Architecture of a Light-weight Non-threaded Event Oriented Workflow Engine

Ahana Pradhan & Rushikesh K. Joshi

Department of Computer Science & Engineering
Indian Institute of Technology Bombay
Powai, Mumbai-400076, India

A Multi-faceted Approach
Workflow Engine Architecture

CCS Component Architecture

- Scheduler
- Application Server
- Event Server

Composition: System as a Whole

\[ \text{SYSTEM} = \text{SCHED} | \text{EVS} | \text{APP} \{ \text{publishTask}, \text{pushTask}, \text{pushNews}, \text{publishNews}, \text{publishComplete} \} \]

CCS Model of the Architecture Components

Scheduler and Service Loop Dynamics

\[ \text{SCHED} = \text{loadWorkflow}.\text{SCHED} \]
\[ + \text{startWorkflow}.' \text{publishTask}.\text{SLOOP} \]
\[ \text{SLOOP} = \text{loadWorkflow}.\text{SLOOP} \]
\[ + \text{startWorkflow}.\text{SLOOP} \]
\[ + \text{startWorkflow}.' \text{publishTask}.\text{SLOOP} \]
\[ + \text{pushNews}.' \text{publishTask}.\text{SLOOP} \]
\[ + \text{pushNews}.' \text{publishComplete}.\text{SLOOP} \]

Event Server Dynamics

\[ \text{EVS} = \text{publishTask}.' \text{pushTask}.\text{EVS} \]
\[ + \text{publishNews}.' \text{pushNews}.\text{EVS} \]
\[ + \text{publishComplete}.' \text{pushComplete}.\text{EVS} \]

State Machine of SCHED

State Machine of EVS
**CCS Model of the Architecture Components**

**Application Server Dynamics**

\[
TC = \text{pushTask}.\text{sendTask}.TC \\
Q = \text{sendTask}.Q + \text{recvTask}.Q + \text{sendNews}.Q + \text{recvNews}.Q \\
TM = \text{recvTask}.\text{sendNews}.TM \\
NP = \text{recvNews}.\text{publishNews}.NP \\
APP = TC|TM|Q|NP\{\text{sendTask}, \text{recvTask}, \text{sendNews}, \text{recvNews}\}
\]

**Mapping Petri Net to Engine Scheduler Events**

Mapping of Petri net events to workflow scheduling:

- Marked source place → Workflow uploaded, to be started
- Input token consumption → Schedule of task for execution
- Output token production → Task execution completion
- Marked sink place → Workflow completed
Implementation & Performance Tests

Sequence Workflow of Empty Tasks

Tree Workflow of Empty Tasks

Sequence Workflow of File-write Tasks

Sequence Workflow of Computation Tasks

DEBS’14 (Poster & Demo Track)

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