International Journal of Scientific Engineering and Science
Volume 8, Issue 5, pp. 10-14, 2024. ISSN (Online): 2456-7361

AI-driven Optimization of Enterprise Software Integration Processes

Rinat Sharipov
Founder at UpLook.AI, Mexico, Guadalajara.
Email address: shamasher@gmail.com

***Abstract*—** *This article provides a comprehensive examination of the transformative impact of Artificial Intelligence (AI) and software integration on modern business practices, emphasizing the shift towards more efficient, agile, and customer-centric operations. It delves into AI capabilities in automating routine tasks, enhancing data analysis for strategic decision-making, and fostering software development processes through intelligent testing, predictive analytics, and code generation. Additionally, the article highlights the pivotal role of software integration in streamlining operations across various business functions, thereby increasing efficiency, reducing error risks, and improving customer service. It advocates for a new management paradigm characterized by less hierarchy, decentralized decision-making, and flexible team organization, all underpinned by rapid information sharing and a focus on predefined objectives. Through its analysis, the article underscores businesses' need to adapt to these technological advancements to remain competitive in the evolving digital landscape*.

***Keywords*—** *Software, IT, software integration, enterprise, process optimization*.

I. INTRODUCTION

Entrepreneurship has yet to become an exception in today's dynamic changing spheres of life. Business processes are constantly improving and developing, and the company is striving to automate and optimize its activities to strengthen its market competitiveness. Integrating software into enterprise systems is becoming a crucial step necessary for achieving effective business management.

However, developing and implementing effective enterprise management solutions requires both technical skills and a deep understanding of the company's business processes. The individual characteristics of each enterprise, its goals, and objectives are important for creating an optimal software solution capable of meeting all the requirements and needs of the business environment.

An enterprise information system (IS) is a set of information resources, processes, and technologies that collect, transform, and distribute corporate information. The summary goal of enterprise IS consists of accumulating, storing, and transforming information for its usage in managerial decision-making. Modern enterprise IS has a complex, frequently heterogeneous structure and addresses a large number of diverse automation tasks. As a rule, the organization of IS information sources and consumers, including users and other IS, determines the structure and functionality of enterprise IS [1].

The article aims to consider the optimization of enterprise software integration. The methodological framework for writing this paper included the scientific works of Russian authors.

1. General Characteristics

Enterprise application integration is a unique structure combining various technologies and services. This comprehensive environment forms a middleware or "integration middleware platform" capable of integrating systems and applications effectively within an enterprise. The process of enterprise application integration aims to combine applications within a single organization to maximize the simplification and automation of business processes while avoiding radical changes to existing applications or data structures. The applications can connect through an API to the server side or (in rare cases) externally through a graphic user interface. Various systems undergoing integration may run on different operating systems using databases, computer languages, or date and time formats. Occasionally, interaction with the legacy systems, no longer supported by the original provider and sometimes referred to as "chimney systems," may be possible. These systems consist of tightly interconnected components, making them difficult to modify [2].

2. Enterprise Application Integration

Enterprise Application Integration (EAI) represents the process of combining business applications and hardware systems a company uses. The primary goal involves automating business processes, increasing employee performance, and improving interdepartmental interaction.

EAI solutions ensure a smooth data flow between applications and databases connected via middleware. These components link applications, often utilizing different technology stacks or outdated technologies not supported by the original provider.

Application integration has four levels of implementation:

1. Data Level: involves extracting and transforming data from one database and transferring it to another with the help of ETL tools.
2. Application Interface Level: the process, referred to as a "hub" or "message broker integration," includes extracting data through each application's interface, transforming it, and transferring it to the target application.
3. Method Level (ESB): defines methods used by multiple applications, providing common business logic for the enterprise software ecosystem. This level requires significant modification of existing applications.

http://ijses.com/
All rights reserved

4. Method (or enterprise bus) integration: this method has long been a preferable EAI approach, but microservices may change the overall picture.

These integration levels suit different enterprises depending on their needs and IT infrastructure framework.

No universal approach is available when addressing the issues of enterprise application integration. Despite successful transitions to microservices of large companies like eBay, PayPal, and Gilt Groupe, small businesses may lack the necessary expertise and resources to support complex microservices systems. Furthermore, new technology trends are worth considering. The Internet of Things, the use of personal devices, and the proliferation of low-code software development solutions create new challenges and threats for companies and their customers. When planning for business application integration, consider selecting an experienced provider that follows the latest EAI trends and best practices [3].

