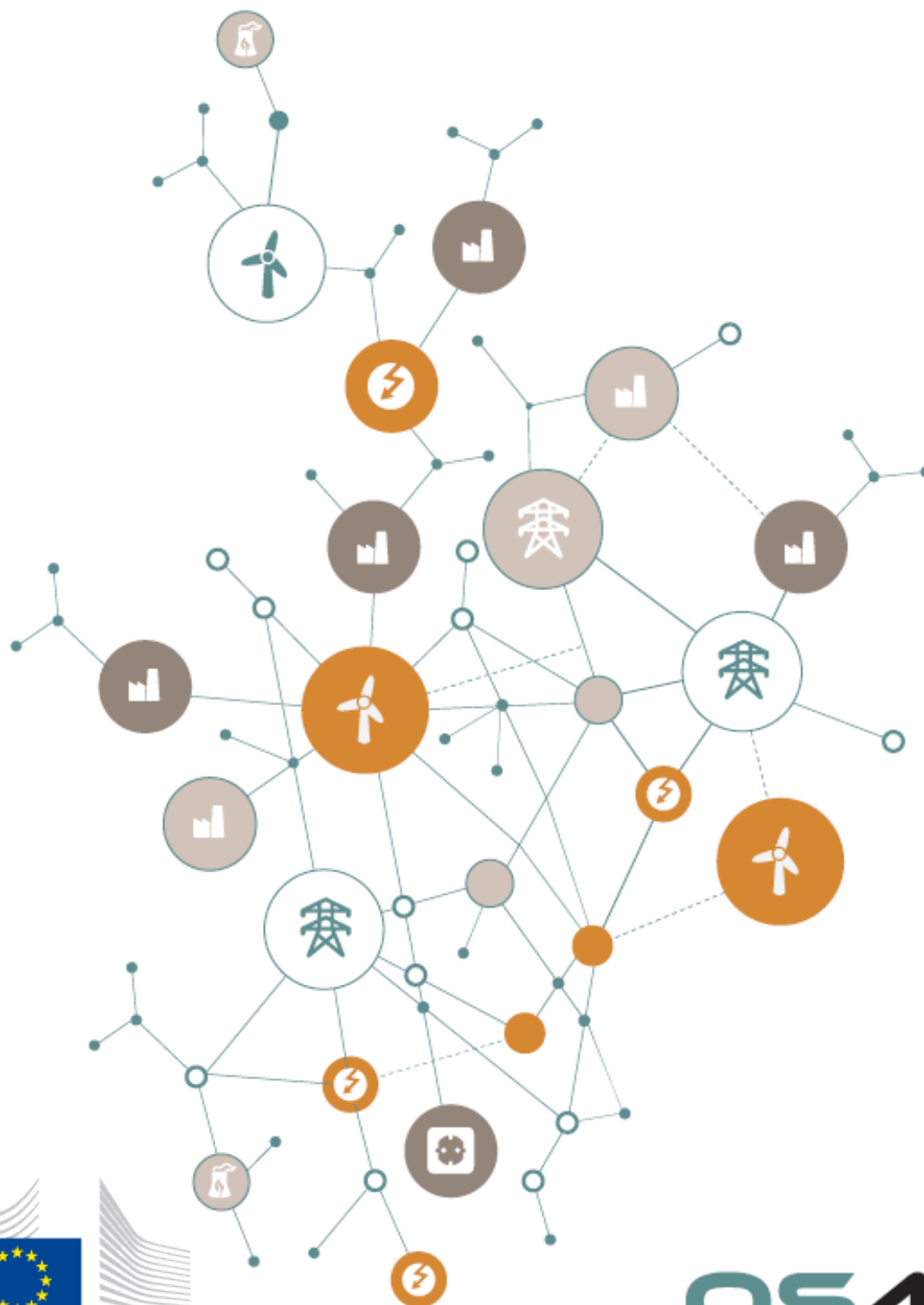


Deliverable 5.2

Definition of test cases for the application prototypes



D5.2 Definition of test cases for the application prototypes

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Executive Summary

This deliverable describes the conceptual design of the test cases that will be used to validate the software application prototypes to be developed in WP5, and which will be executed by the smart grid actors in order to exploit the OS4ES system.

This document is structured in three main chapters:

1. An introductory part describes the scope of the document and provides the necessary information about the applications architecture to understand best the following chapters.
2. A chapter that includes the definition of the different testing levels and the functional decomposition of those WP1 use cases that have been selected to validate the OS4ES system in WP7. This functional decomposition anticipates the application design, which will be delivered in D5.3.
3. The final chapter contains the test cases themselves, described using a common template.

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1 Introduction

1.1 Scope of the document

This deliverable presents the collection of test cases that have been defined in order to validate the software application prototypes to be developed in both tasks T5.3 *Prototyping DER management applications that integrate network operation algorithms and middleware services*, and T5.4 *Prototyping DER management applications that integrate market participation algorithms and middleware services*.

The test cases, as presented in this deliverable, are assessed and therefore conceptually designed. But it is not the intention of this deliverable to present a full specification of the test cases themselves, as for such level of detail the complete application design should be needed, and this is still a running task and which results will be presented in deliverable D5.3, *Design of the DER management applications*, to be issued in M18.

The test cases described in this document aim the functional validation of the OS4ES applications, and also the check of the correct interpretation and exchange of messages between the applications and also with other systems. All those tests will be accomplished in task T5.5 *Application testing in a simulated environment*.

The validation of the applications in the scope of system testing will be done by means of task T7.1 *Testing of OS4ES in a simulation environment*. This testing will include the validation of the applications in terms of acceptable data ranges within the test data.

The application prototypes are being designed with the target of validating the OS4ES system in the frame of the OS4ES use cases defined in the deliverable D1.1. From the base of the list of use cases defined using the technological driven design, a value driven selection process was tackled, which concluded with the resulting list of use cases to be used for validating the OS4ES system. This selection process has been documented in D1.1. Therefore, the application prototypes will implement the features needed to address the functionalities required by the following use cases:

Use Case ID. Use Case name	Selected for OS4ES field/lab trials
UC1. Certified Energy Market	No
UC2. Energy Management using VPP	Yes
UC3. Dwelling Information Exchange	No
UC4. Marketization of Balance Group Management	Yes
UC5. Frequency Control - Primary Control	Yes
UC6. Frequency Control - Secondary Control	Yes
UC7. Frequency Control - Tertiary Control	Yes
UC8. Volt/Var Control - Dynamic	Yes

Use Case ID. Use Case name	Selected for OS4ES field/lab trials
UC9. Volt/Var Control - Static	Yes
UC10. Volt/Var Optimization	Yes
UC11. Dynamic Virtual Power Plant	Yes
UC12. Demand Response	Yes
UC13. Demand Response Management of EVs	No

Table 1: Application use cases, selected for OS4ES field/lab trials

1.2 Systems architecture

There are three different software systems that are used in the frame of the OS4ES project use cases that have been selected for the lab and field trials:

- **OS4ES System:** We designate OS4ES system as the software platform to which the aggregators communicate to manage the DER systems resources, and where resource providers can register their DER system services.
- **OS4ES applications:** This system is composed of the specific applications to be used by the smart grid actors developed by the OS4ES project to cope with the use cases specifications.
- **Business Framework:** This framework represents the interactions between the TSO, DSOs, BRPs and aggregators. The Universal Smart Energy Framework (USEF) provides a software reference implementation providing a standardized way of exchanging information by means of flexibility-oriented messages. It will preferentially be used by the OS4ES applications to exchange messages between those roles. Therefore, hereafter USEF will be referred to wherever the Business Framework is applied. All information exchange not considered by the USEF framework will be accomplished by dedicated inter-OS4ES applications messages.

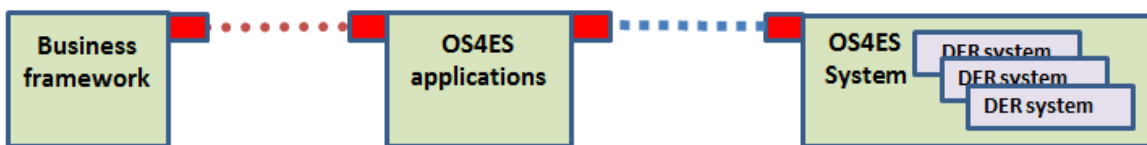


Figure 1: Systems architecture

1.3 OS4ES application components

Although the OS4ES applications design will be extensively documented in deliverable D5.3 *Design of the DER management applications* (to be delivered in M18, October 2016), it is necessary to extract now the most significant details of the applications architecture to understand how the test cases have been planned.

The OS4ES application system is composed of three software applications:

- OS4ES Aggregator Application (**OAA**): Application executed by the aggregators, providing the functionalities required by their two associated roles, the flexibility provider and the flexibility aggregator (see D1.1, section 3 Roles, for role definition).
- OS4ES TSO Application (**OTA**): Application executed by the TSO.
- OS4ES DSO Application (**ODA**): Application executed by the DSO.

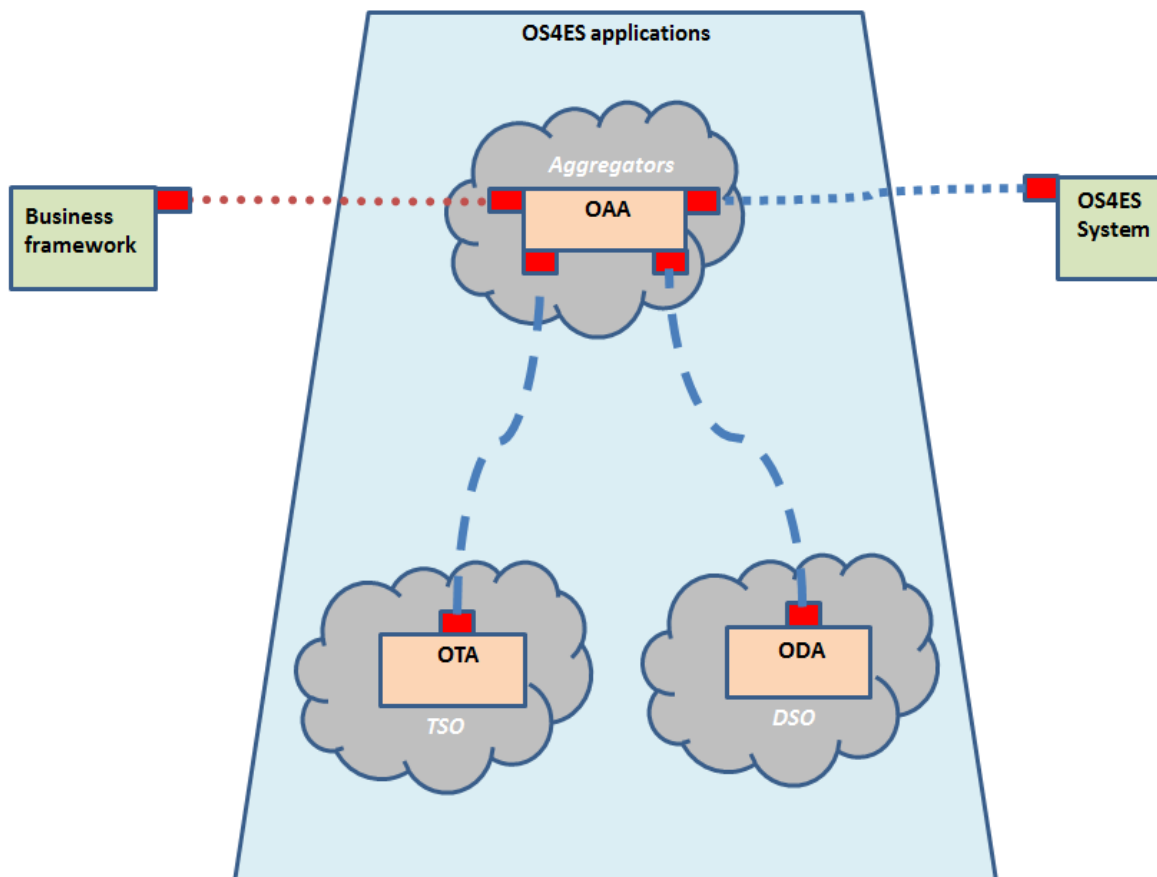


Figure 2: Application components

Not all of the application components are utilized in all the use cases, as:

- in certain use cases either the DSO or the TSO do not play a specific role (see D1.1, Annex C Detailed Use Case Descriptions, for role responsibilities). To be more concrete, the TSO does not participate in the local voltage control depicted in UC8 and UC9, while the DSOs are not involved in the frequency control and the Volt/VAR optimization, as this use cases represent a service for the optimization of the grid as a whole,
- while in other use cases the role played by the TSO, DSOs and BRPs is covered by the business framework (UC2, UC4, UC11 and UC12).

