

## AN INFORMATION MANAGEMENT FRAMEWORK FOR MULTI-USE CASE BUILDING AND DISTRICT DIGITAL TWINS

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### Abstract

Digital twins are increasingly being adopted in the built environment to support data-driven operations, optimisation, and lifecycle decision-making. However, most current implementations remain limited to single use cases and centralised architectures, constraining scalability and interoperability at building and district scales. This paper proposes a use-case-driven information management framework for multi-use case building and district digital twins. The framework combines a layered architecture with a dual semantic modelling strategy that separates stable, standards-aligned core models from flexible, use-case-specific extensions. Semantic alignment is demonstrated through a real pilot. The applicability of the framework to support multi-use case integration will be demonstrated in future work.

### Introduction

Digital twin (DT) technologies are increasingly recognised as a cornerstone of digital transformation in the built environment, enabling data-driven operations, optimisation, and strategic decision-making across the lifecycle of buildings and districts (Boje et al., 2020; Opoku et al., 2021). By creating a dynamic digital representation of physical assets and systems that is continuously updated through data streams, digital twins extend traditional Building Information Modelling (BIM) approaches by enabling real-time analytics, which can be used to improve the performance of the physical twin (Grieves & Vickers, 2017; Lu et al., 2020). As a result, DTs are being actively explored for applications such as energy monitoring and optimisation, predictive maintenance, renovation planning, energy grid stability, and resilience assessment at both building and district scales.

Despite this growing interest, most existing building and district digital twin implementations remain focused on individual use cases or specific stakeholder needs. Many solutions are developed as isolated or BIM-centric systems, tightly coupled to particular data sources or software platforms, which limits scalability and reuse across the many use cases during the building lifecycle (Volk et al., 2014; Pärn et al., 2017). This fragmentation limits the ability of digital twins to support integrated decision-making across multiple domains and time scales.

These challenges are further exacerbated at district scale, where digital twins must integrate data and models from multiple buildings owned and operated by different stakeholders. Centralised data architectures raise concerns related to data sovereignty, privacy, and trust (Batty, 2018; Otto et al., 2021). Conversely, fully decentralised approaches often struggle to achieve semantic interoperability and do not support coordinated analytics.

This paper addresses these challenges by proposing an information management framework designed to support multi-use case digital twins operating across building and district scales. The framework adopts a use-case-driven design methodology, ensuring that information requirements are derived from specific operational and strategic needs rather than exclusively from technical considerations. It combines this with a layered and federated digital twin architecture aligned with emerging standards and data space principles (IDSA 2021, ISO/IEC 2023).

The proposed framework is grounded in the experience and results of the WILSON project, a European research initiative focused on distributed data modelling and federated digital twinning for the sustainable operation and management of buildings and districts. This paper provides four main contributions to the field of building and district digital twins: (i) development and analysis of multi-use case information requirements; (ii) definition of a layered information management framework; (iii) specification of a dual semantic modelling strategy enabling local and federated digital twins; and (iv) illustration of the approach through a real pilot implementation.

### Background and Related Work

#### Digital Twins in the Built Environment

The concept of the digital twin originated in manufacturing and aerospace domains and has since been adopted in the built environment to support various asset management and operational optimisation activities during building and infrastructure lifecycle (Tao et al., 2018; Grieves & Vickers, 2017). In this context, digital twins are commonly defined as digital representations of physical buildings or infrastructure assets that are dynamically linked to their physical counterparts through data streams.

In contrast to BIM, which primarily supports design and construction through static information models, digital twins emphasise dynamic behaviour, continuous data integration, and the ability to support simulation, prediction, and control during operations (Volk et al., 2014; Lu et al., 2020). Building-level digital twins are typically applied to energy monitoring, fault detection, predictive maintenance, and indoor environmental quality management, while district- and urban-scale digital twins extend these capabilities to support aggregated analyses and coordination across multiple assets (Batty, 2018).

### Multi-Use Case Challenges

A persistent limitation of many digital twin implementations in the construction and facilities management domains is their focus on single use cases or isolated lifecycle phases. Different applications often require different data resolutions, update frequencies, and semantic interpretations, making it difficult to reuse data and models across use cases (Pärn et al., 2017).

