

Business Modelling as a Tool for Interactive Multimedia Applications

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Abstract – Implementation of Interactive Multimedia (IM) applications into a business helps to make business more competitive. But, when one applies IM solutions to improve its business a lot of questions can arise. The examples of these questions are: What business process should be supported? What type of interactive multimedia solutions is needed? What workflow can be used to fully utilize new possibilities? etc. The very effective technique to answer to these questions and to support implementation of interactive multimedia solutions is Business Modelling (BM). This article introduces application of BM technique to support IM applications. The guidelines and developed implementation concepts are summarised in Interactive Multimedia Application (IMA) Business Reference Model. This reference model is introduced as well.

I. INTRODUCTION

Running a business today is more competitive than ever. The globalisation of world markets, brought about by technology in general and the Internet in particular requires business people to acquire and adapt to new business logic (see [3]). New Multimedia Technologies (MT) can completely reorganize routine works in modern industry and business processes within SMEs (Small and Medium Enterprises) and large enterprises. They can reorganize all business workflow processes, communication and documentation. Especially, these technologies can revolutionary change the view of documentation used in every day life of an enterprise. A simple textual documentation can be substituted by adding graphics, video, voice and communications behaviours.

But, large scale of possibilities, that brings MT and especially Interactive Multimedia (IM) technologies are not fully utilized in industry. The reasons for it are the following: the implementation of MT is expensive (investments should be done into hardware, software and services); it is not clear what set of MT solutions should be implemented; some business process re-engineering is needed for better utilization of new possibilities and as result a company personal should be trained.

Business Modelling (BM) technique can be used very effectively for solving these problems. BM technique not only reduces the cost and time of implementing such MT solutions (setup and customisation of the system) but also helps with re-engineering of business processes and following modifications them according to the ever-changing business process requirements. Also, BM technique can be used for creating working guidelines (management of process) and personal training.

Business Modelling itself is the study of an organization. During the business-modelling process, one examines the organization's structure and look at the roles within the company and how they interrelate. Modelling can also examine the organization's workflows, the major processes

within the company, how they work, how effective they are, and whether there are any bottlenecks. It will examine the outside entities, either individuals or other companies, which interact with the business, and look at the implications of that interaction.

This paper introduces the technique of BM with UML (Unified Modelling Language) and main concepts from IMA business reference model. This reference model was specially developed to simplify implementation of MT solutions. The basic notations, diagrams and concepts of BM are introduced in the second part of this paper and IMA business reference model is introduced in the forth part.

Some benefits of implementation modelling technology are given in the third part.

At the end of this paper the reference to the project called as Digital Factory hold in Hungary is given. In this project the BM activities have been widely used.

II. BASIC NOTATIONS

The business modelling extension of UML is well defined in the literature (see [1], [2], [3]). This paragraph provides just brief overview.





TABLE 1 describes the business modelling notation and icons used in UML.

These icons can be used to create graphical description of the business. The graphical model is more representative and understandable then just textual description. The graphical part depends on modelling formalism, which is used. This paper introduces the business modelling with UML. The UML provides different diagrams. Each UML diagram provides a different view of the business:

- *use case diagrams* describe the business context.
- *activity diagrams* describe behaviours in the business, or business workflows.
- *class diagrams* describe the static structure in the business.
- *interactions diagrams* (sequence diagrams) describe the dynamic interactions between employees and things that they manipulate. Thus they indicate how the behaviours described in activity diagrams are realized.

Together, all of these various diagrams make up the business object model. This model provides detailed information on how the business process is implemented.

TABLE 1
UML NOTATIONS

Icon	Name	UML Definition
 business actor	Business actor	Someone or something, outside the business that interacts with the business.
 business worker	Business worker	Role or set of roles inside the business. A business worker interacts with other business workers and manipulates business entities.
 business entity	Business entity	A "thing" handled or used by business workers.
 Business UseCase	Business use case	A sequence of actions a business performs that yields an observable result of value to a particular business actor. One business Use Case can contain several business processes

III. BENEFITS OF BM

Let us shortly outline the main benefits that can be gathered from BM activity in case of implementations of IM applications.

Context for a Software Solution. Any implementation of IM applications will ask some software development or adjusting of existing system. In this case, business modelling can help developers understand the context of the system, which they are building. While this may sound trivial, it can have serious consequences on the success or failure of a software project. If we fail to understand the business, we may make faulty assumptions about what the software should do and how it can best be used by the business community.

