SCALITY METALK8S

AN OPINIONATED KUBERNETES DISTRIBUTION WITH A FOCUS ON LONG-TERM ON-PREM DEPLOYMENTS

Nicolas Trangez - Technical Architect
nicolas.trangez@scality.com
@eikke | @Scality | @Zenko

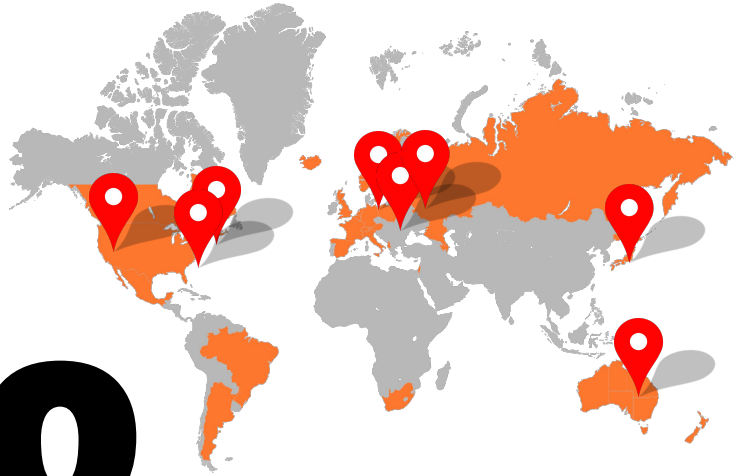
SCALITY

ABOUT SCALITY

ONE PURPOSE

GIVING FREEDOM & CONTROL TO PEOPLE WHO CREATE VALUE WITH DATA

GLOBAL PRESENCE



8 OFFICES

200+ PEOPLE

20+ NATIONALITIES

GLOBAL CLIENT BASE

EUROPE

120+

Ministère de la Défense – Liberté · Égalité · Fraternité – République Française

orange

Metropolitan Police

Mairie de Paris

RTL

SFR

EUROSPORT

COM HEM

dailymotion

NATIXIS

Molotov.tv

TF1

Hospices Civils de Lyon

RENAULT

SNCF

AB

SOCIETE GENERALE

deluxe

EDF

AIRBUS

AMERICAS

60+

Penn Medicine

Bank of America

Bloomberg Media

COMCAST

STAPLES

logitech

HBO

rackspace

AUSTRALIA

~10

EndemolShine Group

MediaHub

foxtel

JAPAN

20+

KDDI

BIGLOBE

DMM.com

@nifty

SCALITY

OUR JOURNEY TO KUBERNETES

Scality RING, S3 Connector & Zenko

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Scality RING

On-premise
Distributed Object & File Storage

- Physical servers, some VMs
- Only the OS available (incl. ‘Legacy’ like CentOS 6)
- Static resource pools
- Static server roles / configurations
- Solution distributed as RPM packages, deployed using SaltStack
- De-facto taking ownership of host, difficult to run multiple instances
- Fairly static post-install

Scality S3 Connector

On-premise S3-compatible Object Storage

- Physical servers, sometimes VMs
- Static resource pools
- “Microservices” architecture
- Solution distributed as Docker container images, deployed using Ansible playbooks
- No runtime orchestration
- Log management, monitoring,... comes with solution

Scality Zenko

Multi-Cloud Data Controller

- Deployed on-prem or ‘in the Cloud’: major paradigm shift
- New challenges, new opportunities
- Multi-Cloud Data Controller, must run on multiple Cloud platforms

Scality Zenko

Deployment Model

- Embraced Docker as distribution mechanism
  - Some shared with Scality S3 Connector
- For Cloud deployments, started with Docker Swarm
  - Ran into scaling, reliability and other technical issues
- Decided to move to Kubernetes
  - Managed platforms for Cloud deployments, where available (GKE, AKS, EKS one day)
  - On-prem clusters

Scality Zenko

Kubernetes Benefits

- Homogenous deployment between in-cloud and on-prem
- Various services provided by cluster:
  - Networking & policies
  - Service restart, rolling upgrades
  - Service log capturing & storage
  - Service monitoring & metering
  - Load-balancing
  - TLS termination
- Flexible resource management
  - If needed, easily add resources to cluster by adding some (VM) nodes
  - HorizontalPodAutoscaler

