2nd International Workshop on Advances and Applications of Problem Frames

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ABSTRACT
Software problems originate from real world problems. A software solution must address its real world problem in a satisfactory way. A software engineer must therefore understand the real world problem that their software intends to address. To be able to do this, the software engineer must understand the problem context and how it is to be affected by the proposed software, expressed as the requirements. Without this knowledge the engineer can only hope to chance upon the right solution for the problem. Application of the Problem Frames approach may well be a way of meeting this need.

Categories and Subject Descriptors
D.2.1 [Requirements/Specifications] Elicitation methods (e.g., rapid prototyping, interviews, JAD), Languages, Methodologies, Tools

General Terms
Design, Languages, Theory.

Keywords
Problem Frames, Software Engineering, Requirements Engineering.

1. INTRODUCTION
An approach to addressing real world problems, Problem Frames, has been proposed by Michael Jackson [e.g. 1, 2]. A problem frame captures a recurring class of problems in software development, akin to a design pattern but for describing problems, not solutions. Problem Frames are a means of understanding and describing the problem context where software will provide (some part) of the solution.

Problem Frames are an attempt to capture the problem domain experience of software engineers, with the intent of allowing it to be reapplied in the analysis of new problems.

In classifying software development problems, Problem Frames structure the analysis of the problem and the world in which it is located – the problem space – describing what is there and what effects one would like a system located there to achieve. With its emphasis on problems rather than solutions, the Problem Frame approach uses an understanding of the problem class to allow the problem owner with their specific domain knowledge to drive the requirements engineering process.

This is the 2nd International Workshop on Advances and Applications of Problem Frames. The first, held at ICSE 04 [3], was a big success, with a keynote from Michael Jackson, more than 35 participants, and lively discussion throughout the day. The workshop culminated in the selection of the best papers being published as a special issue of the Journal of Information and Software Technology [4]. This special issue also included an extensive literature review of the field of Problem Frames research up until that point [5], and an invited paper by Michael Jackson on the role of Problem Frames within software engineering [6].

2. GOALS
The 2nd International Workshop on Advances and Applications of Problem Frames is another opportunity for researchers and practitioners in the Problem Frames area to meet as a community. Work presented at the workshop will relate to a number of topics, including:

- foundations of Problem Frames;
- applications of Problem Frames to software problems, as well as other problem domains;
- the use of Problem Frames for the modelling of organizational change;
- the role of Problem Frames within established software development processes;
- newly proposed software development processes based on Problem Frames;
- relating problem and solution structures via Problem Frames;
- empirical evaluations of Problem Frames; and
- application of Problem Frames to industrial case studies.

Our main goals are:

to understand and improve upon the current state of practice of the Problem Frames approach in industry, research and education.

to investigate and develop new applications for Problem Frames.
to empirically evaluate the Problem Frames approach.

3. CONTRIBUTIONS

Authors were invited to submit full, position and experience papers that were fully reviewed by at least two members of the Program Committee. Authors of those papers deemed of a high enough quality that addressed an advancement, discussion of, and/or application of the Problem Frames approach, were invited to attend and present their work. We also invited other experts in domain modelling and problem analysis to attend the workshop.

Happily, there was a broad selection of papers on many aspects of Problem Frames approach: ranging from semantic foundations for problem analysis to the combination of Problem Frames with narrative approaches to software development; from business technologies to business strategy. The papers accepted for the workshop were the following (listed by author and their position in the proceedings):

3.1 Vasantha Banagala
In this paper, Vasantha Banagala begins a line of research demonstrating that problem frames can effectively capture requirements of transactions, regarded as assemblages of sub-problems, such as those found in data and business transactions. He does this by extending the work-piece frame, one of Jackson’s five basic frames. He concludes that problem frames can accommodate the critical transactional properties in problem diagrams and identifies the difficulties associated with solving such business problems.

3.2 Del Bianco and Lavazza
Del Bianco and Lavazza report their preliminary investigations in enhancing the problem frames methodology with concepts derived from requirements modelling techniques based on scenarios and histories. Their goal is to make problem frames even more appealing to developers, who are generally familiar with the ideas underlying scenario-based modelling. The results they present are encouraging: a well known problem is studied with the help of scenarios, and modelled by means of histories in showing how scenarios can improve the understanding of a problem. The paper adds a time stamp to individual shared phenomena between the system and domain entities, and organises the phenomena into a temporally ordered sequence. Thus, real-time behaviour and constraints can be described with more precision. Interestingly, scenarios are also used to support the merging of sub-problems, often a difficulty in sub-problem recomposition, and the proposal appears helpful, although much work remains.

3.3 Brier, Rapanotti and Hall
Working from the premise that an organization’s competitive advantage is increasingly reliant on the alignment of its socio-technical systems with its business processes, Brier, Rapanotti and Hall take a step towards providing tools which can help in the analysis and synthesis of change which impacts on an organization’s socio-technical systems. They do this by identifying and codifying recurrent change scenarios with tools inspired by Problem Frames.