Business Process Re-engineering. The main workflows of an organisation, where IM solutions will be applied, should be redeveloped to better utilise new possibilities. Some business process re-engineering is needed, in this case. Business modelling is a very helpful tool in a business process-re-engineering effort. One of the main artefacts of the business-modelling process is the workflow diagram. Such a diagram depicts how a particular process flows within the organization. It shows the individuals involved in the process, the steps within the process, and the business entities that are involved in the process. A business process-re-engineering team will start by documenting the current process with workflow diagrams. They can then analyse these diagrams to look for inefficiencies or other problems within the workflow.

Determining of needed IM content. Application of BM is an effective way to implement set of IM solutions which are really needed by the business. The diagrams in business modelling will help to understand what information flow exists inside of organization and what is information exchange with outside world of the business.

The best set of multimedia features for modelled organisation can be defined by using BM.

IV. INTERACTIVE MULTIMEDIA APPLICATION BUSINESS REFERENCE MODEL

The application guidelines for IM solutions have been summarised in IMA business reference model. The developed model consists of two levels. The first level is core model and glossary. At this level main concepts used in reference model are introduced. The model adopts the idea of iterative development from Rational Unified Process (RUP) and Business Modelling (BM) technique. The Unified Modelling Language is used as a modelling formalism for modelling the business processes. Some concepts from core model have been introduced in the second section of this paper.

The second level collects implementation guidelines of IM technology. Currently, this level includes guidelines for management of MT implementation in enterprise business process, guidelines for BM of organisation to support implementation and classification of multimedia sources. This model can be extended with new guidelines. *Fig. 1* shows graphical interpretation of the structure described above.

In the rest of this section business modelling and management guidelines described

Overview of BM guidelines

Let us consider the business processes inside modelled organisation. Under the business process let us understand simply a set of activities designed to produce a specified output for a particular customer or market. A process is affected by business rules and can contain sub processes. A process is thus a specific ordering of work activities across time and place, with a beginning, an end, and clearly identified inputs and outputs: a structure for action. A business process has a goal, a set of input objects and a set of output objects. The input objects are resources that are transformed or consumed as part of the process, such as raw material in a manufacturing process. The input objects also can be refined by the process, in which case the process adds value to them, so that the value of the output of the process is larger than the input. The output objects represent the accomplishment of the goal and are the primary result of the process, such as a finished product in a manufacturing process.

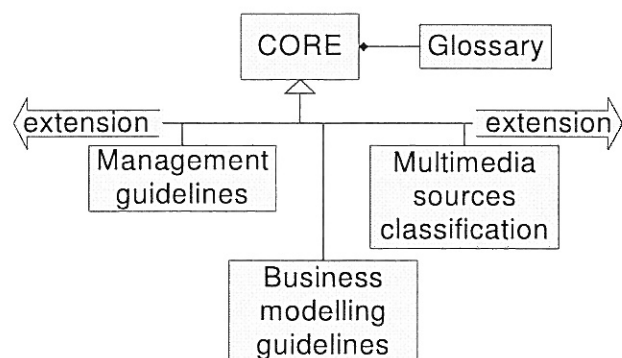


Fig. 1. IMA Business Reference Model

The output object is also a resource. An output object can be a completely new object created during the processes or it can be a transformed input object. The transformations made by the process can be physical, logical, transactional, or informational. Fig. 2 shows UML representation of business process. The process oriented modelling methodology is deeply outlined in [3].

In our case the process is "Provide Multimedia Services". Multimedia technologies can be used to support business processes inside the organization and for communication with outside world. At the left side of Fig. 2 one can see resources. Resources are information – exactly multimedia information.

During a process these resources can be stored, transferred from one place/client to another place/client or reorganized from one type of multimedia to another type. The goal of business process is to provide processed resources to customer. Under customer we understand organization or individual which is interested in this resource. A customer uses special devices to communicate with IT system and to work with MT. Any of these devices communicates with IT system through interface. The interfaces and devices are shown on the right side of Fig. 2. At the same time the multimedia resources can be captured by different devices and transferred into IT system through individual interfaces.

