Flexibility Issues in Process-Aware Information Systems

Business Process Management and Flexibility
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Process Spectrum

- From fully predictable and highly repetitive to
- Fully unpredictable and non-repetitive
Knowledge-intensive Processes

- Processes on the right side of the spectrum are mostly knowledge-intensive

- Unpredictability
  - Course of action depends on situation-specific parameters

- Non-repeatability
  - Two process instances hardly look the same

- Emergence
  - Future course of action depends on knowledge gained through activity execution
Content

- Pre-specified Processes
- Knowledge-Intensive Processes
- Perspectives on a Process-aware Information System
- Components of a PAIS
- Summary
Prespecified and Repetitive Processes

- Repetitive business processes whose logic is known *prior* to their execution and can therefore be prespecified in process models.
Process of Medical Order Handling
Planning and Performing a Keyhole Surgery

1. Admit Patient
2. Perform Checkup
3. Examine Patient
4. Discuss Anesthesia
5. Discuss Risks
6. Make Decision
7. Write Discharge Letter
8. Schedule Surgery
9. Check Patient Record
10. Admit Patient
11. Prepare Patient
12. Send Patient to Surgical Suite
13. Perform Surgery
14. Transport Patient to Ward
15. Provide Postsurgical Care
16. Create Surgery Report
17. Order Lab Test
18. Discharge Patient
19. Write Discharge Letter

End Event
Content

Introduction
Pre-specified Processes
Knowledge-Intensive Processes
Perspectives on a Process-aware Information System
Components of a PAIS
Summary
Knowledge-intensive processes

- Knowledge-intensive processes are very dynamic!!!
  - The concrete activities to be performed, as well as their exact course, may depend on decisions made by process participants during process execution; i.e., knowledge-intensive processes cannot be completely prespecified

- More maneuvering room for process participants and looseness of process execution are required.
  - This can be achieved by using constraint-based process models focusing on what shall be done by describing the activities that may be performed as well as related constraints prohibiting undesired process behavior
  - There are scenarios in which an activity-centric approach is not suitable at all, but a tighter integration of process and data is required.
Loosely-specified Processes

A must be the first executed activity
B needs to be preceded by A
A and B must not co-occur
At least n out of m activities must be executed
If A is executed B should be executed as well (optional)
Object- and Data-driven Processes
Relation between Data and Process Modeling
Content

Introduction
Pre-specified Processes
Knowledge-Intensive Processes
Perspectives on a Process-aware Information System
Components of a PAIS
Summary
Perspectives on a PAIS

Operational Perspective
- activity implementations & application services

Organization Perspective
- organizational model (actors, roles, organizational units)

Time Perspective
- time constraints (e.g., activity deadlines)

Behavior Perspective
- control flow: order & execution constraints

Information Perspective
- data objects & data flow

EXECUTABLE PROCESS MODEL

Function Perspective
- business functions

Perspective
- Perspectives on a PAIS
The operation perspective of a PAIS that is based on activity-centric process models covers the implementation of the process activities.

The function perspective covers the functional building blocks from which activity-centric process models can be composed; i.e., atomic activities representing elementary business functions as well as complex activities representing subprocess models.

The behavior perspective captures the dynamic behavior of an executable process model.

The organization perspective deals with the assignment of human activities to organizational resources.

The time perspective captures temporal constraints that need to be obeyed during process execution.

The information perspective comprises a set of data objects as well as the data flow between the activities.
Function Perspective
Behavior Perspective
Behavior Perspective

[Diagram showing a process of patient care with steps such as Examine patient, Perform X-ray, Perform Surgery, etc.]

Annotated:
- A must be the first executed activity.
- B needs to be preceded by A.
- A and B must not co-occur.
- At least two out of n activities must be executed.
- If A is executed, B should be executed as well (optional).
Behavior Perspective

Behavior Perspective
Object Interactions
Organizational Perspective
Operational Perspective

Activity Input Parameters

Activity Output Parameter

Activity X

Data Flow

Control Flow

Application Service
Content

Introduction

Pre-specified Processes

Knowledge-Intensive Processes

Perspectives on a Process-aware Information System

Components of a PAIS

Summary
**Build-time and Run-time Artifacts of a PAIS**

- **Build-time** components enable the creation and management of the type-level artifacts of the PAIS.
- **Run-time** components refer to the process instance level and support the creation, execution, and management of process instances.

![Diagram](chart.png)
Build-time and Run-time Environment of a PAIS
Basic Components of a PAIS

- Process Model Editor
- Executable Process Model
- Organizational Model
- Process Engine
- Worklist
- Worklist Manager
- End-User Client
- Application Service (e.g., Web Service)
- Application Data
- Process-relevant Data
- Process Control Data

PAIS Administrator
Process Actor
Process Instances and their Lifecycle

- **Created**
  - create
  - start

- **Running**
  - start activity
  - suspend/complete
  - terminate/abort
  - complete

- **Active**
  - (1 or more running activity instances)

- **Suspended**
  - terminate/abort
  - resume
  - suspend/complete

- **Terminated**
  - terminate/abort each running activity instance

- **Completed**
  - suspend or complete all running activities
Internal State of a Process Instance

- **Credit Request**: Borrower: H.A. Reijers, City: Hertogenbosch, Amount: 5,000
- **Collect Credit Data**
  - activity instance is completed
- **Assess Credit Risk**
  - transition condition evaluated to true
  - Amount ≤ 10,000
  - Risk = “low”
  - Risk = “high”
  - Decision = “accept”
  - Decision = “reject”
- **Accept Credit**
  - activity is enabled
- **Reject Credit**
  - activity is skipped
Activity Instances and their Lifecycles

Inactive → enable → Enabled (has workitems) → start → Running (is processed) → complete → Completed

Disabled → skip → Skipped

Running (is processed) → suspend → Suspended

Running (is processed) → resume → Failed
Worklists and Work Items

### Executable Process Model: Biopsy
- Order Lab Test
- Take Biopsy
- Record Biopsy
- Check Record
- Look after Patient

### Process Instances
1. **Process Instance I₁ (Patient: Hajo)**
2. **Process Instance I₂ (Patient: Jan)**
3. **Process Instance I₃ (Patient: Wil)**

### User Worklists
- **Worklist (Michael)**
  - work item (Check Record, Hajo)
  - work item (Look after Patient, Jan)
  - work item (Record Medication, Jan)
  - work item (Take biopsy, Wil)

- **Worklist (Marion)**
  - work item (Administer Drug, Rick)
  - work item (Order Lab Test, Jan)
  - work item (Record Medication, Jan)

### Activity Instance States:
- Completed
- Inactive
- Enabled
Selecting a Work Item from a Worklist

1. User worklist
2. Selection of a particular work item
3. Automatic invocation of the corresponding application service (e.g., user form)
Work Item Lifecycle

Offered → Allocated → Started → Completed
- allocate
- start
- complete

Withdrawn
- withdraw

Failed
- fail

Suspended
- suspend
- resume
Process-aware Information Systems: Summary

- Know the logic of the supported processes
- Ensure that activities are executed in the specified order or considering the specified constraints
- Controls the flow of data between activities
- Knows the application service to be invoked when an atomic activity is started
- Assigns work items related to human activities to the work-lists of authorized users and manages these work-lists
- Enables end users to monitor the progress of process instances and to trace their previous execution
Traditional Process Lifecycle Support