D9.4
Serving key data service stakeholders and policy initiatives version 2

WORK PACKAGE 9 – Service Validation and Deployment

LEADING BENEFICIARY: LUND UNIVERSITY

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ABSTRACT

This second deliverable from Task 9.2 – which takes the form of an on-line survey for evaluation of the ENVRIplus Science Demonstrators – is intended to provide a concrete example of how the dialogue between the developers of these services and their user communities can be facilitated and streamlined, allowing the collection of evaluation information and other feedbacks with the help of a structured on-line questionnaire. The evaluation criteria covered by the survey include Accessibility or Ease of use, Maturity, Sustainability, Visibility, Impact, Portability, Scope, Potential, Domain coverage, and Explicit ENVRIplus contribution. The Service evaluation tool demonstrator can be accessed via the link https://survey2.icos-cp.eu/ENVRIplus-evaluator. The complete survey consists of 70 questions arranged in 15 groups. Depending on which service is evaluated, the respondent is presented with ca 35 questions, which on average should take 15-20 minutes to complete. The publicly available survey response summary is available at https://survey2.icos-cp.eu/ENVRIplus-evaluator-summary; this displays basic statistics for a selected subset of the survey questions.

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TERMINOLOGY

Acronyms used in this report are briefly explained in Appendix A. In addition, the project glossary is found at https://envriplus.manageprojects.com/s/text-documents/LFCMXHHCwS5hh.

ENVRIplus PROJECT SUMMARY

ENVRIplus[1] is a Horizon 2020 project bringing together environmental and Earth system research infrastructures (RIs), projects and networks together with technical specialist partners to create a more coherent, interdisciplinary and interoperable cluster of Environmental Research Infrastructures across Europe. It is driven by three overarching goals: 1) promoting cross-fertilization between infrastructures, 2) implementing innovative concepts and devices across RIs, and 3) facilitating research and innovation in the field of environment for an increasing number of users outside the RIs.

ENVRIplus aligns its activities to a core strategic plan where sharing multi-disciplinary expertise will be most effective. The project aims to improve Earth observation monitoring systems and strategies, including actions to improve harmonization and innovation, and generate common solutions to many shared information technology and data related challenges. It also seeks to harmonise policies for access and provide strategies for knowledge transfer amongst RIs. ENVRIplus develops guidelines to enhance transdisciplinary use of data and data-products supported by applied use-cases involving RIs from different domains. The project coordinates actions to improve communication and cooperation, addressing Environmental RIs at all levels, from management to end-users, implementing RI-staff exchange programs, generating material for RI personnel, and proposing common strategic developments and actions for enhancing services to users and evaluating the socio-economic impacts.

ENVRIplus is expected to facilitate structuration and improve quality of services offered both within single RIs and at the pan-RI level. It promotes efficient and multi-disciplinary research offering new opportunities to users, new tools to RI managers and new communication strategies for environmental RI communities. The resulting solutions, services and other project outcomes are made available to all environmental RI initiatives, thus contributing to the development of a coherent European RI ecosystem.

[1] http://www.envriplus.eu/

EXECUTIVE SUMMARY

Work package 9 in ENVRIplus is tasked with collecting information about the development, and subsequent deployment, of services taking place within the framework of the project. In this context, the term "services" may be seen as covering many different types of entities – ranging from algorithms, software and workflows to fully operational computation or management systems – with the common denominator that they can all be applied by RIs and other stakeholders in order to optimise and facilitate their operations.

While Task 9.1 focuses on service integration and deployment, as well as interfacing e-Infrastructures (e-IRs), the primary objective of Task 9.2 is to track the usability and operational issues of the services deployed by ENVRIplus. As a first step, deliverable D9.3 [Hellström 2018] explored how ENVRIplus can engage with different stakeholder groups, ranging from large actors like regional and global Earth Observation systems to end user communities, which all wish to make use of the wide palette of services and tools for data collection, curation, analysis and dissemination that are being developed by the project members.

This second deliverable from Task 9.2 – which takes the form of an on-line survey for evaluation of the ENVRIplus Science Demonstrators – is intended to provide a concrete example of how the dialogue between the developers of these services and their user communities can be facilitated and streamlined, allowing the collection of evaluation information and other feedbacks with the help of a structured on-line questionnaire.

The evaluation criteria covered by the survey include Accessibility or Ease of use, Maturity, Sustainability, Visibility, Impact, Portability, Scope, Potential, Domain coverage, and Explicit ENVRIplus contribution.

The Service evaluation tool demonstrator can be accessed via the link https://survey2.icos-cp.eu/ENVRIplus-evaluator. The complete survey consists of 70 questions arranged in 15 groups. (See Appendix B for a text copy of all groups and individual questions.) Depending on which service is evaluated, the respondent is presented with ca 35 questions, which on average should take 15-20 minutes to complete. The publicly available survey response summary is available at https://survey2.icos-cp.eu/ENVRIplus-evaluator-summary; this displays basic statistics for a selected subset of the survey questions.

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1 ABOUT WP9

ENVRIplus Work package 9 is tasked with collecting information about the development, and subsequent deployment, of services taking place within the framework of the project. In this context, the term "services" may be seen as covering many different types of entities – ranging from algorithms, software and workflows to fully operational computation or management systems – with the common denominator that they can all be applied by RIs and other stakeholders in order to optimise and facilitate their operations.

Specifically, the Theme 2 objectives [ENVRIplus 2015a] with special relevance to WP 9 are:

- to facilitate discovery of software services and their composition;
- to characterise ICT resources (including sensors and detectors) to allow virtualisation of the environment (for instance onto Grid- or Cloud-based platforms) such that data and information management and analysis are optimised in use of resources and energy usage;
- to facilitate the connection of users, composed software services, appropriate data and necessary resources in order to meet end-user requirements;
- to facilitate data discovery and use, and to provide integrated end-user information technology to access heterogeneous data sources.

While Task 9.1 focuses on service integration and deployment, as well as interfacing e-Infrastructures (e-IRs), the primary objective of Task 9.2 is to track the usability and operational issues of the services deployed by ENVRIplus. As a first step, deliverable D9.3 [Hellstrom 2017] explored how ENVRIplus can engage with different stakeholder groups, ranging from large actors like regional and global Earth Observation systems to end user communities, which all wish to make use of the wide palette of services and tools for data collection, curation, analysis and dissemination that are being developed by the project members.

This second deliverable from Task 9.2 is intended to provide a hands-on working illustration of how the dialogue between the developers of these services and their user communities can be facilitated and streamlined, allowing the collection of evaluation information and other feedbacks with the help of a structured on-line questionnaire.

2 SERVICE EVALUATION AND VALIDATION

The development and deployment of services need to be complemented by activities that follow up on how well the intended goals are met – both in terms of how well the service functionality and performance complies with specifications, and with respect to user experiences. If carried out in a consistent and transparent way, the results of the validation and evaluation activities are useful for both developers and end users: the former get access to direct feedback from people who have tried to use the service, or even to deploy it on their own, while user communities are able to browse through (public parts of) evaluation reports posted by their peers. Indeed, having access to records and reports from validation and evaluation activities will help end users to judge the usefulness and applicability of various services, and thus to make informed choices on which ones to try out. Additionally, the science community, in particular, also gets to try novel services and get a glimpse into future possibilities – as well as having the opportunity to take part in this development.

2.1 Facilitating uptake of ENVRIplus services

In order to maximize the benefits to both scientific communities and society, it is very important for ENVRIplus service developers and providers to understand the needs and requirements of their potential end user categories. This can be achieved through a "listen, engage, collaborate" strategy, covering service exposure & dissemination through catalogues and discovery services, access to documentation & training, operational support, and the provision of interactive platforms for dialogue and feedback.

Indeed, the WP9 Description of Work requires deepening and further developing the contacts between ENVRIplus partner RIs in various domains and their stakeholders and end user communities, in order to jointly map out requirements and to explore solutions to issues relating to data access, replication or transfer. To ensure fruitful and productive interactions, various forms of communication are envisaged, ranging from collaboration on specific use cases, organisation of meetings and workshops, and preparation of documentation and training. Many of these activities fall under the responsibility of WP9 but also the other Theme 2 work packages are engaged in e.g., use case teams.

2.2 Criteria for service validation

Various criteria for service evaluation have already been developed in the framework of many other initiatives, for example INDIGO-DataCloud [INDIGO 2017], and it would indeed be convenient to base the demonstrator on such pre-existing packages – especially if a majority of the ENVRIplus services are disseminated through e.g., the EGI service portal. However, we need to ensure that the system chosen is able to cover – in sufficient detail – the aspects of usability and operationality that are central to Task 9.2.

Specifically, the implemented evaluation criteria should as far as possible cover all aspects described in Chapter 5 of the ENVRIplus deliverable D9.1 [Chen 2017], and optimally support also additions aimed at fully covering the Task 9.2 usability and operationality aspects.

