SANDIA REPORT

SAND2006-0478
Unlimited Release
Printed May 2006

COTS Software Selection Process

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Sandia National Laboratories

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Abstract

Today's need for rapid software development has generated a great interest in employing Commercial-Off-The-Shelf (COTS) software products as a way of managing cost, developing time, and effort. With an abundance of COTS software packages to choose from, the problem now is how to systematically evaluate, rank, and select a COTS product that best meets the software project requirements and at the same time can leverage off the current corporate information technology architectural environment.

This paper describes a systematic process for decision support in evaluating and ranking COTS software. Performed right after the requirements analysis, this process provides the evaluators with more concise, structural, and step-by-step activities for determining the best COTS software product with manageable risk. In addition, the process is presented in phases that are flexible to allow for customization or tailoring to meet various projects' requirements.

ACKNOWLEDGMENTS

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1. Introduction

In an effort to reduce implementation, operating, and maintenance cost and time, Commercial-Off-The-Shelf (COTS) based software development has been considered as an alternative strategy to in-house development. However, using COTS packages introduces various burdens, including COTS evaluation, assessment, familiarization, and vendor interaction. The central problem is how to select a desirable COTS software package that can be easily incorporated into an existing corporate information technology (IT) infrastructure.

This paper describes a systematic process for decision support in evaluating and ranking COTS software. This process provides the evaluators with more concise, structural, and step-by-step activities for determining the best COTS software product with manageable risk. In addition, the process is presented in phases that are flexible to allow for customization or tailoring to meet various projects' requirements.

This process should be performed following the requirements gathering phase. This allows for great flexibility in product choice and allows the team to focus on how the requirements could be met by different COTS products.

2. Process Summary

The basic steps of the evaluation and selection process are:
Phase 1: Form an evaluation team
Phase 2: Apply Team Non-Software Process[1]
- o   Identify goals of the evaluation
- o   Define project tasks to support the goals
- o   Obtain agreement on project plan with stakeholders

Phase 3: Identify COTS criteria
- o   Review functional requirements for IT system
- o   Review non-functional requirements
- o   Create initial filter

Phase 4: Apply Level I filter to COTS products using published vendor information
- o   Review any internal references and public information
- o   If initial information was favorable, contact sales people to complete the survey
- o   Analyze the gathered information and decide on COTS products for further investigation
- o   Develop scenarios for detailed evaluation

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[1] See Reference 7, "Launch Process for Non-Software Projects", Version 1.0, prepared by Soheil Khajenoori, Sandia National Laboratories, Department 09516, November 14, 2004.

Phase 5: Apply Level II filter to COTS products based on vendor demonstrations and information using scenarios

- o Evaluate stock demonstration of the offering showing usability and ability to meet requirements
- o Have technical discussion of the mechanisms most appropriate for implementing the scenarios

