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H-CLOUD

Horizon Cloud – The Forum for Strategy Focused Cloud Stakeholders

D1.5: Online Catalogue and Knowledge Transfer Services

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Abstract

This report aims to document the different knowledge transfer services identified and developed within the first year of the H-Cloud project as well as serve as a technical document outlining the development of the online catalogue of relevant Cloud-related activities.

Keywords:

Catalogue, technical, knowledge transfer, development

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Disclaimer

Project co-funded by the European Commission in the Horizon Cloud Programme		
Nature of the deliverable: R		
Dissemination Level		
PU	Public, fully open, e.g. web	√
CI	Classified, information as referred to in Commission Decision 2001/844/EC	
CO	Confidential to H-CLOUD project and Commission Services	

* 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

This report describes the different knowledge transfer services identified within the first year of the H-Cloud project. The main form of knowledge transfer within this stage of the project is the online catalogue of cloud-related activities and community best practices. This online catalogue takes the form of a series of linked resource web pages that describe the identified activities in greater detail. Some of the information provided within these resource pages includes but is not limited to:

- Cloud Delivery Model
- Geographical Scope
- Industry
- Targeted Domains
- Operating Model

The details identified allow us to create an indexable database of profiles made publicly available, granting members of the community the ability to search for relevant activities in their technological and geographic areas.

In addition to the catalogue, the H-Cloud project also makes use of its online forum as a platform for knowledge sharing and transfer, open to all stakeholder groups.

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ABBREVIATIONS

CMS	Content Management System
IaaS	Infrastructure as a Service
ICT	Information and Communication Technology
IoT	Internet of Things
LAMP	**L**inux, **A**pache, **M**ySQL, **P**HP (an open-source group of technologies)
PaaS	Platform as a Service
SaaS	Software as a Service
RDBMS	Relational Database Management System

1   INTRODUCTION

This section introduces the background of the deliverable as well as outlines the structure of this report.

1.1 Background

In order to facilitate the act of knowledge transfer within the H-Cloud project, a series of different knowledge transfer activities and tools were required. The main tool, the online catalogue of Cloud related activities and community best practices is being developed in such a way that users can easily access information relevant to their needs. The catalogue however, only addresses stakeholders who already possess adequate knowledge of the area. For those who do not, other forms of knowledge transfer needed to take place.

This document proceeds to outline the technical direction that was taken to develop the online catalogue tool as well as what other activities were coordinated and tools developed in order to deliver the necessary knowledge transfer services.

1.2 Document Outline

This report is split into the following sections:

- **Section 1** outlines the deliverable itself. This includes the background of the deliverable as well as the structure of this report.
- **Section 2** focuses on the online catalogue. Specifically, it discusses where the information was sourced from, the technical components that make up the catalogue and the different tools and features added to it in order to facilitate a smooth and useful user experience.
- **Section 3** focuses on the other initiatives used as knowledge transfer services.
- **Section 4** sees the conclusion of the report and details what will be focused on for the second half of this project.

2   ONLINE CATALOGUE

The online catalogue of cloud related activities is the major knowledge transfer service within this deliverable. This catalogue (found on https://catalogue.h-cloud.eu) contains all profiles identified within the beginning of Work Package 1, in particular task 1.1 (Cloud Computing Portfolio: Projects / Initiatives / Organizations / Businesses / Policies).

The catalogue takes the form of an indexable database of profiles which is publicly available to all members of the community. This catalogue offers several different ways of retrieving information, as well as links to other external sources for additional information.

2.1 Backend Framework

The framework chosen to serve as the backend for the online catalogue was an installation of the WordPress (https://wordpress.org/) open source Content Management System (CMS). WordPress was chosen as the most feasible, advantageous and cost-effective solution due to a variety of considerations. The major reasons for this decision were the following:

- **Same system as project website:** The project website (https://www.h-cloud.eu) was also built on top of the WordPress CMS. This would greatly facilitate possibilities for integration of the catalogue into the project website. If the decision was made for the catalogue to be absorbed within the same system, this would make the migration much simpler.

  With digital content being created, modified and stored using the same system, the integration of content could be achieved with much greater ease, flexibility, and at a much lower cost.

