes the data flowing within devices and the cloud computing ecosystem (cloud services, cloud service customers, cloud service users).</p> <p>It also provides foundational concepts as well as a data taxonomy and categories of data that flow across the cloud service customer devices and cloud services.</p>
Main topics addressed (privacy, security, interoperability, portability, vocabulary, architecture, terms, ...)	Data flows
Cloud specific (Y/N)	Y
Year published	2017, revised in 2020

Identification of the standard	ISO / IEC 19941: 2017 - Information technology — Cloud computing — Interoperability and portability
Link	https://www.iso.org/standard/66639.html

Goal and brief description of the standard	<p>This standard specifies the common terminology and concepts for interoperability and portability. It is aimed for cloud service customers, cloud service providers, and cloud service partners acting as developers.</p> <p>This standard is related to ISO/IEC 17788, ISO/IEC 17789, ISO/IEC 19086-1, ISO/IEC 19944.</p>
Main topics addressed (privacy, security, interoperability, portability, vocabulary, architecture, terms, ...)	Interoperability and portability
Cloud specific (Y/N)	Y
Year published	2017

Identification of the standard	<p>Family of 27000</p> <p>ISO/IEC 27000, ISO/IEC 27001 & ISO /IEC 27002</p> <p>Information technology - Security techniques - Information security management systems, ISO/IEC 27017 is a code of practice for information security controls for cloud services).</p>
Link	
Goal and brief description of the standard	<p>This set of standards comprises different standards dealing with ISMS (Information Security Management Systems). ISO/IEC 27001 provides an overview of ISMS and defines the related terms and security controls. It is applicable to all types of organizations, regardless of its size.</p> <p>The ISMS family includes standards that define requirements for ISMS and provide guidance and support for the process to establish, implement and improve ISMS. ISO/IEC 27017 is a code of practice for information security controls for cloud services. It includes the same controls of ISO/IEC 27002 but with the cloud deltas.</p>

Main topics addressed (privacy, security, interoperability, portability, vocabulary, architecture, terms, ...)	Security
Cloud specific (Y/N)	Partly. ISO/IEC 27017 is cloud specific.
Year published	2013

Identification of the standard	OASIS - Cloud Application Management for Platforms Version 1.2
Link	http://docs.oasis-open.org/camp/camp-spec/v1.2/cs01/camp-spec-v1.2-cs01.html
Goal and brief description of the standard	This document defines the APIs that a CSP needs to provide to manage, monitor and patch applications on the cloud. Its purpose is to enable interoperability among self-service interfaces to PaaS clouds by defining artifacts and formats that can be used with any conforming cloud and enable independent vendors to create tools and services that interact with any conforming cloud using the defined interfaces.
Main topics addressed (privacy, security, interoperability, portability, vocabulary, architecture, terms, ...)	Interoperability
Cloud specific (Y/N)	Y
Year published	2018

Identification of the standard	OASIS TOSCA - Topology and Orchestration Specification for Cloud Applications Version 1.0
Link	<p>https://www.oasis-open.org/committees/tc_home.php?wg_abbrev=tosca</p> <p>TOSCA simple profile in YAML v1.3 https://docs.oasis-open.org/tosca/TOSCA-Simple-Profile-YAML/v1.3/os/TOSCA-Simple-Profile-YAML-v1.3-os.pdf</p>
Goal and brief description of the standard	<p>It aims to improve the portability of cloud services and applications across their lifecycle. It provides templates that describes services and parts of the services as well as the operational behaviour of such services.</p> <p>Recently, the TOSCA Simple profile in YAML has been published, becoming a full standard in 2020. The TOSCA Simple profile in YAML aims to provide a more accessible syntax as well as a more concise and incremental expressiveness of the TOSCA Domain Specific Language. The goal is to minimize the learning curve and speed the adoption of the use of TOSCA to portably describe cloud applications.</p>
Main topics addressed (privacy, security, interoperability, portability, vocabulary, architecture, terms, ...)	Portability
Cloud specific (Y/N)	Y
Year published	2013 - 2020

Identification of the standard	ISO 19086 family -Information technology — Cloud computing — Service level agreement (SLA) framework
Link	https://www.iso.org/standard/67545.html https://www.iso.org/standard/67546.html https://www.iso.org/standard/67547.html https://www.iso.org/standard/68242.html
Goal and brief description of the standard	<p>This series of norms looks to establish a common cloud service level agreement building blocks. There are four parts:</p> <ul style="list-style-type: none"> - Part 1: defines common terms, and concepts - Part 2: defines the metrics model - Part 3: defines the core conformance requirements - Part 4: security and protection of personally identifiable information, SLOs, SQOs, requirements and guidance.
Main topics addressed (privacy, security, interoperability, portability, vocabulary, architecture, terms, ...)	SLA
Cloud specific (Y/N)	Y
Year published	2016

