**Integrating Digital Reference Ontology with GENIAL! Basic Ontology (GBO+BFO)**

General Remarks: GBO is more structured, DRO has more terms, DRO imports from SSN and Time ontology, it does not have a ‘unit’ class from the units of measure and related concepts like GBO, but a similar ‘measure’ class. This document shows some similarities and differences.

In general, it seems a good idea to align both ontologies integrating the terms of this table and subclassing the terms of DRO with maybe some intermediary classes.

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| BFO+GBO Term | DRO Term | BFO+GBO Definition | Digital Reference Ontology Definition |
| Entity (superclass of almost everything) | Entity (superclass of major categories, but they are not all classified) | An entity is anything that exists or has existed or will exist. (axiom label in BFO2 Reference: [001-001]) | Anything: real, possible, or imaginary, which some modeller wants to talk about for some purpose. |
| system | System | according to ISO 26262: (continuant that is a) set of components (3.21) or subsystems that relates at least a sensor, a controller and an actuator with one another | <http://www.w3.org/ns/ssn/System>  System is a unit of abstraction for pieces of infrastructure that implement Procedures. A System may have components, its subsystems, which are other systems. |
| software / software element (defined with label) | Software / Software System (defined with equivalence) | one or more softwareunits (3.159)  From definition of element:  Note 1 to entry: When “software element” or “hardware element” is used, this phrase denotes an element of software only or an element of hardware only, respectively. | Software System. The class Software represents a series of computer instructions that tell the computer how to operate and execute specific tasks. |
| material object | Material | We have no definition here yet, but yes it is about the same what we intend to use than DRO | The matter from which something can be made. Material can include but is not limited to raw and processed material, components, parts, assemblies, sub-assemblies, fuels, lubricants, coolants, cleaning agents, and small tools and accessories that may be consumed directly or indirectly. |
| - | Computer Hardware |  | Physical equipment that makes up a computer system, such as circuit boards, keyboard and mouse, monitor, printer, power supply, storage devices. Contrasts with software. |
| material entity | - | A material entity is an independent continuant that has some portion of matter as proper or improper continuant part. (axiom label in BFO2 Reference: [019-002]) |  |
| role | Role | b is a role means: b is a realizable entity & b exists because there is some single bearer that is in some special physical, social, or institutional set of circumstances in which this bearer does not have to be& b is not such that, if it ceases to exist, then the physical make-up of the bearer is thereby changed. (axiom label in BFO2 Reference: [061-001]) | 1. <http://www.w3id.org/ecsel-dr-ORG#Role> Defines the responsibilities assumed by an individual.  2. <http://www.w3id.org/ecsel-dr-PMV#Role> Business Role (Person) that performs task. |
| property (subclass of quality) | Property | A quality or characteristic of a hardware part, software unit or function. A property has a boolean, integer, or real variable through the measure class. (I realize this definition can be improved) | Namespace: http://www.w3.org/ns/ssn/Property. A quality of an entity. An aspect of an entity that is intrinsic to and cannot exist without the entity. |
| measure | Measure | A bfo:quality that are amounts of quantities | To discover the exact size or amount of something |
| - | Device |  | A device in the context of Arrowhead framework is a piece of equipment, machine, hardware, etc. with computational, memory, and communication capabilities which hosts one or several Arrowhead Framework systems.  (Source: Arrowhead) |
| object (we also have engineered object, social object and material object) | Physical object | b is an object means: b is a material entity which manifests causal unity of one or other of the types CUn listed above & is of a type (a material universal) instances of which are maximal relative to this criterion of causal unity. (axiom label in BFO2 Reference: [024-001]) | Any physical object |
| social object | Social Object | - (undefined) | Act of carrying out an (Observation) Procedure to estimate or calculate a value of a property of a FeatureOfInterest. Links to an ObservableProperty to describe what the result is an estimate of, and to a FeatureOfInterest to detail what that proeprty was associated with.  Example: The activity of estimating the intensity of an earthquake using the Mercalli intensity scale is an Observation as is measuring the moment magnitude, i.e., the energy released by said earthquake. (Are you sure this is correct? It seems like a different definition) |
| Object (same as above) | Physical Resource |  | A material thing |
| - | Software system | - | System software is software designed to provide a platform for other software. |
| function | Function object? | A bfo:function that a component, hardware part or software unit implements | In IndustryPrint 5, function objects are used to model the decomposition of a process. |
| actuator | Actuation (the action, actuator is not defined) | Not defined in ISO26262 | An Actuation carries out an (Actuation) Procedure to change the state of the world using an Actuator. |
| sensor | Sensor | Not defined in ISO26262 | Device, agent (including humans), or software (simulation) involved in, or implementing, a Procedure. Sensors respond to a stimulus, e.g., a change in the environment, or input data composed from the results of prior Observations, and generate a Result. Sensors can be hosted by Platforms. |
| process | process | p is a process = Def. p is an occurrent that has temporal proper parts and for some time t, p s-depends\_on some material entity at t. (axiom label in BFO2 Reference: [083-003]) | 1. Sequence of interdependent and linked procedures which, at every stage, consume one or more resources (employee time, energy, machines, money) to convert inputs (data, material, parts, etc.) into outputs. These outputs then serve as inputs for the next stage until a known goal or end result is reached. 2. A process has an output and possibly inputs, and for a compositive process, describes the temporal and dataflow dependencies and relationships amongst its parts. |

Remarks: Role is here a subclass of Person, in BFO (and actually most upper ontologies) a role is not a person, but something a person bears

To be looked at: Integration BFO and Time Ontology

**Merging, integration, Discussion (Comments)**

Take from GBO, BFO:

Entity as top level

Object, Quality (similar to BFO)

Abstract (DUL) is not there directly in BFO, may be close to immaterial entity

Property is also a quality (DUL) DUL:DOLCE UltraLight, a bit different that BFO

->same how we did it with our property

->quality does not have the DUL namespace

Properties: group currents and voltages together

Agent->social object (e.g. people, organization, group) BUT a robot is also an agent, is an actuator an agent because it acts?

Material is a subclass of Input here, that means that everything that is an instance of material is an instance of input->redo

What we also will use in our further models (further down, e.g. eFuse use case):

SiC MOSFET

Solution

Supply Chain

Technology

Application area

customer