Extended information of Semantic Definition Format (SDF) for Digital Twin

draft-lee-asdf-digital-twin-03

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Location extension of an SDF model (1/2) (remind)

- The sdfLocation
  - ➢ is described using conventional GPS coordinates or postal addresses for physical locations,
  - ➢ which enable extensive reuse and interoperability.
  - ➢ is also described by strings or integers for relative locations.

Location extension of an SDF model (2/2) (remind)

- **Thing: boat (hasLocation)**
  - ➢ **geoLocation: ex) GPS**
  - ➢ **postal address : if exists**
- **Objects: Heaters (hasLocation)**
  - ➢ **Location of boat**
    + relative address
    (for indoor location)

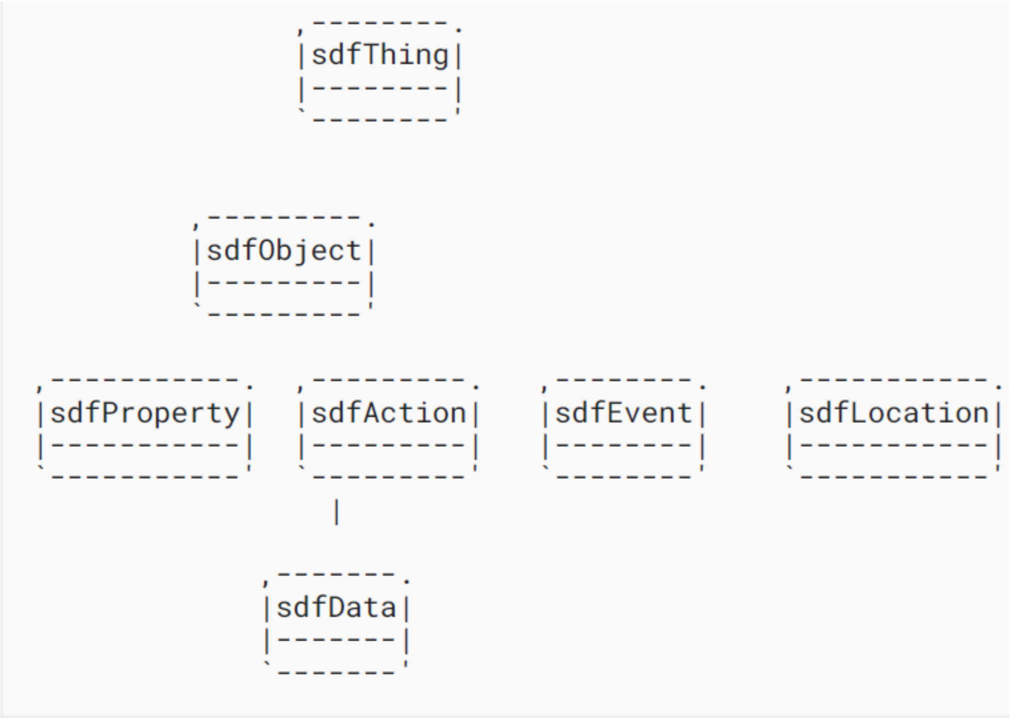

Figure 1: SDF Location Extension of an SDF Model

In this version

- Adjust the table of contents
  - Examples of location in clause 3.4 has been moved to clause 4.
- Requirements for digital twin
  - Added in clause 5
  - With reference to ISO 23247-1 clause 5.3.
- Security Considerations
  - Added in clause 6
  - With reference to ISO 23247-1 clause 5.3.11

Requirements in ISO 23247-1, Version-03 (1/2)

5.3 Requirements of the digital twin for manufacturing

5.3.1 Accuracy → 5.5 Accuracy

A digital twin shall describe the state of its corresponding OME at an appropriate level of fidelity.

5.3.2 Communication

A digital twin shall be connected to an OME using communicate protocols that enable synchronization.

5.3.3 Data acquisition → 5.2 Data acquisition

A digital twin shall collect data from sensors installed on or around an OME. The sensors may be integral or remote to the manufacturing equipment.

5.3.4 Data analysis → 5.3 Data analysis

A digital twin shall enable analysis of the state of its OME.

5.3.5 Data integrity

A digital twin shall correctly describe the state of its OMEs.

5.3.6 Extensibility

A digital twin shall be extensible to new applications.

5.3.7 Granularity

A digital twin shall provide insight into the state of its OME at appropriate levels of detail.

5.3.8 Identification → 5.4 Identification

A digital twin shall contain data that uniquely selects its OME.

5.3.9 Management

A digital twin shall enable optimization of resources.

5.3.10 Product life-cycle

A digital twin shall support information continuity throughout the product life-cycle including design, planning, manufacturing, and maintenance. Examples of product life-cycle digital twins are given in Annex A.

ISO 23247-1

5.5. Accuracy

The sdfThings and sdfObjects should be represented as digital twins with appropriate levels of detail and accuracy, depending on the application.

5.2. Data acquisition

Data related to sdfThing and sdfObject, such as sdfProperty, sdfData, and sdfLocation, should be collected from IP and non-IP devices.

5.3. Data analysis

The collected data needs to be analyzed to understand the state of sdfThing and sdfObject.

5.4. Identification

The sdfThings and sdfObjects should contain data that uniquely identifies them as digital twins.

SDF for Digital Twin

Requirements in ISO 23247-1, Version-03 (2/2)

5.3.11 Security → 6. Security Considerations

A digital twin shall only communicate with authorized resources.

5.3.12 Simulation

A digital twin shall enable simulation of an observable manufacturing element in operation.

5.3.13 Synchronization → 5.6 Synchronization

A digital twin and its observable manufacturing element shall be updated to each other's value using an appropriate method. The method may be event-based or time-based. An event-based method updates the twin in response to an event. A time-based method updates the twin continuously by reading values from a time-stamped data stream.

5.3.14 Viewpoint

A digital twin shall support different views for different objectives.

5.3.15 Hierarchical modelling of digital twin for manufacturing

A digital twin shall model any level of the functional and role-based hierarchy defined in IEC 62264-1.

ISO 23247-1

6. Security Considerations

Only authorized users should have the authority to manage sdfThings and sdfObjects.

5.6. Synchronization

The sdfThings and sdfObjects should be synchronized with their digital twins in real-time as appropriate for the application. Newly added or removed sdfThings and sdfObjects should be recognized and reflected in the digital twin.

SDF for Digital Twin

Conclusion and future plans

- More information to represent an object as a digital twin
- Requirements of SDF model for digital twin, if needed (version 03)
  - Added in clause 5
- The detailed Figure 1 or reference architecture for digital twin
- The protocol for digital twin
- The data format for location