5G DEVELOPMENT AND VALIDATION PLATFORM FOR GLOBAL INDUSTRY-SPECIFIC NETWORK SERVICES AND APPS

Benoit ORIHUELA (EGM)
Eleni Fotopoulou, Anastasios Zafeiropoulos (UBITECH)
#1 - The 5Gtango project
Short intro

• Working at Easy Global Market
• Newcomer in the 5G world
• A “service developers” view
About 5Gtango Project

• 5Gtango is an EU-funded project (Horizon 2020) and part of the 5G-PPP initiative

• 30 month work plan, started in June 2017

• 18 partners representing telecom operators, manufacturers, system integrators, service providers, SME developers, research and academic institutes
5Gtango Objectives

Reduce the time-to-market for networked services by shortening the service development cycle and by qualifying those network services to be adopted.

Enable new business opportunities with the customisation and adaptation of the network to vertical application’s requirements.

Reduce the entry barrier to 3rd party developers and support the creation and composition of Virtual Network Functions (VNFs) and application elements as "Network Services".

Accelerate the NFV uptake in industry via an 'extended' DevOps model and the validation at scale of Network Service capabilities of the 5GTANGO platform in vertical showcases.
5Gtango Key contributions

1. An NFV-enabled SERVICE DEVELOPMENT KIT (SDK).

2. A STORE PLATFORM with advanced VALIDATION AND VERIFICATION MECHANISMS for VNFs/Network Services qualification (including 3rd party contributions).

3. A modular SERVICE PLATFORM with an innovative ORCHESTRATOR in order to bridge the gap between business needs and network operational management systems.

4. Methodology and tools to implement a modern DevOps workflow with a multi-organizational design.
5Gtango High Level Architecture

Catalogues

NFV-enabled SDK

Developer’s V&V and Service Platform

VIM/WIM/infrastructure emulator

V&V Platform and Catalogue

VIM/WIM

Qualification Service Platform

VIM

Qualification Infrastructure

Service Platform

OSS

Slice Mgr

NFV-O

VIM

SD-WAN

Actual Infrastructure

Operation
Three service phases in 5Gtango

Dev triggered
- NS/NetApp Programmability
- Dev support tools
- Local Environment

Store and NS validation
- NS multiple Deployment
- Qualification Environment (multiple options and technologies)

OSS triggered
- NS test and monitoring
- NS policy Deployment
- NS global management
- Production Environment
#2 - The SDK
SDK - Tools

• **Schemas**: schemas defining the structure and syntax of all descriptors within the project (VNF, NS, pkgs, SLA, policies, …)

• **Descriptor generation and project management**: generation of VNFD and NSD descriptors based on high-level information and management of created NFV projects

• **Validator**: validation of generated descriptors and projects based on syntax, integrity, topology, or custom rules

• **Packager**: creation and unpacking of 5GTANGO packages

• **Emulator**: emulation platform to support NS developers in locally prototyping and testing complete NS chains in realistic end-to-end multi-PoP scenarios

• **Benchmarker**: tool for fully automated VNF and network service benchmarking and profiling
SDK - a Model-Based Approach

- Descriptors defining functions and services
  - Used in all phases
- Package layering
  - Support integrity checks
  - Consistent updating at the different phases
  - Integrate VnV procedures
SDK - Project files

File: packages/NSMQTT_OSM/project.yml

---
version: '0.5'
package:
  name: mqtt-osm-cloud-init
  vendor: eu.5gtango.egm
  version: '0.1'
  maintainer: Benoit Orihuela, Easy Global Market, benoit.orihuela@eglobalmark.com
description: A VNF running a MQTT-based Mosquitto broker
descriptor_extension: yml
files:
- path: mosquitto_nsd.yaml
  type: application/vnd.etsi.osm.nsd
tags:
  - etsi.osm
  testing_tags:
    - "osm-mosquitto"
- path: mosquitto_vnfd.yaml
  type: application/vnd.etsi.osm.vnfd
tags:
  - file-ref:cloud_init/mosquitto_cloud_init.cfg
  - etsi.osm
- path: cloud_init/mosquitto_cloud_init.cfg
  type: text/x-shellscriptr
tags:
  - etsi.osm
SDK - Validation of a package