The IMA Business Reference Model considers the implementation of MT to support enterprise processes from business perspectives. The technical details are covered by IT system. The system can be upgraded to satisfy business demands if it is needed. For example, some new interfaces can be added.

Overview of Management guidelines

From a management perspective, the interactive multimedia application lifecycle is decomposed over time into three sequential phases, each concluded by a major milestone; each phase is essentially a time-span between two major milestones (see Fig. 3).

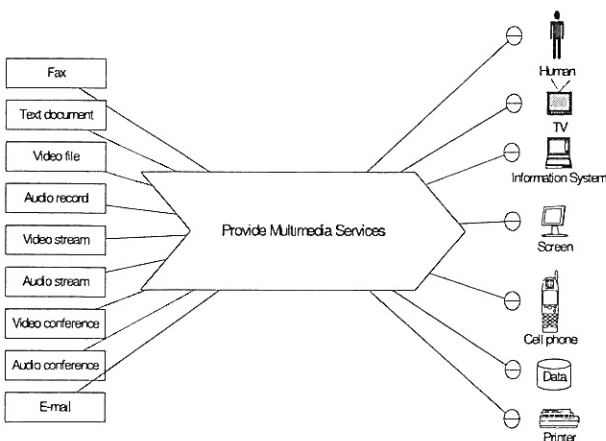


Fig. 2 . Process model for providing MT services

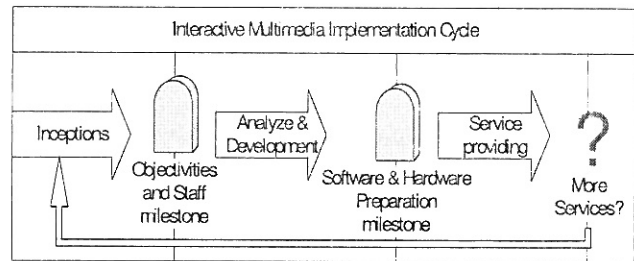


Fig. 3 . Implementation Lifecycle




At each phase-end an assessment is performed to determine whether the objectives of the phase have been met. These assessments can be documented in phase-milestone report. A satisfactory assessment allows the project to move to the next phase.

Inception phase. The overriding goal of the inception phase is to define the information and MT services which are needed for the customer. Let us call our customer as Information Receiver. This information should be approved according to the business rules of the Information Provider side.

At the end of the inception phase the individuals which are responsible for an application of MT from both sides should be determined. Let us call them as Process Owners. In the case when IM solutions are applied on the base of existing software system two process owners can be enough. If a lot of functionality should be added to existing software system an additional process owner can be invited. Let us call this role as IT Representative. This process owner represent IT team which will implement the new features into the system or develop not existing interfaces. This IT team can be entire IT team of the company or can be from a third side participated in the project.

Fig.4 shows the basic work-flow diagram for the inception phase. This phase is initiated when principal decision to implement IM system for supporting business process is made. The first step is to figure out the information which is needed by customer. This information can be captured by organizing meetings or by e-mail, fax or phone conversation. The form in which this information can be captured can be textual description or visual modeling (by using UML, for example). When customer demands are documented Information Provider side should review this document. After review the demandable information can be approved or rejected if it is in conflict with business rules (like company security policy). In this case a customer can be notified and asked to remove this information from or the next step of Inception phase will be involved. The next step is identification of individuals which will be responsible for MT process implementation from Information Receiver and Information Provider sides.

TABLE 2
MAIN ARTIFACTS OF INCEPTION PHASE

Artifact / Business entity	Description
 Bill of Customer Demands	Composed by Information Receiver side. This document fully describes demands of Information Receiver side. It enumerates and explains, if needed, the demanded information and form in which this information should be presented.
 Staff	Composed by Information Receiver and Information Provider sides. This document contains names of Process owners from both sides as well as responsibilities and rights which these individuals have in the frame of the MT implementation project.
 Schedule of Implementation	Composed by Information Receiver and Information Provider sides. This document describe timetable when MT solutions should be ready for exploitation. IT team will analyze this document and finalized version will be recommended during next phase.

