

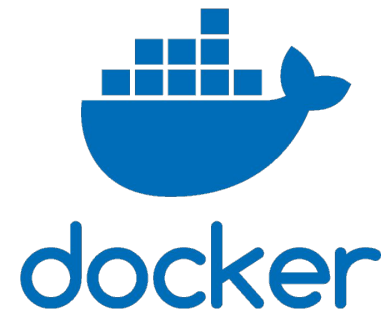
Dynamic Adaptive Scaling Strategy for NFV Routers on Kubernetes

Research Report

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Implementation

- Environment → local, Docker, Kubernetes
- Implementation → router, proxy
- Monitoring → Prometheus
- Visualization → Grafana



Execution - My Router vs. Proxy

Why ?

deployment.apps/proxy	1/1	1	1	6h2m
deployment.apps/router	1/1	1	1	94m
deployment.apps/server	1/1	1	1	94m

service/proxy	LoadBalancer	10.111.199.68	<pending>	8080:32400/TCP	5h58m
service/router	NodePort	10.102.141.66	<none>	8201:31655/TCP	89m
service/server	ClusterIP	10.96.0.20	<none>	8001/TCP	89m

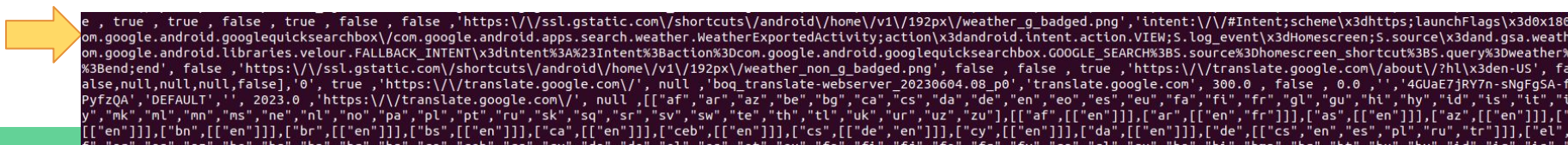
My Stateful Router vs. My Stateless Proxy



