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BORM - Business Object Relation Modeling

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ABSTRACT

BORM is an object-oriented and process-based analysis and design methodology, which has proved to be effective in the development of business systems. The effectiveness gained is largely due to an unified and simple method for presenting necessary aspects of the relevant business model, which can be simulated, verified and validated for subsequent software implementation. The BORM methodology makes extensive use of business process modeling towards the area of software engineering. This paper outlines BORM and presents it on an application example created in Craft.CASE analysis and modeling tool.

Keywords

BORM, business modeling, conceptual modeling, business process, business process simulation, object-oriented approach, MDA, Craft.CASE.

INTRODUCTION

We started our professional career at the beginning of the 1990's as university teachers and software engineers, specializing in the new trend of object-oriented programming (OOP), object-oriented languages and object-oriented database systems. This evolution of OOP has been documented in many books and papers, for example (Goldberg and Rubin, 1995; Taylor, 1995; Yourdon, 1995; Darnton & Darnton, 1997).

As object technology gradually became the main course of our software production, our projects not only became larger, but also began to place considerable emphasis on integration with already existing business systems. More advanced techniques of OOP such as programming technologies and object-oriented databases are presented in (Ambler, 1997; Catell, 1994).

The aim of our projects was to analyze and suggest improvements to business processes, company structure, data flows, organizational structure; as well as providing IT support for them. We soon realized that we needed to carry out analyses of the problems that were supposed to be solved in order to be able to design the system and properly test their solution.

First, it is important to identify, document, and test a system in order to be able to analyze and design a more elaborated system. There are different methods and tools. On one hand, there are methods and tools oriented towards business modeling such as EPC (EPC, 2008) or varieties of Flow Charts. However, these tend to have paradigmatic gap in weak relationships with the software engineering. On the other hand, there are methods and tools of software engineering based on UML, which assume that the business requirements has already been correctly formulated and verified. (Eriksson and Penker, 2000; Kotonya and Sommerville, 1999). We used several methods for our projects, but none of them were able to smoothly combine these two worlds of modeling. This is why we began our own research.

BORM METHOD

BORM, Business Object Relation Modeling is in continuous development since 1993 when it originally was intended as a vehicle to provide support for building object-oriented software systems based on pure object-oriented languages such as Smalltalk and object-oriented databases. It has now evolved into a system development methodology that has been used successfully in about 30 projects. These systems range through all sizes of software development. Recent BORM projects are described in the table 1.

project	number of sketches	number of business functions	number of business scenarios	number of business participants	number of simulated business diagrams	total number of business activities	total number of business states	total number of business conditional paths	number of UML classes of data objects	number of UML class diagrams
Web portal for medicament supplier	70	14	50	15	14	76	23	11	80	35
I.S. for ministry of health care	4	1	11	11	2	69	40	6	64	4
Company knowledge management I.S.	3	13	52	15	5	112	49	3	not yet completed	not yet completed
I.S. for petrol transporter company	2	1	8	11	9	203	74	35	not yet completed	not yet completed
Law analysis – taxes	1	9	89	38	32	619	431	361	not yet completed	not yet completed
Law analysis – administrative acts	1	3	91	70	25	420	213	234	not yet completed	not yet completed
I.S. for ministry of economy	14	4	13	41	7	192	84	25	not yet completed	not yet completed
Law analysis – Digital tachographs	1	1	23	8	11	103	62	44	not yet completed	not yet completed
Law analysis – Personal ID cards	1	2	34	27	16	173	88	12	not yet completed	not yet completed
Law analysis – public information	1	1	6	5	3	63	39	5	not yet completed	not yet completed
Landscape planning I.S.	1	1	4	9	3	69	30	13	not yet completed	not yet completed
Czech law on electronic documentation	1	5	16	34	15	287	172	83	not yet completed	not yet completed

Table 1. Recent projects in BORM

Why do we need another object-oriented analysis methodology?

The first and we think the big problem with existing software engineering methodologies arises in the initial stages of system development cycle. The initial stage of these methodologies should be concerned with two tasks. The first is the specification of the requirements for the system. The second is the construction of an initial object-oriented model, often called an essential or conceptual model built out of a set of the domain specific objects. Both these tasks should be carried out with the active participation of the stakeholders, in order to ensure that the correct system is being developed. Consequently, any tools or diagrams used at these early stages should be meaningful to the stakeholders, whom are not 'software engineering literate'. Moreover, these diagrams must not deform or inadequately simplify the requirement information.

The most common technique for requirements specification in current software development methodologies is Use Case modeling as the start of UML documentation process. The main information about UML is (UML, 2009). Indeed Use Cases are often the foundation of most object-oriented development methods (Jacobson, 1992). It is concerned with the identification of external actors, which interact with the software part of the system. This means that in order to employ Use Case modeling, it is necessary to already know the system boundary and distinguish between entities, which are internal and external to that boundary. It is our experience that the correct identification of the system boundary is a 'non-trivial' task, which often requires significant understanding of the proposed system and consequently can only successfully take place at the end of the requirements specification stage.

Other option is usage of some business engineering method such as EPC (EPC, 2009), miscellaneous Flow Charts etc. They work fine for business system analysis and design, but have poor support for subsequent software engineering activities, because there is a big semantic and conceptual gap between them and recent software modeling methods. This is the reason of frequent misunderstanding among business and software engineering people.

Our experience in system modeling suggests that UML is not suitable for the first stages of analysis, where business processes need to be recognized. UML diagrams are too complex for the business community as they often contain too much detail concerning potential software implementations. This means classes, inheritance, public/private methods, attributes, link classes, etc. Here we got almost the same experience as documented in (Simone and Graham, 1999).

We believe that the business community needs a simple yet expressive tool for modeling; able to play an equivalent role to that played by the Entity-Relation Diagrams, Data-Flows Diagrams or Flow-Charts over the past decades. One of the strengths of these approaches was that they contained only a limited set of concepts (about five) and were comprehensible by problem domain experts after a few minutes of study. Unfortunately the UML approach lost this power.

That is why we developed the BORM process diagram and the way, how to start business system analysis in simple but precise method going smoothly from business analysis and simulation to detailed UML software design based on MDA

principle. Our approach is to start with a small set of the business-level concepts, which can subsequently be transformed into more software-oriented concepts.

BORM fundamentals

The BORM methodology has been developed on academic grounds since the 1990s. It unifies the MDA principle, using an object-oriented paradigm and a unified approach to business and IT system modeling. For more on the BORM method, see (Knott et al., 2000; Liu and Roussev, 2006).

MDA

MDA defines an approach that separates a specification of business system description (*CIM – Computation Independent Model*) from its computer implementation specification (*PIM – Platform Independent Model*); and this computer specification from the final solution on a concrete technological platform (*PSM – Platform Specific Model*). According to MDA, there is a mutual relationship between these three views, and the models should transform from one to another when a system is created. MDA is created and maintained by the Object Management Consortium (MDA, 2009).

Object-oriented approach

The OOP has its origins in the researching of GUI and programming languages, that took place in the 1970s. It differs from other software engineering approaches by incorporating non-traditional ways of thinking into the field of informatics. We look at systems by abstracting the real world in the same way as in ontological, philosophical streams. The basic element is an object that describes data structures and their behavior. In most other modeling approaches, data and behavior are described separately, and, to a certain extent, independently. OOP has been explained in many books, but we think that this one (Goldberg and Rubin, 1995) written by OOP pioneers belongs to the best.

Automata theory

The theory of automata is a study of abstract automatons and the problems they can solve. An automaton is a mathematical model for a device that reacts to its surroundings, gets an input, and provides an output. The automatons can be configured in a way that an output from one of them becomes an input for another of them. An automaton's behavior is defined by a combination of its internal state and its accepted input.

The automata theory is a basis for system behavior descriptions. Its usage for modeling and simulation in software engineering activities has been written in (Shlaer and Mellor, 1992) and many newer publications.

