



# Smart Home's key: Interoperability of Energy Smart Appliances

Towards a Code of Conduct

*Foretić H., Tarramera Gisbert, A.*

27 September 2022

# Agenda

- Introduction - DG Joint Research Centre (JRC)
- Smart Grid Interoperability Laboratory (SGILab)
- European smart grid interoperability testing methodology
- Code of Conduct for interoperability of Energy Smart Appliances
- Energy smart appliances and interoperable systems:  
Why everyone should be involved?

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# Joint Research Centre



The European Commission's (EC) Directorate-General

## Our mission

As the science and knowledge service of the EC, our mission is to support EU policies with independent evidence throughout the whole policy cycle.

# JRC sites

Headquarters in **Brussels**  
and research facilities located  
in **5 Member States**:

- Belgium (Geel)
- Germany (Karlsruhe)
- Italy (Ispra)
- The Netherlands (Petten)
- Spain (Seville)



# JRC role

- **Independent** of private, commercial or national interests
- **Policy neutral**: has no policy agenda of its own
- Works with more than **30 EC policy departments**



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# What is (Smart Grid) Interoperability?

- The ability of a **(Smart Grid) component or application** to:
  - **integrate** in a system,
  - **exchange** meaningful information,
  - **understand** that information and
  - **perform** desired functions,
  - **maintain** the quality of service.
- It is ensuring that equipment is **replaceable** and **interchangeable** as needs change and technologies develop.





# Smart Grid Interoperability Laboratory (SGILab)

JRC's contribution to the Digitalisation of Energy



Petten (NL)



Ispra (IT)

# Main objective of the SGI Lab Petten

Promote the interoperability of digital energy systems in the interface between **smart homes** and smart grids.



# Scope of the SGLab

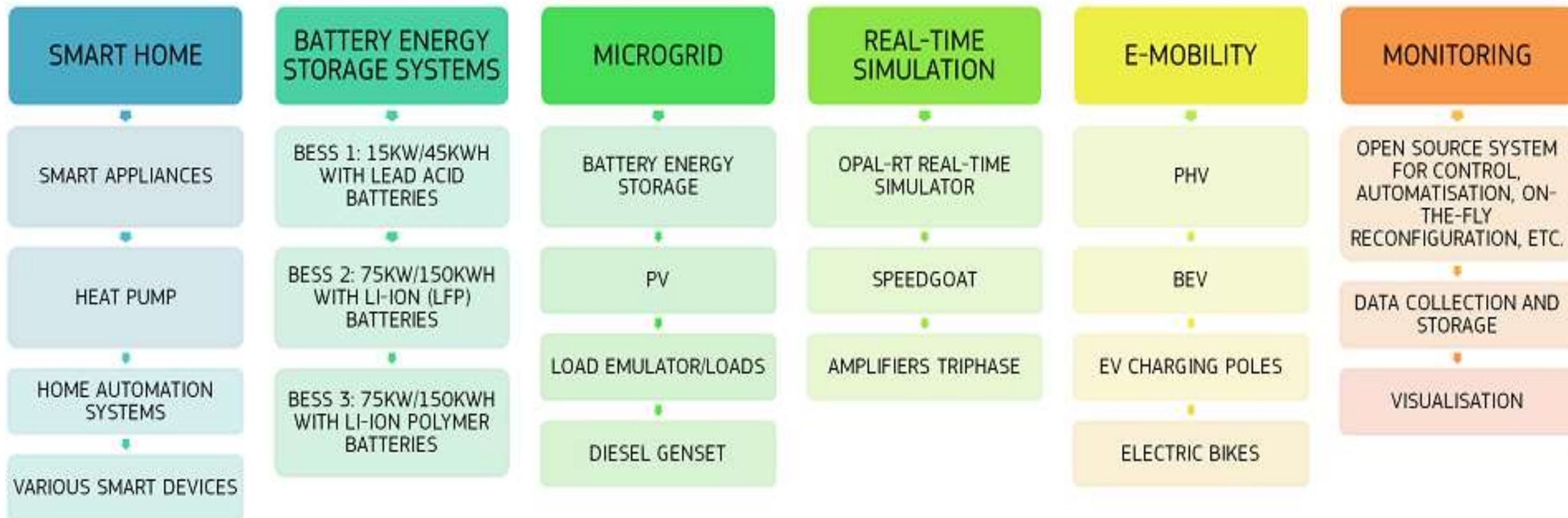
- **Test the Interoperability (IoP) of solutions**  
coming from e.g. industry, market, research projects, etc.
- **Promote a common European IoP testing methodology**  
based on the CEN-CENELEC-ETSI framework
- **Become a knowledge hub**  
by disseminating processes and results of testing campaigns
- **Network with European industrial actors**  
as well as other laboratories and research centres



# SGILab inventory



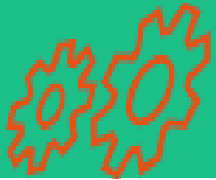
# SGILab inventory



# Who can benefit from SGI Lab activities?



**Consumers**



**Manufacturers**



**Operators**



**Standardisation bodies**

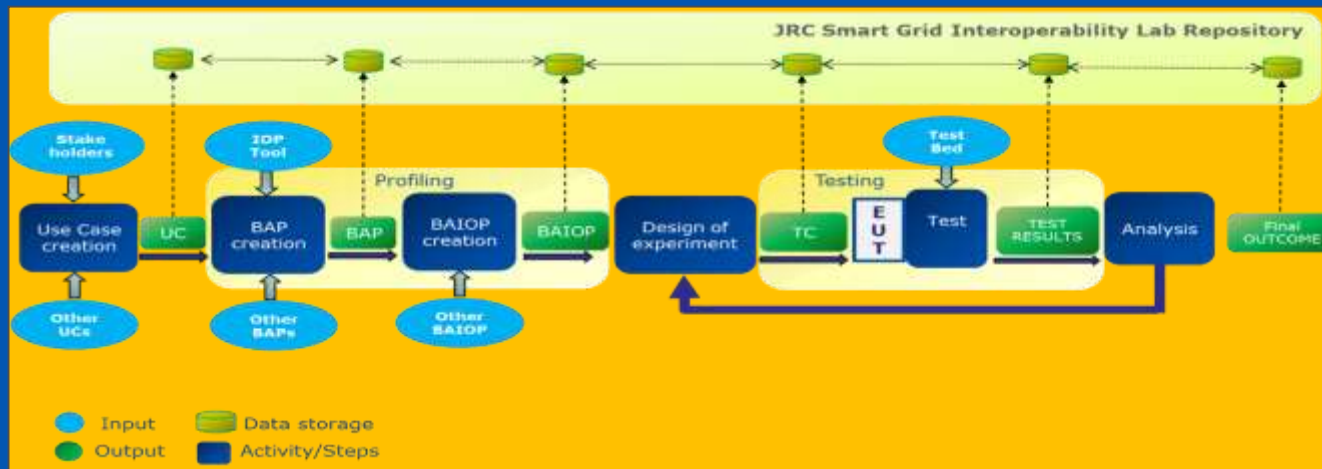
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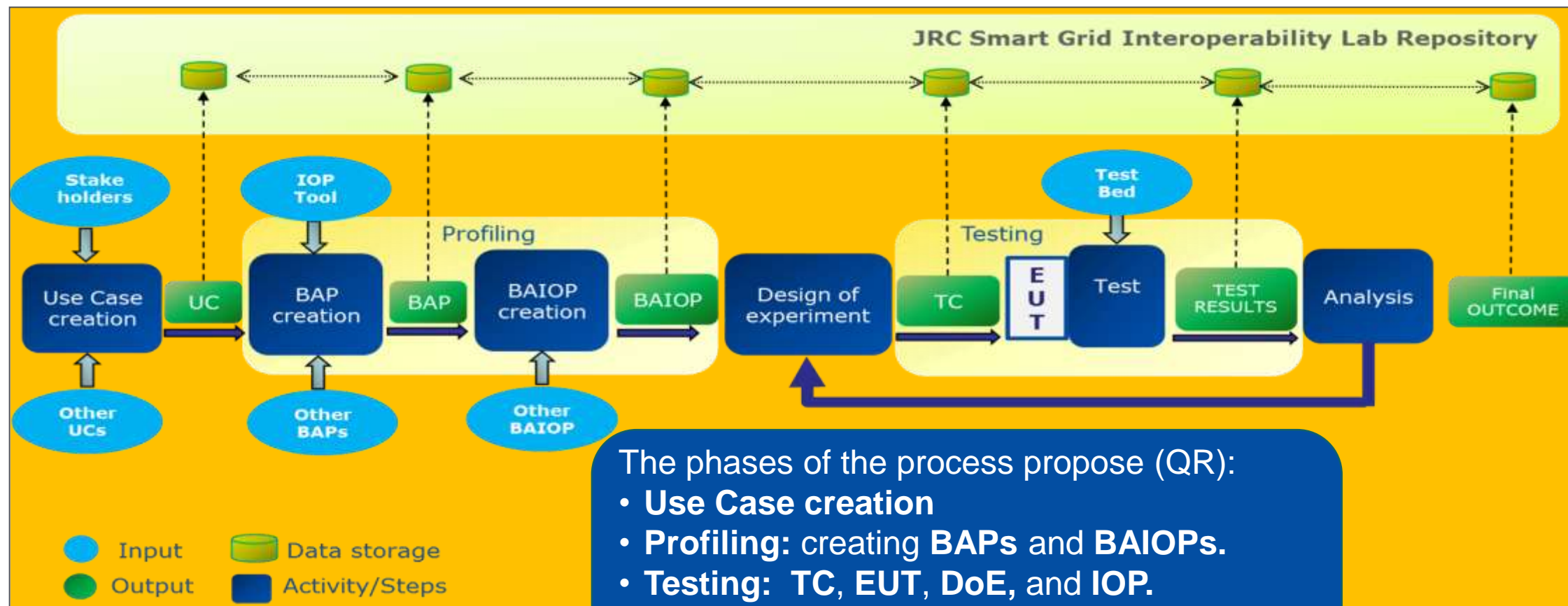
# European smart grid interoperability testing methodology

