The Role of Context in Exception-Driven Rework

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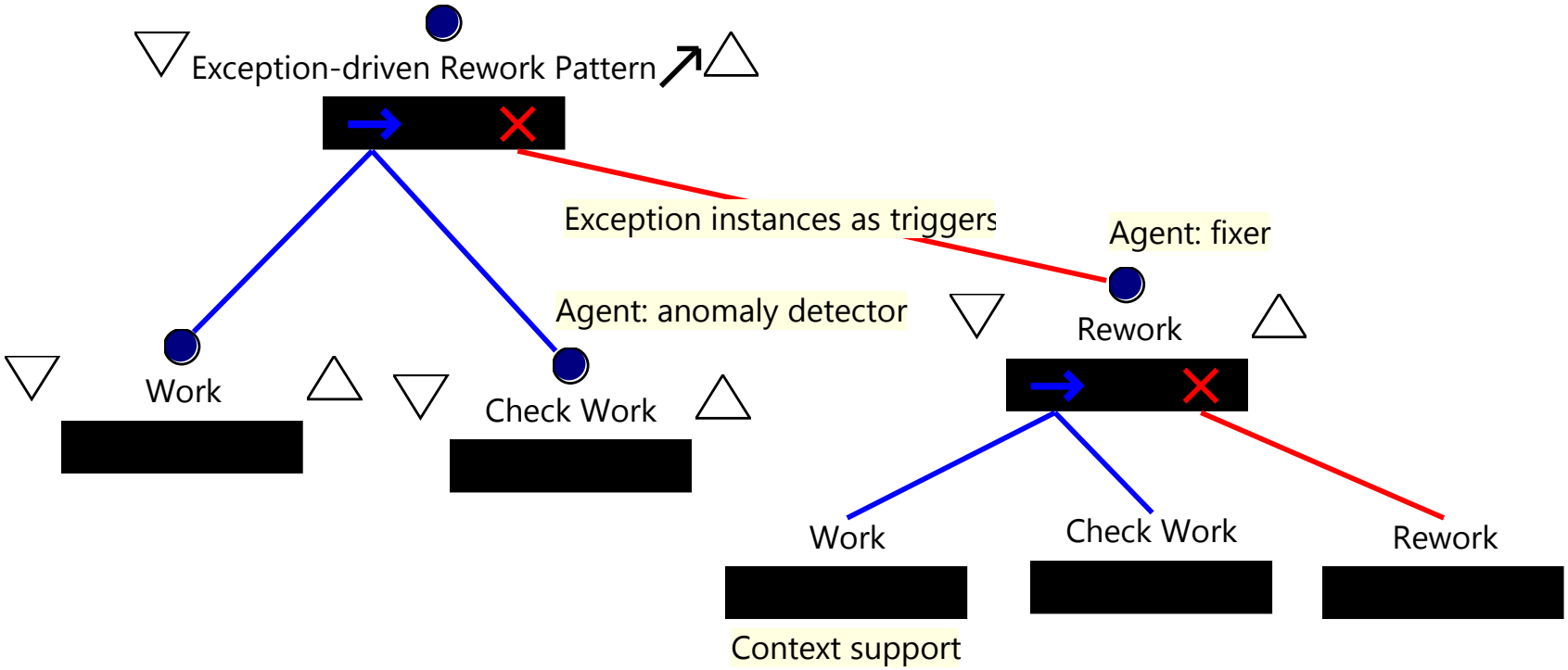
The Problem: How to Support Rework

- Rework is quite common in software development processes
  - Inconsistencies between requirement and design specifications cause reconsideration of both
  - Inconsistencies between code and design too
  - Most software engineering books ignore the topic
- Rework is hard, can become very complex
  - People could use help with it
- Rework can be triggered by exceptions
  - Addressed in an earlier paper of ours

Exception-Driven Rework Pattern

- Previously proposed exception handling pattern[1]



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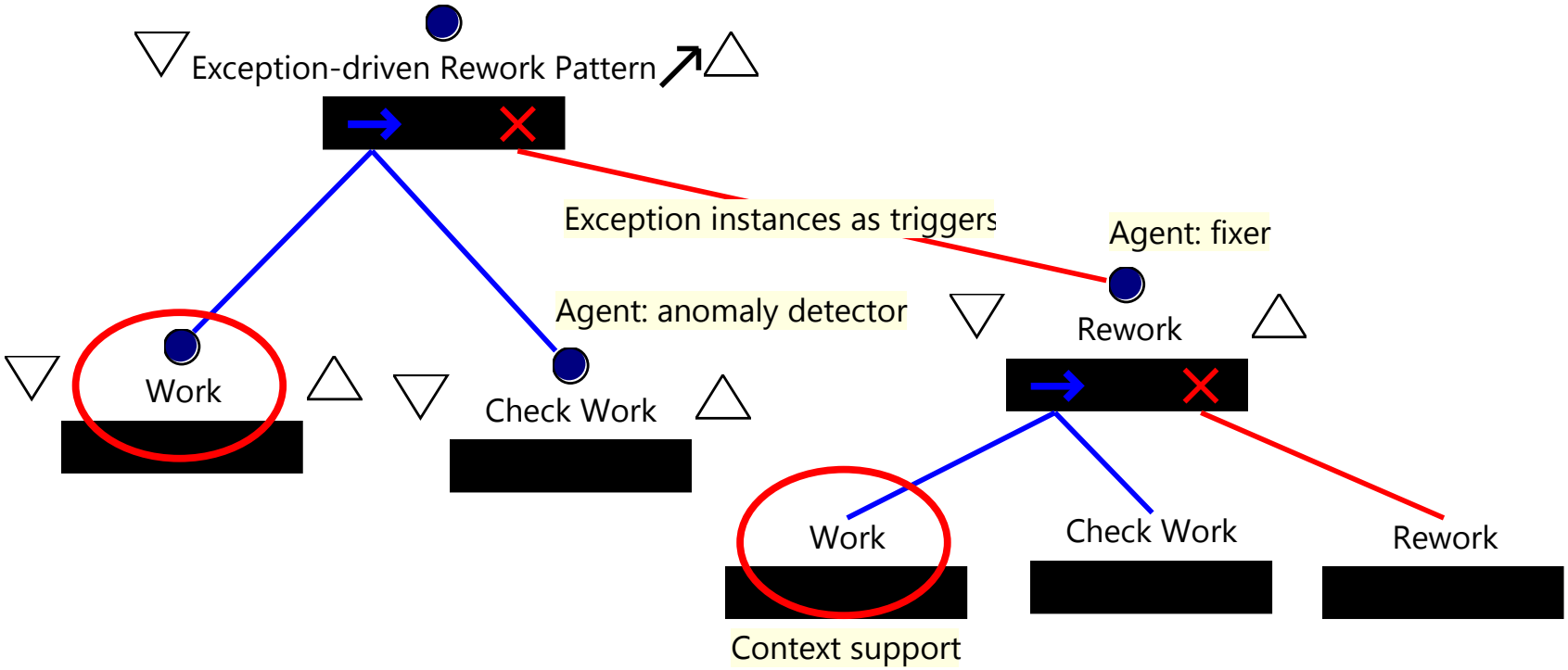

