ESCAPE to the Future
25-26 October 2022
Brussels, Belgium

ESCAPE to the future

Giovanni Lamanna

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CNRS-IN2P3 & USMB

Outlook for the future

The starting point

A domain-based «EOSC-cell»

Data Lake:
Build a scalable, federated, data infrastructure as the basis of open science for the ESFRI projects within ESCAPE.

Software Repository:
Repository of "scientific software" as a major component of the "data" to be curated in EOSC.

Science Platforms:
Flexible science platforms to enable the open data analysis tailored by and for each facility as well as a global one for transversal workflows.

Citizen Science:
Open gateway for citizen science on ESCAPE data archives and ESFRI community

Virtual Observatory:
Extend the VO *FAIR* standards, methods and to a broader scientific context; prepare the VO to interface the large data volumes of next facilities.

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Achievements and recommendations

As from the last ESCAPE Period 2 review report of EC:

*"…**The role of ESCAPE** in the construction of EOSC **is key…"**

*"It is **important for other scientific communities to apply these (ESCAPE) technologies** to" other use cases "…this would help to engage with more users and **increase the benefits of EOSC…"***

External Reviewer recommendations:
« … **promote ESCAPE strategic conceptual and unified vision of EOSC outside the ESCAPE community, including other ESFRI cluster projects**. This would also benefit the ESCAPE community, through new collaborations/projects (for instance, exploitation of services related to the ESCAPE data lake, citizen projects and engagement with users), **recognition of the ESCAPE community as a leading Open Science** and actively contributing to the construction of EOSC…

.. **ESCAPE has the capacity to be a natural leader of the other RI related projects** when it comes to the contribution to the EOSC concept evolution and the implementation of concrete EOSC services. These services must be developed **according to the user needs** … **and the broader society**…

… The ESCAPE project is very well positioned to **be an amplifier of the voice of data producers and data curator**s in EOSC and Open Science community. »

Ref. Ares(2022)1790219 - 10/03/2022

EUROPEAN COMMISSION
EUROPEAN RESEARCH EXECUTIVE AGENCY

REA.C – Future Society
C.4 – Reforming European R&I and Research Infrastructures

GENERAL PROJECT REVIEW CONSOLIDATED REPORT

Grant agreement (GA) number:	824064
Project[1] Acronym:	ESCAPE
Project title:	European Science Cluster of Astronomy & Particle physics ESFRI research infrastructures
Type of action:	RIA
Start date of the project:	01/02/2019
Duration of the project:	48
Name of primary coordinator contact and organisation:	Giovanni Lamanna (CNRS)
Period covered by the report:	from 01/08/2020 to 31/01/2022
Periodic report/Reporting period number:	2
Date of first submission of the periodic report (if applicable):	22/02/2022
Amendments (latest AMD concerning description of the action)[2]	22/09/2021 (AMD-824064-32)
Date of meeting with consortium (if applicable):	02/03/2022

