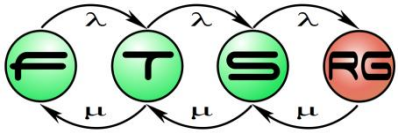
Business Process Modeling



Process, business process

Workflow: sequence of given steps executed in order to reach a goal.

Workflows

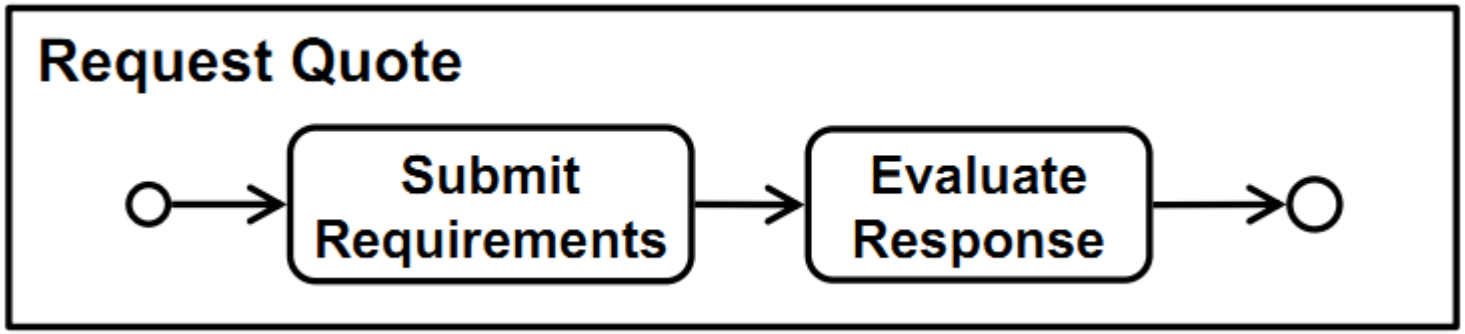
- **Business workflows**
- Development workflows
- Maintenance workflows

Aim of workflow modeling

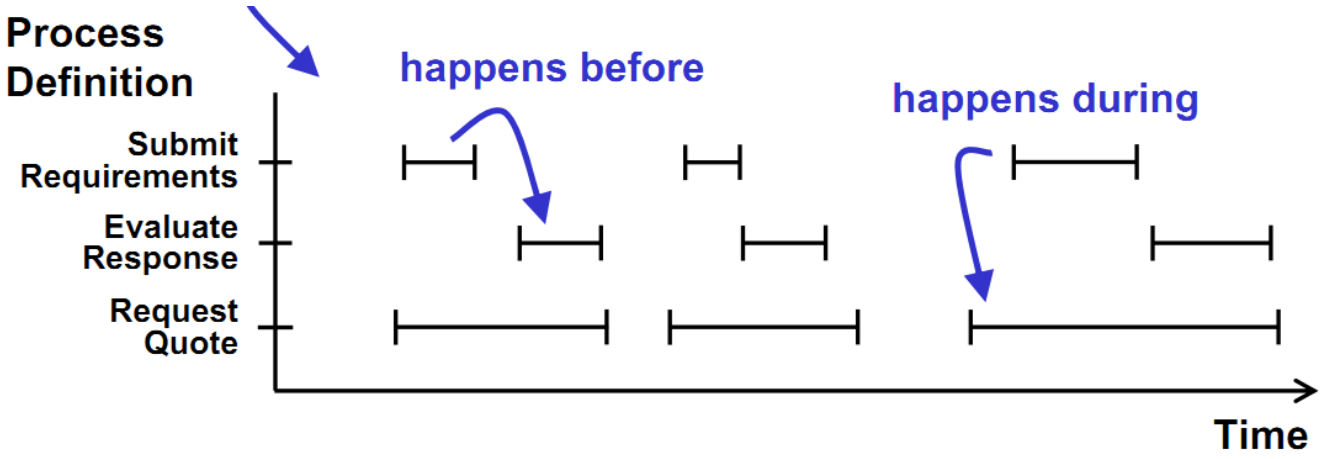
- Why is it good to create models?
  - Documentation
  - Common language
  - Analysis
  - Basis for executable system models/system integration
  - etc.

