



## **D13.2 – VREs Operation Mid-term Activity Report JRA2**

**Version 0.9 (RC)**

**14 January 2021**

**Grant Agreement number:** 823914

**Project acronym:** ARIADNEplus

**Project title:** Advanced Research Infrastructure for Archaeological Dataset Networking in Europe - plus

**Funding Scheme:** H2020-INFRAIA-2018-1

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The research leading to these results has received funding from the European Community's Horizon 2020 Programme (H2020-INFRAIA-2018-1) under grant agreement n° 823914.

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**1. Document History**

- 04.12.2020 - Draft Version 0.1
- 18.12.2020 - Executive Summary and Introduction
- 04.01.2021 - New Section 1 and Section 2
- 12.01.2021 - New Section 3
- 14.01.2021 - Overall revision
- - Quality control check

## 2. Table of Contents

<b><i>Document History</i></b>	3
<b><i>Table of Contents</i></b>	4
<b><i>Executive Summary</i></b>	5
<b><i>Introduction and Objectives</i></b>	6
<b><i>VREs Procedures</i></b>	8
<b><i>VREs Creation, Deployment and Operation</i></b>	9
<i>ARIADNEPlus Project VRE</i>	12
<i>ARIADNEPlus Mappings VRE</i>	14
<i>ARIADNEPlus Aggregation Management VRE</i>	16
<i>Geoportal Prototype VRE</i>	18
<i>Archeomar VRE</i>	19
<b><i>Concluding Remarks</i></b>	22
<b><i>References</i></b>	23

### 3. Executive Summary

This deliverable D13.2 - “VREs Operation Mid-term Activity Report” describes the activities carried out during the first 24 months of the ARIADNEplus project within Work Package 13. Specifically, in Task 13.1 Infrastructure Operation (JRA2.1) and Task 13.3 VREs Operation (JRA2.3). It reports the procedures governing the operation of the VREs as well as the status of the aggregated resources at mid-term in the ARIADNEplus infrastructure.

Virtual Research Environments (VREs) are “systems” specifically conceived to provide their users with a web-based set of facilities (including services, data and computational facilities) to accomplish a set of tasks by dynamically relying on the underlying infrastructure. VREs are among the key products to be developed and delivered by the ARIADNEplus project to support the target communities and application scenarios in archaeology.

The development of VREs is based on three main activities: (i) the development of software artefacts that realise a set of functions (including those needed for accessing certain datasets), (ii) the deployment of these artefacts in an operational infrastructure following the release procedures and tools presented in the deliverable D13.1 “Software Release Procedures and Tools JRA2”, and (iii) the final deployment and operation of well-defined Virtual Research Environments by exploiting the facilities offered by the underlying D4Science infrastructure and its services [1] .

This report documents the last of the above three activities – i.e. the exploitation of the services and technologies offered by the underlying infrastructure to serve the needs of defined scenarios – as implemented in the context of the ARIADNEplus project from January 2019 to December 2020.

As of January 2021, 5 VREs were created and operated. Specifically, the ARIADNEplus Project VRE (cf. Sec 3.1) which was created first and prior to the project kick-off. The ARIADNEplus Mappings VRE, to support metadata mappings. (c.f Sec. 3.2). The ARIADNEplus Aggregation Management VRE, where project partners discuss data integration issues and procedures to activate or propose to the whole consortium (c.f Sec. 3.3). The Geoportal Prototype VRE (c.f Sec. 3.4), developed for the integration, validation, harmonisation, visualisation, and access of archaeological georeferenced datasets collected in Italy, and the Archeomar VRE, developed for the visualisation and controlled access of archaeological georeferenced datasets (c.f Sec. 3.5).

As of January 2021, these VREs have served the needs of more than 260 users in total spread across 21 countries, and nearly 5.000 user sessions. This required to deal with approximately 100 tickets (59 requests for support, 9 requests for incidents and bugs, 9 requests for Virtual Machine or Container creations)

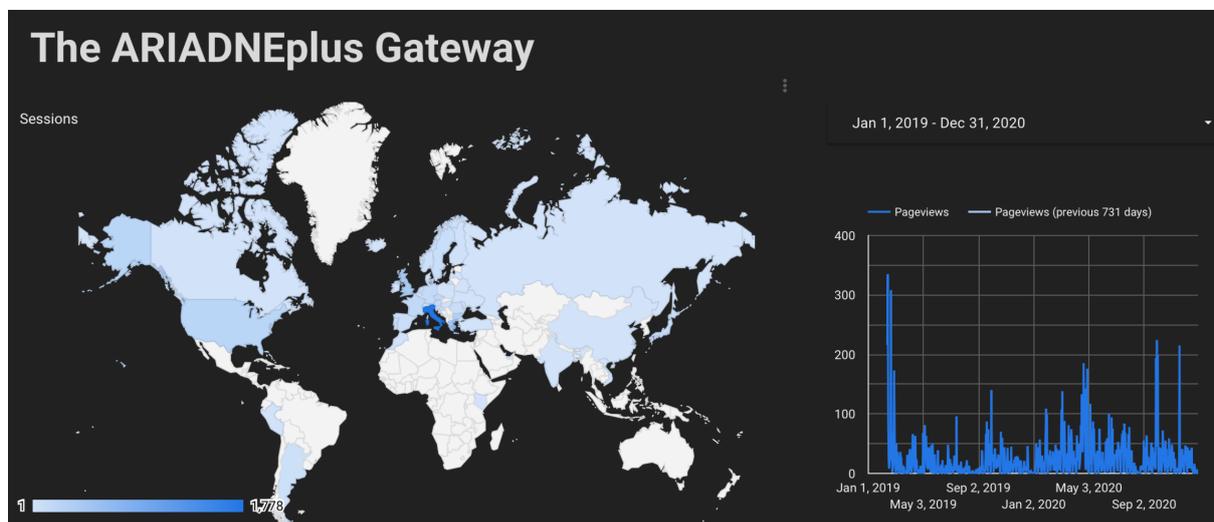
# 1 Introduction and Objectives

Virtual Research Environments (VREs) are “systems” aiming at providing their users with web-based working environments offering the entire spectrum of facilities (including services, data, and computational facilities) needed to accomplish a given task by dynamically relying on the underlying infrastructure. VREs are key products to be delivered by the ARIADNEPlus project to meet the needs of its target community and scenarios, they are dedicated to discussing and developing various approaches and solutions to be applied to concrete cases and scenarios, and also devised to serve specific communities and practitioners confronting a given research question.