2019-09-08 10:55:32 khatovar tango.tngsdk.validation.cli:l123 INFO Syntax, integrity and topology validation
2019-09-08 10:55:32 khatovar tngsdk.project.project[9394] INFO Loading project '/Users/bobeal/egm/dev/5gtango/tng-tests/packages/NSIDIV_hybrid/project.yml'
2019-09-08 10:55:32 khatovar tango.tngsdk.validation.validator:l303 INFO ... syntax: True, integrity: True, topology: True
2019-09-08 10:55:32 khatovar tango.tngsdk.validation.validator:l1123 INFO ... syntax: True, integrity: True
2019-09-08 10:55:32 khatovar tango.tngsdk.validation.validator:l1144 INFO Validating syntax of test descriptor 'eu.5gtango.optare.test-ping-sonata.0.1'
2019-09-08 10:55:32 khatovar tango.tngsdk.validation.validator:l1162 INFO Validating integrity of test descriptor 'eu.5gtango.optare.test-ping-sonata.0.1'
2019-09-08 10:55:32 khatovar tango.tngsdk.validation.validator:l1383 INFO ... syntax: True, integrity: True, topology: True
2019-09-08 10:55:32 khatovar tango.tngsdk.validation.validator:l1694 INFO Validating syntax of service descriptor 'eu.5gtango.test-nsidiv-sonata.0.2'
2019-09-08 10:55:32 khatovar tango.tngsdk.validation.validator:l1776 INFO Validating integrity of service descriptor 'eu.5gtango.test-nsidiv-sonata.0.2'
2019-09-08 10:55:32 khatovar tango.tngsdk.validation.validator:l921 INFO Validating syntax of function descriptor 'eu.5gtango.cirros_vnf.0.2'
2019-09-08 10:55:32 khatovar tango.tngsdk.validation.validator:l941 INFO Validating integrity of function descriptor 'eu.5gtango.cirros_vnf.0.2'
2019-09-08 10:55:32 khatovar tango.tngsdk.validation.validator:l2049 INFO Validating topology of function descriptor 'eu.5gtango.cirros_vnf.0.2'
2019-09-08 10:55:32 khatovar tango.tngsdk.validation.validator:l1086 INFO Built topology graph of function descriptor 'eu.5gtango.cirros_vnf.0.2': [{'mgmt', 'br-mgmt-2-mgmt'}, ('br-mgmt-2-mgmt', 'vdu01')]
2019-09-08 10:55:32 khatovar tango.validator.events:l50 ERROR 1 Undeclared connection point(s)
2019-09-08 10:55:32 khatovar tango.validator.events:l64 ERROR Virtual links section has undeclared connection point: mgmt
2019-09-08 10:55:32 khatovar tango.validator.events:l135 INFO Cant validate the project descriptors
2019-09-08 10:55:32 khatovar tango.validator.events:l1310 ERROR tng-validate error(s): [{'source_id': 'eu.5gtango.test-nsidiv-sonata.0.2', 'event_code': 'evt.nsdl.unddeclared.cpont', 'level': 'error', 'event_id': 'eu.5gtango.test-nsidiv-sonata.0.2', 'header': '1 Undeclared connection point(s)', 'detail': {'message': 'Virtual links section has undeclared connection point: mgmt', 'detail_event_id': 'eu.5gtango.test-nsidiv-sonata.0.2'}}]
SDK - The emulator

- Initial validation
  - Through emulation
  - Connected with the VnV process
- Shaping a DevOps loop suitable for critical infrastructures
VnV - Verifying and Validating

• Support for:
  • Different test specification sources
  • Automated test execution
  • Linked test results
• Enabling Continuous Testing
• Multi-platform support
  • SONATA, OSM, ONAP (WIP)
VnV - Main Features

- **Easy testing automation**
  - Definition of Test plans, which can be applied to multiple NS

- **Complete Network Service/VNF Qualification**
  - Reporting of test results on a Qualification SP and environment

- **Multi-MANO support**
  - Ready to test with SONATA, OSM, ONAP (expected for v5.1)

- **Probes and Metrics**
  - Out-of-the-box probes for your NS

- **Comprehensive result analysis**
  - Analyser component to support tests results analysis
VnV - Flow and Tools
VnV - A (very) simple use-case

NS View

- NS instance id: 5af71c13-2ac7-4eb6-816b-c1af1c79063
- NSD name: mqtt-osm-stress-test-Mosquito_NS-osm
- Operational status: running
- Config status: configured
- Detailed status: done
VnV - Project file for the test

