Enterprise COllaboration & INteroperability

User requirements elicitation adapting Serious Gaming approach.

COIN Summer School 2010
Summer School on Advanced Technologies for Knowledge Intensive Networked Organizations

Aachen, 19.10.2010
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Content

- Challenge in COIN
- Gaming approach
- COIN requirements elicitation methodology
- Gaming phases
- SECONDS, refQuest
- Example results
- Final evaluation by end users
Introduction

• Services and ICT systems are traditionally build on the basis of **specific** requirements formalized and delivered by customers to IT solutions providers.

• Slightly different in RTD projects like COIN, since it aims at developing **innovative** services fulfilling business need in the years to come:
  – If it is an innovation like SMS it meets a not clearly identified and formalized market need.

• Such innovative services are usually **not very well defined**, because the user might not be aware of what he/she really needs and would like to have (limitation of ideas).
Challenge in COIN

- Define a specific user requirements elicitation & management methodology for innovative services in enterprise collaboration (EC) & interoperability (EI).
- Traditionally user requirements are collected by a thorough business process analysis and by completing different questionnaires/interviews, etc.
- This requires that the user knows **exactly** what he wants and needs. In COIN this is not possible, and therefore a new approach needs to be found, which supports the generation of suitable user requirements for innovative services.
## Traditional approaches

<table>
<thead>
<tr>
<th>Technique</th>
<th>Short description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brainstorming</td>
<td>a group creativity technique for generating ideas for the solution of a problem</td>
</tr>
<tr>
<td>Document Analysis</td>
<td>a technique for eliciting requirements of an existing system by studying available documentation</td>
</tr>
<tr>
<td>Questionnaires</td>
<td>an instrument consisting mainly of questions for gathering information from respondents</td>
</tr>
<tr>
<td>Focus Groups</td>
<td>an interactive group environment with the aim to elicit ideas and attitudes about a specific product, service or opportunity</td>
</tr>
<tr>
<td>Interface Analysis</td>
<td>an instrument helping to clarify system boundaries and define requirements subsequently</td>
</tr>
<tr>
<td>Interviews</td>
<td>a systematic approach to elicit information from a person or group by asking questions and documenting responses</td>
</tr>
<tr>
<td>Prototyping</td>
<td>a technique to uncover and visualize interface requirements before application is designed and developed</td>
</tr>
<tr>
<td>Requirements Workshops</td>
<td>a structured way to scope, discover, define, prioritize and reach closure on requirements for a target system</td>
</tr>
<tr>
<td>Reverse Engineering</td>
<td>an elicitation technique that helps extracting implemented requirements from software code</td>
</tr>
</tbody>
</table>

→ Useful, but do for example not sufficiently take into account overall cross-organisational processes in multi actor environments like Collaborative Enterprise Networks.

→ Awareness of needs – limitation of ideas

→ What makes our approach different?
  → While playing, the user experiences needs s/he was earlier not aware of.
Motivation for Serious Games

Harder competition, more complex products in a global production environment leads to changes in the working environment of employees.

From:
Quasi stable, relatively simple socio-technical Systems

To:
complex, instable dynamic socio-technical systems
Challenges

- Manufacturing enterprises need to be able to face new business environment and new collaboration situations on short term.
- Need for continuous organisational and individual learning (the half-life of knowledge declining, the employee need to update his know-how on a regularly basis).
- The dynamical environment leads to new requirements on organisational structure and on the involved employees.
- Fast technological changes and a decreasing product life cycle creates a need for shorter development cycles of products and services.
- Difficult for the involved employees and enterprises to define the needs on future product and services fast and precise enough.
- Traditionally, the employee will learn by either facing the challenges during daily work alone or by learning from more experienced employees.
Addressed problems

- Dynamics in complex systems
  - Various kinds of entities and their inter-relationships
  - Associated risks and uncertainties
  - Impacts of decisions
  - Assessment of side-effects
- Ability to collaborate
- Intercultural communication in enterprise networks
- Ideation in innovation processes
Gaming in Training and Education

- Serious games offer valuable new methods for learning through simulated experience, without the risk of failure in real life.
- Games are playful processes that may or may not contain formal rule structures and winning conditions, but nonetheless seek to inspire, structure or challenge the player.

