Modeling and Verification of Workflows for e-Society

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Process Oriented Approach in Business

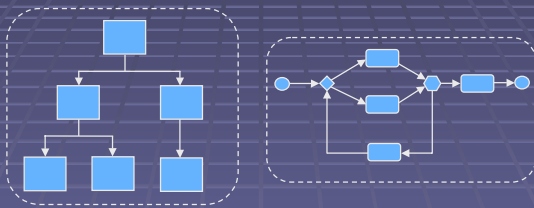1990   1995   2000   2005

Business Process Reengineering

Enterprise Resource Planning

Workflow Management

Enterprise Application Integration

Business Process Modeling

2
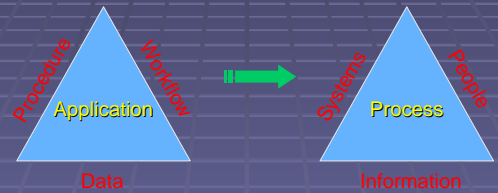

Process Oriented Approach in Business
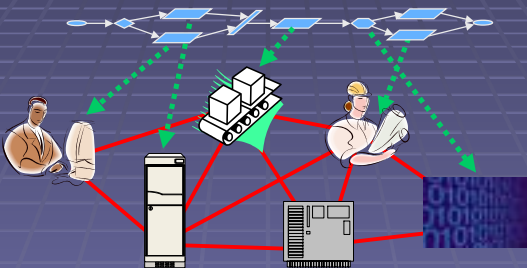
Organization View ⟹ Process View
+ Optimal Resource Assignment

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Process Oriented Approach in Business

Procedure / Workflow
Application
Data
⟹
Systems / People
Process
Information

by Howard Smith, CTO of Computer Science Corporation

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Workflows Integrate People, Systems and Information

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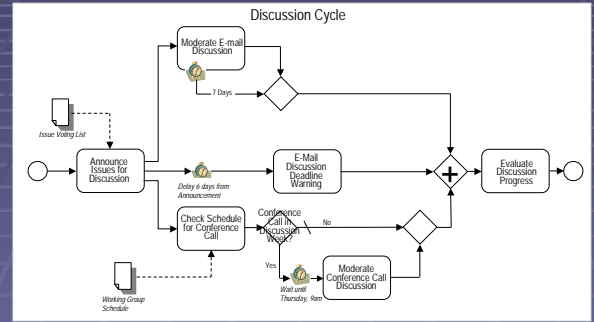
- IDEF (Integrated Definition Method)
- BPMI   Business Process Management Initiative
  - BPML   Business Process Modeling Language
  - BPMN (Business Process Modeling Notation)
  - BPQL (Business Process Query Language)
- WfMC   Workflow Management Coalition
  - Wf-XML
- ebXML (Electronic Business XML)
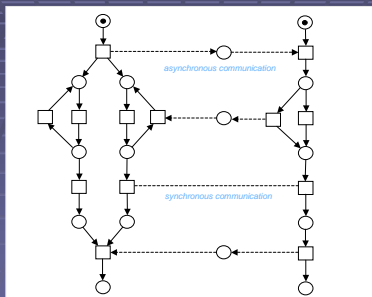- UML (Unified Modeling Language) Activity Diagram
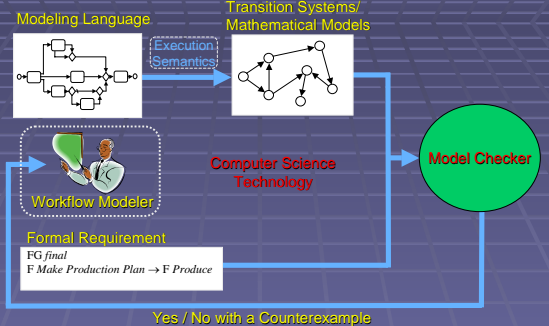- ...

6
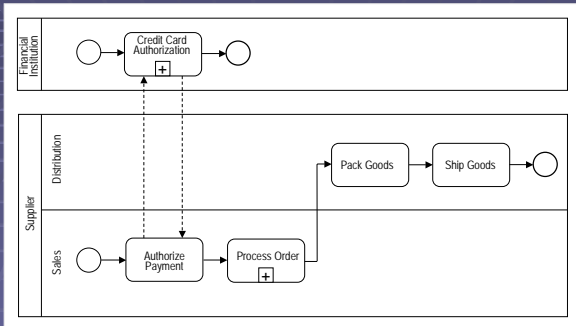
Example: BPMN

Example: BPMN

Background Mathematical Formalism

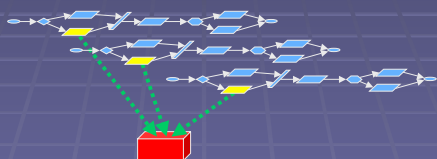A Petri-net-based model for interorganizational workflows

