Context Aware Customizable BPM
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Presented to: Dr. Ahmed Rafea
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Agenda

• Introduction to Business Process Modeling
• BPML Research Directions
• Directions of BPM & Frameworks
• Interesting Areas of Research
• Problem Statement
• Motivation
• Related Work
• Research Approach
• Work Plan
• Related Journals
Business Processing Modeling

• Definition:
  – Is the activity of representing processes of an enterprise, so that the current process may be analyzed and improved in future
  – It addresses the process aspects of a business architecture, leading to an all encompassing enterprise architecture
  – It is integral to:
    • Business process management
    • Business process reengineering
BPM languages : BPMN

• Definition
  – Is a graphical representation for specifying business processes in a workflow
  – The aim behind BPMN was to provide a notation that is readily understandable
  – BPMN is also supported with an internal model that enables generation of executable BPEL (Bridge gap between BP design and implementation)
BPM languages : BPMN (Cont’d)

• Basics
  – Defines a Business Process Diagram (BPD), which is based on a flowcharting technique
  – A Business Process Model, is a network of graphical objects, which are activities (i.e., work) and the flow controls that define their order of performance
  – Categories of elements are:
    – Flow Objects (Events, Activities, Gateways)
    – Connecting Objects (Sequence flow, Message flow, Association)
    – Swim lanes (pools and lanes)
    – Artifacts (Data objects, groups, annotations)
  – Used in Representing:
    – Collaborative (Public) B2B Processes
    – Internal (Private) Business Processes
BPM languages : EPC (Event-driven Process Chain)

- Definition:
  - Is a BPM technique used for analyzing processes for the purpose of enterprise resource planning (ERP) implementation
  - EPCs are directed graphs, which visualize the control flow and consist of events, functions and connectors
    - **Events** can be seen as pre- and/or post-conditions of functions
    - **Functions** are tasks or activities within the company (transition from an initial state to another)
    - **Logical connects** (AND, OR, XOR) represents relationships between elements in the control flow
      *Note: Connects help the control and synchronize flow from one flow to two or more flows*
BPM languages: EPC (Cont’d)

EPC Example: “A configurable business modeling Language”, M Rosemann
BPM languages: UML

- **Definition:**
  - UML is used to specify, visualize, modify, construct and document the artifacts of an Object-Oriented software-intensive system under development.

- **UML elements:**
  - Structure diagrams (Class, Component, Deployment diagrams)
  - Behavior diagrams (Activity, State machine, Use case diagrams)
  - Interaction diagrams (Sequence, Timing, Communication diagrams)
BPML Research Directions

- Extending BPML to support configurability (run time configuration)
  - It isn’t obvious at the system implementation phase what configuration alternative might exist during real time execution
- Extending BPML to support context awareness
  - Current business process models lack the ability to adapt the execution of the instances to the changing contexts and to the stakeholders’ requirements
  - Self Adaptive BPM needs extensible languages that cater for context expression and decision
Example: CEPC (Configurable Event-driven Process Chains)

• CEPC only focused the essential configurations
  – (i.e. the system variability as it is visible and relevant to the project team, not technical configurations)

• The research focused only on syntactical correctness of the model not semantic.
BPML : CEPC Example

- The main goal of a C-EPC is to be able to specify that a concrete EPC is an acceptable configuration or not.

EPC Example: “A configurable business modeling Language”, M Rosemann
BPML : CEPC Example

CEPC model examples & reference rules
“A configurable business modeling Language”, M Rosemann
BPML : CEPC Example

Two configurations of the C-EPC shown

“A configurable business modeling Language”, M Rosemann
Directions in BPM & Frameworks

• Having Reference Models, Architectures, Design patterns & Families of Architectures that are:
  – Re usable
  – Context Aware
  – Customizable and Variable (within these Models)

This can be achieved through certain extensions of the following patterns & architectures
  • SOA (Service Oriented Architecture)
  • SPL (Software Product lines)
  • MDA (Model Driven Architectures)
  • Techniques combing some of them
SPL (Software Product Line)

• Definition:
  – A Software Product Line represents a set of software intensive systems that share a common managed set of features satisfying the specific needs of a particular market segment
  – Entails the strategic development of software assets that are to be reused many times across the members of a product line
  – If properly managed promotes the reusability of assets throughout the iterative and incremental development of software product families
SOA (Service Oriented Architectures)

