

Information-administrative architectures conception and principles of their modeling

Vitaly Danich, Maksym Dyomin

Volodymyr Dahl East-Ukrainian National University, Lugansk, Ukraine

Summary. The articles are devoted to information-administrative architecture and its monitoring conceptions. Approaches, methods and abstractions, allowing to carry out the IAA modeling and being the conceptual level of model with dynamic types definition is described. This allows designing and developing database for information-administrative architecture monitoring.

Key words: information-administrative architecture, monitoring, informational model, benchmarking.

INTRODUCTION

Choice of effective administrative technologies, structures and administrative systems are dictated by market laws. This choice is one of major strategic tasks of management subjects. World experience confirms: subjects, satisfying their demand industry of the administrative consulting, business-processes re-engineering and design of the corporate information systems, information management, busy at a search, creation and introduction of effective administrative systems, and this process in the last decades is multifaceted and fast.

The causal factors of this speed are different. The leading are economic - improving the efficiency, competitiveness, sustainability; technical and information management - development of software and hardware components, new information management technologies (MRP, MRPII, ERP); globalization - the growing influence of the relationships and interdependencies, and to a large extent, psychological - imitating the best or common patterns, suggestion, and the result is the essence of advertising. The essential role of the factors of

imitation and suggestion makes fast, avalanche-like, by the type of chain reaction the nature of the distribution of these processes [Danich 2010].

The problem of creation of effective management systems is solved in the various scientific fields. This fields are: process-based approach in management (re-engineering and improvement of business processes) [Devenport 1990, Hummer 1990, Repin 2004], benchmarking [Biesada 1992, Camp 1989] and the architectural approach [Spewak 1993, Malhotra 1996, Hubert 2002].

Constraining factor introduction of new information and management structures (IMS) is the volumetric procedures of the object survey and architecture design, a low visibility of their results for the heads, making decisions on expansion of new architecture or essential change old serve. Changes' management at the enterprise usually needs complex research [Voronkov 2012]. Often, the top management of the firm has no enough knowledge and time to estimate the project. The subject, who was forced to make a difficult decision, usually seeks a precedent. This is a known psychological peculiarity difficult decisions with limited intellectual and time resources. Therefore, the standard solution of such problems is the search counterpart, in this case, IMS, successfully operating on a similar business or company.

The special sharpness to this problem was given by an economic crisis. Ineffective, badly concerted, overloaded by administrative staff organizational structures pulled at on a "economic bottom" many managing subjects. An exit from a

crisis is related in a great deal to the search of effective organizational structures.

This work focuses on the methods of decision of this problem. A purpose of work is exposition conception of monitoring of information-administrative architectures (IAA), definition of principles of modeling and analysis of architectures, making of practical recommendations on utilizing of monitoring results for a choice and perfection of organizational structures and administrative systems.

RESEARCH OBJECT

Information and administrative structures we proposed to call architecture [Danich 2007]. This phrase – information -administrative architecture - accurately reflects the diverse and, at the same time, the coherent nature of a single entity - the control system. There is great number of analogues to such notion, from architecture of buildings to processor architecture.

Information-administrative architecture (IAA) of enterprise is defined as a union of administrative and information structures that are interconnected and interdependent. Detailed selected, agreed in their characteristics, they get a synergistic effect and allow you to fully realize the production, personnel and financial potential of the company.

Information management architecture is the framework of the control system. Membership of the propagation of information management technologies, structures and systems to the class of fast, avalanche, is justified in [Danich 2010]. They are determined by the speed of the computer equipment and technology, rapid change of

hardware and software platforms, the emergence and development of new management technologies and their dissemination in the environment of business entities under the laws of mass communication. Further concluded that the need for monitoring, ie tracking real information management structures, analysis and selection of the most preferred, synergistic, promising IUA. To achieve this, has the task of modeling, database of real structures and their use for typing, tracking the dynamics of real architecture's portraits, revealing preferred IAA. In fig. 1 shows the main elements of the IAA in their relationship.

It is important to understand that strictly formal definition of IAA is not exists and it is impossible because of the extreme complexity of the research object. Possible only apt description, the common "cliche" that allow clearly identify the class of objects for the purpose of theoretical research and practical application.

RESEARCH RESULTS

Define the concepts and terms used in this work, in particular the "organizational structure", "information-management structure."

The following definition of the structure of the organization is given in [Danich 2004]: "it is a fixed relationship that exists between departments and employees of the organization. This can be understood as an established pattern of interaction and coordination of technological and human elements."

The concept of structure implicitly or explicitly associated with a set of rules, regulations governing the activities of the organizations and its members.

