The GENESIS of a 5G experimentation Facility

5th Generation End-to-end Network, Experimentation, System Integration, and Showcasing

Dr. Harilaos Koumaras
NCSR Demokritos

5genesis.eu  |  @5genesis_h2020
Project Coordinator:
Dr. Anastasios Kourtis and Dr. Harilaos Koumaras, NCSR Demokritos

Technical Manager:
Prof. Pedro Merino Gomez, Universidad de Málaga and Dr. Dimitris Tsolkas, FOGUS

Innovation Manager:
Dr. Valerio Frascolla, Intel Deutschland GmbH

Standardization Manager:
Dr. David Artunedo Guillen, Telefónica I+D
5GENESIS in numbers

Duration: 42 Months
Partners: 29 Partners
Platforms: 5 platforms and 1 portable demonstrator
Integration Phases: 3 phases
Validation Phase with use cases: 6 Last Months
The 5GENESIS facility is based on an experimentation blueprint, that serves as a common architectural reference.
5GENESIS BluePrint – Top to Bottom Approach

5GENESIS EXPERIMENTER INTERFACE

COORDINATION LAYER
End-to-end platform coordination, experiment lifecycle management, KPI processing

MANAGEMENT & ORCHESTRATION LAYER
Slice Management, NFV & MEC MANO, SDN Controllers, PNF Management

INFRASTRUCTURE LAYER
Compute clusters, VNFs, PNFs, Backhaul/Fronthaul networks, MEC platforms, RANs, UEs
Engagement Options

The experimenter/vertical has two options of performing the experiment:

1. Through the **5GENESIS** GUI/Portal, where the experiment descriptor is generated and sent to the dispatcher.

2. Directly via the **5GENESIS open API**, allowing the experimenter to use the facility with its own scripts.
5GENESIS has built the Open5GENESIS Suite that provides a common API for testing and experimentation of new services by vertical industries. 

his open source suite includes the Release A of the 5GENESIS experimentation tools and components that can be integrated on top of any 5G Platform in order to become an experimentation facility and support 5G trials, following the 5GENESIS experimentation methodology.

https://github.com/5genesis
Meant to serve as a standardized template for bridging vertical-oriented requirements with network configurations, the form includes at least the following interlinked fields:

- Experiment description
- Target metric definition
- Test case description
- Scenario identification
- Slice configurations

### Experiment Formalization

<table>
<thead>
<tr>
<th>Experiment Descriptor</th>
<th>Input Values</th>
<th>Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>#</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Description of the fields to be completed</td>
<td>Experiment ID</td>
</tr>
<tr>
<td></td>
<td>Information required to uniquely identify the experiment. Note 1: A Security Manager is used for editing with safety and privacy data related to the experimenter)</td>
<td>Owner ID</td>
</tr>
<tr>
<td></td>
<td>Note 2: Each experiment shall include all the combinations of the target metrics/test cases/scenarios/slice configurations listed in the following fields of this form. (one target metric linked to one test case, for a specific scenario and a slice configuration is the minimum requirement for a complete experiment).</td>
<td>Organization ID</td>
</tr>
<tr>
<td></td>
<td>List of the Target Metric(s)</td>
<td>Platform ID</td>
</tr>
<tr>
<td>2</td>
<td>Selection of the metrics (identified by IDs) that the experiment targets at. (see the Metric Template)</td>
<td>Metric ID1</td>
</tr>
<tr>
<td></td>
<td>List of Test Case(s) to be executed</td>
<td>Test Case ID1</td>
</tr>
<tr>
<td></td>
<td>Selection of the test cases (identified by IDs) to be used in the experiment. Note: A test case includes KPI-associated Information (KPI definition, measurement methodology, complementary monitoring needed, etc) linked to a metric from the list in the field above. (see the Test Case Template)</td>
<td>Test Case ID2</td>
</tr>
<tr>
<td></td>
<td>List of Scenarios to be considered</td>
<td>Test Case IDi</td>
</tr>
<tr>
<td></td>
<td>Selection of the Scenarios (identified by IDs) for which the test cases (selected in the previous field) will be executed. Note: A scenario includes information related to all the parameters that affect the values of the KPIs to be measured (Network deployment and environment conditions, etc.) (see the Scenario Description Template)</td>
<td>Scenario ID1</td>
</tr>
<tr>
<td></td>
<td>List of Slice Configurations to be established</td>
<td>Scenario ID2</td>
</tr>
<tr>
<td></td>
<td>Definition of the Slice templates (identified by IDs) that are required for the experiment(s). (see the Slice Configuration Template)</td>
<td>Scenario IDi</td>
</tr>
<tr>
<td></td>
<td>List of Traffic Configuration Template</td>
<td>Scenario ID</td>
</tr>
<tr>
<td></td>
<td>(at least one traffic source or service type should be specified)</td>
<td>Traffic sources</td>
</tr>
<tr>
<td></td>
<td>UEs identification</td>
<td>Service Type</td>
</tr>
<tr>
<td></td>
<td>Traffic Description Template</td>
<td>Traffic sources</td>
</tr>
</tbody>
</table>
Open5GENESIS: The all-in-one 5G experimentation suite