3. Evolution of Approaches to Information System Integration

The concept of information system integration has a long history. The need for information systems integration emerged when businesses implemented more than one system. Integration approaches have changed over time, especially between the 1970s and 1980s. Back then, enterprise information systems performed simple functions, automating individual processes. With the development of systems, the functionality became more complex, and the concept of modular information systems emerged.

In the early 1990s, universal information systems became the standard for comprehensive automation, covering all areas of a company's activities. A unified hardware and software platform and a common database where modules used a single technological process were the basis for such systems.

The development led to the emergence of modular system architecture in the 1990s. The main trend consisted of creating all-purpose information systems covering all spheres of the enterprise activity. A unified hardware and software platform and a common database with interrelated functional subsystems became their basis.

Examples of such systems include ERP (Enterprise Resource Planning) and CRM (Customer Relationship Management). For instance, CRM modules automate customer support services, sales activities, and marketing. These systems are currently in widespread use; however, the unique business characteristics can create limitations to a complete transition to unified solutions.

Along with general-purpose systems, the specialized software market was developing, competing with individual modules of general-purpose systems. Specialized solutions offered narrow specialization, considering the business process peculiarities. They are currently an integral part of enterprise IT infrastructure alongside general-purpose systems, creating many interconnections between them.

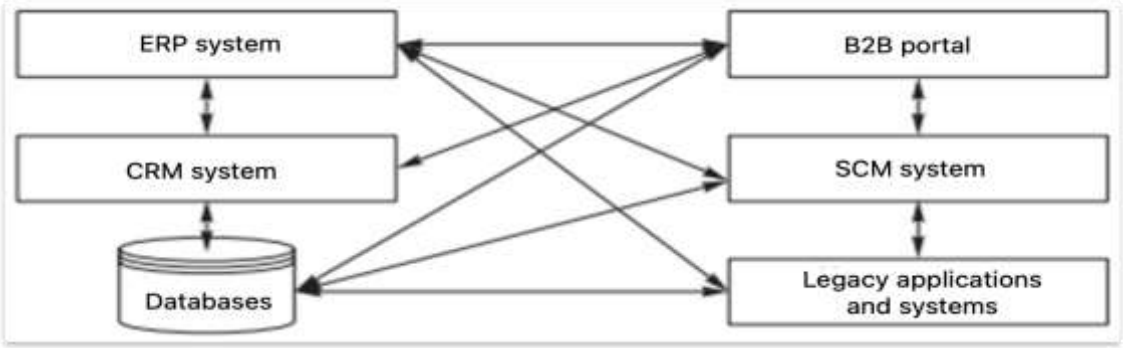

Fig. 1. The scheme of the disordered enterprise infrastructure

4. System Integration Approaches

One of the most versatile application integration methods involves using an approach based on middleware software.

Modern middleware class systems are complex software systems capable of processing messages in universal formats and providing multi-channel message transfer between all business applications (Figure 2). The main components of such systems include a service bus (built on the Enterprise Service Bus (ESB) architecture, performing data reformatting, message routing, transaction management, monitoring, and application interaction control) and a set of adapters allowing different applications to connect to the bus.

This method allows for connecting multiple systems of different classes and manufacturers. The main disadvantage of this approach is the high cost (each system requires a separate adapter) and the limited bus bandwidth (transmitting a document of tens of megabytes can be difficult since the ESB architecture focuses on real-time data transmission, and large amounts of data require splitting).

Integration through ETL (Extract, Transform, Load - a set of methods for transferring data from one source to another) can be used to exchange large files between systems. ETL systems are suitable for system integration in data exchange if real-time processing is unnecessary. For instance, banking systems use ETL solutions for integration when transferring documents from one system to another (Figure 3). While ETL does not provide real-time data transfer, a delay of 15-20 minutes for many document exchange processes is not critical, and the cost of this integration is comparatively less by several times compared to using an ESB. Another advantage of building an integration using ETL is the ease of customization and modifications. When changing the data format, table fields, etc., it is necessary to make similar changes to the ETL tables without affecting the program code (Figure 4) [4].

