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ESCAPE
European Science Cluster of Astronomy & Particle physics ESFRI research Infrastructures

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D3.1: PROJECT PLAN FOR WP3 - OSSR

Work Package	WP3, OSSR – Open Science Software and Service Repository
Lead Author (Org)	Kay Graf (FAU)
Contributing Author(s) (Org)	Cristiano Bozza (INFN), Elena Cuoco (EGO-Virgo), Thomas Vuillaume (CNRS-LAPP)
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X	PU: Public
	PP: Restricted to other programme participants (including the Commission)
	RE: Restricted to a group specified by the consortium (including the Commission)
	CO: Confidential, only for members of the consortium (including the Commission)

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0.2	09.07.2019	Kay Graf (FAU)	Adapting to WP4 work plan
0.3	12.07.2019	Kay Graf (FAU)	Inputs from the first OSSR workshop
0.4	18.07.2019	Cristiano Bozza (INFN)	Update task description T 3.3
0.5	13.09.2019	Elena Cuoco (EGO-Virgo), Thomas Vuillaume (LAPP)	General update and description T 3.4 and T 3.5
0.6	11.10.2019	Kay Graf (FAU)	Integrate partners' feedback
0.7	25.10.2019	Kay Graf (FAU), Jayesh Wagh (LAPP)	Implement changes from WP1 review
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Disclaimer

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Executive Summary

This document describes the project plan for *ESCAPE Work Package 3, OSSR (Open source Software and Service Repository)*, detailing its goals, objectives and structure. It will serve as the work plan at the beginning of the project and will be updated throughout the project.

Project Summary

ESCAPE (European Science Cluster of Astronomy & Particle physics ESFRI research infrastructures) addresses the Open Science challenges shared by ESFRI facilities (SKA, CTA, KM3NeT, EST, ELT, HL-LHC, FAIR) as well as other pan-European research infrastructures (CERN, ESO, JIVE) in astronomy and particle physics. ESCAPE actions are focused on developing solutions for the large data sets handled by the ESFRI facilities. These solutions shall: i) connect ESFRI projects to EOSC ensuring integration of data and tools; ii) foster common approaches to implement open-data stewardship; iii) establish interoperability within EOSC as an integrated multi-messenger facility for fundamental science. To accomplish these objectives, ESCAPE aims to unite astrophysics and particle physics communities with proven expertise in computing and data management by setting up a data infrastructure beyond the current state-of-the-art in support of the FAIR principles. These joint efforts are expected result into a data-lake infrastructure as cloud open-science analysis facility linked with the EOSC. ESCAPE supports already existing infrastructure such as astronomy Virtual Observatory to connect with the EOSC. With the commitment from various ESFRI projects in the cluster, ESCAPE will develop and integrate the EOSC catalogue with a dedicated catalogue of open-source analysis software. This catalogue will provide researchers across the disciplines with new software tools and services developed by astronomy and particle physics community. Through this catalogue, ESCAPE will strive to cater researchers with consistent access to an integrated open-science platform for data-analysis workflows. As a result, a large community "foundation" approach for cross-fertilisation and continuous development will be strengthened. ESCAPE has the ambition to be a flagship for scientific and societal impact that the EOSC can deliver.

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Acronym list

Partners

AIP	Leibnitz-Institut für Astrophysik Potsdam
CERN	European Organization for Nuclear Research
CNRS-LAPP:	Laboratoire d'Annecy de Physique des Particules (CNRS)
CNRS-CPPM:	Centre de Physique des Particules de Marseille (CNRS)
NWO-I-CWI:	Centrum Wiskunde & Informatica (NWO-I)
CTA:	Cherenkov Telescope Array
CTAO:	Cherenkov Telescope Array Observatory
EGO-Virgo:	European Gravitational Observatory
CERN:	European Organization for Nuclear Research
EST:	European Solar Telescope
ESO:	European Southern Observatory
ELT:	Extremely Large Telescope (was E-ELT)
FAIR:	Facility for Antiproton and Ion Research
FAU:	Friedrich-Alexander University Erlangen-Nuremberg
GSI:	GSI Helmholtzzentrum für Schwerionenforschung
HITS:	Heidelberg Institute for Theoretical Studies
HL-LHC:	High-Luminosity Large Hardon Collider
IFAE:	Instituto de Fisica de Altas Energias
INFN:	Istituto Nazionale di Fisica Nucleare
JIVE:	Joint Institute for VLBI ERIC
AIP:	Leibnitz-Institut für Astrophysik Potsdam
MPG-MPIK:	Max-Planck-Institut für Kernphysik (MPG)
KM3NeT:	multi-km3 sized Neutrino Telescope
NWO-I-Nikhef:	Nationaal instituut voor subatomaire fysica (NWO-I)
OROBIX:	OROBIX SRL
SKA:	Square Kilometre Array
SKAO:	Square Kilometre Array Organisation
UCM:	Universidad Complutense de Madrid
UNITOV:	Universita degli Studi di Roma Torvergata

