

A formalization framework of 5G Vertical Experiment Description used in 5G-PPP projects

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5Genesis

The need for a formalization framework

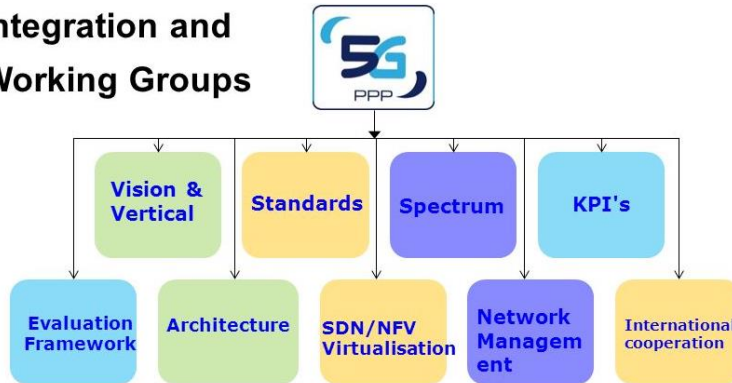
As the experimentation on top of the 5G networks is ongoing, owners of 5G platforms need to selectively expose the network capabilities to experimenters, and allow for configurations, tailored to the needs of the related vertical industries.

- Need for 5G network performance tests
- Need of benchmarking and comparison
- Need of common metrics definitions
- Need of common measurement methodology
- Need of common KPI definition



A formalization framework for 5G Experimentation
addresses all the aforementioned needs

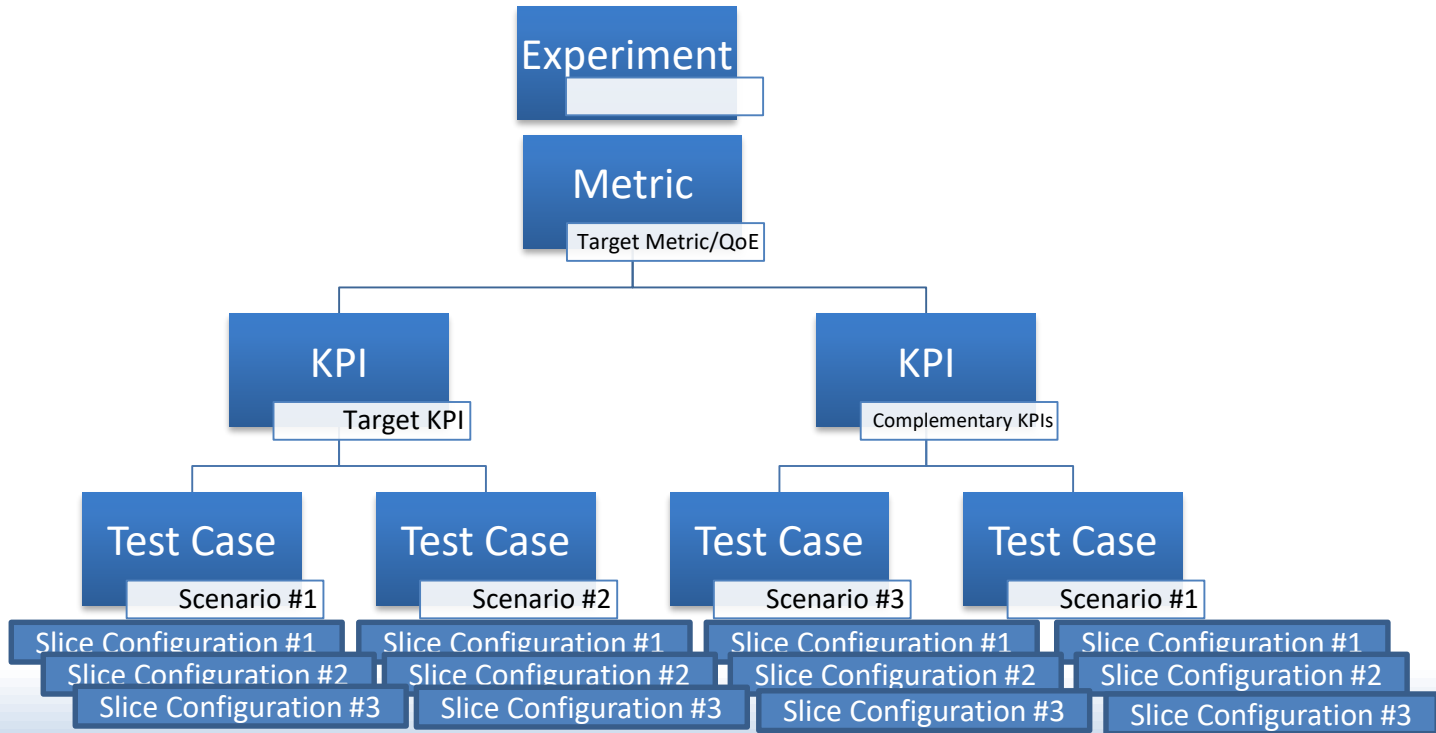
Integration and Working Groups



- An initial response to the formalization request has been provided by the 5GENESIS project, in the framework of the 5GPPP Test Measurement and Validation Working Group (TMV WG), together with the other platforms of 5G VINNI and 5G EVE projects
- The definition of the 5G KPIs is performed within the KPI Working Group (KPI WG) of 5G-PPP, where specific values of the 5G KPIs are defined.

Modular Form and Hierarchical Approach

A modular form has been released, including a formalization of the information needed in order to configure a 5G platform for an experiment.



- ▶ 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 Descriptor

Information required to uniquely identify the experiment. Each experiment shall include combinations of at least the four mandatory fields for the experiment, namely, the target metrics, the test cases, the scenarios, and the slice configuration.

