Managing the Process Conglomeration in Health and Social Care

Monica Winge, Paul Johannesson, Erik Perjons and Benkt Wangler

Department of Computer and Systems Sciences, Stockholm University, Forum, SE-164 40, Kista, Sweden

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Abstract: The organisation and processes of today's health and social care are becoming ever more complex as a consequence of societal trends, including an ageing population and an increased reliance on care at home. One aspect of the increased complexity is that a single patient may receive care from several separate care providers, which easily results in situations with potentially incoherent, uncoordinated and interfering care processes. In order to describe and analyse such situations, the paper introduces the notion of a process conglomeration. This is defined as a set of patient care processes that all influence the same patient, which are overlapping in time, and that all have the goal of improving or maintaining the health and social wellbeing of the patient. Problems and challenges of process conglomerations are investigated using coordination theory and speech act theory. In order to address the challenges, a number of information services are proposed.

1 INTRODUCTION

Today's health and social care systems face a number of challenging trends that contribute to their increased complexity. One trend is that the population in developed countries is ageing meaning that more and more people are suffering from multiple diseases. Many patients are being cared for in their homes due to both individual preferences and needs for cost containment. This adds to complexity as health and social care at home typically requires that many care providers with different specialities are involved, private as well as public ones. Not only health care is required but also social care with assistance for daily living. Furthermore, informal care parties like family members and neighbours also get a more prominent role for support and mediation.

In this complex and patient centered care environment, multiple care parties are hence engaged in concurrent and asynchronous processes for assisting, investigating and treating a patient. The complex environment results in situations where care is provided through an aggregation of potentially incoherent, uncoordinated and interfering processes. In order to represent and analyse these emergent aggregations of processes, we introduce the notion of a process conglomeration that consists of separate and more or less independent care processes. In a process conglomeration, the patient may experience problems like several care parties visiting at the same time, different care parties prescribing conflicting treatments, or care parties neglecting their responsibilities.

Most work on business process management in health care has focused on improving organisational performance, medical effectiveness, knowledge exchange and information system integration (e.g., Lenz and Reichert, 2007; Walburg, 2006; Beveren, 2003). However, to the best of our knowledge, the research literature has as yet not paid any attention to the problems that arise when several similar, interdependent and concurrently ongoing business processes are entangled in what we here refer to as a process conglomeration.

In order to overcome the problems and challenges of process conglomerations, multiple complementing solutions are needed. Some solutions aim at improving organisational structures and processes, while others focus on attitudes and behaviours among personnel. There are also solutions that address reimbursement models and incentive structures. In this paper, we focus on information and communication solutions that enable multiple care parties and patients to coordinate their activities. A main goal of the paper

is to propose a set of information services that, in the context of process conglomerations, can facilitate effective and seamless communication between health care parties.

2 THEORETICAL BASIS

2.1 Language Action Perspective

A common view on business processes is that they transform inputs into outputs. The activities of a process are seen as contributing to more value for a customer as inputs are successively refined into outputs. However, as noted by Goldkuhl and Lind (2008), this view may be too restrictive as it disregards the coordinative aspects of business processes. From a coordination perspective, a business process focuses not on value transformations but on communicative acts like requests, offers, counteroffers, commitments, agreements, acknowledgments, etc. The theoretical foundations of this view come primarily from speech act theory, (Searle, 1970). A basic idea in speech act theory is that people carry out social activities (also called speech acts) that, if properly combined and executed, result in social relationships. For example, a request (social activity) followed by a commitment (social activity) will result in a contract (social relationship) between two actors.

One influential approach to a communicative view on business processes is the action workflow loop (Winograd and Flores, 1987), see Figure 1. The loop consists of four parts:

- *Request*. One party requests another party to carry out some activity.
- *Commitment*. After an optional negotiation, the party who received a request for an activity may commit to carry it out. This results in an agreement, a social relationship, between the two parties that one of them is to carry out an activity for the benefit of the other.
- *Execution*. The party who committed to carry out an activity actually executes it.
- *Acknowledgement*. The requesting party acknowledges the execution of the activity and confirms that she is satisfied with it.

