



A Framework for Maintaining Artefact Consistency during Incremental Software Development

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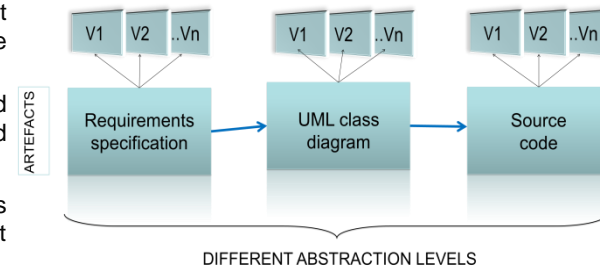
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Motivation and problem statement

The problem: A software system is typically composed of a variety of artefacts, each representing the system at some level of abstraction. In practice, different artefacts evolve at different rates and modifications applied to one artefact may not get reflected in other related artefacts.

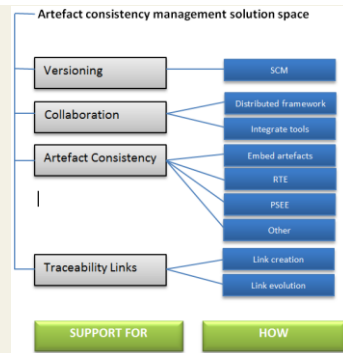
Consequences: This **differential evolution** of software artefacts may result in **synchronisation issues** and **inconsistency** among artefacts. Outdated artefacts constitute impediments to effective system maintenance and lead to a lower level of trust in supporting documents since they do not reflect the current state of the system.

Although incremental development provides a more flexible solution for handling changes [1], artefact consistency is often neglected: different representations of software go through stages of refinement without all the dependent artefacts being considered as the process does not enforce artefact links.



Evaluation of state of the art solutions

- Existing solutions relate to traceability, change impact analysis & consistency management.
- Classification based on support for the above & implementation strategies [2][3][4]



Conclusions:

- Partial solutions in terms of artefacts supported
- Certain aspects of artefact consistency are supported in isolation

Holistic view of artefact consistency

A holistic artefact consistency management solution should support all of the following activities:

- ✓ Traceability creation & maintenance
- ✓ Change detection
- ✓ Impact analysis
- ✓ Consistency checking
- ✓ Change propagation

Research hypothesis

Current trend of emergent and changing requirements for software systems can be better supported by:

- Maintaining artefacts in step with one another, and
- Applying linking, impact analysis and synchronisation mechanisms to propagate changes across all stages of the process

Prototype system design & progress

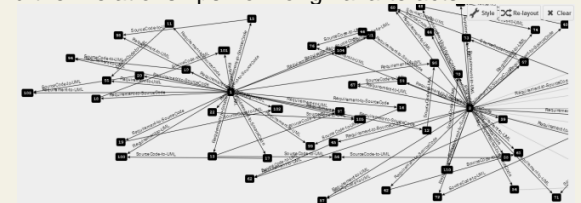
Current work: Implementation of a proof of concept system concentrating on the following aspects of the holistic view of artefact consistency: traceability creation, change detection and impact analysis.

Functionality:

- Extract fine-grained information on elements and their relationships from original artefacts
- Save elements and their relationships in a **graph database (Neo4j)**[5]
- Detect changes to artefacts by developers
- Perform impact analysis (assumption: the graph representation will allow an effective impact analysis mechanism)

Selected artefacts:

Requirements documents, UML class diagrams, source code



Future work

- ✓ Complete **prototype implementation & evaluation**
- ✓ Some **challenges** to be addressed: distributed software development, scalability, ensuring that the prototype is non-intrusive and does not enforce any specific methodologies or tools.