Semantics of business processes

- What we see

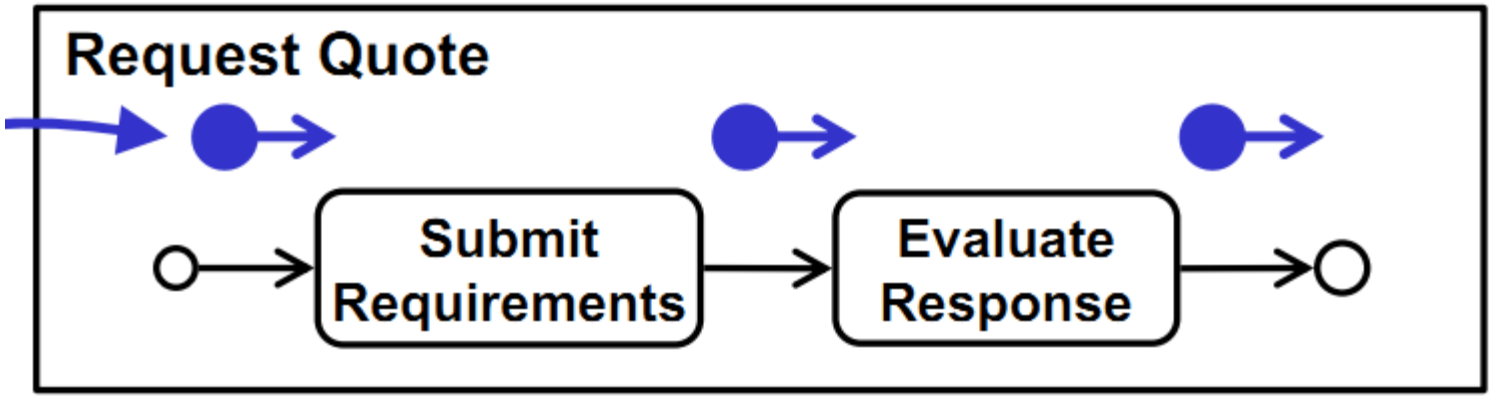


- What we expect

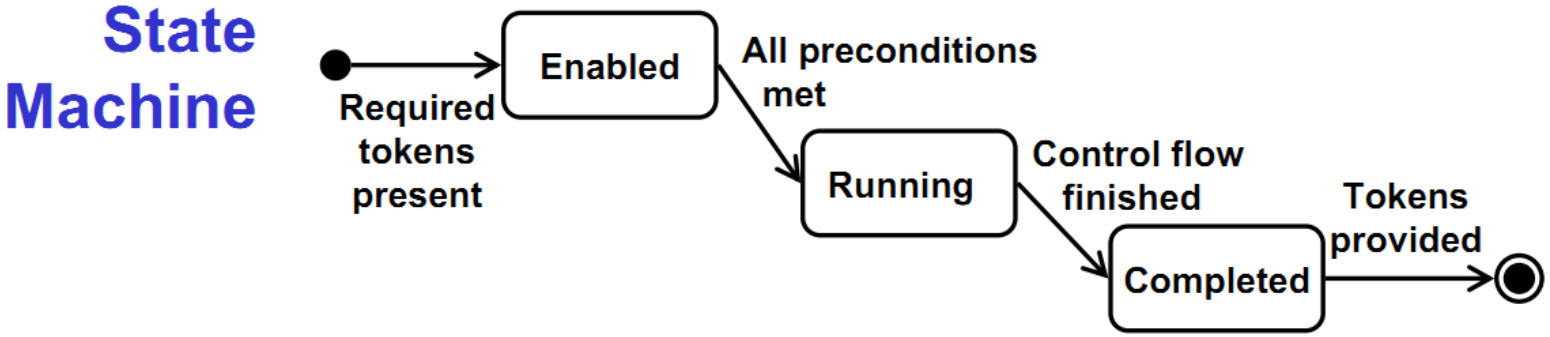


Modeling execution

- Tokens



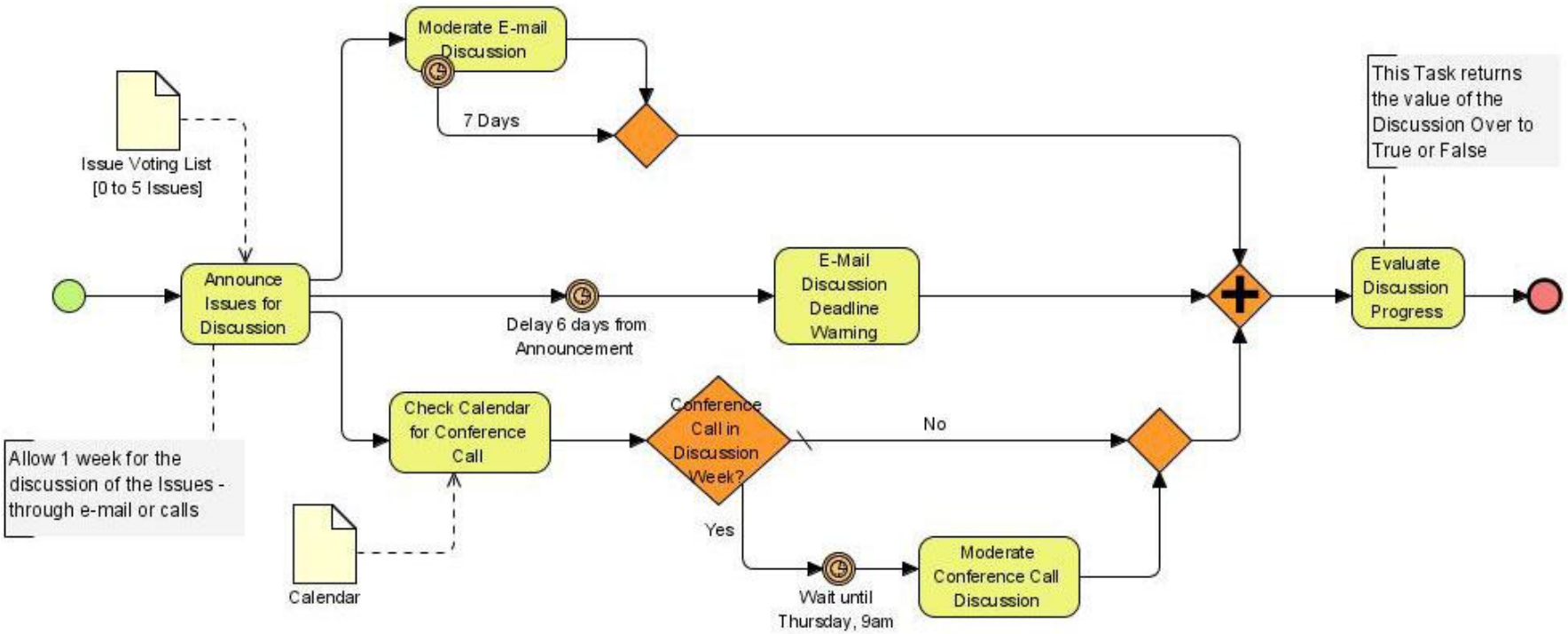
- State of the process



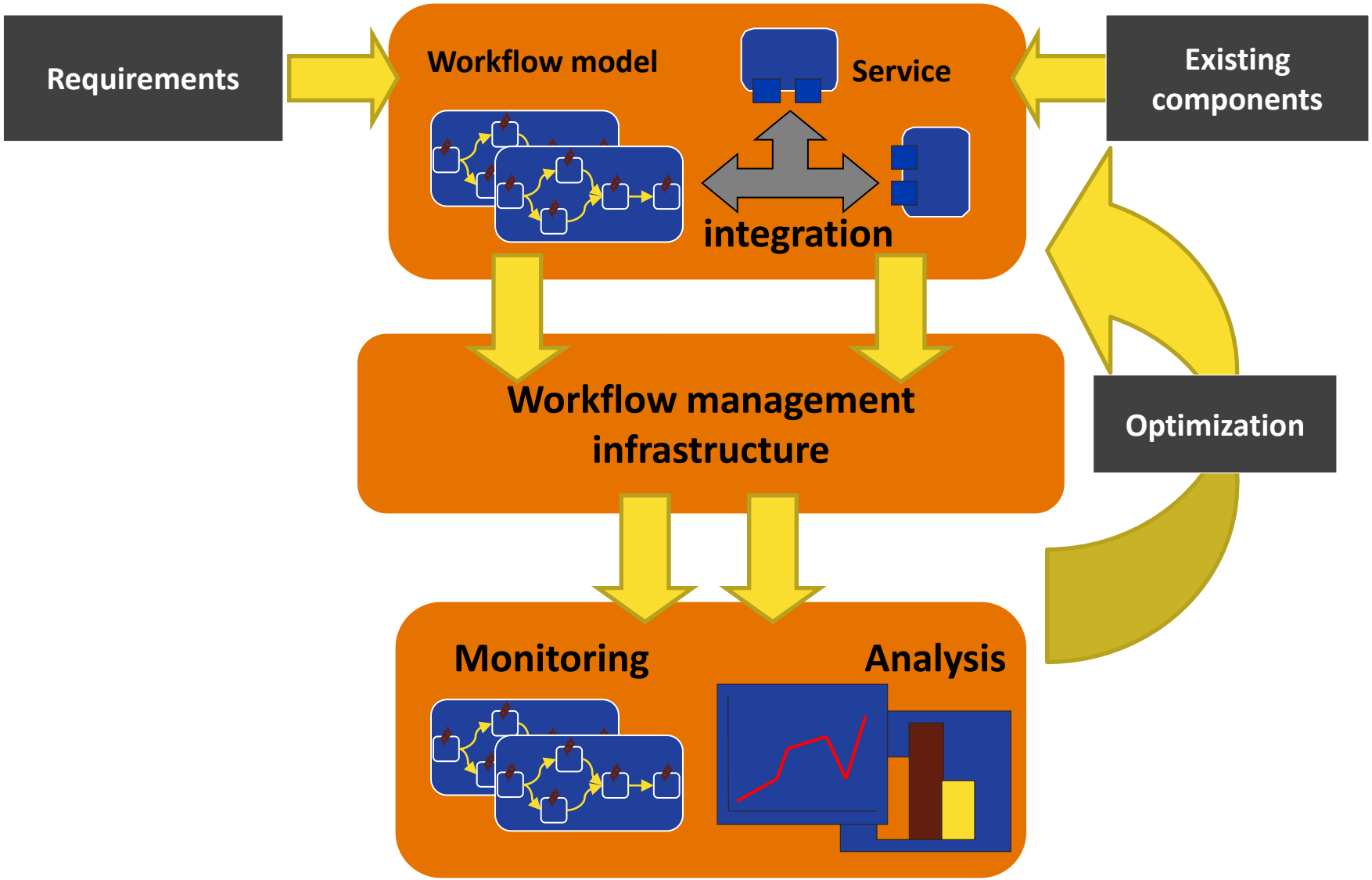
Basic concepts

- Workflow definition language
  - BPMN, jPDL, XPDL, BPEL, UML AD
  - Control and data flow
  - Data structures
  - Definition for executable steps
  - Timing, resources
- Process template
  - E.g., ticket order process
  - Versioning…
- Process instance
  - „László Gönczy orders a ticket to Milan”

„Syntax” for processes



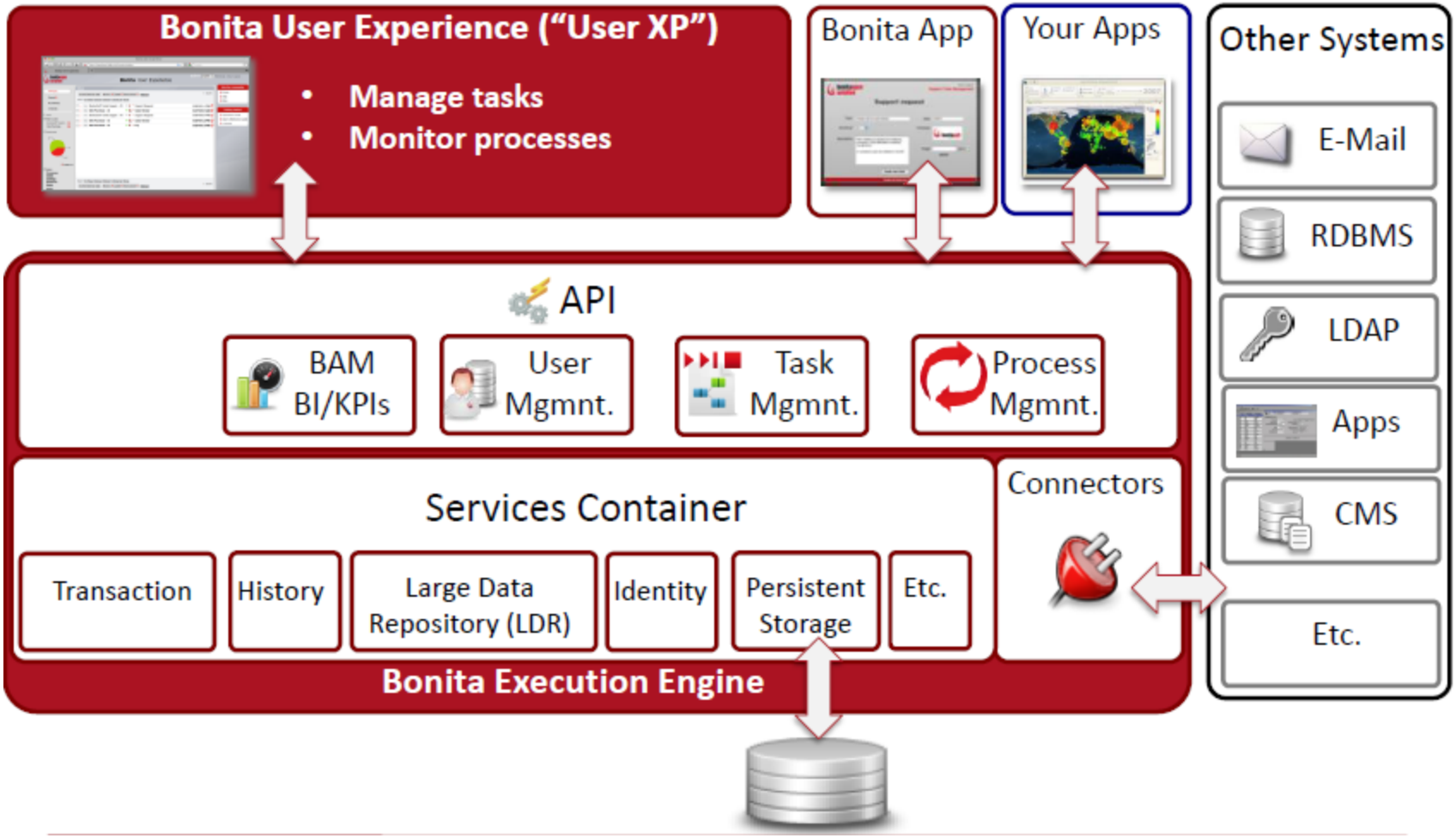
AIM: Workflow management infrastructure



Typical workflow engine features

- Versioning, online management
- API for embedded workflows
  - REST, WS, EJB…
- Business rule management
- Human tasks
  - Browser-based tasklist
  - Authentication/authorization
- Integrating external services
  - Support for typcial components

BonitaSoft architecture (HW)



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Requirements

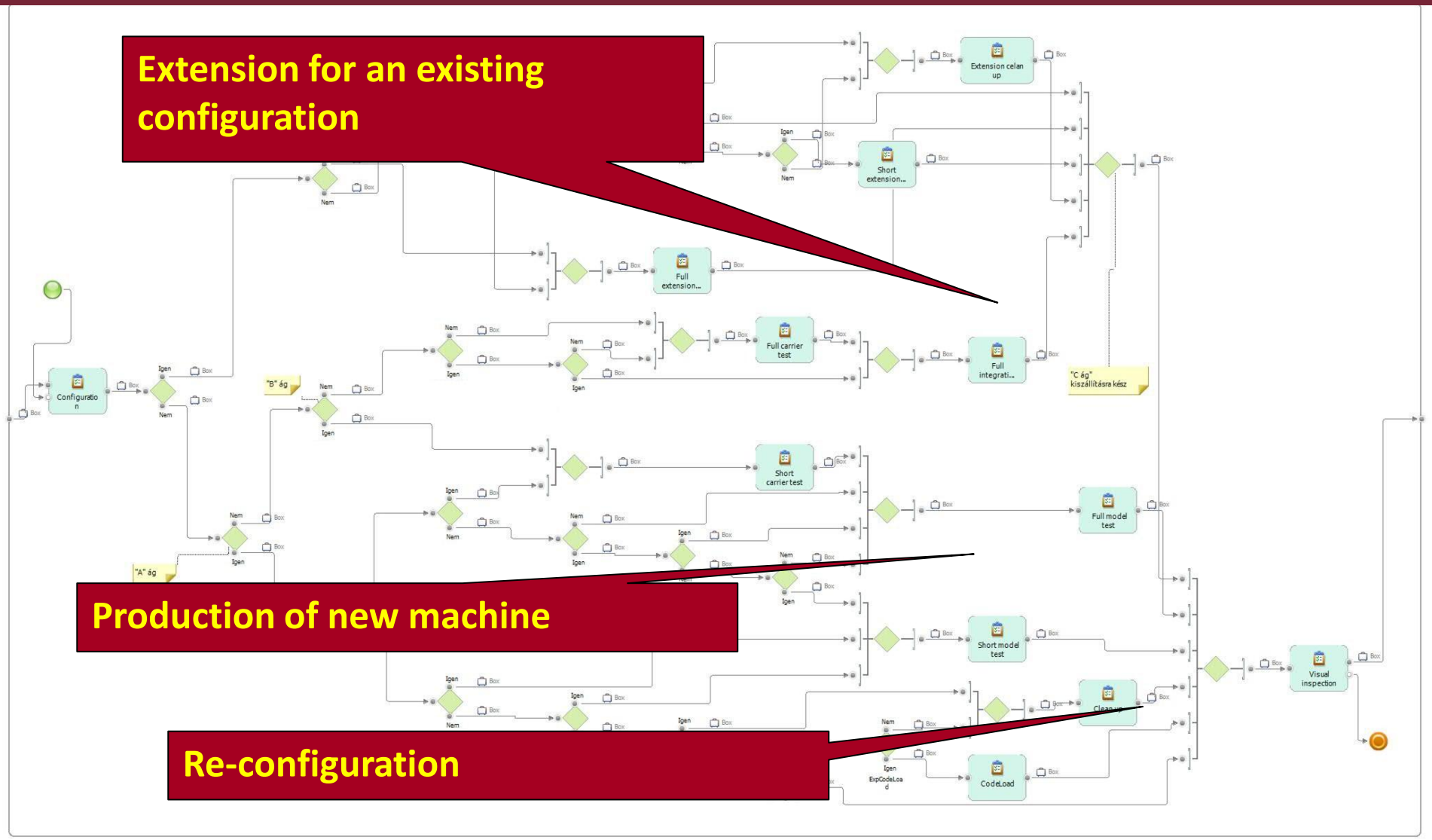
- Goal: exact mathematical model, which includes every aspect important from the analysis point of view
  - Formal semantics
  - Great expressive power
  - Easily interpretable, perspicuous graphical tool
  - explicit state and event representation

