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Report title

Description of the BM discipline (LedsystT): From business to technology

Abstract (not more than 200 words)

This document is a description of the LedsystT business modeling (BM) discipline and the BM process. The BM process is developed to support identification of the business-related requirements, which means identification of requirements on a business level and to prepare the data for the technical design. The scope of BM ranges from the management of the input from LedsystM to the technical use case model developed in collaboration with Analysis and Design (A&D). Moreover, the complexity of the C2-system indicates a great need for collaboration. The BM has two main collaborative partners; LedsystM and A&D. Other groups with interest in the work of BM are Situation Picture (SP), Human-Factors Engineering (HFE), Requirements Derivation (RD) and Development Method (DM). The BM discipline constitutes a bridge between the business and the technique and is the first step in the work with technical design. Hence, it provides the other groups with a chance to influence the input to all of the technical work. However, an understanding of the way of work is critical if this interaction is to be fruitful. Important to note is that this document should be used as input for a more formalized process description, i.e. description of the BM discipline adaptation within the RUP artifact Development Case.

Keywords

Business modelling, RUP, requirements

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Rapportens titel (i översättning)

Beskrivning av BM-disciplinen (LedsystT): Från verksamhet till teknik

Sammanfattning (högst 200 ord)

Detta dokument beskriver disciplinen verksamhetsmodellering och dess process inom LedsystT. Processen för verksamhetsmodellering har som funktion att stödja identifieringen av verksamhetsrelaterade krav, dvs. identifiera krav på verksamhetsnivå och att förbereda insamlade data för den tekniska designen. Verksamhetsmodelleringen omfattar omhändertagandet av indata från LedsystM till den tekniska användningsfallsmodellen som utvecklas i samarbete med Analys och Design (A&D). Dessutom kommer beslutsstödssystemets komplexitet att kräva en hel del samarbete med andra gruppen. Gruppen för verksamhetsmodellering kommer framför allt att samarbeta med LedsystM och A&D. Andra grupper med intresse av verksamhetsmodelleringen är Situation Picture (SP), Human-Factors Engineering (HFE), Requirements Derivation (RD) and Development Method (DM). Disciplinen verksamhetsmodellering fungerar som en brygga mellan verksamheten och tekniken och utgör även ett första steg i arbetet med den tekniska designen. Detta medför att verksamhetsmodelleringen har en nyckelroll gentemot andra grupper och deras möjlighet att påverka indata till det efterföljande tekniska arbetet. En förutsättning för att denna interaktion skall vara fruktsam är dock förståelse för arbetsgången. Viktigt att notera i sammanhanget är att detta dokument skall användas som input för en mer formaliserad processbeskrivning, dvs. en beskrivning av anpassningen av disciplinen verksamhetsmodellering inom RUP-artifakten Development Case.

Nyckelord

Verksamhetsmodellering, RUP, krav

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Contents

1 General

This document is a description of the business modeling discipline in LedsystT and the BM process. The first chapter presents the background of the BM process, the scope of the process and lists reference documents. In chapter two, the process and fundamental entities that constitutes the BM process are described. The third chapter presents the framework of the BM process, the process step-by-step and its output. Finally, a tabular form of revision history is accessible.

1.1 Background

The Business Modeling (BM) discipline is responsible for making the business descriptions that LedsystM develop usable for technical design. In LedsystM the users themselves, i.e. representatives of the Swedish Armed Forces, describes how the organization works today and how they would like it to work in the future, here represented as the year 2010. The organization of the Armed Forces is described in a set of scenarios that are then modeled using the UML-notation as a business use case model with use case diagrams and activity diagrams with swimlanes. This modeling is done by representatives from the Swedish Armed Forces, i.e. LedsystM, with assistance of professional modelers and result in the output from LedsystM, i.e. the input to BM. In addition, the deliverables from LedsystM are supposed to include Business Analysis Models.

Due to the complexity and sheer volume of the Ledsyst project, there is a great need for collaboration among the groups in LedsystT. The Technical Process Management group (TPM) is responsible for the overall coordination in the Analysis and Design Project (ADP). In the case of BM, collaboration will mainly take place with the Analysis and Design (A&D), Situation Picture (SP), Human Factors Engineering (HFE), Requirements Derivation (RD) and Development Method (DM), see figure 1. The A&D will do the technical design. However, the technical use cases will be identified as a joint venture between BM and A&D, where BM will be responsible for the technical use case model. Thereafter A&D will be in charge for the next steps.

The DM coordinates the whole LedsystT development process. Representatives of SP and HFE have off and on been taking part in the planning of the BM process to reassure both that their aspects are incorporated in the process and that they achieve a thorough understanding of the input to their work. In addition, there will be different types of checkpoints with LedsystM since they are the real experts of the business to make sure that the models actually model the business in question. Moreover, BM is, when necessary, responsible for developing a business model of the business systems that are candidates for automation.