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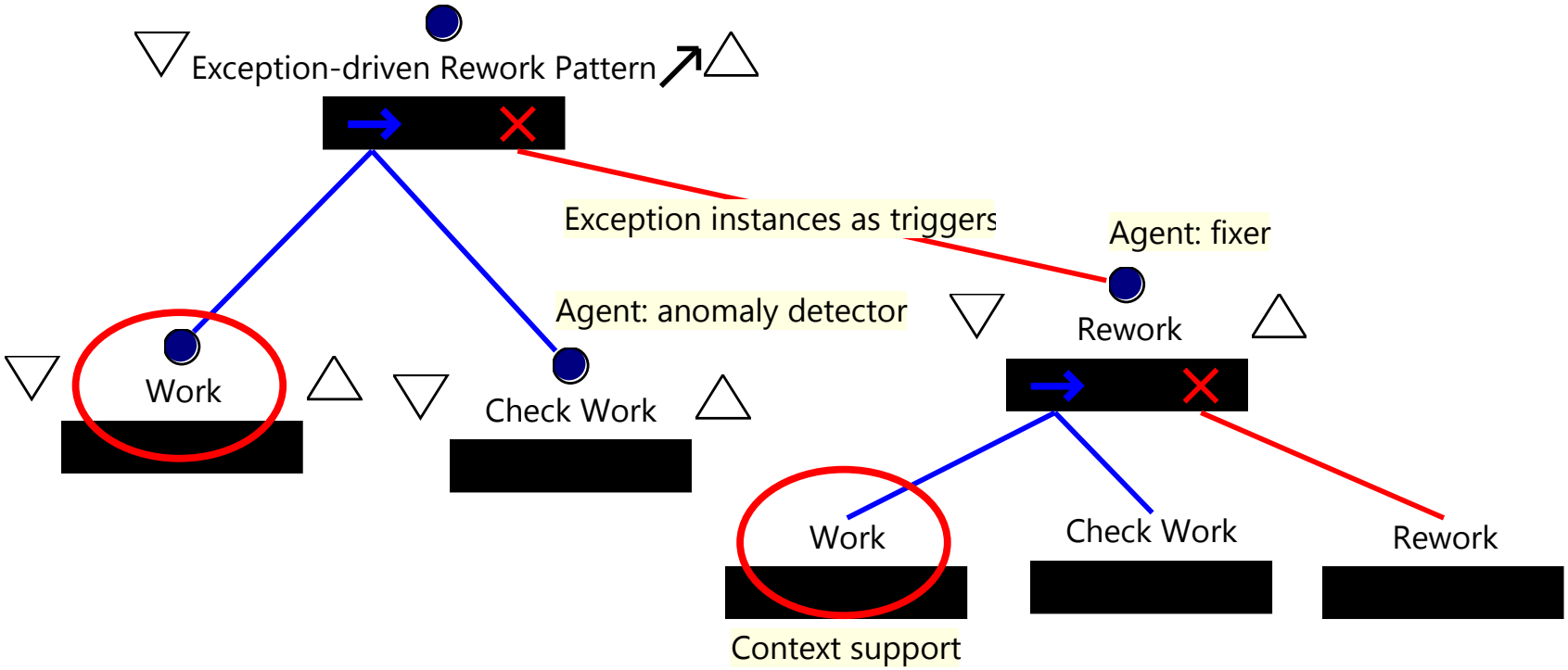

- Repeating activities that had been done previously in an earlier phase triggered by exception instance(s)
  - Reconsideration and revision of previously performed activities
  - Reinstantiation of earlier steps in new contexts

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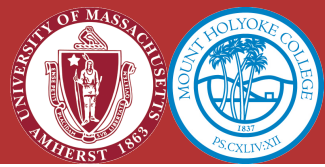
Refactoring as an Example of Exception-Driven Rework



- Refactoring is rework of design
  - May or may not be triggered when code is recognized as being untidy
  - There are many different design patterns [Fowler 1999]

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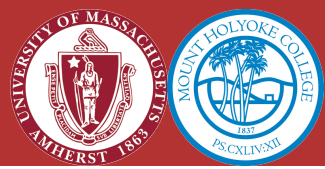

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- Separate Query from Modifier Refactoring
  - Splits a method that was both a query and a modifier into two methods
    - Create a query method to return the same value
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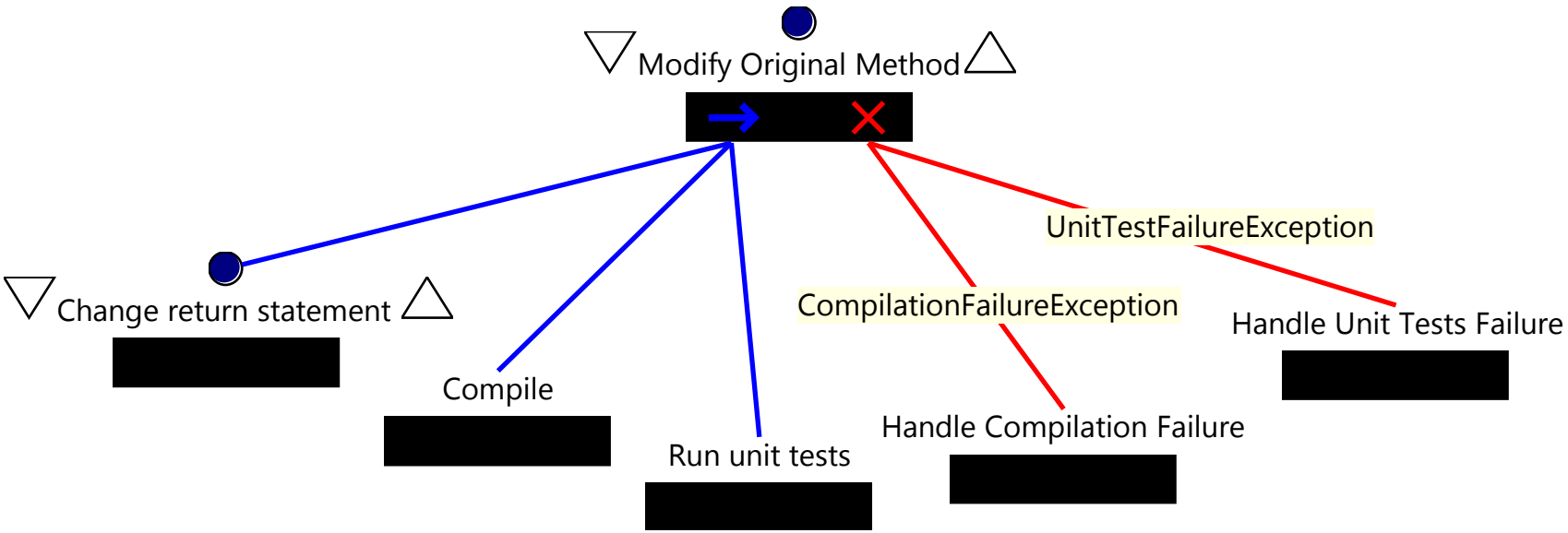
- Executing this rework process can entail carrying out a number of different kinds of rework

