

Network Management as a Service (NMaaS)

NMaaS Infrastructure requirements

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Agenda

General NMaaS Requirements

- Overview
- Hardware perspective
- Software perspective
- Integration with third-party systems

The NMaaS Production Instance

- Design choices
- Implementational details

NMaaS Requirements Overview

- Requires a working Kubernetes cluster
- Infrastructure agnostic
 - Bare-metal deployment
 - Virtual machines deployment
 - Cloud deployment
- Integration with other third-party infrastructure components through existing Kubernetes interfaces
 - Leveraging the power of the open-source community

NMaaS Hardware Requirements (1)

- Kubernetes cluster requirements
 - Depends on the number of users & type of deployed applications
- Testing deployment
 - No high-availability, not for production use
 - 3 virtual machines; 1 master node, 2 worker nodes
 - Master node: 4GB RAM
 - Worker nodes: 8GB RAM

NMaaS Hardware Requirements (2)

- Production deployment
 - At least 3 master nodes; easy vertical scaling
 - Additional worker nodes as needed; horizontal & vertical scaling possible at any moment
- Rule of thumb: better to have more mediocre nodes than a few very powerful ones
- External storage system offering block and/or shared volumes

NMaaS Software Requirements (1)

- NMaaS is a Kubernetes centric software
- Requires a working Kubernetes cluster
 - No preference in terms of deployment or management
 - Supported Kubernetes versions: 1.15+
- Integration with an existing storage system
 - NMaaS does not interact directly with the storage system – a Kubernetes plugin is used as an intermediary
 - NFS (shared volumes)
 - Ceph (block and shared volumes)
 - Any other with a compatible Container Storage Interface (CSI) driver

NMaaS Software Requirements (2)

- Network overlay plugin
 - Essential for intra-cluster communication between containers
 - Various options depending on required feature set and existing network topology
 - Calico
 - Flannel
 - Weave
- Load balancer support
 - Can either be made available by the platform where the cluster is hosted or installed in-cluster

NMaaS Software Requirements (3)

- PostgreSQL for NMaaS specific data
- GitLab for configuring deployed applications
 - GitOps principle
- Email server for notifications and alerts
- Can be either external or installed within the Kubernetes cluster

NMaaS Production Instance (1)

- 7 bare metal servers used as virtualization platforms
 - Total 168 CPU cores, 544GB RAM
- 3 Kubernetes masters, 14 workers
 - Adding new worker nodes as number of customers grows
 - Using the open-source Ansible project Kubespray for lifecycle management
- Ceph storage cluster for persisting application data
 - 3 monitors; 12 OSDs
 - CephFS – shared volumes
 - CephRBD – block storage
 - On-demand volume extension

