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

Process Oriented Approach in Business

1990   1995   2000   2005

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

Process Oriented Approach in Business

1990   1995   2000   2005

Business Process Reengineering

Enterprise Resource Planning

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.

Business Process Modeling

Process Oriented Approach in Business

$$1990 \qquad 1995 \qquad 2000 \qquad 2005$$

Business Process Reengineering

Enterprise Resource Planning

Workflow Management

~~terprise Application Integration~~

Workflow is a defined series of tasks within an organization to produce a final outcome.

Process Oriented Approach in Business

1990   1995   2000   2005

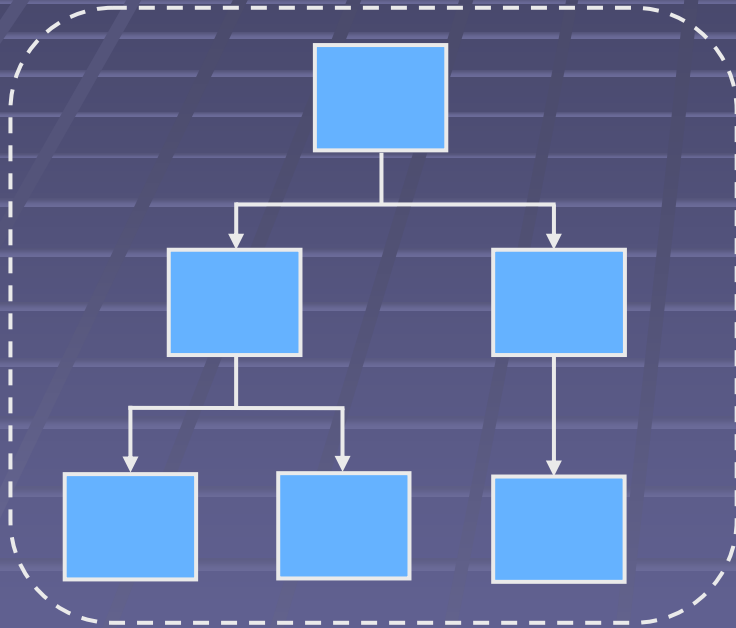*Business Process Reengineering*

Enterprise Resource Planning

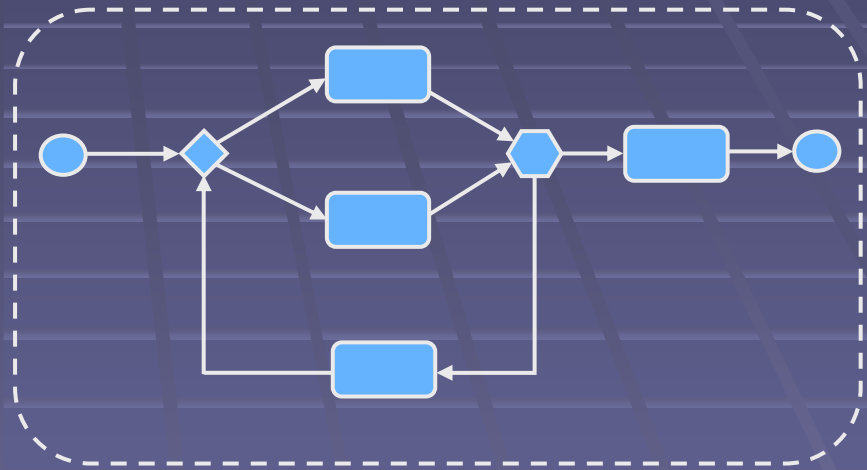*Workflow Management*

Enterprise Application Integration

Business Process Modeling

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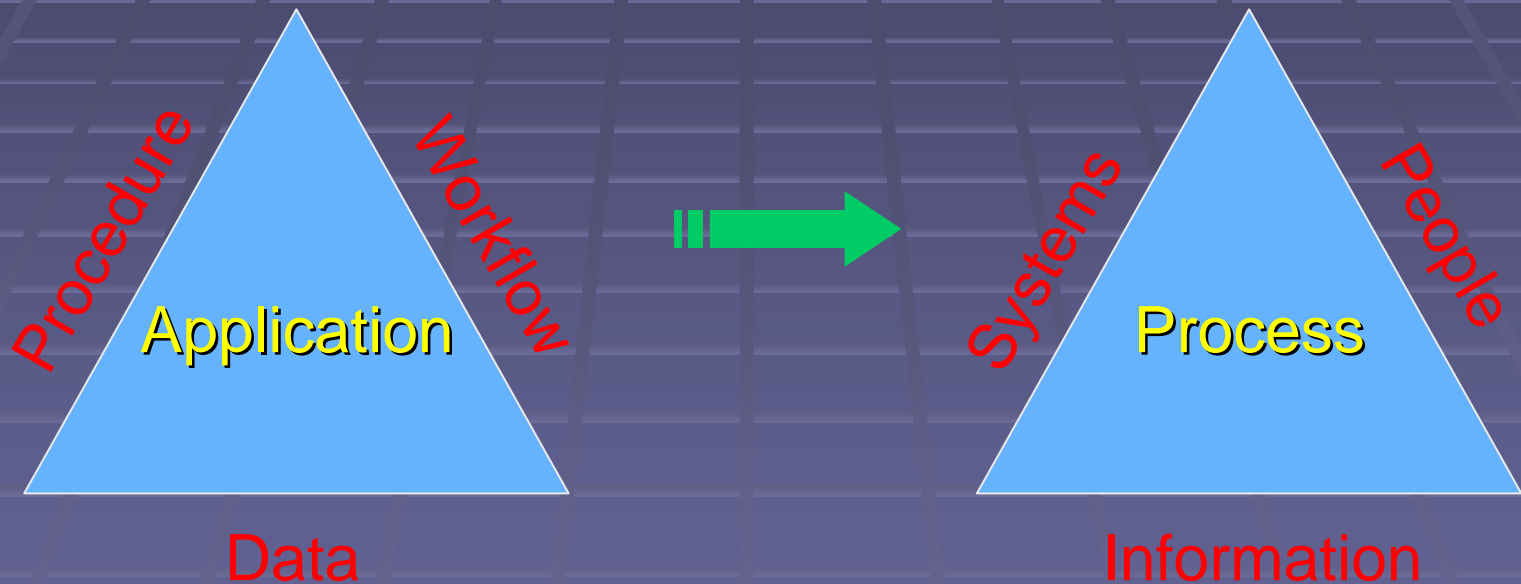
Process Oriented Approach in Business
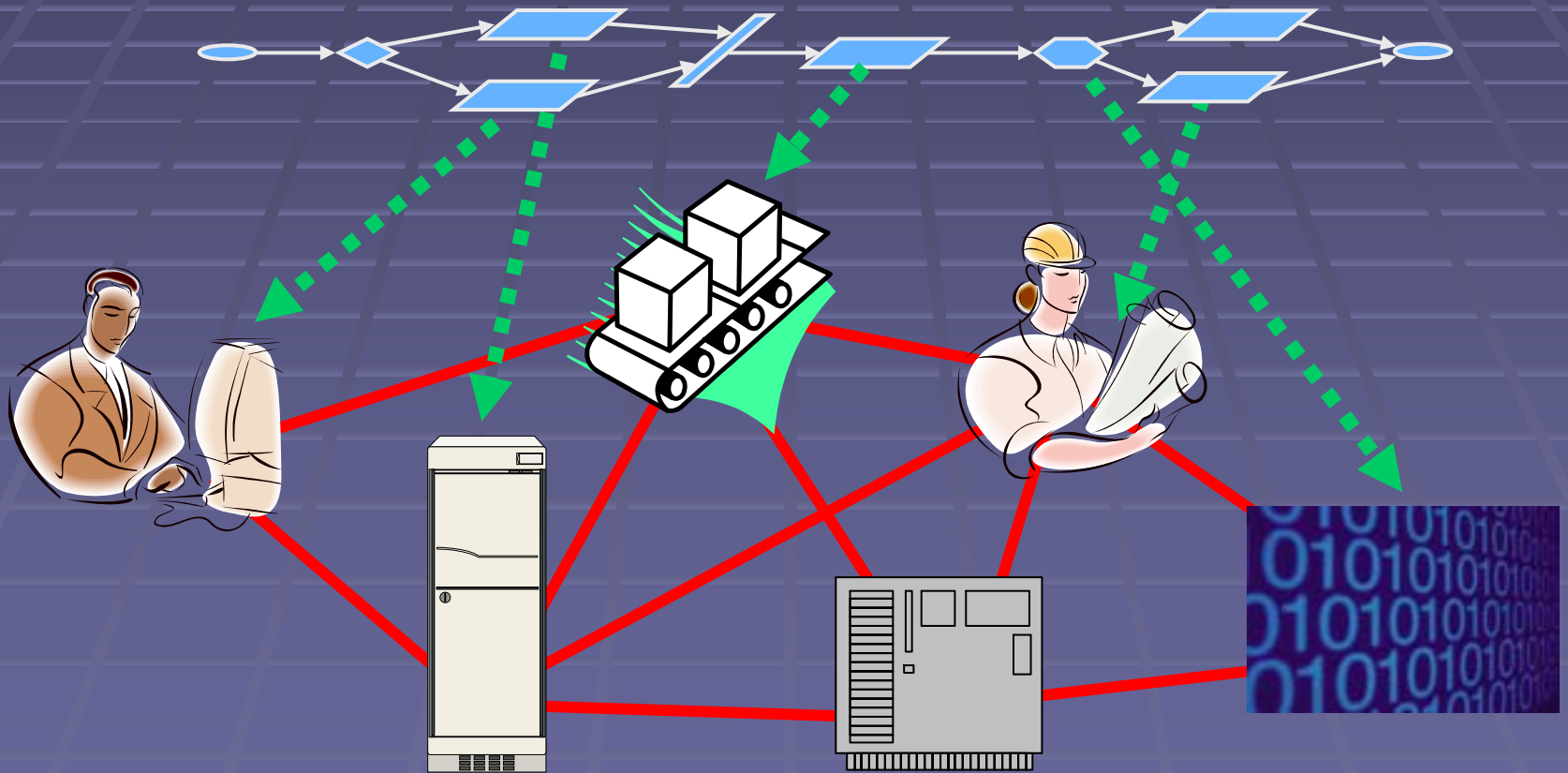