Separate Query from Modifier Refactoring Pattern as an Example of Exception-Driven Rework



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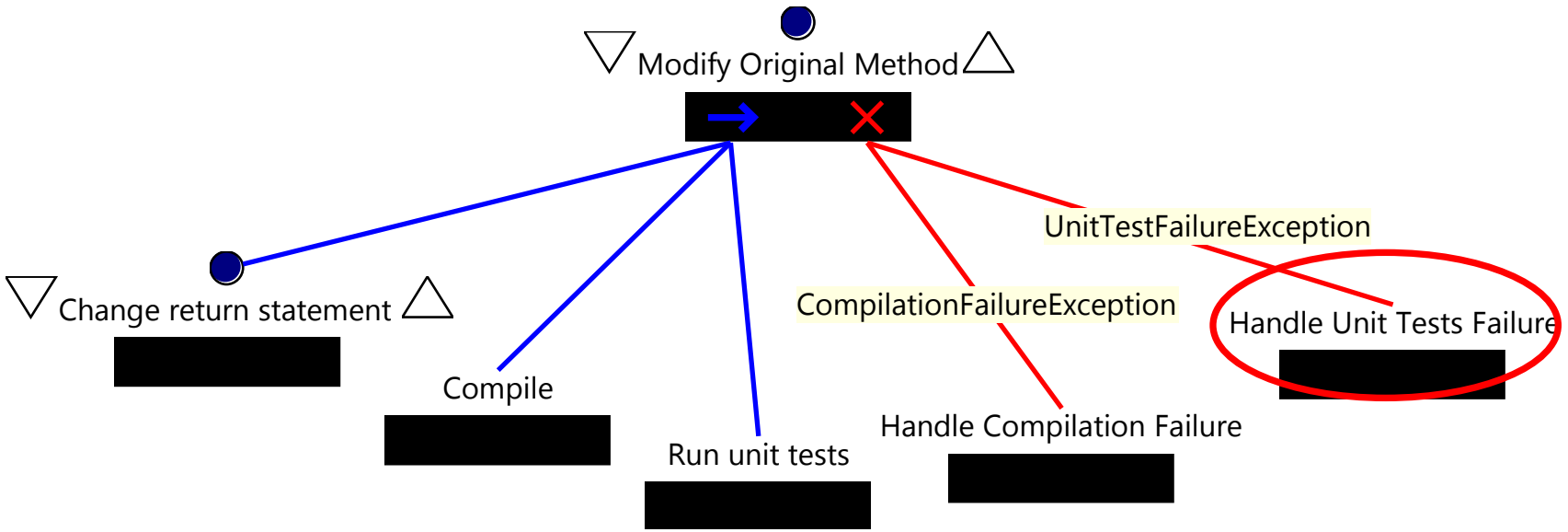

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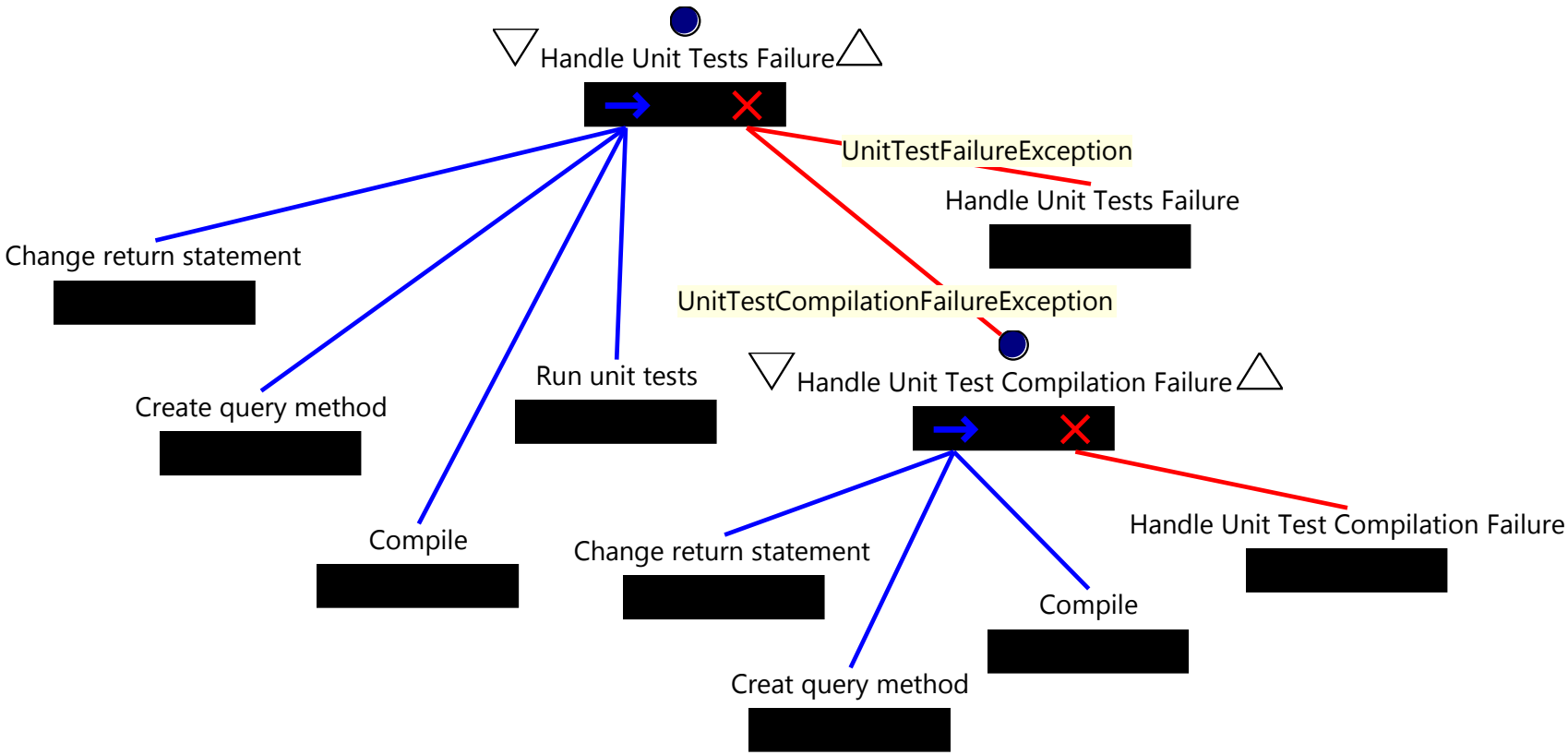
Exception-Triggered Rework Examples