Phase 6: Analyze data and document results

Note: Any issues that arise in a phase can be accommodated by re-evaluation of previous phase results.
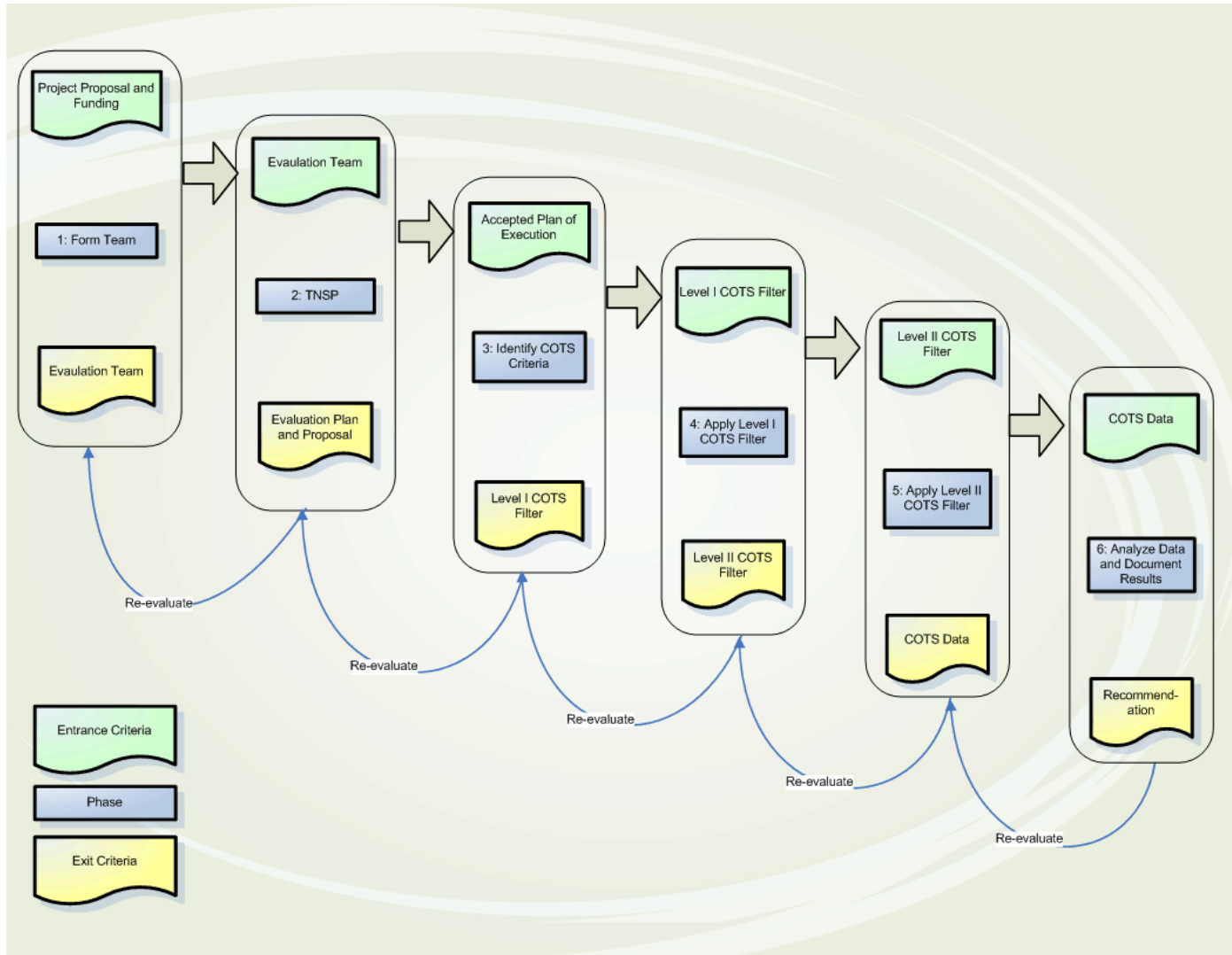
Figure 1 – COTS Evaluation Process Diagram

3. <u>Process Details</u>

Phase 1: Form an Evaluation Team

(Entrance criteria)
- Project proposal
- Funding

(Activities)
- Identify team members (technical experts, subject matter experts, end users, etc.)
- Identify stakeholders (funding customers, business owners, etc.)

(Exit criteria)
- An evaluation team
- List of stakeholders

(Notes)

Depending on the time allotted for the evaluation, the team may need a full-time commitment from its leader.

The team needs full-time commitment from at least one other member or outside consultant to ensure that progress is steady and sufficient time is available to capture the data collected.

Good representation of the key constituencies that have defined the functional requirements is needed.

Representatives are needed to maintain visibility of non-functional requirements. These are key to project success as they define the business constraints, business goals, and constraints on organizational change that in most cases define whether the project will be successful or not.

Phase 2: Apply Team Non-Software Process (TNSP)

(Entrance criteria)

- An evaluation team
- List of stakeholders

(Activities)

- Define objectives and goals
- Set timescale and effort needed
- Identify tasks to perform
- Determine due dates/milestones
- Identify risks, benefits, and trade-offs
- Identify multiple strategies
- Present plan to stakeholders
- Agree on process for addressing issues discovered during the project
- Obtain stakeholders' buy-in on tasks and schedule

(Exit criteria)

- Accepted plan of execution for project

(Notes)

The kickoff of the project for the team members really occurs with this section. The TNSP process guidelines are used to define the project and make the initial project plan. The TNSP kickoff allows for a realistic match between management expectations and team tasks. Key features of the kickoff are:

- Review stakeholders' expectations and the business objectives to be addressed. Expectations and objectives need to include any expected systems to be evaluated, processes to be used, calendar time available, and other business constraints (cost of selected system) that will affect the success of this evaluation project.

