微服务平台中服务划分和选择策略研究与应用

摘 要

随着云平台业务规模的扩展，大型应用的需求增加，传统的单体服务框架的问题越来越明显，微服务架构成为一种趋势。在单体架构向微服务架构转换的过程中，当前流行的微服务划分方法中只考虑微服务的大小，或者没有考虑原有架构中应用之间的功能联系，无法有效提高服务的复用率，减小平台代码冗余；随着Internet中Web服务数量的增加，服务选择技术也相继出现。但是传统的服务选择方法大多只考虑服务静态的Qos，未考虑细粒度的在线服务能力和任务的特征，无法保证应用执行的高效率。

如何有效的划分微服务以及组合微服务实例，实现一种高效的服务路径选择策略，提高整个平台中应用的执行效率是本文的研究重点。首先本文分析当前一些流行的微服务设计思想，提出一种基于领域驱动设计思想的语义耦合的服务划分策略，该策略综合考虑了微服务平台应用功能关联性大的特点以及微服务的划分原则，通过分析微服务平台应用代码的语义耦合关系构建无向加权图，然后利用具有高内聚低耦合原则的GN聚类算法得到最优的微服务组合；其次本文分析当前一些主流的服务选择算法，提出一种细粒度的性能预测模型，该性能预测模型综合考虑了微服务实例的在线处理能力、任务的特征以及微服务实例之间的传输条件等，能够预测每个微服务实例的执行时间。然后，在性能预测模型的基础上，提出一种性能感知的服务路径选择策略（PSPAS），该策略包括初始化路径选择阶段和自适应服务路径更新阶段，初始化路径选择阶段通过构建任务执行的单源点有向加权图使用最短路径算法得出最优服务路径；在自适应服务路径更新阶段，通过使用服务路径搜索空间缩减原则重新构建单源点有向加权图并更新最优服务路径，整体提高了任务的执行效率。最后，本文通过实验验证了提出的微服务划分策略和路径选择策略，实验结果表明本文所提出的微服务划分算法能够提高平台中服务的复用率以及提出的服务选择策略可以有效提高平台中应用的执行效率。

关键词：微服务架构 服务划分 语义耦合 服务选择 自适应更新

RESEARCH AND APPLICATION ON EXTRACTION OF SERVICE AND SELECTION STRATEGY IN MICRO-SERVICE PLATFORM

ABSTRACT

With the expansion of the cloud platform business scale and the increase of the demand for large-scale applications, the problem of the traditional monolithic architecture has become more and more obvious, and the micro-service architecture has become a trend. In the process of transforming monolithic architecture into the micro-service architecture, the current popular extraction method of micro-service from monolithic software architecture either considers the size of micro-service, or without considering the functional connection between the applications in the original architecture. Using traditional approach for extracting micro-service cannot effectively improve the reusability of service and cannot reduce the redundancy of code; as the number of web services on Internet is increasing, a lot of service selection methods have emerged. However, most of the traditional service selection methods only consider the static QoS of the service, and do not consider the fine-grained online service capabilities and task features at the same time, and cannot guarantee the high performance of application.

This thesis focuses on how to effectively extract micro-services and how to combine the micro-service instances to realize an efficient service path selection strategy and improve the execution efficiency of the application. Firstly, according to the analysis of the current mainstream micro-service design algorithm, this thesis proposes a domain-driven design idea based semantic coupling strategy. This strategy considers the function characteristics between the application of micro-service platform that the functional relevance of the two application is strong and the extraction principle of micro-service. The strategy comprehensively considers the characteristics of the micro-service platform application function and the division principle of micro-services. It constructs the undirected weighted graph by analyzing the semantic coupling relationship of the code of the micro-service platform, and then uses the GN algorithm with high cohesion and low coupling principle to get the optimal micro-service combination. Secondly, this thesis proposes a fine-grained performance prediction model that takes into account the online processing capabilities of micro-service instances, the characteristics of tasks, and the transmission conditions between micro-service instances based on the analysis some current mainstream service selection algorithms. It can predict the execution time of each micro-service instance. Then, based on the performance prediction model, a performance-aware service path selection strategy (PSPAS) is proposed, which includes an initial path selection stage and an adaptive service path updating stage. We use the shortest path algorithm to construct an optimal micro-service path at the initial service selection stage. And then we use an adaptive and efficient micro-service path updating method during the task execution, which can narrow the service path search space prior to online performing the micro-service path selection. Finally, we conduct extensive performance experiments for verifying the proposed extraction algorithm of service and service path selection algorithm. The experimental results show that the extraction algorithm of micro-service proposed can improve the reusability of services and the proposed service path selection strategy can effectively improve the execution efficiency of the application.

KEY WORDS**:** micro-service architecture service extraction semantic coupling service selection adaptive updating