Organization View ➡️ Process View
+ Optimal Resource Assignment

Process Oriented Approach in Business

by Howard Smith, CTO of Computer Science Corporation

Workflows Integrate People, Systems and Information
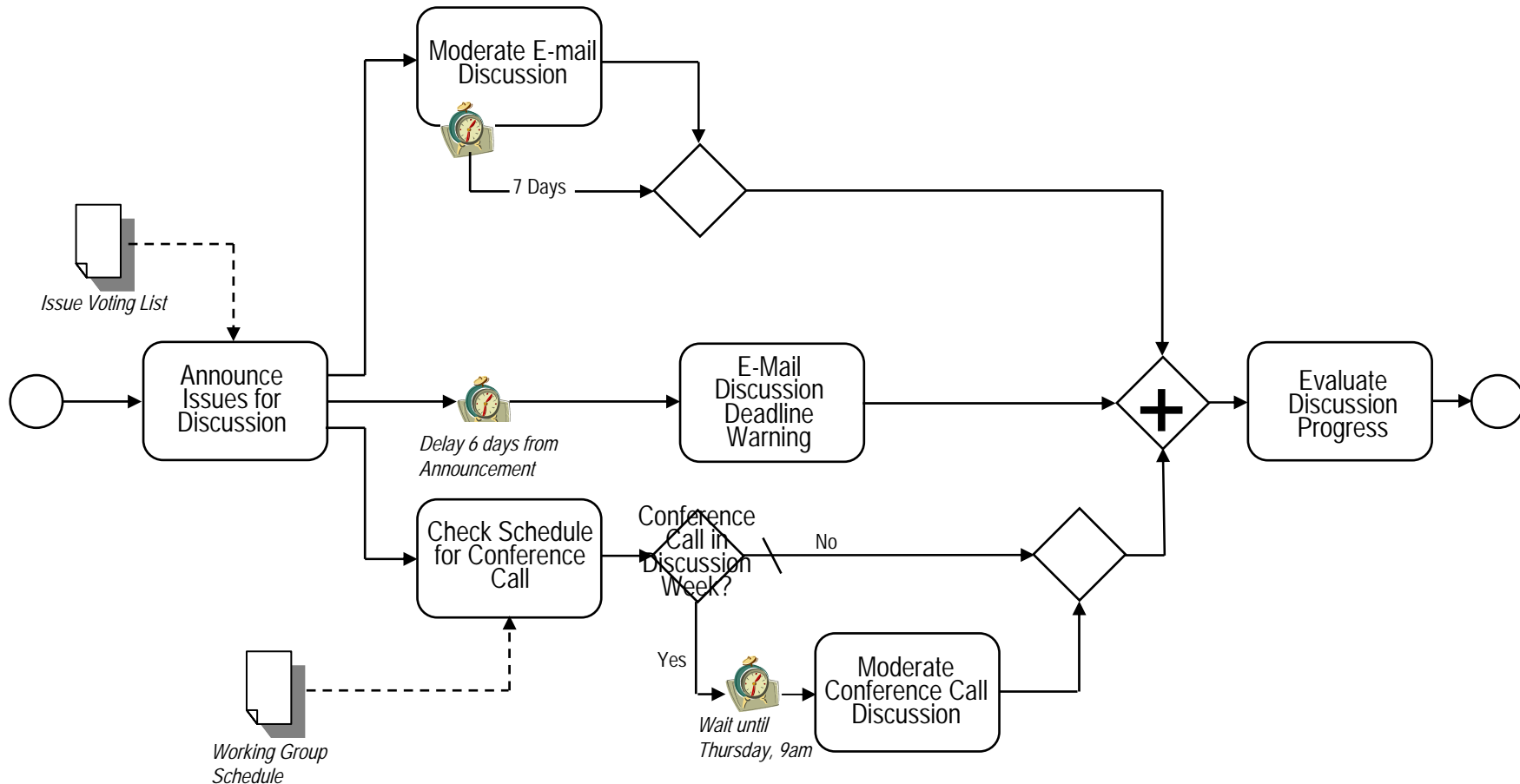
Business Process Modeling Languages