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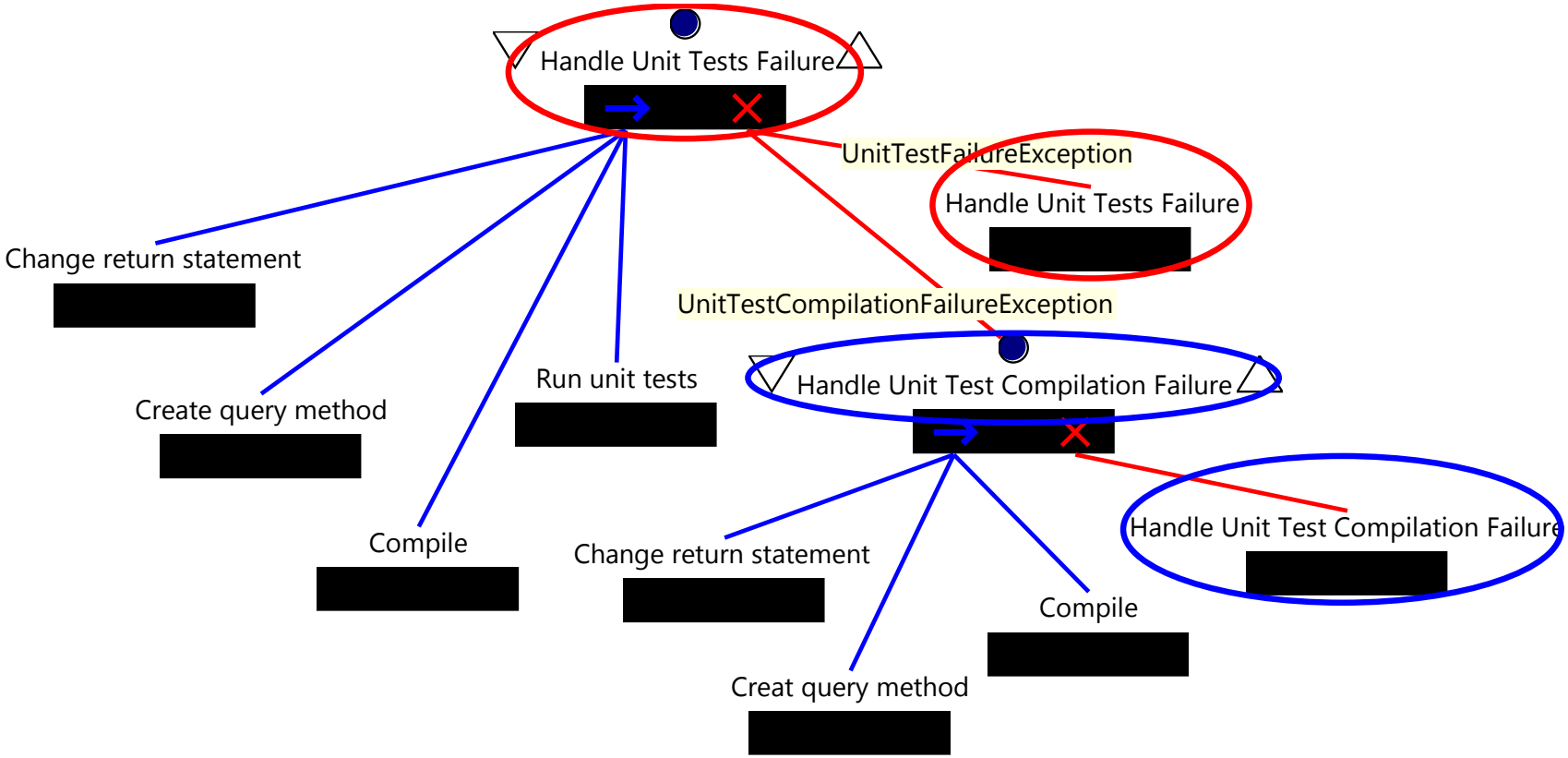

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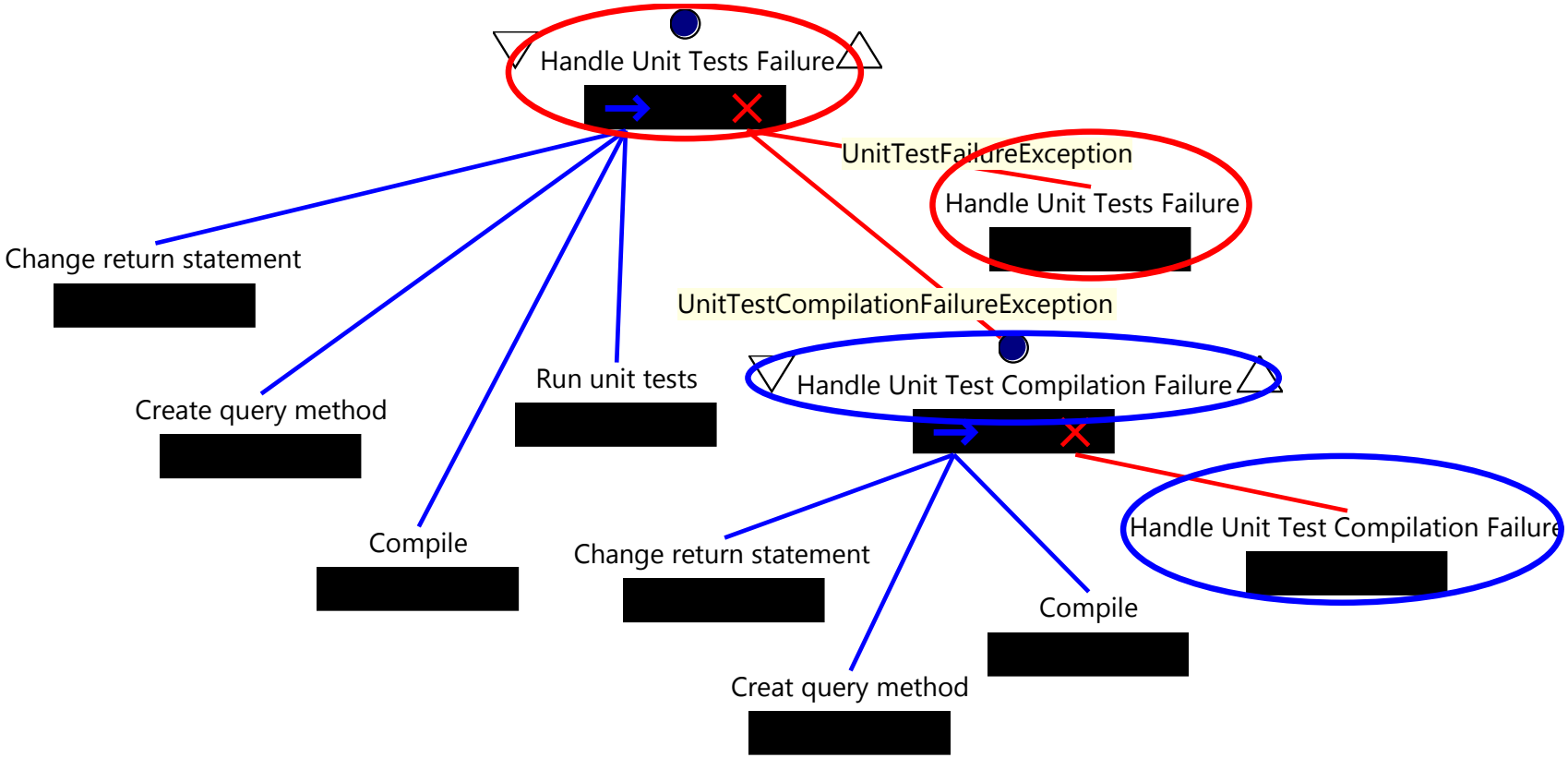

