

Software support of CFIHOS business process

Standard version – 2.0 (Conformance template revision B)

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Software Statement

Software submission identifier: CFIHOS on metaphactory

Company name(s): metaphacts GmbH

Overview

metaphacts is a semantics & AI company delivering innovative solutions that help global enterprises transform data into consumable, contextual and actionable knowledge. We support customers across a range of industries and use cases, with solutions such as building a semantic layer for enterprise information architecture, creating digital twins, or developing trustworthy AI apps for knowledge discovery.

The company's main product, metaphactory, is an enterprise knowledge graph-based platform that leverages semantic knowledge modeling and knowledge discovery capabilities to support you with decision intelligence and drive knowledge democratization across the organization. AI capabilities support both the building and exploration of the underlying knowledge graph, making it easy to surface and make sense of your data while also assisting in the knowledge graph construction process.

Conformance

Categories:

A1, A2, A3, A4

B1, B2, B3

C1, C2

D1, D2, D3, D4

E1

F1, F2

The metaphactory platform leverages its flexible, knowledge graph-based approach to support various aspects of CFIHOS.

Data Model: The software uses Semantic Modeling practices and Knowledge Graphs to model the complex, connected CFIHOS data model. This approach allows for easy navigation of CFIHOS entities and seamless integration with other domain models, ontologies, and taxonomies within the knowledge graph.

RDL: All data from the Reference Data Library (RDL) is loaded into the knowledge graph, where it is connected and can be used by users to define, modify, and manage project standards.

Scope: While *metaphactory* is not an engineering tool, it provides a broader context for the enterprise. Its use of open standards allows for various integration points with other engineering tools, enabling the defined CFIHOS and project standards to be used across different platforms.

Contract Templates: The software's flexible data model supports various contract templates, including custom ones. These templates serve as a backbone for validation and review mechanisms, specifying project requirements and deliverables.

Information Transmission: The platform is built on open standards defined by the W3C, such as the Resource Description Framework (RDF) for its semantic knowledge graph and SPARQL for querying. It

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offers a vendor-lock-in-free solution with interoperable exchange formats, a REST API, and export formats, facilitating easy integration and data exchange between organizations.

Roadmap Plans

- *metaphactory's* support for CFIHOS is expected to evolve with future plans focused on:
- Developing more enriched visualizations.
- Enhancing the platform's UI and UX.
- Achieving closer integration with existing engineering tools.

Notes

metaphactory is a Software-as-a-service solution available on AWS marketplace and also can be deployed on the desired cloud platform or infrastructure as a docker container. It can integrate with various Knowledge Graph databases (triplestores). The platform is compatible with all major browsers including Chrome, Firefox, Edge, and Safari.

Phase A – Project Standard Preparation

Category A1 – Store CFIHOS Standard

Demonstrate how the principal can use a release of the CFIHOS standard as a baseline for one or more projects and manage any impact from subsequent releases of the standard (e.g. different projects based on different releases).

Supported:

Yes. The CFIHOS ontology models the CFIHOS standard and the Project Specification Manager allows creating data according to the CFIHOS 2.0 standard. The ontology and Project Manager are both extensible and can be modified to handle any future CFIHOS versions (including company-specific versions) along with their project data.

Evidence:

<https://www.youtube.com/watch?v=r-lAnzpiQE8>

CFIHOS_on_metaphactory_conformance.pdf

Evidence	Timestamp
Ontology: The CFIHOS V2.0 ontology is provided by <i>CFIHOS on metaphactory</i> which models the entirety of the CFIHOS 2.0 standard <i>metaphactory</i> provides a native versioning capability for ontologies, which allows e.g. version 2.0 and 2.1 ontologies to co-exist in the same environment	YouTube: 1:00 Slide: A1 section
Project Specification Manager/Application pages: <i>CFIHOS on metaphactory</i> provides a project manager that allows handling of projects based on specifications. A default specification is provided for the CFIHOS 2.0 Core RDL, and the specification can be altered or expanded as required. Templates in <i>metaphactory</i> are low-code application pages that can be modified at any time. The <i>CFIHOS on metaphactory</i> app is thus extensible and can be updated to handle any subsequent version and any custom specification.	Youtube: 1:00, 3:27, 3:50
Instance Data and Knowledge Graph: <i>CFIHOS on metaphactory</i> provides a default RDF-based dataset consisting of instance data and supplementary relational information used to populate the CFIHOS RDL entities for the CFIHOS 2.0 standard. Each project manages its own copy of the instance data, allowing any number of different project specifications and CFIHOS versions to co-exist. Instance data can be managed via forms provided by the app,	Youtube: 1:00, 3:27, 3:50

forms can be modified via templates, and all RDF data can be arbitrarily transformed within <i>metaphactory</i> at any time via SPARQL queries when required.	
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References:

- CFIHOS Scope and Procedure, sections 9.1, 9.2
- CFIHOS Guide for Principal, section 3.1.1
- CFIHOS Guide for Contractor, section 2.1.2

Category A2 – Define Project Standard from CFIHOS Template

Demonstrate how the organization or project can adapt the CFIHOS standard to their specific context.

Supported:

Yes. The Project Specification Manager is designed to enable customization of the entity lists provided by the Core RDL to fit a specific context. *CFIHOS on metaphactory* allows selecting a contract scenario template (including custom scenarios) and a base project specification (including custom specifications). After these have been selected, the user can then further customize the pre-selected entity lists.

Evidence:

<https://www.youtube.com/watch?v=r-lAnzpiQE8>

CFIHOS_on_metaphactory_conformance.pdf

Evidence	Timestamp
<p>Project Specification Manager:</p> <p><i>CFIHOS on metaphactory</i> provides a project manager that allows handling of projects based on specifications. A default specification is provided for the CFIHOS 2.0 Core RDL, and the specification can be altered or expanded as required. Entities, e.g. tag classes or properties, can be removed from the lists, and entirely new entities can be added by using the forms provided in the manager.</p> <p>Templates in <i>metaphactory</i> are low-code application pages that can be modified at any time. The <i>CFIHOS on metaphactory</i> app is thus extensible and can be updated to handle any subsequent version and any custom specification, including custom classes, attributes, and relations.</p>	<p>YouTube: 4:17, 5:17</p>
<p>Ontology:</p> <p>The CFIHOS V2.0 ontology is provided by <i>CFIHOS on metaphactory</i> which models the entirety of the CFIHOS 2.0 standard.</p> <p><i>metaphactory</i> provides a native versioning capability for ontologies, which allows e.g. version 2.0 and 2.1 ontologies to co-exist in the same environment. It is also possible to create company-specific ontologies with the ontology editor and adapt the Project Specification Manager to use them.</p>	<p>YouTube: 1:00</p> <p>Slides: A2 section</p>
<p>Diagram viewer:</p> <p>Ontologies as well as instance data can be rendered and traversed interactively with <i>metaphactory's</i> graph visualisation components, and any constructed diagram can be saved. There is also a customized diagram viewer which reflects the colors used in the CFIHOS data model for data sources.</p>	<p>YouTube: 1:54, 3:09</p> <p>Slides: 12, 16</p>

References:

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- CFIHOS Scope and Procedure, sections 9.1, 9.2
- CFIHOS Guide for Principal, sections 3.1.2 to 3.1.5
- CFIHOS Guide for Contractor, sections 2.1.2, 2.1.3

Category A3 – Support ITT & Contract

Demonstrate how the tender and contract award process is supported, including processing of any requests for information (RFIs) allowing the potential contractors to clarify requirements and so provide a better-informed bid.

Supported:

Yes. We store information about the contracts and involved parties to support the process.