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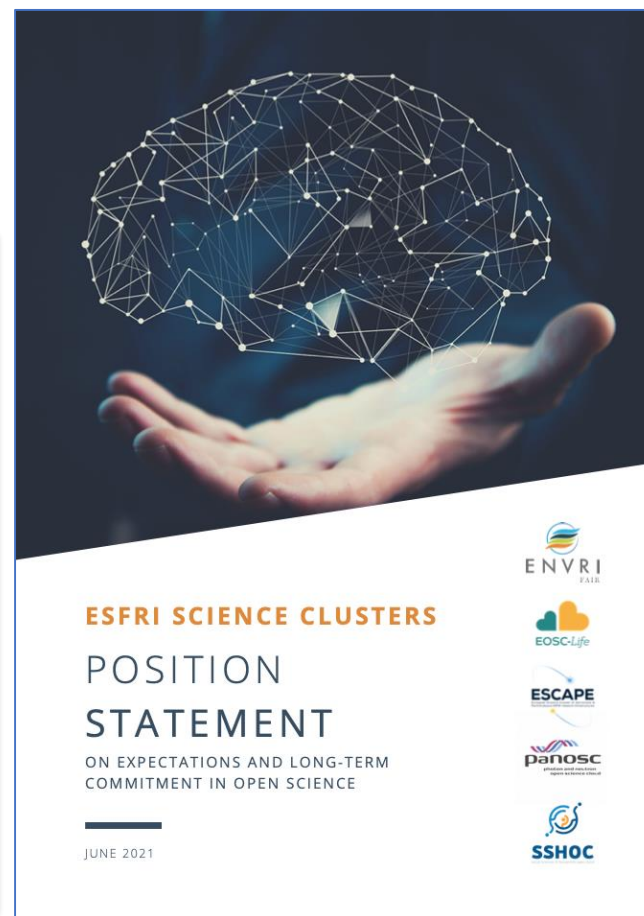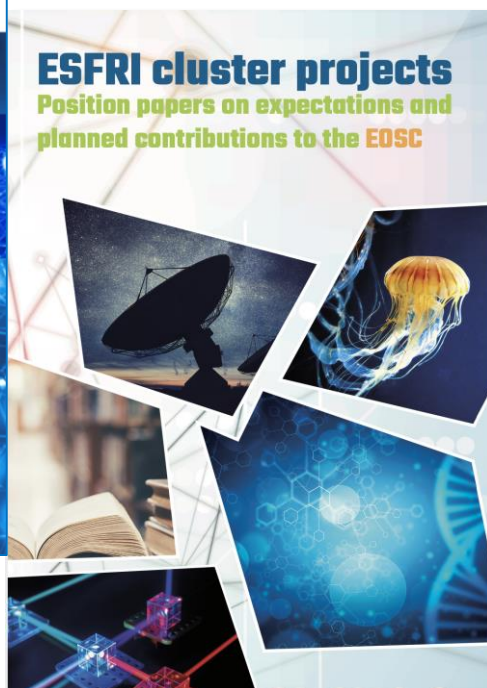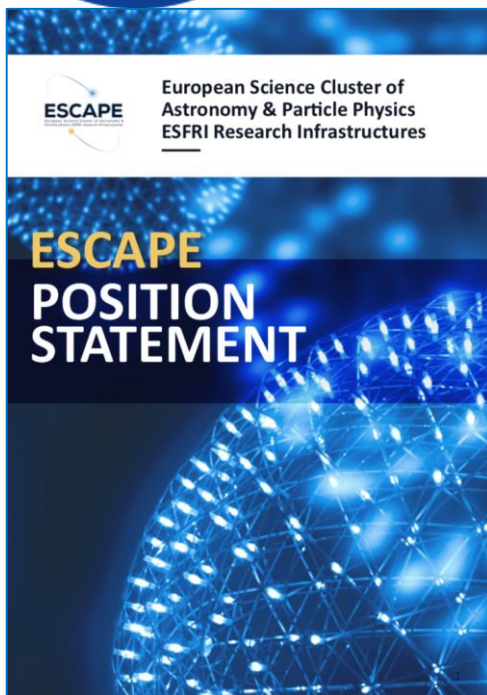# Consolidation of the ESCAPE EOSC CELL
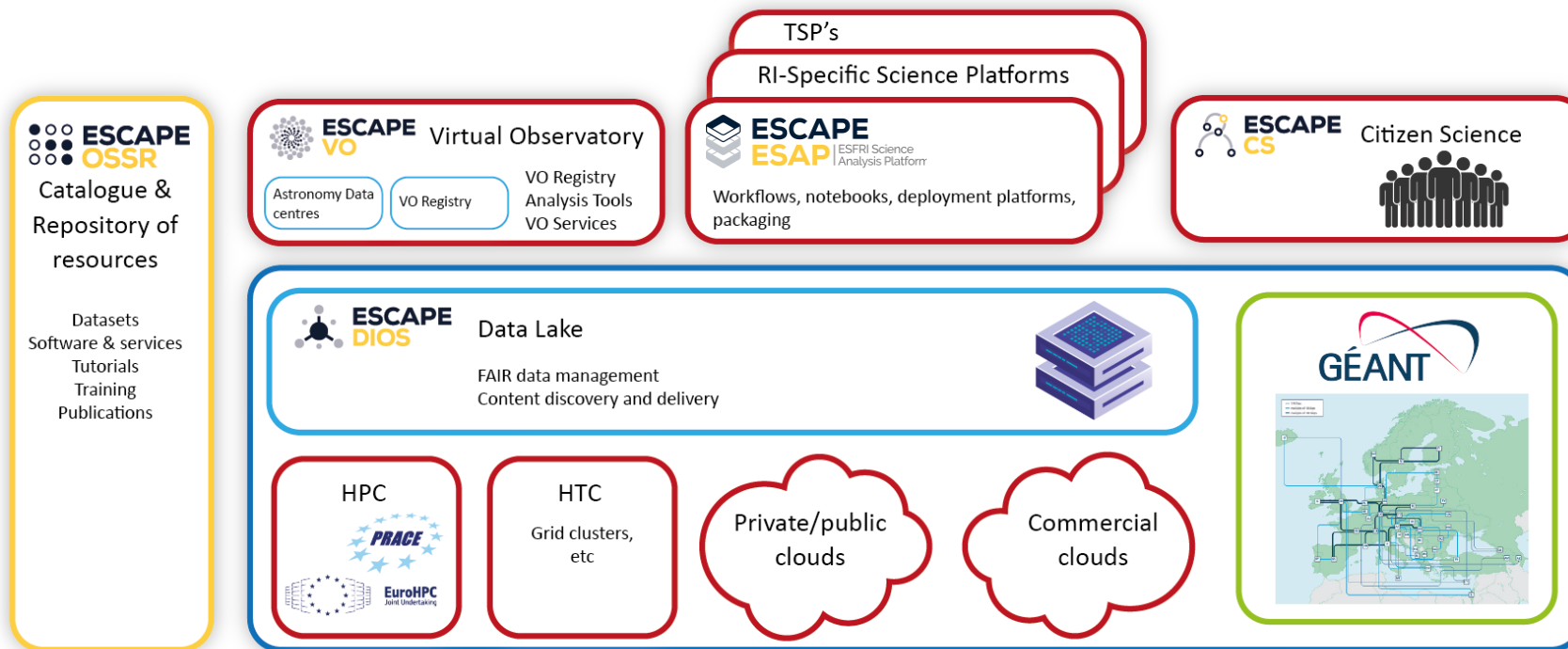
Promoting, implementing and committing to Open Science
- Envisage ESCAPE services moving into the EOSC-Exchange layer, and connections to the Interoperability Framework
- Rely on EOSC-Core for underpinning aspects, e.g. AAI