SOFT SKILLS:
- Collaboration
- Cooperation
- Communication
- Learning in distributed systems
- Insight into different industries
- Creativity

HARD SKILLS:
- Project management
- Risk management
- Process management
- Extended product
- Strategic decision making
BIBA’s Background in Gaming

BIBA is working since 1995 on (web based) collaborative games that

– simulate distributed work in global production networks.
– address Concurrent Engineering in networked organisations.
– reflect inter-organisational learning / knowledge exchange in Virtual Organisations.
– address collaboration and decision making processes in collaborative production scenarios.
– address strategic manufacturing in a multi-player virtual business environment.
Gaming approach

• Games are playful processes that may or may not contain formal rule structures and winning conditions, but nonetheless seek to inspire, structure or challenge the player.

• In COIN we adopt games for requirements elicitation.
  – Provides a safe environment for experimenting with new strategies and to observe the impact of the own decision for partners.
  – Provides a realistic multi-stakeholder environment, supporting collaborative networks.
  – Allows the players to communicate and interact with each other and are thus being confronted with unexpected scenarios which are influenced by the behaviour and decisions of other players.
  – Allow the facilitator to take an active role in the game by using an authoring/monitoring tool.

• The COIN user requirements on new EC and EI services are collected in a three step approach, using two different games (SECONDS and refQuest).
COIN requirements elicitation methodology

Pre-gaming phase

- Analyse collaboration performance
- Collect business processes
- Prepare serious games
- Identify needs (SECONDS)
- Specify requirements (refQuest)
- Analyse gathered data
- Document requirements with req lists

Gaming phase

Post-gaming phase

1. Collect business processes
2. Prepare serious games
3. Identify needs (SECONDS)
4. Specify requirements (refQuest)
5. Analyse gathered data
6. Document requirements with req lists
Pre-gaming phase

• All necessary information that is needed for performing gaming phase is collected.  
  – What do the end users think about current collaboration practices in their companies?
• Then the current business scenarios from each end user have to be collected and analysed.
• The rest of the time of the pre-gaming phase is used to prepare the games used for requirements elicitation.
  – Design a neutral collaboration scenario.
  – Include descriptions of existing baseline services.
The main objective of the gaming phase is the collection of the first main requirements and needs by users by using two different games.

- First the multiplayer game SECONDS is simulating the business processes along the CN life cycle. Missing needs are documented in brainstorming sessions.

- In a second step the multiplayer game refQuest is used for the further refinement of the previously identified needs in SECONDS, more precisely for the formulation in terms of end user requirements.
Objective: Increasing the awareness and understanding of the impact of strategic decision making in distributed manufacturing by simulation of production networks.

A process in Seconds can be virtually anything that deals with resources: manufacturing a product, consuming raw materials, buying goods, etc. Every process needs a certain amount of time, consumes resources and has a specific output.
SECONDS

- SECONDS (in combination with meta-plans)
  - Seconds is a simulation game that is used to provide an experimental “playground” to learn by experiencing.
  - It is a collaborative game in a virtual environment.
  - Simulates the user specific business processes in which the users are playing throughout the collaborative network life cycle.
  - After each phase of the collaborative network life cycle the users specify in brainstorming sessions the services that they have missed while playing Seconds.

Preparation phase → Brainstorming

Formation phase → Brainstorming

Manag. & Operation phase → Brainstorming

Dissolution phase → Brainstorming
Example results from SECONDS

**Preparation phase**
- New product development
- Market analysis
  - Market + Supply chain intelligence (no existing cluster)
  - In reality market & presales driven – sales leads product.
- Collaborative Manufacturing
  - Open info to cluster enterprises about prior network co-op of each enterprise (network experiences)
  - Trust management system
    - Build trust (some method for making this)
  - Secure communication channel