Evidence:

<https://www.youtube.com/watch?v=r-lAnzpiQE8>

CFIHOS_on_metaphactory_conformance.pdf

Evidence	Timestamp
CFIHOS Project Specification Ontology: The Project Specification Ontology provides a model for CFIHOS-related entities can be instantiated to support the process, e.g. creating a list of <i>Companies</i> , <i>Document Revisions</i> , <i>Additional Files</i> , etc. Comments can be provided on these instances as a possible way to communicate.	Slides: A3 section
Project Specification Manager: Data can be shared in one central platform where all parties have access to, or an exchange can be performed between two independent <i>metaphactory</i> systems by exporting the data as RDF and importing it on the other system. Application pages can be modified to display custom metadata elements such as comments or custom clarification flags, as well as links to external files or systems.	YouTube: 1:54 , 6:04 , 6:44 , 7:35 Slides: A4 section

References:

- CFIHOS Scope and Procedure, sections 9.1 to 9.3
- CFIHOS Guide for Principal, sections 3.1.6 to 3.1.8

Category A4 – Communicate Project Standard

Demonstrate how the principal shares the project standard with the selected contractor so that they can deliver the expected information on time.

Supported:

Yes. We provide various export formats so the project standard can be exchanged between different parties. We also offer REST API endpoints for data exchange.

Evidence:

<https://www.youtube.com/watch?v=r-lAnzpiQE8>

CFIHOS_on_metaphactory_conformance.pdf

Evidence	Timestamp
Diagram Viewer & Diagram Import/Export: Diagrams can be exported as RDF data or as PNG/SVG files. Diagrams can also be imported as RDF data and then be viewed in the Diagram Viewer.	YouTube: 1:54 , 6:04
Data Import/export: All instance data of a project can be exported, either as RDF data or as csv spreadsheets. This data can then be imported by another <i>metaphactory</i> system.	YouTube: 6:04

References:

- CFIHOS Scope and Procedure, sections 9.1, 9.4, Annex B
- CFIHOS Guide for Principal, section 3.1.9

Phase B – Contractor System Setup

Category B1 – Implement Project Standard in Creation Tools

Demonstrate how the contractor can configure any information authoring features (e.g. design tools) based on the project standard, so that the principal's requirements can be honored from the outset.

This is a preparation step for Category D1.

Supported:

Yes. We offer various export formats that are customizable using SPARQL queries and can be exported as CSV, JSON-LD. Also we offer REST API endpoints for data exchange. Other tools that are compliant with CFIHOS can use these integration points to set up their authoring systems. We also have various forms that can be used to instantiate CFIHOS entities.

Evidence:

<https://www.youtube.com/watch?v=r-lAnzpiQE8>

CFIHOS_on_metaphactory_conformance.pdf

Evidence	Timestamp
Diagram Viewer/Editor: Diagrams can be created based on the CFIHOS ontology via the Ontology Editor and the Diagram Viewer. Instance data can be rendered and traversed interactively with <i>metaphactory's</i> graph visualisation components, which will reflect the project standard selected.	Youtube: 1:54, 6:04, 9:38 Slides: B1 section
Project Specification Manager: The project specification template can be customized, so either the correct specification is already selected when the project is created, or a default CFIHOS project is selected and then customized to fit the requirements afterwards.	YouTube: 4:17, 5:17, 6:04, 6:44, 9:38 Slides: B1 section

References:

- CFIHOS Scope and Procedure, sections 9.1, 9.5
- CFIHOS Guide for Contractor, section 2.2.5

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Category B2 – Implement Project Standard in Gathering and Aggregation Tools

Demonstrate how the contractor can configure the project standard into any features that are used to collate information from separate systems or from further down the information supply chain, so that this information can be mapped or transformed to what is needed.

This is a preparation step for Category D2.

Supported:

Yes. *metaphactory* offers a Physical Datasource mapping functionality that allows to annotate and map the schema of external systems and databases to CFIHOS ontology and entities. Such information can be used in the ETL pipelines and conformance checks. We further offer a more general taxonomy mapping system which clarifies the relation between multiple different specifications or standards.