Identification of the standard	ISO/IEC 17826:2016 Information technology — Cloud Data Management Interface (CDMI)
Link	https://www.iso.org/standard/70226.html

Goal and brief description of the standard	<p>This standard explains how to access cloud storage and manage the data stored in there. It is for developers.</p> <p>It documents the functional specification that applications need to use to create, retrieve, update and delete data elements from the Cloud.</p>
Main topics addressed (privacy, security, interoperability, portability, vocabulary, architecture, terms, ...)	Storage
Cloud specific (Y/N)	Y
Year published	2016

Identification of the standard	<p>ISO/IEC 22624:2020</p> <p>Information technology — Cloud computing — Taxonomy based data handling for cloud services</p>
Link	https://www.iso.org/standard/73614.html
Goal and brief description of the standard	This standard extends the taxonomy in ISO/IEC 19944 and provides guideline in its application, especially in handing the data
Main topics addressed (privacy, security, interoperability, portability, vocabulary, architecture, terms, ...)	Data handling in cloud services
Cloud specific (Y/N)	Y
Year published	2020

Identification of the standard	EUCS – European Cloud Services certification scheme
Link	https://www.enisa.europa.eu/publications/eucs-cloud-service-scheme
Goal and brief description of the standard	This scheme looks into the certification of cloud services under the European Cybersecurity Act. It is still under development by ENISA and will be brought to CEN-CENELEC for its conversion into a European scheme.
Main topics addressed (privacy, security, interoperability, portability, vocabulary, architecture, terms, ...)	Security
Cloud specific (Y/N)	Y
Year published	2020 (draft)

4 CONSULTATION PROCESS

During the first months of the project, and in collaboration with other tasks, a survey was launched. This survey was published on EUsurvey and was addressed to project coordinators of identified cloud related projects funded under H2020.

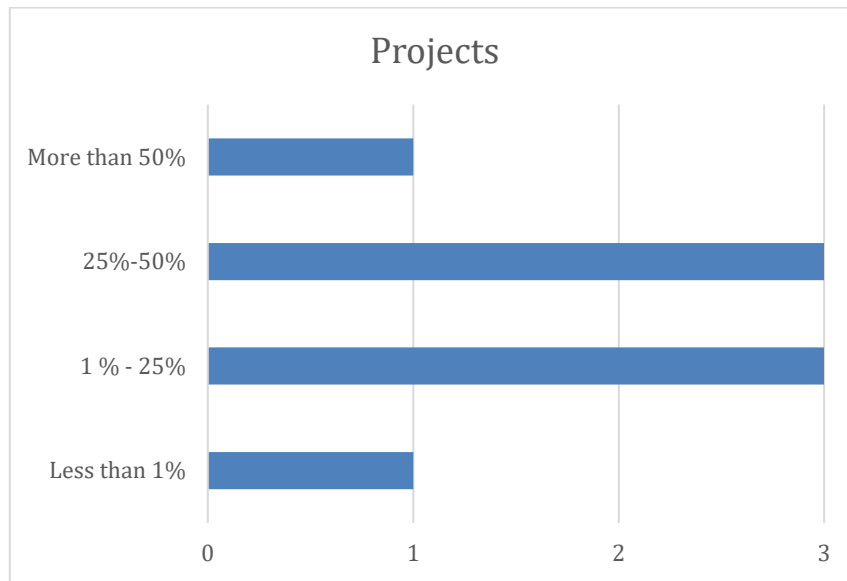
The following projects provided their answer: RAINBOW, SmartCLIDE, ACCORDION, IntelComp, PLEDGER, MARVEL, MORPHEMIC, MEDINA, PolicyCLOUD and DECIDO.