We proposed, designed and disseminated the first complete and actionable **European smart grid interoperability testing methodology** for digital energy and smart homes.





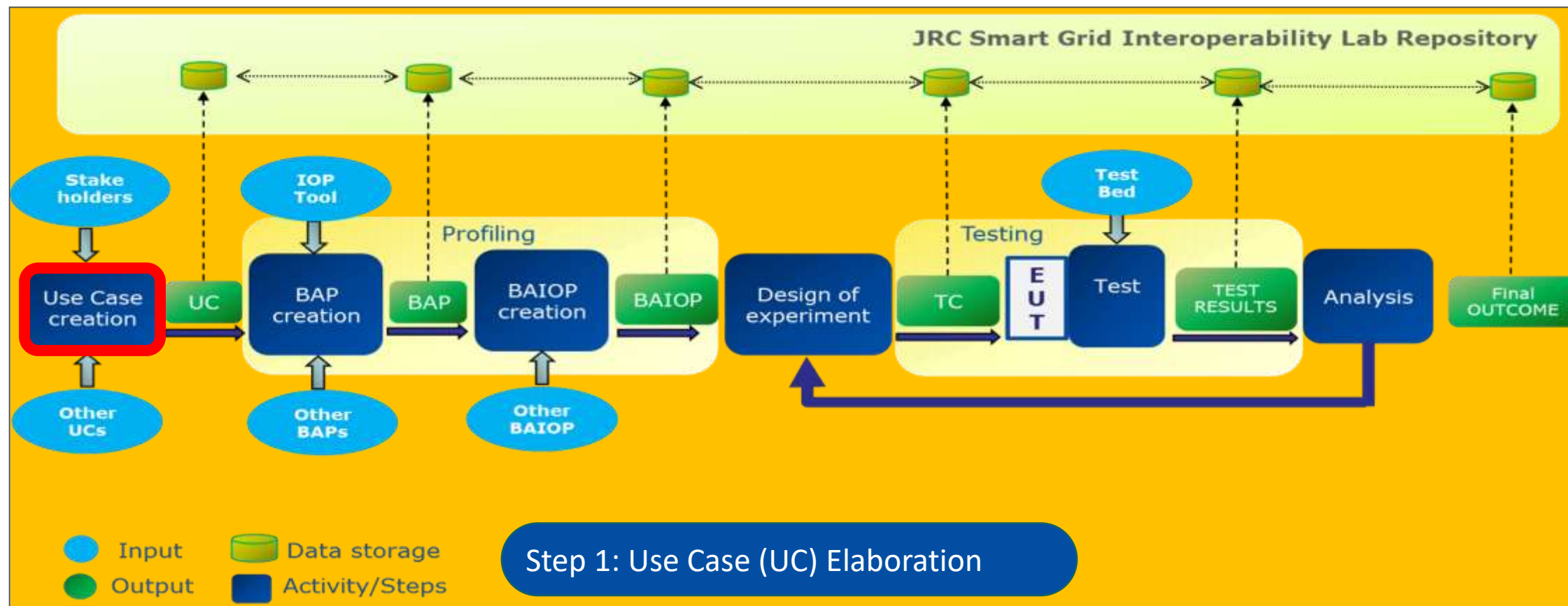
# European smart grid interoperability testing methodology



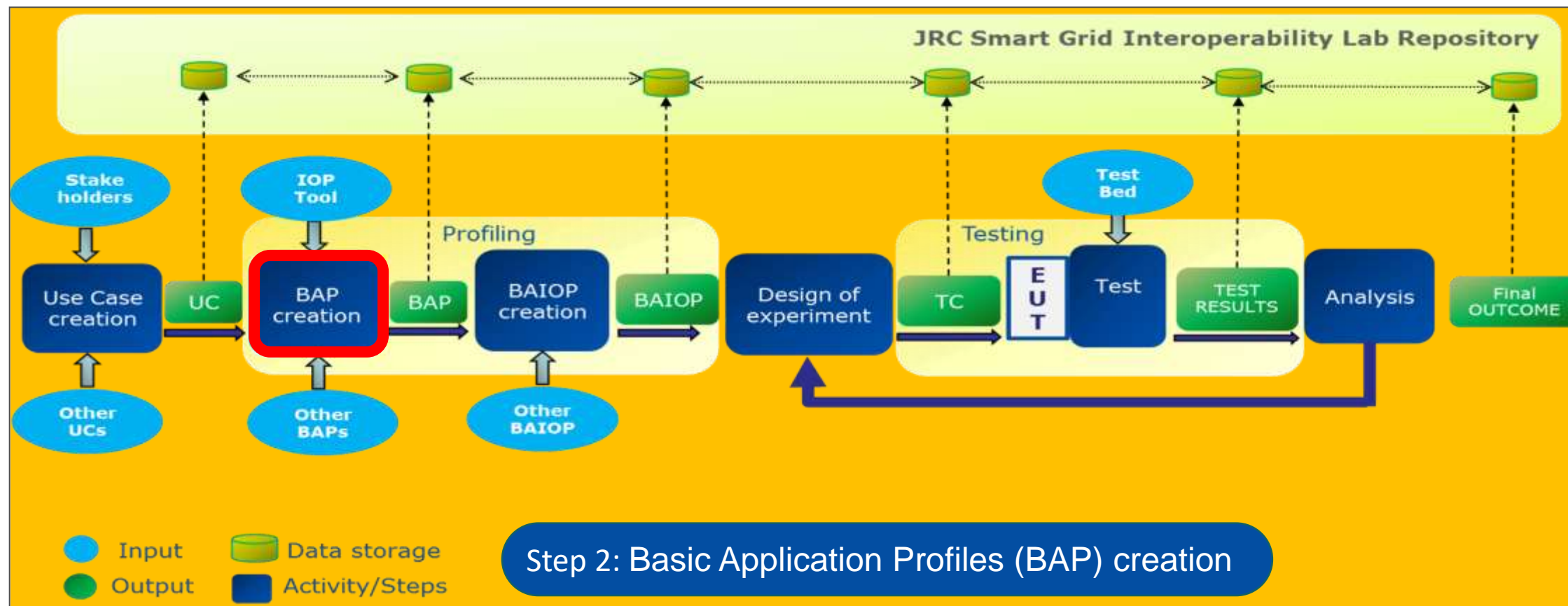
The phases of the process propose (QR):

