fRamework for safE, opEn, collaboratiVe And incLUsive digitisAtion and managemenT of cultural heritagE

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Abbreviations

Abbreviations	Full name
AI	Artificial Intelligence
REST	REpresentational State Transfer
API	Application Programming Interface
CHI	Cultural Heritage Institution
SSO	Single Sign On
JWT	JSON Web Token
RBAC	Role Based Access Control
SAML	Security Assertion Markup Language
LLM	Large Language Model
VLLM	Visual Large Language Model
RDF	Resource Description Framework
AI	Artificial Intelligence

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Publishable summary

This deliverable presents the Integrated REEVALUATE Platform of the REEVALUATE project. The platform brings together a collection of interoperable enablers that collectively support the prioritization, digitization, contextualization, validation, and creative reuse of cultural heritage artefacts.

The Integrated Platform combines advanced artificial intelligence modules, semantic data modelling, blockchain-based intellectual property management, and participatory interfaces into a unified ecosystem. It enables cultural heritage institutions and creative professionals to manage, enrich, and reuse digital artefacts while ensuring provenance, ethical data use, and interoperability. The platform's modular architecture facilitates distributed deployment, scalability, and interoperability among partners and external stakeholders.

This report describes the technical integration of the platform's core components, including the Hub, Data Lake, Marketplace, and the suite of functional enablers developed in Work Packages 3 and 4. Each enabler contributes distinct capabilities—ranging from public-driven artefact prioritization to AI-based contextualization, creative reuse, and rights management—integrated through common APIs and shared ontologies. The deliverable also details the deployment model, data flow, and communication interfaces that underpin the platform's operation.

Overall, Deliverable D4.3 demonstrates how the REEVALUATE Platform realizes a trusted, interoperable, and future-proof digital ecosystem that bridges cultural heritage, technology, and society.

1 Introduction

The REEVALUATE Platform represents the culmination of the project's efforts to develop an integrated, safe, open and collaborative ecosystem for the management and reuse of cultural heritage digital artefacts. REEVALUATE aims to empower cultural heritage institutions (CHIs) and the wider public to engage meaningfully in the digitization, contextualization, and creative reuse of cultural artefacts. Building upon a foundation of interoperable data structures, semantic technologies, and participatory tools, the platform brings together diverse components developed across different work packages into a cohesive operational environment.

At its core, the integrated REEVALUATE Platform serves as the technological backbone of the project, hosting and orchestrating a suite of enablers that address the end-to-end workflow of cultural artefact management. These enablers cover key functional areas such as artefact prioritization, contextualization, validation, intellectual property management, and creative reuse. Through modular architecture and microservice deployment, the platform ensures scalability, flexibility, and efficient collaboration among partners, institutions, and users, enabling seamless interaction between the technical and human dimensions of cultural heritage digitization.

The development of the REEVALUATE Platform has been driven by the requirements defined in earlier project phases, particularly those concerning user needs, interoperability, and ethical data handling. Integration has been achieved through a combination of API-based communication, shared ontologies, and federated data management within a distributed Data Lake. Each component—ranging from AI-based contextualization tools to blockchain-enabled intellectual property registries—has been designed to function autonomously while remaining interoperable within the broader platform ecosystem. This

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approach facilitates both decentralized innovation and coherent system behaviour across multiple platforms.

From an operational standpoint, the REEVALUATE Platform provides an accessible and user-friendly entry point through its Hub and Marketplace. These central interfaces allow curators, researchers, and creative professionals to access, manage, and reuse digital artefacts with confidence in their provenance and contextual integrity. The platform's layered architecture ensures secure authentication, traceable transactions, and compliance with European data governance standards, while encouraging public engagement and the co-creation of cultural knowledge through participatory tools and AI-assisted interfaces.

This deliverable (D4.3) documents the design, development, and integration of the complete REEVALUATE Platform. It outlines the system architecture, deployment model, and technical specifications of its constituent enablers, illustrating how they collectively support the project's vision of a sustainable, transparent, and inclusive digital heritage infrastructure. Furthermore, the document highlights the collaborative development process among consortium partners and provides insights into future enhancements that will extend the platform's functionality beyond the project's lifetime

2 Framework Architecture

The Architecture of the REEVALUATE Platform has been defined and expanded during Task 1.5. While documented in detail in deliverable D1.7, for convenience to the reader it is also briefly presented here in Figure 1.

2.1 High-Level View

The framework elements are grouped into six sections:

1. Users: Represents human users of the REEVALUATE software.
2. Institutions: Covers tools, services and data that are already available in CHIs.
3. Artefact Reuse: Collects all elements concerned with reusing CH artefacts or their digital representations in other contexts.
4. Services: Used by the enabler to fulfil their function. Unlike the enablers, these services are, in most cases, not directly implemented by the project, but existing elements, like databases, AIs, content storage and ledgers, enriched with REEVALUATE specific data and based on available solutions.
5. Applications: Covers all human-facing software used in the REEVALUATE project. These are generally common front ends, mostly utilizing functionality from multiple enablers.
6. Enablers: Comprises the functionality specifically implemented for the REEVALUATE project in work packages WP3 and WP4, required to provide the functionality needed to fulfil the user needs collected in Task 1.3.

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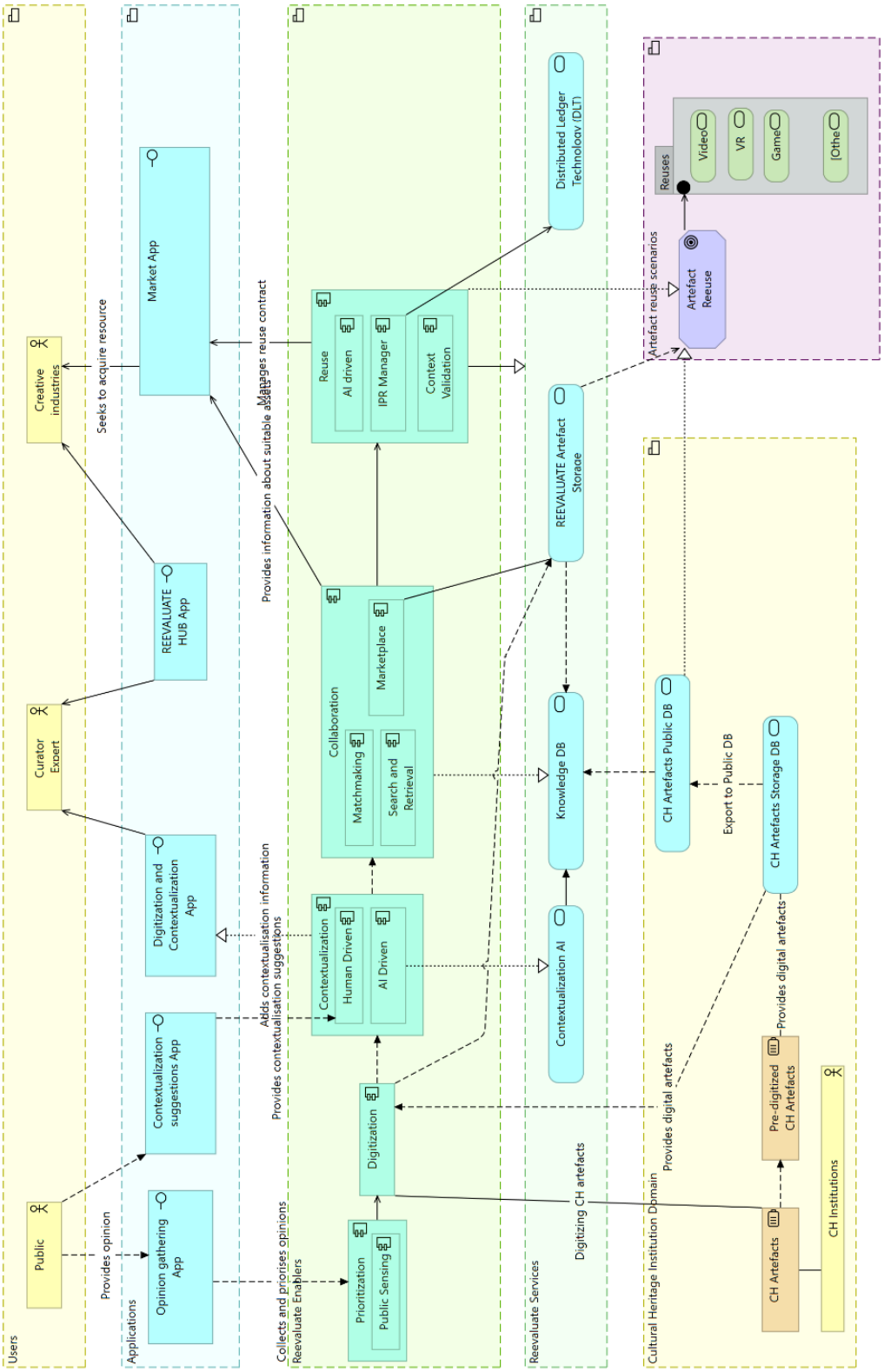

Figure 1: REEVALUATE Framework Architecture

2.2 Deployment View

Based on the high-level architecture a new schematic is developed describing the planned deployment of the enablers in a real-world environment and their interconnections.