- **Definition:**
  - An attempt to provide set of principles or governing concepts used during phases of systems development and integration
  - SOA package functionality as interoperable services within the context of various business domains involved
  - SOA defines the interface in terms of protocols and functionality
  - Services comprise unassociated, loosely coupled units of functionality that have no calls to each other embedded in them
  - Each service implements one action
Interesting Areas of Research

- Specializations of BPML to model business processes from the perspective of interactions of collaborating parties
- Employing Domain Ontologies to define semantic relations between different software artifacts and models
- Introduction of domain ontology as a formal representation of feature models of families of business processes
- Domain Reference Models or Design patterns that support adaptability according to the contextual requirements of business process models and instances
- Exploring Context Models that are appropriate to BP modeling
Problem Definition

- In the course of this research it is intended to carry out an in-depth study of context modeling for a business process, to develop a framework that extends UML to model important contextual aspects of a business process and translate them to appropriate configuration decisions by building on one of the existing customizable business process models.
Motivation

- The strong impact of a process context on business process flow
- The automation of customization decisions based on contextual information
- The focus on context provides a tighter cause-effect relationship between the demands for process flexibility and their impact on processes and vice versa
- Context Modeling has received less research attention within the field of BPM
Application Domain

- The research course of this thesis will focus on the Business processes related to the field of Airline Ticket Reservation
  - It is a rich domain with many decisions and details related to Context
  - It has been used as the application domain for some related works in the field of business process configuration and context modeling with EPC
    - There will be bench marks and results to compare with to be able to judge the efficiency of the model
A goal-oriented process modeling approach to identify relevant context elements and framework and a Meta Model are proposed for classifying relevant context.

Rosemann divides the context of a BP into disjoint categories.

Immediate context:

- Elements that go beyond the constructs that constitute the pure control flow, and covers those elements that directly facilitate the execution of a process

Examples:

- What data do I require?
- Which organizational resource is in charge for the next activity?
- What application supports this process step?
Related Works: Rosemann 2008

Immediate context:

- Most Existing Modeling Techniques support the representation of immediate Context

Table 1: Popular process modelling techniques and supported perspectives

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Internal context:

- Various elements of an organization have indirect influence on a business process
- The internal system of an organization incorporates elements such as resources, norms and values, concerns and interests, strategy, structure and culture

Example:

- A change from a quality-focused strategy to a cost-cutting strategy, for instance, will have an impact on a broad range of business processes (e.g., elimination of quality control activities and scaling down of special resources)
Related Works : Rosemann 2008

External context:

- Compromises the elements that are outside the organization control but reside in the business network where the organization operates
  - it might not affect the minute steps of a business process but will definitely have an impact on the overall design of the business process

External context is divided as follows:

- Elements related to suppliers, competitors, investors and customers
- Factors related to a specific industry
  - Example: overall demand for the services of an industry, technological innovations
- Regulations such as industry-specific practices
  - Example: supply chain management practices
Related Works: Rosemann 2008

- Environmental context:
  - It captures the overall environment as a system with comprehensive boundaries.
  - Its elements include things like environmental variables /factors such as:
    - Weather
      - Example: increasing call volume during storm season
    - Time
      - Example: different business operating models on Sundays or before Christmas
    - Workforce related factors
      - Example: overall shortage or strike
Rosemann used the idea of process goals to allow evaluation of the potential contextual elements and evaluate them according to the four layers described above.

Introduces a context model for BPM (CM4BPM) and a role-based business process model (RBPM), and presents an approach allowing enacting processes with respect to the context.

The approach consists of using contextual knowledge in order to enhance the adequacy and the coherence of the assignments during the enactment of the business processes, for instance, actor-to-role or process-to role assignments.
Related Works: Selmin Nurcan 2009

Related Works: Selmin Nurcan 2009

- Context related knowledge (CRK):
  - The collection of implicit assumptions that is required to activate accurate assignments in the business process at the model and/or instance level
  - The context related knowledge covers any circumstance that impacts the assignment relations

- Context is divided into Static and Dynamic context

- Nurcan based his model on first-order predicate calculus
The context is captured using facets which describe the non-functional features; each facet is addressed by some attributes. Attributes have values that are directly measurable.