Use Case	OS4ES System	OAA	OTA	ODA	USEF business framework
UC2. Energy Management using VPP					
UC4. Marketization of Balance Group Management					
UC5. Frequency Control - Primary Control					
UC6. Frequency Control - Secondary Control					
UC7. Frequency Control - Tertiary Control					
UC8. Volt/Var Control - Dynamic					
UC9. Volt/Var Control - Static					
UC10. Volt/Var Optimization					
UC11. Dynamic Virtual Power Plant					
UC12. Demand Response					

Table 2: Systems and components utilized in each use case

1.4 Notations, abbreviations and acronyms

The following table list all notations, abbreviations and acronyms, used in this document.

Acronym	Description
AFC	Autonomous Frequency Control
AVC	Autonomous Voltage Control
DER	Distributed Energy Resources
DSO	Distribution System Operator
DVPP	Dynamic Virtual Power Plant
OAA	OS4ES Aggregator Application
ODA	OS4ES DSO Application
OTA	OS4ES TSO Application
PCC	Point of Common Coupling
PTU	Program Time Unit
TSO	Transmission System Operator
UC	Use Case
USEF	Universal Smart Energy Framework
VPP	Virtual Power Plant

2 Application testing

2.1 Objective

The objective of the application testing is the validation of the implemented applications, which will be finally used in the scope of the selected use cases in the WP7 laboratory and field trials. These trials will be performed in T7.3, *Demonstration of predefined algorithms and middleware in laboratory and field tests* (M27-M33).

2.2 Test levels

There are defined four levels of tests:

- **Unit testing** refers to tests that verify the minimal meaningful functionalities of the applications. Unit testing alone cannot verify the functionality of each application; its aim is to ensure that the building blocks of the applications work independently from each other.
- **Unit integration testing** aim is to verify the data object exchanges between the OS4ES applications themselves. Thus, this test's aim is the verification of the correct message exchanges.
The correct generation and processing of the message will be checked by means of internal logging, while the delivery and reception will be analysed by the use of an external proxy.
- **Application integration testing** aim is to verify the data exchanges between an OS4ES application and either the USEF and OS4ES systems. While the USEF software implementation will be available for the tests, the OS4ES system will not be implemented yet, so in that case a simulated OS4ES system will be used to generate simulated responses.
- **Application testing** tests each OS4ES application in the frame of the different use cases. Each test is the sequence of unit, unit integration and application integration test cases needed to check the correct execution of each application for each selected use case. These sequences are illustrated in section 2.5 of this document.
- **Acceptance testing** tests the different software systems as a whole and transcends the scope of the OS4ES application system itself, so they are not defined in this deliverable. They will be executed by means of task 7.1, *Testing of OS4ES in a simulation environment*.

2.3 Test groups

Each test groups is a set of test cases that belong to the same level. The following list represents the different groups (and their group IDs) that have been created:

- **UA** (OAA unit testing): Testing of functional blocks of the aggregator application.
- **US** (ODA unit testing / OTA unit testing): The functional blocks of ODA and OTA are analogous in terms of functionality, so they are joined in the same test group.

- **UIS** (ODA – OAA unit integration testing / OTA – OAA unit integration testing): The messages exchanged between ODA and OAA have exactly the same structure as those exchanged between OTA and OAA, so the respective test cases are joined in the same test group.
- **AIU** (USEF – OAA application integration testing). The messages exchanged between OAA and USEF follow the structure dictated by USEF.
- **AIO** (OS4ES – OAA application integration testing): In these tests the OS4ES system will be simulated, as it will not be implemented yet.
- **AA** (OAA application testing): Testing of the aggregator application in all of the use cases.
- **AD** (ODA application testing): Testing of the DSO application in static/dynamic voltage support use cases.
- **AT** (OTA application testing): Testing of the TSO application in frequency support and Volt/VAr optimization use cases.

2.4 Test execution

The unit, integration and application tests relative to the OS4ES applications will be executed by means of task T5.5, *Application testing in a simulated environment*, which will be carried out from month 20 (March 2016) to month 25 (August 2016). Each prototype application will be tested in a simulation environment in order to ensure that the software is free of bugs and that requirements are met. The simulated environment will include:

- The prototype applications
- USEF software reference implementation
- Simulated OS4ES System (including simulated DER Systems)

This testing will be done following the guidelines dictated by the current deliverable D5.2, in which a collection of test cases have been defined with that purpose. The test cases have been defined from:

- The conditions of the scenarios created in the step-by-step analysis of the OS4ES use cases (see D1.1, Annex C, Detailed Use Case Descriptions).
- The applications requirements (see D1.2, section 7.1, Applications requirements).

2.5 Use Case functional decomposition

The functional decomposition is a preliminary work done to design the actions to be executed within the OS4ES applications, and the data objects exchanged as inputs and outputs associated to those actions. This work is done for each of the use cases that will be tested and is represented by means of UML activity diagrams. These diagrams represent the point of view of the OS4ES applications, and therefore external actors (DSO, TSO and BRP) and systems (Business framework and OS4ES system) are not explicitly represented.

In those diagrams (see sections 2.5.1 to 0), for each use case:

- Each **application** is represented by an **activity** (activities are shown as yellow background rectangles in the diagrams), and represents a series of sequence of

actions, each sequence having an activity init-action and an activity final-action. This level of abstraction represents the composition of unit and integration test within each **component test**.

- **Actions** (actions are shown as orange background rectangles in the diagrams), represent the **functional blocks** that are tested by the **unit tests**.
- **Action pins** (action pins are shown as pink background boxes and are attached to actions in the diagrams), represent the data objects that are exchanged as **messages** between an OS4ES application and another OS4ES application or system and have a direct correspondence with the either **unit integration tests** and **application integration test** respectively. The messages themselves are shown in the diagrams as black arrows from an action pin to another action pin. Please note that arrows that go directly from an action to another action represent just the application flow, not messages.

Hereby the diagrams associated to the selected use cases are illustrated:

2.5.1 UCFlex

UCFlex is based on the D1.1 UC12. In this use case the only OS4ES application needed is the OAA, as all the information derived from the DSO and the BRP is exchanged through the USEF business framework.

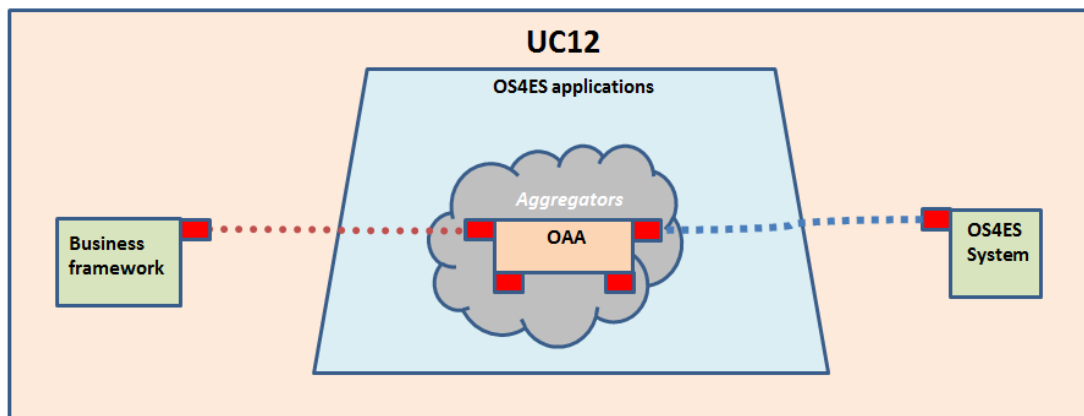


Figure 3: UCFlex system architecture

These are the main series of actions that compose the functional blocks of OAA in UC12. Please note the colour coding in the qualitative description below: **green** → messages → integration tests, **blue** → functional blocks → unit tests.

- **Contract:** It is assumed as a precondition that the contracts for the provision of the DER services between the aggregator and the DER resource owners are negotiated between those parties outside the scope of the OS4ES. Once those parties get to an agreement, it is the aggregator, who is responsible to place the contractual information on the OS4ES system. This functionality is represented by the **introduce contracts** functional block and is to be implemented as a user interface. These pre-agreed contracts are considered to be long-term and exclusive, so that it is the aggregator which signs the contract the only party allowed to operate the service.

The information is exchanged between OAA and the OS4ES system with the *contract request and response* messages.

- **Congestion points reception:** OAA requests periodically to USEF the list of PCCs that compose each congestion point, executing the *update congestion point list* functional block and sending a *CommonReferenceQuery* message. USEF then answers with a *CommonReferenceQueryResponse* message, and OAA store the list locally using the *store congestion points* functional block. Later on, the aggregator will use this info to aggregate the baselines in the D-prognosis on a congestion point basis.
- **Main activity:** This activity is oriented to the reservation and operation of DER services by means of the OAA.

This activity is launched periodically, in direct connection with the day ahead market in the plan phase and the intraday markets in the validate phase. The sequence of actions is intrinsically the same although the trigger conditions are different:

- If the activity is launched in reference with the day ahead market, the aggregator manages its whole portfolio at the same level and the time horizon of the energy matching is the 24 hours of the day after.
- If the activity is launched in relation with an intraday market, the aggregation of DER services is managed per congestion point and the time horizon is the same as the intraday market period referred.

At first, the OAA has to set the parameters of the *capabilities request* message that has to be sent to the OS4ES system in order to retrieve the baselines of all the contracted services for the market time horizon. This work is done by the *baseline search* functional block. As a response to the capabilities request, the OS4ES system sends the requested baselines in a *capabilities response* message.

Then, OAA has to execute the *A-plan calculation*, in order to send the *A-plan* message to the BRP, or the *D-prognosis calculation*, if the purpose is to send the *D-prognosis* message to the DSO, using the baseline information. Conceptually, the information contained in these objects is basically the same: the aggregated energy per time unit (PTU) that the DER services contracted by the aggregator are expected to consume or produce (baselines). The main difference is that the A-plan aggregates all the contracted DER services at the same level and the D-prognosis provides granular information per congestion point. They also differ in the time horizon, as the A-plan covers the day ahead period and the D-prognosis is related to intraday periods.

Once the BRP/DSO collects and assesses all the A-plans/D-prognosis respectively and other relevant information, it can generate a *flex request* message that will be received by OAA from the business framework. In this flex request it is expressed the energy that should be diverted in each PTU.

Then, as the consequence of flex requests, issued either by the DSO or by the BRP, it is the OAA the one that defines the search request parameters depending on the information contained in the flex request, intending to look at the OS4ES system for

contracted DER services that fulfil these constraints. This work is done at the *flexibility search* functional block.

The *capabilities request* message delivery to the OS4ES system will be done among all those services already contracted by the aggregator, retrieving by the *capabilities response* message the flexibility options of all those services that fulfil with the search parameters constraints imposed in the capabilities request.

The next step is that the OAA executes the matching algorithm, in order to decide which are the best DER services that will be aggregated to compose the *flex offer* message. This message will be sent to the flex requesting actor, the DSO or the BRP. This task is executed by the *flexibility aggregation* functional block.

This flex offer could be accepted by the DSO/BRP at this process stage, or later on during the near real time operational phase, being the later the reason, why the DER service contracts are exclusive, so that the service is guaranteed to be able to be reserved anytime later (but before the start of the first PTU in the flex data object). This acceptance comes in a *flex order* message.

When OAA receives the flex order, the *reserve DER services* functional block creates and sends the associated *reserve request* messages to be sent to the OS4ES system.

Hereafter the OAA will receive the pertinent *reserve response* message, indicating that the services have been properly reserved.

The following step will be that the OAA executes the *monitoring data definition*, as the OAA needs to supervise the correct provision of the service by the DER system. The *monitoring data subscription* messages will be sent to the OS4ES system with this purpose.

The next action to be executed will be to *schedule order* functional block, which will decide which will be the energy schedule for each of the confirmed reserved DER services, sent to the OS4ES as *schedule command* messages.

- **Monitoring:** Hereafter the already scheduled DER services will provide the commanded energy as scheduled, but it will be the OAA duty to supervise this energy provision. This will be done by the *reliability assessment* functional block, comparing the ordered schedule with the real provided schedule (obtained with measured energy that the service has provided which is known thanks to the reception of the *monitoring data* messages). Therefore, once the service lifetime has expired, the OAA will judge if the service has been provided correctly or not, sending the corresponding *reliability score* message to the OS4ES system.

