Performance Comparison Analysis of Docker Container and Virtual Machine in the Cloud Computing Environment for Database Management Systems

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Recently, Virtual machine and Container technology have become widely used as two of the most important virtualization technologies in the industry. The virtual machine provides better mechanisms for solving many existing manageability issues in database systems. Therefore, database systems are increasingly running on virtual machines. But after introducing container technology, it has gained increasing attention in recent years and has become an alternative to traditional virtual machines. Some of the core motivations for the enterprise to adopt containerization technologies include application integration and deployment, lightweight operations, as well as resource sharing efficiency and flexibility. This provides many opportunities for researchers in the database systems to deploy the databases with server consolidation, but it is also important to understand the cost of virtualization. The additional abstraction layers provided by virtualization come from the interchange between performance and cost in a cloud computing environment where everything is on a pay-per-use basis. So, containers which are considered to be the future of virtualization are being developed to address mainly this issue. However, a systematic comparative study of the performance of the database servers in the container environment and in the virtual machine environment is still missing. Accordingly, the main objectives of the research study are to monitor, analyze and evaluate the performances of different database servers on the virtual machine and Docker containers and to study which is better for microservice-related database deployments. The proposed comparison environment was designed on the Microsoft Azure cloud computing environment with separated virtual machines and Docker containers on top of the Linux operating system as the host. An experimental research study of comparing virtual machines and containers for the overhead of running a database workload and a critical assessment of each database metric and its behavior basically when subjected to Query execution performance, Load performance and Resource utilization of the standard databases are going to be presented. The initial results have shown that the container gets the manageability benefits of virtualization over the virtual machine. Although query execution is fast, the high query latency is quite noticeable when receiving a large number of data records from container-based database servers. After reviewing the results and discussing the limitations, the conclusion of this research study will be useful for future research as well as database server deployments.

Keywords: Virtual machines; Docker Containers; Cloud computing environment; Microservice-related databases; Database metrics

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