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## Revision History

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<th>Revision</th>
<th>Date</th>
<th>Author</th>
<th>Organisation</th>
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<td>2Culture</td>
<td>Integration of peer review comments</td>
</tr>
</tbody>
</table>
LoCloud

Table of contents

1. Executive summary ........................................................................................................ 5
2. Introduction ....................................................................................................................... 8
   2.1. Objectives .................................................................................................................. 8
3. Methodology ..................................................................................................................... 10
   3.1. Europeana context .................................................................................................... 10
   3.2. Impact framework .................................................................................................... 11
4. Evaluating the infrastructure and services .................................................................... 13
   4.1. Evaluation approach ............................................................................................... 13
   4.2. Overview of LoCloud infrastructure and services ..................................................... 15
      4.2.1. Infrastructure: MORe, MINT and LoCloud Collections .................................... 15
      4.2.2. LoCloud enrichment microservices ................................................................... 17
      4.2.3. LoCloud metadata capture micro-services ....................................................... 19
      4.2.4. Support portal and help desk ........................................................................... 22
   4.3. Findings of the evaluation ......................................................................................... 23
      4.3.1. Relevance .......................................................................................................... 23
      4.3.2. Effectiveness ...................................................................................................... 26
      4.3.3. Efficiency ........................................................................................................... 27
5. Evaluation of content ....................................................................................................... 29
   5.1. Overview of LoCloud content providers ................................................................ 29
   5.2. Cultural institutions providing content ..................................................................... 31
   5.3. Geographic coverage of the content ........................................................................ 35
   5.4. Digital types ............................................................................................................ 36
   5.5. Subject matter of the content .................................................................................. 37
   5.6. Findings of the evaluation ......................................................................................... 40
6. Outcomes and Impact ...................................................................................................... 41
   6.1. Innovating the Metadata Aggregation infrastructure ................................................. 41
      6.1.1. Support for standard metadata schemas ............................................................ 41
      6.1.2. Contributing to the development of EDM .......................................................... 42
   6.2. Take up of LoCloud Services by others .................................................................... 43
      6.2.1. Implementations of MORe .............................................................................. 43
      6.2.2. Integration of the Vocabulary Service in the DISMARC platform ..................... 44
      6.2.3. Use of the Geocoding micro-service in the Sultanate of Oman ......................... 47
      6.2.4. Adoption of LoCloud Collections .................................................................... 49
   6.3. Impact on Content partners’ system development ..................................................... 51
   6.4. Metadata Quality ..................................................................................................... 52
      6.4.1. Increasing the availability of controlled vocabularies in SKOS ......................... 52
      6.4.2. Case study: Historic place names in Lithuania .................................................... 53
      6.4.3. Europeana Task Force on Enrichment and Evaluation .................................... 55
   6.5. Support and facilitation ............................................................................................. 56
      6.5.1. Staff development and use of the LoCloud online courses ................................. 57
      6.5.2. Case study: Technical training and support in Romania ..................................... 57
      6.5.3. Balkan workshops ............................................................................................. 58
      6.5.4. Training for volunteers ...................................................................................... 59
   6.6. Access to local content .............................................................................................. 60
      6.6.1. Case study: participation by local institutions in Gironde, France ..................... 60

D5.2 Operational outcomes and impact on Europeana 3
6.6.2. Case study: local institutions in Umbria, Italy .......................... 61
6.6.3. Case study: involving small institutions in Ireland ......................... 62
6.7. Access and participation ...................................................................... 65
6.7.1. Crowd Sourcing: RSAI Lantern Slide collection, Ireland .................. 65
6.7.2. New exhibitions ................................................................................. 66
6.7.3. Putting culture on the map: eCultureMap ....................................... 67
7. Sustainability ............................................................................................ 68
7.1. General and business-related outcomes .............................................. 68
7.1.1. Outlook ............................................................................................ 71
8. Conclusions .............................................................................................. 72

References .................................................................................................... 74

Annex 1 – Survey of IaaS and SaaS infrastructure: summary of responses ...... 76
PART 1: Evaluation of general and business-related outcomes ...................... 76
PART 2: Evaluation of technical outcomes and pricing aspects ..................... 96
1. Executive summary

LoCloud, funded under the European Commission’s CIP ICT PSP programme, has the overall goal of supporting small and medium-sized institutions in making their content and metadata available to Europeana by exploring the potential of cloud computing technologies. The project has provided a series of services which aim to help reduce the technical, semantic and skills barriers faced by smaller institutions, which typically have limited access to either IT infrastructure or staff with the requisite skills in digital libraries.

This report looks at the operational outcomes and impact of LoCloud on Europeana and its network of content partners.

The operational outcomes of LoCloud include:

- Europeana-oriented metadata ingestion, transformation and aggregation services comprising of MINT and MORe;
- A suite of tested and evaluated micro-services available in the cloud including:
  - Geolocation enrichment services
  - Vocabulary services
  - Vocabulary matching and background linking services
  - Historic place names service
  - Wikimedia application
  - Crawler ready tagging tools
- A light weight digital library service, LoCloud Collections, which is dedicated to the requirements of smaller and local institutions without infrastructural support;
- A support portal providing access to documentation and online training courses;
- The addition of over four million digitized items to Europeana relating to the local cultural heritage.

Section 3 of this report describes the approach taken in evaluating the operational outcomes of LoCloud in the Europeana context. The impact framework developed for this report maps the outcomes of Europeana against Europeana’s vision and the challenges that it has identified.

Section 4 describes the evaluation of the infrastructure and services developed in LoCloud. The approach taken was to assess the development of each service against set criteria. The findings present an overview of the development process, usage possibilities and the beneficiaries of the individual services.

Section 5 provides an evaluation of the content that is being provided to Europeana by LoCloud’s partners. It provides an analysis of the sources of the
content underlining the importance of archives amongst LoCloud’s partner group and revealing some surprises, such as the number of church archives providing content to Europeana.

Section 6 explores the project’s impact:

- Contributing to Europeana’s goal of innovating the metadata aggregation infrastructure by developing tools and services that ease the process for data providers and integrating them into the aggregation platform.
- Lowering barriers for data providers by supporting a set of standard metadata schemas and implementing these into MINT and MORE; this has enabled the integration of LoCloud Collections to the aggregation platform, and eased the process of connecting native content management systems.
- Contributing to the development of EDM by supporting metadata crosswalks to standard schemas, and by proposing an extension to EDM for aggregators.
- Exploitation of services developed under LoCloud by others; services have been made available for implementation by developers, content providers, aggregators and projects. MORE, the Vocabulary Service and the Geo-coding have all been exploited externally, and LoCloud Collections has been adopted by a growing number of cultural institutions.
- Encouraging data providers to develop their information systems to support remote harvesting and enable access for users via Europeana.
- Contributing to Europeana’s goal of improving the quality of its metadata by providing tools and services, which validate metadata quality and enable metadata enrichment to be carried out, and by offering training, advice and support to partners.
- Increasing the number of controlled vocabularies available in SKOS and enabling their creation, management and use by cultural institutions and aggregators via the LoCloud Vocabulary Service; this supports the development of the Linked Open Data and has an impact on data quality, supports multilingualism and searches in the Europeana portal.
- Creating a new service for historic place names, enabling collaboration by Europeana data partners and with external initiatives such as Pleiades; improving the support for historical geography in Europeana.
- Increasing the availability of training and support for Europeana’s data providers by developing documentation, training trainers and developing materials that have been exploited in translation in partner countries for staff, students and volunteers.
- Increasing the access to local cultural heritage content by enabling the
LoCloud

participation of small and medium sized institutions in Europeana via LoCloud’s network of partners; enabling access to new exhibitions and online resources; and participation by local people in crowd-sourcing initiatives.

Section 7 describes the indicators for sustainability of the project’s outcomes by considering support, licensing for developers, free community solutions, fee-based premium solutions, and the integration of LoCloud’s services into Europeana’s Digital Service Infrastructure, and looks at the outlook for future development of the services.

Section 8 presents the conclusions of this report.
LoCloud

2. Introduction

LoCloud, which is funded under the European Commission's CIP ICT PSP programme, has the overall goal of supporting small and medium-sized institutions in making their content and metadata available to Europeana by exploring the potential of cloud computing technologies. The project aimed to provide a series of services that help to reduce the technical, semantic and skills barriers faced by smaller institutions. A main objective has been to add over four million digitized items to Europeana while enabling the institutions involved to use LoCloud services to render their content more discoverable.

This report looks at the operational outcomes and impact of LoCloud on Europeana including its network of content partners.

2.1. Objectives

The broad context for LoCloud is the drive to make all Europe’s cultural resources and scientific records accessible, and to create Europeana as a common access point to millions of objects from all kinds of cultural institutions.

LoCloud has focused on engagement with smaller and medium sized cultural institutions, which hold important and interesting content. However, many small, local institutions have limited IT infrastructure and lack either the requisite staff skills in digitization and digital libraries or the organizational capacity to obtain large-scale external funding.

LoCloud aims to facilitate the role of these institutions by:

- Making it easier for them to make their content and metadata available to Europeana;
- Making available cloud-based software services which enable them to render their content more discoverable and interoperable;
- Rendering interoperable and discoverable together local history and heritage resources which are currently unevenly represented in the Europeana ‘ecosystem’;
- Providing a ‘default’ aggregation infrastructure for those cases where they slip ‘under the radar’ of existing national or domain-based aggregators currently ingested by Europeana;
- Establishing guidance, training and support facilities, built around the LoCloud aggregation service.

The expected outcomes for small and medium institutions of LoCloud include:

- Europeana-oriented ingestion, transformation and aggregation services
LoCloud

in the cloud, dedicated to the requirements of smaller and local institutions without infrastructural support, including a lightweight digital library service configured for Europeana contributors.

• A suite of tested and evaluated services available in the cloud including important tools for:
  o Metadata mapping
  o Metadata aggregation
  o Geolocation enrichment
  o Metadata Enrichment
  o Vocabularies and languages
  o Historic place names
  o Wikimedia and crowd sourcing
  o A light-weight digital library

• An online training course and ongoing support service available through the LoCloud aggregator but capable of extension to the full Europeana service environment where appropriate.

• A much higher level of awareness, through energetic dissemination by the members of the Best Practice Network, among the localities and smaller institutions of Europe of the potential gains to be had from joining Europeana, the availability of tools to ease that process more and make more attractive the results of doing so.

The project’s outcomes include Infrastructure-as-a-Service (IaaS) and Software-as-a-Service (SaaS), which have been evaluated as part of this report to assess their impact in so far as they concern local institutions and their interaction with Europeana.

A specific objective of the project has been adding over four million digital resources from cultural institutions to Europeana. The expected benefits of this include:

• A gradual but visible improvement in the ‘view’ that Europeana’s end-users are able to obtain of the local history of a given locality,
• Stimulating collaborations between cultural institutions in regions in sourcing and delivering content and metadata,
• Encouraging the development of new forms of online access,
• Enabling crowd-sourcing and active participation by volunteers in digitization projects.
3. Methodology

The methodology that was followed for analysing LoCloud’s outcomes and impact was as follows:

**Phase 1** consisted of defining an approach to evaluating the operational outcomes of the infrastructure and services introduced by LoCloud. A questionnaire survey was conducted involving LoCloud developers in preparation for analysis in Phase 4.

**Phase 2** consisted of defining an approach to evaluating the outcomes of LoCloud for its content partners. Qualitative feedback was collected in preparation for analysis in Phase 4.

**Phase 3** consisted of reviewing the Europeana context and defining an impact framework for LoCloud’s outcomes.

**Phase 4** focused on the analysis of the results against the impact framework, the development of conclusions and the preparation of this report.

3.1. Europeana context

Europeana has a vision – to open up Europe’s cultural heritage, harnessing technology to help people learn, make new things and pass them on. Its focus is on the power of culture to change society for the better, and to bring about both social and economic change (Europeana, 2015).

The EU searches for ‘unity in diversity’; Europe, its people and its cultures, are diverse. In the digital age, there are opportunities for everyone everywhere to engage with their own and others’ heritage. Europeana aims to build on Europe’s rich heritage and make it easier for people to use, whether for work, for learning or just for fun.

Europeana has identified four broad target sectors: research, education, tourism and the creative industries. A 2015 White Paper\(^1\) makes a series of recommendations to policy makers and institutions on the next steps on increasing the use of digital cultural heritage by the four target sectors.

However, Europeana has identified two main challenges to its vision:

- Cultural heritage content that is fit for re-use, this means good quality digital resources with good quality descriptive metadata and appropriate licences that allow for re-use,

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LoCloud

- Continued and sustainable funding, for Europeana, digitisation and aggregation programmes, and related work such as data enrichment services.

Services to Data Partners
Europeana has brought together more than 40 million digital objects from more than 3,300 galleries, libraries, museums and archives from across Europe. In its 2015 Business Plan, Europeana highlights the importance of improving the services offered to data providers. Transforming the aggregation process to make it easier for institutions to participate is an important goal for Europeana. The main objectives of the business plan for data partner services include:

- Innovating the aggregation infrastructure,
- Optimising interactions between aggregators and data providers,
- Streamlining and improving the operational workflow,
- Reducing costs and supporting the sustainability of the aggregation infrastructure.

The Europeana Cloud project was funded by the European Commission under the CIP ICT PSP programme. Europeana Cloud was conceived as a shared storage infrastructure for three aggregators including Europeana. It was to be a trusted place to store and back up data and content aggregated from Europeana’s cultural heritage partners.

As the project evolved, it became apparent that a single shared storage for Europeana cultural metadata and content was a good idea, but the national, thematic and domain aggregators had a pressing need for more tailored services that helped with their workflow. A survey found that some of the key challenges faced by aggregators were:

- Finding reliable, usable tools for ingestion and mapping,
- Implementing enrichment services,
- Hosting content.

3.2. Impact framework

The impact framework developed for this report maps the intended outcomes of LoCloud against Europeana’s vision and the challenges that have been identified. The aspects of the framework are:

- Innovating the metadata aggregation infrastructure,
- Take up of LoCloud services by others and the impact on partners’ system development,
- Metadata quality,
- Support and facilitation for smaller institutions,
LoCloud

- Access to local content and involvement of local content partners,
- Participation,
- The potential for sustainability of the services after the project ends.
4. Evaluating the infrastructure and services

LoCloud’s approach has been to provide a series of modular services that can be implemented by data providers, aggregators and developers with a focus on SaaS (Software as a Service) making services and tools available in the cloud. This has involved the following:

- Developing LoCloud Collections as a lightweight digital library service for smaller cultural institutions and providing content hosting,
- Identifying standard metadata export formats in use by cultural institutions,
- Developing the MINT service to support metadata mapping and transformation,
- Developing a series of microservices for metadata enrichment, metadata capture and vocabulary management,
- Developing MORe to support metadata aggregation, validation, enrichment and publication,
- Providing a support portal, help desk and online training courses.

As the project has progressed, LoCloud has developed, tested and deployed production level services for metadata capture, aggregation and enrichment in the cloud.

4.1. Evaluation approach

LoCloud developed a variety of services and tools that contribute to the achievement of outcomes and also impact on the local heritage community, the aggregators and Europeana. The operational outcomes and impacts of these services and tools, which comprise LoCloud’s SaaS and IaaS infrastructure were evaluated against the results envisaged in the LoCloud Description of Work.