For example, real-time operational optimisation requires high-frequency sensor data and control interfaces, whereas renovation planning and investment analysis depend on aggregated historical data and scenario-based simulations. Without a coherent information management and semantic alignment strategy, there is a risk that these requirements are addressed through parallel, redundant data pipelines.

### Semantic Interoperability and Alignment

Semantic interoperability has long been recognised as a key challenge in construction informatics. While standards such as IFC have significantly improved data exchange, they do not fully address the integration of heterogeneous operational data sources or the needs of analytics-driven digital twins (Beetz et al., 2009; Pauwels & Terkaj, 2016).

Ontology-based approaches and semantic web technologies have been proposed to enhance interoperability by providing machine-interpretable structures that unify BIM, sensor data, geospatial information, and external datasets, enabling better knowledge representation and facilitating reasoning (Karabulut et al 2024). However, many existing approaches rely on monolithic or overly complex models that are difficult to adapt and reuse to different project and operational requirements.

## Methodological Approach

### Multi Use-Case-Driven Framework Design

The framework presented in this paper adopts a multi use-case-driven design methodology. Rather than defining information models and architectures in isolation, the approach starts from defining use cases that capture the goals, actors, processes, and decision contexts relevant to building and district management. The use case methodology considers the input from domain experts, providing general ideas and functional requirements, while system experts detail these use cases down to a level that can be used to specify interfaces, dedicated

functionalities, data and service model exchanges. This methodology ensures that the resulting digital twin infrastructure directly supports practical needs and avoids unnecessary complexity.

Within the WILSON project, use cases were developed through an iterative process involving technical partners, pilot site operators, and other stakeholders. This process combined action design research principles (Sein et al. 2011) with established use-case modelling standards (BSI 2020), resulting in a consistent set of use-case descriptions covering functional and non-functional requirements. Each stage in the Action Design Research (ADR) framework adopted in use case development is summarised in Table 1.

*Table 1: Action design research for use case development*

|                                                                                  |                                                                                                                                                                                                                  |
|----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Stage 1</b> - Problem formulation                                             | Use case scoping: Identification of UC leaders and stakeholders                                                                                                                                                  |
| <b>Stage 2</b> - Building, intervention and evaluation - Use case development    | <ul style="list-style-type: none"> <li>• Initial development of use cases</li> <li>• Use case workshops (round 1)</li> <li>• Further development of use cases</li> <li>• Use case workshops (round 2)</li> </ul> |
| <b>Stage 3</b> - Reflection and learning - Developing detailed user requirements | Develop final version of use cases, and identification of main system functionalities                                                                                                                            |
| <b>Stage 4</b> - Formalisation & Reporting                                       | Reporting in project deliverables, scientific publications, etc.                                                                                                                                                 |

### From Use Cases to Information Requirements

Each use case was analysed to identify its information requirements, including actors, scenarios, functional and data requirements. These requirements were then abstracted to identify common information needs across multiple use cases, as well as specific extensions required for particular applications. This analysis provides the basis for defining a shared information management framework capable of supporting multiple use cases without duplication.

## Use Cases and Information Requirements

### Overview of Building and District Use Cases

The information management framework proposed in this paper is grounded in a comprehensive set of building- and district-level use cases that reflect operational and strategic needs in the built environment. Following structured stakeholder engagement and iterative analysis, use cases and their scope was defined (Table 2). The identified use cases illustrate the diversity of objectives, time horizons, and data requirements that the proposed information management framework must support.

### Stakeholders and Decision Layers

The identified use cases (Table 2) involve a wide range of stakeholders, each interacting with the digital twin at different decision layers. Facility managers and building operators typically engage with the digital twin on a short-term operational basis, using real-time or near-real-time information to adjust control strategies, diagnose faults,

or respond to alerts. Their primary concern is maintaining efficient and reliable building operation while ensuring occupant comfort.

