

Digital Twin Support for SDF

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Digital Twin Use Case

- Non-affordance information
 - As a developer of digital twin systems, I need to use SDF to model all the elements of a digital twin, whether or not they expose software interfaces, so that I can offer a simple JSON based interface to full and complete digital twin models
- Instance Graphs
 - As a developer of digital twin systems, I need the capability in SDF to create instance graphs using application-defined relation types, so that the models can interoperate with RDF systems and graph databases

Non-affordance information

- SDF Affordances: Properties, Events, Actions
- Implies a software interface to a physical device
- Digital Twin: Models of things that don't have affordances
- Models of the non-affordance aspects of things that also have affordances
- For example: Assets, Organizations, Equipment, Control Graphs

Declared Properties

- Special Property type with (pre-)declared values (parameters, constants) vs. Affordances with thing-supplied values
- Object or Thing level
- Re-use sdfData definitions, and the sdfProperty pattern
- sdfDeclaredProperty?

sdfDeclaredProperty

sdfThing:

 waterPump:

 sdfRef: "/sdfCommon/sdfObject/pumpTemplate"

 sdfDeclaredProperty:

 housingColor:

 sdfRef: "/sdfCommon/sdfData/color"

 color:

 const: red

 sdfProperty:

 runMode:

 (...)

Instance Graphs

- Graph connections between instances using links
- Transform SDF models to/from RDF and Property Graphs
- Need aspects of both sdfRelations and hyperlinks
- SDF constraint definitions, class definitions, "terminology box"
- SDF subclass/instance definitions, "assertion box"
- Incremental refinement/subclassing, abox becomes tbox for the next level of refinement
- Instance is a singleton subclass
- We don't have a constraint language like SHACL,

High Level Specification Structure

- SDF
 - Digital Twin Support
 - Non-Affordance Information
 - Vocabulary term - DeclaredProperty
 - Location, Color, Physical Dimensions, Ratings, etc.
 - Linking
 - RDF Compatible relation/link
 - Class vs. Instance delineation
 - Vocabulary term needed?
 - Other?