

Mutating Aspect-Oriented Models to Test Cross-Cutting Concerns

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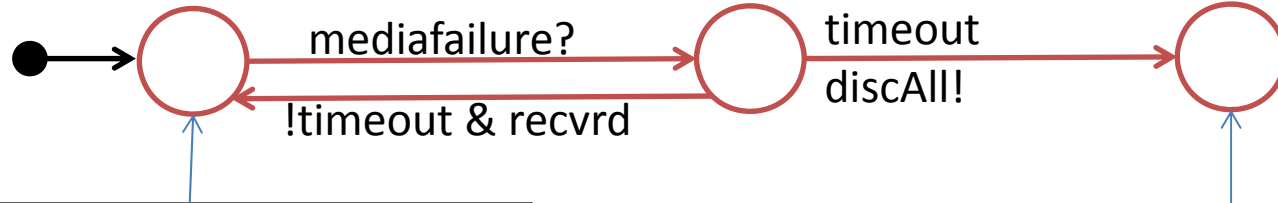
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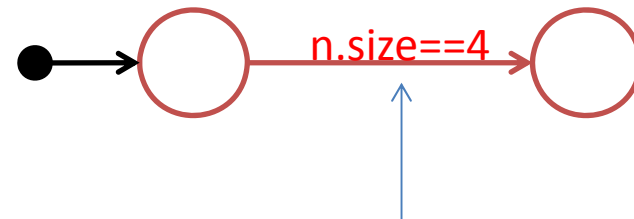
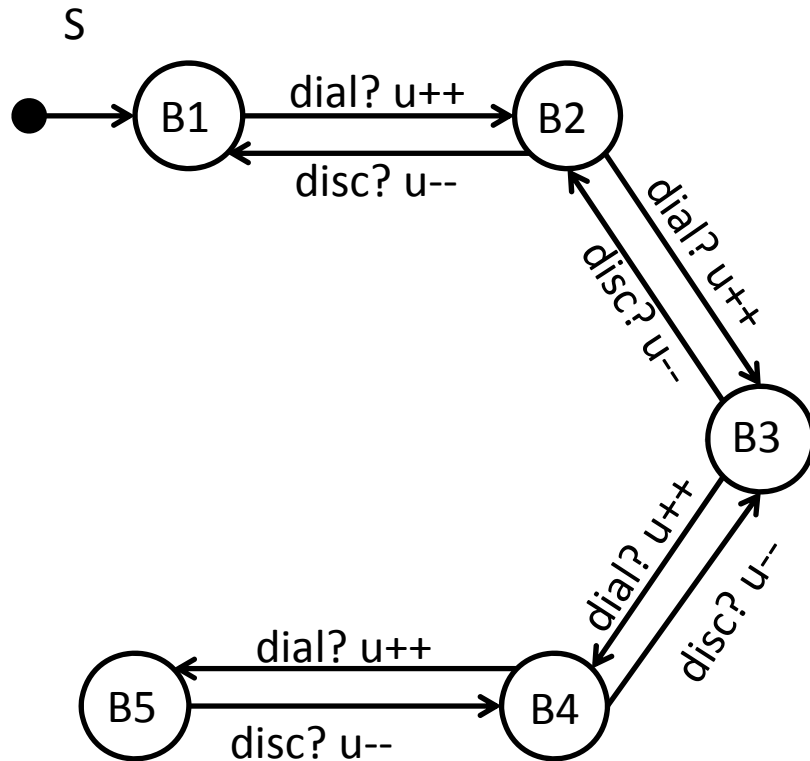
Aspect-Oriented Modeling

- Cross-cutting behavior, e.g., robustness
 - Hard to cover by tests and cluttering models
- AO modeling separates behavior
 - Base-model describing normal behavior
 - Aspect models describing cross-cutting behavior
- Aspect models allow the tester to focus
 - Design tests for one cross-cutting behavior at a time
 - Diversifying the effort according to criticality



