

Adding decision support to workflow systems by reusable standard software components

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Abstract

Industrial information systems like Enterprise Resource Planning (ERP) systems are increasingly comprehensive and integrated. Nevertheless, satisfying all the user requirements regarding information processing or decision support within a unique tool seems still to be unrealistic. As a consequence, being able to quickly provide the users with additional pieces of software for supporting specific decisions remains more than ever a topic of interest. Specific developments take time, are costly, have usually low reliability and are often poorly integrated with the main information system. In order to address these drawbacks, we suggest a structure and the first elements of a toolbox aimed at allowing an easier development of additional pieces of information/decision support system (DSS) by reuse of standard software components. This toolbox allows the implementation of workflow and groupware facilities and the communication between modules is achieved through a database which provides the integration with the main information system. The first decision support modules developed include an expert system generator, a neural network simulator, a simplex module and a Case-Based Reasoning (CBR) module. Examples of applications developed using this toolbox are described, and a development methodology is suggested.

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1. Introduction

Industrial information systems are nowadays mainly implemented through Enterprise Resource Planning (ERP) systems where a comprehensive view addresses all the functions of the company. ERP systems are often considered as providing answers for all the users' needs, and their implementation usually leads to the

prohibition of any internal developments, considered as hard to maintain and communicate with the main information system. Nevertheless, it is recognised that these systems are not panaceas. The arrival of supply chain management tools like the Advanced Planning Systems (APS) requires ERP systems to be considered as integration frameworks, on which different dedicated systems could be plugged-in according to the users' needs [1].

Large companies can afford the development of efficient additional systems which can be connected to the ERPs. The integration of banking applications developed on MS-WordTM and MS-ExcelTM with a

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main information system developed on UNIX through a set of CORBA Business Objects is, for instance, reported in [2]. Nevertheless, such developments are time and money consuming, and trying to decrease the development effort may lead to a software, difficult to maintain and to evolve. These drawbacks are intrinsic characteristics of unique developments and are particularly important for SMEs, in which the required resources (time, money and skilled developers) are often critical. The reuse of standard software components (like the CORBA Business Objects) may help to decrease the effort while preserving the quality of the obtained software. This idea, first introduced by Alexander [3] in architecture with the concept of design patterns has been extensively used in computer science [4]. The object paradigm, through the concept of encapsulation, has brought the idea of reuse from theory to practice. Architectures like object management architecture (OMA) [5] or open system architecture for CIM (CIMOSA) [6] have been suggested to facilitate the integration of reusable components. Reuse-centred development experiments have, for instance, been performed in areas such as the design of production activity control systems [7–9] or in more general business activities [10].

We suggest in this article the reuse of standard components as a means for developing an additional information system providing decision support facilities. Our aim is to better satisfy specific user requirements while saving time, money and skill required to develop the system. The challenges and requirements of such a system is developed in Section 2, while some market solutions with their drawbacks are described in Section 3. The system architecture and the first modules which have been developed are suggested in Section 4, and a methodology to develop an application using this environment is described in Section 5. Examples of applications developed with the suggested toolbox are presented in Section 6.

2. Challenges and requirements

2.1. Support of specific activities in an integrated information system environment

It is interesting to note that an important part of the “know-how” of the companies, especially SMEs,

does not belong to a strategic knowledge but is found in daily subsidiary information processing or decision making activities. These activities, like choosing a provider or a sub-contractor, are typical for a given industrial sector, and are usually poorly supported by the generic business processes implemented in ERP systems.

Quite often, ad-hoc pieces of software are internally developed in order to support these activities. These tools can be very efficient, even if they usually remain very simple, being often developed by their users themselves using tools which require few development skills, like MS-ExcelTM or MS-AccessTM. A problem is that, even if these additional systems take their data from the main information system, their result is seldom returned to the information system. The existence of local decision support systems (DSSs) may set into question the consistency and continuity of the information flow: for this reason, and also because the estimation of the pay-back of an ERP often takes into account the maintenance of all the pieces of software that they replace, such local tools have been prohibited in numerous companies where ERP systems are implemented. The result is either that the corresponding decisions are poorly supported ... or that the systems are clandestinely used.

It is now recognised that in spite of their cost, ERP systems are only a way to create and maintain information which can be used by other more reactive systems, under conditions that they are integrated in the information flow [11]. The requirements for making the development of such systems easier in smaller companies are listed in the next section.

2.2. Requirements for reusable data processing/decision support systems

The following generic requirements summarise some of the previously listed needs, and complement them with other important aspects:

- *Integration with the existing information system:* As stated earlier, the main condition for the acceptability of a DSS is now its integration in the existing information system. It means that its inputs must be provided by the information system (the DSS is usually not an interface with the environment) and

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