



ReInHerit

Redefining the Future of Cultural Heritage, through a disruptive model of sustainability



www.reinherit.eu



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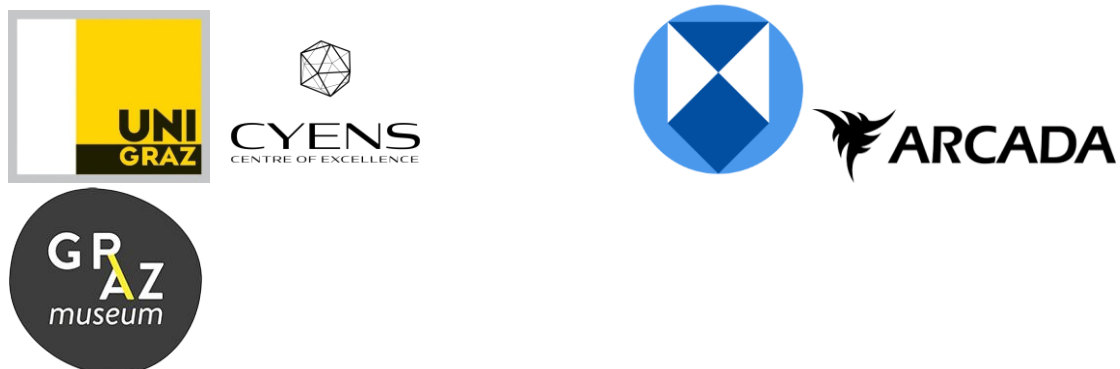
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Executive Summary

D4.2 presents the Digital Hub and documents its architecture, functionalities, and content organisation. This public report draws on the requirements identified in D4.1 - in turn, based on the analysis of the primary and secondary research conducted in WP2 and the need analysis of ReInHerit deliverables in relation to the Digital Hub. D4.2 summarises first these requirements, and it briefly presents the development process. It then focuses on documenting the Digital Hub, by discussing its software architecture, its framework and the services it uses, its information architecture, and its other features and functionalities. D4.2 therefore concludes the Digital Hub core development. The Digital Hub will be further enriched with content, developed by all ReInHerit partners and, in particular, with the resources developed in WP3 (toolkit, webinars, game), WP4 (eShop, immersive performances), and WP6 (digital exhibitions, collection overview). An evaluation of the platform and its sustainability will inform a policy and management document for the future use of the Hub (D4.6). Appendix 1 documents the sections on the Digital Hub at the end of the project (2024).

1. Introduction

This report details the development process of the Digital Hub, and it describes the Hub's software and information architecture. The ReInHerit Digital Hub has two main functions: to showcase the resources and work emerging from the ReInHerit project and to enable and facilitate networking and exchanges between cultural heritage professionals. Given the two main audiences of the Hub, professionals and visitors, the presentation of the resources on the Hub can be further distinguished between material addressed to professionals and material addressed to a more general audience.

The development process responded to the requirements for the Digital Hub, identified in D4.1 "Requirement Analysis", and it was led by UNIGRAZ, with frequent interaction and inputs from the ReInHerit partners. This report will first summarise the requirements and then will focus on describing the ReInHerit software architecture, services, information architecture, and functionalities.

1.1. Objectives

According to the DoA, "The ReInHerit project will develop a Digital Hub in which the toolkits and digital exhibitions can be showcased and made available to the public, and where cultural heritage professionals can connect and contribute to the project themes. The Digital Hub will therefore host a variety of digital content (technical challenge) and will need to satisfy the content and accessibility needs of a variety of stakeholders" (DoA, p.30). The corresponding tasks are T4.2, "Development of hub for professionals within the platform", and T4.3, "Development of public interface of the platform", both started in M8 and completed with this deliverable. T4.2 aimed at developing the backend of the platform, which would allow stakeholders to share information and collaborate. T4.3 relates to the preparation of the public presentation and experience of the platform. In reality, both tasks are closely related and evolved in parallel, with partners' requirements for the delivery of a public output informing the work on both backend and frontend of the platform, as it will be detailed in this report.

The Hub is being launched at the end of M17, and ReInHerit partners will begin to add content to it and use its functions. Therefore it is expected that the piloting of the Hub will lead to minor changes. At the same time, an evaluation of its success in fostering collaboration and networking will also begin leading to D4.6 (due in M28).

1.2. Outline

This report covers the period M1-M17 of the ReInHerit project, and it is based on work conducted in WP4 by UniGraz. Chiara Zuanni (assistant professor in digital humanities at the Center for Information Modelling - Austrian Center for Digital Humanities, University of Graz) was responsible for the development of the Hub and Sina Krottmaier (student assistant at ZIM-ACDH, UNIGRAZ) contributed to the refinement of the requirements and the preparation

of the Hub from M1. In M8, Sebastian Stoff (developer and PhD candidate at ZIM-ACDH, UNIGRAZ) began to work on the programming and development of the Hub.

This report also is closely dependent on the results of D4.1, whose work on requirements identification and analysis proceeded in parallel to the work described here related to the development of the Digital Hub. WP4 officially began in M8, although discussions about the software and uses of the Hub started already in M1, in order to respond to emerging research about its requirements and in order to support the relevant questions in the WP2 questionnaire.

The development process can be summarised in these phases:

- **Phase 1: Preliminary discussions on the approach to the development and identification of key requirements (M1-M8).** In this phase, UniGraz prepared a first presentation on the Hub for the Kickoff Meeting of the project and focused on identifying key requirements for the Hub (as emerging from the DoA) and reviewing existing platforms for cultural heritage. During this period, it was decided to develop the Hub with the Gatsby framework.
- **Phase 2: initial development of the Digital Hub (M8-M12).** Sebastian Stoff was hired in M8, with the official beginning of WP4 and the development work on the Hub began. By M8, the key requirements for the Hub had been identified, and the development of the first version of the hub started. Regular meetings with relevant Consortium partners (detailed in D4.1) helped refining the requirements and testing initial solutions. In M12, a first version of the Hub was published online and presented to the ReInherit partners in a workshop, seeking feedback on it.
- **Phase 3: refining and fine-tuning of the Digital Hub (M13-M17).** In this phase, the feedback from the partners and more one-to-one meetings with WP3, WP4, and WP6 enabled refining the templates and metadata needed for the different sections of the Hub. The second consortium meeting (M13) and feedback collected following the publication of a second version of the Hub in M16 supported the continuous fine-tuning of the Hub.

This deliverable will first summarise the requirements of the Hub, which are discussed more at length in D4.1, and it will subsequently present the approach to the development and describe the technical infrastructure of the Hub and the solution adopted in order to enable partners to share their content through it and address users' needs.

2. Summary of requirements

Task 4.1 considered the requirements for the Digital Hub and its results were presented in Deliverable 4.1, "Requirement analysis". In this section they will be briefly summarised.

The requirements were identified through:

- primary and secondary research emerging from WP2,
- review of existing platforms for connecting cultural heritage professionals,
- analysis of the requirements for all the deliverables to be hosted on the Hub

In WP2, the Focus Groups included a discussions of how the platform could facilitate networking and exchanges among professionals: “access to a discussion and sharing forum that is free of hierarchy, transparent, with a free flow of information exchange” (D2.1, p.27) was deemed as the key requirement, with suggestions about the themes leading conversations. In particular, participants were interested in exchanging information about funding, projects, organisations, and “failures” (and “lessons learnt”).

A review of existing hubs and platforms for cultural heritage highlighted how the “Heritage Hub” already provides the possibility of sharing organisation profiles, events, projects, and funding calls; in parallel, many sector associations use mailing lists to disseminate similar information and there are a series of active groups on social media (mainly, Facebook and LinkedIn). Therefore, it will be important to refer to these existing resources rather than duplicating them in the Hub: a channel in the forum could support general discussions around these themes, and support - by organising the threads - discussions around specific topics within this broad area (e.g. a funding call).

Focus groups participants in WP2 also expressed concern about the moderation and maintenance of the forum, and D4.1 concluded that there was a need “for clear guidelines on the moderation of discussion and content on the platform from the very beginning”, while an evaluation of the engagement and sustainability would become part of D4.6. In June 2022, ReInHerit consortium members were asked about their interest in the proposed forum channels and their willingness to become moderators. The results of this survey (part of the second internal evaluation of the Hub) will inform the organisation of the forum ‘rooms’ and assignment of moderators.

D2.6 suggested as possible content for the Hub podcasts, videos with short presentations or interviews with professionals, promote awareness of new tools, respect of IPR rights and sources of funding from the EU and beyond, training and resources to implement and monitor KPIs in the cultural sector, resources for audience engagement, training in marketing and communication, in social media and digital technologies, tools to support the development of workshops (D2.6, p.19ff). These requirements have informed the type of media (i.e. video, text, audio) the Hub should be able to embed and host and have offered further inspiration for the topics to be discussed on the networking platform and shared in the “news” section. Hub resources will be provided by the whole ReInHerit consortium, and in particular by WP3, in accordance with the DoA.

The resources produced within ReInHerit are targeted at a very diverse audience, with two main user groups (professionals and visitors), and comprise a different range of material. By reviewing existing hubs, it was possible to notice common features and challenges, similar to those that the ReInHerit Digital Hub will face. The review highlighted the need for clear guidance for different users, with clear entry points to the different types of content and clear indications of its target audience. At the same time, D4.1 argued that “in order to foster a truly open and transparent process, preferred paths should not lead to gatekeeping” (D4.1, p.17). A streamlined login process for contributors was also highlighted as an important feature: the Hub should avoid requesting users to log in repeatedly through different services for accessing

different features. Finally, in observing other platforms' architecture, sustainability of the digital platform and findability of the content were also identified as core challenges.

Finally, D4.1 identified two main types of content that need to be hosted on the Hub, following the meetings and workshops with consortium partners. On one hand, simple entries (including text, images, eventually embedded videos) will be emerging from non-technologically-driven WPs (i.e. WP2, WP5). Those partners will produce short reports for specialists and summaries for a broader public of the research conducted in their WPs. On the other hand, WP3, WP4, and WP6 are developing more complex digital outputs, including the toolkit, the game, the webinars, the performances, the eShop, the digital exhibitions, and a collections overview section. In all these cases, functionalities, metadata, design, and structure of each section required more careful discussions with the relevant ReInHerit teams. The expectations and the solutions adopted for each of these deliverables will be discussed in a following section.

3. Summary of development process

The development officially started in M8, although already before this date it had been decided to develop the Digital Hub as a static website. This solution would both constitute an innovation in the field, by drawing on a recent and growing trend in web development, and offer more long-term stability and sustainability.

The development work proceeded in parallel with the identification and refining of the requirements through regular meetings with the ReInHerit relevant partners, and a workshop in Graz (in M15) with members of WP3, WP4 and WP6. During the two ReInHerit consortium meetings happening in this period (November 2021 and March 2022), updates on the work were presented to all partners. In addition, a workshop in M12 (February 2022), after which the Hub was published online so to allow partners to comment on it during M12 and M13, and a questionnaire in M16 (June 2022), including a description of the Hub main areas and a link to a second published version of it, offered the chance to receive feedback from all partners and discuss possible improvements to the Hub. These activities fostered collaboration in designing the requirements and expectations in relation to the Digital Hub, as well as serving for knowledge exchange in relation to the different work and practices of the consortium members, in particular supporting a common awareness of challenges and possibilities in web development. More details on these meetings, the workshop, and the questionnaire are presented in D4.1.

After setting up the website in Gatsby, integrating it with the Netlify CMS, and identifying the main navigation structure, templates and functionalities for each section were progressively prepared. This was an iterative process requiring the testing and refining of each section in collaboration with the ReInHerit partners. Once the overall architecture and the draft sections were ready, the work focused on refining the metadata needed for each type of content hosted on the Hub and the workflows in the CMS for the partners uploading material. This work proceeded in parallel to the development of strategies for the toolkit (D3.2) and the exhibitions (D6.1), thus changes in the planning of those deliverables were subsequently reflected in the Hub preparation (e.g. the implementation of the collection overview page or the separation between apps and components in the toolkit). Finally, the design of the

homepage was the aspect that received most comments from the consortium, during the first workshop presenting the Hub, and thus it was substantially changed in its second version.

