Untangling Domain Concepts in Ontology Design Patterns
Bene Rodríguez-Castro and Hugh Glaser
Dependable Systems and Software Engineering Group
{br205r, hg}@ecs.soton.ac.uk

Motivation
- Certain ontology domain concepts are difficult to model due to:
  - The complexity of their definition.
  - The number of roles they fulfill in the ontology.
  - The different types of relationships they participate in.
- In the context of the ReSIST project, the representation of the Fault domain concept has to fulfill a dual role:
  - Classifying occurrences of actual faults in real world systems.
  - Providing a keyword index for: subjects of publications, research interest areas of projects, institutions or people, and support of resilient mechanisms.
- ReSIST Knowledge Base Explorer: www.rkbexplorer.com/explorer/

Roles of Domain Concepts in ODPs
- Generic Class Hierarchy (GCH): refers to a set of classes organized in any hierarchical structure (e.g. a single class or a set of classes organized in a list, a tree or a directed acyclic graph).
- Domain Class Hierarchy (DCH): refers to any GCH that contains the classes corresponding to the domain concepts that the ontology is intended to represent.
- Value Class Hierarchy (VCH): refers to any GCH that is used to provide anonymous individuals as values to properties for other domain concepts in the ontology.
- Value Partition Class Hierarchy (VPCH): refers to a GCH that: a) is a Value Class Hierarchy and b) conforms to the definition of a value partition.
- Domain Concept Space (DCS): identifies the subset of the ontology model that contains all the classes that belong to a Domain Class Hierarchy.
- Value Space (VS): identifies the subset of the ontology model that contains all the classes that belong to a Value Class Hierarchy or Value Partition Class Hierarchy.

ODP1: Pattern 2 – Variant 2 in [Rector 2005]
Representing Specified Values in OWL: “value partitions” and “value sets”

Similarities between the 2 ODPs examined
- Both use a hierarchy of classes to provide anonymous individuals as property values:
  - In [Rector 2005] the hierarchy is used as a representation of features that describe other concepts in the ontology.
  - In [Noy 2005] the hierarchy is used as a subject index to annotate other domain concepts in the ontology.
- Both keep ontology expressivity within OWL-DL.

Differences between the 2 ODPs examined
- Regarding the hierarchy of classes:
  - In [Rector 2005] it conforms to the definition of value partition.
  - In [Noy 2005] it could be organized in any hierarchical structure.
- Regarding anonymous individuals:
  - In [Rector 2005] they are of the same type of the other individuals in the class.
  - In [Noy 2005] they are of different type of the other individuals in the class.

Representative of Fault in the ontology for ReSIST

Reusability Scenario

Reusability of Domain Concepts in ODPs
- Let us consider a single ontology O1, with two Domain Class Hierarchies DCH1 and DCH2:
  - In the context of [Rector 2005] and [Noy 2005] we can reuse DCH2 as a Value Class Hierarchy for DCH1 in the same ontology O1.
  - In that case DCH2 becomes part of the Value Space in O1 causing both the DCS and the VS in O1 to overlap.

Conclusions
- The characteristics of role and reusability presented untangled these two aspects when modelling the Fault concept in the ontology for ReSIST. Fault is represented as a class hierarchy reused to fulfill a dual role:
  - The role of a DCH to represent instances of actual faults in real world systems.
  - The role of a VCH for other domain concepts in the ReSIST ontology (e.g. topics of publications or people’s research interests).

This work is supported under the ReSIST Network of Excellence (NoE) which is sponsored by the Information Society Technology (IST) priority of the EU Sixth Framework Programme (FP6) under contract number IST-4-026764-NOE