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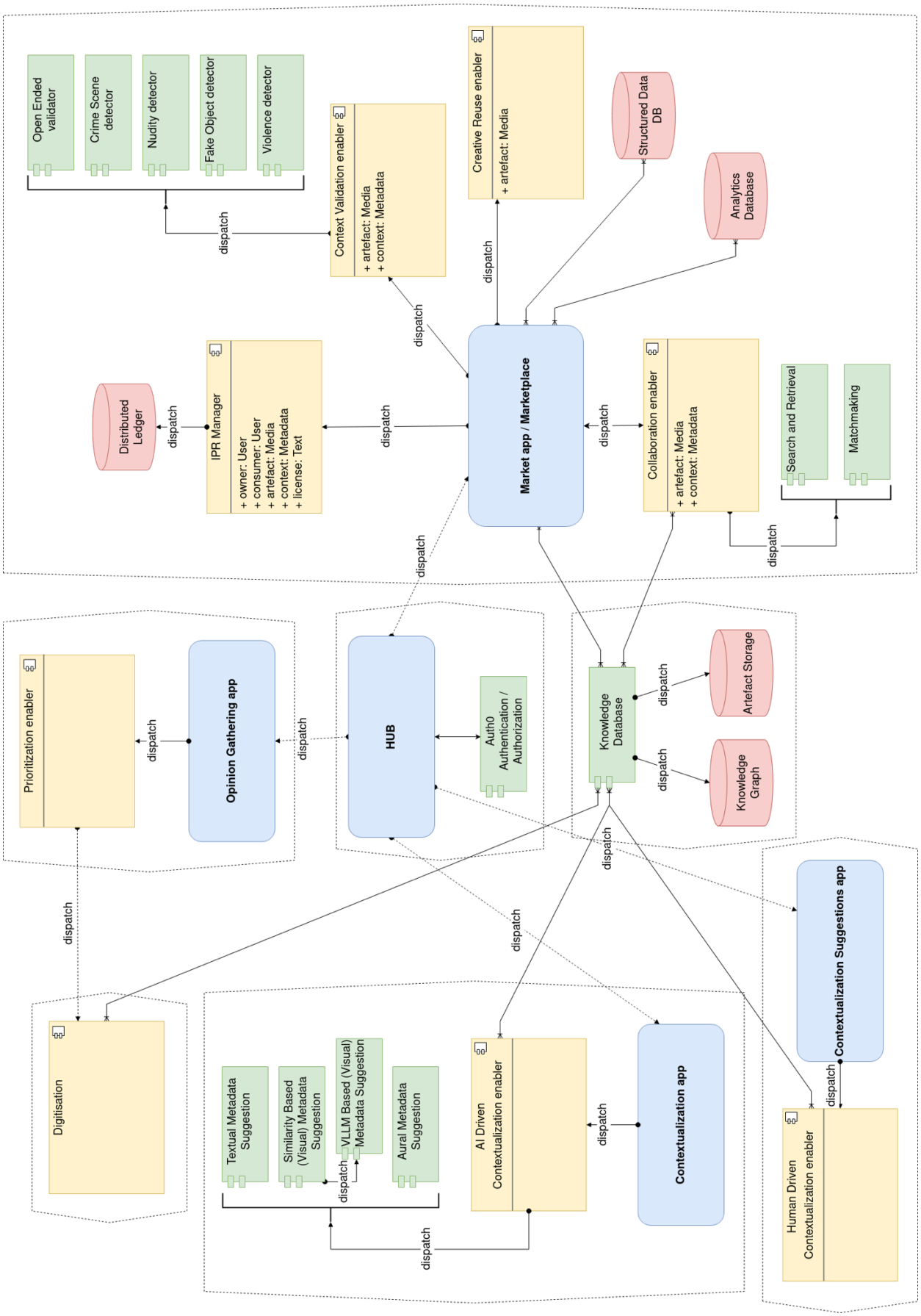

Figure 2: REEVALUATE Deployment viewpoint

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In Figure 2 we present the various integrated components of the REEVALUATE platform. Marked with blue are the *applications* which constitute the access points for the users of the platform. Using yellow colour are the various *enablers* that implement the business logic while with green we mark the *submodules*, helper modules that offer specific functionality to the enablers. In red we mark the data storage modules.

The modules are grouped in the schema based on their functionality and the target user roles. The *Opinion Gathering app* and the *Prioritization enabler* form a self-contained system that allows a curator to run campaigns based on physical artefacts for the selection of the order and necessity of their digitization.

The actual digitization process anticipated by the *Digitization enabler* is not in the primary focus of the REEVALUATE project. It is included in the schematic to provide a complete overview of the process and denotes the source of digital artefacts for the platform. While in the long run the connection between physical artefacts used in the Prioritization enabler should be automatically linked to the digital artefact produced by the Digitization process, for this integration plan it remains a manual process performed by the curator/owner of the digital artefact using the Marketplace.

The main point of access to the platform for the users, based on their roles, is through a single webpage, *the Hub*, that provides authentication for the users and easy access to the various Web applications of the platform, namely the *Contextualization app*, the *Contextualization Suggestions app*, the *Marketplace* and the *Opinion Gathering app*.

As shown in the deployment diagram, the components are designed to be deployable as a distributed system. The core components will be deployed by the partners primarily responsible for the component development, running the components as microservices. This approach allows for fast updates and rapid development during the implementation phase, as partners are directly responsible for individual components and have direct access to and control over their deployment.

2.3 Hub

The REEVALUATE Hub serves as the central access gateway to the platform, providing a unified and user-friendly interface through which all participants can discover, authenticate, and navigate the suite of REEVALUATE enablers and applications. Developed and maintained by CERTH, the Hub functions as the main entry point for curators, researchers, creative professionals, and the general public, to interact with the REEVALUATE ecosystem. It consolidates access to key platform services—including the Marketplace, Contextualization tools, Public Sensing Prioritization Enabler, and administrative dashboards—under a single web environment designed for interoperability, security, and scalability.

Architecturally, the Hub acts as an orchestration layer that integrates the distributed microservices and web applications developed across the consortium. It does not host the enablers directly but instead coordinates access to them through standardized API endpoints and dynamic routing mechanisms. Each enabler registers its service metadata and URLs within the Hub, allowing users to seamlessly transition between applications without re-authentication or loss of session context. This integration is achieved through Auth0-based Single Sign-On (SSO), which ensures that authentication and authorization are handled uniformly across all components. Once authenticated, users receive JSON Web Tokens (JWTs) that are securely propagated between the Hub and connected services to manage session continuity and enforce role-based permissions.

The Hub's front-end interface is designed with accessibility and usability in mind, featuring a responsive layout and clear navigation structure that adapts to different user roles and privileges. Institutional users

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can access administrative functions such as artefact management or campaign creation, while public users can explore open-access tools and participate in crowdsourced contextualization activities. The Hub also provides system-level utilities such as user profile management, service discovery, and notification handling, ensuring a coherent user experience across the platform.

On a technical level, the Hub is implemented as a modular web application built using modern front-end frameworks and RESTful integration with backend services. It operates as a stateless component within the REEVALUATE infrastructure, leveraging containerized deployment for scalability and fault tolerance. Logging, monitoring, and access control are centrally managed, ensuring transparent and auditable interactions across the distributed environment. Through its design and implementation, the Hub embodies the project's commitment to open, secure, and inclusive access to cultural heritage technologies.

Overall, the REEVALUATE Hub is not only a navigational interface but also a structural cornerstone of the platform's integrated architecture. It enables seamless collaboration between technological components, promotes a consistent user experience, and establishes the foundation for future extensibility as new enablers and services are incorporated into the REEVALUATE ecosystem.

2.4 Authentication and Authorization

The REEVALUATE Platform employs Auth0 as its central identity and access management solution to provide a unified authentication and authorization framework across all platform components. Auth0 serves as the Single Sign-On (SSO) provider, enabling users—including cultural heritage professionals, project partners, and public contributors—to access multiple web applications and enablers within the REEVALUATE ecosystem using a single, secure set of credentials. Each platform service, such as the Hub, Marketplace, Contextualization apps, and AI-based enablers, is registered as a trusted Auth0 client application, ensuring consistent authentication flows and secure communication through OAuth 2.0 and OpenID Connect protocols.