Process modeling formalisms

- Dataflow diagrams: DFD,ISAC, SADT, IDEF
- Transition systems, state-transition diagrams
- Statecharts
- Queuing theory and Markov–chains
- Process algebra (ACP, CCS, CSP)
- High-level Petri–nets etc. (Aalst)
- Developer-specific diagram techniques in WFMS, simulation and CASE tools

CASE STUDY: STORAGE PLANT OPTIMIZATION

Testing process for a storage plant



Simulation

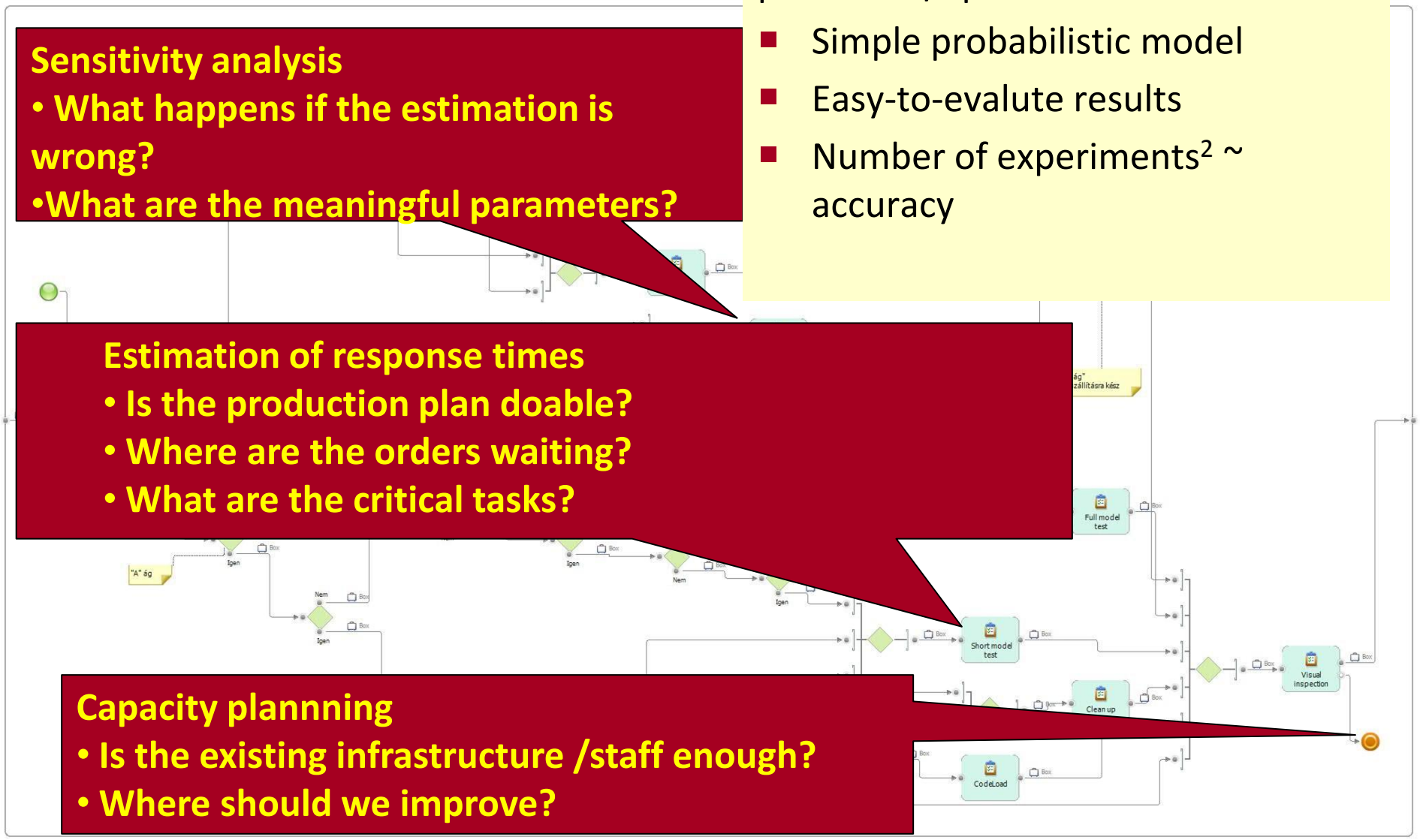
What is the effect of prediction/optimization?

- Simple probabilistic model
- Easy-to-evalute results
- Number of experiments^2 ~ accuracy

Sensitivity analysis
- **What happens if the estimation is wrong?**
- **What are the meaningful parameters?**

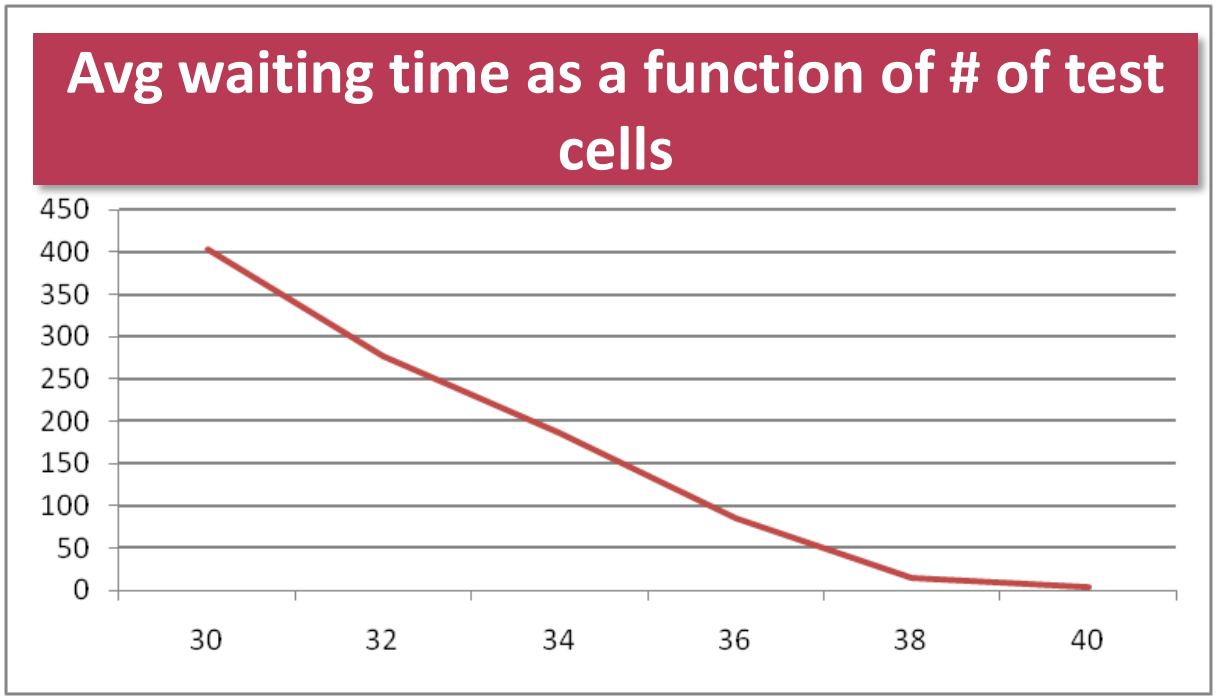
Estimation of response times
- **Is the production plan doable?**
- **Where are the orders waiting?**
- **What are the critical tasks?**

Capacity plannning
- **Is the existing infrastructure /staff enough?**
- **Where should we improve?**



Importance of resources

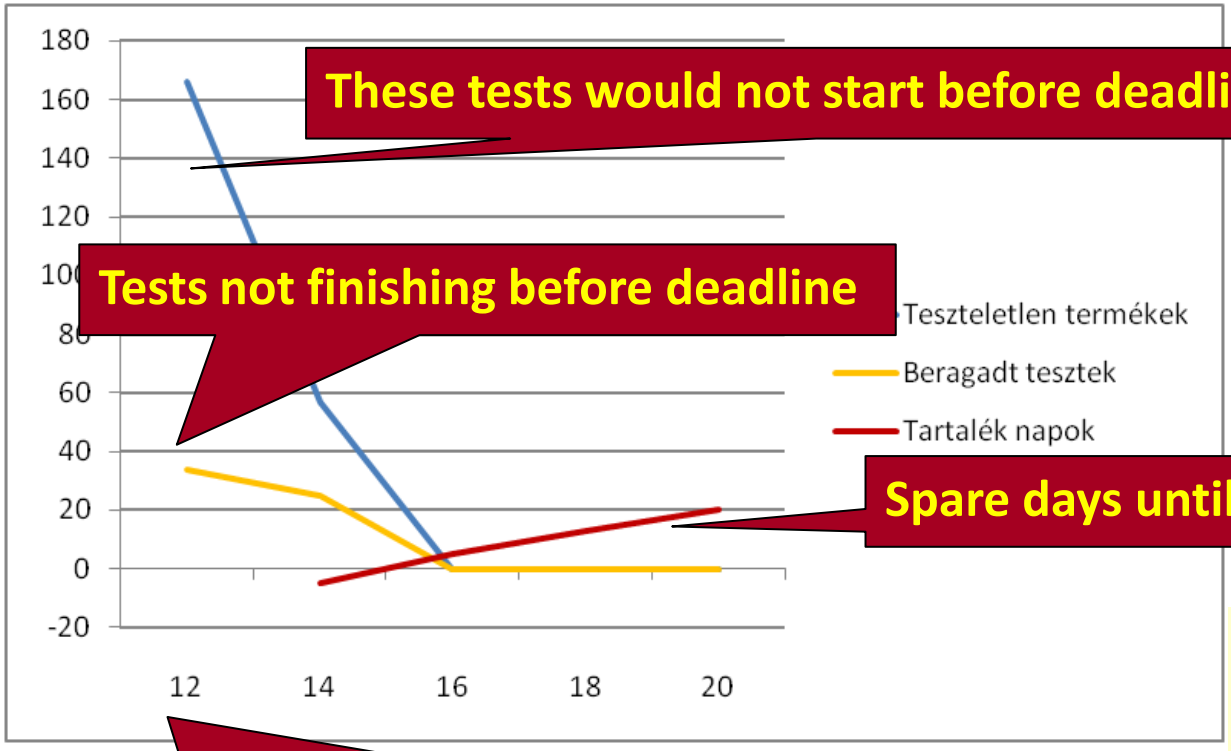
- How does the testing time depend on the number of test cells?



