USING TECHNICAL DEBT DATA IN DECISION MAKING:

Potential Decision Approaches

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Managing Technical Debt should involve...

Gathering TD information
- TD items (defect, design, testing, etc., debt)
- Principal and interest
- Costs and benefits
- Impact and risk

...and Feeding it into Decision Making
- Which TD to pay off?
- What’s the right mix of TD?
- Release Planning

Decision Approaches
- Different domains
- Strengths and weaknesses
## General TD Management Framework

## Technical Debt Item

### Decision on Paying off a Technical Debt Item

<table>
<thead>
<tr>
<th>TD Identification</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>7/18/2009</td>
</tr>
<tr>
<td>Responsible</td>
<td>Rose Angel</td>
</tr>
<tr>
<td>Type</td>
<td>Documentation</td>
</tr>
<tr>
<td>Location</td>
<td>Module S</td>
</tr>
<tr>
<td>Description</td>
<td>In the last release, function F was added to module S, but the documentation has not been updated to reflect this change.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Principal</th>
<th>1.5 person-day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest Amount</td>
<td>2.5 person-day</td>
</tr>
<tr>
<td>Interest Probability</td>
<td>70%</td>
</tr>
<tr>
<td>Time Frame</td>
<td>In the next release</td>
</tr>
</tbody>
</table>
Decision on Paying off Multiple TD items
- Example: Cost/Benefit Matrix

Advantages
- A baseline decision approach
- Works with limited data
- Increased reliability with more data availability
Portfolio Approach (1)

- **Portfolio**
  - Combination of different types of assets
  - Risk reduction strategy
  - Decision making process
    - Determining the types and amounts of assets

- **Basic Principle**
  - Different volatility and performance patterns
  - Reduced investment risk through diversification

- **Portfolio Model**
  - Mean-variance analysis: return and risk
  - Constrained optimization problem: maximize return or minimize risk

weighted sum of the expected returns of the constituent assets

standard deviation of the portfolio return: a function of asset risk and correlations of assets
Transformation to TD Management
- TD item -> Asset
- Principal – interest (net benefit) -> asset return
- Interest standard deviation -> risk of asset return
- Relation with other TD items -> correlations between assets

Advantages and Disadvantages
- Consideration of relations among TD items
- Inapplicability of the assumptions
  - Normal distribution of asset return
  - Continuous divisibility of assets
Options

- **Finance Domain**
  - Derivative financial instrument
  - Future transaction on an asset at a reference price
  - Buying the right, but not the obligation

- **Technical Debt Management**
  - Investment Decision: Refactoring a module or not?
  - A module provides the right to be replaced by a better one.
  - Option value is represented by the changing cost in the future

- **Limitation**
  - Difficulty in determining the key parameters (Black-Scholes model)
  - Technical Potential is hard to estimate (NOV Model)
Analytic Hierarchy Process (AHP)

- **Method**
  - Key elements: Goal, Criteria and Alternatives
  - Process
    - Construct criteria hierarchy
    - Assign weights and scales
    - Perform pair-wise comparisons

- **Application to TD management**

- **Advantages**
  - Group decision making
  - Quantitative and qualitative criteria
  - Objective and subjective criteria
Discussion

- **Questions**
  - Applicability
  - Strengths and Weakness
  - Relations between these approaches
  - Cost-effectiveness

- **Evaluation**
  - Case studies for each approach
  - Comparisons of different approaches
    - Experiments in a lab setting
    - Case studies in industrial contexts

- **Long-term Vision**
  - Provide a technical debt management tool kit
Questions?