

# Process Automation as the Foundation for E-Business

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## Abstract

E-business is becoming the trademark of the 2000s. Companies are using the Web to communicate with their partners, connect with their back-end systems, and perform e-commerce transactions. However, the transition from traditional business to e-business requires a fundamental re-implementation of their business operational systems. Many companies have focused their transitions on developing web-based interfaces to their legacy applications. However, the backend infrastructure is often inadequate to support the offering, not only for established corporations but also, surprisingly, for many newly formed dotcoms.

On the other hand, successful e-business companies have identified workflow as the key technology for connecting front-end and back-end applications, for integrating, automating, and monitoring business and e-commerce processes, and for providing on-line service delivery. In this paper we discuss the benefits of workflow automation and we show why workflow is a key technology for building the foundation for e-business. We will demonstrate these concepts by presenting an example of a very successful e-business startup that has placed HP Changengine at the core of its e-business platform.

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## 1. Behind the Web Façade

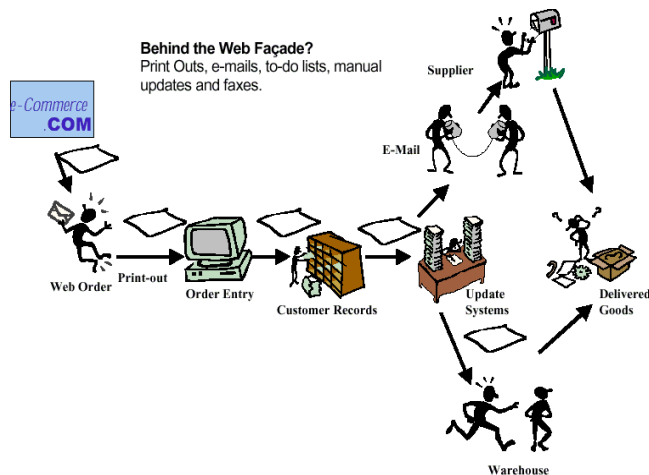
E-Business is transforming corporations, markets, and the global economy. The Web is affecting the business transactions are performed: It makes it easy to find products and services as well as providers and suppliers, compare prices and qualities, and trade, buy, and get products and services quickly delivered to us. Customers are getting used to nice and friendly user interfaces, targeted advertisement, up-to-date product catalogues, and personalized stores.

However, the web façade hides huge inefficiencies, manual and error-prone operations, and slow, complex, inflexible, and unmanageable systems. Indeed, quite surprisingly, in many e-commerce applications the execution of business processes still involves a lot of human intervention in several aspects of business process execution such as (repeated) data entry, monitoring of process executions (that often requires tracking the process over several system in order to find out its current advancement state), exception handling, and even the scheduling of the different activities that are part of the process.

Inefficiencies in e-commerce processes result in high operating costs that, combined with the low margins required in order to provide competitive offers, are strongly affecting the profits of the large majority of e-businesses (see Fig. 1). To compete successfully, enterprises are demanding effective ways to implement e-business and deliver e-services over the Internet.

Most e-business applications are characterized by a web front-end, typically powered by a personalization engine, an application server that supports dynamic generation of web content and links the front-end to business applications, and a set of back-end systems that manage inventory, procurement, billing, payment,

shipment, and all the functions required for performing e-commerce transactions.



**Figure 1. Behind the Web façade, processes are carried out manually**

Currently, no product or vendor can effectively provide the functionality required to support e-business. While some vendors, such as Broadvision, ATG, and Vignette, provide excellent solutions in the front-end space, the back-end side is dominated by ERP and DBMS vendors such as Oracle, SAP, or PeopleSoft. Despite huge efforts by many of them aiming at covering the whole spectrum, none of them has yet provided a complete and satisfactory solution to all the challenges raised by e-business. Therefore, top-class solutions are typically characterized by a number of different software applications provided by different vendors.

While the adoption of best-of-breed applications is a must in order to stay competitive, it also raises significant technical challenges. In fact, most e-business processes require functionality not typically provided by a single application. Hence, they need to span across several software systems. For instance, the process of ordering a product involves checking the inventory, allocating the goods from the stock (and/or procuring them), dispatching the goods, and verifying their shipment, in addition to the customer credit verification, billing, payment, and update of customer information for personalized advertisement campaigns.

The need of accessing several applications to perform a business function generates a lot of issues, ranging from understanding and accessing the different APIs with the appropriate communication protocol, to managing the different security requirements, data formats, programming models, and transmission models (e.g., publish/subscribe, request/reply). To further complicate the picture, different systems often run on top of heterogeneous hardware and software platforms.

