Basic information delivery manual and information delivery specification for facility services handover

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Abstract. The integration of Building Information Modeling (BIM) into Facility Management (FM) remains challenging due to various project constellations and knowledge gaps that make it impossible for FM to set their information requirements (IR) for operation. To address this issue, this research develops a basic Information Delivery Manual (IDM) with an Information Delivery Specification (IDS) for Facility Service (FS) handover. The development process follows an iterative, expert-driven approach to refine the handover process, IR structure, and information definition. A core set of basic information was identified, representing the smallest common denominator of information essential for FS, while allowing for flexible extensions to accommodate building- or operator-specific requirements. The next phase involves practical testing in real-world FM environments to further assess its usability and impact. The results contribute to ongoing standardization efforts.

1 Introduction

Facility Services (FS) are required in the Facility Management (FM) of every property. They serve to support the respective core business of an organization. To carry out these FS, inventory data from the respective property is required, e.g. window areas and floor coverings for cleaning services, or technical data from the ventilation system for maintenance services. If this data is missing, efficient FM processes and decisions are impeded.

The inventory data of a property is enriched by Building Information Modeling (BIM) authors for new buildings and building conversions, from project development to completion of the construction phase. Which information is requested depends on the respective BIM use cases and the associated information requirements (IR). Due to the fact that there is no standardized process for requesting information for building operation (BIM4FM), there is often a lack of the required inventory data to use the Asset Information Modell (AIM) in operation [1–5]. The recovery of this lost data is in turn very time-consuming, costly and only partially possible, but is often still common in conventional projects [6].

The creation of IR is currently failing due to several challenges. It would be ideal if the IR for operation were set by FM itself. However, various and sometimes complex project

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constellations with different stakeholders make it impossible to include the subsequent building operator, for example if the latter does not yet exist [7]. In comparison, it is more often the case that FM can be involved in conversion projects, but even here studies suggest that the stakeholders in operation are not able to formulate their requirements for an AIM [1,3,4].

The aim of this paper is to develop an approach for standardizing IR for building operations that is particularly effective when FM cannot be involved in the planning process at an early stage or does not have the necessary expertise to formulate its own requirements. For this purpose, basic, operationally necessary IR are defined and assigned to a main FS handover process. This also enables stakeholders without FM-specific knowledge to set qualified and process-relevant requirements for the AIM. Only non-residential buildings are considered, as their FM processes, documentation requirements, and operational complexities differ from those of residential buildings. As a result, the proposed approach and the defined IR are not directly transferable to residential use cases. Figure 1 illustrates the relationships between the different information requirements.

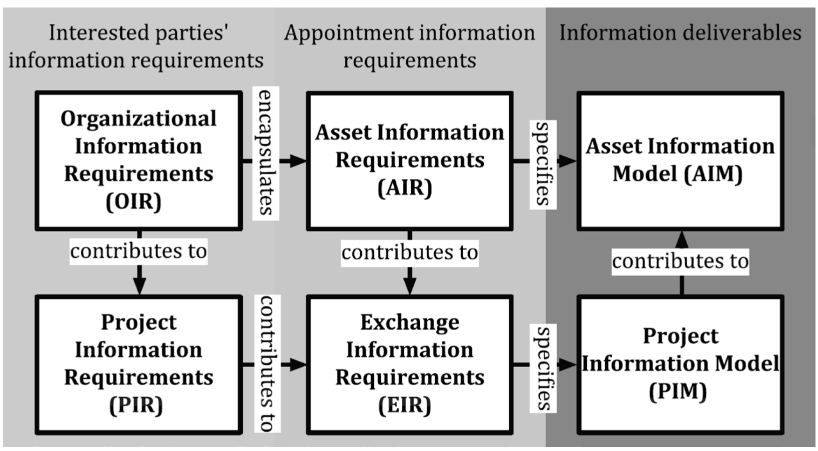


Fig. 1. Hierarchy of information requirements (based on [8])

2 State of research

In recent years, some approaches have been developed to define IR for building operations, as evidenced by several international literature reviews [9–11]. These reviews show that many of these IR are either limited to specific building types or focus on specific building systems. Even those IR that are described as overarching often show a focus on specific building systems or specific services and thus remain limited in their applicability. Furthermore, attributes are often included in the IR that should be categorized as process data, such as maintenance records [9], and therefore cannot be requested during the planning or construction phase.

