

AN INTEGRATED SERVICE MANAGEMENT SYSTEM BUILT ON MICROSOFT DYNAMICS CRM

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Abstract: It is in the nature of companies and firms to have ever-increasing needs for efficiency and productivity. Also due to that, the maintenance-related control and management activities ought to guarantee the expected objectives on service availability, costs control and optimization, and quality assurance. On the other hand, in the last few years customers have been led to demand better quality products with very personalized services, extending throughout the entire period of ownership. As a consequence, nowadays assistance services are no longer considered as a source of costs, they become instead part of the enterprise strategies in order to increase the overall business turnover. A Computerized Maintenance Management System (CMMS) can help in reaching such goals, especially within a complex manufacturing environment. In this paper we present our approach to the subject exposed so far. In short, we have integrated Microsoft Dynamics CRM with Microsoft Dynamics AX and Microsoft Sharepoint. We have then implemented a number of maintenance processes, defined some key performance indexes devoted to measuring the QoS of the offered maintenance service. Finally we obtained a CMMS prototype, named Computerized Integrated Maintenance System (CIMS).

INTRODUCTION

It is in the nature of companies and firms to have ever-increasing needs for efficiency and productivity. Also due to that, the maintenance-related control and management activities ought to guarantee the expected objectives on service availability, costs control and optimization, and quality assurance.

This entails that both on-site and outsourced maintenance functions are becoming more and more relevant, and the very investments in this sector may end up representing significant costs for the firms.

An additional perspective onto this subject is that the product's life-cycle does not end when it is released on the market, but it also continues within the post-sales phase: this possibility enables failures to be continuously monitored and evaluated.

It is therefore of paramount importance to define an ad-hoc analysis metrics to measure the product defect tendency, to identify it at an early stage, allowing the endorsement of test improvements, as well as any appropriate engineering changes.

On the other hand, in the last few years customers have been led to demand better quality products with very personalized services, extending throughout the entire period of ownership.

In this context, both remote and on-site assistance services should evolve into a full customer-oriented strategy, enabling the support to go well beyond the warranty, all the way into the sphere of the steady improvement of the installed base performance indexes.

A change in vision, indeed. Assistance services are no longer considered as a source of costs, they become instead part of the enterprise strategies in order to increase the overall business turnover.

This general scenario so far depicted suggests a need for an efficient computerized system, dedicated to measure and analyze every product life-cycle, possibly offering an integration of the involved functional areas.

A Computerized Maintenance Management System (CMMS) can help in reaching such goals, especially within a complex manufacturing environment.

In this work we present our approach to the subject exposed so far. In short, we have integrated Microsoft Dynamics CRM (Microsoft Corporation - CRM) with Microsoft Dynamics AX (Microsoft Corporation - AX) and Microsoft Sharepoint (Microsoft Corporation - ShP). We have then implemented a number of maintenance processes, defined some key performance indexes devoted to measuring the QoS of the offered maintenance service. Finally we obtained a CMMS prototype, named Computerized Integrated Maintenance System (CIMS).

This paper is organized as follows.

- In Section 1 we briefly outlined the main features a CMMS provides to address the objectives we discussed above.
- Section 2 provides the requirements specifications of the CIMS prototype, as well as the architectural choices we made to design and implement it.
- Finally, conclusions and future works are discussed in Section 3.

CMMS MAIN FEATURES

Roughly speaking, a CMMS is intended to help maintenance officers and technicians do their jobs more effectively (for example, defining and planning machine maintenance tasks, or providing a management tool for help-desk enquiries, and so on); at the same time it is meant to aid the management to make informed decisions (for instance, enabling them to calculate the cost of machine breakdown repair versus preventive maintenance for each machine, possibly leading to better allocation of resources).

CMMS main features may be summarized as follows.

- Planning operations
- Managing execution of maintenance(-related) tasks
- Asset Management
- Collecting and analyzing knowledge-base data on:
 - maintenance service history;
 - reliability data: for example MTBF (mean time between failures, MTTB (mean time to breakdown), MTBR (mean time between removals), and so on;
 - maintenance and repair documentation and best practices;
 - warranty/guarantee documents.

Many of these tasks are addressed in computerized maintenance management systems (CMMS). Data standards have been developed around these activities, most notably MIMOSA (MIMOSA Alliance).