General

ASTERICS:	Astronomy ESFRI & Research Infrastructure Cluster
E-EB	ESCAPE Executive Board
EOSC:	European Open Science Cloud
EOSC-Hub:	Integrating and managing services for the European Open Science Cloud
ESCAPE:	European Science Cluster of Astronomy & Particle physics ESFRI research infrastructures
ESFRI:	European Strategy Forum on Research Infrastructures

ESF/RI:	ESFRIs and major RIs as projects within ESCAPE
FAIR:	Findable, Accessible, Interoperable, Reusable
IVOA:	International Virtual Observatory Alliance
OSSR:	Open Science Software and Service Repository (ESCAPE WP3)
RDA:	Research Data Alliance
RI:	Research Infrastructure
VO:	Virtual Observatory
WP:	Work Package

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1. Introduction and Background

All the ESFRI and RI projects concerned by ESCAPE all have the mission in common to provide open access to their quality-certified scientific data, including dedicated analysis software stacks, and high-level science tools to utilise this data. The complexity of collection, processing and deployment of data produced and handled by the concerned ESFRI/RI facilities demands innovative solutions and calls for cross-fertilisation actions. The development of multi-messenger and multi-probe data analysis practices promotes activities to maximise software re-use and co-development and enables open science, linking not only the ESFRI projects themselves to the EOSC environment but also – via the platform developed in WP5 – the scientific community behind them.

The aim of WP3 OSSR is to expose software tools of the ESCAPE ESF/RI projects in a repository under the EOSC catalogue of services, ensuring compatibility with *FAIR* principles. The tools encompass the software itself, as well as the environment to enable the scientific community to use the software, e.g. documentation, continuous integration and deployment services and evaluation data sets. Also, the platform services developed in WP5 will be linked to the EOSC via the OSSR. We refer to the collection of software, tools and services generally as “services” in the following. The ESFRI facilities and the other major international projects or pathfinders of the ESCAPE cluster are represented by institutions or legal entities which take part in the different tasks and share responsibilities for task deliverables. The ESCAPE partners that are participating in the OSSR work package, and their connection to the ESFRI or major RIs are listed in Table 1.

ESFRI/RI	Institute/SME
CTA	CNRS-LAPP
CTA	CTAO
CTA	IFAE
CTA	MPG-MPIK
CTA	UCM
EGO-Virgo	EGO
ELT	HITS
EST	AIP
EST	NWO-I-CWI
EST	UNITOV
FAIR	GSI
HL-LHC, CERN	CERN
JIVE	JIVE
KM3NeT	CNRS-CPPM
KM3NeT	FAU
KM3NeT	INFN
KM3NeT	NWO-I-Nikhef
SKA	SKAO
SME	OROBIX

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Table 1 OSSR Partners

2. Goals and Objectives

2.1 Goals

The goals of OSSR are defined by the deliverables and milestones of the ESCAPE grant agreement and are listed in Table 2 and Table 3, respectively.

De-liverable Number	Description (type)	Task	Lead participant	Estimated Date
D 3.1	Detailed project plan for WP3 (R)	3.1	FAU	M09
D 3.2	Software and service list and integration plan (R)	3.2, 3.3	FAU	M12
D 3.3	Conceptual design report on the software and service repository, demonstrator (R, DEM)	3.5	CNRS-LAPP	M18
D 3.4	Establishing of innovation competence group (all hands meeting) (OTHER)	3.4	EGO	M18
D 3.5	Thematic training event - first school for software development and deployment in the EOSC (OTHER).	3.1	CNRS-LAPP	M20
D 3.6	Mid-term technology WP3 project progress report (R)	3.1-5	FAU	M24
D 3.7	License and provenance model for the software and service repository (R)	3.5	CNRS-LAPP	M24
D 3.8	Thematic training event - second school for software development and deployment in the EOSC (OTHER)	3.1	CNRS-LAPP	M36

*Table 2 Deliverables (types are **R**eport, **DEM**onstrator and **OTHER**)*

Milestone Number	Milestone name	Estimated date	Means of verification
M 14	List of software and services	M15	Review of D3.2
M 15	Establishment of innovation competence group	M21	Workshop summary report
M 16	Software and service repository demonstrator	M24	Repository online and available to partners (online service), Review of D3.3
M 17	Progress of common software and service proposition	M27	Review of D3.6

