An E-Commerce Framework

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Abstract--**Today more and more companies are using e-commerce solutions to offer new alternatives for distributing their goods. However this kind of distribution is becoming increasingly competitive. Companies are urged to tailor their solutions and to add customer oriented services in order to meet the end user requirements. The purpose of an e-commerce framework is to support the implementation of tailored solutions based on commercial components in a very cost efficient manner. It allows even small companies to implement a customised e-commerce site.**
This work describes the elements of such a framework: a reference architecture, commercial components with open interfaces, and the analysis of supported e-commerce processes. Finally a procedural model is given, describing how to map user requirements onto e-commerce solutions.

I. INTRODUCTION

Electronic commerce solutions are becoming more and more mature and developing to a key factor determining the success of most enterprises. According to Forrester [1],[2] by 2003 6% of all retail purchasing (i.e. $144 billion) and 13% of all business-to-business product revenues (i.e. $1800 billion) will be handled via the Internet in the United States. At the same time the US market for commercial e-commerce software will reach $15 billion per year [3] with an increasing demand for interoperable e-commerce applications running on an underlying e-commerce platform. This requirement implies the support of industry standards for software applications and the ability to be easily integrated. In that conditions the implementation of an e-commerce solution is only a customisation of a selected set of e-commerce applications.

This kind of work can be supported by an e-commerce framework as depicted in Figure 1. Such a framework proves the necessary standards and interfaces as well as a reference architecture which gives a general idea how to build up a complete e-commerce solution. It will be complemented by a list of available components and a procedural model describing how to apply the framework in order to get the e-commerce solution.
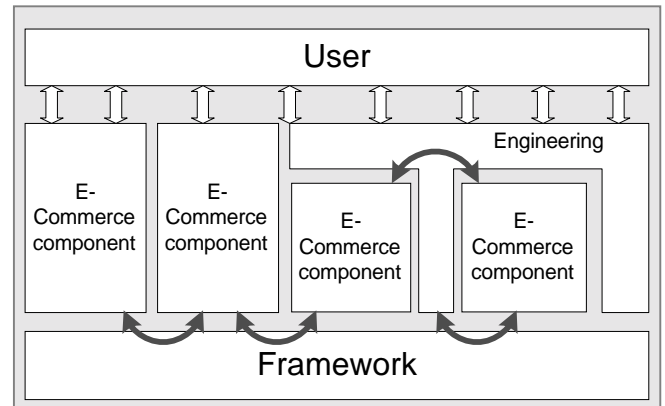

Figure 1: Frameworkbased e-commerce solutions

The usage of an e-commerce framework allows the customisation in a very cost efficient manner. A beneficial effect could be expected when using the framework frequently. This focuses to an application for small and medium enterprises (SMEs) and even allows such companies to implement a customised e-commerce site.

These ideas are influenced by several works on e-commerce frameworks like these of e-commerce XML frameworks dealing with business based processes like transactions or interactions. Examples for this are the Common Business Library [4] or the Biz Talk initiative [5] started by Microsoft.

Within this context EURESCOM [6] has initiated a project: "ICE-Commerce" [7] which is a two years project started in January 2000 with seven Telcos of the EURESCOM shareholders. Its aim is to provide a framework for interoperable and customised e-commerce solutions. This framework will assist the Eurescom shareholders in building tailored e-commerce solutions based on the requirements of their customers.

II. WHO ARE THE PLAYERS

For the development of an e-commerce framework a careful analysis of the environment wherein the framework should

be used is required. A first step will be a categorisation of the different players:

Vendors: Firstly there are the manufacturers and vendors of e-commerce systems and components as well as of e-commerce services like payment processing and trust services.

Commerce service provider (CSP): These players are planning, building and running e-commerce solutions for merchants. There is to distinguish between operator CSPs, portal CSPs, and professional services CSPs. The service operation CSPs build and operate e-commerce application services, selling them on a wholesale basis to other service providers that operate customer pull. The portal CSPs give access for e-merchants, provided by one or more portals, to potential buyers. E-merchant services with a large customer base and strong brand identity can exploit these assets by providing their merchant customers with customer pull. The professional services CSPs providing merchant services customise the application to the needs of each merchant. Some of these customisations include, design of the store-front, configuration of the applications and integration of the commerce application into other systems operated by the merchants.

Framework service provider (FSP): This ought to be a part of the professional services CSPs. By the means of the e-commerce framework a customised solution has to be configured which meets software requirements like exact-ness or efficiency. These requirements are not necessarily covered by the e-merchant requirements. In fact this is cru-cial to the framework service provider who has to guarantee the quality of the used components.

