Faceted Classification Scheme ODP

http://ontologydesignpatterns.org/wiki/Submissions:Faceted_Classification_Scheme

Bene Rodriguez-Castro
School of Electronics and
Computer Science
University of Southampton
Southampton, UK
b.rodriguez@ecs.soton.ac.uk

Hugh Glaser
School of Electronics and
Computer Science
University of Southampton
Southampton, UK
hg@ecs.soton.ac.uk

Les Carr
School of Electronics and
Computer Science
University of Southampton
Southampton, UK
lac@ecs.soton.ac.uk

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1. INTRODUCTION

The Faceted Classification Scheme (FCS) ODP is a Reengineering ODP that transforms a non-ontological resource from the field of Library and Information Science, also known as Faceted Classification Scheme, into an ontological resource. The ontological resource corresponds to an OWL DL model that results from a specific application of the Normalisation ODP [4] [2] based on a series of (a) alignments between the two conceptual models; and (b) transformation guidelines.

The FCS ODP targets a specific, very recurrent modeling issue in ontology development, subject to the vulnerability of ad-hoc modeling practices that could potentially lead to unexpected or undesirable results in ontology artifacts. The scenario consists of domain-specific concepts that can be represented according to multiple alternative classification criteria. To the best of our knowledge, guidelines for the conceptualization and representation of domain-specific concepts prone to be described based on multiple (potentially alternative) classification criteria, has not been explicitly considered in the context of ontology modeling for the Semantic Web.

An extended and detailed version of all the sections that follow and the rationale behind the FCS ODP is presented at length in [5].

2. PATTERN DESCRIPTION

A FCS is defined as: "a set of mutually exclusive and jointly exhaustive categories, each made by isolating one perspective on the items (a *facet*), that combine to completely describe all the objects in question, and which users can use, by searching and browsing, to find what they need" [1].

The Norm. ODP is classified as a "Good Practice" pattern in the catalog of ODPs introduced in [2]. It can be applied to any OWL DL ontology that consists of a polyhierarchy where some *semantic axes* can be pointed. Each of those axes will be a *module*.

The key similarity between these two conceptual models, lies in the notion of (a) facet in FCSs; and (b) module (or semantic axis) in the Norm. ODP. Both elements represent one perspective of the domain being modelled, a single characteristic of division, a single criterion of classification in their respective paradigm.

Library Sc.	Ontology Modeling	
FCS	**FCS ODP**	**OWL Impl.**
TDC	$:TDC$	owl:Class (primitive)
$Facet_i$	$:Facet_i$	owl:Class (primitive)
	$:hasFacet_i$	owl:ObjectProperty
F_iTerm_j	$:F_iTerm_j$	owl:Class (primitive)
	$:F_iTerm_jTDC$	owl:Class (def.) ($\equiv$)
$Item_x$	$:SpecificTDC_x$	owl:Class (primitive)

Table 1: Alignment of a FCS to the Norm. ODP

```
owl:Thing
    |-- :Facet_i
        |-- :F_iTerm_j
    |-- :TargetDomainConcept (or :TDC)
        |-- (≡) :F_iTerm_jTDC
        |-- :SpecificTDC_x

owl:topObjectProperty
    |-- :hasFacet_i
```

($\equiv$) denotes a defined owl:Class.

Figure 1: FCS elements placed into the Norm. ODP

The main principle is to represent each facet as an independent module or semantic axis. Following this principle makes the application of the Norm. ODP *almost* straightforward. Moreover, the resultant ontology includes the representation of the multiple alternative classification criteria that were considered in the original FCS for the target domain concept.

Table 1 summarizes the alignment of the elements in the generic structure of both conceptual models. This alignment enables the conversion of a FCS into an OWL DL ontology by applying the Norm. ODP, where:

- TDC denotes the target domain concept (or domain of discourse) of the FCS.

- $Facet_i$ denotes one of the facets of the FCS.

- F_iTerm_j denotes one of the terms of $Facet_i$.

- $Item_x$ denotes one the items from the domain of discourse to be classified.