The LoCloud result chain may be delineated as shown in Figure 1 below; this is based on the UNDP model for depicting project result chains (United Nations Development Programme, 2011).
The main purpose of the evaluation process was to assess the development work carried out by LoCloud against the following criteria:

- Relevance,
- Effectiveness,
- Efficiency,
- Sustainability,
- Outlook.

In addition, the technical outputs were surveyed in more detail against these criteria:

- Resource Pooling,
- Elasticity,
- Self-Service,
- On-Demand Service,
- Pricing,
- Quality of Service,
- Usage.

A questionnaire was designed for circulation to the development partners of all twelve LoCloud services during summer 2015. The questionnaire consisted of two parts, the first part dealt with general and business-related outcomes such as relevance, effectiveness, efficiency, sustainability and outlook. The second part was devoted to technical and cloud-related outcomes such as resource pooling, elasticity, self-service, on-demand services, pricing, quality of services and usage. A written approach was taken to capture responses to allow easy inclusion of graphics and other written material.
It has been an aim of the evaluation to assess critically within the team how development worked out and what strengths and weaknesses were detected. It also aimed to identify possibilities to carry on the work in future, to provide sustainability for the services and also to provide a baseline for recommendations.

4.2. Overview of LoCloud infrastructure and services

The next pages provide a short overview of the LoCloud infrastructure and services that have been delivered. For a more detailed description of the services, please see [http://support.locloud.eu/tiki-index.php](http://support.locloud.eu/tiki-index.php) and the related project deliverables.

4.2.1. Infrastructure: MORe, MINT and LoCloud Collections

The infrastructure components of the LoCloud aggregator comprise of MINT and MORe (Dallas, Gavrilis et al, 2014). LoCloud Collections provides a lightweight digital library service for cultural institutions and is another component of the infrastructure.

**MORe Aggregator**

The MOntument Repository (MORe), developed by the Digital Curation Unit of the Athena Research Centre, provides a store for the metadata aggregated from content providers and offers services including metadata validation and enrichment, and the delivery of content to Europeana (figure 2).

MORe was developed as a cloud prototype under LoCloud based on a pluggable storage architecture where multiple technologies can be combined to extend the system. The Apache Cassandra framework was used as the storage layer with a content model inspired by the previous MORe version (a content model that supports complex digital objects with versionable data streams). (Dallas et al, 2014)

![Figure 2: LoCloud MORe user interfaces](http://more.locloud.eu/)

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2 MORe: [http://more.locloud.eu/](http://more.locloud.eu/)
LoCloud

MINT
The MINT service, developed by NTUA, is a web-based platform designed to support metadata mapping and ingestion for cultural heritage content and metadata in Europe.

MINT addresses the ingestion of metadata from multiple sources, the mapping of the imported records to the intermediate metadata schema and the transformation and storage of the metadata in a repository (Soufou et al, 2014).

LoCloud Collections
LoCloud Collections, developed by PSNC, provides cultural institutions with a service for hosting their digitized collections and metadata in the cloud. It is designed to enable a new digital library to be created in a few minutes and provides a cataloguing interface, easy publication to a public website and supports remote harvesting for Europeana. This service is available in the so-called Software-as-a-Service model. (Werla et al, 2014).

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4 LoCloud Collections: [https://www.locloudhosting.net/](https://www.locloudhosting.net/)
4.2.2. **LoCloud enrichment microservices**

The LoCloud project developed a series of microservices to help cultural institutions to enrich their data, including historic placenames, geolocation enrichment, geocoding, vocabulary services, vocabulary matching and background linking (Benda et al, 2014b).

**Historic Place names service**

The Historic Place Names service\(^5\), developed by the Faculty of Communication of Vilnius University, provides a Thesaurus of Historical Placenames. This is a service whereby cultural institutions can contribute historical geo-information for aggregation, storage and long-term preservation, and a source of historical geo-information for use in the description of cultural heritage objects (Laužikas, et al, 2014).

![Historical Place Names](image)

**Figure 5: Historical place names service**

**Geolocation API**

LoGeo is a geolocation API\(^6\) (application programming interface), developed by IPCHS, which aims to facilitate geographic enrichment of cultural heritage data. Using this tool, existing content can be parsed, place names recognised and tagged with coordinates and the persistent URIs of known geographical concepts in sources such as Geonames. (Zakrajsek et al, 2014).

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\(^5\) Historical Place names service: http://tautosaka.llti.lt/en/unitedgeo/

\(^6\) [http://support.locloud.eu/Geolocation%20API%20technical%20documentation](http://support.locloud.eu/Geolocation%20API%20technical%20documentation)
**Geocoding service**

The Geocoding service, developed by AVINET, is designed to enable local heritage professionals to set up crowd-sourcing projects to enrich metadata records with geographical locations.

Source data to be geocoded can be uploaded from a local content management system to the service. Records can then be geocoded by manually locating a place on a map or by searching geolocation APIs (including LoGeo) for geographical names and the persistent URIs of known geographical concepts in sources such as Geonames. Records that contain existing coordinate data can be validated against maps to check the locations and make any necessary corrections. Once completed, the geocoded data is exported from the service and can then be re-loaded into the original content management system and web applications (Zakrajsek et al, 2014).

![Geocoding application user interface](image)

**Figure 6: Geocoding application user interface**

**Vocabulary service**

The LoCloud vocabulary service, developed by AIT, provides a means for cultural heritage institutions to collaborate in the development of multilingual vocabularies and enable their use semantic enrichment. The service is based on the well-established open-source vocabulary platform, TemaTres. The platform supports the import of existing Skosified vocabularies, creation of new vocabularies online and the updating of vocabularies. The vocabularies can be browsed online through a user interface\(^7\) or accessed via an API, which enables integration in local cataloguing systems (Benda et al, 2014).

\(^7\) [http://vocabulary.locloud.eu/](http://vocabulary.locloud.eu/)
Vocabulary matching service

The Vocabulary matching micro-service\(^8\), developed by UPV/EHU, automatically links phrases in cultural heritage metadata records to relevant concepts in the provided vocabulary. The service is deployed on a virtual machine (VM) and provides a REST service, which is available for integration into local systems. The Vocabulary matching service is integrated into the MORe aggregator (Soroa et al, 2014).

Background link service

The Background link micro-service\(^9\), developed by UPV/EHU, automatically links phrases in cultural heritage metadata records to background information contained in DBpedia pages. The background link micro-service relies on DBpedia Spotlight, a state-of-the-art tool for performing Named Entity Disambiguation (NED).

The service is deployed on a virtual machine (VM) and provides a REST service, which is available for integration into local systems. The Background link checking service is integrated into the MORe aggregator (Soroa et al, 2014).

4.2.3. LoCloud metadata capture micro-services

The LoCloud project developed two microservices to capture data, the first an application to capture metadata from Wikimedia commons and the second a

\(^8\)http://support.locloud.eu/Metadata\%20enrichment\%20API\%20technical\%20documentation

\(^9\)http://support.locloud.eu/Metadata\%20enrichment\%20API\%20technical\%20documentation
LoCloud

set of crawler-ready tagging tools to capture metadata from websites (Benda et al, 2014b; Bergheim and Slettvåg, 2014).

**Wikimedia application**

The Wikimedia application, developed by the Digital Curation Unit of the Athena Research Centre, has been built as a web service (REST based) and uses the Wikimedia API in order to communicate with Wikimdia. The application can be used to harvest metadata from Wikimdia for a specific user, to parse the metadata and identify useful entities that can be mapped to EDM for ingestion.

The application is connected to the LoCloud infrastructure through its REST services. The LoCloud aggregator (MORe) uses the service to allow users to initiate a harvest and get content. The mapped EDM records are then delivered to MORe, where they can be enriched and provided to Europeana (Gavrilis et al, 2014).

**Crawler ready tagging tools**

The LoCloud crawler-ready tagging tools (CRTT)\textsuperscript{10}, developed by AVINET, are a set of tools for automatically extracting structured metadata from web documents.

An experimental prototype, the CRTT, aims to demonstrate whether the crawling/indexing method applied by the mainstream search engines could be a viable, simplified supplement to mainstream metadata harvesting for Europeana. The tools were tested on capturing metadata from the websites of small cultural heritage institutions that do not have other mechanisms established for providing metadata to Europeana (Bergheim and Slettvåg, 2014). Figure 8 below illustrates the results of a search on metadata that has been extracted from the institutions’ websites.

\textsuperscript{10} The tool is available at \url{http://crtt.avinet.no/} to test the service see \url{http://support.locloud.eu/CRTT}
Figure 8: LoCloud Crawler demo

LoCloud

Full-Text Search Demo
On this page you can test the result of the automatic metadata extraction and indexing process by searching towards the demo index.

stonehenge All collections Search

Search results
Showing 1 - 9 out of 9

1. Stonehenge exterior view
Stonehenge exterior view An exterior view of Stonehenge, south-west, c.1790; coloured aquatint, artist unknown...
Page: Wiltshire, United Kingdom

2. Stonehenge Urn being brought home
Stonehenge Urn being brought home Drawing by Joseph Windham, F.S.A., well known artist and antiquary. It claims to show William Cunningham driving home to Heytesbury on his pony cart, with a Bronze Age barrel urn found inside a burial mound in Amesb.....
4.2.4. Support portal and help desk

The LoCloud support portal, developed by the Digital Curation Unit of the Athena Research Centre, AVINET and PSNC, provides a gateway for partners and members of the public to descriptions of services and applications, technical and user documentation, training materials and a question-and-answer service. The support portal provides access to the help-desk functionality and to a suite of online training courses (Bergheim, Angelis et al, 2014).

![LoCloud Support Portal](http://support.locloud.eu/)

Figure 9: LoCloud Support Portal

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11 [http://support.locloud.eu/](http://support.locloud.eu/)
4.3. Findings of the evaluation

The evaluation of the LoCloud innovation infrastructure and services focussed on what institution and aggregators can do differently now because the LoCloud services have been established. Services were assessed against the following criteria:

- Relevance,
- Effectiveness,
- Efficiency,
- Outlook.

This section presents the overall findings from the survey, for a detailed summary of the responses see Annex 1.

4.3.1. Relevance

All partners reported using good practice methodology standards when developing the LoCloud services. The developments were based on well-known and well-established technical and domain standards.

There are several features that are typical for cloud-based services and which make cloud computing so competitive and popular in the modern IT world. To evaluate to what extent LoCloud services kept the characteristics expected from a cloud offering, the technical project partners were asked to describe how their services fulfill the following assumptions:

- Resource pooling - does the service use a shared pool of resources (processing power, storage, memory, RAM etc.) to handle users requests or has each user a dedicated pool of resources which is not shared with others?

- Elasticity - is it possible for users to scale the usage of the service up and down according to their needs without any additional efforts on their side?

- Usage monitoring - do you measure the use of the service?

- Self-service - is the service available in a way that allows users a self-service (they do not have to be supported to use the service)?

- On-demand service - can the service be provided instantly on users’ demand (they do not have to ask for the permission to use the service in advance)?
Table 1 below summarizes the answers received during the evaluation process. Out of eleven evaluated services, seven fulfill all criteria, three fulfill four out of five criteria and two services fulfill three out of five criteria.

<table>
<thead>
<tr>
<th>Service</th>
<th>Partner</th>
<th>RESOURCE POOLING</th>
<th>ELASTICITY</th>
<th>USAGE MONITORING</th>
<th>SELF-SERVICE</th>
<th>ON-DEMAND SERVICES</th>
<th>YES/NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>MORE</td>
<td>ATHENA</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>NO</td>
<td>4/1</td>
</tr>
<tr>
<td>MINT</td>
<td>NTUA</td>
<td>YES</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>4/1</td>
</tr>
<tr>
<td>LoCloud Collections</td>
<td>PSNC</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>5/0</td>
</tr>
<tr>
<td>Historic Place Names</td>
<td>VUKF</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>NO</td>
<td>3/2</td>
</tr>
<tr>
<td>Geolocation API</td>
<td>IPCHS</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>5/0</td>
</tr>
<tr>
<td>Geocoding service</td>
<td>AVINET</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>5/0</td>
</tr>
<tr>
<td>Vocabulary Service</td>
<td>AIT</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>NO</td>
<td>4/1</td>
</tr>
<tr>
<td>Vocabulary Matching</td>
<td>UPV/EHU</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>5/0</td>
</tr>
<tr>
<td>Background Linking</td>
<td>UPV/EHU</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>5/0</td>
</tr>
<tr>
<td>Wikimedia</td>
<td>ATHENA</td>
<td>YES</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
<td>3/2</td>
<td></td>
</tr>
<tr>
<td>Crawler tools</td>
<td>AVINET</td>
<td>YES</td>
<td>YES</td>
<td>NO</td>
<td>YES</td>
<td>5/0</td>
<td></td>
</tr>
<tr>
<td>Support Portal</td>
<td>ATHENA/AVINET/PSNC</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>5/0</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: LoCloud Technology related requirements

The survey returns included comments and explanations regarding the negative answers received in this evaluation:

In the case of the resource pooling requirement, even if the service itself is not utilizing shared resources, in production deployment sharing can be achieved by using a virtualized environment, similar to LoCloud Test Lab.

A lack of elasticity, reported in relation to the MINT service, is related to the fact that it was designed to handle collections of metadata records that are relatively small in volume (up to tens of megabytes). Elastic storage and processing capabilities could be introduced later on, if required, for a future business model of the service.
The three tools that do not provide a full on demand approach are limited only in the sense that user account approval is required. In all three cases, the service is available on line (i.e. not being manually installed from scratch when user needs it). Before using it, the user needs to apply for an account, which must be approved by the system administrator. The limitation is not related to technical limitations or design flaws, it is a decision made by the service operator. In all three cases, the decision relates to a need to limit users to project partners and could be changed in future, as the sustainability model is defined.

It can be said that majority of LoCloud services fulfill the features of cloud-based offerings. The aspects that are missing at the moment are mostly caused by specificity of the service or its usage in the context of LoCloud project.

Quality of access to LoCloud services, understood as the level of performance and availability, is measured and monitored by most of the partners. Throughout the project there was no single case of long-term lack of availability or performance of services.

The technical infrastructure used for providing services differs between partners, starting from tens of Mbits connections up to tens of Gbits (in case of ATHENA and PSNC). The usage of all services is also measured, but types of measurements differ from one service to another, depending on the service functionality.

The majority of services were adapted specifically to local institutions’ needs. Some services were identified as being suitable for any type of organisation and thus were not adapted specifically for local institutions: the Historic Place Names service, Background linking service and Crawler Ready Tagging Tools.

Table 2 provides an overview of the various usage possibilities:

<table>
<thead>
<tr>
<th>MINT</th>
<th>LoCloud aggregation workflow (MORe)</th>
<th>Integration in local cataloguing systems</th>
<th>Online Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Historic place names service</td>
<td>Part of the metadata enrichment via the vocabulary services</td>
<td>Historic place names web services</td>
<td>Historic Place Names Online Tool</td>
</tr>
<tr>
<td>Geolocation Enrichment Tools</td>
<td>Geolocation API</td>
<td>Geolocation API</td>
<td>Geocoding application (using Geolocation API)</td>
</tr>
</tbody>
</table>
4.3.2. Effectiveness

Overall, the services produced were as envisaged in the LoCloud Description of Work (DoW). Three development teams reported results that were not anticipated in the DoW, these included the use of optimization techniques to address the large size of the vocabularies being loaded into the vocabulary service. The Crawler tools changed from the planned desktop application to a web-based application in response to user feedback. One significant result reported was that the MORe aggregator is now more flexible and includes more functions than envisaged. An unexpected result is that, although designed for small institutions, LoCloud Collections is gaining in popularity amongst humanities research teams and national level organisations.