M 18	Final workshop to evaluate the outcome of WP3 with respects to the main objectives of the call and define the necessary future steps.	M40	Workshop summary report
M 19	Software and Service Repository online	M42	Repository available to community (online service), workshop

Table 3 Milestones

A timetable is available in the chapter 7.1 Schedule

2.2 Objectives

The high-level objectives of OSSR are:

1. Support a community-based approach for continuous development, deployment, exposure and preservation of domain-specific open-source scientific software and services in the global context of the EOSC catalogue of services;
2. Enable open science interoperability and software re-use for the data analysis of the ESCAPE ESF/RI projects based on *FAIR* principles;
3. Create an open innovation environment for establishing open standards, common regulations and shared software libraries for multi-messenger/multi-probe data.

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3. OSSR Structure and Roles

The work in OSSR is organised in five tasks, for management and coordination, software and service collection, exploiting commonalities, fostering new software approaches and finally exposing the software and services in the EOSC-rooted repository:

- Task 3.1: Management Activities, Policy and Support Actions (MAPS)
- Task 3.2: ESFRI Software and Services Collection (ESSC)
- Task 3.3: Common Approaches: Software and Services (CASS)
- Task 3.4: Foundation of Competence for Software and Service Innovation (COSSI)
- Task 3.5: Repository Implementation and Deployment (RIAD)

The interlink between the different tasks is depicted in Figure 1 and is described below. The objectives, as set by the project partners and ESF/RIs, are detailed per task in the following. The status of the individual tasks will be updated during the proposal.