- **Readily accessible talent:** In order to negate any possible risk of a member of the technical team no longer being able to work on the catalogue, the use of the extremely popular WordPress framework ensured that there would be a large supply of developers capable of working on the tool should the need arise to acquire additional help when working on the catalogue.

  The long-established popularity of WordPress amongst web developers, its relative ease of use, and countless training media available for free online, means the skills necessary to manage the tool would not be hard to find. Therefore using this tool allowed us a greater deal of flexibility and protection against unforeseeable risks of staff shortages or loss of talent.

- **User friendliness/ease of use**: With so many websites being built using the WordPress framework, finding people who are experienced with data entry on the system is much simpler. The system itself is very easy to use, and there are countless guides and tutorials available for free on online media that can take a user from zero-familiarity with the framework to a strong working understanding of the interface and its features. Moreover, with the website already developed, entering data and uploading digital content requires virtually no training with the use of the platform.

  This eliminates the bottleneck of only being able to use skilled technical staff to update the catalogue, thus affording us greater freedom of flexibility and the opportunity to save costs and time.

WordPress offers a powerful backend interface which comes preloaded with some of the more essential management features needed to run an online platform such as user registration, roles and permissions. These take the form of a few very user-friendly pages that can be used by non-technical individuals.

- **Vast documentation:** Due to the vast scale of websites and applications built using the framework, research into any issues as well as defining the technical tools required in order to develop the catalogue were made much simpler. Being such a long-established framework, the documentation behind WordPress has been greatly developed, with any issues that may arise in the development of a website likely to have already been addressed. Numerous sources of information regarding the system exist, including online forums where issues and possibilities with WordPress are discussed.

  These provide a comfortable degree of support for any disruptions to workflow that may arise, thus providing us with further protection against risks and greater ease of utilising the software.

- **LAMP Stack:** WordPress is built using the open-source LAMP stack - a set of web service solution components (including the Linux operating system, the Apache HTTP Server, the MySQL relational database management system (RDBMS), and the PHP programming language) which are largely interchangeable and provide a great degree of adaptability and flexibility. The greatest advantage of using the LAMP stack is that its component software is all free and open-source.

  Therefore, using WordPress reduced not only the required performance of the hosting server used but by extension, also the running costs of the catalogue. This will ensure the longevity of the catalogue even after the lifetime of the project.

2.2 Content Management

Thanks to the open-source nature of the WordPress framework, custom content types are able to be defined in order to build a purpose-fit solution to the issue of creating a catalogue of custom object types. Using custom data types allow the creation of user friendly pages for the means of data entry, allowing people of varying levels of technical expertise to assist in the upkeep of the catalogue.
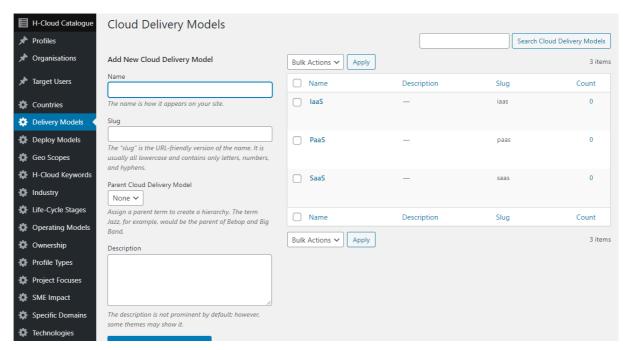
Figure 1: Backend system controlling the custom profile data types

2.3 Custom Data Types

In order to facilitate the different technical requirements of the catalogue such as filtering, searching and linking, it was necessary to create custom data types that would be available within the creation of the catalogue. These data types categorise individual profiles according to shared characteristics between sets, to make it easier to differentiate between them and to identify profiles that meet specific criteria, such as their geographical scope or the industrial field of application. Below is the full list of custom data types identified:

- **Profile Type:** This defines the type of profile listed with the catalogue. Within the category, users canfilter between Research and Innovation projects as well as Deployment profiles, which are then further defined as private, public or private/public initiatives. This data type gives a clear initial idea of what activities the profile involves, how they are funded and the organisations behind them, thus greatly supporting or narrowing down any selection process.