OUR JOURNEY TO KUBERNETES

MetalK8s

SCALITY

On-prem Kubernetes

- Can’t expect a Kubernetes cluster to be available, provided by Scality customer
- Looked into various existing offerings, but in the ends needs to be supported by/through Scality (single offering)
    - Most existing solutions don’t cover enterprise datacenter requirements
- Decided to roll our own

SCALITY METALK8S

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OPINIONATED

We offer an out-of-the-box experience, no non-trivial choices to be made by users

LONG-TERM

Zenko solution is mission-critical, can’t spawn a new cluster to upgrade and use ELB (or similar) in front

ON-PREM

Can’t expect anything to be available but (physical) servers with a base OS

Scality MetalK8s

- Scope: 3-20 physical machine, pre-provisioned by customer or partner
- Built on top of the Kubespray Ansible playbook
- Use Kubespray to lay out a base Kubernetes cluster
  - Also: etcd, CNI
- Add static & dynamic inventory validation pre-checks, OS tuning, OS security
  - Based on experience from large-scale Scality RING deployments
- Augment with various services, deployed using Helm
  - Operations
  - Ingress
  - Cluster services
- Take care of on-prem specific storage architecture

Scality MetalK8s: Cluster Services

- “Stand on the shoulders of giants”
- Heapster for dashboard graphs, `kubectl top`,...
- metrics-server for HorizontalPodAutoscaler
  - Looking into k8s-prometheus-adapter
- Ingress & TLS termination: nginx-ingress-controller
- Cluster monitoring & alerting: Prometheus, prometheus-operator, Alertmanager, kube-prometheus, Grafana
  - Host-based node_exporter on all servers comprising the cluster, including etcd
- Host & container logs: ElasticSearch, Curator, fluentd, fluent-bit, Kibana
- All of the above gives a great out-of-the-box experience for operators

Cluster
Namespaces
Nodes
Persistent Volumes
Roles
Storage Classes

Namespace
zenko

Overview

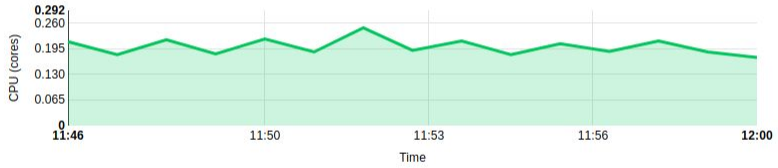
Workloads
Cron Jobs
Daemon Sets
Deployments
Jobs
Pods
Replica Sets
Replication Controllers
Stateful Sets

Discovery and Load Balancing
Ingresses
Services

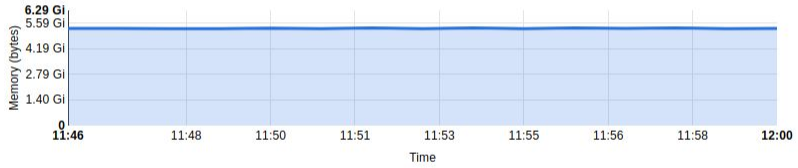
Config and Storage
Config Maps
Persistent Volume Claims
Secrets

Settings

CPU usage



Memory usage



Workloads

Workloads Statuses

Deployments

Name	Labels	Pods	Age	Images
zenko1-backbeat-consumer	app: backbeat-consumer chart: backbeat-consumer-0.1.0 heritage: Tiller release: zenko1	1 / 1	2 days	zenko/backbeat:0.1.4
zenko1-backbeat-producer	app: backbeat-producer chart: backbeat-producer-0.1.0 heritage: Tiller release: zenko1	1 / 1	2 days	zenko/backbeat:0.1.4
zenko1-cloudserver-front	app: cloudserver-front chart: cloudserver-front-0.1.3 heritage: Tiller release: zenko1	1 / 1	2 days	zenko/cloudserver:0.1.6

Discover
Visualize
Dashboard
Timelion
Dev Tools
Management

logstash-*

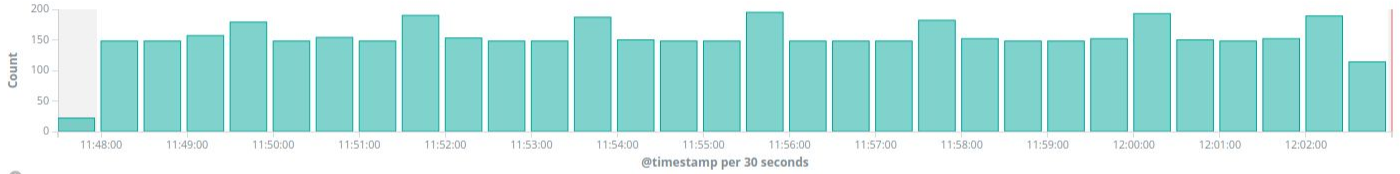
Selected Fields
- t kubernetes.host
- t kubernetes.labels.app
- t log