Evidence:

<https://www.youtube.com/watch?v=r-lAnzpiQE8>

CFIHOS_on_metaphactory_conformance.pdf

Evidence	Timestamp
Vocabulary & Taxonomy Mapping: <i>metaphactory</i> offers an in-built mapping editor for taxonomies. Mappings are used to document the relation between two terms/concepts (exact match, broad match, etc.), allowing better comparison of information stemming from distinct systems using separate specifications.	Slides: B2 section
Physical Datasource Mapping: <i>metaphactory</i> offers a Physical Datasource mapping functionality that allows to annotate and map the schema of external systems and databases to CFIHOS ontology and entities. Such information can be used in the ETL pipelines and conformance checks.	YouTube: 9:38 Slides: B2 section

References:

- CFIHOS Scope and Procedure, sections 9.1, 9.5
- CFIHOS Guide for Contractor, section 2.2.5

Category B3 – Implement Project Standard in Validation Tools

Demonstrate how the contractor can configure any validation features based on the project standard, so that they can make sure the authored information conforms to the principal's requirements.

This is a preparation step for Category D3.

Supported:

Yes. We perform validation checks using SPARQL and SHACL, and they can be customized based on the contract scenario.

Evidence:

<https://www.youtube.com/watch?v=r-lAnzpiQE8>

CFIHOS_on_metaphactory_conformance.pdf

Evidence	Timestamp
SHACL & SPARQL Validation: <i>metaphactory</i> uses SHACL restrictions defined in the ontology to identify breaches in data conformation with SPARQL queries. This includes issues such as not supplying any instances of the 'PLANT' class as principal in a contract scenario where plant 'PLANT' instances are required, or not providing a site code when creating a 'PLANT' instance. Further custom validation checks can be implemented if required.	YouTube: 8:47 Slides: B3 Section

References:

- CFIHOS Scope and Procedure, sections 9.1, 9.5
- CFIHOS Guide for Contractor, section 2.2.5

Phase C - Information Supply Chain Setup

Category C1 – Communicate Project Standard

Demonstrate how the contractor can share the project standard with any other information suppliers (e.g. subcontractors, vendors).

Supported:

Yes. Collaboration can happen on a single *metaphactory* platform, or data can be exported to various formats (CSV, RDF Turtle or JSON-LD) and shared with other *metaphactory* platforms or any other systems that are CFIHOS compliant.

Evidence:

<https://www.youtube.com/watch?v=r-lAnzpiQE8>

CFIHOS_on_metaphactory_conformance.pdf

Evidence	Timestamp
Data Export and Import: Data can be exported in CSV or RDF formats, wherein RDF exports can be imported on other <i>CFIHOS on metaphactory</i> instances, and CSV exports are compatible with any other CFIHOS compliant system that handles CFIHOS CSV imports.	YouTube: 6:04 Slides: C1 section

References:

- CFIHOS Scope and Procedure, sections 5.3.1, 5.3.2, 9.1, 9.5, Annex B
- CFIHOS Guide for Contractor, sections 2.2.3, 2.2.4

Category C2 – Support Information Collection and Aggregation

Demonstrate how other information suppliers (e.g. subcontractors, vendors) can communicate their information deliverables to the contractor, and how the contractor can store these deliverables so they can later be prepared for handover to the principal.

Supported:

Yes. Information requirements can be specified within a project and exported in various formats like CSV or RDF (JSON-LD, Turtle) to be shared with suppliers. Suppliers can provide their data deliverables as RDF files, which can be directly imported, or exchange data via API calls. The platform also features mapping capabilities to align and integrate data from different physical sources and company-specific standards into the CFIHOS model.

