

Digital Architecture's Requirements of Russian Business to Technologies, Providing Its Implementation

Sergey G. SVETUNKOV

Peter the Great Saint Petersburg Polytechnic University, Saint Petersburg, Russian Federation,
sergey@svetunkov.ru

Alexandra D. BORREMANS

Peter the Great Saint Petersburg Polytechnic University, Saint Petersburg, Russian Federation,
alexandra.borremans@mail.ru

Alissa DUBGORN

Peter the Great Saint Petersburg Polytechnic University, Saint Petersburg, Russian Federation,
alissa.dubgorn@gmail.com

Elizaveta A. ZOTOVA

Peter the Great Saint Petersburg Polytechnic University, Saint Petersburg, Russian Federation,
zotova@kafedrapik.ru

Abstract

Nowadays, thanks to the advent and development of such modern information technologies as IoT, Big Data, Blockchain and many others, digitalization affects more and more areas of Russian business. Such changes are inevitably reflected in enterprise architecture. This research discusses the need to adapt the standard enterprise architecture framework, TOGAF, to present the latest technologies in it. Moreover, a list of digital architecture's requirements of the Russian business for the technologies ensuring its implementation has been compiled.

Keywords: digital architecture, enterprise architecture, IT requirements, enterprise architecture framework

Introduction

Digitalization is a business transformation. This is the use of information technologies (IT) for the implementation of business processes and the digitization of all types of information that can benefit the business (Legner et al., 2017). Digitalization is changing not only business, but the whole society, creating electronic services, products, changing the usual approach to production, work, training. For example, the creation of a single digital infrastructure for public services, advanced online banking, electronic medical records, online universities and the robotics of some professions, all this is just an incomplete list of innovations that came with the advent of digitalization (Dubgorn, Zaychenko, & Grashhenko, 2018).

This change in business became possible only thanks to the active development and popularization of the latest technologies. According to the «Hype Cycle for Emerging Technologies» popularity chart, technologies such as Blockchain, Digital Twins, Virtual Assistants, the Internet of Things and Deep Learning are now at the peak of high expectations, which means that they are in the active phase of implementation and use in various fields (Figure 1)(Panetta, 2018).

