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| **Task 2.3 report - eArchiving**  **Ferran Abarca Peris (University of Barcelona)**  **Domingo Iglesias (University of Barcelona)**  **Pilar Romera (University of Barcelona)**  15/07/2023 |
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# 1. Introduction

CEF (Connecting Europe Facility) eArchiving is a set of tools, specifications, software, and documentation aimed at the establishment of data preservation infrastructures. The aim is to keep large amounts of digital documents, records and data accessible and reusable for long periods of time, regardless of the system used to store it, facilitating the migration to future technologies[[1]](#footnote-0).

EDSSI L1 determined at the time that CEF eArchiving was not yet necessary due to the absence of any document, record or data that needed to be preserved in the long term in the Erasmus student exchange programme. In EDSSI L2 though and, after a careful analysis of some of the processes that take place in the framework of the Erasmus student exchange programme, it has been considered that there are documents and information that may need to be preserved for the future, such as, for example, transcripts of records or the Online Learning Agreement (OLA).

In order to test eArchiving features, activity 2.3 will not work on actual Online Learning Agreement for the proof of concept itself but will work with electronically signed documents (that will emulate an actual OLA and its characteristics) under eIDAS (Electronic Identification, Authentication and Trust Services) specifications. This will also link activity 2.3 with activity 2.2 of the project.

Thus, in the framework of the EDSSI L2 project, activity 2.3 consists of learning more about the CEF eArchiving, know which components are part of the system, which requirements and technical elements are necessary for its implementation and which human resources are needed, as well as determining, through a proof of concept, how useful it can be within the framework of the consolidation and expansion of the Erasmus+ infrastructure.

# 2. About CEF eArchiving and activity 2.3

*Important information should be kept accessible and reusable for years to come, regardless of the system used to store it. eArchiving provides core specifications, software, training and knowledge to help people preserve and reuse information over the long-term[[2]](#footnote-1).*

Following EDSSI L1 conclusions, the EDSSI L2 project proposed to move forward exploring the tools available for long term preservation of data, documents and records and will be running a pilot test of the software provided by CEF eArchiving itself (RODA).

For that purpose, the EDSSI L2 project has identified a suitable use case for testing the eArchive software: OLA (Online Learning Agreement). This document seems to be a candidate to test eArchive building block specifications and become an archive record which will need to be preserved long into the future. Moreover, OLA will be digitally signed using the e-signature solution defined in activity 2.2.

After a first general analysis, we have identified 3 major requirements on a EDSSI eArchive Building Block service:

* Useful: keep documents available, accessible and authentic over time
* Plug and play: Should be easy to install and start working with.
* Connectivity: Web services should be available

These are the high-level requirement and are detailed below:

1. **Useful to keep documents available, accessible and authentic over time.** eArchive service must be able to keep information, data and records for the long term.

For testing purposes we will be using RODA[[3]](#footnote-2), an open-source digital repository designed for preservation and the tool the members of the eARK consortium[[4]](#footnote-3) pointed us in order to check eArchive building block specifications applied on a piece of software.

RODA ensures that it is able to keep the documents valid over time. It also specifies that it has functionalities that allow format migration, maintenance of document integrity, virus checking, among others. We will check these and other features.

1. **Plug and play.** eArchive service should be easy to install and use.

In order to check its “plug and play” functionalities we will be installing and running RODA software locally at the University of Barcelona. We will also install it in a Microsoft Azure Cloud in order to deploy an image in the Azure Container and carry out deeper tests.

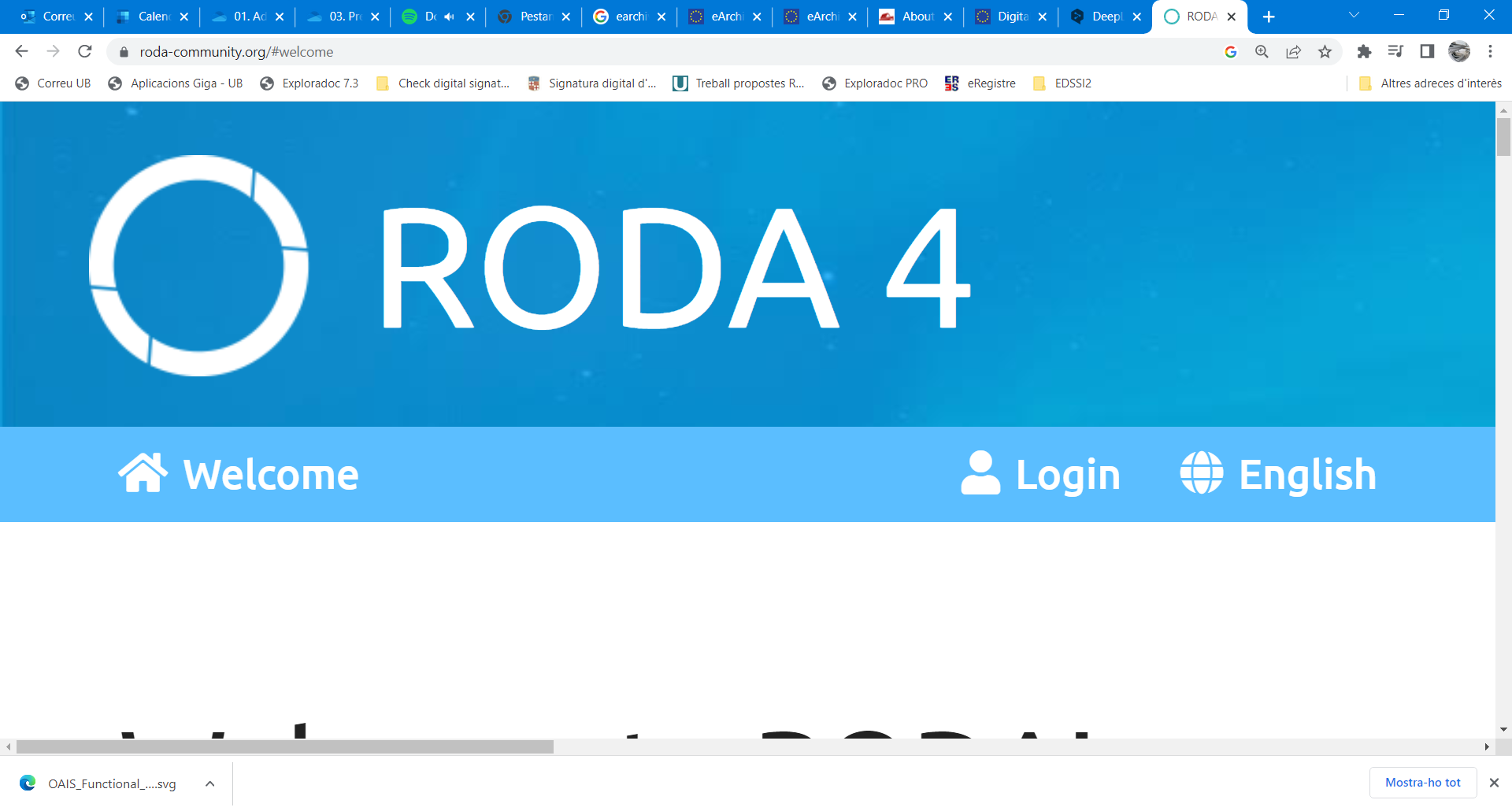
1. **Connectivity: Web Services**. eArchive service should have web services available.

