CONCEPTS AND METHODS OF CREATION OF LARGE SYSTEMS AND SUPPORT OF LARGE PROCESSES

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ABSTRACT

This paper describes development of concepts, methods of creation of large systems, and large processes support. Some heuristics are presented for building up large systems. Management of these heuristic recommendations and statements during creating a large system can improve the quality of the created systems and efficiency of the process of creating large systems.

Key words: government, large systems, large scale

1. METHODOLOGY DEVELOPMENT FOR LARGE SCALE SYSTEMS

Extensive use of information technology in all areas of human activity affects essentially development of the world, creates background for large scale economic and social transformations, and leads to formation of advanced society.

One of the most important components of formation of the information society is creation of "electronic government" - a system of effective interaction between government, citizens and business through services provided on the basis of information and communication technologies (ICT) [1].

Introduction of information and communication technologies (hereinafter - ICT) in public administration ensures the efficiency of government authorities (hereinafter – government authority), the transparency of public administration processes, and plays an important role in implementation of administrative reforms and improvement of the public administration system.

Currently, information and communication technologies and electronic government are introduced in Kazakhstan at a high level. The next step is improvement of public administration using ICT, which means the electronic public administration.

For introduction of the electronic public administration it is necessary to determine the general system – creation of large systems. And also, it is necessary to determine concepts, methods of creation and processes of large systems support.

Currently, there are a lot of methodologies and toolkits of creating systems. Systems created on its basis provide some performance indexes. However, it should be noted that quality performance and operational characteristics of a large scale system that based on these methods, do not always satisfy both its owners and users. Especially because it is typical for large systems that over time there are new requirements and essential changes in operational quality.

It should be noted that the large systems, which are currently being created without any methods and system standards by simplifying design, cope with its mission, carry out tasks assigned to them at a certain quality level. However, this is within subject to conditions stipulated in its design, they keep its functional performance and efficiency, but if design conditions are violated in a confined space, then they may cope with its mission.

This is achieved by spontaneously formulated internal functional backups, which are at minimum in these systems. Functioning of these systems involves a number of problems, in particular:

Firstly, in case of violation of design conditions in a confined space, the system loses its functional qualities and efficiency;

Secondly, integration of these systems is very complex, and often is out of control.

Despite these problems, currently, among the created and operated systems the proportion of large systems increases and this tendency will be kept and/or increased. There are a lot of samples of large systems. These are social systems, government authorities systems, i.e. the system of electronic government, electronic akimats, ministries systems, and systems of the market and financial sector of economy, transport systems etc.

All this shows that the most of problems of large scale systems are caused by poorly developed infrastructures that support the process of constructing the large scale systems. Thus, construction of an infrastructure supporting the process of constructing the large scale systems is a vital task.

Development of the infrastructure should begin with development of methods of constructing large systems. Due to the fact that construction of a large system in a monolithic embodiment is not possible, therefore, we will present the large system in the form of an integrated system of combined separate systems of smaller scale. These systems are specialized, automatizing separate processes that are part of the overall automated process. All these specialized systems must be constructed on the basis of common system principles, which will ensure its full functionality and integration capacity.

Thus, the development method is based on the following principles:

- Decomposition of general process/activity into separate autonomous processes and tasks (based on Workflow-model of general process);
- Construction of each specialized system to be brought to the level of full functionality, self-sufficiency in resources with its own policy and strategy of process support (business-process);
- Ensure compatibility and integration capacity of separate system in one large system.

These systems can be created regardless of others and asynchronously. They can have different owners and resources, but, based on common principles and requirements in order to ensure its integration capacity.

Large (large scale) processes or business-processes, for automation of which there will be created the systems, vary in its features and characteristics; large business-processes are created for different purposes, and its quality are imposed many various requirements. Therefore, the method of creating a system for its support must be concretized according to individual features of the automated processes (business-processes), i.e. the method's actions must be carried out based on specific features of the automated processes (business-processes).

The instantiation is achieved through providing the method with automation rules and rules of constructing automation systems.

Thus, the method should be accompanied with rules of automation of processes of certain type and class (or business-processes). Complete rules of construction of the system include a set of rules of analysing business-processes, designing, development (based on the chosen technology of programming, construction of the system's hardware), testing, verification and validation.

Construction of the rules is carried out on the basis of experience and theoretical skills, which are formulated in the form recommendations and heuristic statements formulated on the basis of knowledge, which was accumulated on the basis of experience and theoretical generalization.