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Science Cluster synergy

https://www.projectesca
pe.eu/sites/default/files/
Escape_position_stateme
nt_web.pdf

https://zenodo.org/record/3675081 - .X2R2PJNLhTY

https://zenodo.org/record/4889503

Authors:
ENVRI-FAIR - Andreas Petzold, Ari Asmi
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Object: Science Cluster inputs to the EOSC Association for the INFRAEOSC destination in the next RI Work Programme (2023-2024).

Title: "Fostering Open Science with Science Clusters of ESFRI research infrastructures through both community-based and interdisciplinary projects and common actions"

Expected goals:
Implementation of EOSC
- Addressing the scientific needs for additional services, interoperability and alignment
Metadata and Data Quality
- Transversal actions towards FAIR stewardship and continued innovation of scientific software
Widening and Outreach
- Open innovation environment for research data, knowledge and services with engaged stakeholders and organisations
Sustaining EOSC
- A sustainable model for science communities to contribute to the EOSC

Preamble
Current landscape.
Research Infrastructures such as the ones on the ESFRI roadmap, are characterised by significant volumes of data they generate and handle. Thousands of researchers across scientific disciplines and other potential users are interested to use these data via Open Access policies. Data-intensive research, and effective data preservation for immediate and future sharing and re-use, are fundamental components of ESFRI projects and landmarks, contributing to their increasing role in responding to societal challenges such as climate change or global pandemics. Before the advent of the Science Clusters, researchers were confronted with a highly fragmented research data landscape and cooperation among ESFRI research infrastructures was community based, with limited scope and focus. The Science Clusters, namely ENVRI-FAIR, EOSC-Life, ESCAPE, PaNOSC and SSHOC, of ESFRI and other pan-European research infrastructures, are successfully helping to address the current situation. They are working with the European Open Science Cloud (EOSC), actively contributing to the setting up of dedicated FAIR services, and promoting practice for open science.