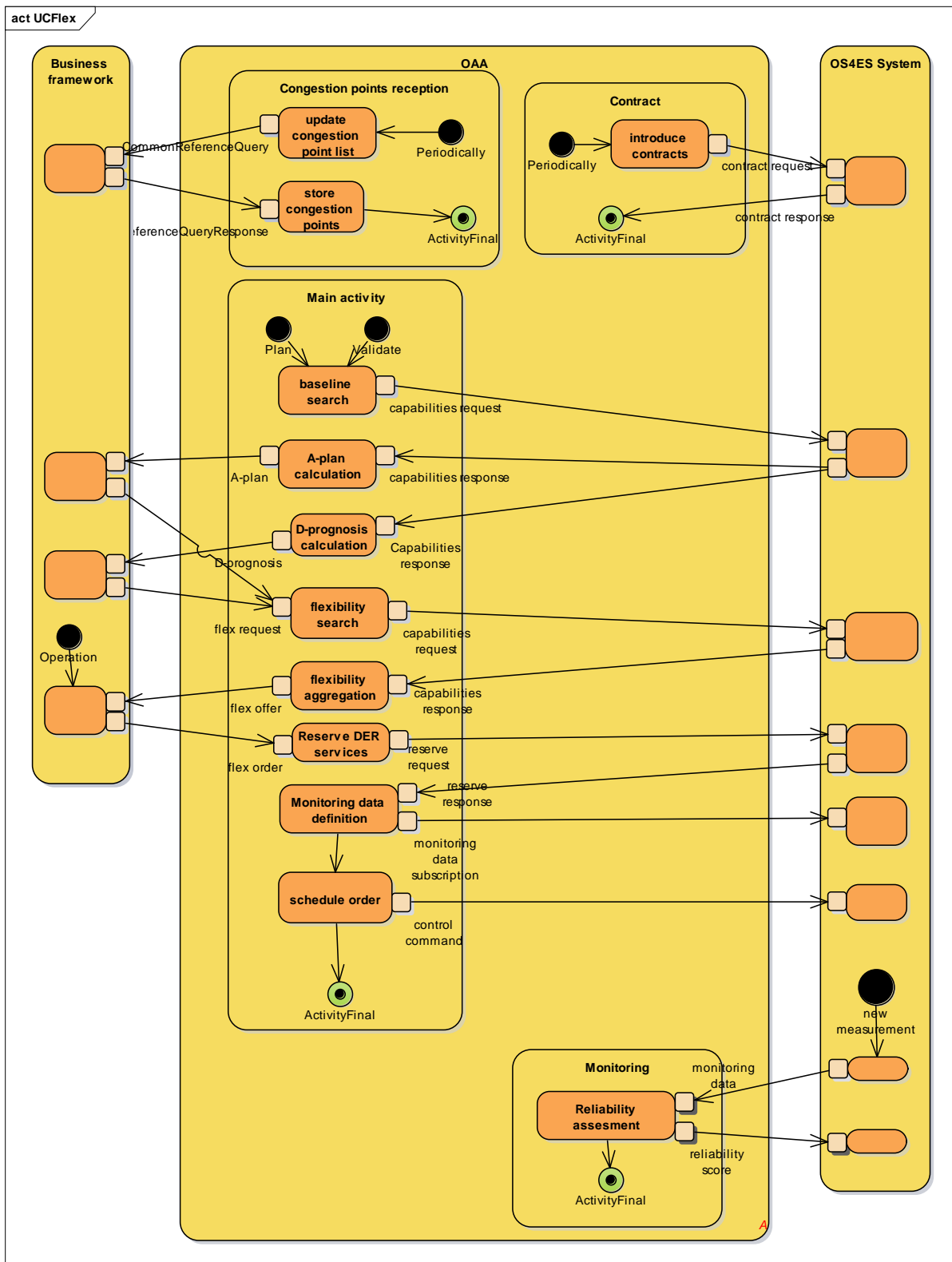


Figure 4: UC Flex functional decomposition

2.5.2 UCVPP

UC2, UC4 and UC11 have been combined in a use case, UCVPP.

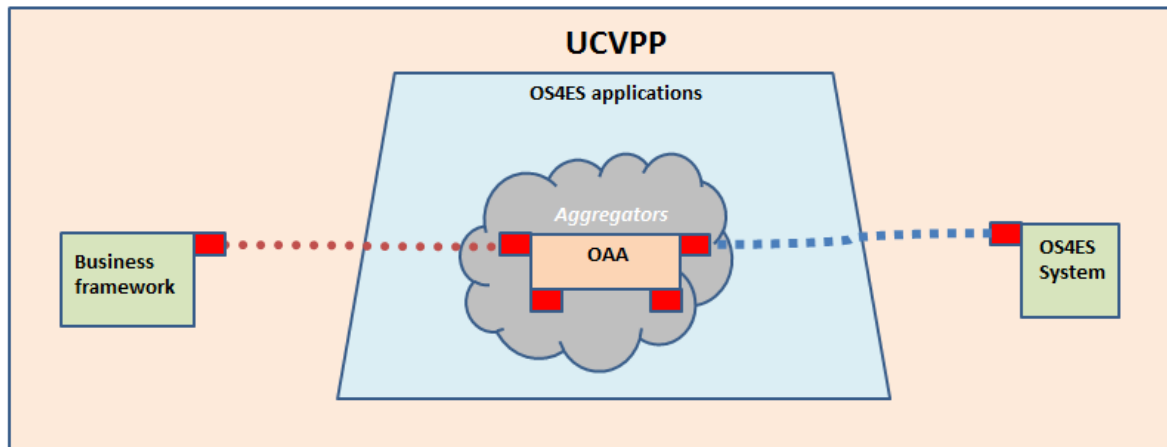


Figure 5: UCVPP system architecture

The three original use cases are really a subpart of UCVPP. Here is the description of its activities:

- Contract:** Periodically, the aggregator searches for new DER services to update its portfolio, defining the criteria that those services should comply using the *update VPP* function block. Then OAA send a *search request* to the OS4ES system and receives a *search response*.

The most interesting services are therefore selected using the *select contracts* functional block and are contracted by exchanging the *contract request and response* messages with the OS4ES system. These contracts are long-term and are negotiated market-wise, as all the negotiation needed to establish the contracts is realized thanks to the mechanisms provided by the OS4ES system. Contracts are also considered to be exclusive, as the composition of the VPP is static.

- Main activity:** This activity refers to both the scheduling and re-scheduling capability of the VPP.

The scheduling activity is launched periodically, in direct connection with the day ahead market in the plan phase.

The capabilities of all the services contracted by the aggregator for the following day have to be retrieved by the aggregator. At this moment no services would be reserved yet for the following day. OAA knows the list of contracted services, which is recovered by the *plan VPP* functional block. The capabilities are then collected exchanging *capabilities request and response* messages with the OS4ES.

Depending on the expected market conditions, the aggregator makes a dispatch plan with the intention of maximizing its profit, using the *VPP dispatch calculation* functional block. This plan includes the decision of which DER services should be reserved for the following day and which should be its schedule. Commonly, the major part of these set of services will be composed by active power services (mainly generators). With this information it produces the *A-plan* to be sent to the BRP.

Then the BRP could either approve the A-plan or impose a variation based of the original A-plan.

If the A-plan is approved, the OAA will execute *reserve DER services* functional block to reserve those services selected in the VPP dispatch calculation. AOO will do it by means of the reserve request and response messages.

In this case, until the end of this activity, the actions will be identical to UC12:

The following step will be that the OAA executes the *monitoring data definition*, as the OAA needs to supervise the correct provision of the service by the DER system. The *monitoring data subscription* messages will be sent to the OS4ES system with this purpose.

The next action to be executed will be to *schedule order* functional block, which will decide which will be the energy schedule for each of the confirmed reserved DER services, sent to the OS4ES as *schedule command* messages.

But this plan of the aggregator could be modified in the following circumstances:

- If the BRP refuses the A-plan and issues a variation in consequence
- If the BRP, after the approval of the A-plan and possibly in the scope of its activity in the intraday markets horizon, decides that it want to impose a reschedule to the aggregator (VPP reschedule of UC2)
- If the BRP, after the intra-day market gate closure but prior to the TSO reaction upon imbalances, forces the aggregator to reschedule (UC4)
- If the aggregator, as a consequence of the detection of the failure of a DER service under operation, replaces that malfunctioning service as an ability of dynamic VPPs (UC11)

All this circumstances have the same consequence, which is that a *flex order* is processed by the *re-plan VPP* function block. Then, the OAA will assess which are the best suitable options (services) to cope with the schedule variation imposed among those services contracted, and retrieve the capabilities of those services from the OS4ES with new *capabilities request and response messages*.

Once these capabilities are known, the *VPP reschedule calculation* function block will decide which services have to be reserved and which will be their schedules.

Monitoring: In addition to the reliability assessment described in UC12, the monitoring system will also detect and launch the VPP dynamic capability. This will be done by the *VPP reestablishment* functional block, which will quickly detect a deviation between the ordered schedule with the measured energy that the service is providing, which is known thanks to the reception of the *monitoring data* messages. If then a service is decided to be discarded, it will be exchanged a pair of *dereserve request and response* messages with the OS4ES system.

Hereafter the *service dereservation* functional block will create a *flex order* that represent the reschedule needed to comply with the original plan of the OAA, and it will be sent to the update VPP service.

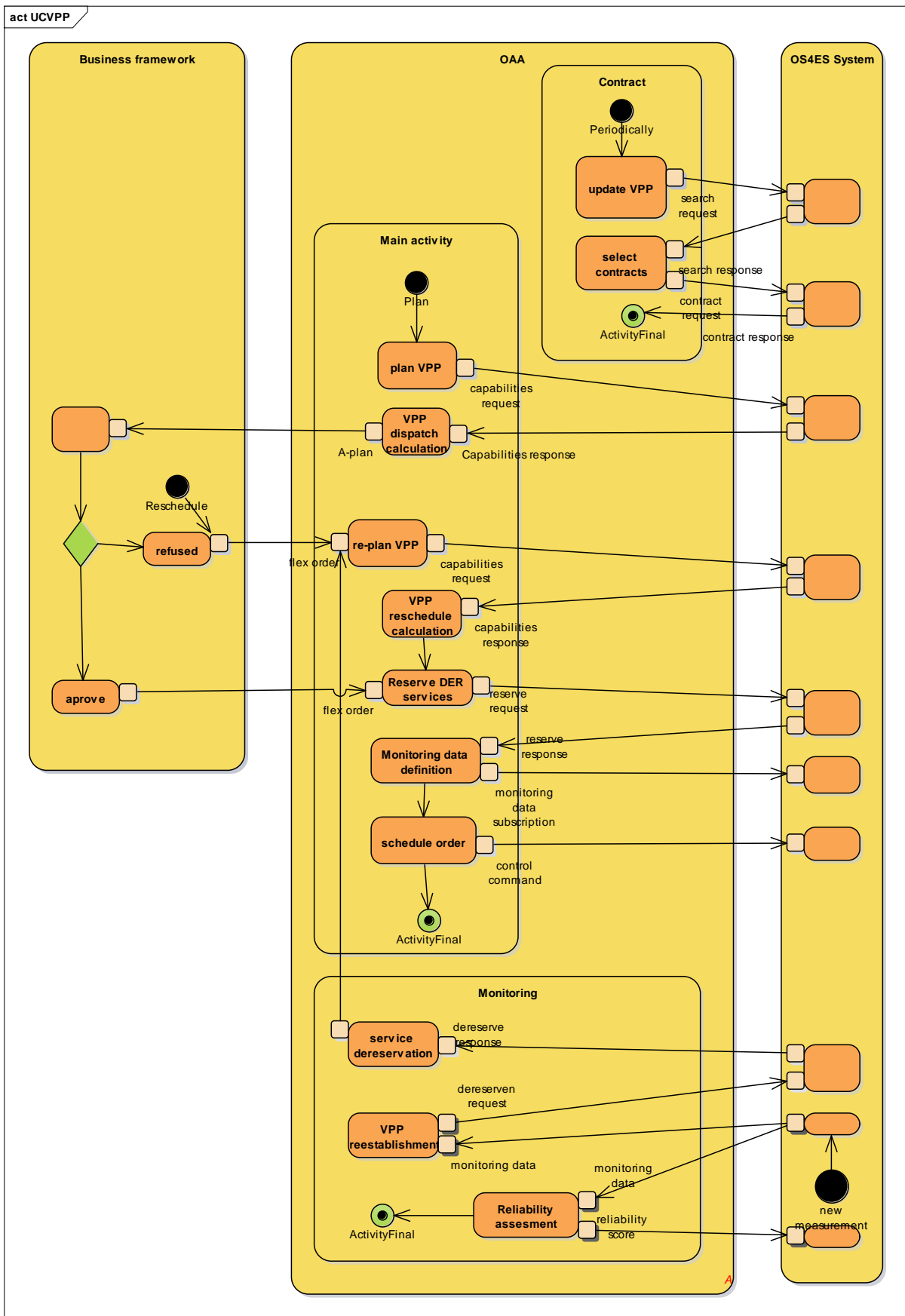


Figure 6: UCVP functional decomposition

2.5.3 UCgrid

All the use cases dealing with grid support (UC5, UC6, UC7, UC8, UC9 and UC10) present the same structure, being that the reason why we group this use cases in a super use case called UCgrid, with only minor variations:

- The service requesting smart grid role is the TSO (UC5, UC6, UC7 and UC10) or the DSO (UC8 and UC9). This implies that the system operator application is the OTA or the ODA respectively, being the functional blocks of these two applications analogue. Therefore we will refer as SO hereafter in this section to either the TSO or DSO.
- The setpoint magnitude is different (voltage in UC8, UC9 and UC10 or active power in UC6 and UC7). In UC5 the setpoint is implicit (frequency setpoint)

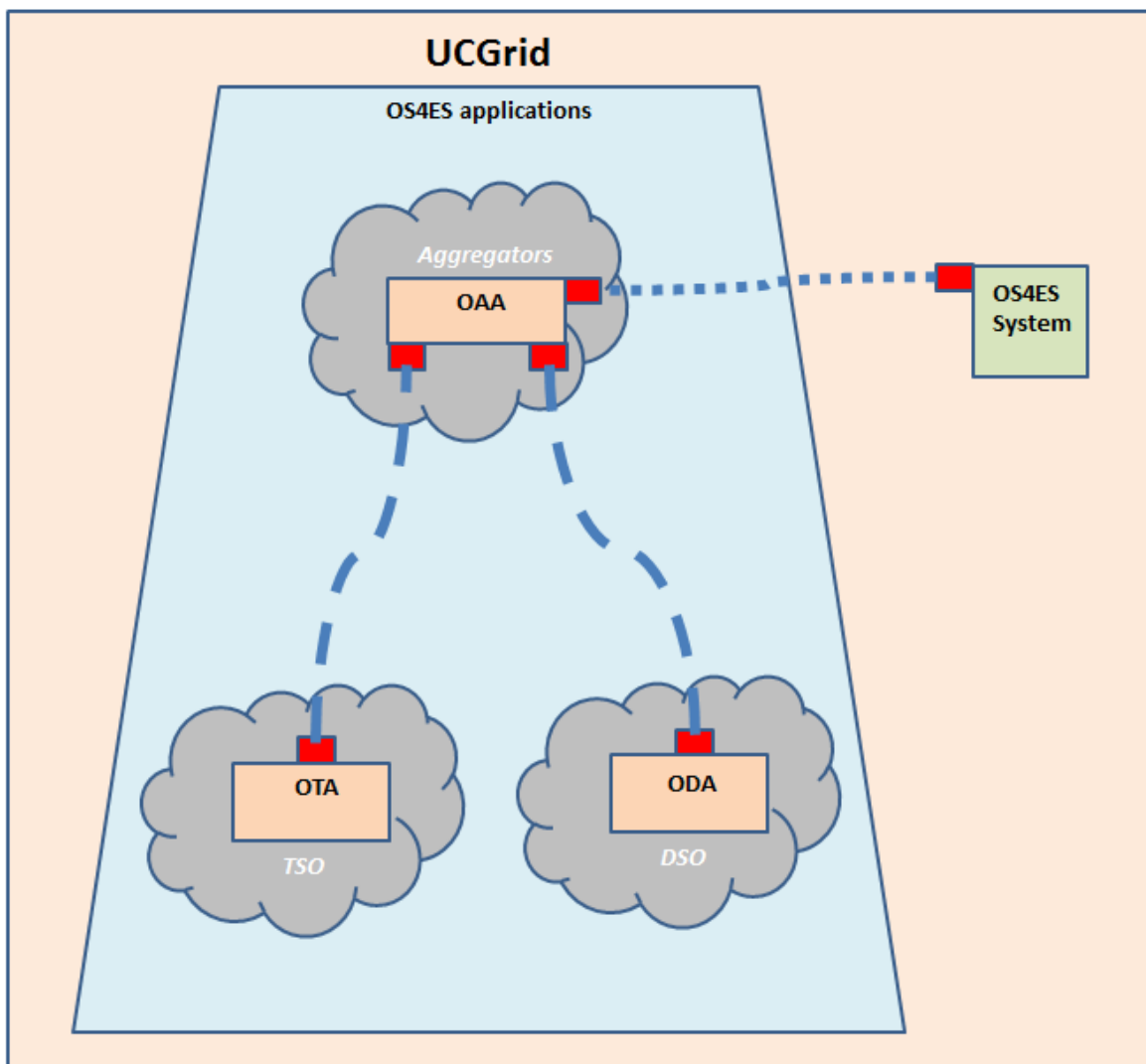


Figure 7: UCGrid system architecture

Here is the description of the activities of both OS4ES applications, OTA/ODA and OAA:

- **OTA/ODA→Contract** and **OAA →Contract**: Periodically, the SO will launch a market mechanism to update the list of resource providers that will provide frequency or voltage support. The SO defines the conditions for the call for bids using the *bid launch* functional block and sends it to the aggregators using a *bid request*. This bid request is received by each aggregator, who executes a *DER search definition* process with the intention of searching available resources (in the OS4ES registry) to be contracted. Therefore, the OAA sends a *search request* and receives an associated *search response*. Then the aggregator executes *compose bid*, to generate the *bid offer* that it will send to the SO. Once the SO receives the bid offers from all the aggregator, executes *bid selection* in order to contract all those aggregator services needed to fulfil its requirements of grid support, and send the *bid orders* to the selected aggregators accordingly. When an aggregator receives the bid order, it has to contract all those DER services that compose its bid offer, and this process is done by the *decompose bid* functional block, which send the needed *contract requests* to the OS4ES system and receives the *contract responses*. These contracts would be exclusive, and what is more, the DER services should be reserved for the whole contract time frame, so that the operational process can be as fast as possible. That is the reason why the OAA executes the *Reserve DER services* and exchanges the *reserve request* and *reserve responses* with the OS4ES system. Then the following step is the OAA execution of the *monitoring data definition*, as so that the OAA gets the measurements associated to the service operation. The *monitoring data subscription* messages will be sent to the OS4ES system with this purpose.
- **OTA/ODA→Operate** and **OAA→Operate**: The main activity of the SO in these use cases is to *analyse* the grid state, using power flow analysis algorithms, resulting in a *power flow* that is interpreted by the *operate* functional block that generates the *control commands* needed to operate the reserved resources accordingly. These control commands are either activation orders, setpoints or deactivation orders that are passed from the SO to the DER resources, acting the OAA as a gateway. Also as a functionality of the operate activity, and triggered by the availability of a new measurement associated to the DER service, the OAA receives new *monitoring data (monitor)* that is also transparently passed to the SO to feedback the grid analysis. These measurements feed also the *reliability assessment* functional block. Once the operational phase concludes, the aggregator judges the provision of the DER service issuing a *reliability score* that is sent to the OS4ES registry. This judgment is possible because the OAA keeps copy of the setpoints and (de)activation commands sent to each service.

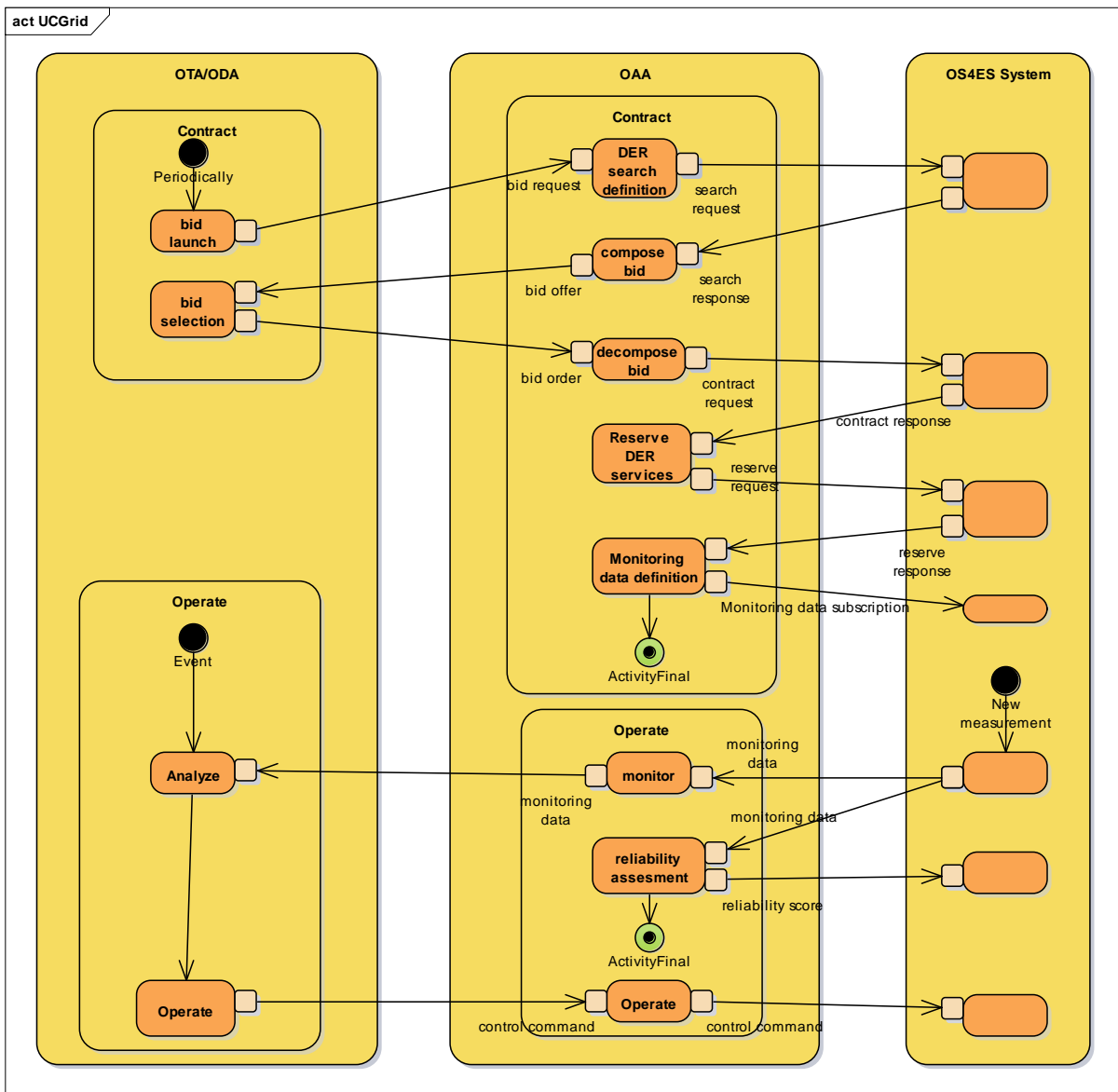


Figure 8: UCGrid functional decomposition

3 Test cases

3.1 Test case list

Test Case ID	Test Case name	Use cases
TC – UA – 01	DER search definition	UCGrid
TC – UA – 02	Compose bid	UCGrid
TC – UA – 03	Decompose bid	UCGrid
TC – UA – 04	Monitor	UCGrid
TC – UA – 05	Operate	UCGrid
TC – UA – 06	Introduce contracts	UCFlex
TC – UA – 07	Update congestion points	UCFlex
TC – UA – 08	Store congestion points	UCFlex
TC – UA – 09	Baseline search	UCFlex
TC – UA – 10	A-plan calculation	UCFlex
TC – UA – 11	D-prognosis calculation	UCFlex
TC – UA – 12	Flexibility search	UCFlex
TC – UA – 13	Flexibility aggregation	UCFlex
TC – UA – 14	Reserve DER services	UCFlex, UCGrid, UCVPP
TC – UA – 15	Monitoring data definition	UCFlex, UCGrid, UCVPP
TC – UA – 16	Schedule order	UCFlex, UCVPP
TC – UA – 17	Reliability assesment	UCFlex, UCGrid, UCVPP
TC – UA – 18	Update VPP	UCVPP
TC – UA – 19	Select contracts	UCVPP
TC – UA – 20	Plan VPP	UCVPP
TC – UA – 21	VPP dispatch calculation	UCVPP
TC – UA – 22	Re-plan VPP	UCVPP
TC – UA – 23	VPP reschedule calculation	UCVPP
TC – UA – 24	Service dereservation	UCVPP
TC – UA – 25	VPP reestablishment	UCVPP
TC – US – 01	Bid launch	UCGrid
TC – US – 02	Bid selection	UCGrid
TC – US – 03	Analyze	UCGrid
TC – US – 04	Operate	UCGrid
TC – AIO – 01	Search request	UCGrid, UCVPP
TC – AIO – 02	Search response	UCGrid, UCVPP
TC – AIO – 03	Contract request	UCFlex, UCGrid, UCVPP
TC – AIO – 04	Contract response	UCFlex, UCGrid, UCVPP
TC – AIO – 05	Capabilities request	UCFlex, UCVPP
TC – AIO – 06	Capabilities response	UCFlex, UCVPP
TC – AIO – 07	Reserve request	UCFlex, UCGrid, UCVPP

