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ERP and CRM Data Integration

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The CRM and ERP systems are usually obtained and implemented separately and at different times. Quite often they are purchased from different sellers and producers, and implemented by different teams.
As a rule, the CRM and ERP systems contain separate databases even if they come from the same manufacturer.
Such separately kept databases also lead to separate basic records (identifiers), which primarily relate to business partners, items and services. This may create problems with updating and maintaining consistency of the data within the information system of a company.
The CRM and ERP systems usually overlap in certain segments of business processes (e.g., orders, order confirmations, quotations, etc.), thus potentially creating redundant information and documents.
More often than not, the CRM and ERP also differ in terms of technology, both by their vertical architectures and with regard to the DBMS and API support.
The objective of this paper is to generate an ERP-CRM integration data model by way of optimising the relevant processes and costs, and to provide details about the processes of integration of the logical and physical data models. The structural integration of the ERP-CRM databases provide the integration services that ensure all the necessary functionalities in various interface logics and technologies with regard to software solutions and applications given, or used for local adaptations of the existing ERP and CRM applications.

Keywords: ERP, CRM, interface, web services, workflow management, business processes, use case diagrams, DBMS, databases

1. Introduction

Many business areas, such as industry, banking, administration, insurance, telecommunications, etc., involve complex business procedures and implement the e-business models (*Jovanović,M., Rankov S., 2012*), (*Veljko Milutinović, Frederic Patricelli, 2003.*) to optimise the business processes, time and profit. They comprise a series of tasks that may be linked (*chained*) to one another to form a sequence, run in parallel or loop, or a combination of these. Such tasks are executed by a number of organisational units (*both internal and external*) and individuals. Besides that, numerous tasks are performed by machines, either independently or in cooperation with humans. In order to accomplish the tasks, a large number of different documents are generated and used. These complex activities need to be managed and supervised, which may prove to be a difficult job.

In order to define the reasons for generating the *integration model* (**interface**) based on the detected problems and shortcomings of a given system, it is crucial to consider both the ERP and CRM models i.e., the specific shortcomings of one or the other system (*from the viewpoints of design, network environment, process/task organisation, optimisation of operating costs, client demands in relation to operation experiences in the implementation of the systems, separate application demands occurring in the implementation of the ERP and CRM systems, and specific demands related to the need for synchronising the company IS (Information system) in relation to the state of the IS before implementing the ERP and CRM systems*), based on which the design and programming framework is defined. From the structural viewpoint, the model of ERP and CRM integration is synchronised (*through interface that synchronises different levels of inconsistencies between the systems, and analytically, at the level of individual needs and demands of companies whose experiences in the implementation of the ERP and CRM systems have been identified based on field research*).

There are different experiences in the ERP and CRM implementation, in terms of their integration into the existing system (*showing the classes of problems that emerge at the level of their adaptation and synchronisation into the existing IS*); e.g., one large telecommunications company, and not only that one we observed, designed and implemented 26 interface modules of various functionalities and corrections that were necessary for the system to function as a whole (*permanent interfaces that enable master data and document exchange between the SAP module and the other applications within the IS of the company*). Permanent interfaces were set up through the appropriate Windows Service on the **non-SAP side**, which calls the **Web Service** implemented **on the SAP side**: master data maintenance, buyers, functional locations and defect reporting, outgoing invoices and received advance payments, daily bank statements, payments by payment cards and international reply coupons, consumption of materials, salaries, data migration interfaces, transfer of the initial state, etc. The level of complexity of specific interfaces largely depends on the structure of the IS and its flexibility with regard to different platforms, structure of data, business process organisation, data processing logic and types of message exchange.

The defining of characteristics, the system logics, and the problems and errors identified during the system implementation processes have generated a framework for designing the interface, i.e., they introduced certain integrations that emerged as a consequence of the issues in the implementation of application solutions and that can be obtained as finished products in the software market.

2. Identified Problems – the Existing Situation

The CRM and ERP systems are usually obtained and implemented separately and at different times. Quite often they are purchased from different sellers and producers, and implemented by different teams, technology and framework for e-business (*Ravi Kalakota and Marcia Robinson, 2011.*), (*Dave Chaffey, 2009*) integration with ERP and CRM models.