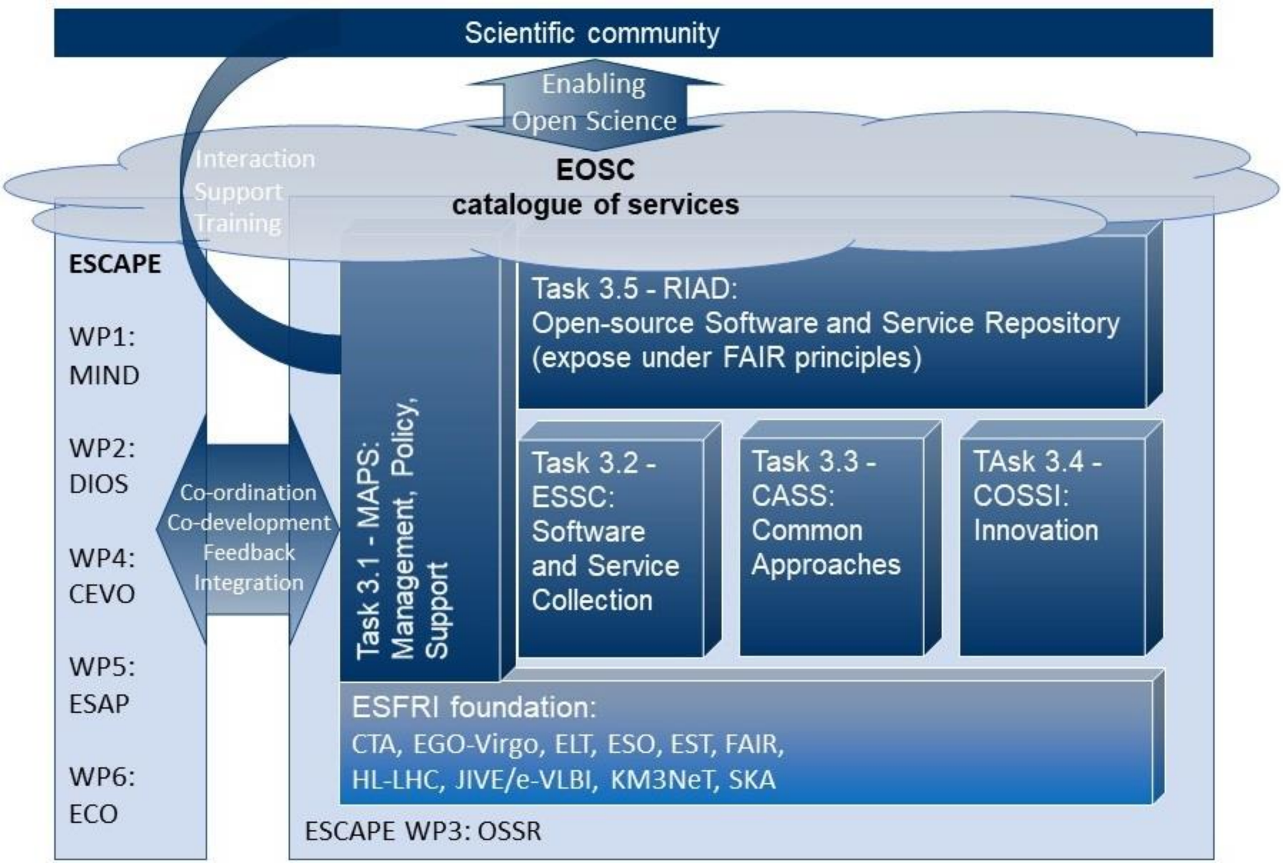

Figure 1 Schematic of ESCAPE WP 3 (OSSR) with its tasks 3.1 to 3.5

3.1 Task 3.1: Management Activities, Policy and Support Actions (MAPS3.1 Task 3.1: Management Activities, Policy and Support Actions (MAPS)

The transversal activities on management, policy and support are handled centrally for the work package in this task. While the general policies concerning the full ESCAPE project are handled in WP1, Task 3.1 focusses on technical and implementation aspects.

It will be responsible for the following activities:

- Prepare and explore co-operation with companies on the innovative use of machine learning tools to cluster-relevant scientific data;
- Establish a helpdesk (technical and administrative) with the main aim of supporting the partners to deploy their software and services to the EOSC and the scientific community to use those tools.
- Organise training activities to provide a consistent level of knowledge amongst the partners and foster the community foundation principle:
    - two five-day open schools for software development, programming and its deployment in the EOSC perpetuating the successful OBELICS schools at CNRS-LAPP;
    - two open science community events:
        - one workshop on innovative methods (together with Task 3.4);
        - one final workshop presenting the successful implementation of the objectives;
    - webinars and online tutorials on the use of the software and services (FAU, MPG-MPIK, further partners).

Together with WP1, external co-operations will be fostered, as well as networking, and the dissemination of the work packages' results. This task will also ensure the efficient coordination with the respective EOSC bodies, e.g. the *Architecture Working Group* (EAWG).

3.2 Task 3.2: ESFRI Software and Services Collection (ESSC)

Aims
Collection of software, evaluation and exploitation of common practices in software development, maintenance and distribution.

High-level Description
This task will provide the platform for incorporation, development, testing, efficiency optimization and benchmarking of software and services into the EOSC regime. The needs for development will be purely science-driven by the ESFRIs. The aim is to provide tools in a way that makes it easy for both other facilities and the general scientific community to use and adopt the developed software and services.
The basic inputs to this task will be the official analysis software and services as released and quality-controlled by the ESF/RIs themselves. An initial list, to be extended during the project, is given below. If applicable, the software and services will be made accessible and comparable through the common EOSC repository via Task 3.5.

Detailed Tasks
The following activities are foreseen – additional approaches may be added during the project:

ESF/RI	Task	Responsible Partner
-	Evaluation common practices in software development, maintenance and distribution *(together with Task 3.3).*	CERN, CNRS-LAPP, CTAO, FAU, NWO-I-Nikhef, GSI, JIVE, SKAO
-	Establishing a platform for incorporation, development, testing, efficiency optimization and benchmarking of software and services.	CERN, CNRS-LAPP, CTAO, FAU, NWO-I-Nikhef, GSI, JIVE, SKAO
-	Definition of requirements and recommendations for software and services to be part of the repository (*together with Task 3.5*).	CERN, CNRS-LAPP, CTAO, FAU, NWO-I-Nikhef, GSI, JIVE, SKAO
-	Establish the link to WP2 and WP5 for collecting the software and services developed in these work packages.	CERN, FAU
CTA	Development, benchmarking and deployment of • the HPC reconstruction and analysis software stack; • open science tools and software packages for astroparticle physics that work on high-level CTA data formats. • an interface between low-level analysis pipeline and high-level science tools, and specifically of an open-source software for the instrument response function production.	CNRS-LAPP CTAO, MPG-MPIK CTAO
EGO-Virgo	Evaluation and development of the open software currently developed and managed by the gravitational wave community with respect to its publishing via the repository.	EGO-Virgo
ELT	Collection and evaluation of software developed under Task 3.4	HITS
EST	Collection and evaluation of software developed under Task 3.4	AIP, NWO-I-CWI, UNITOV
FAIR	Release of the community framework for distributed data processing to a wider scientific community; evaluation of the framework abstraction for the users to utilize heterogeneous platforms within the ESCAPE context.	GSI