- In a given range the system depends strongly on the number of resources
- Whe should improve until test time is below an acceptable threshold

Throughput

- What is the expected performance of the assembly?



These tests would not start before deadline

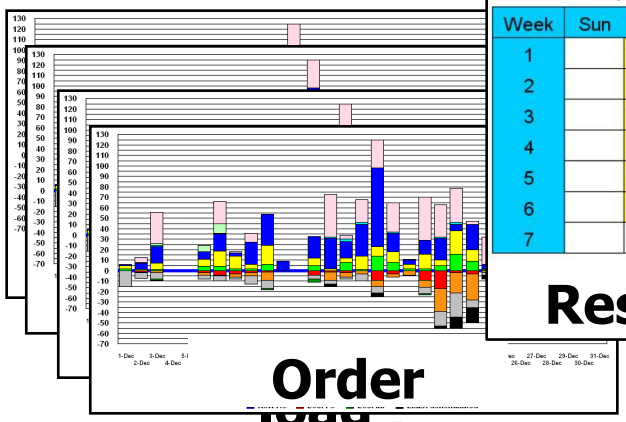
Tests not finishing before deadline

Spare days until deadline

# of assembled machines (input for testing phase)

- Constant assemlby rate is critical even if we have a perfect predictor

Progile



Order load

Weekly Shift Schedule

Week	Sun	Mon	Tue	Wed	Thu	Fri	Sat
1		Day-8		Day-8	Day-8	Day-8	Day-8
2		Day-8	Day-8		Day-8	Day-8	Day-8
3		Day-8	Day-8	Day-8		Day-8	Day-8
4		Day-8	Day-8	Day-8	Day-8		Day-8
5		Day-8	Day-8	Day-8	Day-8	Day-8	
6		Day-8	Day-8	Day-8	Day-8	Day-8	Day-8
7			Day-8	Day-8	Day-8	Day-8	Day-8

Resource shift

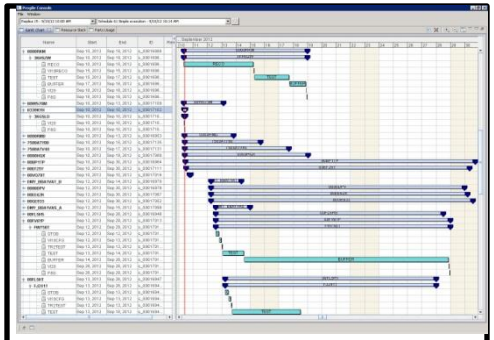
Factory state

Inventory

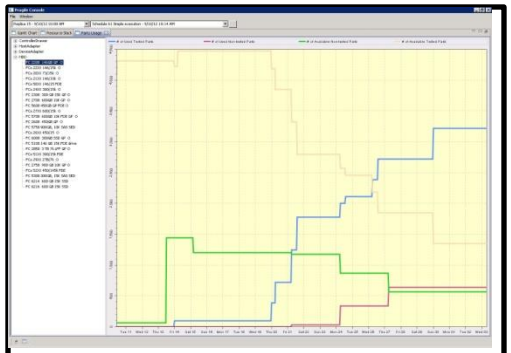
INPUT

PROGILE

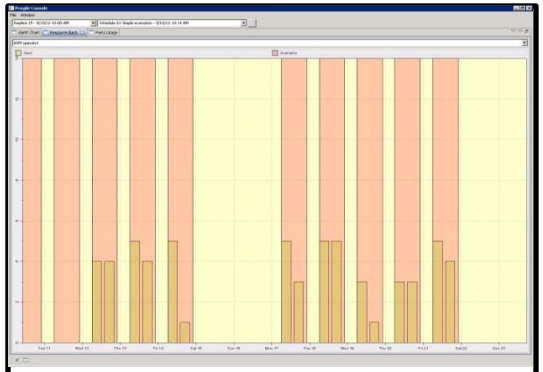
OUTPUT



hour based
execution schedule
for each order



material utilization
timeline

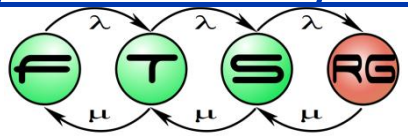


Detailed
resource utilization

Business Process Modeling Notation (BPMN)

Stephen A. White (IBM): *Introduction to BPMN*

http://www.bpmn.org/Documents/Introduction to BPMN.pdf



Business Process Modeling Notation (BPMN)

- Business Process Management Initiative (BPMI)
  - May 2004: BPMN 1.0 specification
- Aims
  - Easy to understand
    - Domain experts
  - Business analysis
    - Initial process design
  - Process engineer
    - Basis of implementation
    - Internal model as a basis of automated translation methods
    - E.g. transformation to BPEL
  - End user (monitoring, management)

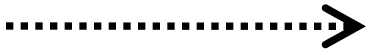
Business Process Diagram (BPD)

- ~Flow-chart diagram
- Elements
  - Data flow
  - Connections
  - Partitions
  - Artifacts

Data flow

Event	State change Cause Types: Start, Intermediate, End	
Action	Atomic/composite Task/subprocess	
Gateway	Sequence/ Convergence/divergence	

Connections

Sequence	Ordering of activities (no explicit control flow)	
Message	Information exchange between processes	
Association	Connecting data, note, etc. to process elements	