http://ijses.com/
All rights reserved

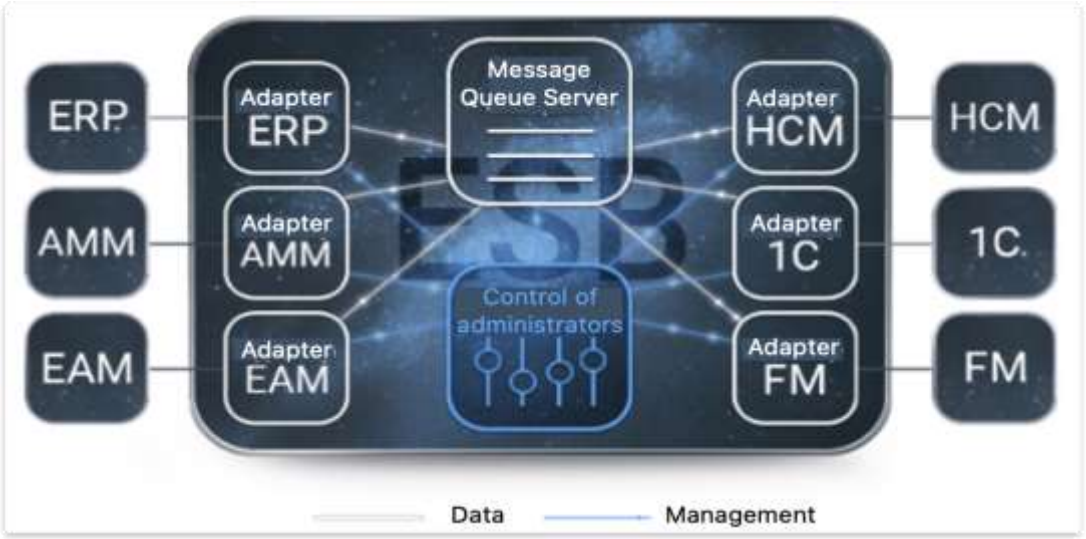

Fig. 2. Architecture of the "Galaktika" Company middleware class solution

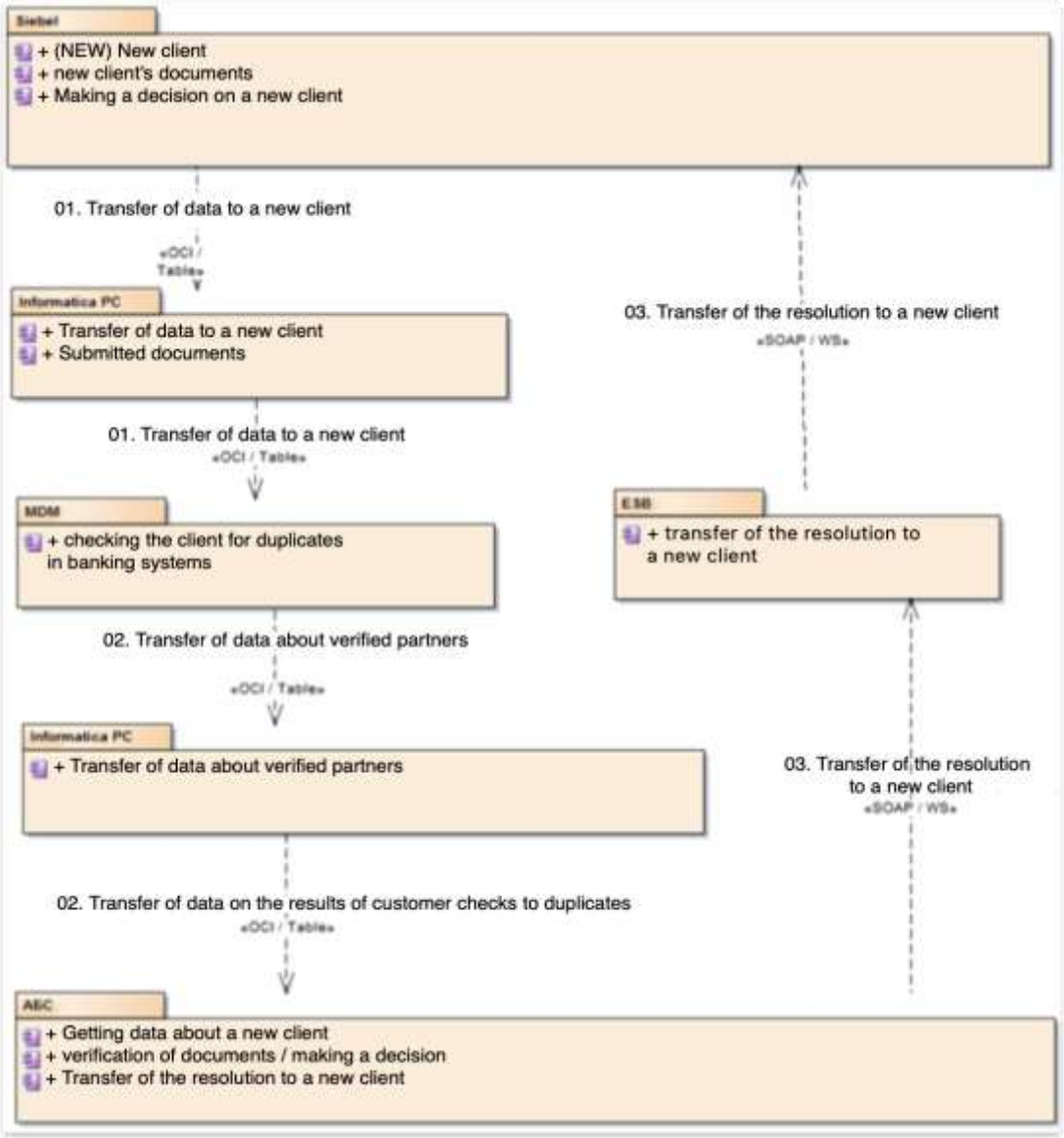

Fig. 3. An example of the integration of Siebel-MDM-ABS systems using the Informatica PC ETL solution

http://ijses.com/
All rights reserved

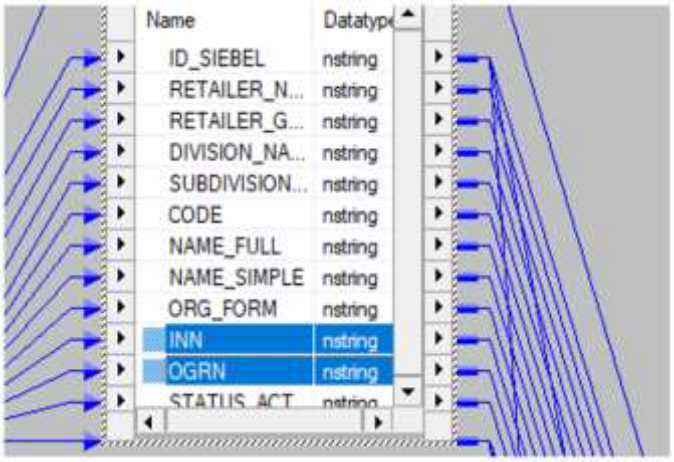

Fig. 4. An example of setting up integration tables in Informatica PC

5. Integration Methods.

The methods for enterprise application integration, covering various aspects, are as follows:

1. "Each-to-Each" Integration. It involves developing specialized interfaces for data exchange between each pair of interacting applications.
2. User Interface Level Integration. In this case, applications can interact with each other using special tools through the user interface.
3. Data Level Integration. This method provides data support in special storages, regardless of the underlying business logic.
4. Information Resource Level Integration, including Enterprise Content Management (ECM) technologies.
5. Enterprise application-level integration implies the joint use of executable code to facilitate interaction.
6. Web Services Integration provides a standard interface for accessing applications and data through web services.
7. Middleware Integration. Establishing an interface between two different systems using specialized software that creates a bridge between them.

Horizontal and vertical levels of integration are also worth mentioning. The horizontal method involves the implementation of middleware known as an Enterprise Service Bus (ESB). This bus stores a functionality repository of those enterprise applications connected to it. An important aspect is ensuring the possibility of using these functions by other applications connected to this bus. For instance, the interaction between applications can occur through messaging or by calling published functions in the REST API form. A special adapter for each system connects the system to the bus. After this, the "published" functions of the system become accessible to other connected systems.

The alternative integration approach is vertical. This method involves selecting a set of expertise from the integrating systems, which should be integrated [6].

The next section of the paper aims to explore artificial intelligence's capabilities in optimizing and integrating enterprise software.

6. AI Capabilities

Artificial Intelligence can replace employees in routine tasks, making them perform more automation-intensive activities. AI can process data, categorize information, and perform repetitive operations. Currently, Artificial Intelligence can analyze data to identify general trends, providing a foundation for strategic decision-making [7].