Connectivity between applications is essential. Being able to connect other pieces of software (the ones producing documents and records) to the archiving solution may allow the document flow to be integrated in an automated way allowing little to none human intervention in the archiving process.

## 2.1 About RODA and RODA-in

RODA is an open-source digital repository designed for preservation that delivers functionality for all the main units of the OAIS reference model. It is capable of ingesting, managing and providing access to the various types of digital objects produced by large corporations or public bodies[[5]](#footnote-4). RODA is at the time of this report in its fourth version.

RODA is based on open-source technologies and is supported by existing standards such as the Metadata Encoding and Transmission Standard (METS), Encoded Archival Description (EAD), Dublin Core (DC) and PREMIS (Preservation Metadata).



As stated, RODA is based on ISO 14721:2012 OAIS model (Open Archival Information System) and, among other specifications and functionalities, includes the ones for generating:

- SIP (submissions information packages)

- AIP (Archival information packages)

- DIP (Dissemination information packages)

These packages are the core of the OAIS system and allow users to generate valid packages and metadata vocabularies that allows, not only to send ready-described documents into the system but also to classify, manage and retrieve them over time.

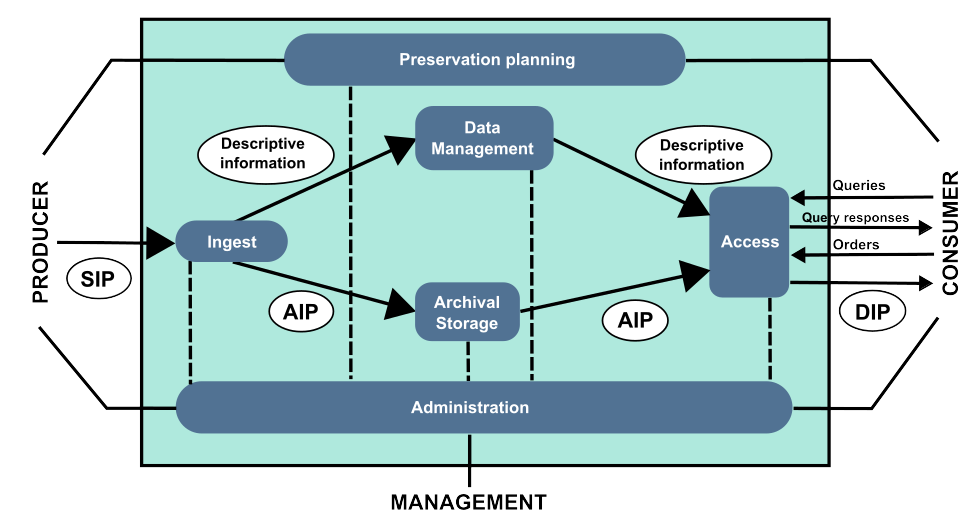


Figure 01. RODA general architecture[[6]](#footnote-5)

According to the information available, RODA comes within RODA-in, a separate piece of software ready to use that helps create SIP ready to be submitted to an Open Archival Information System (OAIS). The tool creates SIPs from files and folders available on the local file system[[7]](#footnote-6). The tool includes features such as:

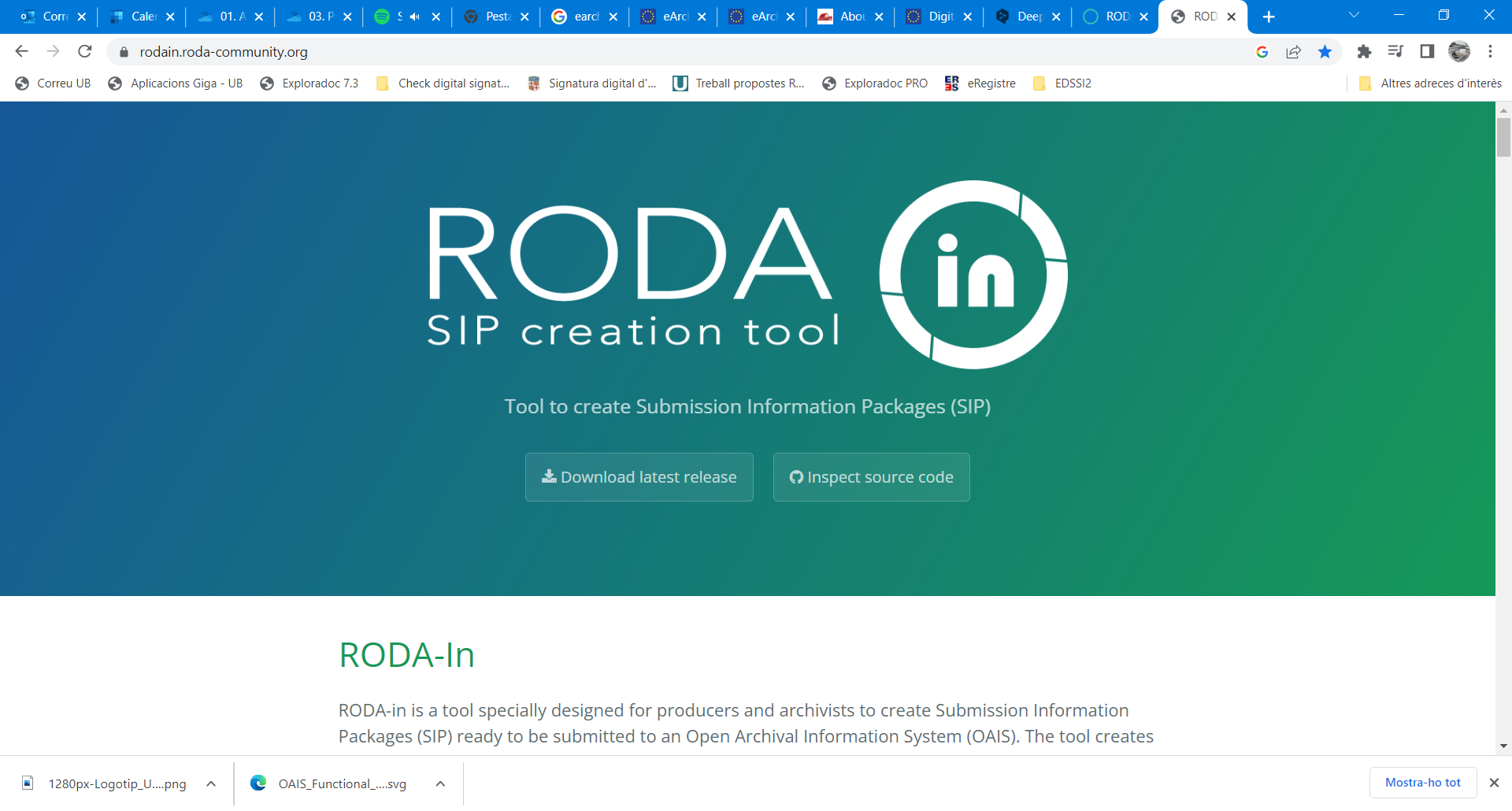
- Create, load and edit classification schemes

- Automatic association of files/folders to SIP

- Automatic association of metadata to SIP

- Definition of metadata templates

- Support for various metadata formats (EAD, DC, etc.)



Full details of RODA, RODA-in and the components of an OAIS system may be found on the official webpages and documentation listed in the bibliography of this report.

# 3. Task 2.3 phases

Activity 2.3 was divided into 3 phases over 10 months:

- Prototyping phase (M13-16)

- Proof of concept phase (M17-20)

- Report phase (M20-23)

The phases as a whole had to allow us to establish the necessary knowledge to understand and test the CEF eArchiving as well as to answer the big question:

**- Can we use eArchiving to guarantee long term preservation of documents and records?**

## 3.1 Prototyping phase – M13 / M16

The prototyping phase started by gathering information about CEF eArchiving. After contacting the CEF earchiving project managers we found out that the eArchiving Building Block is based on the outcomes of the E-ARK project (2014-2017) that piloted an end-to-end OAIS compliant e-archival service.

The OAIS (Open Archival Information System) is an archive system described on the Magenta book of the CSDS (The Consultative Committee for Space Data Systems) which, later on, became an International Standard: ISO 14721:2015

CEF eArchiving project managers provided additional information and guided us through to up-to-date information (information on CEF website was no longer updated). Finally, pointed us to the RODA solution and its Github repositories.

With all the information gathered, the prototyping phase pushed us to increase the list of questions we wanted to answer to the following:

**1**. Can we use it to guarantee long term preservation of documents and records?

**2**. Can we keep the integrity of digitally signed documents?

**3**. How can Higher Education Institutions (HEI) use it?

**4**. Can we automate the use of the solution (web services?)

In order to answer those questions a tighter calendar was defined, resources were made available and digitally signed documents (according to eIDAS) provided.

## 3.2 Proof of concept phase

The proof-of-concept phase was the most intense and forced us to tighten the initially defined schedule. In this phase it was necessary to deploy the software (RODA and RODA-in), check that everything worked correctly, define some of the archival elements of the University of Barcelona Records Management system into RODA (classification table, metadata vocabulary, etc.) and finally launching the tests to answer our questions.

### 3.2.1 Installation phase

In the installation phase we run 3 different types installations:

**RODA – Demo online** - preliminary tests (information sent is deleted after a short period of time)

RODA community offers a very useful online version of the software[[8]](#footnote-7) to start getting closer to the system. We took the first steps with this demo version and were able to test some of the functionalities it offers. Unfortunately, the online version deletes the data entered when logging out, which forced us to redefine all the archival elements in the system and re-generate and re-send the SIP packets to continue with the proof of concept tests. At this point, we considered the option of the desktop application.

**RODA – Installed locally** - deeper tests and exploration. Limited availability

The latest (and previous) versions of RODA can be downloaded from Github[[9]](#footnote-8) and deployed in a local docker installation. This is a very important element to keep in mind because the latest version of the tool is always available. It also allows it to be used in multiple ways. We initially chose to install it on a local desktop computer. This step forward allowed us to have a dedicated computer for testing purposes and, at the same time, overcame the disadvantage of the online demo version.

So we initially did most of our testing in this environment but it quickly became too small again. This time not because we did not have all the options available but because it limited us to work from a single station, which did not allow us to share the progress made with other colleagues in the project in real time nor online.

The next step was to decide to deploy RODA in the cloud so that we could work online, in a single environment and allowing us to create multiple users.

**RODA – Installed on Azure cloud** – production environment for task 2.3

The RODA cloud installation was the production installation for the project. It allowed us not only to perform all the necessary proof of concept tests but also to have an online environment that allowed us to show the tool in real time at the Venice and Berlin conferences.

