Cloud Native Intent Automation

Graduate

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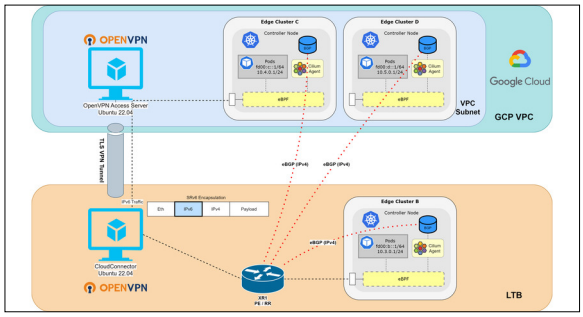
Introduction: Infrastructure providers, such as mobile providers, heavily rely on Kubernetes to orchestrate containerized applications.
More modern and flexible cloud approaches have increased and outpaced the development of flexible infrastructure.
Nowadays, additional clusters are often being deployed manually, which is error-prone and leads to non-standardized infrastructure.
As running workloads on single clusters is manageable, having hundreds of clusters, each running different applications, depicts new challenges.
Deploying and running remote clusters brings up the need for high-performing, flexible, and private networking.
We evaluated Nephio as intent-based automation framework for service orchestration utilizing the concept of Single-Source-of-Truth using GitOps.
Networks between the source and destination must be as flexible as the clusters to automatically ensure private and secure network routing.
This thesis aims to prove possible automation of these challenges with technologies like SRv6 packet-routing, Cilium CNI for Kubernetes, and Nephio service orchestration platform.

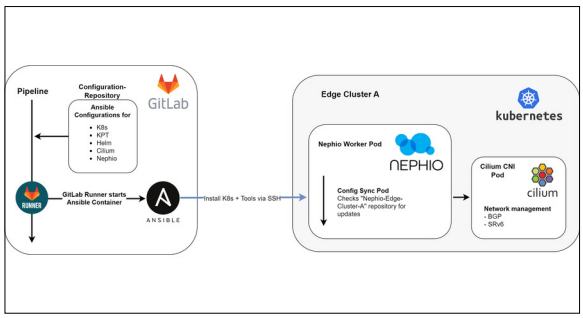
Approach / Technology: In the first stage, the Kubernetes environments were deployed using a customized Ansible playbook based on Kubespray.
The following deployment installed Cilium as CNI on the deployed Kubernetes control-plane node.
Eventually, the third deployment integrated the Kubernetes environment into the central Nephio management cluster.
Nephio allowed us to deploy not only applications but network configurations as well.
A substantial effort was put into network device configuration deployment to ensure networking between Kubernetes containers.
An additional optional use case was achieved by scaling Kubernetes clusters to the public cloud, which were connected to our on-premise environment.

Result: The Kubernetes deployment was executed successfully, enabling low-effort cluster deployments.
Cilium networking was deployed, allowing new networking technologies, like source-determined routing called SRv6.
Nephio, which is still in a pre-launch condition, implements straightforward and effective workload deployments for multi-cluster environments.
As cloud-native infrastructure covers a wide range of topics, we were able to demonstrate the capabilities of further deployments like network devices or public cloud enrollment.
Our thesis, conducted as a proof-of-concept, demonstrates that many manually configured infrastructures may be automatically deployed.

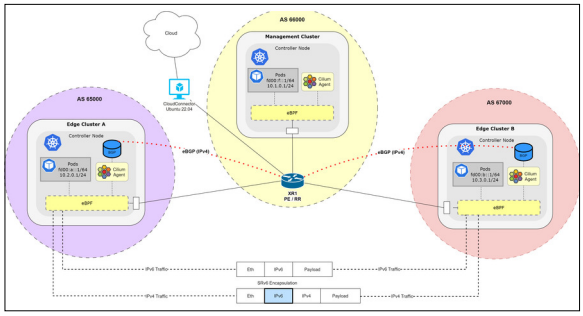
Extension to Public Cloud
Own presentment



Deployment Workflow
Own presentment



Network Overview with SRv6
Own presentment



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Subject Area
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