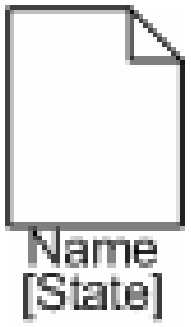
Partitioning

Pool — An actor (role) in the process

Lanes — Logical group for activities of an actor

Artifacts

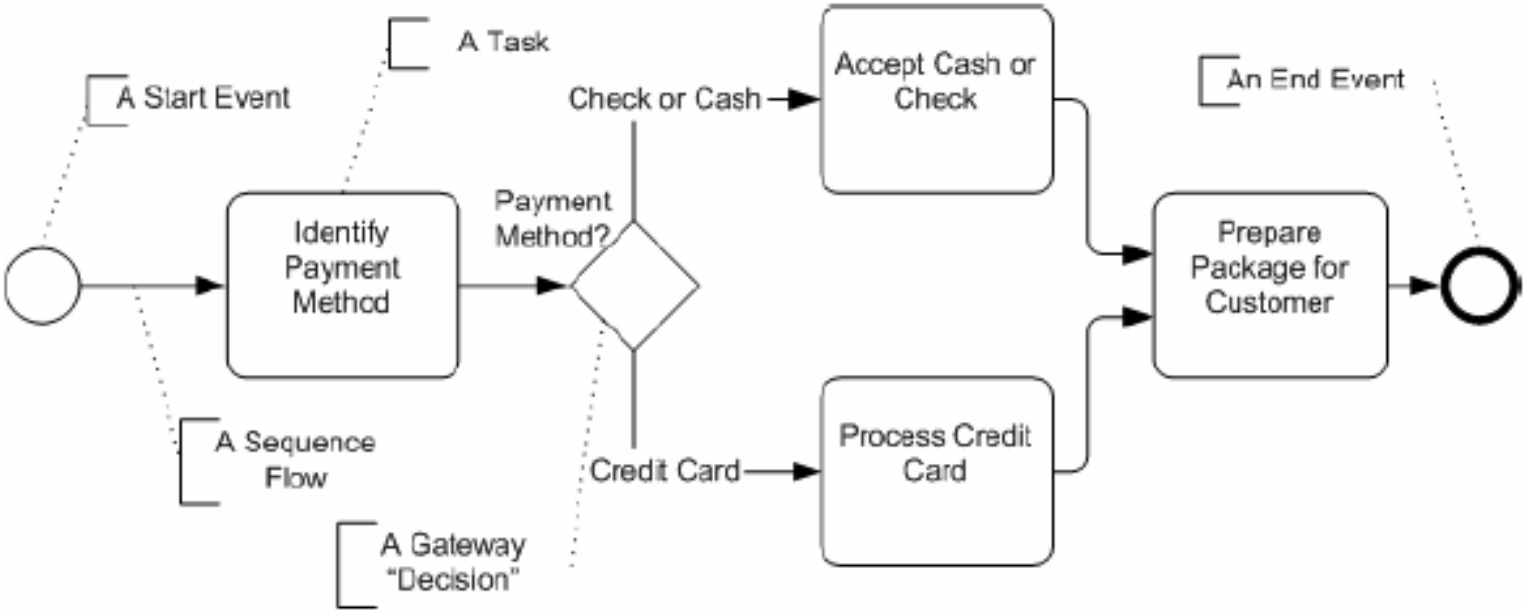
Data objects Symbolic token



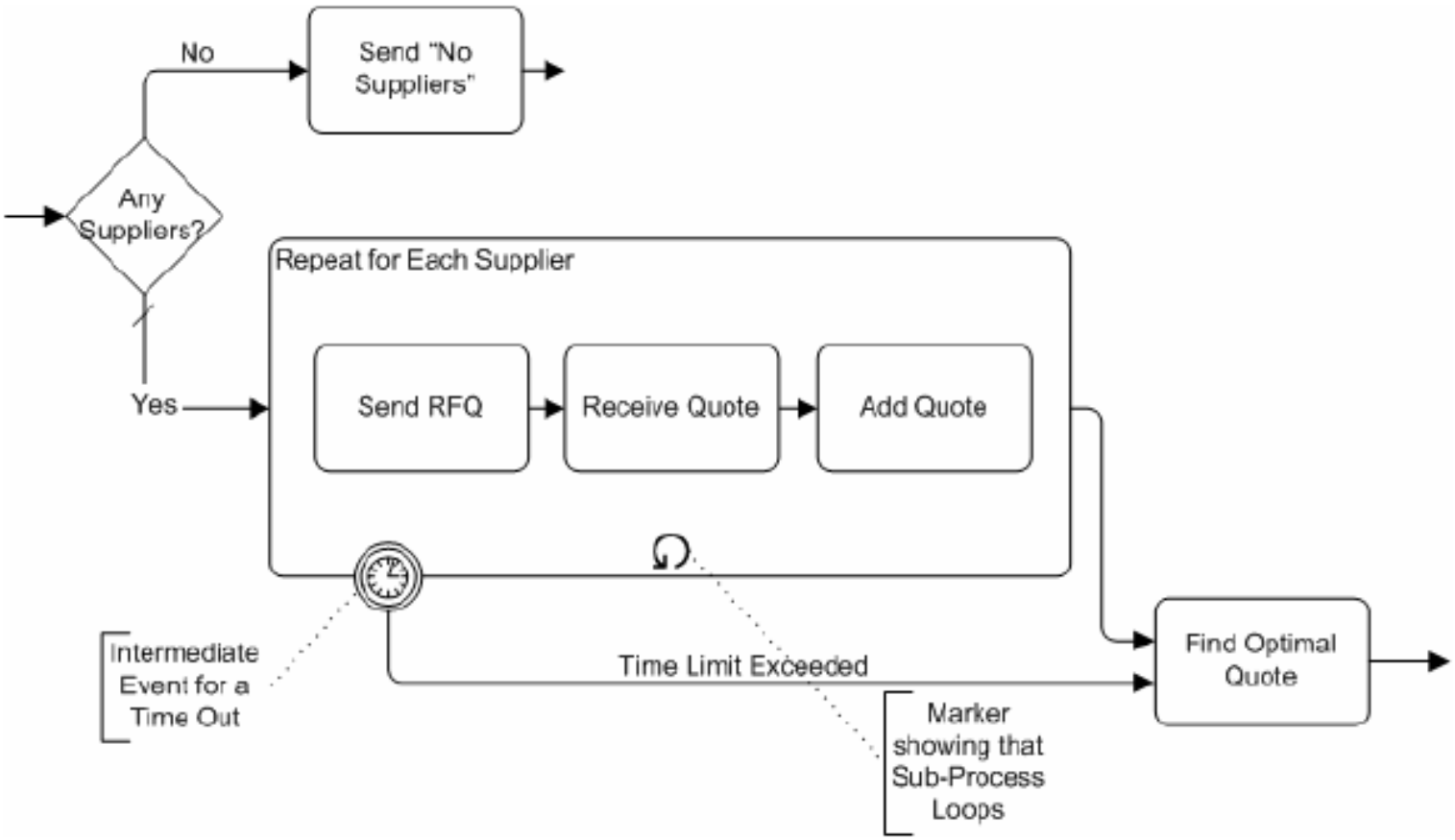
Group Grouping activities

Annotations Textual comments

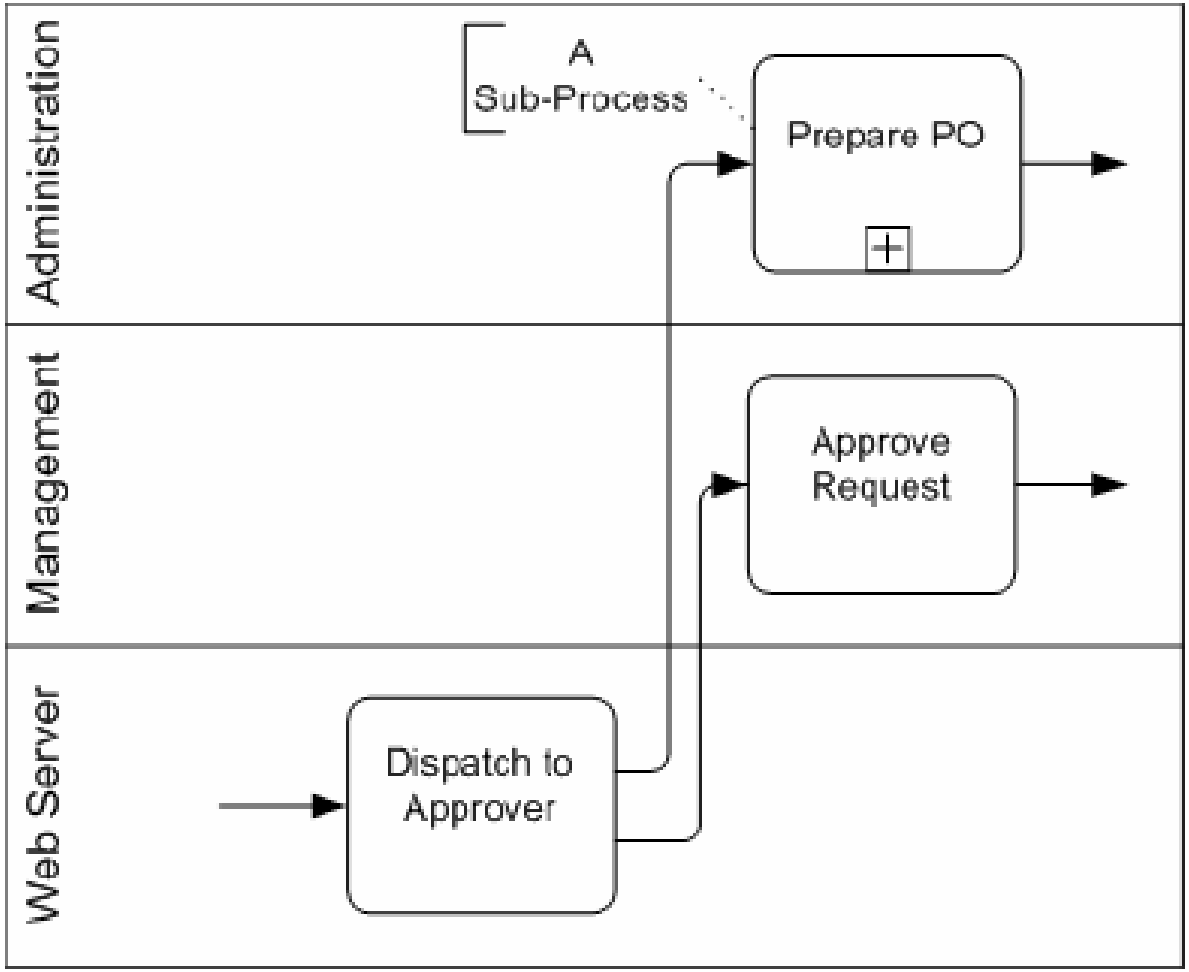
Example


A Task
A Start Event
Check or Cash
Accept Cash or Check
An End Event
Payment Method?
Identify Payment Method
Prepare Package for Customer
A Sequence Flow
Credit Card
Process Credit Card
A Gateway "Decision"

