

Summarization of an inverse n-ary relation

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ABSTRACT

In this paper, we describe a logical ontology design pattern that summarizes a relationship and its inverse between two distinguished members of an n-ary relationship.

Keywords

Ontology design pattern, N-ary relation, inverse relation.

1. INTRODUCTION

In Semantic Web languages such as RDF and OWL, a property is a binary relation. This binary relation is used to link two individuals or an individual and a value. In some cases, however, the natural and convenient way to represent certain situations is to use relations and to link an individual to more than just one individual or value. These relations are called *n-ary relations*¹.

The n-ary relations become even more complex if we pretend to represent inverse relationships² between all the participants in the n-ary relation. However, we might have special interest in the links between two of the participants involved in the relationship, and not have interest in all of them. For this reason, we propose a pattern to speed up both the modelling and the queries of a relationship between two distinguished participants in an n-ary relation, and its inverse relationship.

2. PATTERN DESCRIPTION

2.1 Motivation

It is well known that an n-ary relationship should be used to address any of the following situations [1]:

- A binary relationship that really needs a further argument. For example, to represent the distance between two places.
- Two binary relationships that always go together and should be represented as one n-ary relation. For example, to represent the value of an observation (e.g. temperature in a patient) and its trend.

- A relationship that is really amongst several things. For example, to represent the spatial location of a person in a given point of time.

On the one hand, the motivation of this pattern is to express the inverse relationship of an n-ary relation in which there are two distinguished participants. This means that the relationship exists mainly between two entities and the rest of entities involved in the relationship can be considered as additional arguments. This situation can also mean that there is a single individual standing out as the subject or the "owner" of the relation.

On the other hand, the motivation is to provide a shortcut for queries that involve two distinguished participants in the n-ary relationship.

This pattern is inspired on the third consideration shown in the description of n-ary relations³ from the W3C Semantic Web Best Practices Group (SWBP Group). The difference in our case is that there are two distinguished participants in the relationship. Therefore, this pattern could be considered as an extension of the third consideration shown by the SWBP Group applied to the use case of additional attributes describing a relation⁴.

2.2 Aim

The aim of this pattern is to allow asking for n-ary relationships and their inverse relations between two distinguished participants without a complex query. Such a complex query would involve the class created to support the n-ary relation between the origin and destination classes of the n-ary relationship.

2.3 Solution description

As it can be observed in Figure 1 the class "NAryRelationClass" is the class created to support the n-ary relationship⁵ and its further relations or attributes. The relationship "mainRelationship" and its inverse relation have been created to

¹ <http://www.w3.org/TR/swbp-n-aryRelations/>

² <http://www.w3.org/TR/swbp-n-aryRelations/#choosingPattern1or2>

³ <http://www.w3.org/TR/swbp-n-aryRelations/#choosingPattern1or2>

⁴ <http://www.w3.org/TR/swbp-n-aryRelations/#useCase1>

⁵ This structure is created like in [1] and <http://www.w3.org/TR/swbp-n-aryRelations/#useCase1>

short-circuit the relation between the distinguished participants in the n-ary relationship.

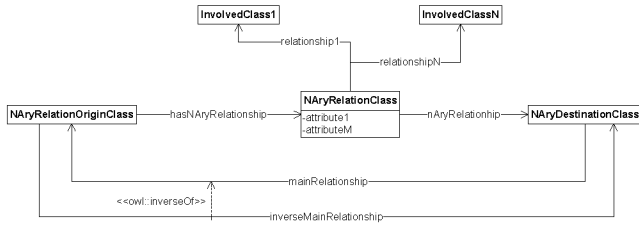


Figure 1. Graphical representation of the “Summarization of an inverse n-ary relation” pattern.

3. Example

3.1 Problem example

We might want to represent that a service provider provides a service at a place in a given period of time with a particular price. The model should also represent that a service is offered by a provider.

In this scenario, we have also observed that the queries executed by our applications often ask for the relationship between providers and their services and rarely ask for the relationships about the services and where they are provided.

Figure 2 depicts the result of applying the “Summarization of an inverse n-ary relation” pattern to represent the abovementioned problem.

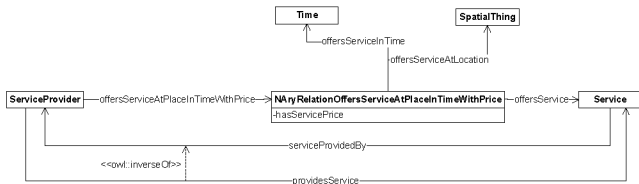


Figure 2. “Summarization of an inverse n-ary relation” pattern applied to service providers.

3.2 Consequences

The main advantage of this pattern is that allows asking for those services that are provided by a service provider and vice-versa without a complex query. This complex query would involve the class created to support the n-ary relation between service providers and services.

4. Related Work

The origin of this pattern is the *Logical Pattern for Modelling N-ary Relation: Introducing a New Class for the Relation* pattern⁶ and the third consideration shown in the description of n-ary relations from the W3C SWBP Group. Therefore, this pattern is related to and can be used in combination with the *Logical Pattern for Modelling N-ary Relation: Introducing a New Class for the Relation*.

5. Summary and Outlook

The *Summarization of an inverse n-ary relation* pattern allows us to speed up the queries involving relationships between two distinguished participants in an n-ary relation.

Future lines of work will address the problem of summarizing the relationships and their inverse between a set of distinguished member (at least three) into an n-ary relationship.

In addition, the elaboration of guidelines that explain in detail how to identify the distinguished members in an n-ary relationship would be very useful to extend the pattern description and to facilitate its use.

6. ACKNOWLEDGMENTS

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7. REFERENCES

- [1] Suárez-Figueroa, M.C., Brockmans, S., Gangemi, A., Gómez-Pérez, A., Lehmann, J., Lewen, H., Presutti, V., Sabou, M. *NeOn D5.1.1: NeOn Modelling Components*. NeOn project. <http://www.neon-project.org>. March 2007

⁶ <http://www.w3.org/TR/swbp-n-aryRelations/#pattern1>