

# The Workflow State Machine

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## 1. Syntax

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

$\mathbf{W} = (\mathbf{S}, \mathbf{T}, \mathbf{E}, \mathbf{C}, \mathbf{A}, \mathbf{V}, \mathbf{s0})$

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  $\mathbb{N}_0$
- $\mathbf{s0}$  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  $\mathbf{W} = (\mathbf{S}, \mathbf{T}, \mathbf{E}, \mathbf{C}, \mathbf{A}, \mathbf{V}, \mathbf{s0})$
- 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

- $t = (e, s, s', cs, as)$
- all  $c$  in  $cs$  are complied
- $i'(v) = b$  for all  $v$  with  $(v, b)$  in  $as$
- $i'(v) = i(v)$  for all other  $v$

(b) **I**, if such a  $t$  does not exist.

### 3. Invoking a Transition

When an event  $e$  is invoked on a workflow instance  $I$ , the following algorithm is executed:

- The current state  $s_{current}$  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  $s_{next}$ .