When a user logs in through the Hub or any connected application, Auth0 handles the verification of credentials and issues a JSON Web Token (JWT) containing user identity attributes, assigned roles, and access scopes. These tokens are used to authorize subsequent API requests across the distributed microservices architecture, ensuring that each enabler can independently validate user permissions without duplicating authentication logic. Role-based access control (RBAC) policies are enforced within Auth0, defining distinct privileges for user groups such as administrators, curators, institutional representatives, and public users. This configuration ensures granular control over platform functionalities, such as artefact management, metadata validation, and marketplace transactions.

By centralizing identity management through Auth0, the REEVALUATE Platform achieves a cohesive and scalable security model that simplifies user onboarding, enhances interoperability among enablers, and ensures compliance with European data protection and privacy standards. The architecture also supports federated identity integration, allowing institutions to authenticate users through their own identity providers (e.g., via SAML or enterprise OAuth), thereby promoting both flexibility and trust across the distributed cultural heritage network.

2.5 Data Lake

The REEVALUATE platform produces and manages a wide range of data related to digital artefacts and their context, which vary significantly in structure and modality, from structured metadata and semantic

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information to unstructured multimedia content such as images and 3D scans. To handle this heterogeneity efficiently, the platform adopts a multi-service architecture based on specialised storage and retrieval components, collectively forming the Knowledge Base of the project.

The actual digital artefact binary data are stored in the Artefact Storage, implemented as a MinIO instance. This component ensures scalable and reliable storage of high-volume multimedia content such as images and digitisations.

The artefact metadata, including descriptive, semantic, and contextual information, is managed in the Knowledge Graph, stored in a graph database that supports SPARQL queries through a dedicated interface.

These two core components are complemented by additional services:

- a vector Database, which stores AI-based vector representations (embeddings) of artefact images to enable advanced similarity search and retrieval
- an API Gateway, which provides a unified access point for all services, ensuring secure and consistent communication among them and with external applications.

Together, these services enable the efficient storage, retrieval, and use of both structured and unstructured data across the platform.

2.6 Knowledge DB

The graph database hosts the Knowledge Graph, which represents structured and interconnected information about the artefacts managed in the REEVALUATE platform. This graph models entities such as artefacts, creators, historical periods, materials, and techniques, as well as the semantic relationships linking them using the contextual ontology (CACAO) developed inside the project and presented in D1.4 and D1.6. This component serves as the semantic backbone of the knowledge base, storing all artefacts' information and linking their metadata with their corresponding digital representations in the object and vector storage layers.

2.7 Artefact Storage

The Artefact Storage is responsible for storing the binary data associated with the artefacts, including images, videos, 3D models, and other digitised materials. It is implemented using MinIO, an object storage solution that provides scalable and durable storage for large multimedia files and effective metadata management for digital objects (e.g., file type, size, format, source). The artefact storage is also integrated with the knowledge graph via unique identifiers that link each stored artefact to the corresponding entity in the graph. This architecture ensures that the artefacts' digital representations remain accessible, secure, and efficiently retrievable for both human users and automated services within the platform.

The Knowledge Graph also offers the functionality to store and eventually retrieve any kind of files related to artefacts. It exposes two endpoints as described in the following tables.

Access

Functionality	Method	Endpoint
Upload binary files	POST	/files

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Input

Parameter	Type	Description
file	str (base64)	Binary data of a digital artefact

Output

Field	Type	Description
Uuid	Str	UUID of the uploaded file

To then retrieve a file previously uploaded, it is necessary to send a GET request at /files putting the file id (returned by the system after file upload) in the end of the URL and the request file will be returned in the body of the response.

Access

Functionality	Method	Endpoint
Retrieve binary files	GET	/files/{file_id}

Input

Parameter	Type	Description
File_id	str	UUID of the requested file

Output

Field	Type	Description
File	File	The stored file

2.8 Other Data

In addition to the described functionalities, the REEVALUATE platform also needs to store other types of data, for example user interactions with artefacts as well as the smart contracts. Storage of these data is performed in dedicated databases for the functionality of individual enablers. Therefore, access to this data is limited to the owning enabler and has no endpoints for outside connections. The detailed description of these databases can be found in the relevant enabler descriptions.

3 Prioritization, Digitization and Contextualization enablers

The artefact ingestion workflow begins with the **Public Sensing Prioritization enabler**, which introduces an innovative, participatory approach to deciding which artefacts should be digitized first. By leveraging public engagement campaigns and AI-driven sentiment analysis, CH institutions can identify items of high societal or cultural interest, ensuring that digitization efforts align with both institutional priorities and community values. This democratic prioritization process makes digitization more inclusive, data-informed, and reflective of public cultural relevance.

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Although the **Digitization enabler** itself is not developed as a core component of the REEVALUATE project, it plays a central role in the overall ingestion pipeline. It represents the process by which artefacts selected through prioritization are transformed into digital surrogates—images, 3D models, or multimedia assets—that serve as the primary inputs for subsequent enablers. While the integration between the digitization process and the platform remains manual for the scope of this project, the architecture anticipates future automation, ensuring that digital artefacts can be seamlessly linked to their corresponding records in the REEVALUATE Marketplace and Knowledge Graph.

Following digitization, artefacts enter the **Contextualization enabler** stage, where their meaning, relationships, and metadata are expanded through both human and AI-driven processes. The REEVALUATE Platform supports two complementary forms of contextualization: human-driven contributions, where curators and domain experts engage external audiences to enrich artefact metadata; and AI-based contextualization, which uses multimodal analysis to suggest semantic annotations across textual, visual, and aural domains. Together, these tools ensure that artefacts are not only preserved digitally but also embedded within their cultural, historical, and interpretive contexts.

In unison, these three enablers establish a comprehensive ingestion framework that transforms artefacts from physical entities into interconnected digital assets within the REEVALUATE ecosystem. The process embodies the project's core principles of openness, collaboration, and inclusivity, ensuring that each artefact's journey—from prioritization to contextualization—enhances both its accessibility and its cultural significance in the digital domain.

3.1 Public Sensing Prioritization enabler

The Public Sensing Prioritization Enabler (PSPE) provides a hybrid mechanism for democratised prioritization of cultural artefacts to be digitized. It enables cultural heritage institutions to engage the public in artefact selection through both active and passive participation. Utilizing social media integrations, gamified campaigns, and sentiment analysis tools, the enabler analyses engagement data (likes, comments, reactions) to identify artefacts of higher societal interest.

3.2 Execution Environment and Requirements

The PSPE is designed as a modular web application, developed with a Python (Flask) backend and a MySQL database, which stores campaign, artefact, and user-related data. The system exposes its functionalities through RESTful APIs, ensuring interoperability and communication with other components of REEVALUATE. To support scalability and ease of deployment, the enabler operates within Dockerised containers, allowing flexible execution and seamless integration on the REEVALUATE integrated platform. Its technical environment relies on several key dependencies: Flask is used for API routing and service orchestration, MySQL manages persistent data storage, and Ollama provides large language model (LLM) inference capabilities for sentiment analysis tasks. Additionally, the Facebook API is integrated to extract social media engagement data for campaign monitoring and evaluation.

In terms of platform interoperability, the enabler is fully accessible through the REEVALUATE Hub and Marketplace. This integration ensures that prioritization insights, derived from public engagement and sentiment analysis, can directly inform cultural artefact selection, and enhance the collaborative workflows of participating cultural heritage institutions.

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3.3 User Interface or API

The enabler is accessible via Web-based User Interface (Public Sensing App) for CHIs and campaign participants, and RESTful API endpoints enabling integration with the main REEVALUATE platform.

