Capability Driven Development of Context-aware Enterprise Applications – Challenges, Approach and Experiences

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based on FP7 project CaaS:
Short info about Janis

- PhD from KTH, 2001
- Prof at SU, 2015
- Teaching UML to 500 students

- Research interests: EM, EA, EE, RE
Outline

The general need for capability
Overview of the CaaS project
Overview of the application cases at SIV (Germany) and Everis (Spain)
Overview of the CaaS methodology and development environment
Other work done
Reflection on challenges and the work ahead
Motivation: context changes, businesses need to adapt

Stockholm Arlanda has a goal not to shut down the flight operations due to snow.

....but
Capability as a Concept

• Enterprises must focus on their capabilities: *the ability and capacity that enables an enterprise to achieve a business goal in a certain operational context*.

• What is a Capability?

  - The ability to engineer a bridge, e.g., skills, experience.
  - The capacity such as money or tools to build a bridge.
  - The context in which the bridge must be built and used (location, weather, etc.).
Key Concepts: Capability & Context

• Capability is the ability and capacity that enable an enterprise to achieve a business goal in a certain context.
• Context refers to situational properties relevant to capability delivery.

• The company wants to sell ice creams on streets as long as it is sunny and the temperature is within a given range.
• Context influences: rain, public events, season
Solution

- **Capability as a Service**
- A (reasonably) novel paradigm supported by four cornerstones

- Defined Best Enterprise Practices as Patterns
- Capability-driven Development (CDD) Methodology
- Capability Delivery Adjustments According to Context
- Capability Design and Delivery Environment
The overall approach is use case driven.

- **WP1** Requirements
- **WP2** Use case (SIV)
- **WP3** Use case (CLMS)
- **WP4** Use case (Everis)
- **WP5** Methodology (UR)
- **WP6** Environment (Croz)
- **WP7** Exploitation (Everis)
- **WP8** Dissemination (UPVLC)
- **WP9** Management (SU)

### Table 11: Medical compliance pattern

<table>
<thead>
<tr>
<th>Name</th>
<th>Rule Compliance Pattern for medical issues (BPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem</td>
<td>To deal with the need of automated rule compliance of vessels approaching different ports with different legislations regarding medical issues</td>
</tr>
<tr>
<td>Context</td>
<td>Vessel approaching a new port, Compliance with local regulations regarding the crew medical status required</td>
</tr>
<tr>
<td>Solution</td>
<td>BPM Pattern</td>
</tr>
</tbody>
</table>

**Guidelines**

User can exploit this set of processes for the overall business process of the rule compliance system regarding medical status of the vessel's crew.

**Keywords**

Rule compliance, Port authorities, Maritime, Business process

5.4.3.2 The Cargo Compliance Pattern (Business Process View)

This pattern is a business process model applicable in the cases where a vessel, approaching a port, is required to ensure compliance regarding its cargo. Table 12 summarizes all the basic characteristics of the proposed pattern.
Capability Driven Development
- overall meta-model -
Capability Driven Development
- life-cycle process -
Architecture Overview of Capability Context Platform (CCP)
## Travel management dashboard

### Trip #849-2014

#### Current Context Situation

- **Travel conditions:** Normal
- **Regulatory requirements:** Compliant
- **Calendar:** Significant conflict
- **Weather:** Normal
- **Traffic:** Low

### Key Performance Indicators (KPIs) and Adjustments

<table>
<thead>
<tr>
<th>KPI</th>
<th>Value</th>
<th>Adjustments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cost</td>
<td>650</td>
<td>Travel day earlier to reduce scheduling</td>
</tr>
<tr>
<td>Days late</td>
<td>0</td>
<td>0 conflicts by 6 hours</td>
</tr>
<tr>
<td>Accommodation cost</td>
<td>300</td>
<td>(click for more details)</td>
</tr>
<tr>
<td>Severity of scheduling conflicts</td>
<td>8</td>
<td>(click for more details)</td>
</tr>
</tbody>
</table>

### Context Indicators

<table>
<thead>
<tr>
<th>Context Indicators</th>
<th>Value</th>
<th>Patterns suggested</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours scheduled</td>
<td>8</td>
<td>Apply Costs justification pattern to justify</td>
</tr>
<tr>
<td>Temperature</td>
<td>25</td>
<td>accommodation costs</td>
</tr>
<tr>
<td>Travel conditions</td>
<td>Normal</td>
<td>(click for more details)</td>
</tr>
<tr>
<td>Accommodation cost limit</td>
<td>200</td>
<td></td>
</tr>
</tbody>
</table>
Capability Elicitation

Capability elicitation, starting perspective:
- *Goal-first*: business strategy
- *Service-first* customer needs
- *Context-first*: business conditions
The CaaS partner SIV is a Germany-based independent software vendor (ISV) and a business process outsourcing (BPO) provider for the utilities industry.

SIV has developed a domain-specific ERP platform kVASy® that supports all relevant value-added processes of market players.

All BPO services offered to SIV’s customers – mostly grid access providers and balance suppliers – are based on the functionalities of kVASy®.

