Coordination of Inter-Organisational Healthcare Processes:
Experiences from Combining Process- and Document Centred Modelling

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Abstract
Experience presented in this paper is based on the E-care project, having the purpose to develop Internet based IT-services for care planning. The intension with this paper is twofold: (a) to present modelling results so far achieved in the E-care project and (b) to show how a combination of process-oriented and document-centred system analysis contributes to integrate the information flow more effectively in the care process. Furthermore, the paper discusses appropriateness of analysis methods selected and relevance of enterprise modelling frameworks.

Key words: Enterprise modelling, healthcare processes, document-centred view, process-centred view
1. **Introduction**

In healthcare an apparent problem is how to deal with the large amount of information that has to be communicated between different organisational units, in order to effectively coordinate the healthcare work. Problems with the traditionally paper-based patient records have been described in numerous papers, and use of IT is considered the solution to this problem. Despite significant investments in IT-systems to handle information, the situation is still complicated. Typically, a lot of information is handled by IT-systems that often cannot communicate with each other, and some information is still managed manually on paper documents. It is argued by (Meijden 2000) that it also is important to consider the positive effects of paper documents.

When planning IT-support in healthcare, in particular for inter-organisational scenarios, it is important to fully understand the communication and coordination processes. When analysing work processes and information flow between different organisations in the E-Care project, the basis of the work presented in this paper, understanding the formal and informal flows and relationships between the stakeholders involved was the main challenge in system analysis. The primary objective of the E-Care project is to contribute to research in care planning for inter-organisational scenarios. Thus the results of the modelling work and their implications on healthcare are present in detail.

Based on this case, the possibilities is investigated to improve the way of performing the system analysis, which was based on a combination of process modelling and modelling of document flow. Although modelling methodology was no focus of E-Care, we consider lessons learned in this project as interesting for other projects in the context of inter-organisational scenarios. In the context of improving the modelling approach, we investigate the contribution of enterprise modelling as integrating element between process, information and organisation view.

Chapter 2 gives an introduction to the current challenges in healthcare and existing activities including the E-Care project. Chapter 3 is dedicated to the E-Care modelling results. In section 3.1 the process models developed is described, what the intension with these process models is, and the results achieved. Section 3.2 describes the enhancements achieved through modelling the information flow based on the paper based documents. Here we integrate the document-centred view with the process-centred view. Chapter 4 presents reflections with respect to experiences from the modelling work and discusses contributions of E-Care to the healthcare field. Finally, in chapter 5, conclusions are presented together with plans for further research.

2. **Inter-Organisational Healthcare Processes**

There are many facets to take into account when searching for the solution of how to coordinate the healthcare work and integrate the information between organisational units (Berg 1999), (Haak 2003):

- The problem of balancing costs and quality of care.
- The problem of having a common terminology between different regions, disciplines, professions and systems.
- The problem that nowadays people have a more flexible lifestyle than previously, leading to higher demands on information transfer between organisational units.
The problem of different organisational structures, as e.g. hospital-, primary- and community care.

The problem of agreeing on a protocol that is capable of transferring information.

The problem of handling the information in a secure way.

The problem of the ownership of the information.

Different attempts have been made to deal with these problems. Several countries have initiated large projects to revise their healthcare organisation. It is important to note that IT-solutions are only part of the plan of action. An important aspect is to find different performance indicators to measure the efficiency of the healthcare organisation. Measuring the efficiency is important for examining the effects of organisational changes as well as for comparing the quality of the care given (InfoVu 2005).

