A Framework for Information Quality Requirements Engineering

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Abstract. Information Quality (IQ) is a key success factor for the efficient performance of any organization. Despite this, most Requirements Engineering frameworks either ignore or loosely define IQ requirements. To this end, we propose a novel conceptual framework for modeling and analyzing IQ requirements of the system-to-be.

1 Introduction

The importance of IQ for organizations is out of discussion, and several solutions for dealing with IQ needs have been proposed in the literature (e.g., integrity constraints, etc.). However, most of these solutions mainly focus on the technical aspects of IQ, and they do not solve problems that may rise at organizational or social levels. More specifically, these techniques do not satisfy the needs of current complex systems, such as socio-technical systems, where humans and organizations are integral part of the system along with the technical components (e.g., smart cities, etc.). At the other hand, we have several Requirements Engineering (RE) approaches that are able to capture the organizational along with the social needs of the system-to-be (e.g., secure Tropos [1], etc.), but their main focus is on the functionality of the system, and they either ignore or loosely define IQ needs. To tackle this problem, we propose a RE framework that is based on secure Tropos and extends it with concepts for capturing IQ requirements.

2 A Framework for Capturing IQ Requirements

Secure Tropos [1] introduces concepts for modeling actors along with their objectives, entitlements and capabilities. However, it does not provide concepts for capturing IQ needs. Thus, we extended its conceptual model with the following concepts to model and analyze IQ requirements[1]: (1) **Goal-information relations**: we provide more refined concepts to capture goals/ information relations, namely: *produces*, *optional read*, *required read*, and *sends*; (2) **Information accuracy**: we provide *trusted production/ trusted provision* concepts to analyze accuracy. For example, information is accurate for read, if it is produced by trusted actor (it will not produce falsified/ fraud information), and

[1] For more information about the concepts/formal framework, you can refer to [2,3]

it has been transferred through trusted provision (it will not be intentionally/ unintentionally modified during its transfer). While *sender* cares only about the *trusted provision* to analyze the accuracy of its information; (3) **Information completeness**: we provide the *part of* concept that enables for addressing information completeness, i.e., information is complete, if it has all its sub parts; (4) **Information timeliness**: we provide *information volatility*, *read timeliness*, *send timeliness*, and *information provision time* concepts to analyze information validity. For example, information is valid for read, if its *read timeliness* is less than its *volatility*. While it is valid for send, if its *read timeliness* at its destination is less than the required send time, and it is invalid otherwise; (5) **Information consistency**: we provide *interdependent readers* and *read-time* concepts to analyze information consistency, where information is consistent, if all its *interdependent readers* have the same *read-time*, otherwise it is inconsistent.

3 ST-IQ Tool

Our framework is supported by a CASE tool (ST-IQ tool)[2] that consists of 3 main parts: (1) GUI that enables for drawing the requirements model; (2) model-to-text techniques that translate the visual requirements model into Datalog formal specifications; and (3) automated reasoning support (DLV system[3]) that is used to verify the correctness and consistency of the requirements model. We demonstrate the utility of our tool by modeling and analyzing IQ requirements of case study concerning a main U.S stock market crash (the Flash Crash) [2,3].

4 Ongoing and Future Work

We are working on extending the framework to be able to derive the final IQ specifications from the requirements model in terms of IQ policies that define the permitted, forbidden and obligated actors' activities toward information. Moreover, we aim to enrich the trust analysis among actors concerning IQ by relaying on beliefs related to their internal structure (capabilities and intentions).

References

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