FAIR 3D HERITAGE
Documentation, Publication and Preservation
of the Digital 3D Heritage on the Web

Towards (H)BIM Integration in Semantic Kompakkt: Evaluaton of Web Libraries for a Modular Import Pipeline

Kai Niebes[1], Zoe Schubert[2], Lozana Rossenova[3] and Ina Blümel[4]

[1,2,3,4] Open Science Lab, TIB – Leibniz Information Centre for Science and Technology and University Library, Germany
[2] Generaldirektion, Berlin State Library – Prussian Cultural Heritage, Germany
[4] Faculty III, Information Management, Hannover University of Applied Sciences and Arts, Germany

Keywords: Semantic Kompakkt, BIM, HBIM, IFC, IIIF, 3D cultural heritage, web-based visualization, interoperability

Abstract

Objectives
This contribution investigates how Semantic Kompakkt can be extended to support Building Information Modelling data. The main research objective is to identify a technically robust basis for integrating heterogeneous (H)BIM models and metadata into Semantic Kompakkt through a modular import pipeline, while preserving the platform's semantic perspective on annotation, contextualisation, and structured metadata integration. We investigate existing FOSS libraries and modules to support scalable import, transformation, and web delivery.

Context
Semantic Kompakkt has been developed in the context of open and sustainable infrastructures for 3D research data (Kompakkt Consortium, 2026). It already supports the viewing, annotation, and semantic enrichment of 3D objects, and thus provides a relevant foundation for an extension particularly relevant for cultural heritage, where 3D building models increasingly need to be contextualised and linked with other research resources (Rossenova, 2024), (Rossenova et al., 2022). At the same time, current developments in interoperability initiatives highlight the need for reusable, standards-aware workflows for 3D publication, referencing, and preservation. Our ongoing development is informed by work towards IIIF 3D compliance and by contributions to the respective Working Group (IIIF Consortium, 2026). Against this background, it is not only a question of file import, but also of sustainable architecture, metadata mapping, and future interoperability across viewers, repositories, and knowledge environments.

Methods

The paper reports on the current stage of the project and presents a comparative evaluation of three candidate libraries for BIM integration: ifc-lite, xeokit, and web-ifc. Their selection was based on a targeted preliminary review, as they represent relevant but technically different approaches to web-based IFC/BIM processing and appeared most suitable for integration into a TypeScript-based viewer environment. The comparison focuses on criteria that are directly relevant for implementation: software maturity, developer activity, organisational backing, licensing, TypeScript support, and the use of native or intermediary data formats. The study also includes practical testing of conversion workflows and derived output formats. Particular attention is given to the suitability of each library for a modular architecture that includes import connectors, validation, transformation and mapping of geometry and metadata, and publication through an IIIF-aware processing chain (see image 1).

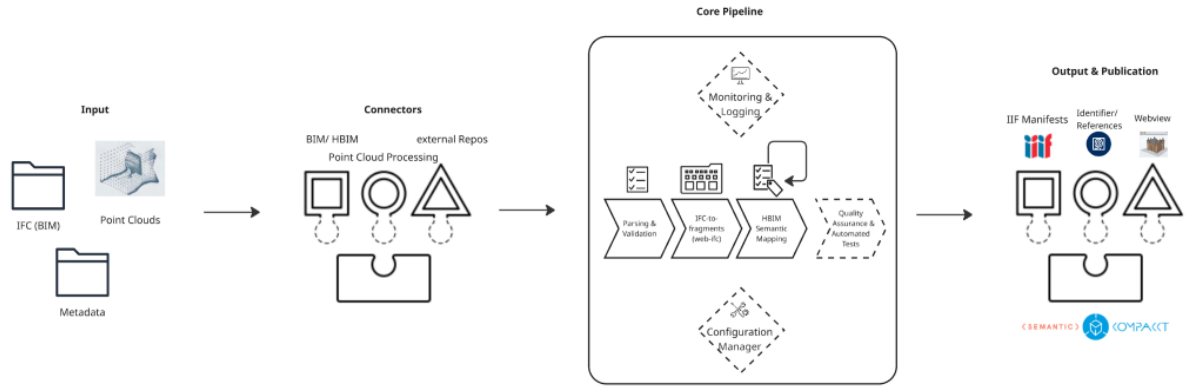

Image 1: Modular architecture with planned (H)BIM integration pipeline: Input datasets such as IFC models and associated metadata are ingested through dedicated import connectors. The pipeline then performs validation, transformation, and mapping to the internal data model, followed by geometry and fragment processing optimized for web delivery. Optional modules allow additional semantic enrichment and metadata extension. Finally, IIIF-conformant manifests and resources are generated to enable publication, visualization, and reuse of the assets within the Semantic Kompakkt environment. The modular design enables extensibility and the integration of alternative processing components.

