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Cots-Based Broker-Oriented Software Development Process In Support Of Mathematical Model

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Abstract: The growing importance of commercial-off-the-shelf (COTS) software packages seems a better hope towards the timely required software development. The ongoing recently popularity of COTS products and component technology in software development is rigorous sign towards maturing the discipline. Software being an economic product faces various issues. The development of software from the COTS products needs some economic transaction process between the COTS buyer (Integrator) and the seller (Vendor). This paper proposes COTS Broker to settle various core issues with the support of mathematical model in between the integrator and the vendor as well as to satisfy COTS buyers' needs in the latest global competitive software marketplace. We have presented the solutions of various existing COTS issues through COTSBr (COTS Broker) as well as focused the need of offshore supply of COTS products through Broker to facilitate the integrator for the rapid development of software, which is existed market need to save the development time.

Keywords: Commercial-off-the-shelf, COTS, COTSBr Mathematical Model.

INTRODUCTION

COTS based software development approaches and methods have been brought forward to deliver the software faster as per customers changing requirements. There is ample evidence in the literature for the solution of various problems in relation to COTS (Conradi, 2003, Santiago, 2002). All presented approaches share common goal to improve software development process, faster changing requirements, frequently delivering working software, and vendor supported products. It's clear that the use of COTS is beneficial especially in reduction of development cost and made the availability of software in time. However COTS software is risky as for as its reliability, fault tolerance and functionality are concerned. Thus, a sound method that helps to decide which COTS software will be used in a specific development context has become mandatory (Ochs, 2000). Software in most of the proposed methods is static, while software development is a dynamic process (Mao Xiaoguang, 2003). As Component-based Software Development (CBSD) starts to be effectively used, some software vendors have commenced to successfully sell and license COTS components. One of the most critical processes in component based software development is the selection of the COTS components that meet the user's requirements (Manuel, 2002). Several observations reported in the literature (Morisio, 2002) pertaining to a COTS-based software development process in which vendor dependability, flexibility in requirement are the major conditions which are necessarily be accepted by the COTS project in relation to the use of COTS in reduction of schedule, efforts and cost of software to be developed. If this business trade-off is managed then there is clear success of the project. As COTS products (COTSPr) are being bought /sold, leased or licensed so there is need of some economic transaction process. The relationship of customers and suppliers is as old as history. Many things like trust payment and delivering are the same today. The concept of brokerage at its basic form implies a market where customers and suppliers come together in order to transact business. Generally there are three phases of interaction between the two main players. The

rendezvous phase where the market gathers information offered by the supplier(s) and is subsequently delivered to the customer(s). The transaction phase involves the establishment of a set of preconditions regarding the nature of transactions**.** The third phase that may or may not be included involves resolution for any complaint from the participant and the allocation of responsibility for resource. In some cases the role of the broker as well as the responsibilities covers the life cycle of the transaction. In other cases the broker may hold additional responsibilities before and after a transaction has taken place (Periorellis, 2000). When more than one supplier is available in the market there is a need of some intermediary who should play the role for acceleration of the process. We have enhanced the process by inclusion of COTSBr with the support of mathematical model can solve and settle various core issues as existed in the literature.

In section 2 of this paper we define COTSBr, along with co-related active organizations. In section 3 we present various COTS identified issues. In section 4 we present solutions of identified issues. In section 5 we present the general functions of COTSBr and vender selection in support of mathematical model in COTS-based software development scenario and section 6 conclusions respectively.

MATERIAL AND METHODS

1. COTSBr Oriented Process

Using one or more COTSPrs has effects on nearly all activities and products of software process: architecture and design, effort and cost estimation, validation and testing and reliability (Periorellis, 2000). The provider of component and user necessarily requires to exchange information during component itself as well as system. The lack of information limits component consumers to understand candidate components sufficiently in a way they can check if a given component fulfills its goal (Fernando, 2009). However this bidirectional information may be limited due to unavailability of strong source (Beydeda, 2003). In the process of COTS-based software development COTS Integrator (COTSInt) is the customer of COTS Vendor (COTSVe). COTSInt may need to use number of COTSves with which it has close relationship. Obviously as there is a chance of increase in number of links more will be the need of establishment and maintenance of connections between COTSVe and COTSInt. Our proposed COTSBr as an intermediary shown in figure 2 can facilitate the development process by supplying the required COTSPrs from various COTSVes.