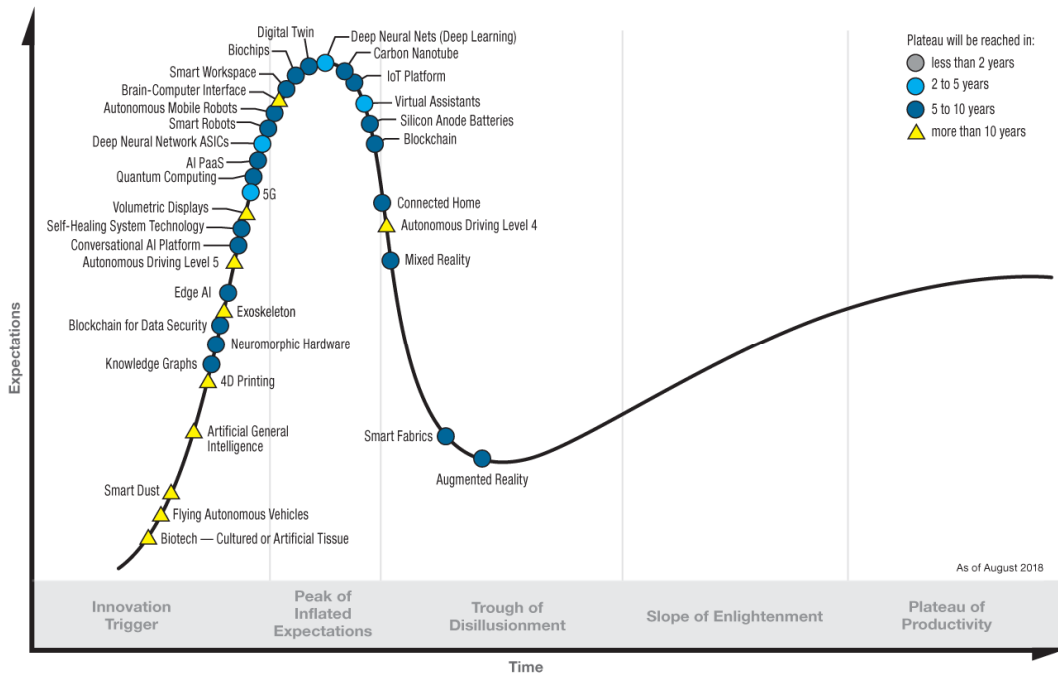


Fig. 1: Hype Cycle for Emerging Technologies, 2018

Consider examples of the implementation of these technologies in Russian business. For example, Blockchain technology has become the basis of a project for registering participatory construction contracts. This project will allow to have more transparent transactions, both for equity holders and for the state (Kolobov, Filatova, Borshcheniuk, Semerianova, & Bayanov, 2019). Moreover, the project of the first information system in Russia for antitumor clinical research based on the Blockchain implemented by one of the oncology research center can be highlighted. Such a system will make it possible not only to register research volunteers, but also to secure their personal information (I. Ilin, Levina, Lepekhin, & Kalyazina, 2018). Digital twin technologies are actively used in one of gas and oil companies to create unified control centers for oil refineries and oil producers. This allows to diagnose objects, manage them, predict and optimize their work remotely (Zaychenko, Smirnova, & Kriukova, 2018). Speaking about virtual assistants, it is worth mentioning first of all voice assistant from Russian IT company, whose monthly audience is 35 million unique users. This assistant can not only answer questions and order a taxi, but also be the basis of a Smart Home system, coordinating all Internet things on the network. Speaking about the Internet of Things, which is the basis of many modern technologies, should be mentioned that production and transport are leaders in investing in the Internet of things in Russia. Moreover, the Internet of Things is actively used in the field of housing and communal services, this is ensured by smart meters that transmit and analyze data (Zaychenko, Borremans, & Gutman, 2018). Deep Learning, in turn, is a field of machine learning research and an area of artificial intelligence (AI) research. According to studies, virtual assistants, machine learning and predictive analysis are the most used AI technologies in Russian business (Figure 2) (Wright & Schultz, 2018).

