

C-Research-Report

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Cloud Computing with scalability, cost-effective and highly available resource usage, has revolutionized the way that companies utilise and deploy infrastructure. This paper explores Unix in the cloud, the advantages and disadvantages that come with it.

I. INTRODUCTION

Unix, and its more frequently used open source Linux have found a natural home in the cloud environment. By deploying Unix on cloud containers, organisations can utilise the full benefits that cloud computing offers. Below explored is the use of Unix and cloud computing, including the various deployment and service models that cloud computing encompasses, such as IaaS, PaaS and SaaS. Furthermore some common tools with their advantages and disadvantages on Unix will be analysed.

II. UNIX ON THE CLOUD

Cloud computing [1] is a technology stack which delivers computing services, such as storage, processing, hosting, data analytics over the internet. Rather than purchasing/implementing/upgrading hardware, businesses and organisations can utilise cloud computing services which is typically paid as you use the service. Cloud computing offers many benefits, such as on demand scaling, cost savings, high availability, high accessibility and many more. Unix or more often Linux, can enjoy all these benefits by being deployed onto a cloud container.

Red Hat [2] is an example of a major version of Enterprise Linux which is widely deployed on cloud service providers, such as Google Cloud, Amazon Web Services, Microsoft Azure, and OpenStack. There can be multiple different deployment and service models such as:

Public Cloud: services offered to the public, owned, and operated by a third-party provider. The same infrastructure is used which results in cost saving and scalability.

Private Cloud: Infrastructure, which is offered for a single organisation, often hosted on-premises. This can offer more control and customisation however involves higher costs.

Hybrid Cloud: Combines both the previous type of clouds, allowing data and applications on both which results in flexibility and optimization of resources.

Infrastructure as a Service (IaaS): Provides virtual resources over the internet which could include Virtual Machines, storage and networking service which is managed and controlled by users.

Platform as a Service (PaaS): Offers a platform inclusive of development tools and application services for developers to build and manage without the need to manage infrastructure.

Software as a Service (SaaS): Applications delivered over the internet on a subscription basis.

III. ADVANTAGES TO UNIX ON CLOUD

There are many ways Unix can be deployed on cloud infrastructure, and then run as IaaS, and even offer PaaS and SaaS services to clients. Having Unix deployed in a cloud environment also takes advantage of all the benefits the cloud has to offer, such as:

A. Availability

Unix can provide highly available systems through a clustering architecture. Clustering is the act of two or more computers acting as a single virtual server. Unix Clusters are typically least expensive to deploy and maintain [3] due to the robustness of the operating system. Software such as Keepalived [4] main purpose is routing which allowed for load balancing and high-availability Linux systems. This is free software under the General Public License, like Unix. While Unix alone does not provide what is defined as high-availability [5], rather a combination of software that work together in an eco-system, it provides a fundamental and stable core and allows for building blocks to be placed upon it.

B. Resources

Furthermore, the Unix OS provides a better handle on resources, specifically memory usage, as Unix makes use of virtual memory, more programs can be running which Unix utilising the hard disk for storing application resources not actively being used at that time [6]. Unix can use multiple strategies for handling memory that includes Overlays, with a large program being divided into small pieces, only parts that are needed for running are placed into memory for execution. Swapping is also used with the program being brought fully into Memory and then either terminated or being placed back onto the disk until needed again [7]. Combining Unix's Memory Management, along with cloud scalability when needed provides for a custom solution that is robust, with the ability to change dynamically when needed – making efficient use of the available resources.

C. Multi-tasking

Unix based operating systems allow for multiple processes to run concurrently, which is achieved by dividing tasks into

individual processes [8]. These processes are then managed by scheduling which is performed by the system kernel. Running time and priority is decided by an algorithm [9]. Like Memory, this means that the infrastructure allocated in the cloud environment is being used efficiently keeping running and pay as you go costs lower compared to other standard operating systems.

D. Security

Using a Unix based operating system in the cloud can offer many benefits when it comes to security. Linux is known for its robust security features and combined with cloud infrastructure and security practices. Firstly, Unix has a sophisticated user permissions for file and application access, [10]. Unix also runs with resource isolation, with each process and user privileges isolated with its own set of permissions reducing the risk of privilege escalation attacks. Furthermore, as Unix, or Linux is open source with anyone able to read and comment upon source code, it allows for anyone to scan and identify vulnerabilities, having the public able to read through the code to catch any back doors [11].

IV. DISADVANTAGES

While Unix based operating systems offer many advantages on the cloud, there are some drawbacks and difficulties associated which other operating systems such as Windows may not be affected by, such as:

A. Support

As each hosting environment is completely unique, in terms of organisation, the purpose, application and many other variables, gaining support for cloud hosted Unix services may prove challenging. This can be for several reasons however cloud providers may not have knowledge or understand how an organisation has setup their environment within the cloud solution. While this issue will affect any OS, Windows Server for example can be covered and supported by Microsoft themselves, whereas Unix is free and open source, it is dependent on the type of Unix and the applications themselves [12].

B. User Interface

If a corporation is operating on Windows Server and employees only have skills/expertise in this OS, then Unix and User Interface – depending on the type of Unix installation may prove to be a challenge. This is due to Unix and the CLI environment that it primarily operates in [13]. This can also be seen below regarding skill availability.

C. Skill Availability

Unix system administration and cloud management require specialised skills. Finding IT professionals that have expertise in both Unix and cloud technologies can be difficult as it combines knowledge of two complex domains [14]. By having recruitment challenges could potentially delay work that needs to be done, or the work could be completed to a sub-par level impacting the overall system efficiency which would make any benefits to the initial system redundant,

V. EXAMPLES OF COMMON TOOLS

Provided below is a brief analysis of common tools that can be hosted in the cloud on a Unix Environment, outlining Positives and disadvantages to each.

A. Docker

Pros: Docker containers can encapsulate Unix-based network services and their dependencies, making it easier to replay and manage across several cloud environments [15].

Cons: Docker can have limited scalability. This can work against the purpose of having Unix on the cloud, being one of the main reasons to scale at ease [16].

B. Ansible

Pros: Ansible can automate the provisioning and configuration of Unix based network services on cloud instances, It is agentless and a lightweight services and has an extensive library of modules [17].

Cons: While Ansible is better at configuration management, it may not be the best choice for dynamic orchestration stand alone, but rather hand in hand with Terraform below [18].

C. Terraform

Pros: Terraform supports multiple cloud providers, making it versatile for deploying Unix-based network services across different platforms [19]

Cons: Terraform has its own configuration language, HashiCorp Configuration Language (HCL), which users need to learn [20]

VI. CONCLUSION

The benefits of deploying Unix in a cloud environment can be very rewarding to a organisation and boast advantages such as: Clustering and load balancing, efficient resource utilisation through memory management, seamless multi-tasking and robust security footprint. Unix's open-source background also allows its source code to be read and analysed by the general public, providing further opportunities for improvement.

However, it is also necessary to plan and prepare for the challenges that may occur when planning to utilise Unix in the cloud, as there can be a learning and skill curve that current staff may face, alongside a lack of external support compared to Microsoft's Windows Server.

Unix and the cloud used in conjunction can help a business utilise the best of both worlds while also running many popular tools to utilise the available resources such as Docker, Ansible and Terraform.

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