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Kun Ma, Bo Yang, Zhe Yang, Ziqiang Yu

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Segment Access-aware Dynamic Semantic Cache in Cloud Computing Environment

Kun Ma^a, Bo Yang^a, Zhe Yang^b, Ziqiang Yu^{a,*}

^aShandong Provincial Key Laboratory of Network Based Intelligent Computing, University of Jinan, Jinan 250022, China

^bSchool of Computer Science and Technology, Shandong University, Jinan 250101, China

Abstract

In recent years, researches focus on addressing the query bottleneck issue using semantic cache. However, the challenges of this method are how to increase cache hit ratio, decrease the query processing time, and address cache consistency issue. In this paper, we construct segment access-aware dynamic semantic cache for relational databases. Some definitions of semantic segment, probe query, and remainder query are proposed to describe the semantic cache. Then, estimation of the query result is proposed. Next, cache access algorithm of our proposed segment access-aware dynamic semantic cache is presented in case of cache exact hit, cache extended hit, cache partial hit and cache miss. Cache item with effective lifecycle tag is proposed to address cache consistency issue. Finally, experimental results show that this approach performs better than regular semantic cache and decisional semantic cache.

Keywords:

semantic cache, data consistency, cache hit, cache miss

1. Introduction

Large-scale and complex data has brought new challenges to the growing demand for more access to data [1] [2]. For example, the browser/server based e-commerce application such as Alibaba Taobao accesses the cloud data and such APIs in the cloud center [3] [4]. In this scenario, some hot spot data in the cloud are frequently accessed. The availability and scalability of cloud resources when combined with techniques of distributed caching and cloud computing provide tools to address these issues, but bring up new multi-dimensional optimization challenges concerning query processing time and consistency [5].

To reduce the amount of the communication throughout and processing cost between the client and the cloud, a cache system is able to address the key issues: cache access algorithm, cache management, and cache consistency [6]. In this paper, we only discuss the semantic cache [7], which allows the cache to be used even though some of the data are not available in the cache. Therefore, the input query called query trimming will be divided into probe query and remainder query. Probe query will be used to retrieve data from the cache, and remainder query will be sent to the cloud to retrieve the missing data of the ordinal query. There are some open-source tools to address the semantic cache such as Memcached [8], EhCache [9] and Redis [10]. The challenges are how to increase the cache hit ratio and reduce the query processing time. In this paper, we have proposed cache access algorithm to distinguish cache hit and cache miss to maintain the data in the cache, and proposed cache item with effective lifecycle tag to address the cache consistency issue. The contributions of our methods are as the follows.

*Corresponding author.

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