Access

Role	Method	Endpoint
CH Curator	Web UI / API key	/api/campaign/create, /api/artefact/add
Public User	Web UI	/campaigns/view, /campaigns/participate
REEVALUATE Platform	API	/api/sentiment/analyse, /api/facebook/comments

Function	Method	Endpoint
Create new campaign	POST	/api/campaign/create
Add artefact to campaign	POST	/api/artefact/add
Retrieve campaign details	GET	/api/campaign/get
Get sentiment metrics	GET	/api/sentiment/analyse
Collect Facebook comments	GET	/api/facebook/comments
Analyse campaign results	GET	/api/sentiment/results

Input

Field	Type	Description
artefact_id	String	Unique identifier of the artefact in REEVALUATE KB
Title	String	Campaign title
Description	Text	Brief description of campaign purpose
start_date	Date	Campaign start date
end_date	Date	Campaign end date
Platform	Enum	Selected social media (Facebook, Instagram, X, etc.)
Reward	String	Description of gamified reward (optional)

Output

Field	Type	Description
campaign_id	String	Unique identifier of the campaign
engagement_score	Float	Calculated metric of public engagement
sentiment_score	Float	Aggregated sentiment analysis result
comments_count	Integer	Total number of analysed comments

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public_interest_index	Float	Combined indicator for artefact prioritisation
winner_user_id	String	ID of the randomly selected participant (if gamified)

3.4 Human Driven Contextualization enabler

The Human Driven Contextualization enabler is a web application that allows the curator of a museum or the owner of a digital artefact to open a window to the audience of a museum or other experts of the field in order to gather information about artefacts that she did not already possess.

Initially, the curator selects an existing artefact from the ones already uploaded in the platform or creates a new one through the enabler. The selected artefact will be the basis of a contextualization campaign. This campaign consists of an email campaign in which each end user receives a link to the contextualization app containing a single-use token, since once the user has submitted their contribution, they cannot contribute again for this artefact.

Using the single-use token, the recipient of the email can access a dedicated webpage in order to provide contextualization information for the campaign they were invited to.

The curator will then have access to all their associated campaigns and can view, for each campaign, the status of user responses, including user contributions, which they can approve or reject at their own discretion. Once the curator considers the campaign ready, they can close it — at that point, all approved attributions will be sent to the Knowledge DB and included in the Knowledge Graph.

3.5 Execution Environment and Requirements

In order for the enabler to store the gathered contextualization information, it is first translated from the local JSON format to RDF statements that are sent to the Knowledge DB using SparQL queries.

Additionally, a local SMTP server is setup in the same environment as the enabler in order for the invitations to be sent to the queried users.

3.6 User Interface or API

The Human Driven Contextualization enabler is accessed through a Web User Interface which is fully described in deliverable D2.3.

3.7 AI Based Contextualization enabler

The AI Based Contextualization enabler, shown in Figure 3, is a Web application that allows the curator to add contextual information for an owned digital artefact. The look and feel of the application are similar to the Human Driven Contextualization enabler with the difference that instead of running campaigns for external users to provide information, a set of AI tools are utilized. The tools that are provided by the REEVALUATE platform operate on various modalities (visual, aural or textual) in order to respond with useful metadata for the curator.

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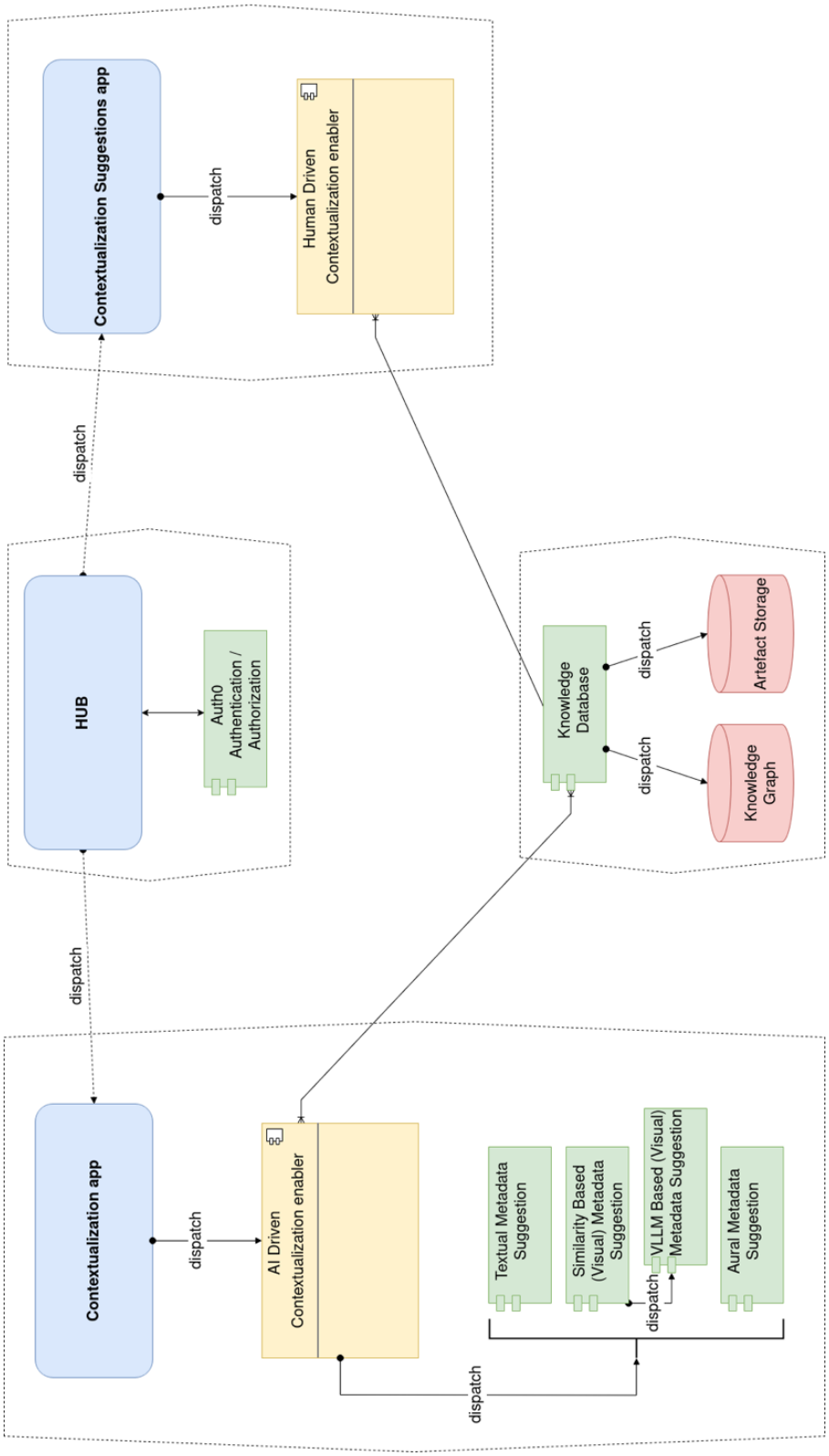

Figure 3: AI Based Contextualization Enabler

Visual modality:

The image part of this enabler will suggest metadata fields (entries from the knowledge graph) based on image similarity. The curator, who started this process, will have the option to accept, decline or edit the suggested metadata, after which this information will be merged into the knowledge graph.

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Aural modality:

The audio part of this enabler works similarly to the image part but is based on historical recordings. A recording is provided to the enabler, similar recordings are found and metadata is suggested. The curator, who started this process, will have the option to accept, decline or edit the suggested metadata, after which this information will be merged into the knowledge graph.

Textual modality:

This enabler positions itself between either a curator and the knowledge graph, or a member of the public and the knowledge graph. Its main goal is to translate plain text into an RDF graph, which is the format supported by the knowledge graph. Rather than suggesting metadata based on similarity to existing artefacts, this enabler will generate a smaller knowledge graph based on the provided input, show this to the curator who can accept, edit or decline the information, after which the smaller knowledge graph is merged into the main KB.

3.8 Execution Environment and Requirements

For the duration of the project, each one of the tools is executed in a separate environment provided by the partner that develops the relevant tool. The communication is orchestrated by the Contextualization Suggestion app which sends requests to the relevant endpoints based on the modalities of the digital artefact.

Image Contextualization tool:

The artwork image is analysed by a deep learning model which is not executed directly inside the backend system but it is instead hosted on a Triton[1] server instance by LINKS. Triton is an open-source platform developed by NVIDIA and designed to serve AI model across any framework. The contextualization tool runs on a backend system provided as a docker image that can be built and run on any machine supporting Docker and is hosted by LINKS. There is an additional metadata suggestion tool utilizing a VLLM that is hosted by CERTH. This tool also uses Docker, for easier deployment, and requires a GPU with at least 16 GB of RAM on the host machine.

Audio Contextualization tool:

The audio Contextualization tool analyses audio files with the use of a deep learning model and a discrete pipeline. The tool consists of a back-end system, with specific services that serve neural network models. The whole pipeline is being hosted by CERTH, and requires an NVIDIA GPU with at least 6 GB of VRAM on the host machine. The back-end uses the FastAPI framework.

Text Contextualization tool:

The service is a Python application hosted on a server at KU Leuven[2]. The service's core logic is built using the Agent Development Kit (ADK)[3] to perform multiple LLM inference calls. These calls are routed through a LiteLLM[4] gateway, connecting to the OpenRouter[5] platform.