The end-user accesses the VREs by exploiting a web component providing access to the ARIADNEPlus infrastructure, namely the ARIADNEPlus Infrastructure Gateway. This gateway is accessible via the URL <https://ariadne.d4science.org/> and it is indeed expected to be the end-user access point to the ARIADNEPlus Virtual Research Environments.

This deliverable – D13.2 ‘VREs Operation Mid-term Activity Report’ – details the activity leading to the deployment and operation of a series of Virtual Research Environments addressing the needs for the first 2 years of the ARIADNEPlus consortium.

This activity led to the deployment and operation of 5 VREs in the period from January 2019 to December 2020. Overall, these VREs are serving the needs of more than 260 users in total spread across 21 countries and nearly 5.000 user sessions.



**Figure 1. Geo-distribution of user sessions on the ARIADNEPlus Infrastructure Gateway in the first 24 months of the project.**

The remainder of this report is organised as follows: Section 2 describes the policies and procedures governing the planning and deployment of Virtual Research Environments. Section

3 describes the Virtual Research Environments that have been deployed and operated during the period. For each Virtual Research Environment, the deliverable describes the goal and the main facilities offered to their users. Section 4 reports conclusions.

## 2 VREs Procedures

Deployment and operation of VREs is a collaborative effort involving the WP13 team called to deploy and configure the technology to create VREs expected by the work packages working to develop the enabling technology, i.e. WP12, WP15 and WP16.

The procedure leading to VRE deployment is a consolidated one, *i.e.* it is the procedure inherited from the D4Science infrastructure and described in the D4Science Wiki:

[https://wiki.d4science.org/index.php?title=Virtual\\_Research\\_Environments\\_Deployment\\_and\\_Operation](https://wiki.d4science.org/index.php?title=Virtual_Research_Environments_Deployment_and_Operation)

For the needs of ARIADNEPlus, it was decided to support this activity by the project activity tracker. A specific VRE tracker has been created with the goal of capturing the entire process from specification to operation. The specification of the VRE is produced by the VRE designer/requester. This specification must contain:

- VRE name and abstract;
- Membership policy, i.e. whether the VRE is open or restricted, who is allowed to invite members; VRE expected datasets;
- VRE expected functionalities;
- VRE due date;

The following statuses are supported:

- **Planned:** the WP4 team is fine with the specification, i.e. the specification contains enough details to proceed with the creation, and acknowledges that the creation of the VRE is feasible by the due date initially requested (or liaise with the designer/requester to find a mutually suitable date);
- **Available:** the VRE is up and running and ready to be validated by the VRE designer/requester;
- **Released:** the VRE has been validated and the target community can start using it;
- **Removed:** the VRE has been disposed as for the request of its manager;
- **Rejected:** the requested VRE cannot be created as the requirements outlined for it cannot be satisfied.

### 3 VREs Creation, Deployment and Operation

This section briefly describes the facilities used by VRE creators for the actual deployment of VREs, reports the complete list of deployed and operated VREs, and offers a characterisation of each available VRE.

The act of definition and deployment of a new VRE is supported by a wizard (cf. Figure 2) that enables authorised users to transform the opened requests according to the procedure described in Sec. 2 into an actual specification and then, automatically, into a working VRE made available by the ARIADNEPlus gateway.

Through the wizard, the user is requested to specify: (i) the descriptive information characterising the expected VRE (i.e. name, description, duration), and (ii) the functionalities and datasets to be made available in the specific VRE by selecting among the available ones. The resulting list of functionalities is derived from the feasible functionalities created thanks to the software version and services hosted by the underlying D4Science infrastructure.

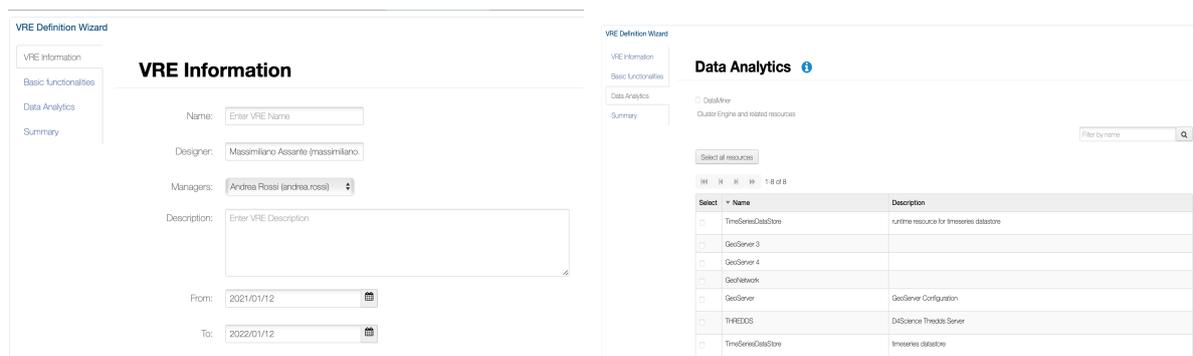
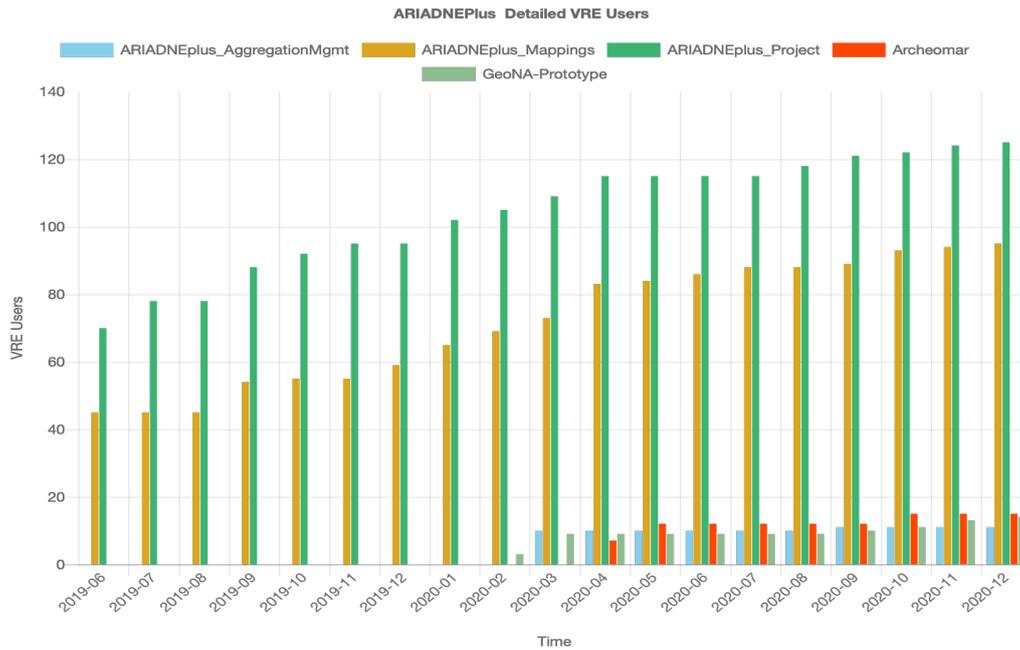


