

# Interoperability Testing Methodology

**CoC on energy management related IOP of ESA**

Brussels, 23 June 2023

# Agenda

- 1. Introduction.** Why a testing methodology linked to the CoC?
- 2. Foundation.** JRC Interoperability Testing Methodology.
- 3. Proposal.** [Trialog](#) & JRC adaptation of the foundation.
- 4. Linking Foundation & Proposal.**
- 5. Conclusions.** Remarks and consultation.

# 1. Introduction

**Why a testing methodology linked to the CoC?**

# Approach



Interconnect project

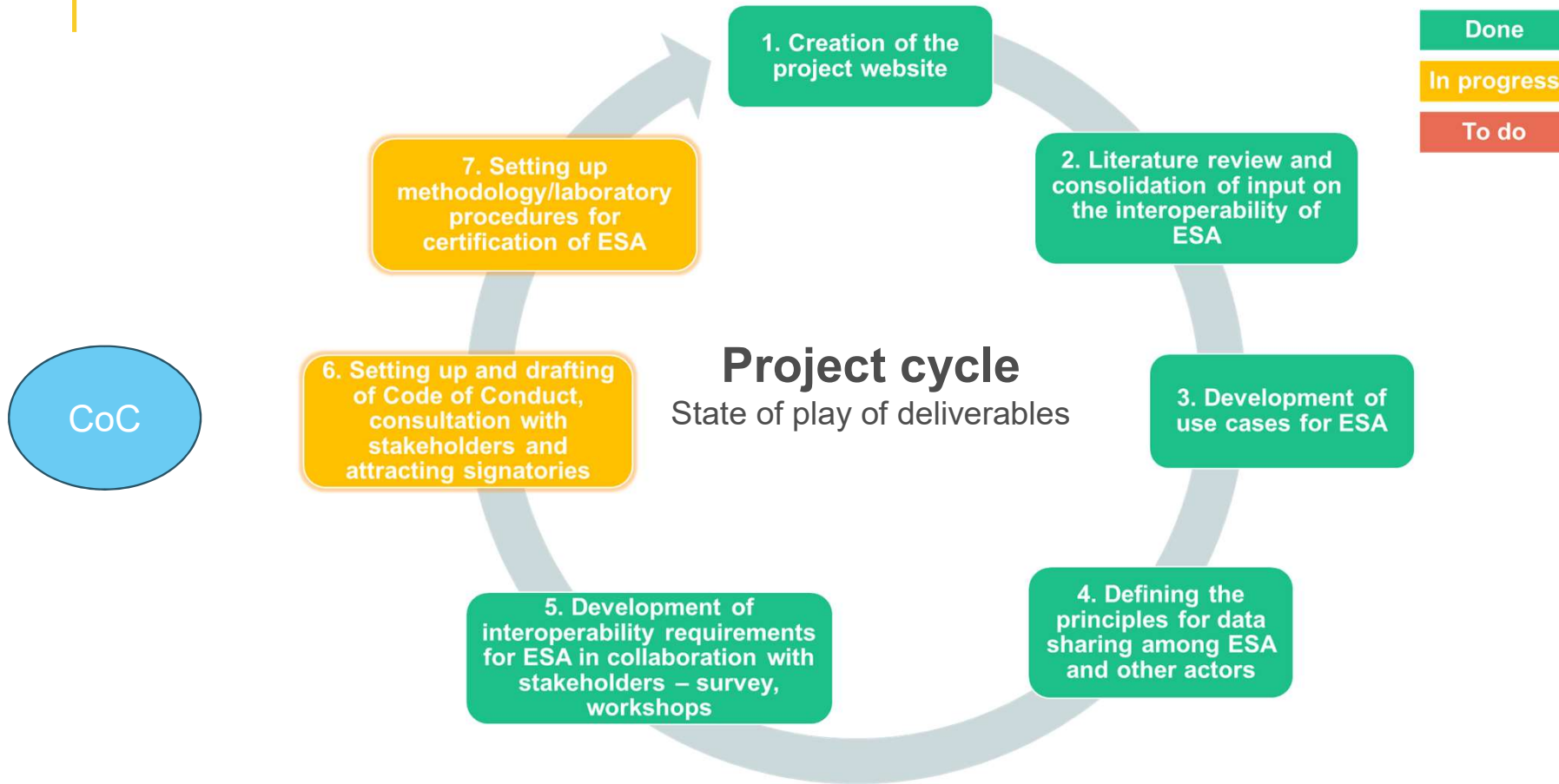


Based on this JRC methodology and on this Interconnect project:  
**A testing approach is proposed to enable information model testing.**

Broad approach:  
JRC's "Smart grid interoperability testing methodology"



# Project track



# Why is a testing methodology needed?



Goal of this project: achieving interoperability



Final version of the CoC published:

Based on SAREF

Use Cases. White goods and HVAC



Implementing and testing

JRC methodology

# Indirect references to methodology in the CoC

## In the introduction:

It is mentioned the annexes which are needed to **comply** with the CoC.