A majority of the criteria in Table 1 below (adapted from [Chen 2017]) have been included in the D9.4 evaluator tool, at least to some level of detail. Because the D9.4 demonstrator is based on Science Demonstrators (see chapter 2.3) rather than fully-fledged services, criteria such as Visibility, Degree of adoption outside ENVRIplus and some of the ENVRIplus-specific categories proved difficult or impossible to implement.

TABLE 1. EXAMPLES OF GENERAL AND ENVRIPLUS-SPECIFIC EVALUATION CRITERIA FOR SERVICES

	Criterion	Description
General	Accessibility or Ease of use	Related to technical skill & knowledge level of adopter, quality and depth of documentation, potential need for access to specific data centres or technologies, …
	Degree of adoption outside of ENVRIplus	Number of RIs or similar organizations that have adopted a service? How many individual users?
	Maturity	Can be a scale from idea or best practice recommendation, proof-of-concept, demonstrator or pilot, operational system – compare with the Technical Readiness Level scale used by e.g., EC evaluators[2].
	Sustainability I	Can be assessed on many levels: Time frame of commitment by the provider; longevity of hardware, operating system and platform; longevity of software and technology; access to expertise and maintenance, etc.
	Sustainability II	To what extent is the quality of engineering good enough? Is there a committed team that can grow as needed e.g., through open source governance, to continue development, handle maintenance and support technical questions that users' own support teams cannot answer?
	Visibility	Has the service been well advertised and disseminated outside of ENVRIplus?
	Impact	Impact of the service being used or available.
	Portability	To what extent is the service tied to a particular platform, toolset, language or data model? Does it embrace standards and enable innovation?
	Scope	How many aspects of the data lifecycle are involved? How many categories of expertise will the service be of use to?
	Potential	Does the direction and skeleton or conceptual framework used for the service provide a good platform on which to continue to build?
	Depth	What proportion of the technical, practical and system details does the service address?
ENVRIplus:-specific	Involvement of partners	How many ENVRIs have been interested in contributing actively in the development (through agile teams or similar)?
	Domain coverage	How many ENVRI sub-domains can make use of the service?
	Scope	How many ENVRIplus WPs are affected (e.g., how many “pillars” and “cross beams” are involved as components of the service itself, or can make use of the service)?
	Explicit ENVRIplus contribution	Would the service have been developed anyway or was ENVRIplus instrumental in the process?
	Adoption by partner RIs	Number of ENVRIplus partners that have adopted the service (in whole or in part). How many individual users?

[2] See e.g. https://enspire.science/trl-scale-horizon-2020-erc-explained/

2.3 ENVRI service candidates for evaluation

Together with the other ENVRIplus Theme 2 work packages (WP5-WP8), WP9 has worked on setting up the ENVRIplus Service Portfolio [ENVRIplus wiki 2019], essentially a catalogue of service products developed within the framework of the Theme 2 work packages. Together with documentation and evaluation outputs, the resulting catalogue[3] will be used by the project to communicate and present Theme 2 service products to RIs and other end users.

Currently, the portfolio encompasses around a dozen of services, spanning a wide range of data management aspects, and representing very different levels of technical readiness. We thus decided to design the D9.4 evaluation tool around the set of Science Demonstrators earlier described in deliverable D9.2 [Chen 2018], and listed in Table 2.

TABLE 2. SCIENCE DEMONSTRATORS INCLUDED IN THE EVALUATION TOOL.

Science demonstrator name	Contact person, wiki entry & YouTube video
SD1: Support EISCAT_3D Users to Reprocess Data Using User's Algorithms (Use Case IC_3)	• Contact person: Ingemar Häggström (EISCAT) • ENVRI wiki entry • YouTube video
SD2: The eddy covariance fluxes of GHGs (Use Case IC_13)	• Contact person: Domenico Vitale (UNITUS) • ENVRI wiki entry • YouTube video
SD3: SOS & SSN ontology based Data Acquisition and NRT Data Quality checking services (Use Case IC_14)	• Contact person: Robert Huber (UniHB) • ENVRI wiki entry • YouTube video
SD4: EuroArgo Data subscription service (Use Case TC_2)	• Contact person: Thierry Carval (Ifremer) • ENVRI wiki entry • YouTube video
SD5: Sensor registry (Use Case TC_4)	• Contact person: Justin Buck (Euro-Argo) • ENVRI wiki entry • YouTube video
SD6: New particle formation event analysis on interoperable infrastructure (Use Case TC_17)	• Contact person: Markus Stocker (UniHB, TIB) • ENVRI wiki entry • YouTube video
SD7: gCube-based VRE for Mosquito Diseases Study (Use Case SC_2)	• Contact person: Baptiste Grenier (EGI) • ENVRI wiki entry • YouTube video
SD8: Dynamic Ecological Information Management System – Site and Dataset Registry (DEIMS-SDR) *	• Contact person: Christoph Wohner (EAA) • ENVRI wiki entry • YouTube video
SD9: PROV-Template Registry and Expansion Service (Use Case IC_10)	• Contact person: Doron Goldfarb (EAA) • ENVRI wiki entry • YouTube video

* All Science Demonstrators except this one were described in D9.2 [Chen 2018].

[3] https://confluence.egi.eu/display/EC/ENVRIplus+Service+Portfolios

3 THE SERVICE EVALUATION DEMONSTRATOR

3.1 Design goals & desired functionality

As outlined above, the D9.4 demonstrator should provide a concrete, usable tool for collecting relevant validation information and making this available to service developers, service providers and end users. The tool should also be user friendly and easy to use, so that the threshold for using it is as low as possible. Importantly, the tool should be relevant and useful to both ENVRIplus partners (service developers and providers) and stakeholders (service end users). Furthermore, it should be easy to build on the demonstrator version, for example by setting up a long-term instance (hosted by one of the ENVRIs) that would be easily maintained, secure, regularly backed-up, and reasonably easy to update as the service catalogue grows or changes. Finally, it should ideally be possible to integrate the tool with the ENVRIplus Service Portfolio, for example by linking to dynamically created result summaries or visualisations of evaluation score statistics.

To this end, we decided to set-up an on-line questionnaire that could be accessed via any web browser, and would not require pre-registration or logging in. The questionnaire platform (operating system, code base language and database) should preferably be free, Open Source and already have an active and sizable user community.

3.2 Target group(s)

There are several target groups who would benefit from the Science Demonstrator evaluations tool:

- Service developers of the Science Demonstrators and other similar services and tools
- Developers of the Virtual Research Environments
- End-users of the Science Demonstrators
- The ENVRI community
- Policy makers and funders
- Administrators of research infrastructures
- E-infrastructure service providers

Obviously the level of technical knowledge and research data management skills varies considerably between these categories, and across the different roles that a person may have within her or his own organisation or community – for example:

- Administrator (project leader)
- Data manager
- System architect
- Programmer or developer
- Researcher
- Other

By engaging these target groups in evaluating Science Demonstrators, there will hopefully be more *active* participation in the development of the Science Demonstrators, and for these target groups to act more as *real stakeholders* of the Science Demonstrator evaluation tool. The first mentioned target-groups, that is service developers and end-users, would be more involved in the input of evaluations in the service evaluation tools, whereas the other groups, that is ENVRI

community, policy makers, RI administrators, would be more interested in the output, results coming out from a service evaluation tool.

The service evaluation tool benefits the target groups in many ways, including:

- *Service developers:* Through the evaluation tool this group obtains valuable feedback of early user tests of their services and tools. Users' opinions also provide good input for the continuing development of the services and tools.
- *Virtual Research environment developers*: Through the evaluation tool they may get valuable feedback of interfacing the data managing services provided by research infrastructures. Users' opinions about might also provide good input for the development of user-centric tools and environments for data-intensive research.
- *End-users:* The evaluation tool can be a good one-stop-shop of services that are available or under development, through the links to the presentations and documentation of the Science Demonstrators. Having tested the Science Demonstrators, end-users will also have the opportunity to rate and comment these through the evaluation tool, and they will therefore make important contributions to the development of the Science Demonstrators.
- *ENVRI community:* The ENVRI community obtains a good overview of the kind of services that are being developed within the domains of the community, and what user needs scientists have.
- *Policy makers and funders:* Having funded research infrastructures and scientists, this target group has an interest in following up with the development of services and tools by the projects they are funding and supporting.
- *Research infrastructure administrators:* People engaged as administrators of research infrastructures might be interested in getting an overview of the available Science Demonstrators and how these are evaluated and rated by end-users.
- *E-infrastructure service providers:* For those actors who are providing e-infrastructure services, such as portal services or high performance computing services, it is of interest to have an overview of the available Science Demonstrators.