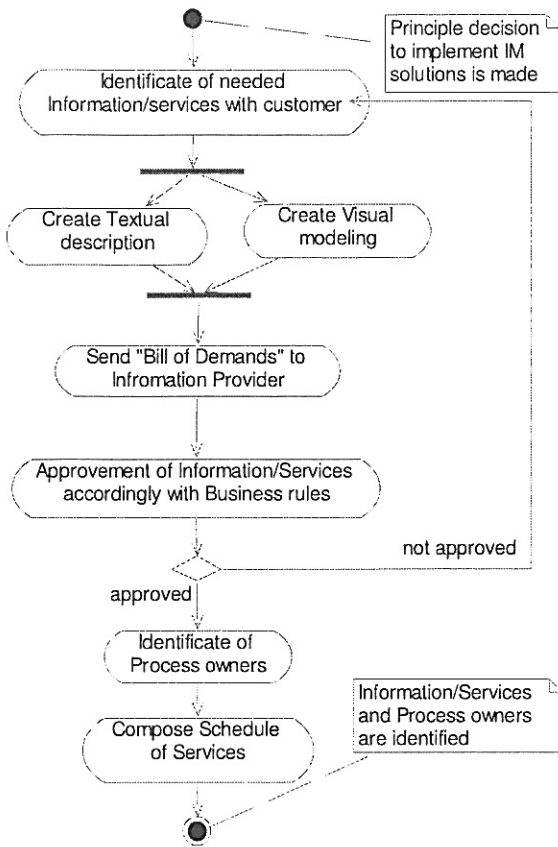


Fig. 4. Activity diagram for inception phase

Let us call them as Process Owners.

- Their responsibilities are:
- Communicate with opposite side
- Defining Process Actors
- Providing interface specification for IT team
- Determination and Purchasing needed equipment

Under Process Actor let us understand individual, information system or equipment which provide/receive information. The Process Actor communicate with the system through interface.

The next step is the creation of preliminary schedule for implementation MT solutions. This schedule is based and on customer demands and will be corrected during the next phase when the interface development possibilities will be analyzed.

The mile stone of an inception phase is reached when Process Owners are determined, Bill of Customer Demands is created and Schedule of services is discussed and captured.

The main artefacts of this phase are outlined in TABLE 2..

Analyze & Development phase. This phase is started when all artifacts of "Objectivities and Staff" milestone are issued. The process owners from both sides use these artifacts as input of they work. The first step in this phase is to determine Process Actors. The input for this activity can be "Bill of Customer Demands".

Demands captured in this document should be analyzed and possible information sources determined. The information sources are process actors. An artifact – "List of Process Actors" can be created on the base of this analyze.

Fig. 5 shows the basic work flow diagram (activity diagram) for analyze and development phase.

When process actors are discovered and possible development amount of work is figured out the IT process owner can be assigned. This process owner is responsible for forming IT staff and for development interfaces between process actors and used system if they are needed. His task is analyzing "List of process actors" and create initial "Interface Specification" document that is technical order for development team. Next step is analyze and estimate the cost, time and effectiveness of implementation. The results of this analyze can be captured in "Cost and efficiency report" and in "Explicit: schedule of implementation". These two documents should be approved. On the base of first artifact some planned functionality and MT services can be cancelled or postponed due to low effectiveness of such behaviour for business or high cost. Because software development is technology driven process the second artifact is very important too. Some interface modules cannot be developed before another ones. In this case the priority for interface development which is given by business demands can be corrected by technology impact. The next steps are software development and software transition. This reference model does not cover the description of these steps as a lot of related methodologies exist and they are well covered in the literature (see, for example, [4]).

The artifacts, which are created during this phase and they descriptions, are given in TABLE 3.