## In the Chapter 4:

(The testing methodology enables to verify some commitments)

### **Commitment e)**

*e) Ensure that all relevant information elements used in the implemented use cases (see point a) as well as in the open protocol (see point b) have a corresponding SAREF representation, fully compliant with the SAREF framework of ontologies according to the technical specification ETSI TS 103 264 (SAREF core) and ETSI TS 103 410 series (SAREF extensions) (see Annex 2).*

### **Commitment i)**

*i) Indicate the compliance with the Code of Conduct when registering new ESA models in the EPREL database. If this compliance is achieved through a dongle attached to the appliance then only the model that includes both appliance and dongle, when placed on the market, can be considered compliant with the Code of Conduct*

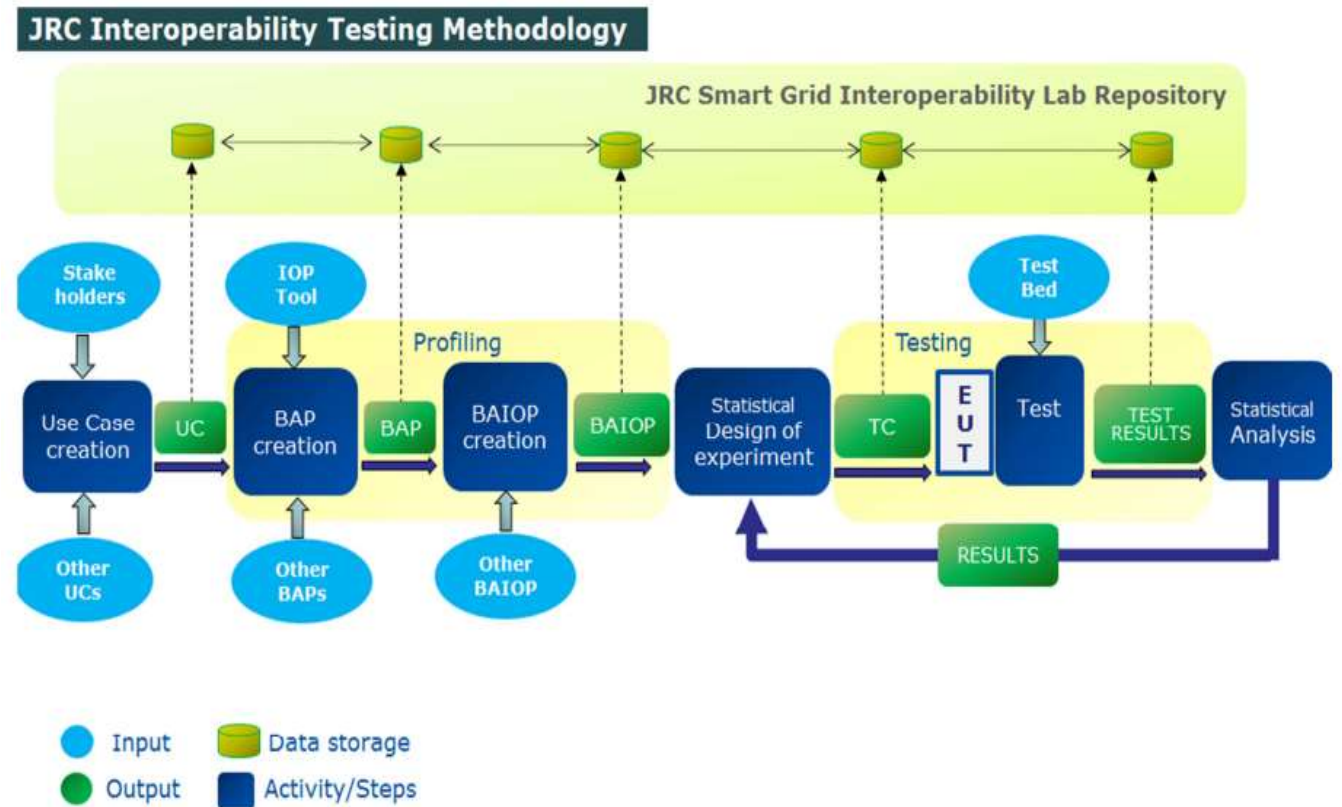
