Modeling and Verification of Workflows for e-Society

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Process Oriented Approach in Business


Business Process Reengineering
Enterprise Resource Planning
Workflow Management
Enterprise Application Integration
Business Process Modeling
Process Oriented Approach in Business

Business Process Reengineering

Analysis and redesign of existing business processes to achieve breakthrough improvements in performance measures such as benefit and customer’s satisfaction.

Enterprise Application Integration

Business Process Modeling

Methodology supported by information systems that attempts to integrate all departments and functions across a company onto a single computer system that can serve all those different departments’ particular needs.
Workflow is a defined series of tasks within an organization to produce a final outcome.
Process Oriented Approach in Business


- **Business Process Reengineering**
- **Enterprise Resource Planning**
- **Workflow Management**
- **Enterprise Application Integration**
- **Business Process Modeling**

Middleware that combines separate applications into a co-operating federation of applications.
Process Oriented Approach in Business

Organization View

Process View

+ Optimal Resource Assignment
Process Oriented Approach in Business

by Howard Smith, CTO of Computer Science Corporation
Workflows Integrate People, Systems and Information
Business Process Modeling Languages

- IDEF (Integrated Definition Method)
- BPMI (Business Process Management Initiative)
  - BPML (Business Process Modeling Language)
  - BPMN (Business Process Modeling Notation)
  - BPQL (Business Process Query Language)
- WfMC (Workflow Management Coalition)
  - Wf-XML
- ebXML (Electronic Business XML)
- UML (Unified Modeling Language) Activity Diagram
- ...
Example: BPMN

Financial Institution

Credit Card Authorization

Supplier

Authorize Payment

Process Order

+ +

Sales

Distribution

Pack Goods

Ship Goods


Discussion Cycle

1. **Announce Issues for Discussion**
2. **Check Schedule for Conference Call**
3. **Moderate E-mail Discussion**
4. **E-Mail Discussion Deadline Warning**
5. **Conference Call in Discussion Week?**
   - No
   - Yes: **Moderate Conference Call Discussion**
6. **Evaluate Discussion Progress**
Background Mathematical Formalism

A Petri-net-based model for interorganizational workflows
Formal Verification of Workflow

Modeling Language → Transition Systems/Mathematical Models → Computer Science Technology → Model Checker

Workflow Modeler → Execution Semantics

Formal Requirement

FG final
F Make Production Plan → F Produce

Yes / No with a Counterexample
Performance Evaluation of Workflow

- Each workflow is a template of a business process.
- Many instances of workflows are running in the information system.
- Optimal resource (people, machines, companies, ... ) assignment is necessary.
Example: Review Process of an Academic Journal

<table>
<thead>
<tr>
<th>Author</th>
<th>Editor</th>
<th>Associate Editor</th>
<th>Reviewer#1</th>
<th>Reviewer#2</th>
</tr>
</thead>
<tbody>
<tr>
<td>paper submission</td>
<td>accept</td>
<td>assign associate</td>
<td>accept</td>
<td>accept</td>
</tr>
<tr>
<td></td>
<td>receive receipt</td>
<td>editor</td>
<td>assign reviewers</td>
<td>accept review</td>
</tr>
<tr>
<td></td>
<td>send receipt</td>
<td></td>
<td>accept review</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Example: Review Process of an Academic Journal

- **Given:**
  - Workflow
  - Statistical data on paper submission
  - Upper bound of the number of papers each associate editor can handle

- **Find:**
  - Optimal number of associate editors in each research fields

- **Method:**
  - Stochastic Petri net
Example: Review Process of an Academic Journal

Continuous Time Markov Chain

\[
\begin{bmatrix}
1, & 0, & 0, & 0, & 0
\end{bmatrix}
\]

Stochastic Petri Net

[\lambda_i] firing rate
Example: Review Process of an Academic Journal

- Statistical data:
  - Average number of paper submissions per month
  - Average length of review periods
- Using SPN, we can know the number of papers each associate editor must handles on average.

Multiple instances of a workflow

Multiple tokens in SPN
Concept of Serviceflow

Preparation, performance and aftercare of an operation

“Serviceflow Beyond Workflow? Concepts and Architectures for Supporting Inter-Organizational Service Processes” by I. Wetzel and R. Klischewski
Concept of Serviceflow

Service Points

Family Doctor
Specialist Investigation
Hospital Consultation
Specialist Preparation
Hospital Admission OP and Ward
Family Doctor Aftercare

Serviceflow Model
Concept of Serviceflow

- Serviceflow should have priority over other subprocesses.
- Designing functions available at each service point is important.
- Using concept of serviceflow, we can evaluate the quality of workflows from the customer’s point of view.
Summary

- Process oriented approach in business
- Business process modeling languages
- Background mathematical formalism
- Formal verification of workflow
- Performance evaluation of workflow
- Concept of serviceflow