Using Work Agreements as Operation-time System Requirements for Emergent Work Community Support Systems

Stijn Hoppenbrouwers, Uwe van Heesch, and Christian Köppe

HAN University of Applied Sciences, Arnhem, the Netherlands
{Stijn.Hoppenbrouwers, Uwe.vanHeesch, Christian.Koppe}@han.nl

Abstract. We propose an approach for capturing evolving requirements for work support systems that are organically created by co-workers in self-organized, networked organizations. It is in the nature of such organisations that comprehensive design-time capturing of the volatile task-related functional requirements is not possible. Therefore, we advocate a combination of two types of requirements: i. stable requirement fragments elicited at design time, based on elementary collaboration and communication patterns likely to occur in an operational context, and ii. highly dynamic requirements in the form of explicit, easy-to-understand yet well-structured work agreements between organisational actors within organisations at operation-time. These agreements capture many aspects and concepts well known from requirements engineering, as well as business process analysis and design, but design-time modeling/specification of work-specific structures is now moved to operation time. Description of such structures by co-workers is supported by mechanisms part of the stable communication patterns under i.

1 Introduction: digital work support for 'SITs'

Self-organizing Interdisciplinary Teams (SITs) are emergent networks of co-workers who organise and re-organise themselves organically and informally rather than being governed or externally organised like traditional teams. Taylored digital support for such widespread organisation forms is currently hardly available.

An example of a SIT is the common, loose cooperation between healthcare professionals dealing with a specific patient. In many cases (in particular outside hospitals), multiple health professionals from different disciplines are involved with a patient, for example some specialist and consulting physicians, specialised nurses, a general practitioner, a dietitian, a physiotherapists, and visiting nurses. SITs extend to non-professionals like family members of the patient or volunteer caregivers, and the patient herself. Team members in SITs primarily interact and communicate with each other indirectly, via the patient. Direct interaction between other team members is often very limited (via notes and dossiers), and sometimes does not happen at all. In some cases, team members do not

even know each other. And yet, in principle they work together towards one common goal: the well-being of the patient. SIT composition may vary from day to day, and team members may not even be aware of this. Tasks, roles and responsibilities are often subject to continuous change.

Flawed cooperation in, and resulting sub-optimal functioning of, SITs in healthcare is usually blamed on lack of exchange, or limited availability, of factual medical and administrative information. However, another important factor hampering cooperation is that information and communication of a more operational, coordinative nature is missing: who is doing what with and for the patient, when, and why. Part of these communicational shortcomings do not even concern medical details. Cooperation in SITs is highly dependent on the current situation and the tasks individual SIT members have to perform.

Although SITs, perhaps even more than traditional forms of organisation based on stable workprocesses, could benefit greatly from digital work support systems (beyond basic message and file exchange), their dynamic characteristics make it very hard to plan and develop such systems. In SITs, 'design time' comprehensive articulation of work is not possible (no resources, no dedicated analyst/developer, very frequent changes in the organisational structure). Traditional pre-design requirements engineering activities are out of the question here. So if design-time RE is out, what is the alternative?

If design time elicitation of requirements is ruled out, only 'operation time' articulation of work is possible in SITs. Interestingly, such 'communication about work' is part and parcel of all cooperative work, and comes natural to humans as they cooperate. It is entwined with communication performed as part of the execution of tasks. Central to such articulation of work are *work agreements* made between co-workers. We propose that dynamic (i.e. operation time) requirements directly pertaining to the emergent organisational structures in SIT operations can in principle be derived from such work agreements. Operation-time requirements can be used to enable self-adaption of work support systems within the boundaries of pre-defined, stable functional building blocks. These building blocks derive from existing, general organisational collaboration and communication patterns, a subset of which directly support the articulation of the volatile work agreements.

The rest of this article is organised as follows: The problem is described in more detail in Section 2. In Section 3 we outline our position, followed by the description of the research goal and approach in Section 4.

2 Problem Statement

Although most work support systems offer support for communication and collaboration, they often fall short of effectively supporting SITs due to either their restrictive and prescriptive nature, or their lack of required situation-specific functionality. This becomes evident in the above example, but can also be observed in other kinds of organizations.