The Science Clusters today ensure strong connections between research infrastructures on the ESFRI Roadmap, between the Science Clusters themselves and jointly towards the EOSC. They are also seen as key for the transitioning of ESFRI RIs from servicing only their communities towards more integrated services in response to the Grand Challenges, and transforming their research products for economic and societal users. In addition, Science Clusters have anticipated the need for interdomain shared views for the benefit of EOSC and excellent science in Europe. They are therefore collaborating,

Science Cluster synergies and outlook for the future

The Science Clusters occupy a unique position between EOSC, ESFRI RIs and scientific communities.
Three momenta mark the success of the **Science Clusters** -> We all want to keep on them for the future.

Top-Down: The **(ESFRI) RIs** legal entities ➡ joining efforts together

Bottom-Up: The **concerned scientists** ➡ willing to pursue the cross-fertilization in science and innovation

Horizontally: The Universities and Institutes ➡ leveraging the inter-domain potential… to be fully exploited
around new academic/training schemes based on data-research

The five Science Clusters have debated and positioned their own community-based expectations in the Horizon Europe perspective.

-> they are moving towards sustained platforms/collaborations

https://indico.in2p3.fr/event/24327/

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A work plan for the future of the Science Clusters

A prompt need and opportunity to support the Science Clusters further (in 2022-2025) within **Horizon Europe framework**
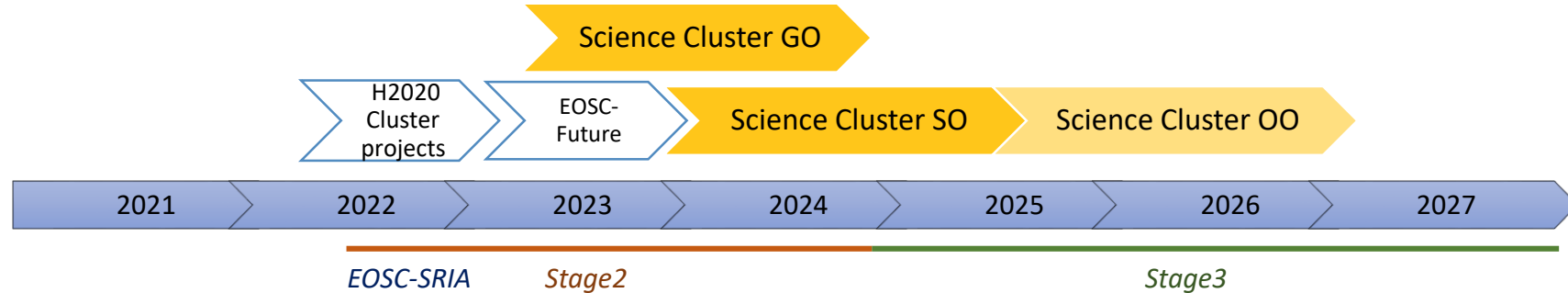
H2020 and potential **Horizon Europe** funded actions (*aligned with the EOSC-SRIA Stage2 -to- Stage3*)

General Objectives (**GO**):
 - consolidation of thematic data infrastructures as parts of a federation.

Specific Objectives (**SO**):
 - achieve relevant scientific results from clusters;
 - increase number of RIs;
 - enhance researchers uptake of OS and widen dimension.

Operational Objectives (**OO**):
- sustainable operation of the deployed cluster as a "platform infrastructure";
- continuous promotion, extension and hosting of inter-domain FAIR Science Projects (new Open Science Objectives).