Figure 1 depicts the placement of the elements of a generic FCS into the generic structure of the Norm. ODP based on the corresponding mappings from Table 1.

```
Agent: dishwasher, person

Form: gel, gelpac, liquid, powder, tablet

Brand Name: Cascade, Electrasol, Ivory, No Name,
            Palmolive, President's Choice, Sunlight

Scent: green apple, green tea, lavender, lemon,
       mandarin, ocean breeze, [...]

Effect on Agent: aroma therapy (subdivisions:
                 invigorating, relaxing)

Special Property: antibacterial
```

Figure 2: Example of "Dishwashing Detergent" FCS.

3. PATTERN USAGE EXAMPLE

Figure 2 presents the facets and terms of a FCS example in the domain of "Dishwashing Detergent" from [1].

To apply the FCS ODP, the elements in the generic ontology structure (derived from the Norm. ODP) in Fig. 1 are populated with the facets and terms of the "Dishwashing Detergent" FCS example in Fig. 2, according to the alignments specified in Table 1. The overall normalised ontology model obtained as a result is presented in Fig. 3. A version of the complete normalised ontology model for the "Dishwashing Detergent" FCS example in [1] is available online[1] in RDF/XML format.

4. RELATED WORK

The FCS ODP considered previous work that defined mappings between different semantic models and OWL ontologies such as the Resource Space Model (RSM) [6] and the concept of Faceted Lightweight Classification Ontology [3]. A detailed discussion is available in [5].

5. CONCLUSIONS

The FCS ODP has presented an initial set of basic design guidelines to develop an OWL DL ontology model that supports the representation of multiple alternative classification criteria of a specific domain concept. These guidelines provides a *partial* solution to potentially hazardous ad-hoc practices in the development of such ontology models, putting forward a systematic and fit-for-purpose approach.

6. REFERENCES

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[1] http://purl.org/net/project/enakting/ontology/detergent_fcs_norm

```
owl:Thing
   |-- :Agent
      |-- :Person
      |-- :Dishwasher
   |-- :Form
      |-- :Gel
      |-- :Gelpac
      |-- (... rest of terms in the facet "Form")
   |-- :BrandName
      |-- :Cascade
      |-- :Electrasol
      |-- (... rest of terms in the facet "Brand Name")
   |-- :Scent
      |-- :GreenApple
      |-- :GreenTea
      |-- (... rest of terms in the facet "Scent")
   |-- :EffectOnAgent
      |-- :AromaTherapy
         |-- :Invigorating
         |-- :Relaxing
   |-- :SpecialProperty
      |-- :Antibacterial
   |-- :DishwashingDetergent (:TDC)
      |-- (≡) :ManualDishDetergent
      |-- (≡) :DishwasherDishDetergent
      |-- (≡) :GelDishDetergent
      |-- (≡) :GelpacDishDetergent
      |-- (≡) (... rest of subclasses for each term
                  in the facet "Form")
      |-- (≡) :CascaseDishDetergent
      |-- (≡) :ElectrasolDishDetergent
      |-- (≡) (... rest of subclasses for each term
                  in the facet "Brand Name")
      |-- (≡) :GreenAppleDishDetergent
      |-- (≡) :GreenTeaDishDetergent
      |-- (≡) (... rest of subclasses for each term
                  in the facet "Scent")
      |-- (≡) :AromaTherapyDishDetergent
        |-- (≡) :InvigoratingDishDetergent
        |-- (≡) :RelaxingDishDetergent
      |-- (≡) :AntibacterialDishDetergent
      |-- :PresidentsPersonLiquidAntibacterial
      |-- :PalmoliveAromaTherapyLavenderYlangYlang
      |-- :SpecificDishDetergent3
      |-- (... rest of specific dish detergent classes
            :SpecificDishDetergent_x to classify)

owl:topObjectProperty
   |-- :hasAgent
   |-- :hasForm
   |-- :hasBrand
   |-- :hasScent
   |-- :hasEffectOnAgent
   |-- :hasSpecialProperty
```

(≡) denotes a defined owl:Class.

Figure 3: Normalised ontology structure of the "Dishwashing Detergent" FCS.

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