- **Use Case creation**
- **Profiling:** creating BAPs and BAIOPs.
- **Testing:** TC, EUT, DoE, and IOP.
- **Analyzing:** results – possible feedback to testing phase for further exploring

# European smart grid interoperability testing methodology (STEP 1/6)

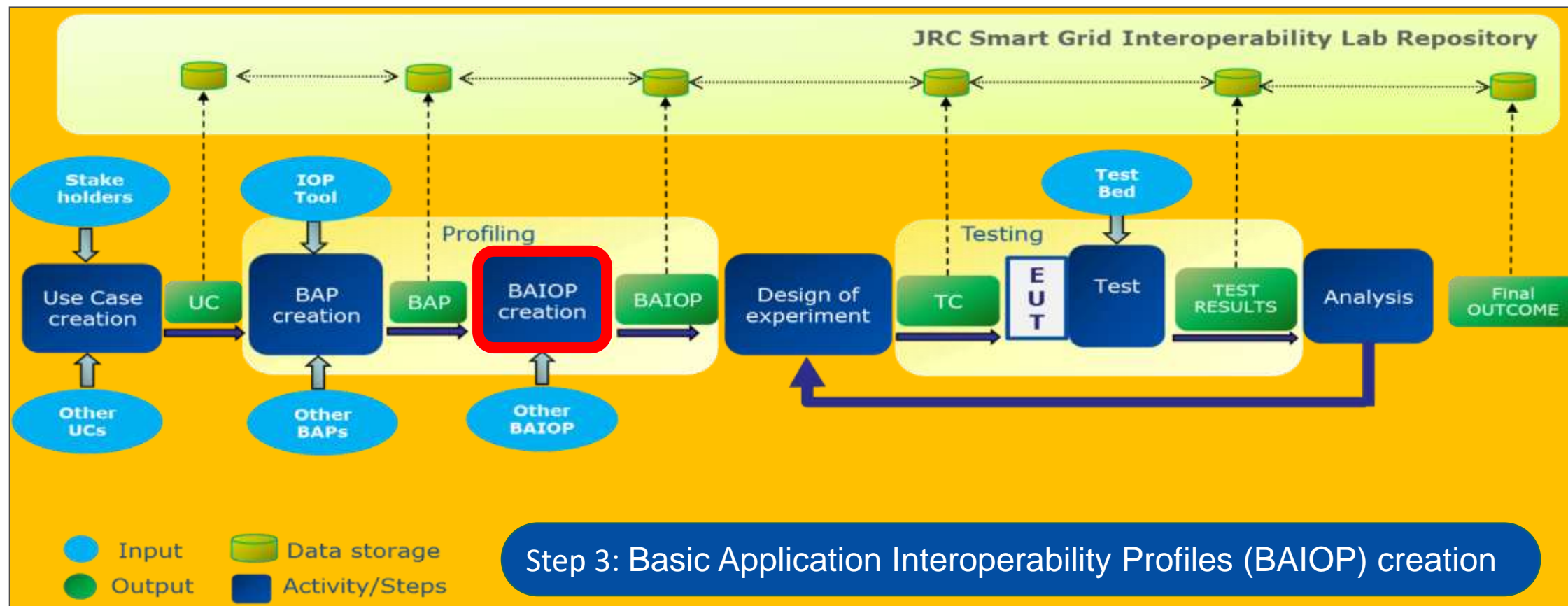


# European smart grid interoperability testing methodology (STEP 2/6)

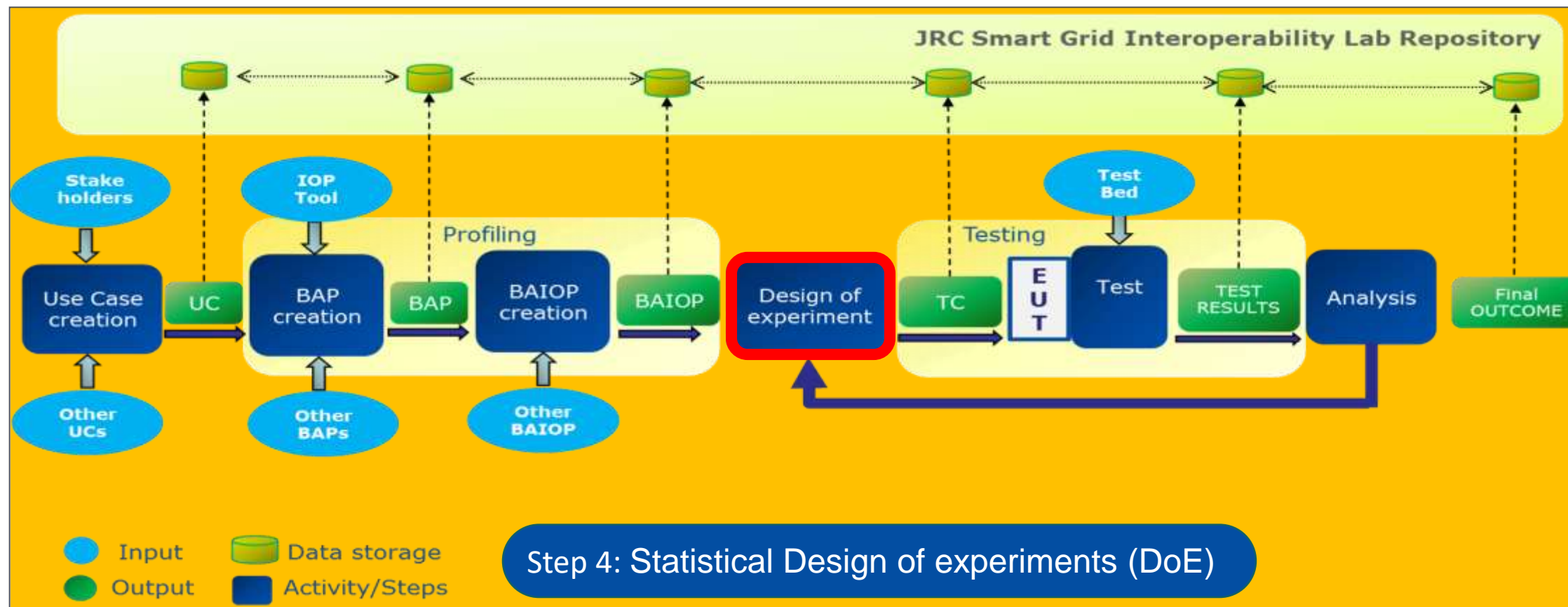




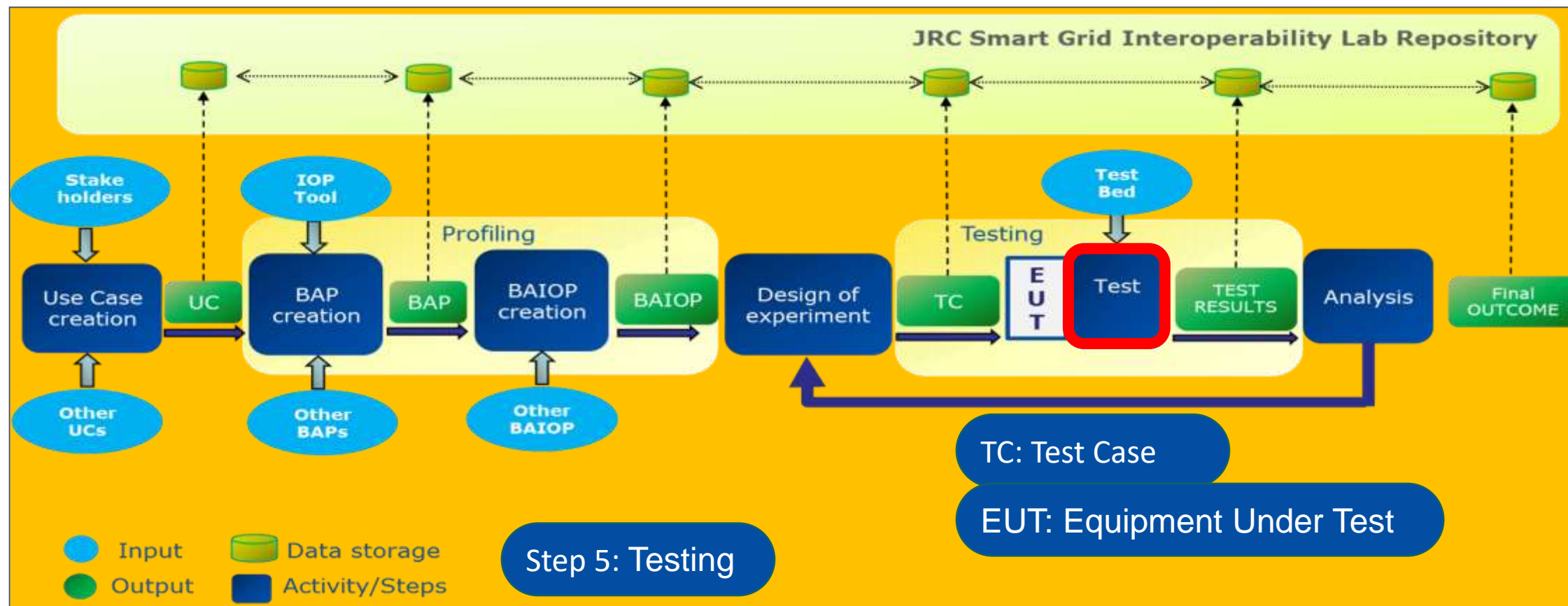
# European smart grid interoperability testing methodology (STEP 3/6)