The list of issues in the GitHub repository (<https://github.com/ReInHerit/digital-hub/issues?q=is%3Aissue>) offers a detailed snapshot of the work and the aspects that were discussed and addressed in the weekly meetings of the development team. In parallel, the list of releases shows the main steps and changes between the successive versions of the Digital Hub (<https://github.com/ReInHerit/digital-hub/releases>).

4. Software Architecture

The ReInHerit Digital Hub is based on a static website, paired with a CMS, with integrated internal and external services, and follows a Jamstack architecture. This section will unpack the previous sentence and justify the development choices in terms of technologies and approach.

4.1. Static website

A static website consists of a set of web pages which are delivered to the user exactly as they are stored. Once a page is deployed in HTML, this content remains fixed and it displays the same content to each visitor. In contrast, dynamic websites (e.g. those built on Wordpress, Wix, or Squarespace) generate each web page 'on-the-go' by pulling data from a database, processing them through a web application (usually written in php), and presenting the final result to the user.

A static website offers a few advantages, in particular improved security and sustainability in comparison to a dynamic website:

1. Having fixed HTML content presented to the user means that this content can withstand attacks, while dynamic websites are at risk of web shells attacks (the web server being infiltrated by malicious scripts), which enable attackers to compromise both the data (i.e. the database on the backend) and the presentation of this data (the web application generating the web pages 'on-the-go').
2. Dynamic websites have multiple dependencies informing the generation of the webpages 'on-the-go' (e.g. plugins customising sections of the web page with different search or visualisation formats); however, these dependencies need regular updates and - if one of those components is not maintained anymore - there is a need for changes to the website. This aspect leads to long-term challenges for the maintenance and presentation of dynamic websites, whose HTML web pages (bringing together data, dependencies, and presentation choices) are constantly regenerated for each new visitor. Conversely, static websites generate their HTML once and maintain it stable over time, thus guaranteeing a better sustainability of the web pages.
3. Given that, once deployed, the content is fixed and directly served to the visitors, the performance is both faster and improved (in contrast to generating 'on-the-go' complex webpages).
4. Ultimately, static websites can be hosted on most cloud spaces, without the need of a complex hosting environment as in dynamic websites. This helps again to reduce costs and complexity over time.

For all the above reasons, ReInHerit’s digital hub was developed as a static website. One notable disadvantage of this approach is that the website is not automatically updated with every new addition (as in a dynamic website), but it needs to be redeployed (i.e. the new HTML content needs to be generated and published by the webmaster) before the new content appears online. For ReInHerit this will mean scheduling regular redeployments during the project length, in coordination with the consortium members adding their content to the hub.

4.2. Jamstack architecture

Jamstack is not a technology, but rather an architectural approach to web development, which was first proposed in 2015 (by Mathias Biilmann). Jamstack “decouples the web experience layer from data and business logic, improving flexibility, scalability, performance, and maintainability” (<https://jamstack.org/>), with JAM standing for JavaScript, APIs, and Markup. In short, there are two key principles behind the Jamstack approach:

1. Pre-rendering, i.e. generating the markup (i.e. the HTML) in advance, rather than on-demand (i.e. creating a static website).
2. Decoupling, i.e. separating the services needed to operate a website, which makes it easier to understand and maintain each component.

In a Jamstack approach, a set of separate services - in JavaScript - talk to each other via APIs and operate on the data, generating the markup (the HTML) of a web page. Therefore, this approach encourages to think of all the individual services as separate modules, to configure them as needed, and to integrate them in the overall architecture. This approach contributes to simplifying the architecture of the website (in comparison to complex dynamic sites with multiple interlinked dependencies) and developing everything using JavaScript in the backend and building static stable web pages on the frontend.

Jamstack is therefore a set of guiding principles of modern web development, and ReInHerit implemented them in its approach. The services used in the Digital Hub and their integration via APIs will be described in the following sections.

5. The Digital Hub Framework and Services

The Digital Hub is a static website, which has been developed following the Jamstack approach. This section details the services used in the Digital Hub, in particular the JavaScript Framework supporting the website generation (Gatsby), the Content Management System supporting the creation and modification of the content (Netlify), the file handling platform (Uploadcare), the chat and networking platform (Gitter), the hosting platform and repository (GitHub), and the analytics tool (Google Analytics).

5.1. Building the website: Gatsby

Gatsby is an open-source static site generator, which uses React (a JavaScript library) and GraphQL (a data query and manipulation language for APIs). Gatsby (<https://www.gatsbyjs.com/>) is one of the most used frameworks for generating static websites, with optimal performances in terms of speed and support of different components.

A summary of the structure of a Gatsby website looks as follow:

- The content is written in markdown, a lightweight markup language for creating formatted text using a plain-text editor, and transformed in HTML during the deployment process.
- The individual markdown files (each representing a web page) can be organised through directories (e.g. in the Digital Hub, we use directories such as “eshop”, “exhibitionCollection”, “news”, “performances”, “toolapps”, “toolcomponents”, “webinars”, etc.).
- Shared characteristics and functionalities across all web pages are programmed individually divided between static components (e.g. a “base layout”, the footer, head, header, navigation bar, etc.) and more complex ones (e.g. publication of images, navigation bar, etc.).
- Each directory (or even each markdown file) can be associated with a different template and set of components. These enable the customisation of the ‘look’ and ‘interaction’ of each page once rendered in HTML. In the Digital Hub, each section has been developed with individual characteristics, as it will be discussed in the next sections.

This structure allows publishing markdown files in HTML, i.e. in static web pages, according to defined requirements in regards to the ‘look and feel’ of those pages.

Components and templates comprise a mix of JavaScript, HTML, and CSS, the building blocks of websites, and are coded in React. React (<https://reactjs.org/>) is an open source JavaScript library for building user interfaces. Each aspect of a web page (e.g. from embedding of a video in a web page to the templates for specific sections) is coded individually, as a single component, and then brought together in the deployment process.

In order to return data from a server, i.e. finding and delivering the content displayed on the Hub, the Digital Hub uses GraphQL. GraphQL (<https://graphql.org/>) is a query language for APIs, allowing to observe the structure of the data and to define which data is served to the server and how. In summary, GraphQL enables filling the templates with the requested content (e.g. it serves the text of a news post within the component describing the ‘news’ template) and to further elaborate on the data when necessary in order to customise the view on the Hub.

In short, Gatsby is a powerful static site generator, which can be customised by programming in React and is well integrated with the GraphQL query and manipulation language. It therefore represents the basis of the ReInHerit Digital Hub. However, in order to further develop the Hub, facilitating the management of its rich content and enabling some functionalities, extra services were added on top of this initial structure.

5.2. Structuring and adding content: Netlify CMS

A Content Management System (CMS) is a software component that supports the creation and modification of digital content, thus enabling so-called CRUD (Create-Read-Update-Delete) functionalities. Static websites can work also without a CMS, but - as the content increases - a CMS is fundamental in supporting its management.

Netlify CMS¹ is one of the most popular CMSs for static websites, since it offers a convenient and customisable editing interface for static websites. It is also built on React and can be easily integrated into Gatsby websites and Git workflows. As such, it was the obvious choice for supporting the ReInHerit Digital Hub, since it simplifies the process of managing the data and adding new content, while adapting input masks for different types of content, in order to support individual metadata and customisation needs.

5.3. Networking Hub: Gitter and Zulip

The review of existing digital platforms and the results of WP2 emphasised the need of a networking area in the ReInHerit Digital Hub. Some of the participants in the focus groups referred to a forum (D4.1, pp. 9-11), others to a social network. For security and scalability reasons, the ReInHerit Digital Hub decided to implement a forum in the Hub.

Since the platform is built with Git workflows, using Gitter as the service supporting forum and chat functionalities seemed the best choice. Gitter (<https://gitter.im/>) is an open source, free, instant messaging and chat application, which can be accessed with a GitHub, GitLab, or Twitter account, and is available also via mobile. At the core of Gitter, there are communities' rooms: an infinite number of rooms can be opened, with permissions granted via GitHub for each room and user. In a 'room', users can share images and links, and create threads for different conversations. In addition, one-to-one chats can also be enabled. The use of the Forum will be evaluated periodically, in order to monitor any issue and promptly address them.

Gitter constituted the Hub forum for the first period (ca. August 2022-February 2023): however, in February 2023 Gitter migrated to a new infrastructure, using Matrix at its backend and the registration process started to become more difficult for project partners and stakeholders (due to the need of selecting the correct server and the two-steps registration). As a consequence, it was decided to close the Gitter forum and migrate to a new platform: solutions identified as alternatives to Gitter already during the first phase of the development were reconsidered and briefly tested. Ultimately, Zulip was chosen as the new Forum infrastructure. It is an open-source platform, with a robust privacy policy and it is compliant to GDPR. Users were not migrated from Gitter, allowing them to choose whether they wanted to continue their involvement and move to the new platform. Registration on Zulip can happen via a GitHub (as in Gitter) or a Google account, and the rooms of Gitter were replicated. In this case, Zulip call the top-level rooms *Streams* and allows the presence of multiple threads (called *Topics*) within a Stream. The existing streams include the ReInHerit products (applications, toolkit, webinars, etc.) and themes (cultural tourism, technology in heritage, etc.), as well as a general chatroom and a space for regular ReInHerit chats (i.e. moderated chats hosted by UNIGRAZ members and any other interested user).

¹ At the time of developing the Digital Hub, Netlify CMS was available at <https://www.netlifycms.org/>. However, in February 2023, Netlify CMS was renamed Decap CMS and is currently available via <https://decapcms.org/>. The change in name and link to this Open Source CMS has not directly affected the Hub development.

In the Digital Hub Forum, both in Gitter and in Zulip, different levels of access, moderation, and control on the number of rooms opened support the safe exchange of information among members (see section 7.3 below).

5.4. File uploading: Uploadcare

The ReInHerit Digital Hub needs to manage a large quantity of files, including many high-quality images (e.g. in the digital exhibitions and collections overview sections). The management of these files directly within the GitHub repository and the Netlify CMS will stress the limits of the platform and might - in the long term - affect its performance.

Uploadcare (<https://uploadcare.com/>) addresses this challenge by providing simple and powerful blocks for managing the upload, processing, and delivery of files. It can be integrated in the Netlify CMS, so that users can seamlessly upload and process (e.g. crop or adjust) their images (or files), which then can be easily delivered on the website.

5.5. Hosting: GitHub

The ReInHerit Digital Hub is hosted on GitHub, and its repository is available at <https://github.com/ReInHerit>. By hosting it on GitHub, ReInHerit is adhering to open source principles, while reducing costs for a hosting server, thus contributing to the long-term sustainability of this solution.

5.6. Visit monitoring: Google Analytics

In order to monitor traffic on the website and be able to report on the number of visitors, as well as noticing usage of the different sections of the Digital Hub, a Google Analytics tag has been added. This monitors traffic to the main website, <https://reinherit-hub.eu/>, and its (sub)pages. It does not, instead, monitor the Forum, for which number of users and number of posts can be evaluated directly within the supporting platform.

As mentioned in the Ethics and Data Management section of D4.1 (D4.1, p.25-27) provisions have been taken to comply with data protection regulations and ethical treatment of user data in the project. In particular, Google Analytics 4, which has stronger privacy controls than its predecessors is being used exclusively to monitor the reach of the KPIs (page views; eShop downloads), with a pop-up declaring the use of Google Analytics and requesting the user's consent to the use of cookies, a limited in scope data collection (number of views and downloads), without any user profiling and without storing any personal data from the users. Data are stored for max. 90 days within Google Analytics and reported as aggregated values to the project coordinator.

6. Information architecture

The ReInHerit Digital Hub serves three key functions:

- to present to cultural heritage professionals the resources developed within ReInHerit;

- to present to the broader public a summary of ReInHerit work and possibilities for engaging in cultural heritage through some of the ReInHerit outputs;
- to serve as a networking platform for stakeholders in cultural heritage.

It addresses two very different audiences, professionals and non-professionals, and therefore should be able to present different types of material with different scopes and target audiences. This characteristic of the Hub represents one of the main challenges faced in the development process: how to address so many different audiences and present such a different range of content?

