

# A Value-Driven Modeling Approach for Crossover Services

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## ABSTRACT

In recent years, crossover services have attracted wide attention as an emerging service mode in the modern service industry. Crossover services can offer values that cannot be provided by single-domain services, and they usually need to cross the boundaries of domains, organizations, and processes, which puts forward more challenges for requirements modeling and analysis under the crossover scenarios. Given the characteristics of crossover services, the authors propose a value-driven meta-model framework from multiple viewpoints to support the requirements analysis of crossover services, which consists of three parts: a value network, a goal network, and a service network. Based on the proposed meta-model framework, a value-driven crossover service modeling tool is developed to help requirements analysts in requirements analysis and design, and a case study is presented to illustrate the usage of the proposed approach. Finally, we evaluate our methods and tools using a controlled experiment, and the experimental results show the effectiveness of the approach.

## KEYWORDS

Case Study, Crossover Service, Goal Network, Meta-Model, Service Design, Service Network, Service Requirement, Value Network

## 1. INTRODUCTION

With the rapid development of modern service industry, crossover services, a new kind of services become increasingly popular, which are viewed as outcomes of modern service industry developed to an advanced stage (Wu *et al.*, 2016). The business scope of crossover services is no longer limited to a single domain, but expands to multiple domains. For example, the largest online payment service, Alipay, has extended its service scope to takeout services, travel services, social services, and digital campus services. Crossover services aim to expand value chains and build a sound business ecosystem, so as to achieve sustainable profits and enhance the core competitiveness of enterprises (Jones *et al.*, 2015). Therefore, crossover service has become a popular trend in the modern service industry, and there has been a dramatic upsurge in crossover convergence, merger and acquisition activities over the past years (Basuil *et al.*, 2017; Li *et al.*, 2016). The dynamic market needs and globalization

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trend bring great pressure to crossover service providers. To maintain competitive in an uncertain market environment, it is essential to focus on both technology decisions and business values when developing new software services (Aurum *et al.*, 2007).

However, due to the lack of a sound and clear value definition, service providers usually do not fully consider whether each participant involved in the value network can achieve the value they expect, which leads to the failure of some crossover services (Basuil *et al.*, 2017). A sound value proposition defined at the stage of requirements analysis is thus important because it is helpful for each stakeholder to make profits in multi-way collaborations (Akkermans *et al.*, 2003). Particularly in crossover scenarios, customers are reluctant to switch from their original services to the new crossover services, unless they can realize the added values offered by the new services. Therefore, it is important to consider value propositions of stakeholders in designing crossover services. Traditional value propositions are often stated informally by utilizing natural language, which may lead to a lack of common understanding among different stakeholders, who represent different enterprises and vary in focus (Akkermans *et al.*, 2003). Therefore, a formal value modeling framework is needed to identify and characterize the value expectations of stakeholders at the early stage of requirements analysis.

Crossover services usually involve the convergence of different business organizations and different value chains (Yin *et al.*, 2018). The crossover convergence process needs to be considered from both business and technology perspectives. Besides the value proposition analysis, there are many other challenges in the open and dynamic crossover scenarios. On the one hand, new target users in the crossover domains increase the difficulties of capturing their potential requirements or real intentions. On the other hand, service resources from various domains usually heterogeneous, complex and dynamical, which also brings difficulties to the design of crossover service (Wu *et al.*, 2016). Faced with these obstacles, the challenging issues to be addressed in requirements analysis and design of crossover services are: how to describe the value proposition and business goals of stakeholders and how to provide service-based solutions for subsequent development stages.

During the past years, many methods have been proposed to address the previously described challenges (Horkoff *et al.*, 2019; Ribeiro *et al.*, 2016; Bukhsh *et al.*, 2017; Gultekin *et al.*, 2016; Horkoff *et al.*, 2016; Chawla *et al.*, 2017; Thew *et al.*, 2018;). For example, a representative value-based requirements engineering method, e3value (Gordijn *et al.*, 2001) provides modeling of value propositions, which characterizes how stakeholders exchange value objects and expect what in return. However, this method only provides a formal way to describe value exchange in the value network from the business value perspective, while neglecting how to leverage value propositions in service analysis and design. Besides value-based methods, goal-based methods (Horkoff *et al.*, 2016; Chawla *et al.*, 2017; Horkoff *et al.*, 2019) are another group of requirements modeling approaches. Similarly, the goal-based approaches focus more on modeling user intention, while neglecting the convergence of values, goals and services. Overall, existing approaches cannot comprehensively characterize the crossover service- featured by cross-organization, cross-value chain, cross-process, and cross-domain. Therefore, it is necessary to analyze crossover services requirements from multiple angles or viewpoints. Based on a prior work, the RGPS requirements meta-model (Wang *et al.*, 2008), in this paper a value-driven crossover service modeling framework which integrates multiple viewpoints is proposed to support requirements modeling and analysis of crossover services. The contributions of this paper are summarized as follows:

1. We propose a value-driven requirements modeling method by integrating value network, goal network and service network to support the requirements elicitation and analysis of crossover services;
2. A modeling tool that can help requirements analysts construct crossover service requirements models is developed. In addition, a case study is presented to illustrate the usage of the proposed modeling framework;

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