A partial solution to this problem is provided by Enterprise Application Integration (EAI) platforms. Integrators such as Tibco Tib/rendezvous,

ActiveSoftware's ActiveWorks, STC eGate, or BEA eLink, ease the daunting task of connecting different applications, by providing uniform access to heterogeneous systems and by offering design tools that help system integrators in appropriately accessing the different applications and managing their results. However, while EAI solutions are useful and even necessary to manage complexity given by heterogeneity, they still do not solve the problem of managing e-commerce processes and making them more efficient.

Typically, attempts to automate processes are based on writing ad-hoc code to execute the flow logic. While this approach does provide advantages over human-driven execution and allows for larger throughput and reduced latency, it still does not address many crucial issues:

- *Rapid process development and change management:* one of the most important requirements in the e-business world is the ability of quickly introducing new services as soon as the need for them is recognized. Therefore, suppliers and service providers must be able to easily and rapidly develop and deploy the corresponding business processes. In addition, the business and IT environment changes very often; hence, processes must transparently adapt as much as possible to such changes, and process modifications should be supported in those cases where human intervention is needed.
- *Process monitoring:* ad-hoc solutions usually lack process monitoring and tracking capabilities, especially when processes span across many systems, and it is difficult to "locate" which process step is currently in execution for a given instance.
- *Process management:* it is often necessary to intervene on running process instances in order to manage unexpected situations and perform the required corrective actions.
- *Performance and the "ilities":* performance, scalability, reliability, and high availability are key issues in e-commerce applications. Indeed, the costs (in terms of loss of customers and of business transactions) due to poor performances and downtimes are too high to be tolerated for any company that does its business on the Web. Therefore, any e-business process solution must provide the appropriate performance level as well as the "ilities".

In fact, trying to automate business processes by hard-coding the process flow is a classic mistake: it makes e-commerce processes - and the overall system itself - difficult to design, deploy, monitor, and modify. In addition, the time-to-market for introducing new services is often very high. Indeed, according to several technology marketing research groups, the main reason

for the April 2000 crash in the Internet stock market is due to the lack of a suitable e-business backbone that efficiently connects the back-end enterprise applications and streamline e-commerce processes. Many dotcoms have been victims of their own success, being unable to sustain the overwhelming responses to their offerings.

## 2. Process Management Support for E-Business Applications

Business processes are at the heart of every e-business operation. Correspondingly, business process management systems (or Workflow Management Systems, WfMSs) should be at the heart of any e-business solution.

State-of-the-art WfMSs, such as HP Changengine [1], address all the issues listed above. In particular, they allow the model-driven design, analysis, and simulation of business processes, which can be designed from scratch or from templates that support rapid application development, as shown in Fig. 2. They also provide features for monitoring the execution of individual process instances (or sets of process instances) and for automatically reacting to exceptional situations.

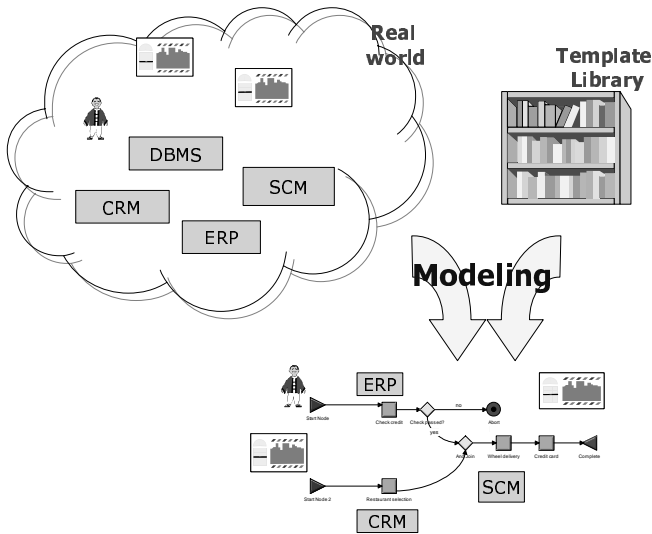


Figure 3. Changengine processes are designed from scratch or through templates

The integration of WfMSs with EAI tools (such as in the case of Changengine and ActiveSoftware [2], depicted in Fig. 3) further increases the effectiveness of these systems, and enable them to handle the two crucial aspects of process automation: end-to-end process flow management and interaction with the (heterogeneous) invoked applications. Finally, WfMSs are designed to deliver the required performance and to be scalable, reliable, and highly available to sustain the needs of e-commerce applications.

WfMSs allow for incremental and controlled process and process management automation. Typically, in the first stages of their introduction, WfMSs are only used to schedule and monitor the work, but the process is still carried out by using the same "old" technology, such as e-mails or manual data entries. Subsequently, the different steps in the process can be progressively automated, possibly by implementing the interaction with external systems through the integrated EAI tool. Once a process has been designed and automated, it can be measured and incrementally improved, as shown in Fig. 4.