SIV’s business goal is to deliver a maximum of business value to its customers by combining best practice business processes with compliance to the market’s ever changing business rules and regulatory requirements.
Elicitation – A Case at SIV

Goal 9
To increase the degree of automation of case handling

Goal 5
To support any communication protocol between market partners

Goal 1
To constantly deliver business value to its customers

Goal 6
To support new market roles

Goal 2
To efficiently control the business processes

Goal 1.1
To implement change requirements for the kVASY® platform in an agile way

Goal 1.2
To run the kVASY® platform as a cloud based service

Goal 1.3
To significantly reduce the complexity of the kVASY® platform

Goal 10
To reduce process costs

Goal 2.1
To optimize case throughput

Goal 2.2
To achieve high process quality

Goal 3
To implement customer change requests in an agile way

Goal 4
To quickly adapt to regulatory changes that affect market communication

Goal 8
To transform kVASY® into a SOA based platform

Goal 7
To reduce time-to-market of product enhancements

Capability 1
Dynamic BSP Support

Goal 2.1
To optimize case throughput

Process 1
Message validation process

Iteration
Elicitation – A Case at SIV

“Message Validation” business process:
...the recipient is supposed to validate each message (such as “energy consumption data”) against the underlying message specification. The sender is to be notified about any invalid message within a deadline specified by the regulatory authority.

Given the large number of messages to be processed, there are usually many concurrent cases that need some clearing. Hence, the size of the backlog can grow considerably over time leading to missed deadlines and/or overtime work. Thus, the customer's workload, the current backlog size, message type, exception types, and other, are represented by (different) context models, and (different) capabilities are elicited to handle those contexts.
Depending on the concrete context situation, the task “Remedy case” can be dynamically routed to the external business service provider (BSP), or left with the customer.
Documentation in the CDT

- Model-oriented, with natural language for annotations
- Open to different modeling languages
- Intra- and inter-model links can be defined for traceability
Summary of experiences at SIV

• The main objective of the process is to facilitate the specification for capability requirements in an integrated way following the multi-perspective views defined in the CMM to facilitate further application development.

• Where to start - from business goals, services, or from relevant business contexts. In any of these strategies, both the functionality and the quality aspects of capability are captured, where the first are dictated by the CM, and latter by the setting of the goals and KPIs.
After the adoption to the new law requirements, it was decided to create a common infrastructure (the SOA platform) for the whole network of councils to share common services. In this way, all the councils could access the services offered by the platform, even though they could customize some aspects depending on each one's needs. It is shown in Figure 4:

Ca 100 municipalities
Varying contexts
Ca 10000 services running
Many external providers
Manual activation and maintenance
Capability Design Model for Dynamic Service Registration

Context model fragment:

Pattern:

Process Variants:

Capability:

Goal:

KPI:
Service Promotion Goals Model

Goal 1 (+): To optimize SOA platform

Goal 2: To improve user satisfaction
Goal 3: To ensure compliance with legal framework
Goal 4: To reduce costs
Goal 5: To improve quality assurance
Goal 6 (+): To be able to promote services

Goal 7: To ensure acceptable response time

Goal 8: Run highlighting procedures automatically
Goal 9: Automatic service highlighting ability?
Goal 10: Run highlighting procedures manually

Goal 11 (+): To be able to promote services

Goal 12: To reduce the number of paper submissions
Goal 13: To reduce the number of face-to-face actions

Goal 14: To inform municipalities about available services
Goal 15: To increase the number of services used
Goal 16: To highlight services in catalogs

Goal 17: To rank services
Goal 18: To calculate similar municipalities
Capability design for automatic service promotion

The sub process of services ranks calculation was described in Section 5.2. The context elements that influence this process are in Table 32. The influence becomes as outputs of the adjustment algorithms execution. They influence the following activities: monitor context data, predict context data and calculate similar municipalities.

The sub process of run highlighting procedures was described in Section 5.2. The context element that influences this process is the number of maximum highlight services. It must be taken into account when deciding the services to be highlighted.
For capability design, incl. goals, KPIs, context, measurable properties, etc.

For variability design

For specifying adjustment algorithms
How should this work?
Elements of a Capability Model
How should this work? Elements of a Capability Model

Business Service (Example: Process + Variants)

Context Model
- Policy Type: advanced forward = specific to size = ....
- Weather: = long cold period = ....

Variation depending on

Capability Model

Patterns
- Entering....
- Joint meta-model
  same modeling tool

Policy Type
- Advanced
- Specific

Enterprise Model (Concepts/Goals)
The third use case: Model Driven Development of CDAs

CCP → MP value push → CNA

MP information → Model and implementations

MP value push → Adjustment information

CDT → CDA

Data providers

zAppDev tool by CLMS, UK
Other work done

- Requirements for the CDD methodology and CDD environment
- Pattern repository
- CDD methodology for designing capabilities and solutions (1\textsuperscript{st} version)
- Application of the CDD methodology at three industrial companies
- CDD environment (two releases)
- Market and exploitation plan
- Dissemination: (1 journal paper, 10+ conference and workshop papers, 2 workshops organized)
Where would we use this approach?

- Strategic planning and organizational design
  - Assessing the impact of context on the business design

- Operational running of business
  - Monitoring the KPIs, adjusting the business delivery

- Making use of emerging theories and technologies
  - E.g. consumer values and preferences, sensors, and big data

- Addressing cross-sectorial challenges
  - E.g. energy efficiency, sustainability, cyber resilience

<table>
<thead>
<tr>
<th>Capability</th>
<th>Goal</th>
<th>Context</th>
<th>Capacity</th>
<th>Ability</th>
<th>Best practice</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
</tr>
</tbody>
</table>
Plan:

- Current state:
  - Year 1: Conceptual feasibility
  - Year 2: Technological feasibility
  - Year 3: Business feasibility

CaaS to market
Contacts

• http://caas-project.eu/

• Papers (among many):


• PoEM 2015 in Valencia, paper deadline July 17

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