The term offshore means located at distance from the shore. Here the term offshore COTSVes means COTS suppliers or sellers who are located at the various offshore places of the world and supplying the COTSPrs under specific requirements and business consideration by the COTSInt. Here COTSVe can be any organization which is supplying COTSPr. COTSVe can be the individual team of professional programmers who design various COTSPrs to supply on sell, lease or license etc.

1.1 COTSBr

Broker means one that acts as an agent for negotiating contracts, purchases, or sells in return for a fee or commission or one who transacts business for another as an agent. While buying the COTSPr, the buyer means the integrator who is possibly to use various number of vendors with those it has a close relationship to buy the products for its choice under timely needed requirements. Where many COTSVes may be involved in providing COTSPrs, from which a system be built. Here COTSBr means Broker who acts as an intermediary agent in between the COTSVe and the COTSInt for negotiations of sell, lease or licenses of COTSPrs from various available global sources.-

1.2 COTSInt

COTSInt is the software developer organization which receives order from the customer for some software to develop under some supplied requirements. COTSInt buys COTSPrs from the COTSVes and COTSInt, integrates these COTS to design software for supply to the customer under specific requirements.

1.3 COTS Offshore Vendor

COTSVe means a COTSPr seller or supplier. COTSPr are already existed pieces of software which are commercially available for sell, lease or on license. The authority who possesses, or build such pieces of software for sell, lease or to give under license for supply under some contract is said to be the COTSVe.

The basic concept of offshore development is when “designers" in one location send specifications and tests to “programmers” in another location, usually in another country. Because the offshore location lacks architectures, designers, and testers, this is quite different from multi-sided development (Alistair, 2002) **(Fig. 1)**.

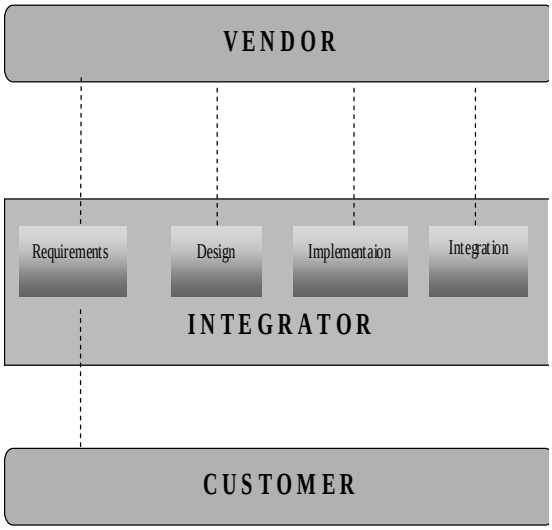

Figure No. 1 COTS Process Showing Relation between Three Co-related Organizations (M. Morisio, 2002)

COTS Identified Issues

There are mainly three co-relative organizations shown in figure 1 existed in the literature (Morisio,2002) for the software development process from the COTS. VENDOR, who supplies pre-built commercially available products from its virtual store shelf. COTS INTEGRETOR, who integrates the supplied COTSPrs and the CUSTOMER, who orders for the software under some specific requirements). As COTS based development process is vender dependent where vender is the only decision maker of the functions available in product, its release schedule, the architecture and reliability etc., documentation concerned and as for as the service level of COTS products are concerned which are supplied, buyer has no influence on the reported issues as these issues can affect the application. Some of the related problems identified by (Morisio, 2002) are such as vendor is the ultimate decision maker in COTS based software development process. Vendor affects the functionality architecture, documentations and service level. Where purchaser has no any influence on the supplied product by the vendor. Timely release of COTS by the vendor, unavailability of documents on product, or incomplete documents some functions of COTS product are promised but are unable to provide those up to mark. Sometimes if vendor modify the provided COTS, can affect the other COTS in use or may cause new bugs.

