# OSM Hackfest – Session 6
# Performance & Fault Management

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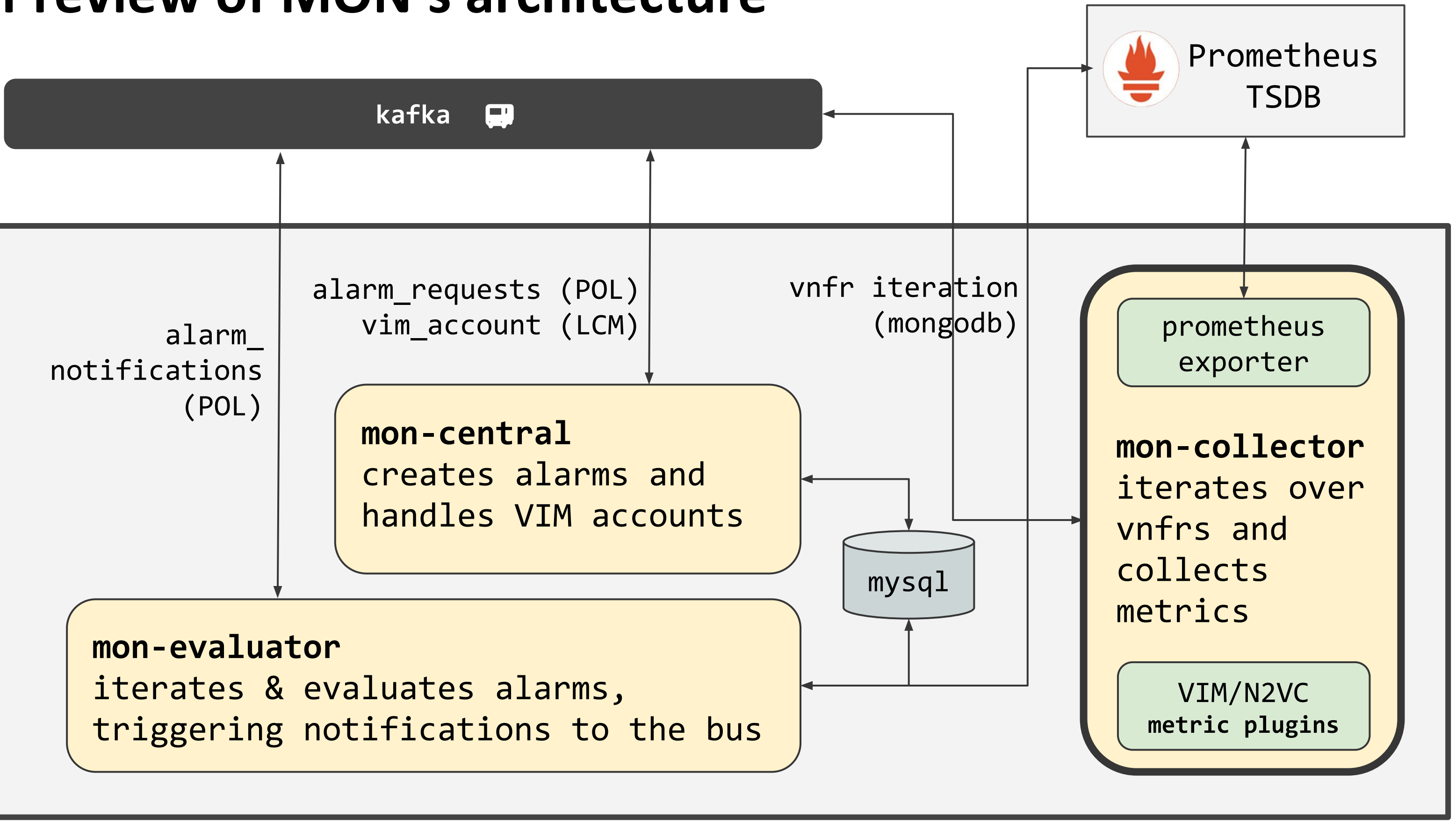
## Introduction

Performance and Fault Management capabilities have made important progress in Release FIVE.

Metrics collection is now automatic, based on descriptor definitions, and supported from both infrastructure and VNFs (through VCA)