# European smart grid interoperability testing methodology (STEP 4/6)

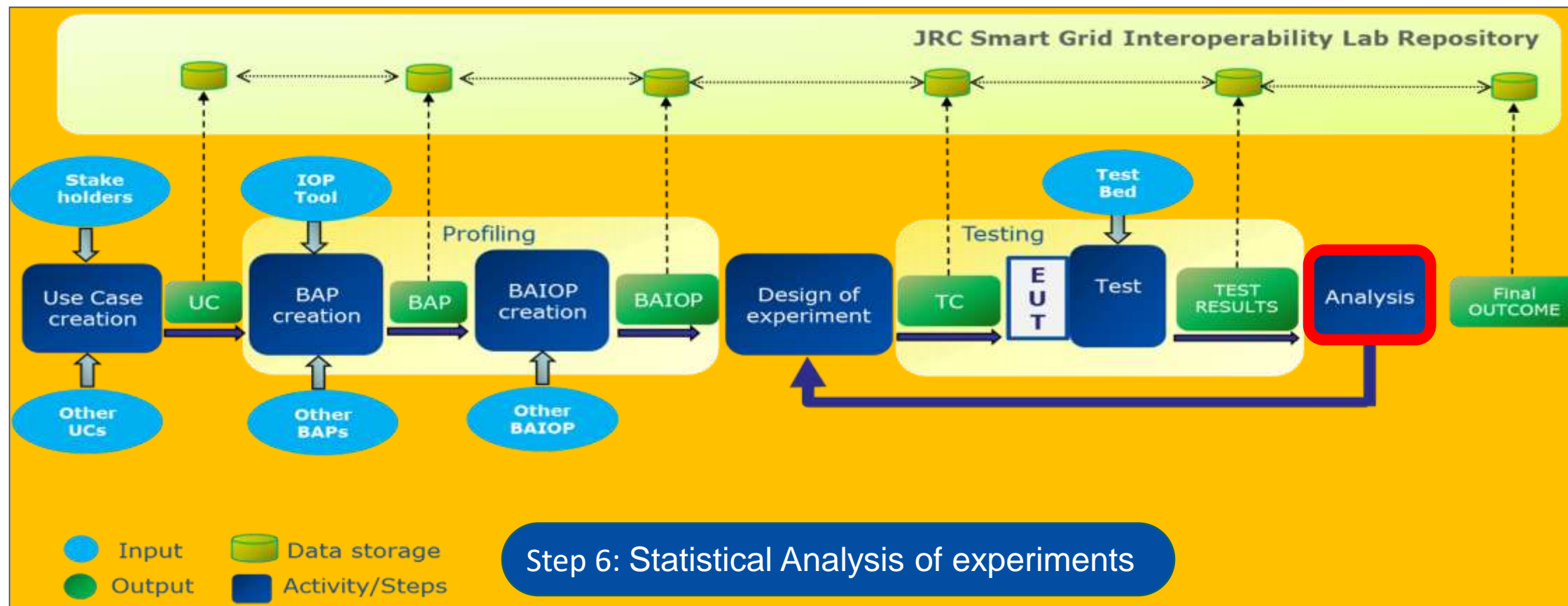


# European smart grid interoperability testing methodology (STEP 5/6)

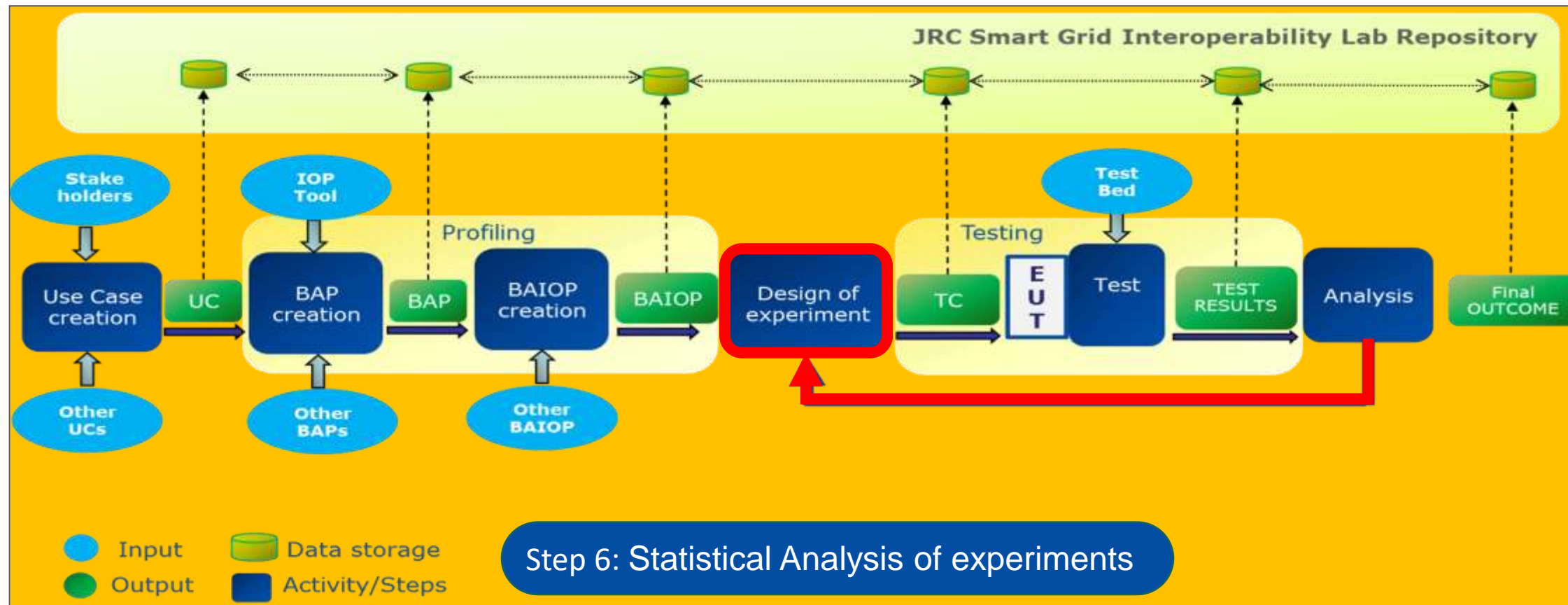




# European smart grid interoperability testing methodology (STEP 6/6)

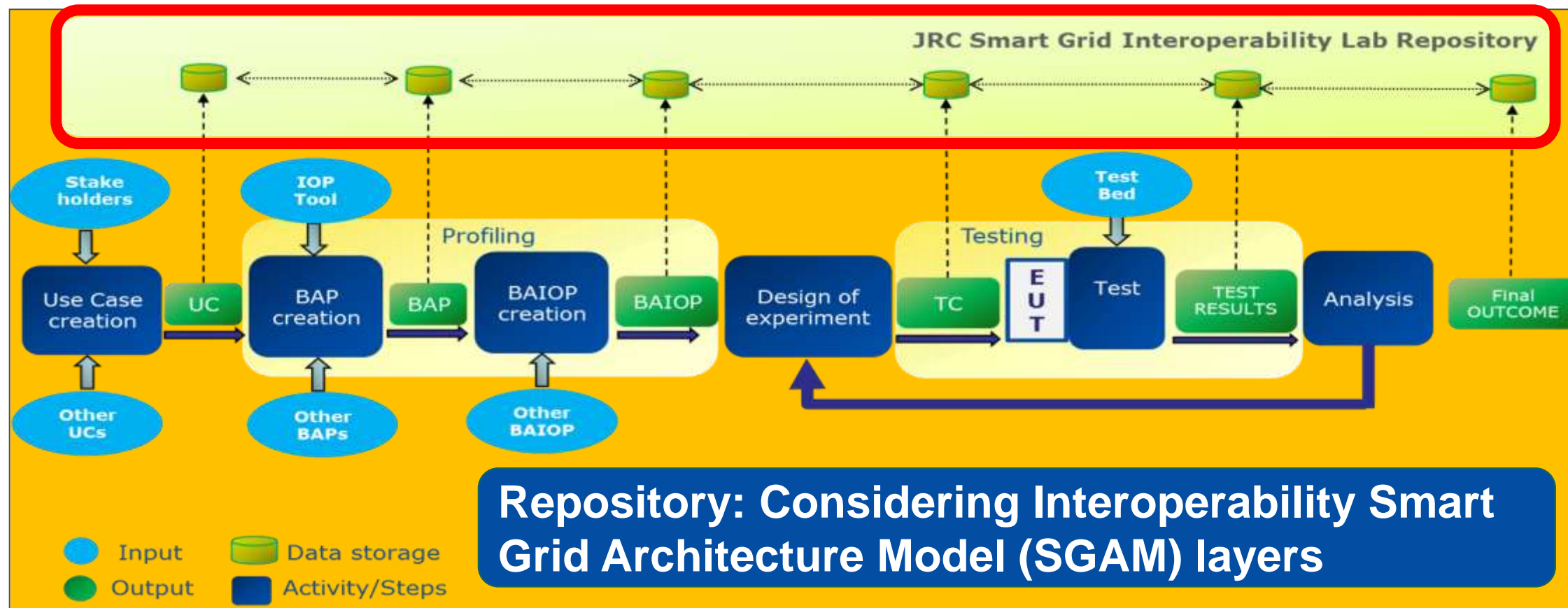


# European smart grid interoperability testing methodology (STEP 6/6)





# European smart grid interoperability testing methodology



# Smart Grid Design of Interoperability Tests (SG-DoIT)

Interoperability Smart Grid

