Funded by
the European Union

HORIZON EUROPE FRAMEWORK PROGRAMME

CLOUDSTARS

(grant agreement No 101086248)

Cloud Open Source Research Mobility Network

D1.2 Data Management Plan

Due date of deliverable: 30-06-2023
Actual submission date: 30-06-2023

Start date of project: 01-01-2023 Duration: 48 months

Summary of the document

Document Type	Data Management Plan
Dissemination level	Public
State	v1.0
Number of pages	10
WP/Task related to this document	WP1 / T1.1
WP/Task responsible	URV
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Document ID	CLOUDSTARS_D1.2_Public.pdf
Abstract	Document describing project data management strategies. The different experiments, workloads, benchmarks, and results will be delivered as Open Research Data for the community.
Keywords	Data Management Plan, Open Access, Open Research Data, FAIR data, ORDP

History of changes

Version	Date	Author	Summary of changes
0.1	25-04-2023	Vanesa Ruana	First draft.
0.2	11-05-2023	Aurora González-Vidal	Added 2 datasets.
0.3	11-05-2023	Pascal Spörri	Added TPC-DS
1.0	30-06-2023	Vanesa Ruana	Final version.

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List of Abbreviations and Acronyms

API	Application Programming Interface
CC	Creative Commons
CSV	Comma-separated values
DMP	Data Management Plan
DOI	Digital Object Identifier

1 Executive summary

CLOUDSTARS project is committed to good data management. In an effort to provide a management life-cycle of the data needed to validate results in scientific publications, this version of the Data Management Plan (DMP) has been provided as deliverable D1.2. This DMP describes how the research data will be made findable, accessible, interoperable and reusable. This DMP also presents a summary of the existing datasets that are currently known to be used over the course of the project.

2 Data Summary

The CLOUDSTARS project wants to enable open access and reuse of the research data generated by Horizon Europe projects. CLOUDSTARS has the commitment to:

- Develop a Data Management Plan (DMP).
- Deposit the project's data in a research data repository.
- Ensure third parties can freely access, mine, exploit, reproduce and disseminate our data.
- Provide related information and identify (or provide) the tools needed to use the raw data to validate our research.

In particular, the project applies to:

- The data (and associated metadata) needed to validate the results presented in scientific publications.
- Other curated and/or raw data (and associated metadata) that is specified within this Data Management Plan.

The main goal of the CLOUDSTARS project is to present a joint research programme in the fields of Cloud computing and AI technologies. CLOUDSTARS pursues innovation in the Cloud infrastructures to support the next generation of low-latency, high-performance complex workloads. CLOUDSTARS also pursues high innovation in the Cloud, making the best application of artificial intelligence techniques and AI models with automatic adaptation to the computing resources.

Although CLOUDSTARS is a project focused mainly on software development, it also works with some datasets. Table 1 presents a summary of the existing datasets that will be processed to validate the results of the CLOUDSTARS project.

Table 1: Used datasets

UD1	
Name:	PLEIAData- consumption, HVAC, temperature, weather and motion sensor data for smart buildings applications
Origin:	H2020 Phoenix Project
Access:	`https://www.nature.com/articles/s41597-023-02023-3`
Volume:	More than 10000000 of observations
Variety:	6 domains (consumption, HVAC, temperature, weather, CO_2 and presence)
Frequency of update:	Static, not updating anymore
UD2	
Name:	VeReMi Vehicular Reference Misbehavior
Origin:	IKT-05 AutoDetect
Access:	`https://github.com/josephkamel/VeReMi-Dataset`
Volume:	More than 2000000 of observations
Variety:	5 types of attacks (related to the position of the cars)
Frequency of update:	Static, not updating anymore

UD3	
Name:	ALOJA: Machine Learning for the Big Data Benchmark Repository and Performance Analysis
Origin:	MSC-BSC, Databricks-BSC agreements, HiEST project ERC GA.639595
Access:	`http://aloja.bsc.es`
Volume:	7121338 entries (ALOJA-Spark dataset) + 800M of records in profiling time series (ALOJA-Hadoop dataset); 2TB data
Variety:	Spark: 900 executions, 30 different Spark applications; Hadoop: 50K executions
Frequency of update:	Static, not updated

Aside from these datasets and benchmarks, the CLOUDSTARS project will generate other data to validate the results presented in scientific publications (test data, APIs, source code used to perform analysis, etc.). All this data will be made available as open data and its re-use will be encouraged. As the project progresses and data is identified and collected, further information on data details will be provided. Table 2 presents a summary of the already generated datasets in the process of validating the results of the CLOUDSTARS project.