E-Merchants: E-Merchants (companies, merchants, dis-tributors etc.) want to sell products by means of electronic media. They are using different CSP services to get a more or less sophisticated e-commerce solution. Within the group of e-merchants SMEs should be regarded particularly be-cause they could be the main target for applying an e-com-merce framework.

End users: This is the group which ought to buy products by means of an e-commerce system. Their requirements have to be analysed very carefully. New e-commerce solu-tions tend to treat different user groups as well as different users individually (personalisation).
Figure 2 depicts the interaction between these different groups which is taken from [1].
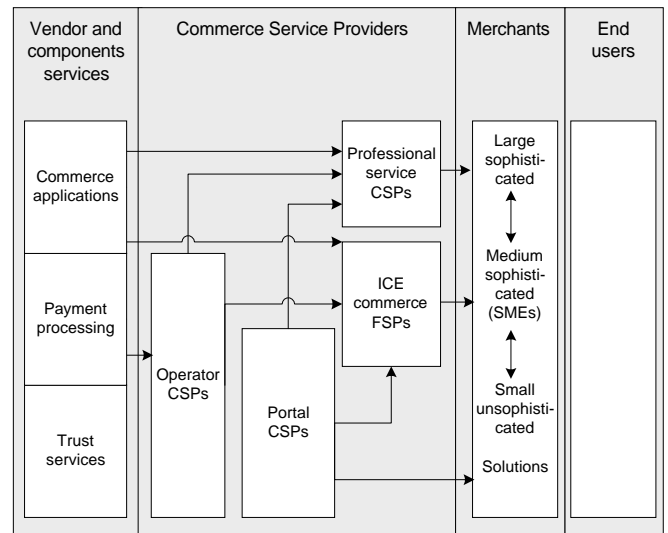

Figure 2: Different roles of commerce service providers

III. PROCEDURAL MODEL

The e-commerce framework helps to develop e-commerce solutions meeting e-merchant requirements by integrating previously-existing e-commerce components. A procedural model describes how to proceed starting from the require-ments and eventually ending in a customised e-commerce solution.
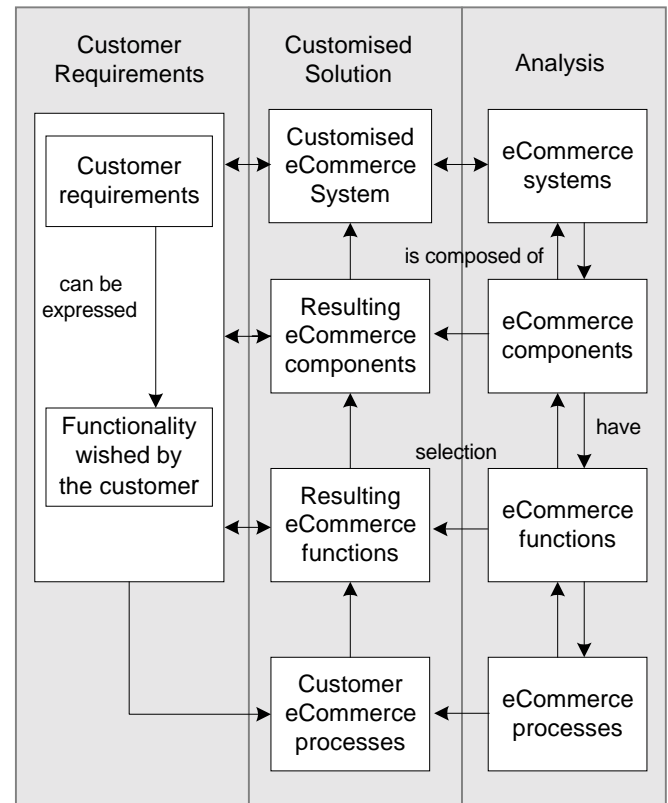

Figure 3: Procedural model

Figure 3 depicts the general idea of how the e-commerce framework will be used. In the "Analysis" column are the main components of the framework located – which implies an analysis of e-commerce solutions in terms of e-commerce components with e-commerce functions and serving for e-commerce processes. This part is determined by the framework and corresponds to static information.

On the left side there are e-merchant requirements expressed as e-commerce functionalities or e-commerce processes. These requirements are specifically defined for each e-merchant.

Finally, to build up a customised e-commerce solution an instantiation of the framework is needed. The result of this instantiation corresponds to the "Customised Solution" part.

The customisation process starts with the e-merchant requirements and proceeds from bottom up. Once the requirements are interpreted in terms of e-commerce processes, functions are deducted, then components and finally e-commerce systems (according to the analysis). At each stage of this customisation, a comparison with the customer requirements is to be done in order to get a maximal adaptation of the system to the e-merchant needs.

