Infrastructure as code

Introduction by example
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Introduction

Cloud Automation is a set of processes and technologies that allow to automate several operations.

Doing things **by hand is rarely a good idea** when complexity increases, and we have already seen several relatively complex technologies.

We have seen that, through a microservice architecture and some related processes and tools such as DevOps, we are able to write applications that are (or at least should be) **scalable, reliable and maintainable**.

However, when it comes to deploying these applications in the Cloud, we naturally need to find and configure the resources that are needed by the application.
Introduction

When working with **cloud resources**, depending on the user needs, different layers of underlying abstraction can be needed and, depending on how many layers and their composition, one can define different categories.
What we want

» **Not care** about the **infrastructure**
» **Not care** about the **volatility** of the **resources**
» A platform with the **frameworks we want to use**
» A **custom environment** for the end users
» A **scalable** solution
» A **replicable** solution

We can **automate** these steps **at different levels**, such as:

- **Infrastructure**: you need an infrastructure manager
- **Cluster**: you have to describe how your resources are organized
- **Software**: you need to specify your customizations
Missing link

» **TOSCA**

TOSCA means Topology and Orchestration Specification for Cloud Applications. It is an **open standard to describe your cloud composition** and applications in a way independent from the infrastructure and the resource manager.

» **Ansible**

It is an **open source software** that **automates software deployment**. With Ansible you can create recipe that customize an environment with your software and your specifications.
The best solution would be something that will do automatically all the wanted stuff for us but, we still need something that interacts with the resources.

This part is taken over by the **Infrastructure Manager**, that controls the resources for us and that we can instruct with **TOSCA** and **Ansible**.
Example context

» **Cluster**: A group of coupled computers that work together. We need to increase our computational power. It’s not trivial to configure and manage.

» **Cloud**: An high-level view of services provided by a cluster of computers. It gives a more user-friendly approach to interact with calculus computing resources.

» **Big Data**: The nightmare of data analysts and treasure for Machine Learning people. They need an appropriate environment to be managed and it’s also a problem the storing of the data themselves.
Target service

A common framework used in this field is Apache Spark.

Apache Spark is an open-source powerful distributed querying and processing engine. It’s quite easy to write a task for this engine (using its API) and it allows you to process a large amount of data.
We have to describe the service with the declarative language named **TOSCA**. The idea is to reproduce the **schema** of the target configuration.

With **TOSCA** we can define **nodes** that represents part of our infrastructure. Plus we can specify configurations, inputs and variable of our environment.
The basic nodes we need are:

- Master
- Slave
- Load balancer

```
mesos_master:
  type: tosca.nodes.indigo.MesosMaster
  [...]

mesos_slave:
  type: tosca.nodes.indigo.MesosSlave
  [...]

mesos_load_balancer:
  type: tosca.nodes.indigo.MesosLoadBalancer
  [...]
```

```
mesos_master_server:
  type: tosca.nodes.indigo.Compute
  [...]

mesos_slave_server:
  type: tosca.nodes.indigo.Compute
  [...]

mesos_lb_server:
  type: tosca.nodes.indigo.Compute
  [...]
```
Make it real

Also, a role for the Spark environment is necessary:

```
spark_application:
  type: tosca.nodes.indigo.SparkMesos
[...]
```

This last part involves also the customization for the end users, that can change the service due to the frameworks they want to use.
To customize the service we prepared a specific ansible recipe that uses also Docker containers.

The container allow us to encapsulate all the requirements we want.

```yaml
- name: "[Spark-Mesos] deploy app container on Marathon"
  run_once: true
  url:
    url: "://marathon.service.consul:v2/apps"
    user:"
    password:""
    validate_certs: "no"
    method: POST
    HEADER_Content-Type: "application/json"
    body: "\{json}\}"
    body_format: json
    status_code: 201
  register: post_result
  when: get_result.status == 404
  tags:
    - spark
```

[...]
Complete TOSCA template

Link to TOSCA file:

tosca_definitions_version: tosca_simple_yam_1_0

imports:
  - indigo_custom_types:

description: >
  TOSCA template for deploying Spark + Mesos cluster. The following flavors can be selected setting the input spark_mesos_flavor
topology_template:

inputs:

  marathon_username:
    type: string
    default: "admin"

  marathon_password:
    type: string
    description: Admin password for accessing Marathon HTTP service
    default: 'passwd'
    required: yes
node_templates:

spark_application:
  type: tosca.nodes.indigo.SparkMesos
  properties:
    marathon_password: { get_input: marathon_password }
    zookeeper_peers: { get_attribute: [ mesos_master_server, private_address ] }
    spark_hdfs_uri: { get_input: hdfs_uri }
    spark_cores_max: { get_input: spark_cores_max }
  requirements:
  - host: mesos_master
  - dependency: mesos_master

[...]

Complete TOSCA template
mesos_master:
    type: tosca.nodes.indigo.MesosMaster
properties:
    mesos_username: { get_input: mesos_username }
    mesos_password: { get_input: mesos_password }
    marathon_username: { get_input: marathon_username }
    marathon_password: { get_input: marathon_password }
    mesos_masters_list: { get_attribute: [ mesos_master_server, private_address ] }
    chronos_password: 's3cret'
requirements:
  - host: mesos_master_server

[...]
Complete TOSCA template

```yaml
mesos_master_server:
  type: tosca.nodes.indigo.Compute
  capabilities:
    endpoint:
      properties:
        dns_name: mesosserverpublic
        network_name: PUBLIC
    ports:
      mesos_port:
        protocol: tcp
        source: 5050
  scalable:
    properties:
      count: { get_input: master_num }

host:
  properties:
    num_cpus: { get_input: master_cpus }
    mem_size: { get_input: master_mem }
  os:
    properties:
      image: { get_input: server_image }
```
Complete TOSCA template

```
outputs:
  spark_bastion:
    value: { concat: [ 'ssh admin@', get_attribute: [ mesos_lb_server, public_address, 0 ], ' -p 31042' ] }
  mesos_endpoint:
    value: { concat: [ 'http://', get_attribute: [ mesos_master_server, public_address, 0 ], ':5050' ] }
  marathon_endpoint:
    value: { concat: [ 'https://', get_attribute: [ mesos_master_server, public_address, 0 ], ':8443' ] }
  master_creds:
    value: { get_attribute: [ mesos_master_server, endpoint, credential, 0 ] }
```
Summary

» We can have tools that automate the platform creation
» We can customize our environment to reflect the workflow requirements
» We can reuse our configuration on several infrastructures
» We can maintain and update easily our frameworks
» We can reuse resources in base of the purpose
And now?

We can use all those stuff?

Yes, let’s move to the next hands-on...
continue...