As a rule, the CRM and ERP systems contain separate databases even if they come from the same manufacturer and certainly require certain rules to follow in implementation processes.

Such separately kept databases also lead to separate basic records (*identifiers*), which primarily relate to business partners, items and services. This may create problems with updating and maintaining consistency of the data within the information system of a company.

The CRM and ERP systems usually overlap in certain segments of business processes (*e.g., orders, order confirmations, quotations, etc.*), thus potentially creating redundant information and documents.

3. Integration Concepts

In order to ensure business continuity and data consistency, as well as high-quality business analysis and reports, e.g., *Business Intelligence* (*Sauter, V. L., 2010*), (*Stefanović, N., 2008*), (*Ćirić, B., 2006*) it is necessary to ensure their integration and:

1. Ensure consistency and integrity of shared records (*Partners, Items and Services*);
2. Set a clear boundary between the CRM and the ERP, i.e., define the activity and the document (or documents) generated within the border activity.

All the resources of the enterprise (*staff, assets, stocks, finances, etc*.) i.e., the continuity of its business operations are managed within the ERP (Enterprise Resource Planning). All of the above resources are important and highly interconnected, and their good management ensures a successful operation and growth of the company. Yet, the most critical resource that can cause immediate business discontinuity is the company FINANCES. Finances can be viewed from the aspect of liquidity and from the aspect of balance (*accounting aspect*). As regards business discontinuity, the more critical of the two aspects is certainly the financial LIQUIDITY of the company, which is why a proper finance management from the liquidity aspect is of utmost importance for preventing business discontinuity (*excluding, of course, cases of force majeure, such as natural disasters, wars, etc.*).

Successful management of financial liquidity of the company requires not only its proper monitoring and supervision, but also proper planning.

Therefore, the ERP should manage all documents that create financial obligations or revenue for the company, regardless of whether they are accounting documents or not. This implies that the ERP must be in charge of ORDERS (*from the time of acceptance*) and QUOTATIONS, as well as CONTRACTS that precisely define the dynamics of revenues and expenses. Everything that happens, before the evidence of the articles and services in the communication with customers, already contains articles and services in databases or some of the other data stores of the systems, if once they have been identified (*materials, finished products, other products informations*) with all necessary data, characteristics and price lists (*bearing in mind that each of the products and services can have more than one price in the price lists*).

4. Consistency the Register of Items and Services

The inventory of items and services contains items (*materials, finished products, goods*) and services, with their features and pricing (*each item and service can have a number of prices*).

From the point of the ERP, all entries in this consolidated inventory are important parts of the different processes managed within the ERP *(Murrell G. Shields, 2001)*.

From the point of the CRM, only those entries that can be delivered (*sold*) to customers are relevant, and they include goods, finished products and services, and involve a limited set of data, which mandatorily include pricelists.

Bearing in mind that detailed data on purchase, input and sales prices and their breakdown must be kept in the ERP system, this consolidated inventory is updated exclusively through the ERP applications in the ERP database, while the other subsystems (*including the CRM*) only use these data, which means that they do not add new or change the existing data in this inventory.

Bearing in mind that the CRM works over a separate database, it is necessary to ensure its integration so that each item added or altered within this consolidated inventory is transferred to the CRM base as soon as it has been successfully processed in the ERP base, thus enabling a continuous synchronisation of data in both databases.

This integration module should ensure the transfer of all the data necessary for the work of the CRM, which represents a subset of the data necessary for the ERP.

5. Consistency of Partner Registers

Company representatives can establish contact with new customers in several ways and in different business scenarios.

The first group of scenarios involves establishing contact with potential customers through presales (*first contact, meetings, presentations, preparation of specifications, etc.*) with an aim to lead the potential customer towards the first formal order, i.e., the initial sale of a product or service. In this group of scenarios the business partner first appears in the presales process that is managed by the CRM (*Jill Dyshe, 2001*), and it is logical that he will first appear in the CRM database. It is only later, upon closing the first sale, that the partner (*buyer*) will also appear in the ERP database.