File: TSTMQTT/project.yml

---
descriptor_extension: yml
version: '0.5'
package:
  vendor: eu.5gtango.egm
  name: mqtt-osm-stress-test
  version: '0.9'
maintainer: Benoit Orihuela, EGM, benoit.orihuela@eglobalmark.com
description: This is a 5GTANGO test package for MQTT benchmarking in OSM
files:
- path: Definitions/test-descriptor.yml
type: application/vnd.5gtango.tstd
testing_tags:
  - "osm-mosquitto"
- path: Icons/upb_logo.png
type: image/png
- path: Licenses/LICENSE
type: text/plain
VnV - Test descriptor - Metadata

File: TSTMQTT/Definitions/test-descriptor.yml

```yaml
---
author: "Benoit Orihuela (EGM)"
description: "Performance test for mqtt broker"
name: "mqtt-osm-stress-test"
vendor: "eu.5gtango.egm"
version: '0.8'

service_platforms:
  - "OSM"
test_category:
  - "benchmarking"
testing_tags:
  - "osm-mosquitto"
```
VnV - Test descriptor - Setup

phases:
- id: setup
  steps:
  - action: deploy
    description: "Deploying a NS"
    name: deployment
  - action: configure
    description: "Configuration"
    name: configuration
  probes:
  - id: mqttprobe
    description: "A service initial configuration container"
    image: "easyglobalmarket/mqtt-probe:latest"
    name: mqttprobe
    parameters:
    - key: IP
      value: "$(Mosquito_VNF/endpoints/name:data_vl1/address)"
    - key: PORT
      value: '1883'
    - key: CLIENTS
      value: '100'
    - key: COUNT
      value: '100'
    - key: SIZE
      value: '100'
    - key: QOS
      value: '0'
    - key: ROUNDS
      value: '50'
VnV - Test descriptor - Exercise & Verify

- id: exercise
  steps:
  - command: /bin/sh
    dependencies: []
    description: "Starting the MQTT probe"
    entrypoint: /app/entrypoint.sh
    index: 1
    instances: 1
    name: mqttprobe
    output:
    - {results: results.log}
    run: mqttprobe
    start_delay: 60

- id: verification
  steps:
  - step: parser
    description: "Check obtained results"
    name: parser
    conditions:
    - condition: present
      file: results.log
      find: ""failures": 0"
      name: no-error
      verdict: pass
VnV - Test execution

```bash
#!/usr/bin/env bash

# VnV configuration

# VnV host
$(VNV_HOST) http://int-vnv.5gtango.eu
# SP host
$(SP_HOST) http://172.31.8.163
# File source directory
$(FILE_SOURCE_DIR) ../packages
# NS package name
$(NS_PACKAGE_NAME) eu.5gtango.egm.mqtt-oss-cloud-init.0.1.tgo
# TST package name
$(TST_PACKAGE_NAME) eu.5gtango.egm.mqtt-oss-stress-test.0.9.tgo
# NS package short name
$(NS_PACKAGE_SHORT_NAME) mqtt-oss-cloud-init
# TST package short name
$(TST_PACKAGE_SHORT_NAME) mqtt-oss-stress-test

# VnV test cases

*** Test Cases ***

Setting the VnV Path
# From date to obtain GrayLogs
$(from_date) = Get Current Date
Set Global Variable $(from_date)
Set SP Path $(VNV_HOST)
Set NS Package Path $(FILE_SOURCE_DIR)/$(NS_PACKAGE_NAME)
Set TST Package Path $(FILE_SOURCE_DIR)/$(TST_PACKAGE_NAME)

Clean the Packages
# (PACKAGES) = Get Packages
FOR (PACKAGE) IN @PACKAGES[] DO
  Run Keyword
    'ns.package= $(PACKAGE[‘name’])' or 'tst.package= $(PACKAGE[‘name’])' == '$(TST_PACKAGE_SHORT_NAME)'
END

Upload the NS Package
$(result) = Upload Package $(FILE_SOURCE_DIR)/$(NS_PACKAGE_NAME)
Should Be True $(result[0])

Upload the TST Package
$(result) = Upload Package $(FILE_SOURCE_DIR)/$(TST_PACKAGE_NAME)
Should Be True $(result[0])

Wait for Service Instance Ready
Set SP Path $(VNV_HOST)
Set NS Package Path $(FILE_SOURCE_DIR)/$(NS_PACKAGE_NAME)
Set TST Package Path $(FILE_SOURCE_DIR)/$(TST_PACKAGE_NAME)

Wait for Service Instance Ready
Set SP Path $(VNV_HOST)
Set NS Package Path $(FILE_SOURCE_DIR)/$(NS_PACKAGE_NAME)
Set TST Package Path $(FILE_SOURCE_DIR)/$(TST_PACKAGE_NAME)

Wait for Test Execution
Set SP Path $(VNV_HOST)
Set NS Package Path $(FILE_SOURCE_DIR)/$(NS_PACKAGE_NAME)
Set TST Package Path $(FILE_SOURCE_DIR)/$(TST_PACKAGE_NAME)

Obtain Graylogs
$(to_date) = Get Current Date
Set Suite Variable $(param_file) True
Get Logs $(from_date) $(to_date) $(VNV_HOST) $(param_file)
```