Table 2: Generated dataset

GD1	
Name:	An Empirical Study of Container Image Configurations and Their Impact on Start Times (Container Image Data)
Description:	Dataset with the container image metadata used for our IEEE/ACM CCGRID 2023 paper "An Empirical Study of Container Image Configurations and Their Impact on Start Times".
Access:	Public - `https://zenodo.org/record/7602500`
Volume:	78 MB
Variety:	The images dataset contains 200,986 entries with 21 features associated to each container image
DOI:	10.5281/zenodo.7602500

CLOUDSTARS data will not only be useful for the current and future generation of big data and cloud technologies researchers, but also big data practitioners and companies (from SMEs to multinationals) with a vested interest in new programming models for data analytics.

3 FAIR data

In general terms, research data should be **FAIR**, that is **findable**, **accessible**, **interoperable** and **reusable** [1].

3.1 Making data findable

Used data In order to ensure that the data used in the project is easily findable, we will make an effort to include standard identification mechanisms in all our publications, source code and tutorials. Although not all datasets used in the project provide these identification mechanisms, we will take special care to provide the necessary instructions, metadata and tools for locating and processing those datasets.

Produced data CLOUDSTARS is expected to deposit generated data in an open online research data repository. We have selected Zenodo as our data repository of choice. Zenodo is an OpenAIRE and CERN collaboration that allows researchers to deposit both publications and data, providing tools to link related items through persistent identifiers and data citations. Zenodo automatically assigns a Digital Object Identifier (DOI) to each item to make them easily and uniquely citable. Moreover, Zenodo is set up to facilitate the finding, accessing, re-using and interoperating of data sets, which are the basic principles that ORD projects must comply with.

To this end, we have created a CLOUDSTARS community in Zenodo[1] to gather all the open data contributions of the project. The repository allows to assign specific keywords to each dataset as well as a minimum of the DataCite's Metadata Schema [2] recommended terms.

Whenever possible (according to publisher copyright policies regarding open access), research publications will also be uploaded to this repository to ensure the maximum dissemination of the results of the project. Publications will be linked to its associated research data.

Source code. To make the source code open to the general public, we have created a code repository in GitHub for CLOUDSTARS[2]. GitHub is currently one of the most popular code management systems due to the advanced features and easy management that it provides to developers. This has various potential benefits to the management and dissemination of CLOUDSTARS source code: for instance, GitHub is well-known across developer communities, which facilitates the access to the source code of CLOUDSTARS. Moreover, GitHub offers a plenty of options to fork/branch/merge

[1] `https://zenodo.org/communities/cloudstars-eu/`

[2] `https://github.com/cloudstars-eu`

versions of a software project that enables third-parties to easily extend the source code developed in CLOUDSTARS (even for internal use). Additionally, we'll also make source code citable and uniquely identifiable by automatically archiving software releases in Zenodo [3].

As of the last release of this document, the CLOUDSTARS Github profile contains XX individual repositories hosting software results.

Finally, the CLOUDSTARS web page[3] will list all project results and provide links to their respective repositories in Zenodo or GitHub.

3.2 Making data openly accessible

It is our intention that all data produced during the CLOUDSTARS project is openly accessible as the default. Pre-existing datasets used in the experiments are mostly public and openly available (see Table 1).

Potential users will find out about the data through publications and the CLOUDSTARS website. Data will be made available on publication of the associated paper and will be made accessible through the Zenodo repository.