The second group of scenarios contains all the situations in which the customer makes a direct contact and seeks a specific product : **Fig 1:** *USE case product* (*J.Rumbaugh, I.Jacobson, G.Booch, 2005*) or service and immediately orders it skipping the presales process (the "*quotation, please*" or "*I would like to order ....." scenario*).

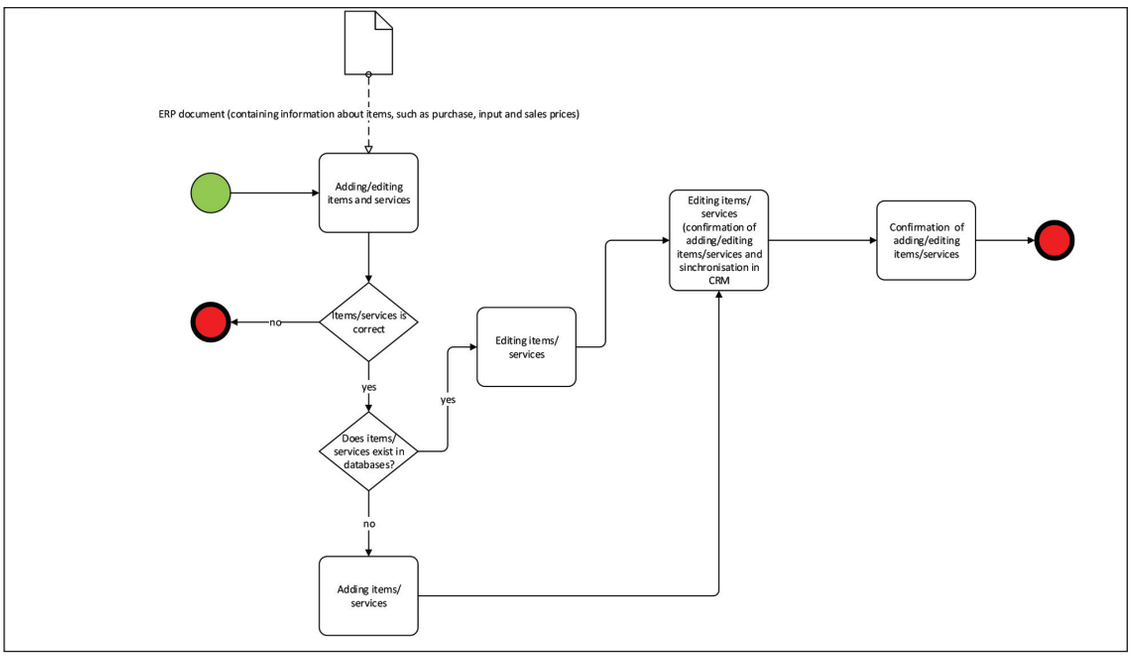

Fig 1: USE Case articles

In this group of scenarios the business partner emerges in the processes managed by the ERP, wherefore it is logical that he will instantly appear in the ERP database.

Besides the above scenarios, it should be noted that companies always introduce the ERP first, simply because it covers the management of the most critical resources, while other systems, including the CRM, are implemented later, when the ERP is already well established. This means that the ERP database already contains a large number of business partners the CRP must inherit.

Based on the main groups of scenarios we can also define global statuses in which the buyer may be found within the business processes covered by the CRM and ERP. The global statuses in which the business partner can be found from the first contact through to the closing of a deal and beyond are:

1. Buyer Candidate - global status in which the partner is located until the initial purchase is completed. Business processes within this global status of the buyer are managed by the CRM system.

2. Buyer - the buyer has realised at least one order, i.e., at least one of the ERP documents (order, dispatch note, invoice, etc.) has been exchanged with him.

Both of the global statuses can be further segmented into a number of intermediate statuses in accordance with business processes that occur in the interaction with the business partner (**Table 1**).

Bearing in mind that, due to their connection with the legal and financial documents and changes that are managed through the ERP (*contracts, invoices, dispatch notes, records, etc.*), it is prohibited to change the data on business partners (customers/buyers) contained in the other systems (*CRM and the like*), it follows that changes to such data from the side of the CRM system are only possible while the partner is located in the "*buyer candidate*" global status.