# 2. Foundation

## JRC Interoperability Testing Methodology



# Smart Grid Interoperability testing Methodology

Testing Methodology  
in a glance

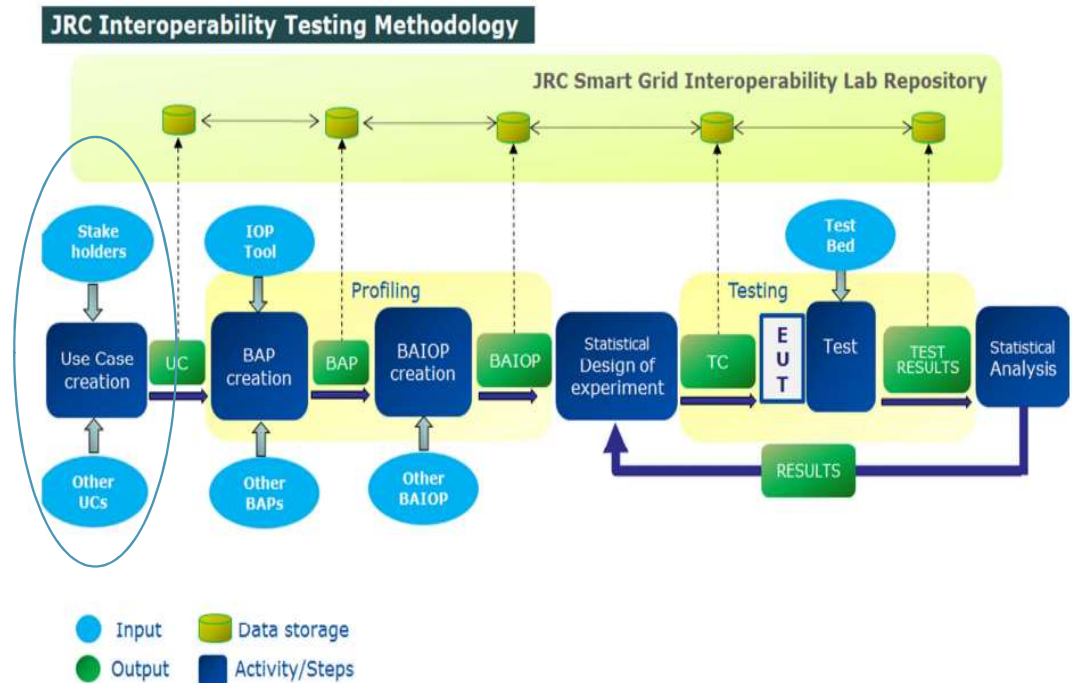


# Smart Grid Interoperability testing Methodology

## 1st step: Define UC

- which actors interact,
- which are the links of interaction;
- which part of the system will be considered as testbed and
- which as Equipment under Test and link under test;

Mapping of Use Case to SGAM



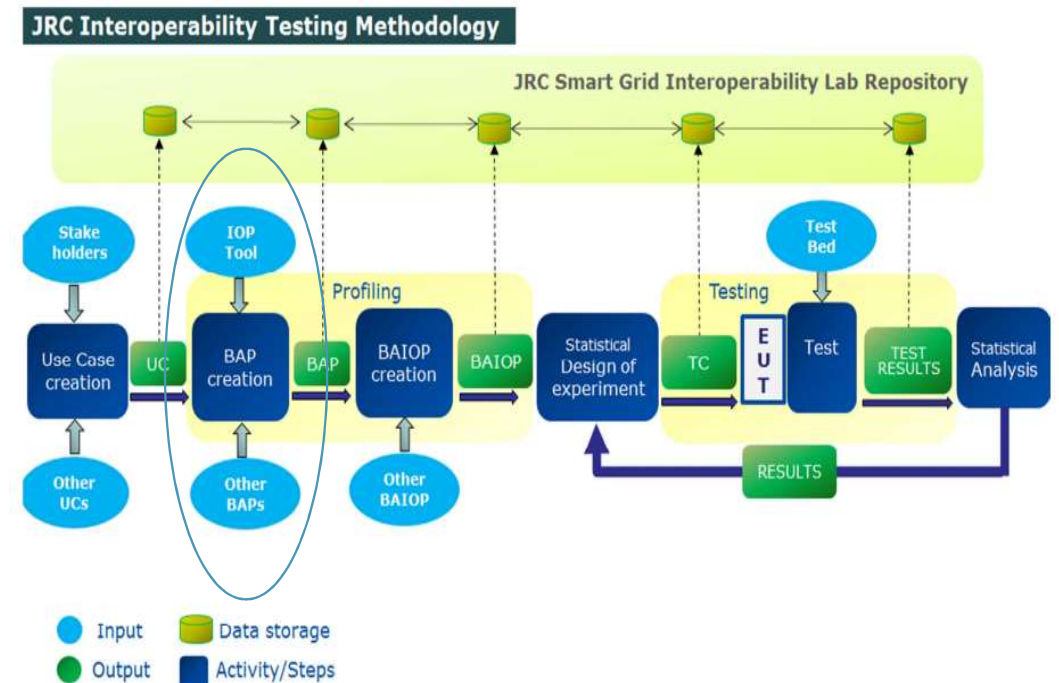
# Smart Grid Interoperability testing Methodology

## 2nd step: BAP creation

- Definition of all possible standards/ options for standards for all links of interest in the test bed and the link under test

**Be aware that this step is generic.**

For a specific Use Case (Protocol, ESA) it will be defined accordingly (simplified).