These are the questions related with open source and standardization initiatives:

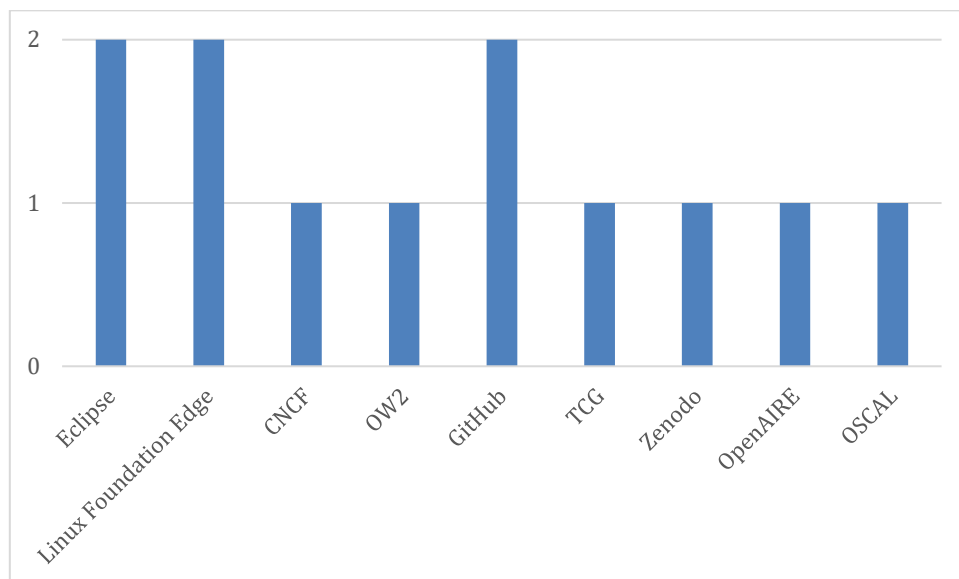
Open Source	Please indicate the % PMs devoted to open source related tasks in the project
	Which open source communities have you identified as potential target for your software components?
	Which OS projects do you plan to contribute to during the project?
	How many OS components have you downloaded and used in your project?
	Explain briefly the strategy you have defined to approach OS communities and provide your results as open source (if it is the case). If no strategy, please indicate as well.
	Which OS strategy from the list would you see more applicable to your project?
	How many software components have you published in a public open source repository?
	How many commits have you been requested in your open source components?
	How are you monitoring the compatibility of all the open source licenses that you are using in the project?
Standardization	Please indicate the % PMs devoted to standardization task in the project
	Which Cloud related standards are you adopting in your project?
	To which Cloud related standards are you contributing or planing to contribute in your project?
	How many workshops agreements are you planning to participate in or promote?
	Are you participating in or using the EUCS?

In the context of open source, nine questions were asked. The answers are reported next.

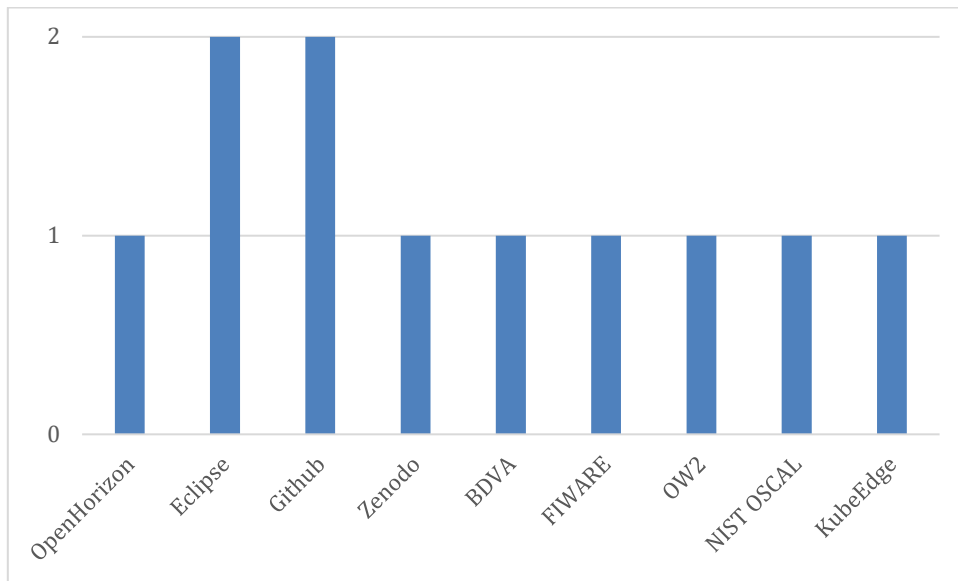
1. Please indicate the % PMs devoted to open source related tasks in the project