3.3 Implementation of the tool

3.3.1 Software platform

As a first step, we reviewed existing questionnaire-based tools used for evaluation and validation of research data-related services, i.e. of similar nature and scope as those listed in the ENVRI Service Portfolio of technologies, standards and recommendations [ENVRI wiki 2019].

While the search returned several papers discussing what functionalities such tools should have (including sets of questions and test criteria), as well as a few limited-scope demonstrators, no non-proprietary, Open Source solution that would be directly applicable "out of the box" for our purposes was identified. We then expanded the search to also cover software packages and server platforms used for e.g., course evaluations and more general surveys. As additional functionalities, special focus was also put on user friendliness, aspects covered and possibilities for customising both the user interface and the output formats.

The inventory produced a short-list including Moodle[4], LimeSurvey[5] and – of more general on-line survey character – EUSurvey[6] and Google Forms[7]. We opted for LimeSurvey [LimeSurvey

[4] https://moodle.org/
[5] https://www.limesurvey.org/

2019], which is an Open-Source web server-based application written in PHP that "enables users using a web interface to develop and publish on-line surveys, collect responses, create statistics, and export the resulting data to other applications" [Wikipedia 2019]. While the basic use of the software is free, access to extended functionality and user support is available only to paying subscribers. However, LimeSurvey provides a free-to-use discussion forum, where an active user community discusses best practices, issues and problems. During the D9.4 development, we received prompt and useful responses to a number of questions posted on the forum.

Important capacities of LimeSurvey are:

- Easy to configure and yet very powerful with functions such as conditions, decision trees, equation questions (the latter allows to define answers based on responses to earlier questions)
- Built-in scripting capabilities (PHP-based) and possibility to customize behaviour using JavaScript
- The survey database can be accessed via a provided RESTful API
- Access to 24 different built-in question types, including single choice (radio, dropdown), multiple-choice, arrays (numbers, text, scaled and configurable answer options), text (short and long), and so-called mask questions (yes/no, date/time, numerical input).
- Auto-generation of statistics, both advanced response evaluations (available to survey administrators) and basic summaries (accessible by the public)
- Support for both "open" and by-invitation-only questionnaires

LimeSurvey users can choose between installing a local instance of the software or creating and running surveys on a hosted LimeSurvey instance. We chose to install and run a free, pre-built instance [Ramirez 2019] of LimeSurvey running inside a Docker[8] container hosted on one of the servers operated by the ICOS Carbon Portal[9]. The instance, accessible at https://survey2.icos-cp.eu/, is at the time of writing operating version 3.15, using a MySQL database. ICOS has committed to host this instance until the end of 2020.

3.3.2 Legal and ethical aspects

In order to understand and interpret the context in which an evaluation is made, it is therefore important to capture at least basic information regarding a respondent's RDM expertise and professional role on the one hand, and on the other, which scientific sub-domain(s) that she or he is working in. At the same time, it is very important to take into consideration the respondents' right to privacy, as well as all relevant aspects of the European Union General Data Protection Regulation[10] (GDPR).

Even though it is possible to complete the Service Evaluator questionnaire without providing personal details, such as first and last name, e-mail address and organizational affiliation, it is nevertheless important to safeguard the survey's underlying database from inadvertent tampering or sharing of data. While the survey system itself, including the database, can be protected by applying e.g. strong administrator account passwords, it is necessary to take special

[6] https://ec.europa.eu/eusurvey/home/welcome
[7] https://www.google.com/forms/about/
[8] https://www.docker.com/
[9] https://www.icos-cp.eu/
[10] https://eugdpr.org/

care when configuring the survey result output that is publicly available, to avoid displaying information that can be easily connected to the individual respondents. In order to make all respondents aware of the GDPR-related issues, and ensure that they only participate after making an informed decision to do so, the following notice is displayed on the welcome page of the questionnaire:

> "We hereby highlight that personal data of those who participate in the survey will be collected and stored. The responses, including personal data, will be stored in a safe way during the survey, and not shared with any party outside of the ENVRIplus project context. The survey responses will be deleted no later than 18 months after the conclusion of ENVRIplus. To participate in the survey you must acknowledge having read this notice and that your personal data can be stored."

3.3.3 Survey questionnaire

The Service evaluation tool demonstrator can be accessed via the link[11] https://survey2.icos-cp.eu/ENVRIplus-evaluator. The complete survey, including all groups and individual questions, is included in Appendix B. The survey consists of 70 questions arranged in 15 groups, as outlined in Table 3. Depending on which service is evaluated, the respondent is presented with ca 35 questions, which on average should take 15-20 minutes to complete.

TABLE 3. AN OVERVIEW OF THE QUESTIONNAIRE STRUCTURE, DESCRIBING THE ORDER AND CONTENT OF THE QUESTION GROUPS

Group name	#	Description
About you	10	Collecting information about the evaluator, including name & e-mail (both optional), affiliation and professional role
Service selection	8	Selection of which service to evaluate, and reasons for evaluation
Service documentation	5	Evaluation of available documentation, including scope and quality
General impressions and potential impact	11	Collecting the evaluator's impression of the service in a larger context, including relations to ENVRIplus concepts of data life cycle and research data management aspects, as well as the potential impact of the services in and outside of the ENVRI community
Technical aspects	9	Examination of various technical aspects, including technologies, user interface, and sustainability
SD1-specific questions	2	Specific questions on Science Demonstrator 1
SD2-specific questions	3	Specific questions on Science Demonstrator 2
SD3-specific questions	2	Specific questions on Science Demonstrator 3
SD4-specific questions	2	Specific questions on Science Demonstrator 4
SD5-specific questions	2	Specific questions on Science Demonstrator 5
SD6-specific questions	6	Specific questions on Science Demonstrator 6
SD7-specific questions	3	Specific questions on Science Demonstrator 7
SD8-specific questions	2	Specific questions on Science Demonstrator 8
SD9-specific questions	3	Specific questions on Science Demonstrator 9
Evaluation of the survey tool	2	Questions relating to the set-up of the evaluation tool

[11] This is an alias for https://survey2.icos-cp.eu/index.php/572397?newtest=Y&lang=en

3.3.4 Statistics & visualizations

The publicly available basic response summary (automatically created by LimeSurvey) is available via the link[12] https://survey2.icos-cp.eu/ENVRIplus-evaluator-summary.

The built-in generic tools in LimeSurvey for visualizing statistics are quite primitive, especially concerning the content and quality of publicly available statistics. These, in the form of summary percentage tables and, where applicable, histogram graphs for selected questions, are displayed as a HTML web page. Due to the compact formatting and primitive styling, the information is quite difficult to extract, especially for persons new to LimeSurvey. It is also not possible for the person viewing the public statistics to apply filtering conditions, e.g. to select only those answers that are associated with a given service.

In contrast, the administrators (owner and editors) of the survey have a wider range of tools at their disposal. The survey administrator can access all recorded information, apply various filters (based on specific responses to key questions), and select from a range of different graph types (bar charts, pie charts, radar charts, etc.), and view the output on-screen (as HTML) or saved as PDF for off-line use. However, the formatting options of these outputs are still quite constrained, and not aesthetically pleasing.

[12] Alias for https://survey2.icos-cp.eu/index.php/statistics_user/572397?language=en

4 OUTCOMES

4.1 Collected responses

Because the finalized version of the questionnaire was only published (opened) at the time of writing D9.4, no responses from "true" evaluators of the Science Demonstrators had been recorded at the time this Deliverable was submitted. It is therefore not possible to present any conclusions on e.g. which target group categories or ENVRI sub-domains may find the tool useful, or indeed any statistics for how the Science Demonstrators themselves were perceived. Based on the responses collected during earlier testing of the evaluator (in connection to the ENVRI Week meetings in Zandvoort, Netherlands in May 2018 and in Riga, Latvia in November 2018), we believe there is a significant interest from especially data managers in the ENVRIs in giving feedback to service developers, and we will therefore promote the now finalized survey via the ENVRI Community information channels.

4.2 Suitability of LimeSurvey as a platform

LimeSurvey is clearly suitable for producing high-quality surveys, as it comes with many useful features and functionalities, including over 20 question types, support to build in complex logic to control question flow, possibilities to manage users, and several options for creating reports and statistics. But this complexity has the drawback that it does require at least a week of active work to master the set of functionalities that were used for the D9.4 demonstrator. In addition, to host and maintain the instance requires assistance from IT staff with experience in Docker and database technologies.

4.3 Experiences from designing the questionnaire

Developing the questionnaire for all the Science Demonstrators gave us the opportunity to deeply study the Science Demonstrators, and to get good insight into their functionalities. The questionnaire is divided into two major parts: one with questions common to all Science Demonstrators and the other for specific questions for each Science Demonstrator. With this arrangement it is possible to get a common picture of users' views of all the Science Demonstrators.

