Applying OWL Ontology to Zachman Framework for Requirement Analysis

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Abstract. When the requirements of stakeholders are identified for the system development, the requirements collected should be formalized for their analysis and use. Zachman Framework is an enterprise architecture framework that provides a formal and highly structured way of viewing and defining an enterprise; it can provide a systematic way to formalize the requirements. This paper proposes an OWL ontology-based Zachman Framework for the requirement analysis. The proposed approach presents overall procedure and details ontology modeling in Protégé OWL.

Keywords: Zachman Framework, OWL Ontology, Requirement Analysis

1 Introduction

Understanding the requirements of stakeholders is a critical factor to determine whether the system meets the purpose for which it was intended. Requirement engineering is the process of discovering that purpose, by identifying stakeholders and their needs, and documenting these in a form that is amenable to analysis, communication, and subsequent implementation [1]. That is, the requirements need to be formalized in a systematic way to support the design and development of system. We applied Zachman Framework to the requirement analysis to satisfy that purpose. However, there were some difficulties in applying Zachman Framework: 1) no relationship among six cells; 2) no recommended procedures; and 3) no consistent modeling method. To address those difficulties, this paper proposes an approach to implement Zachman Framework using OWL (Web Ontology Language) ontology. The approach describes overall procedure and details ontology modeling in Protégé OWL.
2 Zachman Framework

Zachman Framework is an enterprise architecture framework that provides a formal and highly structured way of viewing and defining an enterprise. It consists of a two dimensional classification matrix based on the intersection of six communication questions (What, Where, When, Why, Who and How) with five levels of reification, successively transforming the most abstract ideas (on the Scope level), through the Business Model, System Model, and Technology Model levels, into more concrete ideas (at the Detailed Representation level) [2][3].

This paper considers only the top three layers, namely the Scope, Business Model, and the System Model, in the context of the requirement analysis. Scope is a contextual level and has a planner’s perspective; it describes the models, architectures, and representations that provide the boundaries for the organization and explain what senior executives must consider when they think about the organization and how it interacts with the world. Business Model is a conceptual level and has an owner’s perspective; it describes the models, architectures, and descriptions used by the individuals who are the owners of the business process. System Model is a logical model and has a designer’s perspective; it describes the models, architectures, and descriptions used by technicians, engineers, and contractors who design and create the actual product. Lastly, the Functioning Enterprise level represents the actual deployed or running elements, data, and people of the organization; it is not a perspective but the “real world” [4].

3 OWL Ontology-Based Zachman Framework

![Fig. 1. Ontology-Based Zachman Framework for Requirement Analysis](image)

This paper uses Zachman Framework to formalize user requirements from a system engineering perspective. As shown in Figure 1, we implement OWL ontology
models based on the concepts of Scope, Business Model, and System Model with respect to six aspects. The procedure to implement the ontology-based Zachman Framework is presented as follows. First, at the Scope level, OWL classes for six aspects (i.e., What, Where, When, Why, Who and How) are created without any hierarchical relationship. Second, the Business Model level includes defining hierarchical relationships within the OWL classes of six aspects, creating object properties for each aspect, and defining non-hierarchical relationships within each OWL class using corresponding object properties. Lastly, logical data model and integrated semantic model are generated at the System Model level. For the logical data model, it is required to create data properties for classes’ attributes, define attributes of each class using those data properties, create object properties for logical relationships, and define logical relationships among classes using those object properties. The integrated semantic model can be generated by creating object properties for non-hierarchical relationships among six classes and defining such relationships using the object properties created. The general concept of the non-hierarchical relationships in the integrated semantic model is identified in Figure 2. Figure 3 shows the ontology model of Zachman Framework implemented in Protégé OWL.

![Fig. 2. Integrated System Model of Zachman Framework using OWL Ontology](image)

4 Conclusion

This paper proposed an OWL ontology-based Zachman Framework to formalize user requirements. Six aspects (What, Where, When, Why, Who and How) and three perspectives (Scope, Business Model, and System Model) in Zachman Framework were identified with OWL ontology models. The paper also introduced the procedure to implement those ontology models in Protégé OWL [5].

The proposed approach would contribute to Zachman Framework and requirement engineering. This paper presented a consistent modeling methodology to implement Zachman Framework in a systematic way. The models resulted from different cells can be easily combined and analyzed within a single implementation environment.
(e.g., OWL ontology). Furthermore, the OWL ontology-based Zachman Framework includes an integrated semantic model; thus, it is possible to understand an individual model from a different cell as a whole.

Fig. 3. Implementation of the Ontology-Based Zachman Framework in Protégé OWL

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References