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- Actual rework should be guided by *context* provided by artifact values

Typical Questions that Users Want Answers to during Rework

- Where am I?
- What am I doing here?
- How did I get here?
- How did that work out?
- What alternatives do I have now?
- Which are likely to turn out best?

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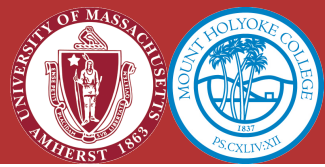

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Contextual information could help

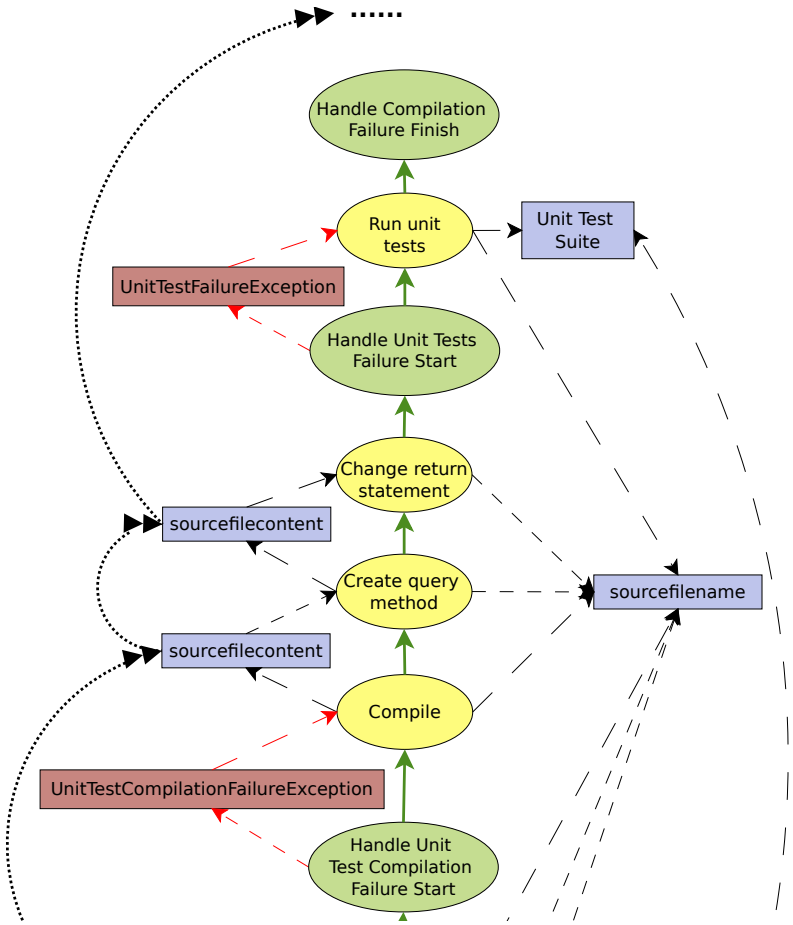
Context Information that could Help

- Present process execution state
  - Current artifact values
  - Pointers to executing steps and their recursions
- A complete process execution history
  - Prior values of artifacts
  - Previous step execution sequences
- Information that could help to form a plan for getting back to "normal"
- etc.

Proposed Support for Exception-Driven Rework

- Rigorous, executable process definition
  - Can provide articulate artifact flows and control flows.
  - Can use scoping to assure visibility of only appropriate artifacts
- Process Introspection
  - The ability to examine current process states
- Process Retrospection
  - Ability to examine past process execution history
- **Data Derivation Graph** provides the previous two

Data Derivation Graph



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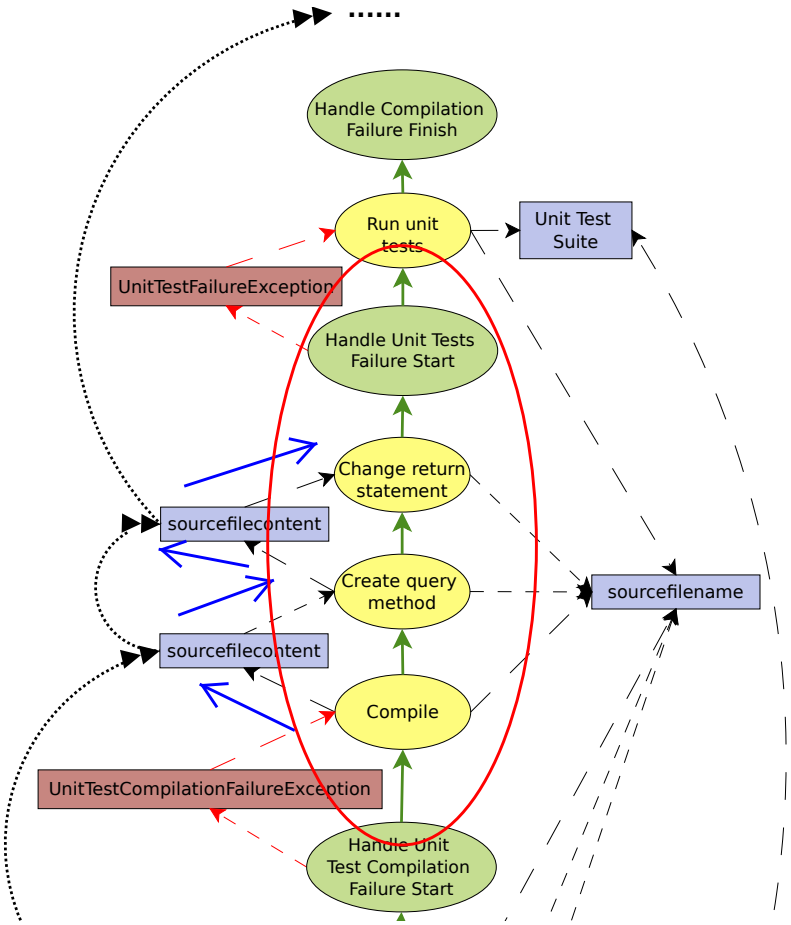