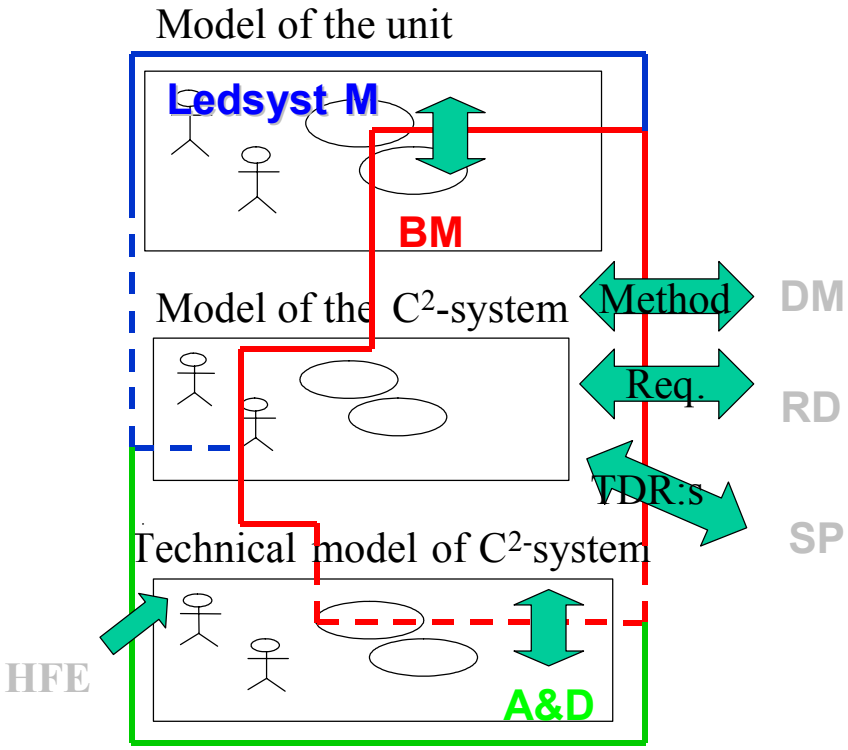

Figure 1. The BM collaboration partners in LedsystT.

The purpose with this discipline description is to present the process where business use cases are transformed to technique i.e. automation. The document describes the process both visually and textually. The target group for this document is the modelers.

1.2Scope

This document covers only the process aspects of the BM work. The BM is responsible for identifying the business-related requirements. This means to first understand the problem and identify requirements on a business level and thereafter focus on the design and the technical requirements i.e. how to solve the requirements with technique. The technical use cases will be identified as a joint venture between BM and A&D, where BM will be responsible for the technical use case model. Thereafter the A&D take responsibility of the technical design. Hence, the scope of BM ranges from the management of the input from LedsystM to the technical use case model. It should also be noted that the preconditions have changed during the work with the process described in this document. For example, the service documents referenced here have not been taken into account when elaborating the process. However, they have been referenced in the text for preparing the document for future work.

1.3 References

[1] Business use case specification LT1O D04-0319 utg 1.0

[2] Report template Information Exchange Requirement (Business Model) - LT1O D04-0301 utg 1.0

[3] Design Rule Template utg 1.0 (Temporary Instruction, 2004-03-31)

[4] DRP Service Description - LT1O D04-0278

[5] Service Definition Template – LT1O D04-0279

[6] Report template Business Model - LT1O D04-0300 utg 1.0

[7] Collaboration between LedsystM and LedsystT - LT1O D04-0297 utg 1.0

[8] Business Architecture - LT1O D04-0296 utg 1.0

[9] Modeling guidelines - LT1O D04-0299 utg 1.0

[10] LedsystT business model template – LT1O D04-0318 utg 1.0

[11] BM discipline description model - LT1O D04-0295 utg 1.0

2 Fundamentals of the BM Process

2.1 General

This chapter presents the process and fundamental entities that constitutes the WP BM process. First the Rational Unified Process (RUP), which is the process on which the WP BM process is based, is presented. Thereafter the entities Information Exchange Requirements (INR), the Technical Design Rules (TDR), and services are described. Finally, a short description of the business model is presented.

2.2 Rational Unified Process

The Rational Unified Process (RUP) is a process mainly developed for software development projects that uses the UML notation, and is a structured way of describing modeling from business to technical design. In this section the different diagrams and objects that are used are described. One thing that should be noted is that the systems-of-systems-concept is not handled specifically by RUP. Eventually, the RUP SE (System Engineering) will be used. However, this RUP-version has not been tested at the writing of this document, although it has influenced the RUP adaptation described here.

Fundamental to the RUP is object orientation and component based architecture. In order to reuse objects all UML elements has to include information about operations, attributes, descriptions and definitions. The attributes/definitions could be either external documents or be identified during the process. In addition, all catalogues will be named after the level they treat to support a tree structure that is easy to navigate in.

2.2.1 Levels of Representations

The BM uses three levels of representation:

- **The Business use case model** is represented by business actors and business use cases which is collected in use case diagrams (describes the abilities that the surrounding world expects of the business)
- **The Business analysis model** is represented by the business entities, business systems, and business workers, which is collected in class diagrams. The class diagrams describes the internal business and its realization. Hence, the business use case realizations are part of the Business Analysis Model.
- **Use case model** is represented by actors and use cases which is collected in use case diagrams (describes the technique in the C2-system)

The traceability between each of these levels is described through (business) use case realizations.