Table 1: Situations when synchronising the business partner (buyer) registers between the CRM and ERP systems:

1. Entered in the CRM base 2. Does not exist in the ERP base	Allowed in the "Buyer Candidate" global status	Synchronised in the ERP base with the available set of data	Changes allowed from the CRM
3. Entered in the ERP base 4. Does not exist in the CRM base	Immediately enters the "Buyer" global status	Synchronised in the CRM base with all the data	Changes not allowed from the CRM
5. Changed in the ERP base 6. Exists in the CRM base	Already in the "Buyer" global status	Synchronised in the CRM base with all the data	Changes not allowed from the CRM
7. Changed in the CRM base 8. Exists in the ERP base	Not allowed *	Not implemented	Changes not allowed from the CRM

* Due to the fact that the partner appears in the legal and financial documents (contracts, invoices, dispatch notes, records, etc.), uncontrolled changes of data from the CRM are not allowed; a possible exception could be to change certain data only in the CRM base, without their synchronisation in the ERP and where the logic of specific web services *(Amazon Web Services LLC sap-on-aws@amazon.com Version: 3 – April 2013)* so requires (*in this case it is checked and adjusted by the authorised person following verification*).

6. Scenarios of the First Appearance of Partners Within the Integrated ERP and CRM

Business partners (*actually the data about them*) may appear for the first time:

1. During the presales process, when they are first entered in the register of partners within the CRM
2. During the sales processes (*contracting, issuing quotations or invoices with the document confirming shipment, provision of service, acceptance, final order, etc.*), when the new partner is entered in the partner register of the ERP base.

In the former case, the partner may be entered with an incomplete set of data, and the accuracy of each piece of information is not of utmost importance here. Generally speaking, the partner could be registered only in the CRM data base as long as he moves through the different phases of the presales process:

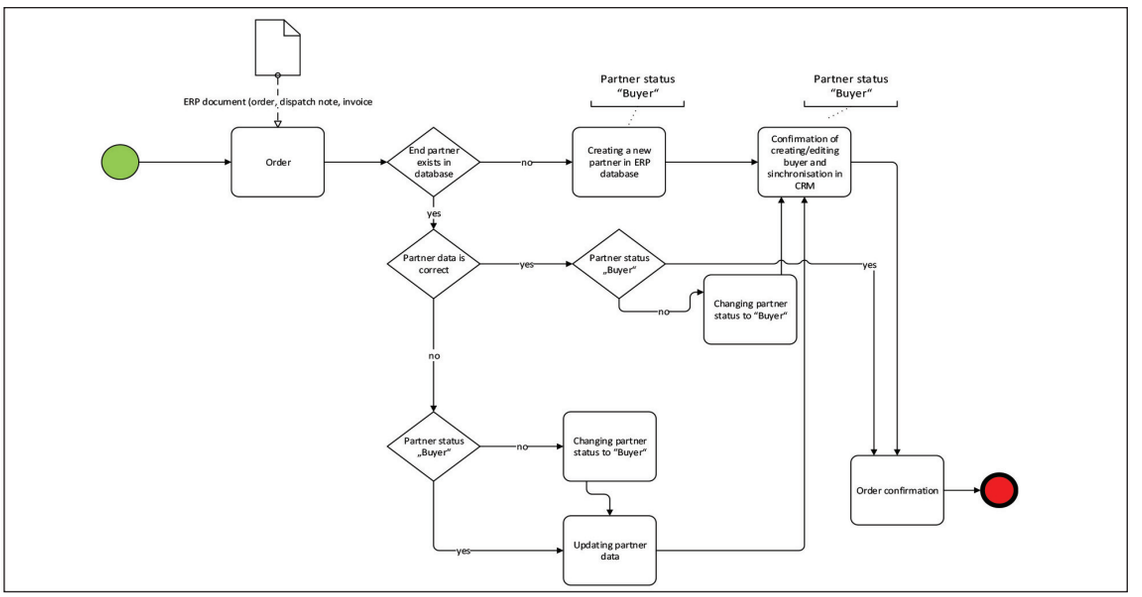

Fig 2: USE Case Creating/editing and sinchronising new partner in ERP database – presales processes

The only limitation is the fact that a partner whose status corresponds with some of the presales phases in regard of one group of products or services may also appear as a direct buyer in the ERP database.