There are several initiatives in German-speaking countries that deal with the structured description of operational IR. These include the BIM2FM data catalogue from buildingSMART Switzerland, which is based on existing facility management service models and describes component-oriented asset information in a structured manner [12]. Within the Use Case Management (UCM) of buildingSMART International there are also some IR predominantly in German for very specific FS developed [13]. With its handbook, RealFM offers a practice-oriented reference work that also contains an attribute list in the appendix and without a structured, process-oriented system [14].

None of the existing approaches combine the necessary requirements for the FS handover process: comprehensive coverage of all FS, applicability even by stakeholders without FM-specific knowledge, barrier-free availability of the content and use of computer-readable IR methods.

3 Methodology

To develop the IR, group discussion [15] with a panel of experts were employed. Led by a moderator, each participant had the opportunity to address key issues while allowing for spontaneous input and exchange. This process involved that each participant got the opportunity to present own materials from their professional or research context, providing insights into diverse perspectives and approaches on the topic. Additionally, three external expert interviews [16] were conducted to cover specific topics for which there was no expert in the group, using a flexible, open-ended approach to enable experts to respond freely without a rigid question list. The collaborative deliberation culminated in a consensus-driven outcome, where the diverse perspectives were synthesized into unified IR.

The expert group consisted of 30 participants. Research experts in BIM4FM provided insights on scientific and practical solutions. Representatives from FM associations and related interest groups were crucial for representing the interests of building owners and operators. A city, acting as a public owner, contributed operational insights. BIM consultants offered a neutral perspective due to their extensive BIM process experience. Additionally, software manufacturers of authoring and (CA)FM systems were included to evaluate the technological feasibility and interoperability required for standardized data transfer.

4 Foundations

Many options have emerged for specifying IR. There is no single solution that covers all aspects of the analysis of use cases [17]. Accordingly, a consideration is necessary depending on the intended purpose. Due to the possibility of linking the data handover to a process map, the decision was made in favour of an Information Delivery Manual (IDM) in conjunction with an Information Delivery Specification (IDS), through which the required attributes and properties can be represented in detail. Both standards offer the possibility of being presentable in the computer-readable XML-format.

Figure 2 shows the basic components for the development of an IDM. The BIM use case, derived from the BIM goals, forms the basis of the IDM. In this case, it is the use of the BIM model in operation for facility services. This use case refers to the main facility service process from which the relevant process steps for determining the IR are taken. The IDM is an integral part of the Asset Information Requirements (AIR), ensuring that the information specified in the AIR are requested in a structured manner. The following development of the IDM follows the procedure of [8].

To be able to map the IR described in the IDM with the Industry Foundation Classes (IFC) format, they are transferred to an IDS as shown in Figure 2. This enables automated compliance checking of the IR. The following development of the IDS follows the description in [18].