- 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
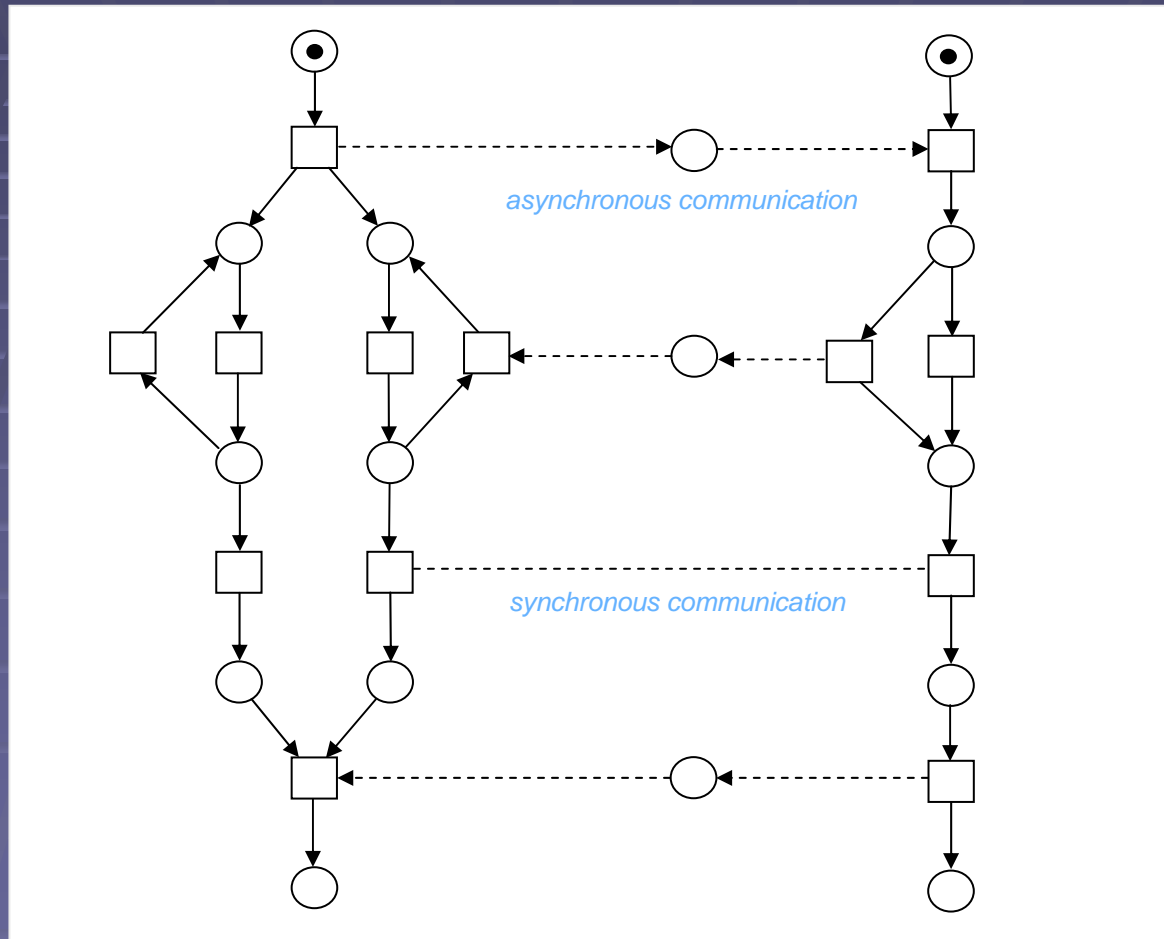- ...

Example: BPMN
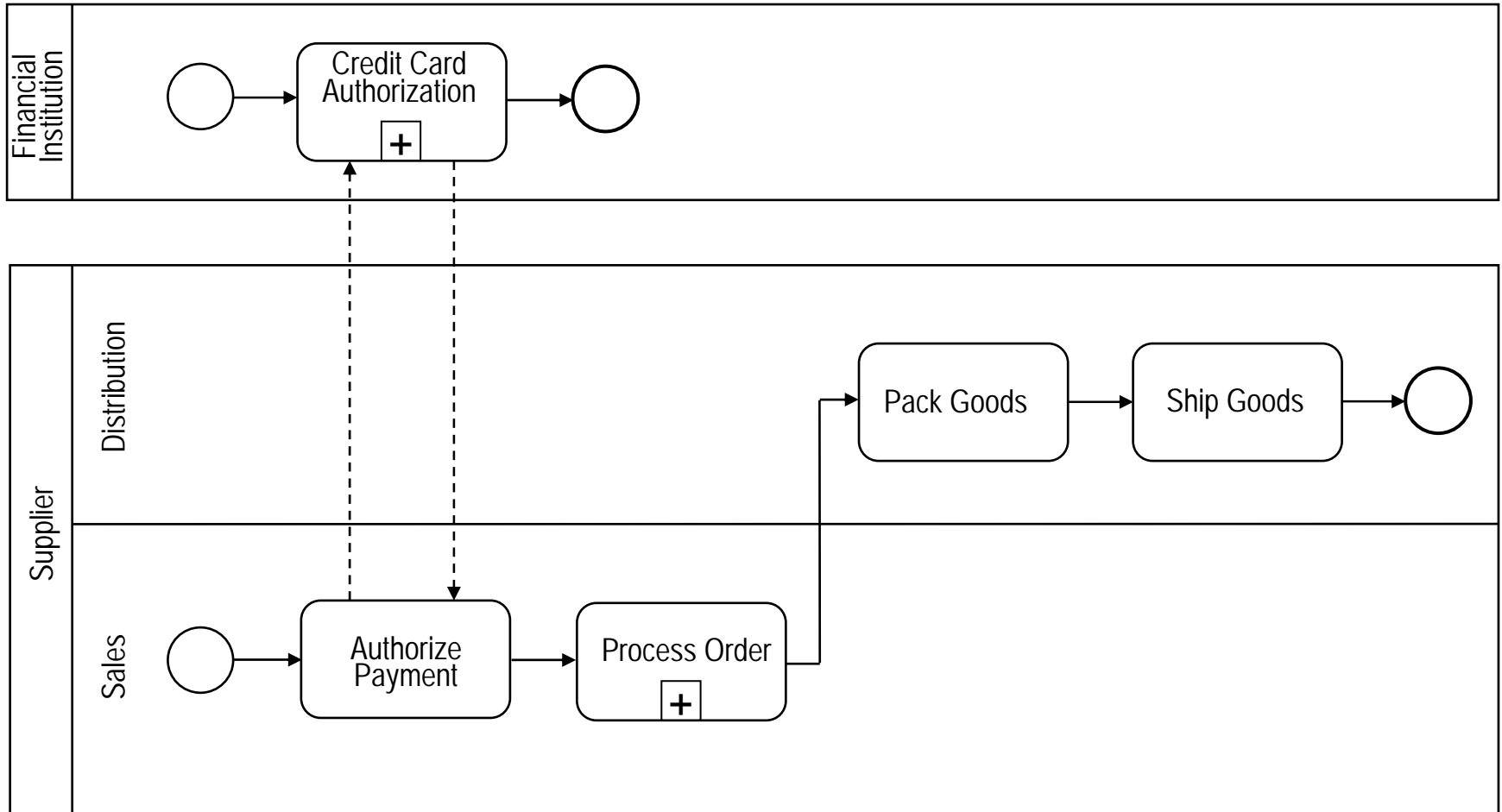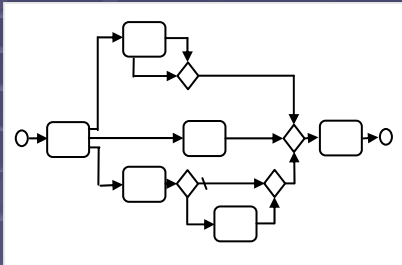
Example: BPMN