Architecture Model

(SGAM) layers

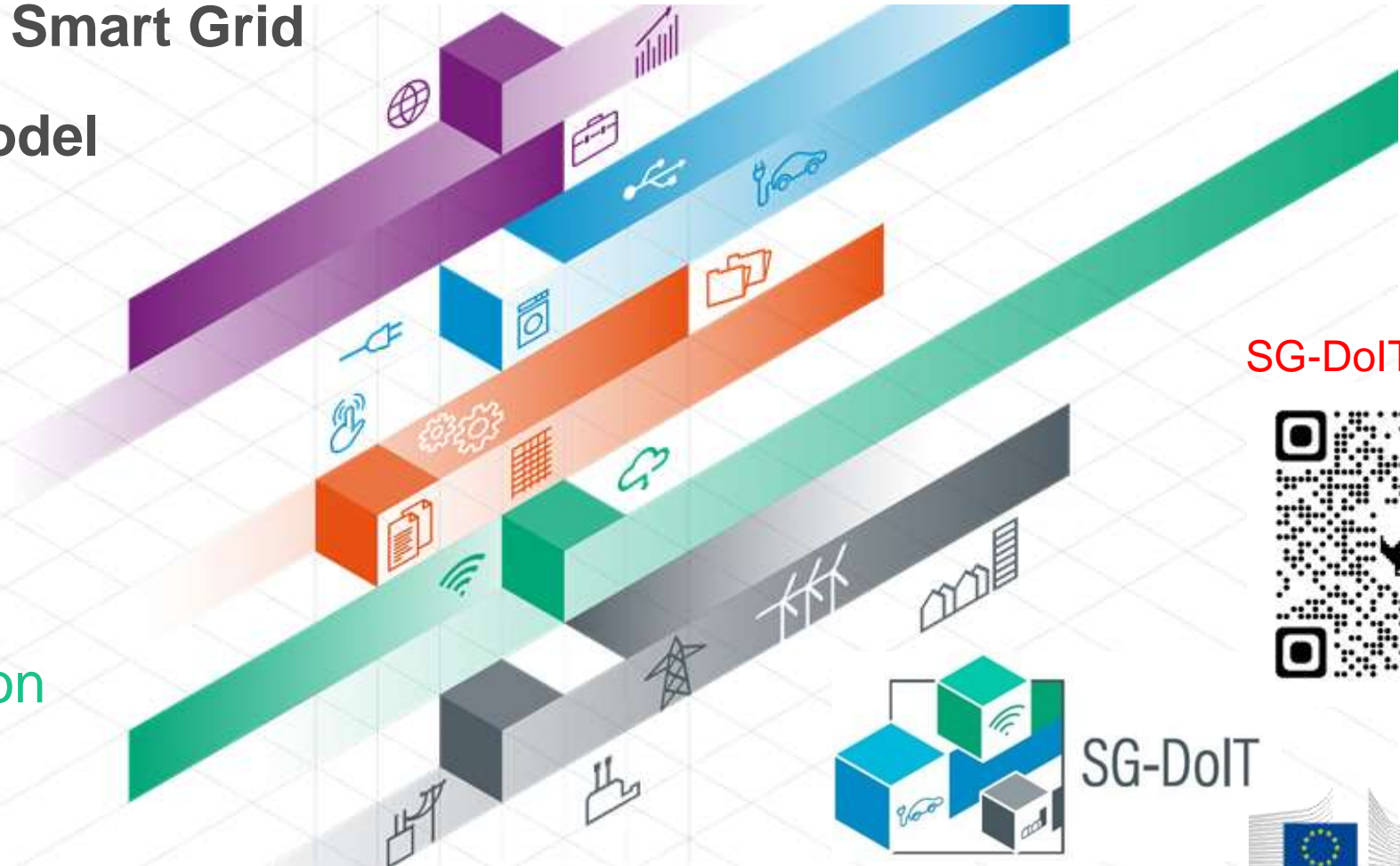
Business

Function

Information

Communication

Component



SG-DoIT website



SG-DoIT

# Agenda

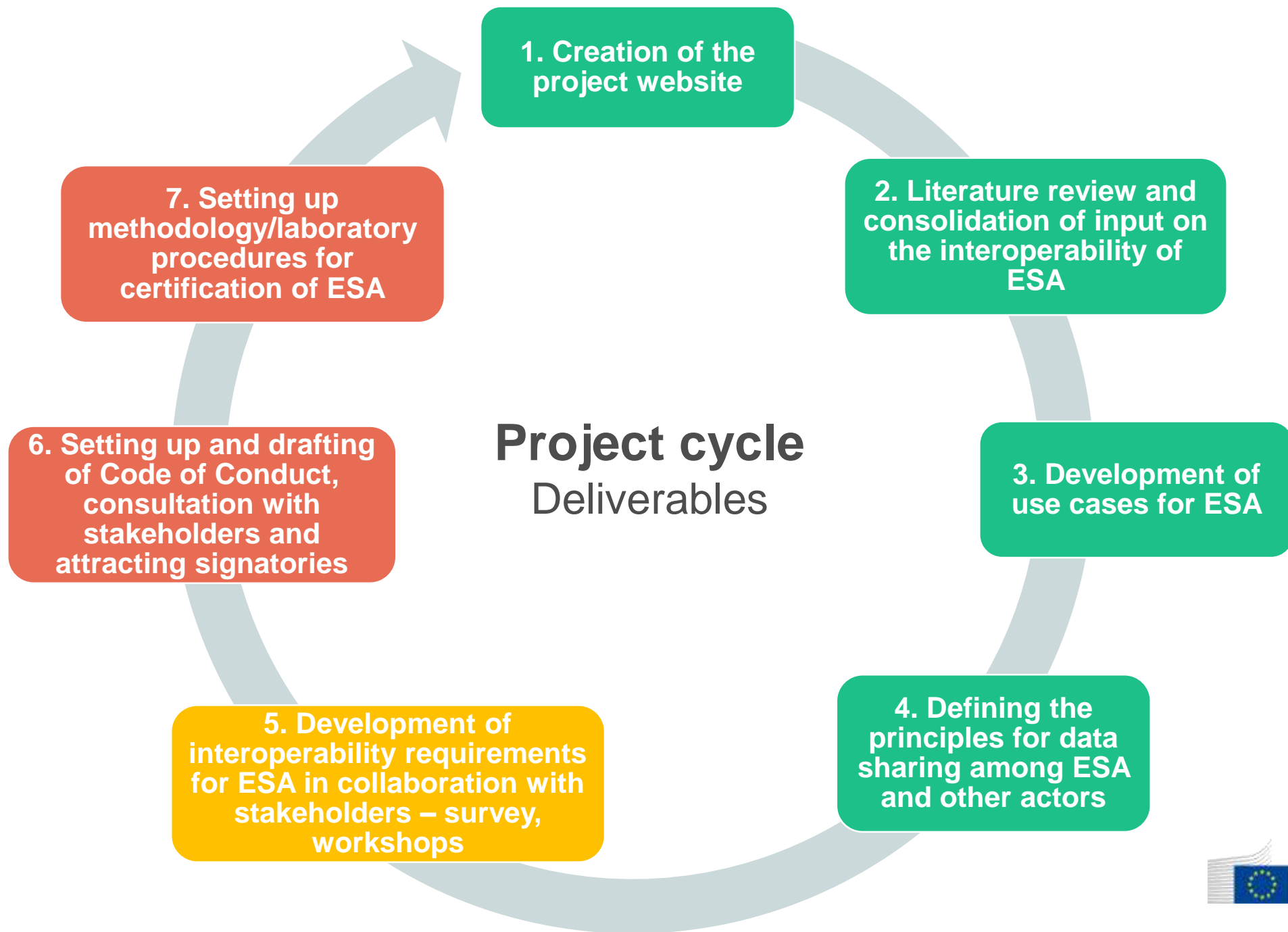
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# Code of Conduct for interoperability of Energy Smart Appliances (ESA)

## DG JRC providing...

Technical & scientific support to the review of EU Energy Efficiency legislation  
i.e. energy performance of buildings and products:

Supporting development of policy proposals for ESA



# JRC delivered to ENER by today:

## 1. Creation of project website ✓

*<https://ses.jrc.ec.europa.eu/development-of-proposals-for-energy-smart-appliances>*

## 2. Literature review ✓

Ecodesign Preparatory work, Interconnect, SGTF EG1, ETSI Smart Appliances, California Legislation, Energy Star Initiative, Energy@ Home, IEA EDNA, APPLiA, EEBUS, BRIDGE and more

