Automating the Management of the Traceability Relation

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Software changes are inevitable in the software development lifecycle. The scope and cost of such changes can be estimated through impact analysis. However, impact analysis is often performed only when it is absolutely necessary due to the level of effort and accuracy of the analysis when performed too early. This is due to the labor intensive and error prone nature of maintaining up-to-date traceability relations. This poster introduces an automated approach to traceability management that informs development activities and assists in tool integration.

Challenges in Traceability Relation Management

• Traceability Relation
  ✓ The link between the artifacts of software development
  ✓ A traceability relation follows the life of a requirement in a forward and backward direction

• Purpose of Traceability Relations
  ✓ Assess the impact of a change in a requirement, design, implementation, and test case
  ✓ Verify that all requirements of the system are designed, implemented, and tested

• Benefits of Traceability Relations
  ✓ Improves software maintainability
    • Easily identify artifacts (e.g. requirement, design, and implementation) related to the changed feature
    • Locate the pieces of artifacts directly
  ✓ Help in planning the schedule and estimating cost/effort

• Challenges in Traceability Relation Management
  ✓ Granularity: Software artifacts are documented using different notations. Such heterogeneity makes it difficult to create an appropriate level of granularity between artifacts
  ✓ Evolution: Traceability relations should evolve with their related artifacts. However, maintaining up-to-date traceability relations is difficult due to the labor intensive and error prone nature
  ✓ Process Integration: Define how to use the traceability relations and when to use the information

Activity-Driven Traceability Relation Management

Activities govern the evolution of software artifacts

Sample Tool Configuration

<table>
<thead>
<tr>
<th>No</th>
<th>Product Configuration</th>
<th>Integration</th>
<th>Remarks</th>
</tr>
</thead>
</table>
| 1  | IBM Rational DOORS, MS Project, IBM Rational ClearQuest, IBM Rational ClearCase, IBM Rational DOORS | IBM Rational DOORS | * Configured by commercial tools
| 2  | IBM Rational Change, IBM Rational Synergy | IBM Rational Change | * Tool itself provides integration
| 3  | MS Excel, MS Project, MS Project, SVN | N/A, N/A, N/A | * Mixed configuration: commercial and open source

Incremental process and tool integration

Bottom-up

• Adopt Configuration Management Process & Tool
• Adopt Change Management Process & Tool
• Integrate Change Management with Configuration Management
• Adopt Project Management Process & Tool
• Adopt Requirement Management Process & Tool
• Integrate Requirement Management with others

Top-Down

• Integration with existing development processes and tools
  ✓ Commercial tools provide integration as a feature of the product
  ✓ Open source tools provide APIs or plug-ins for integration

• Can automate the management of traceability relations
  ✓ Reduces traceability relation management errors
  ✓ Minimizes the amount of manual work in maintaining relations

• Can control the granularity of traceability links
  ✓ The granularity of traceability relations may be proportional to that of change activity

• Can help to improve the accuracy of impact analysis