2.2.2 The diagrams

In the ***use case diagram***, the interaction between the actors and use cases is visualized. In the use case diagram it is important to describe both pre- and post-conditions and scope of the use case to see how everything is interconnected. The pre-conditions are added at the same time as the use case, actors and relations are described. In the use case diagram it is possible to justify the business. A business use

case is initiated by an actor and is justified if an actor is satisfied with the result of its realization. A rule of thumb is that if something extra has to be provided to the use case for an actor to be satisfied it is not a use case. Hence, if the actor is unsatisfied, a further break down of the use case has to be done. At the same time, the questions what value a use case result in and why should be raised.

The ***activity diagram*** describes the chronological sequence of activities. When the activity diagram is extended with swim lanes, the activities are mapped onto business actors and business workers, it is possible to model who is responsible for an activity. However, if the activity diagram is extended with swimlanes, the original activity diagram will not be saved, i.e. only one activity diagram will exist. Further, instead of having several levels of activity diagrams it is better to create a use case diagram as a meta-step and hence increase the readability.

The ***sequence diagram*** is an intermediate step in the Business Analysis Model, i.e. performing a use case realization. The sequence diagram is a realization of a use case with the sole purpose of identifying business entities and relations. The arrows between actors correspond to operations and at the business level these operations correspond to service candidates.

The ***class diagram*** describes the static relation between business entities, service, workers, actors and systems. The Business Analysis Model is created using the class diagram. From the Business Analysis Model some classes could be adopted directly into the logical view of the technique system (if the business is to be automated) while others has to be further specified e.g. via the RUP requirement discipline. A business entity has to be specified by attributes and/or operations.

2.2.3 The Entities

A **business actor** represents a role played in relation to the business by someone or something in the business environment. When defining a business actor in model the attributes including human factors (HF), has to be specified. An example of HF attributes related to actors/workers is presented below, see business worker.

A **business worker** is an abstraction of a human or software system that represents a role performed within business use case realizations. A business worker collaborates with other business workers, is notified of business events and manipulates business entities to perform its responsibilities. When defining a business worker in the model the attributes including human factors (HF), has to be specified. An example of HF attributes related to actors/workers is:

- User type:
  - Primary
  - Secondary and Indirect users

- Skills and knowledge
  - Task experience
  - Qualifications

- Personal attributes
  - Physical limitations and disabilities
  - Attitude
  - Motivation
  - Intellectual ability
  - Learnability
  - Problem solving capability

A **Business Use Case** (class) defines a set of business use-case instances in which each instance is a sequence of actions that a business performs that yields an observable result of value to a particular

business actor. When defining the use case, the HF attributes have to be specified. This specification is done either directly in the model or in the template under “Special requirements”, see [1]. An example of HF attributes related to business use cases is:

- Task frequency of use
- Task duration
- Physical and mental demands
- Risk resulting from error
- Task dependencies
- Task breakdown
- Resource demand

A **Business Use-Case Realization** describes how business workers, business entities, and business events collaborate to perform a particular business use case.

A **Business Entity** represents a significant and persistent piece of information that is manipulated by business actors and business workers. Business Entities are passive; that is, they do not initiate interactions on their own. A Business Entity might be used in many different Business Use-Case Realizations and usually outlives any single interaction. Business Entities provide the basis for sharing information (document flow) among Business Workers participating in different Business Use-Case Realizations.

A **Business System** encapsulates a set of roles and resources that together fulfill a specific purpose and defines a set of responsibilities with which that purpose can be achieved.

2.3 Information Exchange Requirements

Since the identified services describe the protocol used to interface the service, it is recommended that each Information Exchange Requirements (IER) originate from this protocol-description. However, if further analysis must be done the IER’s between business entities, business workers and business actors can be found by using the sequence diagram within business use case realizations as a staring point. By analyzing these diagrams object messages one might find candidate IER’s. These requirements must then be further analyzed to meet the requirements and fully qualify as an IER. The business object class diagram might also be used, where the relations between business entities and business workers/actors should be focused on. The IER’s are reported according to a specific template, see [2].

2.4 Technical Design Rules

The BM identifies (technical) design rules on a business level. Thereafter some of the other groups, i.e. mainly A&D, do a further breakdown at a technical level. The TDR’s will be reported in a design rule template in which a further description of the TDR’s is found as well, see [3].

2.5 Services

Services should be modeled as described by [4] and [5].
There are three levels of services:

- The unit offers the external business actors services.
- The C2-system offers the unit services.
- Internally, there are technical services that the C2-system can use.

The BM is responsible for identifying services on the C2-system level, i.e. the services that the C2-system offers the unit. Services are usually found during the business use case realizations and can then be modeled using another business use case model. Services can be described either as an operation that acts on an UML-interface or as a separate UML-interface representing the entire service.

