

Intelligent Enterprise Application Integration Technologies for Enabling the Collaborative Supply Chain

1. Introduction

In recent years, enterprise resource planning (ERP) project spending at organizations has absorbed the attention, budgets, and energy of information technology (IT) professionals worldwide¹. ERP projects typically represent the single largest investment in an IT project in the histories of these companies and, in many cases, the largest single investment in any corporate wide project (Sumner, 2000). In addition, implementing ERP software, which aims to consolidate most of the disparate systems in an organization, requires a huge amount of business process and cultural change, resulting in a smooth implementation in only 10 to 15 percent of the implementation cases (Rutherford, 2001). Actually, midmarket companies or those that wish to minimize their risks are left with no other alternative than to stick to 'plain vanilla' fast-track ERP versions, with their absolute lack of process customizability (Pender, 2001). And even in the best situations, ERP has not provided the level of integration expected. As a result, IT executives are still left with the challenge of integrating enterprise applications that were not, and will not, be replaced by the implemented systems (Pender, 2000). Furthermore, it's expected that critical knowledge based systems, for example, actuarial repositories for insurance companies, will not be replaced by standard ERP systems, because the former represent organizational core competencies less likely to be substituted by standard ERP offerings.

¹ See *Communications of the ACM* Special Issue on ERP Experiences and Evolution, 43, 4 (April 2000).

2. Enterprise Application Integration Technology

Enterprise application integration (EAI)² is middleware (software that interconnects applications) that can parse, duplicate or transform data from an application to present it in an acceptable format for each application that needs to receive the data (Slater, 2001). There are different types of systems integration, spanning from business architecture, to application architecture, to interorganizational process integration (Horvath, 2000). EAI technology deals with data integration, sometimes from legacy systems, that facilitates re-purposing of old systems into new ways of doing business. Although EAI technology may be considered by some as immature, it has risen to the forefront of the attention of IT executives, specifically to answer the need to enable the collaborative supply chain. Specifically in the area of business process integration, EAI technology is expected to provide the highest returns to the organization, a functionality that had been previously delegated to ERP systems. ERP implementations have consistently required organizations to adapt their own business processes to ERP prescribed 'best practices'. Data integration is a major justification in many ERP project implementations (Sumner, 2001). EAI technology allows application integration without redefining business practices. The change in software infrastructure can essentially be completely invisible to the user. This minimizes the training expense associated with ERP systems, considered to be one of the largest risk factors in ERP implementations (Sumner, 2001). One example of EAI technology is the Celware³ application integration software. EAI solutions could, in fact, manage complex business processes and launch system interactions and data transformations required by such processes (see Figure 1). For

² See *Communications of the ACM* Special Issue on Systems Integration, 43, 6 (June 2000).

³ Celware, www.celware.com is a product of Celcorp, Canada.

example, in a typical procurement process a request for quote triggers a set of business actions such as checking local and supplier's inventory levels, profitability evaluations, and automatic generation of the required quote. Each action in the procurement process may require a set of system interactions with legacy applications, which culminate in the dynamic generation of a quote that needs to be communicated via the Web. In addition to the necessary system interactions, the data required by the procurement process may need to be transformed, in order for the involved applications to converse. Finally, integration of suppliers and vendor systems from the supply chain will increase the integration complexity. Integration technology can enable the required integration, without the requirement of custom coding, an expense that typically amounts to about 30% of all IT budgets, according to Forrester⁴.

EAI automates business workflows through the use of graphical business models. Decomposing a business process into its constituent elements, and the relationship between those elements, enables the re-mapping of new and improved workflows. Traditionally, the method used to model the business workflows is directed by the use of database rules. The limitations of using database rules to integrate business processes include the time required to model, deploy, and maintain business workflows, an increasingly complex task in agile environments where increased system interactions and data transformation are commonplace.

