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Dissertation

Title	<i>A Partial Replication Load Balancing Technique for Distributed Data as a Service on the Cloud</i>
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Abstract

Data as a service (DaaS) is an important model on the Cloud, as DaaS provides clients with different types of large files and data sets in fields like finance, science, health, geography, astronomy, and many others. This includes all types of files with varying sizes from a few kilobytes to hundreds of terabytes. DaaS can be implemented and provided using one data center or using multiple data centers located at different locations and usually connected via the Internet. When data is provided using multiple data centers it is referred to as distributed DaaS. DaaS providers must ensure that their services are fast, reliable, and efficient. However, ensuring these requirements needs to be done while considering the cost associated and will be carried by the DaaS provider and most likely by the users as well. One traditional approach to support a large number of clients is to replicate the services on different servers at different locations. However, this requires full replication of all stored data sets, which requires a huge amount of storage. The huge storage consumption will result in increased costs. Therefore, the aim of this research is to provide a fast, efficient distributed DaaS for the clients, while reducing the storage consumption on the Cloud servers used by the DaaS providers. The method I utilize in this research for fast distributed DaaS is the collaborative dual-direction download of a file or dataset partitions from multiple servers to the client, which will enhance the speed of the download process significantly. Moreover, I partially replicate the file partitions among Cloud servers using the previous download experiences I obtain for each partition. As a result, I generate partial sections of the data sets that will collectively be smaller than the total size needed if full replicas are stored on each server. My method is self-managed; and operates only when more storage is needed. Therefore, replica removals are performed only when necessary. I evaluated my approach against other existing approaches and demonstrated that it provides an important enhancement to current approaches in both download performance and storage consumption. I also developed and analyzed the mathematical model supporting my approach and validated its accuracy. Therefore, I believe that it provides promising results to the area of load balancing and storage optimization for DaaS on the Cloud. Keywords: Cloud Computing, Data-as-a-Service (DaaS), load balancing, storage optimization.

Research Relevance and Potential Impact

This research aims to improve the download time and storage consumption on the cloud. The impact of this research is mainly in reducing the storage costs by reducing the amount of storage needed. Reducing the cost will result in being able to have more resources to improve other services or reduce costs for customers.

Relevant Publications

- Al Nuaimi, Klaithem, et al. "A Novel Approach for Dual-Direction Load Balancing and Storage Optimization in Cloud Services." Network Computing and Applications (NCA), 2014 IEEE 13th International Symposium on. IEEE, 2014. [ERA Ranking: A]
- Al Nuaimi, Klaithem, et al. "Partial Storage Optimization and Load Control Strategy of Cloud Data Centers." The Scientific World Journal, communication section, 2015. In Press. [Impact Factor: 1.219]
- Al Nuaimi, Klaithem, et al. "A Self-Optimized Storage for Distributed Data as a Service", Convergence of Distributed Clouds, Grids and their Management Track, The 24th IEEE International Conference on Enabling Technologies: Infrastructure for Collaborative Enterprises. [ERA Ranking: B]

Career Aspirations

My main goal of obtaining the PhD is to improve myself individually. Another goal is to have better knowledge and experience in the field and conduct practical research that could benefit other individuals, the community, and my country. A successful career in a related field is another goal I am working to achieve.