

INTEGRATION OF SOFTWARE SYSTEMS IN THE CORPORATE ENVIRONMENT

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Abstract: The integration of different software systems in the corporate environment represents a key challenge for organizations that want to efficiently manage their information resources. This paper explores the processes, strategies, and technologies used to successfully connect diverse software systems to improve business processes and operational efficiency. Through an analysis of challenges such as platform compatibility, data security, and system scalability, best practices and techniques to overcome these obstacles are considered. Special emphasis is placed on the role of APIs (application programming interfaces) as key tools for integration, along with the research of methodologies for their efficient implementation and change management. Through this research, the goal is to identify key success factors and provide guidance for organizations seeking to optimize their information resources through software system integration. The paper will give examples of successful integration services that enabled the exchange of various data in the critical business processes of Elektroprivreda BiH, as well as the challenges we faced when designing and implementing them.

Keywords: integration, interface, API, software systems, business processes

INTRODUCTION

In today's business environment, organizations are increasingly relying on complex information and communication systems to support their business processes and increase operational efficiency. The integration of various software systems within a corporate environment presents a key challenge that organizations must overcome to optimally manage their information resources. In this context, integration refers to the connection of diverse software applications and modules, such as Enterprise Resource Planning (ERP) systems like SAP, Customer Relationship Management (CRM) systems, Billing systems, Geographic Information Systems (GIS), and other specialized software. The goal of integration is to enable seamless data exchange between different systems, thereby improving the coordination of business processes, reducing the multiple entry of the same data (thus reducing the possibility of data entry errors), and increasing overall productivity.

However, the integration process is not without its challenges. Organizations face a number of technical and operational obstacles, including platform compatibility, data security, system scalability, and maintaining interoperability between different applications.

Precisely because of these challenges, the choice of appropriate strategies and technologies for integration becomes crucial. Through this work, we explore the processes, strategies, and technologies that enable

successful software system integration. Particular emphasis is placed on the role of Application Programming Interfaces (APIs), which represent a key tool for connecting different software applications.

APIs enable standardized data exchange and functionality between systems, significantly facilitating integration.

In addition, the paper analyzes methodologies for the efficient implementation of APIs and change management, which are necessary to maintain the long-term stability and efficiency of integration solutions.

Through practical examples, particularly from the experiences of Elektroprivreda BiH, we present successful integration cases as well as the challenges we faced when designing and implementing data exchange interfaces.

Finally, the goal of this research is to identify key success factors in software system integration and provide guidelines for organizations seeking to optimize their information resources. Successful integration enables organizations to take full advantage of modern information technologies, improve their business processes, and achieve a greater competitive advantage in the market.

1. SOFTWARE SYSTEM INTEGRATION

Successful integration of software systems offers numerous benefits but also presents certain challenges

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that must be overcome. This chapter will focus in detail on the key obstacles that organizations may encounter when implementing integration solutions, as well as strategies for addressing them.

1.1. Challenges of software system integration

One of the biggest challenges in the corporate information systems environment is platform compatibility. Different software systems are built using different technologies that use their own unique standards and communication protocols. This fact presents a serious challenge when integrating heterogeneous systems and exchanging data between them. There are several strategies that can offer solutions to these challenges:

- Platform standardization (ESB – Enterprise Service Bus): Wherever possible, corporations can implement standardization on a common platform for future software solution implementations. This would eliminate the compatibility problem and enable easier integration.
- API Integration: APIs represent a neutral layer that enables communication between different software systems. Implementing APIs as intermediaries allows for the connection of heterogeneous systems regardless of their underlying platform.
- Point-to-Point Integration: Direct connection of two applications. Simple for small systems but prone to scalability problems.
- Microservices: An architectural style that breaks down applications into smaller, independent services that can be integrated. In practice, a combination of several different ways of integrating system components is most common. In addition to the above, it is very important to pay attention to the following aspects of integration:
- Documentation: It is necessary to create thorough documentation that contains key information about all integration points. Additionally, documentation must be regularly maintained, as systems in the corporate environment are constantly growing and developing, introducing new functionalities.
- Testing: To ensure functionality and desired system performance, it is necessary to test integration solutions.
- Change management: Given the constant upgrading of information systems in the corporate environment, there is also a demand for changes to integration components. In this sense, it is necessary to devise a strategic approach to change in order to minimize risks and ensure quality of service.