Two areas of BORM modeling

- The CIM model, according to the BORM method, is a visualization of the environment in which a project is being executed. It deals primarily with business process models. Its aim is to understand and describe a problem and find a solution. A well-made CIM model enables proper descriptions of settings for information system to be made; a necessary condition for a designed solution.
- PIM modeling, according to the BORM method, is a visualization of the required information system in software engineering concepts. The UML (Unified Modeling Language) standard has an important role.
- The PSM model, according to the BORM method, is a revised form of the PIM model which, unlike PIM, enables specific software implementation, since it includes specific properties of the target environment and reused artifacts of the IT architecture, etc.

Business engineering – business models

The first part of the method covers the CIM field, i.e. business engineering. It transforms a project assignment into a model described by data hierarchies, process participants, process scenarios, various diagrams and generated reports. The main instrument of verification and validation is the process simulator.

For the following purposes, it is possible to use this part of BORM without any relation to a software engineering phase:

- Organizational consultancy projects. These are process analysis, organizational structure analysis, and drafts for processes or organizational structure improvement.

- Projects documenting processes and organizational structure. These are, for instance, projects whose aim is knowledge management, creating training materials, knowledge visualization, etc.
- Projects for preparing the groundwork for selection procedures for organizational consultancy, or other consultancy services.
- Projects for preparing the groundwork for selection procedures for the delivery of information systems, or other software engineering projects.

Software engineering – conceptual models

Second part of the BORM is PIM, i.e. conceptual modeling based on software engineering principles.

- It fluently relates to the preceding phase of business engineering, i.e. that the software system assignment is described as a business model, and is well tested and revised.
- It uses the same, or very similar terms and rules, as the preceding phase. It is unnecessary to learn any other method for either the first phase, or this phase.
- Apart from classical models in the UML standard, the Craft.CASE tool enables work to be carried out with concrete objects (class instances) and collections of concrete objects. An analyst can test a draft on a small prototype created from these concrete objects.

The main instrument of verification and validation of this part of the method is a relationship to preceding parts of the method and option to work with concrete objects (class instances).

Two layers of a model

Process approach and object orientation are the pillars of the BORM method. It is the application of principles that are successful in the field of modeling and software creation. The basis of the object approach is the notion that each action has an object that executes it; or, vice versa; that each object has a behavioral role in a model. It is impermissible to have an action without an object, or an object without an action.

With object-oriented orientation, various process situations can be modeled:

- An object executes an action that influences the action of another object.
- Actions that could be decomposed into a sequence request-solution-result with a particular extent of various object participation.
- Modeling and analysis of process and organizational structure relations.
- Descriptions (requests) of new systems.

The presence of information in a row (behavior, for example) indicates a necessity for new information in another row (subjects), and vice versa. It is advisable to proceed in both rows, step-by-step, whilst modeling. This interconnection of both rows prevents a "jamming" of the project after which an analyst would not know how to continue.

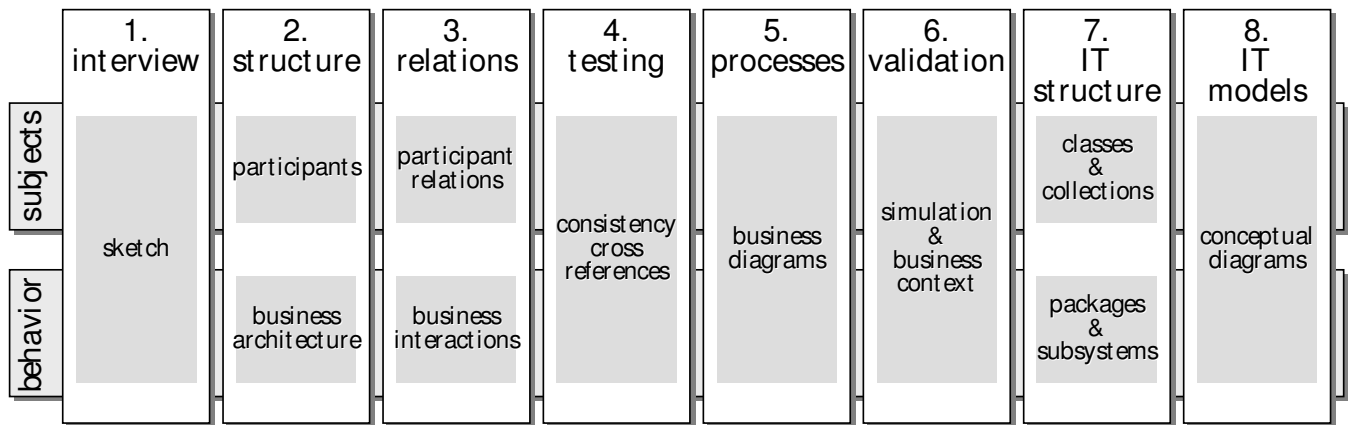


Figure 1. BORM Method

BORM interpretation of MDA

In BORM (see Figure 1 and 2), each concept has some of the following:

1. A Set of predecessor concepts from which it could be derived by an appropriate technique and a Set of successor concepts, which could be derived from it by an appropriate technique.
2. A validity Range - The phases where it is appropriate. In each phase of BORM modeling, only limited set of concepts is recommended.
3. A Set of techniques and rules, which guide the step-by-step transformation and the concept revisions between the system development phases. There are refactoring techniques, data normalization, design patterns and other programming-related techniques (Ambler, 1997) adopted for BORM concept transformations.

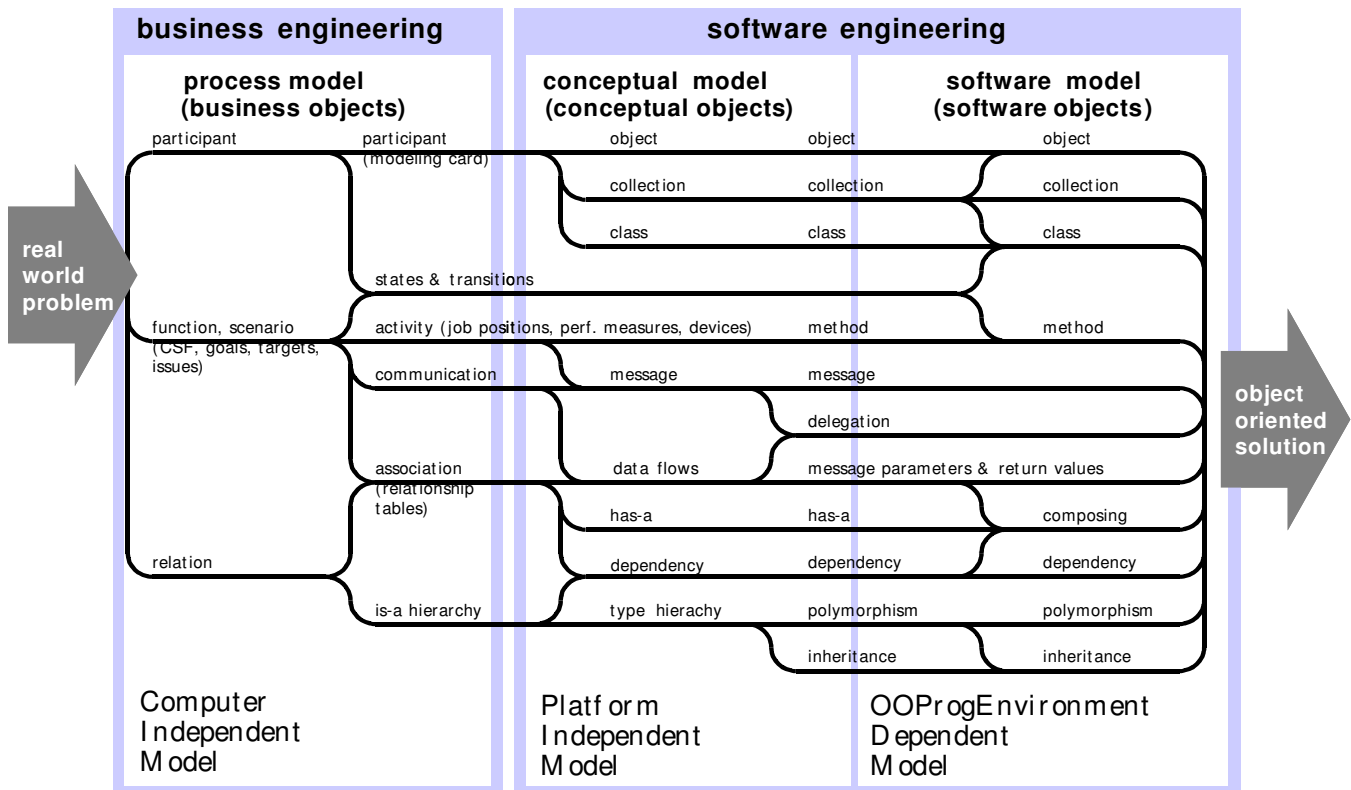


Figure 2. MDA approach in evolution of BORM terms – object-oriented software development example