Table 2: Overview of identified use cases

| Use case                                                      | Scope                                                                                                                                                                                                    |
|---------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Decentralised multi-source data management</b>             | Develop a federated DT approach, to achieve interoperability among diverse data sources scattered across various platforms and formats.                                                                  |
| <b>Energy monitoring and optimisation</b>                     | Optimize energy management at building and district levels, allowing owners and other key actors to make data-driven decisions to enhance energy performance, comfort, and environmental sustainability. |
| <b>Data-driven network asset management</b>                   | Provide energy network operators with tools for optimising asset management, ensuring energy availability and network resilience.                                                                        |
| <b>Predictive maintenance</b>                                 | Enable proactive maintenance by predicting equipment failures and optimising maintenance schedules, reducing downtime and costs.                                                                         |
| <b>Risk, resilience and biodiversity nexus</b>                | Enable building owners to mitigate climate change hazards by identifying environmental risks at building and district levels.                                                                            |
| <b>Renovation planning and design</b>                         | Apply LCA for planning and design of energy-efficient renovations and retrofitting projects.                                                                                                             |
| <b>Technoeconomic investment planning for property owners</b> | Evaluation of energy improvement interventions and economic feasibility at building and community levels.                                                                                                |
| <b>Boost of green energy investments by market actors</b>     | Enhancing green energy investments by leveraging DTs and network planning algorithms                                                                                                                     |

Asset owners and portfolio managers operate at a medium- to long-term decision layer. They use digital twin outputs to support renovation planning, lifecycle cost analysis, and investment decision-making. For these stakeholders, historical data, performance trends, and scenario-based simulations are more important than real-time control.

At district level, additional stakeholders come into play, including energy service companies, distribution system operators, and public authorities. These actors are interested in aggregated performance indicators, flexibility potential, and compliance with regulatory or policy objectives. The coexistence of these diverse stakeholders highlights the need for an information management framework that can present different views

of the same underlying data while enforcing appropriate access controls.

### Information Requirements Analysis

Analysis of the use cases reveals a set of common information requirements that cut across applications and scales. Static information forms the foundation of the digital twin and includes building geometry, construction properties, system topology, and asset metadata. This information is often derived from BIM models and asset registers and changes infrequently over time.

Dynamic information consists primarily of time-series data from sensors, meters, and building management systems. These data streams capture the operational state of buildings and systems, such as energy consumption, temperatures, equipment status, and control signals. Depending on the use case, data may be required at different temporal resolutions, ranging from seconds or minutes for control-oriented applications to hourly or daily aggregates for reporting and analysis.

Contextual information provides essential background for interpreting building performance. Examples include weather data, occupancy schedules, energy tariffs, and grid conditions. Many analytical models rely on such contextual data to generate accurate predictions or recommendations.

In addition to raw data, use cases require access to derived information, such as key performance indicators (KPIs), alarms, forecasts, and optimisation results. Managing these different categories of information in a consistent and reusable manner is a central challenge addressed by the proposed information management framework.

### Cross-Use-Case Synergies and Conflicts

A key finding of the use-case analysis is the significant potential for synergy through shared information resources. For example, the same sensor data streams can support energy optimisation, fault detection, and indoor comfort analysis. Similarly, building geometry and system topology information is relevant for both operational optimisation and long-term renovation planning.

However, conflicts may arise when different use cases impose competing objectives or constraints. Energy optimisation strategies that minimise consumption may negatively affect occupant comfort, while aggressive demand response actions may increase equipment wear. These conflicts cannot be resolved solely at the data level; they require explicit governance, prioritisation, and negotiation mechanisms embedded within the digital twin framework.

## Proposed Information Management Framework

### Framework Overview

The proposed information management framework is designed to address the complexity and diversity of multi-use case digital twins in the built environment. It adopts a multi-layer model inspired by Semantic Web principles

and DT reference architectures (CEN 2026, IDSA 2021, ISO 2021, Karabulut et al. 2024) that separates concerns while enabling strong integration across layers.

Heterogeneous data streams originating from BIM models, IoT sensors, legacy BMS systems, and operational platforms are transformed into semantically enriched and machine-interpretable representations, ensuring that local and federated DTs operate with shared meaning, supporting reasoning, analytics, and standardised data exchanges. By allowing data, models, and services to be shared across multiple applications, the framework enhances scalability, enabling the addition of new buildings, data sources, or use cases without fundamental redesign. The framework comprises the logical layers described below (Figure 1).