Available Fields

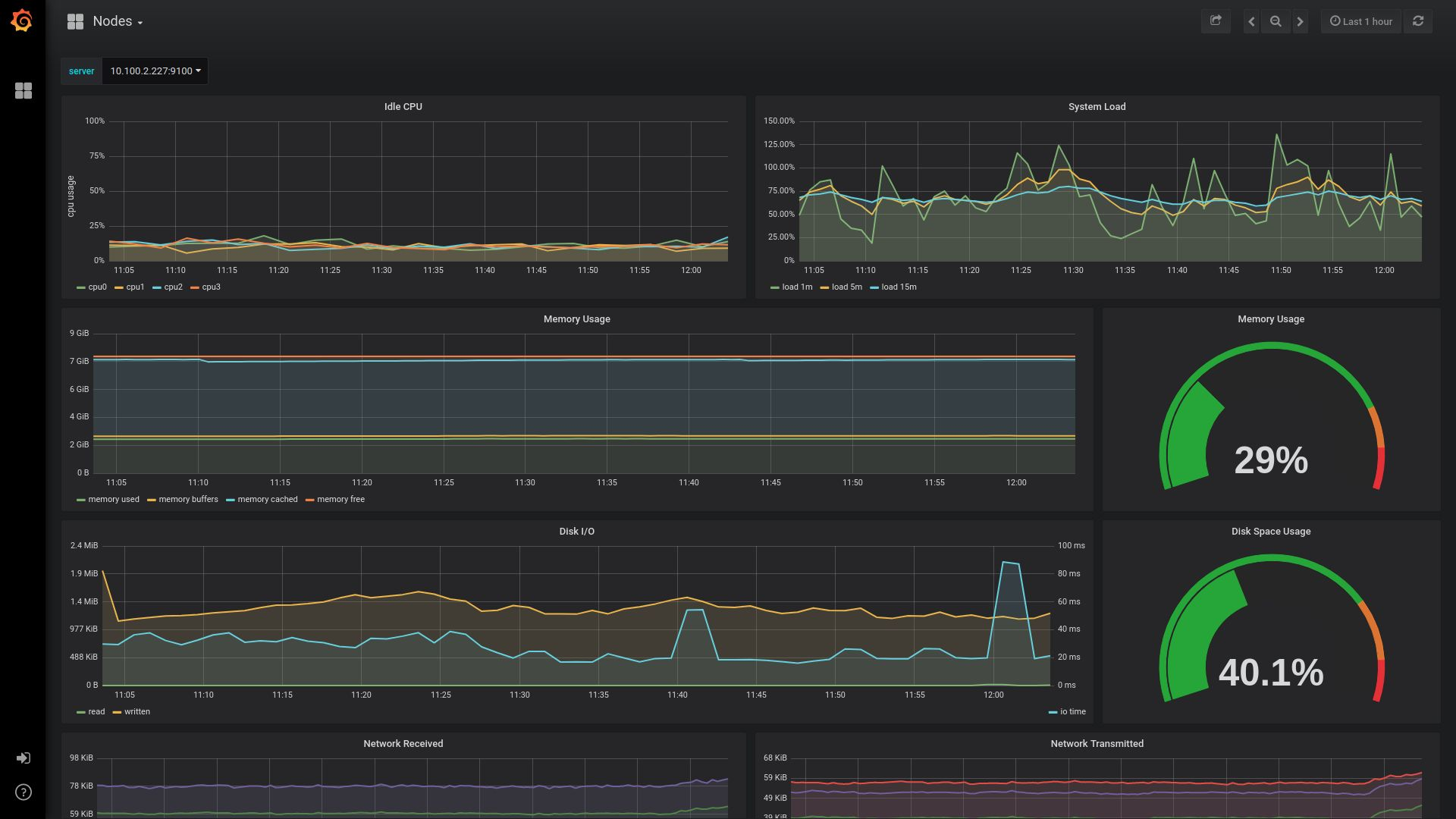
Popular
- t kubernetes.container_name
- @timestamp
- t _id
- t _index
- # _score
- t _type
- ? address
- ? clientIP
- ? clientPort
- ? configurationVersion
- t docker.container_id
- ? error.address
- ? error.code
- ? error.errno
- ? error.port
- ? error.syscall
- ? hostname
- ? httpMethod
- ? httpURL
- ? https
- t kubernetes.labels.chart
- t kubernetes.labels.controller-revisio...