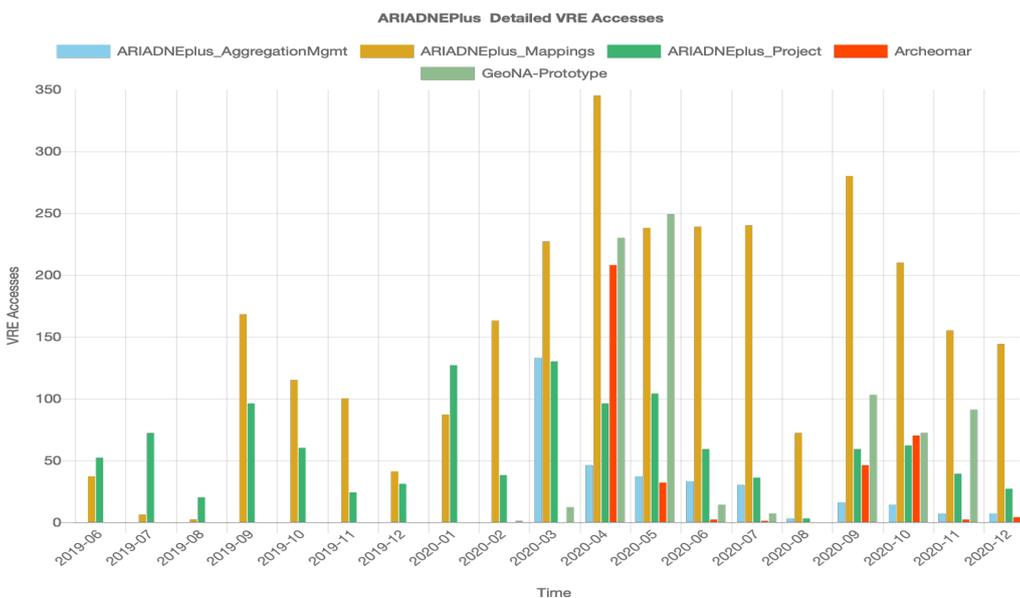
Figure 2. VRE Creation Wizard Screenshots

In the period from January 2019 to December 2020, a total of 5 VREs were created and/or operated to serve the needs arising in the context of the ARIADNEPlus project. Specifically, the ARIADNEplus Project VRE (cf. Sec 3.1) which was created first and prior to the project kick-off and dedicated to the Project management and file exchange, the ARIADNEplus Mappings VRE, which was created after a few months for supporting the metadata mappings in the project. (c.f Sec. 3.2), the ARIADNEplus Aggregation Management VRE, to have a place where only some of the project partners could discuss in a controlled environment about data integration issues and possible procedures to activate or propose to the whole consortium (c.f Sec. 3.3), the Archeomar VRE, developed for the visualisation and controlled access of archaeological georeferenced datasets (c.f Sec. 3.5), and the Geoportal Prototype VRE (c.f Sec. 3.4), developed for the integration, validation, harmonisation, visualisation, and access of archaeological georeferenced datasets collected in Italy.

Figure 3 reports the number of VREs operated per month and their users in the last 18 months of the project. During this period, 2 VREs conceived to support the project activities and mapping tasks were created at the beginning of the project and remained active for the entire period, namely ARIADNEplus Project and ARIADNEplus Mappings. Three additional ones were created later, one in February '20 (Geoportal Prototype, GeoNa-Prototype in the chart), one in March '20 (ARIADNEplus Aggregation Management), and finally one in April '20 (Archeomar).



**Fig. 3 Number of VREs operated per month and their users’s number from June ‘19 to December ‘20**



**Fig. 4 Number of VRE User Accesses per month from June ‘19 to December ‘20**

Figure 4 complements Figure 3 by reporting the number of VRE user accesses per month in the last 18 months of the project, hence by showing how often the ARIADNEPlus Project members have accessed and exploited these VREs. This chart shows peaks up to 350 access per month on more than one VRE. Overall, the most accessed VRE in the last 18 months has been the ARIADNEPlus Mappings, its average number of accesses per month is about 150, reflecting the frequent mapping activity that VRE members have been doing in the period.

The operation of VREs requires the management of requests for support, of issues and malfunctions, but also the creation of new Virtual Machines and Containers (e.g. Docker). Figure 5 shows a screenshot of the issue tracker reporting the tickets for these typologies of tickets. During the reporting period, a total of 98 of such tickets have been resolved (59 requests for support, 9 requests for incidents and bugs, 9 requests for Virtual Machine or Container creations).