In order to overcome this challenge, a lot of the preliminary work consisted in mapping content against target audience and against technical requirements (see D4.1). The mapping of these requirements allowed organising the Hub in three core sections: professionals, visitors, and networking area - which are highlighted on the Homepage and at the top of each page. Each one of these areas leads to a separate landing page including all the content targeted at the relevant user group. In parallel, the navigation bar is reflecting this organisation, although while it groups all the resources for professionals under a single menu item, it lists individually the content targeted at a general public, so to further foster general interest in this content (which could ultimately be of interest also to professionals).

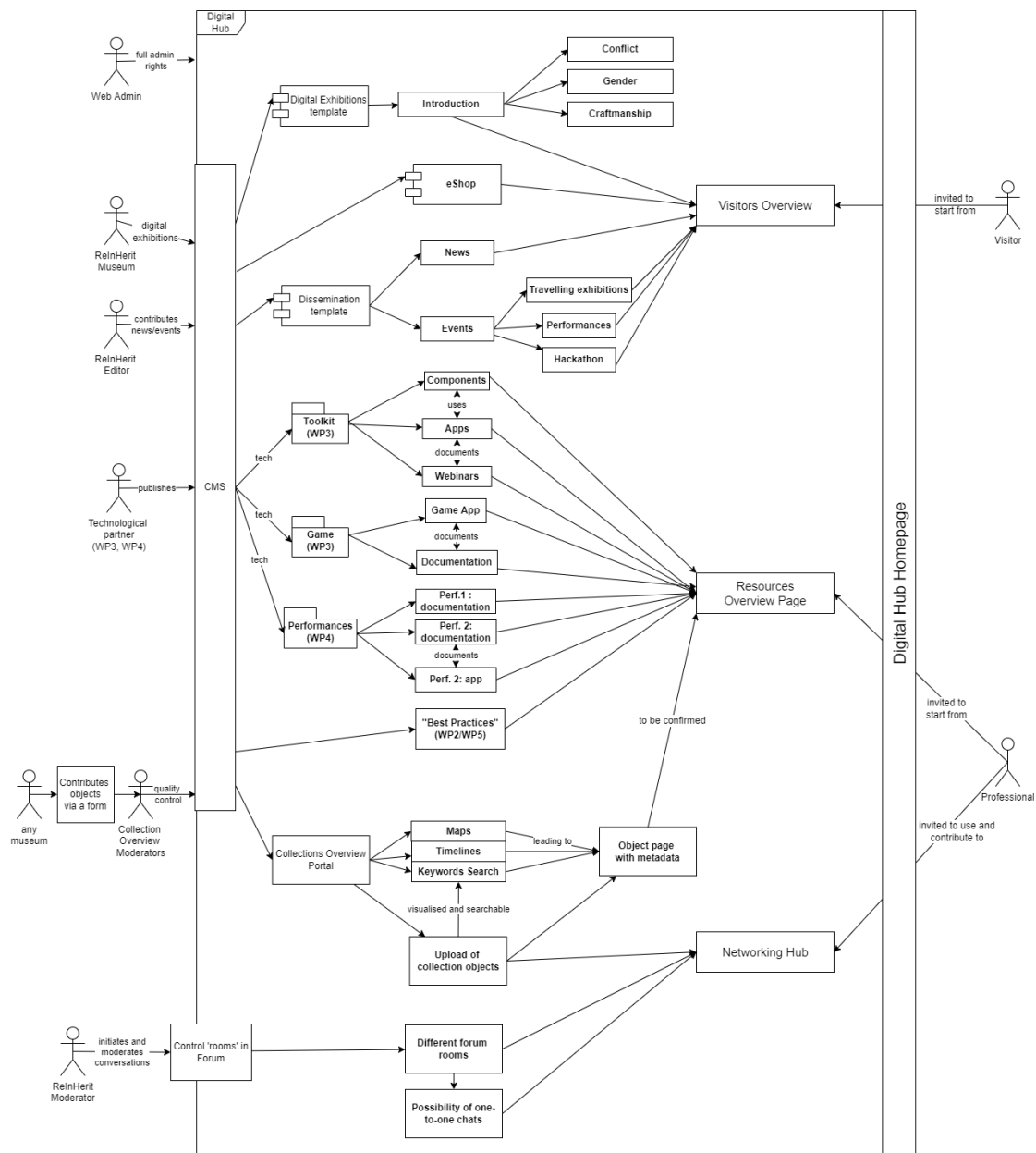


Figure 1. Overview of the information architecture of the Digital Hub: on the right, content-creators; on the left side, users and forum contributors

The next sections will briefly describe how requirements for each section were included in the Hub, through navigation, design templates, and customised CMS areas.

6.1. Homepage

The Digital Hub homepage was kept rather simple, with:

- a navigation bar
- a visually appealing header
- a short section summarising the key scope of the Hub “The Digital Hub of the ReInHerit project presents resources for cultural heritage professionals and a networking hub. It also showcases the project exhibitions and gives access to engaging content for anyone passionate about heritage.”

- 3 sections redirecting to the three core areas of the Hub: “Discover the ReinHerit resources” to resources for professionals; “Share your experience and connect!” to the networking area; “Enjoy cultural heritage online” to the visitor area of the Hub.
- a simple footer, consistent across all the web pages (with usual administrative and legal information, the acknowledgement of EU funding, a direct link to the CMS for contributors, social media links and email contact).

The design of this page, based on an individual and dedicated template, has gone through different iterations and might change again during the course of the project, in order to respond to feedback and improve its accessibility and appeal.



Figure 2. Schematic representation of the Homepage and its content (as of July 2022).

The three subsections serve to collate relevant material: besides being accessible from the Homepage, they are also accessible from the Header of each web page (with some exceptions in the case of digital exhibitions, as it will be discussed). They present simple cards listing the content with a short description:

- Resources: this area lists the tool applications, the tool components, the webinars, the game, the performances, and a best practices section.
- Networking: this area lists the forum, the chat, and - when needed - will list forms for contributions and eventually feedback.
- Explore: this area lists the eShop, the digital exhibitions, the performances, the travelling exhibitions, and the hackathon.

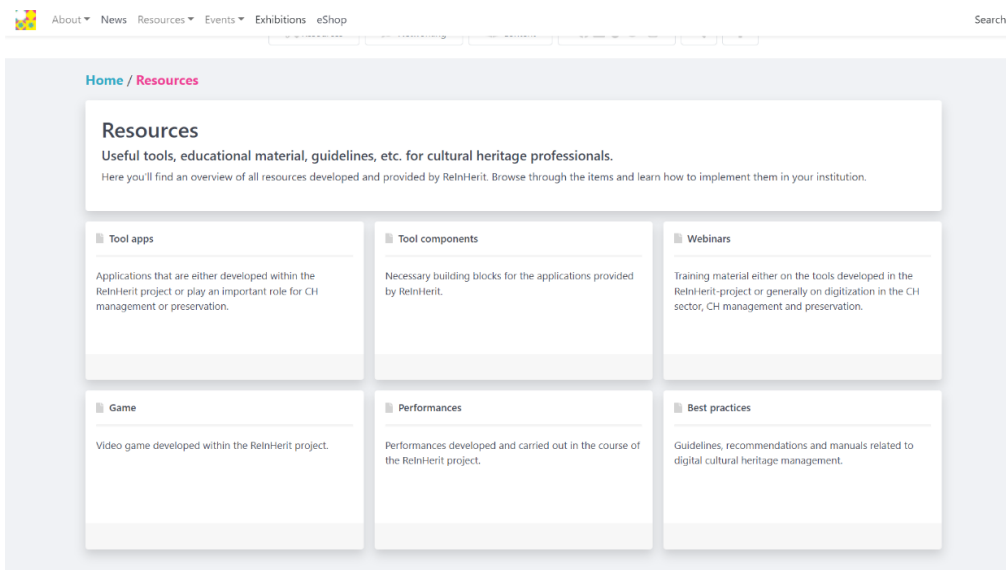


Figure 3. "Resources" landing page (as of July 2022).

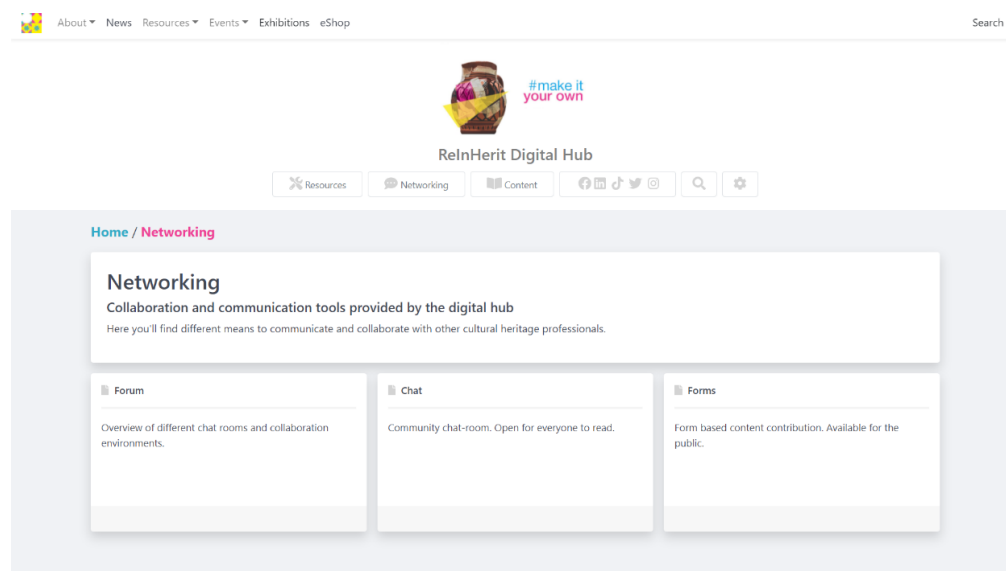


Figure 4. "Networking" landing page (as of July 2022).

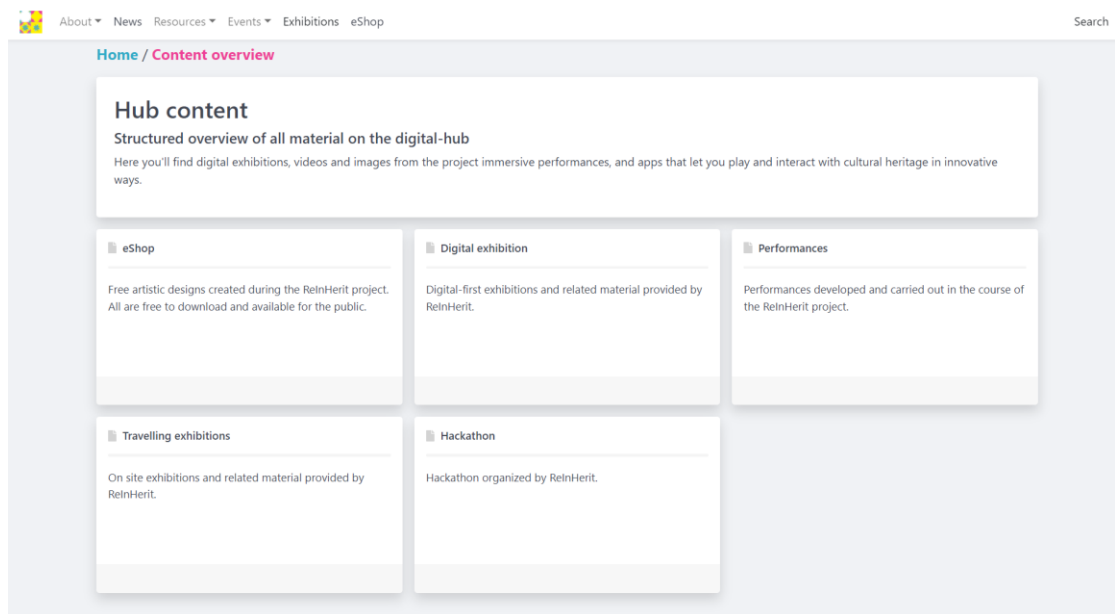


Figure 5. "Visitors" landing page (as of July 2022).

