

Requirements Negotiation for COTS-based Systems: Challenges and Open Issues

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1 Motivation

The development of complex COTS-based systems is known to be an intricate and risk prone process [8, 3]. The failure of these systems is rarely related to a single root. Instead the origins are the interaction of different factors ranging from the technical quality and suitability of the software system to organizational acceptance issues. In this position paper we discuss the risks involved during the acquisition of large, complex COTS systems. In particular, we focus the discussion on the requirements negotiation process for COTS-based development (CBD).

It has been argued that the COTS selection is an intertwined process with the requirements engineering activity [5, 6, 2]. We believe that the challenges faced by the RE process continues even after the “best” product has been selected. This is due to the fact that requirements are constantly evolving during the system lifetime. Adding to that, market competition forces COTS suppliers to always update their products. As a consequence, new organizational requirements needs to remain consistent with the updated versions of the chosen product. However, in reality this hardly occurs and extra adaptation costs and risks are introduced. At this stage, the decisions are quite limited since the organization has already invested a considerable amount of money and effort to acquire and deploy the chosen COTS product.

One of the key aspects of the COTS evaluation is the assessment of how well the COTS alternatives satisfy stakeholder requirements. It is possible that available COTS features are not matched perfectly to organization’s specific needs. Therefore, a main challenge of the selection process is how to handle mismatches between what is desired by the stakeholders and what it is possible to achieve with the COTS product [8, 2]. In order to successfully manage mismatches, stakeholders have to prioritise and negotiate unsatisfied requirements. We have explored this issue in detail in a previous work [1].

Another complication is that the available information about commercial products comes from incomplete and contradictory sources. Suppliers commonly provide biased descriptions about the products. This gives rise to risks that may prevent the successful deployment of the system. Examples of risk include uncertainty on how the COTS adhere to requirements, low confidence in COTS quality, and integration problems. In order to manage risks, stakeholders should be prepared to tradeoff conflicting requirements and make a number of assumptions about uncertain functionalities.

Most selection methods present in the literature provide a systematic approach to compare and rank candidate products [4, 6]. In general, these methods rely on some sort of multiple criteria decision making technique (in which AHP [7] is the most used one) to quantitatively assess how well COTS candidates meet the evaluation criteria. The main objective of this decision process is to determine the overall ranking among products and select the best one (i.e. the product that obtained the higher score). These objective approaches based on mathematical principles are a valuable mechanism to guide the COTS selection. However, the selection of the suitable product is not only a technical decision, in many cases, other more subjective issues might act as the decisive criteria. For instance, a superior package that satisfies most of the required functionality might not be the best solution compared to other technically inferior package but whose supplier is willing to negotiate a strategic partnership that could bring higher value for the organization in the future. As a result, we believe that a more qualitative approach that allows evaluators to reason about the impact of decisions and assess the involved risks is a valuable complement to current approaches.

Another main limitation of proposed selection methods is that they conduct the assessment of COTS products based on pre-defined evaluation criteria that is established at the beginning of the selection process. By doing that, they have neglected the problem of COTS mismatch and consequently requirements negotiation. This also implies the definition of strict requirements, which means that either promising can-

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didate products have to be eliminated because they not meet the stated requirements or that large product modifications will be needed to satisfy such requirements.

2 Main Challenges

We argue that requirements for COTS-based systems should be defined as flexible as possible so that they can be continuously reprioritised and balanced against COTS features. There are situations where critical requirements cannot be entirely satisfied without product adaptation as well as cases where requirements must be compromised to accept product limitations. In both situations, it is important to carefully consider the consequences involved. For instance, the decision to customise the product in order to align it into the organizational business process might result in substantial programming effort that can limit the benefits of using COTS products. Similarly, the decision to change requirements might involve serious risks that could affect the success of the system.

The prioritization of requirements is particularly important when developing COTS-based systems because many requirements might not be satisfied by any available product. Therefore, the assignment of priority helps to distinguish core requirements (i.e. critical needs that should always be satisfied) from irrelevant requirements (i.e. the ones that could be traded off with little trouble for stakeholders). However, depending on the number of requirements it can be difficult, if not impossible, to effectively compare the relative importance of each requirement with regard to each other.

An additional problem is that stakeholders would be unwilling to prioritize requirements afraid that suppliers would limit their effort to satisfy only core functionalities. From our experience, it is common that during the product pre-qualification stage, suppliers tend to state that their products fully satisfy all critical functionalities (which might no be exactly true), by doing that they attempt to pass the qualification process. In fact, the lack of confidence on supplier's claims is a key challenge that COTS evaluators face.

3 Recommendations

Based on the previous discussion, a number of recommendations can be made. Our objective here is to provide generic guidelines in order to maximise system development success and control risks when developing systems using COTS software.

1. Studies suggest that organizations benefit from a systematic and precise evaluation process. However, this process needs to be sufficiently flexible to enable modification

and negotiation of the evaluation criteria through the evaluation process.

2. The selection of COTS products involves a continuous process of requirements negotiation. In order to effectively negotiate stakeholders requirements and manage expectations, it is necessary to carefully analyse the impact of changes. When requesting a change, stakeholders should be provided of mechanisms to understand and balance the added value against the risks and effort involved to perform the modification.

3. Better understanding and quantifying risks early. For risks that are only evident in later phases, the evaluation process should be able to provide ways to trace back the decisions made earlier.

4. In complex projects, managers should see COTS-based development as business change initiative rather than an isolated software project. The effectiveness of the CBD process mostly depends on the appropriate management of technical and social factors.

5. The decision-making to select COTS products should be seen as a collaborative problem solving in which all parties try to find a mutually acceptable solution to a conflicting situation. In CBD, suppliers and customers need each other, so both parties have opportunity to influence the other and negotiate individual interests in a collaborative way.

References

- [1] C. Alves and A. Finkelstein. Investigating conflicts in cots decision making. In S. Chang, editor, *International Journal of Software Engineering and Knowledge Engineering*, pages 473–493. World Scientific Publishing Company, 2003.
- [2] L. Chung and K. Cooper. A knowledge-based cots-aware requirements engineering approach. In *Proceedings of the 14th International Conference on Software Engineering and Knowledge Engineering*, 2003.
- [3] A. Finkelstein, M. Ryan, and G. Spanoudakis. Software package requirements and procurement. In *8th International Workshop on Software Specification Design*, 1996.
- [4] J. Kontio. A case study in applying a systematic method for cots selection. In *18th International Conference on Software Engineering*, pages 201–209, 1996.
- [5] P. K. Lawlis, K. E. Mark, D. A. Thomas, and T. Courtheyn. A formal process for evaluating COTS software products. volume 34, pages 58–63. IEEE Computer Society Press, 2001.
- [6] C. Ncube and N. Maiden. PORE: Procurement-oriented requirements engineering method for the component based systems engineering development paradigm. In *Proceedings of 1999 International Workshop on Component Based Software Engineering*, 1999.
- [7] T. Saaty. *The Analytic Hierarchy Process, Planning, Priority Setting, Resource Allocation*. McGraw-Hill, New york, 1980.
- [8] K. Wallnau, S. Hissam, and R. Seacord. *Building systems from commerical components*. Addison-Wesley Longman Publishing, 2002.