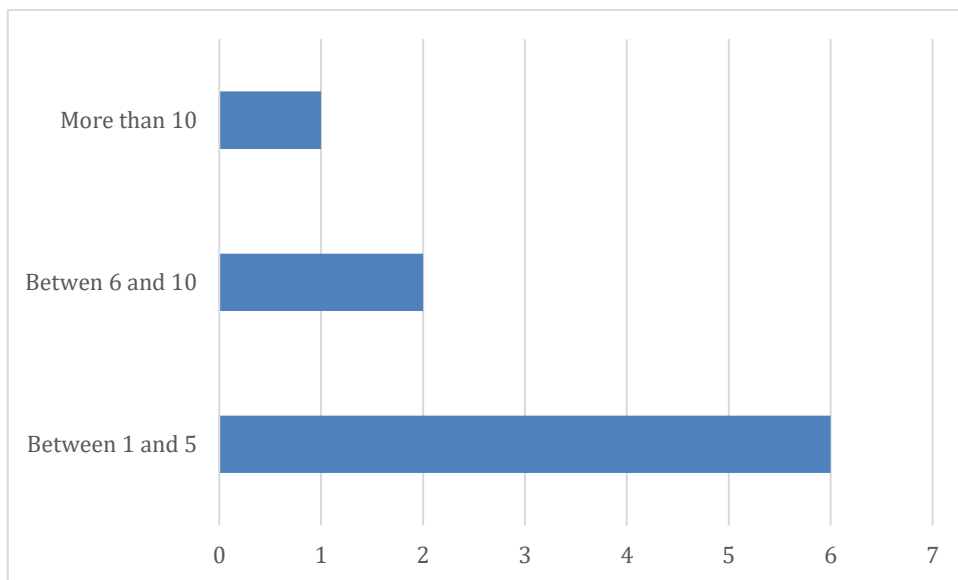
2. Which open-source communities have you identified as potential target for your software components?



3. Which OS projects do you plan to contribute to during the project?



4. How many OS components have you downloaded and used in your project?



5. Explain briefly the strategy you have defined to approach OS communities and provide your results as open source (if it is the case). If no strategy, please indicate as well.

RAINBOW

"TUW has established contact to Open Horizon’s Technical Steering Committee (TSC) in February 2021.

On 29 March 2021 TUW and UCY presented the RAINBOW platform and the contribution candidate components to the Open Horizon TSC. The presentation and discussion have

sparked interest in the RAINBOW platform and the suggested contributions.

The next step for RAINBOW is to evaluate these options and propose a plan to Open Horizon, after they have evaluated the first release of the RAINBOW platform."

SmartCLIDE

Eclipse Foundation is partner of SmartCLIDE, therefore approach Eclipse was natural

ACCORDION

Through events

IntelComp

Year 1. Currently IntelComp have just identified open components and are in the process of deciding the right licenses for them. Diffusion to the research community will be carried out through scientific papers, workshops, social networks.

PLEDGER

Monitor the current status, map architectures and identify gaps. If there's any point for collaboration, contact them to present and share results.

MARVEL

MARVEL is planning to:

- i) give special emphasis on fostering Open Access of MARVEL results at an open access portal,
- ii) strengthen the open science and open data, iii) engage with multiple stakeholders and develop an open source information ecosystem, iv) use Open Source code in its deliverables or to contribute its deliverables to the Open Source communities; v) contribute to standards; vi) to release part of its solutions as open source

MORPHEMIC

Through OW2 Platform, OW2 is an experienced Open Source Software community for collaborative R&D projects. It provides community support and dissemination services.

MEDINA

Approach through standardization activities, and participation in relevant events

