200 clusters vs 1 admin

Building multi CEPH cluster environment
Bartosz Rabiega
DevOps @ OVH

Ceph as a Service team (CAAS)

Working for OVH since 2016, previously:
- IT QA Specialist
- System Analyst
- Software Developer
A few words about OVH

- 26 DCs
- 13 Tbps network
- Anti-DDOS
- Water cooling
- 1M dedicated server capacity
Using Ceph @ OVH
Ceph in numbers @ OVH

- 2,000+ dedicated servers
- 25,000+ HDD disks
- 2,000+ NVMe cards

50 PB of Ceph storage capacity
- 210 CEPH clusters (3 - 800 OSD)
- 20,000+ OSDs, 650 MONs
Typical Ceph setup @ OVH
- design goals

1. No SPoF
2. Maximize performance 😊
3. Minimize costs 😊
4. Good control over HW resources
5. Easy grow/shrink/upgrade
Typical Ceph setup @ OVH
- DC topology

Network

ToR Switch 1
  Rack 1
    Host 1
      ceph

ToR Switch 2
  Rack 2
    Host 2
      ceph

ToR Switch 3
  Rack 3
    Host 3
      ceph
Typical Ceph setup @ OVH - design goals

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Starting in 2015 with Ceph Firefly
Typical Ceph setup @ OVH
- block devices
Typical Ceph setup @ OVH - design goals

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Starting in 2015 with Ceph Firefly
Typical Ceph setup @ OVH

- network

OSD 1

Macvlan Interfaces

- Public Interface
- Replica Interface

OSD 2

- Public Interface
- Replica Interface

40 Gbps NIC

Public Network VLAN X

Private Network VLAN Y
Typical Ceph setup @ OVH
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Starting in 2015 with Ceph Firefly
Ceph inside containers?
Typical Ceph setup @ OVH - whole story

Docker/LXD container

OSD

JOURNAL
block device

DATA
block device

Flashcache

NVMe

Partition
Partition
Partition
Partition
Partition
Partition

HDD
HDD
HDD

40 Gbps NIC

2x Macvlan interfaces for Replication and Client Access
Typical Ceph setup @ OVH - whole story

- Host
- HW Resources
  - Storage
  - Network
  - CPU
  - RAM

- Container Engine
  - 0.94.9 - cluster 1
  - 10.2.10 - cluster 1
  - 13.2.2 - cluster 2
  - 13.2.2 - cluster 2
  - 10.2.6 - cluster 3
  - 10.2.6 - cluster 3
  - 10.2.6 - cluster 3

- 40 Gbps link

- 40 Gbps link
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Starting in 2015 with Ceph Firefly
Typical Ceph cluster environment
Typical Ceph cluster environment @ OVH

Region 1 / DC 1

Region 2 / DC 2

Region 3 / DC 3
Multiple Ceph clusters - Advantages

- Greatly reduced failure domain
- Different workloads for different clients - fine tuning
- Issues are easier to track
Multiple Ceph clusters - Drawbacks

For example: 3 users + 3 pools + 4 config opts + 20 ACLs = 30 objects to manage (for a single Ceph cluster)

30 objects * 200 clusters = 6000 objects to manage!
Multiple Ceph clusters - How to manage them?
Multiple Ceph clusters - How to manage them?

Remote Control Plane
Automation to the rescue!
Ceph as a Service - Control Plane

One Control Plane to rule them all...
Control Plane – What should it manage?

Ceph Configuration
- Ceph ACLs (firewall)
- Ceph Config Options
- Ceph Users
- Ceph Pools

Ceph Clusters
- Ceph OSD (Containers)
- Ceph MON (Containers)

Maintenance
- Automatic Maintenance Operations
Control Plane - What does it do?

Control Plane

- Ceph Configuration
- Maintenance Operations
- Ceph Clusters

Ceph Clusters

Region 1
- ceph
- ceph
- ceph

Region 2
- ceph
- ceph
- ceph

Region 3
- ceph
- ceph
- ceph

Region 4
- ceph
- ceph
- ceph
Control Plane - How is it built?

Source Of Truth (HA DB)
- Ceph Configuration
  - ACLs, Conf
  - Users, Pools
- Ceph Clusters
  - OSDs, MONs
  - Racks, Hosts

Operator
Management API

Provisioner
Host
Host
Host

ACLs, Conf
Users, Pools
OSDs, MONs
Racks, Hosts
Control Plane - Ceph management

Operator

Command Line Interface (CLI)

Ceph Configuration Management API (CRUD)

Provisioning API

Source Of Truth (HA DB)

Provisioner

puppet

OVH
Control Plane - What does it do?

Control Plane
- Ceph Configuration
- Maintenance Operations
- Ceph Clusters

Operator
Control Plane - Cluster management

Operator

Command Line Interface (CLI)

Provisioning API

Provisioner

Ceph Clusters Management API (CRUD)

Source Of Truth (HA DB)

Host

Host

Host
Control Plane - What does it do?

- Ceph Configuration
- Maintenance Operations
- Ceph Clusters
Control Plane - What does it do?

- Control Plane
  - Ceph Configuration
  - Maintenance Operations
  - Ceph Clusters

Operator

User/Owner
Control Plane - Maintenance Operations
Example - Grow PG from 64 to 256

Operator

Check if cluster is OK

Increase PG to 256

Wait for Ceph HEALTH_OK

Increase PGP by 32

Wait for Ceph HEALTH_OK

Is PGP 256?

No

Wait for Ceph HEALTH_OK

Yes

Finished
Control Plane - Maintenance Operations Example - Grow PG from 64 to 256

Start

Wait for Health OK

Set PG 256

Set PGP 96

Set PGP 128

Set PGP 256

Stop
Control Plane - Maintenance Operations
Example - Upgrade 9 OSD cluster

Start

Wait for Health OK

Rack 1

Rack 2

Rack 3

Upgrade OSD

Stop
Control Plane - Maintenance Operations
Generic Workflow

Parallel Processing

Sequential processing

Complex Processing
Control Plane - Maintenance Operations
Workflow Processing Projects

Airflow

Celery

Luigi
Control Plane - Maintenance Operations

Operator

Command Line Interface (CLI)

Maintenance Ops API

Workflow Processing (Python + Celery)

Source Of Truth (HA DB)

Host

Host

MySQL

ceph ceph ceph

ceph ceph ceph

ceph
Control Plane - What does it do?

Operator

User/Owner

Control Plane

- Ceph Configuration
- Maintenance Operations
- Ceph Clusters

- ✔
- ✔*
- ✔*

Ceph Clusters

Ceph Configuration
What’s next?
Monitoring Ceph

Ceph health
Blocked Requests
FS apply latency
PG states

Monitoring

Host
Host
Host

CPU temp
Disk I/O errors
CPU load
SSD/Nvme wear-out

...
The Holy Grail - Self Healing

Control Plane
- Maintenance Operations

Monitoring
- iCINGA

Hosts
- ceph
- ceph
Self Healing - Example
Remove disk with I/O errors

1. Detect issue
2. Notify about the issue
3. Schedule OSD deletion and disk removal
4. Set downtimes
5. Slowly re-weight OSD to 0, then delete
6. Delete container, ask DC to replace the disk