# MON Architecture

## Brief review of MON's architecture

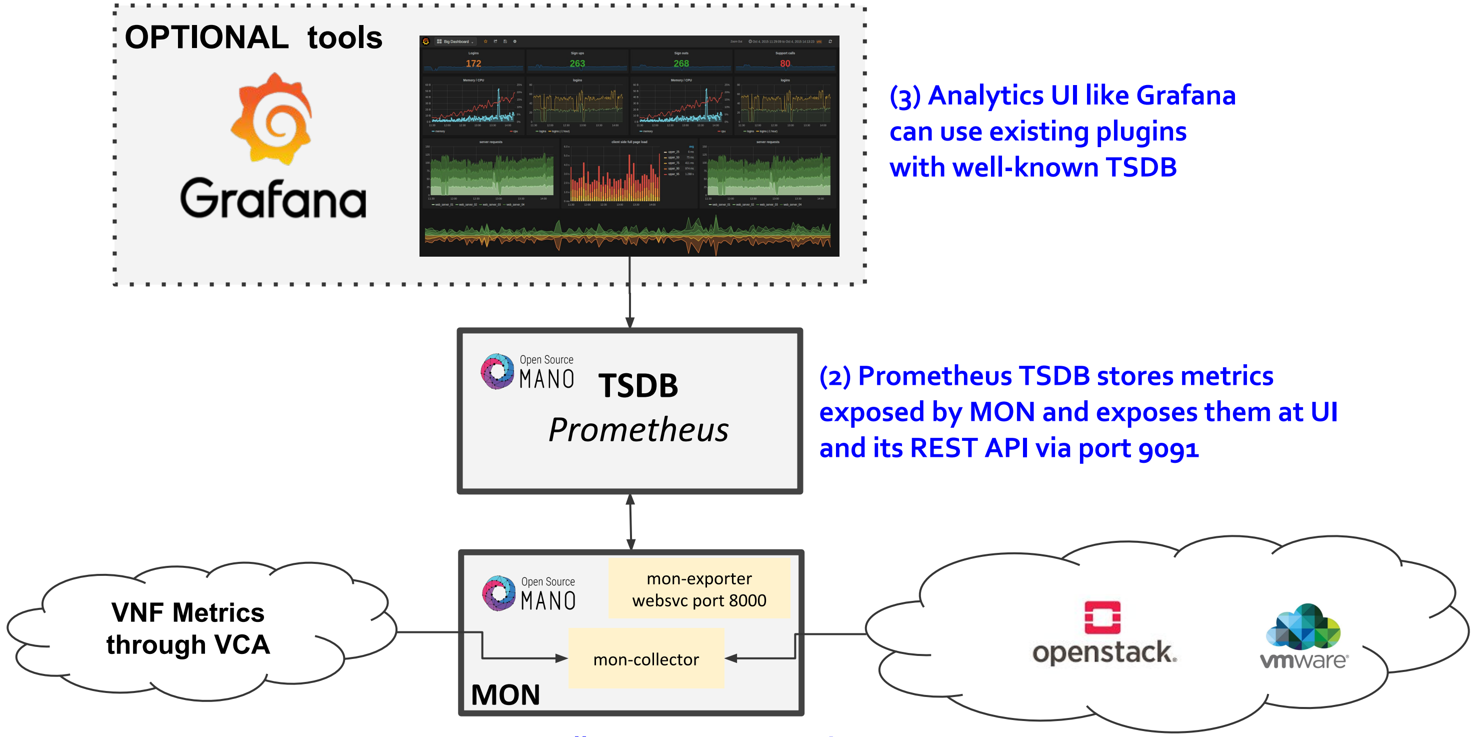

kafka
Prometheus TSDB
alarm_requests (POL)
vim_account (LCM)
vnfr iteration (mongodb)
alarm_ notifications (POL)
mon-central
creates alarms and handles VIM accounts
mysql
mon-evaluator
iterates & evaluates alarms, triggering notifications to the bus
prometheus exporter
mon-collector
iterates over vnfrs and collects metrics
VIM/N2VC metric plugins

Open Source MANO

## Performance Management

- OSM “MON” Component -

# PM – What's available at Release FIVE?



(3) Analytics UI like Grafana can use existing plugins with well-known TSDB

(2) Prometheus TSDB stores metrics exposed by MON and exposes them at UI and its REST API via port 9091

(1) MON collects VIM/VNF metrics defined at VNFD, from VNFs (through N2VC) and/or from NFVI (through VIMs)

## Main features

- Support for VIM metrics (related to VDUs)
  - OpenStack support ready since 5.0.0
  - vROps support ready in *master* (next 5.0.x point release)
  - AWS support pending
  - Supported metrics are cpu_utilization, average_memory_utilization, among others.
- Support for VNF-specific metrics.
  - Collection via proxy charms ‘juju metrics’ layer
  - Commands or API calls are executed from VCA to collect metrics every 5 minutes (fixed period)
- Monitoring happens on a per-VDU basis.

## Model review - Sample VNFD

- VDU Metric Collection from VIM

```
vdu:
  id: apache_vdu
  ...
 monitoring-param:
       - id: "apache_cpu_util"
         nfvi-metric: " cpu_utilization"
...
monitoring-param:
-   id: "apache_vnf_cpu_util"
    name: "apache_vnf_cpu_util"
    aggregation-type: AVERAGE
    vdu-monitoring-param:
      vdu-ref: "apache_vdu"
      vdu-monitoring-param-ref: " apache_cpu_util"
```

**nfvi-metric** corresponds to a established metric name at MON

## Model review - Sample VNFD

- VDU Metric Collection through VCA

```
vdu:
 - id: haproxy_vdu
   ...
   interface:
   - external-connection-point-ref: haproxy_mgmt
     mgmt-interface: true
  ...
  vdu-configuration:
    initial-config-primitive:
    ...
    juju:
      charm: testmetrics
    metrics:
      - name: load
...
monitoring-param:
-   id: "haproxy_load"
    name: "haproxy_load"
    aggregation-type: AVERAGE
    vdu-metric:
      vdu-ref: "haproxy_vdu"
      vdu-metric-name-ref: "load"
```

**metrics "name"** corresponds to a predefined metric name at the proxy charm

# Model review - Sample VNFD

- VNF Metric Collection through VCA

```
vnfd:
...
mgmt-interface:
  cp: haproxy_mgmt
vnf-configuration:
  initial-config-primitive:
  ...
  juju:
    charm: testmetrics
  metrics:
    - name:  users
...
monitoring-param:
-   id: "haproxy_users"
    name: "haproxy_users"
    aggregation-type: AVERAGE
    vnf-metric:
      vnf-metric-name-ref: " users"
```

**metrics "name"** corresponds to a predefined metric name at the proxy charm

# Proxy Charm metrics layer

- Sample of ‘metrics.yaml’ file (root of charm folder)

```
metrics:
   users:
     type: gauge
     description: "# of users"
     command: who|wc -l
   load:
     type: gauge
     description: "5 minute load average"
     command: cat /proc/loadavg |awk '{print $1}'
```

# Metrics collection in action

**Walkthrough Example (VIM Metrics)**

1. Download and review descriptors from here:

   hackfest_autoscale_vimmetric_nsd

   hackfest_autoscale_vimmetric_vnfd

2. Onboard them!

3. Make sure the '**public' network maps to a network your browser can reach, and 'mgmt' network is not mapped to a VIM network**. Your VIM should have Ceilometer/Gnocchi installed.

4. Make sure you MON container matches the metrics granularity of the underlying VIM

```
docker service update --env-add OS_DEFAULT_GRANULARITY=60 osm_mon
```

4. Launch the NS, you will have a LB (HA Proxy) and a Web server (Apache).

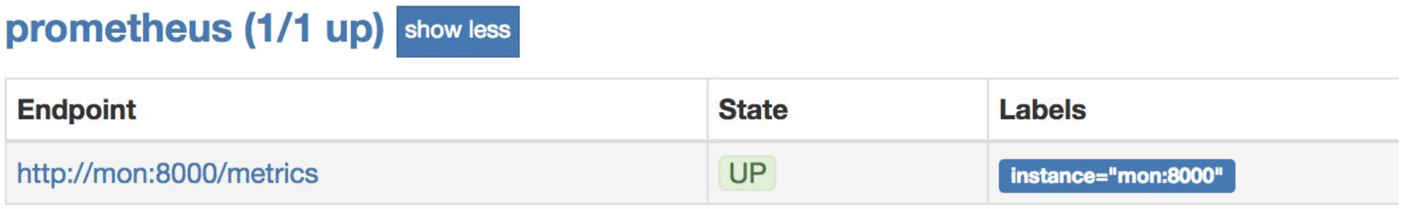
5. Visit the load balancer IP Address with your browser

