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APPROACHES TO ARCHITECTURAL SOLUTIONS OF ENTERPRISE SOFTWARE BASED ON SERVICES AND MICROSERVICES

There has been an increase in the complexity of applications for enterprises in recent years, the growing demands and needs to manage the evolution of these applications. This is the impetus for the search for new architectural solutions based on distributed systems, and the active use of service-oriented architecture (SOA) and microservice architecture (MSA) architecture.

This is especially true for enterprise systems, which are complex software applications for large businesses, and which must meet hundreds of individual requirements. Enterprise programs are scalable, data-oriented, distributed [1]. Distributed architectures provide more advantages over monoliths, namely: component separation, better scalability, and better control over design, testing, and deployment. Another advantage of a distributed architecture is that less interconnected and modular programs can be developed [2]. Such programs can be deployed on various platforms on enterprise networks or Internet.

Thus, traditional enterprise software are usually complex and multifunctional projects. Therefore, the use of service-oriented architecture will provide flexibility by bridging the gap between the level of IT applications and the level of business processes.

Service Oriented Architecture (SOA) is a distributed architectural structure that provides solutions based on a set of interoperable services. SOA has emerged as an architectural approach that increases the productivity of existing traditional systems, while maintaining their most important functions [3]. This architecture has attracted attention due to a number of advantages it offers, such as weakly connected services, platform independence, flexibility, and so on.

But SOA faces some problems and limitations related to the selection and identification of services, collaboration of services, composition of services, interprocess communication between services, etc. [4]. Thus, the sharing of databases in SOA can help create a kind of close connection between data services and other components of the system, which leads to undesirable situations. Another problem is that SOA services tend to have a «high-modulus structure», which can make it difficult to reuse [5].

A further development of SOA is the architectural style of microservices (MSA) – a modern approach to software development, the main principle of which is to create a software project by dividing its business components into small services (services) that can be deployed and work independently [6]. Each of the services works in its own process. Interaction between services takes place through clearly defined interfaces using standard protocols.

It is worth noting that microservices, in a sense, are the next step in the evolution of service-oriented architecture (SOA), because they support many concepts that SOA. First of all, both

approaches have common features inherent in distributed architectures, they offer significant advantages over monolithic and multilevel architectures due to better scalability, better separation and control over development, testing and deployment. The components in these architectures are more autonomous, which simplifies maintenance and change control. This, in turn, leads to more reliable applications.

However, there are some differences that distinguish microservices as an independent direction in the development of distributed systems architecture. According to Mark Richards, the main difference between these approaches is that the microservice architecture is built on the principle of «as few shared elements as possible», and SOA, on the contrary, uses the principle of «as many shared elements as possible», in which the main emphasis is on abstraction and reuse of business logic [7, p.22]. In MSA, service functionality tends to be very small, sometimes implemented through only one or two modules; in SOA services tend to include much more business functionality, sometimes implemented as complete subsystems [2].

Despite the fact that microservices and SOA rely on «service» as the main component of the architecture, they differ greatly in the characteristics of services. Conceptual differences lie in the amount of responsibility assigned to a particular service. In SOA, a service may be responsible for processing a wide range of functions and data domains, while a microservice manages one data domain and one set of corresponding functions or one function in that domain.

These properties provide advantages to microservice architecture in the development of high-scale enterprise projects. This approach allows to solve some problems related to SOA, as well as problems identified with large monolithic applications [7, p. 9].

According to researchers [5, 8, 9], the use of MSA is appropriate for the maintenance and processing of big data. The first factor in the success of big data architectures that use microservices is to maintain data integrity. Another success factor is the technological independence of individual components [8]. Researchers [5] propose the deployment of services on many standard hardware servers to achieve the required modularity and scalability. High scalability is achieved by removing the constraints of a centralized database and using replicated data grids in memory instead.

The results of a survey conducted by IBM Market Development & Insights (2021) [10] show that users see improvements from the application of microservice architecture in enterprise applications for their business. Among the benefits they felt were: high flexibility to increase or decrease program resources, improved data protection, faster market entry and rapid response to changes that occur during application development and implementation, etc., low risks during project deployment etc.

But respondents highlighted a number of problems they encountered while applying this architecture in business. However, only a relatively small percentage (≤25%) of respondents (developers, developer managers and IT managers) mentioned any of them as a serious problem [10]. Lack of proper microservice skills and knowledge, as well as too many outdated systems and lack of enterprise support are the most popular reasons why companies have not integrated microservices into their programs [11].

Thus, the considered architectural approaches have both advantages and certain limitations. However, when developing enterprise software applications, it is necessary to choose an architecture that will meet the new requirements and be as flexible as possible to respond to changes in the future [12]. Of course,

each project has its own characteristics that must be taken into account at the design stage, but if you need to change the hardware, programming language or physical location of your data center, data processing – high expediency is microservice architecture in enterprise software applications. Large companies should consider investing in microservices as a way to alleviate their dependence on their own and outdated systems. They are no longer dependent on a particular hardware or software vendor and can upgrade components of their infrastructure without affecting a large number of applications, using MSA [11].

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