As noted in D4.1 (pp.24-25), a key challenge will be to balance user requirements and interest for a rich platform with the gradual publication of the project outputs over more than a year. During this time, navigation links and showcase of content on the homepage will therefore need to be regularly monitored and updated, in order to reflect the range of content being published and made available by the ReInHerit consortium partners.

6.2. "Best Practices"

A template has been prepared for sharing ReInHerit research in narrative form, especially from WP2 and WP5, which do not consist of technological applications, but rather of analysis, guidelines, and best practices. Thanks to this section, professionals will be able to access summaries and conclusions of the research conducted in ReInHerit.

This template requires minimal metadata (author, publication date, and license) and it allows creating posts, with embedded images or videos, through the editor interface. It is expected that this material will appear - indexed by topic - under the "Best Practices" menu-item (in the 'Resources' area); however, if desired by the consortium partners, specific subsections for the different WPs or topics could be quickly and easily implemented. Furthermore, in the course of 2023 and 2024, the design for this section was expanded to include more metadata categories and downloadable PDFs of the ReInHerit Best Practices for Cultural Heritage Management.

6.3. News and events

A 'news' section is present on the top menu of the Digital Hub and will be used to provide regular updates on the research and events in the project. It is based on the same template as of the non-technological deliverables, requiring minimal metadata (author, publication date, and license) and supporting posts, with embedded images or videos, through the editor interface. Content will be further indexed through a series of flexible tags created by the

editors. Badges and filters allow exploring the content through a set of top-level thematic categories (management, tourism, technology).

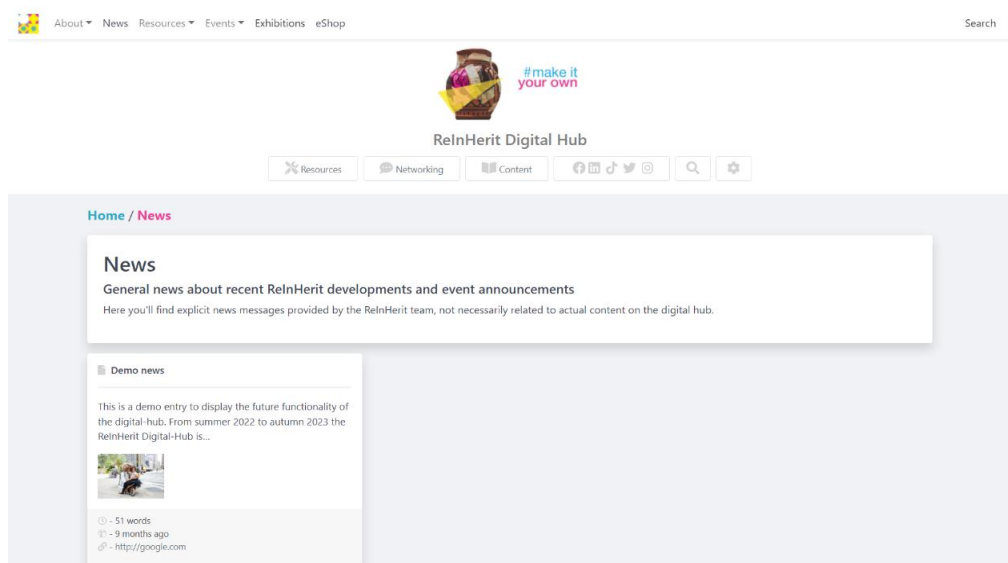


Figure 6. News section (as of July 2022).

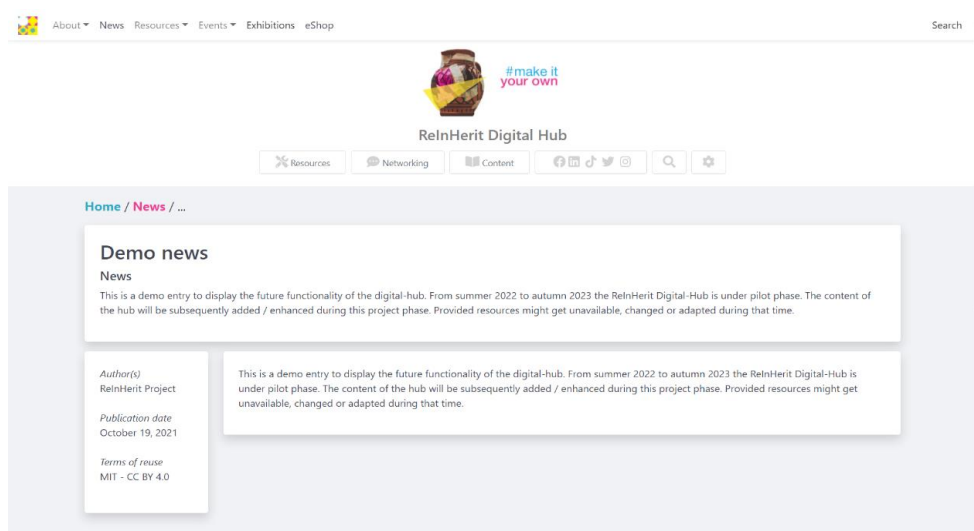


Figure 7. Demo news entry (as of July 2022).

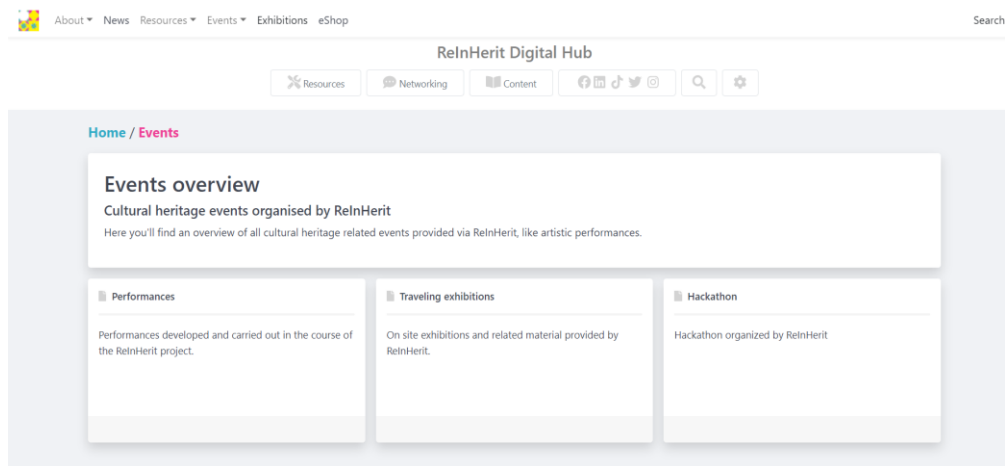


Figure 8. "Events" landing page.

Following the development of the project, selected events required further customization. In particular, two hackathons, one held during the 2023 XR Summer School in Matera and the ReInHerit Smart Tourism Hackathon organized by CYENS in January 2024, required a customized section to share the resources developed within the events and the presentations of the participants projects. In these cases, departing from the initial template described above, further pages were prepared and a dedicated section was created in the Digital Hub for the relevant consortium partners.

6.4. Toolkit

The ReInHerit toolkit, developed in WP3, will produce not only finished applications, but also "share open-source and reusable digital solutions for CH museums and sites" (D3.2, p.48). The requirements of the toolkit were further refined during a workshop with UniFi partners held in Graz in May 2022, while the choice of tools to be developed has been discussed in the ReInHerit Tech Committee meetings. In the Digital Hub, it has been agreed that the toolkit will consist of two main sections: components and apps.

Components are intended as 'building blocks' for the apps, and therefore here there will be a short description - almost like a glossary - of key technologies, frameworks and tools for building the apps, with links to the external provider for these elements. The section "components" will list these components, and an individual component page will allow linking to related training materials (e.g. a ReInHerit webinar) and the apps using that component, besides including the usual metadata (authors, publication date, licensing).

Conversely, the section "apps" comprise more complex applications, including the applications directly developed in ReInHerit (and documented in D3.2, D3.3, D3.5, D3.7, D3.8). It will have a similar template, also linking to the related components. For each app, there will be a step-by-step documentation, enabling other users to develop their own apps by reusing the code and information prepared in ReInHerit. The "apps" section will include first of all the applications developed within ReInHerit, but there will also be links and explanations concerning other useful applications.

A common taxonomy will allow filtering through components and apps by technology, function, and scope. The tags building this taxonomy have been discussed in the workshop between WP4 and WP3 in May 2022, and will be gradually refined and implemented once the toolkit starts to be published in the Digital Hub.

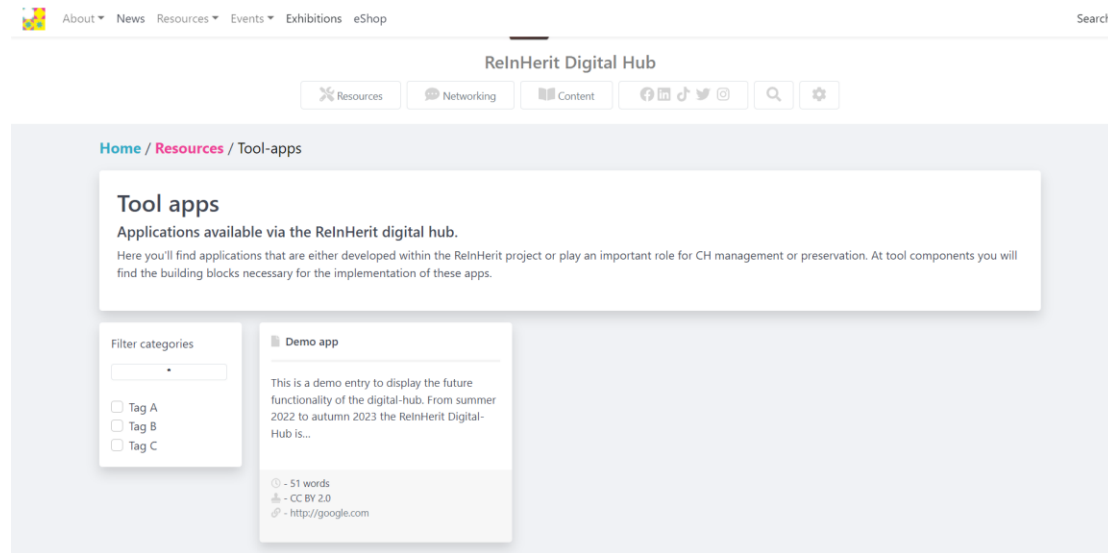


Figure 9. "Apps" section landing page (as of July 2022).

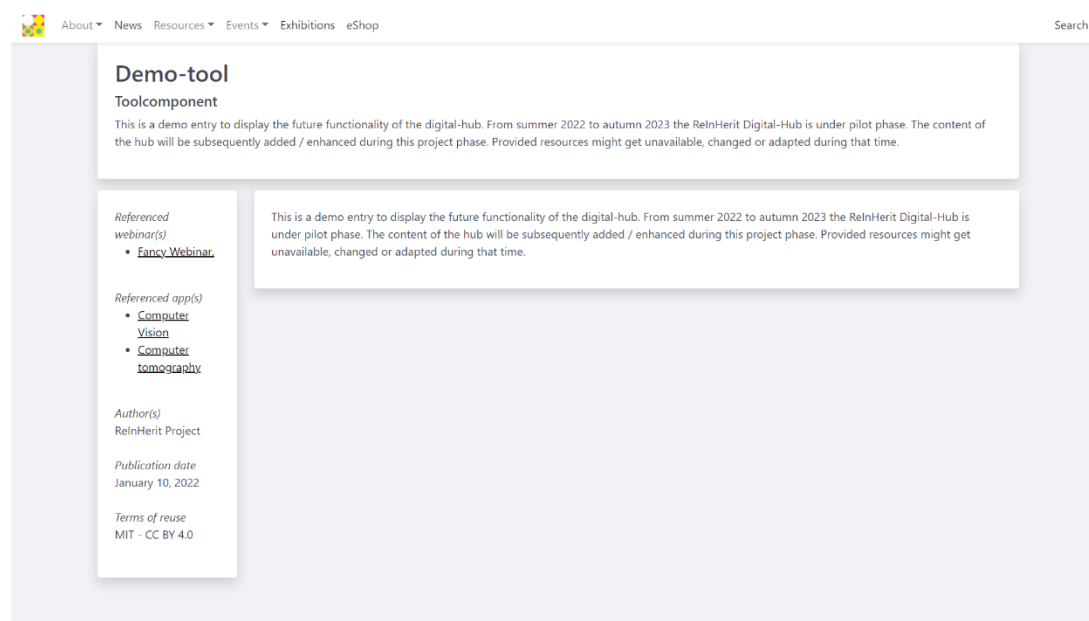


Figure 10. Demo "components" entry on the Hub. Apps have different metadata and template (as of July 2022).