5Gtango
## Project test-osm-onboarding

VnV Industrial pilot stress Test

### Last Successful Artifacts
- graylogs.log: 170.97 KB
- log.html: 222.85 KB
- output.xml: 13.75 KB
- report.html: 224.04 KB

### Recent Changes
- **Disk Usage**
  - Job: 23 MB
  - All builds: 23 MB
  - Locked builds: -
  - All workspaces: 57 MB
  - Slave workspaces: 57 MB
  - Non-slave workspaces: -

### MTTR
- Last 7 Days: 10 hr
- Last 30 Days: 21 hr
- All Time: 21 hr

### MTTF
- Last 7 Days: 7 hr 27 min
- Last 30 Days: 1 day 18 hr
- All Time: 1 day 18 hr

### Standard Deviation
- Last 7 Days: 13 min
- Last 30 Days: 12 min
- All Time: 12 min
VnV - The portal

Platform metrics

Disk Usage

CPU Usage (%)

Memory Usage

Tests status

Completed

36

In progress

47

Scheduled

5

Failing

41

Waiting for confirmation

Stored descriptors

Tests

Network services

Functions

Available platforms

SONATA

OSM

ONAP

3

3

3

1

1

-
## VALIDATION AND VERIFICATION

### Test plans

<table>
<thead>
<tr>
<th>Test name</th>
<th>Service name</th>
<th>Updated at</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>mqtt-osm-stress-test.e5tango.egm.0.8</td>
<td>Mosquitto_NS.Easy Global Market.1.1</td>
<td>Tue, 10 Sep 2019 08:15:13 GMT</td>
<td>Completed</td>
</tr>
<tr>
<td>mqtt-osm-stress-test.e5tango.egm.0.8</td>
<td>Mosquitto_NS.Easy Global Market.1.1</td>
<td>Tue, 10 Sep 2019 08:08:02 GMT</td>
<td>Cancelled</td>
</tr>
<tr>
<td>mqtt-osm-stress-test.e5tango.egm.0.8</td>
<td>Mosquitto_NS.Easy Global Market.1.1</td>
<td>Tue, 10 Sep 2019 07:17:56 GMT</td>
<td>Cancelled</td>
</tr>
<tr>
<td>mqtt-osm-stress-test.e5tango.egm.0.8</td>
<td>Mosquitto_NS.Easy Global Market.1.1</td>
<td>Mon, 09 Sep 2019 14:41:30 GMT</td>
<td>Cancelled</td>
</tr>
<tr>
<td>test-generic-probes.e5tango.optare.0.1</td>
<td>test-nsid1v.e5tango.0.1</td>
<td>Thu, 05 Sep 2019 10:57:22 GMT</td>
<td>Starting</td>
</tr>
<tr>
<td>test-generic-probes.e5tango.optare.0.1</td>
<td>test-nsid1v.e5tango.0.1</td>
<td>Thu, 05 Sep 2019 10:31:37 GMT</td>
<td>Error</td>
</tr>
<tr>
<td>test-generic-probes.e5tango.optare.0.1</td>
<td>test-nsid1v.e5tango.0.1</td>
<td>Thu, 05 Sep 2019 10:11:00 GMT</td>
<td>Error</td>
</tr>
</tbody>
</table>
#4 - Analytics Engine: A Scientific Toolbox for Introducing Automation in Orchestration Mechanisms
• Extract insights building upon the results of VnV tests
  • Main performance KPIs
  • Stability, self-recovery functionalities
  • Scalability aspects
• Identify capacity limits and extract resource consumption trends
  • Proper dimensioning of resources allocation
  • Specification of elasticity policies
• Identify unknown or not well-examined relationships among monitoring metrics
  • Identify bottlenecks in performance of VNFs within a NS triggered by malperformance of other VNFs
Analytics Engine - Motivation (2)

