



Maintenance of the SERIES database

SERA Deliverable 6.1

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DELIVERABLE

D6.1 Maintenance of the SERIES database

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Table of Contents

Summary	4
1 Introduction	5
2 Maintenance of the SERIES Central Site.....	5
2.1 Integration with Celestina Data Viewer	5
2.1.1 Celestina Data Viewer (CDV) configuration tool (cdvconf tool)	6
2.2 Integration with EPOS database.....	8
2.3 Other maintenance tasks.....	9
3 Maintenance and improvement of the SERIES Data Access Portal	10
3.1 UI updates.....	11
3.1.1 UI overhaul.....	11
3.1.2 General interface appearance updates	12
3.1.3 Search functionality.....	16
3.2 Extension of SERIES DAP functionality	19
4 Summary and conclusions	22
5 References	22
Bibliography	22
Glossary.....	23

Summary

This deliverable is written within the framework of the project “Seismology and Earthquake Engineering Research Infrastructure Alliance for Europe – SERA” (Project no: 730900), funded by the Horizon2020, INFRAIA-01-2016-2017 Programme. Main objective of this deliverable is the maintenance of the SERIES databases and the update of user interface of the SERIES Data Access Portal.

1 Introduction

The SERIES project (2009-2013) developed a common computing infrastructure to address the lack of interoperability between the European earthquake engineering institutions. This infrastructure was implemented as a network of distributed data sources that allows access to the SERIES European laboratories' data through a single, centralised user interface, while enabling data integration between the different SERIES institutions. This automated integration of experimental results was one of the major achievements brought by SERIES in terms of experimental data management.

The distributed infrastructure with a centralised access served different purposes:

- Provide experimental results to the earthquake engineering community in a uniform manner. Thanks to this, end users can collect multi-source information from a single place. The distributed nature of the data is invisible to the end user, whose experience should be similar to accessing a single data repository.
- Enable the different SERIES institutions to work autonomously and be in control of their own data.
- Reduce the technological gap between each laboratory part of the SERIES network.

However, at the end of the SERIES project it was evident that the infrastructure lacked some features to take full advantage of the data management, especially those to facilitate the visualisation and acquisition of experimental data at the local nodes in a user-friendly way. The SERA project fulfilled this lack by enhancing the current SERIES infrastructure with the creation of a user-friendly graphical interface and the development of IT tools to facilitate the input of experimental data, namely the Celestina Data Viewer software (Pegon, et al., 2018).

Additionally, one of the aims of the SERA project was to investigate interoperability between SERIES and EPOS, and the integration of the databanks of these projects, concluding, at the end of SERA, into a pre-operational activity to demonstrate the feasibility of this integration.

Furthermore, the web interface of the SERIES Central Site (i.e. the SERIES Data Access Portal) was updated to a more user-friendly interface and enhanced with new tools that allow the visualization of experimental data.

For these two major undertakings, several changes have been performed in the SERIES database during the SERA project.

2 Maintenance of the SERIES Central Site

Maintenance tasks concerning the SERIES Central Site were performed (a) to ensure that the SERIES Central Site is operational and functioning for the duration of the SERA project and beyond and (b) to make targeted modifications to ensure interoperability with other tools or services, i.e. the Celestina Data Viewer or the EPOS ICS-C pre-operational service activity.

2.1 Integration with Celestina Data Viewer

In order to assure that Celestina Data Viewer (CDV) can connect to and publish their metadata in the SERIES Central Site database, a number of targeted modifications in elements of the database needed to be performed. A CDV node uses a different approach to store experimental data, since it is built on



a graph database, compared to the relational storage used in the SERIES Database. The purpose was to ensure that the primary entities of the CDV database are compatible with those in the SERIES database (project, specimen, computational experiment and signal).

The needed modifications were performed in a gradual, test-intensive manner, to ensure that none of them would lead to breakage. The modifications were first applied to a development mirror of the SERIES Central Site, tested extensively, and then carried over to the live site. The modifications concerned primarily the altering of the data type of specific table fields (for example from String to Integer) and the addition of necessary id fields in other tables, so as to have all data tuples properly indexed. There were no additional table creation within the SERIES database, but all the existing tables of the database were altered. After the primary entities were successfully altered, all the tables dependent on them were modified and tested.

SERIESConnector

As stated, CDV nodes follow a different architecture and as such were not able to publish experiment metadata to the SERIES Database out of the box. To make the CDV nodes compatible with the SERIES Database, SERIESConnector was developed. SERIESConnector is a software component of a CDV node and its purpose is to convert data hosted in a CDV node into SERIES Exchange Data Format (EDF), thus allowing the uploading of metadata from a CDV node to the SERIES Database. Using the SERIESConnector, a CDV node can participate as a partner laboratory in the SERIES database. The SERIES Central Site web service connects to a CDV node's SERIESConnector to retrieve data from the node.

It should be noted that during this time period, several bugs of the Central Site web services were fixed. An important bug, that was causing errors in the data retrieval process, was occurring when specific data were omitted by the partner and were not provided to the Central Site, causing failure in the data retrieval process. Several bugs were fixed also in the Central Site web services that were causing problems in the 'Search' process. These issues were resolved. In addition, the 'Search' functionality, as was implemented in the SERIES Central Site, was based on an architecture that was hard to maintain, namely it required that the specific tables assisting the search process were filled each time the database was updated. The 'Search' functionality was refactored and implemented with a simpler, more concise architecture.

SERIES Central Site web service

Finally, the web service that retrieves metadata from partner laboratories was upgraded in order to accommodate both types of partner laboratories, the new CDV nodes and the existing partner nodes (i.e. "DatOX partners").

2.1.1 Celestina Data Viewer (CDV) configuration tool (cdvconf tool)

Celestina Data Viewer (CDV) nodes are delivered as virtual machines (VM), which created the need for a tool that simplifies the installation and the configuration of a new CDV node. The cdvconf tool facilitates the installation of a CDV node, the configuration of specific CDV instances, and the upgrading of software in the future. The goal of the cdvconf tool is to automate the configuration process for the user, so (s)he doesn't have to log into the machine and conduct all the configuration steps manually.

The development of the cdvconf tool consisted of three phases (a) Design of the application (b) Development of the application, (c) Evaluation of the application. During the Design phase, the goal was to organize the architecture of the application that was going to be developed. It was very important to understand the way the tool should connect to the CDV instance and perform its configuration. Next, during the Development phase, the goal was to use the architecture from the previous phase and develop the software of the tool. The cdvconf tool was distributed in a single

executable file for all platforms (Windows, Linux and Mac). In the final phase, Evaluation phase, the goal was to use the tool in order to configure the CDV instance with the first real configuration scripts. During the Development phase, a set of 'test' configuration scripts were used and not the final ones. So after the Evaluation phase the version 1.0 of the tool was developed and was ready for use.

CDV - Design phase

In this section the general architecture of the cdvconf tool is presented. It was very important to understand the way the tool should work and perform the installation and configuration of the CDV instance.