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HL-LHC	Contribution of existing CERN/LHC open software to the service catalogue, especially file transfer services, low-latency storage service, and a *ROOT*-based pipeline for analysis preservation.	CERN
JIVE	Integrating radio-astronomical data reduction techniques into a *Jupyter* notebook, and offering this in containerized form to the user community; creation of data reduction pipelines, while continuing the development and modification of existing data-reduction tools to make them ready for the large instruments of the future and more suitable for integration into the EOSC environment.	JIVE
KM3NeT	Deploying the processing toolchains based on a *C++* and *ROOT*-based data model, as well as *Python* and *HDF5*-file format to the community profiting of containerisation techniques.	FAU, INFN, NWO-I-Nikhef
SKA	Make the SKA software stack open source and develop it to run on e-Infrastructures in general such as the SKA Regional Centres. Tools and techniques within the stack are general purpose in some areas and would therefore have potential benefits for other communities wishing to carry out data analytics in the Exabyte regime on data lake infrastructures	SKAO

Table 4 Detailed tasks for T 3.2

3.3 Task 3.3: Common Approaches: Software and Services (CASS)

Aims

Sharing existing solutions and fostering joint development of new tools for specific analysis, simulation and processing tasks.

High-level Description

To foster the re-use and cross-fertilization of developments between the ESFRIs, common software and service approaches will be clustered in this task. These include common libraries for data formats, data access and exploitation, a simulation tool stack, and the combination/consolidation of data processing and analysis tools which are available via Task 3.2.

The main data sets of the ESFRI facilities can be categorised as signal-based (EGO-Virgo, JIVE, SKA), event based (CTA, FAIR, HL-LHC, KM3NeT), and image-based (ELT, EST). The commonalities between the three categories will be further exploited as well as cross-boundary approaches. The cross-fertilization among ESFRI projects will be guaranteed by cross-usage of the building bricks created in Task 3.2.

Details Tasks

The following activities are foreseen – additional approaches may be added during the project:

Linked ESF/RI	Task	Responsible Partner
CTA – KM3NeT	Evaluation of commonalities between the data analysis pipeline and co-development of tools: • harmonisation of data format and data model for gamma ray and neutrino, exploring the IVOA standards and provide feedback to it (*link to WP4*); • Interface the ROAst library with the common format; • exploring further multi-messenger astronomy use cases for the maximum-likelihood evaluation tool *gLike,* thus broadening the user community; • providing interfaces between the python-based frameworks of CTA and KM3NeT • establishment of a turnkey *CORSIKA* – a matter-radiation interaction simulator package, used for cosmic-ray showers simulation – simulation stack. Cross-use and know-how exchange will be fostered to define a common version and common configurations based on scientific aspects and then sustained within the cluster;	interested partners from CTA and KM3NeT INFN IFAE + interested KM3NeT partner MPI-K, FAU, NWO-I-Nikhef INFN, UCM
FAIR, HL-LHC, KM3NeT	Broaden the user base of distributed processing frameworks by deploying pilot installations, developing use cases and software components to support community pipelines within those frameworks, for • DIRAC • FairRoot/ALFA	CNRS-CPPM GSI

Table 5 Detailed tasks for T 3.3

3.4 Task 3.4: Foundation of Competence for Software and Service Innovation (COSSI)

Aims

The creation of a team of scientists from different ESF/RIs who will investigate new, innovative approaches to data analysis, exploring machine-learning and deep-learning techniques with a special focus on the multi-messenger approach.

High-level Description

All ESFRIs face data and analysis challenges where both, the handling of increasing data rates and volumes, and the deeper exploitation of the available data must be approached. For both challenges, new approaches to data analysis are needed. New approaches and development will be reviewed and – if appropriate – further developed in this task. Especially the field of deep learning for event-based, image-based and signal-based applications for two and higher dimensions has been intensively followed by expert groups within the ESFRIs and will be deployed to the EOSC via ESCAPE.

An innovation competence group will be established to review and steer the developments. Members of all ESFRIs will become part of this body and give recommendations to the work package management. Steered by the innovation competence team, a new approach to multi-messenger analysis using machine learning techniques will be established.

Detailed Tasks

The following activities are foreseen – additional approaches may be added during the project.