[1] https://developer.nvidia.com/dynamo
[2] https://reevaluate.cs.kuleuven.be/
[3] https://google.github.io/adk-docs/
[4] https://www.litellm.ai/
[5] https://openrouter.ai/

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The service requires Python 3.10 (or newer). Key Python libraries include *agent-development-kit* and *litellm*, along with their respective dependencies. In addition, persistent internet access is necessary for the service to communicate with the OpenRouter API. A valid OpenRouter API key must be provided to the service (e.g., as an environment variable) to authenticate inference requests. The service does not require local GPU access, as all LLM inference is offloaded to the OpenRouter service. However, the LiteLLM gateway can be reconfigured to direct inference calls to a local model if one is available and desired. In this case, a GPU is required.

3.9 User Interface or API

The contextualisation enablers are accessible by dedicated REST APIs for each individual modality.

Image Contextualization tool:

The image contextualization tool analyses an image of a given artwork and allows the suggestion of metadata related to the artwork itself. It is accessed by sending a POST request to the endpoint /contextualisation/suggest. It accepts the image representing the artefact and an optional integer field specifying the number of similar artefacts that should be considered for the suggestion. Once the request is fulfilled, the method returns a JSON dictionary containing the list of statement that could be applied to the input artefact. These statements are a JSON representation of RDF statement that could be applied to the input artefact and loaded in Knowledge Graph following the CACAO ontology developed in the project and described in D1.4.

Access

Functionality	Method	Endpoint
Provide Suggestions	POST	/contextualization/suggest

Input

Parameter	Type	Description
File	file	Digital Artefact
Limit	Integer	Number of DB entries to use

Output

Field	Type	Description
Property.type	Str	Type of the returned property
Property.value	Str	The RDF property
Value.type	Str	Type of the returned value
Value.value	Str	The RDF value

Audio Contextualization tool:

Access

Functionality	Method	Endpoint
Denoise and enhance	POST	/denoise_and_enhance

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Input

Parameter	Type	Description
Sound File	.wav	a sound file in the wav format

Output

Field	Type	Description
Sound File	.wav	a sound file in the wav format

Access

Functionality	Method	Endpoint
Provide Suggestions	POST	/contexualize_audio

Input

Parameter	Type	Description
Sound File	.wav	a sound file in the wav format

Output

Field	Type	Description
Property.type	str	Similarity type
Property.value	str	Similarity value

Text Contextualization tool:

The text contextualization tool analyses the text accompanying a given artwork and allows the suggestion of metadata related to the artwork itself.

Access

Functionality	Method	Endpoint
Transform unstructured text to Turtle (.ttl) format	POST	/context/generate

Input

Field	Type	Description
text	str (base64)	Unstructured text context of an artefact

Output

Field	Type	Description
graph	str (base64)	Raw file content of generated turtle file

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4 Marketplace enablers

The Marketplace was developed in T4.2 and is fully described in detail in Deliverable D4.2. The complete set of technical provisions regarding integration of enablers into the marketplace, implemented during the development of T4.2, can be found in the following Section 4.1.

The following sections 4.2 to 4.6 detail the information regarding the integration interfaces i.e. APIs of the 4 enablers that are accessed through the marketplace: collaboration, reuse, validation and IPR manager.

4.1 Marketplace Technical Provision for Enablers Integration

The Marketplace is the main application offering to CH institutions the tools necessary to manage their digitized artifacts. At the same time, it enables public users to search and browse published artifacts. To achieve all its goals, the Marketplace leverages functionalities of different enablers in order to enhance the user experience and integrate within the REEVALUATE ecosystem.

The Marketplace integrates four (4) enablers to achieve its objectives. Specifically, it incorporates:

- The Collaboration Enabler, which manages artifacts and users, serving as the source of truth for all REEVALUATE sub-systems. It makes necessary data available wherever needed, including the Marketplace itself, it provides the search functionality within the Marketplace, and it supports artifacts recommendations which appear in the search results.
- The AI-Driven Creative Reuse Enabler, which is incorporated into the Marketplace to enhance the reusability of the digitized artifacts. The enabler functions with a text or a text and an image as input. Within the Marketplace and the artifact view page, users can invoke the enabler based on an artifact image and provide a textual prompt which acts as instructions. This triggers the generation of a new image as output that is based on the original image but modified according to the given instructions.
- The Context Validation Enabler, which is leveraged to identify potential context violations. It is used within the Marketplace for the AI image generation, supported by the AI-Driven Creative Reuse Enabler. It ensures that the generated images adhere to the provided context restrictions, set by the institute owning the original artifact.
- The Intellectual Property Rights Management Enabler, which connects the Marketplace with a Hyperledger-based NFT system responsible for managing artifact ownership and rights. For any relevant action related to artifacts such as ownership change, generation or related image, deletion, etc, the enabler is triggered in order to reflect those changes and thus keep up-to-date records on the Hyperledger.

Detailed technical provision documentation and specifications, including API calls and their respective payloads are provided within the Annex A of this deliverable.

4.2 Collaboration Enabler

The Collaboration Enabler developed provides the platform's information retrieval and match-making functionalities, connecting users with relevant cultural artefacts and facilitating collaboration across the REEVALUATE platform. It combines two core systems: (1) an Information Retrieval System that enables semantic and multimodal search over the ARTKB (i.e., REEVALUATE Knowledge Graph), and (2) a Match-Making System that suggests personalised artefact recommendations based on user profiles and

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interaction histories. The two systems are integrated into the Marketplace through RESTful APIs and serve as the intermediary between users and the ARTKB. Together, these components facilitate an interactive discovery environment where users can efficiently explore, retrieve, and engage with digitized cultural artefacts.

4.3 Execution Environment and Requirements

The enabler is implemented as a Python FastAPI backend exposing lightweight REST endpoints. It does not require GPU resources in its current configuration, since all neural and language model computations are either executed through optimized CPU inference or delegated to external APIs. As a result, the backend can operate efficiently on standard CPU-based infrastructure. The backend interacts with: (1) the GraphDB endpoint hosting the ARTKB, and (2) a vector database storing embeddings.

4.4 User Interface or API

The Collaboration Enabler is accessed exclusively through REST APIs invoked by the Marketplace front-end. It currently supports two endpoints: /api/search for information retrieval system and /api/matchmaking for match-making system.

Information Retrieval System:

POST /api/search

This endpoint supports multimodal artefact retrieval. This unified endpoint accepts either a text query, an image file, or a combination of both, where the text is the modification description of the image, and returns a ranked list of artefacts filtered by a similarity score threshold. Depending on the provided input, the system automatically applies the appropriate retrieval strategy: text-based semantic search, image-based visual similarity search, or cross-modal retrieval combining both modalities.

Parameters in Request Body (multipart/form-data):

- **text**: text (optional, string) – A natural language query describing the desired artefact(s).
- **image** *(optional, binary file)* – An uploaded image (PNG or JPEG/JPG) representing the artefact to be matched.
- **score**: Optional float value (e.g., 0.85) specifying the minimum similarity score threshold (default = 0.0)

Returns:

- **results**: A ranked list of retrieved artefacts, each containing:
  - iri (string): The unique IRI identifier of the artefact
  - score (float): The similarity score threshold used to filter the retrieved artefacts.

Exceptions:

- **400 Bad Request**: If no text query is provided
- **500 Internal Server Error**: For unexpected errors during retrieval

Access

Functionality	Method	Endpoint

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Multimodal artefact retrieval based on text, image, or combined query.	POST	/api/search

Input

Field	Type	Description
text	str	*(Optional)* Natural language query describing the desired artefact(s).
image	str (base64)	*(Optional)* Binary data of an image representing the artefact.
score	float	*(Optional)* Minimum similarity score threshold.

Output

Field	Type	Description
iri	str	Unique IRI identifier of the retrieved artefact.
score	float	Similarity score between the query and the retrieved artefact.

Match-making System:

POST /api/matchmaking

Returns a personalized list of cultural heritage artefacts based on a user's profile and historical interactions. This endpoint requires a user's identifier and returns a ranked list of artefacts filtered by a similarity score threshold.

Parameters in Request Body (multipart/form-data):

- **id**: The IRI identifier of the user (required)
- **score**: Optional float value (e.g., 0.85) specifying the minimum similarity score threshold (default = 0.0)

Returns:

- **results**: A ranked list of retrieved artefacts, each containing:
  - iri (string): The unique IRI identifier of the artefact
  - score (float): The similarity score threshold used to filter the retrieved artefacts.