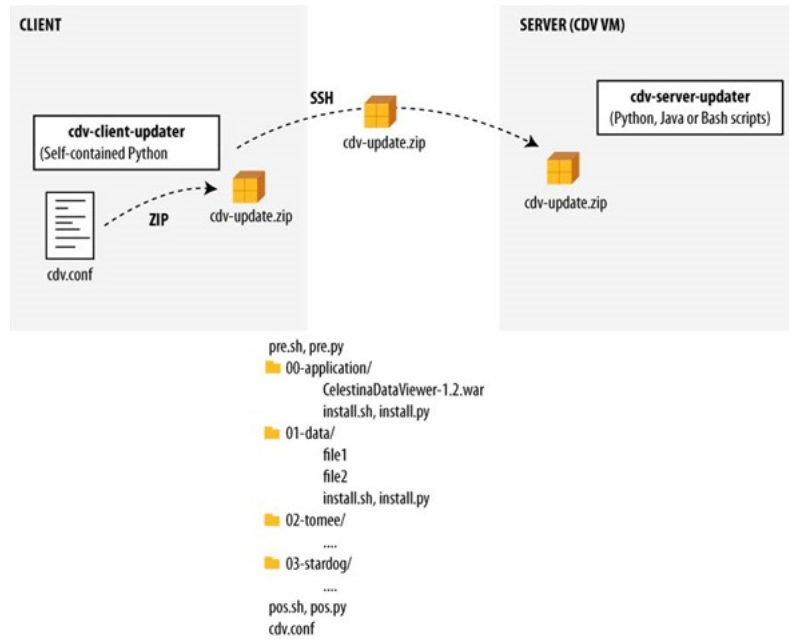


Figure 1. Architecture of cdvconf tool and structure of an Action ZIP file

As it can be seen in Figure 1, the cdvconf tool is to be executed on the client side. On the server side there is the CDV VM instance that needs to be configured. The cdvconf tool is a self-contained application developed in Python. The application needs two specific files in order to configure the CDV VM. The first one is a ZIP file that contains all the action scripts that will be executed in the CDV VM and perform configurations on it. Specific ZIP files are provided for specific updates that need to be done on the CDV VM machine (e.g. initial installation, startCDV, stopCDV, etc). The scripts inside the ZIP file may be Bash, Python or Java scripts. The structure of the ZIP file can be seen in Figure 1 (pre.sh, pos.sh, etc). The second file is the 'cdv.conf' file. This file contains all the configuration values that are modified by the end user and these values will be used by the cdvconf tool to execute the action scripts within the ZIP file.

The cdvconf tool reads the cdv.conf file values and modifies the values inside the ZIP file according to them. Then it creates a new ZIP file, the 'cdv-update.zip' which contains all the necessary files that will be used during the CDV VM configuration. The cdvconf tool connects via Secure Shell (SSH) with the CDV VM and establishes a secure connection with the server side. Then it transfers via Secure Copy Protocol (SCP) the 'cdv-update.zip' to the server side and the only thing that remains to be done is the configuration of the CDV VM. The cdvconf tool then externally unzips the updates in the CDV VM and starts the execution of the scripts. As it can be seen in Figure 1, inside the ZIP file there are folders whose names follow a specific format (XX-Name of the action). The XX is the order of execution. The tool parses each folder's name and finds the sequence in which the actions should be executed. When the cdvconf tool concluded the running of the scripts, the configuration is completed and the

only thing that remains is to delete the update files in the server and close the secure connection with the server side.

Development phase

In this phase, the goal was to develop the tool according to the architecture that was described above. For the source code of the main application Python programming language was used for the development. The final application consisted of the following:

1. The **tool** itself, which is an executable that does not require installation.
2. An **Actions** file (ZIP) containing configuration instructions. The user does not need to do anything inside this file, it will be provided to the end users.
3. A **cdv.conf** file, with all the values that apply in the end user’s specific case. This is the file that the end user will have to edit.

The flow of the application that was developed can be seen in Figure 2.

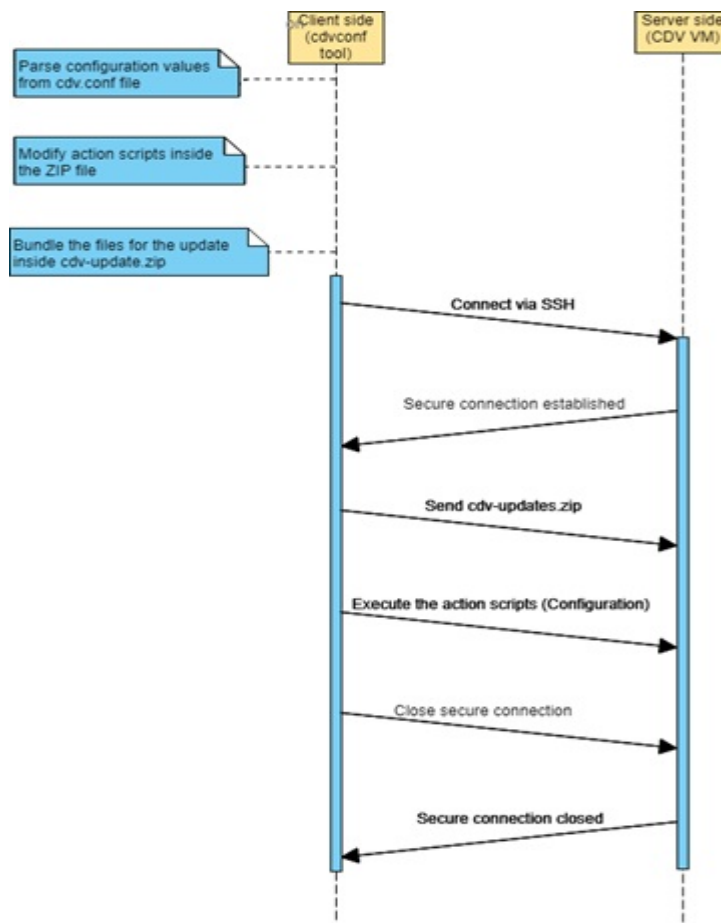


Figure 2. Flow diagram of cdvconf tool

2.2 Integration with EPOS database

As part of SERA Task 6.3, a pre-operational access service was implemented that allows access to selected SERIES data sets via the EPOS ICS-C (Atakan, et al., 2018). Preparation for this service included further modification in the SERIES database so as to be able to store metadata that are

required by the EPOS metadata format (EPOS-DCAT-AP) (Paciello, Trani, & Bailo, 18 January 2019). The extension of the SERIES Database concerned the following additions:

1. Storage of the geographic coordinates of a laboratory. The SERIES Database was enhanced with a new table ('laboratory_coords').
2. Because EPOS requires unique identifiers for each participating organization, the relevant information is now stored in the SERIES Database in a new table ('laboratory_info'). It contains organization-level information related to laboratories (PIC, physical address, etc).
3. Similarly, EPOS requires unique identifiers for persons who are involved with some role in the experimental data that are published via the EPOS ICS-C. The relevant information is stored in the SERIES Database in the new table 'personnel_info'. It contains information related to the personnel of each organization that exists in the SERIES Database.

2.3 Other maintenance tasks

Certificates updates

During the data retrieval process, the SERIES Central Site retrieves metadata from partner nodes by connecting as a client to remote partner nodes. The SERIES client certificate allows a partner node to verify that the Central Site (i.e. the client) is a legitimate entity that is allowed to retrieve the metadata from the remote node. The partner nodes issue client certificates that are used by the SERIES Central Site to authenticate each time it requests metadata from a partner node. Several partner certificates expired during the maintenance period and needed to be re-created.