Linked ESF/RI	Task	Responsible Partner

CTA, EGO-Virgo, ESO, EST, KM3NeT	Collection of data analysis flow for each ESF(RI) from raw data to public data. Information to be collected:
	• data (pre-)processing pipeline configurations;
	• available software:
	  ○ tools for a use-case pipelines;
	  ○ machine-learning pipelines;
	  ○ used libraries;
	  ○ visualization tools;
	• preferred programming languages;
	• available simulated or open data sets.
		AIP, CNRS-LAPP, EGO, HITS, INFN, NWI-I-CWI, OROBIX, UNITOV

-	Establish innovation competence group to steer developments based on information collection above.	EGO-Virgo
CTA	Using the available techniques and support new developments in the multi-messenger regime by • conversion of CTA data to appropriate standards, and adapting and benchmarking machine learning algorithms for them; • contribution to deep-learning projects, with particular focus on machine learning techniques applied in the CTA pipelines	CNRS-LAPP, OROBIX, UCM
EGO-Virgo	Deploying and further developments on a working pipeline for deep learning and machine learning for event classification, opening it up for wider community;	
ESO	Development of deep-learning techniques for the classification of celestial objects in the ESO science archives and of services for the sustained generation of source classification that are to be applied in WP4.	HITS, OROBIX
EST	Developments of classification engine:	AIP, NWO-I-CWI, UNITOV

	• for solar and stellar spectra using *Convolutional Neural Networks* or alternatives; • predicting solar wind conditions (speed and magnetic field) and estimating the flare classes and arrival times of coronal mass ejections based on solar images.	
KM3NeT	Further development on reconstruction and event classification with deep neural networks and other machine learning algorithms (INFN).	INFN

Table 6 Detailed tasks for T 3.4

3.5 Task 3.5: Repository Implementation and Deployment (RIAD)

Aims

Implementation of a trusted digital repository to integrate open-source scientific software and services developed by ESFRI and tasks 3.2-3.4 and integration of this repository in the EOSC catalogue of services.

High-level Description

A common service template will be applied to the solutions developed in Tasks 3.2-3.4. Using this template, the services will be integrated in an open-source scientific software and service repository as integral part of the portfolio of EOSC services and tools. The central federation services of EOSC, e.g. as available from EOSC-hub, will be used or adapted, where applicable. The repository itself will be implemented in phases – first the definition of needs, then an early demonstrator and finally the full integration in EOSC catalogue of services. Where needed, a thin interface or a dedicated service hosting will be generated to run the relevant EOSC service.

Detailed Tasks

The following activities are foreseen – additional approaches may be added during the project:

Linked ESF/RI	Task	Responsible Partner
all	Review among the partners of • the required features for a science repository, definition of needs; • existing solutions and their adequacy with the required needs. Definition of a common service template in agreement with OSSR partners.	CNRS-LAPP/FAU; All partners
-	• Conceptual design report on the software and service repository, demonstrator. Test implementation of the demonstrator with a selected set of software; • Implementation of the chosen repository solution; • Integration of the partners software in the repository; • Integration of the repository in the EOSC catalog.	CNRS-LAPP/FAU

Table 7 Detailed tasks of T 3.5

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4. Resources and Management

The resources are governed by the personnel, in addition sufficient travel cost are available. Both resources are directly handled by the partner institutions, they are responsible for the resource management.

Additional support for events (workshops, schools and meetings) are available organised via FAU and Task 3.1.

The roles of the institutes and main contact persons together with their contributions to the working group and their responsibilities are summarized in Table 8, the available human resources in Table 9 below.

Institutes	ESFRI	Main Contact	Role	Contribution to	Responsible for
CNRS-LAPP	CTA	Thomas Vuillaume	T 3.5 lead	T 3.1, T 3.2, T 3.4, T 3.5	D 3.3, D 3.5, D 3.7, D 3.8
CTAO	CTA	Matthias Fuessling	main CTA contact	T 3.2	
IFAE	CTA	Javier Rico		T 3.3	
MPG-MPIK	CTA	Axel Donath		T 3.1, T3.2, T 3.3	
UCM	CTA	Jose Luis Contreras		T 3.3	
EGO	EGO-Virgo	Elena Cuoco, Stavros Katsanevas	T 3.4 lead, main EGO-Virgo contact	T 3.4	D 3.4
HITS	ELT	Kai Polsterer		T 3.4	
AIP	EST	Carsten Denker		T 3.4	
NWO-I-CWI	EST	Jannis Teunissen		T 3.4	
UNITOV	EST	Dario Del Moro		T 3.4	
GSI	FAIR	Mohammad Al-Turany	Main FAIR contact	T 3.2, T 3.3	
CERN	HL-LHC, CERN	Simone Campana, Ian Bird		T 3.2	
JIVE	JIVE	Arpad Szomoru	main JIVE contact	T 3.2	
CNRS-CPPM	KM3NeT	Paschal Coyle, Andrei Tsaregorodtsev		T 3.3	
FAU	KM3NeT	Kay Graf	WG coordination, T 3.1 and T 3.2 lead	T 3.1, T 3.2, T 3.3, T 3.5	D 3.1, D 3.2, D 3.6