2.6 Business Model

A model includes not only the UML-notations, but also a textual description of each UML-element using a template, see [6]. A business model includes:

- A Business Analysis Model (including: business workers, business entities, business systems and realizations)
- A business use case model (including: business actors, business use cases and relations)

3 The Process

3.1 General

This chapter presents the framework of the BM process and the process step-by-step. Finally, the output of the process is described.

3.2 The Framework

The process starts with modeling specific activities and strives towards generalization. The identification of common processes and/or activities is a central part of the BM work. Prioritization of business use cases is dictated in the iteration plan that the BM management develops (if not developed outside the scope of BM). Checkpoints with LedsystM or others are described in the process when needed to make sure that the modeling is on the right track. At these checkpoints, the models are baselined to allow the possibility of stepping back and not have to do everything from scratch again. The collaboration between LedsystM and LedsystT is defined in a separate document, see [7]. The business use cases have to be documented before it is broken down in e.g. activity diagrams (and textually in the RUP artifact Business Use Case Specification). Different business concepts exist and will affect the model differently, see [8]. Eventually this will result in different models for different concepts. In BM the iterations are estimated to between 5 to 8 weeks.

When data from other groups are processed, a representative of the group should if possible take part in the process from start to end to make sure that both groups have the same perspective. If this is not possible, checkpoints have to be scheduled. Considering requirements from RD, they will probably be presented as a list of requirements that has to be considered throughout the whole process. This work will be conducted by DM.

3.2.1 Levels and perspectives

In LedsystM, four hierarchical levels are used:

1. Strategical
2. Operational
3. Tactical
4. Combat level

Further, three perspectives are used:

1. the unit
2. the C2-business system
3. the technical C2-system.

The business modeling within LedsystT focus on automation, i.e. technical support for the business. This means that some aspects of business modeling concerning for example the organization will be ignored. The unit consists of three actors: C2-system, sensor system, and weapon system. Moreover, the C2-system consists of two parts i.e. the technical- and business system. In BM, the sensor and weapon systems are included in the unit perspective but not in the C2-business system perspective. In addition, only the unit itself and the C2-business system will be treated by BM. This result in a matrix

with two perspectives per level, see table 1. However, in the initial work only the operational level has been handled. The level of the supreme commander decides the hierarchical level. The perspective is depending on if the C2-system is internal or external. Often one of the actors in an activity diagram will act as an interface towards the overlying or underlying level. It should be noted that the different levels could result in different business use cases.

Table 1. The matrix of the perspectives (vertical) and levels (horizontal).

	Strategical	Operational	Tactical	Combat
The unit				
The business system				

The different levels will be color coded to facilitate the notion of what level the different entities belongs to, see [9]. The color-coding will also support the illustration of parallel activities in the activity diagrams. As a result, it is possible to color one activity as a link to another diagram instead of placing all activity diagrams in one.

3.2.2 Traceability

A class/use case diagram is used for traceability, see figure 2. The connection between one actor on one level and its corresponding business worker on another level is shown in the diagram, as well as the connection between business use case realizations and business use cases on different levels. By constructing the traceability diagrams it is possible to check for example an actor and see all its relations although they are not shown in/do not originate from the same diagram.

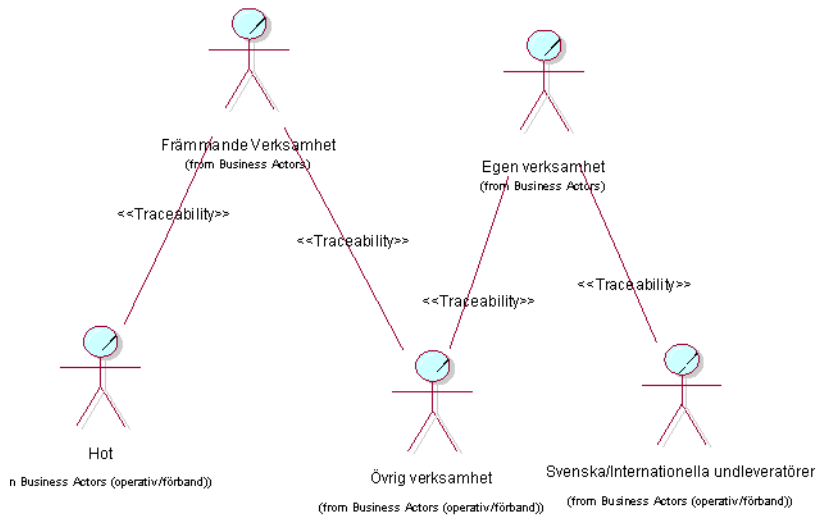

Figure 2. An example of a class diagram for traceability.

3.2.3 Tools used

Rational Rose is used for the **modeling**.
Doors is used as the requirements database and for handling of the **requirements**.
Groove is used for collaboration in and between groups for **file sharing**.
BSCW is used for **archiving** of the official documentation.
The tool for **CM-handling** has not been decided at the time of writing of this document.

3.3 Needs of Tools and Training

3.3.1 General

This section describes the need for tools and training for future work within BM.

3.3.2 Tools

- UML modeling tool, e.g. Rational Rose.
- Requirement management tool, e.g Doors.
- CM-tool, e.g. Clear Case.