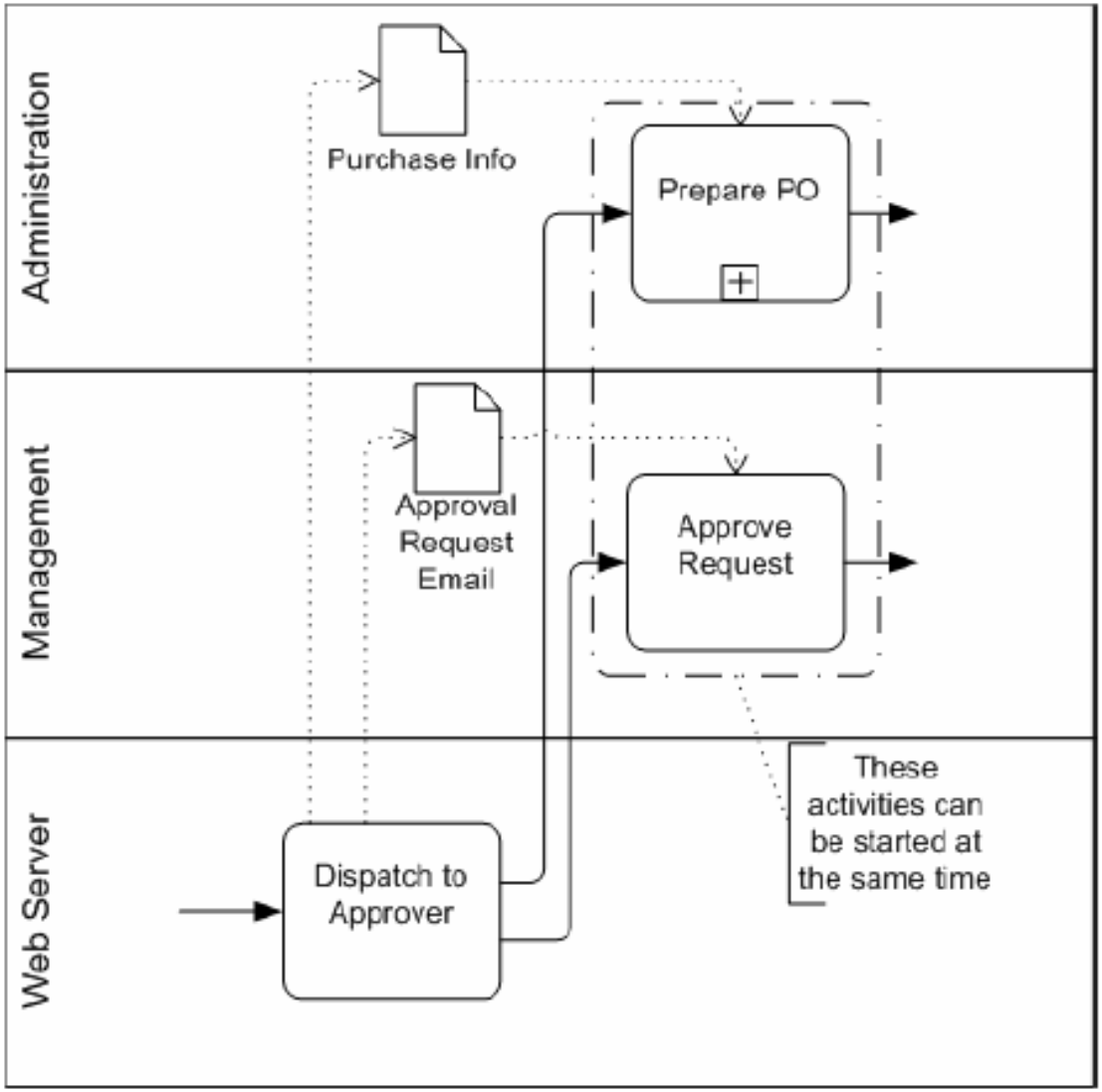
Hierarchical modeling



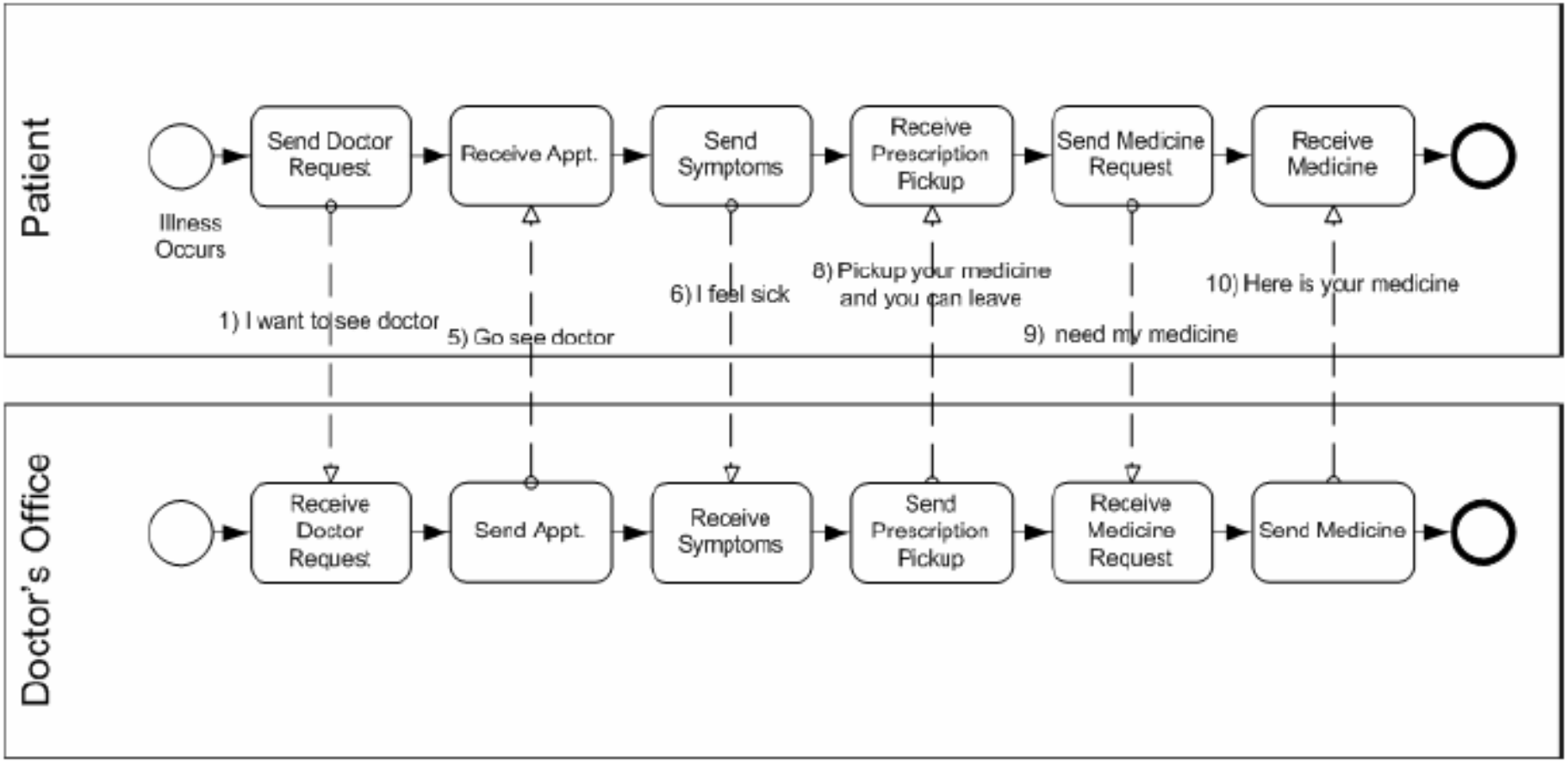
Partitioning



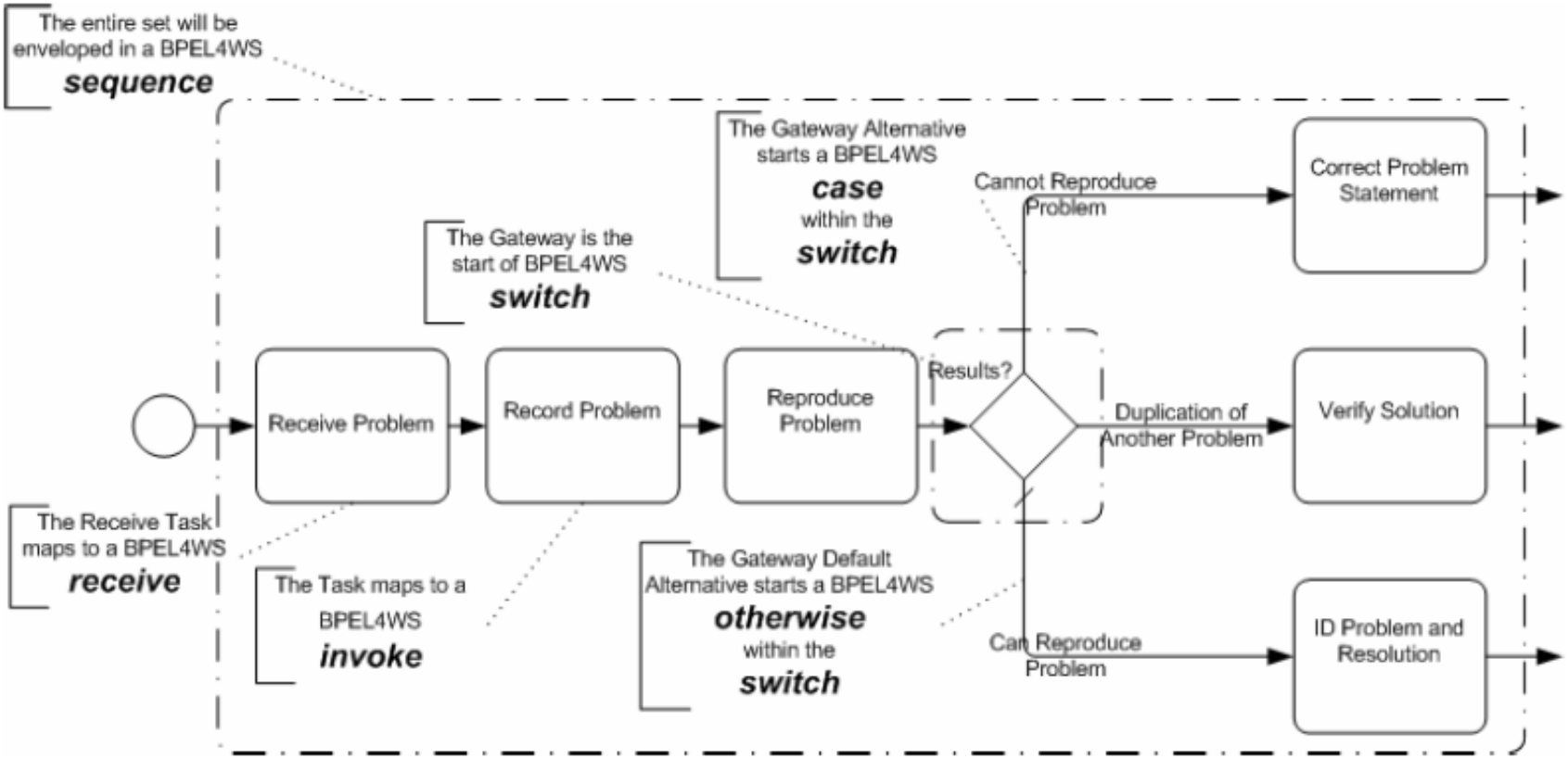
Data objects, groups, annotations



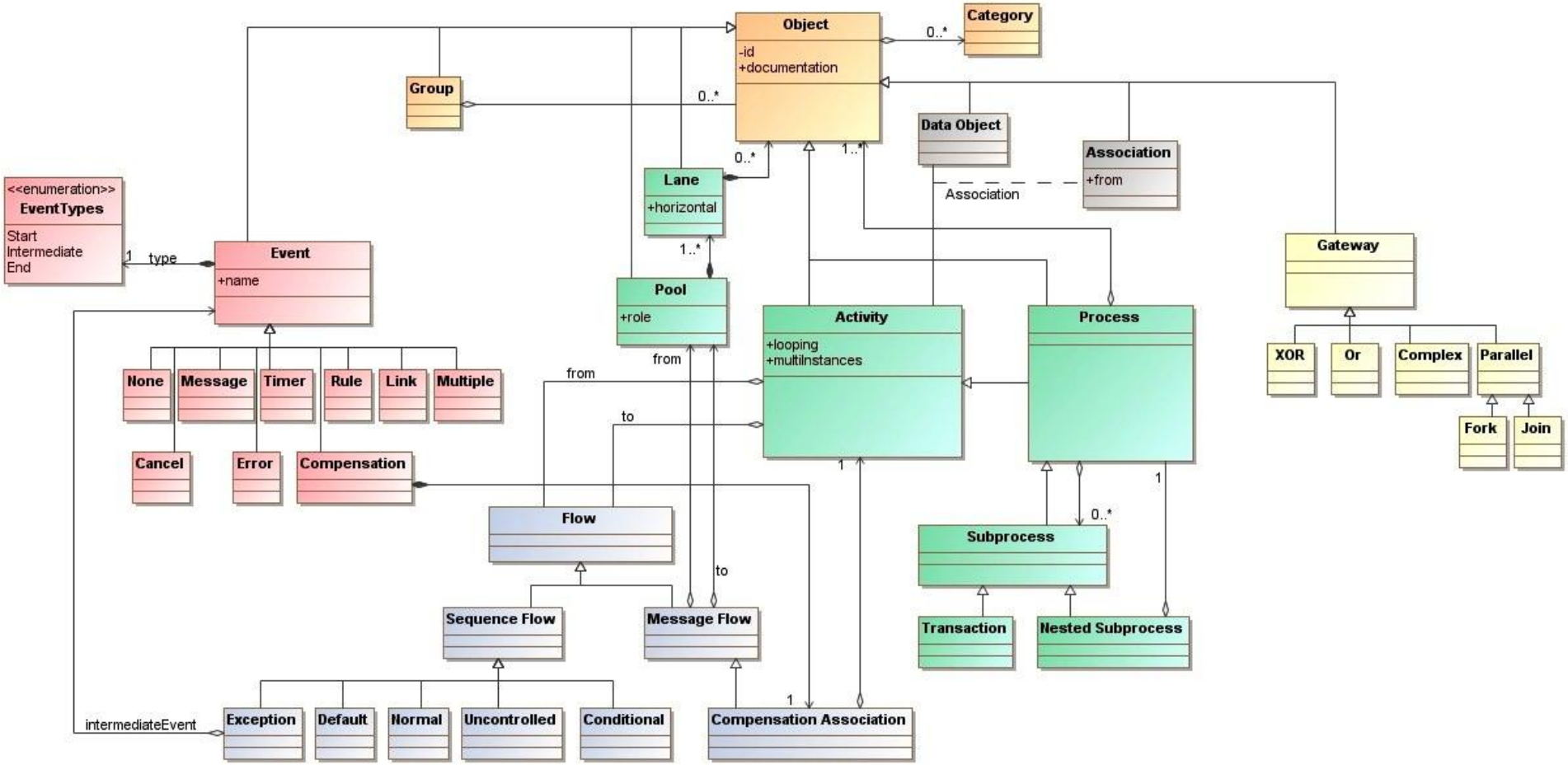
