Towards Intelligent Requirements

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ABSTRACT

IT Projects remain challenging to design and build despite improvements and efficiencies in the detailed-design and construction phases. Extended effort in early requirements gathering and analysis phases are unpopular at present, though poor requirements still impacts on IT project success. Intelligent tools may enhance these early phases but abstraction of the qualitative and wicked nature of Information Systems design problems (difficult enough for inexperienced humans) resists automation. An approach that moves from the concrete ‘known’ towards the abstract unknown in a prescriptive manner may be of use. This paper presents and offers the ATSA:OO methodology as a candidate for consideration as such an approach.

Keywords: Activity Theoretic Systems Architecture (ATSA), Activity Theory, Framework, Requirements Elicitation, Systems Analysis and Design

INTRODUCTION

IT project failure rates are frequently attributable, to no small degree, to poor requirements capture and analysis (Ellis & Berry, 2013). That system design presents a wicked problem (Rittel & Webber, 1973) is a significant hurdle. Whilst CASE toolsets exist for the representation and processing of requirements and systems development, few if any cover crucial early requirements tasks in an, even partially, automatable manner. Any intelligent support technology designed to approach this early phase faces a challenge.

Many design frameworks assume a top-down approach where high-level abstract requirements (typically only ‘functional’) are decomposed, often through the application of standard patterns. In a bottom-up approach, abstracting higher-level entities seems no less difficult for intelligent systems than it is for humans.
Adopting a different vector through the problem space, perhaps there is value in moving from the known to the unknown. Such an approach would gather concrete details elicitable from, and verifiable by, business clients; then moving up or down through abstraction and refinement as necessary, under some consistent theoretical base.

This paper offers the Object Oriented variant of the Activity Theoretic Systems Architecture methodology (ATSA:OO) (Brown & Piper A., 2013) for consideration as a framework for moving from the known to the unknown, and which may inform the construction of future intelligent requirements analysis tools.

ACTIVITY THEORETIC SYSTEMS ARCHITECTURE (ATSA)


Community notions were added to AT in 1987, after which AT found itself deployed in the collaborative work and collaborative learning fields. Fjuk, Nurminen and Smørdal (1997), Kuutti and Molin-Juustila (1998), Gifford and Enyedy (1999) and Jonassen and Rohrer-Murphy (1999) produced various elicitation question based concepts and approaches, some capable of informing initial systems design.

In the more technical domains of system design and software engineering, AT has its greatest currency in the early phases such as elicitation and preliminary requirements analysis. Korpela et al. (2000) suggested AT had general applicability in systems design but offered no codified methodology. Mwanza’s (2002) eight step activity oriented design method (AODM) can identify crucial areas for analysis but doesn’t offer a designer any further guidance. Fuentes et al. (2004) were able to express AT concepts in terms of unified modeling language (UML) constructs. They explored its community concepts with regard to multi-agent systems. Martins (2007) made the case that activity-related requirements should be both elicitable and confirmable with AT but offered no prescriptive method for doing so. Uden et al. (2008) specifically deployed the historical aspects of AT in exploring how requirements change in the web design. They deployed UML activity diagrams with an AT flavour in a well-conceived but as yet incomplete way, based largely on the finer grained (decomposed) layers of the AT concept (as explored below).

The authors are not aware of any attempts in the literature, prior to ATSA, to deploy AT in a broadly applicable analysis and design methodology which produced OO-compatible codeable specifications. Indeed, AT has often been characterised as too difficult to grasp or deploy effectively. (Fjuk et al., 1997; Vrazalic, 2004; Uden et al., 2008; Giffordd and Enyedy, 1999; Williams, 2009; Constantine, 2009).

AT identifies an activity as the smallest meaningful task carried out by a human subject. Vygotsky (1978) states that every human activity is carried out by a subject, using physical or psychological tools to achieve some object (motive) which may result in a physical outcome. AT conceives a system as existing at multiple levels of abstraction. Leont’ev (1978) proposed a three layer hierarchic structure: activity, action and operation to represent different levels of cognitive ‘engagement’ by the subject; with an activity requiring profound strategic engagement, an action being goal-based, and an operation being reactively autonomic. ATSA deploys the terms activity, action and operation...
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