Writing in Toolkit: components collection
CHANGES SAVED

Published ▼ Delete entry

PAGE-ID
 29086240-ba81-4e5d-90f9-2e37afb010dd
 You might use this number to reference this item in another collection. Like: /tools/components/PAGE-ID'

TITLE
 Demo-tool

SHORT DESCRIPTION (OPTIONAL)
 This is a demo entry to display the future functionality of the digital-hub. From summer 2022 to autumn 2023 the R
Short description of current entry. Will be displayed in overviews as preview text.

DATE
 01/10/2022 11:08 AM Now

TARGET AUDIENCE
 VISITOR x | x | ▼

TAGS (OPTIONAL)
▼

MAIN REFERENCE (OPTIONAL)
 http://google.com
Singular (web)-link displayed in the metadata section of the item.

LINKED WEBINARS (OPTIONAL)
▼
Displays titles of already created webinars in this CMS (entries must be already existing)

LINKED TOOLKIT APPS (OPTIONAL)
▼
Displays titles of already created toolkit apps in this CMS (entries must be already existing)

LICENSE
 CC BY 2.0
Remember to check if the license is compatible with the component

THUMBNAIL (OPTIONAL)
 Choose an image
 Insert from URL
Small image limited to 100kb to be used for overviews.

BODY

B *I* **<>** [🔗](#) **H.** **¶¶** **☰** **☰** **+** Rich Text Markdown

This is a demo entry to display the future functionality of the digital-hub. From summer 2022 to autumn 2023 the ReInHerit Digital-Hub is under pilot phase. The content of the hub will be subsequently added / enhanced during this project phase. Provided resources might get unavailable, changed or adapted during that time.

Figure 11. CMS mask for a toolkit "component" entry (as of July 2022).

6.5. Webinars

The ReInHerit webinars, part of WP3, will be organised and hosted on an external vendor, specific for delivering this type of content. On the Digital Hub, they will be announced and promoted through the news pages, supporting the enrollment process.

Once finished, videos and relevant material will be collected and published in the “Webinars” section (under “Resources”). The template of this section is similar to that of apps and components, allowing the inter-linking of content (depending on the type of webinar) and its tagging through a common taxonomy.

The video recordings of the webinars will be uploaded on YouTube, in a ReInHerit channel, and embedded in the Hub. This choice aims to both facilitating the reach of this content - by sharing it on a popular video platform - and minimising the effort on the platform in delivering this content (i.e. a series of embedded video could be served in a quicker and more efficient way). Additionally, by posting the videos on YouTube it would also be possible to redirect traffic from the video’s page to the Digital Hub, thus enhancing the potential reach. Besides the videos, a webinar page on the Digital Hub will also include short summaries and any additional material made available by the speakers.

Finally, webinars will also be an occasion to promote interaction in the networking area, since participants will be invited to carry on the conversation in a dedicated ‘room’ in the Forum.

6.6. Game

A video game will be developed in WP3 and will be presented through the Hub. In this case, the Digital Hub will host a public-friendly short description and the videogame embedded in the Hub as a web application, and richer documentation for professionals (such as a Game Design Document, Concept Notes, etc.).

The dissemination of the game, which will be included in the ‘visitor’ section follows a template similar to that for “news”, whereas the documentation will be included under “resources” and will follow a template similar to that of the “toolkit” apps and components.

6.7. eShop

An eShop will be embedded in the Hub by M18. The content and strategy informing the eShop and its content are presented in D4.3. Discussions with the BoCCF in summer 2021 quickly ruled out a full e-commerce solution, with paid services, which would have created numerous practical and legal issues. It has been decided that, instead, items will be available for download for free in this area.

Digital objects will be displayed as thumbnails in the eShop gallery and each object will be presented with a large size image, a short description, and simple metadata (author and publication date). A download button will encourage the acquisition of these objects by visitors. Furthermore, the eShop and its products will need to be featured and promoted on the Digital Hub homepage and through its social media channels.

6.8. Immersive performances

ReInHerit will produce two immersive performances, which will be described in detail in D4.4 and D4.5. As in the case of the videogame, these performances need to be promoted through the Hub to a broader public and to be documented for professionals in the Hub.

The more public-friendly presentation of the performances will include posts under the menu “events” section (which will be presented also under the “visitor” section of the Hub) announcing and reporting about the events. These posts will include simple texts and images, with the aim of disseminating information in an accessible way, and the template will therefore be similar to that used for “news”. The ReInHerit forum will also become an integral part of the dissemination and co-production of these events. In addition, for the second performance additional descriptions of objects and embedded 3D models (hosted on Sketchfab), which will be accessible to performance participants through QR codes.

In parallel, each performance will also be documented for professionals under “resources”. In this case, the first performance (taking place in Autumn 2022) will be documented in detail with the aim to enable its reproducibility: embedded video, images, and written instructions will be part of this section. A similar documentation will be presented also for the second performance (taking place in Spring 2023). In addition, for the second performance, CYENS will develop an innovative workflow for co-producing part of the event with live audience data. The technological solution developed as part of this performance will also be described, following the template of the “toolkit” components.

Writing in Performances collection
CHANGES SAVED

Published Delete entry

PAGE-ID
20e967d7-7f8b-48a0-b61e-8f318f89919a

TITLE
performance1

SHORT DESCRIPTION (OPTIONAL)
This is a demo entry to display the future functionality of the digital-hub. From summer 2022 to autumn 2023 the R
Short description of current entry. Will be displayed in overviews as preview text.

DATE
01/31/2022 8:00 AM Now

TARGET AUDIENCE
VISITOR x PROFESSIONAL x x v

PERFORMANCE
v

TAGS (OPTIONAL)
v

LICENSE

THUMBNAIL (OPTIONAL)
Choose an image
Insert from URL

Small image limited to 100kb to be used for overviews.

BODY
Rich Text Markdown
This is a demo entry to display the future functionality of the digital-hub. From summer 2022 to autumn 2023 the ReinHerit Digital-Hub is under pilot phase. The content of the hub will be subsequently added / enhanced during this project phase. Provided resources might get unavailable, changed or adapted during that time.

Figure 12. Performances input mask in the CMS (as of July 2022).

6.9. Digital Exhibitions

WP6 will develop both travelling and digital exhibitions, whose strategy and approach is described in D6.1. The description of the digital exhibition in D6.1 is:

“For the front-end, one basic web based template means that the same structural elements, e.g. introductory elements (Introduction chapter for "Social Issues" and connections to the sub-topics and the RelnHerit project itself), three main chapters (the three thematic areas with their subtopics, content, artefacts and in-depth information) or in-depth elements (e.g. regarding the artefacts and additional information on them), are available for the three museum partners. They share one fillable back-end or CMS (Content Management System), from which they can add content. The basic content would be mainly texts, images, video, audio as well as interactive tools/features, for instance annotated 3-D objects or a viewer tool.”

(D6.1, p.62)

The exhibitions will therefore be accessible via a dedicated section in the ‘visitor’ area, and will have a dedicated CMS area. They will be based on a full-page template, without the usual navigation bar and developed in collaboration with a web designer chosen by the museums. At their core, the exhibitions will consist of four web pages: one introductory section, and the three thematic exhibitions (on conflict, gender, and craftsmanship).

Images will be uploaded directly in the Hub, with Uploadcare facilitating the management and editing of these images, while videos and audios might also be embedded. 3D models will be embedded from a popular 3D viewing platform, most likely SketchFab, due to the variety of formats in which 3D models can be prepared (.ply, .obj, .x3d, .collada, etc.). SketchFab already accepts a notably large number of formats and has worked successfully with many museums, thus making it more accessible and easier for participating institutions. Conversely, creating a new viewer that accepts the same range of formats would be impossible within the scope of this project and, similarly, asking museums to convert their models to selected formats would result in a too complicated process and, consequently, less participation.

In the Digital Hub development process, meetings online and in person (given that WP6 is led by the GrazMuseum, so it was possible to meet easily for the development team at UNIGRAZ) and the workshop organised in May 2022 in Graz, to which also UNIFI participated, were crucial for refining ideas and possibilities for embedding the digital exhibitions in the Hub. Since the completion of the strategy for the exhibitions and the identification of the key features needed in relation to the Digital Hub, GrazMuseum and UNIGRAZ have intensified their meetings in order to discuss more precisely aspects of the design and workflow. The designers will begin to develop the design for the digital exhibitions in late summer/early autumn 2022, and consequently this section of the Digital Hub will progressively be refined and polished until the launch of the digital exhibitions in February 2023. Once launched, the digital exhibition will be promoted on the homepage and through the project social media.

6.10. Collections overview

An innovative visualisation, “creating an international, growing collection (...) built on a collaborative basis” (D6.1, p.63) was proposed in WP6. The Digital Collection was elaborated as an additional bonus part of the Digital Exhibition. It was not foreseen in the grant agreement and is therefore not part of the expected outcome. The core idea was to create a landing page, on which objects contributed by European museums will be seen, and could be filtered according to the themes of the ReInHerit exhibitions (conflict, gender, craftsmanship), as well as by place and time.

The workflow would entail museums, also external to ReInHerit, submitting their objects via a web form; GrazMuseum (WP6 leader) checking the submissions for a content-focused quality control (appropriateness, language, quality of information); GrazMuseum/UNIGRAZ checking if metadata are following the guidelines (data standards quality control) and adding the objects with semi-automatic workflows to the Digital Hub. The form would include a consent form for the ‘donation’ of the objects to the ReInHerit collections overview, and fields mirroring the necessary metadata. Media files could be either directly uploaded or shared via a link to any external provider, as chosen by the donating institutions.

The core metadata for each object will include: donating institution, author, date of donation, place, period, theme (according to the exhibitions’ themes, although this category might be expanded in the future, depending on the success of the portal and the interest of museums in expanding this common collection), and Creative Common license. In addition, as mentioned, institutions will be asked to share images and, if available, 3D models of their objects (as in the case of the digital exhibitions, links to published SketchFab models will be privileged, in order to avoid issues due to different 3D formats and incomplete submissions). The submission form will ask institutions to provide also a short description of the object. A template for displaying each object on its own page is being developed, in collaboration with the museums and their chosen exhibition design agency (Studio Itzo, <https://studio-itzo.com/>), in order to ensure consistency across the exhibitions and this online collections view.

All the objects will then be aggregated in a single visualisation: by clicking on each, opening the individual page for each item. The precise characteristics of this visualisation are still under discussion, but the expectation is to organise the object randomly on the page, without a fixed grid, and allow zooming across the canvas and filtering the objects by theme, place, and period. As in the case of the digital exhibitions, this page will be refined in collaboration with the museums and exhibition designers in the running-up to the exhibitions opening.

The following screenshots show the requirements for the management of the data as of Summer 2022, and their first implementation on the Digital Hub.