BORM business diagram

BORM respects UML and MDA, but uses an original diagram for business process modeling. It conveys together information from three separate UML diagrams: *state*, *communication* and *sequence*. The BORM group has found that it is clearly understood by business stakeholders.

- Each subject participating in a process is displayed in its states and transitions.
- This diagram expresses all the possible process interactions between process participants. The business process itself consists of a sequence of particular communications and data flows among participating subjects.

More formally, BORM process diagrams are graphical representations of interconnected Mealy-type finite state machines of particular subjects. Visual simulation of a business process is based on market-graph Petri net. Almost the same approach is described in detail by (Barjis and Reichgett, 2006). Therefore we can show states, transitions and operations for all subjects playing a role in a business process. This is a very powerful, yet simple diagram.

There is an example of BORM business process diagram at Figure 3. It shows an *invoice processing*. There are six participating subjects in this process: *Supplier*, *Invoice Registration Department*, *Store Department*, *Account Payable Department*, *SAP* and *Bank*. The small rectangles within these subjects are their states. The ovals within subjects are their activities, which are conceivable as the transitions between the states as well. The big arrows between subjects are the subject communications, and the very small arrows are the data flows.

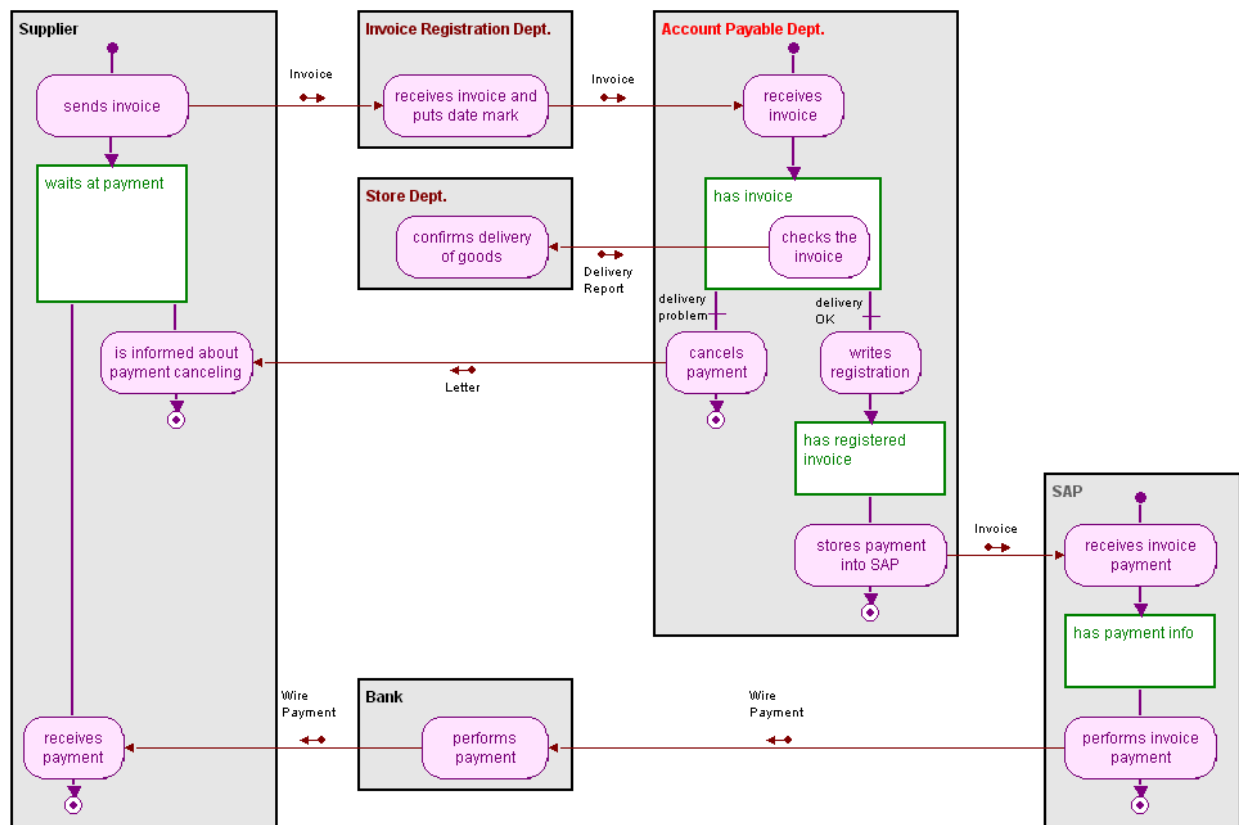


Figure 3. Business Process Example

CRAFT.CASE MODELING TOOL

At first, we attempted to use the existing tools and adapted them for BORM. Our experience covers Microsoft Visio and MetaEdit. (Metacase, 2009) However, we found that none of them allowed us to model, test and simulate in the way we needed.

The Craft.CASE tool has been designed according to state-of-the-art principles of object-oriented software development, and uses a special Smalltalk programming language technology that has been evolving since the 1970's. The program consists of

many user functions, has its own internal object-oriented database, several graphic editors and a programmable interface. The Craft.CASE tool provides all instruments for CIM (as business models) and PIM (as conceptual models), including their mutual interconnection and the possibility to undertake thorough testing. (Craftcase, 2009)

The Craft.CASE can be used in process and organizational consultancy and in analytical projects and information system drafts while identifying requests on newly – designed systems; also in component modeling and service oriented architecture. It works with a system model and its processes in an original way that is based on:

1. An ability not only to visualize processes and systems in the form of diagrams, but also to test them by means of cross-references and graphic simulations.
2. An ability to model not only symbolic terms (for example, a customer, order, payment, etc.) as drawn symbols in a diagram, but also the possibility of working with real objects (several concrete customers, orders, payments, etc. that differ in their real values such as a date, name, price, etc.). Craft.CASE supports both class-level and instance-level of modeling.
3. A method having diagrams as the result of a gradual deriving and checking.

Craft.CASE implements an original approach called C.C method. The C.C method combines majority of CIM and PIM parts of BORM with concept transformations via business process simulators, instance-level modeling and set of transformation rules describing how to derive subsequent concepts from previous ones. Moreover, in each step of the C.C method, Craft.CASE keeps consistency between two layers of a model; subjects and behaviors. Thanks to metamodel background and system internal procedures, there is rigidly checked, whether all subjects from the first layer (e.g. classes, object states, packages etc.) have corresponding behaviors from the second layer (e.g. scenarios, use-cases, operations etc.) and vice versa. More information about Craft.CASE such as its programming facilities, metamodel etc. is described in (Merunka et al., 2008).