## 3. Development of use cases ✓

36 Use Cases  $\Rightarrow$  4 High Level Use Cases

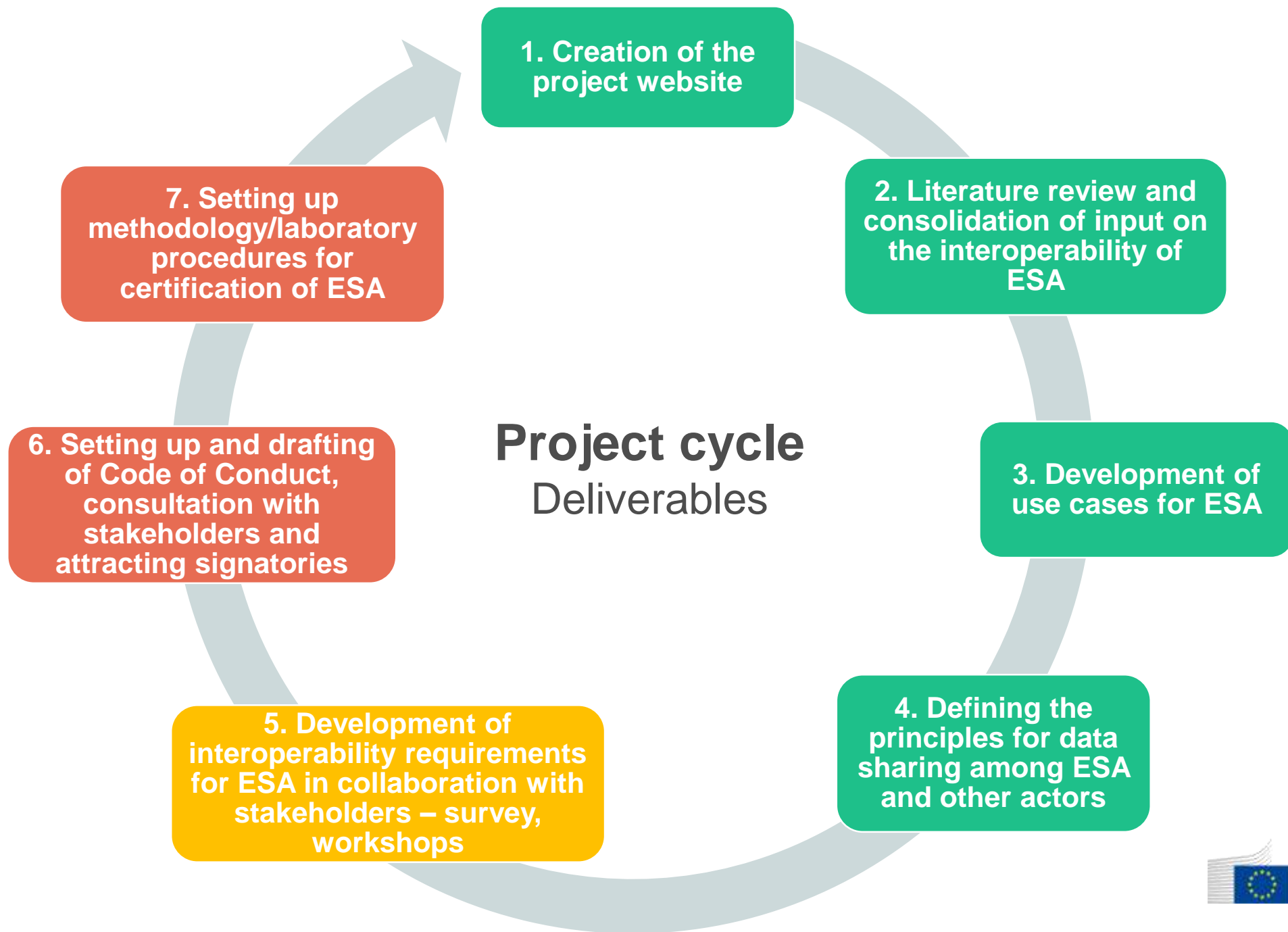
## 4. Defining the principles for data sharing among appliances ✓

Actors/ Message exchange of smart appliances

Technical report 2-3-4.\*



\*Energy Smart Appliances' Interoperability:  
Analysis on Data Exchange from State-of-the-art Use Cases





# JRC's remaining tasks:

5. Development of interoperability requirements for ESA ☒  
in collaboration with external parties, such as manufacturers, etc.
  - **Survey** on interoperability of ESA – **deadline 30 Sep 2022** (this Friday)
  - **Workshop** on interoperability of ESA – **8 November 2022** in Brussels  
→ **Registration opens soon**
6. Setting up a Code of Conduct (CoC) ☒  
Drafting the CoC, consulting the stakeholders and attracting signatories
7. Setting up methodology/laboratory procedures ☒  
for the certification/conformity purposes of energy smart appliances.

More info





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# Energy smart appliances and interoperable systems: Why everyone should be involved?

- **Interoperability issues:** affect everyone.  
(mostly end-users)
- **Goal:** make products/systems interoperable from the start.  
(manufacturing process)
- **Code of Conduct (CoC):** The way to achieve it.  
(manufacturers should contribute/adhere)



# Other stakeholders interested to co-design the Code of Conduct for Interoperability of Energy Smart Appliances

- **APPLiA** - Home Appliance Europe
- **EEBUS**
- **Lighting Europe**
- **EU-BAC** - European Building Automation Controls Association
- **ESMIG** - The European Smart Energy Solution Providers
- **CEN/CENELEC**
- **EHPA** - European Heat Pump Association
- **EUROHEAT & POWER**
- **EHI** - European Heating Industry
- **Vrije Universiteit Amsterdam**
- **TNO**
- ...



# Design of the Code of Conduct: Two main challenges

## 1. Definition of principles for data sharing.

Among appliances, home & building automation systems, EV chargers, aggregators, DSOs, etc.

## 2. The development of Interoperability requirements for ESA.



# Technical Report (TR) tackles challenges

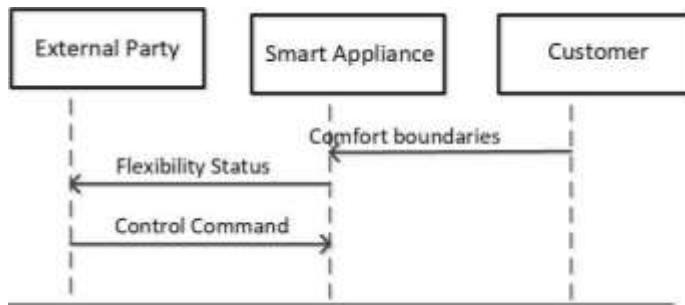
## Definition of principles for data sharing – main actors

1. Device within house for control purposes  
(Home Energy Gateway, Home Gateway, Grid Appliance Controller, Home Energy Controller, Energy Management System (EMS), Central EMS, Building Acquisition Control System (BACS))
2. Energy Service Provider  
(Energy Service Provider, Energy Company, Market Energy Company, Power System, DSO)
3. Existing customer  
(Customer, flexibility owner)
4. Device outside the house  
(Linear Pilot Backend, Signal Receiver, VPP – intelligent load manager, Smart Charging App etc)

