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SOFTWARE CUSTOMIZATION WITH XML

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ABSTRACT

This paper explains technical and business benefits of software front and back end customization and reports advantages of using the XML technology for software customization. An example software development project illustrates a real application.

Keywords: Customization, software, standard, XML

INTRODUCTION

Because customers have different needs they may not be satisfied with a rigid standard software system. They may not want to change business practices to fit new software. However, developing fully custom software for multiple customers would be expensive. Also it is not practical for a software vendor to maintain multiple versions. Therefore customization, a compromise between standard software and fully custom software, is attractive in many cases. Because this approach became practical fairly recently with the introduction of XML [8], there is little guidance available in the literature. We address this gap by reviewing customization with XML. After we explain the two extreme development strategies, we will illustrate software customization aspects and opportunities. Then we will show the differences between coding and configuration, and why customization is worthwhile for software companies. We will outline an application that illustrates the concept. We will conclude with a summary that mentions research opportunities.

STANDARD VS. SPECIALIZED SOFTWARE

Traditional software development has often been at one of two extremes. Some have developed special systems for each customer. Others have developed standard software for many customers. Standard software simplifies upgrades and maintenance (because there is a single system) and support (because the system is well known). However standard software often requires customers to reorganize business processes to fit the software.

Providing specialized software to each customer supports the customer's way of doing business and it could give the customer competitive advantage, but it is expensive and takes a longer time to market. Almost the whole cost may have to be covered by a single customer.

For many situations, better than these two traditional extremes is an approach that combines features of both: software customization.

CUSTOMIZATION ASPECTS

Customization of a product or service means creating or converting a product or service according to the buyer's specifications or prior behavior [7]. Customization is not a new concept. What is new is the ability to quickly customize products or services for customers at prices not much higher than their non-customized counterparts. Dell Computer is a good example of a company that customizes products for its customers. Many other companies are following Dell's lead. The automobile industry is customizing its products. It expects to save billions of dollars in inventory reduction alone every year by producing cars made-to-order. Mattel's My Design lets fashion doll fans custom-build a friend for Barbie at Mattels' Web site. The doll's image is displayed on the screen before the customer orders. Nike allows customers to customize shoes, which can be delivered in a week. De Beers allows customers to design their own engagement ring. Customization of software can provide benefits as substantial as those for tangible consumer goods.

SOFTWARE CUSTOMIZATION OPPORTUNITIES

Software customization is becoming common in electronic commerce. Direct sales from catalogs offer an opportunity for efficient customization. Merchants can target their marketing messages to specific individuals by adjusting the message to a person's name, interests, and past purchases. This ability to personalize and customize service, or components of services, is a major factor under girding the extremely rapid growth of e-commerce services [3].

E-commerce applications have led the way in customization because the environment supports it. A great deal of information about the customer can be gathered at the moment of purchase. Information about the customer's past purchases and behavior can be stored and used by online merchants. This information enables a high level of personalization and customization that would be more difficult for other types of systems.

Some systems provide various levels of self-configuration. For instance, you may be able to shape what you want to see on television by selecting a channel, but you can not change the contents of the channel you have chosen. In contrast, information-content-based software allows varying the content. Sites such as Yahoo, MSN, Netscape, and AOL, allow customers to create their own customized version of the web site. The Wall Street Journal Online allows you to select the type of news stories you want to see first, and to be alerted when certain events happen.

CODING VS. CONFIGURATION

Although we focus on customization through configuration, it may be also be accomplished by coding, the typical method for immature software (Table 1) [4].

Table 1. Market Categories

	Duration of Interaction with Customer	
Software Maturity	**Upfront (customer-focus)**	**On-going (application-focus)**
Mature: Customization by configuration	Traditional development	Application Service Provider
Immature: Customization by code	Web consultancies	Application management

The table above divides the market for application-services into four categories, according to the maturity of the applications delivered and the duration of the interaction with the customer. Portions of the market are so different that they are often accomplished by different service providers.

Also one can put varying customer needs for customization into categories of difficulty (Table 2).

Table 2. Categories of Customization

Degree of Customization	Difficulty of Implementation	Examples of Customization
First level - Individualization	Low difficulty	Setting user preferences Setting user profile
Second level - Tailoring	Medium difficulty	Global UI customization Integration of new encapsulated features
Third level - Core revision	High difficulty	Change of core functions Mass customization

Of course, at the third level software is very expensive and takes a long time to produce.