### Acquisition Layer

The acquisition layer forms the interface between the physical world and the digital twin. It is responsible for ingesting heterogeneous data from a wide range of sources, including BIM repositories, building management systems, IoT devices, and external data services, while preserving essential metadata such as timestamps, sensor calibration, and spatial context. Data ingestion follows the principles of ISO/IEC 30141:2024 - Internet of Things (IoT) — Reference architecture (ISO/IEC 2024) and ISO 12006 for BIM-based information management (ISO 2022). By aligning data acquisition with these standards, it ensures consistent data quality and traceability across both building and district DTs, forming the foundation for accurate semantic mapping and analytics.

### Integration Layer

Data Space connectors are implemented following the International Data Spaces (IDS) Reference Architecture (IDSA 2021) and Gaia-X Federation Services (Gaia-X 2022). This layer ensures data sovereignty and standardised access through policy-based usage control and authentication. Personalised Data Hubs (PDHs) provide APIs for tool access while enforcing local governance (Ramachandrani et al. 2025).

### Semantic Layer

The semantic layer manages semantic mediation and ontology alignment between local data and the Core DT Model. This process follows ISO/IEC 21838 – Top-Level Ontologies for Interoperability (ISO/IEC 2021), to translate data into structured RDF or JSON-LD formats. The layer comprises two components:

- Semantic Mediation Gateways, which perform schema mapping and transformation from raw BIM, sensor, and energy datasets to standard ontologies such as BOT, SSN/SOSA, SAREF, and BRICK;
- Vocabulary Hub, which serves as a central ontology and vocabulary registry that provides shared concepts, mappings, and equivalence rules across DTs, ensuring alignment and semantic consistency (Ramachandrani et al. 2025).

### Knowledge Layer

This layer structures the semantic building and district DTs following the dual-layer ontology model (i.e. core plus use-case specific extensions) to support reasoning and federated queries across DTs. The knowledge layer defines how entities, properties, and behaviours are modelled, enabling both static and dynamic aspects (geometry, operational parameters, behavioural trends, and contextual conditions) to be represented in an interoperable format. This layer provides the structural and semantic basis for the building-level and federated district-level DTs.

### Applications Layer

The applications layer enables reasoning, analytics, and integration across Digital Twins tools and services. It aims to support cross-building insights and district-level use cases aligned with ISO 23247's composability and interoperability of DTs, ensuring that DTs can seamlessly exchange data and coordinate analyses across building (local) and district-level domains (ISO 2021).

### Governance Layer

The governance layer underpins the entire framework by defining rules and mechanisms for data access, sharing, and usage. It addresses critical issues such as privacy,

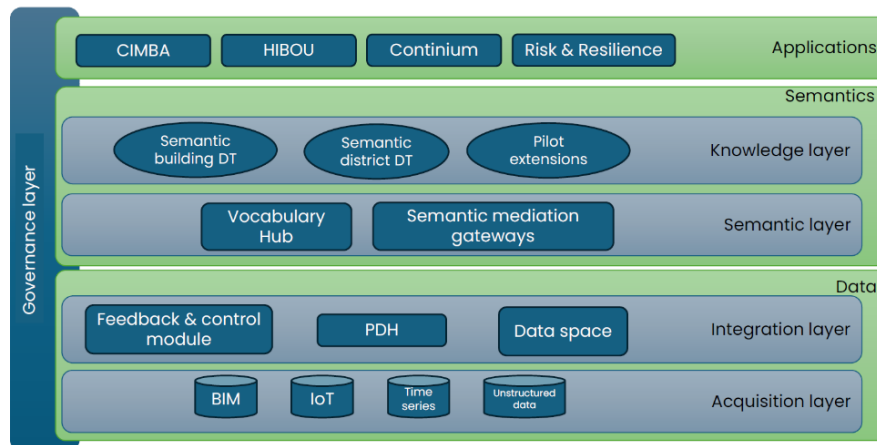


Figure 1 Proposed Information Management Framework

security, consent, and data sovereignty, to allow cross-building analytics and decision support while respecting organisational boundaries and regulatory constraints.