4.4 Usefulness of the tool for Evaluation

In Section 3.2 Target groups, we described how the service evaluation tool could be useful for the different target groups, specifically service developers, ENVRI community, end-users and policy makers. Evaluating and measuring performance of services and tools is today a natural part in both research domains and industry, and this will certainly also be an important part in the services delivered within the ENVRI community. Having a service evaluation tool not only gives "hard facts" to service developers and funders but also contributes to the general impression and trademark of the ENVRI community. Furthermore, it is possible for the developers of each Science Demonstrators to get some user feedback specific for their Science Demonstrator, by periodically creating – either manually (by the survey administrator) or via e.g. a scheduled script execution – evaluation reports for each service included in the tool, and then sharing these with the respective developers.

4.5 Continued developments

4.5.1 Extension to include questions on Service Validation

In the ENVRIplus context, the concept of service validation covers activities and tests undertaken before or in connection with a service being released in order to make sure it is working according to its specifications, and that it can thus meet end user expectations. Examples include looking for dependencies to specific software libraries or operating system characteristics, and investigating that domain- and community-specific data and metadata standards and formats are supported. During the development of each Theme 2 service, developers are supposed to perform internal testing at the function and unit levels. It may also be desirable to provide end users with dedicated "sand box" environments. These can be used for ensuring that installation instructions are correct, that the software works as expected when compiled with specific libraries, and for performing test runs with "golden" datasets. The latter is an important means to identify any deviations from expected processing results due to e.g., algorithm coding or differences in variable precisions.

Because of its modular structure, it will be straightforward to modify the D9.4 demonstrator survey to include also question groups covering relevant facets of validation activities. This was not yet done, as a majority of the included science demonstrators had, at the time of writing, not yet reached a technical readiness level where validation activities had become relevant.

4.5.2 Integration with the ENVRI Service Portfolio and ENVRI-Hub

Based on the evaluation tool demonstrator described here, it is straightforward to set up similar questionnaires for any service developed by ENVRI Community members, including the ENVRI Service Portfolio offerings and the planned ENVRI-Hub currently under development in the ENVRI-FAIR project.

4.5.3 Improving visualization and analysis of collected response statistics

In order to complement and enhance the rather limited (and aesthetically little appealing) statistics and reporting facilities built into the off-the-shelf community version of LimeSurvey, we propose to develop a separate survey visualization tool, based on Python code hosted in a Jupyter Notebook framework. It is straightforward to connect to the LimeSurvey database using the platform's API, allowing data from any survey to be accessed and downloaded. (We note that personal information, or other data that would make it easy to identify the individual respondents, should never be publicly displayed, visualized, or shared in any other way without the express consent of the persons involved!)

Once the response data is available in Jupyter Notebook, advanced analysis and filtering can take place using standard libraries, before visualizing the outputs either as (interactive) graphs inside the Jupyter Notebook or as exported reports. Several different versions of such Notebooks targeting e.g., the general public, service developers and administrators, can be hosted in parallel on a Jupyter Hub and made available via a dedicated web site or be embedded into project service catalogues or portals. (A prototype Notebook of this type is being developed by ICOS Carbon Portal, independent of ENVRIplus activities.)

5 IMPACT ON PROJECT

While the demonstrator in its current form is built on a rather limited set of “services” with low to mid-range technical readiness levels, it can easily be adapted for use with any type of (data) service (e.g. for dissemination, visualisation, computation, analysis). All project partners – as well as the infrastructures in the wider ENVRI community – can therefore benefit from a service evaluation tool of the type described in this Deliverable in a number of contexts. If they are developing and/or operating services, the tool allows collecting feedback from their user community on the functionality and performance of their (data) services. Similarly if they are using, or interested in using, services developed by other parties, they may use the form to report the results of their own testing or implementation activities to the original developers.

6 IMPACT ON STAKEHOLDERS

An important objective of ENVRIplus is to encourage the development of a common set of services and applications that help address the challenges faced by environmental and Earth science research initiatives in their use of data and services. The challenges include discovery and use of data, workflow support, data management and facilitating user interaction [ENVRIplus 2015b]. Towards this goal, all solutions, services, systems and other project outcomes developed by ENVRIplus should be made available across the entire spectrum of potential end users, ranging from large generic initiatives down to individual research groups, as well as SMEs and other commercial actors.

As discussed in ENVRIplus deliverable D9.3 [Hellström 2017], it is of great importance to open up and maintain communication pathways between these stakeholder groups (data users) and the ENVRIs (data producers, and often also data curators). It is of special importance for ENVRIplus service developers and providers to understand the needs and requirements of their potential end user categories. This can be achieved through a "listen, engage, collaborate" strategy, covering service exposure & dissemination through catalogues and discovery services, access to documentation & training, operational support, and the provision of interactive platforms for dialogue and feedback. The service evaluation tool presented here addresses the last of these points, as it is designed to facilitate the provision of structured feedback on services.

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APPENDIX A. ACRONYMS & TERMS USED IN THIS REPORT

This appendix is based on the official ENVRI terminology and glossary, as available at the ENVRI community wiki site (see https://wiki.envri.eu/pages/viewpage.action?pageId=14452608).

App A-1. Terminology & glossary specific to this deliverable

CSW: Catalogue Service for the Web

DEIMS-SDR: Dynamic Ecological Information Management System - Site and Dataset Registry

FAIR: Findable, Accessible, Interoperable, Reusable

GHG: Greenhouse Gas

OAI-PMH: Open Archives Initiative Protocol for Metadata Harvesting, a protocol developed for harvesting (or collecting) metadata descriptions of records in an archive

Prov-O: Provenance Ontology

PROV-Template: Service allowing to store templates for provenance information

QC: Quality Control

SD*x*: Science Demonstrator number *x* (refers to numbering of Science Demonstrators described in the ENVRI Community wiki (see https://wiki.envri.eu/display/EC/Science+Demonstrators).

SOS: Sensor Observation Service

SSN: Semantic Sensor Network

SSNO: Semantic Sensor Network Ontology

TRL: Technical Readiness Level

URL: Uniform Resource Locator, a location-based uniform resource identifier.

WFS: Web Feature Service

WMS: Web Map Service

XML: Extensible Markup Language.

App A-2. Other technical terms and acronyms used in ENVRIplus deliverables

API: Application Program Interface, is a set of routines, protocols, and tools for building software applications

Biodiversity: is the variety of different types of life found on earth

Biodiversity metrics: measurements of the number of species and how they are distributed

CERIF: Common European Research Information Format

CIARD RING: A global directory of information services and datasets in agriculture

D4Science: is an organisation offering a Hybrid Data Infrastructure service and a number of Virtual Research Environments

Data stream: a sequence of digitally encoded coherent signals used to transmit or receive information that is in the process of being transmitted

Data pipeline: In computing, a pipeline is a set of data processing elements connected in series, where the output of one element is the input of the next one.

DCAT: is a resource description format vocabulary designed to facilitate interoperability between data catalogues

DIRAC: Distributed Infrastructure with Remote Agent Control. High-Throughput computing platform operated by EGI.

EduGAIN: is an international inter-federation service interconnecting research and education identity federations

E-infrastructure: can be defined as networked tools, data and resources that support a community of researchers, broadly including all those who participate in and benefit from research

FIM4R: Federated Identity Management for Research collaborations

gCube: is an open-source software toolkit used for building and operating Hybrid Data Infrastructures enabling the dynamic deployment of Virtual Research Environments by favouring the realisation of reuse oriented policies

HPC: High Performance Computing

HTC: High Throughput Computing

IoT: The Internet of Things - is a scenario in which objects, animals or people are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

ICT: Information and Communications technology

IG: Interest Group, open-ended topic group, for example in the Research Data Alliance

IPR: Intellectual Property Rights

KOS: Knowledge Organization Systems - is a generic term used in Knowledge organization about authority lists, classification systems, thesauri, topic maps, ontologies etc.

LOD: Linked open data is linked data that is open content

LOV: Linked Open Vocabularies

Metadata: is data that describes other data. Metadata summarizes basic information about data, which can make finding and working with particular instances of data easier

NGI: National Grid Initiative

NMI: National Metrological Institutes

NREN: National Research and Education Network

NRT: Near Real Time - refers to the time delay introduced, by automated data processing or network transmission, between the occurrence of an event and the use of the processed data (For example, a near-real-time display depicts an event or situation as it existed at the current time minus the processing time, as nearly the time of the live event)

ODP: 1) Open Distributed Processing (for the ENVRI Reference Model); 2) Online Data Processing

OIL-E: The Open Information Linking model for Environmental science - is a semantic linking framework

Ontology: (In computer science and information science) an ontology is a formal naming and definition of the types, properties, and interrelationships of the entities that really or fundamentally exist for a particular domain of discourse

QoE: Quality of user experience

Over dispersion: a statistical characteristic of data such that the data have more clusters than compared to what might be expected if the data were distributed randomly in proportion to the time/space available.