**Formation phase**
- Missing services?
- Multi-disciplinary PM
  - Presorting competencies – trust in the company
  - Identification of competencies and mapping
  - Compare capabilities
  - SME Competence - available companies – free companies
  - Visibility of who is in the VO
  - Communication of who has the business opportunity
- Human Interaction to SOA
  - Empty!
- Collaborative Manufacturing
  - VO facilitator required
  - Broker service – who knows all knowhow to VO
  - Network coaching – behaviour & style management
  - Rules and responsibilities of VO members
- ’Open’ information on offers
  - Communicating the business opportunity to potential partners
- Human Interaction to SOA
  - Rules and responsibilities of VO members
  - Model and visualize value network
  - VO models required
  - Track record and rating others
  - Forecasting capability to deliver
- New product development
  - Risk analysis

**SECONDS results, 02.06.2008**
**Objective:** Support the innovation generation process by giving the player the opportunity to look at a problem in different ways

- Multi-user game.
- Used in a workshop setting.
- Support the teamwork in idea generation within a company (and/or inter-organizationally).
- Each player/team changes the perspective in every round and thereby develops a holistic solution on the problem.
- The idea generated in this process will be evaluated from either the players, the moderator or also from the rest of the company.
- Ideas will be stored in a DB for later use or for exporting.
refQuest

- Develop further ideas on the services they need
- Refining results from Seconds

Considered area

Select a perspective

Identify individually requirements

Identify commonly requirements (in groups)

Prioritise commonly requirements (in groups)
Post-gaming phase

- refQuest DB entries were in XML format.
- A tool was used to extract and transform the refQuest DB entries into readable table format.
- Entries were „mapped“ against list of baseline services for redundancy reasons.
- „Grouping“ of requirements.
- Additional iteration step with end users.

<table>
<thead>
<tr>
<th>name</th>
<th>entry_type</th>
<th>go...</th>
<th>value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirement</td>
<td>simple</td>
<td>txt</td>
<td>null</td>
</tr>
<tr>
<td>Description</td>
<td>textfield</td>
<td>txt</td>
<td>null</td>
</tr>
<tr>
<td>Requirement</td>
<td>simple</td>
<td>txt</td>
<td>null</td>
</tr>
<tr>
<td>Description</td>
<td>textfield</td>
<td>txt</td>
<td>null</td>
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<tr>
<td>Requirement</td>
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<td>txt</td>
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<td>Description</td>
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<tr>
<td>Requirement</td>
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<td>Requirement</td>
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<td>null</td>
</tr>
<tr>
<td>Description</td>
<td>textfield</td>
<td>txt</td>
<td>null</td>
</tr>
</tbody>
</table>
Selection procedure

• A more qualitative approach by asking *end users* to perform a ranking/grading

• Following ranking scheme was applied:

  0) I do not care about this service and requirement(s) respectively.
  1) It could possibly be helpful to have this innovative service.
  2) It could surely be helpful to have this innovative service.
  3) It is crucial to have this innovative service.
Conceptual Approach in a Nutshell

End user meeting in Espoo

Baseline EC
Baseline EI

End user meeting in Bremen (Gaming workshop)

RefQuest
Documentation of requirements
Need → Ideation

Collaboration Preparation
Collaboration Formation
Collaboration Operation
Collaboration Dissolution

Neutral Scenario
Identification of needs

End user involvement from Home

<table>
<thead>
<tr>
<th>EC classes</th>
<th>EI classes</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Product Development</td>
<td>Information Interoperability Services</td>
</tr>
<tr>
<td>Collaborative Manufacturing</td>
<td>Knowledge Interoperability Services</td>
</tr>
<tr>
<td>Multidisciplinary Project Management</td>
<td>Business Interoperability Services</td>
</tr>
<tr>
<td>Human Interaction to SOA</td>
<td></td>
</tr>
</tbody>
</table>

BIBA
Gaming workshop

- Generally the quality of requirements depends much on the willingness of end users to participate in the approach.
  - How good does the approach integrate end users?
  - How did end users feel when being confronted first time with games for requirements collection?
- A first **anonymous** evaluation of the end users during the gaming workshop.
Final evaluation by end users (2/2)

1. Using games for the process of requirements collection was a new and interesting experience for me. [Result: 4.83]

2. The gaming approach led to the identification of many requirements for innovative services. [Result: 4.16]

3. The gaming approach is very useful for bringing in short time together many people from different areas in a lab-controlled business environment. [Result: 3.83]

| Likert scale: | 5-very much | 4-somewhat | 3-undecided | 2-not really | 1- not at all |
**Final evaluation by end users (2/2)**