# Metrics collection in action

## Walkthrough Example (VIM Metrics)

6. After a couple of minutes, visit the Prometheus TSDB GUI at OSM's IP address, port 9091.

7. Validate that MON exporter "target" is properly connected at Status/Targets



**prometheus (1/1 up)** show less

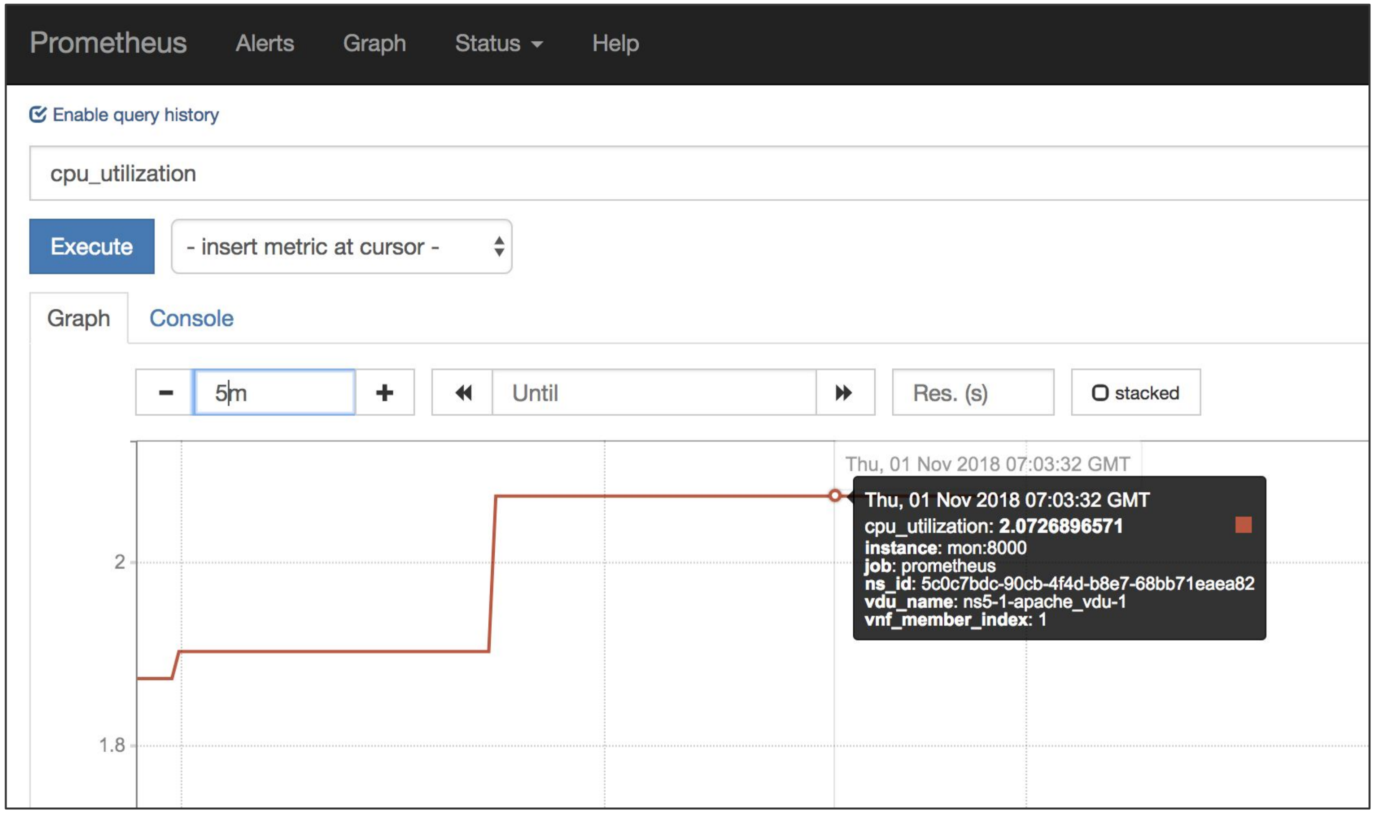
| Endpoint | State | Labels |
|---|---|---|
| http://mon:8000/metrics | UP | instance="mon:8000" |

8. Back in 'Graph', type 'osm_cpu_utilization' or 'osm_average_memory_utilization' and see if metrics are already there.

# Metrics collection in action

## Walkthrough Example (VIM Metrics)

9. Metrics should appear like this:



cpu_utilization

5m

Thu, 01 Nov 2018 07:03:32 GMT

```
Thu, 01 Nov 2018 07:03:32 GMT
cpu_utilization: 2.0726896571
instance: mon:8000
job: prometheus
ns_id: 5c0c7bdc-90cb-4f4d-b8e7-68bb71eaea82
vdu_name: ns5-1-apache_vdu-1
vnf_member_index: 1
```

# Metrics collection in action

## Walkthrough Example (VIM Metrics)

10. Now let’s add the optional Grafana component to see metrics in a friendlier way

### Installing Grafana

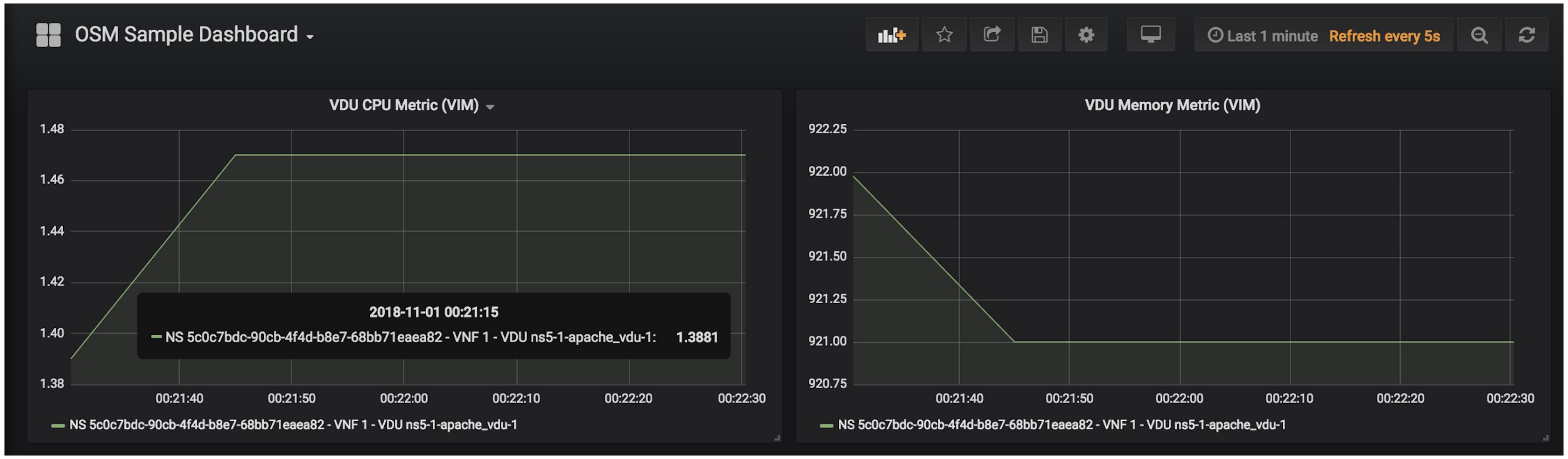
```
./install_osm.sh -o pm_stack
```

## Metrics collection in action

### Walkthrough Example (VIM Metrics)

11. You should be able to visit Grafana at the OSM IP address, port 3000 (admin/admin)

12. There's a default sample dashboard at 'Manage → Dashboards' (to the left), that will show some predefined graphs connected to Prometheus TSDB


