Abstract. The aim of the paper is to describe using REA framework to model enterprise planning not only at the operational level but also at the policy level. Using policy level enlarges the possibility of the models on the base of the REA framework because the policy level in this way represents metalevel of the model. The policy level of the REA framework itself is comprised both of the entities related by typification, grouping and policy relationships and of the Commitment entity with the fulfillment relationship. This entity may be viewed as either a sublayer or a middle layer of the REA framework. The Commitment entity belongs to the fundamental entities of the policy level but has some specifications that are expressed by the fulfillment relationship. This many-to-many relationship forms the link to the operational level. In the paper we discuss the problem and suggest some solution that moves the Commitment entity closer to the typification and grouping semantic abstractions.

Keywords: REA ontology, enterprise planning model, semantic abstractions

1 Introduction

Two core semantic abstractions represent policy level at the REA framework by [1]: typification and grouping. In short, the main task of the policy level is to give answer to the questions: what could, should or must occur. In general the policy level also gives the answers to the questions: what is planned or scheduled. The later questions are answered by the Commitment entity, which has the main relation to the Event entity at the operational level. At the first sight the Commitment entity contains planned or scheduled information while the Event entity comprises the actual information, which may be the same or different from the scheduled information.

From this point of view, it could seem that the typification semantic abstraction can be also applied in this case. However, the relationship between the Commitment entity and the Event entity has also broader meaning that is expressed by a many-to-many relationship. There are not only cases when a Commitment entity is related to one or more Event entities but there also exist cases when a single Event entity is related to several Commitment entities. This gives the reason, why the relationship between the Commitment entity and the Event entity is created by the fulfillment relationship.

The grouping semantic abstraction is used when set-level characteristics are of interest and may even create an integral part together with the typification semantic
abstraction. By this semantic abstraction a collection of individual entities may be specified with respect to some common properties.

2 Method of Advancement and Results

Enterprise Planning Model, which is used for illustration of our approach, is composed of three parts: Material Purchase Model – Fig. 1, Production Planning Model – Fig. 2 and Sales Model – Fig. 3. In the schematic representation of the models we were also inspired by the Purchase Order pattern and the Schedule pattern described in [4]. Material Purchase Model describes a Purchase Order between Enterprise (purchaser) and Supplier. The model has two commitments, the Purchase Line and the Payment Line. In the model material, under the specification of the material type, was purchased at the price agreed before (Cash Type) and paid in the form of Cash.

MATERIAL PURCHASE

Fig. 1 Material Purchase Process
Fig. 2 Production Planning Process
The Production Planning Model consists of five decrement commitments: Labor Requisition, Workplace Requisition, Tool Requisition, Part Requisition and Material Requisition paired through conversion reciprocity with the increment commitment Production Line. The Part Requisition commitment and Material Requisition commitment are promises by a Warehouse Clerk to make a specific amount of Part Types and Material Type available to the Worker. The Tool Requisition commitment is a promise by the Workhouse Clerk that tools of specified Tool Types will be available to the Worker, and a promise by the Worker to deliver the tools back. The Labor Requisition commitment is a promise by the Worker to the Supervisor to consume worker’s Labor in a specific time. The Workplace commitment is a promise by the Supervisor to the Worker that a specified Workplace will be available to the Worker in specific time. Each commitment either uses reservation or consumes reservation of the adequate resource type. The operational level of the model is closely bounded with the policy level and contains five adequate Economic Events corresponding earlier described commitments. Resource types have their counterparts in the operational level in the form of resources.

The third model describes Sales Model and is composed of the Customer Order as a contract with relationship to the Customer and Enterprise entity. The Customer Order comprises two commitments, the Order Line and the Payment Line. At the operational level each commitment has its corresponding Event entity.

SALES

Fig. 3 Sales process
3 Discussion

In the presented results the Commitment entity plays an important role at the policy level of the REA framework. The current REA framework distinguishes two levels, the operation level (lower level) connected with the current facts that occurred in a company and the policy level (upper level) linked with the future activities and guidelines such as plans, commitments and control activities of the company. However, the policy level is not a homogenous one but is actually created by two “sublevels”. One is represented by the Commitment entity with the fulfillment relationship, by which it is related to the operational level. The other represents entities created by the typification and grouping semantic abstractions, which use the typification, grouping and policy relationships. It can be said that two sublevels form “stratification” of the policy level.

