Behaviour-Driven Development of Foundational UML Components

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Behavior Driven Development (BDD)

**Principle**: common language for system behavior specification

**Principle**: any system – identified, verifiable value to the business

User Story/Scenario

Customer

Executable Scenarios

Developer

Attach examples

Arhitect

Business expert
Concepts in BDD
# BDD activities as user stories

| Requirements analysis | US1. Users add new stories to a project  
<table>
<thead>
<tr>
<th></th>
<th>US2. Users add new scenarios to a story</th>
</tr>
</thead>
</table>
| Project Planning      | US3. Users add new iterations to a project  
|                       | US4. Users allocate stories to iterations  
|                       | US5. Developers accept stories |
| Development iteration | US6. Developers implement stories  
|                       | US7. Update iteration status after scenario execution  
|                       | US8. Update project progress after scenario execution |
| Verifiable progress   | US9. Users can obtain iteration status reports  
|                       | US10. Users can obtain project status reports |

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Agile project planning

<table>
<thead>
<tr>
<th>&lt;&lt;Scenario&gt;&gt;</th>
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</thead>
<tbody>
<tr>
<td>Verify story initialization</td>
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<tr>
<td>&lt;&lt;Scenario&gt;&gt;</td>
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<tr>
<td>Estimate a project containing two estimated stories</td>
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<td>Estimate a project containing an estimated story</td>
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</tbody>
</table>

<<Story>>
Add new stories to a project{id = "US1"}
Scenario description

(a) Verify story initialization
- given "a project"
- when "a new story is created"
- then "story status should be defined" and "project should include story"

(b) Estimate project = 2 estimated stories
- given "a project" and "two new stories"
- when "both stories have estimates"
- then "project estimate = \sum story estimates"

(c) Estimate project = estimated story
- given "a project" and "a new story"
- when "the story is estimated"
- then "the project estimate = story estimate"
Research problem

- BDD approach for developing executable fUML components
- fUML defines implementation-oriented abstractions - refer to Platform Independent Models (PIM).
- Refer only structural and behavioral constructs defined by the fUML specification
- tailored to the algorithmic and data-intensive types of programs
- concrete textual syntax is needed - enforces a certain way of constructing models
- generated code is meant to be complete
Solution – consists of:

- UML profile
- Library \(\supseteq\) fUML activities – equality & inclusion
- Activities – executable scenarios
  - Concrete syntax for BDD scenarios
- bUML – BDD tool for fUML models
Return Verdict: pass, fail, inconclusive, error
Scenario description
textual & graphical representation

- **given** "a project"
- **when** "a new story is created"
- **then** "story status should be defined" and "project should include story"

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Scenario implementation

Difficulties:

- Implement scenario – return verdict
  - fUML primitives – low level
- Implement scenario – complex
  - how fUML define behavior of methods
- then part of scenario
  - Testing equality and inclusions
Scenario implementation

Given

- A project

When

- A new story is created

Then

- The story status should be Defined
- The project should include the story

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shouldInclude(list[*], item[0..1]): Boolean
# bUML Tool

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Verifiable progress – remarks:

• After execution, models automatically update:
  – Scenario status
  – User story status.

• Different from platform dependent approaches

• Executed on models
Related work

• no other existing works combine BDD and MDD approaches
• close to easyb http://www.easyb.org/ (2008)
• Business Motivation Model (BMM) and SysML requirements - consistency with the UML testing profile.
• Executable Acceptance Test-Driven Development (EATDD) [Park, Maurer] (2008)
Thank you