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An Exploratory Study for Effective COTS and OSS Product Marketing

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Abstract.

Commercial-off-the-Shelf (COTS) and Open Source Software (OSS) products have had significant impact on software development. The phenomenology of COTS-Based systems challenges the software community by emphasising the problems of COTS/OSS products identification, selection and evaluation. In this paper we address these problems by looking how the marketing of such COTS/OSS products can affect their identification and selection. We propose decisive factors that can help COTS/OSS product providers to market their products more effectively and assist users to conduct COTS/OSS product identification and selection more efficiently.

Keywords. COTS/OSS product marketing

1. Introduction

Component-based software engineering has become a 'sine qua non' in software development today; aiming to address its complexity, increase its productivity and decrease its development costs. COTS Based Software Development (CBSD) adds more towards configuring software systems from pre-built and re-usable software products that are plugged-in into software applications and bought/sold at their marketplace [17]. We discuss the development and deployment of COTS products to deliver tailored software systems [1], and we try to find solutions that make them compatible with other distinct and heterogeneous products (known as complex software systems) [8].

OSS products affect software development further, by pushing developers towards software solutions that are freely available and may have visible source code and give rights to make relatively imaginative derivatives [4]. We witness a rich pool of reusable open software solutions, typically available at the cost of

downloading the code from the Internet. They include everything from using OSS products and libraries, to acquiring frameworks and installing a complete application server [22, 21].

Various works discuss the use of COTS and OSS products in CBSD, and investigate the phenomenology of COTS-based systems [20], [2]. One of the most important issues, shared by both the COTS and OSS communities, is centred on COTS/OSS product acquisition [25], problems and risks of selecting them [23], and processes for evaluating them [10].

In this paper we focus on the problem of *identifying* and *selecting* COTS/OSS products. If we observe that more than 99% of the executing computer instructions come from COTS/OSS products [2], then the ability to find an adequate product becomes crucial. The lack of standard and well-defined COTS/OSS identification, selection and evaluation approaches have resulted in many organisations investing in poor product choices. The research community addresses the problem by proposing:

- processes for product selection [9],
- a customisable approach to COTS selection [16],
- search techniques for product selection [6],
- categories of available COTS to achieve an efficient and reliable selection process [5],
- tools for COTS/OSS product selection [12],
- formal processes for COTS evaluation [14].

In spite of all the research, most organisations still select COTS/OSS products in an ad-hoc manner [13]. Thus we want to address the problem by emphasising that we need to *identify* such products first, before we start evaluating and selecting them. The identification of COTS/OSS products is as important as their selection. However, COTS/OSS markets are problematic [25]. To assume that users might have a comprehensive pool of COTS/OSS products, as in [6, 15], is at the moment unrealistic. We agree with [20] that, in order to

make better decisions in CBSD, we need more collected empirical knowledge that helps us to understand how users are finding, selecting and integrating COTS/OSS products.

Therefore, we decided to place ourselves in the COTS/OSS product user's shoes, make a pool of arbitrary selected COTS/OSS products and analyse if we could recognise any decisive factors that could make our identification and selection tasks more effective. Such an approach has immediately raised the question of whether COTS/OSS products are marketed adequately. It is reasonable to expect that COTS/OSS product marketing may have direct impact on their identification and selection.

The issues of COTS/OSS definition and their classifications are outside the scope of this paper. We adopt the COTS definition from [17]. We call COTS/OSS product owners "*providers*", and people who acquire COTS/OSS products are referred to as "*users*".

Section 2 defines the aims of the paper and briefly overviews the related works. Section 3 outlines a procedure for deriving decisive factors that can help COTS/OSS product providers to market their products effectively. Section 4 describes the application of our decisive factors to 264 COTS/OSS product websites and analyses the results for two of the decisive factors. Section 5 concludes and outlines our future works.