CUSTOMIZATION AREAS

Several different areas are appropriate for customization. Computer screens may reflect a corporate design, an important aspect of corporate-identity appearing on business cards, letterhead, prospectus, TV publicity, and so forth. Likewise a company may have a “corporate language” that helps achieve the company’s communication goals, for example, “Do you yahoo?”. Customizing an interface for individual users may make the user feel more at ease and more productive. Sometimes this is accomplished by providing options to such as choice of fields that appear in a report, or allowing the user to vary the content or ordering of menu choices, as in the application server BEA-Weblogic and the EDS web site. These sites have names like “MyBEA” or “My-EDS” to accentuate the individualization in the user’s view.
A corporate portal should be customized. It should reflect corporate identity. It should provide different options for different users. Software to support knowledge management must be tailored for each company. Its reports should reflect company identity and should be customizable by individual users to insure they get information necessary to support their processes and workflow.

It should be straightforward to customize software improvements or new features. However many current systems like Teamcenter® (for PDM) and SAP R/3 (for ERP) provide customization tools requiring user training [4].

WHY CUSTOMIZATION IS WORTHWHILE

Software customization provides advantages for the customer and the vendor such as achieving competitive advantage, increasing sales, and improving customer relationship management (Table 3). A unique product may be produced at a lower cost than software from competitors who achieve uniqueness through coding. Customization tools and technologies reduce development costs, increase reusability of components, and improve overall quality and maintainability [2]. Software vendors enjoy increasing rates of return, because the incremental cost of a new customer is small compared to reprogramming.

Table 3. Customization Advantages [5]

Customers	**Vendors**
Save time finding information	Competitive advantage
Save implementation time of new software	Differentiation versus competitors
Easier to use software that fits company environment, less user resistance	Targeted approach increases sales
	Higher customer loyalty

APPLIED EXAMPLE

Customization of PDM Software Teamcenter® [6] shows principles presented earlier. Customization is important because PDM Software Teamcenter® is intended to support product data management for many different types of companies [1]. Although this customization project involved almost every technique mentioned in this paper, space permits describing just a few features. To project privacy of actual customers, this project was customized for Clemson University, where one of the authors studied at the time.

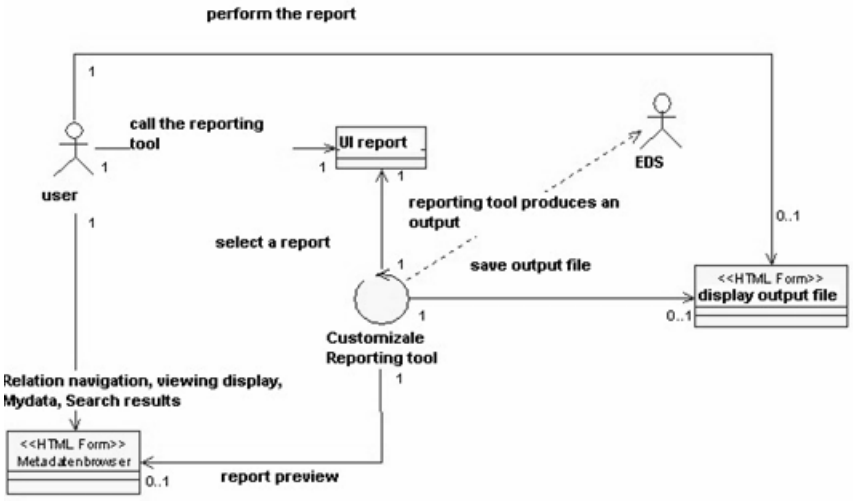

Figure 1. Diagram of requirement "create a report" mentions customization.

The customization issue arose early during requirements analysis. For example the requirement for “create a report” provided for user choice of reports and functions.

The application provides a user-created list of report choices, each of which are driven by XML files that reflect customer choices (Figure 2).