There are several initiatives taken that aim to enhance the use of IT-solutions in Swedish healthcare. Carelink is an organisation with the ambition to improving the cooperation between the healthcare providers and the providers of commercial IT-solutions. The intention is to maintain a forum where the stakeholders can discuss work on standardisation and common reference architecture for building and integrating IT-solutions. Carelink is working with the definition of several services and interfaces to these services. The purpose is to make it easier to integrate IT-solutions from different vendors (Carelink 2004). SAMBA is a national project that has produced a process model for the hospital care of patients. Its purpose is to analyse the information flow in the care process of the patient. This analysis can be used to elicit requirements on IT-services. The project has studied several previous attempts to model the care process. The result is a general process model divided in three different swim lanes: the clinical swim lane with processes for describing the patient’s health condition, the coordinating swim lane with decision processes concerning the mandate for taking care of the patient, and the communication swim lane with processes that communicate information to other processes about resources, documents and messages. The actual documentation process has not been analysed in the project. The project finished its work in 2003 and published their final results in November 2004 (SAMBA 2004). Region-IT is an ongoing project initiated by three different county councils to develop IT-services for hospital care based on a common platform. The project has defined several different services such as patient overview and lab results. Information handled within these services can be provided from several different systems and the Region-IT platform provides the interface for coordinating the information (Internal source). InfoVU is a project with the aim to investigate the balance between goals, results, costs and quality in the healthcare organisation. The aim is also to investigate how IT can be used for coordinating information within the healthcare organisation. The work has been done through several smaller projects and was finished in 2004 (InfoVU 2005).

The E-care project has the purpose to develop practical approaches for internet based IT-services for care planning and searching medical information that is relevant for the subject of care. Care planning is a complicated matter since there are several healthcare organisations involved and the information has to be coordinated between these organisations. Within the project the investigated issues are: national rules for care planning, terminology, previous experiences of IT-use within care planning, care processes for different patient categories, IT-structure for care planning and coordination with the Region-IT project.
It is important to gain knowledge about the care needed for the subject of care, and also to gain knowledge about the processes that are necessary to fulfil this need. Therefore it was considered important in the E-care project to investigate the care processes and how they can be improved. The introduction of IT-technology is a challenge since the experience of using IT within the field of care-planning is limited and it is necessary that healthcare professionals and the subjects of care consider the IT-solutions provided as significant support to the care processes. The primary aim is to develop models on different levels that can be used for development of IT-applications and integration solutions.

The project is divided in several phases. As a first phase care processes for two different patient categories were developed. In the second phase activities, actors and there relationships were modelled in an enterprise model. The third phase comprised the development of two test applications concerning parts of the developed model. One test application was developed in cooperation with the project InfoVU and handles the functional- and activity analysis necessary for making the care plan. The other test application handles admittance of the patient, start of care planning and discharge of patient. The fourth phase, which is currently running, takes into account the results from running the two test applications and develops them further. This is done with the help of students making there final exam works. In the fifth and final phase of the project the Enterprise model and UML models will be finalised. During all the five phases, work has been and is carried out concerning terminology.

Participants in the project come from the municipality of Gislaved, the county council of Jönköping, University of Jönköping, the Swedish Pharmacy Corporation (“Apoteket AB”) and University of Linköping. The project started November 2002 and is scheduled to be finished in November 2005.

3. Modelling Results from E-Care Project

Physicians and others responsible for planning the care work strongly believe that it is necessary to have a clear overview of the care work. What steps does a patient of a certain category go through? Which information is involved in the care processes? Which roles of healthcare professionals are involved in different processes? What are the differences in the care processes between different patient categories? Is it possible to make the care process more efficient? Mapping the work processes and information flow in the healthcare organisation is a possible way of trying to answer these questions.

This chapter summarizes the modelling results from the E-Care Project. One of the objectives of the E-care project was development of appropriate IT-support for coordinating care planning. Thus, the methodology for requirement analysis had to be suitable for preparing design, architecture and implementation of a software system. With this background, attention was primarily focused on established software development processes. The Unified Process (Jacobson 1999) was selected, as previous positive experience with iterative, incremental development existed. Furthermore, the possibility to adapt the process to the project characteristics (Larman 2002) within the different UP disciplines was considered important in an application context that was obviously communication and coordination intensive. The process modelling described in the following section 3.1 is, as part of the UP discipline business modelling, closely related with requirement elicitation. In an initial step, we used use cases to identify the most important
process areas, but decided against detailed textual use case descriptions, like those proposed by usecase.org (UCO 2005), and in favour of visual modelling. Visual modelling provided a suitable way of closely integrating the different stakeholders and refining the analysis results stepwise to a more detailed level.