3.4 Jhu
Jhu aims to capture and describe business to IT problems in the context of business requirements for Web services. As a means to align Web services initiatives with the business strategy, she proposes an extension to the eBusiness Modelling Ontology (eBMO) to capture the business objectives of an organization from strategy to implementation using Progression of Problems to understand the strategic objectives, business needs and the business context. Problem Frames are applied to describe the operational requirements and the Web services context. The method is applied to understand the business strategy and the business needs of Amazon.com.

3.5 Jin and Liu
The fundamental goal of software development is to build software systems that drives computer hardware to achieve desired impacts on its environment. The Problem Frames approach provides a generic paradigm for analysing problems of various types. In their paper, Jin and Liu propose a conceptual description schema based on the problem frames approach, which treats environments as a first-class concept. Requirements are defined as problem descriptions, in terms of the environmental model, so that knowledge about the environment can be used to facilitate the derivation of software specifications from requirements.

3.6 Jørgensen
To address a frame concern in Jackson’s Problem Frames, there must be appropriate descriptions of the problem domain, the requirements, and the specification of the machine and, based thereon, there must be a convincing argument that the given domain properties and the machine specification together entail that the requirements are fulfilled. In his paper, Jørgensen shows how to address certain frame concerns with the use of the formal modelling language Coloured Petri Nets (CPN). In the formal model, problem domain descriptions and machine specification are brought together in a CPN model, which is augmented with a graphical animation. The CPN model is executable and is simulated to address frame concerns. The approach is illustrated with the development of a controller for an elevator.
3.7 Lencastre, Araujo, Moreira and Castro
The main focus of the Problem Frames approach is on improving domain and business modelling, as well as requirements engineering. Until now the Problem Frames approach did not explore in depth the crosscutting nature of some properties of a problem, leaving out the treatment of global properties that affect the whole or part of the system, and which might have a negative impact on the modularisation of concepts and therefore in the systems evolution. On the other hand, aspect-oriented software development offers techniques to handle crosscutting concerns in a systematic and effective way, providing improved support for software maintenance and evolution. This paper integrates aspect concepts into Problem Frames by incorporating these concepts into the Problem Frames meta-model.

3.8 Li, Hall and Rapanotti
Achieving a proper understanding of the problem space before providing the design in the solution space is one of the basic tenets in requirements engineering. The Problem Frames approach provides a way for people to understand and solve software problems. Recently, a denotational semantics for Problem Frames was defined to relate the various elements of Problem Frames together. One of the problems of the semantics is that, as denotation, a problem has the set of all satisfying solution specifications. Whereas this is a sensible initial choice, it does not lend itself easily to the construction of solution specifications. Li, Hall and Rapanotti provide a formal technique which in the context of the given semantics allows for the systematic derivation of software specifications from requirements.

3.9 Seater and Jackson
Seater and Jackson begin from the premise that many system errors and accidents result from implicit assumptions about component boundaries. They hypothesize that, if implicit assumptions were made explicit, they could be easily recognized and corrected. Although the Problem Frames approach describes the interaction between software and other system components it does not, as yet, provide the designer with a means for performing such a decomposition, apart from consulting a catalogue of ‘frame concern’ patterns. The authors therefore extend the Problem Frames approach to include a more systematic method for transforming an end-to-end system requirement into a machine specification plus a set of domain assumptions.

3.10 Strunk and Knight
Problem frames and assurance cases are two current research areas that can improve—and have improved—system dependability, in critical and non-critical systems alike. While these two techniques are effective separately, their synthesis is much more powerful. Strunk and Knight describe the rationale behind such a synthesis, the influences exerted on one partner by the other, and the beginning of a process to integrate the two in software system development.

3.11 Tun and Hall
This short paper considers the interplay between the requirements of two key stake-holder groups, users and developers. It is already known that a user’s requirements usually constrain the behaviour of a solution, with the solution structure largely determined by the developer’s – and other stake-holders’ – non-functional or quality requirements. The intention of Jackson's Problem Frames is to focus attention on the problem domain. Tun and Hall show how, in an extended Problem Frames framework, considerations for developers' needs can influence the problem structure in terms of division of responsibilities between physical domains and selection of a sub-problem recomposition operator.

3.12 Chu, Qian and Liu
In their paper, Chu, Qian and Liu investigate how problem frames can effectively support software component reuse by proposing an architecture-based problem frames construction process that results in problem patterns (business patterns and requirements patterns), and by which traceability between problem space and software requirements is established as a side effect.

3.13 Keynote
Professor Dines Bjørner, of the Technical University of Denmark, currently based at JAIST, Japan, presented the keynote address. Professor Bjørner has recently published three volumes on Software Engineering. These outstanding texts span the early lifecycle of software engineering, which Professor Bjørner has spent researching in his emeritus career.

4. PROGRAM COMMITTEE
Workshop Program co-Chairs and Organisers:
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5. REFERENCES