Flexible Workflow Management Approaches
Motivation – What is Flexibility?

Flexible Workflow Management Approaches
- Exception Handling
- Late Modelling
- Late Binding
- Case Handling

Conclusion
Workflow management systems are usually designed to support
- Highly standardized processes
- Structurally robust processes
- Frequently executed processes

Typical companies using WfMS
- Insurances
- Credit institutions
- (Public) Administration
(Not so) new requirements to WfMS
- Business processes have to become more and more flexible
- I.e. they are changing more or less rapidly
- Support of „Flexible“, „creative“ and „skill-intensive“ industries

Support through „classical“ WfM approaches not available

New WfM approaches have to consider
- Changing business processes
- Unforeseen events that „disturb“ running workflows
  i.e. they have to be „flexible“
Flexibility Techniques

- **Exception Handling**
  - Exceptions (= harmful events usually not modelled in a workflow) are anticipated…
  - … and modelled in a general way

- **Late Modelling**
  - Workflows contain black boxes
  - Black boxes are filled with workflow model at run-time, depending on the particular situation

- **Late Binding**
  - Workflow models are not compiled but interpreted
  - Changes of the workflow model are possible at run-time

- **Case Handling**
  - Workflows are not dependent on control flow
  - Workflows are executed as soon as all required data are available
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Anticipation of events that „disturb“ the execution of workflows

- account not covered
- application system not available
- deadline exceeded

Alternatives

- modelling any possible exception as a part of the workflow model
- modelling exceptions as patterns (in all 135 patterns)

→ Approach of RUSSEL, VAN DER AALST, and TER HOFSTEDE (2006):
  “Workflow Exception Patterns”
Exemplary Workflow (YAWL)
Exception Types

- work item failure
- deadline expiration
- resources not available
- external event
- constraint violation

Exception Handling strategies

- at Work Item Level (only an excerpt; total of 15)
  - force-complete (SFC)
  - reallocate (ARA)
- at Case Level
  - continue current workflow instance
  - cancel current workflow instance
  - cancel any instance of the current workflow type
- **Recovery action**
  - no action
  - rollback
  - compensate

- **Workflow exception handling language**
  - set of modelling elements
  - integration in workflow models
Example 1: Work Item Failure (Task)

- Activity „check credit“ fails

- Exception handling pattern:

- Borrowings < 100 €

- Borrowings > 100 €

Flexible Workflow Management Approaches

Russell et al. (2006)
Example 2: Deadline Expiration (Task)

- Deadline of activity „pick order“ expires

- Exception handling pattern:

```
[Diagram showing exception handling pattern]
```
Example 3: Resources not Available (Process)

- Resources of an arbitrary task are not available

- Exception handling pattern:

  Data resources not available

  Human resources not available
Example 4: External Event (Process)

- Client account is frozen

- Exception handling pattern:

![Diagram showing an event and a process]

Event account_frozen

("R")

Flexible Workflow Management Approaches

Russell et al. (2006)
Example 5: Constraint Violation (Task)

- Constraint „order_value < (client_credit_limit + client_account_balance)“ of task „accept order“ is violated

- Exception handling pattern:

```plaintext
Constraint:
order_value < 
(client_credit_limit + client_account_balance)
```
Workflow Model with Exception Patterns

Layer 2: Exception Handling Definition
- Work Item Failure
- Deadline Expiration
- Constraint Violation

Layer 1: Workflow Definition
- Accept order
- Check credit
- Organise shipping
- Create invoice
- Process order
- Complete order

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Russell et al. (2006)
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Late Modelling

- **Workflow models that consist of**
  - structured parts ("classic" workflow models)
  - semi-structured parts

- **Workflows contain black boxes**

- **Black boxes are filled with workflow model at run-time, depending on the particular situation**

- **Contents of the black boxes cannot be anticipated**

- **Modeller is alerted as soon as late modelling becomes necessary**

Process of publishing a book with „black box“

- Publisher → Contracting → Manuscript → Revision and completion
- Author: „black box“
- Distribution: „white box“ → Sales
Business process section „delivery date query“

- Inventory not sufficient
- Determine components
- Components determined
- Check inventory
- Check capacity
- Inventory sufficient

Flexible Workflow Management Approaches
Hagemeyer et al. (1997)
Flexible Workflow Management Approaches

Sadiq et al. (2001)
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**Late Binding**

- Workflow models are not compiled but interpreted
- Changes of the workflow model are possible at run-time

Workflows in WASA\textsubscript{2}

**Workflow types**
- complex workflow
- atomic workflow
  - manual workflow
  - automatic workflow

Flexible Workflow Management Approaches
Weske et al. (1997)
Flexible Workflow Management Approaches

Weske et al. (1997)

Matthias Voigt
Structural Equivalence of Schema and Instances

Schema

Execution

Instances

Flexible Workflow Management Approaches

Weske et al. (1997)
Workflow schemas are interpreted at run-time (→ Late Binding)
- Workflow schemas are not compiled
- No separation of run-time und build-time.

Advantage
- Modification of running workflow instances is possible
- Running workflow instances can be adapted to new schemas
Adapting Running Instances

Legend

- **COMPLETED**
- **ON WORKLIST**
- **RUNNING**
- **NOT YET STARTED**

Flexible Workflow Management Approaches

Matthias Voigt

Weske et al. (1997)
Modification of the workflow schema

- Deletion of old edges, parameters and conditions
- Insertion of new workflow
- Insertion of new edges, parameters and conditions
Continuing execution…
Automatic Adaption of Running Instances to new Schemas

- Workflow schema is modified

- The WfMS
  - checks which instances of the schema are currently running
  - performs a consistency check → is modification possible
  - adapts instances to new schema
Example: Automatic Adaption

Old workflow schema

New workflow schema

Old workflow instance

New workflow instance

Manual change through user

Automatic change through WFMS

Automatic change through WFMS

Automatic change through WFMS

not possible

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Approach of SCHUSCHEL and WESKE
„Classic“ workflow model

- **A1 Take order**
- **A2 Analyse customer**
- **A3 Create offer**
- **A4 Technical solution**
- **A5 Calculation**

- **D0 Offer request**
- **D1 Customer data**
  - D1 Customer data
  - D3 Requirements
  - D5 Bill of material
- **D2 Customer rating**
- **D4 Own expenses**
- **D6 Offer**

Flexible Workflow Management Approaches
Schuschel, Weske (2002)
Idea: In most cases activities are exclusively dependent on their input data

→ Removal of control flows
Why is this more flexible?

- Data objects can be created by other instances than the workflow model prescribes
- If they already exist, depending activities can start earlier
- Some activities may be left out
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Conclusion
What are benefits and limitations of the approaches shown?
- Exception Handling
- Late Modelling
- Late Binding
- Case Handling

Discussion
Flexible Workflow Management Approaches

Matthias Voigt