One of the project’s aims was to enable cultural heritage institutions, especially small and medium-sized institutions, to make their content accessible via Europeana in an easy and cost effective way. This is reflected in the main beneficiaries identified for the LoCloud services by the survey respondents: first of all content providers and individuals, but also Europeana and other aggregators and content providing communities, which can offer these services now on their platforms.
<table>
<thead>
<tr>
<th>LoCloud Service</th>
<th>Beneficiaries</th>
</tr>
</thead>
<tbody>
<tr>
<td>LoCloud Collections</td>
<td>Cultural heritage institutions, humanities researchers, Europeana.</td>
</tr>
<tr>
<td>Historic Place Names</td>
<td>Cultural heritage institutions, Aggregators, Europeana, researchers, digital heritage databases administrators.</td>
</tr>
<tr>
<td>LoGeo API</td>
<td>Cultural heritage institutions, humanities researchers, Europeana.</td>
</tr>
<tr>
<td>Geocoding Service</td>
<td>Cultural heritage institutions, Regional and National institutions, tourism domain.</td>
</tr>
<tr>
<td>Vocabulary Web Service</td>
<td>Cultural heritage institutions, database administrators, MORE and other aggregation platforms, Europeana.</td>
</tr>
<tr>
<td>Vocabulary Matching</td>
<td>LoCloud content providers, MORe aggregator, other aggregators, Europeana.</td>
</tr>
<tr>
<td>Background Linking</td>
<td>LoCloud content providers, MORe aggregator, other aggregators, Europeana.</td>
</tr>
<tr>
<td>Wikimedia</td>
<td>Individual content providers</td>
</tr>
<tr>
<td>Crawler tools</td>
<td>Europeana</td>
</tr>
<tr>
<td>Support Portal</td>
<td>LoCloud partners and other small cultural heritage institutions</td>
</tr>
</tbody>
</table>

**Table 3: Beneficiaries per LoCloud Service**

Most of the LoCloud enrichment services can be invoked on demand in the MORe aggregator. Some of the LoCloud services, such as LoCloud Collections, the Geocoding application and the Historic Place Names Service, are stand-alone online services used outside the LoCloud aggregation environment.

Most small and medium cultural heritage institutions provide their content to Europeana via aggregators or joint aggregation platforms. This was confirmed in the LoCloud user evaluation survey, which provided evidence that most institutions are using LoCloud services via an aggregation platform (Alkemade et al, 2016). These aggregators provide a range of services such as data mapping, ingesting or data enrichment. Using aggregation services via a one-stop-shop or a joint market place is clearly the preferred way for small institutions.

LoCloud services provide a perfect starting point for such a scenario and also build a good basis for further technical achievements and enhanced products. They are services for a wide European community and have already received quite a lot of attention in the cultural heritage community.

### 4.3.3. Efficiency

The survey findings show that the work distribution and cooperation between LoCloud partners worked well. Development tasks were clearly split and responsibilities were transparent and well divided.
LoCloud

For all services, documentation has been published in the LoCloud support portal. There is potential to improve and enhance the documentation in future with more online help (within tools such as MINT and MORe, etc.) and concise overviews describing services.

Engaging users at an earlier stage in the development process would have helped to accelerate the transition of test results into technical implementation. More initial brainstorming sessions during prototype development were also suggested. A shared user authentication system could have improved the integration of the services into the user interface. The integration of the enrichment services into the aggregation platform required some additional work on metadata transfer formats.

Overall, the developers reported that the development and integration process went in line with the expectations and planning.
5. Evaluation of content

LoCloud’s approach was to involve national and regional aggregators, and individual cultural organisations as content providers. The members of the consortium had the capacity to both provide content directly and to involve other museums, libraries, archives and cultural organisations in their networks. The project’s content objectives included:

- Increasing the participation of small and medium-sized institutions in Europeana,
- Increasing the availability of content relating to local history and local heritage in Europeana,
- Enabling the creation of local views.

This section analyses the content that is actually being provided by LoCloud partners to Europeana. Information about one hundred and eighty nine collections was collected from partners in the LoCloud Collections Roadmap; this provided information about the status of each collection in the aggregation workflow, from signature of the Europeana Data Exchange Agreement, metadata mapping and ingestion in the LoCloud aggregator through to publication in Europeana. Additional information was requested from partners to classify the content by source, type, coverage etc. The analysis is based on 99% of the number of items being classified, and can be considered to provide a reasonably accurate picture of the content being provided.

Two of the collections identified by partners in the Content roadmap are place name gazetteers and one is a controlled vocabulary. These valuable resources have been incorporated into the Historic Place Names Service and the Vocabulary Service amongst others.

One hundred and eighty six collections represent metadata for content being provided to Europeana. Note that the analysis is based upon the number of metadata records – Gironde is supplying around ten times as many digital objects but many of these are represented by one record.

5.1. Overview of LoCloud content providers

There are twenty seven LoCloud content providing partners from twenty two of the twenty eight EU Member states plus Serbia, Turkey, Norway and Iceland, plus an associate partner in Switzerland.

The great majority of these are medium sized (i.e. 10-500 employees) cultural heritage institutions. A few are smaller organisations with specific roles such as the Discovery Programme in Ireland (who specialise in 3D scanning and providing technical assistance) and Zavod Jara from Slovenia who is a NGO.
Overall, the partners represent a good cross section of the many different types of organisations involved in the cultural heritage sector, from heritage agencies, libraries and museums who make up 55% of the providers, to archives, academic institutions and academic institutions.

Figure 10: LoCloud content partners by type of organisation

Many of the LoCloud partners aggregate content on behalf of smaller cultural heritage institutions on a national or regional basis. The number of collections being provided varies from partner to partner; most provided five collections or less. For the national and regional aggregators, a single collection aggregates content from a number of institutions in their network. For example, KUAS aggregates content from eighty five state-funded museums (including the National Museum and the National Art gallery) in its Regin collection.
5.2. Cultural institutions providing content

Analysis indicates that 92% of the collections provided in LoCloud come from museums, libraries and archives. Archives are the source of more than half of all the content items; the project's largest content providing partners are the National Archives of Norway and the Regional Archives of Gironde. Museums and libraries are probably under-represented in this picture as the classification does not take into account the institutions represented in the aggregated collections. For example, Provincie Limburg and Zavad Jara are aggregating content from small cultural institutions in their regions but their collections are all classified as archives. At least seven of the smaller collections are private, belonging to individuals and therefore not archives in the usual understanding of this term. Other small collections come from organisations as diverse as community councils, the Cyprus Police Force, monasteries and some (from Zavad Jara) is user generated content. Hence archive is a very heterogeneous category. The five collections classified under “Other” include a local association, research centre and a professional association.
The predominance of the Archives is even more evident when the classification of each of the items is looked at – Archives provide 63% of all the items with museums also increasing to 31%, leaving just 4% from the libraries and 1% from other content sources (after the 1% unclassified items are taken into account).

Analysis of the content after publication in Europeana provides some additional information about the types of institutions providing content via LoCloud. The LoCloud content roadmap categorises the collections by institution type, which disguises the smaller institutions whose content has been aggregated by regional partners such as Provincie Limburg. However, the
LoCloud

inclusion of the name of the institution that provided the content in the EDM metadata record adds detail. At the time of writing, a total of 1,267,496 metadata records had been published in Europeana with 297 different institutions listed as data providers.

Figure 14: LoCloud data providers in Europeana by institution type

The information in Europeana (see Figures 14 and 15) reveals that there are one hundred and ninety two different church archives providing content. 65% of LoCloud data providers are church archives but these provide only 3% of the content. Local heritage archives make up 7% of the data providers and provide 0.5% of the content. 6% of the data providers are larger national or regional archives but these organisations have provided 81% of the content. Museums make up 9% of LoCloud data providers providing 8% of the content, while Libraries make up 6% of data providers and have provided 2% of the content published in Europeana to date.

It is worth noting that two hundred and forty five of the data providers identified in Europeana were Belgian institutions (mainly church archives) aggregated by Provincie Limburg.

As further LoCloud content is published in Europeana the breakdown of institutions by type may change.
Analysis of the content after publication in Europeana provides some additional information about the geographical location of the data provider. Figure 16 shows that nineteen countries have provided content to Europeana via LoCloud with Norway has provided nearly half (48%), Denmark 20% and France 9%\textsuperscript{12}.

\textsuperscript{12} Please note that this analysis is based on metadata records provided. France is under represented as its 200,000 metadata records link to around 2 million images, which are accessible online for Europeana users to discover.
5.3. Geographic coverage of the content

Partners were asked about the geographic coverage of the collections and content items being provided. The majority of the collections were regional in scope (45%) with a further 24% being classified as national. Community collections account for 8% of the total. The remaining 14% of the collections were described as being either European or International with 2% relating to a single site (this content mainly related to archaeology and the activities of EU archaeologists abroad).

![Pie chart showing geographic coverage of collections](image)

**Figure 17: Geographic coverage of collections**

The high proportion of regional and smaller area collections reflect the profile of the majority of the content providers.

When the content items are analysed, the proportion of items that come from regional collections decreases by 10% to 35% and the national content increases by 37% to 61%. However, only around 2% of the content has European or International coverage, the community contribution has shrunk to 1% of all content supplied and the single site content is also negligible. This is due to the national institutions and aggregators both covering several regions and because national collections tend to be greater in size due to the nature of the institution.
The content coverage by the institution type indicates that the archives have the most varied geographic coverage whilst the libraries and museums are predominantly national and regional. Surprisingly, the libraries supply a larger proportion of European and International content than either archives or museums. The Other sources are mainly national organisations.

5.4. Digital types

Based on the information provided by content partners in the LoCloud content road-map, just over three quarters of the collections consist of images, 12% are text (mainly PDFs), 7% are mixed media and 1% comprise audio-visual content.
Figure 20: Digital types represented in the collections

The picture changes when the individual items published in Europeana are examined (Figure 21 below). This is because the large collection of civil and administrative records being supplied by CG33 (the Gironde regional archives) is classified as text in Europeana; Europeana requested this classification as the content is text although the digital objects are JPG image files. Analysis of the content in Europeana shows that at the time of writing, four hundred and twenty one videos, two hundred and thirty six 3D objects and twenty four sound files had been provided.

Figure 21: LoCloud Digital types in Europeana

5.5. Subject matter of the content

The content was classified by broad category to provide an overview of the spread of the subject matter across the collections. Figure 22 highlights the large number of small collections being provided by CUT, MECD and NRA.
If the descriptions of the content of each collection are analysed (again by the broad categories), as a Wordle then the relative sizes of the categories becomes clearer (figure 23 below). The predominant subject matter is of places and people. Archaeology is also important.

The subject matter is quite diverse, as might be expected with local museums, for example. This ranges from art, pottery, coins, household items, costumes and weapons to trains, medical objects and stamps (as well as historic buildings and pictures of people spanning the last one hundred years or so).
When subject is analysed by number of items, the picture changes again.

**Figure 23: Wordle of the subjects represented in the content**

**Figure 24: Subject matter by number of content items**
5.6. Findings of the evaluation

In summary, LoCloud is contributing content to Europeana from many small to medium-sized institutions, in collections drawn from regional and national aggregators. A few very small collections with more specialist content such as theatre texts, trains, stamps and emigration are also represented.

The size of the collections being provided varies greatly. One provider, NRA from Norway, is providing 22% of the content – several collections coming from national institutions. CUT (Cyprus) has identified the most individual collections (over forty) but these make up 0.3% of the content items. MECD (Spain) is providing eighteen collections, which comprise 3% of the total collection.

The picture is incomplete. Partners who act as regional or national aggregators collect content from institutions in their networks but these individual collections are not separately classified in the LoCloud Content Road map that formed the starting point for this analysis.

What is clear is that the LoCloud partner's collections cover many different regions and municipalities within their countries, involving small, medium and sometimes quite large cultural institutions from across the GLAM domain (Galleries, Libraries, Archives and Museums).
6. Outcomes and Impact

6.1. Innovating the Metadata Aggregation infrastructure

One of Europeana’s main objectives is to innovate the metadata aggregation infrastructure to ease the process for content providers and to reduce costs. LoCloud’s outcomes contribute towards this objective by:

Providing an integrated metadata aggregation platform which:

- Supports harvesting of metadata,
- Integrates MINT and M0Re so that there is an improved aggregation workflow which includes metadata harvesting, metadata mapping, transformation to EDM, metadata enrichment, and publication to Europeana;
- Incorporates metadata enrichment micro-services in M0Re,
- Integrates LoCloud Collections and M0Re so that smaller content providers have a workflow from their content management systems and websites, via M0Re to Europeana,
- Incorporates quality assurance services so that metadata can be validated before provision to Europeana.

Content providers and aggregators can use the LoCloud aggregation infrastructure, which is fully compatible with Europeana’s requirements.

Europeana benefits from the implementation of these services by LoCloud by receiving quality-assured enriched EDM metadata. This eases the process of ingestion by Europeana.

6.1.1. Support for standard metadata schemas

One of the LoCloud’s main objectives has been to reduce barriers for small cultural institutions in providing metadata to Europeana. Museums, libraries, archives, galleries and house museums have experience with different domain metadata schemas. At the start of the project, LoCloud carried out research into which schemas should be supported to mediate between the native metadata held in the content management systems used by heritage organizations and the Europeana EDM schema. The project identified a series of standard schemas including LIDO, CARARE, EAD, EDM, ESE, DC and Omeka-XML.

LoCloud specified that these standard schemas be implemented in its
LoCloud infrastructure enabling its content providing partners to work with familiar domain standards. LoCloud was the first Europeana-related project to support multiple target schemas. As metadata crosswalks are provided to transform the metadata from the target schema to EDM, the process of providing data is simplified.

LoCloud content providing partners are able to upload their metadata to MINT and complete a metadata mapping to one of the supported schemas, with automatic transformation to EDM. As many partners work with institutions coming from different domains, implementing multiple target schemas in MINT makes it a more flexible tool.

Metadata that is available in one of the standard formats (LIDO, CARARE, EDM, ESE, DC and Omeka-XML) can be harvested and ingested directly into the MORe repository. The metadata cross-walks support automatic transformation to EDM. This greatly simplifies the process of providing metadata to Europeana.

Implementing support for multiple target schemas has had a positive impact on the development of both MINT and MORe. It has also provided a useful demonstration for other Europeana aggregators.

### 6.1.2. Contributing to the development of EDM

LoCloud has contributed to the development of EDM in various ways. It supports the series of metadata cross-walks described in 6.1.1 above, has developed tools for capturing metadata in EDM format (4.23 above), and has proposed the extension to EDM described below.