- Team develops a set of value propositions (VPs) to be delivered back to stakeholders that represent the key deliverables to achieve the stated expectations and objectives.

- Team develops a set of tasks to deliver each identified deliverable. These tasks require estimates of effort in terms of hours if at all possible to ensure sufficient detail to be accurate.

- Propose initial and alternative strategies to carry forward. For example, if the team was unable to meet all management goals in the proposed project plans and deliverables with the available staff commitments, it would develop a set of alternatives for stakeholder review to facilitate the process of selecting the project plan and agreed set of deliverables. This allows the stakeholders to quickly prioritize the requirements that the team had been given and make adjustments in those priorities with full knowledge of how this would affect the recommended strategy the team would implement.

- Review the VPs and approach with the stakeholders to ensure that the team is focused on the stakeholders' objectives.

- Commitment by the team and management to track progress in terms of tasks completed rather than a percentage of effort available. This is described as management by data. Key to this is adjusting calendar time for deliverables to take into account the overhead the various team members will have in addition to participation in this project.

Recommendations:

- Allow a minimum of three working days for the kickoff and initial project plan.

- Reviewing any functional requirements developed prior to embarking on a TNSP kickoff is very helpful in gaining team understanding of the goals and the proposed plans.

- Having a template project plan would speed up this kickoff process as it gives the members a structure to push against for inclusion of tasks and deliverables that takes significant time to develop in a vacuum.

- The review of the selected strategy with the funding stakeholder is key to ensuring that expectations are going to be met. This is not optional.

Phase 3: Identify COTS criteria

(Entrance criteria)

- Accepted plan of execution for project

(Activities)

- Gather the functional and non-functional requirements.
- Differentiate the "must-have" from the "nice-to-have" in the requirements
- Define selection criteria for Level I COTS filter
    - Address the vendor qualification (reputation, financial status, ranking among competitors)
    - Address product quality
    - Address the inter-operable factors with regards to either the organization's current IT infrastructure or other third party components at a high level
    - Address any pre-conception of the architecture of the system and the COTS software package (e.g., it uses a middle-ware web server and a back-end database system)
    - Address the basic feature requirement functionalities

(Exit criteria)

- Level I COTS filter

(Notes)

> Be sure the organization's acceptable value of measure is reflected in the criteria of selection.

Value

> For most organizations, there is a cultural norm for evaluating alternative approaches. This can be illustrated with the Value Triangle.
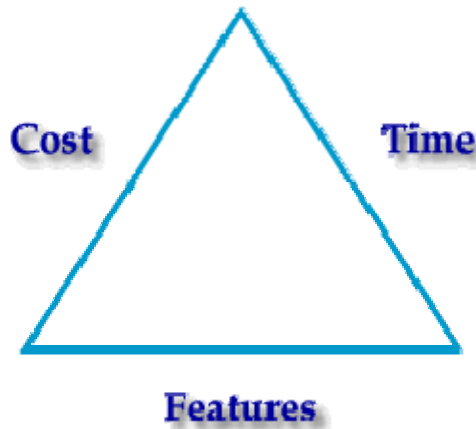
Figure 2 – Value Triangle

> In order to provide a usable ranking of solutions we need to identify several workable solutions that meet all the "must-have" (constrained) features of a system.

> "Must-have" requirements often take the form of calendar constraints (fixed deadlines), or cost constraints (fixed costs must be below some level). It is important to choose the axis that the evaluation team members will focus on measuring in order to efficiently use

their time. The axis covering "must-have" items will be checked for compliance but will not effectively rank multiple options.

For those axes that are not constrained by the organization, one has the most flexibility in ranking vendor solutions. Thus, the evaluation team needs to organize the evaluation to

1. Validate that the "must-have" criteria are met. (YES / NO evaluation criteria would be expected).

2. Measure the "nice-to-have" criteria to develop a ranking that the organization can use to guide their selection. (How much time, cost or feature-type criteria would be expected). This is done in the Level II COTS evaluation (see Phase 5, below).