2. The aims of the paper and related work

In the previous section we have highlighted the problem of finding and selecting COTS/OSS products. The current COTS/OSS product markets do not provide a mechanism, which addresses this problem. Thus our work offers a set of decisive factors that COTS/OSS product providers could follow if they want their products to be considered for selection. An effective COTS and OSS market, which in turn leads towards more efficient CBSD, could help users to conduct:

- a) Identification of possible candidate products
- b) Accurate selection from all candidates
- c) Safe selection from all candidates
- d) Selection of products that are interoperable with the user's existing system.

We propose a set of decisive factors for COTS/OSS product providers that will ensure

activities (a)-(d). This means that these decisive factors can be used by COTS/OSS product providers in order to market their products more effectively. We aim to test our decisive factors by applying them to 264 arbitrarily selected COTS/OSS product websites and assessing if the COTS/OSS product providers are marketing their products effectively.

We are not aware of any similar work that emphasises COTS/OSS product marketing in terms of addressing their identification problem. However, we have been motivated by the works of [23, 1, 5]. Our decisive factors show some overlapping with attributes used to select COTS in [23] (see section 3.1 in this paper). We can also place our decisive factors within a quality features tree, given in Figure 3 from [1], where a knowledge based system has been developed in order to support COTS-based software development. The conceptual model for COTS taxonomies, given in Figure 2 from [5], has helped us to create our decisive factors. We associate each of them to one or more questions, which were asked when browsing our pool of 264 COTS/OSS products provider's websites.

3. Decisive factors for effective COTS/OSS product marketing

3.1. Inspection of COTS/OSS market

In order to derive decisive factors we had to:

- (i) have sufficient knowledge of the current market situation, i.e. to know how COTS/OSS products are currently marketed, and
- (ii) become familiar with the ways in which potential COTS/OSS product users search for such products.

For (i) above, we used Google, which selected COTS/OSS product websites according to given keywords. We also used websites [26] to add to our pool of selected COTS/OSS providers' websites. To ensure that the collection of websites was not biased, we included the findings from our students' works. We set up an assignment in which we asked students to inspect the COTS/OSS product market and provide, for each selected product, a brief overview of the way that they are marketed. This included information on their functionality, prices, maintenance, vendor's information, and so on.

With regards to (ii) above, we looked at works which elaborated on the methods of searching for COTS/OSS products. The methods range from browsing the Internet (as we did in (i)) to visiting trade shows, exhibitions, or calling special interest groups that may provide names of COTS/OSS products suppliers [18]. However, the proliferation of e-markets, i.e. the increasing tendency for marketing any products on the Internet, influenced our decision to keep the arbitrarily chosen 264 websites as the basis of our exploratory study, and not to extend it further.

3.2. Creation of decisive factors

An initial inspection of all 264 websites has indicated the following:

- (i) We have observed that COTS/OSS products may range from (a) part of a large-scale or small-scale system, in which they act as one of the building blocks, to (b) a standalone application used by small companies or by individuals for their personal use at home. In all cases, it is reasonable to expect that the user responsible for the COTS/OSS product selection would have some idea of the budget available. It is almost equally certain that the functionality of the sought COTS/OSS product is also known after a casually-done preliminary enquiry, or a formally-conducted requirements analysis phase, has been carried out. Thus, as with most of the software products on the market, the *budget* and the *functionality* may be treated here as the primary factors when searching for COTS/OSS products.
- (ii) The quality of the information provided by the COTS/OSS product providers varies enormously. There were websites that provided information on functionality and price explicitly, and websites where the same information was difficult to find and understand. There were websites where the same information could be obtained only after careful browsing of all pages. Some websites elaborated on the COTS/OSS product support and maintenance more than others, and some of them gave excellent insight on possible trial versions, a product's development history and current customers.
- (iii) There was no difference in the way that COTS/OSS products were presented in their marketplace. Thus, in this study we do not distinguish between them

The issues above served as the basis for generating decisive factors for COTS/OSS product marketing. We have decided to group them as *functionality*, *price*, *environment*, *support and maintenance*, and *quality assurance* as in Table 1. All these factors are derived from the observations described in (i) and (ii) above.

