DATA BASE META DESIGN

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Abstract. *The automation of activities in a specific business area nowadays is not technological news, but a business need. The necessity of more and more business applications implies the quest for tools and techniques for fast and efficient development of information systems. Rapidity and efficiency are two important directions, in which business application development technologies are developing today, aiming these two important qualities to be achieved as regarding both development process stages and system exploitation. The effective exploitation is related to real usage of the information system. And this is available when information decision follows the pace, in which processes in the business area develop. The achievement of this aim is a new challenge to the technologies. In this article, we are going to present some ideas about changing the patterns of database design, directed to produce applications which are maximum adaptive and scalable.*

Key Words: *Data base, meta design, business application development*

1. PROBLEMS DURING BUSINESS APPLICATIONS DEVELOPMENT

The fact that the world of business today is binding more and more tightly with the automation of information processing is obvious. This commitment is also revealed in the influence of the business over applications, by implying its limitations and requirements, and changing business processes as a result of their automation. This tight commitment creates some problems, which in general terms may be defined as: *Business is changing and abounding in new processes, but it is not easy for business applications to follow this natural progress*.

A much more detailed glance on the problems, which are standing in front of business application developers, is necessary. This would allow to discover directions, in which the cross-purposes between business and applications are most significant and to find out a new way of their development.

Three main problems which have both their own abstract and philosophical explanation and concrete practical behavior may be defined.

1.1. The problem of indefiniteness and narrowness of the expert knowledge [4]

During the process of creation the information system developers encounter insufficient, relatively imprecise and unstructured know-how about the business area. Overcoming of these disadvantages is related to allocation of additional time and resources for tuning the existing solutions, for new elaborations and for involving new experts.

To overcome this problem, it is necessary to provide some mechanisms for addition and adjustments of expert knowledge without enforcing changes in the data structures and existing algorithms of the system.

One possible solution of this problem is the development **of generalized data structures, which can describe (at some stage) a highly varied expert knowledge and which allow relatively simple addition and adjustment, preserving their correctness**.

1.2. The problem of changing the point of view

This problem has two sides, which may be defined as the *problem of different points of view and the problem of changing a particular point of view.*

This problem is directly related to the dynamics of the business environment, some activities of which an application is intended to automate. If we examine the user needs and the ideas of automation, which these needs originate, as dynamic entities with their own life cycle, in practice this life cycle is very short because of the rapid change of user needs.

The change of these ideas expresses in the fact that user expands the area in which his business is developing, so the descriptions of business objects and business rules also change. On the other hand, the point of view to them is also changing – they start participating in new business processes, which impose their different interpretation.

This enforces to find out some tools, technologies and approaches for information systems development, which provide that the shortened life cycle of users needs does not significantly change the life cycle of the information system.

1.3. The problem of similarity

During the elaboration of an information system, the similarities between current and preceding design and implementation of individual items are often unnoticed. Their un-discovering leads to over-again creation of uniform already existing items, which costs recourse and time losses.

The overcoming of this problem is related to deep analysis of many different business areas and many different problems of one and the same area. As a result of this extensive research, a general approach (data structures and algorithms), applicable in most cases, must be possible to invent. Naturally, this approach requires sparing enough time for gathering the necessary information.

An alternative for overcoming this problem is finding out a general approach for examination of business area entities.

2. SOME PRACTICAL ASPECTS OF THE PROBLEMS

The problems, considered above, are thoroughly related to the business area dynamics and have their practical behaviour. It is most often related to particular weaknesses of the existing technologies for business application development and reflects in the irregular distribution of the duration of system life cycle stages.

These problems put a strong challenge both to the technology of business logic design and implementation in an application, and to modeling of data structures maintained by this application as follows:

- Relational database structures cannot be easily expanded, which makes the process of adaptation and adjustment of applications to the new requirements expensive and inefficient. Each change of a set of columns seriously affects some business logic, despite of the layer in which it is implemented – the data base or application and user interface.

- Each change reflects in considerable business application migration, which results in complex maintenance of multiple incompatible versions.