2.2 Coordination Theory

In order to work smoothly, processes need to be coordinated. Malone and Crowston (1990) suggest the following definition of coordination: "the act of
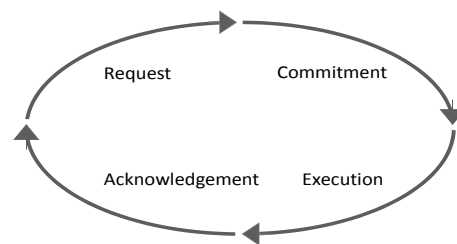

Figure 1: The action workflow loop.

managing interdependencies between activities performed to achieve a goal". Such dependencies may give rise to conflicts and need to be detected and resolved. There are three main kinds of activity dependencies:

- *Flow Dependencies*. A flow dependency between two activities occurs when one of the activities needs to be carried out before the other one, often because the first activity produces some resource required by the other one.
- *Share Dependencies*. A share dependency occurs when two activities try to get exclusive access to the same resource at the same time. An example is that two physicians want to use the same X-ray machine at the same time, or simply that two actors need to get access to a patient at the same time.
- *Fit Dependencies*. A fit dependency occurs when two activities modify the same resource and need to ensure that the modifications are consistent and coherent, taking into account the overall needs and constraints of the resource. An example is that a patient is given two drugs that interfere with each other.

3 THE PROCESS CONGLOMERATION CHALLENGE

This section introduces the notion of process conglomerations as well as the challenges they give rise to. Before addressing these issues we introduce some basic concepts for the actors involved in health care, see Figure 2. These concepts are based on (CONTSYS, 2007) and (Gustafsson and Winge, 2003).

A *health/social care party* (sometimes abbreviated *care party*) is a person or organisation that is involved in health/social care. There are three kinds of care parties: health/social care provider, health/social care third party, and patient. A *health/social care provider* (sometimes abbreviated
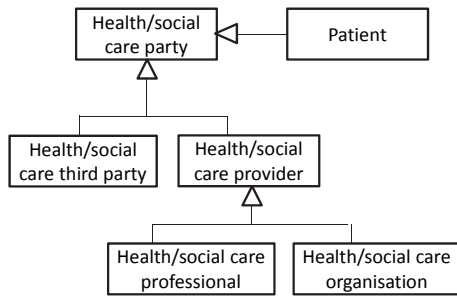
Figure 2: Basic concepts for actors involved in health care.

care provider) is a person or organisation that provides health/social care. A *health/social care third party* (sometimes abbreviated *carer*) is a person or organisation that supports care services and is not a professional health/social care party. An example could be a relative to a patient that performs some or all care activities needed for taking care of the patient. A *patient* is a care party that receives or can receive health/social care. Finally, a care provider can be of two kinds: health/social care organisation and health/social care professional. A *health/social care organisation* (sometimes abbreviated *care organisation*) is a private or public organisation that provides care as its main service, while a *health/social care professional* is a person that in her professional role provides care.

The work carried out by one care provider for one patient can be described as an action workflow loop, see Figure 3, which we refer to as the Patient Care Process. It contains the following activities:

- *Request*. A care provider receives a request from a care party to address a health/social problem for a patient.
- *Negotiation*. The care provider commits to address the care request.

- *Execution*. The care provider together with the patient set up a plan including a set of goals and activities that aims to improve the patient's health/social situation. The care provider then performs the planned activities.
- *Acknowledgment*. Finally, the requester evaluates goal fulfilment.
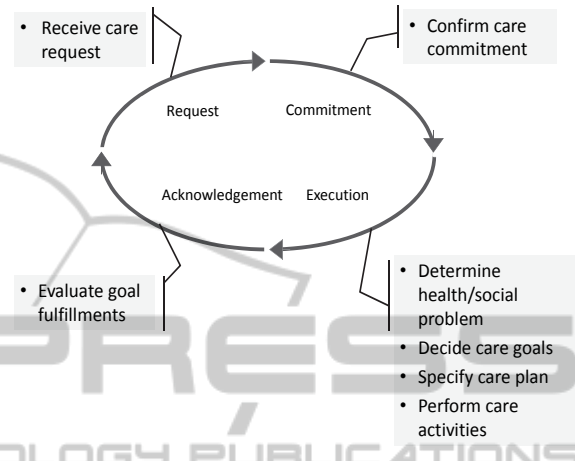

Figure 3: The patient care process described as a workflow loop.