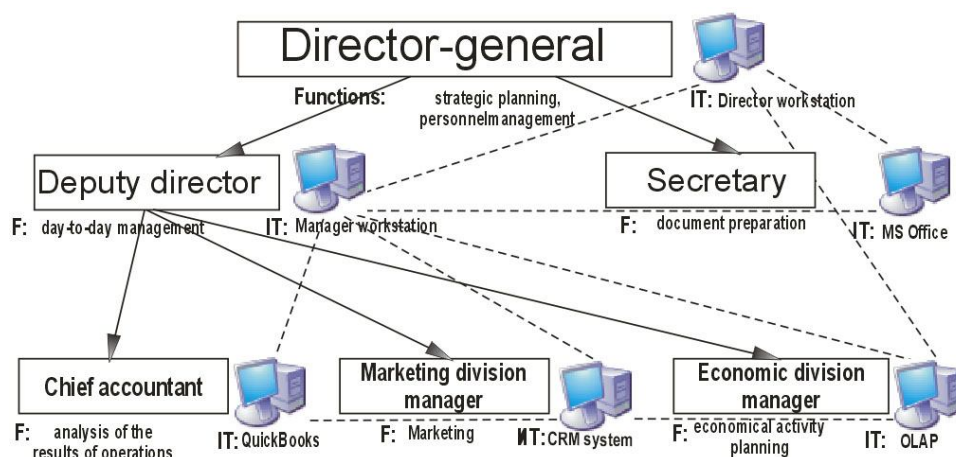


Fig. 1. Example of information-administrative architecture

In [Tolbert 2003] there are several definitions of organizational structures that emphasize balance and interaction of people. It also identifies three key functions of structures: the effective achievement of the objectives, the coordination of staff, and implementation of power (defined hierarchy, information flows). Characteristic features of these definitions are descriptive, weak formalization, blurred, descriptive, emphasizing the human factor. Weakly formalized, blurred are the result of the object complexity. These definitions explain the structure, but our goal - its formalized representation, analysis and reproduction on monitoring results. It is generally accepted definition descriptor complement structural members in the first place, graphic representation of the types of organizational structures - linear, functional, divisional, and others [Tolbert 2003, Vladimirova 1998]. The disadvantages of such submissions should include traditional mixing official and business unit structures (which creates problems in a constructive formalization), its lack of functional information, information-processing characteristics. Furthermore, the organizational structure should include a natural, in fact, based on the production and technological structure that determines the flow of resources, the relationship of components in the production process [ISO/TC 184/SC 5/WG 1]. If you add the organizational, legal and territorial structure, we can see that the organizational structure is a multilayered, multi-level composition requires adequate tools for the representation and manipulation.

The control system is part of the organizational structure, its necessary, system-organizing component, with its own constitution. Under the information-management organization we understand the structure of management of the organization, including termination and guide members in their relationship and interaction. In the context of monitoring natural to restrict the basic elements and relationships which determine the quality of the functioning of the organization.

Decisions about a choice or re-engineering of IAA are appropriate to the field of strategic management. A problem of estimation and prognosis of its (IAA) development dynamics is important here. The tasks of similar type must be decided in the context of structural-informational management [Danich 2004, Danich 2005]. This notion marks the complex of decisions, directed on perfection of executive system by an enterprise, foremost, administrative structure, realized under influence and in the close co-operating with

development of the information system, providing management efficiency and organization reacting on the changes of external environment.

The global, strategic task of structural-informational management consists in guaranteeing of synergy of information and administrative structures, an increase of the information system contribution, information technologies in efficiency of administrative activity is its result. It is arrived at by a careful selection, concordance of information-administrative structure characteristics of enterprise and management by it on all stages of life cycle.

Quickly developing information technologies require from managers practical decisions on modernization and perfection of the information system, re-engineering of enterprises organizationally-administrative structures. Collection and accumulation of information about the real subjects of management, their administrative and information structures can become the rational and inexpensive variant tasks of structural-information management decision. Leaning against [Danich 2004], name such activity monitoring of information-administrative architectures.

Monitoring plugs in the questionnaire-inspection of management subjects, collection and accumulation of information in the public agency of statistics, specialized commercial, consulting firms or other structures, and then further research of information, showing up regularity and IAA development trends, distribution of the received results on commercial or on other basis.