Open answers from an end users‘ perspective:

<table>
<thead>
<tr>
<th>Lessons learnt (PRO)</th>
<th>Lessons learnt (CONTRA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Collection of requirements from different areas</td>
<td>• In particular the refQuest game did not provide that stimulating environment. It was rather a sophisticated questionnaire than a game.</td>
</tr>
<tr>
<td>• Gaming environment supports involvement and placing oneself into a positive/open attitude for generating new ideas and „multi-player“ mode provides good simulation of real life environment</td>
<td>• The high number of requirements did not allow to focus on key requirements</td>
</tr>
<tr>
<td>• Concurrent requirements collection increased partner motivation</td>
<td>• First game (SECONDS) was at very basic level of „business processes“</td>
</tr>
<tr>
<td>• Collective response from parties allowed a degree of consensus</td>
<td></td>
</tr>
</tbody>
</table>
Thank you for your attention!

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Back up
Business use cases

• Business use cases are widely used as a tool in software/systems engineering, but also by business analysts.
• Suitable for documenting end-to-end business processes.
• Use cases consist of
  – Use case diagram
  – Description of the use case
COIN Cross Teams

• BUCs do **not** span complete CN life cycle anymore.

• CTs are mostly concentrated on **one to mostly three** phases of the CN life cycle

  → **Leads to greater detail of use cases**
  → **Less generic**
**Detailed BUC template**

**Several Goals:**

- Being able to **represent end user specific processes at a glance.**
- Having the **differences between the AS-IS and the TO-BE situations next to each other** in order to see differences immediately and to better contrast against each other.
- **Inclusion** of possible performance **indicators** for measuring end user specific benefits.

<table>
<thead>
<tr>
<th>Business Use Case Name: <strong>Template</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AS-IS Business Use Case</strong></td>
</tr>
<tr>
<td><strong>Actors:</strong></td>
</tr>
<tr>
<td>2.</td>
</tr>
<tr>
<td>3.</td>
</tr>
<tr>
<td><strong>Systems (existing):</strong></td>
</tr>
<tr>
<td>2.</td>
</tr>
<tr>
<td>3.</td>
</tr>
<tr>
<td>(4.)</td>
</tr>
<tr>
<td><strong>Precondition:</strong></td>
</tr>
<tr>
<td><strong>Postcondition:</strong></td>
</tr>
<tr>
<td><strong>Business Use Case Diagram:</strong></td>
</tr>
<tr>
<td><strong>Business Use Case Description:</strong></td>
</tr>
<tr>
<td>1. The use case starts when….</td>
</tr>
<tr>
<td>2.</td>
</tr>
<tr>
<td>3.</td>
</tr>
<tr>
<td>4.</td>
</tr>
<tr>
<td>5.</td>
</tr>
<tr>
<td>6.</td>
</tr>
<tr>
<td>7.</td>
</tr>
<tr>
<td>8. The use case ends when ….</td>
</tr>
<tr>
<td><strong>Indicators:</strong></td>
</tr>
<tr>
<td><strong>Only if applicable.</strong></td>
</tr>
</tbody>
</table>
# Example BUC (1/2)