TC – AIO – 08	Reserve response	UCFlex, UCGrid, UCVPP
TC – AIO – 09	Dereserve request	UCVPP
TC – AIO – 10	Dereserve response	UCVPP
TC – AIO – 11	Monitoring data subscription	UCFlex, UCGrid, UCVPP
TC – AIO – 12	Control command	UCFlex, UCGrid, UCVPP
TC – AIO – 13	Monitoring data	UCFlex, UCGrid, UCVPP
TC – AIO – 14	Reliability score	UCFlex, UCGrid, UCVPP
TC – AIU – 01	Common Reference Query	UCFlex
TC – AIU – 02	Common Reference Query Response	UCFlex
TC – AIU – 03	A-plan	UCFlex, UCVPP
TC – AIU – 04	D-prognosis	UCFlex
TC – AIU – 05	Flex request	UCFlex
TC – AIU – 06	Flex offer	UCFlex
TC – AIU – 07	Flex order	UCFlex, UCVPP
TC – UIS – 01	Bid request	UCGrid
TC – UIS – 02	Bid offer	UCGrid
TC – UIS – 03	Bid order	UCGrid
TC – UIS – 04	Monitoring data	UCGrid
TC – UIS – 05	Control command	UCGrid
TC – AA - 01	UC2 – Energy management using VPP	UCVPP
TC – AA - 02	UC4 – Marketization of Balancing Group Management	UCVPP
TC – AA - 03	UC11 - Dynamic Virtual Power Plant	UCVPP
TC – AA - 04	UC12 – Demand response	UCFlex
TC – AA - 05	UC8 - Volt / Var Control – Dynamic	UCGrid
TC – AA - 06	UC9 - Volt / Var Control – Static	UCGrid
TC – AA - 07	UC10 - Volt / Var Optimization	UCGrid
TC – AA - 08	UC5 - Frequency Control – Primary Control	UCGrid
TC – AA - 09	UC6 - Frequency Control – Secondary Control	UCGrid
TC – AA - 10	UC7 - Frequency Control – Tertiary Control	UCGrid
TC – AT - 01	UC10 - Volt / Var Optimization	UCGrid
TC – AT - 02	UC5 - Frequency Control – Primary Control	UCGrid
TC – AT - 03	UC6 - Frequency Control – Secondary Control	UCGrid
TC – AT - 04	UC7 - Frequency Control – Tertiary Control	UCGrid
TC – AD - 01	UC8 - Volt / Var Control – Dynamic	UCGrid
TC – AD - 02	UC9 - Volt / Var Control – Static	UCGrid

Table 3: Test Case list

3.2 Test case descriptions

Hereby there are the description of the defined unit tests, unit integration tests, application integration tests and application tests. Note that the test case ID description is a value composed by these data: *TC – Test level – Case Number*, i.e., TC – UA – 01.

3.2.1 TC – UA – 01 DER search definition

Author	Version	Test Case ID
Tecnia	1.0	TC – UA – 01
Test Case name	DER search definition	
Application requirement	<ul style="list-style-type: none"> FR.AP-S.1 	
Use case scenario	<ul style="list-style-type: none"> UC5 to UC10– Scenario 1 – Registry 	
Use cases	<ul style="list-style-type: none"> UCGrid 	
Preconditions	<ul style="list-style-type: none"> Bid request received from OTA/ODA 	
Test Case Description	<ul style="list-style-type: none"> OAA receives the call for bids from the TSO/DSO OAA sets the search criteria that will be used to compose the AFC/AVC or active power service search to the OS4ES system 	
Postconditions	<ul style="list-style-type: none"> OAA is prepared to send the search request to the OS4ES system 	
Comments	<ul style="list-style-type: none"> UCGrid assumes that there are no pre-agreed contract between the aggregators and the DER resource owners, so contracts will be established market-wise The parameters for the DER service search are derived from the national grid codes 	

3.2.2 TC – UA – 02 Compose bid

Author	Version	Test Case ID
Tecnia	1.0	TC – UA – 02
Test Case name	Compose bid	
Application requirement	<ul style="list-style-type: none"> FR.AP-S.1 	

Use case scenario	<ul style="list-style-type: none"> UC5 to UC10– Scenario 1 – Registry
Use cases	<ul style="list-style-type: none"> UCGrid
Preconditions	<ul style="list-style-type: none"> The search response sent from the OS4ES system has been received
Test Case Description	<ul style="list-style-type: none"> OAA composes the best bid it can offer to the DSO/TSO depending on the execution of the matchmaking algorithm of this module. This algorithm selects which are the most convenient DER services to be included in the bid offer that will be sent to ODA/OTA
Postconditions	<ul style="list-style-type: none"> The information needed to generate the bid offer is available
Comments	

3.2.3 TC - UA - 03 Decompose bid

Author	Version	Test Case ID
Tecnalia	1.0	TC – UA – 03
Test Case name	Decompose bid	
Application requirement	<ul style="list-style-type: none"> FR.AP-R.1 	
Use case scenario	<ul style="list-style-type: none"> UC5 to UC10– Scenario 1 – Registry 	
Use cases	<ul style="list-style-type: none"> UCGrid 	
Preconditions	<ul style="list-style-type: none"> The bid order sent from the ODA/OTA has been received 	
Test Case Description	<ul style="list-style-type: none"> OAA generates the information needed to send to the OS4ES system the contract request associated to all those units included in the bid order received from the ODA/OTA 	
Postconditions	<ul style="list-style-type: none"> The information needed to prepare the contract request is ready 	
Comments		

3.2.4 TC – UA – 04 Monitor

Author	Version	Test Case ID
Tecnia	1.0	TC – UA – 04
Test Case name	Monitor	
Application requirement	<ul style="list-style-type: none"> FR.AP-M.1 FR.AP-M.2 	
Use case scenario	<ul style="list-style-type: none"> UC5 to UC7 – Scenario 4 UC8 to UC10 – Scenario 3 	
Use cases	<ul style="list-style-type: none"> UCGrid 	
Preconditions	<ul style="list-style-type: none"> Monitoring data is being received from the OS4ES system 	
Test Case Description	<ul style="list-style-type: none"> The monitoring data is forwarded to the OTA/ODA, as it is the OAA the only application that communicates with the OS4ES system, and the OTA/ODA need that information 	
Postconditions	<ul style="list-style-type: none"> Monitoring data is ready to be forwarded to OTA/ODA 	
Comments		

3.2.5 TC – UA – 05 Operate

Author	Version	Test Case ID
Tecnia	1.0	TC – UA – 05
Test Case name	Operate	
Application requirement	<ul style="list-style-type: none"> FR.AP-AA.2 FR.AP-C.1 	
Use case scenario	<ul style="list-style-type: none"> UC5 to UC7 – Scenarios 2, 3 and 5 UC8 to UC10 – Scenario 2 	
Use cases	<ul style="list-style-type: none"> UCGrid 	
Preconditions	<ul style="list-style-type: none"> Control commands (Activations, deactivations and setpoints) are received from the ODA/OTA 	
Test Case Description	<ul style="list-style-type: none"> Control commands are forwarded to the OS4ES system Commands are also stored locally to be used by the reliability 	

	assessment functional block
Postconditions	<ul style="list-style-type: none"> Control commands are ready to be forwarded to the OS4ES system
Comments	

3.2.6 TC – UA – 06 Introduce contracts

Author	Version	Test Case ID
Tecnalía	1.0	TC – UA – 06
Test Case name	Introduce contracts	
Application requirement	<ul style="list-style-type: none"> FR.AP-R.1 	
Use case scenario	<ul style="list-style-type: none"> UC12 – Precondition #4 	
Use cases	<ul style="list-style-type: none"> UCFlex 	
Preconditions	<ul style="list-style-type: none"> Resource providers have engaged in a contract with one aggregator for the provision of a service during an agreed period of time. Contract describes the mandate to the Aggregator to control consumption and/or production at the site of the Resource Provider. 	
Test Case Description	<ul style="list-style-type: none"> The aggregator uses the OAA user interface to introduce the contractual information relevant to the OS4ES system (basically the information to be sent in the contract request message) 	
Postconditions	<ul style="list-style-type: none"> OAA has the information to be included in the contract request message (see section B2.1 in [1] for message reference) 	
Comments	<ul style="list-style-type: none"> The aggregator is the entity that introduces the contractual information into the OS4ES system. The resource provider must have allowed permission for that action, so that should be included as a clause in the contract. 	

3.2.7 TC – UA – 07 Update congestion point

Author	Version	Test Case ID
Tecnalia	1.0	TC – UA – 07
Test Case name	Update congestion points	
Application requirement	<ul style="list-style-type: none"> FR.F.1 	
Use case scenario	<ul style="list-style-type: none"> UC12 - Assumption 	
Use cases	<ul style="list-style-type: none"> UCFlex 	
Preconditions	<ul style="list-style-type: none"> A periodic trigger has been launched 	
Test Case Description	<ul style="list-style-type: none"> OAA update the congestion point list, which is the list of PCCs in which the aggregator has a contracted service that can provide flexibility 	
Postconditions	<ul style="list-style-type: none"> OAA is prepared to send the Common Reference Query message to USEF 	
Comments		

3.2.8 TC – UA – 08 Store congestion points

Author	Version	Test Case ID
Tecnalia	1.0	TC – UA – 08
Test Case name	Store congestion points	
Application requirement	<ul style="list-style-type: none"> FR.F.1 	
Use case scenario	<ul style="list-style-type: none"> UC12 - Assumption 	
Use cases	<ul style="list-style-type: none"> UCFlex 	
Preconditions	<ul style="list-style-type: none"> The Common Reference Query Response has been received 	
Test Case Description	<ul style="list-style-type: none"> OAA stores the list that is received in the Common Reference Query Response message 	
Postconditions	<ul style="list-style-type: none"> The congestion point list is available for the preparation of the D-prognosis 	
Comments		

3.2.9 TC – UA – 09 Baseline search

Author	Version	Test Case ID
Tecnia	1.0	TC – UA – 09
Test Case name	Baseline search	
Application requirement	<ul style="list-style-type: none"> FR.AP-S.2 FR.AP-M.4 	
Use case scenario	<ul style="list-style-type: none"> UC2 – Scenario 2 – Analyze need for flexibility 	
Use cases	<ul style="list-style-type: none"> UCFlex 	
Preconditions	<ul style="list-style-type: none"> The contract activity has been executed The trigger from either the plan (day ahead market) or validate (intra day market) USEF phases has been launched 	
Test Case Description	<ul style="list-style-type: none"> OAA prepares the information needed to query the OS4ES system about all the baselines of those DER services that have been contracted by the aggregator The time frame of the baseline depends on the market type, which is related to the USEF phase 	
Postconditions	<ul style="list-style-type: none"> OAA knows about which DER services needs to place the capabilities request to the OS4ES system 	
Comments		

3.2.10 TC – UA – 10 A-plan calculation

Author	Version	Test Case ID
Tecnia	1.0	TC – UA – 10
Test Case name	A-plan calculation	
Application requirement	<ul style="list-style-type: none"> FR.AP-M.4 	
Use case scenario	<ul style="list-style-type: none"> UC2 – Scenario 2 – Analyze need for flexibility 	
Use cases	<ul style="list-style-type: none"> UCFlex 	
Preconditions	<ul style="list-style-type: none"> The capabilities response has been received from the OS4ES system 	
Comments		

Test Case Description	<ul style="list-style-type: none"> The baseline of all those DER services in the capabilities response is aggregated for the time frame defined, in PTU intervals
Postconditions	<ul style="list-style-type: none"> The aggregated baseline is ready to be used to fill up the A-plan
Comments	

3.2.11 TC - UA - 11 D-prognosis calculation

Author	Version	Test Case ID
Tecnalia	1.0	TC - UA - 11
Test Case name	D-prognosis calculation	
Application requirement	<ul style="list-style-type: none"> FR.AP-M.4 	
Use case scenario	<ul style="list-style-type: none"> UC2 - Scenario 2 - Analyze need for flexibility 	
Use cases	<ul style="list-style-type: none"> UCFlex 	
Preconditions	<ul style="list-style-type: none"> The capabilities response has been received from the OS4ES system 	
Test Case Description	<ul style="list-style-type: none"> The baseline of all those DER services in the capabilities response is aggregated for the time frame defined, and it is grouped for all the congestion points included in the local congestion point list of OAA 	
Postconditions	<ul style="list-style-type: none"> The aggregated baseline is ready to be used to fill up the D-prognosis 	
Comments		

3.2.12 TC - UA - 12 Flexibility search

Author	Version	Test Case ID
Tecnalia	1.0	TC - UA - 12
Test Case name	Flexibility search	
Application requirement	<ul style="list-style-type: none"> FR.AP-S.2 FR.AP-M.5 	

