Acquisition Pilot: The Application of OAR in a Lead System Integrator Context

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Introduction to ASP OAR Pilot

Options Analysis for Reengineering (OAR) is a systematic, architecture-centric method for identifying and mining reusable software components within large and complex software systems.

OAR was initially developed for organizations that own both the legacy assets and the target system.

ASP OAR pilot provided a customized version of OAR for the FCS system integrator to quickly evaluate whether specific legacy assets can be effectively mined for reuse within FCS.
Context: Why Mine Existing Components?

Few systems or product lines start from “green fields”

Problem of mining existing components:
- under what conditions should components be extracted
- what types of components are worth extracting
- issues in extraction:
  - existing components are often poorly structured and poorly documented
  - existing components differ in levels of granularity
  - organizations lack clear guidance on how to perform the salvaging

*Bottom line: it is difficult to get off the dime!*
What OAR Provides

OAR provides:

• quick identification of relevant and non-relevant components
• decision making based on consensus and “hands-on” analysis
• identification of target component needs that can be satisfied and those that cannot be satisfied
• estimates of the cost and risk of changes required to each legacy component to satisfy a product line need
Conventional Application of OAR

OAR Analysis Team

Client Organization

Legacy Systems

OAR Process

- Establish Mining Context
- Inventory Components
- Analyze Candidate Components
- Plan Mining Options
- Select Mining Option

Collaborative Effort

Recommended Mining Option

Candidate Mining Options
Multiple Supplier Context for Applying OAR. Lead System Integrator (LSI) Integrates Components From Various Sources
“Divide and Conquer” Approach

Baseline OAR Process:
1. Establish Mining Context
2. Inventory Components
3. Analyze Candidate Components
4. Plan Mining Options
5. Select Mining Option

Customized OAR Approach:
1. Establish Mining Context
2. Inventory Components
3. Analyze Candidate Components
4. Plan Mining Options
5. Recommend Mining Option
6. Evaluate Mining Options

Customize baseline activities and add others as required.
Phase 1 Activities

Initial Mining Analysis

BEGIN Conduct OAR Tutorial

Establish Mining Context

Supplier Mining Analysis Activities

Evaluate Mining Options

“Ballpark” Results

Selectively Mine Assets

Selectively Choose “Not-to-Mine”

Initial IC
Initial ACC
Initial PMO
Initial RMO

Continue or END Analysis
IC: Inventory Components

Select Systems and Software of Interest

Review and Select Legacy Systems

Review Component Documentation
IC: Inventory Components

Select Systems and Software of Interest

Identify High Value Components

- Review Criteria for Selection
- Identify Documentation
- Select Components
IC: Inventory Components

1. Begin
2. Select Systems and Software of Interest
3. Identify High Value Components
4. Identify Components Satisfying Characteristics
5. Create Component Table
6. Expand the Component Table
7. Screen Components
Component Table

<table>
<thead>
<tr>
<th>New System Component Need</th>
<th>Legacy System Software Components</th>
<th>Required Common Component Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of Component Need</td>
<td>Component Name(s)</td>
<td>&lt;entry&gt; &lt;entry&gt; &lt;entry&gt; &lt;entry&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Required Common Component Characteristics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Age (Years)</td>
</tr>
<tr>
<td>Rehabilitation Characteristics</td>
<td></td>
<td>Black Box</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Level of Changes Required</td>
</tr>
<tr>
<td>New Development Estimates</td>
<td></td>
<td>Effort (MM)</td>
</tr>
<tr>
<td>Comparative Data for Mining</td>
<td></td>
<td>Relative Cost</td>
</tr>
</tbody>
</table>
ACC: Analyze Candidate Components

- Begin
- Select Desirable Components
  - Develop Criteria
  - Screen Undesirable Components
ACC: Analyze Candidate Components

- Select Desirable Components
- Identify “As-Is” and Black-Box Components
- Develop Criteria
- Select Components
ACC: Analyze Candidate Components
ACC: Analyze Candidate Components