1.2. Data security

Integration of information system components opens up new access points for potential cyberattacks. Organizations must be sure that data is protected during transfer and exchange between different systems. There

are several ways to overcome security challenges:

- Authentication and authorization: Restricting access to data only to authorized user groups and applications is key to preventing unauthorized access.
- Activity monitoring: Implementing activity monitoring systems enables organizations to track data access and identify potential security incidents.
- Data encryption: Encrypting data at rest and in transit ensures that unauthorized parties cannot access sensitive information even if there is an unauthorized intrusion into the system.

1.3. System scalability

Integration solutions in the corporate environment must be ready to support the constant growth in the number of functionalities, so they must be scalable to accommodate the growing needs of the organization. A system that cannot handle increased data volume or number of users can become a bottleneck and hinder operations.

- Modular architecture: Designing an integration architecture with modular components allows for easier scaling and adding functionality as needed.
- Choosing scalable solutions: When selecting integration tools and platforms, it is important to consider their scalability to support future growth.

2. CASE STUDIES AND PRACTICAL EXAMPLES

This chapter focuses on concrete practical examples that illustrate the challenges and successes in integrating software systems. Particular emphasis is placed on the experiences of Elektroprivreda BiH.

2.1. Case Study: PE Elektroprivreda BiH

Integrating information systems, which differ in their technology, architecture, and criticality to the company, is particularly evident in the implementation of new IT projects, system upgrades, and during regular system maintenance. Namely, when establishing new IT services, it is very important to identify, record, and map all connection points of that system with existing information systems, in order to correctly configure data exchange interfaces during the execution of processes within these systems. Additionally, during regular maintenance of existing services, as well as in cases where certain migrations or infrastructure work is being done, it is very important to have documented integration interfaces, so that a certain change in configuration can be applied timely and accurately to all systems where it is required. For example, a database migration usually means changing the TNS specification, which then needs to be propagated to all application servers, database links, and other settings of all services that use the database internally or via links. In the following, two

practical examples will be described where the issue of interfaces proved to be extremely important for successful modeling and ultimately project implementation. The first case relates to the implementation of a new information system for contracting, billing, and invoicing of electricity supply activities (Billing system). Given that this is a core information system that, for the purposes of conducting the aforementioned processes, takes data from or provides it to other information systems, it was necessary to correctly specify all necessary interfaces, taking into account compatibility with existing technologies used by other systems. The following lists the interfaces to other systems, with brief descriptions of data flows and the technologies used [1], [2]:

1. Integration with the master customer registry – web services on the WebLogic platform
 - a. Synchronization of master customer data and code lists of countries, cities, and addresses
 2. Integration with the DISP system (Information system for connecting customers and producers to the distribution network - SOAP web services on the WebLogic platform)
 - a. Synchronization of power agreements, metering points, customers, and contracts for the use of the distribution network
 3. Integration with the tariff methodology module – SOAP web services on the WebLogic platform
 - a. Synchronization of offer data
 - b. Synchronization of consumption data per metering point
 - c. Synchronization of new customer data
 4. Integration with the MDM system (Meter Data Management) – web services on the Enterprise Service Bus bus of the MDM system
 - a. Synchronization of data on customer connection/ disconnection, tariff group, and supply contracts
 - b. Synchronization of billing items
 - c. Synchronization of requests and orders for customer disconnection/connection
 5. Integration with the CRM system (Customer Relationship Management) - SOAP web services on the CRM platform
 - a. Synchronization of data on: customers, consumers, financial card, additional calculations
 - b. E-invoice synchronization
 6. Integration with the web portal and mobile application for customers - SOAP web services on the backend platform of the web portal
 - a. Synchronization of data on: customers, consumers, financial card, additional calculations
 - b. E-invoice synchronization
 7. Integration with the SAP FMIS system – file transfer
 - a. Exchange of files with a synthesis of issued electricity invoices
 - b. Exchange of files with an analytics of all issued invoices for VAT reporting
 8. Integration with the ODS billing system – web services
- Currently, the technology for exchanging data