A 2015 Europeana White Paper reviews progress with the Europeana Data Model (EDM) and the latest developments (Charles and Isaac, 2015a and 2015b). EDM has been a collaborative effort from the very start with all the domains represented in Europeana (libraries, museums, archives and audio-visual archives) defined the requirements. EDM has become an interoperable framework for describing digital cultural heritage data. The same collaborative effort now supports extensions and refinements that accommodate the subtleties of cultural heritage domain-specific data. Europeana facilitates this by maintaining EDM as a flexible model and providing adequate documentation to support communities’ specific work.

This White Paper gives an account of the latest developments in EDM and highlights the principles that are necessary for the model to continue as a suitable framework for cultural heritage data.
LoCloud has contributed to the development of EDM by requesting an extension to enable the chain of actors involved in metadata aggregation to be recorded. The proposed extension, “intermediateProvider”, will enable intermediate organisations involved in the aggregation chain (such as regional aggregators, national aggregators and projects) to be recorded in the metadata in addition to the final organisation that provides the metadata to Europeana. Recording this chain is important for the provenance of the metadata, and for reporting to the actors involved in the aggregation process. Europeana’s Research and Development team has recommended this extension to EDM for implementation in 2015-2016.

6.2. Take up of LoCloud Services by others

LoCloud has made a number of services available via APIs for implementation by developers, content providers and aggregators in their local technical environment. One of the measures of LoCloud’s impact is the take-up of its services and infrastructure by others.

6.2.1. Implementations of MORe

MORe has been implemented or tested by a number of projects. One prominent example is ARIADNE\textsuperscript{13}, a research infrastructure funded under the European Commission’s 7\textsuperscript{th} Framework Programme.

ARIADNE brings together and integrates archaeological research data so that researchers can use the various distributed datasets. The ARIADNE project has implemented MORe to aggregate data from a variety of archaeological research institutions (Figure 25).

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{MORe.png}
\caption{MORe in use by ARIADNE}
\end{figure}

\textsuperscript{13} http://www.ariadne-infrastructure.eu/
To cope with the complexity of archaeological data, ARIADNE has defined a conceptual catalog model, ACDM. MORe is used to transform the ingested metadata into ACDM XML instances. The enrichment micro-services of MORe are used to provide integration of resources rather than simple aggregation. All resources are enriched with:

a) AAT thematic concepts,
b) periods from the Perio.do thesaurus
c) WGS84 coordinates

Links are automatically created among resources to denote memberships in collections, links to reports and links from datasets to collections, etc.

For ARIADNE, new functionality has been added to MORe to enable micro-mapping of all resources to JSON and publication to an elastic search cluster that powers the ARIADNE Catalogue portal. All resources are micro-mapped to RDF and published to a Virtuoso RDF store that facilitates mining of knowledge through SPARQL.

6.2.2. Integration of the Vocabulary Service in the DISMARC platform

DISMARC\(^\text{14}\) began life as a EU-funded initiative in 2006, intended to encourage and support the interoperability of music-related data. In 2013, a DISMARC-Board of Trustees (“Kuratorium”) was set up to take care of the operation which offers a portal in twenty one languages, providing access to about 2.5 million records from around one thousand two hundred collections worldwide, with around seven hundred registered users and over four hundred newsletter subscriptions. Over 350,000 records have been contributed to Europeana.

The DISMARC\(^\text{15}\) music audio aggregator provides an Audio Aggregation Platform, which is a gateway providing access to discographic catalogue information and audio content held in music archives and in private and public collections. The purpose is two-fold; to make it easier for general users to find audio and audio-related data and also to allow content owners to create more awareness of their content. The DISMARC-AAP Repository Manager harvests metadata from various automated systems and provides powerful search capabilities for searching this diverse data. Among other features the search system supports query extension using the DISMARC Vocabularies\(^\text{16}\).

DISMARC-Version 2 is under development and will integrate a Documentation and Annotation Platform (DISMARC-DAP) to allow the manipulation of data.

\(^{14}\) http://www.dismarc.eu
\(^{15}\) http://devait.co.at/dismarc/wiki/index.php5/Category:Dismarc_portal
\(^{16}\) http://www.dismarc.org/vocabulary/
provider’s records uploaded in a Private Workspace. Figure 26 shows the high level architecture of DISMARC-Version 2. There are three building blocks:

1. The DISMARC-Portal,
2. The already existing DISMARC-AAP, and
3. The new development: DISMARC-DAP.

Semantic Enrichment, implemented in the DISMARC-AAP component, uses the Vocabulary Micro-Services developed within LoCloud project.

Figure 26: DISMARC-V2 high level architecture

The Application designer, an essential tool available in the DISMARC-DAP, can be used by both non-programmers to generate web based applications using the “Design View” and programmers working in the “Code View” and using JavaScript. In the “Code View” mode new micro services can be developed e.g. “Thesaurus Look Up” based on the DISMARC vocabularies and LoCloud micro services.

Figure 27: Entering subject terms
LoCloud

Figure 27 (above) shows part of a data entry application (entering subject terms). Terms can be selected from a range of thesauri; in this example one term has been selected from the English version of the UNESCO Thesaurus, another from the dmGenres Vocabulary.

Figure 28 (below) shows the definition of a Drop Down List for the selection of a controlled vocabulary using the Application Designer in the Design View. The LoCloud Vocabulary Micro Service provides a set of functions invoked by an API, which can accept different parameters. Some functions have been used by DISMARC to develop a “Thesaurus Look Up” micro service, which allows navigation through a vocabulary as well as selecting relevant terms (Figure 27).

![Figure 28: DISMARC application designer](image)

This development can be considered as creating a new micro service providing more complex functionalities, which can be invoked by a data entry application. The DISMARC Application Designer in the Code View (programmer's environment) allows the development of a “Thesaurus Look Up” microservice (Figure 29 below).
6.2.3. Use of the Geocoding micro-service in the Sultanate of Oman

The Ministry of Tourism in the Sultanate of Oman, a client of AVINET, wished to publish an interactive natural and cultural heritage map on the Internet. This map formed part of the ministry’s ongoing efforts to draw tourists to the country and to offer them a quality product once they arrive. The Ministry had a non-spatial portal where each heritage asset was documented, mostly as plain text articles without any coordinate information. There was a need for a simple and functional solution to add geo-locations to their existing collections quickly.

Due to the low maturity of digital resources in the Sultanate, there was no authoritative source available digitally from which locations could have been extracted by automatic means. A manual geo-tagging effort was required to assign appropriate locations to heritage assets. AVINET demonstrated the geocoding solution developed through LoCloud and the Ministry chose to use this solution for the enrichment of their data.

The simple user interface allows operators to select resources, search for and assign locations within a single window (see figure 30 below). The interface coupled with the ability to share the work across a distributed team were the main 'selling points' that lead to the Ministry’s decision to use the application.
The results of using the geocoding micro-service, more than two thousand geolocated natural and cultural heritage assets are published in an interactive map on the Ministry of Tourism’s web site (see figure 31 below). The LoCloud geocoding micro-service is still being used as the platform for maintaining, expanding and improving the quality of the underlying dataset.
LoCloud

6.2.4. Adoption of LoCloud Collections

Partners have collaborated with PSNC to support the translation of LoCloud Collection's interfaces into many different languages. As a result, the system is being used in many different countries. This section provides a list of some of the instances of LoCloud collections.

Rijksdienst voor het Cultureel Erfgoed and Museum Kasteel Wijchen

Rijksdienst voor het Cultureel Erfgoed (the Cultural Heritage Agency of the Netherlands, RCE) commissioned a company to translate the texts needed to provide the user front-end and back-end interfaces of LoCloud collections into Dutch; the translation files were deployed by PSNC.

RCE then worked with the Museum Kasteel Wijchen to help them to get their catalogue into LoCloud Collections and to provide a demonstration of the software for other museums in the Netherlands.

The Museum Castle Wijchen contains collections of archaeology and contemporary art, with permanent and temporary exhibitions as well as a local history exhibition on the five castles in Wijchens' territory. https://museum-kasteel-wijchen.locloudhosting.net/

![Museum Kasteel Wijchen instance of LoCloud collections](image)

Figure 33: Museum Kasteel Wijchen instance of LoCloud collections

**SVeVID: digitalna knjižnica Gradske knjižnice Rijeka, Croatia**

The digital library created by [Gradske knjižnice Rijeka](https://svevid.locloudhosting.net/?lang=en) under the AccessIT project, which was migrated to LoCloud Collections and added to as part of the LoCloud project. https://svevid.locloudhosting.net/?lang=en
LoCloud

**Pikabit, Croatia**
The local history collections of Crikvenica and Selce.
https://pikabit.locloudhosting.net/

**Royal Society of Antiquaries of Ireland**
The RSAI includes content from two of its archival collections: Lantern Slides and a collection of drawings and sketches by George Victor Du Noyer.
https://rsai.locloudhosting.net/

**Pôle de la Mémoire Locale du Bourgeois, France**
The Pôle de la Mémoire Locale du Bourgeois collection includes postcards and aural/audio-visual accounts.
https://pml-bourgeois.locloudhosting.net/

**Conservatoire de l’estuaire de la Gironde, France**
The Conservatoire de l’estuaire de la Gironde collection includes a photographic inventory of tools, boat parts, documents about the collections in the museum from 19th and 20th centuries.
http://ceg.locloudhosting.net/

![Conservatoire de l'estuaire de la Gironde](image)

**Figure 34:** Conservatoire estuaire de la Gironde instance of LoCloud collections

**Nacionalne i univerzitetske biblioteke BiH (NUBBiH), Bosnia and Herzegovnia**
This is the Sarajevo University Library collection.
https://nubbih.locloudhosting.net/?lang=en
6.3. Impact on Content partners’ system development

LoCloud has had an impact on its content providing partners encouraging the adoption of standard metadata schemas for metadata export and developments in interoperability between native systems and externally.

Case study: Narodní památkový ústav, Czech Republic

“We can say, that our experience with the LoCloud and CARARE projects was really important for us and impacted on the development of our new information systems. It also provoked us to gain a new collection of photographs from SOVAMM and to resolve the IPR issues with them. It also accelerated integration of the archeological collection into our information system.”

Irene Blažková, Narodní památkový ústav

Narodní památkový ústav (NPU) is a national institution with statutory responsibility for immovable and movable cultural monuments and objects in the Czech Republic. NPU has three main information systems, which have been under development over the last five years. The systems include the central list of cultural monuments, a Geographic information system and a registry of digital documents.

Figure 32: NPU information systems’ interoperability

NPU’s participation in first the CARARE project and now LoCloud has supported the development of an OAI-PMH provider and remote harvesting for Europeana. Another impact has been the launch of improved online services making content accessible to members of the general public:
LoCloud

- [http://iispp.npu.cz/mis_public/homepage.htm](http://iispp.npu.cz/mis_public/homepage.htm) is a meta-information system that makes digital documents created by specialists about archaeological monuments and buildings available to the public,
- [http://gis.npu.cz/](http://gis.npu.cz/) is an online geographic information system, which includes boundary information about archaeological monuments and buildings,

6.4. Metadata Quality

A main focus of LoCloud’s work has been to support cultural institutions, especially small institutions, in providing their metadata to Europeana. This work has involved:

- Promoting standard metadata schemas and facilitating their use in tools and services,
- Providing tools and services that support data quality and data standards,
- Enabling the creation of linked data by providing vocabulary services, supporting EDM and metadata enrichment,
- Offering advice and support on how to improve metadata quality
- Offering advice on rights labelling,
- Providing documentation, videos and online learning materials.

6.4.1. Increasing the availability of controlled vocabularies in SKOS

One of the outcomes of the implementation of the LoCloud vocabulary service has been making controlled vocabularies available in SKOS. The process of converting a terminology list or thesaurus to SKOS makes it compliant with Semantic Web requirements and ensures its interoperability. The vocabulary becomes available as part of a network of terminology resources for use by institutions in their cataloguing systems, in metadata enrichment and in search portals.

As part of LoCloud project partners have used the Vocabulary Service to skosify the following vocabularies:

- DISMARC Genres (AIT for the Discmarc consortium),
- DISMARC Formats (AIT),
- Irish Monuments (Discovery Programme),
- Irish Periods (Discovery Programme)
The following vocabularies (already in SKOS) were made available by partners for incorporation into the Vocabulary Service:

- Archeological Objects Thesaurus Scotland (UoY ADS)
- Archeological Sciences Thesaurus (UoY ADS)
- Building Materials Thesaurus (UoY ADS)
- Components Thesaurus (UoY ADS)
- Event Type Thesaurus (UoY ADS)
- Evidence Thesaurus (UoY ADS)
- FISH Archeological Objects Thesaurus (UoY ADS)
- Maritime Craft Thesaurus Scotland (UoY ADS)
- Maritime Craft Type Thesaurus (UoY ADS)
- Monument Thesaurus Wales (UoY ADS)
- Monument Type Thesaurus (UoY ADS)
- Monument Type Thesaurus Scotland (UoY ADS)
- Period Thesaurus (UoY ADS)
- Period Thesaurus Wales (UoY ADS)
- Thésaurus de la désignation des objets mobiliers (CG33)
- Thésaurus de la désignation des oeuvres architecturales et des espaces aménagés (CG33)
- Thésaurus-matières pour l’indexation des archives locales (CG33)

6.4.2. Case study: Historic place names in Lithuania

Historical geography is one of most practical problems when digitising and reusing cultural heritage digital data in Lithuania. Most information systems use modern geographical data; however, any large digitization project inevitably leads to historical geography.

Lithuania has witnessed frequent changes in administrative divisions. During the 20th century alone there were six to eight reforms of territorial-administrative divisions. The borders of the state itself have changed during the 20th century. Vilnius has belonged to the Russian Empire, the German Empire, Bolshevist Lithuania, the inter-war Republic of Lithuania, the Republic of Poland, LSSR, the Nazi German, USSR and the Republic of Lithuania. As a result, there have been changes in place-names with names being written in various different languages and writing systems, for instance in Lithuanian, Russian, Polish and German.

Relatively recent Lithuanian written and cartographic traditions aggravate the situation. Most detailed maps were printed in the late 19th century, whereas Lithuanian cultural heritage covers the time period from the 11th millennium BC up to the present. It is not possible to precisely locate some historical place-names; all we can do is to relate them to old parishes and administrative units.
There are also modern problems such as multilingualism (Lithuanian place-names written in foreign languages), other writing systems (Lithuanian place-names written, for example, in the Cyrillic alphabet) and dialecticism (writing place-names in authentic dialectal forms).

From the point view of historical research the following points are important:

- identification of religious and secular territorial units formed during changes in the territory of the state;
- connections and links between historical and current place-names;
- connections and chronological links between historical, extinct, written in other languages (Lithuanian, Russian, Latin, Polish, German, and English) and place-names and personal names in various forms;
- spatial location of historical, extinct and surviving place-names and old maps, and linking these to current place-names and a geographical coordinate system.

A goal for the Historic Place Names micro-service was answering questions such as:

- how historical geo-information could be digitized?
- how contemporary and historical geo-information can be connected?
- how digital heritage objects and historical geo-information can be connected?
- how to combine historical geo-information from different information systems?
- how metadata can be enriched with historical geo-information?
- what services could be created for scientists (professionals), heritage information systems administrators and the general public based on historical geo-information assets?