Collaboration



Support for automated execution

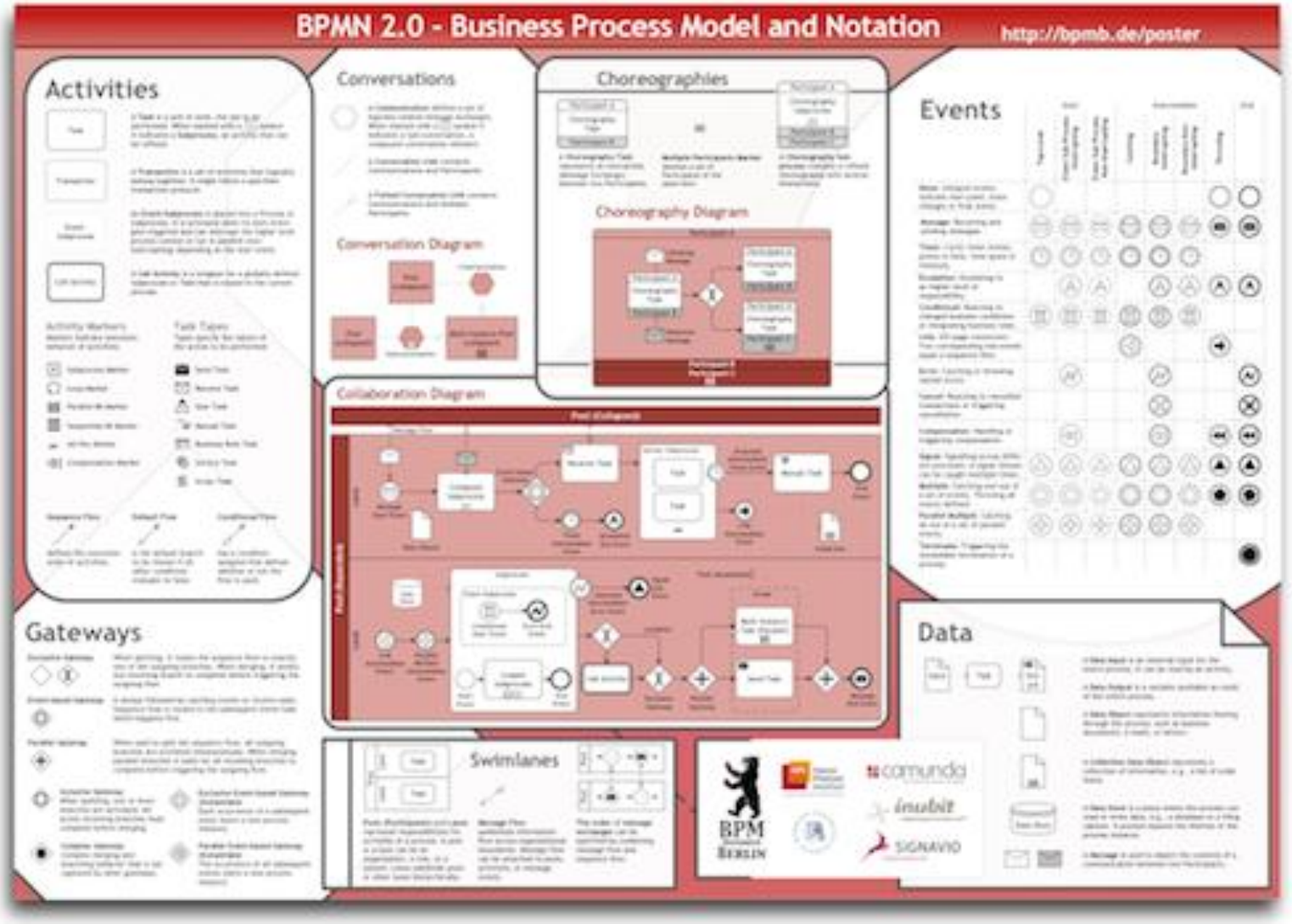


BPMN metamodel



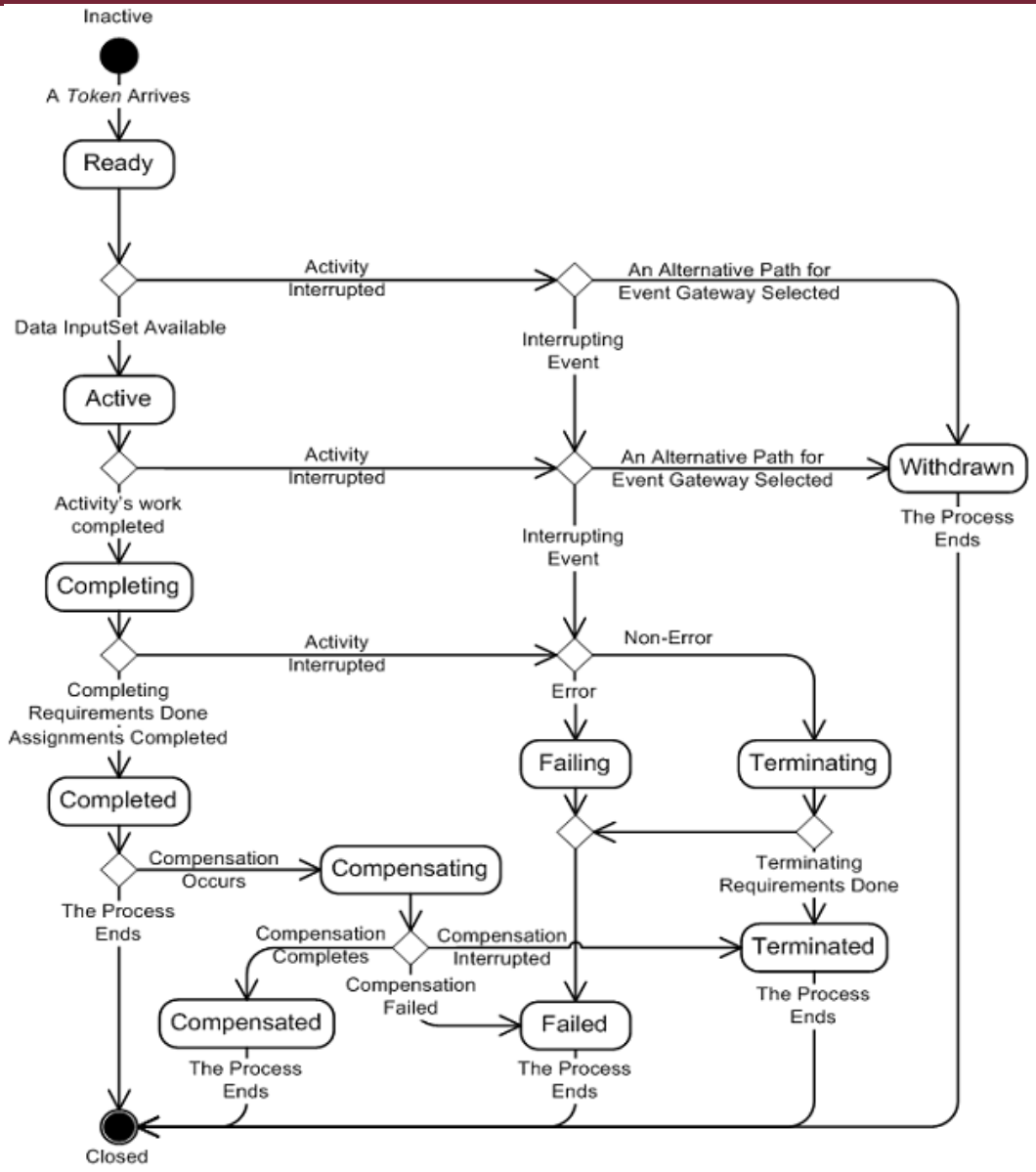
Source: http://www.wsper.org//

Summary of the language (2.0)