INFN	KM3NeT	Cristiano Bozza	T 3.3 lead, main KM3NeT contact	T 3.2, T 3.3, T 3.4	
NWO-I-Nikhef	KM3NeT	Aart Heijboer		T 3.2	
SKAO	SKA	Bolton, Rosie	Main SKA contact	T 3.2	
OROBIX	SME	Luca Antiga		T 3.4	

Table 8 Partner institutes and their role within OSSR

Institute	Total PM	Task 3.1	Task 3.2	Task 3.3	Task 3.4	Task 3.5
AIP	36				36	
CERN	6		6			
CNRS-CPPM	24			24		
CNRS-LAPP	39	6	6		6	21
CTAO	6		6			
EGO	30				30	
FAU	54	30	9	6		9
GSI	36		18	18		
HITS	12				12	
IFAE	20			20		
INFN	36		12	24	12	
JIVE	36		36			
MPG-MPIK	36	3	18	15		
NWO-I-CWI	26				26	
NWO-I-Nikhef	12					
OROBIX	15				15	
SKAO	12		12			
UCM	18			18		
UNITOV	14				14	
TOTAL	468	36	105	146	151	30

Table 9 Partner institutes and their available resources (Person Months - PM)

5. Organisation and Communication

OSSR is organised in tasks with designated task leaders identified in Table 8. Being a distributed work package with many partners, efficient communication and a well-defined information flow are key ingredients to ensure a successful project.

Towards this goal, an open communication environment is encouraged. The organisation and coordination workflow is channelled for internal communication via the work package lead group (that consist of the task leaders, the WP coordinator and a project scientist). Between work packages, the communication flows via the WP coordinators and the E-EB. The distribution of partners over several work packages establish also a communication workflow on the executive level.

Regular meetings of the entire WP will be held in a tri-monthly rhythm and time slots for face-to-face meetings adjacent to the workshops will be organised. The WP lead group will meet at least bi-monthly and during workshops, as well as before E-EB meetings. Minutes to all meeting will be prepared and centrally stored together with all documents produced within the WP. All partners will – in addition – be informed on the general status by bulletins twice a year. Additional sub-groups for individual tasks and challenges will be formed as needed.

The necessary IT services – a chat service, mailing lists, a conference organisation tool, a cloud document sharing environment and a project management software – have been set up in the first six months of the project, which was designated as ramp-up phase of ESCAPE. Others will be set up as needed during the project time.

6. Constrains and Interfaces

The work package partners represent the ESF/RIs within the work package. They will also be responsible to interface the ESF/RIs' expectations with the work programme and the achievements of the WP on an operative level. On the management level this is done via the E-EB via Task 3.1.

All tasks have well-defined interface with:
- WP1 for the link with EOSC general policy regulations concerning the repository and application of services developed in this WP to crowd-sourced data;
- WP2 for the link between the ESCAPE-EOSC software repository and the ESFRI facilities' data archives;
- WP4 for the interface of developed analysis tools with the VO archived data, and incorporation of VO-based developments into the repository;
- WP5 for the integration of the repository access in the analysis platforms, further development of the services exposed in this WP in those platforms and the inclusion of community-based developments into the repository.

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7. Accountability and Decision Process

Task 3.1 will take all necessary measures to ensure that the work package achieves the aim and objectives listed above. This is achieved by assessment of the deliverables and milestones as well as the following key indicator: the number of software and services by ESFRI made available under the EOSC catalogue using *FAIR* principles.
The means of mitigation will be chosen in coordination with the E-EB and the ESFRI projects supervisory committee.
The partner institutions are accountable for reaching the goals and objectives as defined in Table 8. Together with the ESF/RI representatives in the ESFRI projects supervisory committee, the partner institutions representing the different ESF/RIs will ensure that the interests of the projects are observed with the WP.

7.1 Schedule

The schedule of the work package is driven by the deliverables and the milestones, which ensure the successful implementation of the deliverables. It is maintained in the project platform and shown in Figure 2.