3.3.3 Training

- An introduction to UML and the RUP Business modeling discipline will be necessary for all participants.
- An introduction to Doors
- An introduction to CM-handling of UML-models
- An introduction to BSCW

3.4 The Process Step-by-Step

In [10], a template of the file structure of the Rose-model is presented. There are three parallel tracks: Configuration and Change Management (CCM), BM-management, and the BM-process, see figure 3. The model in Rose-format is accessible in [11]. The BM-management is responsible for the management of the business modeling process. The CCM works as the interface towards external partners and includes someone from the BM-management and other stakeholders. LedsystM sends their data (for example business use case diagrams, activity diagrams with swimlanes and business entities) to the CCM. This data is then prioritized on an overall level by CCM before entering the BM-process. In practice, the CCM-group consists of people from the process-track. As a result the overall prioritization and the refinement prioritization are intertwined.

To make the overall prioritization, a list for prioritization of business use cases is needed. If possible, this list should include a map of capabilities to check against. Examples of choice factors:

- Description of capability
- Deliverables of the project
- The functions C2 and information handling
- Illustration of key concepts (i.e. Interoperability, Mobility, Flexibility (IMF))
- Illustration of services and situation systems (sitsyst)

All business actors/workers and business use cases in the model have to be defined when they are identified. The specification includes attributes like HF-attributes. In general, the process should involve active user participation and support an iterative work practice. Usability testing is done by A&D.

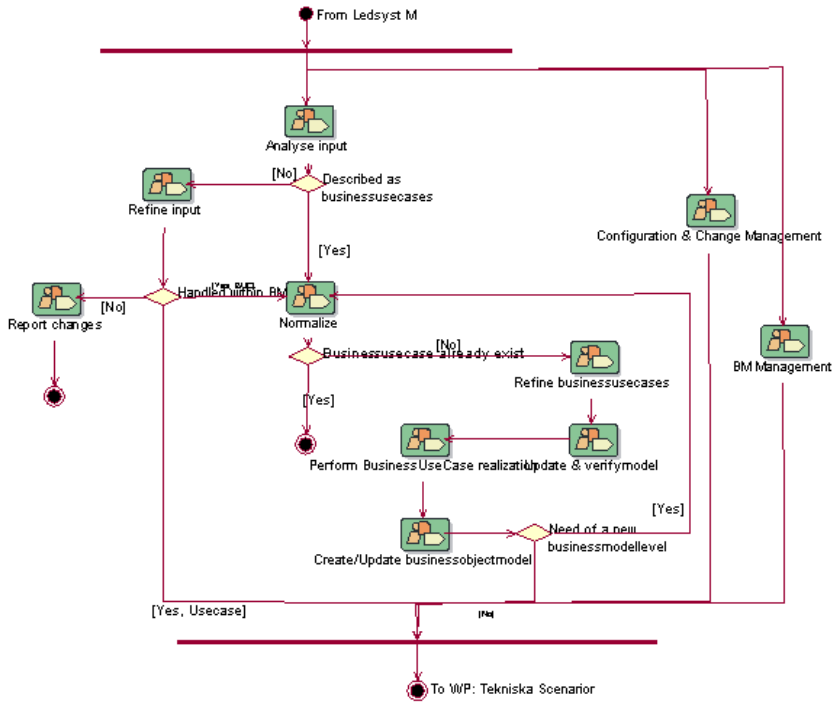

Figure 3. Overview of the BM process.

BM-management
This activity should be replaced by an overall project management discipline.

Configuration and Change Management
This activity should be replaced by an overall CCM management discipline.

Analyze input
From: LedsystM/CCM
Input: Registered and prioritized data from LedsystM/CCM.
In this activity the BM-management analyzes the input artifacts (mainly from LedsystM). The main purpose is to create and refine the iteration plan from CCM that will be use as a guideline for the work during the part of the iteration that lies within the responsibility of the BM-discipline, see figure 4. The analysis includes:

- Refined prioritization of business use cases.
- Specification of what use cases that will be included in this iteration. If parallel work is needed, the work is divide between different groups.
- Time estimation.
- Evaluation of resources.
- Allocation of work.

Output: Iteration plan
To: Decision ”Described as business use case”