Results

We show clear trade-offs between the three libraries (see table 1). Ifc-lite (True, 2026) is technically attractive because it offers full TypeScript support and does not depend on an intermediary proprietary format; however, at its current stage it appears too immature for reliable use in a production-oriented research infrastructure. Xeokit (Xeokit, 2026) is the most mature solution and benefits from a broad ecosystem, but its only partial TypeScript support and comparatively slow conversion workflow may complicate integration. Web-ifc (ThatOpen 2026a) currently appears to be the most suitable option. It combines solid maturity, full TypeScript support, and efficient conversion into its Fragments format (ThatOpen 2026b). Initial tests indicate that this conversion is fast and can significantly reduce file sizes, which is promising for scalable web delivery and reuse.

Library	Maturity	Developers	Corporate support / partners	Own file format	License	TypeScript support
ifc-lite	Not very mature (1 month old)	Few developers	No corporate support yet	No own file format	Suitable license (MPL)	Full TypeScript support
xeokit	Very mature (since 2018)	Large team (19 developers in the last year)	Largest list of partners	Own file format (but slow conversion)	Suitable license (AGPL)	TypeScript only partially supported
web-ifc	Mature (since 2020)	Large team (15 developers in the last year)	Smaller list of partners	Own file format (very fast conversion)	Suitable license (MPL)	Full TypeScript support

Table 1: Comparison of three libraries for BIM integration

Relevance

The contribution relates directly to the conference themes of 3D viewers and publishing platforms. It also addresses user experience and interaction design for exploring 3D heritage, since the technical choice of BIM integration library has direct implications for performance, usability, and the effective exploration of complex building models in the browser. Furthermore, it contributes to cross-platform and cross-viewer interoperability by evaluating technologies that support sustainable and reusable workflows across heterogeneous data sources and viewing environments. The work is equally relevant to the integration of 3D data into Linked Open Data and knowledge graph environments, particularly in view of IIIF 3D and semantically enriched metadata structures. Finally, the project contributes to discussions on national and international infrastructures for 3D cultural heritage, as it is being developed as part of a broader national effort to support open, sustainable, and interoperable research data infrastructures.

References

1. Rossenova, L. (2024). Kompakkt and Semantic Kompakkt: A future-proof alternative for 3D models and cultural heritage institutions. *TIB Blog*. https://blog.tib.eu/2024/09/24/kompakkt-and-semantic-kompakkt-a-future-proof-alternative-for-3d-models-and-cultural-heritage-institutions/
2. Kompakkt. (2026). *Kompakkt Consortium.* Retrieved from https://kompakkt.de/about
3. Rossenova, L. et al. (2022). Collaborative annotation and semantic enrichment of 3D media. *Proceedings of the 22nd ACM/IEEE Joint Conference on Digital Libraries (JCDL '22).* Association for Computing Machinery, New York, NY, USA, Article 40, 1–5. https://doi.org/10.1145/3529372.3533289
4. IIIF Consortium. (2026). *IIIF 3D Technical Specification Group*. Retrieved from https://iiif.io/community/groups/3d/tsg/
5. buildingSMART International. (2026). *Industry Foundation Classes (IFC).* Retrieved from https://www.buildingsmart.org/standards/bsi-standards/industry-foundation-classes/
6. buildingSMART. (2024): *ifcOWL.* GitHub. Retrieved from https://github.com/buildingSMART/technical.buildingsmart.org/

7. True, L. (2026). *ifc-lite* [Source code]. GitHub. Retrieved from https://github.com/louistrue/ifc-lite
8. Xeokit. (2026). *xeokit-sdk* [Source code]. GitHub. Retrieved from https://github.com/xeokit/xeokit-sdk
9. ThatOpen. (2026a). *engine_web-ifc* [Source code]. GitHub. Retrieved from https://github.com/ThatOpen/engine_web-ifc
10. ThatOpen. (2026b). *engine_fragment* [Source code]. GitHub. Retrieved from https://github.com/ThatOpen/engine_fragment