While Figure 3 provides an overview of the Patient Care Process, Figure 4 describes it in greater detail. This model is based on the patient care processes described in SAMBA (Samba, 2004) and SAMS (Winge, 2007), though adapted for the purpose of addressing process conglomerations.

The detailed Patient Care Process (described in Figure 4) contains the following activities:

- *Request*. The Patient Care Process starts when a care provider *receives a care request* from a care party.
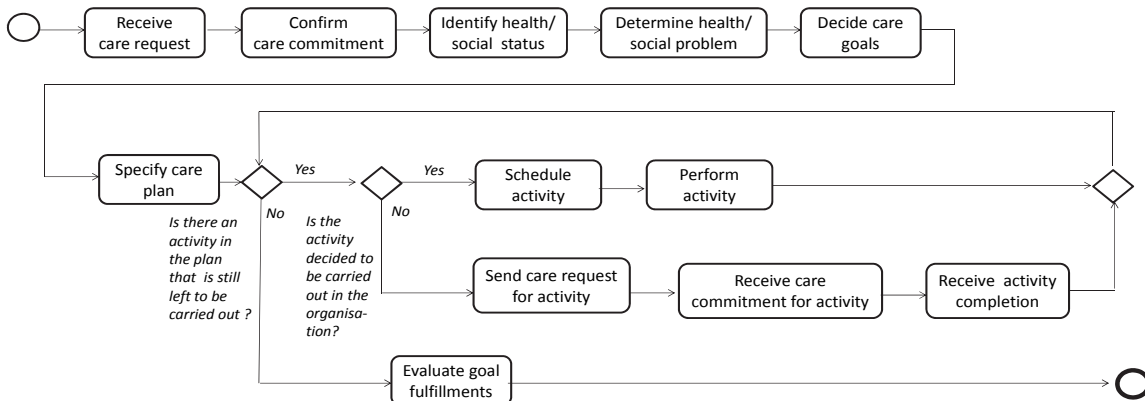- *Negotiation*. The receiving care provider checks

Figure 4: The Patient Care Process described in more detail.

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that it is able to take responsibility for the care request. If so, it *confirms a care commitment*.

- *Execution* - planning level. The responsible care provider *identifies the patient's health/social status*, i.e., anamnesis, symptoms and earlier treatments, and *determines the patient's health/social problems*. Thereafter, a care plan is to be specified. This can often be done by the responsible care provider and the patient themselves, but it sometimes requires a planning conference, in which several care parties participate.
- *Execution* - performance level. Each activity in the care plan needs to be performed by either the responsible care provider or another actor. If the activity is performed by the responsible care provider, it will both *schedule the activity* and then *perform the activity*. If the activity is to be performed by another actor, a *care request* is sent to this actor asking it to be responsible for the activity.
- *Acknowledgment*. Finally, when all the activities in the care plan have been carried out, the responsible care provider evaluates the *goal fulfillment of the care plan*. This includes an acknowledgement from the original requester that the care plan has been executed as well as a confirmation or refutation that the patient's health/social situation has been improved.

A patient is often involved in several processes, as a patient care process can be nested within another as a consequence of a care provider outsourcing some activities. In addition to several processes being *nested* due to activities being outsourced from one care provider to another, a patient can also be subject to a number of more or less independent care processes, each conducted by separate care parties. The reason may be that the patient suffers from and is treated for multiple health/social problems.

A set of independent care processes around a patient will form a process conglomeration, see Figure 5, which includes activities that are potentially incoherent, uncoordinated and interfering. More precisely, we define a *process conglomeration* as a set of patient care processes that all influence the same patient, which are overlapping in time, and that all have the goal of improving or maintaining the health and social wellbeing of the patient.

Process conglomerations give rise to coordination problems that go beyond those encountered in single or nested patient care processes. A key difference between single patient

care processes and conglomerations is that the activity dependencies in a patient care process are
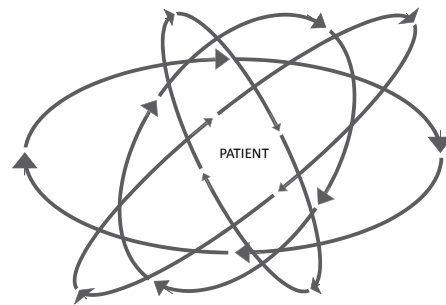

Figure 5: A process conglomeration, i.e., a set of individual though interdependent care processes around a patient.

planned and known beforehand, while those in a conglomeration are emergent and may occur unexpectedly for the involved care parties. While each patient care process is internally coordinated in the form of an action workflow loop with a clear structure and distribution of responsibilities, there is no corresponding coordination across the care processes in a process conglomeration. Thus, dependencies between activities from different patient care processes may easily be neglected, which may cause worries and inconveniences for the patient as well as ineffective and inefficient care. Furthermore, as many parties are involved in a process conglomeration, responsibility issues may arise.