For most organizations, two of the value triangle axes will be constrained by the "must-have" values to the point where the axis itself can be considered constrained. The evaluation team can save a great deal of effort by recognizing these constraints and focusing their evaluation criteria on the value axis that can be optimized.

For example, if the project has a large set of needed feature/functional requirements, this will fix the Features axis in terms of decision criteria. Solutions that do not address all the required features are not going to be successful.

This leaves optimization of the solutions for cost given coverage of the "must-have" features and compliance with the calendar constraints as the best way for selecting the best solution from available alternatives. Optimization based on cost will depend on the concerns of the stakeholders. For instance, if the stakeholders are more concerned about on-going maintenance cost or flexibility of the solution to accommodate future requirements, then the cost should be based on the amount of customization required for a solution to meet all the features rather than absolute dollars. The cost of customization will correlate well with the long-term maintenance costs and required effort for future requirements costs. An additional factor here is that the selected product must be a true COTS product (i.e., there are significant numbers of other users using the product) in order to ensure that the long-term maintenance costs are not affected by the vendor exiting the marketplace or failing to keep up with operating system and database migration requirements.

Level of Change

Organizations have varying levels of willingness to undergo change as new systems are introduced. In new organizations, where the internal processes are forming for the first time, the organization typically adjusts its processes to match the systems available to implement them. More established organizations are often constrained to comply with various processes adopted over their lifetimes to meet their business goals and cannot make major changes to processes without significant risk of business failure.

Make sure that the level of organizational change required for a particular solution falls within the constraints of your organization.

Phase 4: Apply Level I Filter to COTS products using published vendor information

(Entrance criteria)
- Level I COTS filter

(Activities)
- Obtain list of COTS software products to evaluate
- Obtain public information on the products
- Apply the Level I COTS filter to products
  - o Interview in-house developers and users, if applicable
  - o Perform analysis (trade-offs, and rank)
- Identify COTS candidates for further evaluation
- Develop Level II COTS filter
  - o Map feature requirements to product requirements
  - o Define measurable factors for each of the product requirements
  - o Create use case scenarios based on the functional requirements

(Exit criteria)
- Level II COTS filter
- List of COTS products to further evaluate

(Notes)

The filter needs to emphasize features that are likely to differentiate between vendors rather than being a list of all features that all candidate systems have. This reduces the amount of time necessary to apply the filter to each candidate system.

Keep accurate notes on the system release being evaluated and the product name. This can be made more difficult by vendors that are acquiring overlapping solutions through company mergers.

Do not try to rule out a solution based on small differences in capability as it is unlikely that the data from public sources is that accurate.

Review of public information includes reviewing brochures, web sites, publications such as industry reports (e.g., Gardner and Advanced Marketing Resources reports) and solicitation of unrestricted information from sales representatives. Information about "future" products is not included here.

Phase 5: Apply Level II Filter to COTS products based on vendor demonstrations and information using scenarios

(Entrance criteria)

- List of COTS candidates
- Level II COTS filter

(Activities)

- Re-apply Level I evaluation if there is a new release of COTS software.
- Apply the Level II COTS filter to selected systems.
    - View demonstrations given by vendors based on the scenarios
    - Interview COTS candidate's technical and sales representatives. A technical resource will be needed to evaluate the customization effort required.
    - Differentiate between marketing claims and hype.
    - Score COTS product based on data provided in demonstrations and discussions
- Document the evaluation summary for each COTS product

(Exit criteria)

- List of COTS data and their evaluations

(Notes)

Provide three to four weeks notice to potential vendors when requesting a stock demonstration and technical evaluation of the difficulty of implementing the scenarios. Allow the vendors to review the scenarios in order to prepare for the technical discussion. A stock demonstration is a normal demonstration that a company does without custom programming. These demonstrations may be by request or at trade shows but are designed to show the product's strengths in the absence of a set of pre-conceived features. Demonstrations of this type often show how the vendor positions its product and thinks of its product's strengths.

Appoint a representative to answer the vendor's questions.

Ensure that both vendor technical and sales representatives are present at the demonstration.