#	Tracker	Status	Priority	Subject	Assignee	Updated	% Done	Due date	Closed	Sprint
<b>Bug 4</b>										
19957	Bug	New	Normal	Issued and Modified attributes values - 0000	Enrico Ottonello	Nov 02, 2020 12:50 PM				AriadnePlus po
19969	Bug	New	Normal	Duplicates in Resources spatial-data	Enrico Ottonello	Dec 15, 2020 09:58 AM				AriadnePlus po
19956	Bug	Feedback	Normal	New Ariadne Portal - archaeologicalResourceType.id	Enrico Ottonello	Jan 08, 2021 04:26 PM				AriadnePlus po
19615	Bug	Closed	Normal	Links to collection records not shown in the staging portal	Pablo Millet	Jul 16, 2020 05:14 PM		Jul 16, 2020 05:14 PM		AriadnePlus po
<b>Feature 1</b>										
<b>Support 59</b>										
19955	Support	New	Normal	CENIEH: mapping problem	Maria Theodoridou	Oct 13, 2020 11:28 AM				
19970	Support	New	Normal	Re-load OEAW 'UK Material Pool'		Oct 15, 2020 02:57 PM				
20239	Support	New	Normal	HNM data - problems in transformation	Enrico Ottonello	Jan 11, 2021 10:44 AM				
20211	Support	New	High	DOI link as landing page not correctly displayed on portal	Enrico Ottonello	Jan 12, 2021 12:24 PM		Jan 06, 2021		
20212	Support	New	Normal	Details for proper inclusion of all ARIADNE subjects in the elasticsearch records for the index	Enrico Ottonello	Nov 30, 2020 03:57 PM				
20172	Support	New	Normal	Bug in current portal	Carlo Meghini	Dec 01, 2020 05:02 PM				
20411	Support	New	Normal	DIME - from Aarhus University partner	Maria Theodoridou	Jan 11, 2021 12:21 PM				
20221	Support	New	Normal	3M Mapping 657 for NIAM-BAS doesn't generate resource identifiers	Enrico Ottonello	Dec 10, 2020 03:21 PM				
19810	Support	New	Normal	ROAD - Heidelberg Academy of Sciences and Humanities : info	Maria Theodoridou	Sep 28, 2020 03:40 PM				

Fig. 5 A Screenshot of the ARIADNEplus issue tracker used for the management of requests for support and malfunctions.

A brief description of each available VRE is reported in the following sections. All the VREs are provided with:

- A *shared workspace* to enable every user to store and organise the information objects interested in working with. In addition to that, the user is allowed to collaborate with other users by sharing objects and messages;

- A ***VRE Management facility*** to enable authorized users (i.e. VRE Managers) to manage other users using or wanting to access the VRE. VRE Managers can (i) authorize users for access to the VRE, (ii) assign or withdraw roles to users, (iii) remove users, and (iv) send communications to the current users;
- A ***social networking facility*** to enable users to use the common facilities typical of social networks – e.g., posting news, commenting on posted news – yet adapted to the settings of working environments like those characterising ARIADNEplus. Users can post news as well as applications;
- A ***notification facility*** to alert users on relevant activities as they happen. These notifications offer a sense of anticipation and create a productivity boost. Users receive an alert (through a priori selected channels, e.g., email, web portal, twitter) notifying them when something of interest has happened in their VRE(s);
- A ***members' facility*** to provide users with a list of VRE co-workers, i.e. the list of members partaking in the VRE and contributing to it;
- A ***messaging facility*** to provide users with a common email environment as-a-Service. The distinguishing feature is represented by its integration with the rest, e.g., it is possible to send any information object residing in the workspace (regardless of how “big” and “complex” it may be) as an attachment without consuming bandwidth.

### 3.1 ARIADNEplus Project VRE

This VRE was devised to support ARIADNEplus project activities and discussions. Only members of the ARIADNEplus consortium have access to this VRE.

The ARIADNEplus Project VRE is available at:

<https://ariadne.d4science.org/group/ariadneplus-gateway/explore?siteId=164842781>

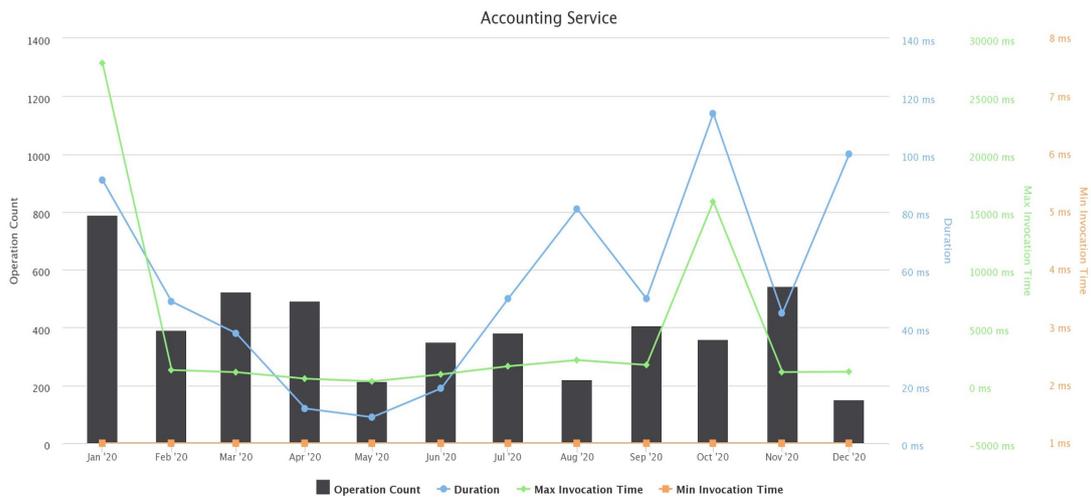
This VRE has been in operational status since January '19 and it is currently serving 126 users, namely the ARIADNEplus Consortium members. A screenshot of the VRE is provided in Figure 6. It shows the home page and the menu items for accessing the VRE facilities.

The screenshot displays the ARIADNEplus Project VRE home page. At the top, there is a navigation bar with the project name and several menu items: Administration, Members, Activity Tracker, and Help Desk. The page is divided into three main sections. On the left, under 'Statistics', there is a table listing project activities with columns for Name, Owner, and Last modified. The middle section features a 'Share updates' area with a text input field and a 'Share' button, followed by a 'News feed' showing a post from Alessia Bardi. The right section includes an 'About' section with the project logo and a description, 'Trending Topics' (No Topics found in News Feed), and 'VRE Managers and Groups' (WP1, WP12, WP13).