## Semantic Local and Federated Digital Twins

### Role of Semantic Alignment in Multi-Use Case Digital Twins

Semantic alignment is a central enabler of multi-use case digital twins, particularly in environments characterised by heterogeneous data sources, legacy systems, and multiple stakeholders. Without a shared semantic understanding, data originating from different buildings, systems, or domains cannot be meaningfully combined or reused across applications. This challenge becomes even greater when moving from building-level digital twins to federated district-level twins.

In the proposed framework, semantic alignment is treated as a continuous and systematic process embedded within the digital twin lifecycle. It provides the foundation for interoperability across data sources, analytical models, and services, enabling different use cases to operate concurrently on a shared information basis.

### Dual-layer Modelling Strategy for Semantic Alignment

To balance interoperability, extensibility, and long-term maintainability, the framework adopts a dual-layer modelling strategy for semantic alignment. This strategy is particularly suited to construction and built-environment contexts, where stable reference models must coexist with project-specific, evolving information needs.

The core digital twin model captures fundamental concepts that are common across buildings, districts, and use cases. It includes the following entities: *District*, *Building*, *Space*, *System*, *Asset/Component*, *Sensor/Actuator*, *Observation*. The core model is intentionally kept compact, stable, and is aligned with internationally recognised standards and specifications used in construction and digital twin ecosystems. This alignment ensures long-term interoperability and supports integration with external platforms and systems (Table 3). Complementing the core model, context- and use-case-specific extension models are defined to represent additional concepts, attributes, or relationships required in specific use cases. These extensions may capture specialised system configurations, custom KPIs, domain-specific constraints, or locally relevant semantics that are not appropriate for inclusion in a generic core. Importantly, extensions are not isolated schemas: they are explicitly linked to the core model through well-defined semantic mappings. New use cases or data sources can be integrated by extending the model rather than modifying the core, reducing the risk of fragmentation and ensuring backward compatibility across the digital twin federation.

Table 3 – Alignment between DT core model entities and reference standards/ontologies

| Core Entity              | Reference Class / Standard Alignment              | Description (ISO 2023, 2024, ETSI 2017, Brick 2023, W3C 2017, 2021)                                                                          |
|--------------------------|---------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| <b>District</b>          | CityObjectGroup                                   | Represents an aggregation of multiple buildings and infrastructures (e.g. energy, mobility, environment) forming a district-level twin.      |
| <b>Building</b>          | bot:Building / IfcBuilding                        | Represents an individual physical building and its associated metadata such as ownership, use, and geolocation.                              |
| <b>Space</b>             | bot:Space / IfcSpace                              | A physical or functional zone within a building (e.g. room, corridor, floor zone). Used to link spatial context with sensors and assets.     |
| <b>System</b>            | saref:DeviceGroup / brick:System/ IfcSystem       | Represents technical systems such as HVAC, lighting, or electrical distribution that connect assets and sensors.                             |
| <b>Asset / Component</b> | saref:Device / brick:Equipment / IfcAsset         | Represents components within a system (e.g. pump, fan, EV charger). Provide the link between physical equipment and their monitoring points. |
| <b>Sensor / Actuator</b> | sosa:Sensor/sosa:Actuator / IfcSensor/IfcActuator | Devices that capture observations or perform control actions on assets and systems.                                                          |
| <b>Observation</b>       | sosa:Observation                                  | A single measurement or data record generated by a sensor or actuator, including timestamp, unit, and value.                                 |

## Semantic Alignment in Practice: Newcastle Helix

The Newcastle Helix innovation district is a mixed-use urban campus developed through a partnership between Newcastle University, Newcastle City Council and private stakeholders (Figure 2). Within the WILSON project, the pilot focuses on three representative buildings: Urban Sciences Building (USB), The Spark, and The Core. These three buildings provide a diversity of typologies and system maturities (higher education research facility, collaborative workspace, and commercial office respectively), which makes Helix an appropriate demonstrator for testing the semantic DT framework across heterogeneous operational contexts.