We used Microsoft cloud to deploy Roda in Azure Containers. We needed to solve some challenges about how to handle persistence in a cloud environment and, also, with versions of Solr and Zookeeper services packaged within different versions of Roda. We finally got installed version 4.3.1.

The final deployment was done with the previous version of RODA and this did work and continues to work correctly maintaining all its features and functions.

**RODA-in** – Installed locally for SIP (submission information packages) creation

RODA-in is not an essential piece of software for working with RODA but its use makes it infinitely easier to generate the SIP packets necessary for ingesting documents into the OAIS-RODA system. Its installation is very simple and fast through an executable file. Each user can have his RODA-in on the local desktop computer and generate the packets easily.

## 3.2 Parametrization phase

Once RODA has been installed (in any of the modes described above), it is time to define some archival parameters. The main one is to create an entity, an authority record, on which the institution's documentary collections will depend. Here one institution may differ from the other, but the tool is perfectly suited to ensure that all the elements that archival science has defined in its theoretical models are available. In this way we can create document collections and document series from which the files, documents and records produced by the different administrative procedures will be described and archived.

Once the authority record has been defined, archivists also have the possibility to define a File Plan. Depending on the archival tradition used, different definitions of a File Plan can be found. For this report we will use the one that refers to a File Plan as a hierarchical and logical structure of the records that reflects the functions that generate the creation or receipt of documents. So, a file plan is a tool for the institution to help manage records. It is a roadmap, listing different records maintained by the institution, where and how they are stored, and how long they are to be kept. A comprehensive office file plan provides a location for every record in an electronic (or paper) filing system.

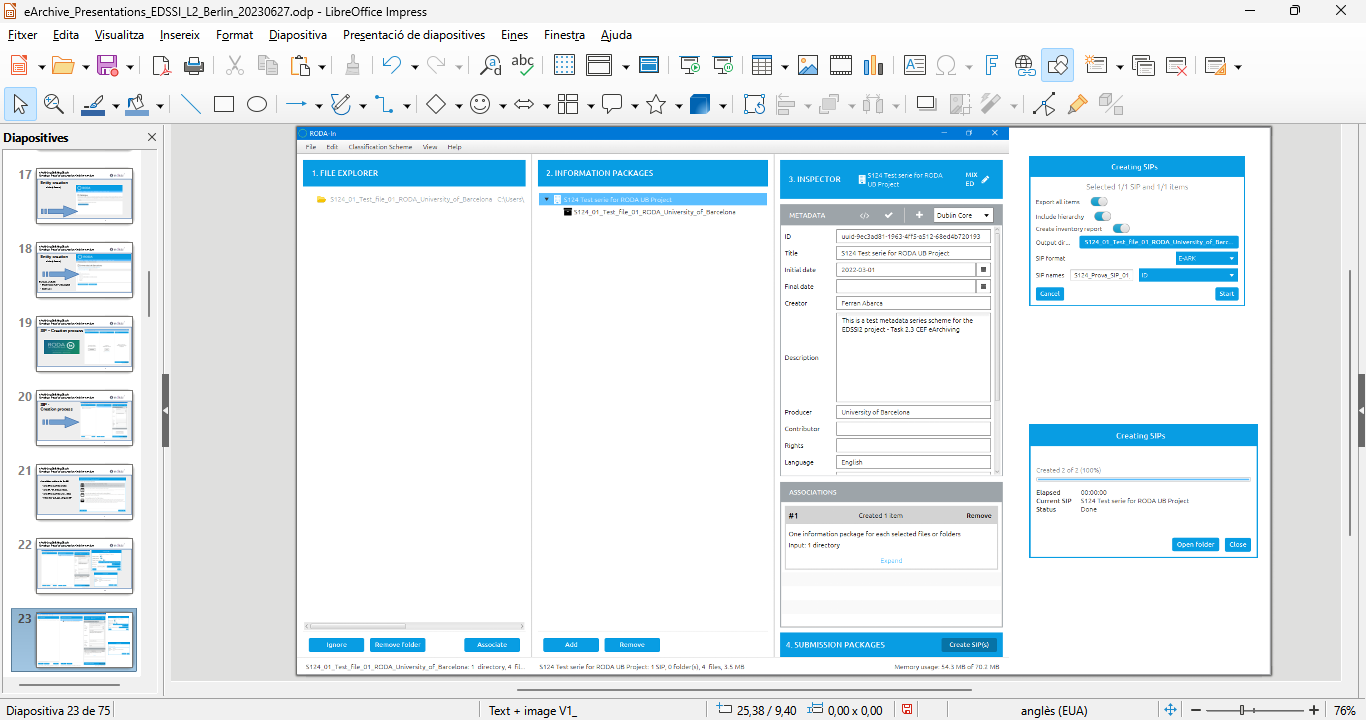
Last but not least we must define a metadata vocabulary. This, together with the authority Record and the File Plan will configure the set of main elements of archival description that will allow us to manage and retrieve documents in eArchiving. RODA provides a variety of vocabulary standards such as METS, Dublin Core, EAD, etc.)

## 3.3 Testing phase

Once all the technological and archival elements were in place, it was time to start the proof of concept testing. For this we generated Online Learning Agreement (OLA) files. Basically we created documents that emulated an OLA and digitally signed them with a qualified signature according to the eIDAS standard. We also added some not digitally signed documents to the files in order to check differences once uploaded into the system.

### 3.3.1 RODA-IN SIP generation

In order to upload documents to RODA we need to generate SIP (submission information packages). This is where we use the RODA-IN tool. The generation of such packages with this tool is not difficult but requires basic archival knowledge. Once acquired, the generation of SIP packages is not a difficult or time-consuming activity.

Figure 02. RODA-IN SIP generation process 

### 3.3.2 Transfer and ingest processes

Once the SIP is generated we can proceed with the ingest transfer (upload files into the system) and then proceed with the ingest into the repository. If the definition of the metadata vocabulary has been correct and the SIP package meets all the established requirements (for example we can make it check certain file formats or look for viruses, etc.) the system will return a message informing us if the upload has been done correctly or if it has found any errors.