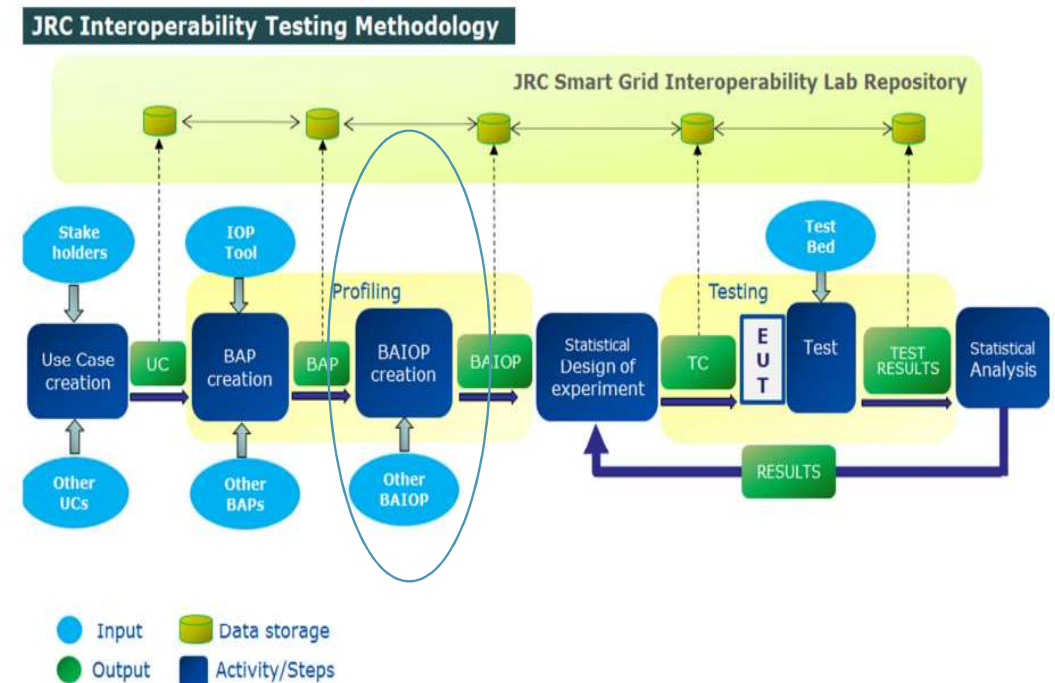
# Smart Grid Interoperability testing Methodology

## 3rd step: BAIOP creation

- The BAIOP describes the test steps; how these are performed and how interoperability is preserved

**Be aware that this step is generic.**

For a specific Use Case (Protocol, ESA) it will be defined accordingly (simplified).



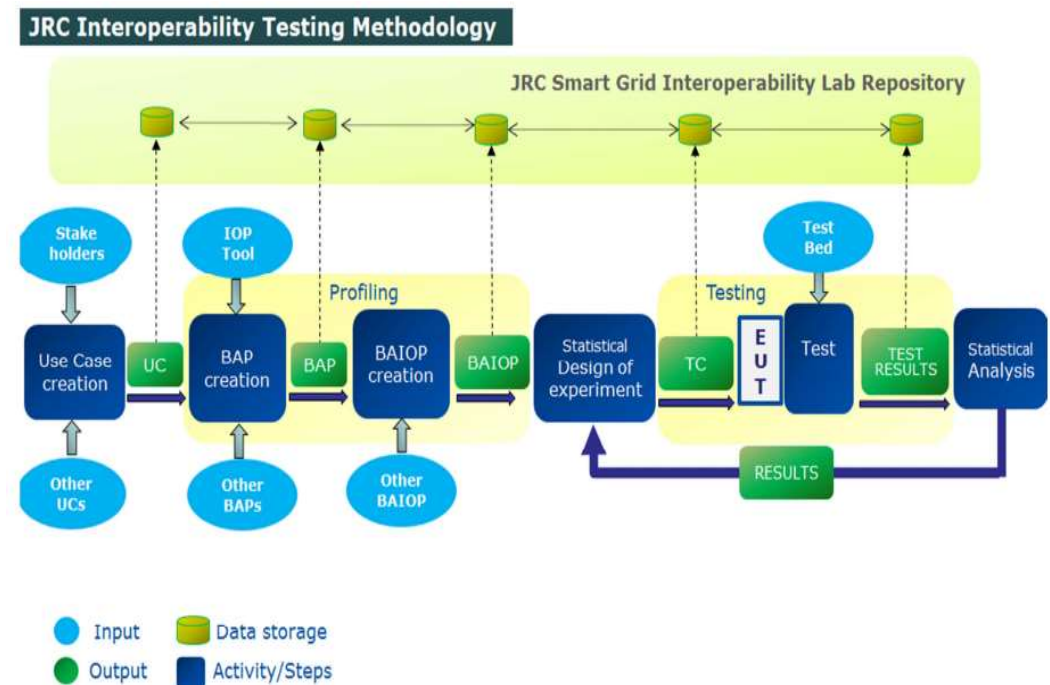
# Smart Grid Interoperability testing Methodology

## 4th step: Statistical Design of the Experiment

One or more parameters are chosen to monitor. When this parameter changes...

- What will happen to the overall functionality of the system?
  - Is interoperability preserved?
- Results are no longer YES/ NO => YES, under what conditions?

