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An approach to building an MRP II class system based on object representations

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ABSRACT: The new economic situation poses a number of tasks for enterprises that they have not previously considered: increasing competition, the requirement to produce products in accordance with current customer orders, and not long-term long-term plans, the need for prompt decision-making in a difficult economic situation, strengthening ties between suppliers, manufacturers and buyers.Modern information technologies help managers of industrial enterprises in solving these problems. One of the most common production and distribution management methods in the world is the MRP II (Manufacturing Resource Planning) standard, which describes the basic requirements for information production systems.

Keyword:MRP II ,RESURS ,MRP objects , DBMS.

INTRODUCTION

MRP II is a set of proven principles, models and procedures of management and control that serve to improve the economic performance of an enterprise. The standard is actually a high-level functional specification and sets the functional requirements for MRP II class systems. Feature groups and features are aligned with a field-proven generic enterprise business model and designed to support enterprise business processes.

However, in each application, thousands of features and particular details of the general model must be taken into account, which lead to the creation of a custom system based on some kernel. Maintaining multiple implementations becomes an almost impossible task. In addition, the specific implementation is also subject to major changes due to changes in the product, enterprise, extensions of the scope of the information system (IS).

It is difficult to change a system that has been made, debugged, implemented and actually used. As a result, IP can become a brake on the development of an enterprise. The reasons are known. For example, the design of IS, which is rigidly based on the details of yesterday's needs for IS and the ways in which management activities are performed. Or too "concrete" programming, freezing yesterday's understanding of managers and system analysts.

Any MRP II class system (like, for example, "RESURS") is designed for many implementations and development. Therefore, it has a huge number of settings and is built as a specialized toolkit for implementing design solutions in the field of enterprise management. Often the system has its own advanced programming and configuration tools. The issue is which enterprise models are used as the basis for customization, and by what means is customization done.

Modern technologies and visual design tools provide everything you need to build a modular, highly customizable system based on object-oriented programming. However, compile-time parameterization is focused on the development team. Changes at this level are rare and usually require a reinstallation of all implementations of the system. In addition, it is not possible at this level to take into account all the features of all implementations of the system, which, moreover, change rapidly.

It is desirable to configure the system for a specific implementation project within the framework of the parameterization of the execution period. To provide such opportunities allows an approach based on the dynamic description of the enterprise model and on using it as a basis for providing the desired properties of a particular implementation.

System setup is always based on the business model of the enterprise, which is often built in the IDEF0, IDEF3 and ER standards. Unfortunately, not all design solutions for setting up the system can be adequately described within the framework of the listed models. These are the limitations of the models, not the toolkit.

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When creating the "RESURS" system, it is proposed to use an object-oriented enterprise model as a basis for describing design solutions for customization. The basis of such a model is the specification of domain classes. This model is supported by the toolkit of the "RESURS" system. It is in terms of this model that it is required to describe the model of a particular enterprise.

The MRP II standard is based on a simple and understandable enterprise process model: products are the result of production activities, during which various resources are planned, moved, consumed and accounted for in accordance with regulations. The key points within the standard are:

specification of products (services) - the composition and operational technology of manufacturing, indicating the consumption rates of the required resources (bill of materials);

specification of production capacities and labor resources;

The composition and rules for performing actions to manage the enterprise (business operations, accounting and other processes) - business logic;

· Models and methods of resource management.

The proposed approach is based on the idea of classifying the entities of the subject area, which is carried out in several stages:

- selection of base classes of the subject area with a high degree of abstraction and stability of the specification;
- development of support tools for these classes both in the DBMS and in the application;
- development of support tools for dynamic creation and specification of subclasses in the DBMS and in the application;
- selection of derived classes of the subject area in relation to each implementation project individually.

A feature of production systems is the presence of at least three groups of components: 1) class (object) - specifies the structure and methods (for example, assembly unit); 2) class element - describes the specific properties and specification of its production (assembly unit. 410.00.112 case); 3) copy - corresponds to the physical object of the subject area (assembly unit. 410.00.112 building. lot 10001). Therefore, the components of each of the groups are supported by the system in accordance with their specifics.

With regard to systems of the MRP II class, based on the analysis of the standard and the experience of enterprise automation, the following basic classes of the subject area were identified: production element; business entity; document; business transaction; event; scheme of work; plan position; storage device; economic element.

To support the possibilities of dynamic description of the model, the following basic instrumental classes (metaobjects) were introduced: subclass (virtual object); basis of classification; attribute-string; attribute-reference to an object; attribute-enum; attribute-number; attribute-date; attribute-aggregate; attribute-function (computed attribute); enumeration (reference).

When developing the production element class, ESKD, ESTD, models of the operational description of activities were used, which allow taking into account the need for resources when performing an operation. The main one is the detail-operations model.

Elements and instances support the concept of lifecycle and persistence of history. A number of subclasses are predefined (for example, materials and components, products, equipment), but their number is small compared to the total number of subclasses in a particular implementation project (several thousand).

All basic objects have a branched classification scheme, each of which must be formed and entered into the system. Each node of the classification scheme is a derived class of the corresponding base class. However, in addition to the parameters of its parent, a derived class can have additional parameters of its own. It is in terms of classes and their properties that the enterprise model is developed and the system is tuned.

The most important class is the production element. The first few levels of its classification are rigidly defined in the system. Each production item can have a specification. However, the purpose of the specification for each subclass can be interpreted differently. As the main subclasses of production elements, the following are distinguished: objects of labor, means of labor, technological operations.

The adopted model supports a multi-aspect multi-level classification of all declared objects. The classification system exists independently and is not connected with the rules for the formation of element designations. Each element must be assigned to one terminal class in each of the alternative classification schemes. A new element can only be declared after the desired terminal class has been selected.

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The classification system provides the following options:
declaration of additional parameters for elements of each class;
Restricting the search for elements within the scope of the selected class;
element class recognition;
· changing the algorithm for processing and presenting data in accordance with the description of the corresponding classes.

A special place is occupied by the setting of business logic. The model used in the system is based on the workflow, event, and status classes, which also support classification and customization. A work scheme is an interconnected set of works and is described as a pattern of cooperation between system elements and users.

The work can be represented as the activity of changing the states of elements (instances), creating new elements and deleting existing ones. The work goes through a series of phases. The configuration of such components as complex work, work scheduling, work plan execution control, work queues is supported. The complex behavior of instances is described by the model of collective interaction of automata. Transition functions are described in terms of element roles, states, events, access rights. The internal representation is fully focused on the capabilities of the DBMS.

The event is presented as a signal-message with a group mailing to all those who requested and are waiting. Reactions to an event are distributed in various elements, are individual and depend on the context of each of them.
In the architecture of the RESOURCE system, in which the described approach is practically implemented, five logical levels of the application are distinguished:
1) basic level - provides modeling of the base classes of the subject area and base instrumental classes;
2) setting level - provides the formation of metadata of the subject area for building an enterprise model and setting up the configuration of the management system;
3) the level of MRP objects - ensures the maintenance of the necessary primary data and the specification of the enterprise model;
4) planning and accounting of production resources - supports the business processes of managing production resources in accordance with the configured enterprise model and the configuration of the system itself;
5) presentation - provides a user interface.
The use of this approach makes it possible to provide ample opportunities for constructing classification schemes and interaction schemes with indication of the given parameters of classes oriented to a specific application.
The development of the class system is the subject of serious project work during the design phase of the implementation project and requires little or no support or intervention from the programming team. Moreover, customization work can be performed by a trained implementation team from the customer.

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