OSM Sample Dashboard
Last 1 minute
Refresh every 5s
VDU CPU Metric (VIM)
2018-11-01 00:21:15
NS 5c0c7bdc-90cb-4f4d-b8e7-68bb71eaea82 - VNF 1 - VDU ns5-1-apache_vdu-1: 1.3881
NS 5c0c7bdc-90cb-4f4d-b8e7-68bb71eaea82 - VNF 1 - VDU ns5-1-apache_vdu-1
VDU Memory Metric (VIM)
NS 5c0c7bdc-90cb-4f4d-b8e7-68bb71eaea82 - VNF 1 - VDU ns5-1-apache_vdu-1

# Metrics collection in action

**Walkthrough Example (VDU Metrics from VCA)**

1. Download and review descriptors from here:

   hackfest_autoscale_vnfmet_nsd

   hackfest_autoscale_vnfmet_vnfd

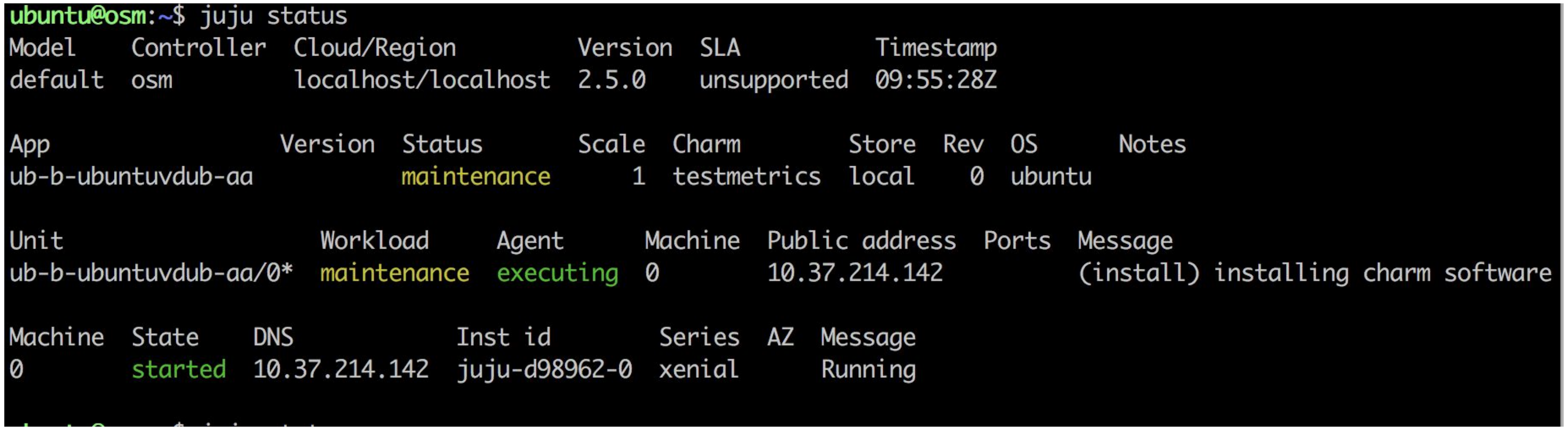
2. Onboard them!

3. **Make sure the ‘vim-network-name’ of the management network points to a “PUBLIC” network that your OSM instance can reach.**

# Metrics collection in action

## Walkthrough Example (VDU Metrics from VCA)

6. You can visit the ‘juju status’ to see if the ‘metrics proxy charm’ is being built:

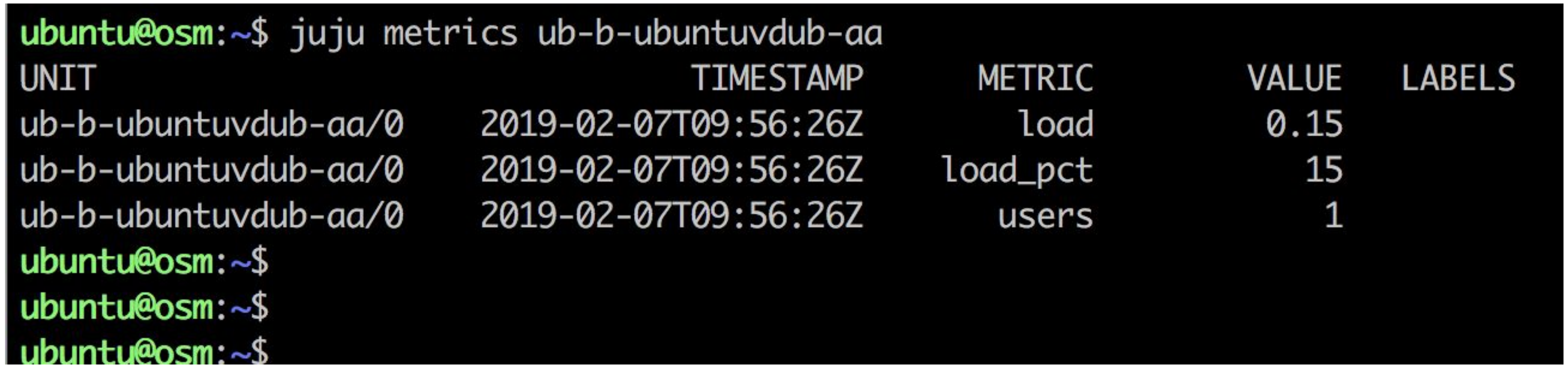


```
ubuntu@osm:~$ juju status
Model    Controller  Cloud/Region         Version  SLA          Timestamp
default  osm         localhost/localhost  2.5.0    unsupported  09:55:28Z

App                  Version  Status       Scale  Charm        Store  Rev  OS      Notes
ub-b-ubuntuvdub-aa            maintenance      1  testmetrics  local    0  ubuntu

Unit                   Workload     Agent      Machine  Public address  Ports  Message
ub-b-ubuntuvdub-aa/0*  maintenance  executing  0        10.37.214.142          (install) installing charm software

Machine  State    DNS            Inst id        Series  AZ  Message
0        started  10.37.214.142  juju-d98962-0  xenial      Running
```