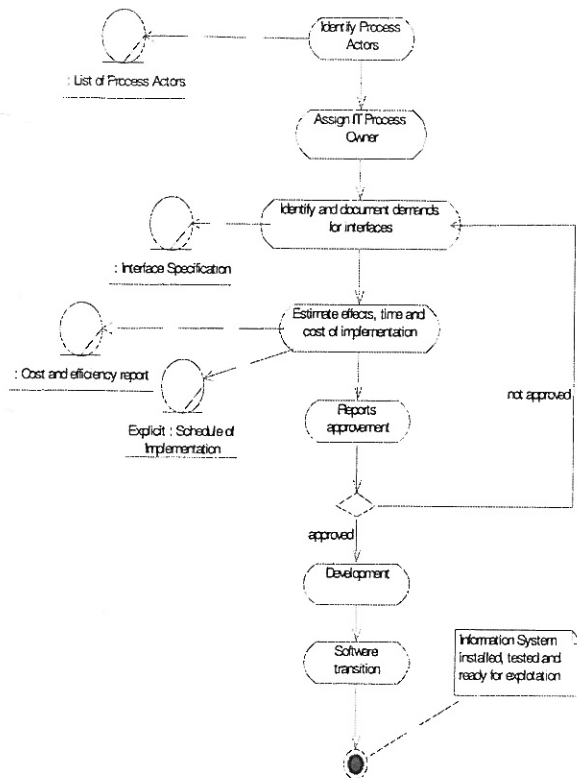


Fig. 5. Activity diagram for analyze and development phase

TABLE 3

MAIN ARTIFACTS OF ANALYZE&DEVELOPMENT PHASE

Artifact / Business entity	Description
List of Process Actors	Composed by Information Receiver and Information Provider sides. This document details “Bill of customer demands” and suggest sources which will provide system with information resources. The source is Process Actor.
Interface Specification	Composed by Information Receiver and Information Provider sides. This document contains all demands to the interfaces between IT system and Process Actor (human, another system or device). This document will be analyzed by IT team and should contain all technical information needed for developers.
Cost and efficiency report	Composed by IT Process Owner and IT team. This document contains time and fund costs of implementation and opinions about how demandable IT solutions can be effective from cost, functionality development-time points of view.
Explicit: Schedule of Implementation	Composed by IT Process Owner Information Receiver and Information Provider sides. This document is agreement between interested sides about what and when should be implemented. This is corrected version of Schedule of Implementation artifact which was developed during inception phase.

When the MT software system is installed and tested the next phase of the project is started. Let us call this phase Service Providing.

Service Providing. The recommendations for these phase are very affected by software system that is used. Because IMA Business Reference Model contains general recommendations the guidelines for this phase are out of scope of this paper.

V. INDUSTRIAL APPLICATION EXPERIENCES

We applied BM in a recent, Hungarian national project called “Digital Factory” where we provided multimedia solutions for the business cases described above.

In this project we developed an enterprise resource integration framework. This framework handles actors (human and software agents), documents (simple and compound ones), enterprise IT components (in the pilot we involved some TQM (Total Quality Management) and monitoring applications and multimedia resources (streams, archives, cameras, processes etc.) in a unified and flexible environment.

At the first phase, BM provided a visionary view about the current and the improved businesses, and led to underlay the developments. The task was to create some network or virtual organisation between several companies. The main goal for this organisation was to provide tele-presence, customer trade services by using the newest available multimedia technologies. Due to the lack of the space the detailed description of the project is omitted here. More detailed information about Digital Factory project can be found in [5].

During the BM activity we realised that many of the concepts that belong to business systems, such as different resources, rules and goals that drive the business, are not defined well in UML. But these terms are much more better understandable by the management of companies then terms from UML BM extension. But at the same time the UML formalism was needed, as developers’ side was very familiar with it.

This difficulty was solved by applying Eriksson-Penker business extensions (see [3]) for describing the business processes. But, unlike Eriksson-Penker patterns we described the business functional requirements of virtual organisation as UML business use case diagram. Discovered business use cases were re-processed by the development and business analysis teams to translate the scenarios into software and system concepts, and to form design and implementation models.

Comparing the development process with and without BM, our experiences suggest the following:

- The relevance and value of BM activities in a project increase with the scope and complexity of the system.
- The cooperation of BM and software architect staff is a key issue, especially in the early phase of the project.
- High level product introducing materials could be derived from BM artefacts by the transition phase.

VI. CONCLUSIONS

The interactive multimedia solutions are very powerful technologies to improve business processes. But, implementation of these technologies into enterprise life requires sophisticated modelling techniques and development methodologies. The suggested IMA business reference model provides business modelling based methodology to support implementation of IM solutions. At the same time the business modelling can be used for improvement of the business process to fully utilise new possibilities. BM helps managers to better understand processes inside the organization as well as processes of the outside world. This technique gives possibility to predict possible risks for the business before they will take place. And, the most important, this technique provides possibility to optimise the business according to current market demands.

VII. ACKNOWLEDGEMENT

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VIII. REFERENCES

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