Analysts would much rather hear "I don't want this" from a client or prospective user while projecting a system, than "I didn't want that" after having completed the project. This is why during modeling, it is important to have an opportunity to test, verify and validate the system and its processes. Proper testing includes visualization and simulation - not only with abstract terms, but also with real objects of the modeled system at the instance level.

EXAMPLE

Our example of modeling using Craft.CASE is to model an information system for a company called FD (Food Delivery); dealing with food products delivered from suppliers to local customers. A typical example of such activity is shopping and delivering the goods to a home, or home delivery of pastries and milk and similar products. The information system is primary designed for communication between a company and its delivery employees. It also provides an information portal for customers to whom the products are to be delivered.

Project initiation

The first stage of business modeling is the initiation of work on a project. At the beginning of this phase there are interviews, and then an initial structure and relations are modeled. The testing of generated reports is executed as the final part of this stage.

Interview

Since kick-off meeting with the client, we have negotiated that the project should focus on ordering a meal through a customer process. The client expressed a preference for communication with customers via web pages. The client also wants work activity descriptions for the logistics manager and van drivers.

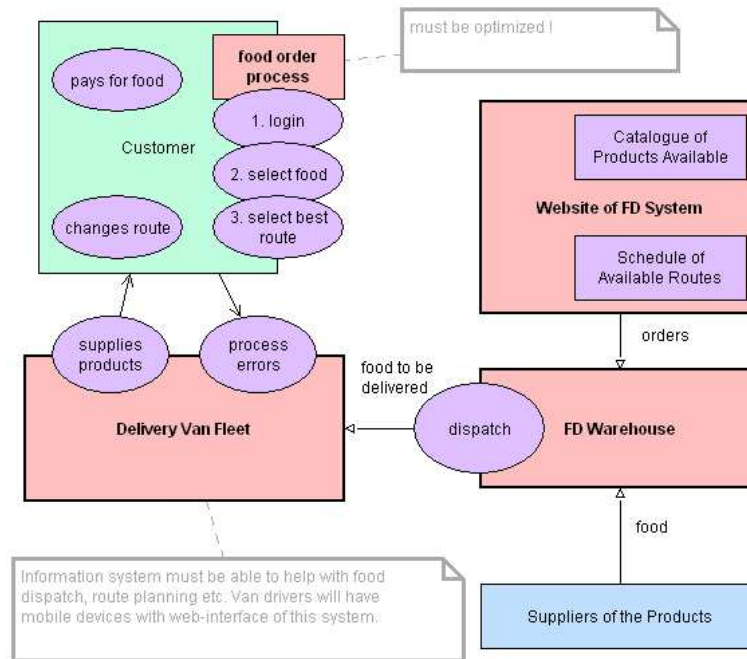


Figure 4. Record of kick-off meeting interview – free drawing in Craft.CASE

The client wishes to enable its customers to choose a delivery time based on a calendar of scheduled delivery routes that have been prepared in advance. Its advantage over the competition is in offering different prices for different deliveries that differ in date and hour; allowing customers to choose between either a cheaper, or a more convenient delivery time.

Business modeling (Computer-Independent Model)

Structure

Structure definition is the first formal step of the method. An analyst should be capable of finding key subjects and process fields on the basis of performed interviews.

Participants

Based on the scope of the project and the allowed project time, eight participants were found (See table 2). These are the job positions of the *logistics manager* and the *van driver*, as well as future software components of the *web interface* and *database system*; and, of course, a *customer* and some *suppliers*, since they take part in the processes.

<i>Customer</i>	Person who orders food or a person who wants to be a customer.
<i>FD Database</i>	Database of products, orders, routes, customers and suppliers.
<i>Logistics Manager</i>	Person responsible for the distribution of orders. This person uses information and scheduling system.
<i>Supermarket Supplier</i>	Department of Supermarket responsible for food delivery.
<i>Supplier</i>	Small company or individual farmer.
<i>Supplier Ordering System</i>	Automatic system for requesting suppliers for food.
<i>Van Driver</i>	Person who delivers food.
<i>Website of FD</i>	Communication software enabling orders.

Table 2. Participants

Hierarchies

For the detailed mapping of problems to be solved and future use of information system creating, two hierarchies of concrete testing data were recognized and modeled. They are food delivery *product catalogue* and a list of *suppliers* for these products.

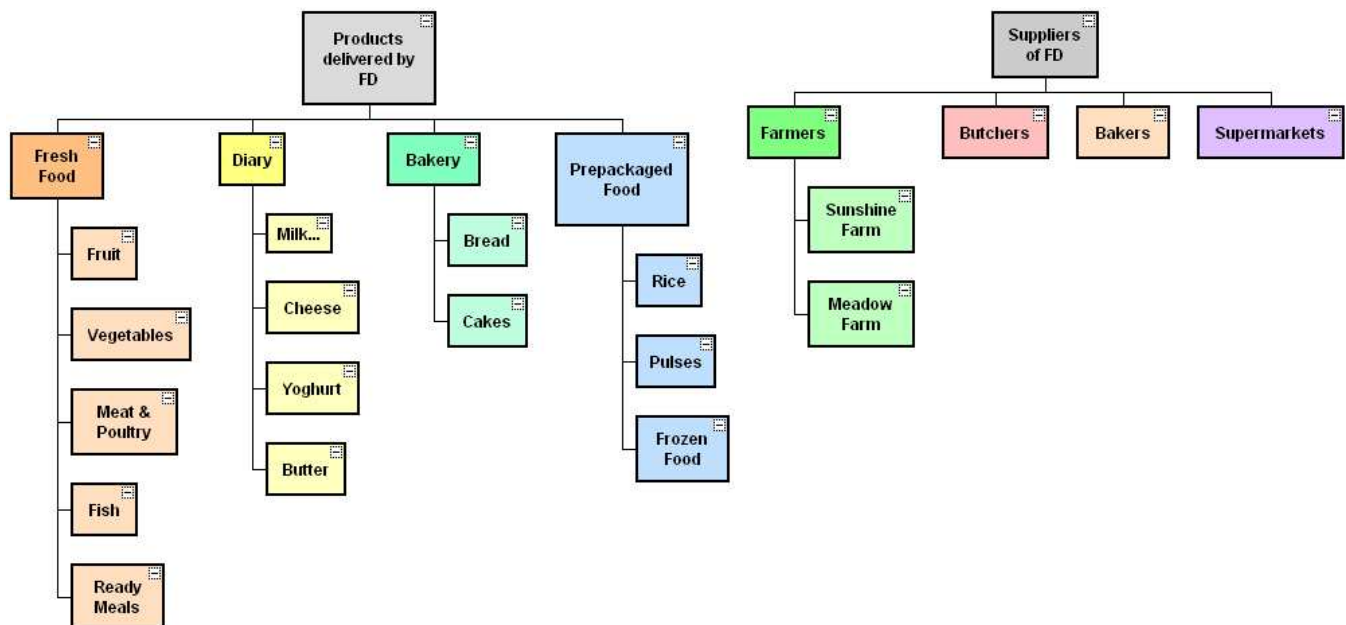


Figure 5. Products and supplier hierarchies

Business architecture

Five functional areas were developed. It was then decided that three functions (marked as external functions) related to care, and that virtual food products warehouse, advertising activity and web page maintenance will not be included in the concrete scope of our project. The project was limited to activities related to ordering and delivering (marked as internal functions).

Name	Description	Status
Advertize FD	Collection of processes promoting FD business (both to clients and food suppliers)	external
Dispatch Orders	Here is collection of processes performed by FD management. This is about route planning, orders dispatching etc.	internal
FD Website Maintenance	User management, database update, SW and HW maintenance.	external
Maintain Stock	FD company internal responsibility. Here is collection of processes with no direct interface to any client.	external
Sell Food	Core business of FD company. Here is collection of proceses performed by or performed for clients.	internal

Value	Owner type	Owner name
external	Function	FD Website Maintenance
		Maintain Stock
		Advertize FD
internal	Function	Sell Food
		Dispatch Orders

Figure 6. Business Functions (Formatted HTML report from Craft.CASE)

Hierarchy relations

Several bindings were modeled between elements of the product hierarchy and the product supplier hierarchy to finalize system requirements. These data relationships (elements of the Cartesian product, more formally) show a concrete supplier of concrete products that can be used later for instance-level testing.