# Metrics collection in action

## Walkthrough Example (VDU Metrics from VCA)

7. After around five minutes, you will see metrics at ‘juju metrics <name-of-the-application>



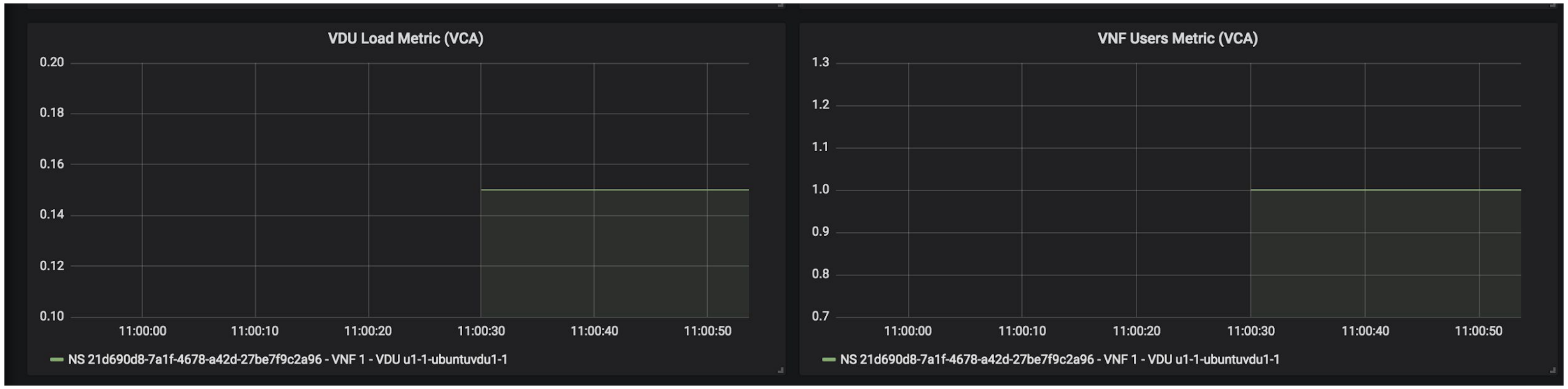
```
ubuntu@osm:~$ juju metrics ub-b-ubuntuvdub-aa
UNIT                               TIMESTAMP       METRIC        VALUE   LABELS
ub-b-ubuntuvdub-aa/0    2019-02-07T09:56:26Z         load         0.15
ub-b-ubuntuvdub-aa/0    2019-02-07T09:56:26Z     load_pct           15
ub-b-ubuntuvdub-aa/0    2019-02-07T09:56:26Z        users            1
ubuntu@osm:~$
ubuntu@osm:~$
ubuntu@osm:~$
```

# Metrics collection in action

## Walkthrough Example (VDU Metrics from VCA)

8. Finally, visit the Prometheus TSDB GUI at OSM's IP address, port 9091. In 'Graph', type 'osm_load' or 'osm_users' and see if metrics are already there.

You can also see the metrics at Grafana.



## Metrics collection in action

**Walkthrough Example (VDU Metrics from VCA)**

9. Access with SSH to the VNF (ubuntu/osm2018) and execute ‘**yes > /dev/null &**’. You should see users and load metrics changing in the next collection interval (5mins).

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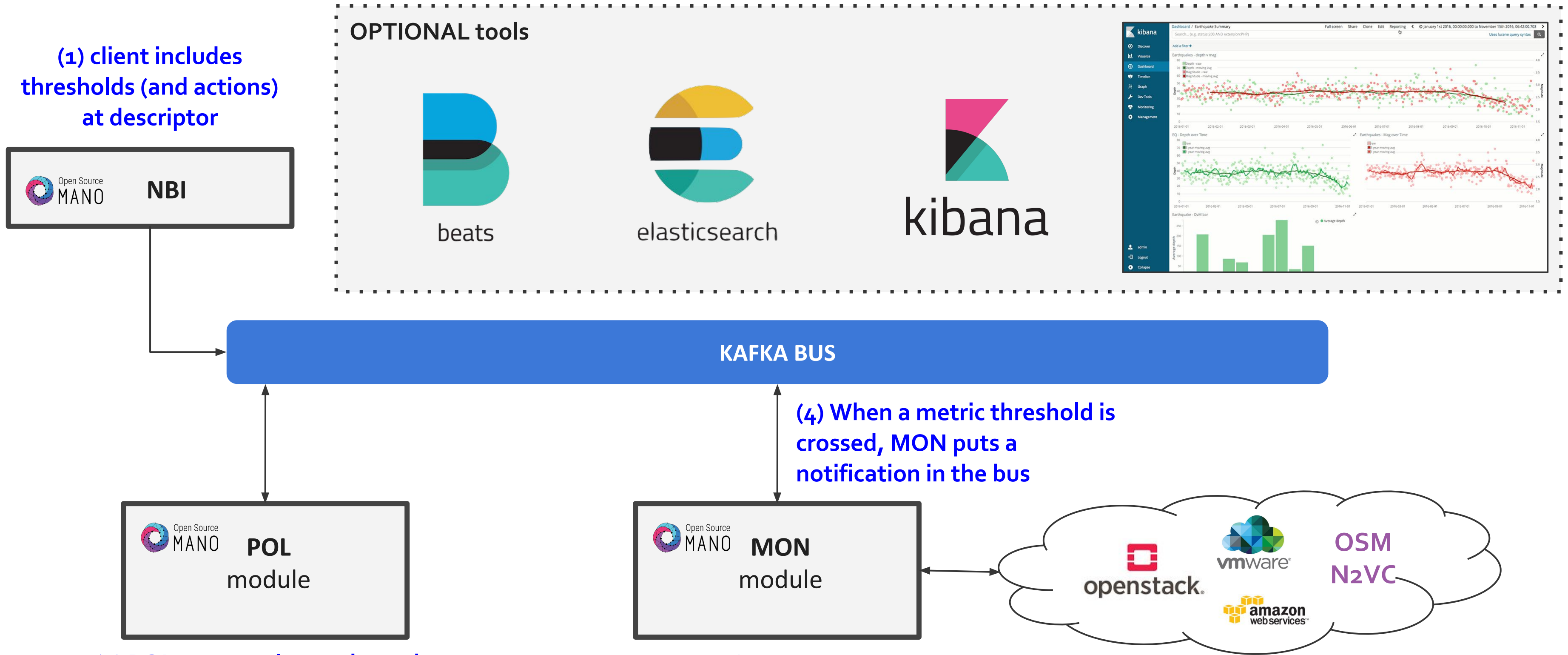
## Fault Management