This model shows the importance of a careful identification of the e-merchant's requirements. The quality of the customised e-commerce solution depends on this analysis very strongly.

IV. USER REQUIREMENTS

Considering the requirements for an e-commerce solution, three of the described in section II players have been considered as especially relevant for the e-commerce framework: end-users, e-merchants and FSPs.

After an identification and definition of the user requirements a first categorisation according to these three players has been carried out.

It has been observed that the requirements are more or less concrete or technical, depending on the type of user (certainly more abstract for end-users, and very technical for FSPs). Even if they are expressed differently for different types of users, a partial overlap of the three sets of users requirements exists, as depicted below.
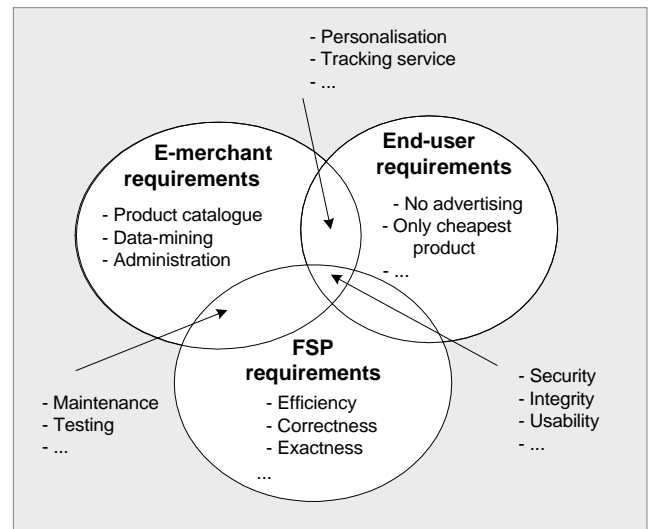
Figure 4: Segmentation of user requirements according to different the users

For usability reasons a further semantic categorisation of the requirements has been carried out. In this first approach eight categories have been identified:
- Products
- Orders
- Payment
- Security
- Policy/regulatory
- Personalisation
- Customer support
- Software quality

The result for one of these categories has been presented in Figure 5 which sums up the product oriented requirements and their relevance to each user group:

	e-merchant	End user	FSP
Number of products/services to be offered ?			
< 100	+		
> 100 and < 1000	+		
>1000	+		
Type of product / service offered ?			
Simple products	+		
Complex products	+		
Digital products - those delivered over the Internet	+		
Personalised products	+		
Which information concerning the product / service to sale ?			
Product features	+	+	
Prices	+	+	
Product reviews	+	+	
Availability of the product	+	+	
Information, opinions of other consumers through communities	+	+	
Product details captured from existing sources	+	+	
Additional information for complex products ?			
Product and price configurator	+	+	
Comparison of the products features	+	+	
Price comparisons	+	+	
Multimedia displays	+	+	

How can the product be found by the customer ?			
Text box Search	+	+	
Parametric Search	+	+	
Case-based reasoning search	+	+	
Predefined searches	+	+	
Social filtering	+	+	
Matchmaker whose focus is on providing a personalised shopping experience to the customer	+	+	
What kind of product offers and promotions is supported ?			
Context free offerings	+	+	
Context-sensitive product offerings	+	+	
Information about the product manufacturer ?			
Identity	+	+	
Physical location (country, address, phone number...)	+	+	
Registration number or license number	+	+	
Size	+	+	
Add-ons for Business-to-Business (B2B) ?			
Ability to organise a product comparison display by product attribute	+		
Customised interfaces (for example, the display of the buyer's logo)	+		
How does the merchant want to design his catalogue ?			
Using a particular design	+		
With a set of templates and a supporting code that can provide a quick set-up	+		
Have a custom-built catalogue	+	+	
Ability to organize a product comparison display by product attribute		+	
Customised interfaces (for exemple, the display of the buyer's logo)			

Figure 5: Example of user requirements (product oriented requirements) vs. validity for different user groups