- Description of the experiment
- List of the Target Metric(s)
- List of Test Case(s) to be executed
- List of Scenarios to be considered
- Lists of Slice Configurations to be established
- Background Traffic Patterns

Experiment Descriptor		-ID number-	
1	Description of the fields to be completed Experiment details 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) 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).	Input Values	Mandatory
		Experiment ID	
		Owner ID	
		Organization ID	
2	List of the Target Metric(s) Selection of the metrics (identified by IDs) that the experiment targets at. (see the Metric Template)	Metric ID1	Mandatory
		..	
3	List of Test Case(s) to be executed 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)	Test Case ID1	Mandatory
		Test Case ID2	
		...	
		Test Case IDi	
4	List of Scenarios to be considered 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 measuredNetwork deployment and environment conditions, etc.) (see the Scenario Description Template)	Scenario ID1	Mandatory
		Scenario ID2	
		...	
		Scenario IDi	
5	List of Slice Configurations to be established Definition of the Slice templates (identified by IDs) that are required for the experiment(s). (see the Slice Configuration Template)	Slice Config ID1	Mandatory
		Slice Config ID2	
		...	
		Slice Config IDi	
	Traffic Description Template (at least one traffic source or service type should be specified)	Traffic sources	Optional
		Service Type	Optional
6	Secondary input required for custom experiments	UEs identification	Mandatory (unattended experiments)
		Application under test	Mandatory (unattended experiments)
		Intermediate reporting of KPIs and Time between intermediate reports	Optional

Metric Descriptor

The term metric refers to a generic definition of the target measurement, i.e., a definition independent of the underlying system, the reference protocol layer, or the tool used for the measurement.

- Metric Definition
 - The minimum requirement for a complete experiment, is the definition of one target metric, linked to at least one test case, for a specific scenario and a slice configuration.
 - Defines the way of measurements
 - It does not defined the tool of measurement

Metric Template	-ID number-
#	Description of the fields to be completed
1	Metric Definition Here goes a generic definition of the metric which is independent of the underlying system and the layer we are measuring it

Scenario Description Template

The scenario includes information which is related to network, service and environment configurations and is related to the selected technologies and the target system.

From the performance perspective the scenario quantifies the parameters that affect the values of the KPIs to be measured.

- Description of the fields to be completed
- Radio Access Technology (4G/5G)
- Standalone / Non-Standalone
- Cell Power
-

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Scenario Description Template	-ID number-
#	Description of the fields to be completed
1	Radio access technology 4G,5G
2	Standalone / Non-Standalone (if applicable)
3	Cell Power
4	Frequency band: Sub 6GHz mmWave
5	Maximum bandwidth per component carrier 50 MHz, 100 MHz, 200 MHz, 400 MHz
6	Sub-carrier spacing Sub 6GHz: 15kHz, 30 kHz, 60 kHz mmWave: 60kHz, 120kHz, 240kHz, 480 kHz
7	Number of component carriers Maximum number of CC = 16 (5G) Maximum number of CC = 5 (4G)
8	CP Cyclic Prefix: normal, extended
9	Massive MIMO Number of antennas on NodeB
10	MIMO schemes (codeword and number of layers) The number of codewords per PDSCH assignment per UE <ul style="list-style-type: none"> ○ 1 codeword for 1 to 4-layer transmission ○ 2 codewords for 5 to 8-layer transmission. DL DMRS based spatial multiplexing (SU-MIMO/MU-MIMO) is supported <ul style="list-style-type: none"> ○ At least, the 8 orthogonal DL DMRS ports are supported for SU-MIMO ○ Maximum 12 orthogonal DL DMRS ports are supported for MU-MIMO
11	Modulation schemes Downlink : QPSK, 16 QAM, 64 QAM, 256 QAM Uplink : QPSK, 16 QAM, 64 QAM, 256 QAM
12	Duplex mode FDD, TDD
13	TDD uplink/downlink pattern (if applicable) 0.5 ms, 0.625 ms, 1 ms, 1.25 ms, 2 ms, 2.5ms, 5 ms, 10 ms
14	Contention based random access procedure/contention free (if applicable)
15	User location and speed



Slice Configuration and Traffic Description Template

Slice Configuration Template	-ID number-
#	Description of the fields to be completed
1	Service level configurations Here goes the configuration for the setup of the service (VNFs/PNFs initiation, associated physical machines, initial parameters for the servers, etc.)
2	VNF descriptors Here goes the definition of the VNF, the images, VDUs, networks to be used, etc...
3	Location Here goes the datacenter where the Network service will be deployed
4	Slice Blueprint(s)/Template(s) A complete description of the structure, configuration and the plans/work flows for how to instantiate and control the slice

The list of slice(s) needed for the experiment, including the slice type(s) and the related slice template(s).

Background traffic description, defining traffic sources and service types

Traffic Description Template	-ID number-
#	Description of the fields to be completed
1	Traffic sources Here goes the description of the traffic sources that emulate the traffic from real applications or reproduce background traffic conditions
2	Service Type (optional) Here goes a description of the service provided while the KPI is measured

Opportunity for 5G experimentation...

- European platforms offer an opportunity for 5G experimentation
- Vertical Industries and SMEs are invited to explore the opportunity and test their product and services at 5G experimental facility.
- 5G-PPP Experimental 5G Facilities are open to experimentation requests
 - **5GENESIS** (<https://5g-ppp.eu/5genesis/>)
 - **5G-EVE** (<https://5g-ppp.eu/5g-eve/>)
 - **5G-VINNI** (<https://5g-ppp.eu/5g-vinni/>)



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White Paper

- Validating 5G Technology Performance Assessing 5G architecture and Application Scenarios
- **Download it at <https://urlzs.com/g9ooH>**



Thank you

- Questions?