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Outlook for the future

The starting point*:*
- 🟡 The ESCAPE achievements
- 🟡 A statement about Science Cluster long-term commitment
- 🟡 Plan and objectives

The method

Annoncing a new ESCAPE Collaboration Agreement

**After the successful experience of the H2020 ESCAPE Project,
the nine partner Research Infrastructure Directorates <u>have signed a new</u>
<u>"Open Collaboration Agreement"</u>,
which consolidates their action for the benefit of Open Science,
the implementation of the EOSC and
the establishment of new sustainable cooperative schemes within
Horizon Europe, the European Strategy for Data and Excellence Science.**

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A new ESCAPE Collaboration Agreement

The ESCAPE Collaboration

- It will continue to work as a "domain-based" Science Cluster and open to new RIs

- Its parties will convene their national partner institutes to join and support the ESCAPE work programme

- Potential partnership is largely inclusive since embracing the concerned scientific community at large at pan-European level

- It will leverage the existing international bridges and consortia to operate more globally (many RIs are indeed international)

- It could open up a path towards an "Open data science management infrastructure" for domain-based RIs (this is related to SCL sustainability and EOSC architecture topics)

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The method:
- 🟡 ESCAPE Open Collaboration

Next ESCAPE challenges for EOSC

ESCAPE-collaboration Pillar A activities

Two major approaches (Pillar A & B) in the Horizon Europe framework proposed by the five Science Clusters:

Pillar A - Inter-cluster common data services co-developments
General Objectives (**GO**)

I.   Structuring, consolidating and sustaining their wide cooperative VREs for the benefit of EOSC operations -> ESCAPE VRE needs to become fully operative.

II. Some of the most successful achievements of the Science Clusters are the key data services within EOSC for "data provision, discovery, and exploitation", e.g. catalogues, analysis frameworks, FAIR data archives… -> ESCAPE supports inter-cluster projects for interoperability and commons.

III. Consolidating a "few core services" per cluster to become part of the EOSC sustainable core services, and increase customization and composability of services -> ESCAPE will test cross-border services through pilots

VRE services

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ESCAPE-collaboration Pillar B activities

Pillar B - Delivering Content to EOSC
Open Science Projects (OSP) and Cross-Cluster Open Science Projects (COSP)

The next challenging "programme" (starting from 2023) in the Science Cluster agendas will be to uptake emerging and concrete "Open Science Objectives", further than the current (Test) Science Projects (within EOSC-Future).

ESCAPE commits (with the other SCLs):
Managing open calls for disciplinary and multi-disciplinary science projects not only limited to partner RIs or within an inter-RI context but also involving smaller or less structured communities with less experience in open science or lacking relevant competences.

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VRE services

Programmes

ESCAPE COSO
Challenging "Open Science Objectives" by RI commitments in Open Science Projects (OSP) as well as Cross-Cluster Open Science Projects (COSP)

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Defining Open Science projects

🟡 A complete FAIR-data scientific workflow developed and accessible within the ESCAPE VRE: RI data analysis, phenomenological and simulation works, multi-RI/multi-probe data combined study, re-analysis through innovative and more powerful software algorithms/methods…

🟡 Any development providing a service that strengthens the operation and widens the applicability of the ESCAPE EOSC-cell infrastructure: legacy data access, user platforms, infrastructure provision, RI-focused user open-source tools, aligned international cooperation, open-source software co-development and provision, scientific results reproducibility framework, emerging technology for open-access environment…

🟡 Any cooperative action that aims at results extending the FAIR data stewardship to any new or emerging RI: data/metadata standards, data management plans, RI-based cooperative framework for simulation and perspective studies, integration in the VRE consolidation and operation, adoption and maintenance of services…

🟡 Any of the above or further explorative digital workflow that has the ambition to leverage fundamental science for society at large: cooperative work with SMEs, RI data for innovation, cross-cluster projects, citizen science, data-science training and education services, digital transformation, regional initiatives leveraging EOSC, Europe-competitive data-cloud alignment with industry, green digital services and infrastructures…

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Sector Data Space in Europe

European Data Spaces: "…The European strategy for data aims at creating a single market for data that will ensure <u>Europe's global competitiveness and data sovereignty</u>.