- Docker logging & ‘POL’ Component -

# FM – What's available in Release FIVE?



(1) client includes thresholds (and actions) at descriptor

(2) POL creates alarms through MON

(3) MON configures the alarm locally and starts its evaluation process (by default every 30 seconds)

(4) When a metric threshold is crossed, MON puts a notification in the bus

## Main Features

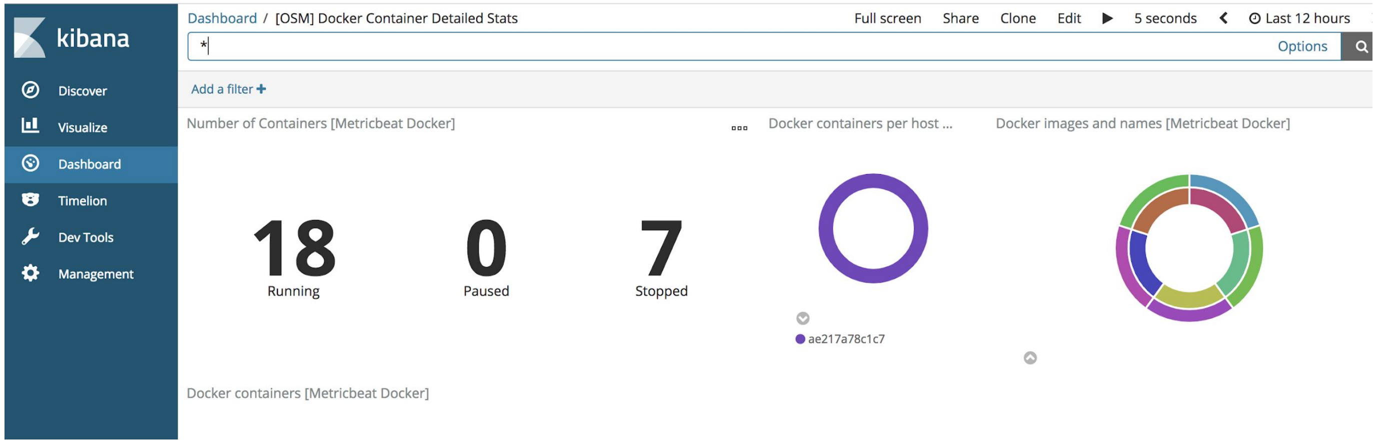
- Logging
  - docker containers send their logs to stdout.
  - They can be checked on the fly using:
    - docker logs osm_mon.1…
    - docker logs osm_lcm.1…
  - They can also be found at: /var/lib/containers/[container-id]/[container-id].json.log
  - VCA logs
    - Run ‘juju debug-log’ from the host

## Main Features

- Alarming
  - As of Release FIVE, MON includes a new module called 'mon-evaluator'. The only use case supported today by this module is the configuration of local alarms and evaluation of thresholds related to metrics, for the Policy Manager module (POL) to take actions such as auto-scaling (next chapter)
  - Whenever a threshold is crossed and an alarm is triggered, the notification is generated by MON and put in the Kafka bus so other components can consume them. This event is today logged by both MON (generates notification) and POL (consumes notification, for its auto-scaling action)

# FM Experimental Features

- We can enable a “EBK” stack to visualize logs and metrics (Elasticsearch, Beats, Kibana)
  - **Filebeats** collects logs from all docker containers
  - **Metricbeats** collects metrics from the host, containers and applications, through modules.
  - **Elasticsearch** organizes information and provides a way to filter and further process it.
  - **Kibana** provides a way for visualizing information and building dashboards.


kibana
Discover
Visualize
Dashboard
Timelion
Dev Tools
Management
Dashboard / [OSM] Docker Container Detailed Stats
Full screen
Share
Clone
Edit
5 seconds
Last 12 hours
*
Options
Add a filter +
Number of Containers [Metricbeat Docker]
18
Running
0
Paused
7
Stopped
Docker containers per host ...
ae217a78c1c7
Docker images and names [Metricbeat Docker]
Docker containers [Metricbeat Docker]

# FM Experimental Features

- You can enable the EBK stack by using:

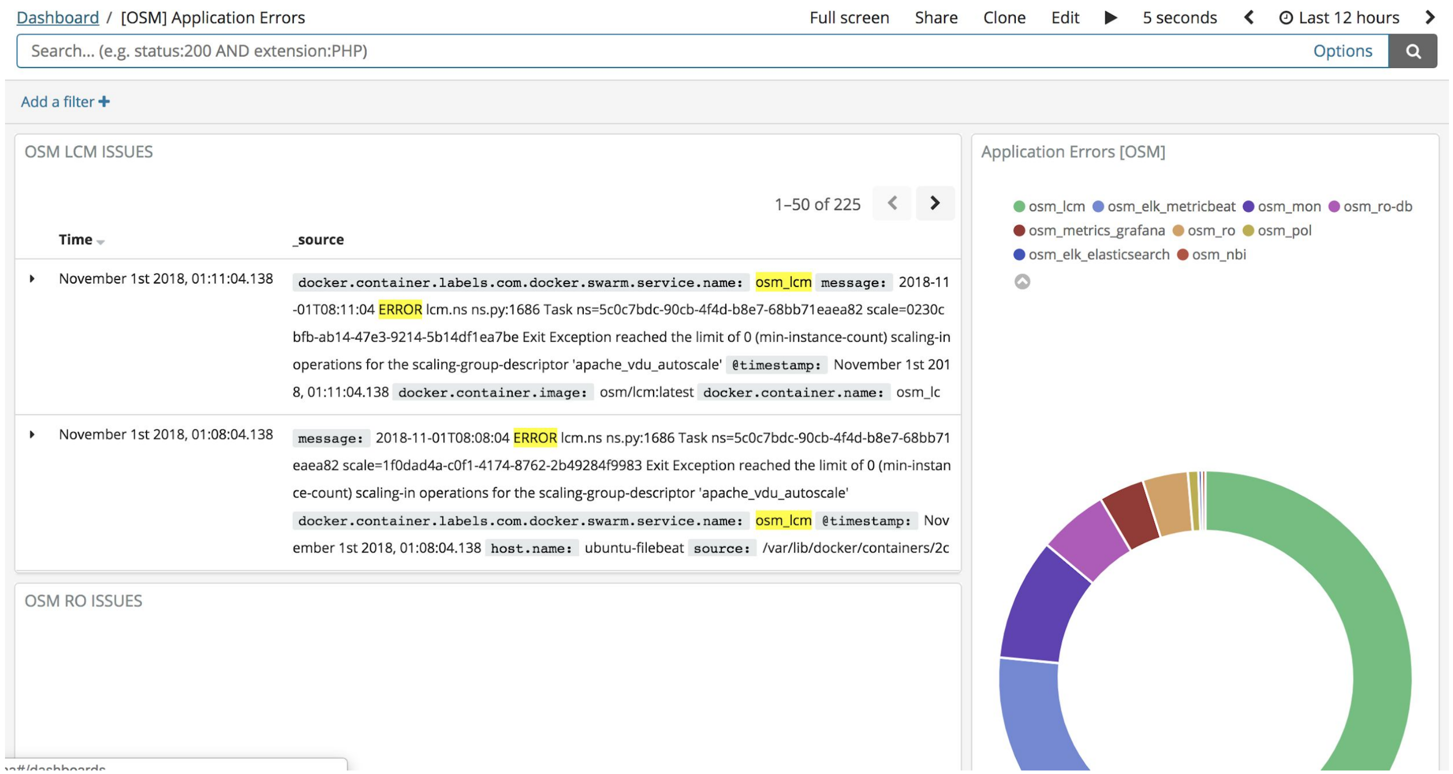
```
./install_osm.sh -o elk_stack
```

- After it's up, visit it with your browser with the OSM IP, port 5601
- Import sample dashboards using this file: https://osm-download.etsi.org/ftp/osm-4.0-four/4th-hackfest/other/osm_elastic_dashboards.json (Management → Saved objects → Import)
- Go to 'Discover' and you will be asked to define one of the 'beats' as default 'index pattern', do so by selecting 'filebeat-*' and clicking

★

# FM Experimental Features

- All metrics and logging activity will appear at Kibana.
- Navigate the sample OSM dashboards and provide feedback!



Dashboard / [OSM] Application Errors

OSM LCM ISSUES

1–50 of 225

| Time | _source |
|---|---|
| November 1st 2018, 01:11:04.138 | docker.container.labels.com.docker.swarm.service.name: osm_lcm message: 2018-11-01T08:11:04 ERROR lcm.ns ns.py:1686 Task ns=5c0c7bdc-90cb-4f4d-b8e7-68bb71eaea82 scale=0230cbfb-ab14-47e3-9214-5b14df1ea7be Exit Exception reached the limit of 0 (min-instance-count) scaling-in operations for the scaling-group-descriptor 'apache_vdu_autoscale' @timestamp: November 1st 2018, 01:11:04.138 docker.container.image: osm/lcm:latest docker.container.name: osm_lc |
| November 1st 2018, 01:08:04.138 | message: 2018-11-01T08:08:04 ERROR lcm.ns ns.py:1686 Task ns=5c0c7bdc-90cb-4f4d-b8e7-68bb71eaea82 scale=1f0dad4a-c0f1-4174-8762-2b49284f9983 Exit Exception reached the limit of 0 (min-instance-count) scaling-in operations for the scaling-group-descriptor 'apache_vdu_autoscale' docker.container.labels.com.docker.swarm.service.name: osm_lcm @timestamp: November 1st 2018, 01:08:04.138 host.name: ubuntu-filebeat source: /var/lib/docker/containers/2c |

OSM RO ISSUES

Application Errors [OSM]

● osm_lcm ● osm_elk_metricbeat ● osm_mon ● osm_ro-db
● osm_metrics_grafana ● osm_ro ● osm_pol
● osm_elk_elasticsearch ● osm_nbi

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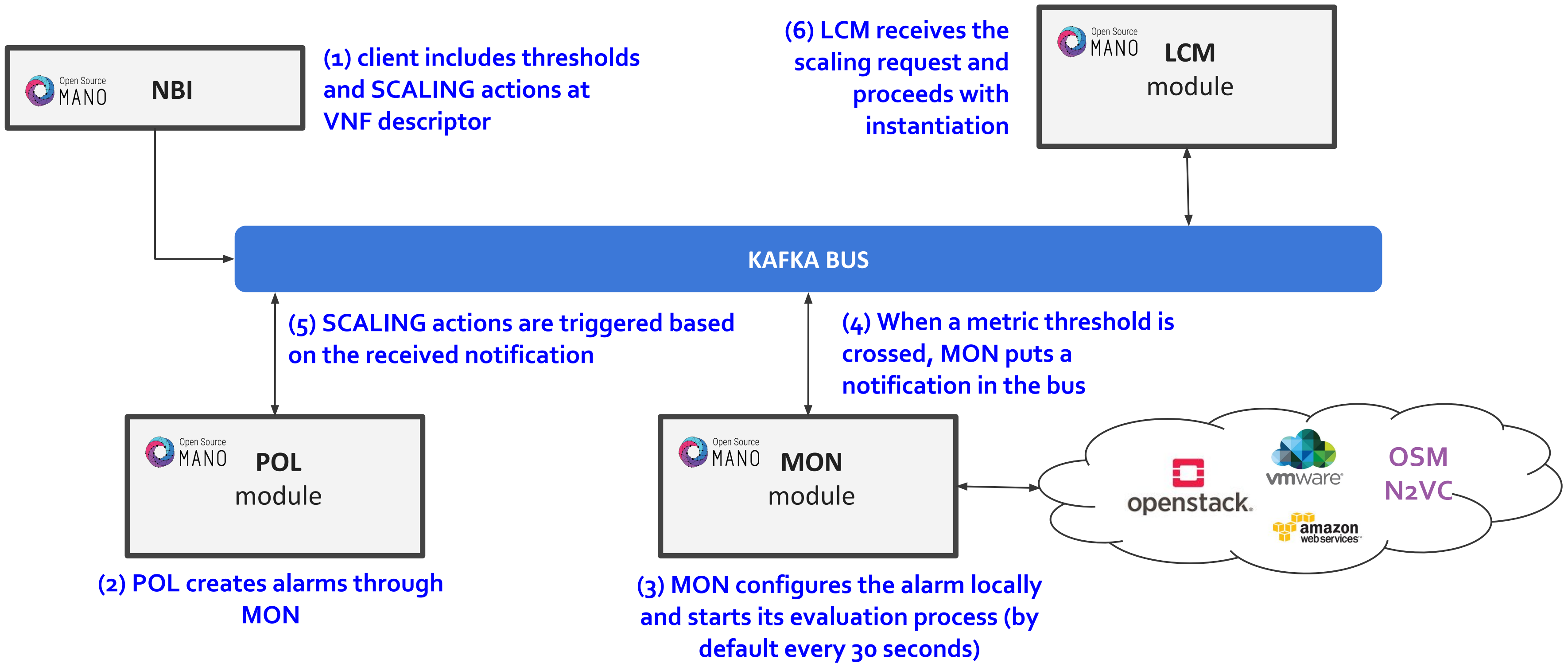
## Policy Management