EAI provide a flexible alternative in developing, deploying, and maintaining integrated solutions through the use of models and an intelligent reasoning engine instead of traditional methods of accessing data, such as business rules and scripting. Intelligent systems models define the business process integration, system interaction, and data

⁴ www.forrester.com. Also, refer to this web page for a list of integration servers and their rankings.

transformation. Models are used to aptly describe the business tasks, and the reasoning engine is used to define the optimal task sequence through analysis of the pre- and post-conditions for each business task. During deployment, the reasoning engine can identify failed runtime conditions, and re-define a new business process task plan.

3. e-Course Scheduling for Florida International University

Florida International University (FIU) decided to adopt PeopleSoft ERP software to support many of the university's administrative processes. FIU, located in Miami, is part of the Florida State University System. Implementation of PeopleSoft began in 2001 and the project is expected to complete in about three years. To address the urgent needs for improvement in the course scheduling process, the College of Business Administration (CBA) considered alternative solutions to develop a new e-Course Scheduling system. FIU-CBA needed an integrated, task-specific interface that would allow them to remotely access the State Registrar System, located in Tallahassee, Florida, without directly interacting with the legacy system and its many cumbersome screens. The EAI technology involved in the new e-Course Scheduling system is Celware. Now that this project has been implemented, CBA staff is able to streamline and course scheduling through the web, as well as other administrative procedures with the State University mainframe.

Previous to this implementation, FIU staff was required to access the Tallahassee mainframe via a series of legacy IBM 3270 access screens (see Figure 2). Figure 3 illustrates the workflow diagram for course scheduling process prior to the EAI implementation. Each semester this process was repeated at each of the academic units, requiring paperwork to change hands repeatedly between the individual departments and

the CBA Dean's Office Administration. After the updates for the semester schedule were made, checked and double-checked, the CBA Administration could finally submit the new semester schedule, one course at a time, to the Northwest Regional Data Center in Tallahassee, also known as NWRDC. The College of Business then had to update their own database to reflect the changes.

A proof of concept of the e-Course Scheduling system was designed and implemented in three days. This timeframe also included some training, since the group of graduate students involved in the implementation had only taken a one-week introductory course on the use of the EAI technology.

The full implementation of the e-Course Scheduling system was completed in two months, as originally planned. Figure 4 depicts the new e-course scheduling implementation, and figure 5 represents the new course scheduling process based on the Celware implementation. The new e-course scheduling process demonstrates how it dramatically improves the previously labor-intensive process. Furthermore, automating the upload of course scheduling information to the NWRDC results in a higher degree of data integrity and reliability, as well as reduced registration time and paperwork. This streamlined scheduling process is facilitated through the use of a front-end user-friendly web based application. The cornerstone of this new scheduling strategy is the ability to integrate existing NWRDC applications with the CBA application architectures. Celware acts as a powerful integration framework that allows the fast delivery of seamless solutions. The Celware developer provides a suite of products that perform intelligent remote application control. Celware enters and reads data, and performs all the navigation tasks that a user would normally have to perform. Celware's intelligence lies

in its ability to independently plan the complex navigation path and task executions required to control disparate systems.

Prior to putting the system in production, the system was tested off-line. The time window for remotely updating the course data is one week, after which the updating window is closed. This requirement forced the immediate production use of the system, without the opportunity to first test the system on-line. The new e-Course Scheduling system was put into production flawlessly. Using the previous system, updating each course required up to 330 seconds, something that can now be done in ten to fifteen seconds. The time required to update 250 courses translates in savings from up to 23 hours in the previous system to about 42 minutes in the new system. In addition, data integrity is preserved through the avoidance of the need to re-key data.

4. Implications for the Collaborative Supply Chain

For FIU, the benefits of the new e-Course Scheduling system are numerous:

1. Reduced time and labor required for the registration process – since the current system required the CBA staff to step through a series of legacy screens to obtain the required course information. The data entry into the remote legacy system will be completely automated through a browser interface, eliminating the need for repetitive data entry and the use of terminal screens.
2. Increased data integrity through a paperless approach – since the current system required the CBA staff to write down the required information and then manually re-enter it into other databases.

