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Addressing Challenges of Ultra Large Scale System on Requirements Engineering

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Abstract

According to the growing evolution in complex systems and their integrations, Internet of things, communication, massive information flows and big data, a new type of systems has been raised to software engineers known as Ultra Large Scale (ULS) Systems. Hence, it requires dramatic change in all aspects of "Software Engineering" practices and their artifacts due to its unique characteristics.

Attendance of all software development members is impossible to meet in regular way and face-to-face, especially stakeholders from different national and organizational cultures. In addition, huge amount of data stored, number of integrations among software components and number of hardware elements. Those obstacles constrict design, development, testing, evolution, assessment and implementation phases of current software development methods

In this respect, ULS system that's considered as a system of systems, has gained considerable reflections on system development activities, as the scale is incomparable to the traditional systems since there are thousands of different stakeholders are involved in developing software, were each of them has different interests, complex and changing needs beside there are already new services are being integrated simultaneously to the current running ULS systems.

The scale of ULS systems makes a lot of challenges for Requirements Engineers (RE). As a result, the requirements engineering experts are working on some automatic tools to support requirement engineering activities to overcome many challenges.

This paper points to the limitations of the current RE practices for the challenges forced by ULS nature, and focus on the contributions of several approaches to overcome these difficulties in order to tackle unsolved areas of these solutions.

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As a result, the current approaches for ULS miss some RE essential practices related to find vital dependent requirements, and are not capable to measure the changes impact on ULS systems or other integrated legacy systems, in addition the requirements validation are somehow depended on the user ratings without solid approval from the stakeholders.

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1. Introduction

Computer-based systems are built for people and by people. Requirements engineering (RE) is essentially a social collaboration activity, in which involved stakeholders (e.g., customers and developers) have to closely work together to communicate, elicit, negotiate, define, confirm, and finally come up with the requirements (including functional and non-functional requirements) for the system to be implemented or upgraded [1].

As globalization is driving organizations to become more and more distributed, multi-site development is becoming a norm. With the increasing globalization in this industry, it is necessary to better prepare software development projects to manage work in distributed environments[2].

Especially in large-scale and distributed software projects, it is infeasible to organize personal meetings on a regular basis. In such scenarios, requirements are often defined in wiki-based forums which are receptive to the problems of information overload, redundancy, incompleteness of information, and diverging opinions of different stakeholders[3].

2. Requirement Engineering Practices

Requirements engineering covers several activities, including determining stakeholders, requirements elicitation, analysis, specification, verification and management as follows:

2.1. Stakeholder Analysis

Stakeholder is anyone is influencing or influenced by the system development and use the system either directly or indirectly[18]. Stakeholder's determination involves identifying the relevant stakeholders and prioritizing them based on their influence and interest in the project [4],

2.2. Requirement Elicitation

Requirement elicitation are the practices of discovering, reviewing, documenting and understanding the user's needs and constraints for a system[19]. And typical resulting artifacts are, for example, textual requirements descriptions, use cases, process diagrams and prototypical user interfaces

2.3. Requirement Analysis and Specifications

It's the process of refining the user's needs and constraints and documenting the user's needs and constraints clearly and precisely. In addition it includes the activities related to find the conflicts of interest and solve the problem in the requirements that contradict the organization and business rules.

2.4. Requirement Prioritization

Discovering the important requirements by interacting with the stakeholders and organize them in to most priority order [20]