Additionally, a new download certificate was issued by the SERIES Central Site. The download certificate is installed in all partner nodes and allows them to verify download requests as authentic. The new certificate, along with instructions for partners, was issued and distributed. The new client certificates were set to expire in 2070, so as to avoid similar verification issues in the near future.

Data retrieval from partner nodes

It should be noted that the SERIES Central Site retrieves data from partner nodes through two components:

1. **Web Service for Retrieving Lab Metadata:** This web service is used to retrieve data from a specified target host (i.e. a partner node). Then it updates the SERIES Database with the new metadata.
2. **Task Scheduler:** This application iterates all the available partner nodes within the SERIES Database, manages their corresponding certificates and attempts to retrieve data from each of them. This application triggers the Web Service for Retrieving Lab Metadata for each of the available partner in the SERIES Database. This application is scheduled to run regularly (once per day), querying all known partner nodes for data.

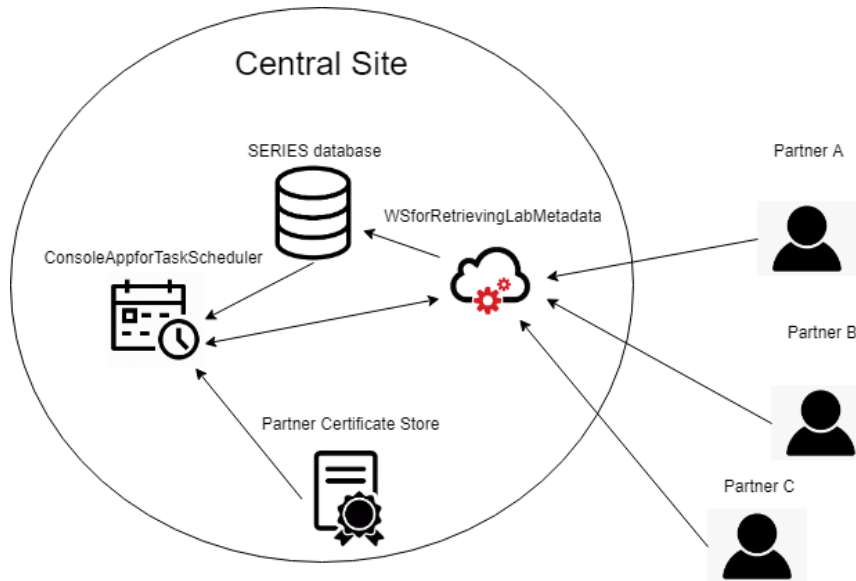


Figure 3. Metadata retrieval process

During operations to accommodate CDV nodes (see Section 2.1), several problems were found in the Task Scheduler, relating to the ways that it handled the partner certificates, causing problematic connections with some partners. To overcome these issues, the Task Scheduler application was re-developed from scratch in a way that the addition of a new partner and its corresponding certificates could be easily implemented and updated. Moreover, it was updated and deployed, to successfully be able to retrieve data from any node of the new CDV type within the SERIES network.

In Figure 3, the data retrieval procedure of the newly developed Task Scheduler is described. The procedure consists mainly of the following steps:

1. First, the Task Scheduler retrieves the list of available partners from the SERIES Database.
2. For each of the partners it looks up the corresponding client certificate in the Partner Certificate Store in order to find the proper client certificate for the establishment of a secure connection with the remote endpoint.
3. It calls the Web Service for Metadata Retrieval, providing it the proper parameters and the proper client certificate in order to start the retrieval process.
4. The Web Service for Metadata Retrieval establishes a secure connection with the remote partner and the metadata retrieval process starts.
5. Steps 2, 3, 4 are repeated for each of the available partners in the SERIES Database.

An additional feature that was implemented in the Task Scheduler component, was the remote inspection of the retrieval procedure by the SERIES Database administrator. Via this implementation, the administrator can easily inspect the procedures related to the SERIES Database and intervene whenever a problem occurs.

3 Maintenance and improvement of the SERIES Data Access Portal

SERA Task 6.1 focuses on the continuity, enhancement, and enrichment of services developed by the experimental research infrastructures of the SERIES project. The activities include maintenance of the portal, upgrades relating to the user friendliness and responsiveness of the user interface, implementation and integration of new tools that allow the visualization of the experimental data.

3.1 UI updates

The SERIES Data Access Portal UI was completely reimplemented aiming at responsiveness and user friendliness, switching to the widely used Bootstrap library. The search functionality was completely redesigned and overhauled. Finally, a set of visualization tools were implemented and incorporated in a new 'Workspace' area in the SERIES DAP.

The SERIES Data Access Portal is accessible under the URL <http://www.dap.series.upatras.gr/>.

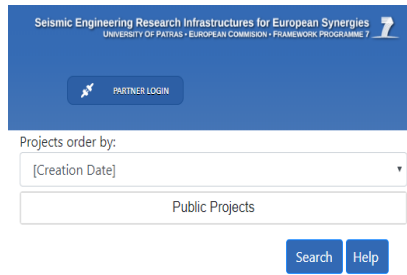
3.1.1 UI overhaul

Significant efforts were directed towards updating the SERIES Data Access Portal (DAP) user interface. The main aim was to render the interface responsive, i.e. adaptable to the user agent (browser) viewport, be it mobile or stationary. Responsiveness allows the SERIES DAP user interface to be rendered on a variety of devices and window or screen sizes, without loss of functionality. Responsiveness is a major factor for improved usability and user satisfaction since it allows users to navigate the portal from any device (Figure 4, Figure 5). A secondary aim was to achieve responsiveness while maintaining the overall look and feel of the SERIES DAP (Figure 4).

The screenshot displays the SERIES Data Access Portal (DAP) interface. At the top, there is a blue header with the SERIES logo on the left and the text "Seismic Engineering Research Infrastructures for European Synergies" and "UNIVERSITY OF PATRAS - EUROPEAN COMMISSION - FUNDING PROGRAMME 7" on the right. A "PARTNER LOGIN" button is also present. Below the header, the page is divided into several sections:

- Left Sidebar:** A tree view titled "Public Projects" showing a hierarchical structure of research projects, including categories like "Literature RC Slabs", "Seismic Performance Assessment and Rehabilitation of Existing Buildings", and "Optimum Design of Passive Controlled Steel Frame Structures".
- Main Content Area:**
 - About SERIES Data Access Portal:** A section with a title and a paragraph explaining the portal's purpose: "The creation of the distributed database aims to improve the dissemination and use of experimental results and to foster the impact of earthquake engineering research on practice, innovation and earthquake risk mitigation. This requires harmonisation and unification of the European databases in earthquake engineering and the possibility of accessing, through a unique portal, the data stored at different database nodes which are able to dialog with the central portal using a common communication protocol." It also includes a mission statement: "The mission of the Data Access Portal is to foster a sustainable culture of co-operation among all of the research infrastructures and teams that are active in earthquake engineering in Europe".
 - Exchange Data Format:** A section with a title and a paragraph: "The European scientific community is currently fragmented with each laboratory holding experimental data with a unique local data model and user interface, language and scheme. As a consequence, the dissemination and use of these experimental results outside of the laboratory where they are produced can be problematic. To overcome this, it is proposed to add a layer on top of the existing local databases that is accessible through a unique Data Access Portal. The aim is not to build a central database where local databases either migrate or merge but instead to provide centralised access to database nodes that are distributed over the network which are able to dialog with a central portal in a uniform manner. For achieving the aforementioned goal a common Exchange Data Format is needed." Below this text is a "Learn More" button.
 - User Manual:** A section with a title and a paragraph: "From a conceptual point of view the Data Access Portal has been designed to act as an information space. Taking the above into consideration Data Access Portal supports two complementary modes of information retrieval: a) direct navigation mechanism which allows users to browse through the published projects by interacting with a tree view control which is always visible at the left side of the web application. This panel contains all the available published projects which are structured according to the Exchanged Data Format b) direct search functionality which is a structured keyword-based search where can be found specific information based on exchange data format keywords." Below this text is a "Learn More" button.
 - Recently Published Projects:** A section with a title and a list of project entries, though the details are not fully visible.