As a process conglomeration can be highly complex, problems can easily occur if it is not adequately managed. Based on coordination theory and previous work in Gustafsson and Winge (2003) and Centrum för e-Hälsa (2007), we have identified four main categories of problems in a process conglomeration.

- *Share Negligence.* Two or more care parties try to provide care to a patient at the same time. In other words, the parties try to carry out activities between which there exists a share dependency. For example, a patient may be busy with her physiotherapist when a nurse shows up to plaster a leg ulcer.
- *Flow Negligence.* Two care parties carry out activities in the wrong order. In other words, there is a flow dependency between activities that is not respected by the care parties. For example, a nurse first plasters the leg ulcer of a patient, and thereafter the home care personnel give the patient a shower, while these activities ought to be carried out in the opposite order.

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- *Fit Negligence.* Two activities are carried out though they may conflict with each other. In other words, there is a fit dependency between activities that is not respected. For example, a patient is given a therapy by a physiotherapist that is not suitable for a certain medical treatment given by a nurse from primary care.
- *Responsibility Negligence.* A health care party who is responsible for a task does not carry it out or carries it out in an unsatisfactory way. For example, a nurse may not distribute prescribed medication to a patient, though this is her responsibility.

The underlying causes to these problems may vary, including deficiencies in organisational structures and gaps in personnel competence. However, in a process conglomeration, a main cause for the problems is lack of information, knowledge and common views due to inadequate communication. Based on the activities of the Patient Care Process as well as previous work by Gustafsson and Winge (2003), we have identified four categories of knowledge deficiencies that cause problems in process conglomerations.

- Lack of knowledge about the health/social problems and health/social status of patients
- Lack of knowledge about performed, ongoing and planned activities as well as activity dependencies and changes in plans
- Lack of knowledge and consensus on care goals and their priorities
- Lack of clearly allocated responsibilities and knowledge about them.

4 SOLUTION REQUIREMENTS

The information and communication problems of process conglomerations can be addressed by providing care parties with information services that support them in exchanging information, building consensus and distributing responsibilities. This section identifies a number of requirements that these services need to fulfil in order to effectively address the problems. The requirements below are structured according to the problem causes they address.
Lack of knowledge about the health/social problems and health/social status of patients

R1: Care providers shall be able to exchange their assessments on the health/social problems of a patient

R2: Care providers shall receive support for detecting, discussing and negotiating differences in their assessments of the health/social problems of patient

R3: Care parties shall be able to communicate about the health/social status of a patient

Lack of knowledge about performed, ongoing and planned activities as well as activity dependencies and changes in plans

R4: Care parties shall be able to communicate about care activities planned to be carried out

R5: Care parties shall be able to request care from other care parties as well as commit to carry out care

R6: Care parties shall be able to communicate ongoing and completed care activities

R7: Care parties shall be able to communicate about the results of care activities

R8: Care parties shall receive support for detecting and managing activity dependencies

Lack of knowledge and consensus on care goals and their priorities

R9: Care parties shall be able to communicate about the goals for activities carried out by care providers

R10: Care parties shall receive support for detecting and managing care goal conflicts

Lack of clearly allocated responsibilities and knowledge about them

R11: Care parties shall be able to communicate about the responsibilities of care providers

R12: Care parties shall receive support for detecting and managing responsibility negligence

As can be seen from the above requirements, the information services need to handle complex information structures. A first step towards defining the services is, therefore, to construct an information model that can represent all the information needed by the services.