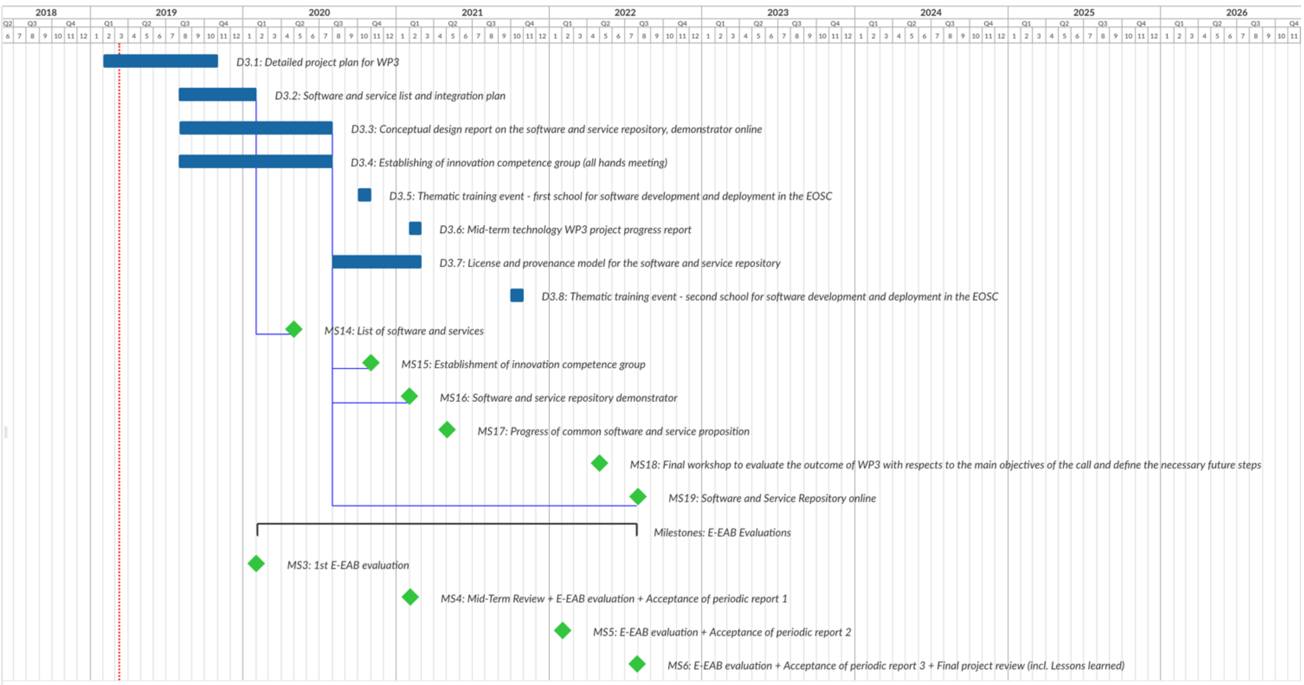

Figure 2 Schedule of OSSR

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8. Risk analysis

Several risks have been identified and mitigation measures proposed:

Description of risk (level)	Proposed risk-mitigation measures
Lack of ICT infrastructures to deploy software and services repository. (Low)	Assessment via D3.3 and M3.4; Mitigation via the ESFRI/RI facilities and the ESCAPE project partners themselves that operate major computing facilities (CERN, CNRS, INFN). Influence possible via the work package management and the ESCAPE management including the ESFRI projects supervisory committee.
Lack of cross-fertilization and coherence in software and services. (High)	Assessment via D3.5 and M3.3; Mitigation via pro-active action of the help desk, the work package management, and the E-EB. Regulations for standards from EOSC must be followed for deployment in EOSC catalogue.
Innovation activities with limited impact. (Medium)	Assessment via D3.5; Mitigation via assessment and steering of activities by WP3.4 competence group, gathering the know-how of all ESFRI/RIs. Work package management, together with the E-EB, will ensure developments with limited impact will be ceased, and new approaches opened, further cooperation with private companies can be used to stimulate the innovation impact.
Lack of availability or immaturity of underlying core EOSC services. (Medium)	Establish collaboration with EOSC-hub and EOSC pilot activities to identify and track current EOSC capabilities. Adjust ESCAPE WP5 development priorities as necessary.

Table 10 Risks and mitigation measures identified at the proposal stage

Additional risks that have been identified in the first 6-month ramp-up period of the project are mostly related to practical issues of recruitment by the partners for various aspects of the OSSR tasks.

Description of risk (Level)	Proposed risk-mitigation measures
Difficulty to find suitable contract staff (Medium)	Advertisements for contractual positions are to be distributed as widely as possible using the channels of the ESCAPE project.
Hired contract staff depart prematurely (Medium)	The partners will manage their contract personnel and indicate any risks if they arise to the WP management (Task 3.1).

Table 11 Risks and mitigation measures identified in the first 6 months

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