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Case Report

Automated Deployment in Action: A Case Study on IT Infrastructure Deployment with Ansible Playbooks

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ABSTRACT

This study delves into how using Infrastructure automation solutions, with playbooks can revolutionize datacenter operations. By combining Cisco Unified Computing Systems along with NetApp storage systems, the research showcases an improvement in IT efficiency and operational accuracy. The implementation of customized playbooks for setup leads to a shift towards fully automated configurations of computer, networking, storage and hypervisor layers following industry best practices identified during testing and validation phases. The findings highlight the effectiveness of automation in reducing times from hours to minutes speeding up service delivery and enabling IT staff to focus on strategic initiatives. Automation is applied throughout both infrastructure and application layers to ensure error deployment processes. An interesting discovery is the ability to reuse code/roles within the automation package for execution of tasks boosting operational efficiency and maintaining consistency, across deployments.

Keywords: Infrastructure Deployment; IT Efficiency; Operational Precision; Datacenter Optimization

1. Introduction

In today's moving realm of information technology setting up software infrastructure poses a challenge for companies striving to remain competitive and effective. The traditional deployment methods that heavily rely on processes are proving to be less effective in adapting to the evolving digital landscape. The emergence of Infrastructure Deployment Automation (IDA) as both a field of study and practical application is a response to this shift. IDA encompasses a range of tools, frameworks and strategies designed to automate the deployment of software and hardware infrastructure. The primary goals of Infrastructure Deployment Automation (IDA) include minimizing errors expediting deployment procedures and ensuring uniformity and dependability across environments to optimize time and resources usage.

The integration of automation technologies into infrastructure deployment represents a shift in how businesses manage the creation, testing and maintenance of their IT environments. These tools offer opportunities to streamline deployment processes enabling companies to make changes reliably. However, transitioning from manual to automated procedures comes with its challenges. Organizations must navigate a landscape of tools, integration points and established practices to effectively leverage automation in their deployment strategies.

This special edition of the journal aims to deepen understanding of Infrastructure Deployment Automation by exploring the organizational aspects of transitioning to automated systems. The goal is to provide an examination of methodologies, challenges, and future directions in IDA with a focus on leveraging automation technologies for optimized deployment processes. The contributions cover topics including comparisons of automation tools case studies on successful and unsuccessful automation projects, theoretical frameworks for understanding automation in deployment scenarios and guidance on implementing automation within organizational settings.

The objective is for this edition to furnish researchers, practitioners and decision makers with a grasp of Infrastructure Deployment Automation and practical insights into applying automation technologies. It aims to equip them with the knowledge to navigate the complexities of infrastructure deployment efficiently.

The articles provided here strive to enhance the field by blending real world research, theoretical perspectives, and hands on support. Their goal is to encourage the adoption of automation to streamline infrastructure deployment processes for efficiency, dependability and scalability.

2. From Day 0 to Day N: The Lifecycle of Infrastructure Automation

The journey of Infrastructure Automation, from its inception (Day 0) to its phase (Day N) is a groundbreaking process that transforms the management and operation of IT environments. It all starts with the phase of planning and designing where crucial decisions regarding the structure, tools and methods to be used are made. This marks the birth of the concept of an automated infrastructure laying the groundwork for a effective and resilient IT ecosystem. As time progresses beyond Day 0 different stages unfold involving implementation, refinement and ongoing enhancement each marked by achievements and challenges. In the phases the focus is on introducing automation technologies and streamlining repetitive tasks. With continued automation efforts by businesses over time come complex processes being automated leading to a reduction in manual interventions as well as accelerated deployment speed and consistency.

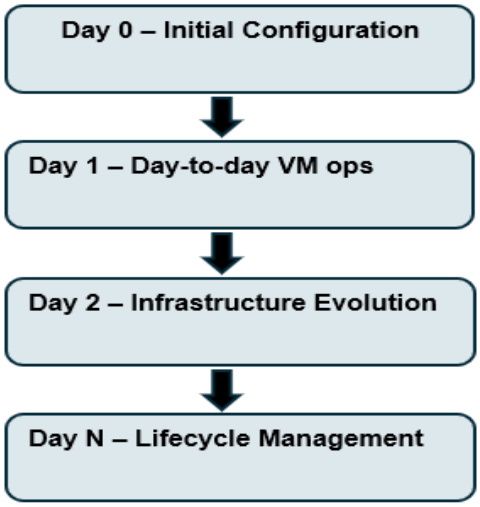

Figure 1: Day 0 to Day N Automation.

Throughout their lifespan companies conquer challenges, including resistance to change the complexity of integrating different tools and systems and the need to enhance team skills to effectively navigate automated environments. However, with each obstacle overcome the infrastructure grows stronger and more flexible, capable of adapting to evolving business needs with disruption. The transition from processes to an automated infrastructure is not immediate but rather a gradual evolution that requires commitment, financial investment and a mindset of continuous learning. From inception to completion Infrastructure Automation unfolds as a journey toward establishing an IT environment that's both efficient and responsive, to advancements and market shifts.

Using Infrastructure, as Code (IaC) is a part of the Infrastructure Automation movement changing how companies set up and manage their IT environments. By considering infrastructure setup and configurations as code IaC brings advantages that improve system flexibility, dependability and scalability. One key benefit is the ability to automate infrastructure provisioning and management resulting in deployment times and fewer manual errors. This automation guarantees replication of environments, which supports DevOps practices and integration/ continuous deployment (CI/CD) workflows.

