

ASSIGNMENT 1: PART A

TASK : Read the paper: "Performance comparison between container-based and VM-based services" and write a summary.

Authors of numerous articles demonstrated that services deployed in Docker containers beat virtual machines in terms of overall throughput. The Amazon cloud, on the other hand, hosts containers on top of EC2 virtual computers. Amazon AWS may have taken this strategy for a variety of reasons, including making better use of existing infrastructure (such as EC2 VMs) and providing more services (i.e., container ECS). Moreover, because ECS provides excellent administration and auto-scaling features, users will be able to simply manage their container instances and Amazon claims that leveraging EC2 VMs to deploy containers will simplify management and boost deployment speed while keeping flexibility.

Containerized services aren't a key priority in the Amazon cloud, which could lead to longer response times and a drop in overall performance. The authors focus on comparing the performance of container-based services to VM-based services when both are deployed on the same Amazon cloud. Thus, the performance of EC2 and ECS is investigated in this paper based on throughput, CPU use, and response time.

Three evaluation scenarios were created, each with a different number of web services installed and results were as follows:

To reduce network overhead and unpredictability, JMeter was installed locally (i.e. within the AWS cloud Tokyo region and within the same availability zone) on a Windows EC2 computer. A big instance size was chosen, with two virtual CPUs and 8 GB of memory.

1. **An EC2-based structure was used in this situation, with a single web service running on a single container instance. Port 80 is used by the container. Aside from ECS, where the containers just use httpd images, an Apache server required to be setup on the EC2 instance. The size of both instances is t2.small.**

Results: The performance measurements of the first scenario show that EC2 is faster than ECS at handling requests of 10 users and above, with a saturating throughput of 10,000 requests per second for EC2, and 8000 requests per second for ECS. ECS results show almost 26.3% additional time compared to EC2 at a workload of 10 users and 44.4 % extra time at a workload of 20 users.

2. **The second case includes using multiple container instances to scale tasks. The first job connects to port 80, while the second connects to port 8080. Both services will get the requests at the same time. On an EC2 instance, two similar web applications will be compared using ports 80 and 8080. For EC2 to listen to another port, httpd had to be re-configured.**

Results: The throughput is flattening off at 9000 requests per second for EC2 and at approximately 6000 requests per second for ECS. The response time increases by 64% for ECS compared to EC2.

3. In this section, one can track the performance of many web services running on the same container instance. There are three web services that run on ports 80, 8080, and 81. To add a web service using port 8181, another httpd port was configured. At the same moment, the requests will be issued to the three services.

Results: In scenario 3, an additional job is added to the ECS instance, and an additional web service is introduced to the EC2 instance. The throughput flattens at 7000 req/s for EC2 and 5500 req/s for ECS, with EC2 having a 1000 req/s lower throughput and a 1 ms longer response time.

In conclusion, the existence of the hypervisor layer of the EC2 VMs on which containers are installed revealed a large performance overhead, which was reflected in the testing results. In every performance parameter, VM-based web services outperform container-based web services, therefore, authors strongly advise utilizing EC2 in the AWS cloud over ECS for deploying applications with high performance needs, as VM-based web services can outperform container-based web services by 125 percent.

REFERENCES:

[1] 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.