Decisive Factors	Description
Functionality	Capabilities that the COTS/OSS product facilitates in terms of functions, operation etc.
Price	The cost of the COTS/OSS product to be paid at the time of purchase, and the possible future costs associated with upgrades, licensing and so on.
Environment	Hardware and software required for the successful integration of the COTS/OSS product into an existing system.
Support and Maintenance	Technical and non-technical assistance offered to the COTS/OSS product users when installing and maintaining the product.
Quality Assurance	The COTS/OSS product's fitness for its intended purpose, which can be measured by an offered trial version, or by considering the product's age, its market share, the feedback given by existing users etc.

Table 1. Decisive Factors

We compared our decisive factors with the COTS/OSS product's characterisation attributes from [23], aiming to enrich our list of decisive factors. It did not happen, because we believe that some of the attributes found in their work are not crucial for COTS/OSS product's identification and selection. For example, their definition of learnability and usability attributes cannot be placed within the left column of our Table 1. When selecting a COTS/OSS product, user's satisfaction is difficult to assess in advance, except if a trial version is offered and the COTS/OSS product has been run and used for a while. Furthermore, we believe that the learnability attribute reflects the readiness of a user who happens to use COTS/OSS products, but cannot be crucial for its selection. The decisive factors we present in this paper do not impose an order of importance and they may be adopted and omitted as and when (ir)relevant.

3.3. Creation of the questionnaire

We have elaborated on each decisive factor by transforming it into a set of questions. Each set of questions tries to establish if the relevant information on each of the 264 websites is:

- available,
- explicitly given, and
- easy to understand.

Such questions serve as a skeleton for the questionnaire that has been applied to the 264 websites, to assess if COTS/OSS product providers market their products adequately and enable users to conduct (a)-(d) from section 2. Due to space restrictions we give, in Table 2, an extract from our questionnaire that comprises two decisive factors: *functionality* and *environment*. A more comprehensive version of our paper, where a full questionnaire and all decisive factors associated with it are applied to the 264 COTS/OSS product providers' websites, is available in [7]. The questions in Table 2 are self-explanatory.

<p>Functionality: (F)</p> <p>1. Does the COTS name reflect its functionality?</p> <p>1.1. If no, is the description of a COTS product readily available and unambiguous?</p> <p>2. Is the functionality explicitly given?</p> <p>2.1. If no, can the functionality be deduced after carefully analysing the entire website?</p> <p>2.2. If yes, is the functionality given easy to understand?</p> <p>2.2.1. If no, is it because of a difficult language or specialist language being used?</p> <p>2.2.2. If no, is it because the web site is overloaded with information and it is difficult to extract the desired information?</p> <p>Environment: (E)</p> <p>1. Is the environment needed for successful COTS product integration explicitly stated?</p> <p>1.1. If no, can the environment be deduced after carefully analysing the whole website?</p> <p>1.2. If yes, is the environment easy to understand?</p> <p>1.2.1. If no, is it because of a difficult language or specialist language being used?</p> <p>1.2.2. If no, is it because the website is overloaded with information and it is difficult to extract the desired information?</p>
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Table 2. Extract from the questionnaire

We have mapped a set of questions from the questionnaire to the activities used for identifying and selecting COTS/OSS products, given in (a)-(d) in section 2. Table 3 shows the mapping of a set of questions for the *functionality* and *environment* decisive factors to

activities (a)-(d). For example, questions F-1 and F1.1 (associated with the decisive factor "*functionality*") address activity (a) by putting an emphasis on effortless identification of a COTS/OSS product. The questions in section (E) from table 2 (associated with decisive factor "*environment*") mainly deal with activity (d), which addresses the selected COTS/OSS product's interoperability with the user's existing system.

<i>Activities in COTS/OSS product identification/selection</i>	<i>Questions from questionnaire</i>
a) Identification of possible candidate products	F-1 and F-1.1
b) Accurate selection from all candidates	F-2 to F-2.2.2.
c) Safe selection from all candidates	Maps to other questions not shown in Table 2
d) Selection of products, which are interoperable with user's existing system	E-1 to E-1.2.2.