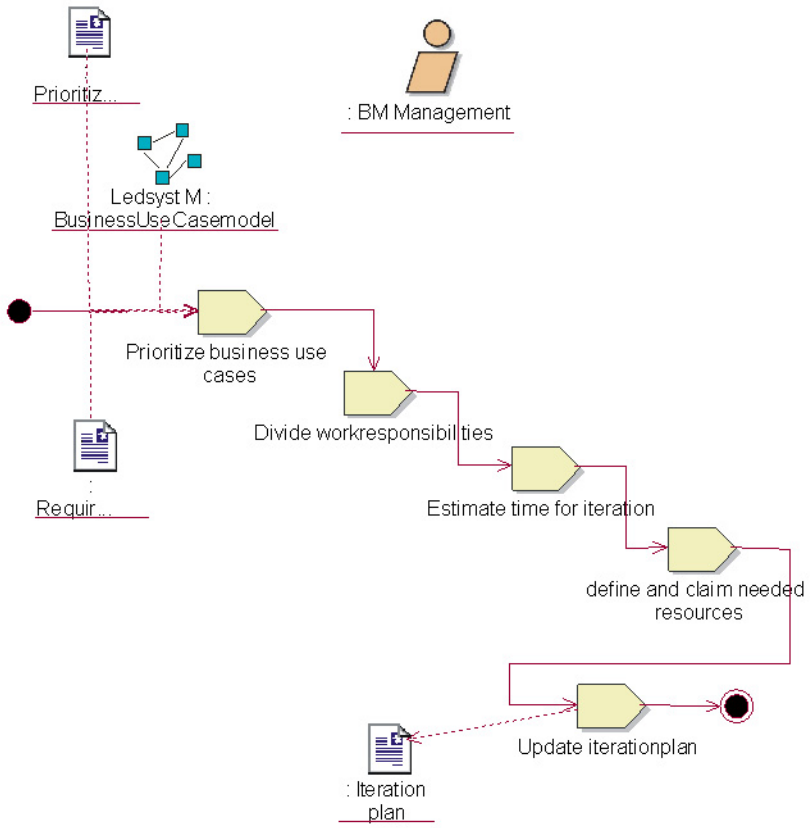

Figure 4. The process of analyzing input.

Decision "Described as business use case"
From: Analyze input
Checklist: Are the input artifacts described as business use case?
[Yes] go to Normalize
[No] go to Refine input

Refine input
From: Decision "Described as business use case"
Input: Unformatted in-data.
This activity aims to analyze the input in order to determine which form is appropriate for this type of input, see figure 5.
Output: Refined data.
To: Decision "Handled within BM".

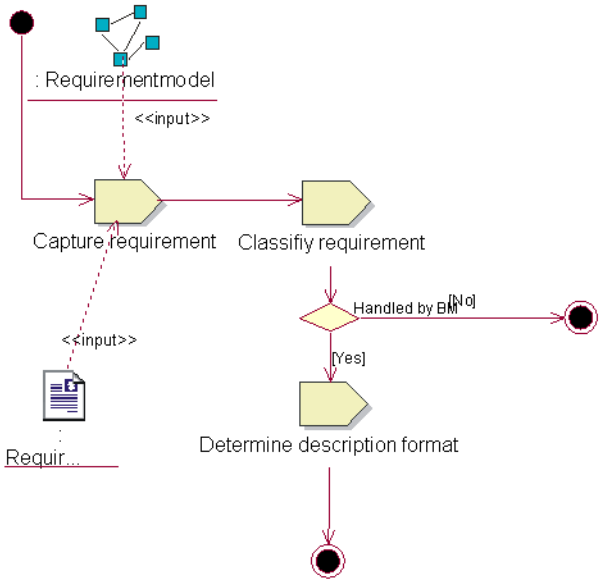

Figure 5. The process of refining input.

Decision "Handled within BM"
From: Refine input
Checklist: Should this data be handled within the BM process?
[No] go to Report changes
[Yes, Business Use Case] go to Normalize
[Yes, Use case] go to A&D.

Report changes
From: Decision "Handled within BM"
Input: The data that should not be handled within the BM process
This activity aims to report changes that might affect other stakeholders.
Output: A report of the changes made.
To: End point.

Normalize
From: Decision "Described as business use case" [Yes] or Decision "Handled within BM" [Yes] or Decision "Need of a new business model level" [Yes].
Input: Refined business use case(s) .
The main goal with this activity is to adjust the input business use case model, including business actors, to fit the system boundary of the business use case model already described in prior iterations, see figure 6. In normalization each business use case is compared to the overall model to find the right level, i.e. here a common system boundary is defined. If there are major changes there is a need to check with CCM that decides if and how to continue. When the model is saturated only the delta, i.e. the differences, will be treated.
Output: A normalized business use case model.
To: Decision "Business use case already exist".

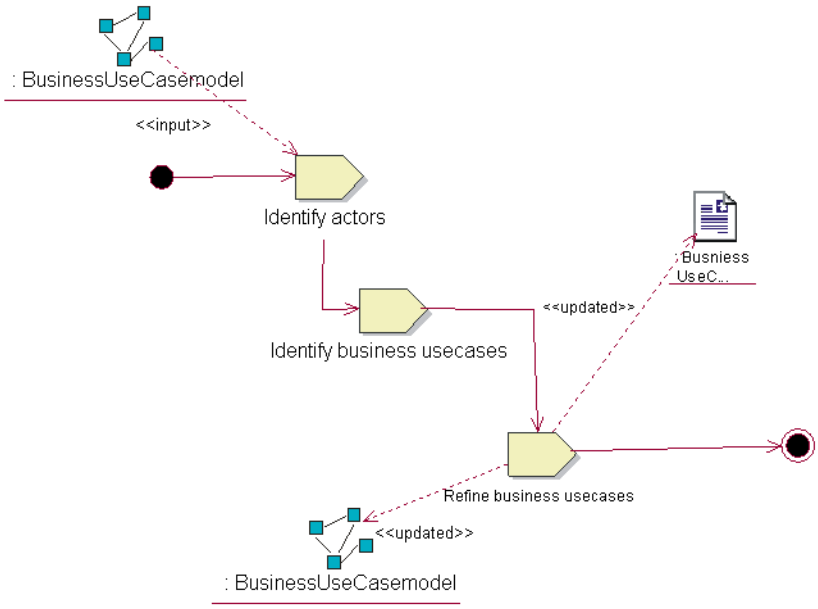

Figure 6. The normalization process.