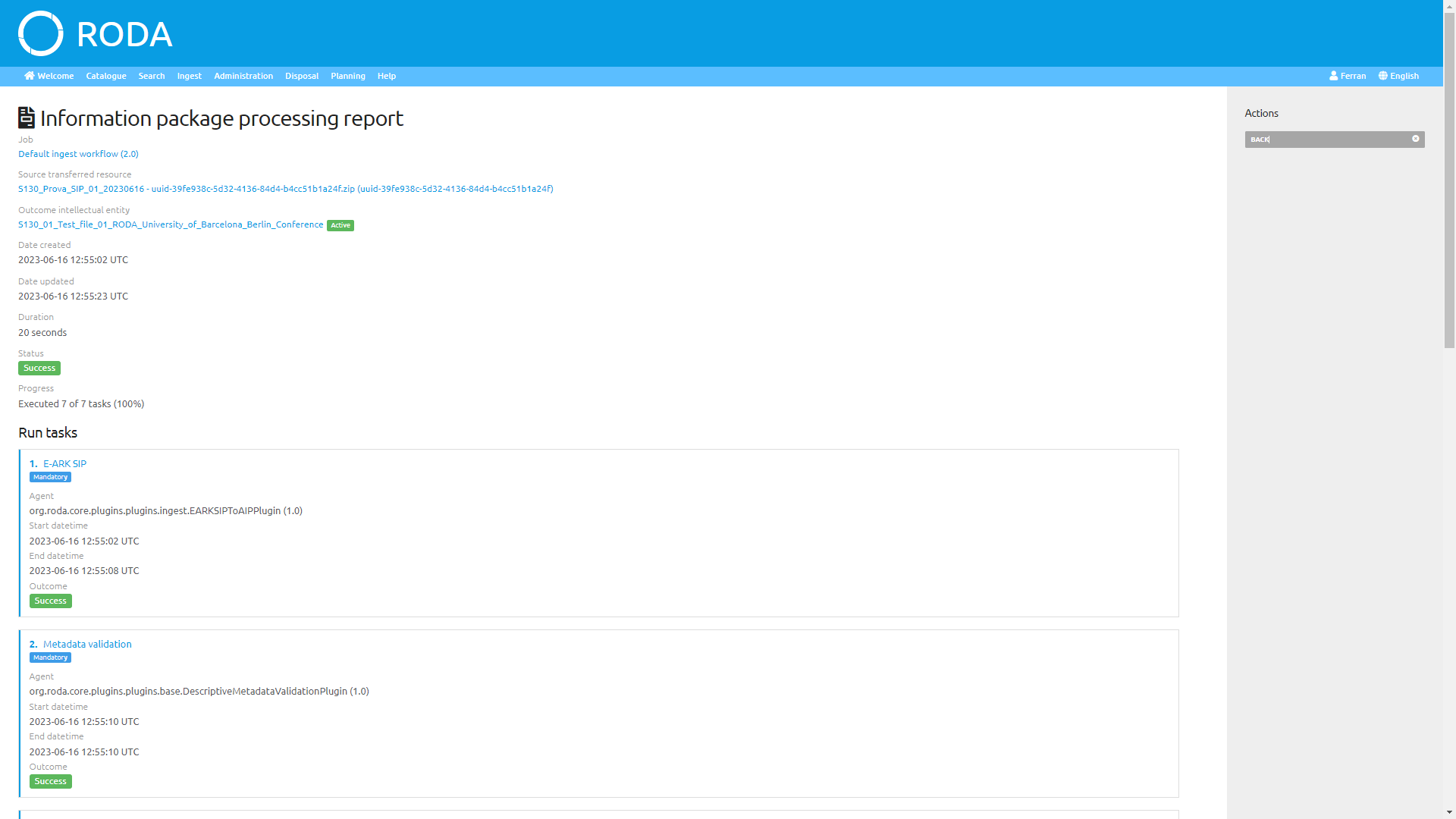


Figure 03. RODA transfer and ingest process

Once the SIP package is correctly loaded into the system is the time when we can start performing actions on it. We can now retrieve the files, records and documents (even view them from RODA itself if they are in pdf format), download them through a DIP (dissemination information package) or manage them through disposition policies as well as activate preservation actions.

At this point we’d like to point out that RODA performs a Checksum on the ingest process. This will later on allow us to check this checksum and determine if there has been any change since the package entered into the system (and thus guarantee the documentary integrity of the documents).

### 3.3.3 Preservation actions module

Preservation actions are tasks performed on the contents of the repository that aim to enhance the accessibility of archived files or to mitigate digital preservation risks.

- Preservation actions include format conversions, checksum verifications, reporting (e.g. to automatically send SIP acceptance/rejection emails), virus checks, etc.

- Within RODA, preservation actions are handled by a job execution module

- The job execution module allows the repository manager to run actions over a given set of data (AIPs, representations or files)

The preservation actions are divided into 6 categories which contain more than 30 different actions. Categories:

* Validation processes
* Management processes
* Format identification processes
* Risk management processes
* Reindex processes
* Characterization

One of the questions we asked ourselves at the beginning of the project was whether eArchiving **could ensure the integrity of the documents** that are deposited in the system. In order to check that functionality, we have tested the function: **Fixity information computation process**. The process runs a Secure Hashing Algorithm – SHA256 in any AIP (Archival Information package) and allows us, through a checksum verification feature, to know if it has been modified.

If this function works we may guarantee integrity documents and records (regardless if the digital signature has expired or not).

From the tests we learned that in order to check the integrity of an AIP, two processes had to be run. First one is the Fixity information computation process (in order to generate a new checksum) and then followed by a **Risk Management: AIP corruption risk assessment action**.