Figure 4. SERIES DAP displayed in a desktop browser



About SERIES Data Access Portal

The creation of the distributed database aims to improve the dissemination and use of experimental results and to foster the impact of earthquake engineering research on practice, innovation and earthquake risk mitigation. This requires harmonisation and unification of the European databases in earthquake engineering and the possibility of accessing, through a unique portal, the data stored at different database nodes which are able to dialog with the central portal using a common communication protocol.

"The mission of the Data Access Portal is to foster a sustainable culture of co-operation among all of the research infrastructures and teams that are active in earthquake engineering in Europe"



Figure 5. SERIES DAP displayed in a mobile browser

3.1.2 General interface appearance updates

In order to improve the attractiveness of the SERIES DAP, several interventions in the appearance of the user interface were made. Firstly, the home page of SERIES DAP was redesigned (see Figure 6 and Figure 7).



Figure 6. SERIES DAP Home Page prior to the updates

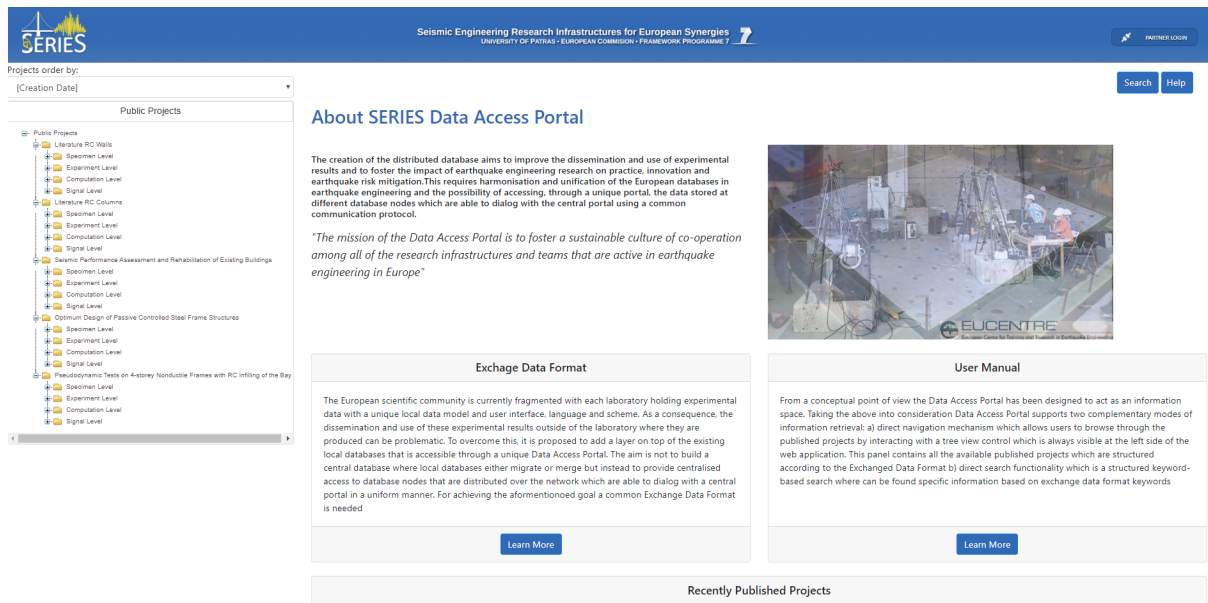


Figure 7. Updated Home Page.

Home page redesign was one of the prime tasks of the UI updates. Areas for important pieces of information, like the “Recently Published project”, “Exchange Data Format” and “User Manual” needed to be redesigned (Figure 8, Figure 9). The new format consists of cards that contain the title of each information field, the description and the “Learn more” information button for the first two fields and the link “...more” for the last one. The information of the field “Recently Published project” is organized in a better way so that users can read them in an easier way than in its old version.

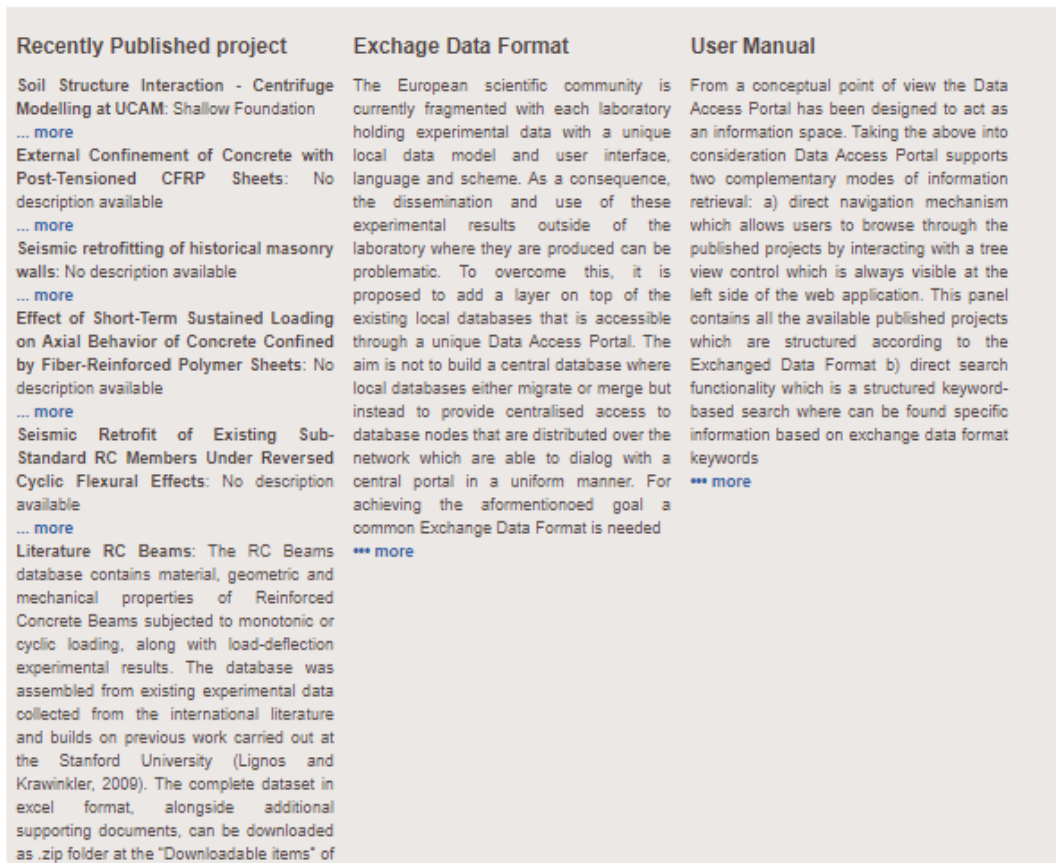


Figure 8. Old version of “Recently Published project”, “Exchange Data Format” and “User Manual” prior to the updates