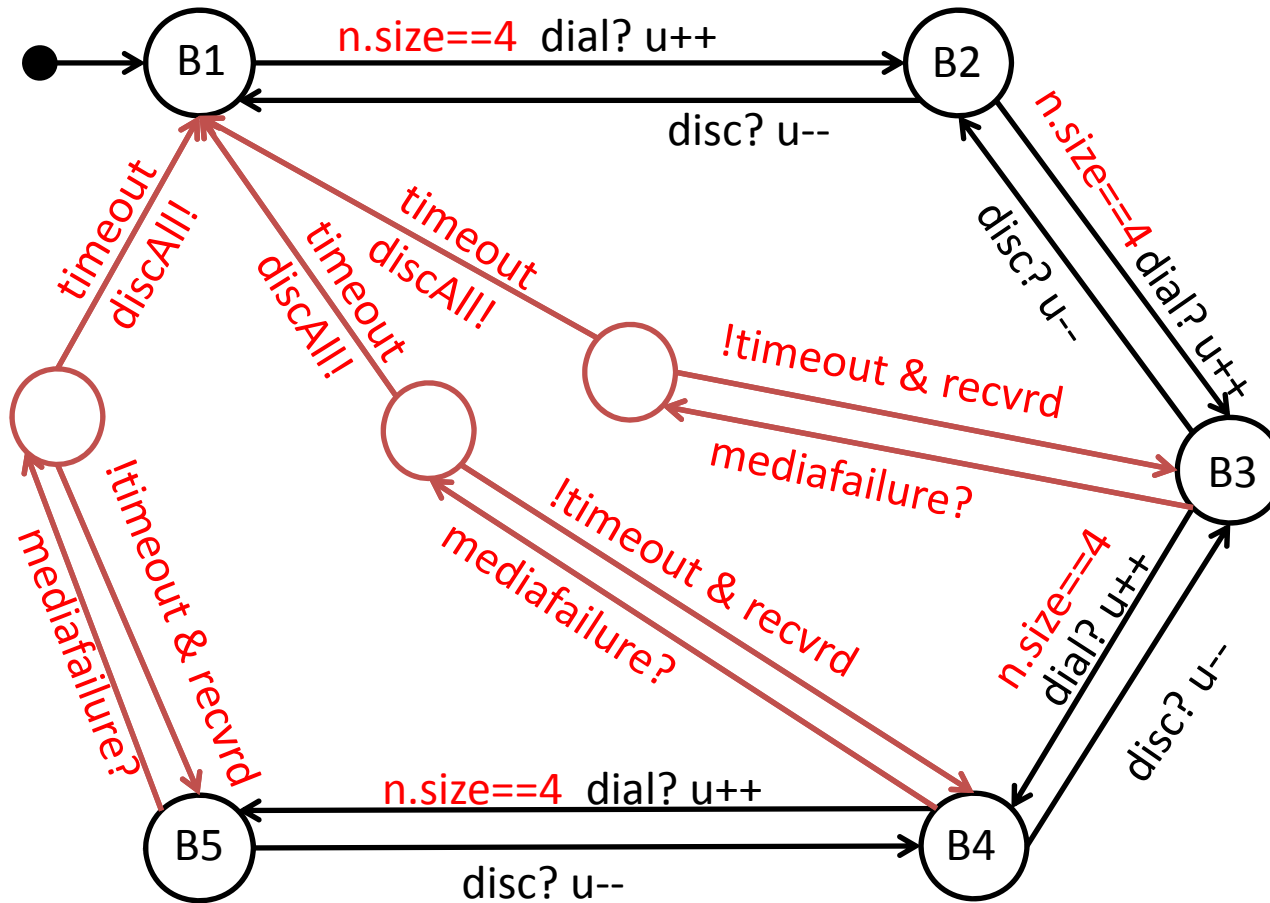
Pointcut:
select nodes named B3, B4 or B5

Pointcut:
select node B1



Pointcut: select edges with event dial?
Advice: *before* add guard n.size==4

Woven system S



Aspect Mutation

- Most aspect elements add to the woven model
 - But some advice can replace elements
- Hence, **aspects are mutated before weaving**
 - Hard to go back and undo part of weaving