Collapse

March 26th 2018, 11:47:57.351 - March 26th 2018, 12:02:57.351 — Auto



Time	kubernetes.labels.app	kubernetes.host	log
March 26th 2018, 12:02:53.930	mongodb-replicaset	metalk8s5-03	2018-03-26T19:02:53.930+0000 I - [conn22297] end connection 127.0.0.1:58200 (15 connections now open)
March 26th 2018, 12:02:53.928	mongodb-replicaset	metalk8s5-03	2018-03-26T19:02:53.928+0000 I NETWORK [thread1] connection accepted from 127.0.0.1:58200 #22297 (15 connections now open)
March 26th 2018, 12:02:53.928	mongodb-replicaset	metalk8s5-03	2018-03-26T19:02:53.928+0000 I NETWORK [conn22297] received client metadata from 127.0.0.1:58200 conn22297: { application: { name: "MongoDB Shell" }, driver: { name: "MongoDB Internal Client", version: "3.4.14" }, os: { type: "Linux", name: "PRETTY_NAME="Debian GNU/Linux 8 (jessie)"", architecture: "x86_64", version: "Kernel 4.4.0-116-generic" } }
March 26th 2018, 12:02:53.280	mongodb-replicaset	metalk8s5-04	2018-03-26T19:02:53.280+0000 I - [conn20573] end connection 127.0.0.1:41600 (13 connections now open)
March 26th 2018, 12:02:53.278	mongodb-replicaset	metalk8s5-04	2018-03-26T19:02:53.277+0000 I NETWORK [conn20573] received client metadata from 127.0.0.1:41600 conn20573: { application: { name: "MongoDB Shell" }, driver: { name: "MongoDB Internal Client", version: "3.4.14" }, os: { type: "Linux", name: "PRETTY_NAME="Debian GNU/Linux 8 (jessie)"", architecture: "x86_64", version: "Kernel 4.4.0-116-generic" } }
March 26th 2018, 12:02:53.277	mongodb-replicaset	metalk8s5-04	2018-03-26T19:02:53.277+0000 I NETWORK [thread1] connection accepted from 127.0.0.1:41600 #20573 (13 connections now open)
March 26th 2018, 12:02:50.643	mongodb-replicaset	metalk8s5-04	2018-03-26T19:02:50.643+0000 I - [conn20572] end connection 127.0.0.1:41594 (13 connections now open)
March 26th 2018, 12:02:50.638	mongodb-replicaset	metalk8s5-04	2018-03-26T19:02:50.638+0000 I NETWORK [conn20572] received client metadata from 127.0.0.1:41594 conn20572: { application: { name: "MongoDB Shell" }, driver: { name: "MongoDB Internal Client", version: "3.4.14" }, os: { type: "Linux", name: "PRETTY_NAME="Debian GNU/Linux 8 (jessie)"", architecture: "x86_64", version: "Kernel 4.4.0-116-generic" } }
March 26th 2018, 12:02:50.638	mongodb-replicaset	metalk8s5-04	2018-03-26T19:02:50.638+0000 I NETWORK [thread1] connection accepted from 127.0.0.1:41594 #20572 (13 connections now open)
March 26th 2018, 12:02:50.521	mongodb-replicaset	metalk8s5-01	2018-03-26T19:02:50.521+0000 I - [conn21254] end connection 127.0.0.1:45634 (9 connections now open)
March 26th 2018, 12:02:50.518	mongodb-replicaset	metalk8s5-01	2018-03-26T19:02:50.517+0000 I NETWORK [conn21254] received client metadata from 127.0.0.1:45634 conn21254: { application: { name: "MongoDB Shell" }, driver: { name: "MongoDB Internal Client", version: "3.4.14" }, os: { type: "Linux", name: "PRETTY_NAME="Debian GNU/Linux 8 (jessie)"", architecture: "x86_64", version: "Kernel 4.4.0-116-generic" } }


