Usage of Dockers in Networking: A Survey

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Abstract

Docker is an open source software platform that is used to create, deploy, and manage virtualized applications on containers that share a common operating system. The docker services are more powerful and can be integrated with the network to increase their efficiency. Dockers have inbuilt networking drivers and can be used in various types of networking such as host, bridge, and containers.

In this paper, the survey of different papers that used docker in networking applications which increased their performance are listed and discussed. Mostly, the Kubernetes is taken as an example which is implemented in virtual environment and various networking clusters and cluster containers are discussed.

Keywords: **Docker, Kubernetes, networking, virtual environment**

I. INTRODUCTION

This survey paper depicts the usage of dockers in networking that enhances the performance of network.

II. SIGNIFICANCE OF DOCKER

The significance of docker is described as follows:
(i) Docker promotes rapid application deployment.
(ii) Docker promotes portability across machines.
(iii) Docker promotes version control and component reuse.
(iv) Docker promotes sharing across various machines in a virtual environment.
(v) Docker promotes lightweight footprint and minimal overhead.
(vi) Docker promotes simplified maintenance.

III. SIGNIFICANCE OF NETWORKING

The significance of networking is described as follows:
(i) Ease of access from anywhere and anytime
(ii) More flexible approach
(iii) Includes sharing of resources
(iv) Secures information
(v) Utilization of common resources
(vi) Cost effective
(vii) Greater flexibility
(viii) Connects geographic boundaries

IV. RELATED RESEARCH WORKS

A. Network Quality of Service in Docker Containers

[1] developed an extension of docker networks to promote guaranteed quality of service on the networks. In this approach, the user can assign priorities to dockers and can configure the assigned priority. The merits include cost reduction and efficient usage of resources. This docker implementation ensures time-bound and mission critical applications that are hosted in high-priority containers which get a greater share of network bandwidth without starving other containers.

Providing QOS to containers includes two advantages such as containers that can host real time critical applications and operating cost is reduced. The delay in transmission is reduced using UDP protocol. The output is monitored using Net hogs and compared using Wireshark.

B. Networking in Containers and Container Clusters.

[2] presents ways to implement docker in networking

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configurations and explores containers that rely on networking. Example taken for implementation is Kubernetes.

The findings in this paper are as follows:

Services are key for communication in Kubernetes and IP can be discovered by using pods. This is suited for small clusters and internal cluster DNS service for large clusters to resolve the IP.

The networking configuration includes a Software Defined Network under the Google compute engine named Andromeda which is flexible and can allocate subnets for pods. The next configuration includes flannel which is an overlay network developed for CENTOS that creates a virtual machine to create subnets and the others include OVS on Kubernetes and Weave which use a similar approach.

C. Provision of Docker and InfiniBand in High Performance Computing

[3] represents ways to implement docker and Infi Band in high performance computing as it plays a vital role in on demand high level computational capacity. Infi Band improves networking and can be used in the creation of virtual machines. Usage of docker promises higher performance. In this work, the docker has been implemented on a virtual machine in Infi Band infrastructure. The advantages include reduction of overhead in virtual machine, high availability, and capability.

D. Measurement and Evaluation for Docker Container Networking

[4] illustrates the usage of containers for light weight resource management in the virtualization technology.

The proposed work investigates the development of the container model for networking and evaluates the performance of mainstream network solutions such as Flannel, Swarm Overlay, and Calico.

This has the UDP framework and the output shows that calico gains the highest performance but this configuration is difficult and flannel designed for Kubernetes whose configuration is simple with low performance and Swarm overlay configuration is simple with low performance.

E. Evaluation of Docker as Edge Computing Platform

[5] discusses a way to implement edge computing platform that reduces the response time and improves user experience.

This paper evaluates the use of edge computing in docker with major principles such as deployment and termination, service and resource management, fault tolerance, and caching.

It has been used in larger organizations where the data is needed to be shifted. The docker shifts the container with less overhead and low data transfer overhead. It is used in Hadoop applications such as Hadoop streaming and map reduce functionalities.

The output shows that docker provides high efficiency, faster deployment, and good performance in the edge computing platform.

TABLE I.
SUMMARY OF RESEARCH RELATED WORKS

S.No.	Title	Author Name	Description	Applications Used For	Merits	Demerits
A	Network Quality of Service in Docker Containers	Dusia, A. et al.	Installing and configuring the docker with priorities on network to assure quality of service.	Time-bound, mission critical applications that are hosted in high-priority containers	Cost reduction and efficient usage of resources.	Uses UDP protocol that is insecure, bandwidth of channel must match with priority assigned. Hence, it cannot be used when network is slow.
B	Networking in containers and container clusters.	Marmol, V. et al.	It has the various networking configurations that have been tested on docker ,say Kubernetes and their container clusters been used in the network.	Application that needs networking containers along with docker	Light weight, used both in internal and external clusters and easy	It has conflict in configuring the other networking containers except Andromeda, Flannel,

					deployment.	OVS, and Weave.
C	Docker container cluster deployment across different networks.	Babu, Y. et al.	Usage of docker in Virtual machine in Infi Band architecture to improve efficiency.	Applications that need high computational power run on virtual machines.	High availability, efficient usage of resources, cost reduction, capability, and less overhead.	It has configuration issues when the architecture shares the same kernel with the host.
D	Measurement and evaluation for docker container networking	Hao Zeng., et al.	Deploying different types of network containers in dockers under virtualization environment and measuring their performance.	Used in applications that need network containers for their implementation.	Calico is the best used network container based on throughput and flannel is used for Kubernetes.	Implemented only on virtual environment and UDP framework which is highly insecure.
E	Evaluation of Docker as Edge Computing Platform	Ismail, B. I. et al.	Discusses the way to implement docker in edge computing platform that has high performance, scalability, elasticity and reduced overhead.	Big data processing applications such as Hadoop map reduce Hadoop streaming.	Less overhead, easy transfer of data, high availability, elasticity and reliability.	It has configuration issues between edge computing platform dockers in virtualized environment.

V. CONCLUSION

This survey paper comprises of usage of dockers in networking which have various advantages. Dockers are light weight, scalable, and easily portable [5]. Dockers can be used for time-bound, mission critical applications that are hosted in high-priority containers [1]. This has advantages like efficient usage of resources and less overhead. They can be used in clusters that have merits like light weight, used both in internal and external clusters, and easy deployment in dockers like Kubernetes [2].

Dockers can be used in applications that need high computational power and run on virtual machines [3]. The popularly used containers include calico and flannel for Kubernetes [4].

It can also be used in big data processing applications such as Hadoop map reduce and Hadoop streaming [5]. The drawbacks are that it uses UDP framework [1][4], which is highly insecure and has a lot of configuration issues [3][5] with the virtual environment which can definitely be resolved.

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