After the second refinement of the process modelling, it became clear that essential parts of the communication between different stakeholders were based on documents, which were not clearly linked to certain process steps. As a consequence, a document-centred analysis of the inter-organisational care planning was initiated in order to enhance the results of the process view. Section 3.2 focuses on the results of this modelling step.

3.1 **Process-centred analysis**

Five different patient categories were considered by the project to be of particular interest: stroke, hip fracture, heart disease, dementia and severely malign diseases. Out of these, process models were built for stroke and hip fracture. Reasons for starting with these patient categories are: They have a rather long rehabilitation period after being discharged from hospital care, and thereby need careful care planning. The care processes between these two different patient categories, stroke and hip fracture, are considered to be the most different, when compared to the other patient categories.

![Fig. 1 Overview to the different parts of the process model for stroke patients.](image-url)
For modelling the processes the project established one group for each patient category consisting of different healthcare professionals. These groups had several meetings during a six months period working out all details in the process for the treatment of stroke patients and hip fracture patients. Thus the process models built is intended to capture all major possibilities and not just a typical scenario.

The process model for stroke patients is divided in several sub processes as shown in fig. 1. Even though the process model shows the process of the whole episode of care, from the patient demanding until (s)he is in no need of healthcare service, it is focusing on how the care plan may evolve, depending on e.g. how a patient is going to live after leaving the hospital. This is clearly reflected in how the process model is divided in sub processes and thus makes possible different care plans.

**Care process for a stroke patient**

The process starts with a patient having a demand for care after showing symptoms of a stroke, possibly in combination with other symptoms. There are several possibilities to contact the healthcare providers. The three main possibilities utilised are given in the process “Demand for care”. A patient can either be given the advice to contact a primary care facility or be transported by ambulance to the emergency care unit. See fig. 2.

After the patient has been examined, the emergency care unit decides where to transfer the patient. Depending on the symptoms the patient is transferred to some other unit at the hospital. This is described in the process “Inhospital care of stroke patients” shown in fig. 3.
One of the sub processes described is the care given at the stroke care unit, shown in fig. 4.

An essential part in the work of healthcare professionals is to give oral reports to each other, denoted “Communication between care workers”, which can be done at any time. The patient condition is analysed when (s)he comes to the ward and is a collaboration between different healthcare professionals. This is an ongoing procedure where the different healthcare
professionals give their opinions about the patients’ condition and the treatment for the patient. It is also part of the process “Treatment and evaluation”. When the patient comes to the ward (s)he is signed in and a sign in message is sent to the assistance dealing officer in the municipality (abbreviated “BiH”), in order to inform about the patient being signed in to the hospital. The assistance dealing officer is responsible for deciding the activities that should be provided for the patient in the municipality care, given to the patient after being discharge from the hospital. This information is important since there might be ongoing activities, in the municipality care, that have to be cancelled. Once every week there is a meeting for discussing matters such as when to start care planning for the patient.

One of the outcomes from the process named “Stroke care unit” is the decision to discharge the patient. This decision has to be prepared thoroughly. It must be clarified were to send the patient and the need of care the patient has. The patients home situation is investigated, sometimes by letting the patient go on leave or alternatively on a short visit to the home. Since the home situation and the remaining need of care differ the process diverges into several different sub processes. This is shown in the process “Discharge of patient” (see fig. 5). The patient can be discharged to his home in different ways: with need for community care and primary care, with need for only primary care or without need for care. If the patient cannot be discharged to home (s)he can be discharged to either Service apartment, Care apartment with nursing services or Temporary residence.

![Discharge of patient](image)

**Fig. 5 Discharge of patient**

**Implications of the process model**

The focus of the work with the process model was to shed light on how the care planning for the patient is carried out. The model is not simplified and becomes quit complicated. The described process model captures very well all the activities concerning care planning for the patient, the decisions taken, messaging between healthcare professionals within and between organisational boundaries, and physical movement of the patient. It also captures fairly well the different roles
of healthcare professionals involved in the parts of the care process. On the other hand it becomes apparent that information or documents are poorly mapped towards the different parts of the process. It is also impossible to see how information and documents are associated to different roles of healthcare professionals. One exception is documents describing the methodologies used. These documents are rather easy to associate to the respective parts of the process model.