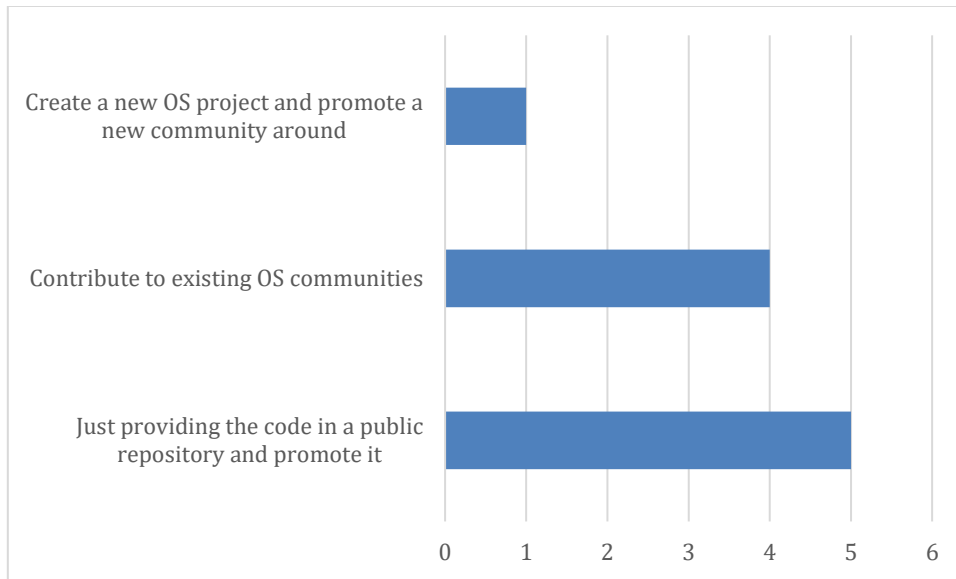
PolicyCLOUD

Not a specific strategy yet.

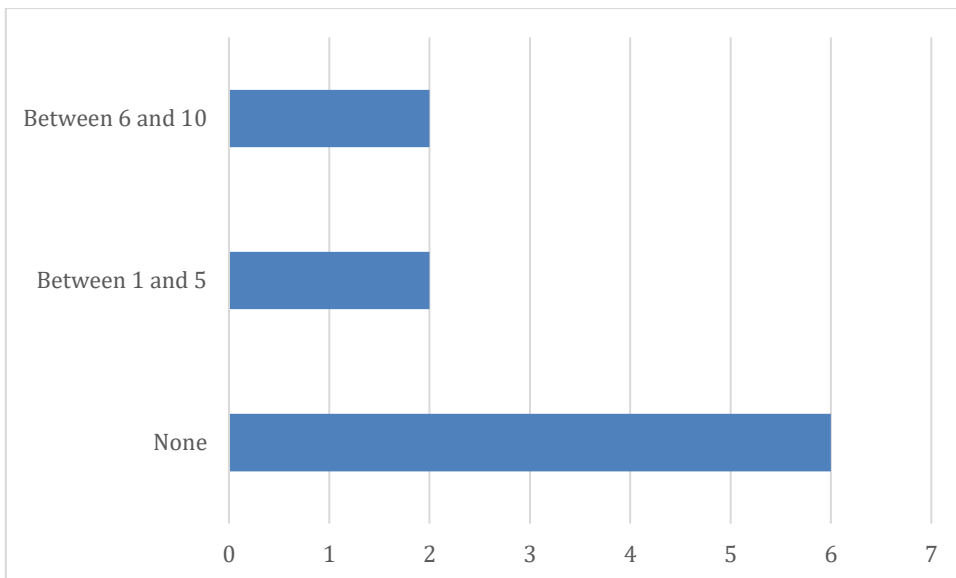
DECIDO

Exploiting OS assets, belonging to the project partners, developed in previous projects, and releasing new project components as OS.

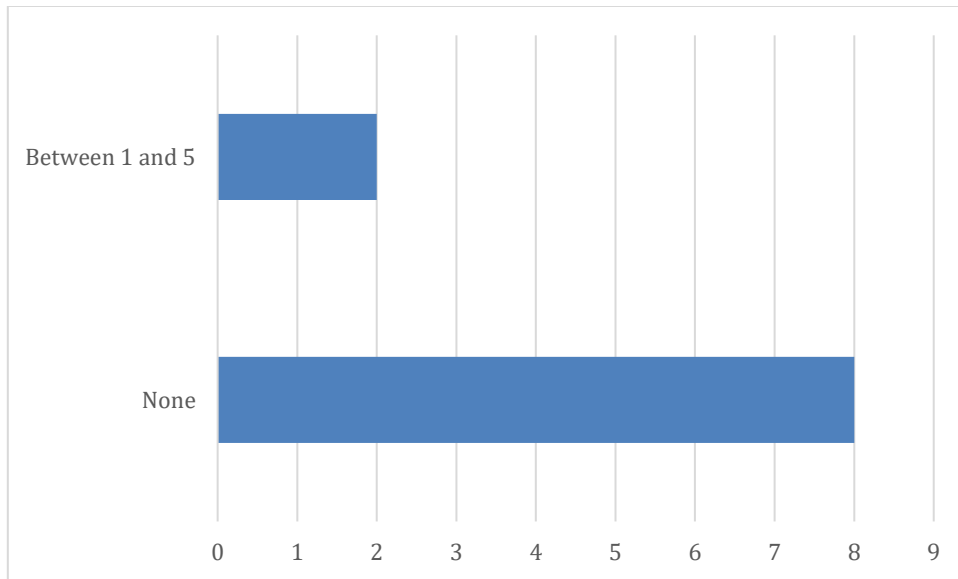
6. Which OS strategy from the list would you see more applicable to your project?