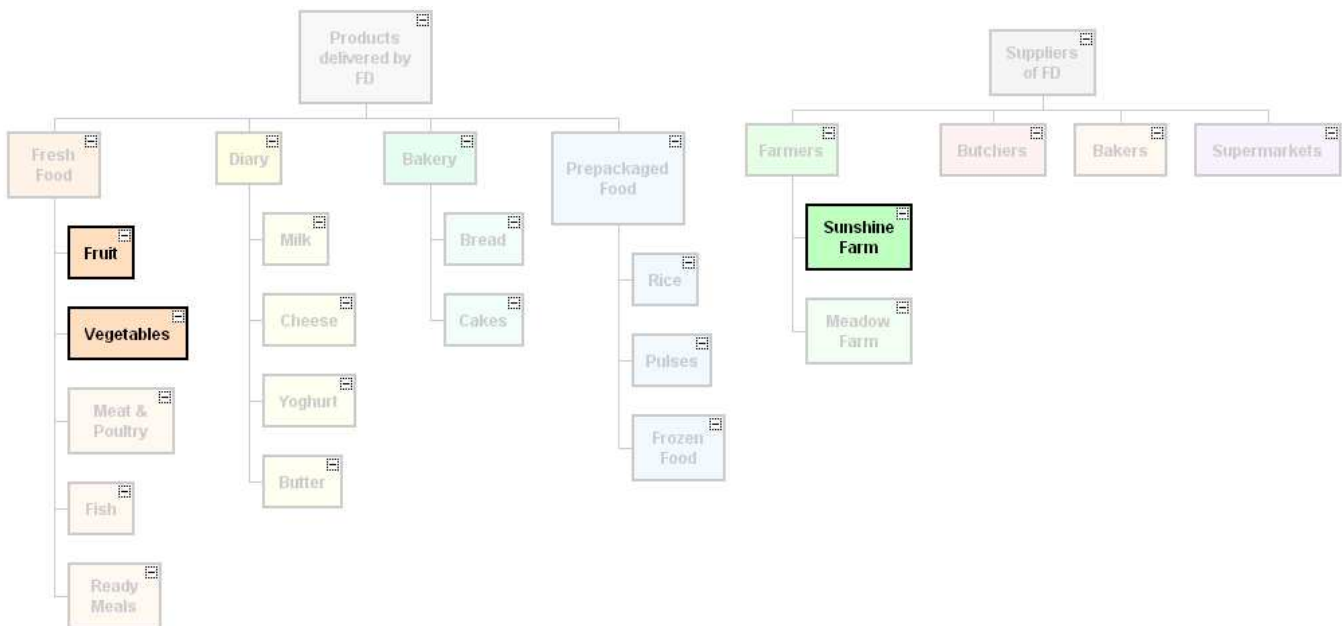


Figure 7. Fruit and vegetables delivery as an example of instance-level binding between hierarchies

Detailed scenarios and participant roles in scenarios

Six business process scenarios were analyzed in three functional areas – see Figure 9. Concept of a business scenario is described in (Taylor, 1995). Although this project does not deal with web page maintenance, a new customer registration scenario was modeled into the system because its content evoked problems that are being solved. (Note small icons in corners of rectangles indicating diagram decompositions.)

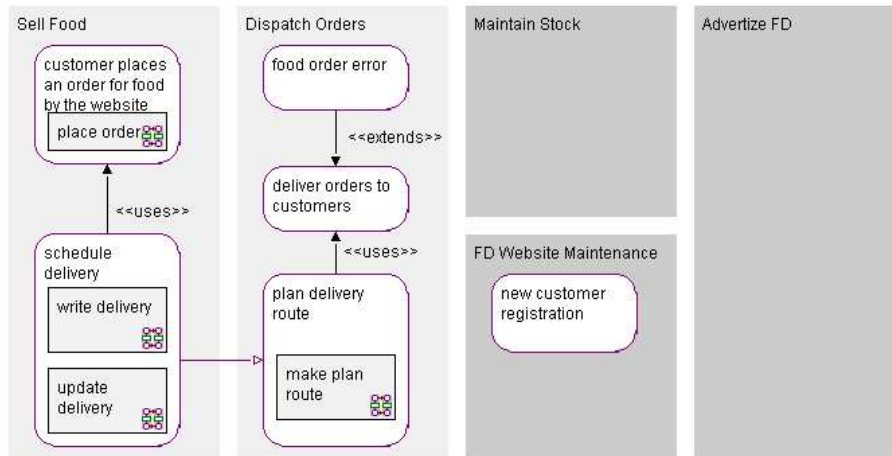


Figure 8. Business architecture diagram (Use-Case clone) of the whole system requirements

customer places an order for food by the website	
initiation:	roles:
Customer want to buy food.	Customer initiates
action:	FD Database provides information
Customer logs into the website, selects food, and places his/her order.	Website of FD cooperates
result:	
Order is accepted.	
Integrated functions: Sell Food	
Derived diagrams: place order	
Is used by: schedule delivery	

plan delivery route	
initiation:	roles:
New day started.	FD Database provides information
action:	Logistics Manager is responsible
Routes are planned from information on website for all orders requested for delivery on current day.	Van Driver cooperates
result:	Website of FD cooperates
Route for each van driver for the current day is produced.	
Integrated functions: Dispatch Orders	
Follows: schedule delivery	
Derived diagrams: make plan route	
Uses: deliver orders to customers	

schedule delivery	
initiation:	roles:
Customer wants to arrange delivery on specific date.	Customer initiates
action:	FD Database provides information
Customer selects the best delivery date on website.	Website of FD cooperates
result:	
Order delivery is planned on selected date.	
Integrated functions: Sell Food	
Is followed by: plan delivery route	
Derived diagrams: update delivery , write delivery	
Uses: customer places an order for food by the website	

deliver orders to customers	
initiation:	roles:
Routes are planned and optimized.	Customer receives
action:	FD Database provides information
Van follows the predetermined route to deliver its orders to customers.	Logistics Manager initiates
result:	Van Driver is responsible
Food has been delivered. Order has been accepted. Payment done.	
Integrated functions: Dispatch Orders	
Is extended by: food order error	
Is used by: plan delivery route	

food order error	
initiation:	roles:
Food is damaged of incorrect item has been delivered.	Customer initiates
action:	FD Database provides information
Van driver and customer agreed that food should be returned and payment adjusted.	Logistics Manager approves
result:	Van Driver cooperates
The item is returned and the customer credited with his/her cost.	
Integrated functions: Dispatch Orders	
Extends: deliver orders to customers	

new customer registration	
initiation:	roles:
A person wants to be a new customer.	Customer initiates
action:	FD Database provides information
Person supplies his/her name, address etc. into website.	Website of FD cooperates
result:	
Customer is registered and ready to apply order or is refused.	
Integrated functions: FD Website Maintenance	

Figure 9. Business process scenarios in formatted HTML report from Craft.CASE

Testing

Testing was done using presenting participants' modeling cards. On the basis of this testing, it was decided to model both the ordering and distribution planning processes in detail. Our concept of the modeling card originates from CRC – Class-Responsibility-Collaborator technique (Bellin and Simone, 1997).