Discussion Cycle

Background Mathematical Formalism

asynchronous communication

synchronous communication

A Petri-net-based model for interorganizational workflows

Formal Verification of Workflow

Modeling Language

Transition Systems/ Mathematical Models

Execution Semantics
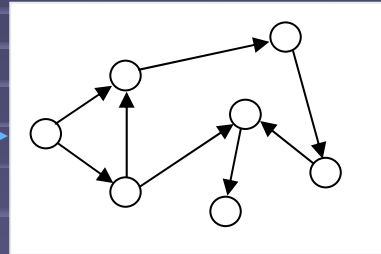
Workflow Modeler

Computer Science Technology

Model Checker

Formal Requirement

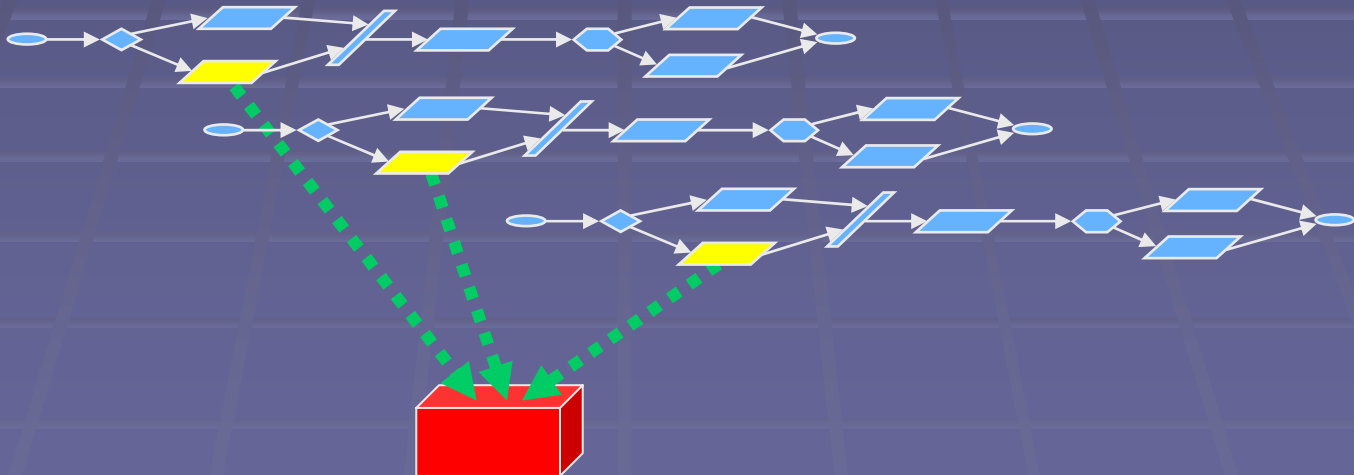FG *final*

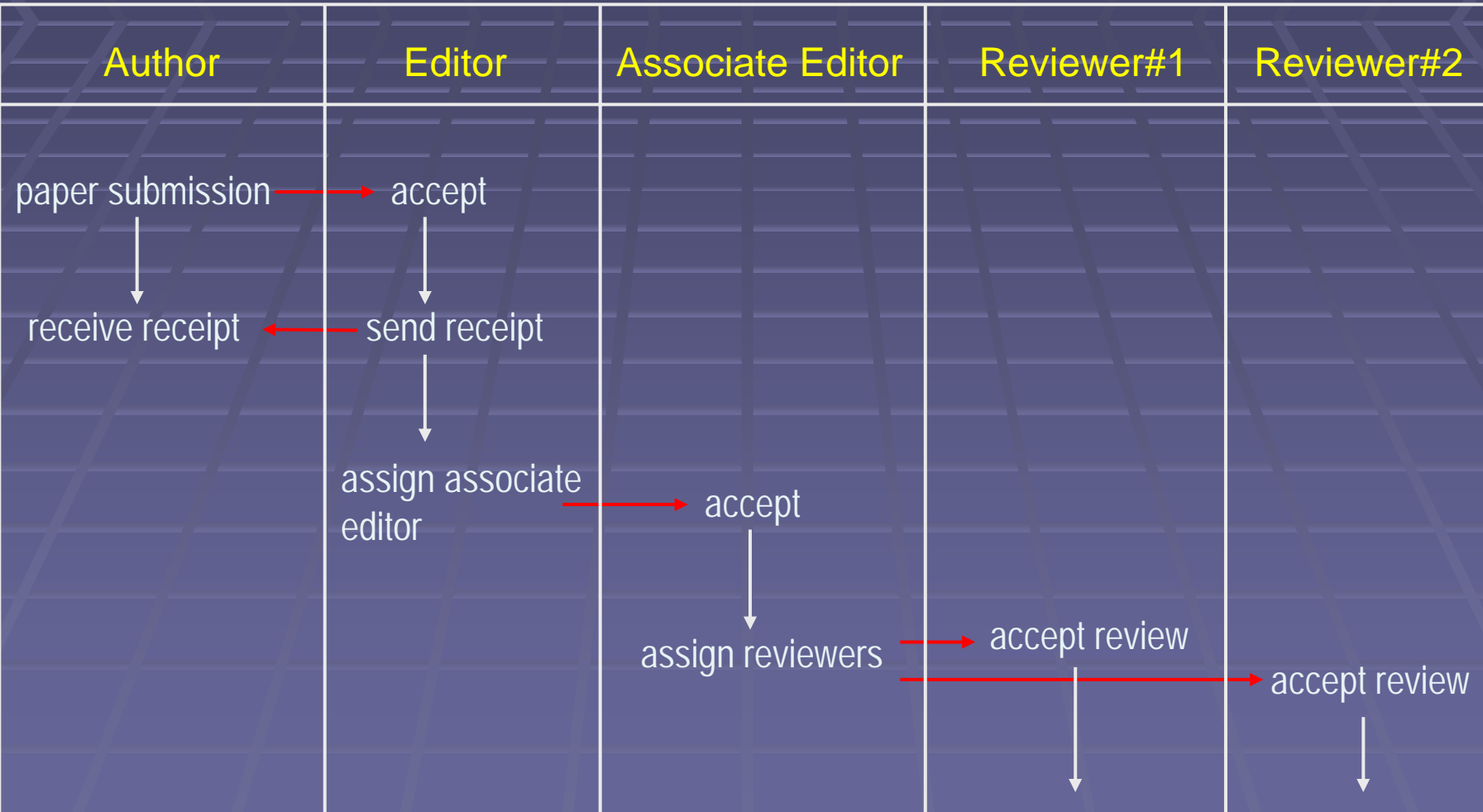F *Make Production Plan* $\rightarrow$ F *Produce*