5 SOLUTION - INFORMATION MODEL AND INFORMATION SERVICES

A solution to the process conglomeration challenge is suggested in this section in the form of a number of information services, see Section 5.2. First, in
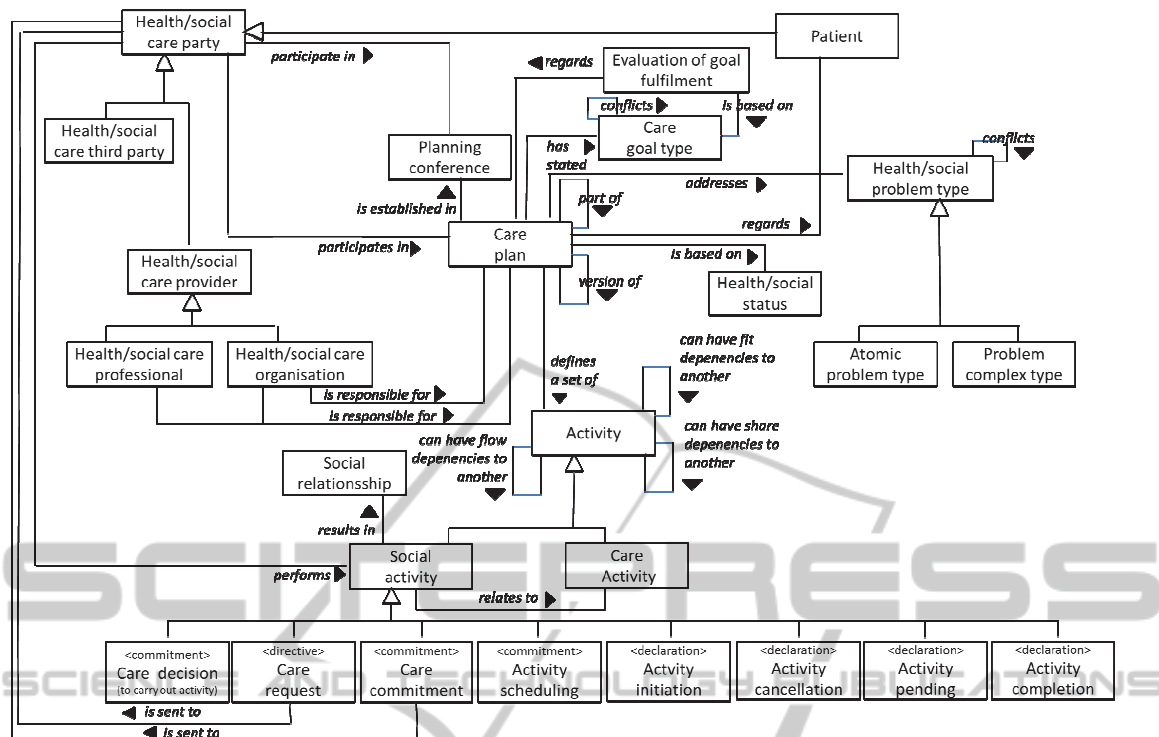
Figure 6: An information model that represents all the information needed by the services.

section 5.1, an underlying information model is presented, which can represent all the information needed by the services.

5.1 Information Model

The proposed information model, which is based on (CONTSYS, 2007) and (Gustafsson and Winge, 2004), is described below and shown as a UML class diagram in Figure 6. The first group of requirements in Section 4 demands that the information services be able to manage information about the health/social problems and health/social status of patients. To handle this, the information model includes the classes *health/social problem type* (sometimes abbreviated *health problem*) and *health/social status* (sometimes abbreviated *health status*). A health/social care problem type is a need for care for a patient as defined by a care provider, often expressed as a diagnosis. A health/social problem type is either an *atomic problem type* or a combination of problem types, called *problem complex type*. The latter notion is useful as patients often experience a number of related health/social problems, which can be effectively addressed by the same care plan. The information model also includes the class health/social status, which contains a

description of a patient's anamnesis, symptoms and earlier treatments when a care plan is established.

The second group of requirements in Section 4 demands that the information services be able to manage information about activities and activity dependencies. To handle this, the information model includes the class *care plan*. A care plan can be a *part of* or a *version of* another care plan. To establish the care plan, there is sometimes a need for a *planning conference*, which can be carried out synchronously or asynchronously as well as at a central place or in a distributed way. To represent activity dependencies, the information model includes associations for *flow dependency*, *fit dependency* and *share dependency*.