The non-functional requirements such as usability, performance, and customization technique should be part of the scoring during the stock demonstration. The intent is to see how good the system is out of the box. (A demo that is fully customized to the scenarios is showing just another custom solution and increasing the likelihood that the benefits of COTS will not be achieved. Configuration, which consists of selecting readily available settings and options to make the demo more understandable, is acceptable.)

Make sure the evaluation team has a member with experience in implementing similar COTS solutions. This member's job will be to clarify the vendor's assertions to the team and separate marketing claims from actual functionality being delivered. The key is to understand how something is to be done not just that it can be done.

It is recommended that the team

- Review estimates and key advantages seen for each vendor immediately after the demonstration. A consensus will give a clearer and more defensible answer than

just averaging the individual scores from the evaluators. Do this step while the presentations and question-and-answer period are fresh in everyone's mind.

- Identify any questions to be passed to vendor later that did not get addressed during demonstration and technical discussion.

- Appoint a recorder to summarize each vendor's strengths and weaknesses and to be an advocate for the vendor.

Phase 6: Analyze data and document results

(Entrance criteria)

- List of COTS data and their evaluations

(Activities)

- Re-evaluate COTS products if necessary (e.g., there are delays in project, requirements change)
- Trade-offs analysis
    - Address the customization efforts (if any) for each of the product requirements
    - Address the other non-functional requirements in depth (usability, performance, etc.)
    - Address cost (maintenance, support, custom, etc.)
- Rank COTS products and apply the value triangle
- Document results
- Identify lessons learned

(Exit criteria)

- Recommendation

(Notes)

Review the non-functional requirements to ensure that those not covered by the scenarios are being addressed (i.e., is this a COTS solution or a full custom solution).

Normalize the scoring between different vendors. As each vendor does a presentation, the team's expertise increases. The scores given reflect this and should be re-checked to make sure that the team consensus remains in support of the earlier scores.

Rank the solutions that meet all requirements based on scores.

Throw out any solutions that do not meet the "must-have" requirements.

If more than one vendor scores well, further analysis should be recommended to stakeholders.

Additional questions can be identified by the team to influence the selection as well.

Provide the implementation team with sufficient information about the scenarios, requirements, and assumptions of the evaluation to assist in the development of an implementation plan.

Key risk:

- The scoring depends on the expertise provided by the vendor to estimate the cost of customization / configuration necessary to address each of the scenarios.

4. <u>Conclusion</u>

A traditional COTS evaluation involves gathering requirements, developing the system architecture, and developing a detailed design prior to evaluating any COTS products. This approach can present two disadvantages. First, it can be restrictive in that it can narrow the search of a suitable COTS product to a very limited few that only can fit within the anticipated design. Second, it requires more time invested prior to proceeding with COTS products evaluation and selection.

With the approach presented in this document, the evaluation is performed earlier in the project, following the requirements gathering phase. By not proceeding to the design phase before choosing the COTS product, the team will approach the evaluation with an open-minded perspective allowing for exposure to new capabilities and technologies that could assist in improving the design and business practices. The team will not be constrained to one implementation from the beginning and will stay focused on the actual system requirements.

In general, evaluating, ranking, and selecting COTS software packages involve a specific set of activities. They require that the evaluation team not only keep a good communication channel open with the stakeholders but also with the chosen vendor. By applying the proposed COTS evaluation process, the evaluation team will have a more structured set of activities, will incur minimal risks, and will avoid common pitfalls in COTS software selection.

5. <u>References</u>

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6. Appendix A: Process Template

Phase 1: Form an evaluation Team

(Entrance criteria)
- Project proposal
- Funding

(Activities)
- Identify team members (technical experts, subject matter experts, end users, etc.)
- Identify stakeholders (funding customers, business owners, etc.)