- The preceding point strongly affects the system life cycle. From the point of view of their real exploitation by users, business applications developed are with a considerably shortened "life". "Life cycle" of user ideas is much briefer, then the system life cycle, which leads to a very brief period of usage and respectively makes the application inefficient and even inadequate to users' business needs (Fig. 1).
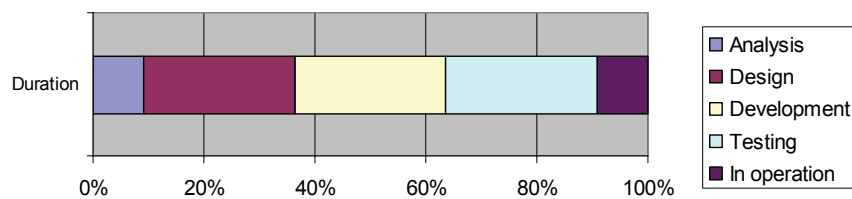

Fig. 1. Proportion of business application life cycle stages

The problems discussed exhibit most tangible in business areas which are loosely structured and in which the business objects descriptions are incomplete and often changing. In practice, this takes away the possibilities of process automation in these areas.

On the other hand, well defined (concerning business processes and data) business areas cannot rely on an adequate solution for automation, because it is tightly coupled with its business processes. In practice, the business applications developed do not possess resources to adapt quickly and easily to the novelties in business practice.

3. META-DESIGN

As it was mentioned above, relational data does not permit to change easily enough the data structures in a business application, without causing significant corrections in the

application itself. On the other hand, the relational data base is abstract enough regarding these structures from the point of view of their maintenance, i.e. it does good enough guarantee the referential integrity through foreign keys, uniqueness through primary keys, correct result of queries and so on, without being "interested in" the particular problem, which has been described by the tables in the user's scheme. DataBase Management System (DBMS) achieves this by virtue of meta description of its own structures [8].

Similar approach is necessary for data description, so that the application can "transform" itself into an "abstract interpreter" of the data.

Applying meta-design during data structures design, through which to abstract objects and their descriptions is the suggestion we are going to make in this article. **With meta-design the data base converts into a united structure for storing business objects meta data and their particular instances**.

A fundamental meta-design approach is business objects abstraction and treatment not from the point of view of their semantics in the business process, but regarding their more general role in it. This more general role is to describe entities. So the point of view to the object description is changing. Their description is not specific, but is a meta-description – *description of their description*.

Proceeding from this assumption and from the necessity to preserve main functionality of the DBMS, especially the ability to distinguish object description and object identification, the following structures for meta-design are necessary and sufficient:

- **Types** – A nomenclature of different business objects, which are described in the data base. It is expandable and is needed to provide object diversion and typification of their description.
- **Entities** - A nomenclature of all business objects, described in the data base. It is arbitrarily expandable and does not contain a concrete description of these objects.
- **Properties** - A nomenclature of necessary properties of all business objects, which are interesting for the business application. This nomenclature is also arbitrarily expandable and thanks to this, the description of business objects can easily be added with new object properties. To guarantee the quality and correct interpretation of the data, each attribute must be defined regarding:
  - Obligatory (Mandatory) for object description
  - Repeatability within one and the same object description (Single or Multiple)
  - Relationship with other objects (i.e. description of relationships between objects in the 1 to M direction). The relation of type "child-parent" is presented.
  - Value Type – the type of the value, with which it instantiates in the description
  - Additional constraints on the value (Checks)

- **Templates** – To ensure not a general description, but an adequate attribute set, through which to provide the possibility of specific interpretation of attributes of the same name belonging to different entity types, the meta model maintains a template of each business object. The template is a concrete attribute set for a specific entity type. These templates are expandable in the terms of a single type. They can be supplemented with new attributes or the existing attribute set may be revised. In conjunction, the template nomenclature is also expandable regarding supplementation with new templates for new object types.

- **Description** – Through this structure the storage of each object's concrete attribute values is ensured. The content of this structure is controlled by the attribute properties, which set in their nomenclature.

