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