Evidence:

<https://www.youtube.com/watch?v=r-lAnzpiQE8>

CFIHOS_on_metaphactory_conformance.pdf

Evidence	Timestamp
Instance Creation Forms: All CFIHOS classes of the ontology can be instantiated. By expanding the data model, additional metadata can be added to allow recording of information like document IDs, submission dates, and other requirements. Received deliverables can be organized and stored within the knowledge graph, ready for processing and handover to the principal.	YouTube: 6:04 Slides: C2 section
Data Exchange and Mapping: All CFIHOS classes of the ontology can be instantiated. The platform supports exporting project specifications and importing data deliverables from third parties. Mapping tools allow the contractor to aggregate and link information from various suppliers (e.g., mapping a vendor's database schema to the CFIHOS ontology)	YouTube: 9:38

References:

- CFIHOS Scope and Procedure, sections 9.1, 9.5, Annex B
- CFIHOS Guide for Contractor, section 2.2.5, 2.2.6

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Phase D - Contractor Information Delivery

Category D1 – Create Information

Demonstrate how the contractor authors information as documents and data, and later corrects that information in response to comments from the principal.

Supported:

Yes, information can be authored using forms that are dynamically generated from the CFIHOS ontology, ensuring compliance with the project standard. The platform has a commenting feature that allows principals to leave feedback on specific data elements, which contractors can then address and resolve.

Evidence:

<https://www.youtube.com/watch?v=r-lAnzpiQE8>

CFIHOS_on_metaphactory_conformance.pdf

Evidence	Timestamp
Instance Creation Forms: All CFIHOS classes of the ontology can be instantiated. By expanding the data model, additional metadata can be added to allow recording of information like document IDs, submission dates, and other requirements. Received deliverables can be organized and stored within the knowledge graph, ready for processing and handover to the principal.	YouTube: 5:17 Slides: D1 section

References:

- CFIHOS Scope and Procedure, sections 9.1, 9.5
- CFIHOS Guide for Principal, section 3.2.4
- CFIHOS Guide for Contractor, section 2.2.6

Category D2 – Gather and Integrate Information

Demonstrate how the contractor prepares information deliverables for handover to the principal, integrating information they have authored or revised with information from elsewhere in the supply chain, so that a set of deliverables is ready to be quality checked.

Supported:

Yes, *metaphactory* acts as a central environment to gather and integrate information. Data can be authored internally or imported from suppliers. The platform provides powerful mapping tools to align data from various sources with the CFIHOS standard, ensuring consistency. Validation features help determine when a set of deliverables is ready for a quality check.

Evidence:

<https://www.youtube.com/watch?v=r-lAnzpiQE8>

CFIHOS_on_metaphactory_conformance.pdf

Evidence	Timestamp
Mapping and Integration Tools: The contractor can integrate information from external suppliers using Vocabulary- and Schema-Mapping features. These tools allow mapping of physical data sources and proprietary vocabularies to the CFIHOS ontology, ensuring all information from different origins is structured consistently. Relationships between data points are inherently defined as they are linked within the unified knowledge graph model.	YouTube: 9:38 Slides: D2 section

References:

- CFIHOS Scope and Procedure, sections 9.1, 9.5
- CFIHOS Guide for Contractor, section 2.2.6

Category D3 – Check Information Quality

Demonstrate how the contractor assesses the completeness, accuracy and contractual compliance of the information deliverables before handover.

Supported:

Yes, the platform has extensive information-checking capabilities. Integrity checks based on **SPARQL** and **SHACL** are used to assess the completeness and compliance of information against the project standard and contract scenario. These validation rules can be customized to enforce specific quality requirements.

Evidence:

<https://www.youtube.com/watch?v=r-lAnzpiQE8>

CFIHOS_on_metaphactory_conformance.pdf

Evidence	Timestamp
SHACL & SPARQL Validation: <i>metaphactory</i> uses SPARQL and SHACL to run quality checks. Contractors can extend these rules to perform custom checks for accuracy and compliance, such as verifying that tag numbering matches the project standard or that all required properties for a tag class have values.	YouTube: 8:47 Slides: D3 Section

References:

- CFIHOS Scope and Procedure, sections 8.3, 9.1, 9.5
- CFIHOS Guide for Contractor, section 2.2.6

Category D4 – Transfer Information

Demonstrate how the information deliverables are transferred from the contractor to the principal.