Use case scenario	<ul style="list-style-type: none"> UC 12 – Scenario 3 – Request flexibility
Use cases	<ul style="list-style-type: none"> UCFlex
Preconditions	<ul style="list-style-type: none"> The flex request has been received from USEF
Test Case Description	<ul style="list-style-type: none"> As a consequence of the assessment of all the A-plans/D-prognosis by means of the BRP/DSO, the aggregator can receive a flex request . This flex request will contain the energy to be diverted in each PTU, either for all the portfolio of the aggregator as a whole or for each subset of services contracted per congestion point OAA has to query the OS4ES registry to look for the available flexibility of the services that the aggregator has contracted and are not yet reserved
Postconditions	<ul style="list-style-type: none"> The information to be included in the capabilities request is ready
Comments	

3.2.13 TC – UA – 13 Flexibility aggregation

Author	Version	Test Case ID
Tecnalía	1.0	TC – UA – 13
Test Case name	Flexibility aggregation	
Application requirement	<ul style="list-style-type: none"> FR.AP-M.5 	
Use case scenario	<ul style="list-style-type: none"> UC 12 – Scenario 4 – Offer flexibility 	
Use cases	<ul style="list-style-type: none"> UCFlex 	
Preconditions	<ul style="list-style-type: none"> The capabilities response has been received from the OS4ES system 	
Test Case Description	<ul style="list-style-type: none"> OAA has to matchmake which are the DER services that fit best the flex request from the flexibility possibilities included in the capabilities response 	
Postconditions	<ul style="list-style-type: none"> The services have been selected and the flex offer can be composed 	
Comments		

3.2.14 TC – UA – 14 Reserve DER services

Author	Version	Test Case ID
Tecnalia	1.0	TC – UA – 14
Test Case name	Reserve DER services	
Application requirement	<ul style="list-style-type: none"> FR.AP-R.1 	
Use case scenario	<ul style="list-style-type: none"> UC2 – Scenario 1 – Add DER System UC4 – Scenario 1 – Imbalance Compensation UC5 – Scenario 1 – Registry UC6 – Scenario 1 – Registry UC7 – Scenario 1 – Registry UC8 – Scenario 1 – Registry UC9 – Scenario 1 – Registry UC10 – Scenario 1 – Registry UC11 – Scenario 1 – Define VPP UC11 – Scenario 2 – Reestablishment of VPP UC12 – Scenario 4 – Offer flexibility UC12 – Scenario 5 – Order flexibility 	
Use cases	<ul style="list-style-type: none"> UCFlex, UCVPP, UCGrid 	
Preconditions	<ul style="list-style-type: none"> The flex order has been received (UCVPP, UCFlex) or the contract responses have been received (UCGrid) 	
Test Case Description	<ul style="list-style-type: none"> OAA knows which services have to be reserved. In UCGrid the duration of the reservation coincides with the contract time frame, so the contract and the reservation process are sequential In UCFlex and UCVPP the contracts are generally more long term than the reservations, and the services are just reserved for the time frame included in the flex order 	
Postconditions	<ul style="list-style-type: none"> Reserve request is ready to be sent 	
Comments		

3.2.15 TC – UA – 15 Monitoring data definition

Author	Version	Test Case ID
Tecnalia	1.0	TC – UA – 15
Test Case name	Monitoring data definition	
Application requirement	<ul style="list-style-type: none"> FR.AP-AA.1 	
Use case scenario	<ul style="list-style-type: none"> UC5 to UC7 – Scenario 4 UC8 to UC10 – Scenario 3 Assumed in all other use cases 	
Use cases	<ul style="list-style-type: none"> UCFlex, UCVPP, UCGrid 	
Preconditions	<ul style="list-style-type: none"> The reserve response has been received from the OS4ES system 	
Test Case Description	<ul style="list-style-type: none"> OAA has to send a monitoring data subscription for all those services which have been reserved. The purpose is that the providing DER systems send the monitoring data directly to the OAA, without interaction with the OS4ES registry. 	
Postconditions	<ul style="list-style-type: none"> The monitoring data subscription is ready to be sent 	
Comments		

3.2.16 TC – UA – 16 Schedule order

Author	Version	Test Case ID
Tecnalia	1.0	TC – UA – 16
Test Case name	Schedule order	
Application requirement	<ul style="list-style-type: none"> FR.AP-AA.2 FR.AP-C.2 	
Use case scenario	<ul style="list-style-type: none"> Assumed in all UCFlex and UCVPP use cases 	
Use cases	<ul style="list-style-type: none"> UCFlex, UCVPP 	
Preconditions	<ul style="list-style-type: none"> The schedule to be sent to each reserved DER service is known 	
Test Case Description	<ul style="list-style-type: none"> The schedule to be sent to the DER systems has been previously defined by other functional blocks: UCFlex: Flexibility aggregation 	

	<ul style="list-style-type: none"> UCVPP: VPP dispatch calculation (flex order refused approved) or VPP reschedule calculation (flex order refused or reschedule)
Postconditions	<ul style="list-style-type: none"> The schedules are ready to be sent
Comments	

3.2.17 TC - UA - 17 Reliability assessment

Author	Version	Test Case ID
Tecnia	1.0	TC - UA - 17
Test Case name	Reliability assessment	
Application requirement	<ul style="list-style-type: none"> FR.AP-M.2 FR.AP-C.4 	
Use case scenario	<ul style="list-style-type: none"> Assumed in all use cases 	
Use cases	<ul style="list-style-type: none"> UCFlex, UCVPP, UCGrid 	
Preconditions	<ul style="list-style-type: none"> The monitoring data is being received from the OS4ES system 	
Test Case Description	<ul style="list-style-type: none"> Once the reservation phase concludes, the OAA judges if the service has been properly provided or not, comparing the control commands to the monitoring data 	
Postconditions	<ul style="list-style-type: none"> The reliability score is ready to be sent 	
Comments		

3.2.18 TC - UA - 18 Update VPP

Author	Version	Test Case ID
Tecnia	1.0	TC - UA - 18
Test Case name	Update VPP	
Application requirement	<ul style="list-style-type: none"> FR.AP-S.1 	
Use case scenario	<ul style="list-style-type: none"> UC2 - Scenario 1 - Add DER 	
Use cases	<ul style="list-style-type: none"> UCVPP 	
Preconditions	<ul style="list-style-type: none"> The aggregator periodically wants to update its portfolio 	

Test Case Description	<ul style="list-style-type: none"> Periodically OAA searches in the OS4ES system for service that are not contracted by the aggregator and that can be attractive for updating its portfolio
Postconditions	<ul style="list-style-type: none"> OAA has the search criteria to be issued in the search request
Comments	

3.2.19 TC - UA - 19 Select contracts

Author	Version	Test Case ID
Tecnalia	1.0	TC - UA - 19
Test Case name	Select contracts	
Application requirement	<ul style="list-style-type: none"> FR.AP-R.1 	
Use case scenario	<ul style="list-style-type: none"> UC2 - Scenario 1 - Add DER 	
Use cases	<ul style="list-style-type: none"> UCVPP 	
Preconditions	<ul style="list-style-type: none"> The search response sent from the OS4ES has been received by the OAA 	
Test Case Description	<ul style="list-style-type: none"> OAA decides which services should be contracted matchmaking the price requested by the DER system owner (and registered in the OS4ES system) to its capacity needs. 	
Postconditions	<ul style="list-style-type: none"> OAA knows which DER services should be contracted 	
Comments		

3.2.20 TC - UA - 20 Plan VPP

Author	Version	Test Case ID
Tecnalia	1.0	TC - UA - 20
Test Case name	Plan VPP	
Application requirement	<ul style="list-style-type: none"> FR.AP-S.2 FR.AP-M.4 FR.AP-M.5 	

Use case scenario	<ul style="list-style-type: none"> UC2 – Scenario 2 – Schedule power
Use cases	<ul style="list-style-type: none"> UCVPP
Preconditions	<ul style="list-style-type: none"> The contract activity has been executed by OAA A periodical trigger associated to the day ahead market has been launched
Test Case Description	<ul style="list-style-type: none"> The Aggregator wants to compose the expected production/demand of its portfolio. Therefore, it has to query about the baselines and the flexibility of all the services under contract.
Postconditions	<ul style="list-style-type: none"> OAA knows how to compose the capabilities request (the services it has to query about)
Comments	

3.2.21 TC - UA - 21 VPP dispatch calculation

Author	Version	Test Case ID
Tecnalia	1.0	TC – UA – 21
Test Case name	VPP dispatch calculation	
Application requirement	<ul style="list-style-type: none"> FR.AP-R.1 	
Use case scenario	<ul style="list-style-type: none"> UC2 – Scenario 2 – Schedule power 	
Use cases	<ul style="list-style-type: none"> UCVPP 	
Preconditions	<ul style="list-style-type: none"> OAA has received the capabilities response 	
Test Case Description	<ul style="list-style-type: none"> OAA has to decide which is the schedule of all those contracted services that can provide flexibility, and adding it up to the baseline of the non-dispatchable services, compose the A-plan that will be sent to the BRP with the energy expectations for the following day 	
Postconditions	<ul style="list-style-type: none"> A-plan ready to go 	
Comments		

3.2.22 TC – UA – 22 Re-plan VPP

Author	Version	Test Case ID
Tecnalia	1.0	TC – UA – 22
Test Case name	Re-plan VPP	
Application requirement	<ul style="list-style-type: none"> • FR.AP-S.2 • FR.AP-M.4 • FR.AP-M.5 	
Use case scenario	<ul style="list-style-type: none"> • UC2 – Scenario 2 – Schedule power • UC2 – Scenario 3 – Reschedule power • UC4 – Scenario 1 – Imbalance compensation 	
Use cases	<ul style="list-style-type: none"> • UCVPP 	
Preconditions	<ul style="list-style-type: none"> • Flex order received from the BRP 	
Test Case Description	<ul style="list-style-type: none"> • OAA has to replan its resources to adapt them to the flex order received from the BRP. This flex order refers to the energy that has to be diverted compared to the current A-plan. The flex order can be referred to the day ahead (A-plan refusal) or a reschedule for an intra-day period (A-plan approved). In the latter case the reschedule could be before (UC2) or after (UC4) the intraday gate closure. • In order to do the replan, the aggregator would add some reservations to its reserved VPP (among those services already contracted), so it has to search the OS4ES for available services and its associated capabilities. • The functionality of this action is to decide which are the criteria to be included in the capabilities request in order to search for the most convenient DER services to be reserved 	
Postconditions	<ul style="list-style-type: none"> • OAA has the information to prepare the capabilities request 	
Comments		

3.2.23 TC – UA – 23 VPP reschedule calculation

Author	Version	Test Case ID
Tecnalia	1.0	TC – UA – 23
Test Case name	VPP reschedule calculation	

Application requirement	<ul style="list-style-type: none"> FR.AP-R.1
Use case scenario	<ul style="list-style-type: none"> UC2 – Scenario 2 – Schedule power UC2 – Scenario 3 – Reschedule power
Use cases	<ul style="list-style-type: none"> UCVPP
Preconditions	<ul style="list-style-type: none"> The capabilities response associated to a reschedule has been received by the OAA
Test Case Description	<ul style="list-style-type: none"> The most convenient services to be reserved and operated are selected from those included in the capabilities response, to match best the flex order
Postconditions	<ul style="list-style-type: none"> Services to be reserved are selected
Comments	

3.2.24 TC – UA – 24 Service dereservation

Author	Version	Test Case ID
Tecnalía	1.0	TC – UA – 24
Test Case name	Service dereservation	
Application requirement	<ul style="list-style-type: none"> FR.AP-R.3 	
Use case scenario	<ul style="list-style-type: none"> UC11 – Scenario 2 - Reestablishment of VPP after malicious behaviour of one or more participating DERs 	
Use cases	<ul style="list-style-type: none"> UCVPP 	
Preconditions	<ul style="list-style-type: none"> Dereservation response received 	
Test Case Description	<ul style="list-style-type: none"> The service that has been dereserved has to be repoladed by another. Therefore, a flex order (internal) has to be prepared to proceed with a reschedule that will intend to fit the current operation to the A-plan 	
Postconditions	<ul style="list-style-type: none"> Flex order like information ready (basically the remaining schedule of the failing service) which has been dereserved 	
Comments		

3.2.25 TC – UA – 25 VPP reestablishment

Author	Version	Test Case ID
Tecnalia	1.0	TC – UA – 25
Test Case name	VPP reestablishment	
Application requirement	<ul style="list-style-type: none"> FR.AP-R.3 FR.AP-M.2 FR.AP-M.3 	
Use case scenario	<ul style="list-style-type: none"> UC11 – Scenario 2 - Reestablishment of VPP after malicious behaviour of one or more participating DERs 	
Use cases	<ul style="list-style-type: none"> UCVPP 	
Preconditions	<ul style="list-style-type: none"> Monitoring data is being received 	
Test Case Description	<ul style="list-style-type: none"> OAA detects that a DER service that is being operated is failing and decides that it has to be dereserved. 	
Postconditions	<ul style="list-style-type: none"> Dereservation request ready to be sent to the OS4ES system 	
Comments		