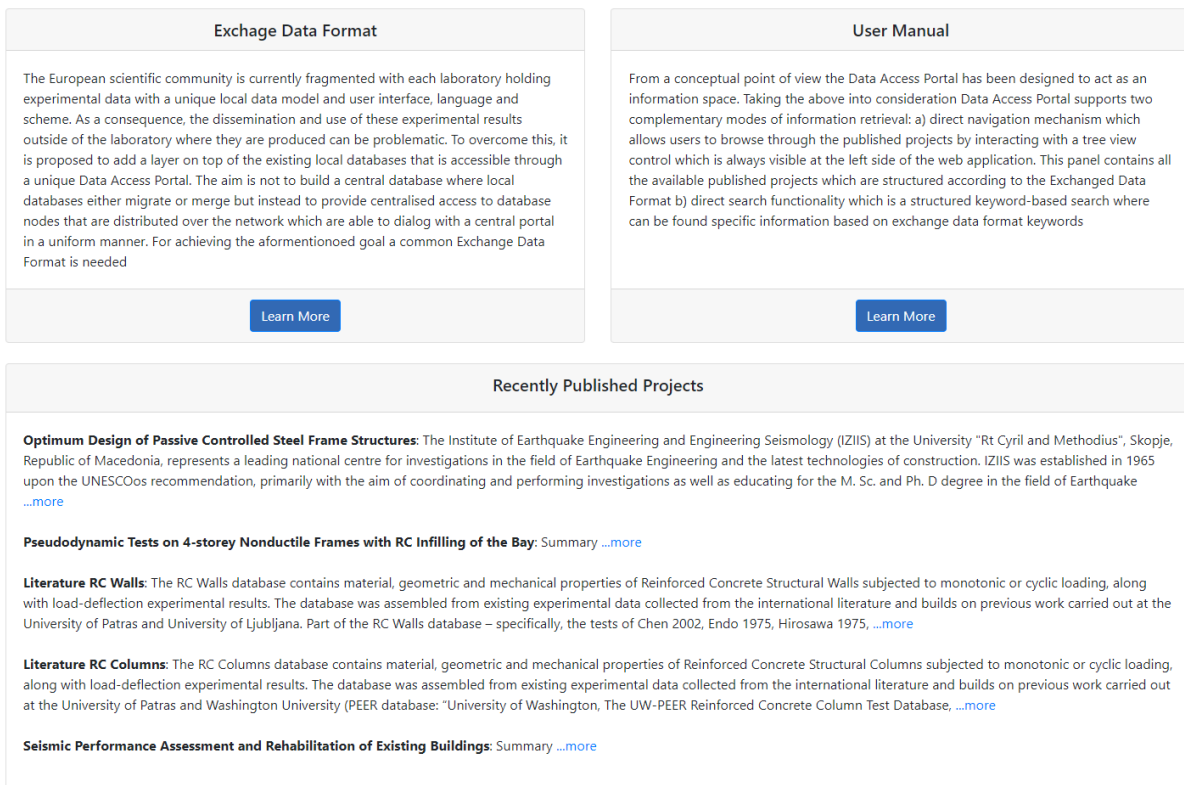


Figure 9. Updated view of “Recently Published project”, “Exchange Data Format” and “User Manual”

Furthermore, the Project lists pane (Public Projects, Search Results and Partner Projects) was also updated for a better representation (Figure 10). Numerous omissions in the previous interface were corrected, for example, users can now open or close the Project lists by clicking the header of each list. Such omissions are of a secondary importance when considered one by one but aggregated together they contributed in a perceived lack of usability.

In addition, changes were made in the data tables of each project (Figure 11 and Figure 12). Their new format renders responsive tables and the information is now easier to read. Data table sections are now collapsible. By clicking on the title of each category, it will be extended (“+”) or diminished (“-”).

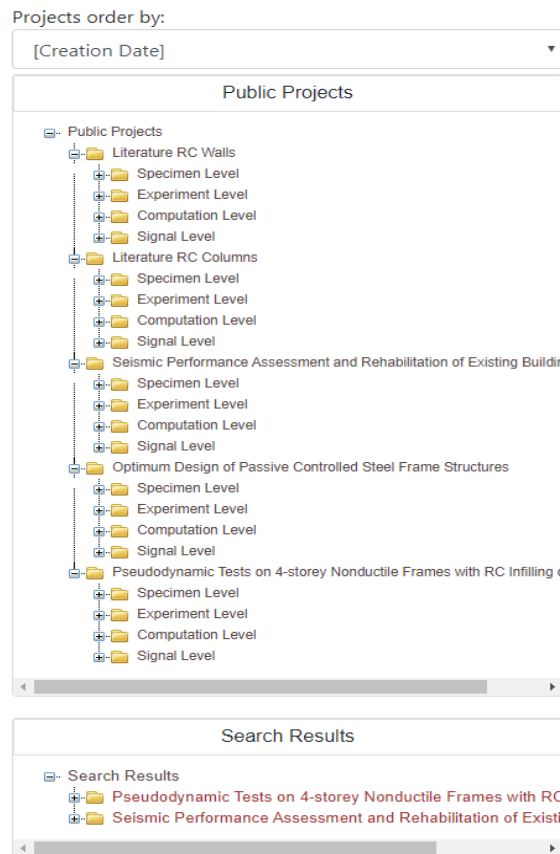


Figure 10. Project lists pane

Project Data (1 items)									
Laboratory Name	Title	Acronym	Sponsor	Project Main Focus	Summary	StartDate	EndDate	Status	
ULFGG	Literature RC Beams	Lit_RCBeam		_LIT_RM_projectMainF1	The RC Beams database contains material, geometric and mechanical properties of Reinforced Concrete Beams subjected to monotonic or cyclic loading, along with load-deflection experimental results. The database was assembled from existing experimental data collected from the international literature and builds on previous work carried out at the Stanford University (Lignos and Krawinkler, 2009). The complete dataset in excel format, alongside additional supporting documents, can be downloaded as .zip folder at the "Downloadable items" of the main menu of the present database. A complete list of references is also available there. ACKNOWLEDGMENT The research leading to these results has received funding from the European Union Seventh Framework Programme [FP7/2007-2013] under grant agreement n° 227887 [SERIES] and from the Slovenian Research Agency..	1/1/0001 12:00:00 AM	1/1/0001 12:00:00 AM		

Project Documents (1 items)							
Title	Author	Abstract	Date	Role	Scope	Format	
RCBeams	ULJ FGG	-	9/1/2013 1:00:00 AM	FINAL	-	14816.00 KB,OTH	

Figure 11. Data tables prior to the updates

Current project: Literature RC Walls Search Help

Project Info Detailed Information Downloadable Items Workspace

Project data (10 items)