After having worked out the process model we had a seminar and several meetings, with healthcare professionals representing different roles, to try to investigate the information flow and how it can be related to the process model. In general it turned out to be difficult to capture the information flow in a very precise way, more difficult than mapping activities, decisions and messages within the process flow. The resulting mapping was interesting, but inconsistent in the levels of detail. The most important channel for communication of information between healthcare professionals is the documents used. The documents are primarily used to follow up the patients, e.g. when they come to other healthcare professionals, in a future care situation, but their purpose is generally not to capture the sequence of activities. It is therefore not so easy to elicit the information flow using the process model as a catalyst. This indicated to us that the documents should be used as a starting point for investigating the information flow more thoroughly, which here is called a document-centred view.

3.2 Document-centred enhancement of the process view
In order to get a more detailed knowledge of the information processing a study was initiated to reveal:
• How are the documents in the care of stroke patients used as a coordinating instrument and how well does this work?
• How is the transfer of information carried out?
• What missing information can be related to the documents?

This study was performed by a group of three students, doing their final exam work (Almborg 2004). The essence of this work can be summarised as follows. Information between healthcare professionals is today essentially given through documents. It is important that the structure of these documents promotes unambiguous and comprehensible information. Problems with documents are that they convey a one-way communication, especially when done in several steps. Therefore it is important to find ways for conveying feedback.

The coordination of the work in the healthcare organisation is mostly done in three ways:
• Written rules and procedures.
• Standardised knowledge within categories of healthcare professionals.
• Mutual agreements by oral communication.

The main reasons for the first two ways are to guarantee the quality of the care given and for the last is to be a feedback mechanism.

The study was a qualitative study in which several healthcare professionals with different roles were interviewed. To have a high reliability in the collected material a questionnaire for the interviews was developed and they were all tape recorded. A limitation with the study was that only one person from each work category was interviewed. The study was performed with respect to 20 different documents, of which many are collected in a special folder called the
patients folder. The results of the elaborated interviews were presented for each document by a short summary of the contents, the persons involved and the purpose of the document. A diagram was also presented showing the flow of the document and possibly relating it to different activities. The relevance of the information for the different healthcare professionals was commented. The part denoted as oral information and participation states if the information is received from another source, e.g. orally from another person. It also states if the information is of specific interest for someone. Finally comments made by the healthcare professionals were presented, relating the document information to the future care of the patient.

**Analysis of two different documents**

Below two examples of document flows are given, Contact Information and Report from the Home Rehabilitation Unit.

The symbols in the diagrams for the document flows in fig. 6 and 7 have the following meaning:

- 🔄 Activities performed in the care process
- → Oral information flow
- → Document flow
- —— Information also given within other documents

Fig. 6 shows the flow of the document **Contact Information**. (Summary) The document informs physicians and nurses at stroke care unit how and when the patient became ill and the patient’s condition before this occurred.

**Fig. 6 Flow of the document contact information. Adapted from (Almborg 2004).**
The information is filled in by the nurse in the municipality or the district nurse in primary care and is provided to the hospital. The physician at the emergency care unit receives the information and it is further delivered to the nurse at the stroke care unit. (Relevance) According to the nurse at the stroke care unit the information about how and when the patient became ill is important for the future care of the patient. It is also important to know how the patient managed her/his life before becoming ill. (Oral information and participation) The occupational therapist is interested in receiving the information in the document. Today it is given orally by contacting the nurse at the stroke care unit. Some of the information is of interest for the assistance dealing officer at the municipality, but (s)he receives it through an IT-system “Sofia omfale”. The subordinate nurse in primary care is interested in information about medicine given to the patient and activity related information, but they can get this information from the document “Discharge message” and orally from the district nurse. (Comments from healthcare professionals) Information about diet is missing. Sometimes the document gets stuck at the emergency care unit and is collected in the patient record folder, and does not reach the stroke care unit. Besides this the healthcare professionals have the opinion that this document works very well. It is easy to fill in and understand.