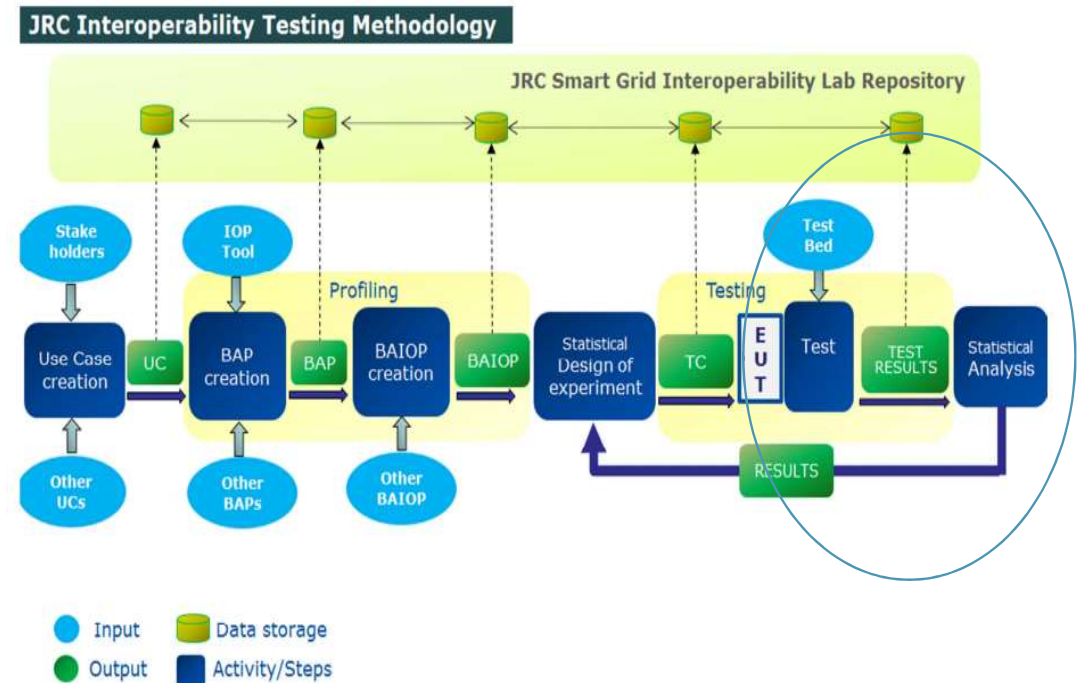
- Statistical analysis is optional



# Smart Grid Interoperability testing Methodology

## 5th step: Testing and Statistical Analysis

- The tests and the (optional) statistical analysis are performed; if needed, the range of parameters examined is changed (or the parameters themselves)





# Smart Grid Interoperability Methodology for testing – applied for the CoC

## Considerations:

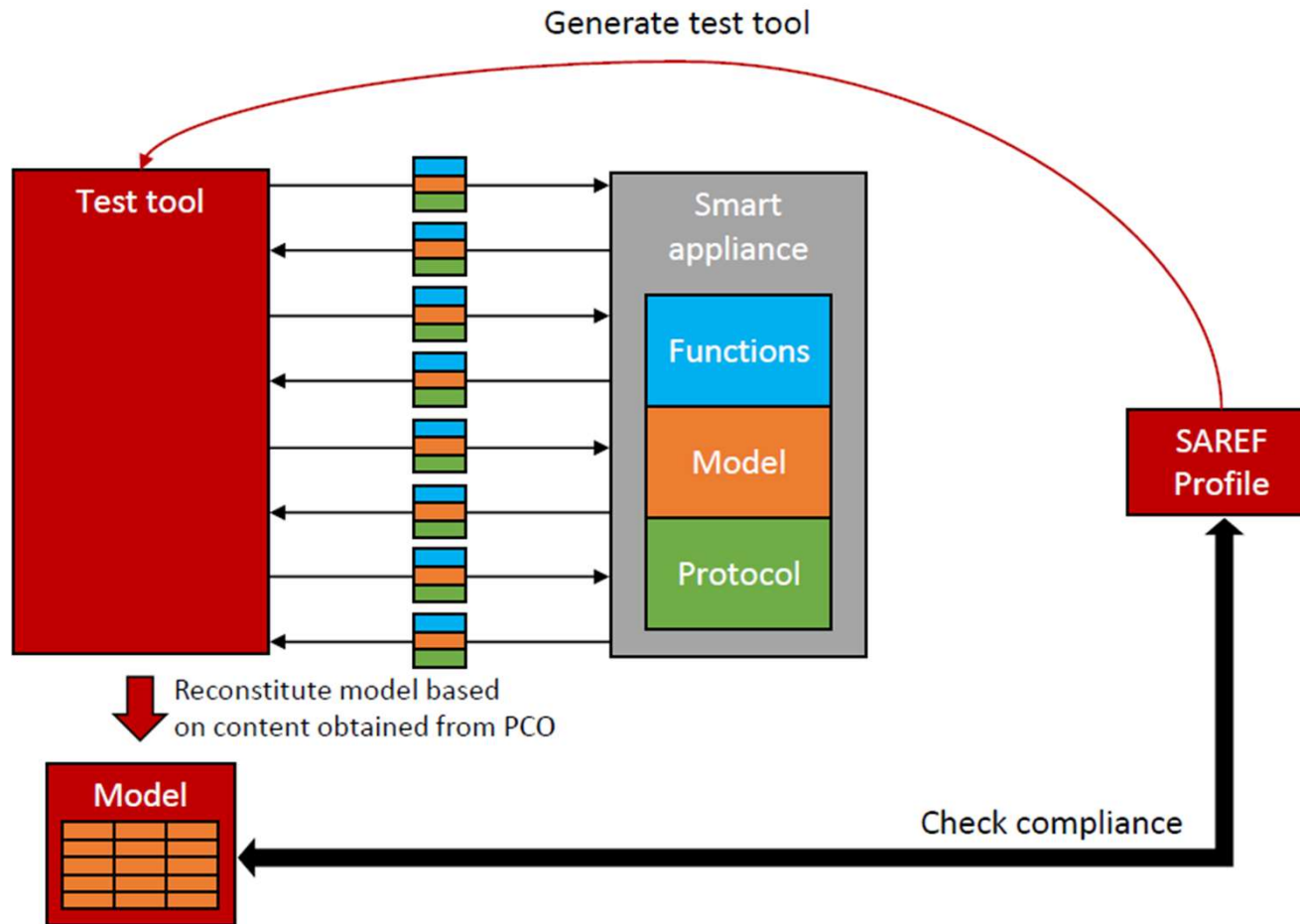
- 1. Use Case description, actors involved:**  
The ESA and the EMS that exchange messages.
- 2. Interoperability layers of SGAM that are of our interest:**  
Information Layer.
- 3. The communication layer is out of the scope.**  
Assumption: interoperability is preserved for the communication layer, regardless of the communication protocol used.