Based on the experience of developing the Historical Place Names Service, the impact of the LoCloud project for Vilnius University Faculty of Communication could be described as follows:

Collaboration with other European partners working on similar problems concerning historical geo-information in heritage information systems; with other similar international projects, e.g. Pleiades; and with the national public sector (Lithuanian Society of Archaeology) and business institutions (VŠĮ „Atviro kodo sprendimai“). This collaboration was important for broader understanding of the problem concerning historical geo-information. It contributed to the investigation of different solutions and for developing new schemas that allow very diverse (semantically) assets of historical geo-information to be connected.
Experience was gained in developing historical geo-information management schemas and tools, which will serve in similar future projects and endeavours.

The Historic Place Name service will serve as a prototype in a national project focused on the development of digital heritage datasets in Lithuania – the Virtual Electronic Heritage System (VEPS). LoCloud solutions for Historic Place Names and the lessons learned will be used for solving similar problems concerning historical chronology, historical personal and group names. Experience gained during LoCloud will used as the basis for improving the Integral Thesaurus of historical places, personal names and historical chronology in Lithuania, which serves as an effective tool for semantic interoperability within the Virtual Electronic Heritage System (VEPS).

Ideas discussed within LoCloud project concerning the development of “second level” services based on historical geo-information may also be realised during the 3rd stage of development of the Virtual Electronic Heritage System (VEPS). Services for the general public such as educational mobile apps and apps for tourism are included in the plans. Historical geo-information will be used as an interface tool between heritage objects, digital heritage objects and end users.

6.4.3. **Europeana Task Force on Enrichment and Evaluation**

LoCloud partners University of the Basque Country (UPV/EHU) and the Athena Research Centre participated in this Europeana task force contributing their expertise and experience. LoCloud’s MORe aggregation tool provided examples included in the report on the application of enrichment services and enrichment planning.

For example, the MORe tool used in the LoCloud project allows enrichers to create simple rules in the form: if the subject of an object contains X or some keyword attached to it contains Y then add the subject K, where K is taken from a collections of subject terms that refer to a specific theme.

For example, the MORe aggregation toolkit developed and used in the LoCloud project makes available various enrichment services, which the enricher can combine using an enrichment plan editor.

The task force recommendations included defining enrichment goals, choosing the right components, defining the enrichment workflow, testing and evaluating. The work in LoCloud to integrate enrichment microservices into MORe had a particular impact on the recommendation to define and plan the enrichment workflow, so that services are applied in the appropriate order.
6.5. **Support and facilitation**

"When it comes to metadata standards and the skills and knowledge for mapping between them, this can be a challenging area for curators. Moving from LoCloud Collections to directly to MORe, this is not really an issue and I think that workflow will work really well for people, but for those who need to use MINT, it’s a different challenge and one which will require different support from the national partners, so maybe as we move toward the project end we could consider methods and sustainability around that particular issue."

Louise Kennedy, Discovery Programme

Providing training and support for content partners has been an important aspect of the project. LoCloud planned and delivered a series of training workshops for partners during the second project year of the project. The training covered all of the project tools and services. Three workshops were delivered during 2014 resulting in the preparation of a set of presentations that formed the basis of the training materials, which include screen-cast videos.

During one of the training workshops, the individual trainers were filmed presenting their services in a TV recording studio. The recordings were subsequently processed to provide a set of online videos providing detailed introductions and walk-throughs of core LoCloud services including: MORe, MINT, LoCloud Collections, the Historical Place Names service, the Vocabulary service, the Geocoding tools and the LoCloud support portal.

The experience gained in delivering the training workshops and the materials that were produced were later used to inform the development of an online training course in LoCloud technologies.

In addition to providing training and training materials, LoCloud established a support portal. This portal provides access to technical and user documentation, the training materials and course, the training videos and a question and answer service.

The outcomes of this work have included enabling the development of local training courses delivered by partners and supporting staff development.

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18 [http://support.locloud.eu/courses/](http://support.locloud.eu/courses/)
19 [http://support.locloud.eu/](http://support.locloud.eu/)
6.5.1. Staff development and use of the LoCloud online courses

“Participation in LoCloud led to increasing use of digital technologies by FRS staff. In particular we improved our skills in the use of catalogues online as Samira - Catalogo Umbria Cultura, our software for cataloguing online for art collections, LoCloud Collections and Bibliowin for the bibliographic collections. We learned to manage our dataset in software for mapping, harvesting and enriching metadata in MINT and More.”

Giulia Coletti, Fondazione Ranieri di Sorbello

Hacettepe University Department of Library Science, Turkey

Hacettepe University (HU) has implemented a learning management system for in-house training (http://locloudegitim.org). The LoCloud Tools and Services online course is included in the system. Technical staff at Koc University VEKAM (HU data providing partner in LoCloud), students and staff at Hacettepe University have been used the courses. There have been seventy eight participants in the courses so far.

Figure 35: Hacettepe University LoCloud e-learning course modules

6.5.2. Case study: Technical training and support in Romania

Cluj County Library (BJC) organized training which is supporting professional development by staff in public libraries in Romania on digital libraries. The BJC team trained public librarians about the digitization process, from choosing the items to by digitized, then technical aspect of digitization, which technical solution to use and how to create rich metadata for the digital objects, to assure the access to those objects.
The LoCloud workshop delivered by BJC covered the use of MINT and MORe. and the Omeka application for creating metadata. It was attended by forty four people including IT specialists, bibliographers, heads of library departments from public libraries in Romania, the National Library of Romania and the Metropolitan Library in Bucharest.

BJC has established an instance of Omeka to provide a demonstration and training resource for their content partners. This instance is available at: http://omeka.bjc.ro/omeka/.

The workshop also provided an opportunity for LoCloud content providing partners to present their results, and to discuss progress with digitization and metadata creation.

Topics that were discussed during the workshop included the labelling of files, the use of the Romanian character set in metadata descriptions, the use of a subjects list, adding localities using the Geolocation menu, and the creation of exhibitions using Omeka. Participants discussed the importance of having written instructions for describing different types of digital objects to improve the results and make the process easier.

6.5.3. Balkan workshops

LoCloud partners Belgrade City Library, Rijeka City Library and Zavad Jara organized a series of five workshops in the Balkans region: Cetinje,
LoCloud

Montenegro; Trebinje, Bosnia and Herzegovina; Skopje, Macedonia; Sarajevo, Bosnia and Herzegovina; and Tirana, Albania.

The workshops were organized in collaboration with the National library of Montenegro, the Library Association of the Republic of Srpska, University of Sarajevo and the University of Tirana Library. The co-organizers helped in advertising the workshops to professionals in libraries, museums and archives, which resulted in the workshops being attended by one hundred and twenty one participants.

The workshops presented the outcomes of LoCloud project including MINT mapping, MORe, the micro-services, LoCloud Collections and the online courses, and also preparing digital content and metadata in a digital library for publication online. Participants’ experience and knowledge of digital libraries varied. For some the workshop was an opportunity to build on their existing professional knowledge, for others the topics were new and continuing support and/or follow up would be beneficial.

Figure 37: Sarejevo University Library’s instance of LoCloud Collections

6.5.4. Training for volunteers

The Discovery Programme has been working with the Royal Society of Antiquaries of Ireland in an advisory capacity to support its project to digitise its archival collections. The project to digitise the slides captured during the Dublin Housing Inquiry in 1913 has involved a team of volunteers who have
been trained and supervised by the RSAI. Discovery has offered guidance and training on the LoCloud tools and services, and on metadata standards to RSAI staff and volunteers.

6.6. Access to local content

“We are promoting the results of our participation in LoCloud at local and national digital heritage events and through our website and the main social networks. These activities have for sure involved an increasing number of visits to our website (analyzed by Google Analytics). For reasons of time, (a part of our collections has been available in Europeana only since April of this year) we haven’t observed an increasing in the number of visitors informed of our digital content in Europeana. We foresee an increase of the number of visitors in the house museum as soon as our resources will be completely published by Europeana.”

Giulia Coletti, Fondazione Ranieri di Sorbello

LoCloud involved a consortium of thirty one partners including a number of organisations that act as national and regional aggregation services, alongside others representing specific domains (such as specialised archives, public libraries and house museums). One of the objectives of the project has been for partners to exploit the project’s results in order to involve local organisations within their networks in providing content to Europeana.

Partners such as the Gironde Archives, provincie Limburg and Zavod Jara were actively involved in their regional networks of cultural institutions before the start of LoCloud. For others, such as Fondazione Ranieri di Sorbello, the project was a stimulus to working with organisations within their local area.

6.6.1. Case study: participation by local institutions in Gironde, France

The Gironde Archives had previously participated in regional networks such as the Aquitaine digital knowledge bank and the Estuaire network, and in the EuropeanaLocal project. LoCloud provided an opportunity for Gironde to encourage local players to participate in providing their content to Europeana including:

- Pôle de la Mémoire Locale du Bourgeais, a public service with local history resources,
- Conservatoire de l’estuaire de la Gironde, a local association working to promote cultural heritage via a Gironde Estuary interpretation centre in Blaye,
- Société archéologique de Bordeaux, an academic society founded in 1873 that conserves major documentary and archaeological collections,
• In Video Veritas, a local rural association using light video production as a means to promote all kinds of heritage, particularly old films,
• Musée National des Douanes, a national museum about evolution and administration of customs from Antiquity to the present day, and the history of the constitution of the French State.

Gironde presented LoCloud tools to its partners in local training workshops and dissemination events. Some partners have taken up the opportunity to establish instances of LoCloud Collections to make their content available. Others have their existing systems. But their feedback showed that providing data online and making it accessible to users via Europeana is an area of IT that is new to most smaller cultural heritage organisations. Access to training and support is important in enabling such institutions to contribute to Europeana.

Gironde noted that involvement in LoCloud and with Europeana represents a modification of the role of the regional archives, which have traditionally been a repository of data. One of the outcomes of the project is that Gironde is becoming an active advisor in document engineering for partners in the area. It has become a player in the promotion of small heritage organisations and local players who have been anonymous up until now.

6.6.2. Case study: local institutions in Umbria, Italy

LoCloud partner the Fondazione Ranieri di Sorbello has been developing partnerships with local cultural organisations to enable them to provide content to Europeana. Partners include:

The Fondazione Centro Studi Aldo Capitini, which manages the personal archive of Aldo Capitini (1899-1968) - a famous Italian philosopher and exponent of the non-violence movement in Italy. The Fondazione holds the archive and a library, and coordinates meetings and cultural events. It is located in Biblioteca San Matteo degli Armeni, Perugia.
The **Istituto Conestabile Piastrelli**, which is a cultural institution founded in 1955 by don Luigi Piastrelli (1883-1975), a local priest inspired by social ideals. The Istituto promotes cultural and scientific events and manages a library, named after Giuseppe Toniolo.

The **Fondazione Barbanera 1762**, which was founded in 2002 in Spello by the publisher Feliciano Campi. The Fondazione preserves an important archive recreating the history of the Almanacco Barbanera from 1762, the beginning of its press work. A selection of Barbanera ancient almanacs is in the final list for the publication in the Memory of the world register of UNESCO.

As a result of the partnership with FRS, the Fondazione Capitini and Istituto Conestabile Piastrelli are using LoCloud Collections, while Fondazione Barbanera (which has its own online catalogue) is using MINT. All three institutions will provide content to Europeana via MORe. FRS is supporting these institutions by providing training materials and courses from LoCloud portal.

**6.6.3. Case study: involving small institutions in Ireland**

The Irish Galleries, Libraries, Archives and Museums (GLAM) sector includes four hundred and seventy eight museums listed with the Irish Museums Association, three hundred and fifty nine branch libraries administered by local government and thirty six archives services with a number of other
museums, collections and archives also accessible to the public. Many, if not almost all, of the organisations are small and medium sized.

By comparison, as of September 2015, there were twenty Irish contributors listed in Europeana, mostly larger institutions. These include nine publicly funded bodies (mainly National Cultural Institutions), four universities, three independent organisations supported by public funding (The Heritage Council and The Arts Council), two State organisations (the national broadcaster and the Parliamentary library), a well established voluntary organisation of members and a media business. Ireland has contributed two hundred and forty thousand items with almost one hundred and seventeen thousand of them from one provider: the website Ask about Ireland.

As part of its involvement in LoCloud, the Discovery Programme has been working with several small or medium organisations with a diversity of content.

The Royal Society of Antiquaries of Ireland (RSAI) was established in 1849 ‘to preserve, examine and illustrate all ancient monuments and memorials of the arts, manners and customs of the past, as connected with the antiquities, language, literature and history of Ireland’. Through LoCloud, the RSAI has digitally published content from two of its archival collections for the first time; its Lantern Slides collection which contains thousands of images of 19th and 20th century antiquarian research and its collection of drawings and sketches by George Victor Du Noyer.

The **RSAI’s Du Noyer collection** consists of topographical drawings and sketches of buildings in Ireland produced by George Victor Du Noyer in the late 19th century. This collection was digitised through a grant from the Department of Environment in 2009. During LoCloud, the existing metadata was mapped to the Dublin Core fields of LoCloud Collections and web-sized images were created from the original scans. The metadata records were uploaded to LoCloud Collections in a bulk ingest and the image files added one by one to the item records. Although this was a somewhat daunting prospect given that there were over two thousand images the process and return on effort with this collection compared favourably to other digitisation projects.

The DuNoyer collection was harvested directly from LoCloud Collections to MORe and enriched using the Geonames Geocoding microservice. Whilst it might have been helpful to be able to exclude some local placenames from other countries (some placenames returned points in other hemispheres, such as Dingle Lake in Antartica), the results were good. It would also be useful to curators to be able to import the enriched metadata set: for example, the RSAI
would then be able to add the map points generated to the items in LoCloud collections.

The **Leo Swan collection** was left to the National Museum of Ireland by the aerial photographer in his will. Over six thousand photographs were deposited with minimal metadata. The project to digitise this collection began with grant-aid from the Heritage Council in 2011. More recently the project has continued on a voluntary basis, with support and advice from the National Museum of Ireland and the Discovery Programme.

Most of the images in the collection date between the 1970s and 1990s. They provide an important record of both archaeological sites and the landscape, which changed significantly from the later 1990s through the economic 'boom' years up to 2008.

As with the RSAI’s digitisation project, it has proved challenging to find the human and time resources required to digitise the film, to conduct research and capture metadata. These are important issues that face many small and medium institutions creating digital content.

For the curators involved in the RSAI and Leo Swan digitisation projects, publishing the content online would have involved additional challenges were it not for the availability of LoCloud Collections. Simply put, the material would not have been published online until an undetermined time in the future. The metadata almost certainly would not have reached Europeana. The availability of LoCloud Collections provided the curators with reassurance that there was an achievable route to publication for the content they had invested in creating.

**Ogham in 3D** is a collection from the Dublin Institute of Advanced Studies (DIAS), a publicly funded independent centre for research. Ogham stones are perpendicular stones which bear inscriptions in the uniquely Irish Ogham alphabet. This uses a system of notches and horizontal or diagonal lines to represent the sounds of an early form of the Irish language. The stone date at least as far back as the 5th century AD. The stones were digitised in 3D as part of a research project, which produced a range of images, 3D PDFs, 3D models and some with some metadata. The metadata presented some challenges as it had been marked up in the Epidoc specification of TEI, a standard used for text editing. LoCloud’s MINT tool was used to map from the TEI XML to EDM, where the enumerated, concatenate and value mapping features proved particularly useful. This worked quite well and has allowed the metadata for the online digital objects to be made available to Europeana.