Improvement of quality of the created system and efficiency of the constructing system process allows us to use those heuristic recommendations and statements during creation of the large scale system. Let's present some heuristics for the process of constructing large systems.

Heuristics 1. During constructing a large scale system it is necessary to perform designing processes for the following purposes:

- Designing architecture and structure of the specialized system in accordance with the designed architecture of general system;
- Designing architecture and structure of the integration system in accordance with the designed architecture of the specialized systems;
- Designing architecture and structure of the IT-Governance system in accordance with the designed functional architecture of this system.

Due to the fact that carrying out general part of the design processes to be automatic, it is necessary to generalize all methods of carrying out the design processes into a single scheme at a certain generalized level. Then, the generalized scheme of performance of the design works should be presented as "designing" micro-operations.

Macro-operations of development, verification and validation can be performed in the same way.

Heuristics 2. In order to determine the system's architecture, it is necessary to analyse the automated processes on the basis of models of the process without system support (As-is) and (To-be).

Heuristics 3. When determining the system's architecture, it is necessary to identify all possible options of service, and select one of them according to original design conditions, recommendations and heuristic rules for processes of creating systems.

In particular, the following options:

Let the large system service to the processes from region A and B. Here, it is possible that the business-process support, which is made in region A of all running area of the system, can be carried out in two ways: from the server, which is in region A, and from the server, which is in region B.

Here, two ways are possible:

- It can be performed by the system (i.e. the server's software and dataware), which is in region B, and so it is possible:
- Downloading to the A region's server of the part of B's software and dataware, which is necessary for the business-process of region A;
- Directly from the server of B, without downloading;
- It can be performed by the system (the server, the server's software and dataware), which is in region A.

Choosing one of the ways of service is carried out according to the volume of data flow, corrosiveness of medium, business-process' criticality, security and risk levels.

Heuristics 4. The system (i.e. software, hardware and dataware of the system) can be centralized as the data centre, or it can be decentralized. In this connection, decentralization can be made with a variety of ways. For example, through dataware or software of the system it can be distributed among regional servers or personal work stations.

Heuristics 5. The system is completely locally-centralized, but, to deliver service to a remote area or in order to receive service from other remote systems, services of Internet or other systems can be used.

A sample of a completely centralized system is the data centre – the data processing centre.

Heuristics 6. Designing architecture of specialized and general systems should be carried out on the basis of the systems' structures. The following ways of distributed structure of the system are possible:

- Distributed at all levels: at hardware, dataware and software levels;
- Distributed at hardware level, centralized: at software and dataware levels;
- Distributed at hardware and dataware levels, centralized at software level;
- Distributed at hardware and software levels, centralized at dataware level.

The multi-level structure and architecture of the systems provide integration of the systems at different levels.

Heuristics 7. There are two possible ways of designing the system's functionality:

- Consistent design. At first, a work system is designed, then a cover, which provides functionality.

- Integrated design, in which the work system and functional system are integrated.

Heuristics 8. Automation of large business-processes is characterized by identifying separate business-processes as independent ones, for the specialized systems, which provide automation of these processes, to be compatible and integrated.

Such approach is similar to the "analysis – synthesis" system approach and is natural. I.e. at first, separating – in order to solve a small scale problem, then its connection/unification – in order to solve a large scale problem.

Heuristics 9. Modelling large scale processes, in particular, government activities or activities of authorities is a very complex task. Therefore, completeness and accuracy of modelling must be as much as possible in order to accomplish the task.

Models of a large scale process or government activities are presented by combined processes, combination of which is the model of life cycle. The rule of one of the aspects of constructing architecture of government systems, based on heuristics 4 and 5, can be presented as follows.

The embassy should have its own system. This system shall be connected to the central system of the E-government. The embassies have no own system. Then the embassies shall work with the central system of the E-government.

E-government = E-centralized apparatus + $\{$E-embassy$_k\}$, k = 1,

K/E-state = E-government + $\{$E-ministry$_i\}$ + $\{$E-akimat$_j\}$, i = 1, m, j = 1, n.

E-public = $\{$E-public organizations$_h\}$ + $\{$E-international public organizations$_g\}$, h=1, H; g=1, G.

E-state = E-state + $\{$E-public$_i\}$ + $\{$E-akimat$_j\}$, i = 1, m, j = 1, n.

Based on this method, it is necessary to establish rules of performing macro-operations for specialized and general systems: design, development, verification and validation during creation of the large process support system (activity, business-process).

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