NetCDF: a file format.

OceanSITES: a worldwide system of long-term, open-ocean reference stations measuring dozens of variables and monitoring the full depth of the ocean from air-sea interactions down to the seafloor

OOI: Ocean Observatories Initiative

RDA: Resource Description and Access, a standard for descriptive cataloguing. See also A.3. (Organisational acronyms) below.

RM: Reference Model - is an abstract framework or domain-specific ontology consisting of an interlinked set of clearly defined concepts produced by an expert or body of experts in order to encourage clear communication

SensorML: The primary focus of the Sensor Model Language is to provide a robust and semantically-tied means of defining processes and processing components associated with the measurement and post-measurement transformation of observations

Semantics: is the study of meaning

Syntax: In computer science, the syntax of a computer language is the set of rules that defines the combinations of symbols that are considered to be a correctly structured document or fragment in that language

SLA: Service Level Agreement

SME: Small and medium-sized enterprise

UV: Unmanned vehicles

VL: Virtual Laboratory

VRE: Virtual Research Environments, web based package tailored to a specific community

WG: Working Group, time-limited topic group, for example in the Research Data Alliance

App A-3. Organisational acronyms

ACTRIS: Aerosols, Clouds, and Trace gases Research Infrastructure network. ENVRIplus partner.

AnaEE: Analysis and Experimentation on Ecosystems. European research infrastructure, ENVRIplus partner.

AQUACOSM: EU network of mesocosms facilities for research on marine and freshwater ecosystems open for global collaboration

ARISE: Atmospheric dynamics Research Infrastructure in Europe. RI associated with ENVRIplus and part of the ENVRI Community

CDI: Collaborative Data Infrastructure. European e-service provider organisation,

CEA: Commissariat à l'Energie Atomique et aux Energies Alternatives. French research agency, ENVRIplus participant.

CETAF: Consortium of European Taxonomic Facilities. RI associated with ENVRIplus and part of the ENVRI Community

CINECA: Consorzio Interuniversitario. Italian non-profit research consortium, ENVRIplus participant.

CNR: Consiglio Nazionale delle Richerche. Italian national research council, ENVRIplus participant.

CNRS: Centre National de la Recherche Scientifique. French research organisation, ENVRIplus participant.

CODATA: Committee on Data for Science and Technology.

ConnectinGEO: Coordinating an Observation Network of Networks EnCompassing saTellite and IN-situ to fill the Gaps in European Observations

COOPEUS: Strengthening the cooperation between the US and the EU in the field of environmental research infrastructures. Project funded under EU FP7, continued as COOP+ under Horizon 2020.

COPERNICUS: previously known as GMES (Global Monitoring for Environment and Security), is the European Programme for the establishment of a European capacity for Earth Observation

CREEM: Centre for Research into Ecological and Environmental Modelling, operated by University of St Andrews (USTAN).

CSC: Center for Science (Tieteen tietotekniikan keskus Oy). Finnish national high-performance computing centre, ENVRIplus participant.

CU: Cardiff University. UK university, ENVRIplus participant.

DANUBIUS: The international center for Adavanced studies on river-sea systems. RI associated with ENVRIplus and part of the ENVRI Community

DASSH: Data archive for seabed species (a UK marine biology resource centre)

DiSSCo: Distributed Systems of Scientific Collections

DKRZ: German Climate Computation Center (Deutsches Klimarechenzentrum GmBH). German research organisation, ENVRIplus participant.

EAA: Umweltbundesamt GmbH - Environment Agency Austria. Austrian governmental agency, ENVRIplus participant.

EEA: European Environment Agency

EGI: Stichting European Grid Initiative. European research foundation, ENVRIplus participant.

EISCAT: EISCAT Scientific Association. European research organisation, ENVRIplus participant.

EISCAT_3D: Multi-static phased array radar system. Operated by EISCAT Scientific Association, ENVRIplus partner.

EMBL: European Molecular Biology Laboratory. European research organisation, ENVRIplus participant.

EMBRC: European Marine Biological Resource Centre. A research infrastructure and consortium of research organisations interested in marine biology. ENVRIplus partner.

EMODNET: The European Marine Observation and Data Network

EMPHASIS: European Infrastructure for Multi-scale Plant Phenomics and Simulation. RI associated with ENVRIplus and part of the ENVRI Community

EMRP: European Metrology Research Programme

EMSC: European-Mediterranean Seismological Centre. European non-governmental organisation, ENVRIplus participant.

EMSO: European Multidisciplinary Seafloor and Water Column Observatory. European research infrastructure, ENVRIplus partner.

EOSC: European Open Science Cloud. Initiative from the European Commission.

EPOS: The European Plate Observing System. European research infrastructure, ENVRIplus partner.

ERIS: Environmental Research Infrastructure Strategy 2030

ESONET VI: European Seafloor Observatory NETwork. European research infrastructure, ENVRIplus partner.

ETHZ: Eidgenössische Technische Hochschule Zürich. Swiss technical university, ENVRIplus participant.

EUDAT: H2020 project on Research Data Services, Expertise & Technology Solutions (previously funded by FP7). Continues as the Collaborative Data Infrastructure (CDI).

EUFAR: European Facility for Airborne Research. RI associated with ENVRIplus and part of the ENVRI Community

EURO-ARGO: European research infrastructure, ENVRIplus partner.

EUROCHAMP2020: European atmospheric simulation chambers. RI associated with ENVRIplus and part of the ENVRI Community

EUROFLEETS: New operational steps towards an alliance of European research fleets. ENVRIplus partner.

EUROGOOS: European Global Ocean Survey System. International non-profit association, ENVRIplus participant.

EuroSITES: European Ocean Observatory Network

FixO3: Fix point open ocean observatories (survey programme). European research infrastructure, ENVRIplus partner.

FMI: Finnish Meteorological Institute (Ilmatieteen Laitos). Finnish research and service agency, ENVRIplus participant.

FZJ: Research Centre Jülich (Forschungszentrum Jülich GmbH). German research centre, ENVRIplus participant.

GBIF: Global Biodiversity Information Facility

GEO: The Group on Earth Observations.

GEOMAR: Helmholtz Zentrum für Ozeanforschung Kiel. German research institution, ENVRIplus participant.

GEOSS: Global Earth Observation System of Systems, coordinated by GEO (The Group on Earth Observations)

GMES: Global Monitoring for Environment and Security, previous name for COPERNICUS.

GROOM: Gliders for research ocean observation and management

HELIX Nebula: partnership between big science and big business in Europe that is charting the course towards the sustainable provision of cloud computing - the Science Cloud

IAGOS: In-service Aircraft for a Global Observing System. European research infrastructure, ENVRIplus partner.

ICOS: Integrated Carbon Observation System. European research infrastructure, ENVRIplus partner.

ICSU: The International Council for Science

IFREMER: Institute Français de Recherche Pour l'Exploitation de la Mer. French research organisation, ENVRIplus participant.

INGV: Istituto Nazionale di Geofisica e Vulcanologia. Italian research institute, ENVRIplus participant.

INRA: Institut National de la Recherche Agronomique. French research institute, ENVRIplus participant.

INSPIRE: Integrated Sustainable Pan-European Infrastructure for Researchers in Europe

INTERACT: International Network for Terrestrial Research and Monitoring in the Arctic. European research infrastructure, ENVRIplus partner.

IPBES: Intergovernmental Platform on Biodiversity & Ecosystem Services

IS-ENES: Infrastructure for the European Network for Earth System Modelling. European research infrastructure, ENVRIplus partner.

JERICO: Towards a joint European research infrastructure network for coastal observatories. European research project, ENVRIplus partner.

LifeWatch: European e-Science infrastructure for biodiversity and ecosystem research. ENVRIplus partner.

LTER: The Long-term Ecological Research Network. International research organisation.

LTER-Europe: European Long-term Ecosystem Research network of 21 national LTER networks. ENVRIplus partner.

LU: Lund University (Lunds universitet). Swedish university, ENVRIplus participant.

MARUM: Centre for Marine Environmental Sciences at University of Bremen (UniHB).

MBA: Marine Biological Association of the United Kingdom. UK research organisation, ENVRIplus participant.

NERC: Natural Environment Research Council. UK research council, ENVRIplus participant.

NILU: Norwegian Institute of Air Research (Norsk Institutt for Luftforskning). Norwegian research institute, ENVRIplus participant.

OASIS: Advancing Open Standards for the Information Society (non-profit consortium)

PANGAEA: Information system and data publisher for geoscientific and environmental data, operated by MARUM and UniHB. German data repository, ENVRIplus participant.

PLOCAN: Oceanic Platform of the Canary Islands (Consorcio Para el Diseno, Construccion, Equipamiento y Explotacion de la Plataforma Oceanica de Canarias). Spanish research organisation, ENVRIplus participant.