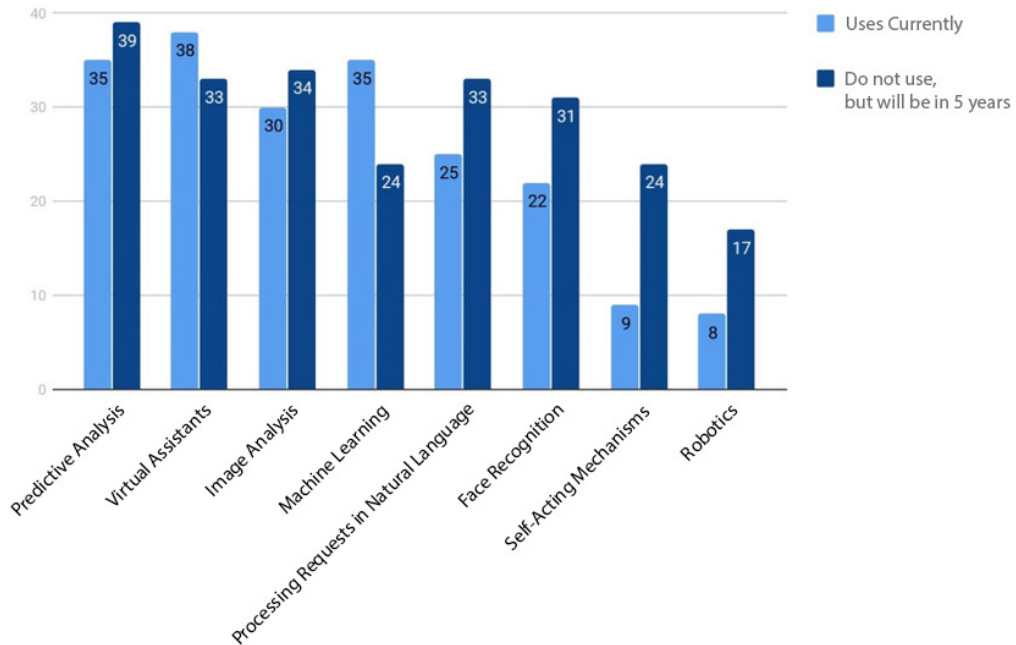


Fig. 2: AI technologies in Russian companies, %

Since many of these technologies have recently begun to be applied on real projects, it is now too early to judge the success and effectiveness of these technologies in the long term, but nevertheless, active business changes are already noticeable. Moreover, a changing business dictates requirements for changing the architecture of the enterprise.

Today, the most famous and used enterprise architecture description framework is TOGAF. It is based on the ADM method, which step by step describes the development of architecture. Three TOGAF enterprise architecture domains, which can be called three layers of architecture, are distinguished: a Business layer, an Application layer, and a Technological layer (Figure 3) (Levina, Borremans, & Burmistrov, 2018).

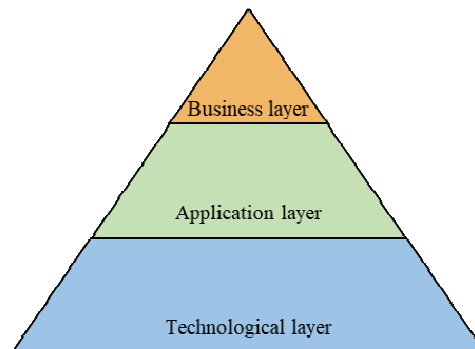


Fig. 3: TOGAF domains

TOGAF itself is a comprehensive framework that can be adapted to the development of a specific corporate architecture. However, from the point of view of modern IT, this framework cannot be considered universal.

Despite the fact that TOGAF mentions and describes business services on the Business layer, application services on the Applications layer, platform services on the Technology layer, and there is also a special notation “Mobile IT Category” and the API is mentioned in the Applications layer and the Technology layer, there are no cloud elements in this framework (Masuda, Shirasaka, Yamamoto, & Hardjono, 2018).

The purpose of this article is to formulate a list of requirements for information technology for the subsequent description of the new digital business architecture framework for Russian business.

Literature Review

Information technology requirements imply a description of the properties and qualities of information systems, software and hardware. Speaking about IT requirements in general, there are two types of requirements: functional and non-functional in nature. The first type describes the requirements for the behavior of the system, the second - shows the requirements for the nature of the behavior of the system (Becker, Tebes, Peppino, & Olsina, 2019). The subtypes of requirements and their case examples in more details are presented in the Table 1. The examples are made on the basis of Russian transport industry (I. V. Ilin, Iliashenko, Klimin, & Makov, 2018).

Table 1: IT requirements

Type of requirements nature	Subtype of requirements	Characteristic and example of requirements
1. Functional	1.1 Business requirements	Description of the high-level goals of the enterprise that will be achieved by implementing IT. Example: Intelligent Transport Infrastructure, within the framework of the Smart City concept, should automatically inform the traffic participants with up-to-date information using digital information boards (DIB) (Bolobonov, Ilin, Korolev, & Frolov, 2019).
	1.2 User requirements	Description of how the product is used by the end user. Example: User Stories describing the driver, who changed the route, having learned the latest information from the DIB.
	1.3 Functional requirements	Description of the functionality that can be implemented in this system. Example: The digital information boards should display the optimal speed, calculated taking into account weather conditions and congestion routes.
2. Non-functional	2.1 Business rules	A characteristic defining or restricting certain aspects of a business. Example: Placement of the DIB should be in accordance with the standard.
	2.2 System	Description of a specific method for implementing product functionality. Example: a system for analyzing the current situation on the road should be located on a cloud platform where