By its character, the Commitment entity is semantically very close to the other “typed” entities in the policy level in the scope of the relationship to the operational level. The main difference between the fulfillment relationship and the typification relationship is cardinality. While the typification relationship represents a one-to-many relationship, the fulfillment relationship forms a many-to-many relationship. Commitment Pattern (see [4]) describes it all in a more detailed way – see the Fig. 4.

The problem is, that one Economic Commitment can be fulfilled by one or more Economic Events, and one Economic Event can be fulfilled by one or more Economic Commitments. A typical example of this situation is a production run resulting in a lot that has been planned based on several sales contracts. The main aim of our proposal is to replace a many-to-many relationship by one-to-many relationships, which is unambiguous and in general more acceptable for software systems.

This ambiguity between the Commitment and Event entities requires some specific solution in the form of unambiguous relationships. From the previous description emerges that the fulfillment relation encompasses two cases that do not occur simultaneously.

![Fig. 4 Commitment and Economic Event](source [4])
The first one happens when the Commitment entity is performed by one or more Event entities. In this particular case the fulfillment relationship can be replaced by the typification relationship.

The second one happens when the Event entity is performed by more Commitment entities. To make the relationship unambiguous an auxiliary entity has to be added to the current structure. In this case the CommittedElement entity is used to divide the Commitment entity into smaller parts so that each part corresponds only to one Event entity. The proposed solution is illustrated in the Fig. 5, where we use {or} restriction to indicate that only one relationship is in force. The original fulfillment relation is replaced by the grouping and typification relationships.

![Diagram](image)

Fig. 5 Proposed modification of the Commitment and Economic Event

Proposed modification illustrated in Fig. 5 brings some drawbacks. The REA ontology does not know the {or} relationship and the Economic Event is related to the Economic Commitment by two relationships, which is a bit awkward. The other possibility that would improve the proposed modification solution should conform the REA ontology and be simpler.

The typification relation is a very powerful tool that enables categorization of the typified entities. In the presented example it means that instances of the Economic Event can access data attributes of the instance of the Commitment entity that also comprises CommittedElement instances. The CommittedElement instances are stored in a collection that is represented by an attribute in the Commitment entity. The improved solution is in Fig. 6.
Fig. 6 Improved proposal

However, the improved proposal diagram is rather isolated from the whole REA model. The proposal in the context of the REA model is illustrated in Fig. 7.

Fig. 7. Improved proposal in context of the REA model
It is obvious from the Fig. 7 that the Economic Event entity is related to the Commitment entity and to the Event Type entity through the typification relation. This solution however is not implementable by any software platform. One of the other improvements of this issue is to eliminate one of the typification relations. We will maintain the more important relationship, which is the relationship that relates the Economic Event and the Economic Event Type entities as we suppose to put the Commitment entity under the Event Type entity. The final solution is illustrated in Fig. 8.

Fig. 8 Resulting diagram

5 Conclusion

The typification and grouping semantic abstractions specify policy-level extension of the REA framework. These abstractions enable to work with the types of declared entities and with a special form of aggregation with set-level characteristics. The Economic Commitment entity with its fulfillment relationship stands a bit outside of the above mentioned abstractions. In the paper we tried to bring this entity closer to the typification and grouping semantic abstractions by introducing a new entity called CommittedElement. In this way, the Commitment entity can be composed of the CommittedElement entities, which result in the replacement the many-to-many relationship by two one-to-many relationships that occur not simultaneously.
The similar technique is utilized in the process of analysis and design of the information systems. While the relationship between analytical classes can have a many-to-many relationship, the relationship between designed classes is restricted only to one-to-many relationships, by [6].

The proposed solution was set into the whole context of the REA model and gradually improved. The resulting solution illustrated in the last figure however does not take into account the important aspect of the original REA model and it is the granularity of the successive steps of the entities. This gradual refinement of the requirements starts from the Event Type entity, which may represents normative or recipe information, goes on to the Commitment entity that represents planned information and ends up at the Event entity with the actual information. That is the deficiency of the proposed solution.

Nevertheless the proposed solution moves the Commitment and other planning entities closer to the typification and grouping semantic abstraction.

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References