3. Implementation of a new browser-based graphical user interface - which minimizes time required for training on the new system, since the interface is intuitive.
4. Increased accessibility to the data – since the new e-Course Scheduling system will allow CBA department heads and administrative staff to perform scheduling tasks through the web and therefore convert the process from a paper intensive to a paperless approach.
5. Speed of implementation – since this solution will be implemented within two months and will complement future solutions.
6. Integration without interference – since the legacy systems must not be affected in any way, due to their current use by other state university’s administrative processes.

The Celware advantage lies in the application of intelligent systems for business-to-business integration. With Celware you first model the numerous processes that drive your business, whether those processes are critical to just your organization or extend to include your partners. Using this model, Celware discovers and deploys optimal integration solutions by accessing the appropriate information required from existing systems. This model presents a simple unified view of process and data transformation models.

EAI technologies can be instrumental in enabling the collaborative supply chain. In particular, EAI technologies are expected to aid the integration of mission critical knowledge bases to existing ERP systems. Furthermore, EAI technologies can aid “ramping into” ERP implementations, rather than using the traditional “big-bang” (cross-

your-fingers and pray) approach. A ramped approach to ERP implementations can help minimize the risk and potential for failure in large-scale ERP projects.

Companies and organizations are seeing the benefits of integrating business processes and offering new internal and external services over the Web. Examples include: health care organizations linking systems to provide caregivers, administrators, and payers the information they need to deliver care more effectively; manufacturing companies integrating their supply chain for more accurate inventory replenishment and better anticipation of consumer demand; and government organizations web-enabling citizens and businesses with self-services such as permitting, tax collection, licensing, payments, and polling or voting.

5. References

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Slater, D. (2000) Middleware Demystified. *CIO*. May