“For small and medium institutions without any or very much digital content, I think the tools and services LoCloud provides are absolutely crucial—while
that might sound strange, it means at the planning stage for digitisation that there is a route and services they can afford, which reduces the barriers to beginning in the first place. It will take time. While curators will see the benefits of LoCloud Collections very easily, we also have to find ways to be persuasive about the returns for publishing within Europeana.”

Louise Kennedy, Discovery Programme

6.7. Access and participation

One of the benefits of working with smaller cultural institutions is their involvement with local people and the active participation of volunteers in digitization projects.

6.7.1. Crowd Sourcing: RSAI Lantern Slide collection, Ireland

The RSAI Lantern Slide collection is being digitised with the involvement of a team of volunteers who are recruited, trained and supervised by the RSAI. As part of the project, two RSAI staff members were given guidance and training by the Discovery Programme on LoCloud tools and services, including LoCloud Collections, with training being passed on to the volunteers.

![Figure 39 “Street view, Summerhill, Dublin City, Co. Dublin, Ireland,”
Royal Society of Antiquaries of Ireland
http://rsai.locloudhosting.net/items/show/24371.](image)

The collection that is being digitised includes a sub-collection referred to as Darkest Dublin. These images document the Dublin Housing Inquiry carried
out in 1913 following the death of seven people in a tenement collapse. It is an important record of the city in the same year as the pivotal industrial conflict that was the Dublin Lockout and just before the 1916 Rising.

6.7.2. New exhibitions

GKR has created six exhibitions using the SVeVID instance of LoCloud Collections:

**60 Years of Children's Libraries in Rijeka, Croatia**
An exhibition created by GKR using the SVeVID in LoCloud Collections. The exhibition recalls the early days of children's libraries and describes the work of the children's department at Stribor today in words and pictures.
https://svevid.locloudhosting.net/exhibits/show/djecje_knjiznice

**Andrija Maurović: 110 naslovnica za 110 godina, Croatia**
The exhibition covers books illustrated Andrew Maurović on the occasion of the 110th anniversary of his birth.
https://svevid.locloudhosting.net/exhibits/show/izlozba_maurovic

**Europski polozi Ljube Babića hrvatskoj kulturi: likovno oblikovanje knjiga i časopisa, Croatia**
An exploration of book covers.
https://svevid.locloudhosting.net/exhibits/show/izlozba_babic

**Gradska knjižnica Rijeka, Croatia**
An exhibition about the foundation and history of Rijeka City Library; the central public library of Rijeka and the central library for public and school libraries in Kvarner County.
https://svevid.locloudhosting.net/exhibits/show/izlozbagkr

**Hlapićeva baština, Croatia**
Exhibition dedicated to "Lapitch the Little Shoemaker" published for the first time in Zagreb in 1913.
https://svevid.locloudhosting.net/exhibits/show/hlapiceva-bastina

**Three reasons to celebrate in Rijeka City Library (GKR 2009), Croatia**
An exhibition held in the Reading Room of Rijeka City Library to celebrate the anniversary of Rijeka Public Reading Room 1849-2009; the new Reading Room and the 40th anniversary of Rijeka Mobile Library.
https://svevid.locloudhosting.net/exhibits/show/slavlje2009
6.7.3. Putting culture on the map: eCultureMap

eCultureMap is a map-based search interface for Europeana content that was developed under the CARARE project by the Institute for the Protection of Cultural Heritage of Slovenia (IPCHS) and which now includes content from several projects. eCultureMap enables users to search for content relating to a place starting from a map. The results bring together content such as books, photographs and videos with monuments and buildings, and can be used to prepare walking tours and visits to a place.

![Figure 40: Finding content for the Czech Republic using eCultureMap](image-url)
7. Sustainability

This section outlines what indications there are that the outcomes will be sustained. As part of the evaluation, the availability of existing frameworks that could support the continuation of the services and support were investigated.

7.1. General and business-related outcomes

The potential for sustainability of the services after a project ends is crucial to preserving the project’s outcomes and impact. As part of the survey of operational outcomes, LoCloud service developers were asked about their future plans for maintaining and sustaining their service in the future. 75% of the LoCloud service providers described their plans; their answers indicate that various options are under consideration. Several of the services will be distributed, maintained and hosted for free. Other partners are considering pricing schemas; these schemes are still under development but there was some mention of differentiated subscription costs in the coming years. The idea of creating both community and premium versions of the services was expressed. Some web-services, like the Background Linking and the Vocabulary Matching are backend technical services for which the source code has been published under free licences.

<table>
<thead>
<tr>
<th>LoCloud Service</th>
<th>Maintenance</th>
<th>Paid usage</th>
<th>Free usage</th>
<th>Further develop</th>
<th>Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>MORE</td>
<td>Yes, software updates/maintenance</td>
<td>Full functionality for medium and large institutions.</td>
<td>Full functionality for small institutions.</td>
<td>Planned, Operation in multiple domains</td>
<td>Yes, system operations, hardware</td>
</tr>
<tr>
<td>MINT</td>
<td>Yes, via Europeana DSI</td>
<td></td>
<td></td>
<td>Yes, Via Europeana DSI</td>
<td>Yes, via Europeana DSI</td>
</tr>
<tr>
<td>LoCloud Collections</td>
<td>Yes</td>
<td>Full functionality for datasets above 500 MB</td>
<td>Full functionality for smallest datasets (up to 500 MB)</td>
<td>Yes, via PSNC resources and possibly DSI.</td>
<td>Yes, Help desk</td>
</tr>
<tr>
<td>Historic Place Names</td>
<td>Planned via national infrastructure</td>
<td>N/A</td>
<td>Full service functionality</td>
<td>Planned by integration into other platforms</td>
<td>Planned via national infrastructure</td>
</tr>
<tr>
<td>Geolocation API</td>
<td>Yes</td>
<td>N/A</td>
<td>API access with limited number of requests per IP per day.</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>LoCloud Service</td>
<td>Maintenance</td>
<td>Paid usage</td>
<td>Free usage</td>
<td>Further develop</td>
<td>Support</td>
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<td>---------------------------------</td>
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<td>------------------------------------------------------</td>
<td>-----------------</td>
<td>---------------------------------------</td>
</tr>
<tr>
<td>Geocoding service</td>
<td>Yes</td>
<td>Premium features</td>
<td>Yes, with limited data amount</td>
<td>Yes</td>
<td>Yes, Per-product basis and help desk</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vocabulary Service</td>
<td>Yes</td>
<td>Data storage with fixed price or usage-based price.</td>
<td>Depending on the overall approach of project consortium after the project.</td>
<td>Yes, via new projects</td>
<td>Yes, Help desk and second level support</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vocabulary Matching</td>
<td></td>
<td>Dedicated support and maintenance services</td>
<td>Source code, free license (Apache license)</td>
<td>Yes, via new projects or Europeana DSI</td>
<td>Yes, paid</td>
</tr>
<tr>
<td>Background Linking</td>
<td></td>
<td>Dedicated support and maintenance services</td>
<td>Source code, free license (Apache license)</td>
<td>Yes, via new projects or Europeana DSI</td>
<td>Yes, paid</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wikimedia</td>
<td>Yes, updates / maintenance</td>
<td>N/A</td>
<td>Full functionality for small institutions</td>
<td>Yes</td>
<td>Yes, via MORE</td>
</tr>
<tr>
<td>Crawler ready tagging tools</td>
<td>Yes, community version</td>
<td>N/A</td>
<td>Community version in GitHub.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Support Portal</td>
<td>Yes</td>
<td>Access to all documentation, training materials and other self-service services.</td>
<td>Support requiring human intervention from tools and services providers, probably based on individual agreements.</td>
<td>Yes, if there will be proper agreement of LoCloud partners after the end of the project.</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Table 4: LoCloud Services sustainability**

Throughout the project’s lifetime LoCloud has had close contact with the Europeana office and the Europeana Cloud project. Both have been very interested in the LoCloud outcomes, especially the MORE aggregation framework, MINT, the enrichment services and LoCloud collections.

The project is currently in discussion with Europeana concerning the integration of LoCloud services into Europeana’s Digital Service Infrastructure;
and service providers are currently making preparations to pave the way for this. Such cooperation with Europeana would provide network capabilities and should help to secure funding to maintain, support and develop the services in future. Europeana is currently investigating the possibility of setting up a cooperative to run Europeana Cloud as an independent service. Pricing and funding schemes for any LoCloud services offered as part of the Europeana DSI (or Europeana Cloud), would be developed within the framework of Europeana's overall business strategy.

The LoCloud services are quite varied in type. Some are technical web-services that can mainly be used and implemented by technicians (LoGeo API, Background Linking and Vocabulary Matching, Vocabulary Web Service). Other services have an end-user interface and can be used via online tools (LoCloud Collections, Geocoding App, Vocabulary Application, Historic Place Names Service). Others are specifically tailored services or proof-of-concept prototypes (Wikimedia Service, Crawler Ready Tagging Tool). Other LoCloud developments are platforms in which LoCloud micro-services have been integrated, and in this way made them more usable for end users (MORe). The differing scopes of the services and applications mean that the business scenarios vary considerably:

- The technical web-services have mostly been licensed under free public licenses and published in online repositories like GitHub,
- The service providers who have developed or shaped end user interfaces are planning to provide their services under different pricing schemes ranging from free community solutions to fee-based premium solutions,
- The tailored services and proof-of-concept prototypes would need to be developed and shaped further in order to become out-of-the-box solutions for a wider end-user audience,
- The platform services provided within LoCloud are currently seeking or forming professional partnerships with Europeana and other projects/initiatives to secure sustainability of their services.

Figure 41 gives a graphical overview of the business scenarios for one of the services, see Annex 1 for graphical overviews for all services.
7.1.1. Outlook

During the development phases of the project users expressed ideas for further development or applications of the services. These ideas were recorded by the developers and will be considered in future development plans.

In their responses to the survey carried out for this report, LoCloud developers focussed on improvements to the existing tools in order to to widen their user target group. The enhancements envisioned include:

- Adding RDF relationships and RDF serialization,
- Enabling easier integration of specific services into local systems,
- Enriching the current database and the service offered (by including new vocabularies and data),
- Work on interoperability with other services,
- Focus on data quality and data linking,
- Optimizing the user interfaces, and
- Simplifying authentication to the suite of LoCloud services by offering a combined login.

See Annex 1 for a detailed description of the various outlook scenarios.
8. Conclusions

This report has considered the operational outcomes of LoCloud on Europeana and the network of cultural institutions that provide Europeana’s content.

LoCloud was funded under the European Commission’s CIP ICT PSP programme with the overall goal of exploring the potential of cloud technologies to ease the task for smaller cultural institutions in making their content available to Europeana. Many cultural institutions face limitations in their IT infrastructure, in their funding and in accessing staff with the skills and experience of working with digitization and digital libraries.

The outcomes of the project include a range of tools and services designed to support smaller cultural institutions and aggregators in the process of capturing content and metadata for their online audiences and Europeana. Importantly, the outcomes also include increasing the availability of support, guidance and training for staff and volunteers working in cultural institutions on digitization projects. Both the technical and the human outcomes of the project contribute to Europeana’s vision of opening up access to Europe’s cultural heritage.

One of the main challenges identified by Europeana in delivering its vision, is accessing good quality cultural heritage content that is ready for re-use in research, education, tourism and the creative industries. Europeana is currently exploring ways of transforming the process by with content is aggregated to make it easier for institutions to participate and, at the same time, to improve the quality of the provided metadata. LoCloud is having a direct impact on this work.

Most cultural heritage institutions provide their content to Europeana via aggregators taking advantage of the range of services being made available. By integrating LoCloud Collections, MINT and the enrichment services into the MORe aggregation platform, LoCloud has demonstrated the potential for offering a one-stop-shop for cultural institutions and for making improvements to the aggregation platform. At the same time, LoCloud has used the service to deliver enriched cultural heritage metadata from its network of two hundred and ninety seven data providing institutions to Europeana.

LoCloud’s services are adapted for the wide Europeana community and have already received quite a lot of attention from institutions, aggregators, projects, developers and Europeana itself. Several of the services are being exploited by external organisations and projects. The growing use of LoCloud Collections is helping to increase the amount of local and regional heritage information available for inclusion in Europeana.
LoCloud

There is an increase in the capacity of smaller cultural institutions to participate in Europeana as a direct result of LoCloud’s work. The establishment of the support portal, documentation and training materials, and LoCloud’s partners work to rollout the support and training to their local partners in their national languages all contributed. The impact on Europeana is through the increased availability of local cultural heritage content online that complies with its specifications.

The outlook for LoCloud services foresees various business scenarios including support services, licensing for developers, free community solutions, fee-based premium solutions and further development. Discussions are currently underway with Europeana concerning the integration of some of LoCloud’s services into Europeana’s core infrastructure.

LoCloud’s approach of developing cloud-based micro-services has proved to be very flexible. It provides the perfect starting point for a joint market place scenario, and a good basis for further technical achievements and enhanced products and continuing impact on Europeana, its aggregators and content partners.
References


Annex 1 – Survey of IaaS and SaaS infrastructure: summary of responses

A survey was carried out among the developers of the LoCloud services to evaluate the outcomes and outputs. The following pages provide an overview of the results of this survey and the questions asked.

The questionnaire consisted of two parts, the first part dealt with general and business-related outcomes such as relevance, effectiveness, efficiency, sustainability and outlook. The second part of the questionnaire was devoted to technical and cloud-related outcomes such as resource pooling, elasticity, self-service, on-demand services, pricing, quality of services and usage.

**PART 1: Evaluation of general and business-related outcomes**

**RELEVANCE**

*Q: Have you followed good practices (standards) in the development work?*

12 YES

All partners replied that they used good practice methodology and standards in their development work. Among the good practices used for development were:

- Agile development methodology scrum
- Code peer review
- Performance testing
- Source code in GIT repository
- Redmine bug tracker

The developments were based on the following technical and domain standards:

- JSON, XML
- PureCSS, jQuery, LAMP
- Open standard formats
- REST
- ANSI/NISO Z39.19-2005 thesaurus norm
- CIDOC-CRM
Q: Has the output been adequately adapted to local institutions’ needs?

9 YES
3 NO

It was a prime objective for all service developers to provide solutions that meet a variety of institutions’ needs. Therefore the development teams analysed possible use cases and the local content providers’ community demands. Some development teams received direct requests from the LoCloud content providers and implemented these needs in the technical services offered.

Some of the services, like the background linking and the Historic Place Names service, are standard services for any type of institution and the Crawler Ready Tagging tool is mainly a prototype effort that targeted at demonstrating the concept of ingesting non-processed data. These services have not been adapted to institutions’ needs. The Wikimedia application was been adapted to content captured by an individual photographer, which included several customizations.

EFFECTIVENESS

Q: Does the output differ from the envisaged result that has been described in the LoCloud Description of Work (DOW)?

1 YES
11 NO

All but one service stated that the developed output corresponds to the envisaged result described in the LoCloud work plan. The Crawler ready tagging tool differed as it changed from a desktop application to web based application. This change was realized based on the user feedback received in the testing phase.