# 3. Proposal

**Trialog** & JRC adaptation of the foundation



# How to check ESA compliance?



# Four Phases

① Reference specifications

② Reference for implementation (profile)

③ Implementation

④ Tests execution and compliance check



# 2nd – Reference for implementation (Profile)

## Reference for implementation (profile)

Profile based on a standard

Defines UC implementation by devices: SAREF4ENER subset, messages, data objects, ...

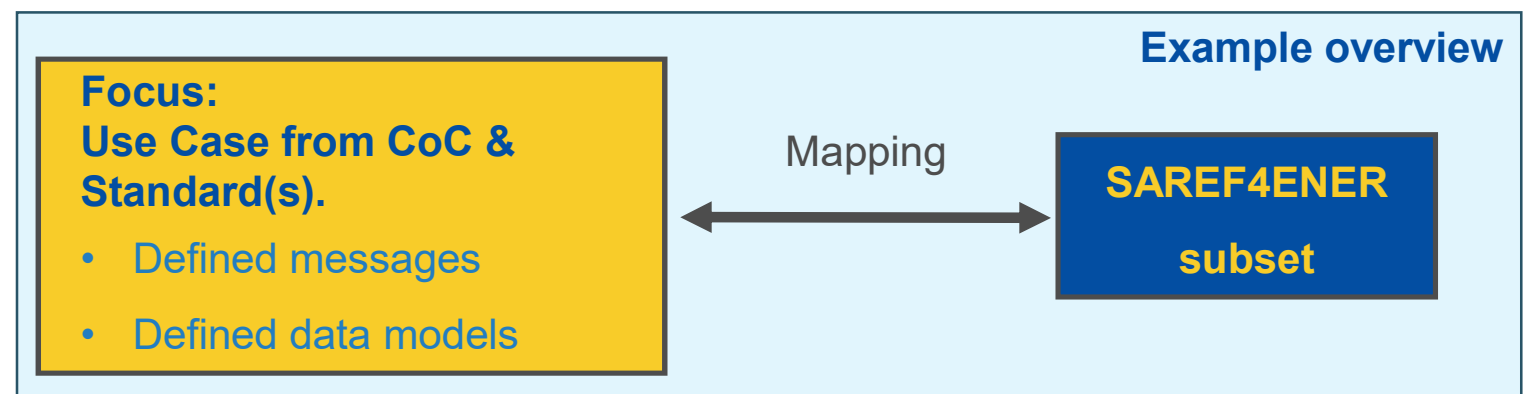
2

## A profile defines :

- an agreed subset of SAREF4ENER to be used.
- an agreed selection of standard(s) & its(their) mapping to SAREF4ENER subset.

## A profile enables implementation of 1st step (Reference specifications)

This step is performed several times  
Several profiles are possible



# 3<sup>rd</sup> – Implementation

## Implementation

Smart  
Appliance

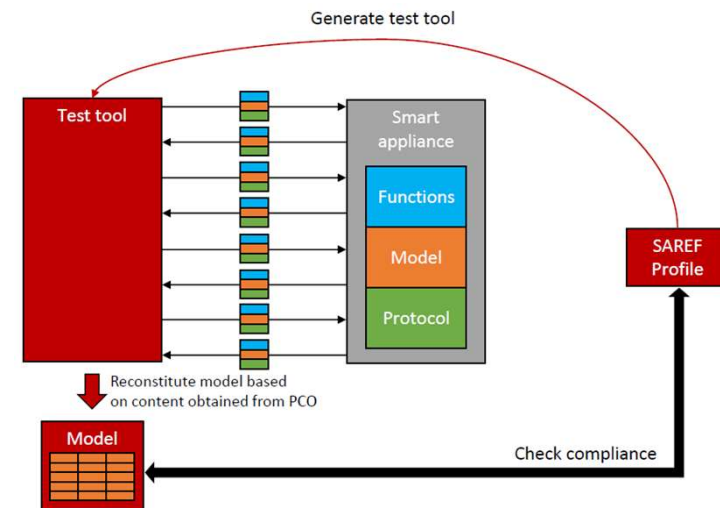
Smart Appliance is implemented based on the Reference for implementation

