Performance comparison between container-based and VM-based services

CSCI 5401 Assignment 1, Part 1

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Overview

The paper talks about the prime differences and compares **Container-based and VM-based Services** with an example of AWS EC2 (VM-based) and ECS (Container-based) and shows the unpopular opinion that the VM-based services outperforms the container-based architecture. Containerization is portable and among the must-haves in a microservice architecture in the context of the traditional SOA model (Service Oriented Architecture) to make services flexible to change, higher scalability, throughput, and better fault tolerance. Most reports clearly indicate that using containerization tools such as Docker offers better performance and lower resource utilization because of the ability to unpack dependencies and deploy multiple containers under the same VM. However, the conclusion may not be valid for all cloud providers (Infra as a Service). For instance, Amazon reported that the docker containers are deployed on top EC2 VMs, which is not a traditional deployment strategy. However, it does make sense for Amazon to follow such an approach to better scale and offer Infra as a service to its consumers. Thereby, the need to compare VM-based and container-based architecture within the AWS cloud is important and has probably never been done before to quantify the **overhead**.

The above experiment's **set-up** is as follows: Amazon Web Services as the cloud provider (IaaS), with EC2 Container Service (ECS) to deploy Docker Containers and EC2 as Virtual Machines to compare with. To make the results fair, the different scenarios to compare the performance include (1) one instance of EC2 and one ECS container instance, (2) 2 tasks listening to different ports within the container and two different EC2 instances, and (3) finally, a set-up similar to (2), more services and multiple requests at the same time. The experiment **results** are as follows: The performance is measured by considering server throughput, response time, and CPU utilization. In all the three metrics, ECS showed lower or degraded performance compared to EC2, with a 19% higher response time of ECS and worse as the workload increases and reaching CPU peaks much ahead of EC2 even at a lower throughput. To conclude, considering the performance of EC2 being significantly higher (as high as 125% in some instances), applications with **stringent performance** needs, using **EC2 over ECS** is a better go, specifically in AWS, which may not be the case for other providers depending on the architecture used to power Infrastructure as a Service.

References

T. Salah, M. J. Zemerly, C. Y. Yeun, M. Al-Qutayri and Y. Al-Hammadi, "Performance comparison between container-based and VM-based services," 2017 20th Conference on Innovations in Clouds, Internet and Networks (ICIN), 2017, pp. 185-190, doi: 10.1109/ICIN.2017.7899408.