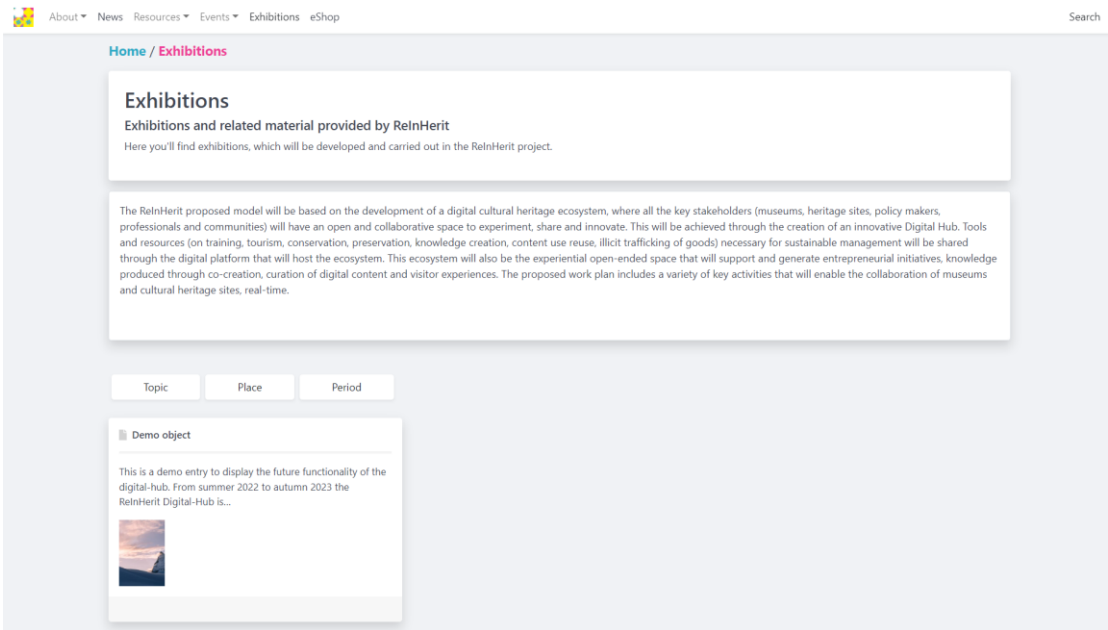


Figure 13. Collections overview landing page (as of July 2022).

Writing in Exhibition-collection collection
CHANGES SAVED Published Delete entry


PAGE ID
 1bbe8baf-1a30-44ed-ada4-1d0728e09055

TITLE
 Demo object

DATE
 07/11/2022 11:26 AM Now

Date associated with this post on the digital-hub.

IMAGE



Choose different image
Replace with URL
Remove image

Primary image for the object to be displayed.

SHORT DESCRIPTION (OPTIONAL)
 This is a demo entry to display the future functionality of the digital-hub. From summer 2022 to autumn 2023 the R

Short description of current entry. Will be displayed in overviews as preview text.

TARGET AUDIENCE
 VISITOR x x v

TOPIC

| v


- Gender
- Craftmanship
- Conflict

Time period of object like 'early-modern-times' or '18th century'.

PLACE
 Europe

Associated place of object like 'Berlin' or 'Europe'.

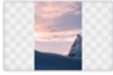
LOCATION (OPTIONAL)



Associated coordinates to the object. © OpenStreetMap contributors.

LICENSE
 CC BY 2.0

THUMBNAIL (OPTIONAL)



Choose different image
Replace with URL
Remove image

Small image limited to 100kb to be used for overviews.

BODY

B I <> H. ¶ ☰ ☷ + Rich Text Markdown

This is a demo entry to display the future functionality of the digital-hub. From summer 2022 to autumn 2023 the RetiHerit Digital-Hub is under pilot phase. The content of the hub will be subsequently added / enhanced during this project phase. Provided resources might get unavailable, changed or adapted during that time.

Figure 14. CMS input mask for collections overview objects (as of July 2022).

It should be noted, however, that as of Winter 2023 the design, budget, and infrastructure requirements for this online collection evolved in a different direction so that the ReInHerit collection is now hosted on a different platform, Wordpress-based, developed independently by Tronic. This platform is included as a sub-domain in the Digital Hub, and has a design consistent with the digital exhibitions (thus, Tronic and UNIGRAZ worked together on polishing the design of both these sections, so to ensure consistency and coherency across exhibitions and collection).

The Digital Collection with its object (content) contributions is constantly growing and there is no limit set here in terms of time or content. Since the future of the Digital Hub is not yet clear, the Graz Museum has decided to take over the future development and maintenance of the Digital Collection. Therefore, the Digital Collection is technically implemented (and outsourced) in such a way that employees of the Graz Museum can continue to work with it without any problems. Wordpress responded both to the technical requirements and to the needs of the museum, who has experience and staff able to keep on working with this platform.

At the end of May 2023, Tronic Innovations GmbH set up "matomo" as a monitoring tool for the Digital Collection. Both the developers at Tronic and the Graz Museum have access to the number of digital visitors, the number of clicks and the countries in which clicks are generated in the collection. Since the Graz Museum uploads the new incoming objects to the collection, it is also possible to check the number of objects. As of July 2023, 22 objects have been uploaded. It can be observed that the Open Call is mainly responded to after directly contacting individual museums. There has been almost no resonance so far via various museum networks.

6.11. Forum and chats

The main content of the networking area is represented by the Gitter forum, which also includes the possibility of one-to-one chats. The characteristics of the Gitter platform have already been described (section 5.3).

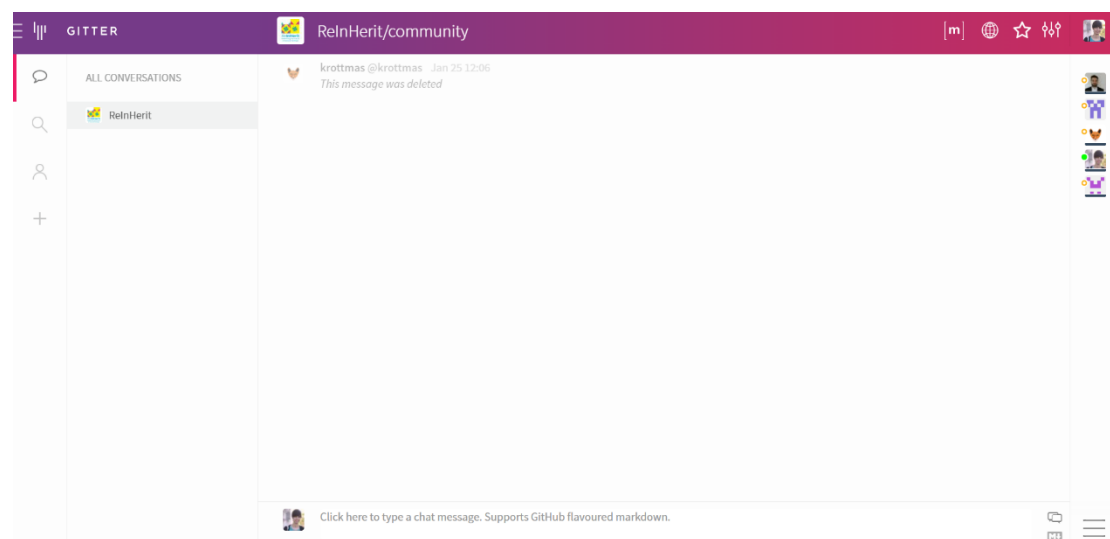


Figure 15. Forum space, room "community" (as of July 2022).

'Rooms' can be created on demand, although the Hub is being launched with at least a "Digital Hub Users - FAQs" room and a "ReInHerit Consortium Room" room. In parallel, other rooms dedicated to specific deliverables have been discussed with specific partners and will be implemented in due time - coinciding with the respective deliverables and events. These targeted rooms are:

- "Tools and apps FAQs", for supporting professionals using the toolkit,
- a room for each webinar topic, in order to foster discussion and continue conversations in the week preceding and following each webinar,
- at least one room for each immersive performance, and possibly more, depending on how partners will choose to organise visitor journeys to these events, i.e. by using a single room or creating before/during/after rooms and whether they will require separate rooms for visitors and professionals,
- a room for "FAQs Collections Overview", to support museums donating objects and enhance the collaborative aspect of these collections.

In addition, in the survey for consortium partners conducted in June 2022 (D4.1, p. 21) some options were proposed, and "Museum Management", "Cultural Tourism Management", "Cultural Tourism and Sustainable Practices", "Cultural Tourism in the EU" were all approved and had partners available to undertake the moderation of these spaces. Other rooms were approved by the partners, but - at the time of writing - moderation is still open. In parallel, partners also proposed alternative rooms, or grouping of the above ones. In these cases, further discussions are needed before officially launching these spaces, and it is envisioned that the rooms will be launched in autumn 2022.

During Autumn 2022 and early Winter 2023, project partners gradually joined the forum and in January/February 2023 UNIGRAZ organized a series of chats to foster participation. However, as mentioned above, a major change in the infrastructure of Gitter – with its move to Matrix – affected the accessibility and usability of the platform. Therefore, as detailed in section 5.3 (p.14), it was decided to switch platform. The forum migrated to Zulip, which organizes content in Streams (equivalent to Gitter rooms) and Topics (equivalent to threads), and also allows one-to-one messaging.

The Gitter forum was archived and a selection of existing chats remain visible at this link: <https://reinherit-hub.eu/forumarchive>.² In particular, the "conversations" (group discussion around selected themes, with a richer content exchange than normal forum activities) have been archived and made available. Conversely, everyday low-content chats (e.g. about current events and practicalities, without any substantial content or information) have not been made available in this archive. The new forum replicated the rooms that proved successful in Gitter. In addition, a stream for the ReInHerit applications was added, with the possibility of asking questions and sharing experiences about them. These threads were also linked directly on the digital hub, next to each app presentation. Other rooms, following

² Note that the Forum Archive links to the archived threads in the Gitter/Matrix interface and might thus be slower to load than other content hosted directly on the Digital Hub.

requests from ReInHerit partners were added (e.g. for the XR/AI Summer School in Matera in Summer 2023).

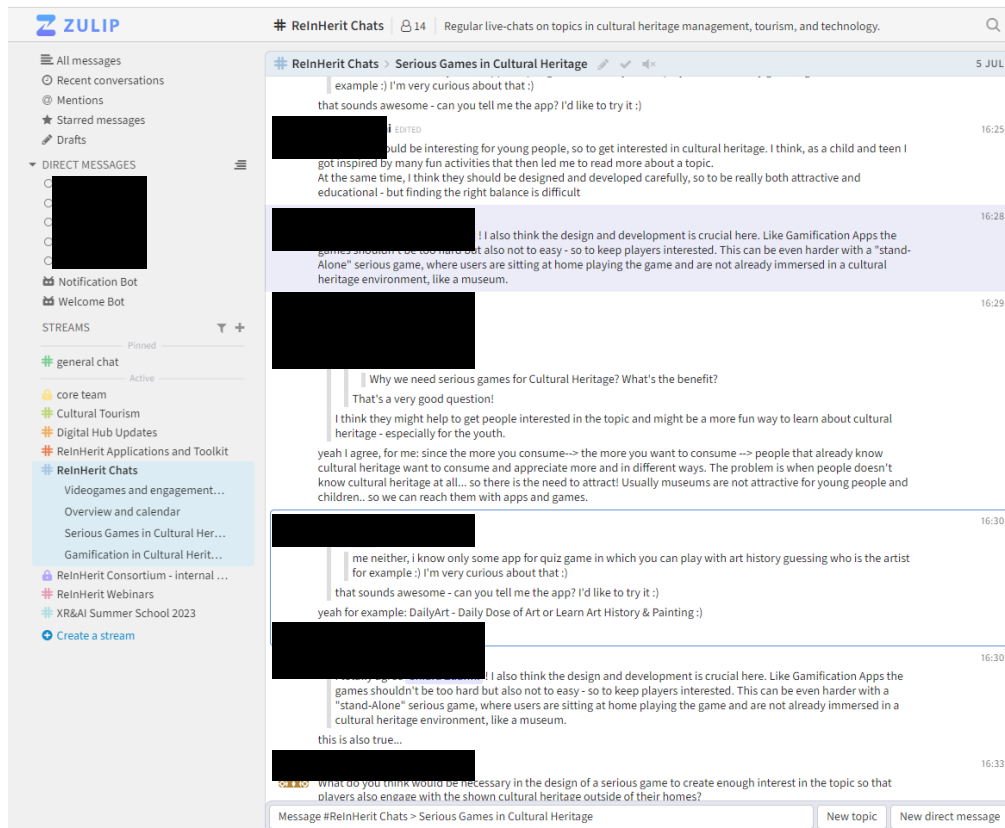


Figure 16. Screenshot of a chat in Zulip (with usernames and avatars covered).