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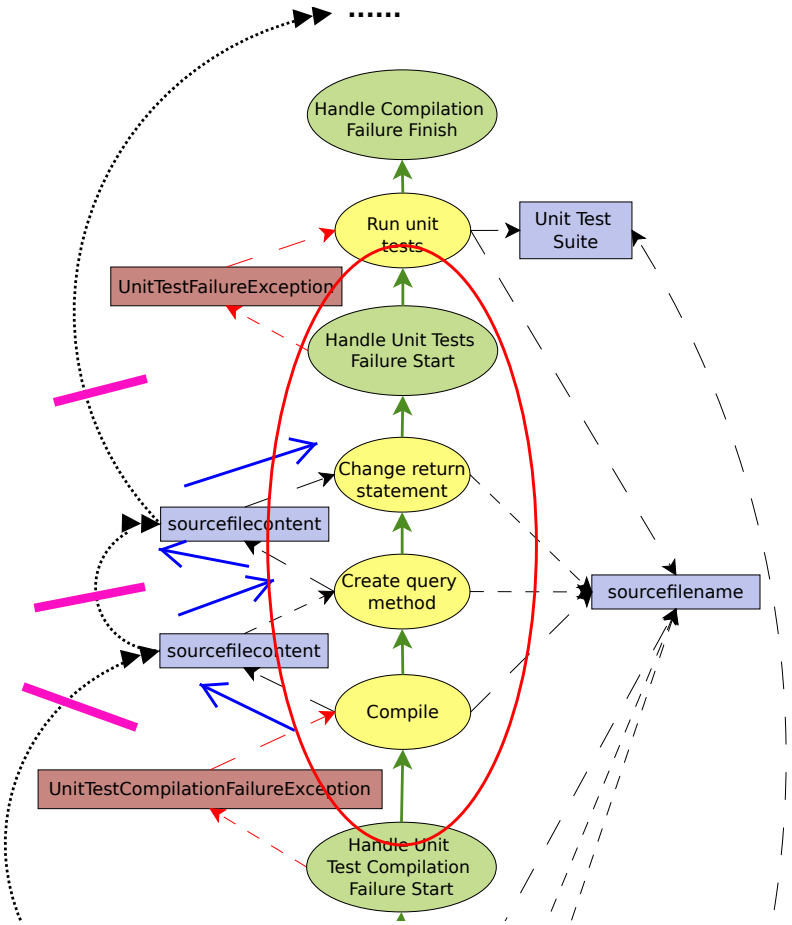

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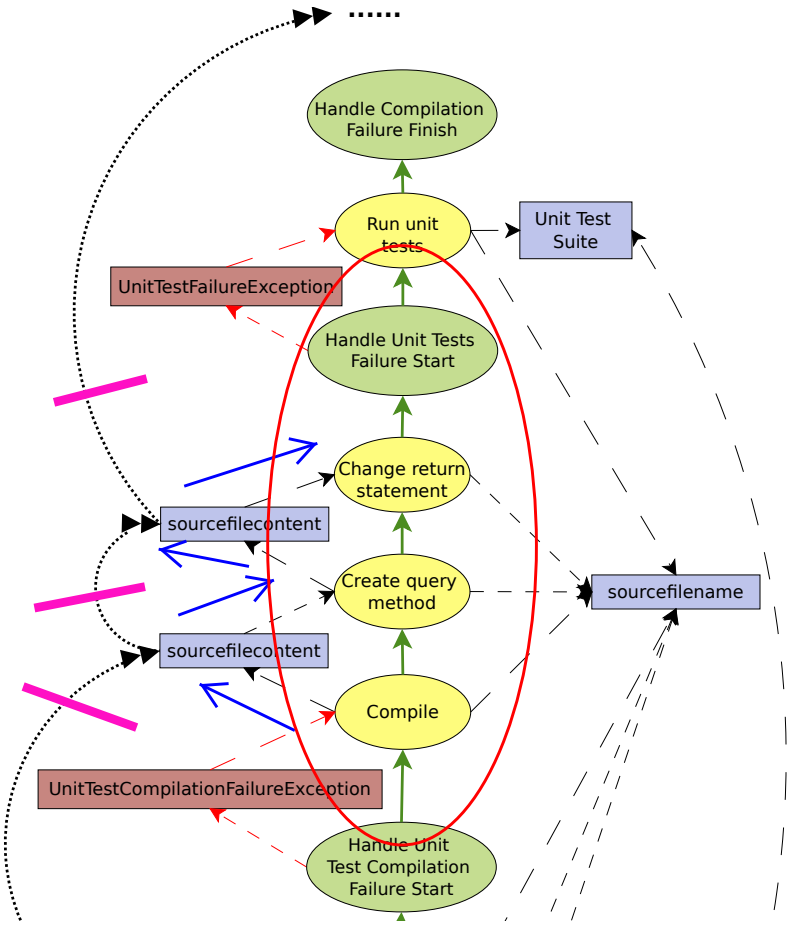