Decision "Business use case already exists"
From: Normalization
Checklist: Does the business use case exist already?
[No] go to Refine Business use case
[Yes] go to End point
Important to note is that to be able to answer [Yes], the business use case has to be described in its whole. As a result, the answer [Yes] demands a high level of certainty to make sure no information is lost.

Refine business use cases

From: Decision "Business use case already exist"
Input: A normalized business use case that needs refinement.
The main purpose with this activity is to refine the definition of the business use cases in order to make a more detailed definition for further work, see figure 7. The refinement could also include textual additions or refinements in the Business Use Case Specification.
Output: A refined definition of the business use case and/or the Business Use Case Specification.
To: Update and verify model

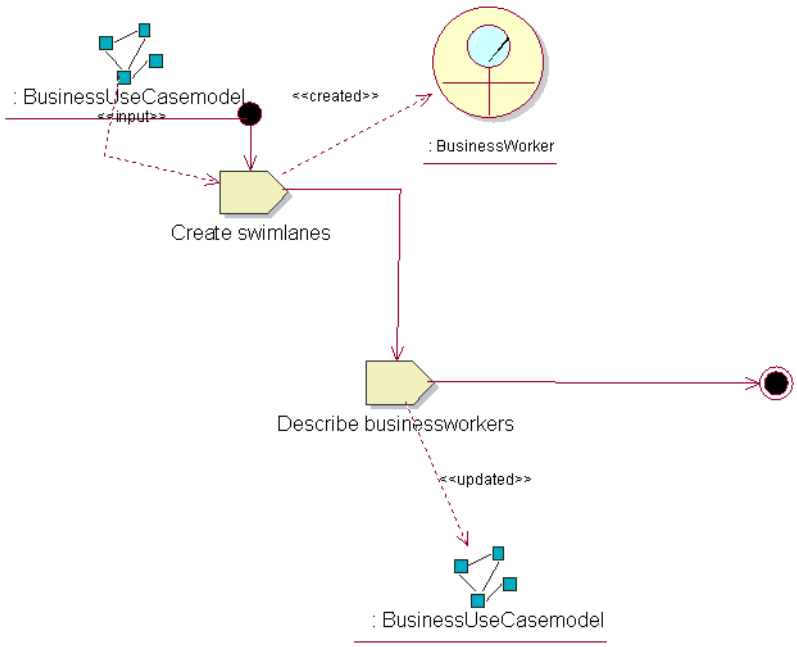

Figure 7. The process of refining the business use cases.

Update and verify business use case model
From: Refine business use cases.
Input: Business use cases with a refined definition.
This activity aims to update and verify the business use case model to make sure that the overall architecture is unambiguous and consistent, see figure 8.
Output: An updated business use case model.
To: Perform Business use case realization.

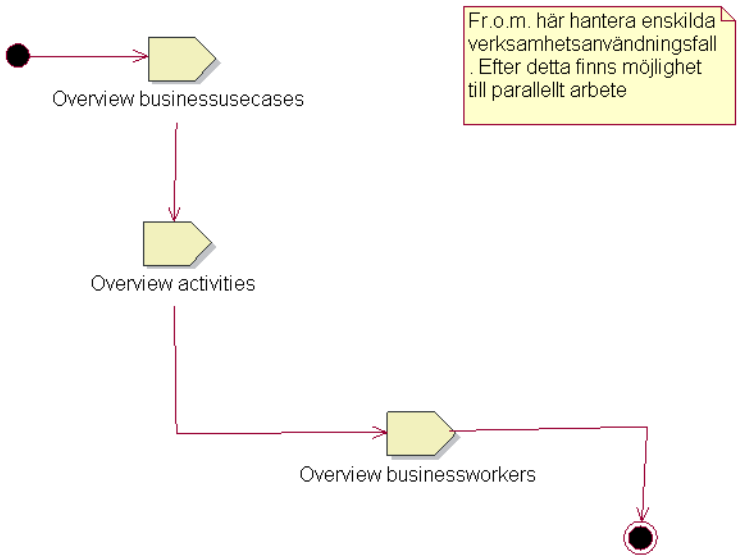

Figure 8. The process of updating and verifying the business use case model.

Perform Business Use Case realization
From: Update and verify model.

Input: An updated use case model.
This activity aims to perform a business use case realization, see figure 9. Each Business use case is realized by using a sequence diagram that describes the scenario through the business use case in order to find business entities. In the sequence diagrams, relations between business entities are identified and between business actors and business entities information exchange needs could be identified.
Output: Sequence diagrams.
To: Create/Update Business Analysis Model.