## (CT c-Production Planning)

## Business Use Case Name: Plan the production process

<table>
<thead>
<tr>
<th>AS-IS Business Use Case</th>
<th>TO-BE Business Use Case</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Actors:</strong></td>
<td><strong>Actors:</strong></td>
</tr>
<tr>
<td>1. Supplier’s purchase office</td>
<td>1. Supplier’s purchase office</td>
</tr>
<tr>
<td>2. Supplier’s project manager</td>
<td>2. Supplier’s project manager</td>
</tr>
<tr>
<td>3. Supplier’s program manager</td>
<td>3. Supplier’s program manager</td>
</tr>
<tr>
<td>4. Sub-supplier sales dep.</td>
<td>4. Sub-supplier sales dep.</td>
</tr>
<tr>
<td>5. Sub-supplier technical dep.</td>
<td>5. Sub-supplier technical dep.</td>
</tr>
<tr>
<td><strong>Systems (existing):</strong></td>
<td><strong>Systems:</strong></td>
</tr>
<tr>
<td>1. Production planning software (open source)</td>
<td>1. Production Planning Service (PPS) (IS WP4.3)</td>
</tr>
<tr>
<td>2. E-mail system</td>
<td>2. Partner Search &amp; Suggestion (BS)</td>
</tr>
<tr>
<td>3. Telephone system</td>
<td>3. Collaborative Production Planning Platform (C3P) (IS WP4.3)</td>
</tr>
<tr>
<td><strong>Precondition:</strong></td>
<td><strong>Precondition:</strong></td>
</tr>
<tr>
<td>An existing supply contract with a sub-supplier.</td>
<td>An existing supply contract with a sub-supplier.</td>
</tr>
<tr>
<td><strong>Postcondition:</strong></td>
<td><strong>Postcondition:</strong></td>
</tr>
<tr>
<td>A complete production planning schedule</td>
<td>A complete production planning schedule</td>
</tr>
</tbody>
</table>

### Business Use Case Diagram:

![AS-IS Business Use Case Diagram](image1)

![TO-BE Business Use Case Diagram](image2)
### Example BUC (2/2)
**CT c-Production Planning**

#### Business Use Case Description:
1. Supplier’s Program and Project managers plan the production of final products by verifying and inserting into Production planning software the following data:
   a. monthly rate of final products to be produced
   b. annual rate of final products to be produced
   c. personnel to be involved to ensure the number of final products required according to supply contracts.
2. Supplier’s Program and Project managers then verify with supplier’s purchase office the list of available sub-suppliers to involve in the production process.
3. Supplier’s purchase office contacts by e-mail/telephone selected sub-suppliers’ sales and technical departments and eventually a supply contracts of components is signed (see the BUC “Select sub-suppliers”).
4. The use case ends when a complete production planning is scheduled and Production planning software contains all data.

#### Indicators:
- Better control of final products production planning
- Better control of products and materials

---

#### Business Use Case Description:
1. Supplier’s Program and Project managers plan the production of final products by verifying and inserting into PPS tool (IS WP4.3) the following data:
   a. monthly rate of final products to be produced
   b. annual rate of final products to be produced
   c. personnel to be involved to ensure the number of final products required according to supply contracts
   d. personnel to be involved and assembly line occupancy to ensure both final products production and maintenance/assistance of defective products.
2. Supplier’s Program and Project managers then verify with supplier’s purchase office the list of available sub-suppliers to involve in the production process by using the tool “Partner Search & Suggestion (BS)”.
3. Supplier’s purchase office contacts selected sub-suppliers’ sales and technical departments by using the tool “C3P (IS WP4.3)” and eventually a supply contracts of components is signed (see the BUC “Select sub-suppliers”).
4. The use case ends when a complete production planning is scheduled and PPS tool (IS WP4.3) contains all data.

#### Indicators:
- Personnel allocation costs
- Better control of final products production planning
- Better control of products and materials
Benefits are generated from process improvements: The workshop concept

Functional capabilities of COIN services

Changes in process parameters (e.g. response times or delivered lot size)

Improvement of process performance (results, capabilities e.g. on-time-delivery)

Expected business effects => Benefits (e.g. reduced cost for penalties)

... these parameters can be influenced directly by the organisation (“enablers”), they can be regarded as “Process Xs”

... this represents the process performance received by customers and stakeholders; corresponding performance indicators can be regarded as “Process Ys”

... the corresponding indicators can be regarded as “Business Ys”

„Y is a function of X“
Benefits and performance indicators for a BUC “Do project scheduled meeting”

PÖYRY – Do project scheduled collaboration

**Changed process parameters**
- Time needed for preparation, invitation, participation and document distribution
  - COIN Innovative Services from WP4.4 provide support

**Improvements in process performance**
- Shorter time for selecting meeting participants
- Easy expansion of meeting participants
- Instant distribution of documents to all selected meeting participants
- Decrease requirement of being online while being contacted

**Benefits**
- Reduced time in the meeting scheduling process
- Reduce personnel costs
- More effective meeting
- Less iterations needed due to unavailability of participants