	requirements	unstructured big data will be processed.
	2.3 Documentation Requirements	Description of the content of documents required for implementation. Example: documentation for the development of an information system must comply with an international standard IEEE Std 1016-1998 «IEEE Recommended Practice for Software Design Descriptions».
	2.4 Design and usability requirements	Description of graphic, visual and navigational aspects of the developed IT. Example: The font used in the DIB should be read when visibility is poor.
	2.5 Security and Reliability Requirements	Description of the created security levels, access levels, identification process and information flows. Example: Only leading programmers can access changes to the system algorithm.
	2.6 Function metric requirements	Description of performance indicators, fault tolerance, etc. Example: a system can be updated only at night.
	2.7 Operation and Personnel Requirements	Description of the required level of staff skills and requirements for working with IT. Example: After each major update of the information system, staff training is required.
	2.8 Other requirements and restrictions	Description of the possibility of integration, mobility, autonomy. Example: a system must be integrated with all Smart City systems (Chourabi et al., 2012).

It can be noted that all the requirements listed above relate to different layers of the enterprise architecture: from the goals and initiatives of the business (1.1, 2.1, 2.3, 2.7, 2.8) and specific applications (1.2, 1.3, 2.4.), ending with the requirements for networks and IT infrastructure (2.2, 2.5, 2.6).

Results

The enterprise architecture represents a comprehensive vision of the organization. That is why the framework on which it is built should reflect all aspects of the business, including new information technologies. To create this new framework for building a digital architecture, it is necessary to take into account not only existing standards and contain not only the basic requirements for IT, but also include a number of additional organizational requirements (Masuda & Viswanathan, 2019). The list of such requirements includes:

1. Standardization of the main business processes of the selected industry.

One of these requirements is the standardization of the main business processes of a particular industry and the creation of flexible data management platforms. Such standardization will allow the development of more “box version” IT solutions, which will accelerate the pace of digitalization of area. Moreover, this will allow the creation of adapted versions of reference models of enterprise architecture for specific industries.

2. Creation and incorporation of an Architecture Board into organization.

The next requirement is the mandatory inclusion of Architecture Board in the organization, which would allow to create high-quality and flexible models, as well as understand the necessary level of IT implementation in a particular case.

3. Analysis of demand for IT.

This analysis and subsequent management in a specific area should also become the basis for building the architecture of a digital enterprise. This will not only reduce the cost of introducing new IT in the industry, but also make it possible to predict the risks associated with their implementation.

4. Assessment of the enterprise maturity regarding the application of IT.

Another important aspect may be the level of the enterprise maturity for the implementation of modern technologies. The created assessment model will allow building models for implementing various IT for specific cases.

The requirements described above should be the core of the enterprises development along with functional and non-functional requirements. It is a combination of organizational, functional and non-functional requirements that will allow to build an ecosystem of enterprise architecture for the subsequent creation of reference models and a new framework.

Conclusions and Discussions

The digitalization and development of modern enterprises is inextricably linked with a change in the enterprise architecture. The new digital architecture puts new demands on information technology. Now these requirements should be not only functional in nature, for example, a description of the strategy and technical means of its implementation based on user requirements. Also, requirements of a non-functional nature should be taken into account, for instance, requirements for documentation, interface, standardization, personnel, etc. Moreover, the organizational requirements describing the approach to IT implementation become the most important requirement of the digital space architecture.

In the further studies, the issue of forming a reference model of the digital Russian business based on the described IT requirements can be considered. Moreover, the question of formalizing organizational requirements, for example, by creating a model for assessing the enterprise maturity and their readiness to implement modern IT, can be raised.

Acknowledgments

The reported study was funded by RSCF according to the research project № 19-18-00452.