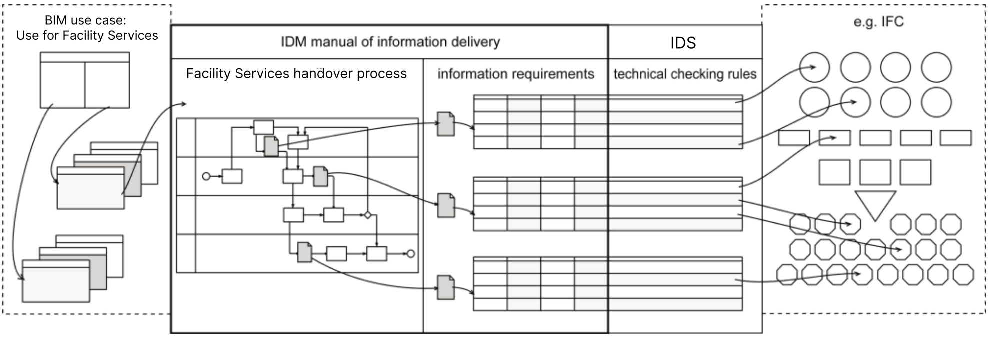


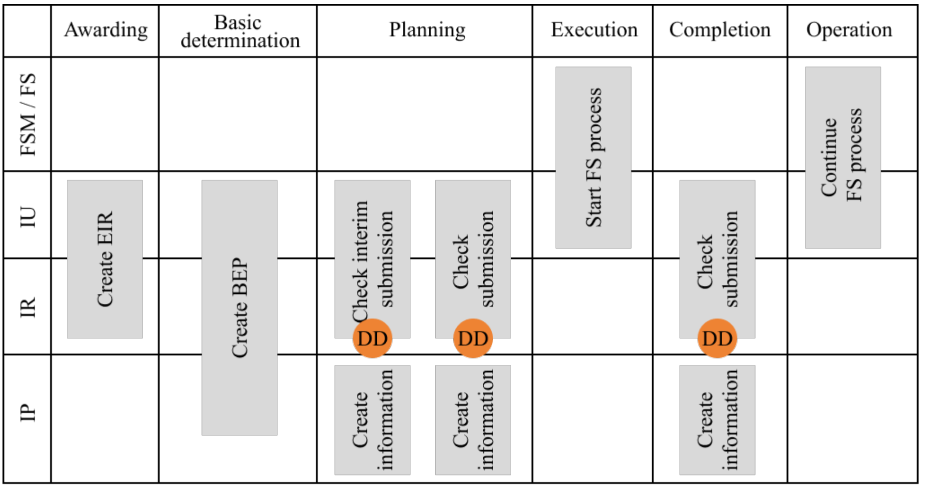
Fig. 2. Information Delivery Manual for BIM4FM (based on [19])

5 Development of the FS handover IDM

5.1 FS handover process

[8] describes various approaches for considering the type and context of information exchange, of which the process diagram is chosen here to illustrate the main FS process. The main process is developed in such a way that it can describe the multitude of each FS comprehensively without the need for a process diagram for each FS itself. However, each individual FS must be considered within this process to be able to derive the necessary IR later. The part of the FS process is based on [20,21], which was additionally evaluated by the expert group, and the FM handover process is based on [22,23]. The two parts of the process were combined and modelled in BPMN format [24] to form a holistic process.

In the process, there are three key data drops (DD), each serving distinct functions. The first data drop occurs during the planning phase and is primarily intended as a quality assurance test. This stage facilitates the early detection of planning errors. The second handover takes place at the conclusion of the planning phase, at which point the as-planned model's information is transferred to FM. This enables FM to initiate the procurement process for FS without requiring comprehensive information depth. The final handover occurs at the end of the execution phase, where the as-built model is delivered and integrated into the operational system as the AIM. At this stage, the execution of FS can be instructed, leveraging the full depth of information available. Figure 3 shows a rough schematic of the process.



IP: Information provider, IR: Information requestor (Purchaser / Client), IU: Information user (Facility Management), FSM / FS: Facility Service Management / Facility Service, EIR: Exchange information requirements, BEP: BIM Execution plan

Fig. 3. Schematic FS handover process

5.2 IR

To structure the IR, an analysis was conducted with the expert group from the perspective of FM to identify which entities are relevant for FS. Two main categories emerged from this analysis: Spaces on the one hand, including plot, external area, building, floor, usage area, room, and room zone. Objects on the other hand, including door and gate, window, flooring, facade, roof, and technical installation.

The basic attributes, obtained from the evaluation with the help of the experts, represent the core set of information that is universally required across all FS processes, forming the smallest common denominator of essential data. These attributes ensure that fundamental information is consistently available, regardless of the specific building type or operational requirements. However, this core set is designed to be flexible and extendable, allowing additional attributes to be incorporated as needed based on building-specific or operator-specific requirements. This modular approach ensures that while a standardized baseline is maintained, it remains adaptable to different needs. Additional attributes can be integrated using classifications such as CAFM-Connect or Omniclass and enable a granular description of specific elements. This approach ensures that all relevant information is captured at the appropriate level of detail while maintaining consistency across different domains and applications.

5.3 Conversion into an idmxml

Converting the IR into idmxml format enhances data interoperability and standardization in BIM processes. This conversion follows [25], ensuring consistent and accurate information exchange across platforms. Fig. 4 shows an excerpt of the idmxml, consisting of the BIM use case “Use for Facility Service”, the derived process map (see 5.1) and the link to the associated IDS.