The CRK can be represented using a structure of graphs. The procedure for BP instantiation is illustrated in Figure 2.

Figure 2. Procedure for BP instantiation

Nurcan’s conclusion:

- The support of the CRK requires four main steps as follows:
  - Context elicitation which allows to capture, to assemble, and to structure the contextual information.
  - Context categorization using the context tree.
  - Adaptation of CRK to a particular application domain and to measure it.
  - Selection and activation of the appropriate instances of BP model entities and assignments.
Related Works: Salomie 2008

- Salomie discusses two fundamental research problems in the domain of context sensitive systems:
  - The development of a generic context model that can be used to represent general purpose contexts in a computer interpretable way
  - The context model management
Related Works : Salomie 2008

- The context model is based on representing actors, resources and policies from the real world and uses BDI (Believes Desires Intentions) agents for context management and processing.
- The basic context model is defined as a triple $C = <R, A, P>$.
- The context model is mapped onto different real contexts by populating the sets with real context specific elements.
  - The mapping result is a specific context model $CS = <RS, AS, PS>$. 
Related Works: Salomie 2008

RAP Context Model quoted from Ioan Salomie, Tudor Cioara, Ionut Anghel, Mihaela Dinsoreanu “RAP – A Basic Context Model, 2008"
Related Works: Salomie 2008

Context Model Concept quoted from Ioan Salomie, Tudor Cioara, Ionut Anghel, Mihaela Dinsoreanu “RAP – A Basic Context Model, 2008"
Related Works: Salomie 2008

- A context resource is defined as a physical / virtual entity which generates and / or processes context information.

- An actor represents a physical or virtual entity that interacts directly with the context or uses the context resources to fulfill its needs.

- A policy represents a set of rules that must be followed by actors or resources present in the context influence zone.
Related Works : Salomie 2008

- Salomie et Al (2008) also explored in their research the idea of context management; in the suggested management model four types of generic agents were introduced:
  
  Context Model
  
  - Administering Agents
  - Context Interpreting Agents
  - Request Processing Agents and
  - Execution and Monitoring Agents
Simsons et Al (2007) explores UML Context Modeling Profile for Mobile Distributed Systems

The paper proposes the Context Modeling Profile (CMP), a lightweight UML extension, as a visual language for context models in mobile distributed systems.

The resulting models visualize meta information of the context, i.e. source and validity of context information, and reflect privacy restrictions.

The profile provides several well-formedness rules for context models supporting the development of context-aware mobile applications through an adequate visual modeling language.
Related Works: Simons 2007

Extract of the context model of a meeting system quoted from Simson et Al “A UML Context Modeling Profile for Mobile Distributed Systems” Proceedings of the 40th Hawaii International Conference on System Sciences - 2007
Related Works: Simons 2007

- Meeting Room Context Model:
  - The model consists of small classes each representing a context item type
    - A context item of type Person has the properties forename and surname and is linked with other context items, e.g. an activity or a room.
    - The end names of the associations are used to access the linked context items
  - When exchanging a context item
    - This facilitates the transfer of a context item
    - The model provides a suitable way to achieve the intended distributed storage of individual user contexts
Research Approach

- Extending UML to support extended context modeling in one or more of the following:
  - Immediate Context
  - Internal Context
  - External Context
  - Environment Context
- Using the new context modeling extension together with current configurability extension to design a framework for BPM that is context aware and configurable
Research Approach

• Linking the context model to do automatic configuration decisions on the existing configurable BPM in UML
• Setting metrics to evaluate the efficiency of the framework
• Studying Reference BPM for a chosen application domain (e.g. Airline Ticket Reservation)
Tool Needed

- IBM Rational Rose (Currently under investigation)
  - Reasons for choosing the tool:
    - Its support for extensibility in previous researches for configurable BPM
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Related Journals

- TOSEM (ACM Transactions on Software Engineering and Methodology)
- TOMACS (ACM Transactions on Modeling and Computer simulations)
- TSE (IEEE Transactions on Software Engineering)
- IJBPIIM (Int. J. Business Process Integration and Management)
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