**Fig. 6 A Screenshot of the ARIADNEPlus Project VRE home page and the menu items for accessing the VRE facilities.**

In addition to the basic functionality, as social networking area for supporting the discussions among members and a user management facility for managing membership, this VRE is specifically equipped with the following capabilities:

- **ARIADNEPlus Activity Tracker System:** a facility enabling project members to access the project issue tracking system;
- **ARIADNEPlus help desk:** a facility enabling project members to access the help desk, useful for reporting queries or any features to request/bugs to report;
- A shared area in the workspace, for making available objects of interests, e.g. project deliverables, presentations, working notes;
- A user management area, to enable authorised users (i.e. VRE Managers) to manage other users using or willing to access the VRE. VRE Managers can (i) authorise users in accessing the VRE and its services, (ii) assign or withdraw roles to users, (iii) remove users, and (iv) send a communication to the current users;
- A Members area, for enabling each VRE member to be informed on the rest of VRE members and acquire details for contacting them.



**Fig. 7 ARIADNEPlus Project VREOperations per Month**

Figure 7 reports the total amount of operations performed in the context of this VRE during the whole year 2020. Operations include service tasks needed to maintain the VRE operational as well as human tasks.

### 3.2 ARIADNEPlus Mappings VRE

This VRE was conceived to be the working environment supporting the metadata mappings in the ARIADNEplus project. Only members of the ARIADNEplus consortium that deal with metadata mappings have access to this VRE.

The ARIADNEplus Mappings VRE is available at

<https://ariadne.d4science.org/group/ariadneplus-gateway/explore?siteId=164895341>

This VRE has been in operational status since February '19 and it is currently serving 96 users. A screenshot of the VRE is provided in Figure 8. It shows the home page and the menu items for accessing the VRE tools, among which we find those tools needed by the members to perform their metadata mapping activities. Specifically, the XML3 Mapping Tool, the Vocabulary Matching Tool, and the Activity Dash Tool aiming at tracking the several processes (activities) of a workflow that might or not be executed in a certain order.

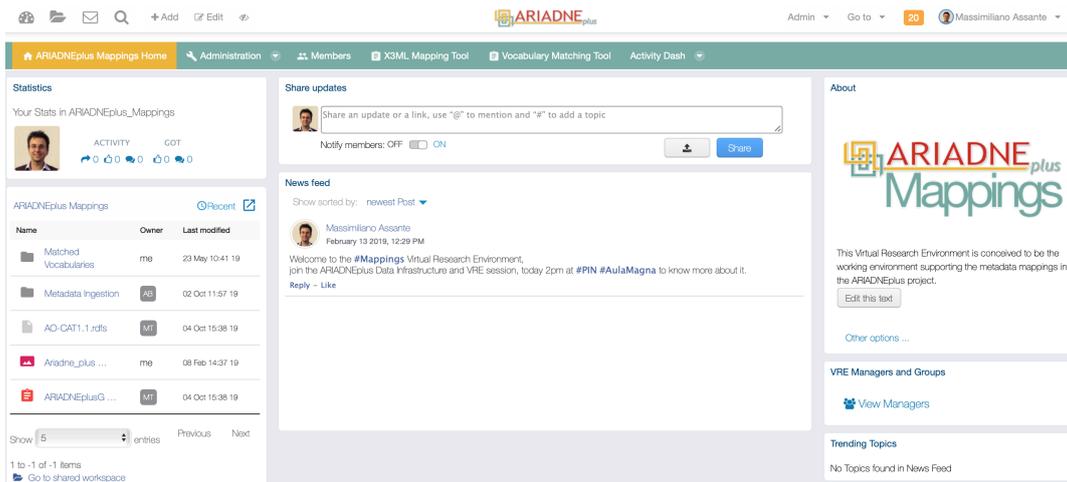


Fig. 8 A Screenshot of the ARIADNEplus Mappings VRE home page and the menu items for the VRE tools.

In addition to the aforementioned VRE tools for metadata mappings, and to the basic social communication functionality, this VRE is equipped with the following capabilities:

- A shared area in the workspace, for making available objects of interests, e.g. mappings, vocabularies and working notes;
- A user management area, to enable authorised users (i.e. VRE Managers) to manage other users using or willing to access the VRE. VRE Managers can (i) authorise users in accessing the VRE and its services, (ii) assign or withdraw roles to users, (iii) remove users, and (iv) send a communication to the current users;
- A Members area, for enabling each VRE member to be informed on the rest of VRE members and acquire details for contacting them.

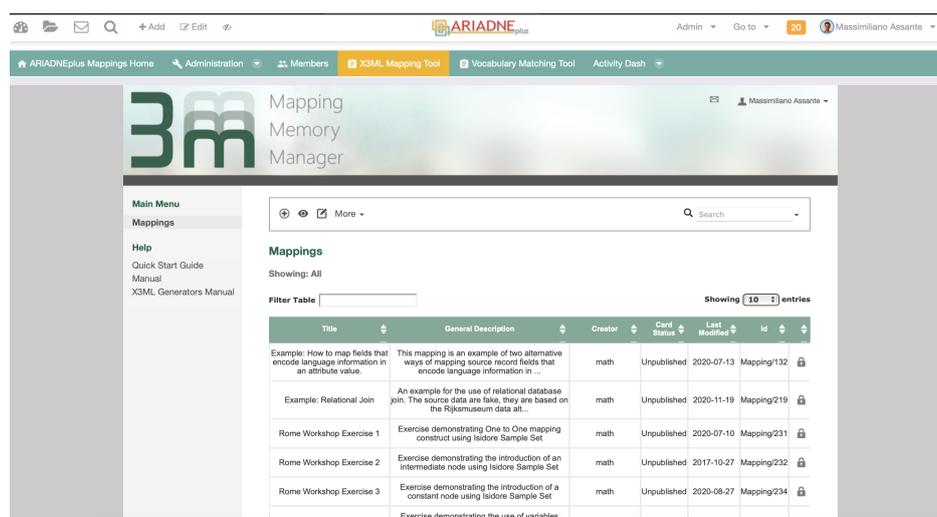


Fig. 9 A Screenshot of one of the ARIADNEplus Mappings VRE tool: the 3M Mapping tool

Figure 9 shows the 3M Mapping tool available in the VRE. The 3M Mapping tool is provided by FORTH-ICS partner and integrated into the infrastructure. This tool assists users during the mapping definition process, using a human-friendly user interface and a set of sub-components that either suggests or validates the user input.