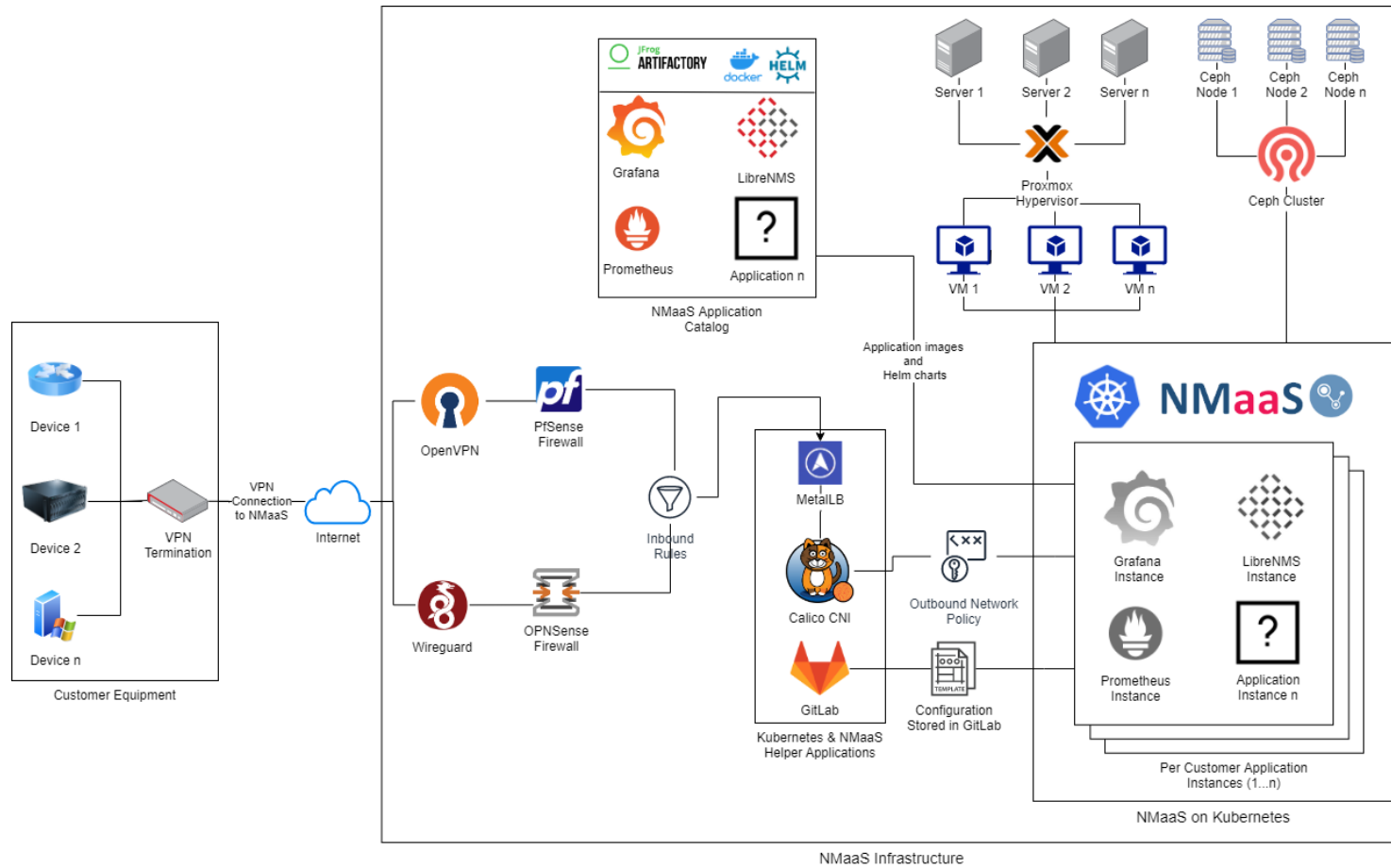
NMaaS Production Instance (2)

- Calico with two additional route reflectors used as a networking plugin
 - Offers granular definition of security rules, ensuring customer isolation
- MetalLB as a load balancer plugin
 - Helps assign a unique IP address reachable from the outside world to any application that needs it
 - Each customer has their own dedicated range of IP addresses to which inbound access is controlled by the perimeter firewalls and outbound access is controlled by the networking plugin
- PostgreSQL and GitLab run in-cluster
- PfSense and OPNSense used as firewalls and VPN servers

NMaaS Requirements - Conclusion

- Only fixed requirements are PostgreSQL and GitLab
- Agnostic to other systems being used – communication through standardized Kubernetes interfaces
- Elasticity through addition or removal of worker nodes at any time
- High-availability makes upgrades easy

NMaaS Production Instance Architecture Diagram



Thank you

Any questions?

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References

- Kubespray - <https://github.com/kubernetes-sigs/kubespray>
- MetalLB - <https://metallb.universe.tf/>
- Calico - <https://www.projectcalico.org/>
- Ceph - <https://ceph.io/>
- Kubernetes CSI - <https://kubernetes.io/blog/2019/01/15/container-storage-interface-ga/>
- Kubernetes Storage Drivers - <https://kubernetes-csi.github.io/docs/drivers.html>