However, for several reasons the purchaser could be obliged to upgrade to the new version. Communication with the vendor can be one way, with many questions but no answers. Still others reported main conflicts when they had little power over either system requirements or COTS selection.

RESULT AND DISCUSSION

2. COTSBr and Identified issues

Following are the reported identified issues:

2.1 COTSPr Slippage in schedule

In the existing process of software development from COTSPrs, the delay in releasing the COTSPr by the vendor is reported in the literature (Morisio, 2002). Proposed COTSBr would be responsible for the negotiations to keep the schedule intact between the both i-e COTSVes and the COTSInt. As per business terms and conditions, COTSBr could be the accepted authority to compel the vendor for fulfillments of schedule strictly.

2.2 COTS Product Documentation

There is evidence in the literature for the non availability or incompleteness or unreliability of documentation on the product (Morisio, 2002). COTSBr may bound the vendor to produce the needed required documents under the agreement of supply, otherwise COTSBr may have various options to buy the products from various COTSVe around the globe. It is obvious for the COTSBr that it may contact to those COTSVes those deemed fit to provide the COTSPr along with documents.

2.3 COTS Vaporware

Today computer industry are often accused of vapor ware, they mostly announce their new version of product untruthfully. They claim that they have a new product but critics argue, these firms try to deter potential entrants (Marco 2003**)**. This existed evidence of vaporware in the literature (Morisio, 2002) where some functions are promised but never implemented is also a hamper which needs to be solved. The services of COTSBr in the supply chain, no doubt would help to solve this problem.

2.4 Vendor Modifications

Vendor provided COTS are mostly facing matching problems due to not being compatible with the system. These types of problems are stressing a need for the purchaser to upgrade its system (Morisio, 2002). For this COTSBr would be responsible to make arrangement in between the

COTSVe and COTSInt under the business contracts. Here COTSBr would be able to compel the COTSVe to supply the compatible COTSPrs or COTSBr would have wide options to make available various compatible COTSPrs from various offshore COTSVe sources.

2.5 Vendor communication

Due to one way communication, it is observed that there may be many questions but no answer. Still others reported major conflicts when they had little control over either existing system requirements or selection of COTS (Morisio, 2002). COTSBr would be responsible to manage the bidirectional communication in between both of the COTSVe and the COTSInt for the smooth sailing. COTSBr can also solve various conflicts if found in between these two time to time under strict observed business contracts.

2.6 COTSBr Scenario

As It is a common problem with the components that these are developed by different parties with clearly specified interfaces (Xiaoguang, 2003). More components be in option to select, better chance would be acquired suitable component. For these reasons and more COTSBr provides better options to select the best appropriate components from the offshore COTSVe. In addition to this COTSBr can perform following tasks in the scenario.

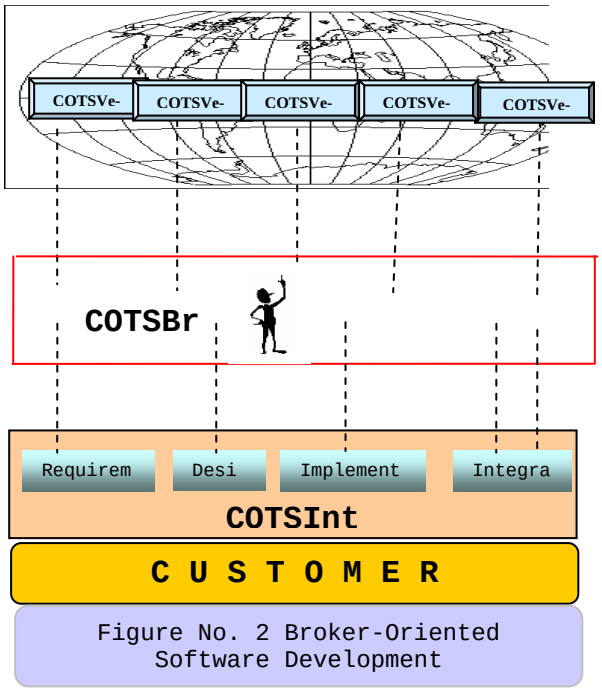

Figure No. 2 Broker-Oriented Software Development

5.1 COTS-Catalog

COTSBr may provide the instant access facility to the integrator through internet for the availability of COTSPrs at the various offshore COTSVes through means of COTS-Catalog.