- **Anomalies detection**
  - Considering performance or security aspects
- **Introduce automation in orchestration mechanisms**
  - Design efficient deployment and runtime policies based on:
  - Resource consumption trends
  - Machine learning mechanisms for guaranteeing desired objectives
  - Design forecasting models for proactive decision making (e.g. scaling, anomaly detection)
- **Compare performance of software providing similar functionality**
  - Resource usage and achieved performance
Analytics Engine Architecture
Analytics Engine Rest APIs

http://int-vnv.5gtango.eu:8085/swagger-ui.html#/gp-controller
Supported Analysis Services

<table>
<thead>
<tr>
<th>Analysis Service</th>
<th>Description</th>
<th>Result</th>
</tr>
</thead>
</table>
| correlogram            | generation of correlogram with all high significant (positive and negative) correlation between the retrieved metrics from prometheus for a specific application graph | ![correlogram](http://int-vnv.5gtango.eu:8085/list)
|                        |                                                                             | {{
|                        | "name": "correlogram",
|                        | "description": "Provide a correlogram with high statistical correlations between metrics",
|                        | "id": "5d778342a927cb000104c8aa",
|                        | "constraints": "Select the set of metrics (more than one) to be used for the calculation of the correlation matrix",
|                        | "results": ["correlogram.html"],
|                        | "url": "/ocpu/library/Physiognomica/R/correlogram"
|                        |                                                                             | }
| chord diagram          | generation of chord diagram with all high significant (positive and negative) correlation between the retrieved metrics from prometheus for a specific application graph | ![chord diagram](http://int-vnv.5gtango.eu:8085/list)
|                        |                                                                             | {{
|                        | "name": "chord",
|                        | "description": "Provide a correlogram with high statistical correlations between metrics via an interactive chord diagram",
|                        | "id": "5d778342a927cb000104c8ab",
|                        | "constraints": "Select the set of metrics (more than one) to be used for the calculation of the correlation matrix",
|                        | "results": ["correlation_page.html"],
|                        | "url": "/ocpu/library/Physiognomica/R/chord"
|                        |                                                                             | }
| linear regression      | calculation and representation of the linear regression model for two application graph metrics | ![linear regression](http://int-vnv.5gtango.eu:8085/list)
| multiple linear regression | calculation and representation of a multilinear regression model for many application graph metrics | ![multiple linear regression](http://int-vnv.5gtango.eu:8085/list)
| times series decomposition | time series decomposition and forecasting for a metric time series | ![times series decomposition](http://int-vnv.5gtango.eu:8085/list)
| filter healthy metrics | separate monitoring metrics to healthy and unhealthy. Provide basic statistics | ![filter healthy metrics](http://int-vnv.5gtango.eu:8085/list)
V&V - Focus on Analytics Engine

List all V&V executed tests:
http://int-vnv.5gtango.eu:4012/trr/test-suite-results

```json
[
  {
    "created_at": "2019-09-11T06:30:00.829+00:00",
    "ended_at": "2019-09-11T06:30:00.785Z",
    "instance_uuid": "c65f337c-edf8-4c2b-9124-53928e1da557",
    "package_id": "2ebfe959-bb47-415f-b9f9c5599a",
    "service_uuid": "99d3a768-a93c-4b8f-9f0b-498901",
    "started_at": "2019-09-11T06:22:01.276Z",
    "status": "PASSED",
    "test_uuid": "c34cf687-8653-4804-be7ecd43f91b",
    "updated_at": "2019-09-11T06:30:00.779+00:00",
    "uuid": "2f05c095-0a42-4bbe-96b0-d40327146020"
  }
]
```
Gather monitoring metrics

http://int-vnv.5gtango.eu:8085/tests/vnv/{test_results_uuid}/metrics

Example:

http://int-vnv.5gtango.eu:8085/tests/vnv/2f05c095-0a42-4bbe-96b0-d40327146020/metrics

["libvirt_block_stats_errors_number{resource_id='8d8fcbf4-c1da-4db9-9547-41f5b4cfa090'}",
"libvirt_block_stats_read_bytes{resource_id='8d8fcbf4-c1da-4db9-9547-41f5b4cfa090'}",
"libvirt_block_stats_read_requests_issued{resource_id='8d8fcbf4-c1da-4db9-9547-41f5b4cfa090'}",
"libvirt_block_stats_write_bytes{resource_id='8d8fcbf4-c1da-4db9-9547-41f5b4cfa090'}",
"libvirt_block_stats_write_requests_issued{resource_id='8d8fcbf4-c1da-4db9-9547-41f5b4cfa090'}"]
V&V - Focus on Analytics Engine