The main directions of the monitoring should be considered as external and internal monitoring. The main task of internal monitoring is to determine the current state of their own IAA, consistency of its various components, its development trends and security. The main task of the external monitoring is definition of the current standard and preferred IAA, their tendencies. One of the attributes of the preferred architecture can be the use of modern scientific research results in management. For example, use at the enterprise quantum time management method [Walczak 2012] can serve as a reason for the priority consideration of the enterprise architecture during the search for preferred IAA. IAA monitoring suggests tracking the state of information-administrative architectures of enterprises of the city, the region, a macro to determine their tendencies, identifying preferred IAA and further distribution in order to improve

economic management as specific subjects and the overall economy. Based on the results of internal and external monitoring of preparing proposals for change and development of own IAA.

Main monitoring tools are legal and organizational scheme for the collection of data, information technology, providing registration, storage, processing, transfer of the resulting information.

Let us consider in more detail the parameters of state, coherence component trends IAA.

Under the state of IAA of enterprise or establishment we will understand the set of properties of its elements and architecture on the whole.

Selection of desirable IAA features is made by method of typification, the search for the best synergistic architectures that are successfully operating in similar businesses. To achieve this goal the problems of IAA modeling have to be solved, database of real architectures have to be created for using them to store the results of monitoring, surveillance dynamics, typification, determine the best IAA.

The most appropriate parametric typification allows us to classify members in ascending or descending order of a parameter (at least at the level of rank, for example, small, medium and large enterprise). In general, the parameter values can be ordered or partially ordered set. Parametric order typification allows extrapolating the results of research to the next point, which allows, on the one hand, foreseeing the development and on the other - to transfer IAA property from one object to another.

We note several features of organizational structures that determine the best choice of the shape of the image. First of all, it is a hierarchy. It is typical for all the components of the social system: the object of management, administrative and information system. Structure components are closely interlinked, and in many of its manifestations, they are identical, even authentic. The observed relationship means to choose the format for the organizational structure, which corresponds to the same extent in all three components.

IAA is a set of elements that perform or support the management, with the given system of relationships that characterizes the order, affiliation, dependence. The most iconic elements of IAA are divisions and posts. Each element has a specific function. Function performed by the person or department requires certain information technology delivered through software and

hardware. Synergistic match between management, software and hardware components makes the technology effective.

Fundamental properties of IAA are the changeability and the multilayeredness. Property of changeability means the possibility of permanent IAA reorganizations, of its structure, appearances of new element types, disappearances of old and modifications of existing. The multilayeredness is a feature of architecture which consists of possibility of subsystems selection by the types of connections between elements or attributes of such elements.

Description of essence of IAA stipulates for its information model, i.e. aggregate of data structures, which are utilized for the IAA representation. We will stop for conceptions, constituent's basis of information-administrative architectures modeling.

There are two basic approaches to building information-administrative architectures models. The first is this: based on the analysis of the domain (business, law, etc.) in the real world, identifies entities and relations between them. These entities are directly displayed in the model in the form of classes, relations of type "common-private" in the form of inheritance, and the inclusion - by aggregation. The model of this kind is called a model with static type definition. Information-management architecture is changing very rapidly. This is the main obstacle to the use of models with a static definition of the types in the IAA databases, because the model itself in such conditions needs to be modified very often.

Therefore, a model of another kind was proposed: a model with dynamic types definition. It provides a means to describe the entities in the domain and to work with their instances. These descriptions can be added at runtime. This is achieved by unifying data storage mechanisms. With this approach, the user can create their own descriptions of subject area entities.

Let's pass directly to description of conceptual level of model with dynamic types definition. A model includes general description of enterprise, containing such information as the name of the enterprise, department subordination, type of ownership, legal form, industry and type of activity, quantity of manufacturing staff, size, efficiency, description of the modern information technologies use in the decision of management tasks, mission and strategy of the enterprise.

The structure of IAA appears as an aggregate of information layers, each of which describes IAA subsystem. The IAA layers can be divided into

main groups. It is layers, describing organizational and administrative structures of enterprise, describing the information system of enterprise, describing business-processes and documents circulation of enterprise. Common representation of IAA is formed from layers, the quantity of which depends on an enterprise, chosen detailed level and from plenitude of information about an object. A layer of IAA is the hierarchically ordered set of elements.