Supported:

Yes, information deliverables are transferred by exporting the project data into standard formats like CSV or RDF (JSON-LD, Turtle). These files can be shared offline or exchanged via API calls, allowing the principal to import them into their system.

Evidence:

<https://www.youtube.com/watch?v=r-lAnzpiQE8>

CFIHOS_on_metaphactory_conformance.pdf

Evidence	Timestamp
Data Import/export: All instance data of a project can be exported, either as RDF data or as csv spreadsheets. This data can then be imported by another <i>metaphactory</i> system.	YouTube: 6:04 Slides: D4 Section

References:

- CFIHOS Scope and Procedure, sections 9.1, 9.5, Annex B
- CFIHOS Guide for Contractor, section 2.2.7

Phase E - Principal Information Review

Category E1 – Review and Validate

Demonstrate how the principal reviews the information deliverables that have been provided by the contractor to make sure they comply with the contractual requirements.

Supported:

Yes, the platform supports the principal's review and validation process. The principal can import the contractor's deliverables and use built-in and customizable validation rules to automatically check for compliance and completeness. A commenting feature is also available for manual reviews and to track required corrections. It is also possible to compare two project specifications and see changes.

Vocabularies and ontologies have built-in provenance information.

Evidence:

<https://www.youtube.com/watch?v=r-lAnzpiQE8>

CFIHOS_on_metaphactory_conformance.pdf

Evidence	Timestamp
<p>Compare & Validate:</p> <p>In a project specification page we provide a compare button to see the changes. Moreover, the validation page shows all validation errors and can be customized. Vocabularies and Ontologies have built-in commenting and review features.</p>	<p>Slides: E1 Section</p>

References:

- CFIHOS Scope and Procedure, sections 8.4.1, 9.1, 9.5.3
- CFIHOS Guide for Principal section 3.2.2

Category E2 – Report Review Outcome

Demonstrate how the principal communicates the outcome of their review of the information deliverables to the contractor, including details of any corrections required.

Supported: No

Evidence: None

References:

- CFIHOS Scope and Procedure, sections 8.3, 8.4, 9.1, 9.5.3, Annex B
- CFIHOS Guide for Principal, section 3.2.2, 3.2.3

Phase F - Principal Handover to Business Systems

Category F1 – Deliver to Business Systems

Demonstrate how the principal's project team can prepare the project information for delivery to business systems that support ongoing activities (e.g. operations and maintenance teams).

Supported:

Yes, once information is validated, it can be prepared for delivery to business systems. The platform supports exporting data into various machine-readable formats, like CSV and JSON-LD, or making it available via API calls for seamless handover to operations and maintenance systems. The system's data model is also designed to manage projects involving multiple contractors.

Evidence:

<https://www.youtube.com/watch?v=r-lAnzpiQE8>

CFIHOS_on_metaphactory_conformance.pdf

Evidence	Timestamp
Data Export and Import: Data can be exported in CSV or RDF formats, wherein RDF exports can be imported by other <i>CFIHOS on metaphactory</i> instances, and CSV exports are compatible with any other CFIHOS compliant system that handles CFIHOS CSV imports.	YouTube: 6:04 Slides: F1 section

References:

- CFIHOS Scope and Procedure, sections 9.1, 9.6
- CFIHOS Guide for Principal, section 3.3

Category F2 – Track and Update

Demonstrate how all deliverables are tracked and updated (including final deliverables).

Supported:

Yes, *metaphactory* supports a commenting and review mechanism for ontologies and vocabularies out-of-the-box. This is also supported for other entities. We offer a compare feature that highlights the changes between two versions of a project specification.

Evidence:

<https://www.youtube.com/watch?v=r-lAnzpiQE8>

CFIHOS_on_metaphactory_conformance.pdf

Evidence	Timestamp
Compare & Comments: In a project specification page, we have a compare button to see the changes. Vocabularies and Ontologies have built-in commenting and review features.	Slides: F2 Section

References:

- CFIHOS Scope and Procedure, sections 9.1, 9.6
- CFIHOS Guide for Principal, section 3.3