References

- Becker, P., Tebes, G., Peppino, D., & Olsina, L. (2019). *Strategies for achieving Business Goals that imply Functional and Non-Functional Requirements*.
- Bolobonov, D., Ilin, I., Korolev, I., & Frolov, A. (2019). IoT in Smart Cities' Utility Systems: From prototype to production. *International Conference on Digital Technologies in Logistics and Infrastructure (ICDTLI 2019)*. Atlantis Press.
- Chourabi, H., Nam, T., Walker, S., Gil-Garcia, J. R., Mellouli, S., Nahon, K., ... Scholl, H. J. (2012). Understanding smart cities: An integrative framework. *2012 45th Hawaii International Conference on System Sciences*, 2289–2297. IEEE.
- Dubgorn, A., Zaychenko, I., & Grashhenko, N. (2018). A rationale for choosing the mechanism of public-private partnership for the sustainable development of social infrastructure facilities. *MATEC Web of Conferences*, 170, 01056. EDP Sciences.
- Ilin, I., Levina, A., Lepekhin, A., & Kalyazina, S. (2018). Business Requirements to the IT Architecture: A Case of a Healthcare Organization. *Energy Management of Municipal Transportation Facilities and Transport*, 287–294. Springer.
- Ilin, I. V., Iliashenko, O. Y., Klimin, A. I., & Makov, K. M. (2018). Big data processing in Russian transport industry. *Proceedings of the 31st International Business Information Management Association Conference, IBIMA 2018: Innovation Management and Education Excellence through Vision 2020*, 1967–1971.
- Kolobov, R., Filatova, U., Borshcheniuk, V., Semerianova, N., & Bayanov, D. (2019). Reform of participation in shared construction as a condition for urban development. *E3S Web of Conferences*, 110, 02095. EDP Sciences.
- Legner, C., Eymann, T., Hess, T., Matt, C., Böhmman, T., Drews, P., ... Ahlemann, F. (2017). Digitalization: Opportunity and Challenge for the Business and Information Systems Engineering Community. *Business & Information Systems Engineering*, 59(4), 301–308. <https://doi.org/10.1007/s12599-017-0484-2>
- Levina, A. I., Borremans, A. D., & Burmistrov, A. N. (2018). *Features of enterprise architecture designing of infrastructure-intensive companies (2018) Proceedings of the 31st International Business Information Management Association Conference*. IBIMA.
- Masuda, Y., Shirasaka, S., Yamamoto, S., & Hardjono, T. (2018). Risk Management for Digital Transformation and Big Data in Architecture Board: A Case Study on Global Enterprise. *Information Engineering Express*, 4(1), 33–51.
- Masuda, Y., & Viswanathan, M. (2019). *Enterprise Architecture for Global Companies in a Digital IT Era: Adaptive Integrated Digital Architecture Framework (AIDAF)*. Springer.
- Panetta, K. (2018). 5 Trends Emerge in the Gartner Hype Cycle for Emerging Technologies, 2018—Smarter With Gartner. Retrieved 7 October 2019, from <https://www.gartner.com/smarterwithgartner/5-trends-emerge-in-gartner-hype-cycle-for-emerging-technologies-2018/>

Wright, S. A., & Schultz, A. E. (2018). The rising tide of artificial intelligence and business automation: Developing an ethical framework. *Business Horizons*, *61*(6), 823–832. <https://doi.org/10.1016/j.bushor.2018.07.001>

Zaychenko, I., Borremans, A., & Gutman, S. (2018). Analysis of administrative barriers in the industry of the high-rise construction in Russian Federation. *E3S Web of Conferences*, *33*, 03010. EDP Sciences.

Zaychenko, I., Smirnova, A., & Kriukova, V. (2018). Application of Digital Technologies in Human Resources Management at the Enterprises of Fuel and Energy Complex in the Far North. *Energy Management of Municipal Transportation Facilities and Transport*, 321–328. Springer.