The second example given here is the treatment Report from the Home Rehabilitation Unit. The flow of the document is shown in fig. 7. (Summary) The document contains information about the rehabilitation of the patient and the purpose is to give feedback. Information given is the cause for the care, the treatment period, the goals for the rehabilitation and the measures taken to achieve the goals. (Document flow) The information in the document is filled in by the healthcare professionals working in the home rehabilitation unit upon finishing the treatment of the patient. The document is sent to the assistance dealing officer, rehabilitation staff at the hospital and to the rehabilitation staff working at the care unit. (Relevance) The information is important as a feedback mechanism. If the patient has improved by the treatment it might be possible to reduce the efforts that are planned. (Oral information and participation) The document should be sent to the nurse at the stroke care unit, but this is not always done. The subordinate nurse in primary care receives the information in the document orally through the district nurse, but wishes to receive the document directly. The nurse in the municipality receives the information through the document Summary of Care Events (“care epicrisis”).
Implications of the document-centred view
Integration of the document-centred view with the process centred view can readily be done for some of the documents. These connection points can be found where an activity or a location is visible in the document flow, and also indirectly when a location is connected to a role of a healthcare professional.

It is apparent when studying the report by (Almborg 2004) that very often information is delivered orally. It is also obvious that the same information is entered in several documents, giving rise to possible inconsistencies. Different groups of healthcare professionals use different documents as their sources of information, for retrieving the same type of information, which may be a ground for misconceptions.

The limitation, that only one person from each working category was interviewed, affects the picture in some ways. For example: It is possible that some knowledge about the documents may have been neglected and there may be different opinions about the relevance of the information in the documents. This study also only considers the care situation in one particular region. For a nation or world wide study one has to take into account that there are organisational differences between the regions and countries, and that the documents used may differ.

The documents described are different in that the first document, Contact Information (“Kontaktblad”), has several direct connection points to the process flow, whereas the second document does not have such connection points. This illustrates that the intention with the documents is to give information that is necessary for the future care of the patient.

Each of the documents has a specific purpose, except some of the documents that were considered as obsolete by the healthcare professionals. The fact that some information on almost every document could be found on other documents should indicate that there is a potential for making the information flow more efficient. This can be done by studying the correlation of the information content in the documents with the healthcare professionals accessing the documents and also the activities where the information should be available.

From the report by (Almborg 2004) conclusions can be drawn about issues necessary to deal with, in order to accomplish successful information integration:

- Information that is crucial for the work of healthcare professionals
- Information that a specific group wishes to retrieve (and probably have difficulties to retrieve as it is now).
- Missing information.
- Information that are duplicated in several documents.
- Possible disturbances or security weaknesses in the information flow.

Examples on such critical success factors that can be derived from the examination of the document Contact Information are:

- Vital information for the nurse at the stroke care unit is information about how the patient became ill and the time it happened.
- The occupational therapist at the hospital wishes to receive information about what the patient managed to do before becoming ill.
- Consider inconsistencies of information also available in the system “Sofia omfale” (e.g. information about effort carried out by the home service team in the community).
- Information about diet is missing.
- Consider inconsistencies of information also available in the document “Discharge of Patient”.

4. Reflection and Discussion

Chapter 3 summarised and illustrated the results achieved when modelling the care organisation from a process-centred view and – for selected areas – with a document centred perspective. Both modelling approaches belong to the standard repertoire of system analysis techniques in information system development.

4.1 Modelling Approaches

Techniques for modelling data flow, which are the basis for document-centred modelling, are well-known in software engineering since Larry Constantine’s work in the 1970’s. Integration of the data flow perspective into the business modelling perspective would have been possible from the UP and from practical viewpoints, but seemed to be a sub-ordinal aspect to the process view. After the second iteration of process modelling in the E-Care project, i.e. with increasing level of detail, it became clear that a lot of non-formalised communication between the stakeholders was based on using and processing documents. In terms of organisational semiotics, as described in Stampers’s organisational onion from 1973, we learned that the formal layer in this organisation, i.e. rules guiding the individual actions, is to an unexpectedly large part represented by documents. The values and behaviour of the acting individuals, which are essential for the care planning process, could only be understood in a sufficient way when focusing on document flow and processing.