Customer

Collaborators:	FD Database	Logistics Manager	Van Driver	Website of FD
customer places an order for food by the website (initiates)	provides information			cooperates
deliver orders to customers (receives)	provides information	initiates	is responsible	
food order error (initiates)	provides information	approves	cooperates	
new customer registration (initiates)	provides information			cooperates
schedule delivery (initiates)	provides information			cooperates

Logistics Manager

Collaborators:	Customer	FD Database	Van Driver	Website of FD
deliver orders to customers (initiates)	receives	provides information	is responsible	
food order error (approves)	initiates	provides information	cooperates	
plan delivery route (is responsible)		provides information	cooperates	cooperates

Van Driver

Collaborators:	Customer	FD Database	Logistics Manager	Website of FD
deliver orders to customers (is responsible)	receives	provides information	initiates	
food order error (cooperates)	initiates	provides information	approves	
plan delivery route (cooperates)		provides information	is responsible	cooperates

FD Database

Collaborators:	Customer	Logistics Manager	Van Driver	Website of FD
customer places an order for food by the website (provides information)	initiates			cooperates
deliver orders to customers (provides information)	receives	initiates	is responsible	
food order error (provides information)	initiates	approves	cooperates	
new customer registration (provides information)	initiates			cooperates
plan delivery route (provides information)		is responsible	cooperates	cooperates
schedule delivery (provides information)	initiates			cooperates

Website of FD

Collaborators:	Customer	FD Database	Logistics Manager	Van Driver
customer places an order for food by the website (cooperates)	initiates	provides information		
new customer registration (cooperates)	initiates	provides information		
plan delivery route (cooperates)		provides information	is responsible	cooperates
schedule delivery (cooperates)	initiates	provides information		

Figure 10. Modeling cards of participants in formatted HTML report from Craft.CASE

Detailed business modeling – business process simulation

Processes

First, the ordering process was modeled. Based on the project focus, a new property for communications was created, with „manual" or „automatic" values, with a relation to the graphic interface where, for automatic communication -- expecting a software realization -- a thick arrowed line between oval activities is drawn. Manual communications are visualized in the standard way of thin arrowed line between oval activities.