Exceptions:

- **400 Bad Request**: If no user identifier is given or the format is invalid
- **500 Internal Server Error**: For unexpected errors during retrieval

Access

Functionality	Method	Endpoint

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Personalised artefact recommendation based on user profile and interaction history.	POST	/api/matchmaking

Input

Field	Type	Description
id	str	*(required)* Unique identifier (IRI or internal ID) of the user.
score	float	*(Optional)* Minimum similarity score threshold.

Output

Field	Type	Description
iri	str	Unique IRI identifier of the retrieved artefact.
score	float	Similarity score between the artefact and the user interests.

4.5 AI Driven Creative Reuse Enabler

The AI-Driven Creative Reuse Enabler aims to promote the reuse of digitized cultural artefacts by allowing users to generate new versions of historical items. By combining descriptive text prompts with optional image references from digital archives, users can creatively reimagine heritage materials while maintaining ties to their historical roots. For example, for the concept of historical fashion users can provide a prompt like “an emerald green formal dress from the 1700s” and receive a newly generated image reflecting that clothing style.

The enabler is powered by Stable Diffusion 3 model which is fine-tuned to address the diverse visual and conceptual needs of the REEVALUATE project. To facilitate its integration across different platforms and applications, the enabler is accessible via a web API, making it a flexible resource for innovative cultural engagement.

4.6 Execution Environment and Requirements

The AI-Driven Creative Reuse Enabler operates through a cloud-based, high-performance infrastructure supporting the computational demands of AI-driven image generation. It is accessible via a secure web API, allowing external services to integrate it easily. At the heart of the image generation process is the **RunPod Instance**, an on-demand GPU environment that dynamically activates when needed and powers down during inactivity to optimize resource usage. Specifically, the system utilizes a single 16GB VRAM GPU such as the RTX A4000, RTX A4500, RTX 4000 Ada, and RTX 2000 Ada and requires 20GB of storage.

The **Backend API** acts as a secure intermediary between external services and the RunPod Instance. Hosted separately on a virtual machine with 4 CPU cores, 8GB of RAM and 20 GB of storage, it manages authentication through Auth0 SSO and ensures structured request handling. Together, the RunPod Instance and the Backend API form the core components of the AI-Driven Creative Reuse Enabler.

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4.7 API

Base URL: https://enabler-ai-reuse.reevaluate.eu/

Documentation: https://enabler-ai-reuse.reevaluate.eu/docs

Access

Functionality	Method	Endpoint	Authorization
Generates a new artefact image, given a textual prompt or a combination of a reference image and a prompt	POST	/api/generate	Requires a JWT token as "Bearer". The JWT token should be provided by the Auth0 service used within the REEVALUATE project.

Input

Field	Type	Description	Restrictions
prompt	str	The textual instructions describing how the artefact image should be generated.	Max **300** characters
image	str (base64)	(**Optional**) Binary data of the reference image	**png** or **jpg** format max **10MB**

Output

Binary data in Base64 format containing the generated image. The image is returned as a PNG file with a resolution of 1024×1024 pixels.

Exceptions

- **400 Bad Request**: If the uploaded image is not PNG or JPG format
- **408 Request Timeout**: If image generation takes too long
- **500 Internal Server Error**: For other unexpected errors during generation

4.8 Context Validation enabler

The Context Validation enabler provides the digital artefact owner the reassurance that derived artefacts do not violate restricted context for reuse.

4.9 Execution Environment and Requirements

The enabler uses multiple experts that detect the reuse of an artefact in specific contexts. Each expert is executed in an individual environment and provides a communication endpoint that is accessed only by the enabler. The Context Validation enabler will then combine the responses from the experts and return a final unified response. The execution and deployment environment are unique for each individual expert, as well as the requirements for their functionality, and described in the relevant sections in deliverable *D3.3 Context Validation enabler,* therefore not elaborated here. In general, most of the experts are LLMs and VLLMs and as such the main restriction for their deployment is the existence of multiple CUDA capable GPUs with sufficient volatile RAM.

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4.10 User Interface or API

The following RESTful API endpoints are provided by the Context Validation enabler so that any interested enabler can send a digital artefact for validation and retrieve the context detections. There exists an endpoint for the upload of the binary data and separate endpoints for the analysis of said binary data per requested modality.

Access

Functionality	Method	Endpoint
Upload file to analyse	POST	/api/data/upload

Input

Parameter	Type	Description
File	str (binary)	Binary data of a file

Output

Field	Type	Description
Uuid	Str	UUID of uploaded file

Access

Functionality	Method	Endpoint
List available files	GET	/api/data/list

Input

Field	Type	Description
-	-	None

Output

Field	Type	Description
Files	List of str	List of all available uuids

Access

Functionality	Method	Endpoint
Analyse audio modality	POST	/api/audio/verify

Input

Field	Type	Description
audio.audio_bytes	Str	Binary data of an audio file
audio.filename	Str	Optional filename

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Output

Field	Type	Description
violence	bool	True if violence was detected
nudity	bool	True if nudity was detected
crime scene	bool	True if a crime scene was detected
fake object	bool	True if a fake object was detected
other	List of str	List of other detected violations

Access

Functionality	Method	Endpoint
Analyze image modality	POST	/api/image/verify

Input

Field	Type	Description
image.image_bytes	Str	Binary data of an image file
image.filename	Str	Optional filename

Output

Field	Type	Description
violence	bool	True if violence was detected
nudity	bool	True if nudity was detected
crime_scene	bool	True if a crime scene was detected
fake_object	bool	True if a fake object was detected
other	List of str	List of other detected violations

Access

Functionality	Method	Endpoint
Analyze video modality	POST	/api/video/verify

Input

Field	Type	Description
video.video_bytes	Str	Binary data of a video file
video.filename	Str	Optional filename

Output

Field	Type	Description
violence	bool	True if violence was detected
nudity	bool	True if nudity was detected
crime scene	bool	True if a crime scene was detected

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fake object	bool	True if a fake object was detected
other	List of str	List of other detected violations

An additional endpoint is provided for the convenience of the AI Driven Creative Reuse enabler.

Access

Functionality	Method	Endpoint
Verify a suggested reuse	POST	/api/context/validate

Input

Parameter	Type	Description
image	str (base64)	Binary data of a file
related_item	Str	UUID of the original artefact (optional)
identifier	Str	UUID of the validated reuse (optional)
arbitrary	List of str	List of user defined contexts to be verified

Output

Field	Type	Description
detections.violence	bool	True if violence was detected
detections.nudity	bool	True if nudity was detected
detections.crime_scene	bool	True if a crime scene was detected
detections.fake_object	bool	True if a fake object was detected
detections.other	List of tuples (str, str)	List of user defined context detections, as tuples of definition and Boolean values

4.11 IPR Management

The IPR Management Enabler introduces Non-Fungible Tokens (NFTs) as the cornerstone for securing provenance, ownership, and licensing of cultural-heritage (CH) assets in REEVALUATE. Every digitised artefact ingested by the platform is represented as an NFT, uniquely identifiable, non-duplicable, and cryptographically linked to its descriptive metadata and digital files. The NFT serves simultaneously as (i) a proof of authenticity and origin, (ii) a vessel for licensing information and rights management, and (iii) a handle that enables controlled sharing and reuse across REEVALUATE services.

When a museum or custodian digitises an artefact, the Marketplace requests the IPR Enabler to mint an NFT on the blockchain. The token embeds the asset identifier and references the hash of the stored record, ensuring that the artefact's digital representation can always be verified. Later operations—such as transfer of ownership, licensing for reuse, or proof-of-ownership verification—are expressed as NFT transactions.

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Derivatives generated through the Creative Reuse Enabler are registered as linked NFTs, binding new content to the rights and obligations of the source material.

The NFT-centric model ensures that all cultural-heritage assets in REEVALUATE have a tamper-evident, auditable lifecycle. The system also provides RESTful APIs so that front-end applications can invoke NFT operations without requiring blockchain expertise. Each call (mint, transfer, license issue, proof creation) results in a signed blockchain transaction, and clients can query token state/history to verify rights at any time.