Nodes
Last 1 hour
server
10.100.2.227:9100
Idle CPU
cpu usage
100%
75%
50%
25%
0%
11:05
11:10
11:15
11:20
11:25
11:30
11:35
11:40
11:45
11:50
11:55
12:00
cpu0
cpu1
cpu2
cpu3
System Load
150.00%
125.00%
100.00%
75.00%
50.00%
25.00%
0%
load 1m
load 5m
load 15m
Memory Usage
9 GiB
7 GiB
6 GiB
4 GiB
2 GiB
0 B
memory used
memory buffers
memory cached
memory free
Memory Usage
29%
Disk I/O
2.4 MiB
1.9 MiB
1.4 MiB
977 KiB
488 KiB
0 B
100 ms
80 ms
60 ms
40 ms
20 ms
0 ms
read
written
io time
Disk Space Usage
40.1%
Network Received
98 KiB
78 KiB
59 KiB
Network Transmitted
68 KiB
59 KiB
49 KiB

Scality MetalK8s: Storage

- On-prem: no EBS, no GCP Persistent Disks, no Azure Storage Disk,...
- Also: can’t rely on NAS (e.g. through OpenStack Cinder) to be available
- Lowest common denominator: local disks in a node
- PVs bound to a node, hence PVCs bound, hence Pods bound
  - Thanks PersistentLocalVolumes & VolumeScheduling!
- Decided not to use LocalVolumeProvisioner, but static approach (for now)
  - Based on LVM2 Logical Volumes for flexibility
  - PV, VG, LVs defined in inventory, created/formatted/mounted by playbook
  - K8s PV objects created by playbook
  - May support whole partitions/drives depending on application need
- Dynamic local volume provisioning (using LVM) is getting there…
  - Future: volume encryption?

Scality MetalK8s: Deployment

- Based on years of years of experience deploying Scality RING at enterprise customers, service providers,...
- Constraints in datacentra often very different from ‘VMs on EC2’
  - No direct internet access: everything through HTTP(S) proxy, no non-HTTP traffic
  - Dynamic server IP assignment
  - Security rules requiring services to bind to specific IPs only, different subnets for control & workload,...
  - Fully air gapped systems: requires 100% offline installation
  - Non-standard OS/kernel
  - Integration with corporate authn/authz systems
- Not all of the above supported yet, tackling one by one
  - Relevant patches to be upstreamed to Kubespray
- Only support RHEL/CentOS family of Linux distributions
  - Support for Ubuntu and others can be community-driven, Kubespray supports them
  - RHEL/CentOS sometimes difficult targets for containers/Docker/Kubernetes

Scality MetalK8s: Ease of Deployment

```
$ # Requirements: a Linux or OSX machine with Python and coreutils-like

$ # Create inventory

$ vim inventory/...

$ make shell # Launches a ‘virtualenv’ with Ansible & deps, ‘kubectl’, ‘helm’

$ # Demo @ https://asciinema.org/a/9kNIpBWg4KiwjT5mNSrH0tmj9

$ ansible-playbook -i inventory -b playbooks/deploy.yml

$ # Grab a coffee, and done
```

SCALITY

Scality MetalK8s: Non-technical goodies

- Documentation
  - Various guides: Installation, Operations, Reference
  - https://metal-k8s.readthedocs.io
- Extensive testing
  - Installation
  - Upgrade
  - Services
  - Failure testing

Scality MetalK8s: Shifting focus

- Today: general-purpose deployment tool, fulfil K8s cluster pre-req of $product

- Future: use-case specific component a vendor (you!) can embed in on-prem solution/product running on K8s without being a K8s product
  - More configurable to match solution requirements
  - Tighten out-of-the-box security

Scality MetalK8s: The road forward

- Increase documentation coverage
- Considering removing Kubespray
  - Too ‘big’ for our purposes
  - kubeadm brought kubelet bootstrapping and other goodies
  - Non-trivial to implement certain requirements/features
- Considering removing Docker
  - Plain CRI with containerd or cri-o
- Looking into cluster federation (multi-site solutions), built-in over-the-wire encryption (Wireguard?), ‘active’ cluster controller (refresh short-TTL TLS certs, provision new nodes,...), netboot (like CoreOS/Matchbox/Tectonic, but plain CentOS/RHEL), other CNIs, integration of failover (VIP) and load-balancing service,...

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https://zenko.io

https://github.com/scality/metalk8s

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