V. E-COMMERCE PROCESSES

While a sale process can be easily modelled by the three phases of pre-sale, sale and post-sale, the consumer buying behaviour shows a greater complexity for its modelling. In a first approximation, this behaviour can be segmented into the six fundamental phases given at Figure 6 (compare with Pattie Maes model [10]). These phases can be supported by the e-commerce processes given as example.
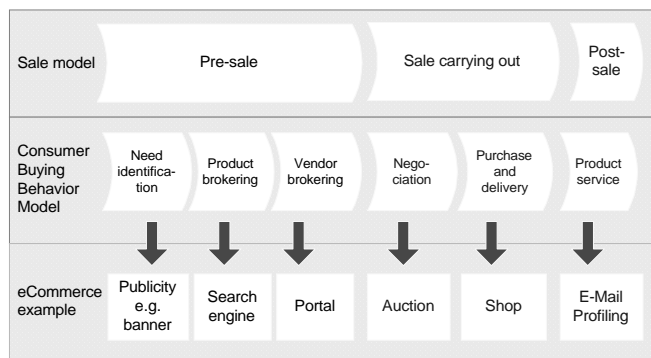

Figure 6: Consumer Buying Behaviour Model

The limits of this first model are that within consumer behaviours, the stages often overlap and reorder differently. This observation have conducted to look for another modelling approach that focus on consumer buying behaviour within e-commerce sites.

Several of these stages can be supported by an e-commerce site. Figure 7 shows a related process model for a Business-to-Consumer (B2C) e-commerce site. This more detailed process model allows a wider flexibility and thereby a greater ability to describe different customer behaviours.
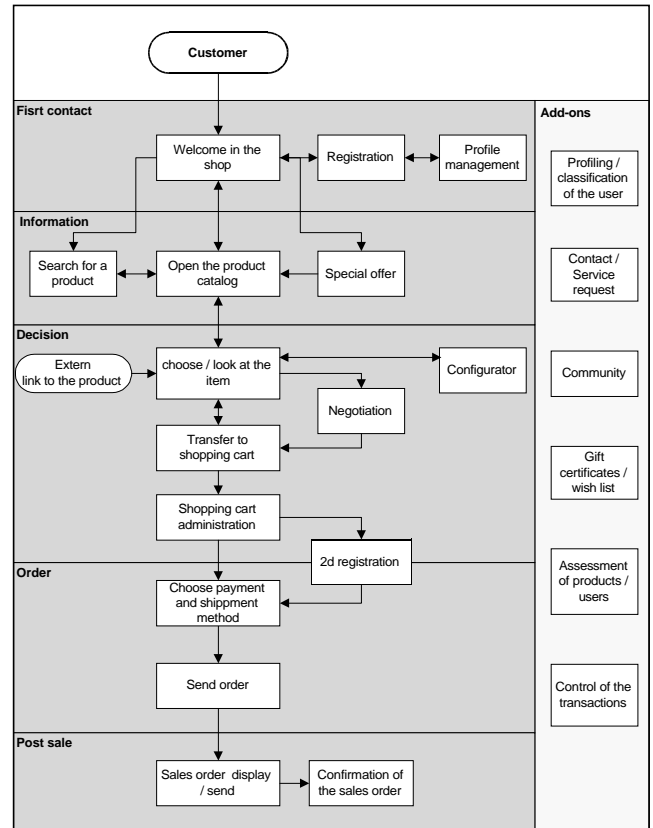

Figure 7: E-commerce customer buying process model

The process model allows to decompose a buyer's purchase action into phases (like "first contact", "information", ...) and processes (like "welcome to the shop", "Registration", ...). While typical shopping sessions can be described by following the existing paths, different sequences can be described by adding new paths.

Regarding this process model within the procedural model (section III) a mapping of e-merchant requirements onto e-commerce processes is needed. One possibility to get a correlation between requirements and processes is given by analysing many e-commerce scenarios in terms of processes.

This first step in the procedural model is of particular importance to reach a well customised solution.

VI. E-COMMERCE COMPONENTS AND SYSTEMS

The objective of this section is to identify and analyse the key components in order to define a common categorisation scheme valid for diverse e-commerce solutions.
A first identification of components can be provided by standard architecture layers. One can distinguish for a three level architecture presentation-related, business-related, and resource-related components.