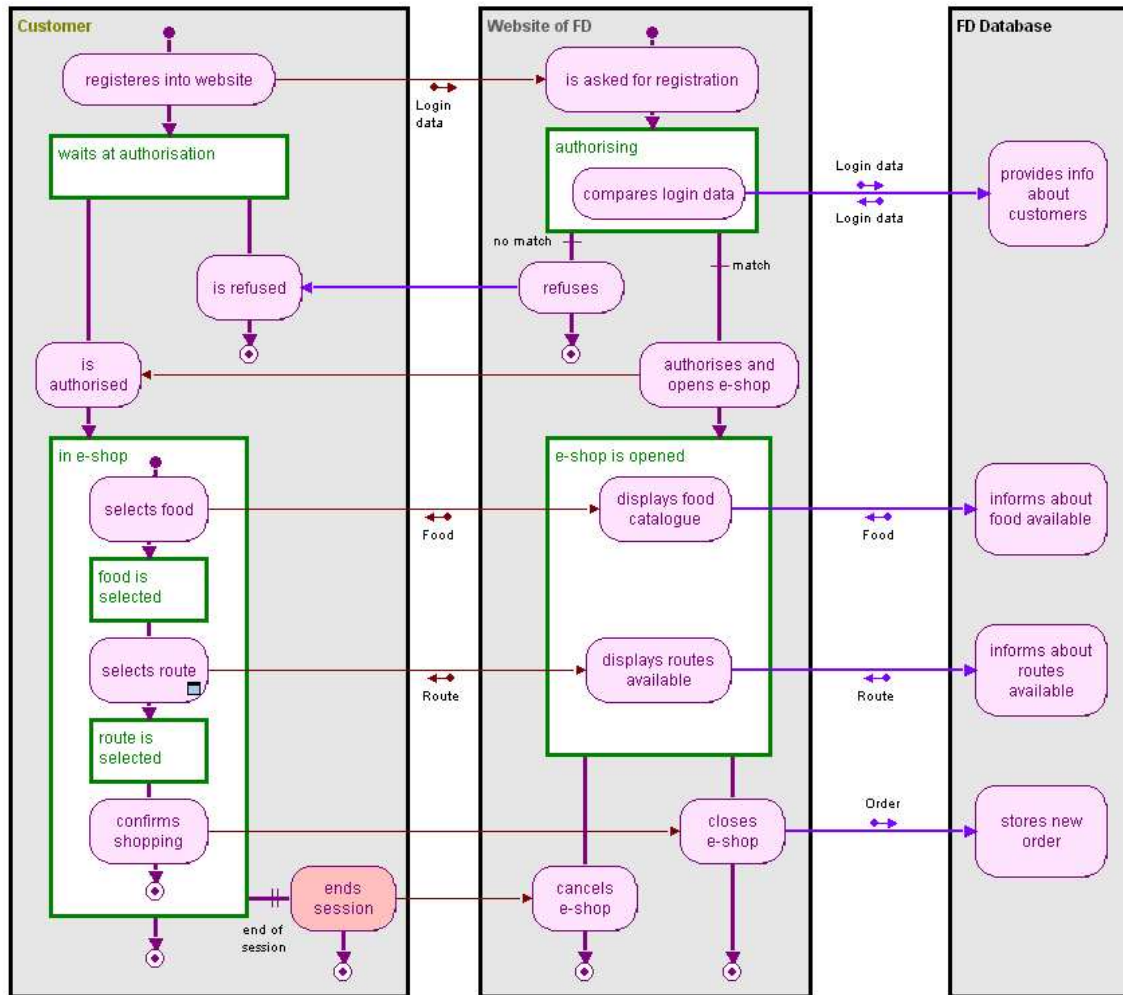


Figure 11. Business process of ordering goods

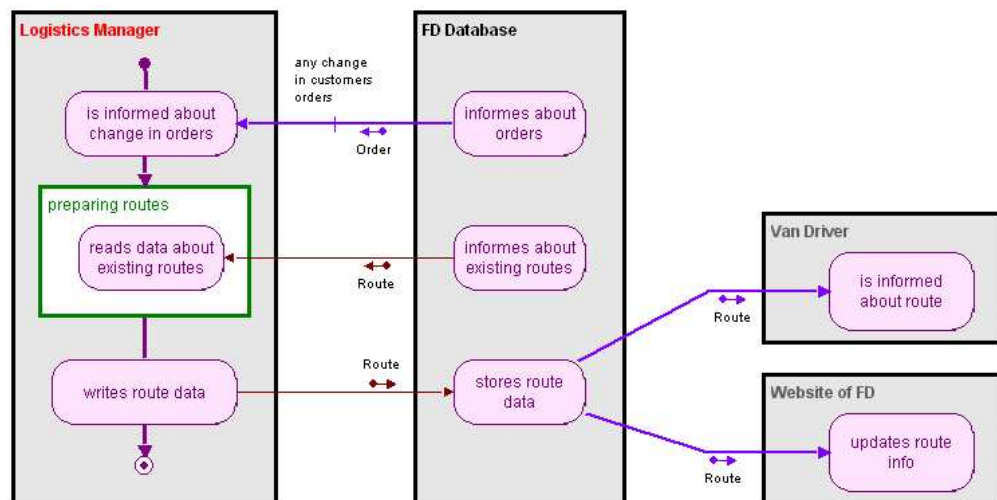


Figure 12. Delivery planning business process

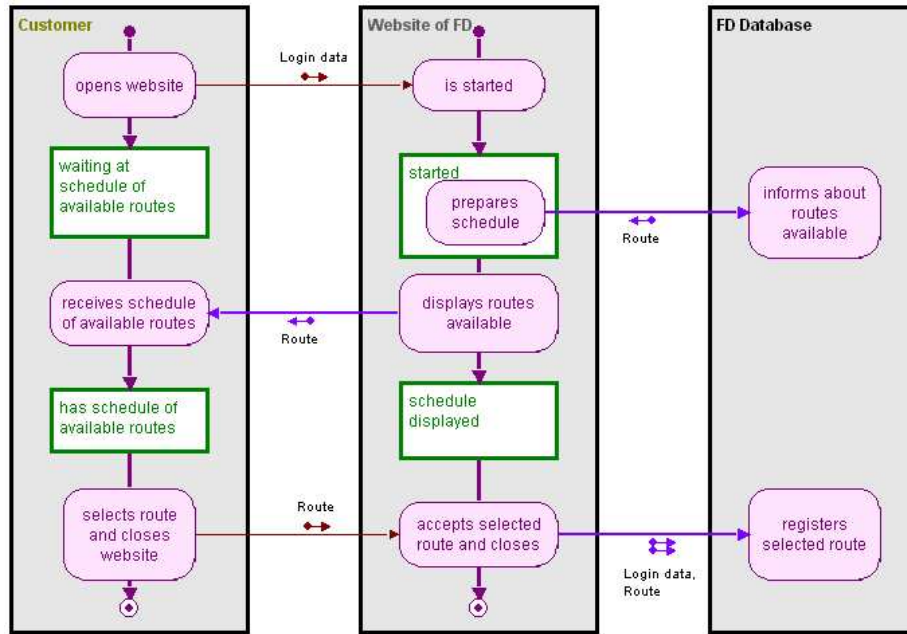


Figure 13. Sub-process of delivery ordering by a customer

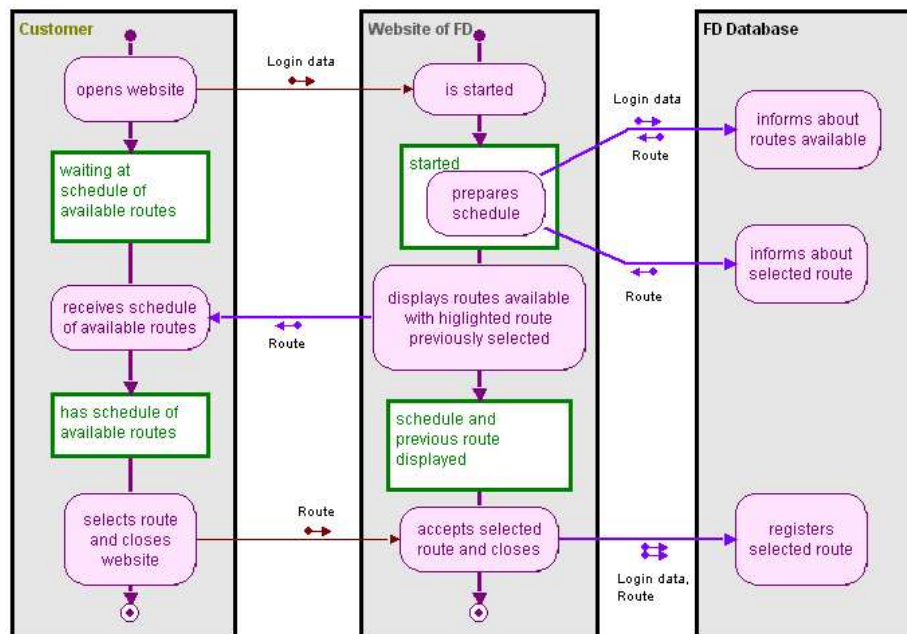


Figure 14. Sub-process of delivery adjustment by a customer

Process testing

Detailed modeling cards and a simulator were used for testing in this step. Craft.CASE simulator displays particular simulation steps and allows dialogue with the user.

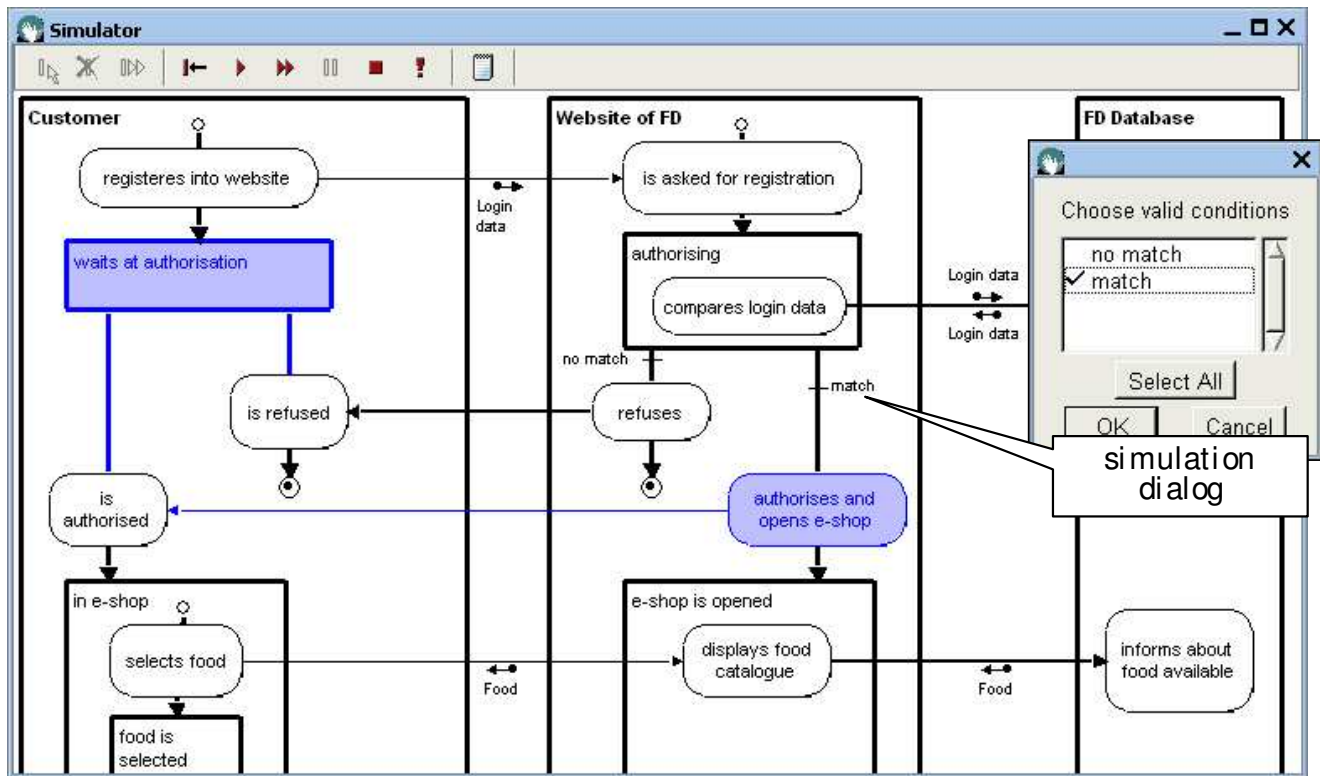


Figure 15. One concrete simulation step in Craft.CASE

Modeling cards

The modeling cards of selected objects were presented during a meeting with the client. Based on these cards (generated as a result of the simulation) a process model was finally confirmed by clients/stakeholders for subsequent software implementation.

Collaborators in diagram with name 'write delivery':	FD Database	Website of FD
start: opens website		>>
waiting at schedule of available routes: receives schedule of available routes		<<
has schedule of available routes: selects route and closes website		>>

Collaborators in diagram with name 'place order':	FD Database	Website of FD
route is selected: confirms shopping		>>
in e-shop: ends session		>>
waits at authorisation: is authorised		<<
waits at authorisation: is refused		<<
start: registres into website		>>
start: selects food		
food is selected: selects route		

Collaborators in diagram with name 'update delivery':	FD Database	Website of FD
start: opens website		>>
waiting at schedule of available routes: receives schedule of available routes		<<
has schedule of available routes: selects route and closes website		>>

Figure 16. Cards of a customer's detailed behaviour (Customer)

'Route' from 'Website of FD'	Customer	FD Database
accepts selected route and closes		registers selected route
accepts selected route and closes		registers selected route
displays routes available	receives schedule of available routes	
displays routes available with highlighted route previously selected	receives schedule of available routes	
prepares schedule		informs about routes available, informs about selected route
prepares schedule		informs about routes available

'Route' from 'Customer'	Website of FD
selects route and closes website	accepts selected route and closes
selects route and closes website	accepts selected route and closes

'Route' from 'FD Database'	Logistics Manager	Van Driver	Website of FD
informs about existing routes	reads data about existing routes		
stores route data		is informed about route	updates route info

'Route' from 'Logistics Manager'	FD Database
writes route data	stores route data

Figure 17. Modeling cards of route data flow behavior (Route)

IT modeling (Platform-Independent Model)

After finishing the business model and confirming its business requirements, a conceptual model of the company's information system was initiated. All business-modeling outputs are also the most important part of the documentation for the software solutions supplier.