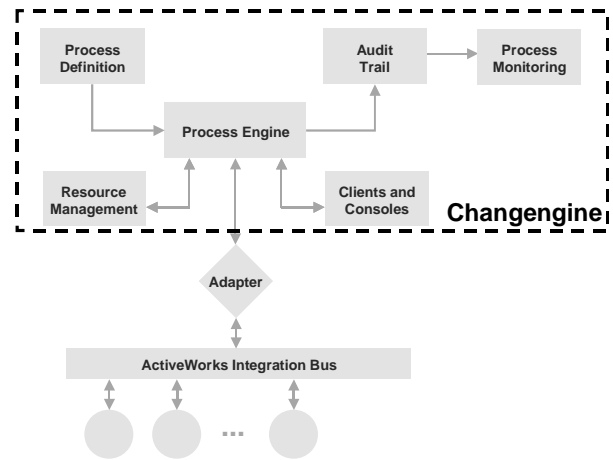


Figure 3. Changengine can access any business application through the ActiveWorks EAI tool.

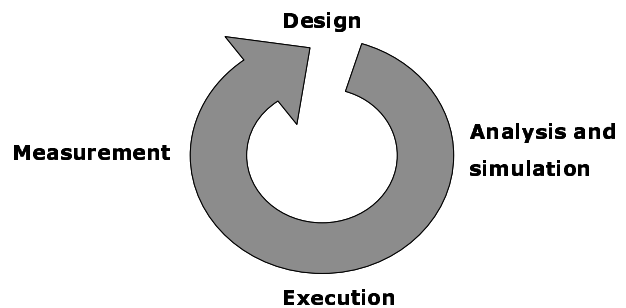


Figure 4. Process lifecycle

Indeed, successful e-business companies build their e-commerce applications on top of state-of-the-art process management tools. One of the most amazing and shining examples is the case of *LetsBuyIt.com*, an e-commerce site that provides branded goods at discounted prices through the concept of co-buying: Buyers interested in the same product can join their efforts on *LetsBuyIt.com* in order to achieve more purchasing power.

*LetsBuyIt.com* was founded in April 1999, and has already become the leading e-commerce site in Europe.

They have achieved this position in such an incredible short time through an excellent customer service provided at extremely low operating costs.

There are a lot of web sites offering branded goods at competitive prices. They all have nice and friendly front-ends, but the weak part is often the integration between front- and back-end systems and among the different back-end systems themselves. Hence, they suffer from excessive delays and unreliable and untraceable order management. On the contrary, *LetsBuyIt.com* achieves an effective and flexible integration of the different components of the e-business application by exploiting the many features of Changengine.

The process management and automation achieved through Changengine allows the successful Stockholm-based company to drastically reduce costs, improve quality of service and time to market, and respond to the ever-changing business environment. In addition, in an environment where customer service is crucial, Changengine provides the key ability of tracking the status of any process. For instance, *LetsBuyIt.com* uses Changengine for managing the Promotions Management process, which is critical for securing better goods at lower prices and for ensuring that they are in stock when required by customers, even upon sudden surge in the demand due to special promotions.

### 3. Still Ahead

Despite the great benefits that WfMSs can provide today, there is still much work to be done in order to better support the development and management of e-business solutions. We list some of the issues below:

- *Adaptive and dynamic process flows*: the business and IT scenario changes constantly in the Internet age. It is necessary to minimize the need for human intervention in order to cope with such changes and with the need of the different, individual customers. WfMSs provide some support in this area, but there is still much work to be done in order to enable the design of adaptive flows. In addition, WfMSs must improve their capability of handling dynamic changes, i.e., modifications applied to running process executions.
- *Transaction management*: current WfMSs provide poor support for transactional properties (such as atomicity and isolation) at the business process level. Such properties are very useful in order to properly handle concurrent executions and to cope with failures in a more effective way.
- *Configurable systems*: different WfMSs users require different features. It often happens that a

user only needs a subset of the features provided by a WfMS. For this reason, it is important that the WfMS is configurable, so that users only get the features they need, and therefore can use a version of the product which is lightweight compared to the full-fledged one.

- *Process Knowledge Management*: no WfMS offers functionality for analyzing process logs and automatically identifying which processes can be improved and how. We foresee that process knowledge management will be an important differentiator for WfMS solutions, especially in a rapidly evolving environments, where reactions to changes need to be very quick and effective.

At HP we are working on addressing these issues, focusing in particular on composition of e-services. Preliminary results of our efforts can be found in [4,5].

Another key application of business process management technology will very likely be within *E-Hubs*, i.e., web sites that handle e-commerce and e-service transactions, by directly fulfilling them or by redirecting them to the appropriate supplier or service provider. E-Hubs provide facility for flow-through process management, business process knowledge management, security, and various CRM, ERP, and supply chain management applications, in order to be able to satisfy all the e-business requirements of customers that want to host their applications on the E-Hub.

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