3.2.26 TC – US – 01 Bid launch

Author	Version	Test Case ID
Tecnalia	1.0	TC – US – 01
Test Case name	Bid launch	
Application requirement	<ul style="list-style-type: none"> N/A 	
Use case scenario	<ul style="list-style-type: none"> Considered as precondition in the use cases 	
Use cases	<ul style="list-style-type: none"> UCGrid 	
Preconditions	<ul style="list-style-type: none"> The TSO/DSO knows which are the possible aggregators to whom the call for bids has to be sent 	
Test Case Description	<ul style="list-style-type: none"> The TSO/DSO opens periodically a market process for provision of PC, SC or TC power or Volt/Var static, dynamic or optimization services TSO/DSO defines the service period time frame 	

	<ul style="list-style-type: none"> • OTA/ODA sends the call for bids command to the OAAs
Postconditions	<ul style="list-style-type: none"> • Bid request prepared to be sent to the aggregators
Comments	<ul style="list-style-type: none"> • This test case will be tested for use cases UC5 to UC10 • The service parameters follow the guidelines dictated by the applicable regulation code, which have to be known by the aggregators

3.2.27 TC - US - 02 Bid selection

Author	Version	Test Case ID
Tecnalia	1.0	TC - US - 02
Test Case name	Bid selection	
Application requirement	<ul style="list-style-type: none"> • N/A 	
Use case scenario	<ul style="list-style-type: none"> • Considered as precondition in the use cases 	
Use cases	<ul style="list-style-type: none"> • UCGrid 	
Preconditions	<ul style="list-style-type: none"> • Bid offers received by the TSO/DSO 	
Test Case Description	<ul style="list-style-type: none"> • The TSO/DSO has to decide which bid offers should be accepted and contracted with the aggregators, in order to guarantee the availability of resources for voltage or frequency support 	
Postconditions	<ul style="list-style-type: none"> • Bid orders ready to be sent to the OAA 	
Comments		

3.2.28 TC - US - 03 Analyze

Author	Version	Test Case ID
Tecnalia	1.0	TC - US - 03
Test Case name	Analyze	
Application requirement	<ul style="list-style-type: none"> • FR.AP-M.1 	
Use case scenario	<ul style="list-style-type: none"> • N/A 	

Use cases	<ul style="list-style-type: none"> UCGrid
Preconditions	<ul style="list-style-type: none"> An event associated to the operation of the grid by means of the DSO/TSO has been detected
Test Case Description	<ul style="list-style-type: none"> The DSO/TSO executes a power flow algorithm to analyse how the grid voltage or frequency could be optimised by means of operating the contracted aggregator services.
Postconditions	<ul style="list-style-type: none"> Power flow analysis done
Comments	

3.2.29 TC - US - 04 Operate

Author	Version	Test Case ID
Tecnalía	1.0	TC - US - 04
Test Case name	Operate	
Application requirement	<ul style="list-style-type: none"> FR.AP-AA.3 FR.AP-C.1 	
Use case scenario	<ul style="list-style-type: none"> UC5 to UC7 – Scenarios 2, 3 and 5 UC8 to UC10 – Scenario 2 	
Use cases	<ul style="list-style-type: none"> UCGrid 	
Preconditions	<ul style="list-style-type: none"> Power flow analysis has been done 	
Test Case Description	<ul style="list-style-type: none"> The power flow analysis result is converted in a set of control commands (activation and deactivation commands and setpoints) to be sent to the reserved DER system services (acting OAA as a gateway) 	
Postconditions	<ul style="list-style-type: none"> Control commands ready to be sent 	
Comments		

3.2.30 TC - AIO - 01 Search request

Author	Version	Test Case ID
HUAS	1.0	TC - AIO - 01
Test Case name	Search request	
Comments		

Application requirement	<ul style="list-style-type: none"> FR.AP-S.1 FR.AP-M.4
Use case scenario	<ul style="list-style-type: none"> UC5 – Scenario 1 – Registry UC6 – Scenario 1 – Registry UC7 – Scenario 1 – Registry UC8 – Scenario 1 – Registry UC9 – Scenario 1 – Registry UC10 – Scenario 1 – Registry UC2 – Scenario 1 – Add DER System UC4 – Scenario 1 – Imbalance Compensation UC11 – Scenario 1 – Define VPP UC11 – Scenario 2 – Reestablishment of VPP UC12 – Scenario 4 – Offer flexibility
Use cases	<ul style="list-style-type: none"> UCGrid, UCVPP
Preconditions	<ul style="list-style-type: none"> DER service must be registered in the OS4ES Registry OAA has defined the service search parameters
Test Case Description	<ul style="list-style-type: none"> OAA sends a Search Request to the OS4ES system To validate the error handling the Aggregator must cause all known errors
Postconditions	<ul style="list-style-type: none"> The search request has been successfully sent to the OS4ES system Error Handling is validated
Comments	<ul style="list-style-type: none"> See section B1.1 of D4.2 [1] for message reference

3.2.31 TC – AIO – 02 Search response

Author	Version	Test Case ID
HUAS	1.0	TC – AIO – 02
Test Case name	Search response	
Application requirement	<ul style="list-style-type: none"> FR.AP-S.1 FR.AP-M.4 	
Use case scenario	<ul style="list-style-type: none"> UC5 – Scenario 1 – Registry UC6 – Scenario 1 – Registry UC7 – Scenario 1 – Registry UC8 – Scenario 1 – Registry UC9 – Scenario 1 – Registry UC10 – Scenario 1 – Registry 	

	<ul style="list-style-type: none"> • UC2 – Scenario 1 – Add DER System • UC4 – Scenario 1 – Imbalance Compensation • UC11 – Scenario 1 – Define VPP • UC11 – Scenario 2 – Reestablishment of VPP • UC12 – Scenario 4 – Offer flexibility
Use cases	<ul style="list-style-type: none"> • UCGrid, UCVPP
Preconditions	<ul style="list-style-type: none"> • The Search Request has been successfully sent to the OS4ES system
Test Case Description	<ul style="list-style-type: none"> • The Search Response score is sent from OS4ES to OAA
Postconditions	<ul style="list-style-type: none"> • Acquired information is verified • Error Handling is validated
Comments	<ul style="list-style-type: none"> • See section B1.2 of D4.2 [1] for message reference

3.2.32 TC – AIO – 03 Contract request

Author	Version	Test Case ID
HUAS	1.0	TC – AIO - 03
Test Case name	Contract request	
Application requirement	<ul style="list-style-type: none"> • FR.AP-R.1 • FR.AP-R.2 	
Use case scenario	<ul style="list-style-type: none"> • Considered as assumption in most of the use cases 	
Use cases	<ul style="list-style-type: none"> • UCVPP, UCGrid, UCFlex 	
Preconditions	<ul style="list-style-type: none"> • OAA has the information about which DER services have to be contracted • In market-wise contract requests, OAA has decided the price that will be offered for contracting each service • In pre-agreed contract requests, OAA knows the pre-agreed price agreed between the aggregator and the resource provider owner 	
Test Case Description	<ul style="list-style-type: none"> • The Contract Request is sent from OAA to OS4ES 	
Postconditions	<ul style="list-style-type: none"> • The contract request has been successfully sent to the OS4ES system • Error Handling is validated 	
Comments	<ul style="list-style-type: none"> • See section B2.1 of D4.2 [1] for message reference 	

3.2.33 TC – AIO – 04 Contract response

Author	Version	Test Case ID
HUAS	1.0	TC – AIO – 04
Test Case name	Contract response	
Application requirement	<ul style="list-style-type: none"> FR.AP-R.1 	
Use case scenario	<ul style="list-style-type: none"> Considered as assumption in most of the use cases 	
Use cases	<ul style="list-style-type: none"> UCVPP, UCGrid, UCFlex 	
Preconditions	<ul style="list-style-type: none"> The Contract Request has been successfully sent to the OS4ES system 	
Test Case Description	<ul style="list-style-type: none"> The Contract Response score is sent from OS4ES to OAA 	
Postconditions	<ul style="list-style-type: none"> Acquired information is verified Error Handling is validated 	
Comments	<ul style="list-style-type: none"> See section B2.3 of D4.2 [1] for message reference 	

3.2.34 TC – AIO – 05 Capabilities request

Author	Version	Test Case ID
HUAS	1.0	TC – AIO - 05
Test Case name	Capabilities request	
Application requirement	<ul style="list-style-type: none"> FR.AP-AA.1 FR.AP-AA.3 FR.AP-M.2 FR.AP-M.5 FR.AP-S.2 FR.AP-M.4 FR.AP-M.5 	
Use case scenario	<ul style="list-style-type: none"> UC2 – Scenario 2 – Schedule Power UC2 – Scenario 3 – Reschedule Power UC4 – Scenario 1 – Imbalance Compensation UC11 – Scenario 1 – Define VPP UC11 – Scenario 2 – Reestablishment of VPP UC12 – Scenario 2 – Analyse need for flexibility 	

Use cases	<ul style="list-style-type: none"> • UCVPP, UCFlex
Preconditions	<ul style="list-style-type: none"> • OAA has defined the constraints list to be imposed to the search, so that the search is only referred to a subset of those services already contracted by the aggregator
Test Case Description	<ul style="list-style-type: none"> • The Capabilities Request is sent from OAA to OS4ES
Postconditions	<ul style="list-style-type: none"> • The capabilities request has been successfully sent to the OS4ES system • Error Handling is validated
Comments	<ul style="list-style-type: none"> • See section B5.3 of D4.2 [1] for message reference

3.2.35 TC – AIO – 06 Capabilities response

Author	Version	Test Case ID
HUAS	1.0	TC – AIO – 06
Test Case name	Capabilities response	
Application requirement	<ul style="list-style-type: none"> • FR.AP-S.2 • FR.AP-M.4 • FR.AP-M.5 	
Use case scenario	<ul style="list-style-type: none"> • UC2 – Scenario 2 – Schedule Power • UC2 – Scenario 3 – Reschedule Power • UC4 – Scenario 1 – Imbalance Compensation • UC11 – Scenario 1 – Define VPP • UC11 – Scenario 2 – Reestablishment of VPP • UC12 – Scenario 2 – Analyse need for flexibility 	
Use cases	<ul style="list-style-type: none"> • UCVPP, UCFlex 	
Preconditions	<ul style="list-style-type: none"> • The Capabilities Request has been successfully sent to the OS4ES system 	
Test Case Description	<ul style="list-style-type: none"> • The Capabilities Response score is sent from OS4ES to OAA 	
Postconditions	<ul style="list-style-type: none"> • Acquired information is verified • Error Handling is validated 	
Comments	<ul style="list-style-type: none"> • See section B5.4 of D4.2 [1] for message reference 	

3.2.36 TC – AIO – 07 Reserve request

Author	Version	Test Case ID
HUAS	1.0	TC – AIO – 07
Test Case name	Reserve request	
Application requirement	<ul style="list-style-type: none"> FR.AP-R.1 	
Use case scenario	<ul style="list-style-type: none"> UC5 to UC10 – Scenario 01 - Registry 	
Use cases	<ul style="list-style-type: none"> UCGrid, UCVPP, UCFlex 	
Preconditions	<ul style="list-style-type: none"> The reserve DER services action has been executed in OAA 	
Test Case Description	<ul style="list-style-type: none"> The Reserve Request is sent from OAA to OS4ES 	
Postconditions	<ul style="list-style-type: none"> The reserve request has been successfully sent to the OS4ES system Error Handling is validated 	
Comments	<ul style="list-style-type: none"> See section B3.1 of D4.2 [1] for message reference 	

3.2.37 TC – AIO – 08 Reserve response

Author	Version	Test Case ID
HUAS	1.0	TC – AIO – 08
Test Case name	Reserve response	
Application requirement	<ul style="list-style-type: none"> FR.AP-R.1 FR.AP-AA.1 	
Use case scenario	<ul style="list-style-type: none"> UC5 to UC10 – Scenario 01 - Registry 	
Use cases	<ul style="list-style-type: none"> UCGrid, UCVPP, UCFlex 	
Preconditions	<ul style="list-style-type: none"> The Reserve Request has been successfully sent to the OS4ES system 	
Test Case Description	<ul style="list-style-type: none"> The Reserve Response score is sent from OS4ES to OAA 	
Postconditions	<ul style="list-style-type: none"> Acquired information is verified Error Handling is validated 	
Comments	<ul style="list-style-type: none"> See section B3.3 of D4.2 [1] for message reference 	

