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Derivation of Stochastic Reward net (SRN) from UML specification considering cost efficient deployment management of collaborative service components

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ABSTRACT

Performance evaluation of distributed system is always an intricate undertaking where system behavior is distributed among several components those are physically distributed. Bearing this concept in mind, we delineate a performance modeling framework for a distributed system that proposes a transformation process from high level UML notation to SRN model and solves the model for relevant performance metrics. To capture the system dynamics through our proposed framework we outline a specification style that focuses on UML collaboration and activity as reusable specification building blocks, while deployment diagram identify the physical components of the system and the assignment of software artifacts to identified system components. Optimal deployment mapping of software artifacts on the available physical resources of the system is investigated by deriving the cost function. The way to deal with parallel thread processing of the network nodes by defining the upper bound is precisely mentioned to generate the SRN model. The proposed performance modeling framework provides transformation rules of UML elements into corresponding SRN representations and also the prediction result of a system such as throughput. The applicability of our proposed framework is demonstrated in the context of performance modeling of a distributed system.

Keywords

UML, SRN, Performance attributes

1 Introduction

Distributed system poses one of the main streams of information and communication technology arena with immense complexity. Designing and implementation of such complex systems are always an intricate endeavor. Likewise performance evaluation is also a great concern of such complex system to evaluate whether the system meets the performance related system requirements. Hence modeling phase plays an important role in the whole design process of the system for qualitative and quantitative analysis. However in a distributed system, system behavior is normally distributed among several objects. The overall behavior of the system is composed of the partial behavior of the distributed objects of the system. So it is obvious to capture the behavior of the distributed objects for appropriate analysis to evaluate the performance related factors of the overall system. We therefore adopt UML collaboration and activity oriented approach as UML is the most widely used modeling language which models both the system requirements and qualitative behavior through different notations [2]. Collaboration and activity diagram are utilized to demonstrate the overall system behavior by defining both the structure of the partial object behavior as well as the interaction