The contribution of documents to enterprise analysis and software development has been investigated in a number of research activities during the last decade. Examples are the role of documents as communication instruments in requirements engineering (Cronholm and Goldkuhl, 2004), as part of an enterprise communication structure (Krallmann et al. 1989), or as user interface (Bier and Goodisman, 1990). Furthermore, the importance of including documents in a system analysis process in general and in the application field of healthcare in particular is confirmed by Goldkuhl and Röstinger (2002). They investigate knowledge sources in work practice based on a scenario in elder care and observe that formal and informal documents are an important means of communication.

The process-centred view in system analysis, i.e. modelling of activities and of processes consisting of activities, became increasingly popular at the end of the 1970s with the introduction of SADT (Structured Analysis and Design Technique) (Ross, 1977). Although the original idea was to support understanding and solving of problems by decomposing them into smaller parts, which very often resulted in functional decomposition when used in software engineering, SADT soon was used for modelling processes in requirements engineering (Ross, 1985). Process-based modelling has been extensively studied in computer science (Curtis et al., 1992) and is also a key
concept in business process re-engineering approaches and workbenches, like ARIS (Scheer and Kruse, 1994).

Although the modelling results of the E-Care project created a good understanding of the inter-organisational communication, we see room for improvements with respect to at least two aspects: (1) the interrelationships between processes, documents and organisation structures (like roles or organisation units) are expressed in different models, which does not ease consistency checking and visualisation of relationships, and (2) resources, like personnel, IT-systems or expensive equipment, are not part of the models, but could support an understanding of the effects of changes. With respect to these two aspects, we expect significant benefits of integrating the process-centred and the document-oriented models into a joint model based on a modelling framework allowing for representation and visualisation of organisational structures and resources.

Traditional modelling languages used in software engineering, like UML, provide possibilities for integration, but have limitations when it comes to capturing organisational structures, including organisation units and roles. UML use cases consider different types of actors and thus provide possibilities to capture roles, but organisational structures would have to be modelled like domain concepts. SADT integrates process and data flow quite effectively by providing actigrams and datagrams, but organisational structures are not captured explicitly.

In the context of integrating different modelling viewpoints enterprise modelling, which were heavily influenced by manufacturing industries, offer interesting possibilities. Enterprise models usually consist of different models, like activity models, information models, organisation models, resource models and economic models (Vernadat, 1996).

Examples for enterprise modelling frameworks are C4ISR, GERAM, IDEF or UEML. These approaches support capturing of different viewpoints of an organisation, including organisational structures, and interrelationships and interdependencies between these viewpoints.

The IDEF (Integrated Computer Aided Manufacturing Definition) group of methods (IDEF 2005)(IDEF 2005) aims at supporting enterprise integration and includes among others, IDEF0 for functional modelling, IDEF3 for process modelling and IDEF1X for data modelling. C4ISR (Vernadat 1996) supports definition of an information exchange matrix for explicating information flow, and an activity model for describing activities and information exchanged between them. The GERAM (Generalised Enterprise Reference Architecture and Methodology) framework (Berneus 1997)(Bernus, Nemes 1997) includes among other elements enterprise modeling languages. These languages provide constructs to model human roles, organizational processes and their functional contents, supporting information, and production technologies. The objective of UEML (UEML 2005) is definition of a unified enterprise modeling language, which would facilitate interoperability in the frame of on-going standardization efforts in enterprise modeling language. The common language was defined in terms of a core set of modeling constructs.