Q: Were there significant unexpected results or achievements?

3 YES
9 NO

Three development teams described unexpected results that were achieved during the development phase. Due to the large size of
LoCloud

the vocabularies loaded into the vocabulary tool optimization techniques had to be applied in order to reduce the loading phase and, thus, the overall performance of the service.

The main challenges in the development of Historic Place Names (HPN) micro service were the different existing information systems and the different approaches to geographic data and its management applied by the creators of these systems. Thus a matching algorithm, which qualified the main principles of service operation, was developed during the implementation process to ensure the interoperability between different information objects. The matching procedure is based on the algorithm, which evaluates lexical and geographical distances between places and creates matching log entries that are preserved in the HPN information system.

The LoCloud collection service was originally designed for small institutions but seems to be gaining popularity also among humanities research teams. Several big, national level institutions expressed interest in running similar service on their own, potentially re-using LoCloud technology.

**Q: Have any significant events occurred affecting the output?**

1 YES
11 NO

One service reported a significant event that directly affected the development output. The MORe aggregator became more flexible and now includes now more functionalities than the originally envisaged in the DOW. Examples include: dynamic enrichment plans, more enrichment services such as the language identification and the semi-automated vocab. matching, etc.

Other service teams stated that the feedback and improvement cycle were prolonged but this had not affected the output.
Q: Who are the main beneficiaries of your output?

The development partners have been asked to identify the main beneficiaries of the outputs they have produced. The answers showed that the majority of the services have been tailored for (small or medium) content providers or content providing institutions. Several development partners listed end users and individuals as beneficiaries of their services (the geo enrichment services, the Wikimedia service, crawler tools and the LoCloud collections). Some services are especially intended and useful for LoCloud partners (e.g. vocabulary matching and support portal) and some for aggregators (e.g. vocabulary services, vocabulary matching, Historic Place Names) and aggregation platforms like Europeana. The tourist sector and other content providing communities and networks are mentioned once as possible beneficiaries by two services.

The following table lists the replies to this question made by the technical LoCloud partners.

<table>
<thead>
<tr>
<th>LoCloud Service</th>
<th>Beneficiaries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geocoding App</td>
<td><strong>Any institution</strong> or <strong>individual</strong> with tabular data that are potential beneficiaries. The initial target market is regional and national institutions within the <strong>MLA</strong> and <strong>tourism</strong> domains that would like to enrich their existing data through crowd sourcing.</td>
</tr>
<tr>
<td>LoGeo API</td>
<td>The main beneficiaries are <strong>institutions</strong> or <strong>individuals</strong> with the need to enrich their metadata or place names data into geographical coordinates.</td>
</tr>
<tr>
<td>Background Linking</td>
<td><strong>LoCloud content providers</strong> and <strong>aggregators.</strong></td>
</tr>
<tr>
<td>Vocabulary Matching</td>
<td><strong>LoCloud content providers</strong> and <strong>aggregators.</strong></td>
</tr>
<tr>
<td>LoCloud Service</td>
<td>Beneficiaries</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Vocabulary Web Service</td>
<td>&quot;(i) <strong>Content providers</strong> that want to use vocabularies for enrichment of their data during the transformation process. (ii) Content providers that want to skosify their vocabularies and make them available for use in the LoCloud metadata transformation process. (iii) The MORe and other <strong>aggregation platforms</strong> that integrate the vocabularies via web services in the automated enrichment process.&quot;</td>
</tr>
<tr>
<td>Historic Place Names</td>
<td>The service is mainly orientated towards digital <strong>content providers</strong> and <strong>aggregators</strong> and <strong>people</strong> who are interested in history, geography and historic geography (researchers, amateurs, etc.). The functionalities of the microservice vary depending on the type of user (registered and non-registered users). Specific functionalities of the HPN microservice are more orientated towards professional users as they require specific knowledge of the field or technical skills. Professional users of the HPN microservice could be digital heritage databases administrators, content providers and aggregators, memory or research organizations and especially budget-limited cultural institutions that cannot afford to invest in development of high quality computer infrastructure.</td>
</tr>
<tr>
<td>Wikimedia</td>
<td>Wikimedia application is focused on <strong>individual</strong> content.</td>
</tr>
<tr>
<td>MORe</td>
<td>Although initially the target was the <strong>cultural heritage sector</strong> and more specifically <strong>Europeana</strong>, currently there is interest from a large variety of <strong>communities</strong> and domains including: DARIAH, ARIADNE, Research Data Alliance, etc.</td>
</tr>
<tr>
<td>Crawler tools</td>
<td>&quot;The main beneficiary of the prototype experiment is <strong>Europeana</strong> as it proves the concept of complementing the current ingestion workflow with a self-service mechanism for quickly aggregating a large quantity of data to achieve comprehensive coverage and critical mass. <strong>End-users</strong> will only become beneficiaries once the CRTT is connected to either an aggregator or to Europeana itself.&quot;</td>
</tr>
<tr>
<td>MINT</td>
<td><strong>Content providers</strong> can easily transform the metadata</td>
</tr>
<tr>
<td>LoCloud Service</td>
<td>Beneficiaries</td>
</tr>
<tr>
<td>-----------------</td>
<td>---------------</td>
</tr>
<tr>
<td>to the project standards by using MINT and European benefits by getting high quantity EDM metadata.</td>
<td></td>
</tr>
<tr>
<td>LoCloud Collections</td>
<td>Small cultural heritage institutions which can put their collections on-line and anyone who is interested in access to and aggregation of their data, including Europeana.</td>
</tr>
<tr>
<td>Support Portal</td>
<td>LoCloud partners and other small cultural heritage institutions which can access information about LoCloud tools and services and ask for support.</td>
</tr>
</tbody>
</table>

**Q: Please list any content providers/aggregators that are using your service on their own platforms?**

The LoCloud services can be either used on the content providers’ own software and aggregation platform, or via the online ingestion platforms provided by the project. As the services have been implemented only recently the majority of LoCloud content providers are using the services on the platforms provided by LoCloud (MORe and MINT) rather than their own systems.

<table>
<thead>
<tr>
<th>LoCloud Service</th>
<th>Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geocoding App</td>
<td>The National Archives of Norway.</td>
</tr>
<tr>
<td>LoGeo API</td>
<td>The MORE ingestion tool is already using LoGeo service on its own platform.</td>
</tr>
<tr>
<td>Background Linking</td>
<td>The MORe ingestion tool is already using the background linking service.</td>
</tr>
<tr>
<td>Vocabulary Matching</td>
<td>The MORe ingestion tool is already using the vocabulary matching service.</td>
</tr>
<tr>
<td>Vocabulary Web Service</td>
<td>Via MORe all LoCloud aggregators and content providers can use the vocabulary service. The vocabularies of several LoCloud partners were uploaded to the vocabulary application and made available in MORe.</td>
</tr>
<tr>
<td>Historic Place Names</td>
<td>No answer provided.</td>
</tr>
<tr>
<td>Wikimedia</td>
<td>Paul Mayert, Wiki loves Monuments</td>
</tr>
<tr>
<td>MORe</td>
<td>All the [LoCloud] content providers and aggregators used and use MORe.</td>
</tr>
<tr>
<td>Crawler tools</td>
<td>The solution is only a prototype and has been applied</td>
</tr>
</tbody>
</table>
LoCloud

<table>
<thead>
<tr>
<th>LoCloud Service</th>
<th>Users</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>to three test collections as outlined in the deliverable documentation. It is not presently in use in production environments.</td>
</tr>
<tr>
<td>MINT</td>
<td>All the [LoCloud] content providers and aggregators used and use MINT.</td>
</tr>
<tr>
<td>LoCloud Collections</td>
<td>The LoCloud Collections Platform is currently operated just by PSNC. Europeana is considering inclusion of the platform into their service offering.</td>
</tr>
<tr>
<td>Support Portal</td>
<td>LoCloud Support portal is by its nature unique and is not distributed to other platforms.</td>
</tr>
</tbody>
</table>

**Q: What longer-term effects were produced?**

Several technical partners pointed out that their developments and the technology used for LoCloud build a basis for further technical achievements and enhanced products, which can be regarded as longer-term effects of their work. The potential of the aggregation platform, the LoCloud Collections service and the vocabulary service has been rated high by the partners as they are services for a wide European community and these services received quite a lot of attention in the cultural heritage community. Nevertheless, for some LoCloud services it was hard to determine more detailed longer-term effects because the services have just been developed recently. The longer-term effects of the Support portal are perceived in the availability of a considerable amount of documentation material and its support offering functionalities that will persist well beyond project end.

**EFFICIENCY**

**Q: Have the work plan and cooperation among the developing partners worked well for you?**

All partners responded that the cooperation among them worked well and no issues were identified that could have been handled in a better way. The development tasks have been clearly split among the partners, and responsibilities were also clearly divided. The technical partners met online in regular time intervals and discussed their status of development and clarified timely any questions or issues.
Have you been able to finish comprehensive documentation of your work in time?

11 YES
1 NO

All but one of the LoCloud technical services teams responded that the documentation has been finished on time. The services are documented in simple user guides, technical guides and online tutorials are available in the LoCloud support centre: http://support.locloud.eu/. For some services there is in-line code documentation is included, this is targeted at code contributors.

One feedback was given that in addition to the existing documentation it would be good to create a short overview and introduction to all services and to insert several quick guides for end-users within the MORe aggregation platform.

The LoCloud Crawler tool is documented in terms of in-line code comments as well as self-explanatory captions and lead texts in the user interface. As this is a prototype, no comprehensive end-user documentation has been prepared beyond the guide and examples included in the deliverable report.

Q: Thinking about the development process of your output/service. What went well? What could have been done better?

What went well...

Most partners responded that the development and integration process of the various services went very well and in line with the expectations and planning. Partners have used a straight forward developing process and adapted already existing tools to LoCloud needs. One technical partner pointed out the positive experiences they had with introducing Scrum meetings for the development process, because everybody was on track and motivated.

Another partner stated that the cooperation with content partners and their involvement in testing and translation of the service went very well. And the cooperation with technical partners and their involvement in providing documentation went very well, too.

What could have gone better...

The following statements depict issues that have appeared during the development process that could have been solved better:
• “In retrospect, faster engagement of test users at key milestones would have made it possible to fix “showstoppers” and bugs at an earlier stage and cause less “hold-ups” in the testing cycle.”
• “Regarding the vocabulary matching service, there were some issues related with the multilingual nature of the input.”
• “As for Wikimedia service, the main functionality went well while the normalization and customizations of Wikimedia content could have been better.”
• “The integration of enrichment services into the MORe platform could be done better.”
• “It would have been beneficial to have a brainstorm session for the crawler tool with a select panel of end-users prior to starting the first part of the development in order to avoid the 2 month delay incurred by the effort of initially developing a desktop application where the market were interested in a web application.”
• “On the other hand, integration of development between technical partners could be closer, especially in the context of shared user authentication system.”
• “On the other hand content partners could provide more translations of the documentation into their languages.”

Summing up the main points that could have been done better for some outputs were:
• User related: Faster engagement of test users, initial brainstorming sessions, multilingual documentation;
• Integration related: Integration of enrichment services, integration of a shared authentication system;
• Development related: Multilingual features, normalization and customization.

SUSTAINABILITY

Q: How will your project achievements/outputs be maintained and expanded over time?

While three LoCloud services development partners did not give a precise response on how they intend to keep up their services the majority of the partners, representing nine services, expressed quite clearly their future plans. These nine services will be distributed, maintained or hosted mostly for free in the coming years. One partner indicated that there will be community versions of the services that will be distributed without costs, but that premium features will be charged. One service is already part of the Europeana service plan and will be enhanced and maintained within the Europeana infrastructure. Two
partners also indicated that they are aiming to enhance the existing services via new project participations.

<table>
<thead>
<tr>
<th>LoCloud Service</th>
<th>Plans for maintaining and expanding the output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geocoding App</td>
<td>The service will be further developed into a stand-alone SaaS service where users can setup new accounts and upload their data in a self-service environment. <strong>Limited data volumes will be available for free</strong> and premium features may be inactive in order to provide for a pay-wall type of business model.</td>
</tr>
<tr>
<td>LoGeo API</td>
<td>The service will be maintained accordingly to DoW. <strong>Help and support</strong> for using the basic existing web-based console and API will be provided to all potential users for <strong>free</strong>.</td>
</tr>
<tr>
<td>Background Linking</td>
<td>The <strong>software is publicly available</strong> and is distributed using free licenses. This ensures that anybody can deploy it into their machines. Because the source code is available, anybody can use, inspect, and expand it.</td>
</tr>
<tr>
<td>Vocabulary Matching</td>
<td>The <strong>software is publicly available</strong> and is distributed using free licenses. This ensures that anybody can deploy it into their machines. Because the source code is available, anybody can use, inspect, and expand it.</td>
</tr>
<tr>
<td>Vocabulary Web Service</td>
<td>The <strong>existing status will be pertained</strong> and future enhancements could be carried out via new project involvements.</td>
</tr>
</tbody>
</table>
| Historic Place Names  | To ensure the sustainability of the microservice it’s important that it is used and re-used in future collaborations and similar projects. Further development of the HPN infrastructure should consider:  
  • applying HPN microservice and its functionalities within Europeana;  
  • introducing HPN microservice to other international research communities (e.g. DARIAH) and/or projects;  
  • integrating HPN microservice into key national systems and/or projects.                                                                 |
| Wikimedia              | -                                                                                                               |
| MORe                  | The increased flexibility and re-use capabilities of                                                                 |

D5.2 Operational outcomes and impact on Europeana  85
<table>
<thead>
<tr>
<th>LoCloud Service</th>
<th>Plans for maintaining and expanding the output</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>MORE</strong> enable it to operate in multiple domains both in the public and in the private sector.</td>
</tr>
<tr>
<td>Crawler tools</td>
<td>LoCloud will use the experiment as a proof of concept at joint meeting points with Europeana, seeking to influence to the future development direction and overall paradigm of the central technology stack. A <strong>community version</strong> of the software will be maintained on GitHub to secure the availability of LoCloud results <strong>for re-use</strong>.</td>
</tr>
<tr>
<td>MINT</td>
<td>NTUA will participate in EUROPEANA digital service infrastructure for sustaining and expanding MINT according to <strong>EUROPEANA developing plan</strong>.</td>
</tr>
<tr>
<td>LoCloud Collections</td>
<td>PSNC will be <strong>running LoCloud Collections service</strong> after the project. It will be further <strong>promoted and developed</strong> using PSNC's own resources. It is also planned to include the service in future PSNC projects on both national and international level.</td>
</tr>
<tr>
<td>Support Portal</td>
<td>PSNC will continue <strong>hosting LoCloud Support portal</strong>, but the maintenance of the portal content depends on how technical partners will be interested in doing it.</td>
</tr>
</tbody>
</table>

Q: Which support functions are needed for your service in future and how do you plan to continue support and help desk activities?

The LoCloud project has already established a comprehensive online help desk where end users and aggregators can download documentation on the various services and get directly into contact with the individual development teams. Nevertheless the majority of the technical partners have also indicated to carry out the day-to-day support for LoCloud products and services via their corporate help-desk in future.