Table 3. Mapping of activities for COTS/OSS product identification/selection and the questions from Table 2

4. Results

The results of the study send some interesting messages in terms of COTS/OSS marketing. For example, question F-1 demonstrated that 58% of COTS/OSS providers did not choose a reflective name for their products. This means that users will have to scan through the description of COTS/OSS products in order to decide if they can be chosen as candidates for COTS/OSS product selection. Fortunately, amongst these providers, the majority provided a description that is clear and immediately visible to users. Still, this means that 12% of all 264 websites were at risk of being eliminated because they required a great effort to check if their products could be candidates for COTS/OSS product selection. However, from the perspective of COTS/OSS product functionality, the results were not very impressive. 58% of websites did not provide an explicit functionality for their COTS/OSS products and hence users have to carefully browse the provider's entire website in order to extract the functionality. 8% of these websites did not provide any adequate explanation for the functionality.

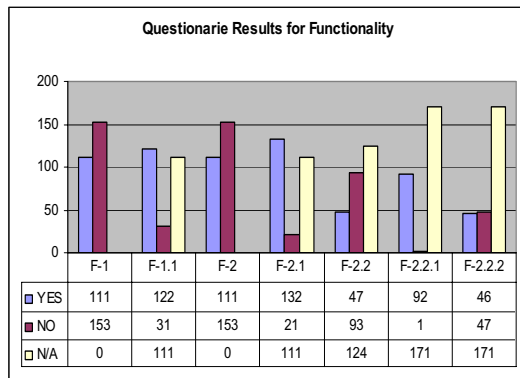


Figure 1: Questionnaire results for the decisive factor “functionality”

A similar picture emerges from the results for the “environment” decisive factor. 27% of providers do not specify the required hardware and software for the successful integration of their COTS/OSS products. Furthermore, amongst the websites that do provide the relevant information, 80% of them do not provide it explicitly. Therefore, users have to scrutinise the entire website in order to deduce the required hardware and software. The rest of the results for the two decisive factors (i.e. *functionality* and *environment*) are provided in Figures 1 and 2.

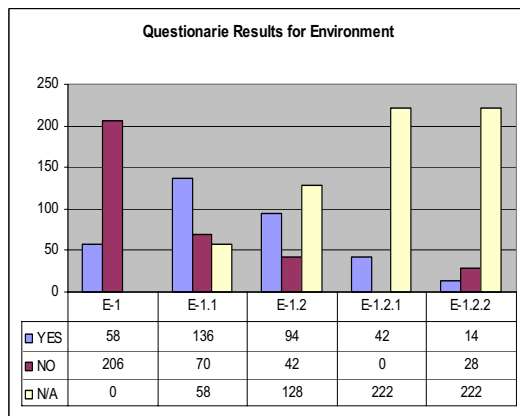


Figure 2: Questionnaire results for decisive factor “environment”

5. Conclusion

In this paper we outlined the likely consequences of ineffective COTS/OSS product marketing in terms of its impact on COTS/OSS product identification and selection. We have emphasised that for users, COTS/OSS product identification is as important as their selection. Therefore, we have derived decisive factors

(primarily aimed at COTS/OSS product providers) for guiding them towards creating more effective marketplaces. Such marketplaces will in turn ensure that users conduct COTS/OSS identification and accurate and safe selection of interoperable COTS/OSS products more efficiently.

We plan to evaluate our decisive factors further. They can be incorporated within Template-1 from [18], which may prove their facilitation of the Procurement-Oriented Requirements Engineering (PORE) method. (PORE integrates requirements acquisition and COTS/OSS product selection.) Template-1 is based on COTS/OSS product selection derived from information given by their providers, which suits our decisive factors very well. We are currently categorising all 264 websites intuitively, which will help us to evaluate our decisive factors further and understand better how the COTS/OSS product markets work. Such a categorisation may help to propose tailored guidelines for each COTS/OSS product marketing category. We will apply all our decisive factors for marketing to our COTS products we have developed for the automation of medicinal product evaluations [11].

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