Select Desirable Components

Identify "As-Is" and Black-Box Components

Identify White-Box Components

Identify Architectural Mismatches

Analyze Changes Required

Determine Required Changes

Determine Difficulty, Risk and Comparative Difficulty & Risk

Estimate Cost, Effort and Comparative Cost & Effort

Validate Results
PMO: Plan Mining Options

Begin

Select Promising Components

Develop Criteria

Evaluate Results

Select Components
PMO: Plan Mining Options

1. Select Promising Components
2. Perform Component Tradeoffs
3. Create Options Table
4. Adjust Candidate Options
5. Form Component Aggregations
   - Develop Criteria for Aggregating
   - Identify Candidate Options
   - Determine Cost, Effort, and Comparative Cost & Effort
   - Determine Difficulty, Risk, and Comparative Difficulty & Risk
OAR Options Table (Multiple Options)

<table>
<thead>
<tr>
<th>Option Number</th>
<th>Component Need Satisfied</th>
<th>Rehabilitation Estimates</th>
<th>New Development Estimates</th>
<th>Mining Versus New Development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mining Option #1</td>
<td>Name of Component Need</td>
<td>N Q Q Q MM $K</td>
<td>MM $K Q Q</td>
<td>% % Q Q</td>
</tr>
<tr>
<td>Mining Option #2</td>
<td>Name of Component Need</td>
<td>N Q Q Q MM $K</td>
<td>MM $K Q Q</td>
<td>% % Q Q</td>
</tr>
<tr>
<td>Mining Option #3</td>
<td>Name of Component Need</td>
<td>N Q Q Q MM $K</td>
<td>MM $K Q Q</td>
<td>% % Q Q</td>
</tr>
</tbody>
</table>
RMO: Recommend Mining Option

1. Prioritize Selection Drivers
2. Select Most Desirable/Effective Option
3. Evaluate Desirability and Effectiveness

Choose Best Option

Begin
RMO: Recommend Mining Option

1. Choose Best Option
2. Verify Option
3. Identify Component Needs Satisfied
4. Produce Out-Brief and Present Findings
5. Produce Summary Analysis Report
6. End RMO
EMO: Evaluate Mining Options

1. Evaluate Each Mining Presentation
2. Evaluate Each Mining Report
3. Map Ability to Satisfy Component Needs
4. Explore Satisfaction of Maximum Number of Component Needs
5. Select Options Offering Best Mining Solution
6. Produce Report and De-Brief All Suppliers

End EMO
LSI OAR Phase 2 Activities

BEGIN

Conduct Phase 2 Briefing

Supplier X
Supplier Y
Supplier Z

Evaluate Mining Options

Detailed Results

Selectively Mine Assets

Continue or END Analysis

Selectively Choose “Not-to-Mine”

In-Depth Mining Analysis

Supplier Mining Analysis Activities
Outcome of Disciplined Reuse Decision-making Process

RESULTS

- Findings describing results of analyses
- Description of each option with ranking
- Rationale for option or combination of options selected
- Cost and effort of selected mining options
- Final list of satisfied and unsatisfied component needs corresponding to options selected
Impact of LSI OAR Approach

The benefits of the LSI approach include:

• Work is allocated corresponding to a natural division of responsibilities (i.e., who is in best position to perform activity).
• Obtaining early “Ballpark” results will speed up decision making process.
• Fewer LSI resources (manpower and time) required to complete the mining analyses resulting in reduced cost.
• In-Depth analysis accommodates desired refinement of analysis results.
• Common process will ensure consistency of results and equitable evaluations.
• Process focuses on what needs to be done -- suppliers have freedom to decide how to best perform the prescribed activities/tasks and collect the needed data.

More planning and coordination though are required by the LSI.
Results of Pilot

• The pilot was performed on a small set of reusable assets. The results provided more credible reuse estimates.
• The LSI has adapted the general OAR approach, but has permitted suppliers to use their own specific processes to produce the OAR outcomes.
• The results were fed into the COCOMO II estimating model. Follow-up work is analyzing how to systematically connect OAR with COCOMO II.
• Government acquisition officers view the method as a mechanism for getting better metrics as well as better estimates.
ASP OAR Documentation