Test tool

Test tool knows how to access the data based on the Reference for implementation  
⇒ Generated test tool

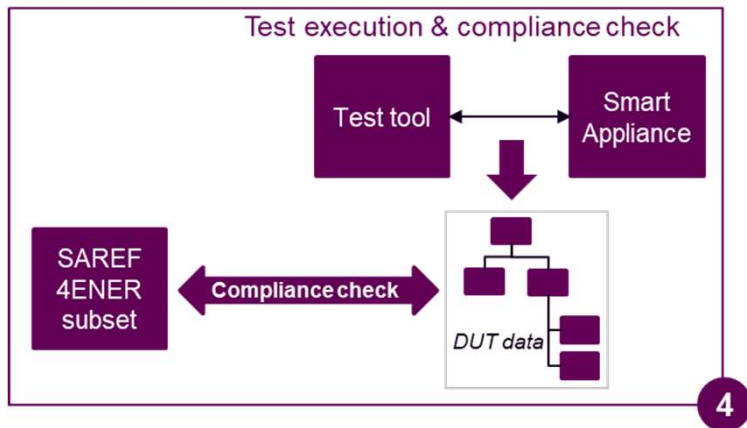
3

This step is performed for each profile by the ESA Manufacturer



- An ESA is implemented based on step 2: Profile (Reference for implementation)
- A test tool could be implemented based on this Profile.
- The focus of this test is on the results: the information of the **replied messages** got after a requirement

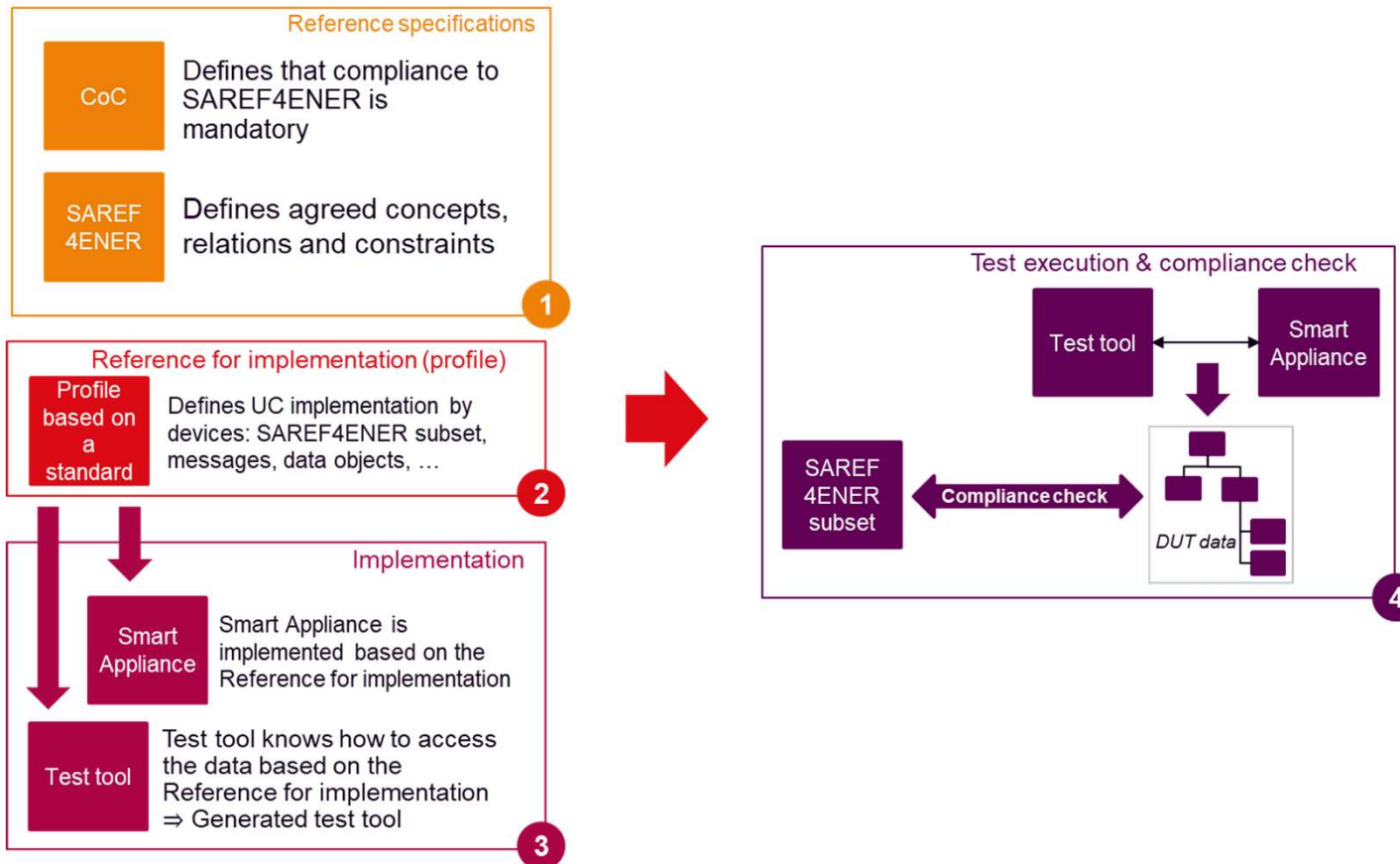
# 4<sup>th</sup> – Test execution and compliance check