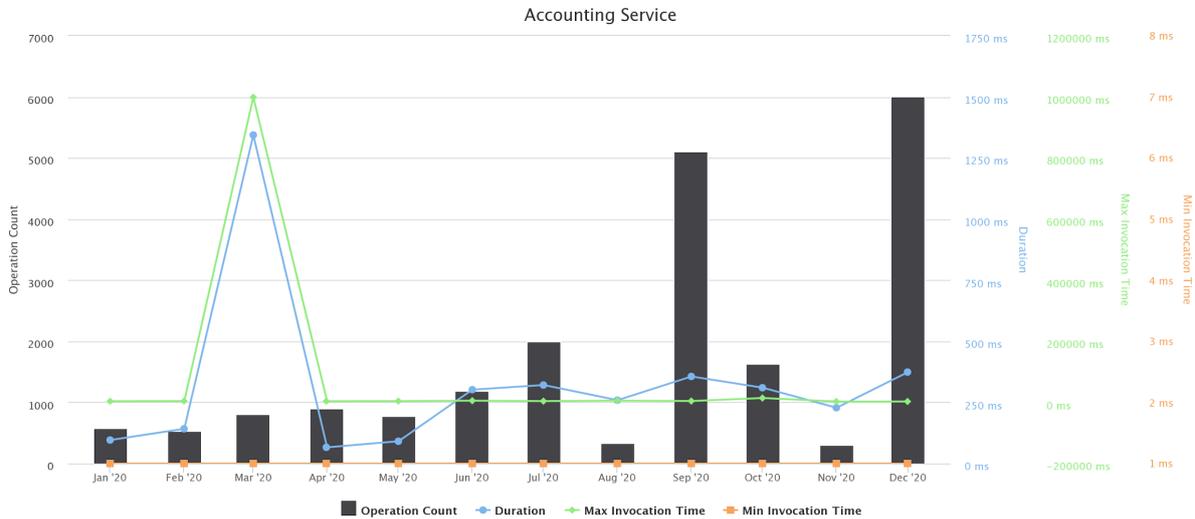


Fig. 10 The ARIADNEPlus Mappings VRE Operations per Month

Figure 10 reports the total amount of operations performed in the context of this VRE during the whole year 2020. Operations include service tasks needed to maintain the VRE operational as well as human tasks.

### 3.3 ARIADNEPlus Aggregation Management VRE

The goal of the VRE is to have a place where only some of the project partners can discuss in a controlled environment about data integration issues and possible procedures to activate or propose to the whole consortium. The VRE access is therefore private, access only via managers' invitation.

The ARIADNEPlus Aggregation Management VRE is available at:

<https://ariadne.d4science.org/group/ariadneplus-gateway/explore?siteId=233677541>

This VRE has been in operational status since March '20 and it is currently serving 11 users, the ones needing to discuss data integration issues and procedures. A screenshot of the VRE is provided in Figure 11.

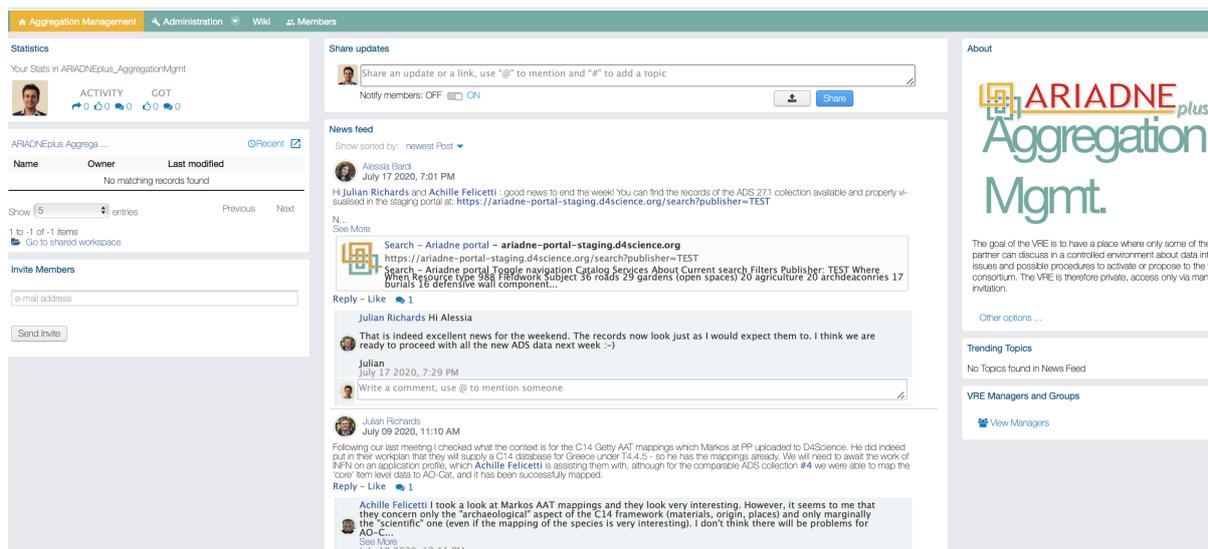


Fig. 11 A Screenshot of the ARIADNEplus Aggregation Management VRE home page.

This VRE features basic functionality only. Specifically, a social networking area for supporting the discussions among members - which is especially used in this VRE - and a user management facility for managing membership.

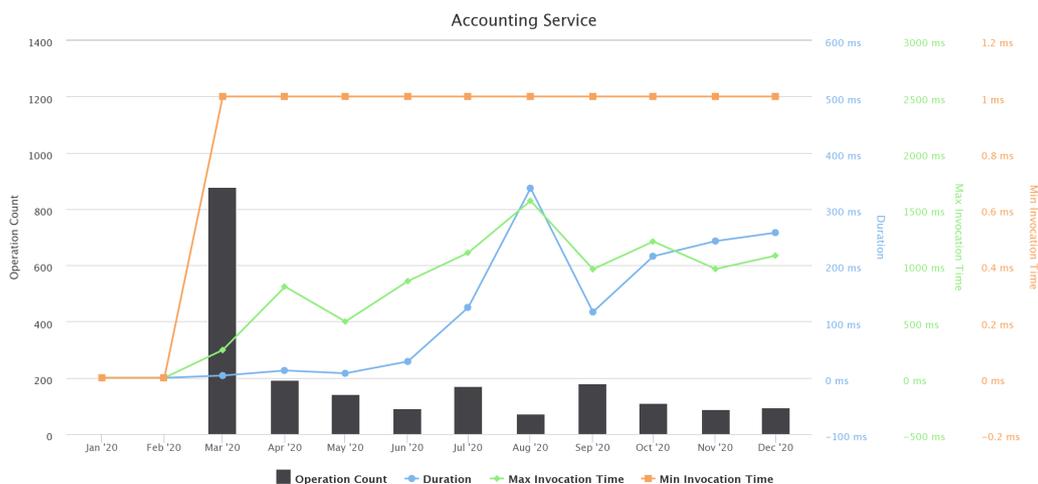


Fig. 12 The ARIADNEplus Aggregation Management VRE Operations per Month

Figure 12 reports the total amount of operations performed in the context of this VRE during the whole year 2020, as one can see there are no operations prior March '20 as the VRE was not existing yet. Operations include service tasks needed to maintain the VRE operational as well as human tasks.