Laboratory Name	UPAT
Title	Literature RC Walls
Acronym	Lit_RCWalls
Sponsor	
Main Focus	RC Walls Database
Summary	The RC Walls database contains material, geometric and mechanical properties of Reinforced Concrete Structural Walls subjected to monotonic or cyclic loading, along with load-deflection experimental results. The database was assembled from existing experimental data collected from the international literature and builds on previous work carried out at the University of Patras and University of Ljubljana. Part of the RC Walls database – specifically, the tests of Chen 2002, Endo 1975, Hirose 1975, Kokusho 1975, Sugano 1973, Tanabe 1975, Tuboi 1975, Zhang 2007 – was assembled by researchers at Tongji University and is also available at NEEShub: http://nees.org/resources/1683 (Citation for those tests: Xilin Lu, Ying Zhou, Juhua Yang, Jiang Qian, Cheng Song & Ying Wang, 2010: "Shear Wall Database," Network for Earthquake Engineering Simulation (database), Dataset, DOI:10.4231/D38C9R416). The complete dataset in excel format, alongside additional supporting documents, can be downloaded as .zip folder at the "Downloadable items" of the main menu of the present database. A complete list of references is also available there. ACKNOWLEDGMENT The research leading to these results has received funding from the European Union Seventh Framework Programme [FP7/2007-2013] under grant agreement n° 227887 [SERIES].
Start Date	1/1/0001 12:00:00 πμ
End Date	1/1/0001 12:00:00 πμ
Status	

Project Documents (9 items)

Figure 12. Data tables after the updates

3.1.3 Search functionality

Search functionality was another major focus of refactoring in order to improve user friendliness. Prior to the update, search functionality in the SERIES DAP consisted of list boxes for each category of search filter, in which the user had to press “Ctrl” and click in order to select multiple filters (Figure 13). Similarly, in order to deselect a search filter, the user had to perform the same key combination once again. Furthermore, should the user wish to apply multiple filter items, (s)he could easily lose overview.

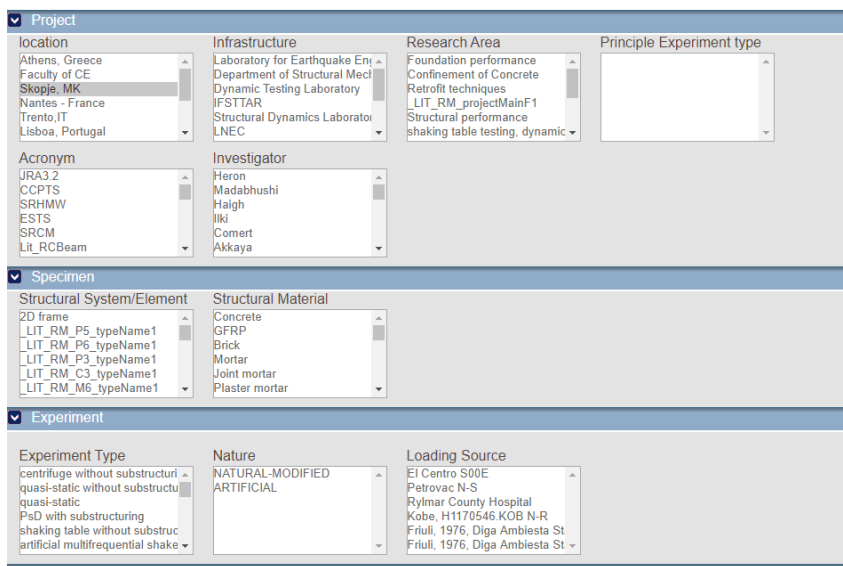


Figure 13. Search filter UI prior to the updates

The new implementation of Search functionality consists of modern list boxes. When the user selects an option, a tag with this option appears inside the box (Figure 14). The user can see what has been chosen at any time. Furthermore, cancelling of an option is much more intuitive, by pressing the corresponding “x”.

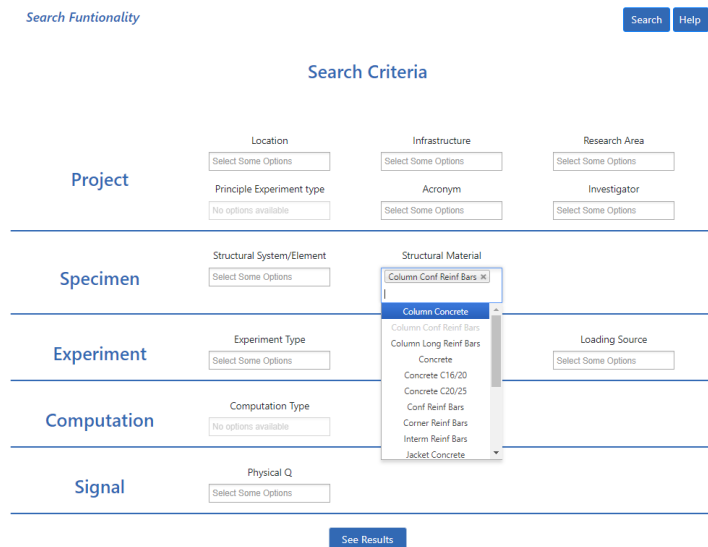


Figure 14. Search functionality after the updates

Upon choosing filters and applying them to the search, by pressing the “See Results” button, the results will appear in a new format (see in Figure 15 and Figure 16). Results are included in cards which contain the title of the project, the “Go to download” button in order to redirect to Downloadable items of each project, the description, the Start and the End Date. The number of the results that have been found now also appear correctly. Furthermore, if a search is initiated without applying any filters, all projects which included in the database will appear.

Results Found:

<p>1. Project title: Performance of Innovative Mechanical Connections in Precast Building Structures Under Seismic Conditions (1 results at Project level) Go to download</p> <p>Start Date: 3/1/2009 12:00:00 AM End Date: 2/29/2012 12:00:00 AM</p> <p><u>Description:</u> The seismic behaviour of connections in precast construction systems has been largely recognized as a crucial matter to be addressed both by the industry sector and by the related research community. In spite of this situation, the complexity of the problem and the variety of inherent issues to be harmonizedly dealt with in proposing design procedures for connections and precast structures as a whole, have made it difficult so far to conceive self-sufficient solutions and approaches of general validity. Scope of SAFECAST is to give effective answers to this need of self-sufficient, harmonized solution of the problems of correct seismic design of joints and connections in precast structures.</p>
<p>2. Project title: Optimum Design of Passive Controlled Steel Frame Structures (1 results at Project level) Go to download</p> <p>Start Date: 12/1/2001 12:00:00 AM End Date: 12/15/2001 12:00:00 AM</p> <p><u>Description:</u> The Institute of Earthquake Engineering and Engineering Seismology (IZIIS) at the University "Rt Cyril and Methodius", Skopje, Republic of Macedonia, represents a leading national centre for investigations in the field of Earthquake Engineering and the latest technologies of construction. IZIIS was established in 1965 upon the UNESCO's recommendation, primarily with the aim of coordinating and performing investigations as well as educating for the M. Sc. and Ph. D degree in the field of Earthquake Structural Engineering at both national and international level. The investigations in this centre are financed from several sources: • Ministry of Education and Science of Republic of Macedonia; • International programmes based on permanent bilateral scientific cooperation signed between R.Macedonia and a certain number of countries; • Industry, national or foreign, by establishment of special research consortia; • Services for industrial needs. This research project has been financed by the UR-Macedonian Joint Board for Scientific and Technological Cooperation signed between the US Government and R. Macedonia. The project was approved four years ago. The cooperative agency on the USA part was NIST (National Institute for Standards and Technology), while the UR co-investigator was Prof. Dr. George C. Lee from MCEER. The investigations presented in this report refer to project 123/NIST, i.e., "Optimum Design of Passively Controlled Steel Frame Structures". The concept of passive control of seismic response of structures represents a radical change and a considerable qualitative advance in the approach to design and construction of seismically resistant structures. At the same time, it also offers possibilities for direct application in both construction of new structures and strengthening of existing ones. The investigations performed within the study are in the field of passively controlled structures. A complex analytical-experimental-analytical programme has been realized for the purpose of investigating and evaluating the efficiency of the proposed system for passive dissipation of energy DEFD, involving preliminary analytical investigations of frame structures of different number of storeys with and without DEFD system, quasi-static tests on models of a single storey fragment with DEFD system and dynamic tests on five storey model of a hypothetical frame structure with DEFD system on seismic shaking table by simulation of actual earthquakes, mathematical modeling of the tested models and comparative numerical analysis of three different structural systems (DEFD, DUAL and MRF).</p>