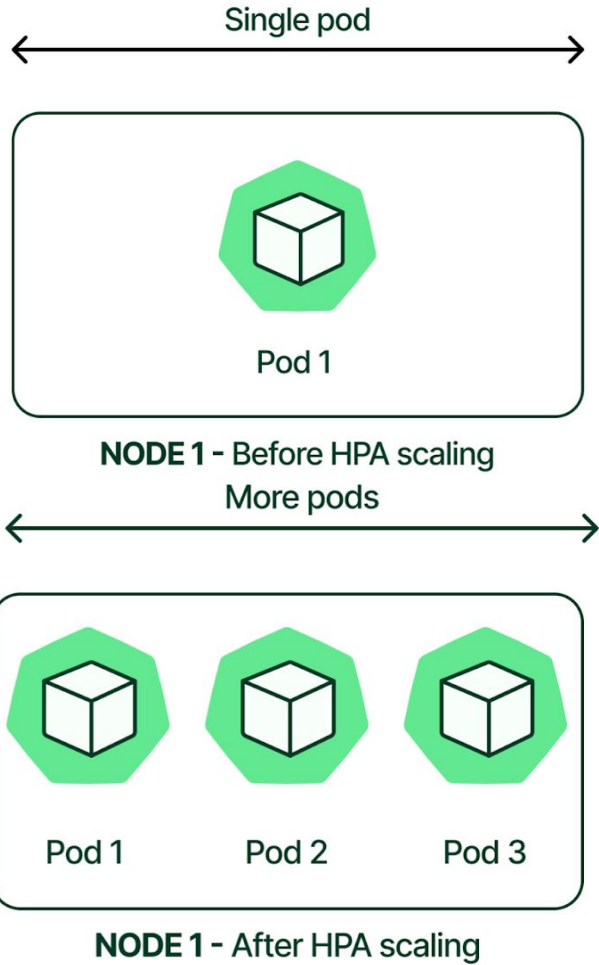
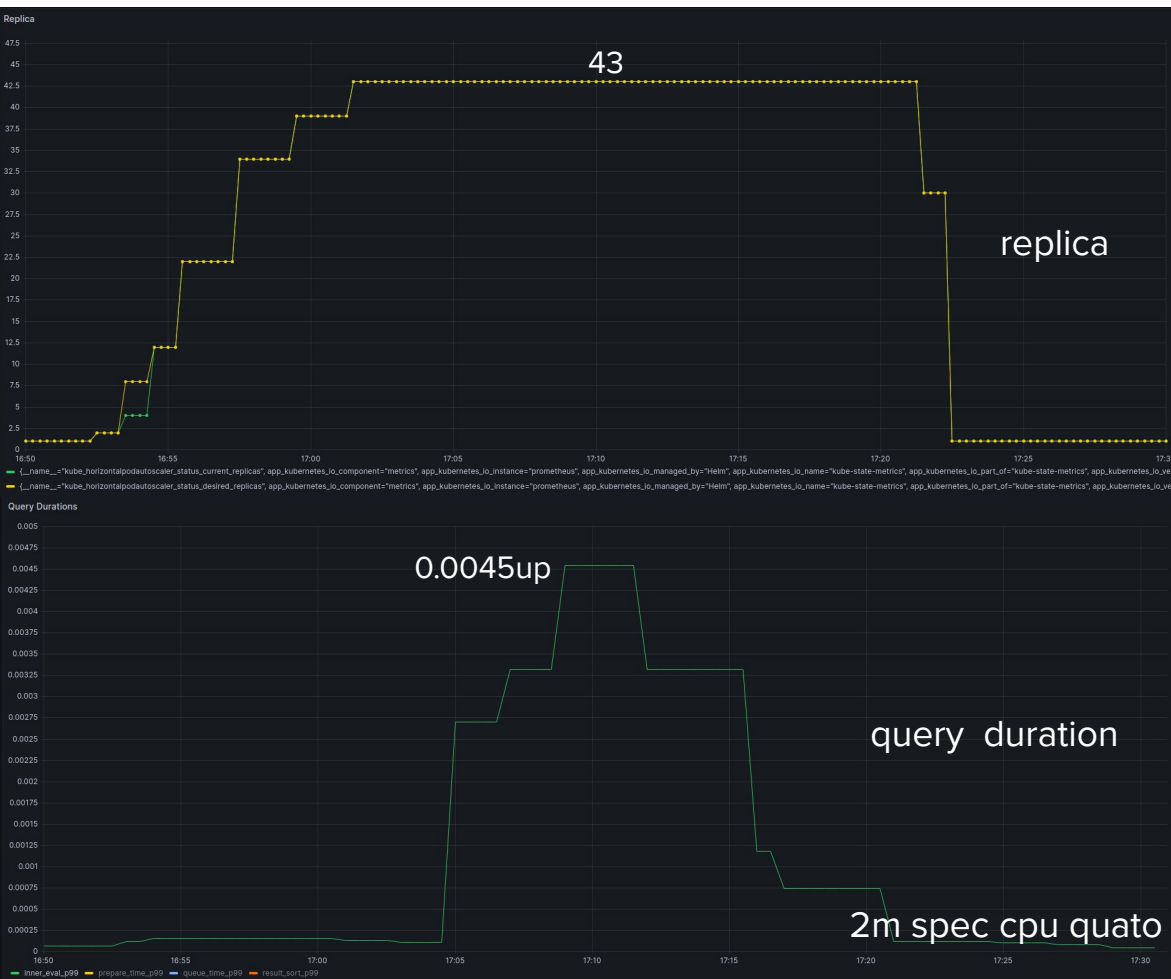
NAME	REFERENCE	TARGETS	MINPODS	MAXPODS	REPLICAS	AGE
horizontalpodautoscaler.autoscaling/proxy	Deployment/proxy	0%/50%	1	100	1	79m