Work support systems are often designed using a top-down approach. They are designed up-front and reflect the *intended* and *anticipated* collaboration and communication structures in the organization. But SITs often emerge at 'operation-time' and they have requirements that are not addressed by the supporting systems. SITs therefore often use a variety of standard facilities like oral communication, mail, unstructured file exchange, and meetings via informal communication channels like social media. All of these are mainly unstructured and are often not included in the systems supporting the work processes of the organization, and the related tasks as performed by co-workers. This is the core of the problem: due to their continuously changing nature and partial occurrence, the situation-specific communication and collaboration needs of SITs cannot be adequately addressed by work support systems designed and developed based on traditional design-time requirements engineering.

3 Position Statement: using work agreements for capturing operation-time requirements

Following Taylor et al., who identify (the communication of) agreements between team members as the basis of human organization [1,2], the work agreements made between the patient and other team members (and other team members among each other) constitute the organisation of a SIT. Such work agreements, or in our case, care agreements, are the basic building blocks of cooperation and organization. This has been acknowledged and embraced by information system scientists and practitioners who came up with ways of modeling various aspects of work agreements in context of stable and large-scale organisational patterns (transactional business process models) [3,4]. They articulate them as business processes, work-flows, protocols, business rules, and the information structures used in and between them. A primary use of such business modelling is as requirements in view of information system design, or work support system design. However, as explained above, pre-described organisational work statements cannot be expected to be available for SITs.

Figure 1 shows a conceptual model of requirement fragments and work agreements in support systems for SITs. A SIT organisation, although being dynamic and emergent in nature, still operates in a stable context from a generalized organisation perspective: patterns of organisation and communication *do* occur, alongside ad-hoc or emergent interactions and agreements. An example of such a context is the local healthcare system, as mentioned above. From this context, but also from universal cooperative communication patterns, we can elicit collaboration and communication requirement fragments that can be anticipated to occur. We deliberately use the term 'requirement fragment' as contrasted against the basic practice in requirements engineering to comprehensively capture functionality known to be required at operation-time. A requirement fragment is rather a partial functionality likely to be required in combination with other requirement fragments at operation-time. For instance, and central to our approach, communication about work generically requires agreements to be made

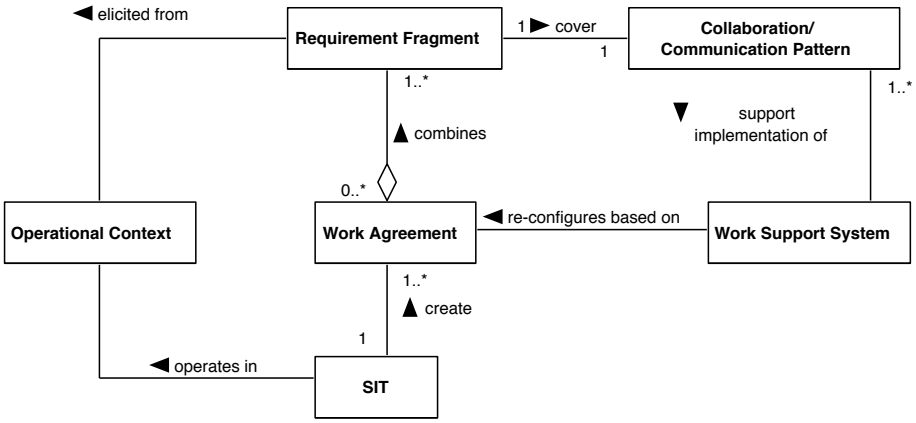

Fig. 1. Conceptual model of requirements use in SIT support systems

(i.e. stating, structuring, negotiating, discussing, agreeing, committing), to be monitored, and to be managed. Concepts required to cover such activities are available (see for instance [4]), but we intend to apply them in a different way: drawing them from operational but explicit work agreements.

Organizational communication and collaboration has been extensively studied in the past. As a result, several patterns of organisational communication, collaboration, and workflow were published, see for instance [5], [6], [7], [8], [9], [10]. Such patterns can be leveraged to elicit and describe requirement fragments of organisational communication. The advantage of using existing patterns is twofold: On the one hand, they can serve as candidates when eliciting requirement fragments in a specific operational context; on the other hand, the implementation of such patterns in work support systems can be based upon proven implementation of the patterns in existing systems.

While the elicitation of requirement fragments based on patterns in an operation context happens at design-time, the concrete operation-time communication and collaboration requirements of SITs are not comprehensively known at design-time. Therefore, we propose to continuously capture operation-time requirements of SITs in the form of work agreements. Work agreements as artefacts represent agreements made between co-workers in a SIT at operation time. They combine and instantiate requirement fragments. The work support system analyzes the work agreements at run-time to dynamically re-configure itself to support the collaboration and communication requirements of the SIT. This embraces the volatile nature of SITs, while enabling operation specific support to the co-workers.