A data model, created applying the approach of meta-design looks as shown on Fig. 2. It does not concretize a particular business area, but using it many different areas may be described.
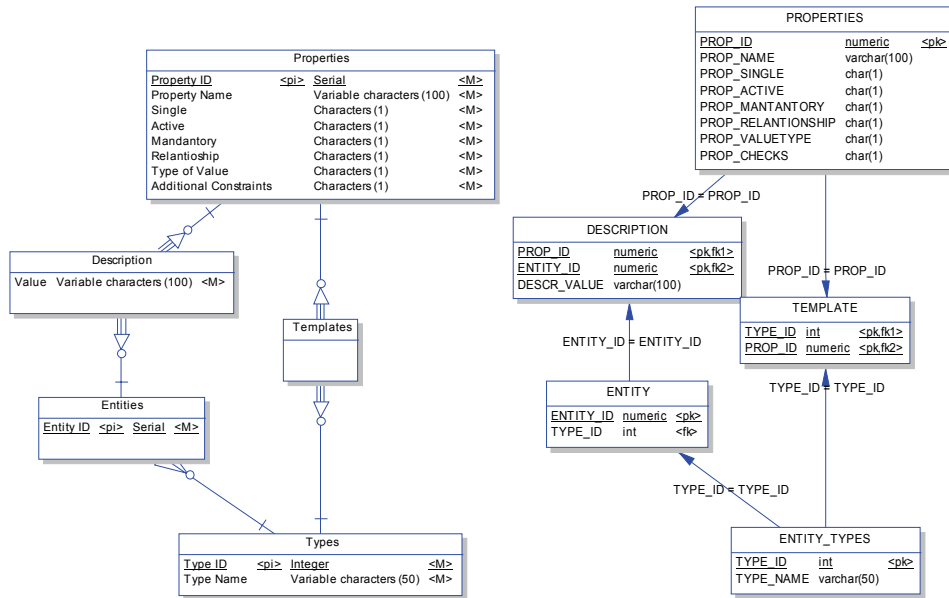

Fig. 2. Logical and physical data base meta model

The analysis of the life cycle of an application, built based on the data meta model being suggested, shows that through similar design approach, a significant augmentation of the system exploitation duration and reduction of the design and implementation stages duration may be achieved, as far as a ready and reusable solution is available (Fig 3).
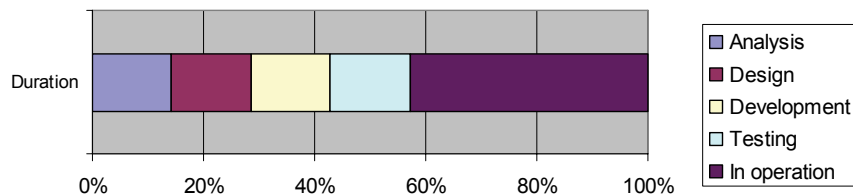

Fig. 3. Proportion of business application life cycle stages built using meta-design

Meta-design has very strong influence over the implementation of business logic. It permits the application to "release from it" in a significant degree, as far as it is implemented in the database [5,4]. This is completely possible and logical, due to the abstract data description, which on one hand allows more abstract algorithms, and on the other hand gives the possibility to further develop meta-design, so that it does not only embrace data structures, but can also describe their behaviour.

Application of meta-design throughout database design may be completely committed or just individual its ideas may be implemented, combining them with traditional design style.

4. CONCLUSION

Meta-design is a real alternative to the classical data base design for business applications. Endorsing on the data structures, it really grants new possibilities for design and implementation of all items of application architecture – user interface and business logic. The suggestion made in this article is entirely based on the relational data model, but a more courageous glance forwards, may find out some ideas for a new data base engine.

The application of meta-design may lead to design and implementation of reach multifunctional libraries with the general purpose to maintain all the necessary data structures.

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META DIZAJN BAZA PODATAKA

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Automatizacija aktivnosti u modernom poslovanjunije tehnološka novost, nego poslovna potreba. Neophodnost sve većeg broja poslovnih aplikacija utiče na jačanje potrebe za sredstvima i tehnikama za brz i efikasan razvoj informacionih sistema. Brzina i efikasnost su dve bitne stvari, u kojima se danas razvijaju poslovne aplikacije razvojnih tehnologija, čiji je cilj da ova dva bitna elementa budu dostignuta i u razvojnom procesu i u procesu eksploatacije. Efikasna eksploatacija u vezi je sa realnom upotrebom informacionih sistema. A to je moguće kada informaciono odlučivanje sledi tok. Ostvarenje ovog cilja novi je izazov tehnologijama. U ovom radu ćemo prezentovati neke ideje o promeni načina dizajniranja baza podataka.

Ključne reči: *baza podataka, meta dizajn, razvoj poslovnih aplikacija*