3.3 Making data interoperable

Interoperability of data produced within the CLOUDSTARS project is promoted through best practices. Data formats should adhere to widely used standards and should be compliant with available software applications. Where possible, standard codes will be followed (e.g.: ISO 639 for language codes, ISO 3166 for country codes, NUTS for region codes, ...).

As the project progresses and data is identified and collected, further information on making data interoperable will be outlined. Specifically, information on data and metadata vocabularies, standards or methodology to follow to facilitate interoperability and whether the project uses standard vocabulary for all data types present to allow interdisciplinary interoperability.

3.4 Increase data re-use (through clarifying licenses)

Data will be made accessible, and therefore available for re-use, within one month of the publication of the related peer-reviewed scientific article. Data will be shared under the Creative Commons Attribution 4.0 International Public License (CC BY 4.0) [4]. This license guarantees the widest possible re-use and redistribution while only requiring that appropriate credit is given.

The shared data will remain re-usable after the end of the project by anyone interested in it, with no access or time restrictions.

3.5 Management principles

The protocol below summarizes the management principles behind making generated research data FAIR:

[3] `http://cloudstars.eu`

PROTOCOL: Storing generated research data in CLOUDSTARS project and making it FAIR

Beneficiaries will follow these procedures for each dataset collected or generated during the CLOUDSTARS project:

- Store and make findable the dataset in the CLOUDSTARS community of the Zenodo repository.
- Ensure that publications and research data behind them are cross-referencing each other through standard identification mechanisms.
- Ensure that each dataset provides metadata, particularly regarding access rights, licenses, and funding information.
- Each Work Package Leader is responsible for storing relevant research data to the repository.
- Data will be made accessible within one month of the publication of the related peer-reviewed scientific article.

Beneficiaries will follow these procedures for source code generated during the CLOUDSTARS project:

- Store the source code under the CLOUDSTARS organization in GitHub repository.
- Provide a comprehensive README file with instructions to run the code.
- Store each release of the source code to Zenodo repository and cross-reference related datasets and publications.
- Each Work Package Leader is responsible for storing relevant source code to the repository.

4 Allocation of resources

Regarding Open Access to research data, archiving at Zenodo is free of charge. Storing source code at the GitHub repository is also free of charge. Therefore, no costs are currently foreseen regarding the long term preservation of data.

The project coordinator has the ultimate responsibility for the data management in the project.

5 Data security

As CLOUDSTARS delegates the archiving of data to Zenodo, their policies regarding data security apply:

- **Replicas**: All data files are stored in CERN Data Centres, primarily Geneva, with replicas in Budapest. Data files are kept in multiple replicas in a distributed file system, which is backed up to tape on a nightly basis.
- **Retention period**: Items will be retained for the lifetime of the repository. This is currently the lifetime of the host laboratory CERN, which currently has an experimental programme defined for the next 20 years at least.
- **File preservation**: Data files and metadata are backed up nightly and replicated into multiple copies in the online system.

- **Fixity and authenticity**: All data files are stored along with a MD5 checksum of the file content. Files are regularly checked against their checksums to assure that file content remains constant.
- **Succession plans**: In case of closure of the repository, best efforts will be made by CERN to integrate all content into suitable alternative institutional and/or subject based repositories.

6 Ethical aspects

There is no sensitive ethical issue of collecting, storing, processing and archiving data raised by the research of the CLOUDSTARS project. Any potential ethical issue raised during the life of the project may be reported to the CLOUDSTARS project board, which would, if necessary, raise immediate awareness of internal consortium members' executives, in order to take appropriate actions to resolve this issue.

Concerning potential ethical conflicts all issues will be resolved through the procedures depicted in relative legal documents (e.g., Consortium Agreement) and Commission guidelines.

7 Conclusions

This document is the unique version of the CLOUDSTARS Data Management Plan. It presents the status of reflection within the CLOUDSTARS consortium about the research data used, collected or generated alongside the project. This DMP describes how the research data has been, and will be made findable, accessible, interoperable and reusable.

References

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