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6. Figures

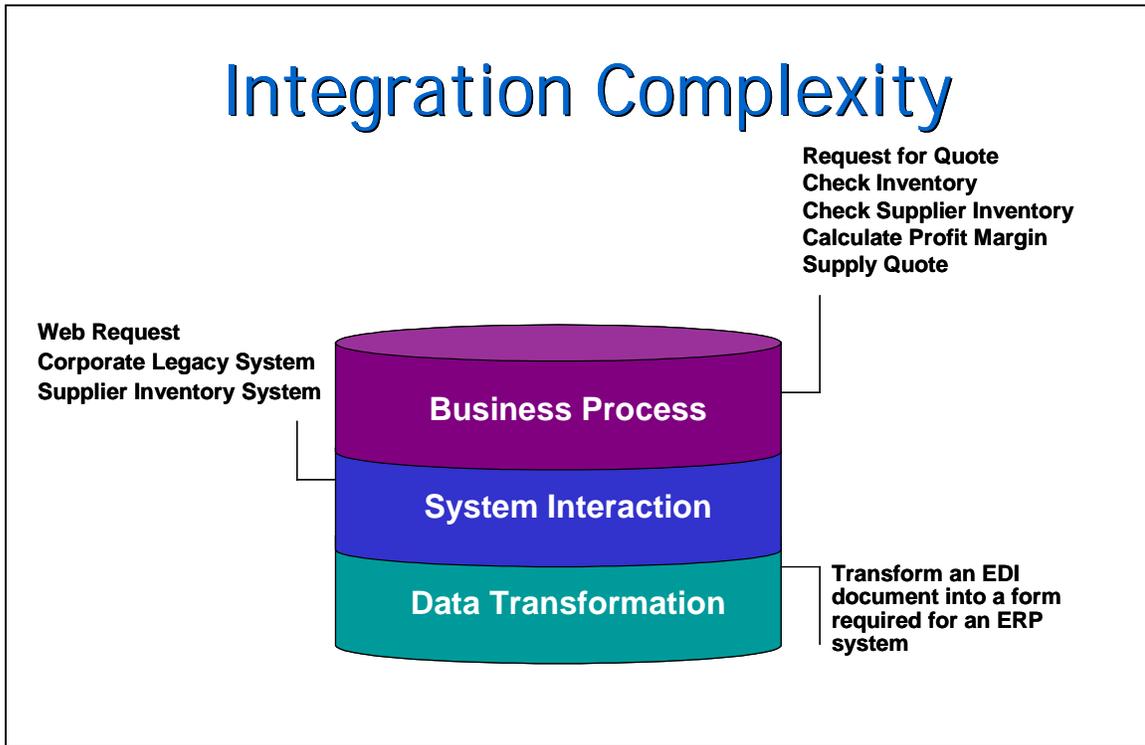


Figure 1 – Integration Complexity Canisters

