A methodology to develop awareness in computer supported collaborative work using policies

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ABSTRACT

Cooperation is significantly influenced by participants' awareness of relevant information. The objective of this paper is to propose a methodology to design and develop applications that assist individuals to identify their awareness. Through extending Cooperative management Methodology for Enterprise Networks (CoMEN), this article introduces Policy-based Awareness Management (PAM) – a software engineering methodology that proposes the use of existing policy rules as a source to identify awareness. The methodology has been built on the logic of general awareness, and implements Directory Enabled Networks (DEN) policy structure. The contribution of the paper is illustrated through the wireless communication system at a hospital in Norway. We conclude that theory of general awareness and in particular PAM as an extension of CoMEN, is effective to identify relevant information for agents.

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1. Introduction

People increasingly work and live in cooperative environments, where by growing communication technologies they are overloaded with irrelevant or loosely relevant information [1]. In addition, cooperative environments such as social networks, B2B e-commerce, healthcare and disaster management teams are emerged in line with the concept of information uncertainty [2], which requires adapting new approaches in cooperation. The evolution of cooperative environments has been marked by the methods that utilize intelligent IT tools to enhance cooperation among participants [3]. As such, cooperative environments have to deal with information uncertainty [4,5], and one issue that has arisen from the use of IT is that individuals are often overloaded with irrelevant or loosely relevant information [1]. This requires methods to identify the relevance of information as new, certain information comes to the fore. Research and design practices in Computer Supported Cooperative Work (CSCW) emphasize the role of awareness in understanding the relevance of information [3,6–8]. Daneshgar and Wang [9] encourage researchers to work on definitive methods to identify such awareness.

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The initial ideas of this article have been borrowed from Cooperative management Methodology for Enterprise Networks (CoMEN) [3]. The contribution is motivated by the following drawbacks of CoMEN. It is regarded as uncontroversial that the dynamic and uncertain nature of everyday life overloads individuals with irrelevant or loosely relevant information [3,4]. Once new, certain information comes to the fore, a method to identify awareness is essential. This is missing in CoMEN. In addition to that, Computer Supported Cooperative Work (CSCW) has recently evolved to embrace the complexity-based paradigm [5]. This paradigm replaces deterministic perspectives of the internal and external views of systems by agency principles [6]. The agency principles emphasize the role of individuals in a system. Zacarias et al. [5] define the agency relationship as interactions between individuals and software agents to perform tasks on individuals' behalf. Much research proposes the use of agents to aid individuals maintaining their awareness [7–9]. Although CoMEN proposes the use of software agents to implement CSCW-based applications, it lacks authoritative stages to design and implement such applications to identify awareness in run-time. By extending the initial ideas from CoMEN, Policy-based Awareness Management (PAM), the proposal of this paper, employs software agents to assist individuals identifying their awareness. The main product of this work is a software engineering methodology for developing such applications that are able to assist individuals to become aware of relevant information in cooperation.

To this end, we extend Cooperative management Methodology for Enterprise Networks (CoMEN) [3] to enable cooperative roles to identify the relevant information. We employ intelligent agents to assist individuals obtaining awareness. We describe a framework – the Policy-based Awareness Management (PAM) – to model agents' awareness based on existing policies. This framework provides a foundation borrowed from literature in which the process towards policy-based awareness is grounded. We also propose a step-wise process to identify awareness from given sets of policies.

The paper is organized in the following way: Section 2 motivates the work by comparing different cooperative management methodologies. This section also provides the background knowledge of the work. Section 3 presents methodological guidelines of PAM to extend CoMEN. The section also presents how PAM transforms analysis phase to system design. Section 4 presents an interpretive case study at St. Olavs Hospital. This section applies PAM and the methodological guidelines to the wireless communication system at this hospital. The section also discusses some experiments on how the wireless communication system in the hospital can benefit from PAM. Section 5 discusses the implications and limitations of PAM as well as our conclusions and directions for future research.

2. Related work and background

The need for management of cooperative systems has been an objective of research in recent years [10]. Cooperative management involves formalizing the cooperation among number of individuals and organizational entities [3]. One of the major questions facing the management is how to utilize the emerging Information Technologies (IT) to facilitate cooperation [9]. There have been several methodologies proposed for the use of IT in cooperative management. We evaluate the different approaches in the literature based on the following criteria. These criteria are based on the work presented in [11]:

- *Concept management* that involves (1) understanding cooperative roles' definitions for the same or similar concepts and (2) understanding the relationship of concepts defined by different cooperative roles, (3) ability to define local concepts as well as global concepts.
- *Application management* that involves the ability of one software system run by a cooperative role to interact to the software run by another role.
- *Scenario management* that involves recognizing the sequences of interactions between cooperative roles.
- *Event management* that involves recognizing events that initiate the scenarios.
- *Awareness management* that involves realizing the relevance of information.

A summary of our analysis is shown in Table 1.

2.1. Cooperative management Methodology for Enterprise Networks (CoMEN)

CoMEN uses Computer Supported Cooperative Work (CSCW) techniques to analyze scenarios. This involves a top–down analysis of the system in the following steps:

1. *Overall system study* that involves study the overall "big picture" of the system including the activities and environment.
2. *Logical component identification* that involves recognizing roles, possible actions and information structure in the system.
3. *Process study* that consists of study possible scenarios
4. *Cooperation enhancement* that involves identifying the relevant information, called awareness in each scenario for the roles. The basic idea is that a cooperative role becomes aware of information, if she/he can identify the relevance of that. While the information is not available to the cooperative role, he/she interacts with others who already know the required information. Therefore the role will know the information. This process is called cooperation enhancement.