All the consortium partners will have crucial roles in ensuring the moderation of the conversations and in developing further the discussions, by prompting new topics and maintaining a regular engagement within the Digital Hub community. The long-term sustainability and policy of the Hub (D4.6) will need to build on a careful examination of the level of engagement and the level of moderation needed in these rooms, in order to evaluate how to maintain the community safe and active after the end of ReInHerit.

6.12. About

As it is common practice, the ReInHerit Digital Hub has an “About” section, available via the menu on the top navigation bar, which includes a short description of the project, a presentation of the consortium, an imprint section, and the data protection statement (presenting the policy and provisions to protect users’ data in the Hub). These pages are also individually accessible from the Footer.

They have a full-width simple template and have been written directly by UNIGRAZ team members following the ReInHerit guidelines for data protection, ethics, and dissemination.

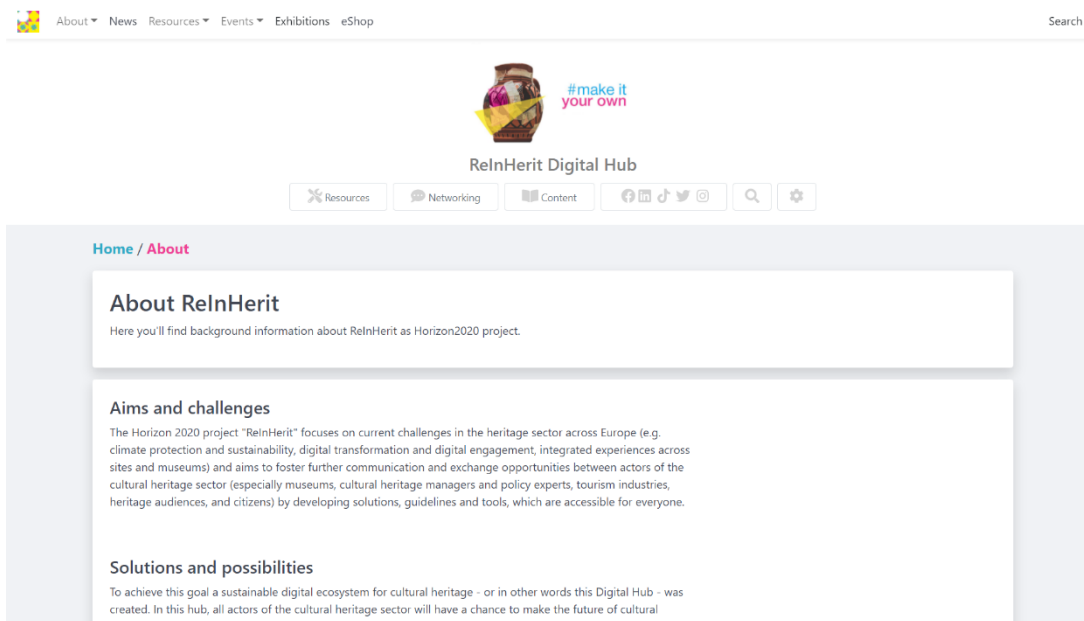


Figure 17. "About" section (as of July 2022).

6.13. Hub documentation

The technical documentation of the Hub, as presented in this deliverable, will also be available on the Hub, under the "About" menu. The template of this section follows common conventions in documentation pages, with a side menu listing the key topics. A summarised description of the Hub architecture and technologies, will be complemented by a description of the different user roles (as described below, in section 7.3).

In addition, for project partners contributing material to the Hub, UNIGRAZ will prepare simple manuals offering guidance for using the CMS and uploading material, as well as a series of FAQs for Hub users (divided between questions relevant to contributors and to visitors). After the launch of the Hub, in July 2022, a workshop during the summer will train consortium members in using the Hub. Based on the reactions and feedback from the partners, the material presented in the workshop will be revised and published in this support area.

6.14. Additional sections: Scientific Publications and Deliverables

Towards the end of the project, two additional sections were added to the project. First, a page presenting the scientific publications was created, following the model of the "About" section. Secondly, a section presenting all the public deliverables, and enabling their download, was launched on the Hub: in this case, the page had a grid format, in which each deliverable was shortly presented – with a button enabling its direct download. A link to the EU CORDIS portal completed the presentation of the project outputs in this section and aimed to ensure further long-term sustainability and reuse of the project results.

7. Other features

The software and information architecture of the Digital Hub, including the external services used, has been described in the previous sections. This section completes the description of the main features and content of the Digital Hub by documenting the configuration and personalisation features that have been implemented, i.e. how the different components of the software architecture have been refined and adapted to better respond to the needs of Hub users.

7.1. Netlify configuration

The Digital Hub uses Netlify as its Content Management System (see section 5.2). As mentioned, ‘areas’ have been created for different types of content: technically these are called ‘collections’ (according to Netlify’s own terminology), although we reckon that this term is confusing within the context of ReInHerit, and thus we refrained from using it in the guidance and description.

The current areas, as of late 2022, are:

- Toolkit: components
- Toolkit: apps
- Webinars
- Performances
- Exhibition-Collection
- News
- eShop
- Digital Hub: flexible tags (see below)
- Digital Hub: FAQ
- Digital Hub: Manuals and how-tos

New areas can, of course, easily be added if needed. Each ‘area’ has customised metadata fields and can be linked to customised templates. In the backend, the code setting up each area is included in a config.yml file, which defines the characteristics of each Netlify collection (the ‘areas’). For example, Fig. 17 shows how the area dedicated to the “components” in the Toolkit (see above, section 6.4) is configured.

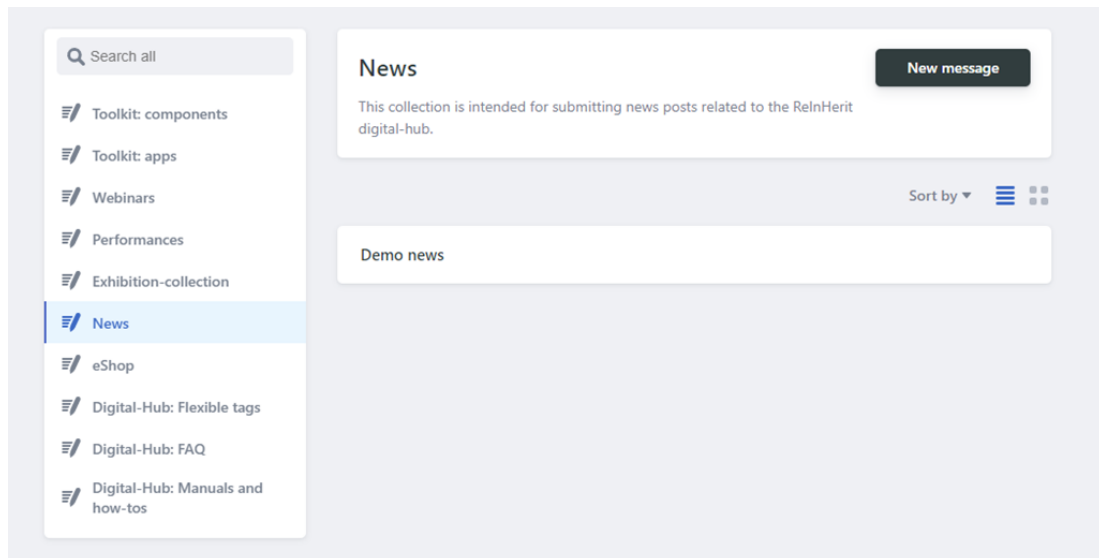


Figure 18. Netlify CMS areas (as of July 2022).

7.2. Taxonomies

Tags allow organising content and, subsequently, facilitate indexing, linking and delivery of additional services. These tags can be added through the metadata fields configured in Netlify.

In the Digital Hub, there are two main types of tags:

- fixed, i.e. users can choose between pre-established lists of tags,
- flexible, i.e. users can add their own tags.

Currently, ‘fixed’ tags are used to:

- define the target audience of a contribution (“Professional”, “Visitor”, or both): this tag is required for all content and it is subsequently re-used in customising paths and visualisation when/if needed (see below),
- in the performances, to distinguish information relating to the first or the second performance,
- in the exhibitions and in the collections overview, to distinguish the three exhibition themes (Gender, Craftmanship, Conflict),
- to distinguish “news” and “events”, since they are currently served by the same ‘area’ in the CMS (given they use the same metadata and template): this tag allows listing them separately in the navigation bar and in the Hub sections.

Other possible fixed tags have been discussed, e.g. in relation to the Toolkit (WP3, e.g. a fixed thesaurus for the types of technologies used and described) or the Collection Overview (WP6, e.g. a thesaurus for the time periods to which an object can be ascribed). Therefore, as the Hub starts to be filled with content, the list of fixed tags will be further refined and expanded, depending on the partners’ needs.

Flexible tags give contributors total freedom in choosing how to tag their content; once a tag has been created it can be reused by every Hub user. The risk is, of course, a proliferation of tags which could be synonyms with a subsequent failure in using tags to control information hierarchies. In order to avoid this risk, an 'area' of the CMS is dedicated to describing and listing existing tags. Each partner wanting to create a new tag will be required to first add the tag in this section (so he will also be able to verify the list of existing tags and eventually avoid duplicating a tag), and only afterwards they will be able to use it in their own post.

Given the interdisciplinary nature of the ReInHerit project and consortium, a flexible tag needs also to be precisely described - so to facilitate clear and shared understanding of its use. Therefore the creation of a new tag requires users to fill some metadata fields. First, a "Tag type" field is required, with a fixed choice between "technical" or "content-based" tag. The difference is therefore between an information about the technologies used/described in the post and the cultural heritage-related theme the topic can be ascribed to. The necessity for these categories emerged from the workshop with UNIFI colleagues in May 2022, but it was felt that this difference could be relevant to more content, and therefore it has been included as a general requirement for all new flexible tags. An use case for this tag is, for example, represented by the difference between an user interested in a machine learning framework (and searching if there are resources about it in the toolkit) and an user searching instead for posts related to the theme of "gamification" or "cultural heritage management". By using this field to identify technology-driven and theme-driven tags, filtering and indexing possibilities can be cascaded to the Hub content so to satisfy different users (e.g. in the "toolkit" and "webinars" filters or in the "news" section). Then, a "Tag group" field is mainly aimed at ReInHerit contributors, so to help them quickly identify tags in their content section. It allows choosing between "toolkit", "news", "eShop", "performance", "exhibition", "training". A short (optional) description to be used as preview text when listing tags, and a 'body' to add any eventual comment complete the requirements for creating new flexible tags.

Writing in Digital-Hub: Flexible tags collection
 Published

CHANGES SAVED

PAGE ID
 05b087e0-a599-4523-abf4-9eb085a3c412

TAG NAME
 Demo tag

DATE
 05/26/2022 5:29 PM Now

TAG TYPE
 [Dropdown menu]

TAG GROUP
 TOOLKIT [X] [Dropdown menu]

SHORT DESCRIPTION (OPTIONAL)
 This is a demo entry to display the future functionality of the digital-hub. From summer 2022 to autumn 2023 the R

Short description of current entry. Will be displayed in overview as preview text.

BODY (OPTIONAL)
 B I <> H. ¶ [List icon] [List icon] +. Rich Text [Toggle] Markdown

This is a demo entry to display the future functionality of the digital-hub. From summer 2022 to autumn 2023 the ReInHerit Digital-Hub is under pilot phase. The content of the hub will be subsequently added / enhanced during this project phase. Provided resources might get unavailable, changed or adapted during that time.

Figure 19. CMS mask for adding flexible tags (as of July 2022).