Common European data spaces will ensure that <u>more data becomes available for use in the economy and society</u>, while keeping companies and individuals <u>who generate the data in control.</u>

<u>Data is an essential resource for</u> economic growth, competitiveness, innovation, job creation and <u>societal progress in general</u>…"

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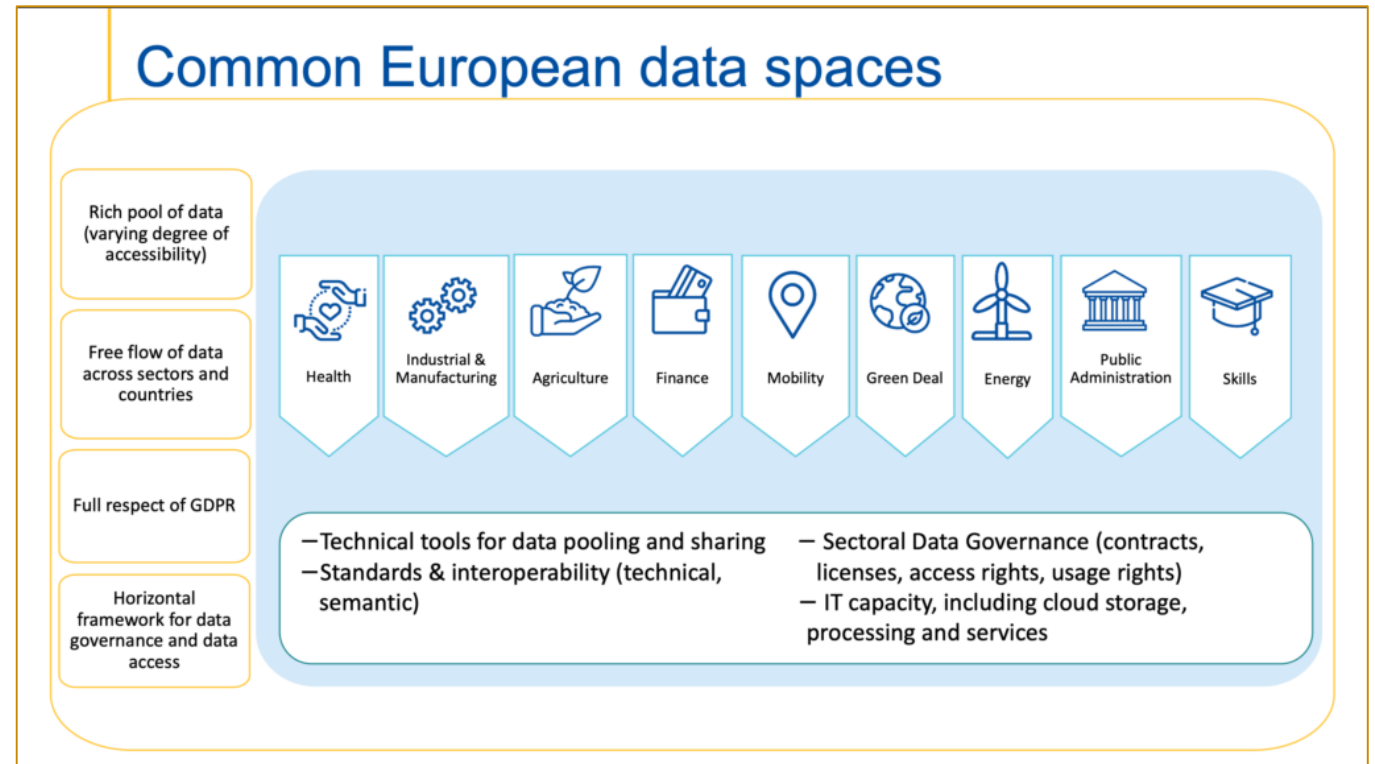
Sector Data Spaces and EOSC Data Federation?