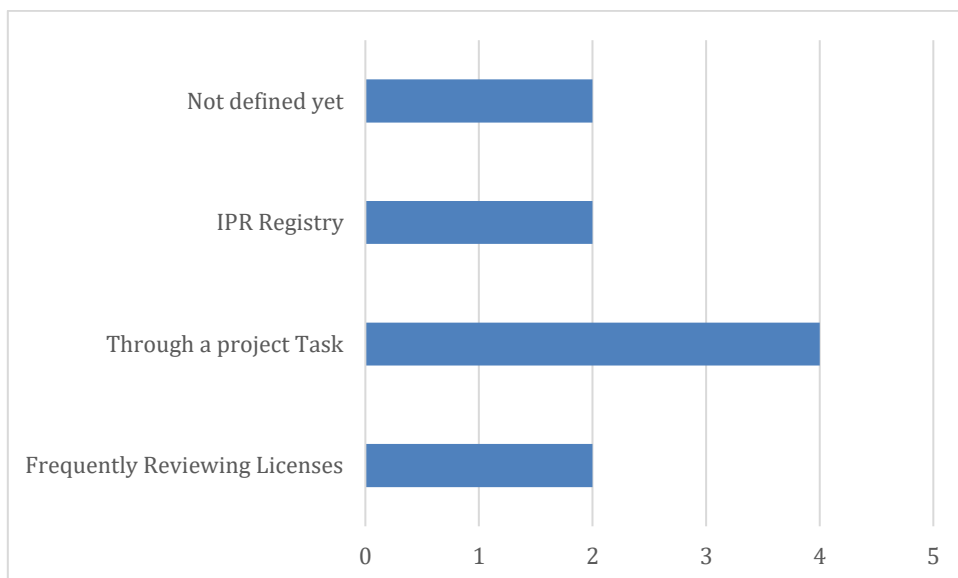
7. How many software components have you published in a public open source repository?



8. How many commits have you been requested in your open source components?



9. How are you monitoring the compatibility of all the open source licenses that you are using in the project?

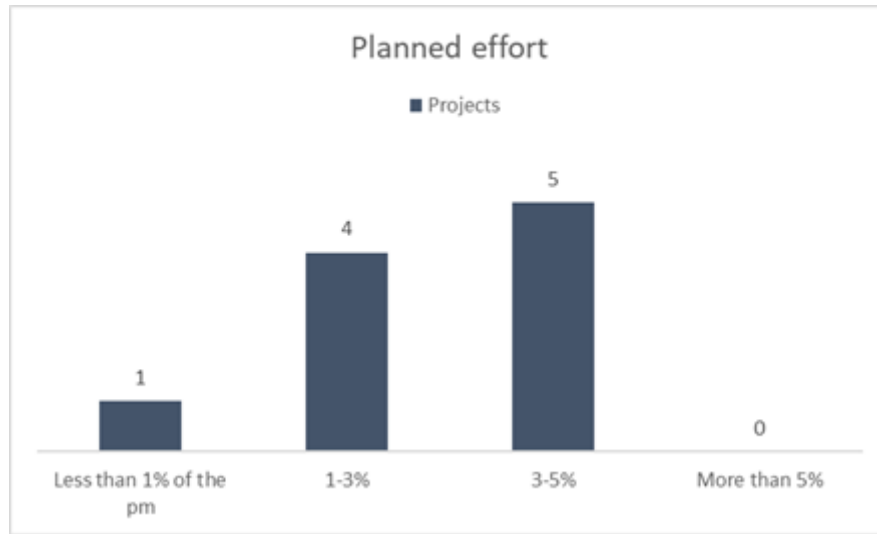


In the context of standardization, five questions were asked. The answers are reported next.