between the two future billing systems is unknown, but it should enable synchronization of:

- a. Calculated network charges items
- b. Consolidated network charge invoices

If the billing system receives data from another system via web services, the following data exchange flow must be implemented (Figure 1):

1. Initial import of data into the billing database
2. Process of obtaining data from the external system
 - a. Periodic call of the web service to retrieve data from the external system (job)
 - b. Calling the data confirmation method. Confirmation is based on confirming the timestamp up to which changes were obtained. Thanks to the confirmation, the method returns only those changes that occurred after the confirmed timestamp.
 - c. The obtained data is placed in the billing database in specially created intermediate tables from which the processing process reads the data.
3. Data processing from the external system
 - a. Create separate processes for reading and processing data from dedicated intermediate tables
 - b. Ensure mapping of data to production tables and objects of the billing database and application.

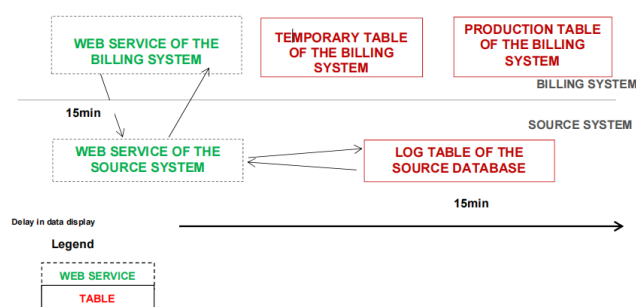


Figure 1: Schematic view of downloading data from an external system

If the Billing system is a source of data for other systems, the following data exchange flow must be implemented (Figure 2):

- Initial import of data into the destination database
- The destination software periodically (e.g., every 15 minutes) calls a web service implemented on the Billing system side
- The Billing system checks if there have been any changes in the log tables and, if so, returns the data as a response, which is written to the corresponding tables of the destination system.

Note: The interface can also be implemented through a database link between the two databases, and data can be retrieved through a job.

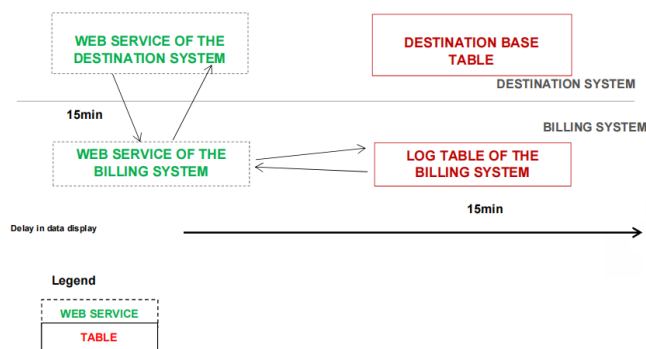


Figure 2: Schematic diagram of data synchronization between the Billing system and the destination system

Figure 3 gives a schematic representation of the interface of the future Billing system in PE Elektroprivreda BiH.

Another example that is a good indicator of the heterogeneity of information systems in Elektroprivreda, and the challenges of implementing new systems is the project of implementing a new distribution web portal.