Compliance is checked each time

- **Use the test tool** (3rd phase) to **check compliance of ESA** (3rd phase) with **SAREF4ENER subset / profile** (2nd phase).
- **Check the compliance to SAREF4ENER rules and constraints:**
  - ✓ Are the relations compliant?
  - ✓ Are the mandatory properties present
  - ✓ Are the values within range?
  - ✓ ...

# Overview of all four phases



# 4. Linking Foundation & Proposal

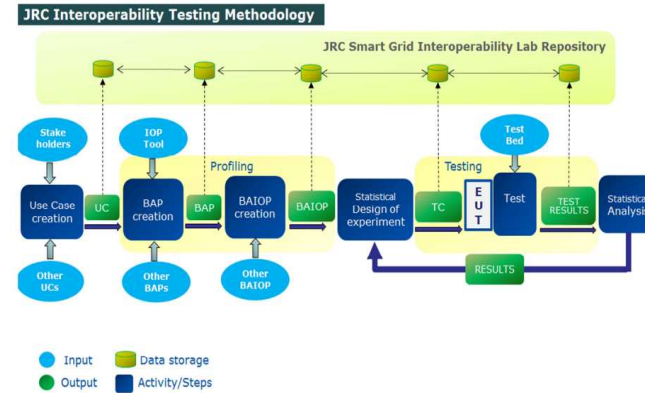
Using the JRC's methodology for the Code of Conduct



# Linking Foundation and Proposal

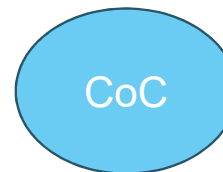
## FOUNDATION

JRC's "Smart grid interoperability testing methodology"



## PROPOSAL

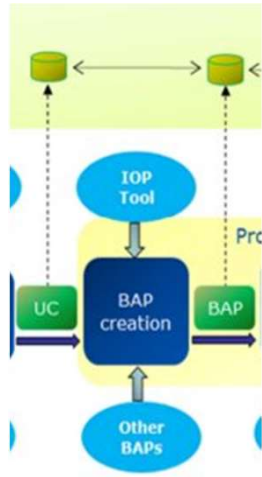
CoC and adaptation in 4 phases



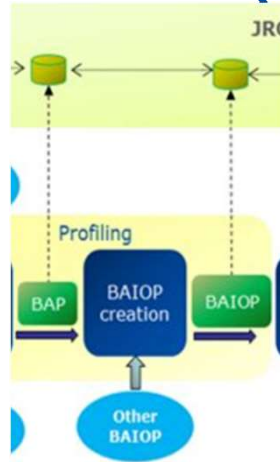
# Linking Foundation and Proposal



UC is established in our CoC

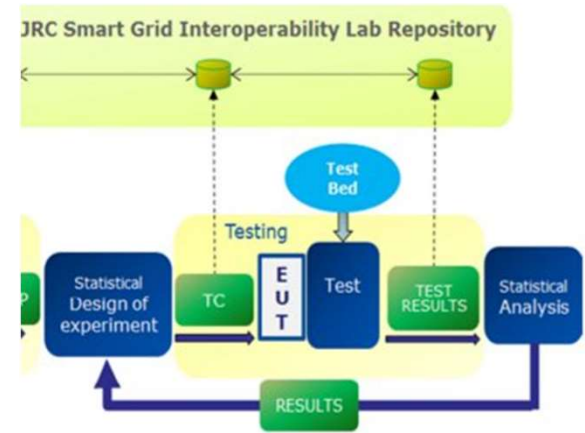


The manufacturer chooses a protocol



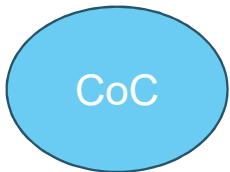
- SAREF4ENER is chosen for our CoC
- Mapping of data models of the selected standard to the subset of SAREF4ENER
- A test tool is implemented

- ① Reference specifications
- ② Reference for implementation (profile)
- ③ Implementation



Tests are executed

④ Tests execution and compliance check



# 5. Conclusions

## Remarks and consultation

# Conclusion



The signatories of CoC need a precise interoperability testing methodology to guarantee their compliance



This methodology is based on the JRC's testing methodology



A novel tool is proposed to verify interoperability between devices from different manufacturers.



The centrepiece to develop this tool is stakeholders' contributions

# Thank you



## The project








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# Thank you and keep in touch



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