We will be stopped more detailed for that, how layers describe one or another IAA part. We will begin with a organizational and staff structure. It appears as a set of layers within the model framework. It is layers of linear and functional submissions and layer of organizational structure of enterprise. For layers, determining a submission, hierarchical order is natural, connections in these layers set relations between the chief and the subordinate. A linear submission is built «on the basis of vertical administrative hierarchy, being based on the strict submission of the lower unit to higher» [Milner 2003]. The division of administrative plenary powers and responsibility often takes a place «on the wide classes of tasks» [Milner 2003]. In this case it is possible to select a functional submission on the specified classes of tasks. For educational establishments it can be: functional submission on educational work, functional submission on an pedagogical work and other, for a production enterprise functional submission on questions of labor protection et cetera. Only aggregate of linear and functional submissions describes the organizational structure of enterprise to a full degree (for traditional organizational structures). Linear and functional submissions often contain the same elements, but in different relations. In the layer of organizational structure connections has other semantic, they determine a not submission, but inclusion in the structure of subdivisions. A layer determines the structure of subdivisions of all of enterprise on the whole.

As noted in [Vladimirova 1998] except for hierarchical organizational structures there are also matrix, project and flat patterns. Flat structures are hierarchical however, but for them the insignificant hierarchies depth and plenty of subordinates for one chief is characteristic. For flat structures a submission carries a little other nature, what for traditional, because many more plenary powers are delegated, a chief in a considerably lesser degree carries out control functions (lesser control depth), in a greater measure carries out the role of leader and tutor. But a submission is however, therefore

flat structures appear directly within the model framework.

It is necessary to elaborate the possibilities of presenting project and matrix structures. In fig. 2 shows an example of a project structure. Here, the solid line represents the linear submission, dashed - the subordination of the project 1, dot dashed - the subordination of the project 2. Each submission alone is hierarchical, but all three of subordination imposed on the same post. The model allows the presence of the same elements in different hierarchies. Therefore, the project structure can be represented in the form of several hierarchies. Similarly presented and the matrix structure.

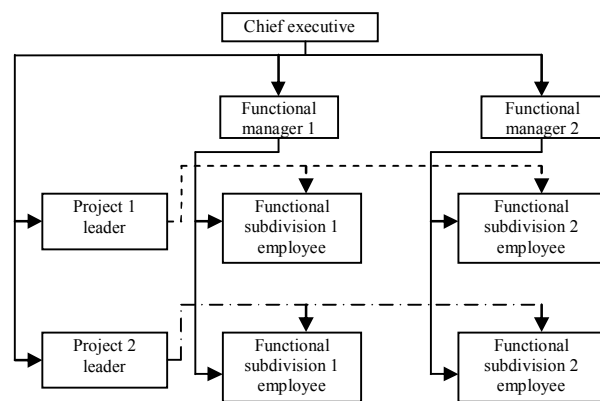


Fig. 2. Project organizational structure

The important constituent of the information system (IS) is hardware, in-use on an enterprise. Information about hardware can be represented through a layer the «Computer technique». In this layer there will be objects, describing a computer technique and groupings elements.

The business-process layer contains descriptions of business-process and subprocesses. Connections in this layer determine belonging of business-processes and subprocesses. There can be groupings elements in this layer. In particular root element usually can not describe business-process, but must be a grouping element. The documents circulation layer can contain the properly grouped set of objects, describing documents.

It was shown that all of the information about the architecture can be represented as a set of layers. For each layer is fixed semantic load, define what it means hierarchical order in this layer. For each layer is allocated a fixed set of entities, copies of which may be present. The model assumed that the semantic of relationships in the layer and a set of valid entities determines the layer type.

Every layer of IAA contains the objects of certain types. Within the examined model a type sets the structure of objects description, which

determines the list of attributes, values of which describe an object. Attributes have the name, type and sign of multiplicity. One of five types is assumed: integer, real, date and reference. References are typified. The sign of multiplicity determines whether an attribute can have more than one value. For example, type "Computer" attribute of the "Software" can have several meanings, and in this case, the sign must be installed.

For the types of elements an inheritance is assumed. The derived type inherits its set of attributes from base. Addition of new attributes or overriding for existing is possible. An overriding takes a place by attribute definition in the derived type with the same name, as well as in base. Thus information about the type of attribute must differ. We will make an example of overriding. We will suppose in a type «Subdivision» an attribute is set «Chief» - reference to «Position». For a type there is «Department», derived type from «Subdivision», overriding is possible for the specified attribute, changing its type on reference to the object of type«Manager of a department». Such overriding will allow narrowing the set of objects from which a choice is made during setting of attributes values, and the same to lighten the constructing of concrete IAA.

Aggregation of objects is not foreseen directly. But a necessary effect can be attained through the use of references. At first an object must be added to some layer, and then it is possible to set reference to it. So a layer is the only possible container for objects, presenting the elements of IAA. It was noted that an object can simultaneously be in some layers.