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
			↓	↓

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:
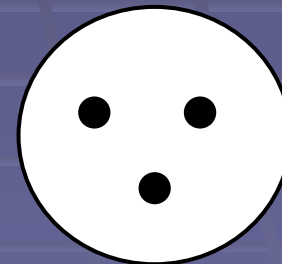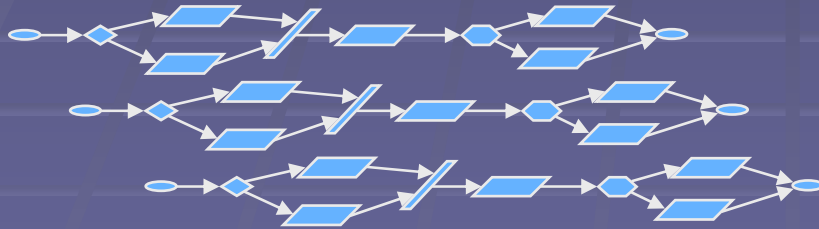# Review Process of an Academic Journal
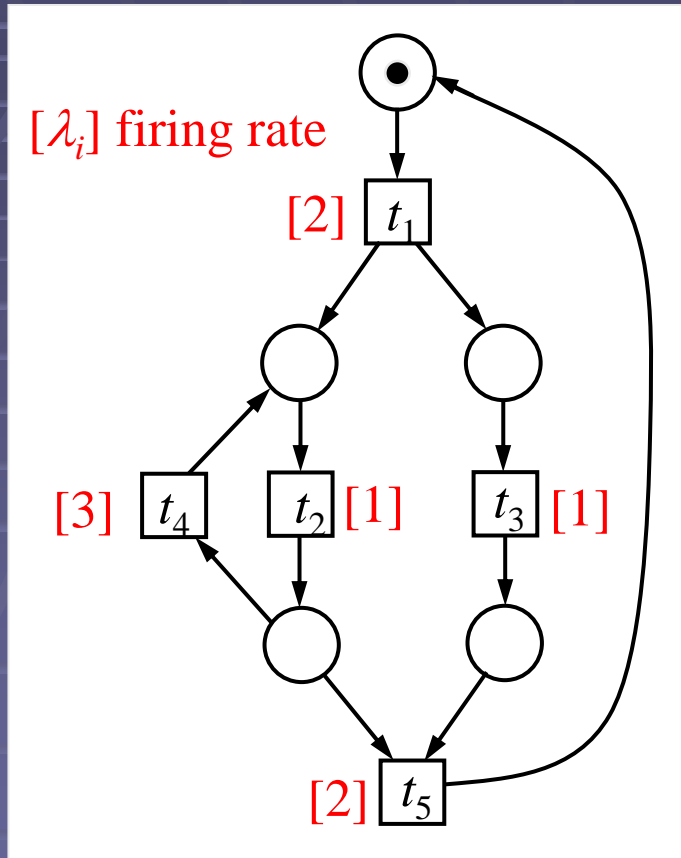
Stochastic Petri Net
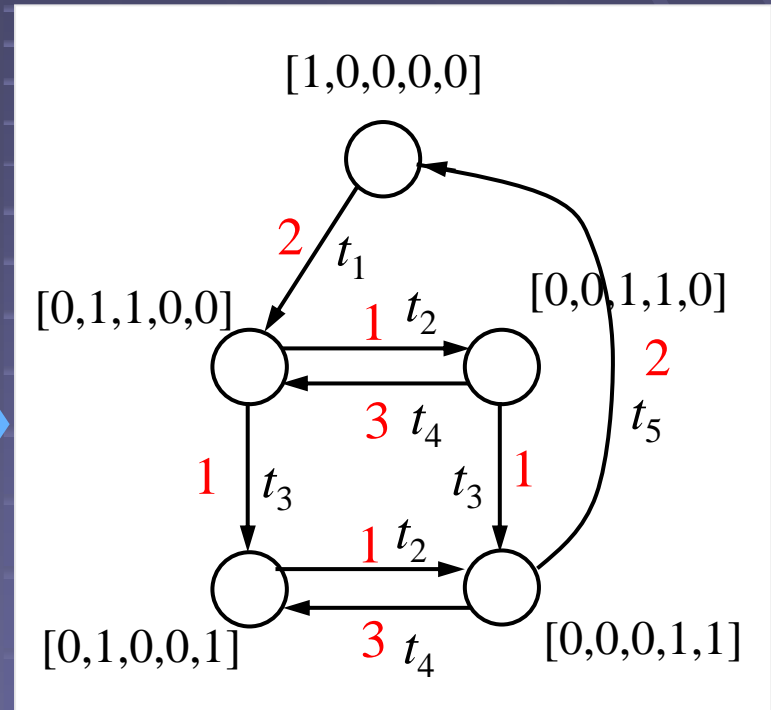
Continuous Time Markov Chain

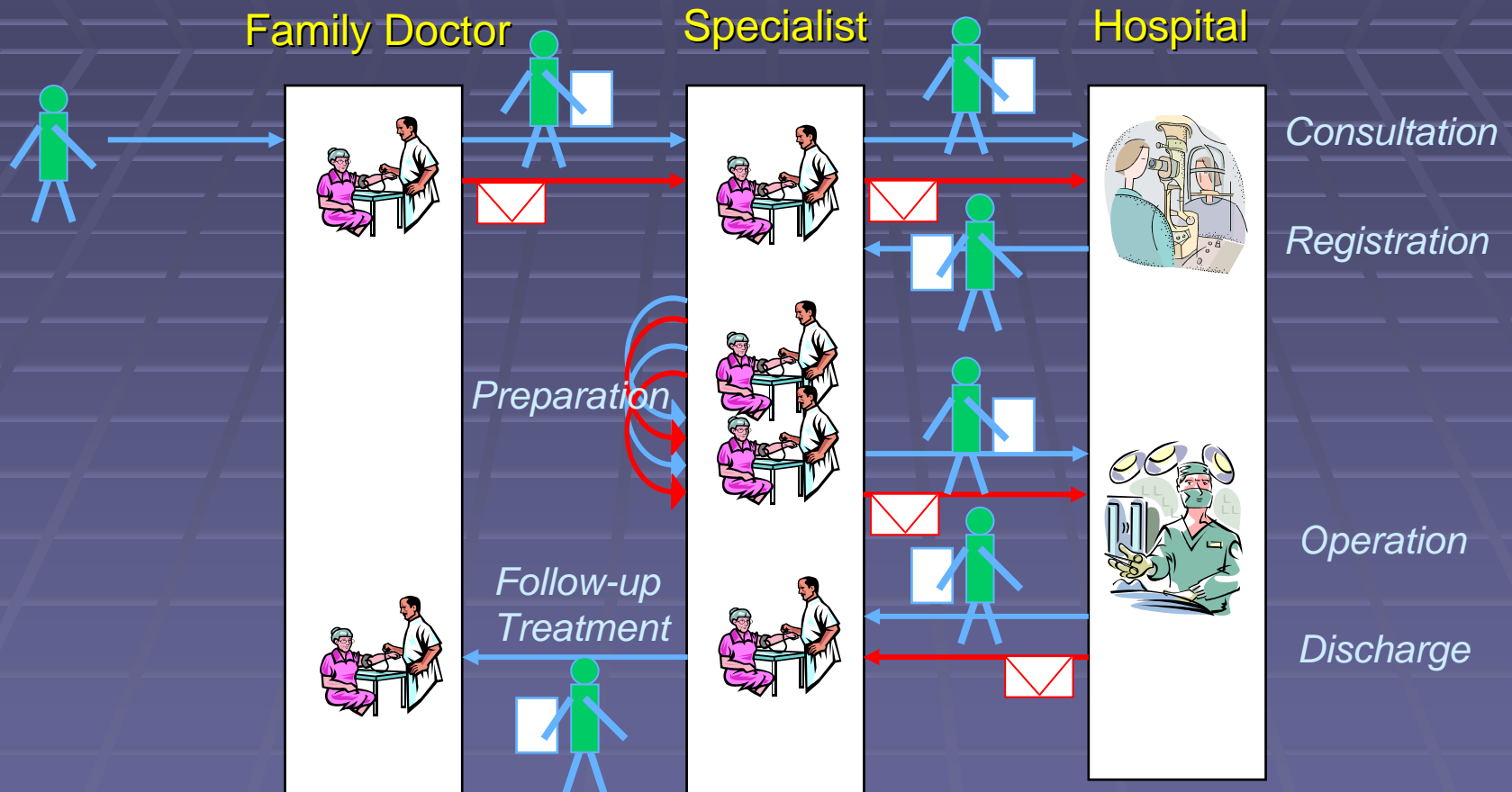# Example: Review Process of an Academic Journal