IaC encourages teamwork and transparency among stakeholders by utilizing version-controlled code that can be examined tested and enhanced. This collaborative approach enhances infrastructure quality. Also nurtures a culture of sharing knowledge and joint accountability. An additional advantage of IaC is resource management; it allows for scaling up or down of infrastructure leading to cost optimization. Furthermore, IaC boosts disaster recovery efforts by reliably restoring infrastructure states in case of failure or compromise reducing downtime impact on business operations. In essence IaC plays a role, in the lifecycle of Infrastructure Automation by empowering organizations to meet the evolving demands of the digital age with confidence and efficiency.

3. Literature Review

The research extensively delves into the use of playbooks to automate infrastructure deployment. Georgakopoulos (2005)[1] and Juve (2011)[2] stress the importance of streamlining workflows in environments with the latter focusing on scientific workflow applications. Singh (2015)[3] and Mysari (2020)[6] underscore the importance of Ansible in automating the deployment of customer applications in cloud environments. Mysari (2020)[6] also delves into integrating Jenkins for automating the integration and deployment (CI/CD) process. The study highlights the growing demand for cloud technologies, the role of DevOps teams in automation and the focus on automating customer applications through providers and orchestration engines. Automation plays a role in projects. Implementing CI/CD with Jenkins and Ansible is proven to be highly effective for web application development. Integration with Jenkins is simple while using Ansible with YAML configuration aids, in time saving efforts.

Rodero Merino (2010) and Morris (2016)[4] both advocate for the shift, from focusing on infrastructure delivery to emphasizing service management within the realm of cloud computing. Morris specifically provides a guide on deploying infrastructure using code. By embracing infrastructure as code organizations can streamline their IT operations by leveraging DevOps principles. The book highlights the hurdles in adopting technologies and suggests effective strategies for server management. Despite the promises made by cloud platforms there have been challenges in utilizing them for infrastructure management. One proposed solution involves introducing an abstract layer that aligns closely with service lifecycles. This layer would enable automated deployment and scaling of services based on their status allowing for seamless federation of service execution across cloud providers.

In his work Howard (2022)[7] introduces Terraform as a tool that automates the setup of infrastructure and complements to augment its capabilities. Terraform streamlines the automation of infrastructure provisioning through a development and review process providing a framework for managing various resources efficiently. The importance of maintaining thoroughness

in infrastructure provisioning is likened to that of software application development.

4. Results

We utilized an infrastructure called FlexPod[8] automation solutions with Ansible to demonstrate improvements in IT efficiency and operational accuracy in our datacenter design. Our main goal was to set up a FlexPod system by integrating Cisco Unified Computing System (UCS) Cisco Nexus switches, Cisco MDS switches and NetApp AFF/FAS/ASA systems. Through the use of playbooks tailored for the setup of FlexPod we automated the configuration processes for computer, networking, storage and hypervisor layers. This automation followed practices identified during testing and validation.

Prior to implementing automation setting up and provisioning services, our infrastructure required effort leading to a time-consuming process that lasted several hours. With the introduction of automation deployment times were significantly reduced, allowing tasks that previously took hours to be completed within minutes. This improvement reduced the time needed to deliver services but also enabled IT staff to focus on other critical tasks greatly enhancing overall productivity.

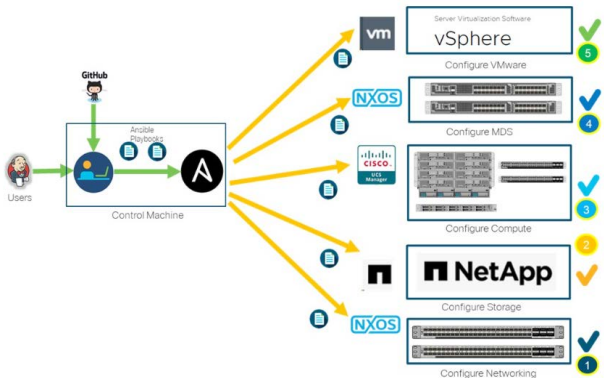

Figure 2: Ansible Automation steps.

Our research findings show that FlexPod automation offers a solution covering all infrastructure and application layers. The setup process, for Cisco UCS Manager (UCSM) NetApp Storage, Cisco Network and Compute and VMware was fully automated using playbooks tailored for FlexPod configuration. This automation extended to the hypervisor layer ensuring an implementation of the stack in line with FlexPod solution best practices.

The Ansible playbooks employed in FlexPod automation are crafted to provide configurability and scalability. They leverage a variety of roles and necessary variables for solution setup allowing for user input customization and adherence to defaults/practices. This approach enables adaptation to installation environments empowering clients to tweak variables based on their requirements. Notably the automation for NetApp ONTAP stands out for its scalability accommodating setups ranging from High Availability (HA) pairs, to extensive 24 node ONTAP AFF/FAS clusters.

Our research highlights an advantage in terms of code/role reusability embedded within the automation framework. Customers can make use of this function to efficiently perform tasks by using tags associated with detailed actions, in the Ansible playbooks. This aspect of the automation system enhances effectiveness. Also sets a framework for maintaining consistency and compliance with regulations, across all deployments.

5. Conclusion

The use of Ansible based automation tools in managing data centers is a step making operations more efficient reducing errors and simplifying deployment processes. Research results confirm that these tools cover infrastructure and application layers comprehensively providing a flexible and scalable automation solution that enhances efficiency. The advantages go beyond saving time creating an IT foundation that can adjust to changing business requirements with disruptions. This study offers insights into using automation for infrastructure deployment, serving as a guide for organizations seeking to leverage automation, for their IT infrastructure needs.

6. Acknowledgements

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