IT structure

It was proposed that the software solution be comprised of three subsystems: a web interface, a delivery planning system and a product and supplier database.

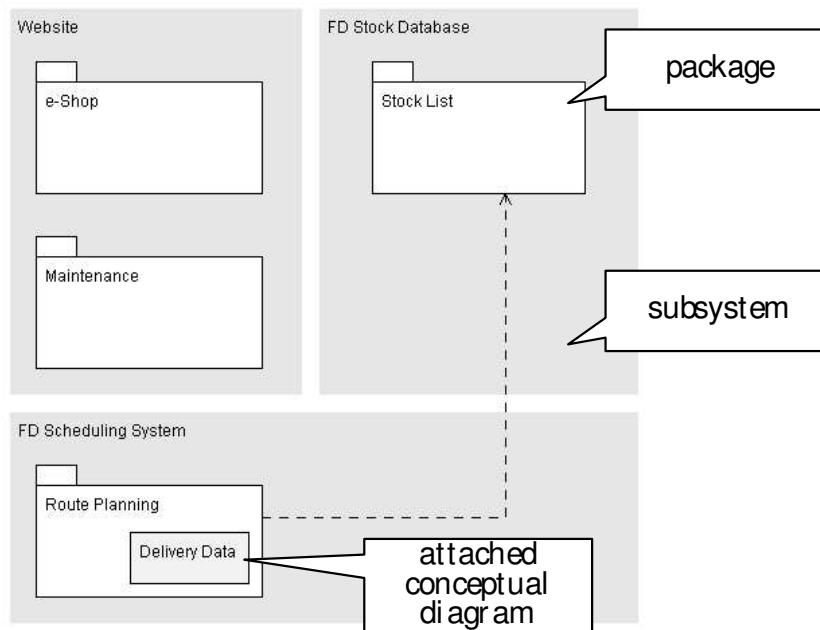


Figure 18. IT architecture of the company's system (Clone of UML component model)

IT models

Based on information from the business model, it was finally possible to create a conceptual diagram of classes and related instances and collections in UML standard related to ordering and delivering. The conceptual model has also to be negotiated with business objects (hierarchies, participants and data flows) and validated using several concrete data.

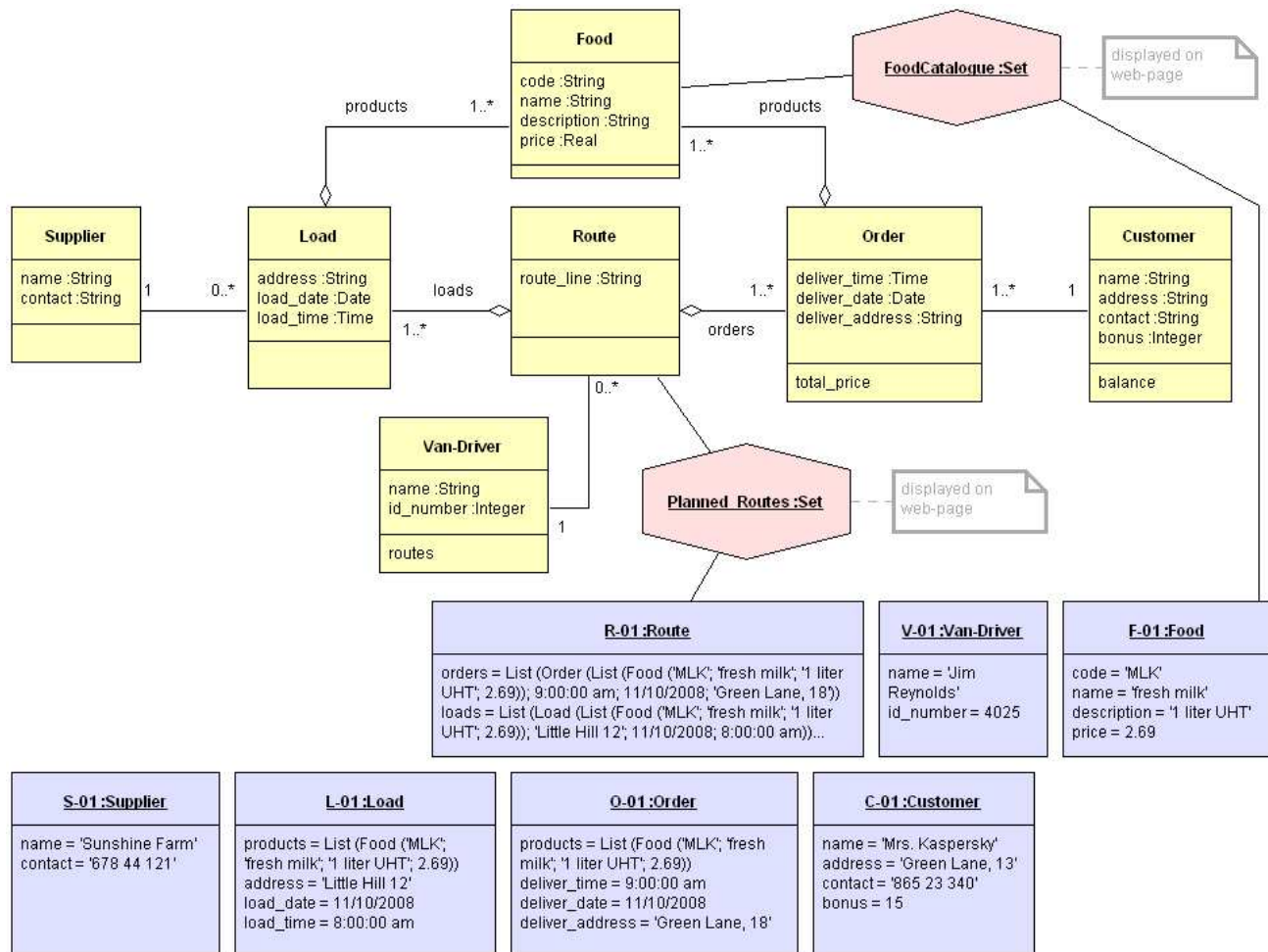


Figure 19. Class and testing instances model

CONCLUSION

We feel that the highest value of BORM is generated by the way of modeling, which covers two different worlds: business engineering and software engineering. BORM is a comprehensible tool for the collaboration between software developers and problem domain experts.

The number of projects executed in past 10 years gives us an important feedback. Our experience with business clients shows that clients do not like to hear we are bringing a simple solution to their complex requirements. They prefer to depict and simulate each important relationship between/among flows of material, finance, resources, and information, but in one coherent model. Therefore the clients appreciate our approach instead of using the separate activity, state-transition, and sequence and communication diagrams of the same business situation. The clients say our analysis gives them a complex and context view of issues they did not see before. Clients appreciate BORM models having collection of business elements and their relationships being visualized and simulated together.

Moreover, several clients use miscellaneous legacy Process Modeling Systems for historical reasons (e.g. EPC-based ARIS, for example). (EPC, 2009) However they prefer to analyze and design processes using BORM as well. Later they convert the results into their legacy systems. One of the clients even produced 15 pages handbook on how to use as many as possible BORM results for the input into their legacy modeling system.

Our next work will concentrate on elaboration of the BORM, its concept transformations from and to other methodologies and research in the area of business process patterns.

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