4.12 Execution Environment and Requirements

Operating System:

- Linux Ubuntu 20.04 (tested also on Ubuntu 22.04)

Programming Language & Frameworks:

- Go (Golang) 1.19+ (for Hyperledger Fabric chaincode and REST Smart Contract Gateway)
- Docker 20.10+ / Docker Compose (for containerized deployment)

Blockchain Framework:

- Hyperledger Fabric v2.3
- Fabric CA for identity and certificate management

Other Libraries & Components:

- Fabric SDK for Golang (gateway integration)
- PostgreSQL 14 (asset and user registry)
- NGINX (reverse proxy / TLS termination)

Authentication & Security:

- JWT-based API authentication

Hardware Requirements:

- CPU: 4 vCPUs minimum per node
- RAM: 8 GB minimum recommended
- Disk: 100 GB SSD per peer/orderer node (expandable depending on asset volume)
- No GPU required

The IPR Enabler is deployed as containerized services built around the NFT model:

- Hyperledger Fabric blockchain. A permissioned Fabric network acts as the authoritative NFT ledger. Smart contracts (chaincode) written in Golang implement an ERC-721–like standard for NFTs, extended with licensing and access-control logic. Core functions include:
    - Minting new NFTs for CH artefacts.
    - Transferring NFTs between stakeholders.
    - Burning NFTs when assets are decommissioned.
    - Proof creation & verification: generating cryptographic proofs of NFT ownership.
    - Query functions to retrieve NFT metadata and historical state.

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- REST Smart Contract Gateway. Microservice written in Golang to provide easy-to-use REST endpoints that map directly to NFT functions. It authenticates requests with JWT tokens, signs blockchain transactions on behalf of the client, and stores credentials securely.
- Community Management Service (CMS). Handles OAuth2 / OIDC flows for user authentication and service-to-service authorization. It ensures that only authorized stakeholders can mint, transfer, or license NFTs.

Functional and integration testing has validated that NFTs minted and transferred through this setup correctly log state on the blockchain.

4.13 User Interface or API

Access

Functionality	Method	Endpoint
Mints, or creates, a new NFT that is assigned to a specific owner.	POST	http/nft/mint
Transfer the ownership of a non-fungible token to another user.	POST	http/nft/transfer
Create a proof-of-ownership of an NFT. The response contains a verification URL that can be communicated to third parties for verification.	POST	http/nft/create-proof
Burns, or destroys the specified NFT. This function is restricted to NFT owners.	DELETE	http/nft/burn
This function queries the contract's state for the concrete NFT objects that are owned by the invoker.	GET	http/nft/nfts
Retrieve the information associated with an NFT from the ledger.	GET	http/nft/nfts/{id}
Verify the validity of a NFT's proof-of-ownership.	GET	http/nft/verify-proof/{proof}

Input

Field	Type	Description
Mint payload	JSON-encoded	NFT data, NFT image uri, metadata uri
TokenID	string	Unique identifier of the NFT
Verification URL	Base64URL-encoded string	Proof-of-Ownership Identifier for NFT

Output

Field	Type	Description
Verification URL	Base64URL-encoded string	Proof-of-Ownership Identifier for NFT

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NFT List	JSON-encoded data object	List of NFTs for specific owner
NFT	JSON-encoded array	Data associated to specific NFT id
fake object	bool	

4.14 Distributed Ledger

The distributed ledger is integrated into the REEVALUATE platform through the backend of the REEVALUATE Marketplace, which orchestrates all interactions with the blockchain on behalf of end users. When a cultural-heritage artefact is ingested and registered in the Marketplace, the backend calls the IPR Enabler to mint an NFT on the Hyperledger Fabric network, embedding the asset's metadata and content hash for authenticity and long-term verification.

All subsequent operations are also initiated in the Marketplace frontend but executed in its backend as blockchain transactions. The REST Smart Contract Gateway connects the Marketplace backend with the Fabric chaincode, while the Community Management Service (CMS) ensures that only authorised users and services can perform NFT actions. This integration model allows the Marketplace to provide a seamless, user-friendly interface while the distributed ledger ensures tamper-evident, auditable management of NFTs in the background.

Full technical details of the ledger's configuration, smart contracts, and integration flows are provided in Deliverable D3.4.

5 Conclusion & Future Work

The integration of the REEVALUATE Platform marks a significant milestone in the project's progression. By consolidating the technological outputs of multiple work packages into a single, interoperable environment, the platform demonstrates the feasibility of an ecosystem that bridges artificial intelligence, semantic data representation, participatory engagement, and blockchain-based intellectual property management. It provides a robust foundation upon which cultural heritage institutions can digitize, enrich, and share their collections responsibly and innovatively.

The modular microservice-based architecture ensures that each enabler—ranging from artefact prioritization to contextualization, validation, and creative reuse—operates as an independent yet interconnected service. This design choice enhances flexibility, scalability, and maintainability while allowing for the seamless incorporation of new tools and functionalities. The Marketplace and Hub serve as central access points, ensuring that end-users, including curators, researchers, and creative practitioners, can interact with the system intuitively and securely.

Future work will focus on refining the interoperability between enablers, enhancing performance, and extending the platform's usability taking into account the outcomes of the project pilots. The pilot implementations and stakeholder feedback will guide the development of advanced user interfaces and integration pathways with external repositories and platforms.

In conclusion, the Integrated REEVALUATE Platform provides a forward-looking model for how Europe's cultural heritage can be digitized, managed, and creatively reused in an ethical and collaborative digital ecosystem. Its architecture and philosophy embody the project's vision of an inclusive, sustainable, and technologically empowered future for cultural heritage management.

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Annex 1

Annex A provides the detailed technical documentation and specifications, including API calls and their respective payloads, regarding Marketplace's technical provision for enabler integration.

Collaboration Enabler

Endpoints 1–12 are provided by the Collaboration Enabler, while Endpoint 13 is offered by the Marketplace and is intended for use by the Collaboration Enabler.

1. Create User

- **Method**: POST
- **Endpoint**: /users
- **Content-Type**: application/json

Request Payload:

```
{
  "id": "string",
   "institution_name": "string",
   "user_name": "string",
   "user_role": "INSTITUTION" | "USER",
   "interests": [InterestEnum],
   "iprUserId": "string"
}
```

Name	Type	Value
NEWSPAPERS	integer	0
NATURAL_HISTORY	integer	1
PHOTOGRAPHY	integer	2
SPORT	integer	3
ARCHAEOLOGY	integer	4
ART	integer	5
FASHION	integer	6
INDUSTRIAL_HERITAGE	integer	7
MANUSCRIPTS	integer	8
MAPS_AND_GEOGRAPHY	integer	9
MIGRATION	integer	10

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MUSIC	integer	11
CENTURY_14TH	integer	12
CENTURY_15TH	integer	13
CENTURY_16TH	integer	14
RENAISSANCE	integer	15
ANIMALS	integer	16
ART_NOUVEAU	integer	17
ASIAN_ART_AND_HERITAGE	integer	18
BLACK_HISTORY	integer	19
COLOURING_BOOKS	integer	20
COMPOSERS	integer	21
DISABILITY_HERITAGE	integer	22

2. Update User

- **Method**: PATCH
- **Endpoint**: /users
- **Content-Type**: application/json

Request Payload:

```
{
  "institution_name": "string",
  "user_name": "string",
  "user_role": "INSTITUTION" | "USER",
  "interests": [integer]
}
```

3. Create Artifact

- **Method**: POST
- **Endpoint**: /artifacts
- **Content-Type**: multipart/form-data

Request & Response Payload:

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```
{
  "id": "string",
   "title": "string",
  "creator": "string",
  "date": "string",
   "place": "string",
  "publisher": "string",
  "identifier": "string",
  "medium": "string",
  "object_measurements": "string",
  "provenance": "string",
   "description": "string",
  "is_negotiable": boolean,
  "published": boolean,
  "confirmed": boolean,
   "payment_method": PaymentMethodEnum,
  "purchase_price": decimal,
   "free_borrow_weeks": integer,
  "borrow_price": decimal,
  "reuse_price": decimal,
  "licence_id": integer,
  "no_use": NoUseEnum,
  "no_use_other_value": "string",
  "owner_id": "string",
  "ai_generated": boolean,
  "ai_prompt": "string",
  "ai_origin_id": integer,
  "ipr_id": "string",
          [binary files streams]
}
```

PaymentMethodEnum

Name	Type	Value
FREE_DOWNLOAD	integer	0
PURCHASE	integer	1
FREE_BORROW	integer	2
BORROW	integer	3

NoUseEnum

Name	Type	Value
VIOLENCE	integer	0
NUDITY	integer	1

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OFFENSIVE_SPEECH	integer	2
CRIME	integer	3
OTHER	integer	4

4. Update Artifact

- **Method**: PATCH
- **Endpoint**: /artifacts
- **Content-Type**: multipart/form-data

Request & Response Payload:

```
{
  "id": "string",
            { // Same as in the 'Create Artefact'
without including the "id"}
}
```

5. Delete Artifact

- **Method**: DELETE
- **Endpoint**: /artifacts/{id}
- **Content-Type**: application/json

Request & Response Payload: None

6. Get Artifact

- Method: GET
- **Endpoint**: /artifacts/{id}
- **Content-Type**: application/json

Response Payload:

```
{
  "id": "string",
   "title": "string",
  "creator": "string",
  "date": "string",
   "place": "string",
  "publisher": "string",
  "identifier": "string",
  "medium": "string",
```

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```
  "object_measurements": "string",
  "provenance": "string",
   "description": "string",
  "is_negotiable": boolean,
  "published": boolean,
  "confirmed": boolean,
   "payment_method": PaymentMethodEnum,
  "purchase_price": decimal,
   "free_borrow_weeks": integer,
  "borrow_price": decimal,
  "reuse_price": decimal,
  "licence_id": integer,
  "no_use": NoUseEnum,
  "no_use_other_value": "string",
  "owner_id": "string",
  "ai_generated": boolean,
  "ai_prompt": "string",
  "ai_origin_id": integer,
  "ipr_id": "string",
          [binary files streams]
}
```

7. Publish/Unpublish Artifact

- **Method**: POST
- **Endpoint**: /artifacts/publish
- **Content-Type**: application/json

Request Payload:

```
{
  "id": integer,
  "published": boolean,
  "iprId": "string"
}
```

8. Get Artifact Files

- Method: GET
- **Endpoint**: /artifacts/files?id={artifactId}
- **Content-Type**: application/json

Response Payload: Binary ZIP file stream

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9. Get Artifact File

- Method: GET
- **Endpoint**: /artifacts/file-by-name?id={artifactId}&filename={filename}

Request Payload:

```
{ "id": integer, "filename": "string"}
```

Response Payload:

- **Content-Type**: application/octet-stream (containing image in binary format)

10. Search Artifact by Text

- **Method**: POST
- **Endpoint**: /api/search/text
- **Content-Type**: multipart/form-data

Request Payload:

```
{ "text": "string", "score": integer}
```

Response Payload:

```
{ "results":[
   {
    "iri": "string",
    "score": integer
   },
  ...
 ]}
```

11. Search Artifact by Image

- **Method**: POST
- **Endpoint**: /api/search/image
- **Content-Type**: multipart/form-data

Request Payload:

```
"binary file stream"          integer
```

Response Payload:

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```
{ "results":[
  {
   "iri": "string",
   "score": integer
  },
  ...
 ]}
```


12. Artifact Recommendation

- **Method**: POST
- **Endpoint**: /api/recommend
- **Content-Type**: multipart/form-data

Request Payload:


```
{ "text": "string", "score": integer}
```


Response Payload:


```
{ "results":[
  {
   "iri": "string",
   "score": integer
  },
  ...
 ]}
```


13. Artifact Recommendation

This endpoint is made available by the Marketplace and is intended to be used by the Collaboration Enabler:

- **Method**: POST
- **Full Endpoint**: https://marketplace-api.reevaluate.eu/analytics
- **Content-Type**: application/json

Request Payload:


```
{ "apiToken": "string"}
```


Response Payload:

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```
{
"searchLogs":
[{
   "id": "string",
   "userId": "string",
   "searchText": "string",
   "searchImage": binary image stream,
   "fileTypes": [integer],
   "licenseTypes": [integer],
    "priceCategories": [integer],
    "usagePeriods": [integer],
   "priceNegotiability": [integer],
    "timestamp": date time stamp
}],
 "artifactClicks":
[ {
   "id": "string",
   "userId": "string",
    "artifactId": "string",
   "searchId": "string",
   "timestamp": date time stamp
}],
 "artifactDwellTime":
 [ {
   "id": "string",
    "userId": "string",
    "artifactId": "string",
   "searchId": "string",
    "clickId": "string",
   "dwellTime": double,
    "timestamp": date time stamp
} ],
"purchases":
 [ {
   "id": "string",
   "artifactId": integer,
    "buyerId": "string",
   "price": decimal,
    "purchaseDate": date time stamp,
   "borrowedWeeks": integer,
    "expireDate": date time stamp,
    "negotiationId": integer  } ],
"bookmarks": [  {    "artifactId": integer  } ]}
```


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AI-Driven Creative Reuse Enabler

The endpoint is provided by the AI-Driven Creative Reuse Enabler.

1. Generate Image

- **Method**: POST
- **Endpoint**: /api/generate
- **Content-Type**: multipart/form-data
- **Authorization**: Auth0 SSO Bearer token

Request Payload:

"string" (binary image stream)

Response Payload: Binary file stream

Context Validation Enabler

The endpoint is provided by the Context Validation Enabler.

1. Verify Image Context

- **Method**: POST
- **Endpoint**: /context/verify
- **Content-Type**: application/json

Request Payload:

```
{ "restrictions": {
    "violence": boolean,
    "nudity": boolean,
    "crime_scene": boolean,
    "harassment": boolean,
    "other": "string"  },
"media": { "image": base64 image string  }}
```

Response Payload:

```
{
   "status": "string",
   "message": "string",
   "violations": {
         "violence": boolean,
         "nudity": boolean,
```

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```
            "crime_scene": boolean,
            "harassment": boolean,
            "other": boolean
        }
    }
```


IPR Management Enabler

All endpoints are provided by the IPR Management Enabler.

1. Login User

- **Method**: POST
- **Endpoint**: /protocol/openid-connect/token
- **Content-Type**: multipart/form-data

Request Payload:


```
{ "username": "string", "password": "string", "grant_type": "string", "client_id": "string"}
```


Response Payload:


```
{ "access_token": "string", "expires_in": integer,
  "refresh_expires_in": integer, "refresh_token": "string",
  "type_token": "string",
  "not-before-policy": integer,
  "session_state": "string",
  "scope": "string"
}
```


2. Create User

- **Method**: POST
- **Endpoint**: /api/v1/users/admins
- **Content-Type**: application/json
- **Authorization**: Bearer token in headers

Request Payload:

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```
{ "username": "string", "password": "string", "grant_type":
"string", "client_id": "string",}
```

Response Payload:

```
{ "access_token": "string", "expires_in": integer,
 "refresh_expires_in": integer, "refresh_token":
"string",
 "type_token": "string",
 "not-before-policy": integer,
 "session_state": "string",
 "scope": "string"
}
```

3. Create Artifact

- **Method**: POST
- **Endpoint**: /api/v1/nfts
- **Content-Type**: application/json
- **Authorization**: Bearer token in headers

Request Payload:

```
{
  "data": {
     "id": "integer",
     "aiGenerated": boolean
   },
   "metadata": {
      "hash": "string",
      "tokenURI": "string"
   },
   "ownerID": "string"
}
```

Response Payload:

```
{ "id": "string", "ownerID": "string"}
```

4. Delete Artifact

- **Method**: POST

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- **Endpoint**: /api/v1/nfts/{id}
- **Content-Type**: application/json
- **Authorization**: Bearer token in headers

Request Payload: None

5. Transfer Artifact

- **Method**: POST
- **Endpoint**: /api/v1/nfts/transfers
- **Content-Type**: application/json
- **Authorization**: Bearer token in headers

Request Payload:

```
{ "id": "string", "receiverID": "string"}
```

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Annex 1

PARTNER		SHORT NAME
CERTH CENTRE FOR RESEARCH & TECHNOLOGY HELLAS	CENTRE FOR RESEARCH & TECHNOLOGY HELLAS	CERTH
Fraunhofer FOKUS	FRAUNHOFER INSTITUTE FOR OPEN COMMUNICATION SYSTEMS FOKUS	FOKUS
.fs	FROMSCRATCH DESIGN STUDIO BV	FS
FONDAZIONE links PASSION FOR INNOVATION	FONDAZIONE LINKS - LEADING INNOVATION & KNOWLEDGE FOR SOCIETY	LINKS
FFP PRODUCTIONS	FFP FILM- & FERNSEHPRODUKTION GMBH	FFP
NUROGAMES	NUROGAMES GMBH	NURO
GVAM MOBILE GUIDES FOR ALL	GVAM GUIAS INTERACTIVAS SL	GVAM
Stiftung Preußischer Kulturbesitz	STIFTUNG PREUSSISCHER KULTURBESITZ	SPK
Hypertech	HYPERTECH	HYP
Thessaloniki Olympic Museum	OLYMPIAKO MOUSEIO	OLYMPIC
ARTHUR LEGAL, STRATEGIES & SYSTEMS	ARTHUR'S LEGAL BV	ARTHUR
KU LEUVEN	KATHOLIEKE UNIVERSITEIT LEUVEN	KU Leuven

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	AG CULTURELE INSTELLINGEN ANTWERPEN/ ERFGOED	MoMU
	EUROPEAN FASHION HERITAGE ASSOCIATION	EFHA
	3D RESEARCH SRL	3DR
	FONDAZIONE AQUILEIA	AQUILEIA

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