To apply an enterprise modelling approach to the E-Care healthcare scenario would in the first step require a strict definition of the system boundaries, as the objective should not be to develop complete enterprise models of all organisations involved but part models covering the relevant organisation units. First steps into that direction, which were made based on the modelling tool
METIS (METIS 2005) and the GEM language showed in promising results: the visualisation of relationships between roles in different healthcare organisations, processes and documents contributed to discovering dependencies and discussing them with the stakeholders involved.

4.2 E-Care in the Context of Healthcare Initiatives

Carelink takes a holistic view on how to organise, nation wide, the work for the future use of IT in healthcare. This is necessary in order to coordinate all the different initiatives taken in projects and by vendors. Projects like E-care can benefit from this by taking part of results from other projects within the same field.

In E-care a survey of available IT-support for care planning was carried out. This survey showed that several vendors have applications that support part of the work with the care plan, but no vendor has an IT-solution that covers the integration between hospital care, primary care and community care. (Lejon 2004) This shows that it is necessary to work with such an integration solution. The survey also pointed out that there are several similar projects to the E-care project that is working on developing an integration solution. Such a project, which is referred to in the survey is called TILLIT, and is partly founded by Carelink. More information about the project Tillit can be found in reference (Tillit 2005). Both E-care and TILLIT base the project work on a close cooperation with the users, across the organisational boundaries, to elicit user requirements. While TILLIT is focusing more on developing the technical solutions together with a system developer on the market, E-care is focusing on developing models and test applications. The work with developing the test applications, primarily developed by students doing their final exam works, is a well accepted way of eliciting user requirements. These user requirements are then used to develop UML models as well as an enterprise model.

There are similarities between the E-care project and the InfoVU project. Part of the Info VU is defining a general process for the information flow between different healthcare organisations and has chosen to use care planning as the process to define. It is therefore natural to have a close cooperation between these projects. In the E-care project results from InfoVU is being implemented and tested. The E-care project has developed, as part of an enterprise model, a more detailed process model for care planning than the general model developed by InfoVU.

E-care is cooperating with Region-IT in that the project is following the guidelines given for application development and the results from E-care will be available for Region-IT.

5. Conclusions and Future work

The analysis work in E-Care with respect to how the different documents interoperate has not yet been completed. National regulations in Sweden for how to perform the care work exist, but it is up to the different regions to explore and develop them into their organisation. This is the reason for our statement that the documents do not reflect the process of the care work, implying that we have to use the documents for eliciting the information flow. A further investigation should be to develop the “meta process” that describes how the documents in the document centred view interoperate and correlate this with the process centred view.
It would also be interesting to harmonise the results of the process centred view and document centred view with the process model developed in the project SAMBA. This is interesting since SAMBA has not focused on document processing and the information content handled within there processes are on a high level of comprehension.

Looking back at the combination of process-centred and document-focused modelling, our conclusion for future projects is that during the initial steps of business modelling there should be an analysis of process and data flow in parallel, with focus on interrelation between both viewpoints. By analysing thoroughly whether the data flow reflects input and output of process steps or whether it shows additional activities not part of these processes, the importance of different views will become clearer. Although we consider the results achieved in the E-care project as good, we expect a reduction of business modelling time by modelling both perspective in parallel.

Within enterprise modelling, we intend to continue the integration of roles, processes and documents described at the end of chapter 4. The added value of enterprise modelling approaches are modelling languages integrating all different viewpoints on basis of the same formalism, which in some cases even is supported by visual modelling tools. The drawback from our perspective is the missing integration with software engineering processes and software production environments. To transform results from business modelling for use in modelling structural and dynamic characteristics of software systems is a task that is neither trivial nor supported by today's tools. This area will be subject to further investigation.

Furthermore, we intend to continue working on how enterprise models can be used for supporting system integration in healthcare. The main idea is to include existing IT-systems as resources into enterprise models. Interrelationships between these resources and processes, roles and information flow will also have to be captured. Linking enterprise models for different organisations by creating inter-organisational work flows should support detection of characteristics and requirements for interface between IT-systems involved.

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References


Goldkuhl, Göran; Röstlinger, Annie; (2002) "The practices of knowledge – investigating functions and sources" accepted to the 3rd European Conference on Knowledge Management (3ECKM), Dublin