Formal Verification of Workflow

Modeling Language

Transition Systems/
Mathematical Models

Execution
Semantics

Workflow Modeler

Computer Science
Technology

Model Checker

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

Author	Editor	Associate Editor	Reviewer#1	Reviewer#2
paper submission	accept			
receive receipt	send receipt			
	assign associate editor	accept		
		assign reviewers	accept review	accept review

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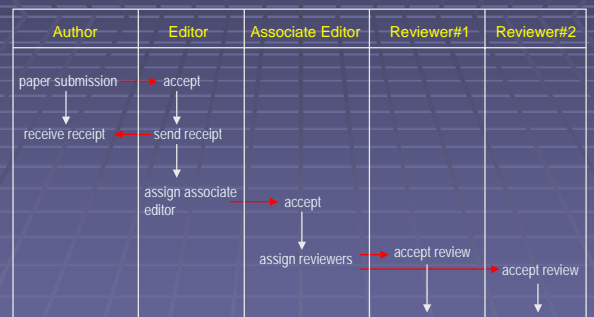
Example:
Review Process of an Academic Journal

- Given:
  - Workflow
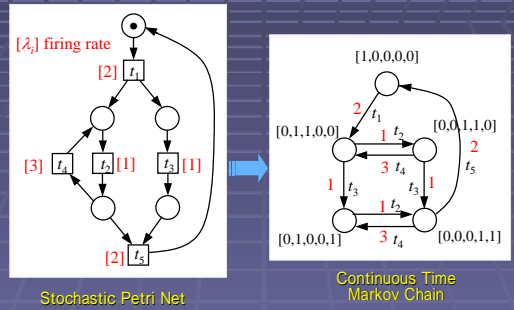 - Statistical data on paper submission
  - Upper bound of the number of papers each associate editor can handle
- Find:
  - Optimal number of associate editors in each research fields
- Method:
  - Stochastic Petri net

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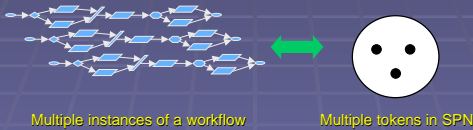
Example:
Review Process of an Academic Journal

$[\lambda_i]$ firing rate

$[2]\ t_1$
$[3]\ t_4$ $\ t_5[1]$ $\ t_3[1]$
$[2]\ t_5$

Stochastic Petri Net

$[1,0,0,0,0]$
$[0,1,1,0,0]$ t_1 $\ 2$ $\ t_2\ 1$ $[0,0,1,1,0]$
$3\ t_4$ $\ t_5\ 2$
$1\ t_3$ $\ t_3\ 1$
$[0,1,0,0,1]$ $t_2\ 1$ $3\ t_4$ $[0,0,0,1,1]$
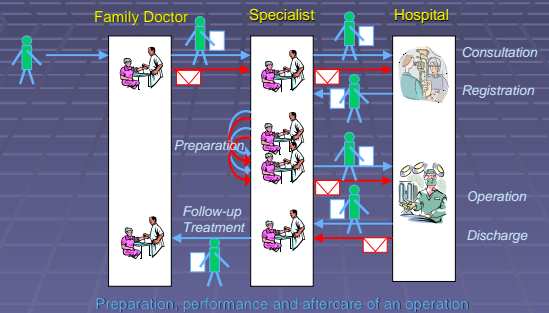
Continuous Time Markov Chain

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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.
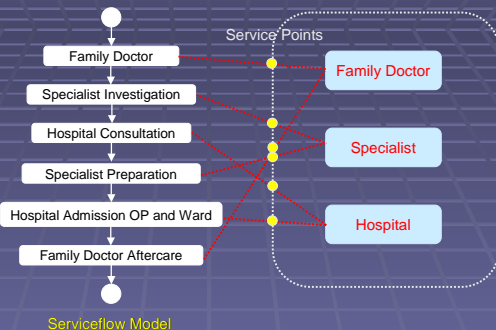

Multiple instances of a workflow

Multiple tokens in SPN

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Concept of Serviceflow

Family Doctor   Specialist   Hospital

Consultation
Registration
Preparation
Follow-up Treatment
Operation
Discharge

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

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Concept of Serviceflow

Service Points

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

Family Doctor
Specialist
Hospital

Serviceflow Model

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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

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