1. Indicate the percentage of person-months devoted to the standardization task in the project

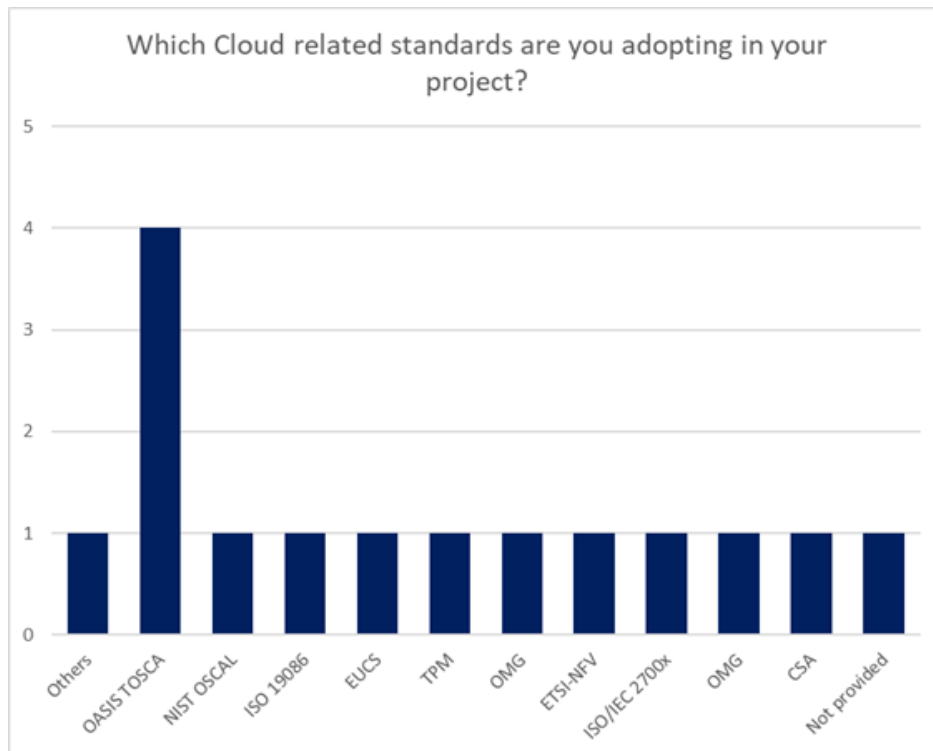
The picture below depicts the planned effort reported by the projects in terms of standardization

compared to the overall effort of the project. The majority report to dedicate an average of 3% to 5% of the effort to activities related to standardization, be them observing or contributing.



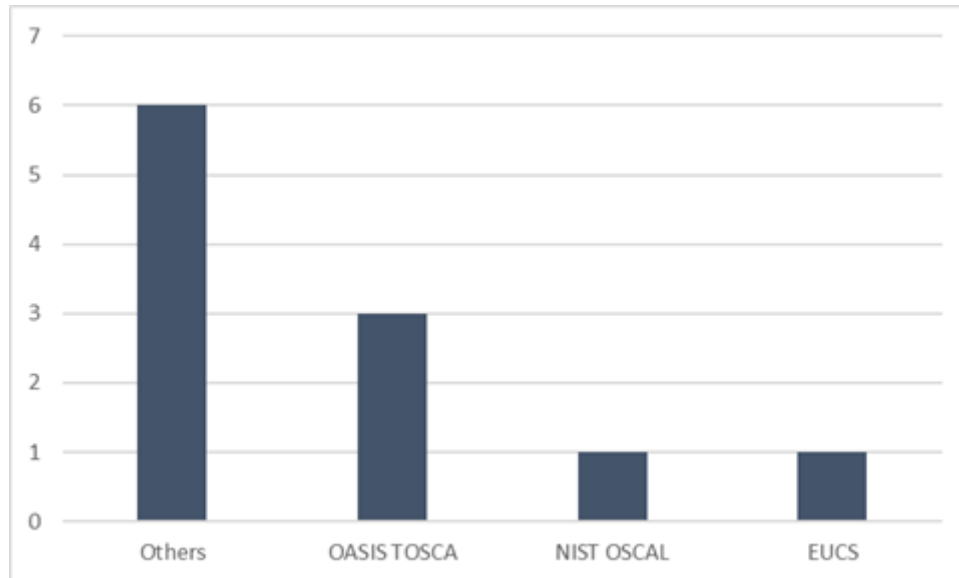
2. Which Cloud related standards are you adopting in your project?

