Conformance to standards

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Abstract. In this paper we present the **S**tandards **E**nforcer **P**attern (SEP). The remit of SEP is to enable the ontological modelling of processes, activities, operations and services that enforce guideline(s) recommended by a specific standard and need to explicitly indicate their conformance to it. The pattern allows the inclusion of minimalistic information regarding the conformance, while retaining the flexibility to extend the ontological primitives as required. As an exemplifier for the pattern, we present a use case from the algal biomass domain. We model the process of algal biomass production that enforces the Minimum Descriptive Language (MDL) standard for algal operations.

1 Introduction

Activities, operations, processes and services in most domains of interest are governed by standards. The objective of a standard is to ensure consistency in implementations and uniformity in quality by ensuring the **repeated** and continuous use of prescribed rules and guidelines. The ISO/IEC Guide 2:1996 [1], definition 3.2 defines a standard as a set of specification that is "established by consensus and approved by a recognized body that provides for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context".

In order to provide a generic mechanism for the inclusion of ontological modelling primitives of conformance to standards, independent of the domain of application and the context of processes, we propose the content ontology design pattern **S**tandards **E**nforcer **P**attern (SEP).

2 Standards Enforcer Pattern (SEP)

2.1 Intent

The remit of the SEP content pattern is to represent the relation between standards and the processes, operations, activities and services that enforce them,

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[1] http://www.etsi.org/WebSite/Standards/WhatIsAStandard.aspx

the domains they cater to and the scope of that specific process, operation, activity, service within the context of the domain.

2.2 Competency Questions:

- Which are the standards enforced by this process?
- Which processes enforce these standards ?
- What is/are the domain level scope(s) of the standard?
- Within the context of the domain what is the scope of the process, activity, operation and service to which the standard is applicable?
- What are the prescribed guidelines for a standard?
- Which prescribed guideline(s) of a standard does a specific process conform to?

2.3 Some Conceptual Elements

- `Standard`: A specification established through domain expert consensus that prescribes a set of rules and guidelines for a given contextual activity within a domain. The standard must be described informally or formally in a written document.
- `Guideline`: An entity defining a guideline included in a standard. Guidelines are usually prescribed as clauses in the written document for the standard.
- `StandardEnforcingProcess`/`Operation`/`Activity`: The domain specific entity which enforces one or more guidelines from one or more standard.
- `DomainScope`: The domain/industry/paradigm for which the standard has been designed.
- `ProcessScope`: The activity within a specific domain/industry/paradigm which is governed by the process, e.g., algae harvesting activity which is part of the biomass production process in the domain of biofuels, shielded metal arc welding used in the production of tools in the manufacturing domain.
- `enforcesStandard`: The relationship between the enforcing process and the standard.
- `enforcedBy`: The relationship between the standard and the enforcing process. This is an inverse relationship to `enforcesStandard`.
- `hasDomainScope`: The relationship linking the standard with the domain to which it is applicable. A standard can cover multiple domains.
- `hasProcessScope`: The relationship linking the standard enforcing process with the scope of the process. A standard enforcing process can include multiple process scopes.
- `hasDescriptionDocument`: The relationship linking the standard to the real world document that informally/formally describes it. The object value for this property is a pointer (URI) to the document resource representing the standard.
- `hasDescriptionClause`: The relationship linking a guideline to the prescribing clause in the real world document for the standard. The object value for this property is a pointer (URI) to the clause in the document resource representing the standard.
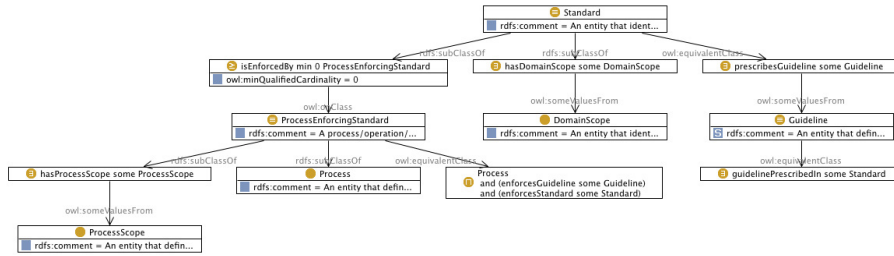
2.4 Pattern Representation

The Manchester syntax rendering for the concept `Standard` are illustrated below:

```
Class: Standard
    EquivalentTo:
        (hasDomainScope some DomainScope)
         and (prescribesGuideline some Guideline)
         and (hasDescriptionDocument min 1 owl:Thing)
    SubClassOf:
        isEnforcedBy min 0 ProcessEnforcingStandar
```

Note that in the definition of a standard, we require that it includes the scope of the domain, guidelines and the description document that informally defines the standard.

Figure 1 illustrates the graphical representation of SEP [2] [3].

Fig. 1. Graphical Representation of **S**tandards **E**nforcer **P**attern (SEP)

2.5 Consequences

The pattern can be applied to use cases in all those domains where a standard is enforced to regulate processes. The main advantage of this pattern is that it provides the capability to link processes, operations, activities and services to

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[2] The OWL ontology for the pattern is available at http://purl.org/biomass/SEP

[3] Graphical representations of the pattern in this paper have been produced using a trial version of the Maestro edition of TopBraid Composer.

their governing standards in a generic and "compositional" manner. In some scenarios it is possible that a process or an operation does not enforce all prescribed guidelines but enforces atleast some. The pattern accounts for that through the definition of the process enforcing the standard.

2.6 Example usage: Algal Biomass Domain

As an exemplifier for SEP, we present a use case from the domain of algal biomass production. Figure 2 depicts the application of SEP to an ontology that models algal biomass production. The "Minimum Descriptive Language"(MDL) standard[4] proposed by the Algal Biomass Association is enforced by the production operation. MDL recommends a set of descriptive metrics to uniformly characterise the analysis of large scale algal operations. In this use case, the ontology defines the concepts and relationships for the operation and incorporates SEP by enforcing a guideline for measuring Carbon input to the operation.
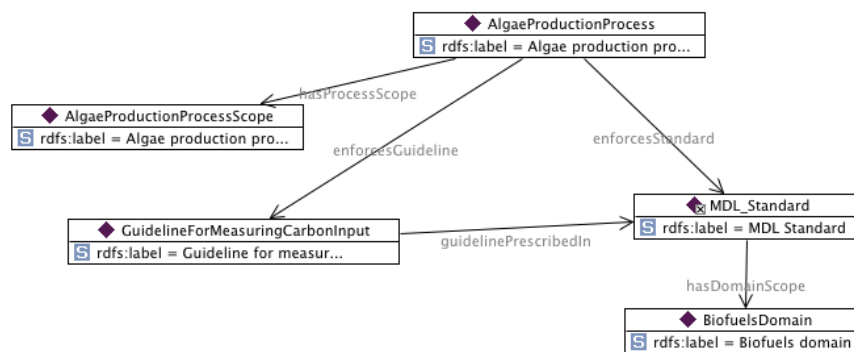
Fig. 2. Graphical Representation of SEP as applied to the domain of algal biomass production

3 Summary

SEP provides a mechanism to ontologically declare the conformance of a process with one or more standards. The pattern is flexible and compositional. It can be exploited to include few or more guidelines from multiple standards and can be easily combined with other patterns.

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[4] http://www.algalbiomass.org/