Figure 2 - Newcastle HELIX innovation district (UK)

The dual-layer approach to data modelling was applied to the Helix pilot considering:

- A core alignment layer, providing a common shared vocabulary and minimal schema.
- Pilot-specific extensions, representing Helix-specific concepts such as district heating nodes, site-wide EV infrastructure, and Urban Observatory (UO 2026) sensor feeds.

Figure 3 provides the UML diagram for the WILSON DT data model for Newcastle Helix pilot, highlighting the implementation of the proposed dual-layer modelling approach. The core model entities are represented in white, while pilot-specific extensions, representing Helix-specific concepts are highlighted in orange, represented as extensions (or inherited by) the core model.

The mapping of Helix datasets to the WILSON model follows these rules:

BIM data mapped to *Building / Space / Asset*. BIM models are mapped to the WILSON Building and Space classes. Asset registers (e.g. for AHUs, pumps, EV chargers) populate Asset entities with manufacturer and model metadata. The code snippet in TTL syntax in Listing 1 illustrates this example using existing ontologies:

Listing 1 - BIM data mapped to Building / Space / Asset

```
@prefix : <https://wilson-project.eu/helix/> .
@prefix bot: <https://w3id.org/bot#> .
@prefix schema: <https://schema.org/> .

:USB_Building a bot:Building ;
  schema:name "Urban Sciences Building" ;
  bot:hasSpace :Some_USB_Lab ;
  bot:hasElement :USB_AHU_x .

:USB_Lab_2F a bot:Space ;
  schema:name "Second Floor Lab" .

:USB_AHU_01 a schema:Product ;
  schema:manufacturer "Some Manufacturer" ;
  schema:model "Some model" .
```

BMS / IoT feeds mapped to *Sensor / Observation* (Timeseries). Real-time building management system (BMS) feeds, available at the USB and selected systems in other buildings, populate the Sensor and Observation entities. Where structured APIs are available (as in the Urban Observatory APIs (UO 2026)), the Entity–Feed–Timeseries chain is preserved to maintain semantic richness. Aggregated datasets (e.g. hourly averages) are represented as Observations, with metadata describing aggregation level and sampling frequency. The code snippet in TTL syntax in Listing 2 illustrates this example using existing ontologies:

Listing 2 - BMS / IoT feeds mapped to Sensor / Observation

```
@prefix : <https://wilson-project.eu/helix/> .
@prefix sosa: <http://www.w3.org/ns/sosa/> .
@prefix xsd:
<http://www.w3.org/2001/XMLSchema#> .

:USB_TempSensor_2F a sosa:Sensor ;
  sosa:observes :AirTemperature ;
  sosa:madeObservation :Obs_2025_10_24_1200 .

:Obs_2025_10_24_1200 a sosa:Observation ;
  sosa:hasResult "21.3"^^xsd:float ;
  sosa:resultTime "2025-10-24T12:00:00Z"^^xsd:dateTime .
```