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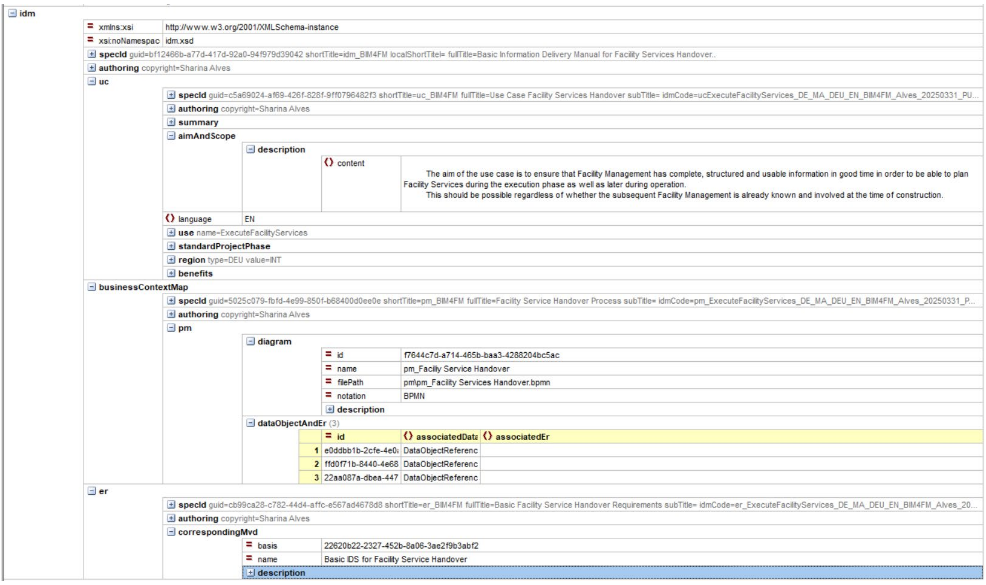

Fig. 4. Excerpt from the idmxml

6 Conversion of the IR into an idsxml

The idmxml format facilitates the association of process steps with specific exchange requirements, which can be encapsulated within an idsxml. This configuration enables the comprehensive mapping of all requisite information to corresponding attributes, properties, and quantities in IFC. The incorporation of various facets allows for the filtration of elements, thus enhancing the specificity and customization of requirement definitions. Fig. 5 shows an excerpt of the idsxml, containing all the IR mapped to IFC. Its validation was conducted using the xbim auditing service [26].

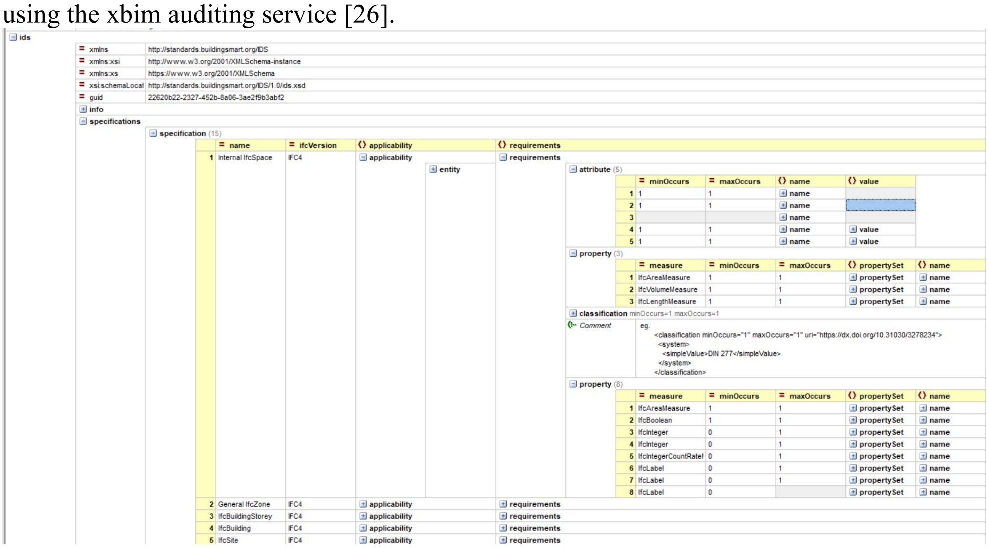

Fig. 5. Excerpt from the idsxml

7 Conclusion

This paper presents an approach to define IR for FS. Based on the process development, relevant IR were identified and formalized, resulting in an IDM and a corresponding IDS. The developed work lays the foundation for formulating basic IR for FM without the need for in-depth FM-specific expertise, enabling early and structured data provision for the FS process.

Expert feedback on the content of the IDM and IDS ensures that the model is conceptually sound, comprehensive, and aligned with industry needs. However, real-world application is necessary to test its usability, effectiveness, and interoperability within actual BIM and FM workflows. Future research should therefore focus on pilot projects and field studies to assess the impact on data quality, process efficiency, and the seamless integration of BIM data into FM operations. To this end, it is important that a guideline is developed to explain these results, which also helps to further supplement the requirements. The results of this work are intended to contribute to ongoing standardization efforts in the field of BIM for FM.

In addition, the development and classification of IR are influenced by the regulatory and professional context of FM practices in German-speaking countries. This may limit the applicability of the approach in regions with different legal frameworks or standardization landscapes. Future work should explore the transferability of the approach in international contexts.

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