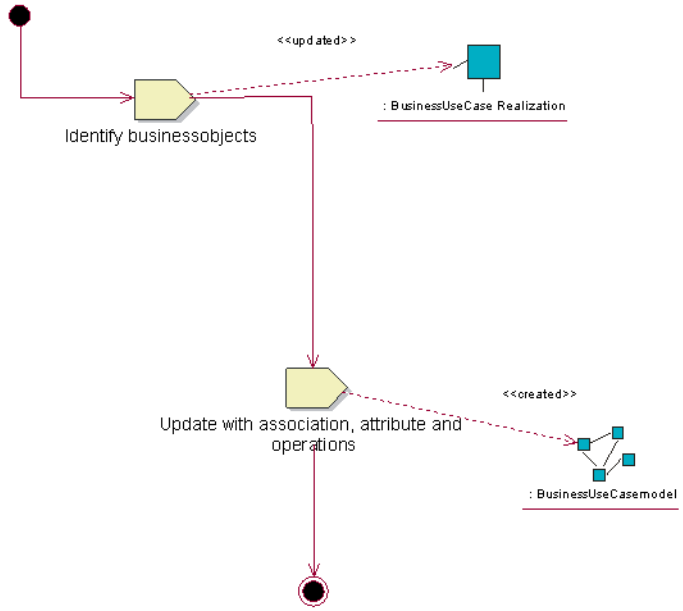

Figure 9. The process of performing the Business Use Case realization.

Create/Update Business Analysis Model
From: Perform Business use case realization.
Input: Sequence diagrams.
This activity aims to refine and overview the Business Analysis Model in order to make sure that it still is unambiguous and consistent, see figure 10. Realization of a Business Analysis Model is done by a class diagram. A class diagram is also used to identify operations and attributes. A Business Analysis Model is a way of aggregating sequence diagrams from different levels and to see how different objects are interconnected. This step also includes identification of new business entities and to extend the class diagrams with operations and attributes. If the diagram already is extended, the Business Analysis Model is updated directly.

Hypothesis: In this step (and in the technical use case model) decisions about automatization is taken. Important is that BM has to be able to handle both automatization and manual handling of tasks.

Output: A Business Analysis Model.
To: Decision “Need of a new business model level”

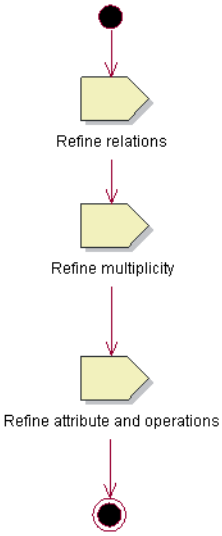

Figure 10. The process of Creation/Updating the Business Analysis Model

Decision "Need of a new business model level"
From: Create/Update Business Analysis Model
Checklist: Is there a need to add a new business model level (i.e. Strategical, Operative, Tactical or Combat level)?
[Yes] go to Normalize
[No] go to End point

3.5 Output from the BM process

Here the recipients and/or users of the output from BM, where the output is available, who is informed etc. is presented. The resulting Rose-model is presented in [11]. The output consist of:

1. A business model in Rose-format including:
   - A Business Analysis Model (including: business workers, business entities, and relations)
   - A business use case model (including: business actors, business use cases (descriptions) and relations)

2. A use case model in Rose-format. Created in cooperation with A&D, but BM is responsible. This model includes actors, use cases (descriptions), relations and derived supplementary requirements i.e. mainly non-functional requirements and some functional requirements that are not possible to describe as use case (e.g. security, performance).

3. Reports, i.e. the results of analysis of:
   - Information exchange requirements
   - Services
   - Business model
   - TDR including a test specification
   - Use-case-report (together with A&D and SP)

4. Descriptions of the BM discipline in LedsystT, including:
   - Rules for modeling of:
     - Services (according to [4] and [5])
     - Information exchange requirements

    - Business systems
- Workflow both visually and textually
    - Checklists
    - Descriptions of activities
    - Descriptions of artifacts

5. Business concept

6. Tools and training

This report corresponds to 4.

3.5.1 Users of the BM output

For use:

- A&D: Business model, Use case model, All reports.
- SP: Business model, Use case model, All reports.
- OA (Overall Architecture): All reports, Business concept.
- DM: Descriptions of the BM discipline in LedsystT and Tools and training.

Customers:

- TPM: Business model, Use case model, IER-report, Service-report, TDR-report, Business concept.
- The person(s) responsible for the method in LedsystT: Descriptions of the BM discipline in LedsystT and Tools and training.

For checking against:

- LedsystM: Business model.

4 Revision history

Date	Revision	Description	Signature
2004-06-17	0.1	The first revision of this document	KÖ
2004-06-17	0.2	Some sections modified according to RUP	JÅ
2004-06-22	0.3	Some sections updated due to change of preconditions.	JÅ
2004-06-23	0.4	Overall refinement of the document.	KÖ
2004-06-29	1.0	Corrections according to review comments.	KÖ