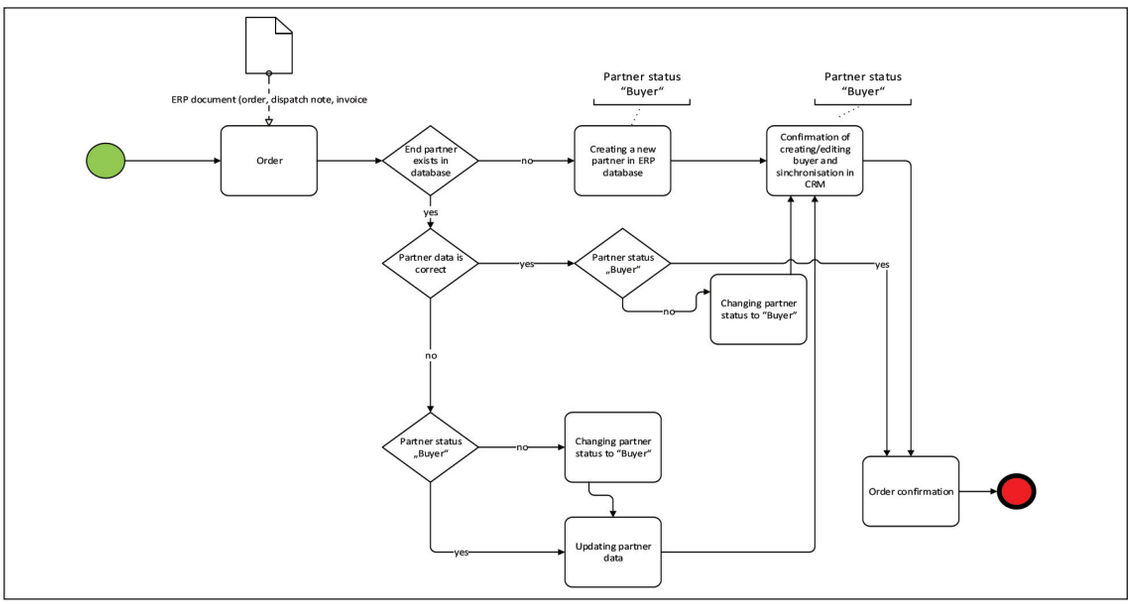

Fig 3: USE Case Creating/editing sinchronising new partner in ERP database in sales processes

In order to avoid double entries of the same partner in the CRM and ERP bases, each new partner entered in the CRM base must be synchronised in the ERP base: **Fig 3:** *Buyer status, partner use case status*, but together with one of the adopted presales statuses (*in general the "Buyer Candidate" status*). While the partner is in this status it is allowed to change or supplement the data about him through the CRM base and applications, but each of them must be synchronised with the ERP base. In the case the same partner first appears in one of the roles managed by the ERP, further changes can only be effected through the ERP base and applications, and each such change is synchronised with the CRM base.

If a new partner appears directly in the sales (*ERP*) processes, he is entered in the partner register in the ERP base and synchronised with the CRM, while all further data changes are effected through the ERP base and applications. It is prohibited to change partner data through the CRM applications.

7. Resolving the Issue of Integration

The general case of having separate CRM and ERP systems means and has been resolved:

1. That the systems can work on different DBMSs (*Oracle, 2012*), *see the ERP-CRM system integration image-fig. 4*, and the information (*Sandra Jednak, Dragana Kragulj, 2015*) and data flow between the databases and intelligent independent agents (*Adam Sofronijević Vesna Milićević, Aleksandar Marković, 2015*) running for the data integration