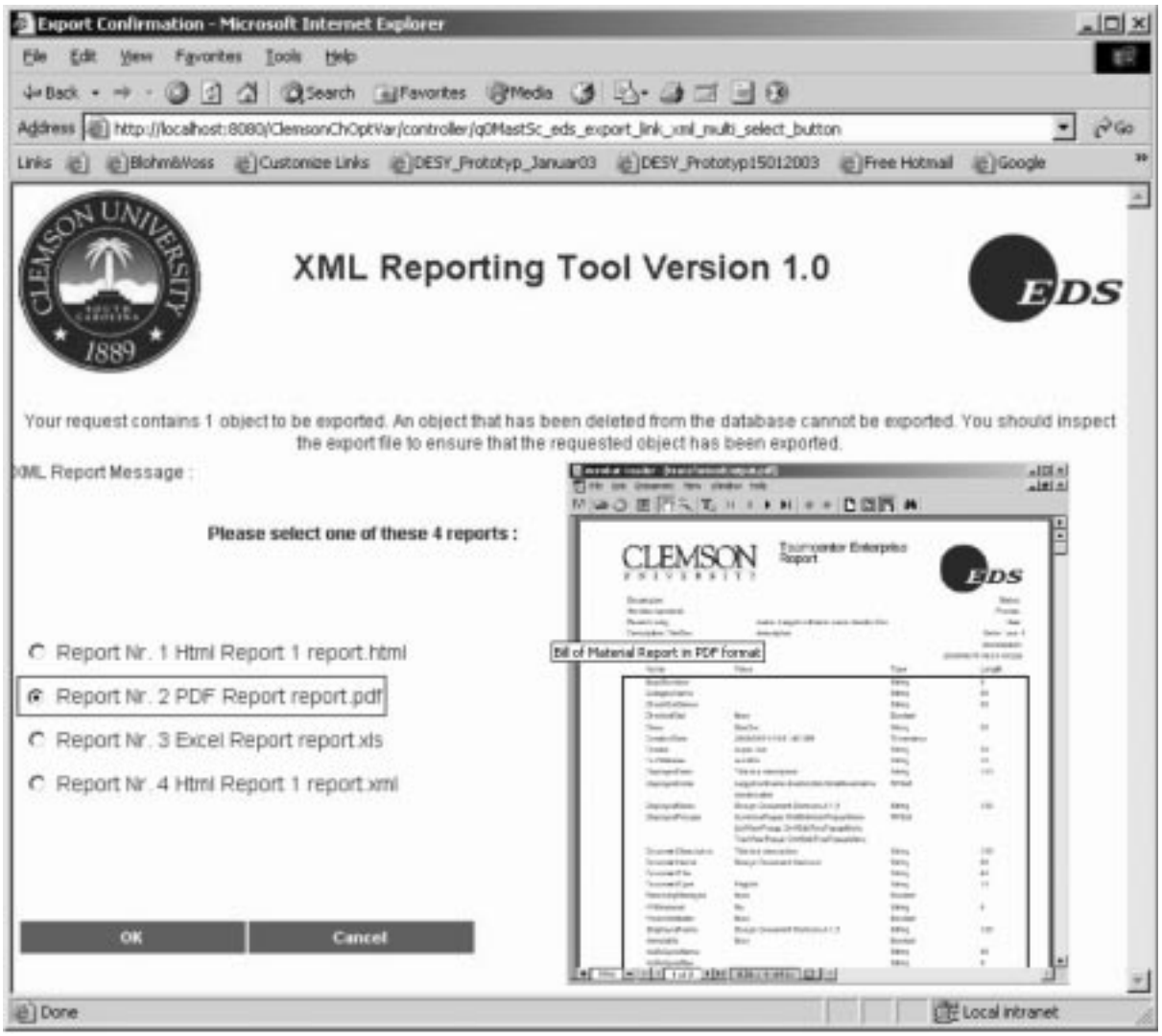

Figure 2. Screen Showing Report Choices That Have Been Customized For The User

We changed several items on all pages from the standard design to achieve a look and feel consistent with the current Web site, including the top logo, the main picture, and the content on the left side. These changes required modifying XML files but not the main code. Also we set up a multi-language capability, again using XML files that are independent of the source code. Part of the XML file that supports the report page is shown in Figure 3.

```
<edit parent="/PageInfo/PageElements">
<add>
…
<node name="XMLReport1">…</node>
<node name="XMLReport2">
   <map>
         <entry key="label" value="XMLREPORT2_LABEL"/>
         <entry key="image_preview" value="../clemson/q0MastSc/pics/prev2.jpg" />
         <entry key="tooltip" value="PREV2_PHOTO_TOOLTIP" />
         <entry key="width" value="537" />
               <entry key="height" value="167" />
               <entry key="xslt_file" value="../clemson/q0MastSc/report2_xslt" />
   </map>
</node>

•••
<IDMap>
         <!-- US -->
         <TextID        name="XMLREPORT2_LABEL"
                        text="Report Nr. 2 PDF Report report.pdf”
         />
         <TextID        name=" PREV2_PHOTO_TOOLTIP"
                        text="Bill of Material Report in PDF format”
         />
```

Figure 3. Part of the XML File that Supports the Report Page

CONCLUSION

Because customization advantages include reducing cost and increasing customer loyalty, software developers should consider employing it. Current technologies, especially XML, make it easier than it used to be. XML is still being improved and supported by the leaders of object-oriented programming languages. Further research should explore how XML can be integrated in complex enterprise systems to make customization tools more user-friendly.

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