To recapitulate, the requirements engineering process is split into a stable design-time process used to elicit requirement fragments as anticipated functional building blocks, and a continuous requirements capturing process based on work agreements at operation time. The former process is applied by re-

quirements engineers, while the latter process is executed by the actors of the system.

4 Outline of Research Project

The goal of this research project is to improve work support systems for SITs by means of dynamic work agreements captured at operation time. We plan to identify and describe collaboration patterns that support self-organizing interdisciplinary teams with their work agreements and to provide these patterns as functional building blocks for system design in order to enable continuous requirements engineering.

In first instance we focus on SITs in healthcare contexts, in particular outside tightly organized institutions. There is a strong demand for improving the collaboration between co-workers in order to improve healthcare quality and efficiency. We utilise our existing cooperations with local healthcare organisations in the Netherlands. In the following, we sketch the phases of the research project:

Step 1 : Identify and categorize types of work agreement used in local healthcare organizations. For this purpose, we will conduct interviews with stakeholders from our partner healthcare institutions and observe individual workers in their daily work.

Step 2 : In addition, collect examples of work agreements and communication about them using an explerimental application (currently being alphatested) that supports the situation-independent articulation, negotiation, setting and monitoring of work agreements and related cooperative communication. This will not be done in a healthcare environment (yet) but in our own team and in various other teams in educational and research organizations interested in our research.

Step 3 : Perform a systematic mapping study for collaboration and communication patterns.

Step 4 : Map the collaboration patterns identified in Step 3 to the work agreements types and observed communication found in Steps 1 and 2. We expect that several work agreements and communcations can be de-composed into one or more fragments that instantiate one of the collaboration patterns.

Step 5 : Develop a reference architecture for work support systems that provides means for dynamic re-configurations of workflow support modules based on work agreements. We will leverage proven solutions promoted for the implementation of the corresponding collaboration patterns.

The results of our research project can be used for designing innovative SIT-oriented work support systems for use in healthcare organizations, and beyond.

References

1. James R Taylor, Carole Groleau, Lorna Heaton, and Elizabeth Van Every-Taylor. *The Computerization of Work: A Communication Perspective*. Sage Publications, Inc, Thousand Oaks, CA, 2000.

2. James R Taylor and Elizabeth J Van Every. *The Emergent Organization: Communication as its Site and Surface*. Lawrence Erlbaum Associates, Mahwah, NJ, 1999.
3. Hans Weigand. Two decades of the language-action perspective: Introduction. *Communications of the ACM*, 49(5):44, May 2006.
4. Jan L. G. Dietz. *Enterprise Ontology - Theory and Methodology*. Springer Berlin Heidelberg, Berlin, Heidelberg, 2006.
5. Nick Russell, Wil M P van der Aalst, Natalya Mulyar, and Others. Workflow Control-Flow Patterns: A Revised View. *BPM Center Report BPM-06-22*, 2006.
6. W M P Van Der Aalst, A H M Ter Hofstede, B Kiepuszewski, and A P Barros. Workflow Patterns. *Distributed and Parallel Databases*, 14(1):5–51, 2003.
7. Dongsoo Kim, Minsoo Kim, and Hoontae Kim. Dynamic Business Process Management Based on Process Change Patterns. In *Proceedings of the 2007 International Conference on Convergence Information Technology*, pages 1154–1161. IEEE Computer Society, 2007.
8. Till Schümmer. GAMA: A Pattern Language for Computer Supported Dynamic Collaboration. In *Proceedings of the 8th European Conference on Pattern Languages of Programs (EuroPLoP 2003)*, pages 53–114, 2003.
9. Yiannis Verginadis, Dimitris Apostolou, Nikos Papageorgiou, and Gregoris Mentzas. An Architecture for Collaboration Patterns in Agile Event-Driven Environments. In *Proceedings of the 2009 18th IEEE International Workshops on Enabling Technologies: Infrastructures for Collaborative Enterprises*, pages 227–230. IEEE Computer Society, 2009.
10. Brian T Pentland and Martha S Feldman. Narrative Networks: Patterns of Technology and Organization. *Organization Science*, 18(5):781–795, 2007.