Request Analytic Process:
http://int-vnv.5gtango.eu:8085/analytic_service

Fetch Analytic Result
http://int-vnv.5gtango.eu:8085/results/list

prometheus_url: http://int-vnv.5gtango.eu:9090

```json
{
   "name": "filter_healthy_metrics",
   "vendor": "5gtango.vnv",
   "testr_uuuid": "2f05c095-0a42-4bbe-96b0-d40327146020",
   "step": "1s"
}
```

```
{
   "analyticServiceName": "filter_healthy_metrics",
   "executionDate": "Tue Sep 10 09:31:52 UTC 2019",
   "executionMessage": "The analytic service has successfully completed."
   "id": "5d776d88a927cb000104c89c",
   "results": [
      {
         "result": "http://int-vnv.5gtango.eu:8083/ocpu/tmp/x060db1646ea938/files/filter_healthy_metrics.html",
         "type": "html"
      },
      {
         "result": "http://int-vnv.5gtango.eu:8083/ocpu/tmp/x060db1646ea938/files/healthy_metrics.json",
         "type": "json"
      },
      {
         "result": "http://int-vnv.5gtango.eu:8083/ocpu/tmp/x060db1646ea938/files/unhealthy_metrics.json",
         "type": "json"
      }
   ],
   "status": "SUCCESS"
}
```
V&V - Focus on Analytics Engine

Request Analytic Process:
http://int-vnv.5gtango.eu:8085/analytic_service

Fetch Analytic Result
http://int-vnv.5gtango.eu:8085/results/list

```json
{
    "name": "correlogram",
    "vendor": "5gtango.vnv",
    "testr_uuid": "2f05c095-0a42-4bbe-96b0-d40327146020",
    "step": "1s",
    "metrics": ["libvirt_block_stats_read_bytes{resource_id='c40e65f9-c202-408a-bc33-84999d13a237'}",
                 "libvirt_mem_stats_unused{resource_id='c40e65f9-c202-408a-bc33-84999d13a237'}"]
}
```

```json
{
    "analyticServiceName": "correlogram",
    "executionDate": "Wed Sep 11 07:00:51 UTC 2019",
    "executionMessage": "The analytic service has successfully completed.",
    "id": "5d789ba3a927cb000104c8b9",
    "results": [{
        "result": "http://int-vnv.5gtango.eu:8083/ocpu/tmp/x06dbee443f4e8a/files/correlogram.html",
        "type": "html"
    }],
    "status": "SUCCESS"
}
```
V&V - Focus on Analytics Engine

Request Analytic Process:
http://int-vnv.5gtango.eu:8085/analytic_service

```json
{
  "name": "linear_regression",
  "vendor": "5gtango.vnv",
  "testr_uuid": "2f05c095-0a42-4bbe-96b0-d40327146020",
  "step": "1s",
  "metrics": [
    "libvirt_cpu_stats_cpu_time_nanos{resource_id='c40e65f9-c202-408a-bc33-84999d13a237'}",
    "libvirt_mem_stats_mem_util{resource_id='c40e65f9-c202-408a-bc33-84999d13a237'}"
  ]
}
```
Fetch Linear Regression Analytic Result
http://int-vnv.5gtango.eu:8085/results/list

```json
{
    "analyticServiceName": "linear_regression",
    "executionDate": "Wed Sep 11 07:05:59 UTC 2019",
    "executionMessage": "The analytic service has successfully completed.",
    "id": "5d789cd7a927cb000104c8ba",
    "results": [
        {
            "result": "http://int-vnv.5gtango.eu:8083/ocpu/tmp/x063142329e5e6e/files/linear_regression.html",
            "type": "html"
        }
    ],
    "status": "SUCCESS"
}
```
#5 - The future (and a bit of present)
SONATA release 5.0

• Release 5 has been published last week 👏
• Quick hands on guide: https://sonata-nfv.github.io/quickguide
• And the code on GH: https://github.com/sonata-nfv/
What’s next?

• Main features are integrated with OSM
• The V&V Platform and the Analytics Engine support the realisation of tests and the analysis of test results with OSM
• EGM is willing to help and contribute
• Join the community! 😎
5GTANGO on the web

www.5gtango.eu

@5Gtango