The third group of requirements demands that the information services be able to manage information on care goals. To handle this, the information model includes the class *care goal type*, which is a set of predefined goals. To represent goal conflicts, the information model includes an association called *conflicts*. Each plan has one or several of these goals related to it. The information model is also able to represent the *evaluation of the goal fulfillment* of the plan, that is, the result of a performed care plan.

The fourth group of requirements demands that the information services be able to manage information about responsibility allocation. A *care*

activity is a clinical activity that aims to investigate or treat a patient. Around a care activity, various care parties take a number of decisions that can be seen as driving the care activity forwards. For example, one care party can decide that a certain care activity is to be carried out, and another care party can decide to actually carry it out.

In order to represent decisions about care activities, we introduce a class *social activity*. A social activity, as described in Section 2.1, is a sequence of speech acts that results in one or several *social relationships*. There exist a number of subclasses to social activity:

- A *care decision* is a decision taken by a care professional that a certain care activity is to be carried out.
- A *care request* is a social activity where one care party asks another care party to take on the responsibility for a care activity.
- A *care commitment* is a commitment by a care party, who has received a care request and that takes on the responsibility for the care activity.
- An *activity scheduling* includes a commitment by a care party to start carrying out a care activity at a time point.
- An *activity initiation* includes a declaration by a care party that a care activity has started.
- An *activity cancellation* includes a declaration that a care activity has been aborted before completion and that no further work is planned.
- An *activity pending* includes a declaration that a care activity has been aborted before completion as well as a commitment that it is to be restarted.
- An *activity completion* includes a declaration that a care activity has been completed as intended.

5.2 Information Services

Five high level services are identified, based on the activities of the patient care process, and for each of these a number of sub-services. For each sub-service, its relationship to the information model is specified and the requirements (R) it addresses.

Identify Health/Social Status and Determine Health/Social Problem

This service provides support for communicating about care need assessments. The included sub-services are:

- Create, read and update health/social status and health/social problem (R1, R3)
- Notify about conflicting views of health/social problem among care parties (R2)

Decide Care Goals

This service provides support for communicating about care goal creation. The included sub-services are:

- Create, read and update care goals (R9)
- Notify about about conflicting views of care goals among care parties (R10)

Specify Care Plan

This service provides support for communicating and negotiating care planning. The included sub-services are:

- Create, read and update care plans, care activities, care decisions, care requests and care commitments (R4, R5, R11)
- Notify about activity dependencies that occur when creating new care decisions and care plans (R8)
- Support resolution of conflicts due to activity dependencies (R8)
- Check for outstanding care decisions, i.e., care decisions for which there are as yet no care requests (R12)
- Check for outstanding care requests, i.e., care requests for which there are as yet no care commitments (R12)

Schedule and Perform Care Activity

This service provides support for communicating about and managing the performance of care activities. The included sub-services are:

- Create, read and update activity initiations, activity cancellations, activity pendings, and activity completions (R6)
- Notify about activity dependencies that occurred when care activities were initiated or completed (R8)
- Check for outstanding activity schedulings, i.e. activity schedulings for which there are as yet no activity initiations (R12)

Care Evaluation

This service provides support for communicating about care evaluation. The included sub-services are:

- Create, read and update evaluations of goal fulfilment (R7)

6 CONCLUDING REMARKS

In this paper, we have investigated how care activities and processes are organised in today's complex and patient centered health and social care

landscape. The main theoretical contribution of the paper is the introduction of the notion of process conglomeration, which is used to capture the emergent nature of health care provisioning in an environment of independent care parties. The paper also provides practical contributions through an analysis of the challenges posed by process conglomerations as well as solutions in the form of information services.

The proposed information services are based on the assumption that care activities offered by one care provider can be structured according to the patient care process, basically an action workflow loop. The patient care process structures the internal work of a care provider and its interactions with a patient, thereby producing a large amount of information. This constitutes the bulk of the information needed by the proposed information services. Thus, implementing the services does not require extensive additional information management for care providers that already use the patient care process.

Our work has been carried out according to the design science framework, which is also reflected by the structure of the paper that follows the methods proposed by Peffers et al. (2007). While this paper focuses on problem analysis, requirements definition and solution design, previous work has addressed demonstration and evaluation of the services.

In future work, we will detail the contents of the information services and integrate them into an overarching systems and service architecture. We will also continue our work on empirical validation of this architecture.

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