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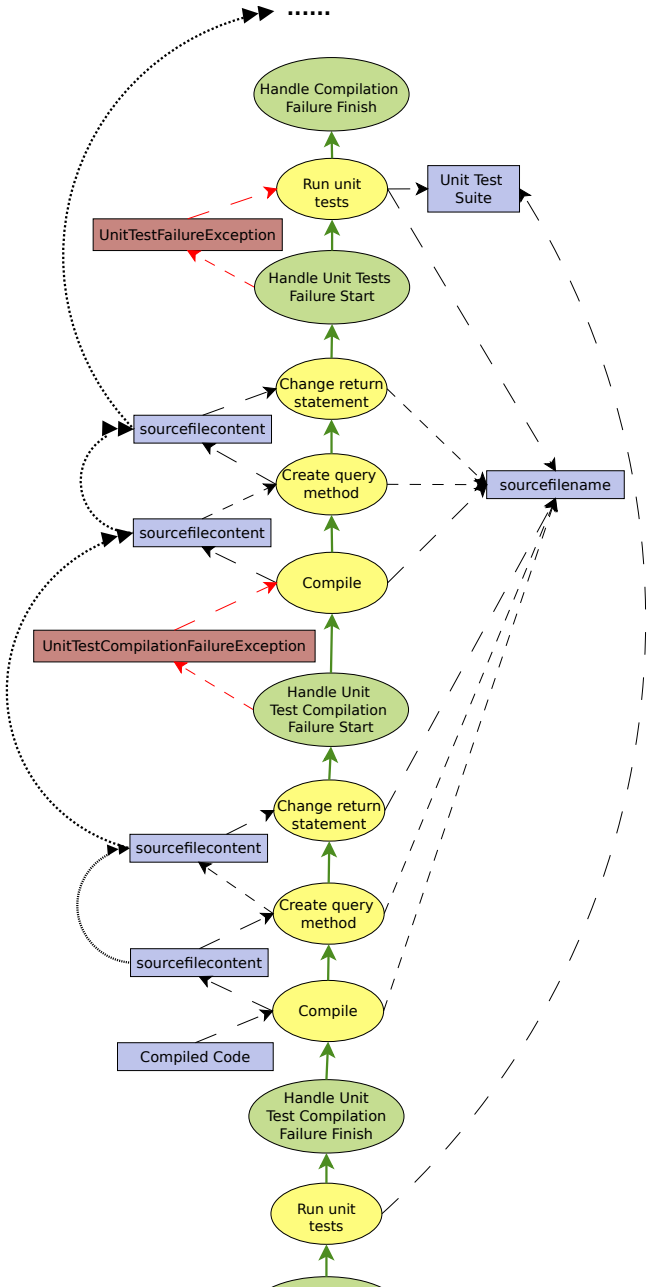
- Can generate DDGs dynamically while the process is executing

How is it Supposed to be Helpful?



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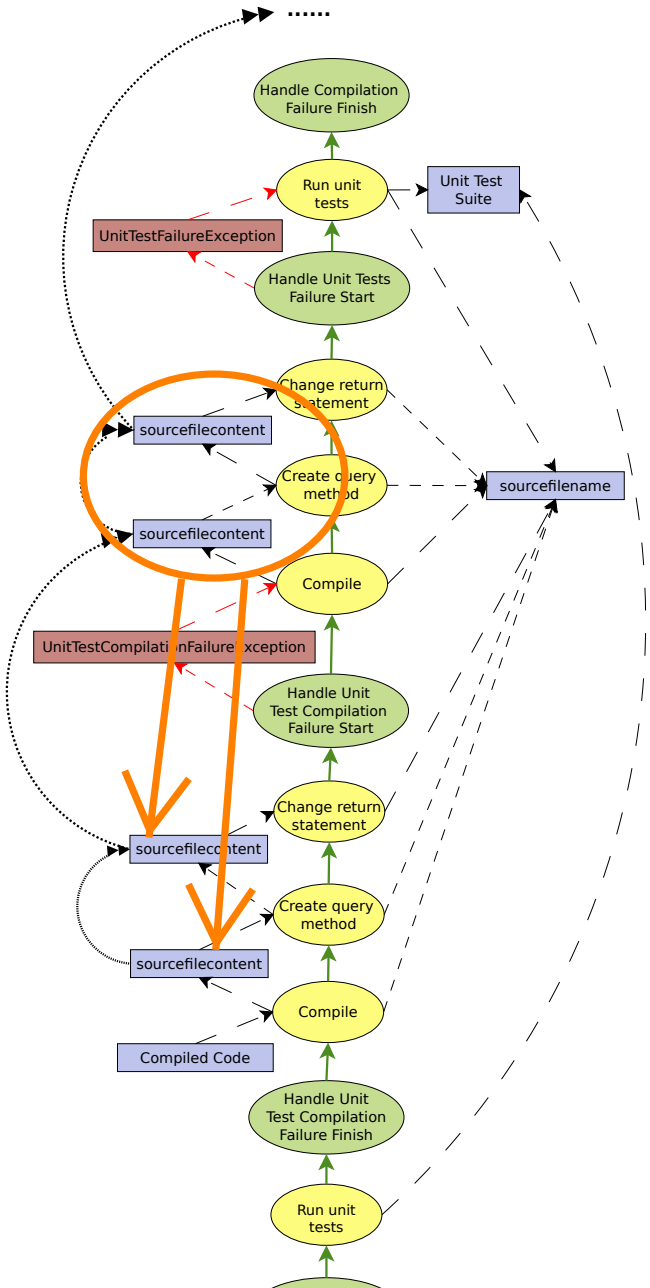

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A: See the DDG

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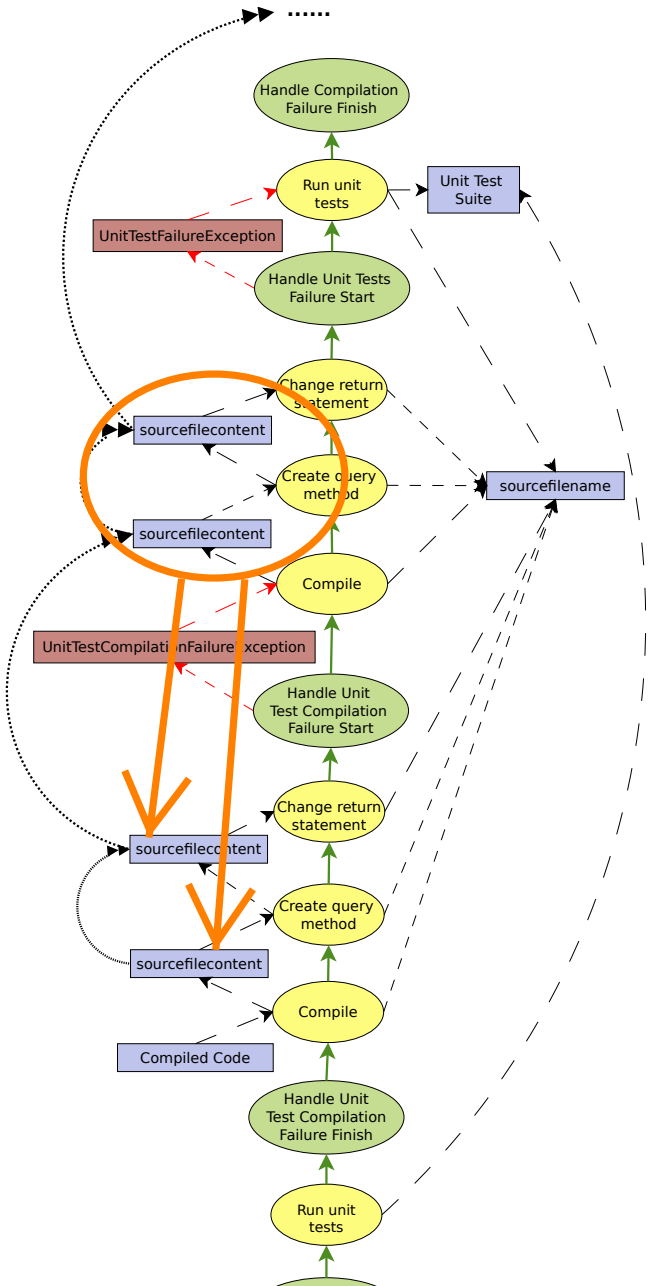