EOSC is recognised by the Council of the European Union **as the science, research and innovation data space** which will be fully articulated with the other sectoral data spaces defined in the [European strategy for data](#).

My personal suggestions: natural evolution through a matrix architecture of competences

Vertical (V)
- **Constellation of national open platforms for public data (preserving sovereignty and multilingualism)**

Horizontal (H)
- **Domain-based "Science Cluster" data platforms (linking existing ones & ESFRI-based data platforms to EOSC)**

V, towards citizens, society and authorities, would include high-level science products and services
H, excellence science oriented, respond to scientists' needs, avoid duplication and operate services
   for all domain-based RIs, as well as into EOSC Exchange.
   (**H** can nourish **V; V** can support Citizen Science, therefore back to **H**)

Sustainability? **V** under EU national authorities; EOSC supports **V** as well as any EU common platform; Science Clusters support **H** and operate their own domain-based EOSC cell; **H** links inter-cluster Open Science projects therefore platforms for inter-sector data spaces. EOSC supports Science Cluster Competence centres for **H. ESFRIs** transfer authority, competence and operational duties for Open Data Science to the Science Cluster platform (for economy of scale and sharing duties as well as innovation).

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Aligning next ESCAPE OS projects with EU Strategy for Data

The ESCAPE Big-Science RIs are concerned by the European Data Strategy...

ESFRI facilities in Physics to support EU's industry; as well as global coordination for innovation, e.g. Quantum Computing as a service and for tech. R&D; algorithms and standards for Industry 4.0; AI; HPC.

Industrial & Manufacturing

Aligning Innovation programmes and technology R&D with environmental implications.

Green Deal

Cross-sector sharing of data for an unifying, forward-looking approach of any Big Science facility for energy efficiency, water management, etc.

Energy

Data and experience to improve accountability of public spending for research; management and sustainability of Big Science RIs through socio-economic impact model analyses.

Public Administration

Finance

European Strategy for Data

A common European data space, a single market for data

Data can flow within the EU and across sectors

Availability of high quality data to create and innovate

European rules and values are fully respected

Rules for access and use of data are fair, practical and clear & clear data governance mechanisms are in place

European Commission

Science Data to reduce the skills mismatches between the education and training systems and the labour market needs.

Skills

Health data essential for EOSC-Life advances but also link with particle/nuclear physics facilities applied to healthcare

Health

VRE services

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ESCAPE SDSS
Building synergies on "Sector Data Spaces" for Society: Green deal, Health, Manufacturing, Education and Skills

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Aligning further ESCAPE domain-based data to EOSC

A dedicated ESCAPE programme to the FAIRness of TECH-data is needed.

- Low-latency and edge computing are two fields where data FAIRness and Open Science services need to be adopted/adapted: data formats and metadata standards as well as services for multi-messenger astrophysics real-time alerts management; workflow and computing at the edge of sensors/detectors for virtual access to research infrastructures as well as large data volume reduction; management of housekeeping data or application data...

- R&D and technology data of Big-Science projects during their feasibility studies: data from radiation hardness simulation and beam tests, accelerator optics and material science simulation workflows and results, collaborative platforms for fast physics simulation study versus technologies and prototypes for next generation facilities such as Einstein Telescope (ET), Future Circular Collider (FCC)...

- Technological, industrial and applicative FAIR data platforms: namely, exploring the nuclear physics multi-domain application in innovation and society...

ERA would demand: prioritisation, coordination and direction of R&I investments.
We should anticipate it by an effective cross-work through the Science Cluster...

VRE services

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European evolution of research assessment

Council conclusions on research assessment and implementation of open science

Research assessment and implementation of Open Science
European Union Council conclusions
General Secretariat of the Council
10 June 2022

✓ Recognising all forms of research and innovation output and processes, including *inter alia*, **datasets, software, codes, methodologies, protocols and patents, and not only publications** and in line with the FAIR principles;

✓ Taking into consideration **diverse career pathways** and all research and innovation activities, including mentoring, leadership roles, entrepreneurship, data management, teaching, knowledge valorisation, industry-academia cooperation, support for evidence- informed policy making, interaction with society, including citizen science and public engagement;

✓ Taking **into consideration the specificities** of the various research disciplines and the missions of research institutions;

✓ Through launch of pilot projects to establish **assessment procedures** and involving researchers in Open Science because of the peer-reviewing

An ESCAPE framework of community curation to ensure quality of software and code..