- **Geographical Scope:** When filtering by geographical scope, the user is selecting what kind of geographical area the activity is confined to. This can be as specific as activities which took part in a local/regional level concerning local communities or the jurisdiction of local or regional governments. National initiatives concerning entire countries can also be targeted. Further up are European scale profiles, including projects that ran within the European Union or involving international activities between European states. Moving further outwards, profiles belonging to activities which ran on a global scale can also be targeted.

- **Keywords:** Keywords are used to help isolate specific areas of cloud technologies identified during the profiling of activities. These keywords currently include edge, federation and green activities. By selecting and searching for these specific keywords, users can easily identify profiles that match their particular field of interest within the broad umbrella of cloud computing.

- **Cloud Delivery Model:** This data type addresses which of the three cloud services delivery models the activity falls within, which concern how the cloud service is packaged, deployed and provided for use by the end-user. The available options for this type include Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS).

- **Cloud Deployment Model:** This data type addresses the specific parameters of the activity mainly the accessibility of the deployment infrastructure. Within the catalogue, the available options are Enterprise Private, Hosted Private, Hybrid, Local and Public.

- **Industry:** The industry object type addresses which specific industry the activity in question falls within and the general field of application of the project or activities of the profile concerned. The following are the available industries within the catalogue at the time of writing, along with the types of profiles associated with each industry:

  - **Agriculture** - Profiles of activities related to farming, including the cultivation of crops and the rearing of livestock.

  - **Construction** - Profiles of activities related to the construction of buildings, infrastructure, industrial facilities, and associated fields such as architectural planning, zoning, design, maintenance, and demolition.

  - **Education and Skills** - Profiles of activities related to the facilitation of learning and training, including the provision of pedagogical material, and delivery of resources related to professional skill development.

  - **Finance** - Profiles of activities related to the management, generation and financial studies and investments, including the funding of capital, risk management and planning of investments in the contexts of personal, public and corporate finance.

  - **Health** - Profiles of activities related to physical, social and mental well-being of individuals and communities, including actions involving the provision of medical care, treatment of diseases and infirmity, and promotion of activities and awareness that support good health.

  - **Information and Communications** - Profiles of activities involving the transmission and processing of data and information through Information and Communication Technology (ICT) such as telecommunication devices, computers and associated networks.

  - **Manufacturing** - Profiles of activities related to the creation and production of goods for use or sale involving the use of labour, machines, tools, and biochemical formulation or processing.

  - **Professional Services** - Profiles of activities related to the provision of services within the tertiary or quaternary sector, involving the use of skills, training, and knowledge developed within that profession, such as lawyers or accountants.

  - **Public Administration** - Profiles of activities related to the implementation of government policy and the work of civil employees within the public service.

- ○ **Retail** - Profiles of activities related to the sale and provision of consumer goods or services through multiple channels of distribution such as supply chain stores.

- ○ **Transport** - Profiles of activities related to the movement of people or goods through modes and systems of transport, and the associated transport infrastructure and vehicles.

- ○ **Utilities** - Profiles of activities related to the provision of infrastructure for the delivery of public services and goods for public consumption including electricity, water, natural gas and sewage.

- ● **Domains Targeted:** This field categorises activities according to the general area of objectives which they target. The following domains are currently available within the catalogue:

  - ○ **Green Deal** - Profiles within this domain are in-line with the objectives of the European Green Deal, and target actions related to sustainability, environmental protection, resource-efficiency as in a circular economy, and actions that protect against climate change.

  - ○ **Mobility** - Profiles within this domain involve actions that target the provision of accessible means of transport and mobility, with a focus on safety, affordability, competitiveness and sustainability,

  - ○ **Science and Research** - Profiles within this domain involve actions that involve scientific activities such as research and development, innovation across many fields, the production of new technologies, and education related to STEM subjects.

  - ○ **Small and Medium Enterprises (SMEs)** - Profiles within this domain involve activities that support small businesses, promote competitiveness and innovation, and aid growth and scalability.

  - ○ **Smart Cities** - Profiles within this domain involve activities that concern the development of urban areas that integrate electronic methods and sensors for data collection to manage assets, resources and services efficiently.

