

The Workflow State Machine

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1. Syntax

A workflow description is called a **workflow schema**. It is a guarded automaton:

$$\mathbf{W} = (\mathbf{S}, \mathbf{T}, \mathbf{E}, \mathbf{C}, \mathbf{A}, \mathbf{V}, \mathbf{s}_0)$$

with

- \mathbf{S} is a set of states
- \mathbf{E} is a set of events
- \mathbf{C} is a set of conditions
- \mathbf{A} is a set of actions
- \mathbf{V} is a set of boolean variables
- \mathbf{Ass} is a set of assignments: $\mathbf{Ass} \subseteq \mathbf{V} \times \{\text{true}, \text{false}\}$
- \mathbf{T} is a set of transitions: $\mathbf{T} \subseteq \mathbf{E} \times \mathbf{S} \rightarrow \mathbf{S} \times \mathbf{CS} \times \mathbf{AS}$
 - with
 - $\mathbf{CS} \subseteq \mathbf{C}$
 - $\mathbf{AS} = \{(A_1, \dots, A_n)\}$ for A_i in \mathbf{A} union \mathbf{Ass} and n in \mathbb{N}_0
- \mathbf{s}_0 in \mathbf{S} is the initial state

2. Semantics

A **workflow instance** is defined as follows:

$$\mathbf{I} = (\mathbf{W}, \mathbf{s}, \mathbf{i})$$

with

- a workflow schema $\mathbf{W} = (\mathbf{S}, \mathbf{T}, \mathbf{E}, \mathbf{C}, \mathbf{A}, \mathbf{V}, \mathbf{s}_0)$
- a current state \mathbf{s} in \mathbf{S}
- a variable instantiation $\mathbf{i}: \mathbf{V} \rightarrow \{\text{true}, \text{false}\}$

Be $\mathbf{I} = (\mathbf{W}, \mathbf{s}, \mathbf{i})$ a workflow instance. The successor of \mathbf{I} for the event \mathbf{e} is

(a) the workflow instance $\mathbf{I}' = (\mathbf{W}, \mathbf{s}', \mathbf{i}')$ with

- there is a \mathbf{t} in \mathbf{T} with
 - $\mathbf{t} = (\mathbf{e}, \mathbf{s}, \mathbf{s}', \mathbf{cs}, \mathbf{as})$
 - all \mathbf{c} in \mathbf{cs} are complied
- $\mathbf{i}'(\mathbf{v}) = \mathbf{b}$ for all \mathbf{v} with (\mathbf{v}, \mathbf{b}) in \mathbf{as}
- $\mathbf{i}'(\mathbf{v}) = \mathbf{i}(\mathbf{v})$ for all other \mathbf{v}

(b) \mathbf{I} , if such a \mathbf{t} does not exist.

3. Invoking a Transition

When an event \mathbf{e} is invoked on a workflow instance \mathbf{I} , the following algorithm is executed:

- The current state $\mathbf{s}_{current}$ is determined.

- The transition t from $s_{current}$ to s_{next} which has the event e is determined.
- If t is not exactly defined, an exception is thrown.
- All conditions of t are validated.
- If all conditions are complied, the transition t fires:
 - All assignments of t are executed.
 - The workflow instance I is advanced to the state s_{next} .