ESCAPE leverages the cross-domain competences. The promotion of careers demands the operation of VRE to access outputs beyond publications and data, and to assess their impact.

Big-Science projects are affected by diversity not equally rewarded.

Researchers uptake OS and are also educated peer-reviewers, therefore should be able to set up procedures

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VRE services

ESCAPE
DIOS | Data Infrastructure for Open Science
Access physical & e-infrastructures
Processing & Analysis
Security & Operations

ESCAPE
OSSR | Open-source Scientific Software and Service Repository
Aggregator & Integrators
Sharing and Discover
Training & Support

ESCAPE
ESAP | ESFRI Science Analysis Platform
Processing & Analysis
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ESCAPE
CS | Citizen Science
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ESCAPE "instances" for EOSC: Competence Centre

The ESCAPE Collaboration
- ✓ preserves **the original mission:** « Connecting ESFRI projects» and
- ✓ keeps **the main focus**: «Open data science strategy to rise excellence research and innovation».

- ✓ It has a new operational role to pursue achievements, to widen the participation and to commit to new expectations for the benefit of EOSC and ERA.

The new ESCAPE work programme is challenging ahead the **support to some key "Instances" such as**

| **"Competence Centre"** |

… participates also in ensuring a sustainable governance framework and a global architecture

Instances

ESCAPE CC
Operating the community-based "Competence Center" for EOSC-alignment, train and support, extended outreach, financial model for services and networking with other SCL-CCs

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

VRE services

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EOSC

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Inter-cluster ESCAPE "instance"

One of the announced goals within the new ESCAPE collaboration agreement work programme is the establishment of a:

"European Virtual Institute for Research Software"
 an inter-cluster Competence Centre for Research Software and Skills

In this context the term Research Software encompasses the software and tools used for scientific data processing and analysis, and also the software and tools associated with building and supporting the computing and data environment within which that processing and analysis is performed.

European Virtual Institute for Research Software

- Developed **in collaboration across the Science Clusters** and existing **national competence centres.**

- Providing a framework to train and to cross-fertilize knowledge between different science domains and available across domains.

- A scalable approach to the stewardship of reusable scientific software for Open Science.

- The activity should build on work in national projects as well as international cooperative frameworks such as the "foundation ones", namely the existing High Energy Physics Software Foundation (HSF) and the ESCAPE software innovation foundation group.

- It will be part of the ESCAPE "Instances",
  - ✓ raising also **awareness** of software and computing as a **key enabler in science**;
  - ✓ ensuring that software development and scientific computing is regarded as a **first-class activity** of performing science.

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Instances

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ESCAPE EVSI
R&I for an "European Virtual Institute for Research Software" for advanced technologies

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

EOSC

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The new ESCAPE Collaboration work programme

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The method:
- 🟡 ESCAPE Open Collaboration

Next ESCAPE challenges for EOSC:
- 🟡 Open Science projects
- 🟡 Digital objects (including software) access
- 🟡 Career and rewarding
- 🟡 Cross-domain
- 🟡 Training, education, technology and society
- 🟡 "Competence centre" and "Virtual Institute"

Conclusion

"OPEN DATA and OPEN RESEARCH" for ESCAPE is a change of paradigm and a source of challenging opportunities, enabling...

Expectation

Accelerate the discoveries and increase scientific value

Enable opportunities offered by the digital revolution

Commitment

Shape and operate platforms for data interoperability

Sustain the federation of RIs for excellence science

Widen impacts of Open (Data) Science

Cooperation

EOSC Association and EC

Inter-domain and cross-disciplines

SMEs for co-developments

Society at large

Inclusiveness

Attracting more thematic and emerging RIs

Lead a regional as well as international alliance in Science

Universities, Institutes and citizens

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Thank you

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