Namely, the new web portal is designed as a front-end application through which customers, suppliers and balance-responsible parties (BOS) will have access to all necessary information about ODS. It was foreseen that through the same portal, users have the possibility of two-way interaction in the form of activating certain services, submitting online requests for connection, etc. In order to

be able to implement the aforementioned functionalities, and for customers to have quick and easy access to information, the integration of the new web portal with existing business ICT services is recognized as a key part of the technical realization of the project.

The analysis of existing interfaces, as well as the possibility of refining them, showed that some of the required functionalities can be realized using existing services without any modifications, some require adjustments, while for some functionalities completely new web services must be developed.

Functionalities that can fully utilize existing services are:

1. Web portal user authentication (login, logout, password reset): REST API web service implemented on the backend base of the corporate web portal is used
2. Customer complaint submission: a web service developed on the SOAP technology of the existing CRM system is used and enables the insertion of a set of data into the complaints table by calling the web service on the side of the CRM application
3. Fault report: a web service developed for the needs of a mobile application for customers based on REST API technology is used, which enables, and by calling the web service on the side of the CRM application, the data set is inserted into the complaints table

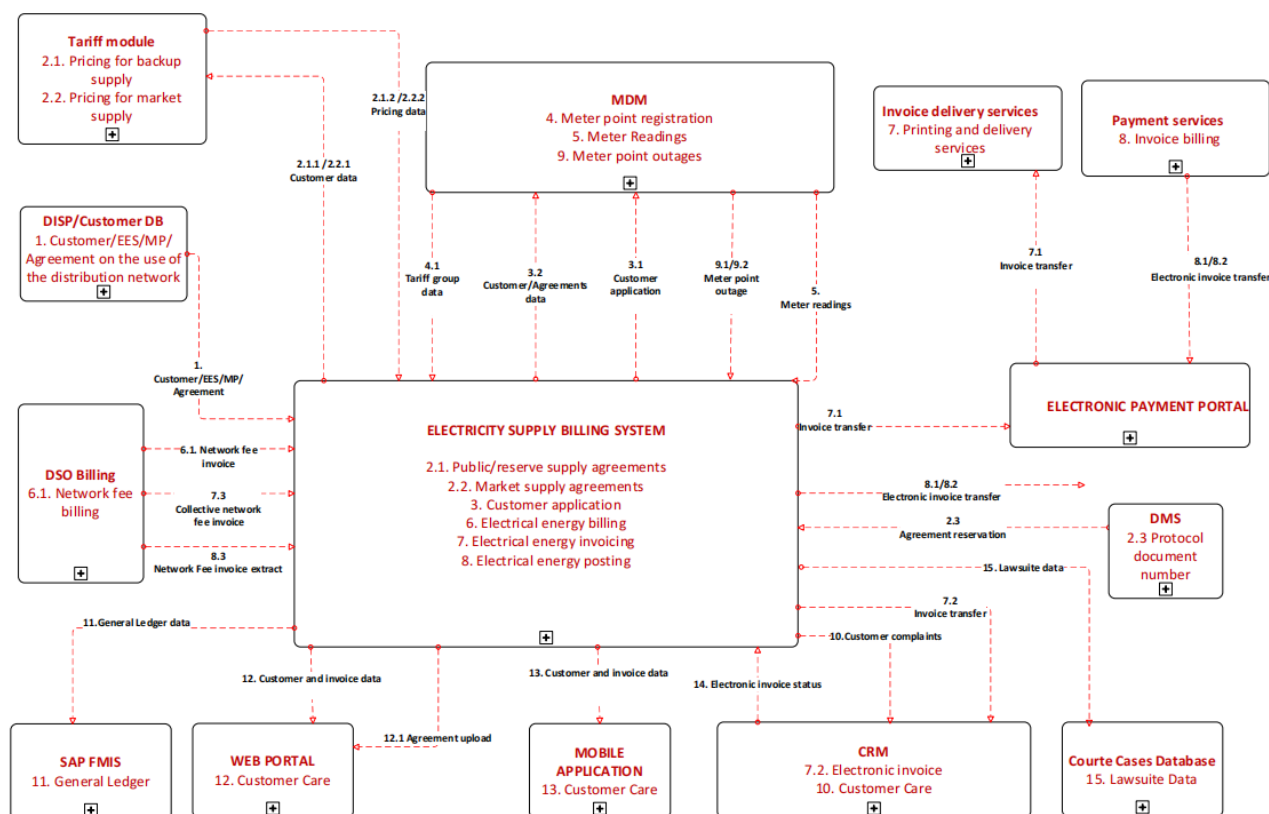


Figure 3: Schematic representation of the interface of the future Billing system in JP Elektroprivreda BiH.

4. Notification of announced planned disconnection: a SOAP UI web service developed on the side of the CRM application is used, which returns information if there is a planned disconnection for a given measuring point