NAME	MODE	CPU	MEM	PROVIDED	AGE
verticalpodautoscaler.autoscaling.k8s.io/proxy-vpa	Auto	25m		True	6h1m

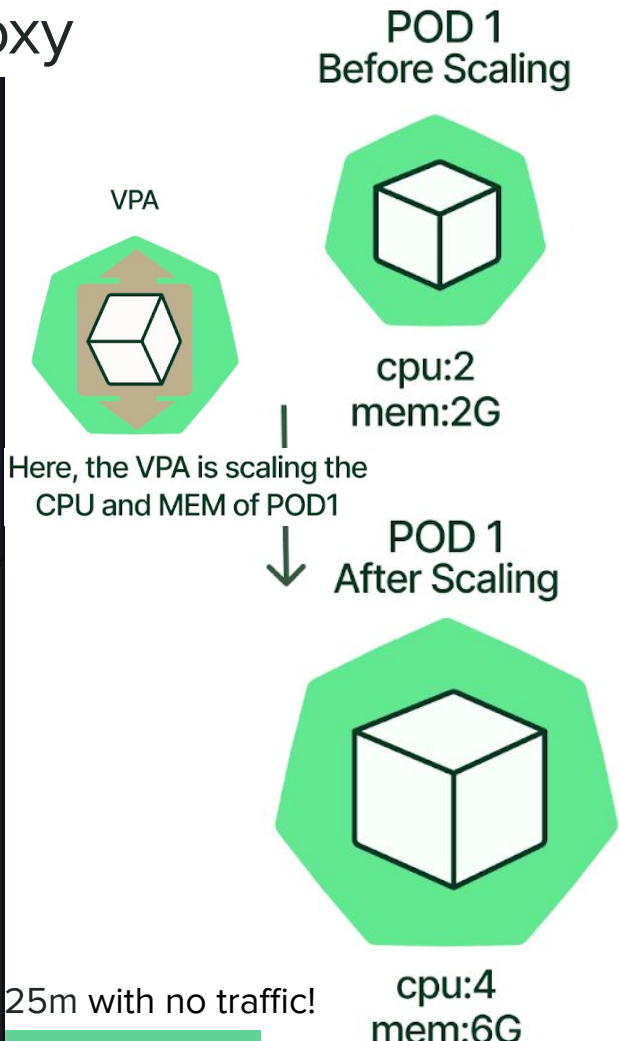
10^21 “curl -v -x socks4://192.168.49.2:32400/ https://translate.google.com/” concurrently executing.



Result - Horizontal Pod Autoscaling on Proxy



Result - Vertical Pod Autoscaling on Proxy



Conclusion: HPA vs. VPA

Aspect	HPA	VPA
Based on	CPU/memory usage across pods	CPU/memory usage per pod
Direction	Number of pod replicas	CPU/memory per pod
Use	Stateless applications	Applications needing more resources
On K8s	Achieving the constraint standards at minimum cost	Targeting more on improving reliability than on cost-saving
Limitations	Needs correct resource specification	Pod restart required
Complexity	Higher	Lower
Cost efficiency	Potential underutilization	Scales to individual pod needs (but in k8s arch.maybe not!)

Reference

1. Horizontal Pod Autoscaling
<https://kubernetes.io/docs/tasks/run-application/horizontal-pod-autoscale/>
2. Vertical Pod Autoscaler (VPA) not updating
<https://discuss.kubernetes.io/t/vertical-pod-autoscaler-vpa-not-updating-request-limits/18603>
3. Minikube
<https://kubernetes.io/docs/tutorials/hello-minikube/>
4. Install and Set Up kubectl on Linux
<https://kubernetes.io/docs/tasks/tools/install-kubectl-linux/>
5. Prometheus and Grafana setup in Minikube
<https://brain2life.hashnode.dev/prometheus-and-grafana-setup-in-minikube>