(Exit criteria)
- An evaluation team
- List of stakeholders

Phase 2: Apply Team Non-Software Process

(Entrance criteria)
- An evaluation team
- List of stakeholders

(Activities)
- Define objectives and goals
- Set timescale and effort needed
- Identify tasks to perform
- Determine due dates/milestones
- Identify risks, benefits, and trade-offs
- Identify multiple strategies
- Present plan to stakeholders
- Agree on process for addressing issues discovered during the project
- Obtain stakeholders' buy-in on tasks and schedule

(Exit criteria)
- Accepted plan of execution for project

Phase 3: Identify COTS criteria

(Entrance criteria)
- Accepted plan of execution for project

(Activities)
- Gather the functional and non-functional requirements.
- Differentiate the "must have" from the "nice to have" in the requirements
- Define selection criteria for Level I COTS filter
  - Address the vendor qualification (reputation, financial status, ranking among competitors)
  - Address product quality
  - Address the inter-operable factors with regards to either the organization's current IT infrastructure or other third party components at a high level

- o Address any pre-conception of the architecture of the system and the COTS software package (e.g., it uses a middle-ware web server and a back-end database system)
  - o Address the basic feature requirement functionalities

(Exit criteria)
- Level I COTS filter

Phase 4: Apply Level I Filter to COTS products using published vendor information

(Entrance criteria)
- Level I COTS filter

(Activities)
- Obtain list of COTS software packages to evaluate
- Obtain public information on the packages
- Apply the Level I COTS filter to packages
  - o Interview in-house developers and users, if applicable
  - o Perform analysis (trade-offs, and rank)
- Identify COTS candidates for further evaluation
- Develop Level II COTS filter
  - o Map feature requirements to product requirements
  - o Define measurable factors for each of the product requirements
  - o Create use case scenarios based on the functional requirements

(Exit criteria)
- Level II COTS filter
- List of COTS packages to further evaluate

Phase 5: Apply Level II Filter to COTS products based on vendor demonstrations and information using scenarios

(Entrance criteria)
- List of COTS candidates
- Level II COTS filter

(Activities)
- Re-apply Level I evaluation if there is a new release of COTS software.
- Apply the Level II COTS filter to selected systems.
  - o View demonstrations given by vendors based on the scenarios
  - o Interview COTS candidate's technical and sales representatives. A technical resource will be needed to evaluate the customization effort required.
  - o Differentiate between marketing claims and hype.
  - o Score COTS product based on data provided in demonstrations and discussions
- Document the evaluation summary for each COTS product

(Exit criteria)
- List of COTS data and their evaluations

Phase 6: Analyze data and document results

(Entrance criteria)
- List of COTS data and their evaluations

(Activities)
- Re-evaluate COTS products if necessary (e.g., there are delays in project, requirements change)
- Trade-offs analysis
    - Address the customization efforts (if any) for each of the product requirements
    - Address the other non-functional requirements in depth (usability, performance, etc.)
    - Address cost (maintenance, support, custom, etc.)
- Rank COTS products and apply the value triangle
- Document results
- Identify lessons learned

(Exit criteria)
- Recommendation

7. <u>Additional Information</u>

Some techniques for soliciting information from vendors:

- *Survey* – Review of public information includes reviewing brochures, web sites, publications such as industry reports (e.g., Gardner and Advanced Marketing Resources reports), and solicitation of unrestricted information from sales representatives. Information about "future" products is not included here.

- *Request for Information and Request for Proposal (RFI / RFP)* – A set of requirements is developed and sent out for a response from vendors. Very often this is the only approach for full-custom solutions. The vendor interprets the requirements and enters into a negotiation with the organization on approaches, Intellectual Property, and specific responsibility for success of the resulting solution. Depending on the time constraint, this technique can be too slow in obtaining information from the vendors.

- *Guided or Scripted Demonstration of Capability* – The vendor reviews a specific set of requirements expressed as user scenarios and suggests implementation strategy, effort estimates, and compliance with requirements. The vendor is far more likely to be able to understand a user scenario and the relative importance of requirements than a long list of functions. NOTE: These scenarios form the starting point for development of acceptance tests during the implementation phase of a COTS software solution.

- *Custom Demonstrations or Conference Room Pilots* – In some cases a prototype may be necessary to validate vendor claims and increase the accuracy of estimated costs for implementation of a complete solution. This can be addressed by taking a representative set of functionality and implementing it on a "pilot" system. This allows testing of interfaces to legacy databases, performance validations, and other difficult to access items before final commitment to a vendor or solution

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