CIMS: A COMPUTERIZED INTEGRATED MAINTENANCE SYSTEM

We have developed a CMMS-like prototype called Computerized Integrated Maintenance System(CIMS). CIMS represents only one expected outcome of a granted project, jointly led by our department and Capgemini BS (a Capgemini Italia S.p.A's subsidiary). In fact, the project objectives were:

- **Objective 1:** Studying, designing, and analyzing an innovative platform, allowing the creation of three-layer applications, as well as being able to integrate itself into a selected set of core management systems.
- **Objective 2:** Designing and developing a Web portal, which lets information sharing and visualization.
- **Objective 3:** Prototyping a Web application, which manage the life-cycle typically related to the service management area. This application can also be used on mobile devices.

In this section we illustrate our integrated platform, which the CIMS prototype is built on. We finally list and discuss CIMS main features.

An Integrated Platform Based on Microsoft Dynamics CRM

With the purpose to meet the above cited project **Objective 1**, we have first chosen Microsoft Dynamics CRM 2011 as the core system able to provide a set of capabilities, which are useful to implement service-oriented three-layer enterprise applications.

This choice was mainly based on the Microsoft Dynamics CRM to allow a solution designer to define, create and manage business processes. In addition, it provides a number of features, which allows different interfaces to interact with it. This because its architectural design is strongly service-oriented. Microsoft Dynamics CRM appears as a very suited building tool for developing enterprise applications.

Secondly, we decided to integrate the core system with Microsoft Dynamics AX, in order to exploit the information and processes it provides, for example: accounting functions, customer entity, vendor items, employee management procedures, and so on. We used a connector named Connector for Microsoft Dynamics (CMD) (Microsoft Corporation - CMD) to reach that goal.

Lastly, we linked the core system with Microsoft Sharepoint, using the Windows Communication Foundation (WCF) framework (Microsoft Corporation - WCF), to obtain an integrated platform, which also allows a Web-based information exchange. This step was also taken to meet the project **Objective 2**.

The resulting architecture of our integrated platform is showed in Figure 1.

The CIMS Prototype: Main Features and Architectural Concerns

The CIMS prototype (**Objective 3**) we implemented lets an enterprise to deliver a number of maintenance services (related to the equipment, components, accessories it supplies) using the service-oriented and integrated platform we discussed so far.

We mainly concentrated on enabling an enterprise using this system:

- **Feature 1:** To take in charge and manage the customer's request for assistance due to a system breakdown.
- **Feature 2:** To schedule and manage the customer's maintenance plans.
- **Feature 3:** To organize a knowledge base to collect information on breakdown statistics, meantime to fix problems , best practices to repair an equipment and so on.
- **Feature 4:** To define, calculate and visualize the QoS of the offered maintenance services.
- **Feature 5:** To let its internal and external maintenance technicians to access and communicate useful data and documents to get the work done.

The overall architectural components and connections are shown in Figure 2.

Each feature above listed is based on the Microsoft Dynamics CRM component (the core system) and was implemented by means of Entities and Workflows interfaces.

The core system can import and export data from and to the Microsoft Dynamics AX component. This allows an enterprise to use (and subsequently synchronizing with) the already available data referring to customers, accounts, depots, equipment, etc. To achieve that, we configured the mapping services provided by the CMD.

The Sharepoint component was exploited to provide the CIMS prototype with a Web-portal access, as well as with a document management technology needed to build the enterprise knowledge base. The integration between Microsoft Dynamics CRM and Microsoft Sharepoint was realized with the WCF framework.

The Web-portal also allows the enterprise and the maintenance technicians to exchange information about the task life-cycle. A technician shall communicate when he takes in charge the assigned work, as well as every suspend and restarting event, and also when he ends his maintenance work.

The temporal information entailed in these information exchanges will be collected and analyzed by the Sharepoint component in order to provide useful statistics for evaluating the maintenance operations QoS.

The CIMS prototype principal users are the following.

- **Help-desk Officers:** They directly access the core system. Their primary role is to assess customer's requests.
- **Internal and External Technicians:** They receive and manage the works assigned to them by the help-desk team. The CIMS functionalities are accessible to them only through the Sharepoint component, which exposes a set of services to provide both the Web-based and the mobile App-based access.
- **Internal Managers:** They directly access the CRM component to visualize the overall enterprise's QoS performances, provided with a set of dashboards and reports.
- **External Supply Managers:** They are usually the external technicians managers. The Microsoft Sharepoint component of CIMS provides them with the possibility to visualize their employees performances.