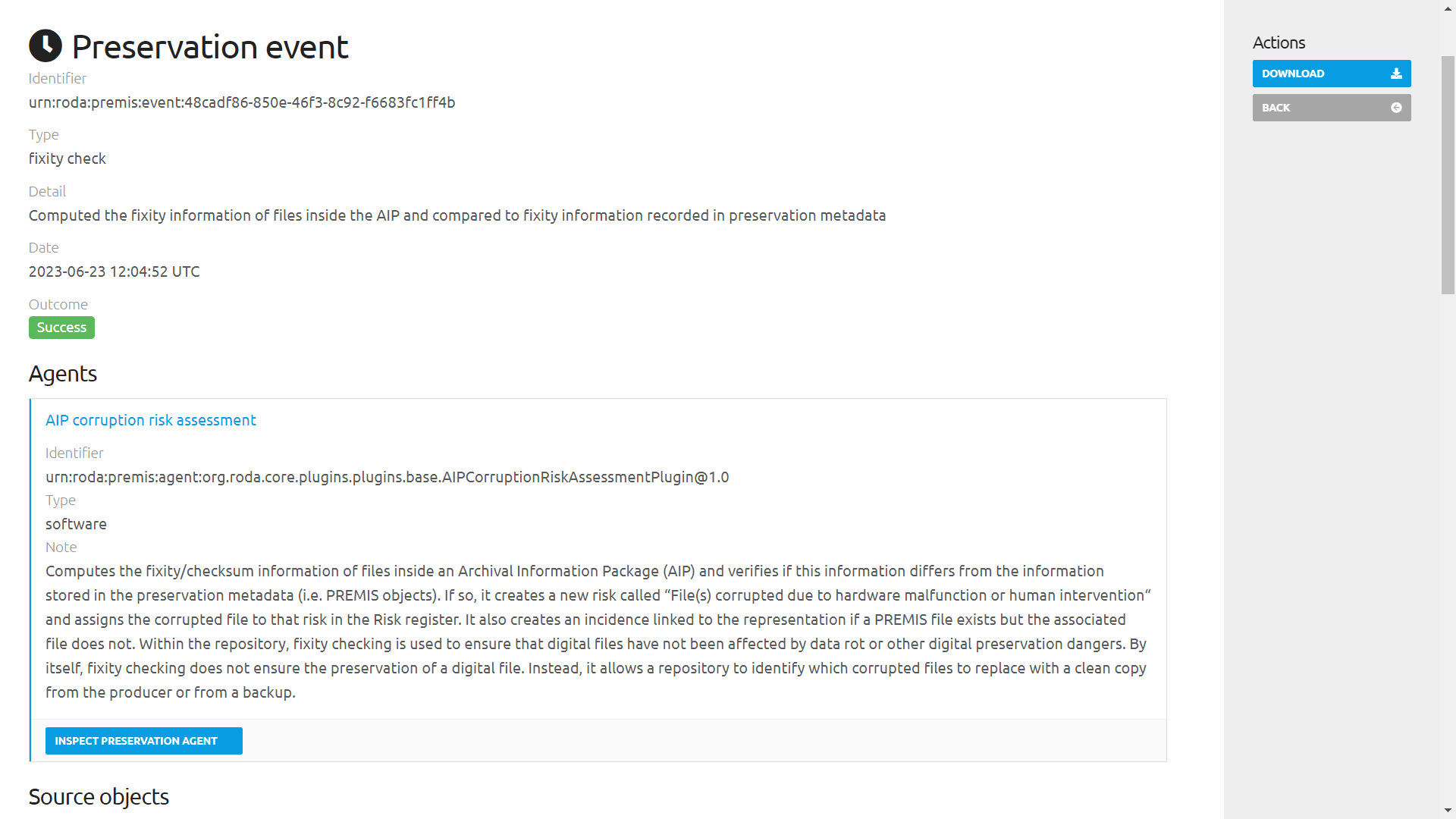


Figure 04. RODA preservation action

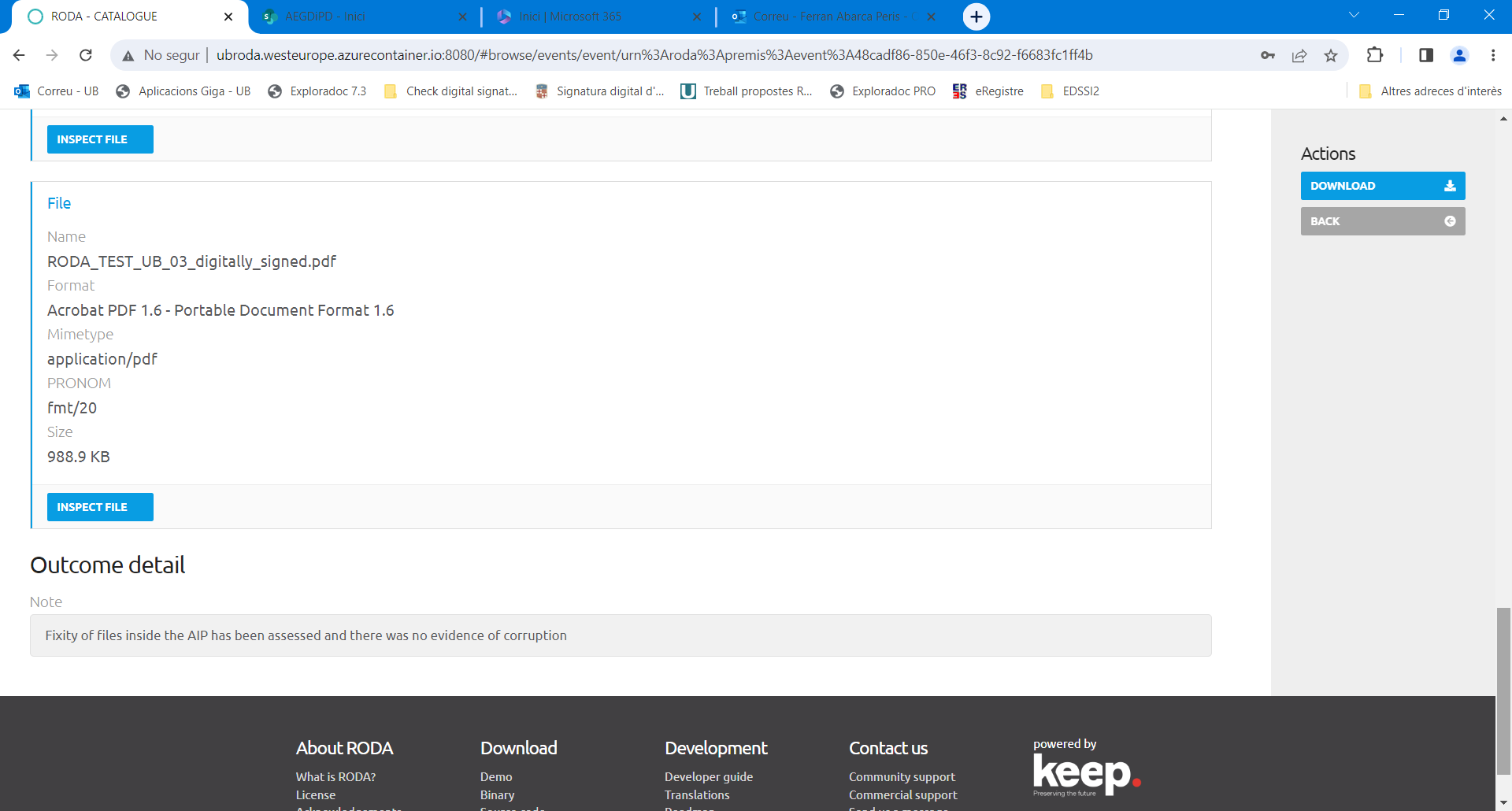


Figure 05. RODA preservation action report

“Fixity of files inside the AIP has been assessed and there was no evidence of corruption”

After running some test on this function we concluded:

1. File fixity information (also known as checksum) runs for all data files within an AIP, representation or file and stores this information in PREMIS objects within the corresponding entity.

2. This task uses SHA-256 as the default checksum algorithm (other algorithms can be configured in “roda-core.properties” if needed)

3. File fixity is the property of a digital file being fixed, or unchanged –> “AIP corruption risk assessment” is the process of validating that a file has not changed or been altered from a previous state.

4. File fixity can be used to check AIP integrity and thus make sure no modifications or alterations have been made since the information entered into the system.

### 3.3.4 Disposal policies module

Disposal of records does not always mean destruction.

Traditionally (hard copies), disposal policies may include transfer to a historical archive but disposal also applies to digital records (and transfer them to digital archives), not only due to the need to keep some information for the years to come but also for security or transparency reasons.

Public entities may also need to be authorized by law, statute, regulation, or operating procedure, and the records should be disposed of with care to avoid inadvertent disclosure of information.

The process needs to be well-documented, starting with a records retention schedule and policies and procedures that have been approved at the highest level. An inventory of the records disposed of should be maintained, including certification that they have been destroyed. Records should never simply be discarded as refuse. In order to comply, RODA has 3 retention policies available:

* Retain permanently
* Review at the end of the retention period
* Destroy at the end of the retention period

In order to use any of these policies a retention schedule has to be created. You can create as many retention schedules you need for the records stored in RODA. Once the schedule is created a retention policy can be linked and applied to the records stored into the system.

Disposal holds can be created in order to prevent some records from being disposed of by a retention policy. This is useful when some specific files contained in a collection may apply a different policy for a period of time.