<table>
<thead>
<tr>
<th>LoCloud Service</th>
<th>Future support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geocoding App</td>
<td>It is AVINET’s strategy to provide support on a per-product basis, i.e. to transfer the support for the geocoding service to our <strong>corporate help-desk</strong> after the completion of the LoCloud project.</td>
</tr>
<tr>
<td>LoGeo API</td>
<td><strong>Help and support</strong> for using the web-based application and <strong>API</strong> is going to be provided to all potential users for free.</td>
</tr>
<tr>
<td>Background</td>
<td>-</td>
</tr>
<tr>
<td>LoCloud Service</td>
<td>Future support</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>---------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Linking</td>
<td></td>
</tr>
<tr>
<td>Vocabulary Matching</td>
<td>We will continue the cooperation with the help desk and offer second level support.</td>
</tr>
<tr>
<td>Vocabulary Web Service</td>
<td></td>
</tr>
<tr>
<td>Historic Place Names</td>
<td>Integration into national and international technical infrastructures should be considered to be the main factors ensuring further support of the service. In order to avoid duplication of products among different Europeana projects, LoCloud partners should focus on promoting developed microservices to the groups of interest and raising awareness in digital heritage community. At the national level HPN microservice was integrated into ARUODAI information system which constitutes a national infrastructure for Humanities research and is included into national roadmap.</td>
</tr>
<tr>
<td>Wikimedia</td>
<td></td>
</tr>
<tr>
<td>MORe</td>
<td>System operations, hardware, software updates / maintenance.</td>
</tr>
<tr>
<td>Crawler tools</td>
<td>Until a service like CRTT becomes part of either an aggregator or Europeana, no support functions are planned.</td>
</tr>
<tr>
<td>MINT</td>
<td>User manual that described MINT functionalities can be found at <a href="http://support.locloud.eu">http://support.locloud.eu</a> If the MINT function expands or changes the user manual will also be updated.</td>
</tr>
<tr>
<td>LoCloud Collections</td>
<td>The service needs documentation, which is currently available in the form of wiki pages, e-learning course and training videos. This part will be maintained further by PSNC. Regarding help desk, it will be also necessary but, depending on the sustainability of LoCloud’s help desk after the project, it is considered to provide support for LoCloud Collections users via general PSNC help desk facilities. International help desk will on the other hand require cooperation with LoCloud content partners from other countries.</td>
</tr>
<tr>
<td>Support Portal</td>
<td>The support will be provided by each technical partner respectively.</td>
</tr>
</tbody>
</table>
Q: Are there indications that other partners or Europeana will continue to support your achievements/outputs?

8 YES
3 NO

Three of the eleven partners that responded to this question indicated that although there is potential of integrating their services to platforms like MORe or Europeana no concrete steps in this direction have been taken yet.

Europeana and Europeana Cloud have been interested in the results of the LoCloud services since the start of development. These services are considered an important feature to be added to the Europeana Cloud and Europeana environment in future. Further collaboration may include its usage in the Europeana Digital service infrastructure project. There have been several coordination meetings with Europeana during the past year to discuss options for the future.

The integration of the Historic Place Names (HPN) service into the LoCloud technical infrastructure and its cohesion with CARARE project is seen as an important factor considering further exploitation of the HPN micro-service through Europeana and any other Europeana related projects.

The MORe platform is aiming to continue its collaboration with the vocabulary services provider. Europeana has also shown interest in using MORe as an aggregation service. MORe is used by the CARARE aggregator for Europeana.

Europeana uses a version of the MINT service itself for content ingestion and its use some of the aggregators is being supported under the Europeana DSI with funding from the CEF programme.

Several content partners of the LoCloud project have expressed interest in promoting and further using the LoCloud Collections platform. Europeana on the other hand is initially interested in using the platform to store the results of community collection days (Europeana 1989 and Europeana 1914-1918). Some technical partners of LoCloud will also be interested in the further support of the support portal, as it is the main way of providing information for the users of their tools.
Q: Please describe a short business scenario(s) for your service and indicate the target user communities

As part of the survey the partners were asked to draft briefly any possible future business scenarios they could identify for their services.

The next pages provide an overview of the responses received and graphically depict the various ways business may be conducted for the LoCloud services in future. For further details on the individual descriptions of the business scenarios please see the quoted survey responses in the annex to this document.

Short scenario MORE:

- Strategic partnerships in private sectors for aggregating corporate data
- Expand MORE’s capabilities in order to be used in other domains and fund through H2020 projects

Short scenario MINT:

- MINT can be used as a web service in cloud environments where users will use it to map and transform metadata and publish to EUROPEANA. The target users are content providers that want to publish to EUROPEANA.
Short scenario **LoCloud Collections:**

First business scenario assumes that users which are hosting their content in LoCloud Collections are paying very low fees for the service. More details can be found at [https://locloudhosting.net/offer](https://locloudhosting.net/offer)

Second business scenario assumes that bigger institutions like national libraries are covering costs of many small users of LoCloud Collections at once, for example by getting funding from their Ministry of Culture. In such case fees will be negotiated individually.

Short scenario **Historic Place Names Service:**

National and international interested parties – all institutions or projects which are involved in digitizing cultural heritage

Use HPN as joint promoting solution in connection with Europeana and other international partners.

Use HPN as a part of LoCloud package of software solutions (LoCloud micro-services).

Use HPN as separate software solution.
Short scenario **Geolocation API:**

- User signs up for an account and geocodes dataset herself – price according to data volume – potentially free
- LoGeo API and LoGeo Console basic version (existing service) for free
- LoGeo advanced version (will be developed), enhancement of the basic version with additional more sophisticated tools will be payable

Short scenario **Geocoding Service**

- User has one or more datasets that he/she would like to show on a map
- Requests professional services for geocoding – receives a quote
- Signs up for an account and geocodes dataset herself – price according to data volume – potentially free
- Payment
Short scenario **Vocabulary Service:**

A content provider is looking for a means to publish vocabularies that are used during metadata generation online and make them available for cooperation purposes.

The content provider seeks support to set up an own internal vocabulary platform and needs guidance on creating skosified vocabularies.

The content provider imports the vocabularies into the LoCloud vocabulary service. The content provider acknowledges to LoCloud that these vocabularies are open and free to use by other partners.

The vocabularies become available at the LoCloud vocabulary website and can be publicly used via web services for cataloguing purposes.

The vocabularies are integrated into the MORe platform and available for all MORe partners.

Short scenario **Background Linking and Vocabulary Matching:**

Content provider/aggregator that wishes to automatically enrich content with background links

Content provider/aggregator that wishes to automatically enrich their content with background links and vocabulary concepts

We can offer services for supporting the installation and deployment of the services.
LoCloud

**Short scenario Wikimedia Service:**

Expand Wikimedia service to be used for harvesting content from Wiki loves monuments.

**Short scenario Crawler ready tagging tools:**

Crawler Ready Tagging Tool as an alternative ingestion channel for Europeana: CRTT would allow users self-service configuration of extraction of data directly from the institutions HTML presentation.

**Short scenario Support Portal:**

One business scenario assumes that costs of providing the support services and support portal maintenance will be covered by the technical partners, who will be achieving income from their services.

The second business scenario assumes that the support portal will be a paid service, operating in financial terms independently from other LoCloud tools and services.
Q: Did you receive user requests that could not have been realized?

2 YES
10 No

Two LoCloud service partners responded that they received requests from users that could not have been realized. One of these requests was the implementation of multilingual support in the Background Link service.

Another request was from a user of LoCloud Collections that was interested in getting direct access to the infrastructure on which his digital collections system was hosted and this was not possible due to security restrictions. Concerning LoCloud collections several users provided ideas for further development of service functionality, which are not yet implemented but are included in service development plans.

Q: Which usage and development possibilities do you see for your service in future? What ideas have been suggested by the users of your service?

The responses received on future usage possibilities put a focus on various aspects for improvement of the existing tools in order to reach a wider audience of users. Among the envisioned enhancements are adding RDF relationships and RDF serialization, easy integration into local systems, enriching of the database and the service offer, work on interoperability with other services and, focus on data quality and data linking, optimization of user interfaces and reducing authentication complexity.

The following table enlists the various answers provided by the partners.

<table>
<thead>
<tr>
<th>LoCloud Service</th>
<th>Usage and Development possibilities in future</th>
</tr>
</thead>
<tbody>
<tr>
<td>MORe</td>
<td><strong>Expanding</strong> the list of supported enrichment micro-services.</td>
</tr>
<tr>
<td>MINT</td>
<td>In future focus will be given on the evaluation of the <strong>metadata quality</strong>, linking to external data sources and supporting <strong>RDF serialization</strong></td>
</tr>
<tr>
<td>LoCloud Collections</td>
<td>Ideas suggested by users are mostly related to the area of <strong>automated batch import</strong> of data to LoCloud Collections platform from their old systems. Other scope of development is <strong>extension of metadata modelling features</strong> to facilitate the use of LoCloud</td>
</tr>
<tr>
<td>LoCloud Service</td>
<td>Usage and Development possibilities in future</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Historic Place Names</td>
<td>• <strong>Enriching</strong> HPN Thesaurus content;</td>
</tr>
<tr>
<td></td>
<td>• Investigating different <strong>GIS data management</strong> models from contemporary point based model to polygon based model;</td>
</tr>
<tr>
<td></td>
<td>• Creating HPN “<strong>toolbox</strong>” (e.g. by historical maps visualization, historical geo-information analysis tool, etc.);</td>
</tr>
<tr>
<td></td>
<td>• Enabling <strong>interoperability</strong> between LoCloud HPN micro-services and another similar tools (e.g. Pleiades Plus).</td>
</tr>
<tr>
<td>Geolocation API</td>
<td>The service is already functioning well and users are satisfied.</td>
</tr>
<tr>
<td>Geocoding Service</td>
<td>It is likely that the service will include the possibility to <strong>add RDF relationships to existing data</strong> in addition to geospatial coordinates.</td>
</tr>
<tr>
<td>Vocabulary Service</td>
<td>The <strong>integration of the service in local collection management</strong> systems (value control for specific data fields)</td>
</tr>
<tr>
<td>Vocabulary Matching</td>
<td>-</td>
</tr>
<tr>
<td>Background Linking</td>
<td>-</td>
</tr>
<tr>
<td>Wikimedia</td>
<td>-</td>
</tr>
<tr>
<td>Crawler tools</td>
<td>For the service to be used in a production context, some form of <strong>preview</strong> of the impact of individual extraction rules would be useful. As would a generally improved <strong>user interface for authoring extraction rules</strong>.</td>
</tr>
<tr>
<td>Support Portal</td>
<td><strong>Common authentication system</strong> for all components of LoCloud Support portal is often suggested by users.</td>
</tr>
</tbody>
</table>
PART 2: Evaluation of technical outcomes and pricing aspects

RESOURCE POOLING

Q: Does the service use shared pool of resources (processing power, storage, memory, RAM etc.) to handle users requests or has each user a dedicated pool of resources which is not shared with others?

Most of services use resource pooling. The two services which do not use it (LoGeo API and Historic Placenames Service) can be hosted in virtualized or containerized environment which will add proper resource pooling layer.

ELASTICITY

Q: Is it possible for users to scale the usage of the service up and down according to their needs without any additional efforts on their side?

The only service which does not allow scaling the service capacities according to the users’ needs is MINT. This is because the service offers full capabilities to all users and the nature of the service is that users process relatively small amounts of data (i.e. metadata records) and from that perspective the storage and processing resources can be seen as infinite from the point of view of a single user.
LoCloud

SELF-SERVICE

Q: Is the service available in a way that allows users a self-service? Or do they have to be supported to use the service?

All services offer full self-service for end users.

ON-DEMAND SERVICES

Q: Can the service be provided instantly on users’ demand? Or do they have to ask for the permission to use the service in advance?

Only two services (Vocabulary Service and Historic Placenames Service) require administrator's acceptance of new user accounts. This can be changed, depending on the sustainability model developed for the further operations of the service.
PRICING

Q: Is there any initial fee or investment needed to start using the service?

All LoCloud services can be used without any initial cost from the end-user point of view.

Q: What is the (current or planned) cost model of the service from end-users’ perspective – what is it based upon?

Not all partners plan to charge end-users for using their service in future. Among services that may be charged for in the future; the pricing basis is diverse, as the diverse is functionality of these services.

<table>
<thead>
<tr>
<th>Service</th>
<th>Responsible partner</th>
<th>PRICING BASIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geocoding App</td>
<td>AVINET</td>
<td>Fee based on number of users / data volume / features</td>
</tr>
<tr>
<td>LoGeo API</td>
<td>IPCHS</td>
<td>Free service</td>
</tr>
<tr>
<td>Background Linking</td>
<td>UPV/EHU</td>
<td>Additional services</td>
</tr>
<tr>
<td>Vocabulary Matching</td>
<td>UPV/EHU</td>
<td>Additional services</td>
</tr>
<tr>
<td>Vocabulary Web Service</td>
<td>AIT</td>
<td>Fixed fee and/or usage-based fee</td>
</tr>
<tr>
<td>Historic Place Names</td>
<td>VUKF</td>
<td>Free service</td>
</tr>
<tr>
<td>MORE + Wikimedia</td>
<td>ATHENA</td>
<td>Size of institutional user</td>
</tr>
<tr>
<td>Crawler tools</td>
<td>AVINET</td>
<td>Free service</td>
</tr>
<tr>
<td>MINT</td>
<td>NTUA</td>
<td>Usage-based fee</td>
</tr>
<tr>
<td>LoCloud Collections</td>
<td>PSNC</td>
<td>Storage-based fee</td>
</tr>
<tr>
<td>Support Portal</td>
<td>PSNC</td>
<td>Free service</td>
</tr>
</tbody>
</table>
Q: What are the overall costs for providing and maintaining the service in future? Please comment on the basic costs of keeping the service running, essential support and simple development (e.g. Bug fixing, compatibility).

Not all service providers were able to precisely describe costs associated with the further maintenance of the service. Where partners provided detailed costs, staff costs were usually the most important factor. In several answers the infrastructure cost was negligible. The answers show that higher automation of the service allows a decrease in maintenance costs.

QUALITY OF SERVICE

Q: What is the performance of the service? How is it determined/measured?

LoCloud services providers had very diverse approach to measuring performance of the service:

- Monitoring response time,
- Analysing system load,
- Performing periodic performance tests,
- Providing custom performance metrics related to service functionality (e.g. number of records processed in a given time).

All partners measure and monitor the performance of their services.

Q: What is the network connectivity of the service (bandwidth available to handle external users’ requests)?
All services are offered via broadband connection, and almost half are accessible via 10 Gbps fiber network, which guarantees high connectivity even for high amount of traffic and transfer of large data volumes.

Q: What is the availability level of the service (in %)? How is it ensured? How is it monitored?

![Pie chart showing availability distribution]

Availability of all services is very good, at least 99%, which is comparable with offerings of commercial cloud services providers.

**USAGE**

Q: Please indicate how you measure the use of the service and provide statistics for the past 6 months

All partners measure the use of the service, but as with service performance, the basis for usage monitoring varies from one service to another. The partners use the following types of usage measuring tools:

- Processing of HTTP Server logs,
- Google Analytics / Piwik Web Analytics,
- Processing of internal service logs,
- Internal built-in statistics/reporting module.