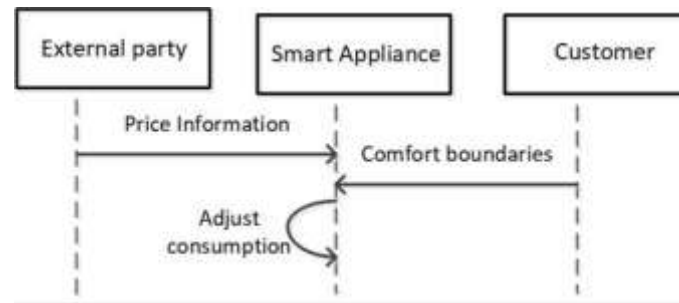
# TR: General categories of Use Cases

## Interaction b/w ESA - External Actors

### Explicit Demand Response UC

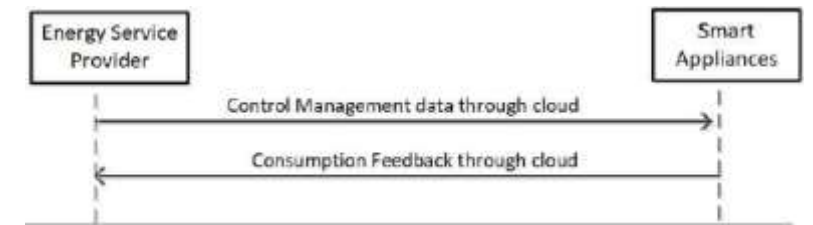


### Implicit Demand Response UC

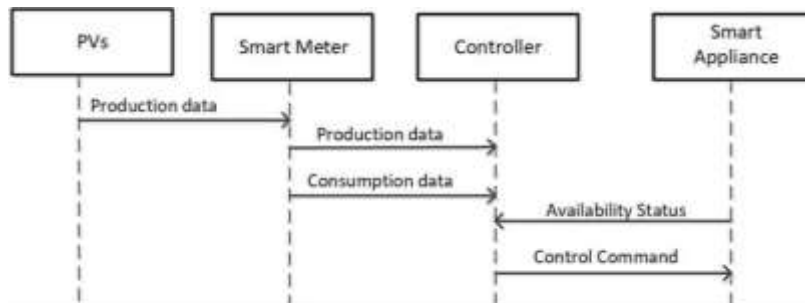


## Communication b/w ESA - Energy Service Provider

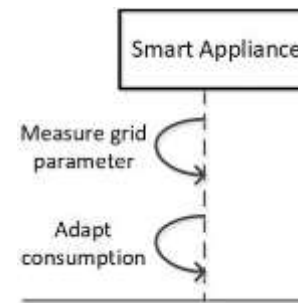
### Direct through Cloud



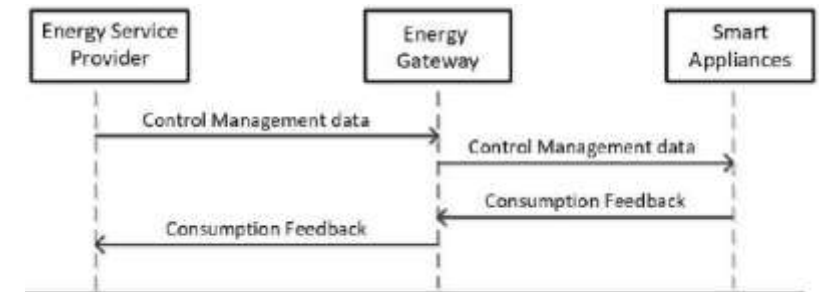
### Local optimal energy consumption UC



### Standalone demand response UC



### Using a Getaway



# TR: Messages Exchanged → Actor/ESA

			0 – Energy Smart Appliance							
			1		2		3		4	
			Consumer control point		Energy service provider		Customer		Provider control point	
Data / Messages exchanged			0←1	0→1	0←2	0→2	0←3	0→3	0←4	0→4
Data management	Control Commands (CC)	Switch On/Off	X		X		X		X	
		Schedule of activation/deactivation	X		X				X	
		Schedule time slot: Active/ Non-active	X		X				X	
		Time window duration	X		X				X	
		Override commands / stop activation	X		X				X	
		Energy	X		X				X	
			X		X				X	
			X	X		X	X			
				X		X	X			
	Feedback CC	General acknowledge / Update <sup>(1)</sup>		X		X		X		X
		Conflicting message <sup>(1)</sup>		X		X				
		User presence or preferences <sup>(1)</sup>						X		
		Energy								
				X		X		X		X
				X		X		X		X



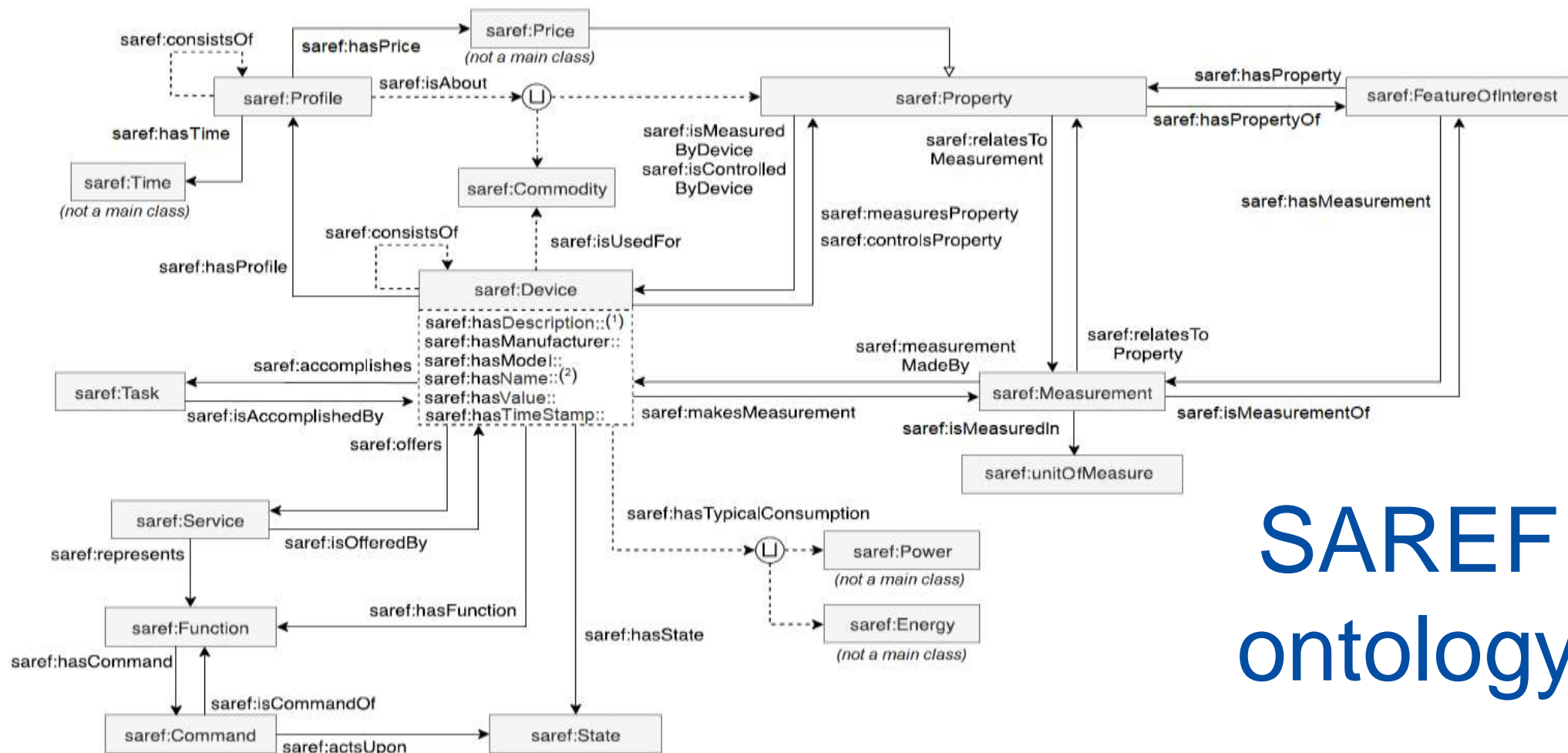
# TR: Messages Exchanged → Actor/ESA



Flexibility	Request	Availability status / Status update	X		X				X		
		Price information/ Tariffs		X		X	X		X		
		Schedule of charging									
		Control override							X		
	Broadcast	Availability status / Status update		X		X		X		X	
		Price information/ tariffs	X		X			X		X	
		User presence or preferences (¹)						X			
		Control overwrite event (external actor)					X	X			
Comfort boundary		Time slots for on/ off					X			X	
		Duration of on/ off time slots					X				X
		temperature limits					X				X
Warning / Emergency		Emergency turn On/off						X			
		Warning (¹)									
		Overload - consumption exceeds limits	X								
		Critical parameter notification			X					X	
Control actions		Manual Switch: On/Off					X				
		Adjust/Adapt consumption					X				
		Activation of a non-smart appliance					X				



# TR: Smart Applications Reference



SAREF  
ontology

# Get involved! Code of Conduct Interoperability Energy Smart Appliances

**ONLINE SURVEY**

Deadline

**30 September 2022** (this Friday)

**WORKSHOP**

**8 November 2022** in Brussels

Registration open soon

Project's Website



# Thank you and keep in touch Questions?



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# Reference links

## **Smart Grid Interoperability Laboratory.**

- *Smart Grid Interoperability Laboratory (Annual report 2021)*  
<https://publications.jrc.ec.europa.eu/repository/handle/JRC128465>
- *Smart Grid Design of Interoperability Tests (SG-DoIT)*  
<https://ses.jrc.ec.europa.eu/sgdoit>
- *Smart Electricity Systems and Interoperability:*  
<https://ses.jrc.ec.europa.eu/>