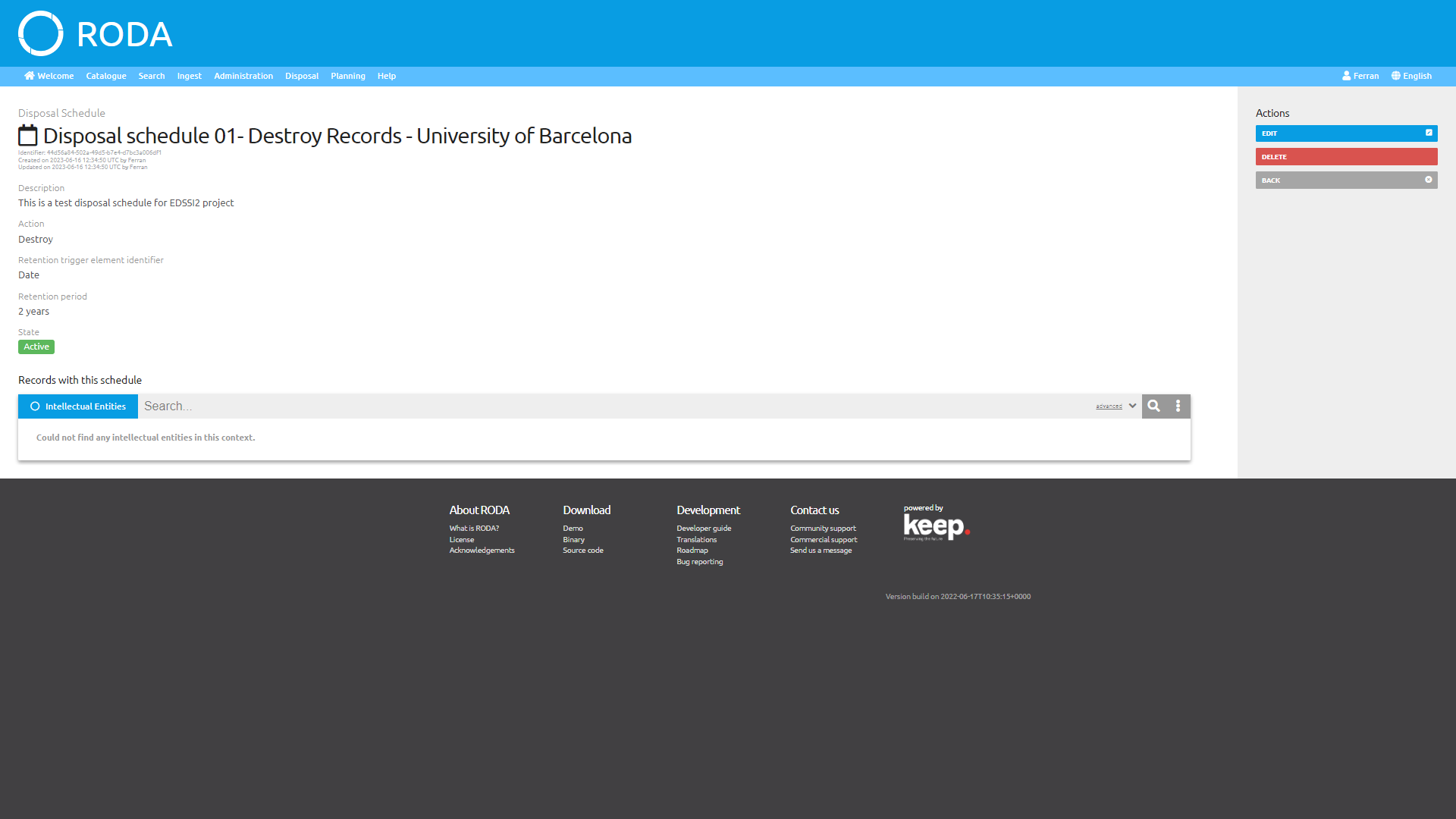


Figure 06. RODA Retention schedule example

The disposal module completes one of the core functions of a given records management system allowing users to dispose of information in accordance with any legislation in force on document management, access to information and data protection.

# 4. Technical and functional report

## 4.1 Technical report

Roda is a software ready to use, as it is packaged in a docker image, and can be easily deployed both in a desktop environment or in the cloud. There is also a Roda Enterprise version[[10]](#footnote-9) (not tested in the scope of this project).

From a technical point of view, the cloud installation requires certain considerations and elements to be taken into account. At the date of this report it was impossible to deploy the latest version in an Azure Cloud container. For the purposes of the project we were able to deploy the previous version (Version 4.3.1) perfectly and perform all the tests we wanted to carry out.

Also related to the technical aspect, we had to take into account the additional costs of a cloud deployment. Costs that disappear in a local installation or on the institution's own servers. Each institution can evaluate the pros and cons of each of the deployments but the tool is prepared to support any of them.

At the level of web services. Through the information available on Github we found the technical specifications to be able to develop and connect data production systems. The aim of the project though was not so much to make use of them as to find out about their existence. These web services can be of help to implement automated packet transfer systems between applications. With this in mind it would be interesting to link, via these web services, OLA Portal with eArchiving. With this association of components, this administrative management tool of the Erasmus programme would be able to work with a definitive archiving tool that would guarantee the preservation of data, documents and information for the future. This, in turn, would help to make it extensible to other tools and software applications, thus extending its use.

## 4.2 Functional report

So far we have seen what RODA is, what technological requirements are necessary and what elements need to be defined for the proper functioning of the system.

RODA is a tool created by and for archivists and they play a fundamental role, not only in the implementation of electronic document management systems in organizations, but also because they are the experts in providing the necessary information and knowledge to establish how to organize the information and data generated by administrative processes and what information is important for the future and what is the best way to preserve it and keep it accessible.

In this sense, for RODA to work, the active intervention of archival professionals is compulsory. They have to define in RODA the core elements of any document management system such as the institutional Classification Scheme or the institutional Metadata Vocabulary. These two elements are the cornerstone for understanding the context in which an organisation's information is created, but at the same time they play a fundamental role for retrieving information purposes as well as for making this information quickly accessible.

It is also archivists who can determine the disposition policies for such data and documents, ensuring that they are preserved for as long as is strictly necessary. At the same time, they are the specialists in ensuring that such information will be accessible over time, updating formats when necessary.

The use of RODA is therefore a team effort between the functional business staff, the IT teams and the document and data management experts, the archivists. The institution that wants to benefit from this tool will need to create multidisciplinary teams that work side by side in its implementation.

So, after carrying out the proof of concept tests, and in view of the results obtained, we can answer the four initial questions of activity 2.3:

**1. Can we use it to guarantee long term preservation of documents and records?**

Yes, CEF eArchiving is a real solution for long term preservation purposes of information, data, documents and records.

**2. Can we keep integrity of digitally signed documents?**

Yes, using File fixity feature alongside AIP corruption risk assessment we can guarantee that a document / records has not been modified while stored in the system

**3. How Higher Education Institutions (HEI) can use it?**

Yes, by downloading and installing RODA, which is a ready made software solution compliant with international standards that can be used “out of the box”

**4. Can we automate the use of the solution (web services?)**

Yes, RODA has the possibility to develop external services and integrate other applications with the repository (connect OLA portal and RODA) through its REST API functionalities.

# 5. Conclusions

CEF eArchiving (RODA) is an impressive piece of software that covers the final phase of document management systems. Any document management system must cover from the beginning to the end of the generation of information and documents. Not only is it necessary to keep documents accessible, intact, authentic and reliable in the administrative phase, but it is often necessary for some of these documents to be accessible for long periods of time. eArchiving provides us with this ability and allows us to be sure that what we retrieve has not been altered or modified. This functionality is of vital importance for the transparency of organizations but also useful to ensure the highest standards of democracy when we apply it at the governmental and public service levels.

In this sense, using eArchiving in the Erasmus+ environment would only be beneficial. On the one hand we could all benefit from the same tool and have at our disposal a final and reliable electronic archive that would guarantee that no important information could be lost in time. A tool that facilitates the work, not only to the staff of the organizations that use it, but also to the end users (in this case the students of the Erasmus program). On the other hand, we would be contributing to the deployment of tools provided by the projects promoted by the European Commission that can revert to all the members of the union and, finally, due to the characteristics of eArchiving, promoting higher levels of democracy and administrative transparency.

A final thought that we cannot avoid making is that if a single installation of RODA at the European Union level was available it would allow to go a step further in this project and provide a single electronic archive of the European Union. This single installation would avoid the creation of multiple RODAs that would eventually be difficult (if necessary) to connect with each other. This would help to raise awareness of the tool, standardize ways of working and optimize resources.

In this regard, perhaps a pilot test at the university level would be a good scenario that would allow to determine if having the Union archive would be beneficial in the long run.

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