### 3.4 Geoportal Prototype VRE

The Geoportal Prototype VRE (also named Geo-NA Prototype) was conceived to be a working environment developed for the integration, validation, harmonisation, visualisation, and access of archaeological georeferenced datasets collected in Italy. This prototype is intended to be a pilot for other national archaeological geoportals to be then integrated into a European geoportal.

Being still a prototype, the VRE contains data in Italian only to facilitate the participation of Italian archaeologists who are contributing to its development. The final versions will be bi-lingual, in English and in the national language.

The Geoportal Prototype (Geo-NA Prototype) VRE is available at:

<https://ariadne.d4science.org/group/ariadneplus-gateway/explore?siteId=229043941>

This VRE has been in operational status since April '20 and it is currently serving 14 users, the ones who are contributing to its development. A screenshot of the VRE is provided in Figure 13.

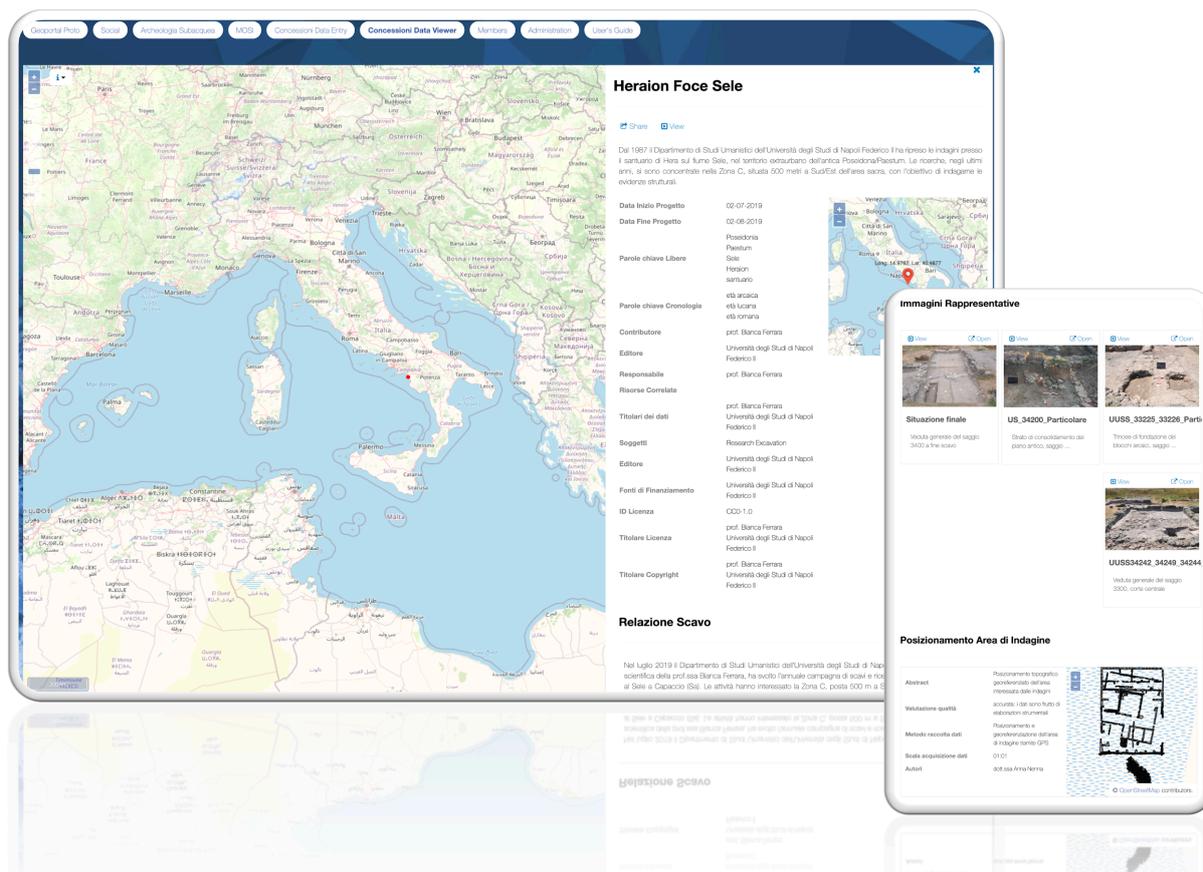


Fig. 13 A Screenshot of the Geoportal Prototype VRE GIS Data Viewer page.

This VRE provides the following Dynamic GUIs:

- **Data Collection Form** assisting users to publish GIS projects;
- **GIS Viewer** allowing any user to visualise projects on a map;
- **Project Viewer** assisting users in accessing information, documents, images and datasets associated with the GIS project.

These dynamic GUIs exploit the (i) GeoPortal service, managing validation and management of GIS projects, described in D15.1 “Mid-term interim report on ARIADNEplus services”; the (ii) D4Science Workspace to store and access attached documents; and the (iii) D4Science SDI (Spatial Data Infrastructure) to offer OGC Compliant Services (e.g. WMS, WFS, WCS, etc.).

