METHODS OF DESIGNING INFORMATION SYSTEMS ARCHITECTURE

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ABSTRACT

This article discusses methods for designing information system architectures. The advantages and disadvantages of the approaches discussed are described. The author's opinion on the appropriate use of these methods when designing the architecture of various software products is presented.
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Information system design is a complex process that translates specified customer requirements into a description of the architecture of a software product capable of performing the desired functions. Information systems architects typically address the task by focusing on individual design aspects, such as data or specific applications, and by drawing on their previous experience to compare alternative architectural solutions. The acquisition costs of the necessary hardware are typically considered, but the associated operating and maintenance costs are often ignored or underestimated. The difficulty of optimizing individual design problems leads researchers to avoid a global optimization perspective, and thus, information system architecture typically results from a comparison of several local optima [1]. Broadly speaking, an information system is a complex that includes computing and communications hardware, software, linguistic tools and information resources, as well as system personnel, and that provides support for a dynamic information model of some part of the real world to meet the information needs of users.

Quite often, an information system is understood as an application software subsystem aimed at collecting, storing, searching and processing textual and/or factual information [3].

IS design is a sequence of interdependent actions—procedures. These procedures, in turn, imply the use of specific methods based on certain laws of nature and society. The complexity of information system design (as with any other creative activity) and the unconventional nature of project (real-life) situations necessitate knowledge of and mastery of various information system design methods.

The method of designing information systems is a targeted set of procedures that allows one to obtain as a result a description of the information system being developed with a level of detail that is sufficient for its implementation [4].

There are 5 main methodologies for designing information systems [5]:

– calendar method;

– a method based on requirements management;

– a method based on the documentation development process;

– a method based on quality management;

– architectural method.

When designing an information system using the calendar method, the work is based on a schedule of activities, which are carried out in stages. Project implementation decisions are based on the goals and objectives of a specific development stage. A disadvantage of this method is that design decisions are based on localized objectives, paying little attention to the development process, technical documentation, creation of a stable architecture, and change management. This results in high overall project costs for the client. This method is considered obsolete, yet many organizations continue to use it.

The requirements-based approach focuses primarily on the functional characteristics of a system, often underestimating non-functional characteristics such as scalability. This approach is quite effective when requirements are defined at the outset of a project and remain consistent throughout the design process, which is extremely rare today. The main drawback of this approach is the lack of a stable architecture, as each implemented function is mapped to one or more functional components, significantly complicating the addition of new requirements to the system. This approach successfully tracks the progress of all requirements within the project implementation plan, but its use for long-term projects is ineffective.

A method based on the documentation development process aims to develop the necessary technical documentation for a project. This approach continues to be used in government organizations and large companies. The main drawbacks of this method include the significant time and effort spent on documentation development at the expense of the quality and testing of the code being developed. Furthermore, the user and client often fail to utilize the documentation produced.

A quality management-based approach involves using various measures to track specific software product parameters. For example, if the technical specifications call for a system response time of less than one millisecond, this parameter is monitored throughout all stages of the information system design. This often comes at the expense of other characteristics, such as scalability and ease of maintenance. This approach has the following drawbacks: often, the parameters optimized are not those actually required, and when new customer requirements emerge, problems with changing the functionality of the information system under development may arise. Information systems created in this manner typically represent low-quality architectural solutions, and this approach is considered conservative. Its use may be justified when systems with extreme characteristics need to be created.

The architectural method is based on the creation of frameworks that can be easily adapted to all technical requirements of all potential clients. A distinctive feature of this approach is the division of the design task into two separate subtasks: the design and development of a reusable framework and the creation of a specific software product based on

it. Moreover, these two tasks can be accomplished by different specialists. Using an architectural approach allows for the rapid modification of existing functionality and the addition of new ones to the designed information system.

Table 1 presents the advantages and disadvantages of the considered approaches to building the architecture of information systems.

Advantages and disadvantages of methods for constructing information systems architecture

No.	Method	Advantages	Flaws
1	Calendar method	Completing the project on time as the work schedule is a priority. Phased implementation of works.	Design decisions are made based on local objectives. Creating a stable architecture is not a priority. Obsolete method.
2	Requirements management based method	Monitoring the implementation of all requirements in the project implementation plan. Particular attention is paid to the functional characteristics of the system.	Lack of stable development architecture. Difficulty adding new requirements to a project. Insufficient development of non-functional characteristics. Not effective for long-term projects.
3	A method based on the documentation development process	Detailed documentation for the user and customer. Use in government organizations and large companies.	Large expenditure of team resources on documentation development at the expense of quality. The user and the customer most often do not use the created documentation.
4	Quality management based method	Creating systems with extreme characteristics. Covering most of the code with tests. Using various measures to track certain parameters of a software product.	Optimization of parameters that are not actually required. Difficulty changing functionality when new requirements arise.
5	Architectural method	Breaking a task into subtasks. Creation of frameworks that can be easily adapted to different customer requirements. Prompt addition of new functionality.	Execution of work by different specialists.

Based on the information system architecture design methods presented above, it can be assumed that the architectural method is best suited for mobile application design, as it is currently relevant and simplifies the developer's work if a similar software product has already been written. When designing a desktop application, a requirements-based approach is preferable, as desktop programs are created for predefined purposes and perform specific functionality that remains virtually unchanged. For website development, the architectural method is most suitable, as there are currently a large number of frameworks available that can be used to implement the task.

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