Figure 15. Presentation of search results prior to the update

4 - Result(s) found:

<p>1. Pseudodynamic Tests on 4-storey Nonductile Frames with RC Infilling of the Bay (1 results at Project level) Go to download</p> <p>Summary</p> <p>Start Date: 1/1/2010 12:00:00 πμ End Date: 31/12/2010 12:00:00 πμ</p>
<p>2. Seismic Performance Assessment and Rehabilitation of Existing Buildings (1 results at Project level) Go to download</p> <p>Summary</p> <p>Start Date: 1/1/2001 12:00:00 πμ End Date: 31/12/2004 12:00:00 πμ</p>
<p>3. Optimum Design of Passive Controlled Steel Frame Structures (1 results at Project level) Go to download</p> <p>The Institute of Earthquake Engineering and Engineering Seismology (IZIIS) at the University "Rt Cyril and Methodius", Skopje, Republic of Macedonia, represents a leading national centre for investigations in the field of Earthquake Engineering and the latest technologies of construction. IZIIS was established in 1965 upon the UNESCO's recommendation, primarily with the aim of coordinating and performing investigations as well as educating for the M. Sc. and Ph. D degree in the field of Earthquake structural Engineering at both national and international level. The investigations in this centre are financed from several sources:</p> <ul style="list-style-type: none"> • Ministry of Education and Science of Republic of Macedonia; • International programmes based on permanent bilateral scientific cooperation signed between R.Macedonia and a certain number of countries; • Industry, national or foreign, by establishment of special research consortia; • Services for industrial needs. <p>This research project has been financed by the UR-Macedonian Joint Board for Scientific and Technological Cooperation signed between the US Government and R. Macedonia. The project was approved four years ago. The cooperative agency on the USA part was NIST (National Institute for Standards and Technology), while the UR co-investigator was Prof. Dr. George C. Lee from MCEER. The investigations presented in this report refer to project 123/NIST, i.e., "Optimum Design of Passively Controlled Steel Frame Structures".</p> <p>The concept of passive control of seismic response of structures represents a radical change and a considerable qualitative advance in the approach to design and construction of seismically resistant structures. At the same time, it also offers possibilities for direct application in both construction of new structures and strengthening of existing ones.</p> <p>The investigations performed within the study are in the field of passively controlled structures. A complex analytical-experimental-analytical programme has been realized for the purpose of investigating and evaluating the efficiency of the proposed system for passive dissipation of energy DEFD, involving preliminary analytical investigations of frame structures of different number of storeys with and without DEFD system, quasi-static tests on models of a single storey fragment with DEFD system and dynamic tests on five storey model of a hypothetical frame structure with DEFD system on seismic shaking table by simulation of actual earthquakes, mathematical modeling of the tested models and comparative numerical analysis of three different structural systems (DEFD, DUAL and MRF).</p> <p>Start Date: 1/12/2001 12:00:00 πμ End Date: 15/12/2001 12:00:00 πμ</p>

Figure 16. Presentation of the search results after the UI update

3.2 Extension of SERIES DAP functionality

A new functionality was implemented in the user interface of the SERIES DAP, namely the “Workspace”. The Workspace is a tool for the visual representation of experimental data. More specifically, it displays diagrams related to the signals stored in the partner databases. The end-user enters the Workspace by clicking the corresponding “Workspace” tab in any project (Figure 17). First, an experiment is chosen, then, the signals of the chosen experiment for which a plot is to be computed and displayed. The final step is to choose the type of the diagram. The available diagram types are:

- Force – Displacement plot.
- Absorbed energy – Half-cycle maximum displacement (absolute value).
- Half-cycle residual displacement (absolute value) – Half-cycle maximum displacement (absolute value).
- Absorbed energy – Half-cycle number.
- Damping – Cycle number.
- Half-cycle maximum displacement (absolute value) – Half-cycle number.
- Half-cycle residual displacement (absolute value) – Half-cycle number.
- Residual/Maximum displacement – Half-cycle number.

Figure 17. The Workspace provides tools for signal visualization

The requested plot appears in a new tab (Figure 18). The “Plot” browser tab, except from the diagram, contains the name of the experiment, the x-y axe values’ names and their corresponding units (in “Force – Displacement” diagram) and the name of the signals. In all other types of diagrams except “Force – Displacement”, under the title of the experiment, there are displayed the units of the force and displacement signals in the corresponding x-y axes. A toolbar contains functionalities like

Zoom in, Zoom out, Auto scale, Pan, Reset Axes etc. The library which used for this plotting is the Plotly.

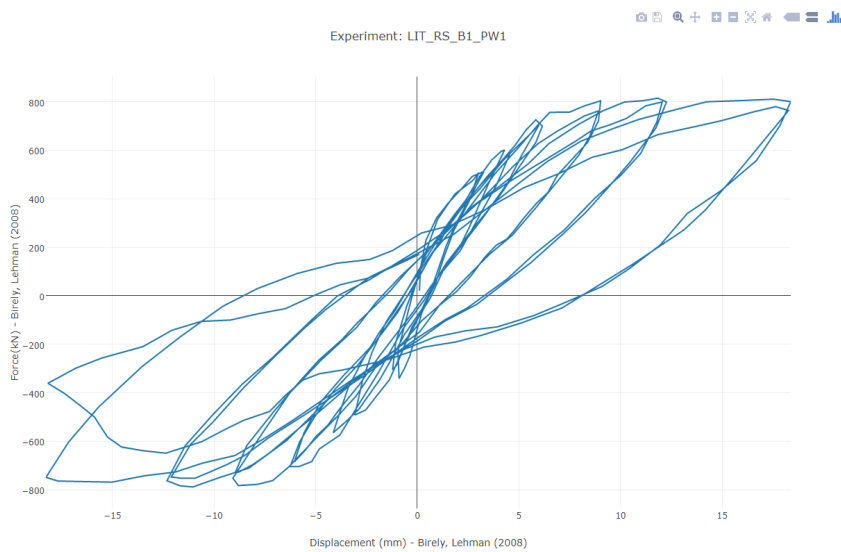


Figure 18. Force-Displacement plot as produced in the DAP Workspace

One challenge in implementing the Workspace plot functionality in the DAP, and within the SERIES Central Site in general, was the distributed nature of data storage in SERIES. The signal files are not actually stored in the central SERIES Database, but in the database in the remote node of the corresponding partner laboratory. In order to retrieve the data and perform the calculations, an additional web service (the Signal Data Retrieval WS) was developed for the SERIES Central Site. The web service retrieves the signal files from a partner database that are needed for plotting the requested diagrams. Signal files are retrieved, parsed, and the raw data are extracted (Figure 19).