- 'POL' Component -

# PM – What's available in Release FIVE?



Open Source MANO NBI
(1) client includes thresholds and SCALING actions at VNF descriptor
(6) LCM receives the scaling request and proceeds with instantiation
Open Source MANO LCM module
KAFKA BUS
(5) SCALING actions are triggered based on the received notification
(4) When a metric threshold is crossed, MON puts a notification in the bus
Open Source MANO POL module
Open Source MANO MON module
openstack.
vmware
amazon web services
OSM N2VC
(2) POL creates alarms through MON
(3) MON configures the alarm locally and starts its evaluation process (by default every 30 seconds)

## Main Features

- Autoscaling
  - Scaling descriptors can be included and be tied to automatic reaction to VIM/VNF metric thresholds.
  - An internal alarm manager is supported, so that both VIM and VNF metrics can trigger threshold-violation alarms and scaling actions.

## Model review - Sample VNFD

- VNF Scaling Descriptor (automatic, based on metrics)

```
scaling-group-descriptor:
-   name: "apache_vdu_autoscale"
    min-instance-count: 0
    max-instance-count: 10
    scaling-policy:
    -   name: "apache_cpu_util_above_threshold"
        scaling-type: "automatic"
        threshold-time: 10
        cooldown-time: 120
        scaling-criteria:
        -   name: "apache_cpu_util_above_threshold"
            scale-in-threshold: 20
            scale-in-relational-operation: "LT"
            scale-out-threshold: 80
            scale-out-relational-operation: "GT"
            vnf-monitoring-param-ref: "apache_vnf_cpu_util"
```

**vnf-monitoring-param-ref** corresponds to a predefined ‘monitoring param’

## Model review - Sample VNFD

- Please note that scaling actions can also be triggered manually as long as there is a scaling descriptor of type ‘manual’
- The VNFD would look like this:

```
scaling-group-descriptor:
-   name: "apache_vdu_manualscale"
    min-instance-count: 0
    max-instance-count: 10
    scaling-policy:
    -   name: "apache_cpu_util_manual"
        scaling-type: "manual"
        threshold-time: 10
        cooldown-time: 120
```

# Model review - Sample VNFD

- The API call for that is:
  - URL: POST to nslcm/v1/ns_instances/{{nsInstanceId}}/scale
  - Body

```
{"scaleType": "SCALE_VNF",
"scaleVnfData":
        {"scaleVnfType": "SCALE_OUT",
                "scaleByStepData": {
                        "scaling-group-descriptor": "apache_vdu_manualscale",
                        "member-vnf-index": "1"
}}}
```

## Autoscaling in action

### Walkthrough Example

1. Launch a ubuntu machine with a m1-small flavor to use it as a client for stressing our HAProxy+Apache VNF locally.  Instiatiate it at the PUBLIC network.

Make sure you will be able to access it, either by using your ssh-key or the following configuration script:

```
#cloud-config
hostname: ubuntu_client
password: osm2018
chpasswd: { expire: False }
ssh_pwauth: True
```

2. Install Apache-Bench: `sudo apt-install apache2-utils`

## Autoscaling in action

**Walkthrough Example**

2. From this client, run a stress test towards your load balancer’s IP address:

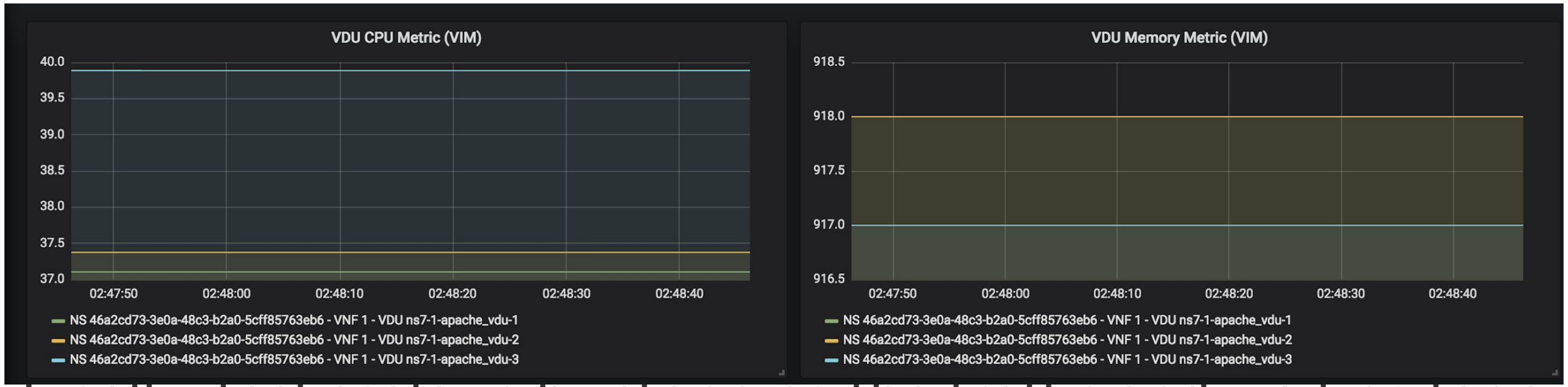
```
ab -n 5000000 -c 2 http://[HA-Proxy-IP]/test.php
```

3. Watch the policy manager logs to detect for autoscaling instructions. CPU should start going up in a minute, validate that at the Grafana Dashboard.

# Autoscaling in action

## Walkthrough Example

4. Instances of Apache Web Server should start appearing (up to 2 or 3 before it starts load balancing traffic accordingly), validate this at the OpenStack Network Topology and visiting the HAProxy IP address.



5. Finally, test scale-in by stopping the traffic and waiting for a couple of minutes.

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Find us at:

osm.etsi.org
osm.etsi.org/wikipub