GUI Experiment Composer (Portal)

Results Visualization

Experiment Descriptor Validation

Experiment Automation
5GENESIS 5G Infrastructure

5G NR Coverage at the Surrey Platform

Nokia AirScale 5G BBU, b. AirScale Micro 4T4R at the Athens Platform

Amarisoft Callbox 5G NSA/SA Solution

Egaleo Site Cabinets for edge equipment

Huawei 5G SA NR at Berlin Platform

Nokia 5G and 4G micro RRH in Ada Byron building Malaga
mmWave wireless link consisting of two IHP’s 60 GHz devices
5GENESIS Trials and KPI Achievements

**Latency KPI measurements**
- 45 sec
- 102 sec
- ~12.5 msec
- ~10.5 msec
- ~1 msec

**Throughput KPI measurements**
- ~500 Mbps
- ~12.5 msec
- ~10.5 msec
- ~500 Mbps

**Slice creation Time (Central DC and Edge Computing Node)**
- 45 sec
- 102 sec
- ~1 msec

**RTT backhaul via mmWave 60 GHz**
5GENESIS Trials and KPI Achievements
5GENESIS Showcasing trials

Drone Flight with C2 over 5G in Athens
https://www.youtube.com/watch?v=zGQ3sw8gTaE

5G Showcasing activity at the 5GENESIS Malaga Platform with First Responders
https://www.youtube.com/watch?v=9H6OkjX74iw

Festival of Lights Field Trial with the Portable 5GENESIS Deployment
https://www.youtube.com/watch?v=DBSs96DgWf0

5G Integration with Avanti’s HYLAS 2 satellite
Within the framework of ICT-19 the following verticals are already performing experiments on top of 5GENESIS facility:

- **5G!DRONES: Drones Vertical** at Athens 5GENESIS facility
- **5G-VICTORI: Transportation and Media Vertical** at Berlin 5GENESIS facility
- **5G-HEART: Healthcare, transport and aquaculture Verticals** at Surrey 5GENESIS facility.
5G!Drones trials on 5GENESIS Athens platform
Engagement Process of Vertical Industries in 5GENESIS

Each platform owner acts as the single point of contact for the vertical user/experimenter, negotiating the terms of use/SLA as well as the compensation for the human and technical resources, which will be employed for the support of the experiment.

5GENESIS Athens Facility:
  athens@5genesis.eu

5GENESIS Malaga Facility:
  malaga@5genesis.eu

5GENESIS Limassol Facility:
  limassol@5genesis.eu

5GENESIS Berlin Facility:
  berlin@5genesis.eu

5GENESIS Surrey Facility:
  surrey@5genesis.eu
Thank you
Questions?