5. Management of the list of measurement points for a given user: the existing REST API web service implemented on the backend base of the corporate web portal is used

Functionalities that require refinement of existing web services are:

1. Insight into the customer's financial card and overview of the bill for the network fee: refinement is needed in the part of the web service call, in such a way that instead of the consumer's code as an input parameter, the code of the metering point is passed as the distributor's data. Both web services are implemented using SOAP technology on the central WebLogic server, while the data preparation itself is implemented in the Billing database (SODM - System for calculating the distribution network fee).
2. Validation of the metering point and application to the e-service: the existing SOAP web service on the side of the CRM application needs to be refined, in such a way that the code of the metering point and the serial

number of the meter are passed as input parameters instead of the consumer's code

The functionalities that require the development of new web services in order to additionally computerize the interaction with the end users of the portal are:

1. On-line submission of requests for connection to the distribution network: on the side of the DISP application, new SOAP web services are being developed that will enable the insertion of all data from the on-line application into intermediate tables, from which, after data validation by the user, work will be done automatic transfer to tables for further processing and implementation of requests for connection
2. Timescale of online requests: web services on the DISP system side will return the current status for each request submitted online, and the web portal will, based on it, provide a graphic display of the current status in the entire connection process
3. Management of data on measuring points of suppliers and balance-responsible parties. On the side of the MDM system, web services will be implemented that will enable: adding measuring points of the garden power plant, editing data on the purchase agreement, downloading data on monthly production, etc.