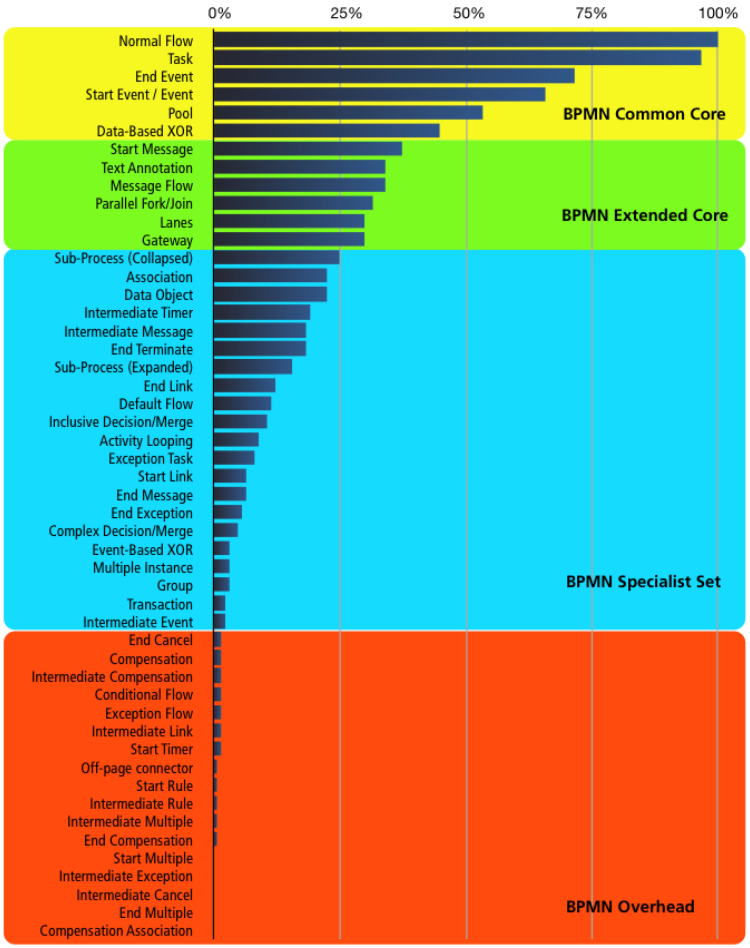


Source: http://www.bpmb.de

State machine for BPMN activities

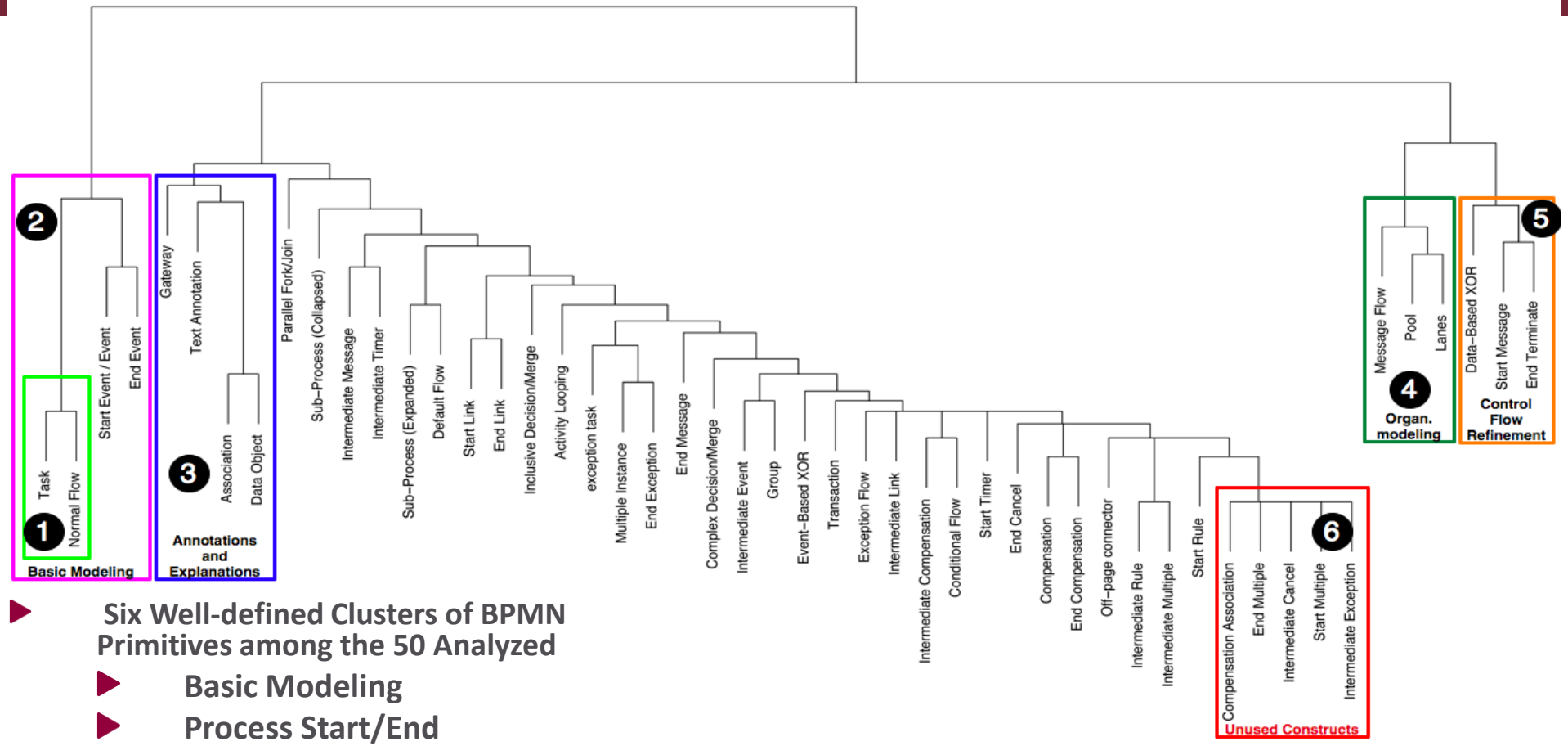


A statistics…



Source: Process Modelling. What Really Matters
Keynote of Michael Rosemann @ UNISCON2009 conference

Usage of BPMN elements



- Six Well-defined Clusters of BPMN Primitives among the 50 Analyzed
  - Basic Modeling
  - Process Start/End
  - Control Flow Refinement
  - Organization Modeling
  - Annotations and Explanations
  - Unused Constructs

Source: Process Modelling. What Really Matters
Keynote of Michael Rosemann @ UNISCON2009 conference

Challenges

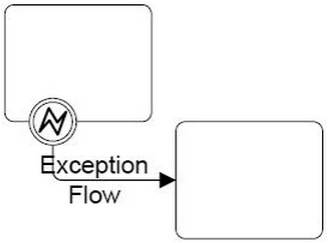
- How to capture domain specific expertise
  - „libraries”
  - „Web2.0”-based information handling
  - Effective modeling constructs
- Consistency of models
  - Static analysis: ~200 possibilities according to BPEL2
  - Process models and other descriptions
- Deplyoment:
  - Process vs. Organizational model vs. Resources
  - … cf. TDK2013 (Student contest)
- Compliance vs. flexibility

What is NOT shown in these models?

- Execution environment
- Roles
- Data structure
- Resources
  - Type definition, instances
- Timing conditions
- Exception handling

BPMN exceptions

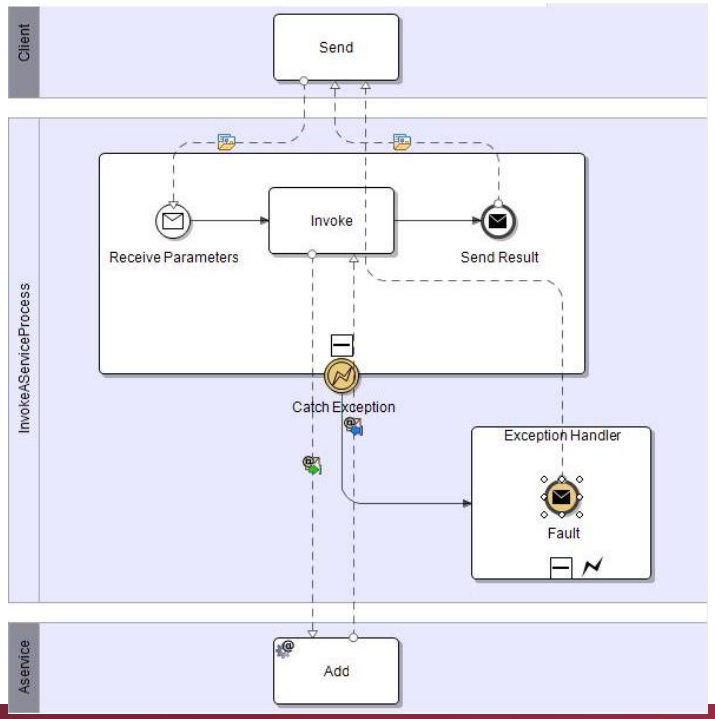
- Internal fault: triggered by some condition



- Hint: use FT design patterns
  - Recovery block, NVP…

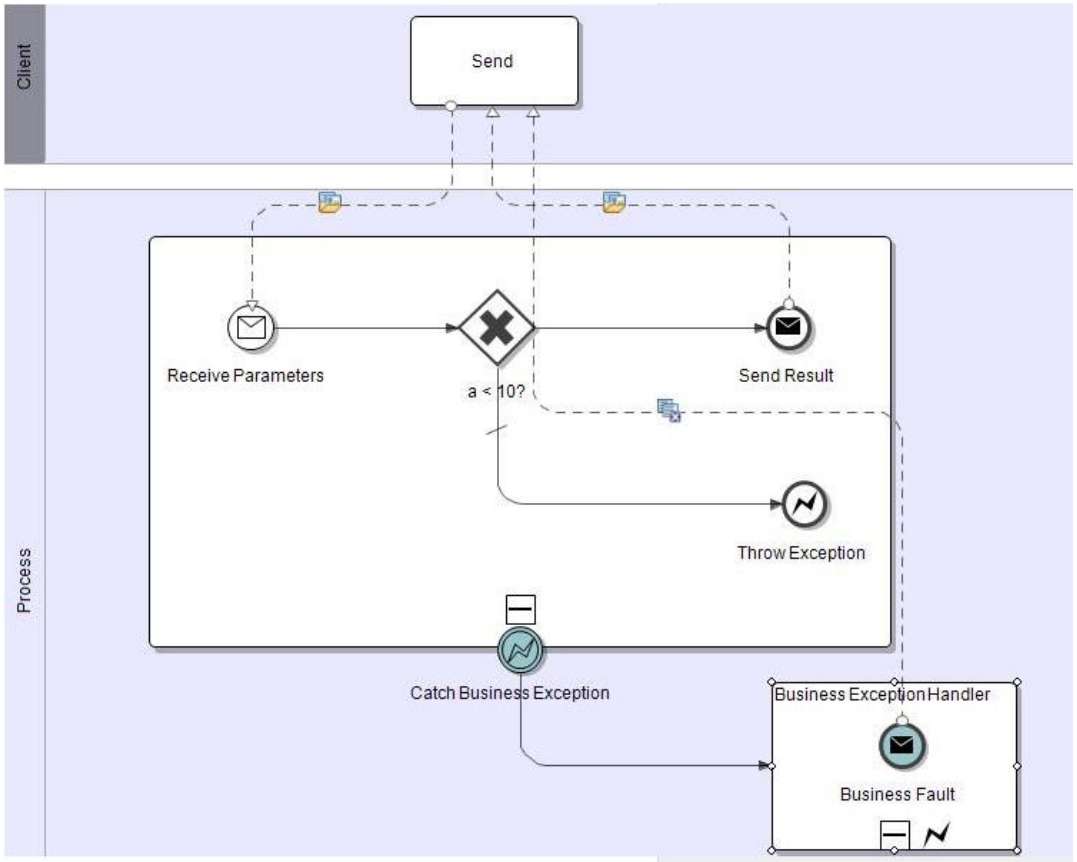
BPMN error handling

- Technology-level faults
  - Data, timing, availability, internal faults in components..
  - Support for explicit failure definition (e.g., BPEL)



BPMN error handling

- „Business logic error”
- Internal checkpoint in the process



BPMN modeling tools

- **jBPM Designer**
- Eclipse BPMN
- Tibco Business Studio
- IBM Websphere Business Modeler
- Intalio Designer
- BPMN Composer
- BPMN Designer
- Bonita Open Solution
- Adonis
- Activiti
- Obeo Designer

+ other (general purpose) non-BPMN tools

BPMN tools

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+ other „general purpose” modeling tools

Background

- http://www.sdn.sap.com/irj/scn/index?rid=/library/uuid/609cb540-3ca6-2a10-60a7-dc470a9b7adf
- http://community.intalio.com/tutorials/exception-handling.html
- http://www.conradbock.org/bock-bpmn-2-business-process-semantics-web.pdf
- Stephen A. White (IBM): *Introduction to BPMN*