RCN: Research Council of Norway (Norges Forskningsrad). Norwegian national research council, ENVRIplus participant.

RDA: Research Data Alliance. International organisation working to promote collaboration on the management of research data. See also A.2 (Other technical terms and acronyms) above.

SCAPE: SCAlable Preservation Environments. European research project, financed under FP7.

SeaDataNet: Pan-European infrastructure for ocean & marine data management. European research infrastructure, ENVRIplus partner.

SIOS: Svalbard Integrated Arctic Earth Observing System. European research infrastructure, ENVRIplus partner.

TIB: TIB Leibniz Information Centre for Science and Technology.

UCPH: University of Copenhagen (Københavns Universitet). Danish university, ENVRIplus participant.

UEDIN: University of Edinburgh. UK university, ENVRIplus participant.

UGOT: University of Gothenburg (Göteborgs Universitet). Swedish university, ENVRIplus participant.

UHEL: University of Helsinki (Helsingin Yliopisto). Finnish university, ENVRIplus participant.

UiT: University of Tromso (Universitetet i Tromsø). Norwegian university, ENVRIplus participant.

UniHB: University of Bremen (Universität Bremen). German university, ENVRIplus participant.

UNILE: University of Salento (Universitá del Salento). Italian university, ENVRIplus participant.

UNITUS: University of Tuscia (Universitá Degli Studi della Tuscia). Italian university, ENVRIplus participant.

USTAN: The University Court of the University of St. Andrews. UK university, ENVRIplus participant.

UvA: University of Amsterdam (Universiteit van Amsterdam). Dutch university, ENVRIplus participant.

App A-4. ENVRIplus project-related acronyms & terms

AC: Active Collab (ENVRIplus Project Management System)

BEERi: Board of European Environmental Research Infrastructures - is an internal advisory board representing the needs of environmental Research Infrastructures

CA: Consortium Agreement - Legal contract between the ENVRIplus beneficiaries

DL: Deliverable / Deadline

DoA: Description of Action

DoW: Description of Work

EB: Executive Board - supervisory body for the execution of the Project

EC: European Commission - is the executive body of the European Union responsible for proposing legislation, implementing decisions, upholding the EU treaties and managing the day-to-day business of the EU

EINFRA-1-2014: H2020 Call for e-infrastructures (Managing, preserving and computing with big research data), funding source for ENVRIplus

ENV SWG: the Strategic Working Group on Environment of ESFRI

ENVRI: FP7 project on Implementation of common solutions for a cluster of ESFRI infrastructures in the field of environmental Sciences. Precursor of ENVRIplus.

ENVRIplus: Horizon 2020 project bringing together Environmental and Earth System Research Infrastructures, projects and networks together with technical specialist partners to create a coherent, interdisciplinary and interoperable cluster of Environmental Research Infrastructures across Europe.

ESFRI: the European Strategy Forum on Research Infrastructures

GA: 1) Grant Agreement - Contract between Coordinator and Commission; 2) General Assembly - GA is the ultimate decision-making body of the consortium

H2020: Horizon 2020, European level research funding scheme

I3: Integrated Infrastructures Initiative (I3) combines several activities essential to reinforce research infrastructures and to provide an integrated service at the European level

INFRADEV-4: Sub-call topic of the H2020 INFRADEV call for Implementation and operation of cross-cutting services and solutions for clusters of ESFRI and other relevant research infrastructure initiatives

PM: Person Month

RI: Research Infrastructure. RIs are facilities, resources and related services used by the scientific community to conduct top-level research in their respective fields, ranging from social sciences to astronomy, genomics to nanotechnologies.

VCP: Virtual Community Platform

WP: Work Package

APPENDIX B. SURVEY QUESTIONNAIRE

ENVRIplus Science Demonstrator evaluator (D9.4)

This survey-based service evaluation tool demonstrator has been developed in the framework of ENVRIplus Work Package 9, "Service validation and deployment". The tool is described in more detail in the ENVRIplus deliverable report "D9.4 Serving key data service stakeholders and policy initiatives version 2", available at http://www.envriplus.eu/deliverables/. If you have questions or concerns about the survey and how your answers are managed, please get in touch with Maria Johnsson (maria.johnsson at ub.lu.se) and Margareta Hellström (margareta.hellstrom at nateko.lu.se).

Welcome to the ENVRIplus WP9 Science Demonstrator evaluation tool!

This evaluation tool demonstrates how one can collect feedback on services by using the ENVRIplus Science Demonstrators (as defined in ENVRIplus deliverable 9.2) as examples. The main objectives of this Demonstrator are to 1) provide experience of how to build a service evaluation tool based on a generic survey platform like LimeSurvey, and 2) allow the ENVRI community to give feedback to the developer teams behind the Science Demonstrators.

Please note that the Science Demonstrators are not "fully developed" services, but rather reflect relatively early stages of development. For this reason, some of the common questions may be difficult to answer, or appear to be less than 100% applicable. We hope that this won't be too much of a problem.

At the end, you will be able to leave feedback on the survey itself. To make this easier, all questions have a number - please note down the number of any "problem questions" as you go along, so that you can report back to us - this will really be a great help to the survey development team! (Depending on the choices you make, some questions may not be shown - this is not an error!)

Thank you for your participation!

Q0. GDPR Notice *

We hereby highlight that personal data of those who participate in the survey will be collected and stored. The responses, including personal data, will be stored in a safe way during the survey, and not shared with any party outside of the ENVRIplus project context. The survey responses will be deleted no later than 18 months after the conclusion of ENVRIplus. To participate in the survey you must acknowledge having read this notice and that your personal data can be stored.

I acknowledge that I have read the GDPR notice, and accept that my survey response, including any personal data, is stored

About you

Q1 What is your name?

Please write your answer here: _____

HELP: Enter your name as First name Last name, e.g. "Jane Doe". Please leave empty if you choose to be anonymous!

Q2 What is your e-mail address?

Please write your answer here: _____

HELP: Enter a valid e-mail address, like jane.doe@gmail.com. Please leave empty if you choose to be anonymous!

Q3 Are you willing to be contacted for follow-up questions? *

NOTE: This question is only shown if Q2 has been answered.

Please choose **only one** of the following:

- Yes, by both survey organizers and service developers
- Yes, but only by survey organizers
- Yes, but only by service developers
- No

Q4 Are you working for an ENVRIplus partner RI? *

Please choose **only one** of the following:

- Yes
- No
- Not sure

HELP: This includes the following RIs:

> atmosphere: ACTRIS, EISCAT_3D, IAGOS
> marine: EMSO, EURO-ARGO, EUROFLEETS2, ESONET IV, EUROGOOS, FIXO3, JERICO NEXT, SEADATANET
> solid earth: EPOS
> biosphere/ecosystem: AnaEE, ELIXIR, INTERACT, LTER
> multi-domain: EMBRC, ICOS, IS-ENES2, SIOS

Q5 Which ENVRIplus partner RIs are you working for? *

NOTE: This question is only shown if Q4 = "Yes"

Please choose **all** that apply:

- ACTRIS
- EISCAT_3D
- IAGOS
- EMSO
- EURO-ARGO
- EUROFLEETS2
- ESONET IV
- EUROGOOS
- FIXO3
- JERICO NEXT
- SEADATANET
- EPOS
- AnaEE
- ELIXIR
- INTERACT
- LTER
- EMBRC
- ICOS
- IS-ENES2
- SIOS
- Don't want to say

Q6 Are you working for an ENVRIplus associated RI? *

NOTE: This question is only shown if Q4 = "No" or "Not sure"

Please choose **only one** of the following:

- Yes
- No
- Don't know

HELP: This includes the following: ARISE, CETAF, DANUBIUS, EMPHASIS, EUFAR, EUROCHAMP, LifeWatch

Q7 Which ENVRIplus associated RIs are you working for? *

NOTE: This question is only shown if Q6= "Yes"

Please choose **all** that apply:

- ARISE
- CETAF
- DANUBIUS
- EMPHASIS
- EUFAR
- EUROCHAMP
- LifeWatch
- Don't want to say
- Other: _____

Q8 Which organization (RI or equivalent) do you work for? *

NOTE: This question is only shown if Q4 = "No" or "Not sure" AND Q6 = "No" or "Not sure"

Please choose **all** that apply and provide a comment, as applicable:

- I work for an RI named: _____
- I work for another type of organisation, named: _____
- I'd rather not say

Q9 Which Earth Science sub-domain do you work in? *

NOTE: This question is only shown if Q4 = "No" or "Not sure" AND Q6 = "No" or "Not sure"

Please choose **all** that apply:

- Atmosphere
- Ecosystems & biodiversity
- Marine
- Solid earth
- I don't work within an ENVRI subdomain
- I'd rather not say

Q10 What is your professional role? Tick all that apply. *

Please choose **all** that apply:

- Administrator (project leader)
- Data manager
- System architect
- Programmer or developer
- Researcher
- Other: _____

Service selection

Q11 Please select the Science Demonstrator you are evaluating: *

Please choose **only one** of the following:

- SD1: Support EISCAT_3D Users to Reprocess Data Using User's Algorithms
- SD2: The Eddy Covariance Fluxes of GHGs
- SD3: SOS & SSN Ontology Based Data Acquisition & Near Real Time Quality Control
- SD4: EuroArgo Data Subscription Service
- SD5: Sensor Registry
- SD6: New particle formation event analysis on interoperable infrastructure
- SD7: gCube-based VRE for Mosquito Diseases Study
- SD8: Dynamic Ecological Information System - Site and Dataset Registry
- SD9: PROV-Template Registry and Expansion Service

Q12-Q16 (hidden questions)

Questions 12-16 are hidden from the respondent. They are used to assign relevant metadata (e.g. ENVRI wiki documentation page URL, YouTube video URL, contact person name and contact person e-mail address) associated with the selected science demonstrator.