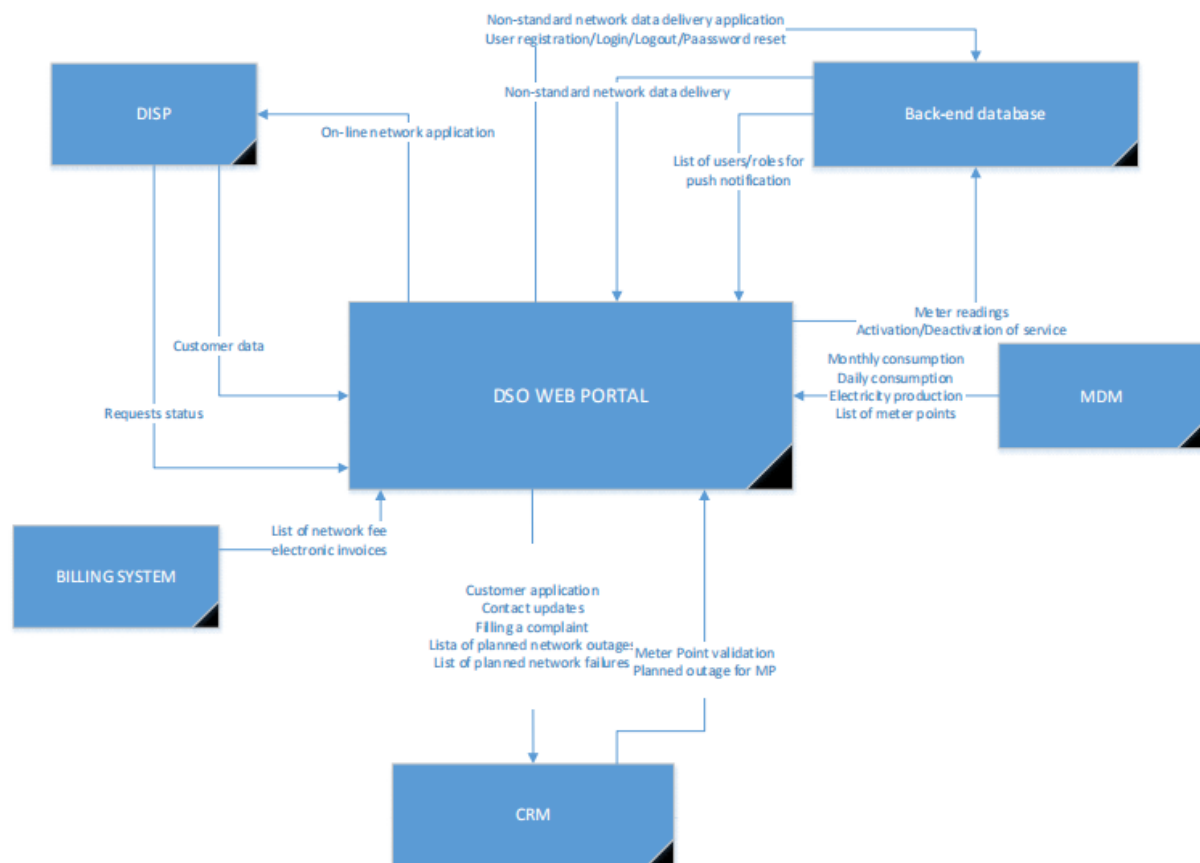


Figure 4: Graphic representation of the integration interfaces of the ODS Web portal

3. CONCLUSION

This paper tried to clarify the segment of integration interfaces and their importance in a complex and heterogeneous ICT environment such as the system of Elektroprivreda [3]. The paper presented the key challenges faced by ICT teams when implementing new and maintaining existing systems. In the end, the paper gave two examples of the implementation of new information systems in the Electric Power Industry of BiH, where the issue of the interface proved to be extremely important for successful modeling and ultimately the implementation of the project. What we can conclude from these two examples, as well as numerous others not mentioned in the paper, is that without adequate analysis, design and implementation of the interface, most of the functionality of any future software could not be realized.

After successful implementation, testing and release into production, it is very important to establish an adequate system of maintenance and documentation of all changes on the interfaces, as well as good practices of information exchange at the level of teams in charge of individual services, in order to minimize service interruptions, facilitated by the administration itself systems and interfaces, and ultimately improved the user experience on these systems.

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BIOGRAPHY

Adnan Fehratbegović is a seasoned professional with over 20 years of experience at Bosnia and Herzegovina's largest power utility, JP Elektroprivreda BiH. As a Team Lead and Software Architect, he has designed and implemented enterprise numerous systems, driving efficiency across departments. Certified in Agile methodologies (PMI-ACP, PSM I), Adnan excels in stakeholder collaboration, digital transformation, and technologies such as Java, Spring Boot, React, and Oracle, delivering impactful solutions for the utility sector.

Selma Kovačević has more than 20 years of experience in JP Elektroprivreda BiH, current position Head of department for ICT services. Previous positions: System administrator, Expert associate for planning, developing and implementing ICT projects. Academic achievements: Master science degree at Faculty of Electrical Engineering, Department for Computer Science and Informatics, Sarajevo, BiH. Actively engaged in BH K CIGRE D2 Committee as Secretary. Published more than 30 expert papers at international conferences and symposia on the topic of IT systems and applications in the business environment. Topics of interest: Project management, IT leadership, IT security management and audit, digitalization and optimization of business processes in complex business environments.

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- Information Security Management systems (ISMS) certified expert
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- Project Management systems (MS Project server)