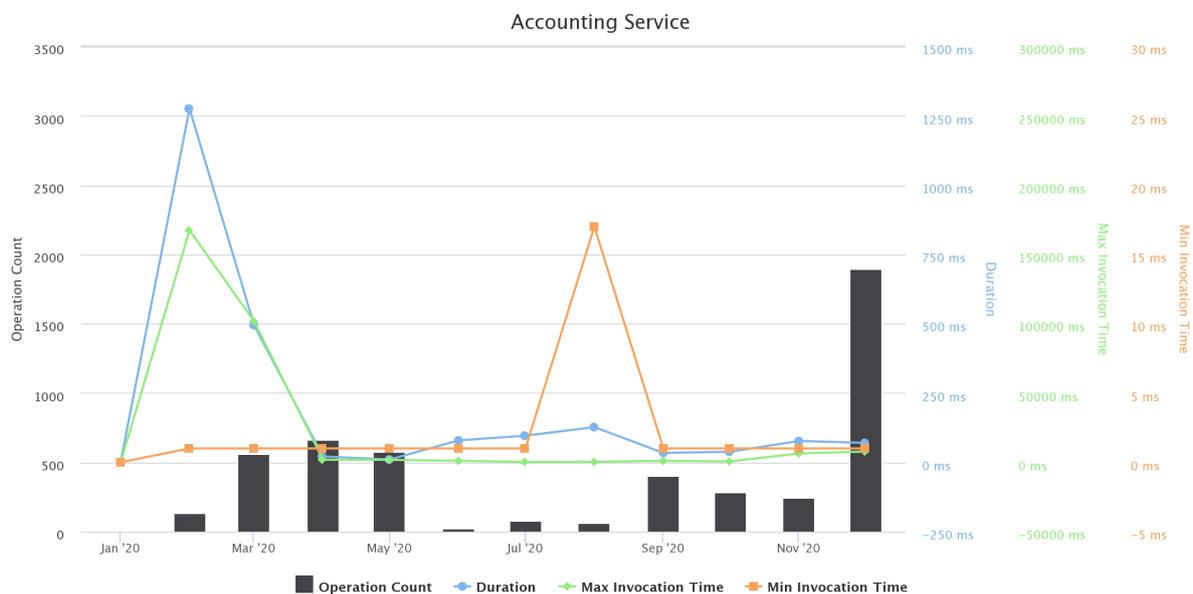


Fig. 14 The Geoportal Prototype VRE Operations per Month

Figure 14 reports the total amount of operations performed in the context of this VRE during the whole year 2020, as one can see there are no operations prior February '20 as the VRE was not existing yet. Operations include service tasks needed to maintain the VRE operational as well as human tasks.

### 3.5 Archeomar VRE

The Archeomar VRE was conceived to be a working environment developed for the visualisation and controlled access of archaeological georeferenced datasets. These datasets contribute also to the Geoportal Prototype VRE.

This prototype is intended to be a pilot for other national archaeological geoportals to be then integrated in a European geoportal.

At the moment the VRE contains data in Italian only, to facilitate the participation of Italian archaeologists who are contributing to its development. The final versions will be bi-lingual, in English and in the national language.

The Archeomar VRE is available at <https://archeomar.d4science.org>

**Archeomar abstract**

Archeomar è un ambiente di lavoro sviluppato per la visualizzazione e l'accesso controllato di dataset archeologici georeferenziati. Questi set di dati contribuiscono anche al Geo-NA Prototype VRE. Questo prototipo vuole essere un pilota per altri geoportali archeologici nazionali da integrare poi in un geoportale europeo. Al momento il VRE contiene dati solo in italiano, per facilitare la partecipazione degli archeologi italiani che stanno contribuendo al suo sviluppo.

Le versioni finali saranno bilingue, in inglese e nella lingua nazionale.

**Legenda:**

- Ingrandisci all'estensione massima della base map
- spostati su mappa
- Ingrandisci alla selezione
- seleziona gli elementi su mappa con un singolo click
- seleziona gli elementi su mappa con un rettangolo
- annulla la selezione degli elementi su mappa
- esporta la vista della mappa in diversi formati (e.g. .jpg, .png, etc)

Name	Owner	Last modified
Datasets	IS	26 Apr 16:13:20
User Guide - Archeomar.pdf	MS	02 Oct 09:49:20

Show 5 entries

1 to -1 of -1 items

Go to shared workspace

Fig. 15 A Screenshot of the Archeomar VRE home page.

The Archeomar (Figure 15) offers an interactive map which contains data that can be visualized through the application GIS viewer. The map displays part of the datasets created by the Archeomar Project (2004-2006). The project, coordinated by the Directorate General of Archeology of the MiBACT<sup>1</sup> Italy, carried out a census of the archaeological assets submerged in the seabed located along the coasts of Campania, Basilicata, Puglia and Calabria regions, mainly aimed at supporting the activity of protection.

This VRE has been in operational status since April '20 and it is currently serving 15 users, the ones needing to discuss data integration issues and contributing to its development. A screenshot of the VRE is provided in Figure 15.

<sup>1</sup> <https://www.beniculturali.it>



**Fig. 16 The Archeomar VRE Operations per Month**

Figure 16 reports the total amount of operations performed in the context of this VRE during the whole year 2020, as one can see there are no operations prior April '20 as the VRE was not existing yet. Operations include service tasks needed to maintain the VRE operational as well as human tasks.

## 4 Concluding Remarks

Virtual Research Environments are among the key products to be delivered by the ARIADNEPlus project to meet the needs of its target community and application scenarios. They are “systems” aiming at providing their users with web-based working environments that offer the entire spectrum of facilities (including services, data and computational facilities) needed to accomplish a given task by dynamically relying on the underlying infrastructure.

This deliverable has detailed the Virtual Research Environments deployed and operated during the first 2 years of the ARIADNEPlus Project (from January 2019 to December 2020). Overall, 5 VREs have been deployed and operated, two of them at the very beginning of the project, and the remaining 3 in 2020.

These VREs are serving more than 260 users in total spread across 21 countries and nearly 5.000 user sessions in the period. The creation and operation of these environments required nearly 100 requests for support, incident or bug.

## 5 References

4. *M. Assante, L. Candela, D. Castelli, R. Cirillo, G. Coro, L. Frosini, L. Lelii, F. Mangiacrapa, P. Pagano, G. Panichi, F. Sinibaldi.* (2019). **Enacting open science by D4Science**, Future Generation Computer System
5. *Assante, M., Candela, L., Castelli, D., Cirillo, R., Coro, G., Frosini, L., Lelii, L., Mangiacrapa, F., Marioli, V., Pagano, P., Panichi, G., Perciante, C., Sinibaldi, F.* (2019). **The gCube System: Delivering Virtual Research Environments as-a-Service**. Future Generation Computer Systems, Vol. 95