Artificial Intelligence (AI) is becoming an increasingly important tool for optimizing various processes in the field of information technology and software:

1. One of the key areas where Artificial Intelligence offers significant advantages is the automation of software testing and debugging. AI capabilities include developing intelligent testing systems that can identify bugs and vulnerabilities in code quickly and accurately, offering effective solutions to fix them. That, in turn, reduces the time spent on manual testing significantly and increases the software product reliability.
2. AI has the ability to analyze and process large volumes of data, including information about previous projects. Based on such analysis, it can predict the completion times of the current project, identify risks, and suggest optimal planning strategies.
3. With AI, developers can identify patterns and trends, which helps them make better-informed decisions for product improvement and optimization.
4. Artificial Intelligence could also generate code, simplifying and speeding up development. For instance, machine-learning techniques can create algorithms and functions optimized for specific tasks. Additionally, AI can assist in designing software architecture, offering optimal structures and components for solving the set tasks.
5. Artificial Intelligence is capable of analyzing data about competitors and market trends, allowing developers to predict and adapt to changes in the industry. The analytics provided by AI helps in making informed decisions regarding development strategy.
6. Artificial intelligence can create educational materials and interactive programs for developers, increasing the development team's knowledge and skills and ultimately leading to more efficient work. Moreover, AI can analyze feedback from users and developers, identifying the product's weaknesses and helping improve its quality [8].

II. Conclusion

The new production style features less hierarchy in organization and management, decentralized administration, and flexible management based on instant information. The new-type manager relies on informal communication and a set of predetermined goals (more than on formal planning), flexible organization of teams and individuals working on a particular task, and customer orientation for achieving coordination in the interaction of workers.

The main reasons for the software integration to be necessary are as follows:

Software integration is always a subject of discussion and offers the following benefits:

http://ijses.com/
All rights reserved

Increased efficiency: Consider job roles that intersect, such as sales, marketing, legal and compliance, finance, and payroll. Manual data entry and its transfer to other departments through various forms of communication slow down the work. System integration allows the business data to be transmitted between tools.

Increased economic efficiency: Searching and exporting information consumes a lot of time, which could make the business more productive. Software integration saves both time and money.

Increased productivity: The interaction of all applications eliminates delays associated with the manual exchange of information between departments, accelerating the flow of information and ensuring quick access to files and project statuses.

Reduced risk of errors: Integration reduces errors associated with manual data entry from other sources, thus contributing to reliability and higher productivity.

Improved customer service: Integration improves customer service by providing team members with all the necessary information for a customer. Regardless of the field (sales, marketing, support), employees can quickly get the data they need.

REFERENCES

1. Shakhimova Y.A., Abdrakhmanova.A. Problems of integration of corporate information systems. [Electronic resource] Access mode: https://studylib.ru/doc/680004/problemy-integracii-korporativnyh-informacionnyh-sistem-sh... .– (accessed 01.01.2024).
2. Integration of enterprise applications. [Electronic resource] Access mode: https://alphapedia.ru/w/Enterprise_application_integration .– (accessed 10.12.2023).
3. Understanding the integration of enterprise applications. [Electronic resource] Access mode: https://skine.ru/articles/506098 /.– (accessed 10.12.2023).
4. Volkov I.S., Burlakov A.I. Modern approaches to the integration of corporate information systems. [Electronic resource] Access mode: https://nauka21veka.ru/articles/tekhnicheskie-nauki/sovremennye-podkhody-k-integratsii-korporativnykh-informatsionnykh-sistem-1528986523/. – (accessed 10.12.2023).
5. Dumchenkov, I. A. Review of methods of integration of information systems, their advantages and disadvantages // Young Scientist. 2018. No. 23 (209). pp. 176-177.
6. Integration technologies FROM systems. [Electronic resource] Access mode: https://habr.com/ru/companies/otus/articles/792694 /(accessed 10.12.2023).
7. Kazakov R. G. Optimization of business processes of an enterprise using artificial intelligence // Research of young scientists: materials of the LXIX International Scientific Conference (Kazan, November 2023). Kazan: Young Scientist, 2023. pp. 1-6.
8. Implementation and optimization of business processes. [Electronic resource] Access mode: https://companies.rbc.ru/news/JQ2Jn4QQED/vnedrenie-ii-dlya-optimizatsii-biznes-protsessov /(accessed 10.12.2023).

http://ijses.com/
All rights reserved