5.2 COTS-selling

COTSBr may act like a COTS-seller of various COTSPrs available at the virtual store shelf of various offshore COTSVes under delegated authority.

5.3 COTS-procurement

The COTSBr may create own COTS-procurement catalogs and allow the COTSVes to post their COTS offerings/catalogs for the promotion of their available products for sell, lease or license.
The potential benefits of COTS-procurement include:

- Reducing costs to buyers means the COTSInt
- Reducing supply time to COTSInt
- Decreasing time to find correct COTSPr needed
- Decreasing time to place and process orders
- Improving quality of information
- Improving COTSInt service

In all cases the COTSBr can perform the buyers' and sellers' tasks in the COTS-Marketplace including COTS catalog search, matching, transaction negotiation and ordering.

5.4 COTS-Sell, COTS-Leasing or COTS-Licensing

The supply of COTSPr can be facilitated through negotiation or bargaining. The COTSVes who sell the COTSPrs create forward openings for selling products to the intended COTSInt in the COTS-Marketplace. The COTSBr can manage the issues like, leasing, licensing, sell etc in between COTSInt and COTSVes. This process will also leverage the trend to sell, lease or license already existed reusable components in organizations which helps the COTSInt for the instant development of new software from COTS.

5.5 COTSBr in Mathematical Model

The induction of COTSBr is necessarily supported with the following mathematical model. *Let,*

- COTS Vendor (***COTSVe***) $V_e = \{v_{e1}, v_{e2}, \dots, v_{en}\}$
V_e a set of COTS vendor (COTSVe) means a COTSPr seller or supplier. The authority who possesses, or build such pieces of software for sell, lease or to give under license for supply under some contract is said to be the COTSVe.

- COTS Broker (***COTSBr***) $C = \{c_1, c_2, \dots, c_n\}$
C a set of COTS Product, collected from COTS vendor in the word. COTSBr means Broker who acts as an intermediary agent in between the COTSVe and the COTSInt for negotiations of sell, lease or licenses of COTSPrs from various available global sources.

- COTS Integrator (*COTSInt*) $I = \{i_1, i_2, \dots, i_n\}$

I a set of software development designed under specific requirements (Requirements, design, Implementation, Integration). COTSInt buys COTSPrs from the COTSVes and COTSInt, integrates these COTS to design software for supply to the customer under specific requirements.

- Procedure of COTSBr and COST Vendor is $V_e \subseteq C$.
- Procedure of COTSBr and Integrator is $I \subseteq C$.
Now,

Every i_n O $v_{en} = c_n$

- The model rules:
A COTS Vendor V_e contains X, a set of COTSBr in COTSBr C, if $X \subseteq V_e$.
So, COTSMed can service any customer divider from other customer.

CONCLUSIONS

In summary software is known as a product so the customers' satisfaction, changing requirements and timely development of software from COTSPrs is the top burning issue, needs to be solved for the smooth sailing of software development from commercially available products. In this paper we have discussed some of the current issues in supply chain of COTS in between COTSVe and COTSInt existing in the literature. We have introduced COTSBr for the solutions of existing issues. We have presented various other tasks of COTSBr in the COTS-based software development scenario along with the concept of offshore supply of COTSPrs for wider options for COTSInt to use better offshore COTS for rapid development of software as well as to satisfy the COTSInt needs. The COTSBr will also prove to be a hamper for the monopoly in the COTSVe market as it may have the various options from various COTSVes to make available timely COTSPrs. The inclusion of COTSBr will reduce the software development time as well as add value in development process and make it more dynamic as per changing requirements.

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