Chapter XX

Towards an Ontology for Information Systems Development:
A Contextual Approach

Mauri Leppänen
University of Jyväskylä, Finland

ABSTRACT

This chapter presents an ISD ontology, which aims to provide an integrated conceptualization of ISD through anchoring it upon a contextual approach. The ISD ontology is composed of concepts, relationships, and constraints referring to purposes, actors, actions, and objects of ISD. It is presented as a vocabulary with explicit definitions and in meta models in a UML-based ontology representation language. We believe that although not complete the ISD ontology can promote the achievement of a shared understanding of contextual aspects in ISD. It can be used to analyze and compare existing frameworks and meta models and as a groundwork for engineering new ISD methods, and parts thereof.

INTRODUCTION

To advance the understanding, management, and improvement of an information system development (ISD) process, a large number of frameworks, meta models, and reference models, in short ISD artifacts, have been suggested for ISD and ISD methods. Most of these artifacts view ISD from perspectives that are based on some specific approaches, such as a transformation approach (e.g., Moynihan, 1993; Saeki, Iguchi, Wen-yin, & Shinokara, 1993; Song, & Osterweil, 1992), a decision-making approach (e.g., Grozs et al., 1997; Jarke, Jeusfeld, & Rose, 1990; NATURE Team, 1996; Rolland, Souveyet, & Moreno, 1995), a problem-solving approach (e.g., Bodard et al., 1983; Jayaratna, 1994; Sol, 1992), or a learning approach (e.g., Iivari, 1990). In consequence of

this, ranges of concepts and constructs in these artifacts are rather narrow. To enable a more comprehensive view on ISD, ISD should be conceived as a context with all its meaningful facets, distinguishing purposes, actors, actions, objects, facilities, locations, and time aspects.

The purpose of this study is to present an ISD ontology that is based on a contextual approach. An ontology is a kind of framework unifying different viewpoints, thus functioning in a way like a lingua-franga (Chandrasekaran, Josephson, & Benjamins, 1999). More specifically, an ontology is an explicit specification of a conceptualization of some part of reality that is of interest (Gruber, 1993). The *ISD ontology* provides a conceptualization of contextual aspects of ISD through a vocabulary with explicit definitions. To enhance the clarity and preciseness of the ontology, we deploy a UML-based ontology representation language to describe the ISD ontology in meta models.

The ISD ontology is intended for descriptive, analytical, and constructive use. For the descriptive purposes, the ontology offers concepts and a vocabulary for conceiving, understanding, structuring, and presenting contextual aspects of ISD. In the analytical sense, the ontology can be used to analyze and compare existing ISD artifacts. In the constructive sense, the ontology is to support the engineering of new ISD artifacts, such as ISD models, techniques and methods, by providing a coherent and consistent groundwork for them. The ISD ontology is not yet a complete ontology. It should be enhanced with more specialized concepts and constructs and assessed for validity and applicability by empirical tests.

The rest of the chapter is structured as follows. In the next section, we define the notions of context and contextual approach and apply them to define the ISD ontology. Moreover, we discuss the process of engineering the ISD ontology. In the next five sections, we specify four main ISD domains (i.e., ISD purpose domain, ISD actor domain, ISD action domain, and ISD object domain)

and inter-relationships between them. After that, we make a comparative analysis of current ISD artifacts to find out how comprehensive they are in terms of contextual features and demonstrate the usability of the ISD ontology as an analytical means. The chapter concludes with discussions and implications to research and practice.

CONTEXTUAL APPROACH AND ENGINEERING OF THE ISD ONTOLOGY

Based on a large literature review on the notion of context in several disciplines, such as knowledge representation and reasoning (e.g., Brezillon, Pomerol, & Saker, 1998; Sowa, 2000), pragmatics (e.g., Levinson, 1983), computational linguistics (e.g., Clark & Carlson, 1981), sociolinguistics (e.g., Halliday, 1978), organizational theory (e.g., Weick, 1995), and information systems (e.g., Kyng & Mathiassen, 1997), we came to the following generic conclusion: *context* denotes a whole that is composed of things connected to one another with contextual relationships. A thing captures its meaning through the relationships it has to the other things in that context. To recognize a proper set of contextual concepts and relationships, we drew upon relevant meaning theories. Based on the three topmost layers in the semiotic ladder (Stamper, 1975), we identified semantics (especially case grammar by Fillmore (1968)), pragmatics (Levinson, 1983), and the activity theory (Engeström, 1987) to be such theories. They concern sentence context, conversation context, and action context, correspondingly.

In the case grammar (Fillmore, 1968), the sentence in its basic structure consists of a verb and one or more noun phrases, each associated with the verb in a particular case relationship. The notion of case is a language element that is more stable than surface-level grammatical terms. Cases identify "certain types of judgments human beings are capable of making about the

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