It is recommended to create a new type for every IAA entity, even if on some stage of design it is possible to treat base. In many cases is possible not to enter types: «Accountant», «Chief of sales department», et cetera, to take advantage of base type «Position». But new types creating is desirable by three reasons. First, even if types are in the relations of inheritance, they use the different sets of the shared values. In the second place, more extensive types system allows to specify references more precisely. Thirdly, the IAA model can develop and go into a detail. For description of some IAA elements can be required additional attributes. It is desirable to be in a position to enter them independently. If in the architecture model of enterprise both a accounts department and shop, and marketing department, is described the objects of type «Subdivision», there

will not be possibility to add additional attributes only for shops.

Objects of the some type of attribute that save values that describe the characteristics of the element IAA as a whole. The Information about the structure of that element is represented by means of other objects that are subsidiaries for the source or under other layers. In other layers of the objects that describe the structure of the elements are not arbitrary and are usually grouped hierarchically in the form of a subtree. Often different IAA elements have a similar structure. In creating a IAA model needs to be able to reuse similar items. It can do this using the template elements.

The item template is a description of the IUA, which contains as its general characteristics and structure. Templates can be composed of several layers.

For example you want to construct a model of the enterprise - trading networks. The first step is to determine the template of the department. It will contain information on its linear and functional subordination, of computers and organizational structure. Some layers can be relatively simple. A layer of the organizational structure will contain only one object describing department within the department as there are no other units. The rest of the layers will be more complicated. After the template units "Shop" is constructed. For each layer defined template is the root object. Next, the structure of the model is detailed in the store including using a template section. With the template user can create multilayered representation of some part of the IUA. For each layer, the position of insertion of objects describing the unit being set up on the template has to be specified. Even similarities IAA are rarely completely identical. Therefore, after the use of a template is usually necessary to modify the resulting representation to reflect the specifics of the elements of the IAA. Once the template of shop is set up you can start constructing representations of enterprise architecture, which is built with already-defined templates.

After the template use almost always is a few to change turning out presentation of IAA element, it presentation in future is unconnected with an initial template. That at making alteration in a template, they in any way do not affect IAA elements, constructed by this template before. It is consequently necessary to define it fully before the use of its template (work out in detail in necessary degree). At such use of templates the modeling of concrete IAA is carried out a method from below

upwards. But a method from above – downward is more comfortable to carry out the IAA modeling. At the memberwise constructing of IAA representation without the use of templates a modeling is carried out exactly a method from above – downward. For support of this method of IAA design with the use of templates possibility to create a template, based on the fragment of the already constructed IAA, is foreseen. At such creation of template an element which together with children will form the proper template layer gets out in every layer of existent representation. After it information of template modify, deleting or changing information which behaves to the concrete enterprise or part. Such modification is less labour-intensive then constructing of template structure from a beginning.

In the research process realization of the above expounded conceptual model was with the use of two object-oriented DBMS: Jasmine and Versant [Danich 2006, Danich 2007]. In Jasmine the object-oriented model must be described twice: in ODQL language for DBMS and in language of client application. For Versant the classes declaration of client application serve as of database schema.

In this work, looked through the problems of the monitoring arrangements, the results of monitoring carried out in enterprises Luhansk region in the period from 2000 to 2008 was obtained and to organized.

IAA monitoring companies in the region showed that the IS and IT has become an integral part of enterprise management systems. They provide a solution to problems of accounting, information technology management activities of individual departments.

CONCLUSIONS

The article describes the concept of information-administrative architecture. The approaches, methods and abstraction, allowing for the modeling of the IAA is a conceptual level model with a dynamic type definition. System (database), which provides a toolkit that supports these methods, will be IAA modeling environment. That is what will allow the database to store the information about IAA different classes of enterprises, which allow you to define and distribute the most effective and preferred information-administrative architectures.

The most important area for further research in the field of IAA monitoring is the development

of a specialized query language to databases of information management architectures, as well as classification of the types of hierarchies and overall architecture types, highlight the best of them.

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КОНЦЕПЦИЯ ИНФОРМАЦИОННО-УПРАВЛЕНЧЕСКИХ АРХИТЕКТУР И ПРИНЦИПЫ ИХ МОДЕЛИРОВАНИЯ

Виталий Данич, Максим Дёмин

Аннотация. Статья посвящена концепциям информационно-управленческих архитектур и их мониторинга. Описаны подходы, методы и абстракции, позволяющие осуществлять моделирование архитектуры, являющиеся концептуальным уровнем модели с динамическим определением типов, что позволяет проектировать и реализовывать базы данных для мониторинга информационно-управленческих архитектур

Ключевые слова: информационно-управленческая архитектура, мониторинг, информационная модель, бенчмаркинг.