- ● **Technology:** Technology refers to the core technologies described within the activity. Given that the full potential of cloud computing is still being discovered, many of these profiles concern technologies that are at the forefront of scientific development, and some that are still being researched and developed. Below is a list of the current technology areas identified that can be found in the catalogue:

  - ○ **Artificial Intelligence/Machine Learning** - Artificial Intelligence technology involves the theory and development of machine systems that are capable of mimicking human cognitive functions such as perceiving its environment, problem solving and learning. Machine learning involves the use of such a system to learn from past data through algorithms, to adapt and draw inferences to codify new behaviour that is independent from any explicit instructions programmed by humans.

- ○ **Augmented Reality/Virtual Reality** - Virtual reality technology involves the production of immersive simulated experiences that are similar or different to the real world, such as through the use of virtual reality headsets. Whereas, augmented reality uses simulated modalities to enhance objects that exist in the real world, such as by overlaying information over a real-time recording of one's environment.

- ○ **Big Data** - Big Data technologies refer to activities that analyse, extract information, or process data sets of vast sizes, that are too large or complex to be processed or handled by traditional software applications.

- ○ **Blockchain** - A blockchain is a growing list of records that are each cryptographically linked, timestamped and contain their own transaction data. It is effectively a way to store data in a way that is tamper-proof and resistant to modification, thus providing various opportunities for secure data transfer such as online transactions through cryptocurrencies. This emergent technology is still being explored and many potential ground-breaking applications are still to be discovered.

- ○ **Edge Computing** - Edge computing is a concept related to cloud computing, that involves the transfer of computing power and data storage away from centralised data centres to the point of application where it is used by the end-user, such as in smart homes.

- ○ **Internet of Things (IoT)** - IoT technologies refer to the development of networks between physical objects through embedded sensors and software for the purpose of connecting with other devices and the internet.

- ○ **Next-Gen Connectivity (5G/6G/Wi-Fi 6)** - This area of technology refers to the innovations and infrastructure that will support the next generation of connectivity technology, which will allow for faster more efficient communication between devices and the internet.

- ○ **Quantum Computing** - This field of technology involves the application of quantum phenomena including superposition and entanglement for the purposes of computation, allowing for the solution of a set of complex computational problems with much faster speeds than traditional computers.

- ○ **Social Media** - Technologies within this field refer to devices and software that facilitate the generation or sharing of information through networks and virtual communities.

- **Operating Model:** The Operating Model addresses the system, structure and organisation of how an activity is being operated and managed. Activities are currently catalogued as either Centralised, Consortium or Federated.

- **Ownership:** This data type describes how the ownership of the activity has been identified, currently either as centralised or collaborative.

- **Organisation:** In order to store all the different components of the stakeholders associated with profiles, a more complex custom data type was made for organisations. Unlike the majority of other custom data types, 'organisations' involves a series of internal attributes containing the different fields that define them such as name and country.

2.4   Filtering

In order to improve the ability to traverse the catalogue as well as facilitate the discovery of activities, it was imperative that users would be able to filter the catalogue based on different attributes. These attributes, or metadata, are taken directly from the different data types identified during the landscaping phase of WP 1 and listed above in 2.4 Custom Data Types.

By scanning each profile's metadata for corresponding values to the filters selected, we are able to remove irrelevant results and only display those records within the set of query data.

2.5   Searching

Similar to filtering, the use of text allows the user to search for profiles this time however, based on known textual information. This enabled the user to search for profiles based on values such as name, funding programme, shareholders and much more.

Text search uses similarity-based queries to first locate all targeted fields containing possible matching values and then sort them based on a percentage-based matching system, placing higher similarity profiles on top of the list of search results.

2.6   Geographical Mapping

Using the locational data connected to organisations, we are able to construct a geographical map of stakeholders connected to our profiles. Making use of the OpenStreetMap mapping framework, we are able to take location information from each organisation associated with a profile and plot a marking point on the map, offering a geographical overview of a profile's makeup.
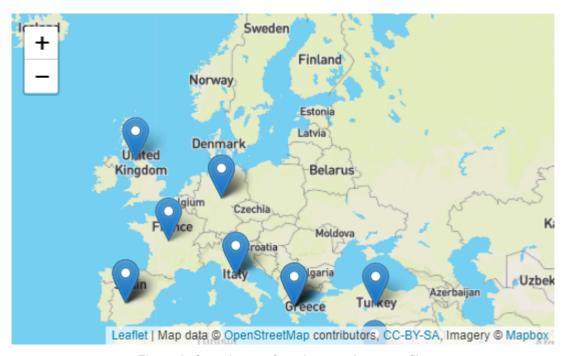

Figure 2: Sample map found on catalogue profiles

2.7 Linking

In order to demonstrate and reference where information about profiles was acquired as well as to allow users to find out more, entries within the catalogue are linked to other sources such as their main website and in the case of profile items derived from European projects, links to their respective entries on the CORDIS system.

