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An Introduction to Dockers: From Monolithic to Containerized Environment

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Abstract: ***The main purpose of this article is to highlight the recent trends in virtualization and containerization. It provides a brief history of the evolution of virtualization followed by brief details of containerization and Docker. It further summarizes out the key features and reasons to consider Docker for IT infrastructure.***

Keywords: Docker, Containers, Light-weight, Open-Source, Secure

1. Introduction

The information technology (IT) infrastructure landscape has tremendously changed from the inception of the digital world back in 90's. It started with big boxes, having limited memory and processing capabilities, to the present-day supercomputers. Behind the scenes, optimization of physical resources has always been of paramount importance for the infrastructure administrators. We progressed from deploying a single application on a box to multiple applications, using virtualization, on the same machine. It aids in not only increasing flexibility and satisfying the market demand but also helped in reducing the cost as well as harnessing the maximum capacity of the physical device allowing companies to remain competitive in the market [5].

Now, a new milestone has been reached by the use of containerization for deploying and maintaining the new world applications. Containerization not only meets the dynamic and challenging scenario of the present day infrastructure needs but also promises further cost reduction with several other added benefits [2]. IT industry is quick in embracing this technology and many companies are switching from virtualized environment to containerized environments.

2. Brief History

In the nascent stage of IT, one application was deployed on one physical machine. If it was required to run another application, an entirely new physical server was required. This whole procurement process of new server was a huge bottleneck and can lead to slippage of production timeline.

With the advent of virtualization, companies were able to deploy multiple applications on the same physical server. It helped in reducing the cost of running an application as well as reduced the market goes to time.

But, this approach too had inherent imperfections associated with it. Each of the virtual machines required dedicated guest operating system and computational resources, which has led to a maintenance nightmare. Each of them requires security patch updates and risk monitoring along with the inherent cost of licenses. As compared to monolithic silos, firing up a virtual environment is relatively less painstaking, but it is still a resource intensive process.

The industry architects contemplated about the pros and cons of virtualization and came out gradually with containerization. Containerization preserves the core concept of virtualization but eliminates the need for the guest operating system and many other relevant overheads.

3. Containerization

In very simple words, it is a lightweight counterpart of full machine virtualization. It is encapsulating the application in a container bundled with its operating environment. The container provides many benefits as compared to virtual machines, as it allows to run an application on any suitable physical machine without worrying about dependencies every time [2].

Containerization has come into the limelight with the advent of open source container platform Docker in the market. Docker containers can be fired up on any platform ranging from physical boxes to virtual machines, cloud clusters, public instances and much more. There are also several other container technologies present in the market like Rocket and DrawBridge.

4. Dockers

Dockers supply a means for revealing the potentiality of the Linux containers by providing the standardized format with its increase ease of use. Thus, the standardization allows its rapid adoption. Further, it allowed packaging of all the dependencies required for application as a unit (a container). This unit contains everything related to the execution of apps like code, runtime, system tools and system libraries [4]. Additionally, it ensures that the application maintains a consistent behavior irrespective of the execution environment.

It has similar resource isolation and allocation benefits as compared to virtual machines. These are the reasons for which 70% of the respondents are either already using container technology or are in the way to evaluate it for adoption in future as per one survey [3]. In contrast, 23%

have the know-how about the technology but not used it, and rest of them never listen to it. Thus, the Docker is the rapidly evolving technology that will bring dynamic changes in the IT world.

5. Key Features of Dockers

Lightweight In a contrast comparison to virtual machines, Docker does not require a dedicated guest operating system in addition to the host operating system[4]. All the Dockers running on the physical machine share the same operating system. It empowers them with a quick boot time and efficient usage of RAM. Images form the basis of Docker technology stack. They act as the foundation material for the stack and are constructed using layered filesystems. Since file systems lie at the base of the images, they can be shared across the multiple images. It reduces the memory footprint of the Docker images. It further reduces the bandwidth required to download because previously downloaded files can be used.

Open Source Docker containers are built using open standards. Hence, it is compatible with all notable Linux distributions and Microsoft Windows operating system. It has support for every infrastructure. Open source nature leads to the elimination of licensing cost. Additionally, any company can modify it as per its requirements.

Secure Containers maintain an isolation level between the applications. Also, the underlying infrastructure provides an added layer of protection [1].

6. Reasons to consider containers

There are numerous reasons for which containers gain importance. Some of them are as following:

Lightweight and breakneck fast Dockers are lighter than their virtual counterpart hypervisors. This ecosystem has no guest operating system. Hence available processing power, memory, and storage are automatically diverted towards performance enhancement of the deployed application.

Component reusability Images form the basis of container ecosystem. New images are derived using existing images, thereby allowing component reuse.

Simplified Isolation Containers have their network stack and specific access permissions configured. By default, external communication with other containers and third party application is denied. Particular configurations need to be carried out at network stack level for interaction.

Enhanced Security Container controls the application installed using scripted instructions in the setup file. For hosting a critical workload, only the related dependencies will be exposed, thereby reducing the attack surface.

Resource-Friendly All the containers running on a physical server uses the same host operating system. So, a system running 10 to 100 virtual machines is capable of 100 to 1000 containers having the same workload. Also, when migrating from one environment to another, only application binaries needs to be copied.

Reduced maintenance and minimal overhead Lightweight containers enable rapid delivery and deployment. The container allows updating the environment as a part of the application refresh.

7. Conclusion

In conclusion, Dockers and containerization are all set to revolutionize IT infrastructure landscape. Dockers promise all the benefits of virtualization but eliminate all the downsides to an excellent approximation. Thus the companies who will adopt it will gain advantages in the form of costs effectiveness, greater productivity and increased competitiveness while other those are missing out this wave of modernization may be beaten up by their competitors in the near future.

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Author Profile

Ravi Kumar received the B.E. in Computer Technology from Nagpur University in 2011. He develops product for banks using java and webmethods. His areas of interests include Middleware, Micro services, Big data and Dockers. He has around 5 years of industry experience and is currently working with Fiserv.