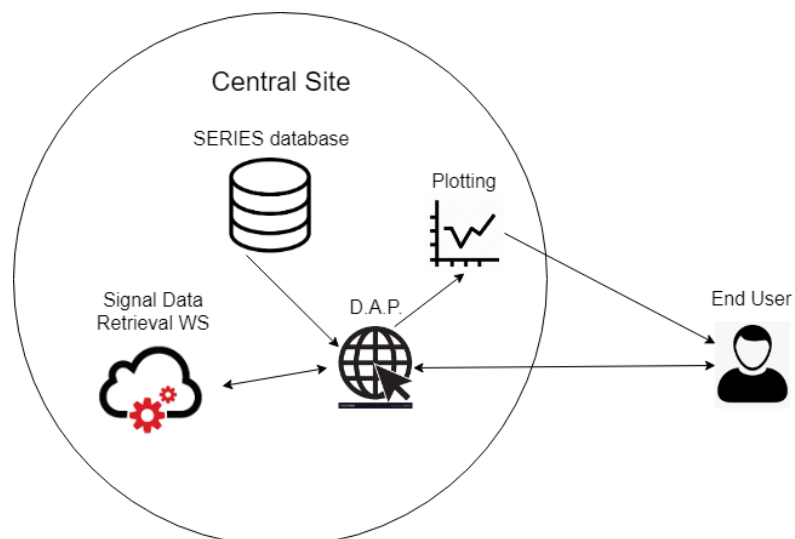


Figure 19. Signal retrieval and plotting

For the “Force and Displacement” type of diagram, which was the pilot functionality of the “Workspace”, the implementation process was simple. The other types of diagrams required a more

significant intervention, since the computation to estimate the values of these diagrams is performed by MATLAB functions. By employing the MATLAB Compiler SDK (Figure 19Figure 20), these computation functions are packaged in order to be imported in the .NET application (Figure 21). Once this package was imported, the .NET SERIES DAP application can execute the MATLAB functions, receive the computation result and plot the resulting data.

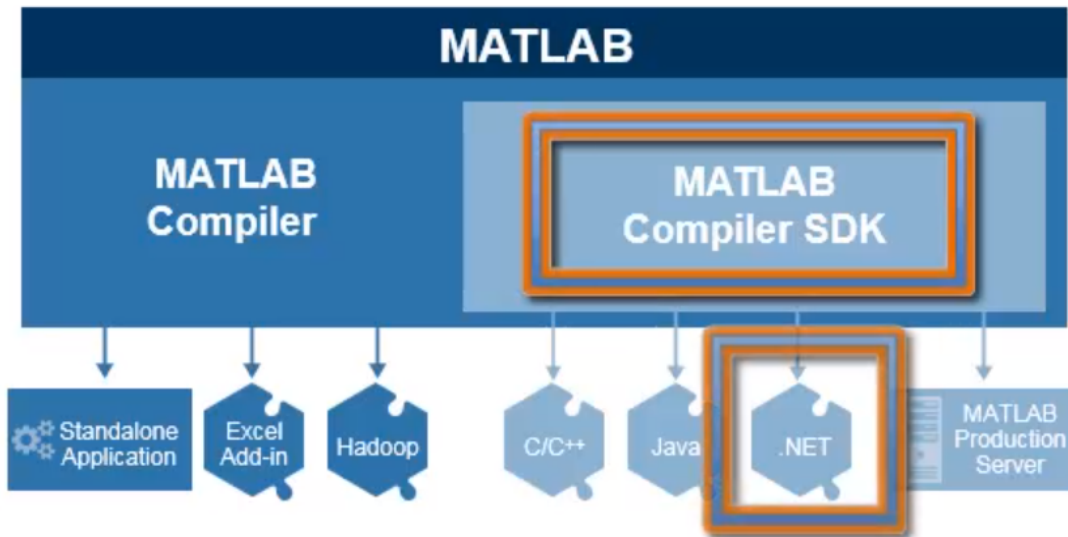


Figure 20. The MATLAB Compiler SDK creates .NET application package



Figure 21. The process needed to import the MATLAB data in the .NET application

Additionally, the downloadable items from each partner were not raw data, ready to be used. Specifically, the download URLs that were used at the Central Site are pointing to files that either are in the csv format or each file contains a single column of data (so-called 'bin' files).

The Workspace tool has been reviewed internally, by partners of the SERIES consortium, in close cooperation between the development team and domain experts, who provided both the calculation

modules and feedback on the correctness of the calculated quantities and diagrams. Informal evaluations of the Workspace UI have been conducted incrementally, during the development cycle.

4 Summary and conclusions

The present Deliverable describes the activities that have been undertaken for the maintenance and the upgrade of the SERIES Central Site together with the relevant systems and subsystems.

The work described in this deliverable concerns either tasks relating to maintenance and interoperability with other systems (Section 2) or the upgrade and modernization of the SERIES Data Access Portal (Section 3).

As for the former, specialized Celestina Data Viewer nodes (CDV nodes) can now be integrated with the SERIES system, thus increasing the prospects of SERIES Central Site as a long term hub for data exchange within the Seismic Engineering Community. In turn, the SERIES Central Site can also be integrated with EPOS, which brings together a wider scope of scientists and organizations active in the sciences of solid Earth. Finally, the operation of the SERIES Central Site required maintenance tasks, scheduled or unscheduled, that needed to be carried out in order to keep the infrastructure operational.

As for the latter, the SERIES Data Access Portal interface has been overhauled, along two axes, (a) to modernize and upgrade the underlying technical infrastructure and, simultaneously, to adhere to modern user expectations, like responsive layouts, and (b) to be conservative in the redesign of the user workflow, i.e. to not interfere with user interaction paradigms used in the original design of the SERIES DAP, so as to not disrupt the expectations of experienced users of the DAP. Additionally, the SERIES DAP was extended with a major functionality upgrade in the form of the Workspace tool, which allows the end users to perform and plot a number of calculations based on the signals that are shared in the SERIES Central Site.

The upgrades in the SERIES DAP user interface and the Workspace tool have been reviewed by partners of the SERIES consortium and their feedback has been taken into consideration during the maintenance and upgrade works.

5 References

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Glossary

CDV: Celestina Data Viewer

EPOS: European Plate Observation System

EPOS-ICS-C: EPOS Integrated Core Services - Central

SERIES: Seismic Engineering Research Infrastructures for European Synergies

SERIES DAP: SERIES Data Access Portal

SERIES EDF: SERIES Exchange Data Format

SSH: Secure shell

SCP: Secure copy

TCS: Thematic Core Services