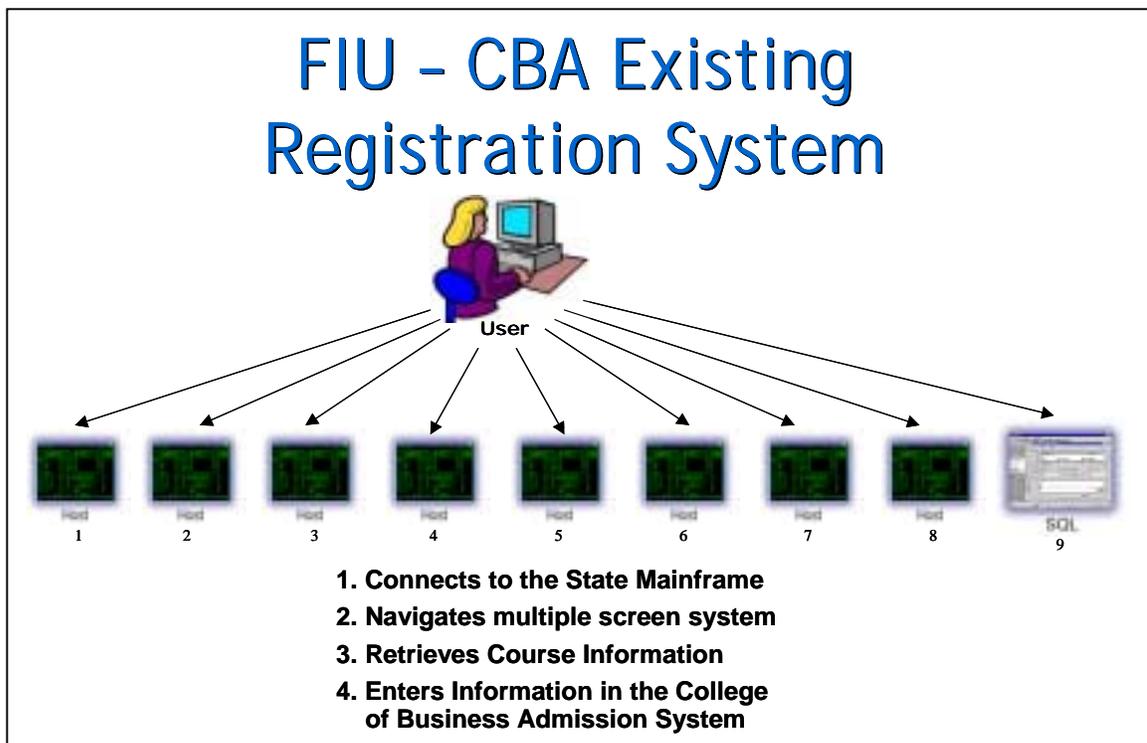


Figure 2 – FIU-CBA existing registration system

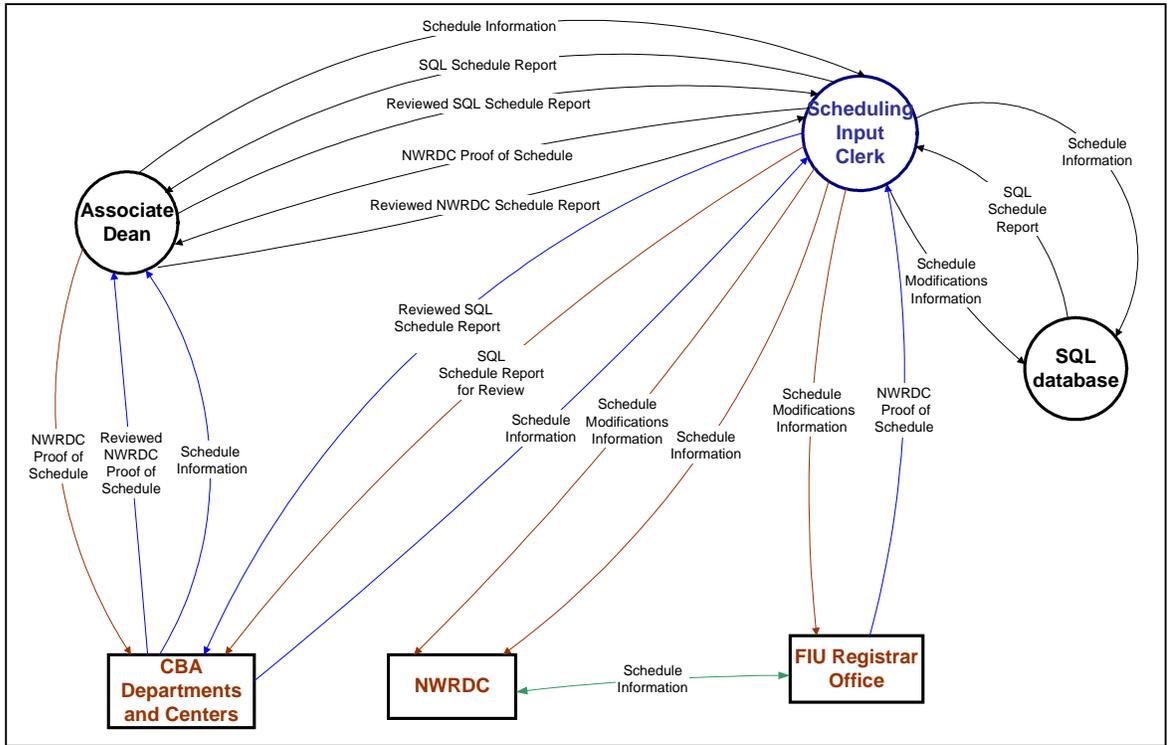


Figure 3 – FIU-CBA existing registration system process.