Another approach follows a segmentation of e-commerce solutions into functional components. Figure 8 depicts these components and their relationships following [9].
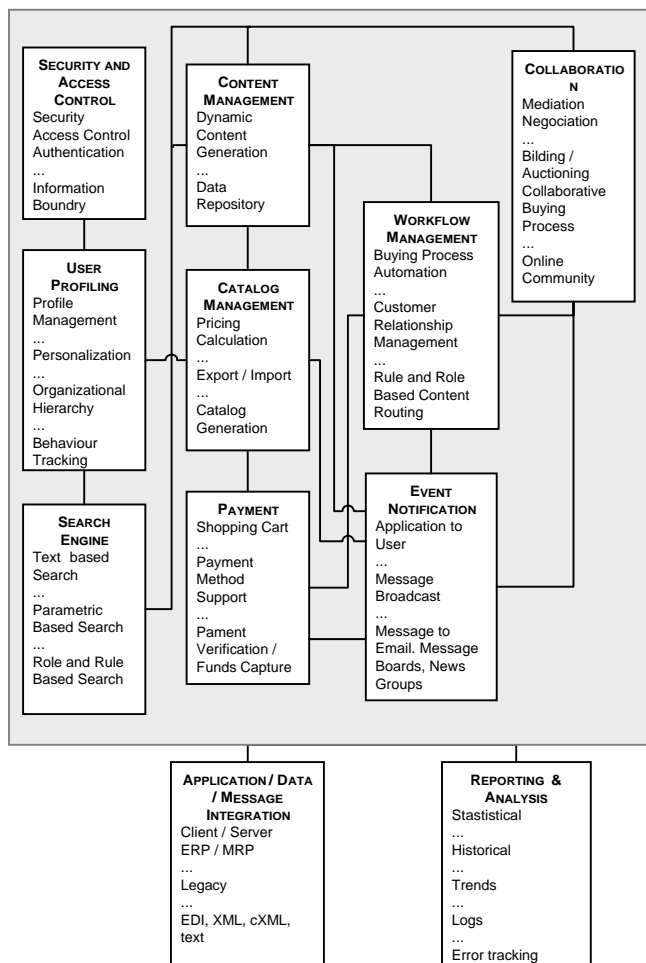
Figure 8: Fundamental components of e-commerce solutions

This decomposition into functional components is intended to serve as a guideline for the analysis of existing e-commerce systems, and is therefore an essential issue.

As an example the catalogue management component will be discussed in more details.
The most obvious use for this type of component is the on-line catalogue employed by e-Shops or virtual marketplace.

Whereas in the past it was sufficient to create static pages of HTML to present product information, page contents are now generated dynamically using data and Web page templates separately.

As one key advantage, the catalogue component, in collaboration with the user profiling component can easily deliver personalised and individually relevant information to the customer. Typically, the catalogue component queries the users profile component and the product database to return dynamically generated product information pages to each viewer's personal profile.

VII. E-COMMERCE FUNCTIONALITIES

Each of the above mentioned e-commerce components can be cha0racterised by its functionality.
As an example two components corresponding to the product oriented user requirements of section II are listed with their functions:

COMPONENT: CATALOGUE MANAGEMENT
General functions
- Dynamic creation of HTML pages
- Product configuration
Import and export of tables
- Import/export of an existing product database
- Import of tools and/or wizards
Organisation of product catalogues
- Maximal number of product categories
- Hierarchical organisation (tree structure)
- Maximal hierarchical levels of product categories
- Allocation of an product item to several categories
- Addition at will of product features
- Administration of product variations (such as size and colour)
Sales and discounts
- Definition and monitoring of special offers
- Product specific discounts
- Replacement items (for sold out products)
- Up-Selling
- Cross-Selling

COMPONENT: SEARCH ENGINE
General functions
- Full-text search in product description
- Search restricted to product category
- Search according to product attributes
- Search within a product attribute
- Search according to product prices with predetermined scale of values
- Search according to product attributes with predetermined scale of values

VIII. REFERENCE ARCHITECTURE

For building customised e-commerce solutions a functional reference architecture is required. It includes the relationships of classes of potential e-commerce components, constraints between components, and gateways to the environment. Inputs to it are given by the architecture of "off the shelf" e-commerce systems and standard software architecture models like a 3-level model regarding presentation, applications, and resources separately. Another input is given by the categorisation of e-commerce components (compare section VI) which support certain aspects of a reference architecture. Additional impact on the architecture comes from interfaces of the e-commerce gateway services like trust or payment services.

The question if there is only one architecture which fits all scenarios (B2C as well as B2B) is unsolved. The work to this reference architecture is still at the beginning and no further results can be presented yet.

IX. CONCLUSION AND OUTLOOK

In this work basic ideas to and some preliminary results of the EURESCOM ICE-Commerce project were shown. After giving a motivation to use a framework for customise e-commerce solutions a discussion of a procedural model led to a kind of agenda expressing what to do in the project. The discussion of user requirements brought a distinction between end user and e-merchant requirements which have to be balanced to build a successful e-commerce solution. This is followed by an analysis of e-commerce processes.

A general process model for a sale process in the business to consumer case was given. The work on e-commerce components and their related functionalities as well as an e-commerce reference architecture is in the very beginning and provides therefore an outlook to ongoing work within this project. From the current point of view the first results are very promising to use an e-commerce framework for customised e-commerce solutions.

X. ACKNOWLEDGEMENT

XI. REFERENCES

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