Q17 What is the main reason for you to evaluate this science demonstrator? *

Please choose **only one** of the following:

- to see if it could be of general interest to my organisation
- to investigate if it addresses a specific issue/need
- to learn more about the technologies involved
- not sure
- Other: _____

Q18 How did you learn about the demonstrator you are evaluating? *

Please choose **all** that apply:

- Read about it in the ENVRIplus WP9 deliverable 9.2
- Heard a presentation at a ENVRI Week meeting
- Saw it mentioned on the ENVRIplus website
- It was mentioned on social media
- A colleague told me about it
- Other: _____

Service documentation

Q19 Have you read the ENVRI Community wiki description of the service? *

Please choose **only one** of the following:

- Yes
- No
- Don't know

HELP: Here we refer to the documentation available at <wiki URL set in Q12, based on response to Q11>.

Q20 Please let us know what you thought about the wiki documentation: *

NOTE: This question is only shown if Q19 = "Yes"

Please choose the appropriate response (Very bad, Bad, Acceptable, Good, Very good, Don't know) for **each** item:

- Scope and level of coverage
- Layout (balance of text and figures)
- Style and quality of writing
- Level of text (e.g. appropriate to give a good overview)
- Usefulness to first-time users of the service
- Using a wiki as a platform for dissemination

HELP: Here we refer to the documentation available at <YouTube video URL set in Q13, based on response to Q11>.

Q21 Did you watch the YouTube video describing the service? *

Please choose **only one** of the following:

- Yes
- No
- Don't know

Q22 Please let us know what you thought about the accompanying YouTube video: *

NOTE: This question is only shown if Q21 = "Yes"

Please choose the appropriate response (Very bad, Bad, Acceptable, Good, Very good, Don't know) for **each** item:

- Scope and level of coverage
- Pace (speed) of presentation
- Quality of video (e.g. resolution, readability)
- Quality of sound (e.g. volume setting, noise level)
- Usefulness to first-time users of the service
- Using YouTube as a platform for dissemination

Q23 What forms of documentation should be made available for this type of service? *

Please choose **all** that apply:

- ○ Printable manual(s), e.g. in PDF or Word
- ○ Wiki-type online manual(s)
- ○ Topic-specific help built into the service or app
- ○ Introductory YouTube video
- ○ Webinars (accessible as recordings)
- ○ Other: _____

General impressions and potential impact

Q24 Have you tried out the service yourself? *

Please choose **all** that apply:

- ○ I installed a local instance
- ○ I used a centrally hosted instance
- ○ I took part in a live demonstration
- ○ I read the documentation
- ○ I have communicated with the developers
- ○ I don't know/I'd rather not say
- ○ Other: _____

Q25 What is your impression of the fields of application of the service? *

Please choose **all** that apply:

- ○ Acquisition of observational data
- ○ Curation and publishing of data (repository or archive)
- ○ Facilitating data dissemination (data portal tool)
- ○ Managing metadata (cataloguing, PID assignment, provenance collection,...)
- ○ Data processing for internal RI use
- ○ Supporting RI-external scientific end users in their data processing
- ○ Providing a computational platform (for modellers)
- ○ I don't know/I'd rather not say
- ○ Other: _____

Q26 Did the service meet your expectations (compared to how you interpreted its name)? *

Please choose **only one** of the following:

- Yes
- No
- I don't know/I prefer not to say

Q27 Which user groups do you believe can benefit from this service? *

Please choose **all** that apply:

- ○ Researchers (domain specialists)
- ○ Researchers (from another scientific domain)
- ○ Data managers or curators
- ○ Software developers
- ○ IT resource experts (storage, computation etc.)

- ○ General public
- ○ I don't know/I'd rather not say
- ○ Other: _____

Q28 How would you rate the maturity of this service? *

Please choose **only one** of the following:

- TRL 1 – basic principles observed
- TRL 2 – technology concept formulated
- TRL 3 – experimental proof of concept
- TRL 4 – technology validated in lab
- TRL 5 – technology validated in relevant environment (industrially relevant environment in the case of key enabling technologies)
- TRL 6 – technology demonstrated in relevant environment (industrially relevant environment in the case of key enabling technologies)
- TRL 7 – system prototype demonstration in operational environment
- TRL 8 – system complete and qualified
- TRL 9 – actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies; or in space)
- I don't know/I'd rather not say

HELP: Here we use the Technical Readiness Level (TLR) scale defined for Horizon2020. See definitions at e.g. https://enspire.science/trl-scale-horizon-2020-erc-explained/ .

Q29 How would you rate the potential impact on the ENVRI Community of the service in its current state? *

Please choose **only one** of the following:

- Very high - it is already very useful
- High - the concept is very good, and development should be continued
- Medium - it will solve some issues
- Low - there are other service options available already now
- Very low - the addressed issue is no longer interesting
- I don't know/I'd rather not say

Q30 How would you rate the potential impact on non-ENVRI infrastructures of the service in its current state? *

Please choose **only one** of the following:

- Very high - it is already very useful
- High - the concept is very good, and development should be continued
- Medium - it will solve some issues
- Low - there are other service options available already now
- Very low - the addressed issue is no longer interesting
- I don't know/I'd rather not say

Q31 Which of the research data lifecycle steps are addressed by the service? *

Please choose **all** that apply:

- ○ Acquisition
- ○ Curation
- ○ Publishing
- ○ Processing
- ○ Use
- ○ I don't know/I'd rather not say

HELP: Here we use the life cycle steps defined in the ENVRI Reference Model, see https://wiki.envri.eu/display/EC/ENVRI+Reference+Model .

Q32 Which of the following research data management topics are involved in the service? *

Please choose **all** that apply:

- ○ Cataloguing
- ○ Curation
- ○ Identification & citation
- ○ Optimization
- ○ Processing
- ○ Provenance
- ○ Architecture design
- ○ Meta-information linking
- ○ Common reference model
- ○ I don't know/I'd rather not say

HELP: Here we are referring to the "pillars and cross-beams" defined in the ENVRIplus project, see e.g. Figure 1 of ENVRIplus Deliverable D9.3.

Q33 Are you aware of any similar service? *

Please choose **only one** of the following:

- Yes
- No
- I don't know/I'd rather not say

Q34 If you can, please provide the names and URLs of those similar services!

NOTE: This question is only shown if Q33 = "Yes"

Please write your answer here: _____

Technical aspects

Q35 What user experience level is needed to use this service? *

Please choose **only one** of the following:

- Researcher
- Domain specialist
- Data manager
- Developer
- Other

Q36 What kind training or instruction is needed to use this service? *

Please choose **all** that apply:

- ○ FAQ
- ○ Web based training
- ○ Seminars
- ○ Manuals in PDF
- ○ Other
- ○ None

Q37 In your opinion, does operating the service require access to specific data centers or technologies? *

Please choose **only one** of the following:

- Yes, specialized technologies only available at specific data centers, are required
- Partly, specialized technologies are needed, but these are available at many data centers
- Partly, no specialized technologies are required, but only some data centers would operate the service
- No, no special technologies are needed and the service can be operated at any data center
- I don't know/I'd rather not say

Q38 How do you rate the state of the following technical aspects of the service? *

Please choose the appropriate response (Very poor, Poor, Good, Very good, Not applicable, I don't know/I'd rather not say) for **each** item:

- Access requirements (need for users to register)
- Authentication methods (via user accounts, social network logins etc.)
- Portability (avoiding lock-in to a specific technology or platform)
- Choice of programming language(s)
- Ability for integration with other services
- Reliability of used external e-services (storage, computation)

Q39 Do you have any further comments regarding the technical issues?