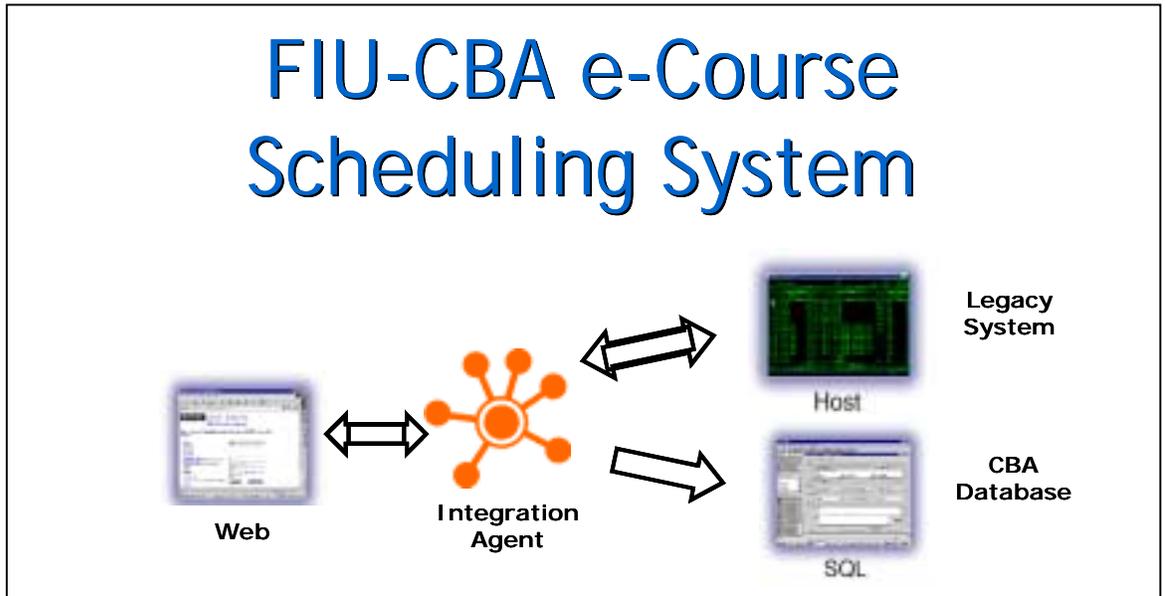


Figure 4 – FIU-CBA new EAI-enabled e-registration system.

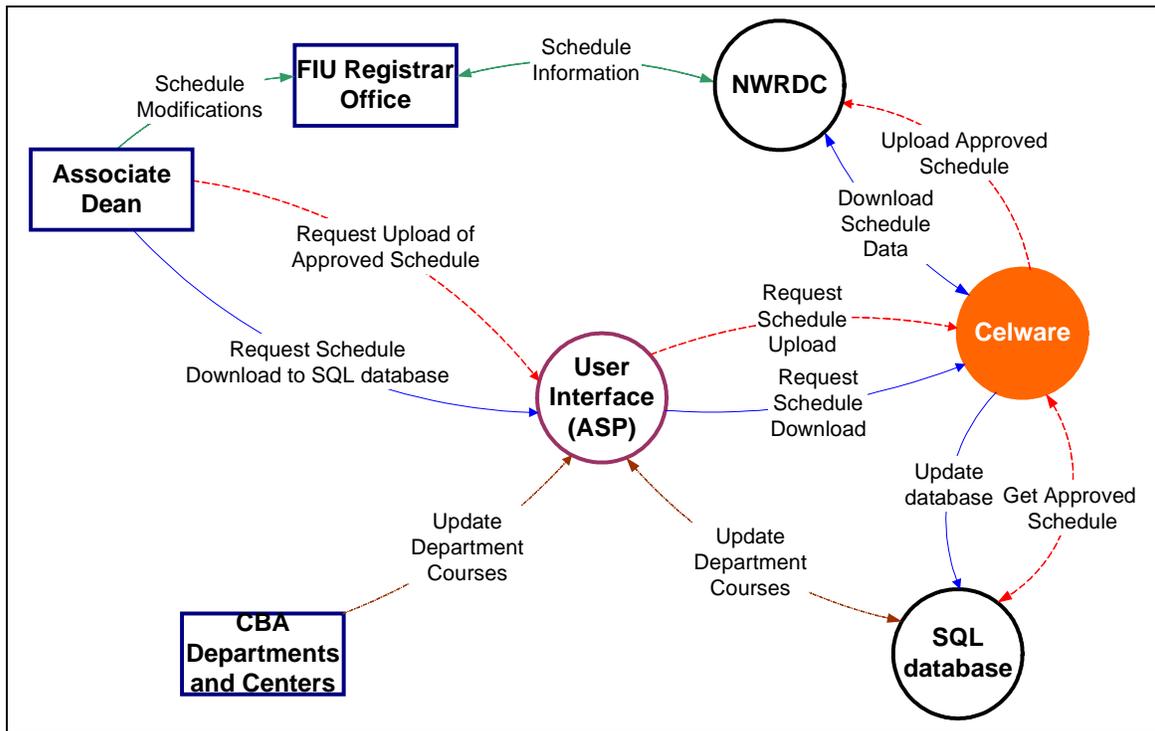


Figure 5 – FIU-CBA new EAI-enabled e-registration system process.