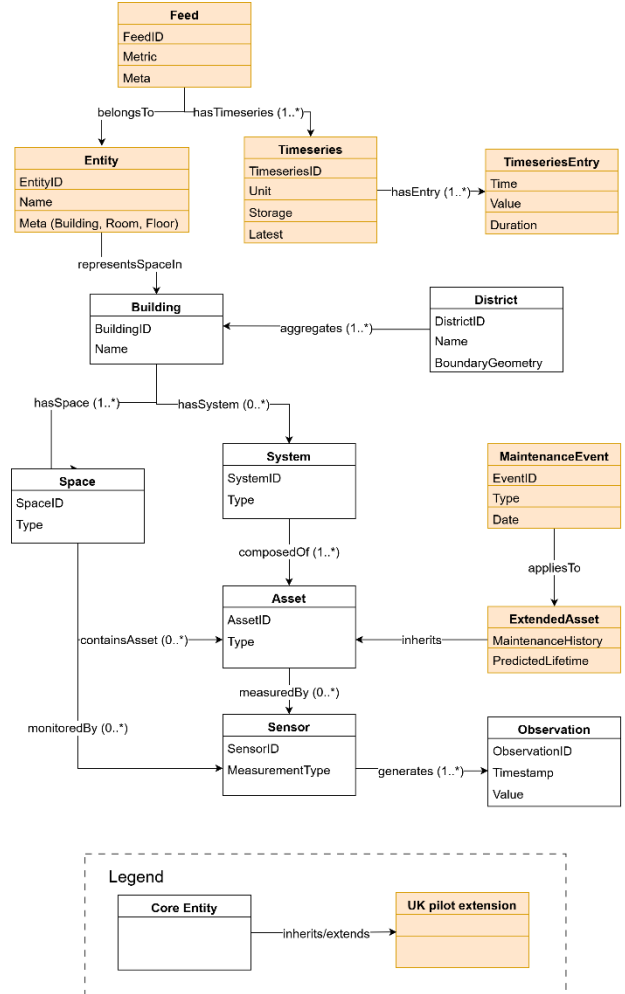


Figure 3 - Digital Twin data model for Helix UK pilot

Asset registers & maintenance logs mapped to *Asset / MaintenanceEvent*. Structured asset condition scores and lifecycle estimates are mapped to attributes of the Asset class (e.g. conditionScore, remainingLifetime). Maintenance actions are captured as MaintenanceEvent, linked to ExtendedAsset metadata. The code snippet using TTL syntax in Listing 3 illustrates this example using existing ontologies:

### Listing 3 - Asset registers & maintenance logs mapped to Asset /MaintenanceEvent

```
@prefix : <https://wilson-project.eu/helix/> .
@prefix schema: <https://schema.org/> .

:Spark_Pump_03 a schema:Product ;
  schema:name "Heating Pump x" ;
  schema:manufacturer "Manufacturer Name" ;
  schema:model "Heating Pump model" ;
  schema:additionalProperty [
    schema:name "conditionScore" ;
    schema:value "0.80"
  ] .

:Spark_Pump_03_Maint_2025_05_14 a
schema:MaintenanceEvent ;
  schema:object :Spark_Pump_x ;
  schema:startDate "2025-01-01" ;
  schema:description "Bearing replacement" .
```

The Helix pilot illustrates several benefits of the proposed semantic alignment approach. Shared core semantics enable the same underlying data to support multiple use cases, while pilot-specific extensions preserve the semantic richness required for detailed local analyses. From a scalability perspective, the dual modelling strategy reduces integration effort when adding new buildings or data sources, as only mappings to the core model are required. Additionally, it enables selective exposure of information at district level, supporting data sovereignty and compliance with the organisational constraints of the Helix district.

## Discussion

The primary contribution of this work lies in the integration of a dual semantic modelling strategy with a federated digital twin architecture, grounded in real multi-use case requirements. While semantic models, BIM standards, and digital twins have been extensively studied individually, their systematic combination to support multiple building- and district-level use cases remains limited. Unlike monolithic or purely BIM-centric approaches, the proposed framework:

- Treats semantics as a key architectural concern, not merely a data integration layer;
- Separates stable, standards-aligned semantics from evolving, use case-specific requirements;
- Aligns with emerging federated data and data space paradigms, which are increasingly relevant for cross-organisational construction ecosystems.

## Limitations and Practical Considerations

Despite its advantages, the proposed approach also presents challenges. Establishing and maintaining high-quality semantic mappings requires upfront effort and domain expertise. Legacy systems and incomplete BIM models may limit the availability of structured information, necessitating incremental or hybrid integration strategies.

Furthermore, while the framework supports federation conceptually and architecturally, its effectiveness will depend on stakeholder willingness to adopt shared governance principles and semantic conventions.

Addressing these factors is an important focus for future work, both during and beyond the duration of the WILSON project.

## Conclusions and Future Work

This paper has presented an information management framework for multi-use case building and district digital twins. By combining a use-case-driven design methodology with a layered and federated architecture, the framework addresses the complexity inherent in supporting diverse applications and stakeholders across multiple spatial scales.

Future work will focus on the implementation and evaluation of the framework in real-world pilots, to demonstrate how shared information resources, model management, and governance mechanisms can enable scalable and reusable digital twin implementations to support use cases at the local (building) and district level.

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