Fault Model

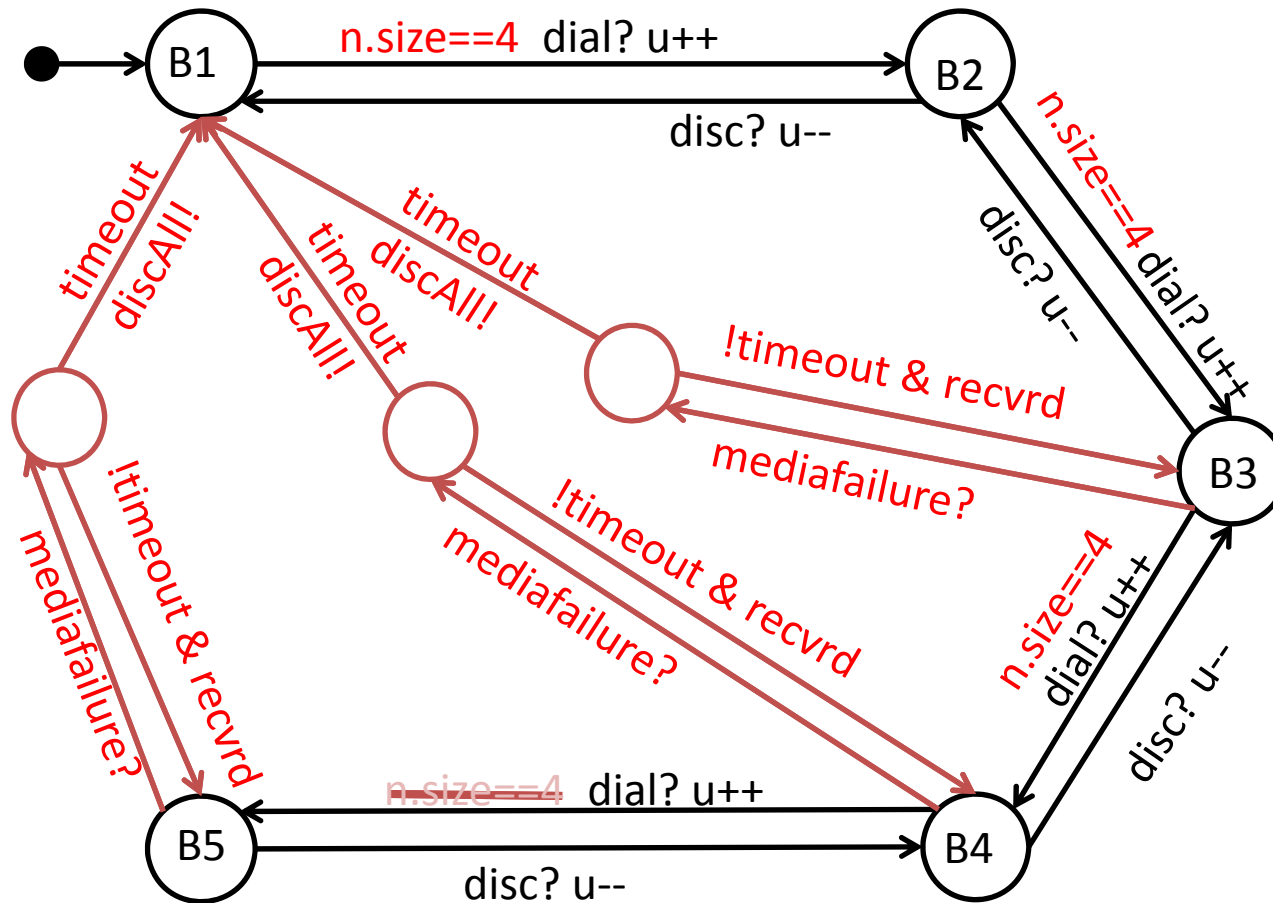
- Assuming a model-driven development using AO

A **fault** in an aspect element propagates to all corresponding elements in the woven model

- Normal behavior modeled by developer
 - Tester creates aspects

Faults might reside at single joinpoints and tests created for each joinpoint w.r.t. its existence and correctness