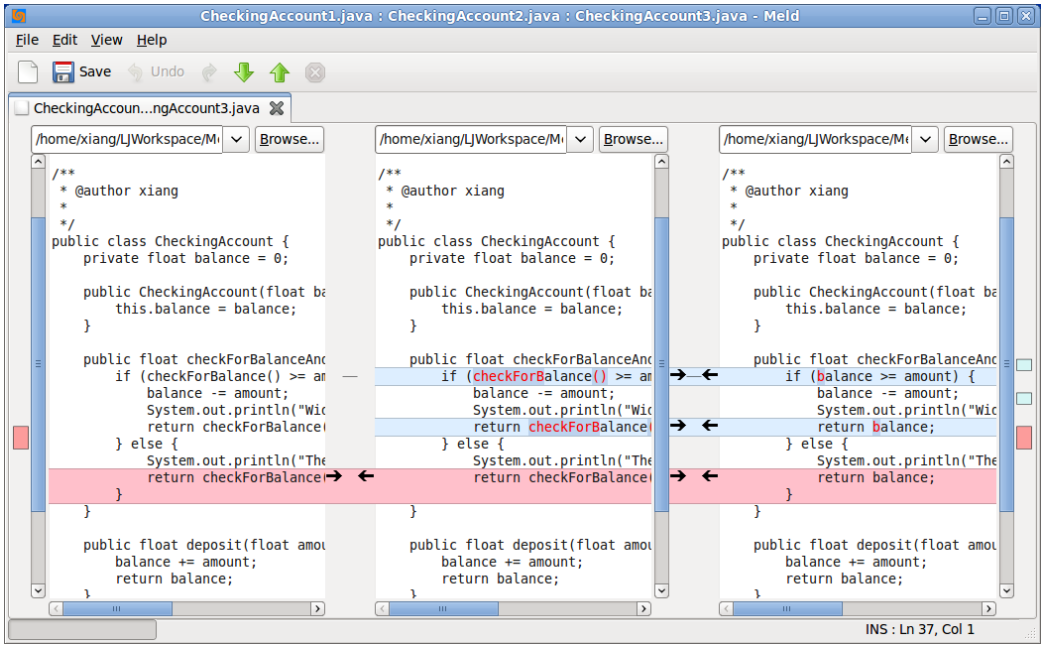

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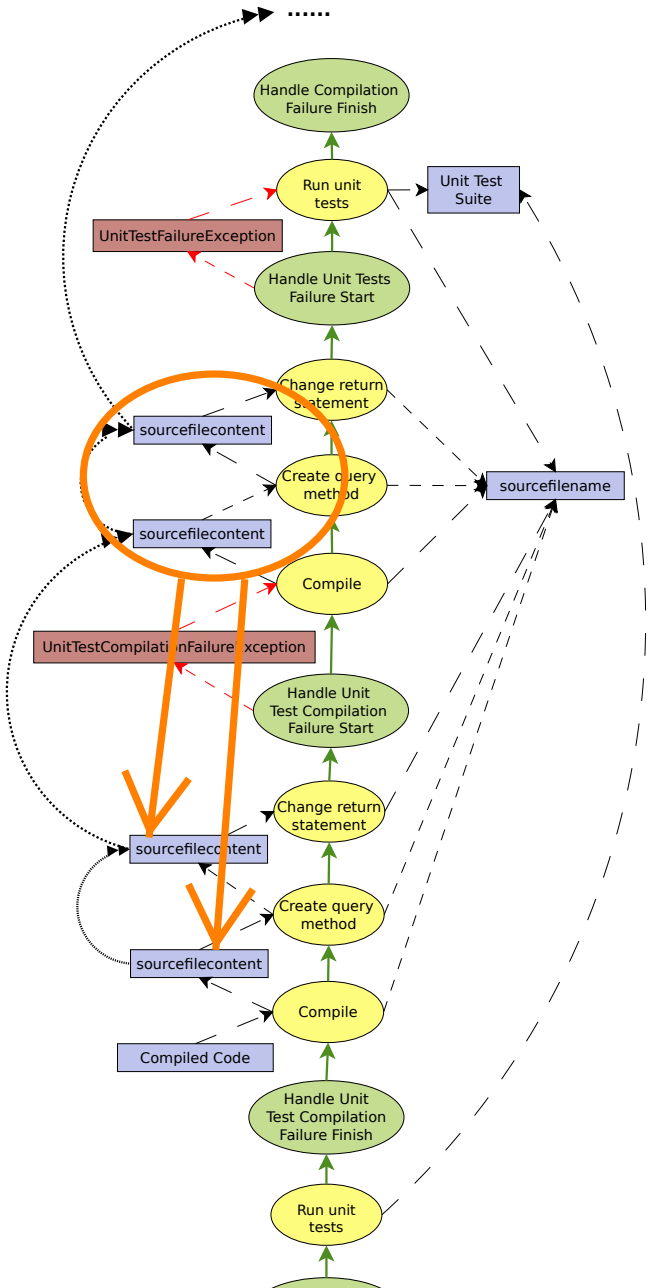

DDG suffers from scalability issues!

Future Work

- A DDG Query Language
  - How to support asking questions during rework?
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- A DDG Query Language
  - How to support asking questions during rework?
  - How to provide clear answers quickly?
- Ripple effects
  - Support for helping users decide the order in which to handle exceptions when many are thrown
    - Probably can use prospection for this
- Study more refactoring patterns

Related Work

- Exception Handling in Workflow Systems
  - [Eder et al. EDBT '98] discussed the concept of handling exceptions with partial rollback and forward execution
  - Event driven architectures (EDA)
- Rework Formalization
  - [Cass et al. EWSPT] proposed initial approaches of formalizing rework
  - A pattern for modeling rework[Cass et al. ICSP '09]
- Context Support
  - [Antunes et al. AITSE '10] proposed a context model in software development with multiple layers and perspectives.
  - Mylyn [12] is a tool integrating task management and task context[Kersten et al. AOSD '05]

Thank You

- Questions?