7.3. Levels of access

The Digital Hub provides different user roles, with different levels of access to the forum and to the CMS. In particular, there are 5 different roles configured within the Hub:

1. An online visitor, anonymous. A visitor has reading access to all the publicly available content on the hub and can also read the discussions in the public forum channels. However, a simple visitor cannot actively participate in the forum or contribute content to the Hub.
2. A forum participant needs to be authenticated - the Gitter forum provides authentication via GitHub or Twitter. Once the login has happened through one of these external providers, this role can participate in the forum by joining rooms, contributing content to the forum discussions, and starting one-to-one chats with other forum members. Conversely, this user can not create new rooms in the forum nor can they access the Hub CMS.
3. A forum moderator is a member of the ReInHerit project (or, if external, has the agreement of the consortium for getting this role) and has more control in the forum. They can create new rooms and manage forum users. Conversely, they do not have access to the Hub CMS.
4. An Hub contributor is a member of the ReInHerit project who is actively contributing content to the Digital Hub. This role has full forum rights and, crucially, access to the CMS: partners will be given this role, so to enable them to publish content on the Hub. It is envisioned that key members in WP3 (toolkit, game, webinars), WP4 (performances), and WP6 (exhibitions) will have this role. In addition, while all consortium members will be invited to contribute and will be offered training in using the CMS, an editor (from UNIGRAZ) will also be appointed for managing news and events posts as well as 'best practices' content. Ultimately, the editor will support non-technical partners in preparing material to the Hub and liaise with them during the publication process. Users with this role cannot delete code repositories nor can access internal configurations.
5. The Hub admin role has full control over all the functionalities and code of the digital hub. Therefore, since there is the risk of deleting content and even the Hub, the role will be retained by the UNIGRAZ development team members for the duration of the project.

In short, access roles 3-5 (forum moderator, hub contributor, and hub admin) are all managed through GitHub: users in these roles need to have a GitHub account and will be assigned different roles through the ReInHerit organisation in GitHub. For the moment, it is envisioned that these roles will be held exclusively by members of the ReInHerit consortium (with the Hub admin role held only by the Hub development team), although changes might occur during the project and, especially, after.

In particular, the idea of creating forum channels dedicated to the topic of each webinar for a limited time (so to keep the conversations from the webinars going and field asynchronously questions which might emerge afterwards/by watching the video recordings) implies giving

moderation right to webinars' speakers, some of which might not be part of the ReInHerit consortium. Hence, those users might be given a forum moderator role in the future.

More importantly, D4.6 will cover the policy and management of the Hub, including its future. Based on the experiences and feedback received during M17 (launch of the hub) and M28 (due date for D4.6), a different approach for appointing contributors and moderators to the forum and the hub might be considered. Especially in the future, roles could shift between consortium members and with the inclusion of external stakeholders: this process will eventually lead to new users being appointed in these roles, but the roles will remain stable since they cover all potential use cases (forum member, moderator, CMS contributor, admin).

7.4. Navigation

The navigation, as mentioned previously, is organised through three main areas (presented on the homepage and in the header of all the subpages) and a top navigation bar. In addition, breadcrumb trails are also used as further orientation aid for the user.

7.5. Search

The Hub will be launched with a full text search: this means that users will be able to input a word and find all the results across metadata and texts. From a technical standpoint, this search is based on an aggregation of all content (metadata, texts) in GraphQL and a client-side search.

This solution will facilitate finding material and exploring the Hub during its first period, i.e. when there will be still limited content available (since content will be added by ReInHerit partners during autumn 2022-early 2023), however, it has limitations in relation to its scalability. In the future, once the content grows, finding all the instances of a word might not be optimal since it could lead to both a slow search and an overwhelming quantity of results. For this reason, the feasibility of a faceted search has been already evaluated, with positive results, and it might be implemented once the Hub reaches a critical amount of data. In 2024, the search function has therefore been further developed to encompass the breadth of the content on the Hub.

Both these types of search refer to the content added by ReInHerit partners to the Hub via the CMS. The forum will not be part of this search results (also so to protect users' privacy), and will be searchable only through its own separate search function, which is present in both Gitter and Zulip.

7.6. Embedding of external resources

An external service, Uploadcare, will support the management of images and other files on the Hub. In parallel, it will be possible also to add content via the HTML <iframe> tag, so to embed viewers for some objects. This will be particularly crucial in the exhibitions and online collections for embedding 3D models from SketchFab and for embedding YouTube videos.

For embedding the webinar software with its registration form and the live-streaming of webinars, an additional code is being implemented.

7.7. Visitors vs professionals paths

Another Hub functionality relies on the “target audience” metadata field, i.e. the tag “visitor” or “professional”, to directly customise the experience of the Hub. At its basic, this functionality works by filtering content through this metadata field (via GraphQL) and presents two different interfaces, depending on the user.

This option was implemented in the first version of the Hub, allowing users to choose their path from the homepage of the Digital Hub, and eventually switch through the navigation bar. However, following the evolution of the development process (with the identification of three key areas on the homepage) and the feedback of the partners (considering that all content could be shown to all users, with recommended paths - rather than hiding some content depending on the user type), it was decided to deactivate it for the time being.

7.8. Personal collections

The possibility of creating personal ‘databaskets’, i.e. the possibility for each user to create a personal collection saving locally content they were interested in for future reading/easy retrieval, have also been developed. The code behind this function enables local storage on the client-side (i.e. in the cache of each user’s browser) of the URLs and IDs of the selected material. Through this process no data will be stored on the Digital Hub (i.e. ReInHerit members will not have access to any user data).

This option was deactivated at the launch of the Hub and will be activated and promoted once more stable content will be added to the Hub: at the moment of its launch, the Hub includes only ‘demo’ posts which will be deleted once ReInHerit partners begin to enrich it with their deliverables. Hence, there is currently no need for this function and it could create issues if a user begins to store ‘demo’ posts and maintain them in their databasket even after the deletion of said posts. Therefore, for both clarity and technical reason, it has been decided to wait to activate this function. Subsequently, this function was launched in 2023 and tested with consortium members and users. After the testing phase, the use of this function was evaluated and, given users’ preferences to bookmark the content via their browsers rather than creating temporary collections on the Hub, it was decided to deactivate it.

8. Hosting, Domain, Performance, Analytics

The Digital Hub is hosted on Github, thus its code is also fully open access in the corresponding repository. It is published as a Github site, under the domain <https://reinherit-hub.eu/> (bought initially for 5 years by UNIGRAZ).

It corresponds therefore to the DMP of ReInHerit, having an even more open license for the Hub’s own code (CC BY 4.0), and assigning by default a CC BY 2.0 license to all the content published on the Hub (unless each partner chooses to grant a more open license).

It uses Google Analytics to monitor website visitor numbers and behaviours: a standard Cookie disclaimer on a first visit and the “Data Protection” page alert visitors to the use of this tool. Besides, it does not store any visitor data: personal collections are processed on the client side (i.e. in each user’s own browser); CMS and forum registered accounts are managed via GitHub.

Partners contributing content via the CMS will be granted the selected level of permission to their Github account; forum moderators and members will also be able to receive access via personal GitHub accounts. More details on the decisions and practices concerning data protection and ethics are presented in D4.1 (pp.25-27).

In terms of performance, the Digital Hub has been tested using Lighthouse, a Google open-source, automated tool for measuring the quality of web pages that can be applied to any website (via developer tools in Chrome). The results are excellent at the moment of launch and will be monitored regularly once the Hub will begin to be used by all partners, addressing any eventual issue. In particular, as of M17, the Hub scores 100 in performance, 90 in accessibility, 92 in best practices, and 100 in SEO.

9. Conclusion

This report has described the process adopted in developing the Digital Hub and how the requirements (D4.1) were implemented in the development of the platform. It has offered details on the software and information architecture of the Hub, its features and the services and frameworks it uses. The Hub is being launched at the end of M17 and will begin to be used by partners to add content in the respective sections, while the forum will begin to be promoted to external stakeholders. The dissemination and exploitation of the plan, as noticed in D4.1, will need to be staggered over the coming months, so to avoid disappointing users by promoting a platform still without most of its expected content. In parallel, the Hub can also be promoted in sector conferences and a publication will be prepared by UNIGRAZ, focusing on platforms enhancing collaborations in the cultural sector and the contribution the ReInHerit Digital Hub hopes to make.

An evaluation of the engagement and management of the platform will be carried on during the Hub's pilot phase, culminating in D4.6, a policy and management document suggesting future strategies and uses of the Hub. The Hub is already innovating significantly on the landscape of digital platforms for heritage stakeholders by drawing on a static website framework and a Jamstack approach, rather than a dynamic website, thus ensuring better chances for its long-term maintenance and sustainability. By providing a forum as a space for networking, it is also addressing concerns emerged in WP2 by offering a type of interaction simple, but effective, filling a needed gap in the sector. Ultimately, the Hub's success will be guaranteed by the quality of its content, which the ReInHerit consortium will begin to add in M18.

Appendix 1: overview of the ReInHerit Digital Hub content

This deliverable has described the sections of the Digital Hub as planned and evolved during the project. This Appendix lists the main sections of the Digital Hub and their content. As mentioned, the Homepage is divided into three main sections (content for heritage professionals; visitors content; calls for participation), while an additional two top-level sections (About and News) are present in the navigation bar. Within these sections, the content of the ReInHerit Digital Hub is structured as follows:

- **About**
 - Project: <https://reinherit-hub.eu/about/dd779b45-1ce5-411a-9c80-f887f1ddb4c2>
 - Consortium: <https://reinherit-hub.eu/about/12654fad-79d5-4c78-99a1-dd6d4b777cb1>
 - About the Digital Hub: <https://reinherit-hub.eu/doc/2096bb3c-78d3-4d21-b9cc-992e6e170a2f>
 - FAQ: <https://reinherit-hub.eu/doc/531acbf-b-d484-4c46-9c5c-dc6ed84ef62a>
 - Imprint: <https://reinherit-hub.eu/about/69482c10-2859-452f-b7fc-fdc901f9e0a1>
 - Data protection: <https://reinherit-hub.eu/about/3b13e4f5-741f-472c-a58d-a9895088b486>
- **News:** <https://reinherit-hub.eu/news>
- **Resources**
 - Overview of all the ReInHerit resources: <https://reinherit-hub.eu/resources>
 - Webinars: <https://reinherit-hub.eu/webinars>
 - Research factsheets: <https://reinherit-hub.eu/factsheets>
 - Best Practices: <https://reinherit-hub.eu/bestpractices>
 - Handbook: <https://reinherit-hub.eu/handbook/e85d8d26-e074-4f5e-b5f6-329d76bba0f0>
 - Scientific Publications: <https://reinherit-hub.eu/about/3b438d0d-239e-4027-a5c3-917263e373aa>
 - Project (public) Deliverables: <https://reinherit-hub.eu/deliverables>
 - Hackathon Training Material: <https://reinherit-hub.eu/hackathonnicosia>
 - Toolkit Apps documentation: <https://reinherit-hub.eu/tools/apps>
 - Toolkit components: <https://reinherit-hub.eu/tools/components>
 - Videogame documentation: <https://reinherit-hub.eu/gamedoc/>
 - eShop documentation: <https://reinherit-hub.eu/eshopdoc/7ad7993f-c1c6-42dc-a183-192aae852ccd>
 - Exhibitions documentation: <https://reinherit-hub.eu/exhibdoc/>
 - Online collection documentation: <https://reinherit-hub.eu/exhibdoc/doonlinecoll/>
 - First performance documentation: <https://reinherit-hub.eu/firstperfdoc/>
 - Second performance documentation: <https://reinherit-hub.eu/secondperfdoc/>
- **Discover**
 - Overview of the ReInHerit products: <https://reinherit-hub.eu/visitorhub>
 - Digital Exhibitions: <https://reinherit-hub.eu/exhibitions>

- Digital Collection: <https://collection.reinherit-hub.eu/>
- Travelling Exhibitions: <https://reinherit-hub.eu/travellingexhibitions>
- eShop: <https://reinherit-hub.eu/eshop>
- Videogame: <https://reinherit-hub.eu/game>
- Museum Up podcast: <https://reinherit-hub.eu/podcasts>
- Toolkit Apps: <https://reinherit-hub.eu/applications>
- Events: <https://reinherit-hub.eu/events>
- **Participate**
 - Forum: <https://reinherit-hub.eu/forum>
 - Forum Archive: <https://reinherit-hub.eu/forumarchive>
 - Host an exhibition: <https://reinherit-hub.eu/museumcalls/ecef209d-8276-4aff-90d7-4228f5238731>
 - Contribute to the collection: <https://reinherit-hub.eu/museumcalls/96ee4e71-7184-4557-ac18-ca825fe33b05>
 - ReInHerit Hackathon: <https://reinherithackathon.cyens.org.cy/homepage/>
- **Search:** <https://reinherit-hub.eu/search>

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