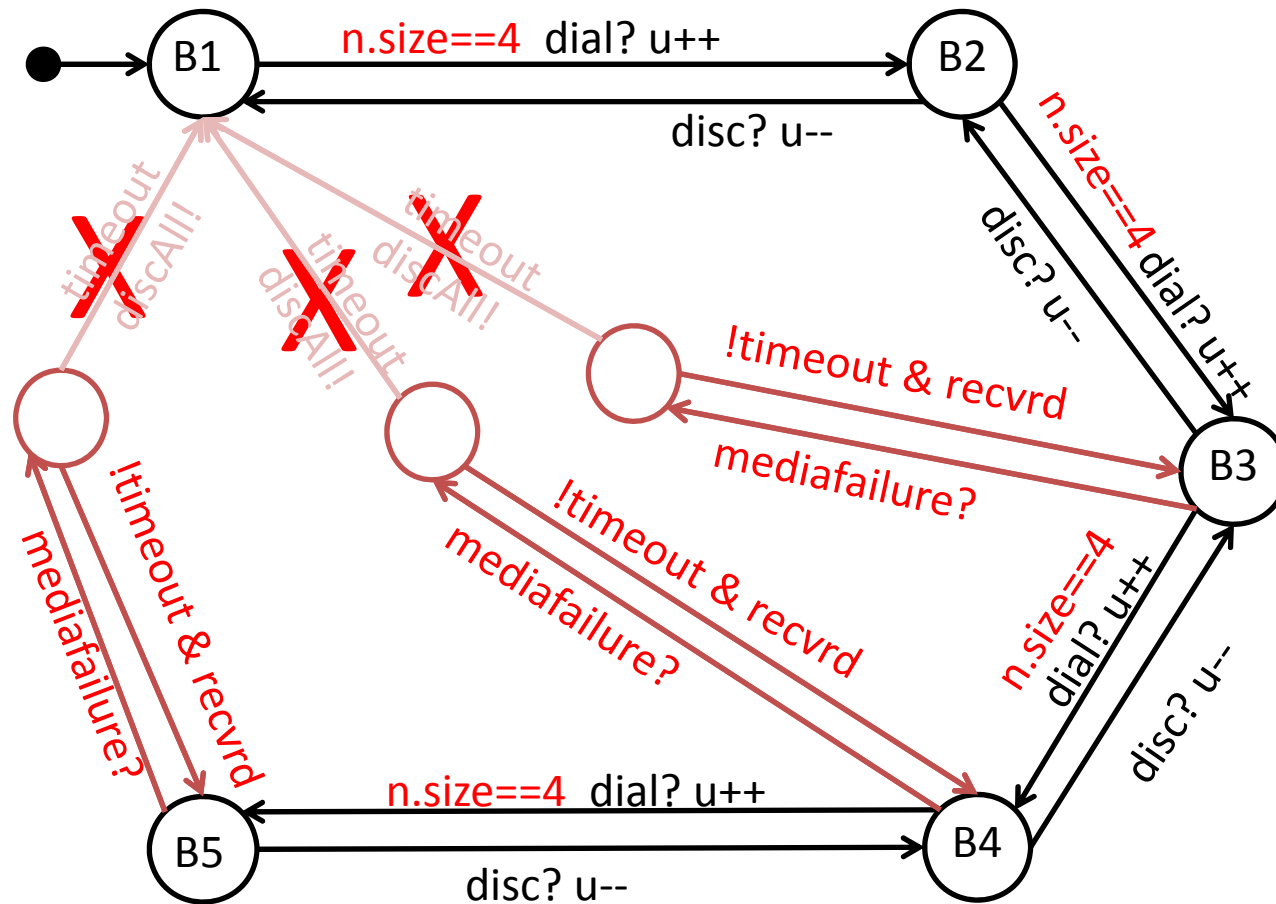
ADJ: Advice Deletion at Joinpoint



Killing trace

- $n.size=4$
- P1 → dial → S
- $n.size=4$
- P2 → dial → S
- $n.size=4$
- P3 → dial → S
- $n.size=3$
- P4 → dial → S

PDL: Pointcut Deletion



Killing trace

- $n.size=4$
- $P1 \rightarrow \text{dial} \rightarrow S$
- $n.size=4$
- $P2 \rightarrow \text{dial} \rightarrow S$
- $\text{recvrd}=\text{false}$
- $E \rightarrow \text{mediafailure} \rightarrow S$
- $S \rightarrow \text{discAll} \rightarrow P1, P2$

Preliminary Work

- Defined mutators for aspect models
 - Applied to aspects **before** weaving
- Tests generated by killing mutant models
- Feasibility study in timed automata
- Remains
 - Evaluation w.r.t. effectiveness and efficiency TBD