With respect to the standards that are being adopted by the projects participating in the survey, it can be seen that TOSCA OASIS is the most popular one. 4 projects are adopting TOSCA OASIS, 3 of them in its “pure” status, while one of them, MORPHEMIC, is adopting it in its CAMEL flavour, an extension developed in previous projects such as MELODIC. Other standards include security related ones such as the upcoming European Cloud services certification scheme (EUCS) and the related ISO / IEC 2700x, and NIST OSCAL. OMG is also mentioned; however no further details are provided on which exact standard is being observed.



3. To which Cloud related standards are you contributing or planning to contribute in your project?

With respect to the standards to which the projects aim to contribute, the projects have responded “other”, but few details have been provided in the “please specify” textbox. One of the projects has mentioned ITU-T but not the exact number of the standard. As in the standards that are being observed it can be seen that the OASIS TOSCA is the standard to which most projects aim or will aim to contribute.



4. How many CEN workshops agreements (CWA) are you planning to participate in or promote?

The aim of this question is to understand how many projects are aiming to eventually create a CEN workshops agreement (CWA). CWAs are specifications drawn up in an open workshop environment.

Out of the 10 projects only two (ACCORDION and MEDINA) are planning to participate. In the case of MEDINA, they will be doing so in the context of their participation as members of the ad-hoc working group of ENISA of the EUCS.

5. Are you participating in or using the EUCS?

The European Cloud Services Certification Scheme (EUCS) is one of the main initiatives launched in the field of cloud security in recent years. EUCS is the second certification scheme launched to be developed under the Cybersecurity Act, which aims at creating a certification framework for ICT products, services and processes. Out of the 10 projects that answered only one project, MEDINA is using, participating in and extending EUCS.

5 ASSESSMENT

These are the CC open-source communities and standardisation initiatives mapping around the H2020 EU projects selected within the first iteration of the HUB4CLOUD EU Survey.

Project	Topic	OS Potential Target Community	OS Projects Contribution Planned	CC Standards Adopted	CC Standards Contribution Planned
RAINBOW	Self-healing Cloud/ Cloud Federation	Open Horizon, Linux Foundation Edge	Open Horizon Scenarios	Trusted Platform Module standard others	Open Horizon, Trusted Computing Group
SmartCLIDE	AI for the Cloud/Cloud Federation	Eclipse Foundation	Eclipse Theia, Eclipse Che	OASIS; OMG	OASIS TOSCA
ACCORDION	Cognitive cloud/Cloud Federation	Eclipse Foundation	Cloud Application Management Framework	OASIS; ETSI-NFV	ITU-T
IntelComp	Cognitive cloud; AI for the Cloud	Open Data communities	Github, Zenodo	NA	NA
PLEDGER	Cloud Federation	LF Edge, CNCF	EdgeX Foundry and KubeEdge	OASIS	OASIS TOSCA
MARVEL	AI for the Cloud	OpenAire, GitHub, Zenodo	BDVA, FIWARE, ETP4HPC, EuroHPC	Cloud Security Alliance	Cloud Security Alliance
MORPHEMIC	AI for the Cloud	OW2	OW2 Melodic OS Project	TOSCA adapted in CAMEL	CAMEL
MEDINA	Cloud certification	NIST OSCAL	NIST OSCAL, Clouditor, Azure at Github	OSCAL; ISO19086; EUCS	OSCAL; EUCS
PolicyCLOUD	Legislation aware Cloud	n/a	n/a	StandICT	Others
DECIDO	Cloud Federation	GitHUB	None	OASIS	OASIS TOSCA

6 LESSONS LEARNT AND FUTURE WORK

The collaboration between OSS and SDOs is a key element for the adoption of CC and edge new architecture paradigms. OSS technologies allow the combination of different services or systems allowing producers to break applications and connect them through service endpoints. Nevertheless, the lack of Cloud interoperability and the consequent vendor lock-in is seen as a barrier that the standards could minimize. For this purpose, SDOs and OSS should change the way they are operating nowadays towards a closer collaboration instead of working as different entities. However, this is not an easy goal to accomplish as OSS ecosystem moves forward rapidly boosted by large communities and market giants which release open-source version of their solutions, while SDOs produce standards at slower pace.

HUB4CLOUD aims to establish well-defined mechanisms through support activities to assist growing the impact and relevance of Cloud Computing research as well as the collaboration between OSS and SDOs in the scope of EU funded projects.

The current report, as starting point, offers an overview of the most relevant OSS and SDOs initiatives across the EU community as well as within the EU projects included in the first round of the EU Survey.

Further iterations of the same report will be released in every project cycle in order to provide guidance and recommendations while re-evaluate the project needs during their lifetime.