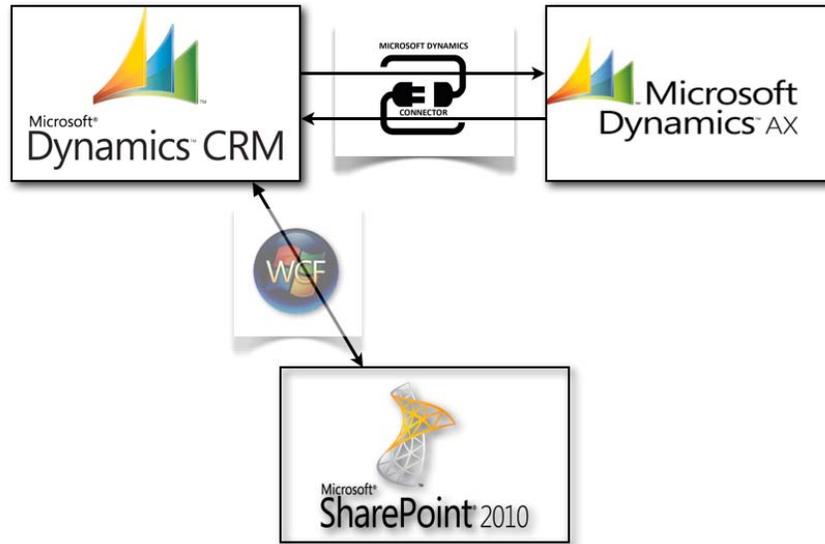


Figure 1. An architectural view of our Microsoft products-based integrated platform

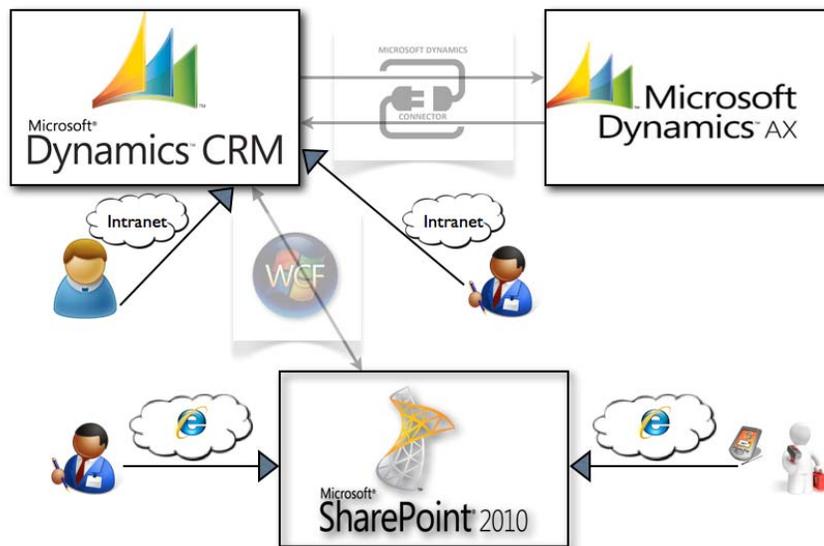


Figure 2. The CIMS architectural view

CONCLUSIONS AND FUTURE WORKS

In this work we presented an integrated platform, allowing the creation of three-layer service-oriented applications. This platform is based on Microsoft Dynamics CRM and it communicates with Microsoft Dynamics AX and Microsoft Sharepoint.

In order to test the newly created platform we analyzed, designed and implemented a Service Management System prototype, belonging to the class of Computerized Maintenance Management Systems. We named it CIMS (Computerized Integrated Maintenance System). CIMS provides a number of maintenance processes and uses some key performance indexes devoted to measuring the QoS of the offered maintenance service. In addition, CIMS can also be used by mobile devices, by means of a mobile application we developed using the Windows Phone 8 Software Development Kit.

The integrated platform and the CIMS prototype were designed, implemented and tested by a team composed of eight people, within the following development environment:

- Host 1 (Server Infrastructure) - Microsoft Windows Server 64bit
 - Virtual Guest - Microsoft SQL Server 2008 R2
 - Virtual Guest - Microsoft Dynamics CRM 2011
 - Virtual Guest - Active Directory, DNS, WINS
- Host 2 (Server Infrastructure) - Microsoft Windows Server 64bit
 - Virtual Guest - Microsoft Sharepoint 2010
 - Virtual Guest - Microsoft Dynamics AX 2012
 - Virtual Guest - Active Directory, DNS, WINS
- Microsoft Visual Studio 2010, 2012
- Microsoft Phone 8 Software Development Kit
- Microsoft Team Foundation Service

Future works will explore the possibility to generalize CIMS, in order to easily connect it with other sources of ERP data.

This work is the result of a research project supported by grant by Aive BS, now Capgemini BS, with reference to the Decreto Sviluppo 2011.

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