Please write your answer here: _____

Q40 How do you rate the state of the following user interface aspects of the service? *

Please choose the appropriate response (Very poor, Poor, Good, Very good, Not applicable, I don't know/I'd rather not say) for **each** item:

- Accessibility (support for e.g. visually impaired)
- Data input (available methods, allowed formats etc.)
- Data output (available methods, allowed formats etc.)
- Graphical User Interface (design, functionality)
- Command-line user interface (functionality)
- Application Programming Interface (functionality)

Q41 Do you have any further comments regarding the user interface?

Please write your answer here: _____

Q42 Please rate the sustainability of the service, concerning the following aspects: *

Please choose the appropriate response (Very unlikely, Unlikely, Likely, Very likely, I don't know/I'd rather not say) for **each** item:

- Continued development efforts by the original RI team
- Adoption of development efforts by the ENVRI community
- Pick-up by Open Source community developers
- Maintenance & availability of the current version
- Software platform & operating system used by current service version
- Hardware platform used by current service version
- General e-services (storage, networking, ...) used by current version
- Continued availability of assistance from relevant ICT experts

Q43 Do you have any further comments on the sustainability aspects?

Please write your answer here: _____

SD1-specific questions

HELP: Please help the developer <name and e-mail set in Q14 and Q15, based on response to Q11> by giving some feedback!

Q44 What do you think of the idea to be able to share algorithms for processing data of EISCAT?

NOTE: This question is only displayed if SD1 is selected in Q11.

Please write your answer here: _____

Q45 In Science Demonstrator 1 a kind of "data movies" are demonstrated to visualize the processed the data. What do you think about these visualizations?

NOTE: This question is only displayed if SD1 is selected in Q11.

Please write your answer here: _____

SD2-specific questions

HELP: Please help the developer <name and e-mail set in Q14 and Q15, based on response to Q11> by giving some feedback!

Q46 In your opinion, how important is it from a data reusability perspective to collect the details of VRE-based data processing and store these as provenance metadata?

NOTE: This question is only displayed if SD2 is selected in Q11.

Please write your answer here: _____

Q47 Have you come across similar implementations of "nearly real-time" combined analysis and quality assessment of environmental observation data? If so, please add project names and links!

NOTE: This question is only displayed if SD2 is selected in Q11.

Please write your answer here: _____

Q48 This is an example of processing of observational data using computational resources hosted in a Virtual Research Environment platform, rather than letting it run directly on a high-throughput computation (HTC) platform. What do you think are the benefits of the VRE approach over the more "traditional" one?

NOTE: This question is only displayed if SD2 is selected in Q11.

Please write your answer here: _____

SD3-specific questions

HELP: Please help the developer <name and e-mail set in Q14 and Q15, based on response to Q11> by giving some feedback!

Q49 This use case is addressing the problem with quality control of data at different facilities and instruments. The quality control is often performed a bit late in the data process. Do you recognize this problem in your own research/work?

NOTE: This question is only displayed if SD3 is selected in Q11.

Please write your answer here: _____

Q50 The use case brings up the importance of data in standardised format. Are you familiar with the following formats for data capture and transmission: SSNO, SOS (Sensor Observation service), O&M (Observation & measurement)?

NOTE: This question is only displayed if SD3 is selected in Q11.

Please write your answer here: _____

QSD4-specific questions

HELP: Please help the developer <name and e-mail set in Q14 and Q15, based on response to Q11> by giving some feedback!

Q51 What you do think about the idea of getting results of the subscriptions service available to user space in EUDAT?

NOTE: This question is only displayed if SD4 is selected in Q11.

Please write your answer here: _____

Q52 Would you use a data subscription service to updated datasets, such as described in the EuroArgo Data Subscription service?

NOTE: This question is only displayed if SD4 is selected in Q11.

Please choose **only one** of the following:

- Yes
- No
- Not sure/I'd rather not say

SD5-specific questions

HELP: Please help the developer <name and e-mail set in Q14 and Q15, based on response to Q11> by giving some feedback!

Q53 What do you think of the idea of sharing sensor metadata between organisations and RIs?

NOTE: This question is only displayed if SD5 is selected in Q11.

Please write your answer here: _____

Q54 Would you use a common service of sensor metadata, with standardised classifications included?

NOTE: This question is only displayed if SD5 is selected in Q11.

Please choose **only one** of the following:

- Yes
- No
- Not sure/I'd rather not say

SD6-specific questions

HELP: Please help the developer <name and e-mail set in Q14 and Q15, based on response to Q11> by giving some feedback!

Q55 Do you think it is feasible to bring data analysis conducted by research communities into Virtual Research Environments?

NOTE: This question is only displayed if SD6 is selected in Q11.

Please write your answer here: _____

Q56 Even if this is a good idea, it obviously isn't entirely trivial. Can you list three incentives?

NOTE: This question is only displayed if SD6 is selected in Q11.

Please write your answer here: _____

Q57 The Science Demonstrator suggests systematic acquisition and cataloguing of derivative data, i.e. data resulting in primary data analysis conducted by research communities. Is this a sensible thing to do?

NOTE: This question is only displayed if SD6 is selected in Q11.

Please write your answer here: _____

Q58 If yes, is it practicable to do so systematically ("at birth") as the Science Demonstrator suggests or should it be done later in the research lifecycle?

NOTE: This question is only displayed if SD6 is selected in Q11.

Please write your answer here: _____

Q59 If it is practicable, which infrastructure is best equipped to systematically acquire and catalogue derivative data? RIs, e-Infras (VREs), Data Publishers such as PANGAEA, University/Institutional infrastructure, other?

NOTE: This question is only displayed if SD6 is selected in Q11.

Please write your answer here: _____

Q60 If a systematic acquisition "at birth" is impracticable, how can we ensure data are acquired (e.g. for reproducibility) and that they follow a high degree of FAIRness, especially principles on interoperability?

NOTE: This question is only displayed if SD6 is selected in Q11.

Please write your answer here: _____

SD7-specific questions

HELP: Please help the developer <name and e-mail set in Q14 and Q15, based on response to Q11> by giving some feedback!

Q61 Would you use a system for sharing and re-using algorithms for data analysis, such as the gCube-based VRE for mosquito diseases study?

NOTE: This question is only displayed if SD7 is selected in Q11.

Please choose **only one** of the following:

- Yes
- No
- Not sure/I'd rather not say

Q62 What do you think about the idea of sharing algorithms for data analysis?

NOTE: This question is only displayed if SD7 is selected in Q11.

Please write your answer here: _____

Q63 Do you see any risks with the possibility for users to upload and share algorithms and processed data from this specific community?

NOTE: This question is only displayed if SD7 is selected in Q11.

Please write your answer here: _____

SD8-specific questions

HELP: Please help the developer <name and e-mail set in Q14 and Q15, based on response to Q11> by giving some feedback!

Q64 What is your opinion about the accompanying metadata to the different data types in the DEIMS Repository, https://deims.org/?

NOTE: This question is only displayed if SD8 is selected in Q11.

Please write your answer here: _____

Q65 The DEIMS SDR Repository is inter-operable with the following external protocols: Web Feature Service (WFS), Web Map Service (WMS), Catalogue Service for the Web (CSW), Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH). Is there any protocol missing here?

NOTE: This question is only displayed if SD8 is selected in Q11.

Please write your answer here: _____

SD9-specific questions

HELP: Please help the developer <name and e-mail set in Q14 and Q15, based on response to Q11> by giving some feedback!

Q66 Which usage scenarios could you imagine for the PROV-Template registry, are there any particular types of workflows you consider especially suited for being described using PROV-Template?

NOTE: This question is only displayed if SD9 is selected in Q11.

Please write your answer here: _____

Q67 What benefits do you see in sharing PROV-Templates amongst institutions, and what drawbacks?

NOTE: This question is only displayed if SD9 is selected in Q11.

Please write your answer here: _____

Q68 Do you see any issues in using a Web service for provenance conversion/generation, if yes, which kind of issues?

NOTE: This question is only displayed if SD9 is selected in Q11.

Please write your answer here: _____

Evaluation of the survey tool

Q69 Please let us know what your impressions are of the following aspects of the service evaluator tool! *

Please choose the appropriate response (Very bad, Bad, OK, Good, Very good, Don't know) for **each** item:

- Web page design & layout
- Scope (topics & aspects covered)
- Question grouping
- Clarity of questions & answer options
- User friendliness
- Relevance for service developers

Q70 This is a pilot evaluation tool. What could be improved in order to use it for evaluation of the Science Demonstrators and other upcoming services?

Please write your answer here: _____

Thank you!

Thank you for giving feedback - both on the science demonstrator and the survey itself!

If you have questions or concerns about the survey and how your answers are managed, please get in touch with Maria Johnsson (maria.johnsson at ub.lu.se) and Margareta Hellström (margareta.hellstrom at nateko.lu.se).