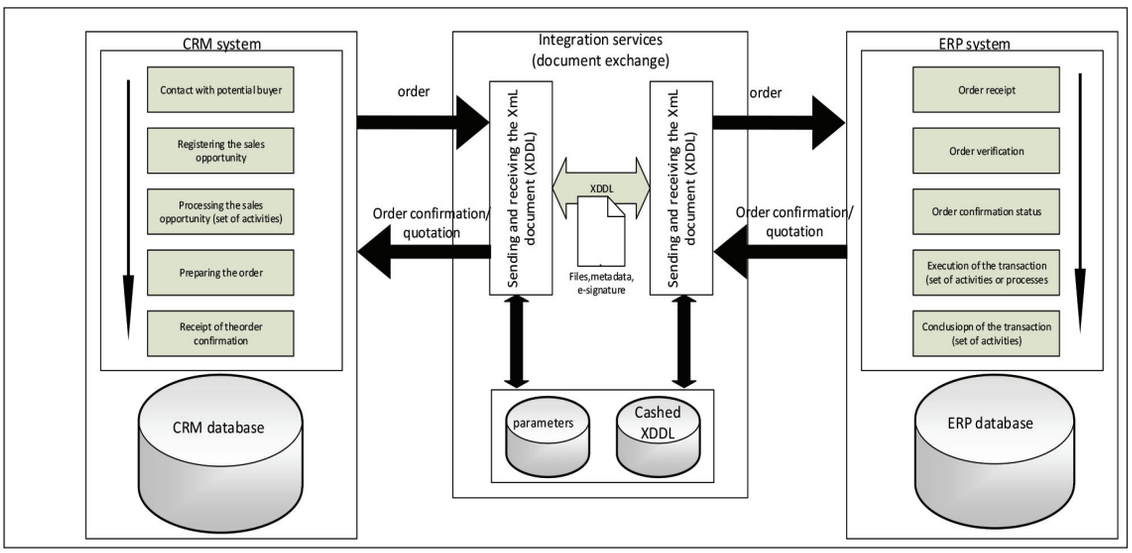

Fig. 4 – ERP-CRM model of data integration (*interface*)

2. That the systems can have different vertical architectures (*with or without application servers, as desktop or web applications* (*David Chappell, Tyler Jewell, 2002*) etc.

3. That they can be installed on servers located in different physical locations and having completely independent systems that ensure continuity of work (UPS, RAID, etc.), (*Somasundaram Gnanasundaram Alok Shrivastava, 2012*) which makes it very likely that interruptions in their operation can occur separately.

4. That it is not possible to ensure changes of any system application by the producer, but only the producer's API is used.

Considering the above characteristics of the general case, it follows that the integration programme module must be and is:

1. Autonomous and independent of the CRM and ERP;

2. Configurable and easily adaptable to the data integration structure;

3. Capable of providing integration templates for different CRM and ERP databases and/or application servers;

4. Capable of ensuring detection of failures of either of the two systems and waiting for it to resume working without losses in terms of data synchronisation.

The current trends in the field of software development suggest that the integration module should be developed as a service, or several services, or broadly speaking as a web service.(*Chong Kwong Chen, 2011*), (*Li Fang, Sylvia Patrecia, June 2005*)

The service should communicate with both systems by receiving and sending the corresponding XML data structures regarding partners and contacts, and products and services. The XML structures should be configurable by way of parameterisation within the parameter base of the service itself, but without changing the programme code or recompiling the service.

The service should be able to locally cache (*store*) data until it is finally checked that the data have been synchronised (*in cases where one of the systems is temporarily unavailable*).
It is advisable to ensure that the service is accompanied by templates for the communication between the service and various databases or application servers of the CRM and ERP systems. It is also recommended to cover the most frequently used DBMSs (e.g., *Oracle, MS SQL Server*).

Conclusion

As recommended, the authors have fulfilled all the requirements in line with the integration of the ERP and CRM applications and model structure, i.e., first the processes of both systems are listed and later optimized, all in order to prepare the ground for the midleware interface, the data exchange and store in the ERP and CRM databases and the design and implementation of the generated software applications that support the integration in favour of the customers.

The key elements of the integration processes are the cost optimisation and reconsiliation of both transactions and data flow, respecting the principles and business rules from the data input in both systems to the final booking and data store in the sequence, ordered by those mentioned business rules and situations when synchronising the business partner (buyer data) registers between the CRM and ERP systems.

The paper is part of the complex research and scientific project which is connected to the detailed work in software design and programming, later implementation for a certain number of customers proving that the value created has to serve the strategic and operational purpose, to simplify the work and processes of the both ERP and CRM systems implementations increasing the customer satisfaction.

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