2.8 Statistics

In order to track the quality of the catalogue based on the amount of data contained within, it is important to track the different entries found within it during the first and second years of the project. Following is the current list of all the different entries created within the catalogue.

2.8.1 High-level overview

Detail	Year 1 Value	Year 2 Value
Projects and initiatives	117	
Businesses and organisations	718	
Countries	60	

Table 1 : High-level statistical overview of the catalogue

2.8.2 Entries by Profile Type

Detail	Year 1 Value	Year 2 Value
Research and Innovation	69	
Deployment - Private	12	
Deployment - Public	27	
Deployment - Public/Private Initiative	10	

Table 2 : Entries by Profile Type

2.8.3 Entries by Geographical Scope

Detail	Year 1 Value	Year 2 Value
European	59	
Global	21	
Local/Regional	9	
National	20	

Table 3 : Entries by known Geographical Scope

2.8.4 Entries by known Cloud Delivery Model

Detail	Year 1 Value	Year 2 Value
IaaS	36	
PaaS	42	
SaaS	40	

Table 4 : Entries by known Cloud Delivery Model

2.8.5 Entries by known Cloud Deployment Model

Detail	Year 1 Value	Year 2 Value
Enterprise Private	36	
Hosted Private	9	
Hybrid	30	
Local	7	
Public	18	

Table 5 : Entries by known Cloud Deployment Model

2.8.6 Entries by known Industry

Detail	Year 1 Value	Year 2 Value
Agriculture	2	
Construction	6	
Education and Skills	23	
Finance	5	
Health	29	
Information and Communication	51	
Manufacturing	16	
Professional Services	17	
Public Administration	41	
Retail	8	
Transport	13	
Utilities	15	

Table 6 : Entries by known Industry

3 OTHER KNOWLEDGE TRANSFER SERVICES

This section describes the other forms of knowledge transfer services made available through the H-Cloud project.

3.1 H-Cloud Forum

The H-CLOUD Forum aims to connect cloud stakeholders, increase awareness and collaboration across different stakeholder groups, provide cross-fertilisation opportunities, and stimulate the adoption of research and innovation outputs so as to ensure technological sovereignty and global competitiveness of Europe. This by leveraging, complementing and expanding the results of the European Cloud Strategy 2012.

The ambition of the H-CLOUD Forum is to remove fragmentation and increase collaboration in Europe and beyond, while aligning on a common direction to help create a Cloud agenda for the future of the Digital Single Market. The H-CLOUD Forum has been conceived to be inclusive and open to all stakeholder groups including Cloud technology innovators, application developers and open standards contributors, Cloud providers, user communities, policymakers, public authorities and standards groups.

The H-Cloud forum can be accessed at https://community.h-cloud.eu/

4   CONCLUSIONS

The mission of the catalogue was to develop an easily traversable collection of information that stakeholders could access in order to discover the different initiatives collected within the first work package of the H-Cloud project. The catalogue achieves this by making use of filtering individual metadata, and makes it very easy to navigate the existing dataset. The next steps for the catalogue are to expand on the existing functionalities and offer more ways for users to access all the data. These tools will include search functionality, collections of related profiles based on similar metadata and additional filtering tools. Any new initiative identified during the next stages of the project will be added to the catalogue, and feedback mechanisms will be created in order to improve the user experience when using the tool.

The other knowledge transfer services within the project, namely the forum and other forms of communication activities have begun, with the forum being used by a small group of stakeholders and the first H-Cloud summit having been held. These other forms of knowledge transfer blend with the dissemination activities of the project and as such will continue to be used to reach out and share information to the public throughout the lifetime of the project.