- 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

Family Doctor   **Specialist**   **Hospital**

Consultation

Registration

Preparation

Operation

Follow-up Treatment

Discharge
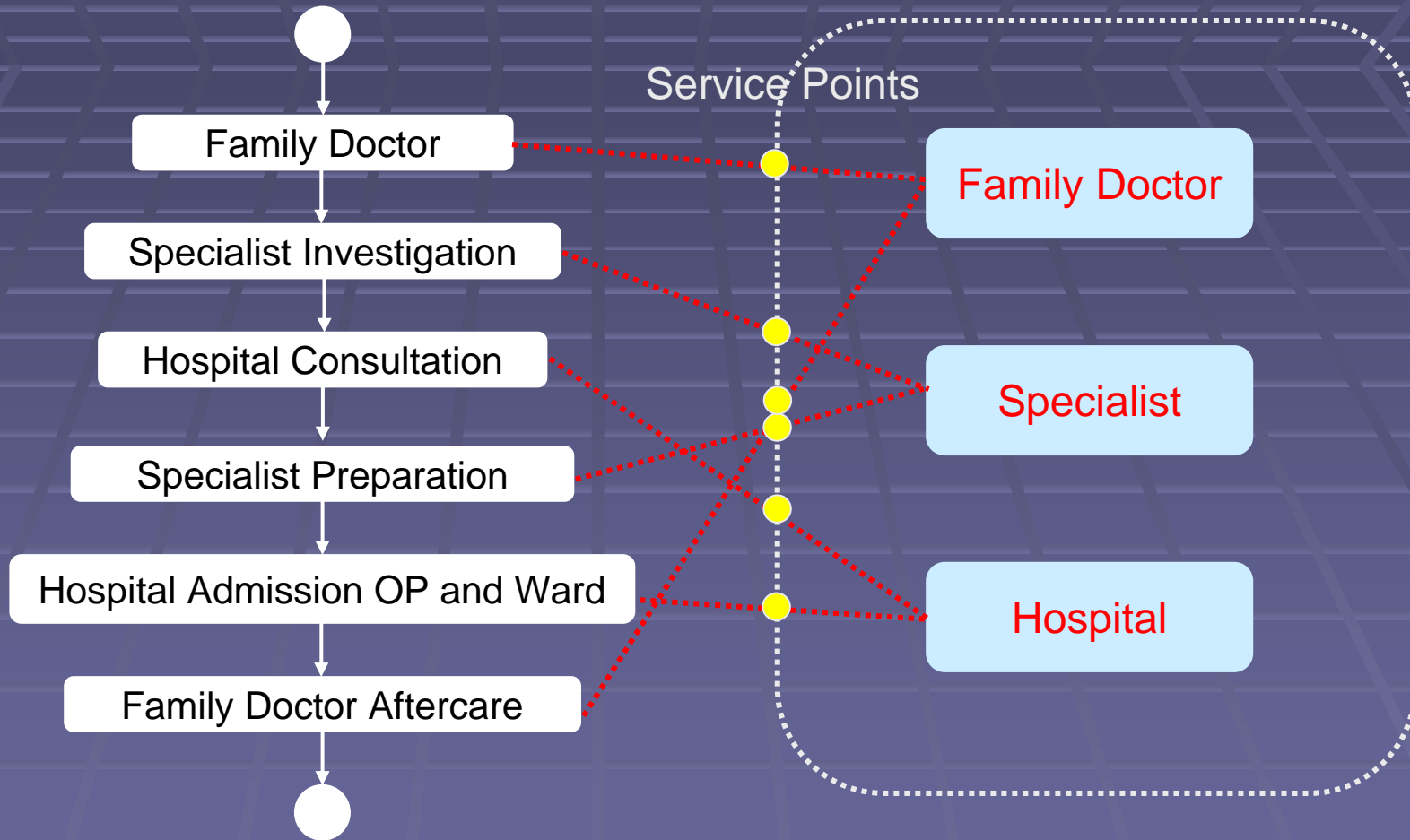
Preparation, performance and aftercare of an operation

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

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

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