3.2.38 TC – AIO – 09 Dereserve request

Author	Version	Test Case ID
HUAS	1.0	TC – AIO – 09
Test Case name	Dereserve request	
Application requirement	<ul style="list-style-type: none"> FR.AP-R.3 	
Use case scenario	<ul style="list-style-type: none"> UC11 – Scenario 2 	
Use cases	<ul style="list-style-type: none"> UCVPP 	
Preconditions	<ul style="list-style-type: none"> The VPP reestablishment has been executed in OAA 	
Test Case Description	<ul style="list-style-type: none"> The Dereserve Request is sent from OAA to OS4ES 	
Postconditions	<ul style="list-style-type: none"> The dereserve request has been successfully sent to the OS4ES system Error Handling is validated 	
Comments	<ul style="list-style-type: none"> See section B3.6 of D4.2 [1] for message reference 	

3.2.39 TC – AIO – 10 Dereserve response

Author	Version	Test Case ID
HUAS	1.0	TC – AIO – 10
Test Case name	Dereserve response	
Application requirement	<ul style="list-style-type: none"> FR.AP-R.3 	
Use case scenario	<ul style="list-style-type: none"> UC11 – Scenario 2 	
Use cases	<ul style="list-style-type: none"> UCVPP 	
Preconditions	<ul style="list-style-type: none"> The Dereserve Request has been successfully sent to the OS4ES system 	
Test Case Description	<ul style="list-style-type: none"> The Dereserve Response score is sent from OS4ES to OAA 	
Postconditions	<ul style="list-style-type: none"> Acquired information is verified Error Handling is validated 	
Comments	<ul style="list-style-type: none"> See section B3.7 of D4.2 [1] for message reference 	

3.2.40 TC – AIO – 11 Monitoring data subscription

Author	Version	Test Case ID
Tecnalia	1.0	TC – AIO – 11
Test Case name	Monitoring data subscription	
Application requirement	<ul style="list-style-type: none"> FR.AP-AA.1 	
Use case scenario	<ul style="list-style-type: none"> Assumed in all use cases 	
Use cases	<ul style="list-style-type: none"> UCGrid, UCVPP, UCFlex 	
Preconditions	<ul style="list-style-type: none"> The Monitoring data definition has been executed in OAA 	
Test Case Description	<ul style="list-style-type: none"> The Monitoring data subscription is sent from OAA to OS4ES 	
Postconditions	<ul style="list-style-type: none"> The monitoring data subscription has been successfully sent to the OS4ES system Error Handling is validated 	
Comments	<ul style="list-style-type: none"> See section B6.2 of D4.2 [1] for message reference 	

3.2.41 TC – AIO – 12 Control command

Author	Version	Test Case ID
Tecnalia	1.0	TC – AIO – 12
Test Case name	Control command	
Application requirement	<ul style="list-style-type: none"> FR.AP-C.1 FR.AP-C.2 FR.AP-AA.2 	
Use case scenario	<ul style="list-style-type: none"> UC5 to UC7 – Scenarios 2, 3 and 5 UC8 to UC10 – Scenario 2 Assumed in all other use cases 	
Use cases	<ul style="list-style-type: none"> UCGrid, UCVPP, UCFlex 	
Preconditions	<ul style="list-style-type: none"> The schedule order has been executed in OAA in UCGrid or UCVPP, or the control command has been received and processed by the operate function in UCGrid 	
Test Case	<ul style="list-style-type: none"> The Control command is sent from OAA to OS4ES 	

Description	
Postconditions	<ul style="list-style-type: none"> • The control command has been successfully sent to the OS4ES system • Error Handling is validated
Comments	<ul style="list-style-type: none"> • See section B6.1 of D4.2 [1] for message reference

3.2.42 TC – AIO – 13 Monitoring data

Author	Version	Test Case ID
Tecnalía	1.0	TC – AIO – 13
Test Case name	Monitoring data	
Application requirement	<ul style="list-style-type: none"> • FR.AP-M.1 	
Use case scenario	<ul style="list-style-type: none"> • UC5 to UC7 – Scenario 4 • UC8 to UC10 – Scenario 3 • Assumed in all other use cases 	
Use cases	<ul style="list-style-type: none"> • UCGrid, UCVPP, UCFlex 	
Preconditions	<ul style="list-style-type: none"> • The Monitoring data subscription has been successfully sent to the OS4ES system 	
Test Case Description	<ul style="list-style-type: none"> • The Contract Request is sent from OS4ES to OAA 	
Postconditions	<ul style="list-style-type: none"> • Acquired information is verified • Error Handling is validated 	
Comments	<ul style="list-style-type: none"> • See section B6.3 of D4.2 [1] for message reference 	

3.2.43 TC – AIO – 14 Reliability score

Author	Version	Test Case ID
Tecnalía	1.0	TC – AIO – 14
Test Case name	Reliability score	
Application requirement	<ul style="list-style-type: none"> • FR.AP-C.4 	
Use case scenario	<ul style="list-style-type: none"> • Assumed in all use cases 	

Use cases	<ul style="list-style-type: none"> UCGrid, UCVP, UCFlex
Preconditions	<ul style="list-style-type: none"> The Reliability assessment has been executed in OAA
Test Case Description	<ul style="list-style-type: none"> The Reliability score is sent from OAA to OS4ES
Postconditions	<ul style="list-style-type: none"> The reliability score has been successfully sent to the OS4ES system Error Handling is validated
Comments	<ul style="list-style-type: none"> See section B6.4 of D4.2 [1] for message reference

3.2.44 TC – AIU – 01 Common Reference Query

Author	Version	Test Case ID
Tecnalía	1.0	TC – AIU – 01
Test Case name	Common Reference Query	
Application requirement	<ul style="list-style-type: none"> FR.F.1 	
Use case scenario	<ul style="list-style-type: none"> UC12 - Assumption 	
Use cases	<ul style="list-style-type: none"> UCFlex 	
Preconditions	<ul style="list-style-type: none"> The Update congestion point list action has been launched in OAA 	
Test Case Description	<ul style="list-style-type: none"> The Common Reference Query is sent from OAA to USEF 	
Postconditions	<ul style="list-style-type: none"> Acquired information is verified Error Handling is validated 	
Comments	<ul style="list-style-type: none"> See section 12.4.9 of USEF specifications [2] for message reference 	

3.2.45 TC – AIU – 02 Common Reference Query Response

Author	Version	Test Case ID
Tecnalía	1.0	TC – AIU – 02
Test Case name	Common Reference Query Response	

Application requirement	<ul style="list-style-type: none"> FR.F.1
Use case scenario	<ul style="list-style-type: none"> UC12 - Assumption
Use cases	<ul style="list-style-type: none"> UCFlex
Preconditions	<ul style="list-style-type: none"> The Common Reference entity within USEF has the information of which are the PCCs in which the aggregator has contracted a service which is capable of providing flexibility, i.e. it can be dispatched varying the expected energy consumption/demand profile (baseline) OAA has sent the Common Reference Query to USEF
Test Case Description	<ul style="list-style-type: none"> The Common Reference Query Response is sent from USEF to OAA
Postconditions	<ul style="list-style-type: none"> Acquired information is verified Error Handling is validated
Comments	<ul style="list-style-type: none"> See section 12.4.12 of USEF specifications [2] for message reference

3.2.46 TC - AIU - 03 A-plan

Author	Version	Test Case ID
Tecnalia	1.0	TC – AIU – 03
Test Case name	A-plan	
Application requirement	<ul style="list-style-type: none"> Assumed in UCFlex and UCVPP 	
Use case scenario	<ul style="list-style-type: none"> UC12 – Scenario 2 -Analyze need for flexibility 	
Use cases	<ul style="list-style-type: none"> UCFlex, UCVPP 	
Preconditions	<ul style="list-style-type: none"> A-plan calculation executed in OAA (UCFlex) VPP dispatch calculation executed in OAA (UCVPP) 	
Test Case Description	<ul style="list-style-type: none"> The A-plan is sent from OAA to USEF, using a prognosis message as defined in USEF 	
Postconditions	<ul style="list-style-type: none"> The A-plan has been successfully sent to the USEF system Error Handling is validated 	
Comments	<ul style="list-style-type: none"> See section 12.4.14 of USEF specifications [2] for message reference 	

3.2.47 TC – AIU – 04 D-prognosis

Author	Version	Test Case ID
Tecnia	1.0	TC – AIU – 04
Test Case name	D-prognosis	
Application requirement	<ul style="list-style-type: none"> Assumed in UCFlex 	
Use case scenario	<ul style="list-style-type: none"> UC12 – Scenario 2 -Analyze need for flexibility 	
Use cases	<ul style="list-style-type: none"> UCFlex 	
Preconditions	<ul style="list-style-type: none"> D-prognosis calculation executed in OAA 	
Test Case Description	<ul style="list-style-type: none"> The D-prognosis is sent from OAA to USEF, using a prognosis message as defined in USEF 	
Postconditions	<ul style="list-style-type: none"> The D-prognosis request has been successfully sent to the USEF system Error Handling is validated 	
Comments	<ul style="list-style-type: none"> See section 12.4.14 of USEF specifications [2] for message reference 	

3.2.48 TC – AIU – 05 Flex request

Author	Version	Test Case ID
Tecnia	1.0	TC – AIU – 05
Test Case name	Flex request	
Application requirement	<ul style="list-style-type: none"> N/A 	
Use case scenario	<ul style="list-style-type: none"> UC12 – Scenario 3 -Request flexibility 	
Use cases	<ul style="list-style-type: none"> UCFlex 	
Preconditions	<ul style="list-style-type: none"> Either A-plan or D-prognosis sent to the BRP or DSO through USEF 	
Test Case Description	<ul style="list-style-type: none"> The Flex request is sent from USEF to OAA 	
Postconditions	<ul style="list-style-type: none"> Acquired information is verified 	

	<ul style="list-style-type: none"> • Error Handling is validated
Comments	<ul style="list-style-type: none"> • See section 12 of USEF specifications [2] for message reference

3.2.49 TC – AIU – 06 Flex offer

Author	Version	Test Case ID
Tecnia	1.0	TC – AIU – 06
Test Case name	Flex offer	
Application requirement	<ul style="list-style-type: none"> • N/A 	
Use case scenario	<ul style="list-style-type: none"> • UC12 – Scenario 4 -Offer flexibility 	
Use cases	<ul style="list-style-type: none"> • UCFlex 	
Preconditions	<ul style="list-style-type: none"> • The flexibility aggregation has been executed in OAA 	
Test Case Description	<ul style="list-style-type: none"> • The Flex offer is sent from OAA to USEF 	
Postconditions	<ul style="list-style-type: none"> • The flex offer request has been successfully sent to the USEF system • Error Handling is validated 	
Comments	<ul style="list-style-type: none"> • See section 12 of USEF specifications [2] for message reference 	

3.2.50 TC – AIU – 07 Flex order

Author	Version	Test Case ID
Tecnia	1.0	TC – AIU – 07
Test Case name	Flex order	
Application requirement	<ul style="list-style-type: none"> • N/A 	
Use case scenario	<ul style="list-style-type: none"> • UC12 – Scenario 5 -Order flexibility 	
Use cases	<ul style="list-style-type: none"> • UCFlex, UCVPP 	
Preconditions	<ul style="list-style-type: none"> • UCFlex: The BRP or the DSO accepts the flex request sent by the aggregator, either in the plan, validate or operating phase 	

	<ul style="list-style-type: none"> of USEF UCVPP: The BRP accepts the flex offer sent by OAA or orders a reschedule
Test Case Description	<ul style="list-style-type: none"> The Flex order is sent from USEF to OAA
Postconditions	<ul style="list-style-type: none"> Acquired information is verified Error Handling is validated
Comments	<ul style="list-style-type: none"> See section 12 of USEF specifications [2] for message reference

3.2.51 TC - UIS - 01 Bid request

Author	Version	Test Case ID
Tecnia	1.0	TC - UIS - 01
Test Case name	Bid request	
Application requirement	<ul style="list-style-type: none"> Assumed in UC5 to UC10 	
Use case scenario	<ul style="list-style-type: none"> Assumed in UC8 to UC10 UC5 to UC7 - Scenario 01 - Registry 	
Use cases	<ul style="list-style-type: none"> UCGrid 	
Preconditions	<ul style="list-style-type: none"> Bid launch executed in OTA/ODA 	
Test Case Description	<ul style="list-style-type: none"> The bid offer is sent from OTA/ODA to OAA 	
Postconditions	<ul style="list-style-type: none"> Acquired information is verified Error Handling is validated 	
Comments	<ul style="list-style-type: none"> Message definition will be included in D5.3 	

3.2.52 TC - UIS - 02 Bid offer

Author	Version	Test Case ID
Tecnia	1.0	TC - UIS - 02
Test Case name	Bid offer	

Application requirement	<ul style="list-style-type: none"> Assumed in UC5 to UC10
Use case scenario	<ul style="list-style-type: none"> Assumed in UC8 to UC10 UC5 to UC7 – Scenario 01 - Registry
Use cases	<ul style="list-style-type: none"> UCGrid
Preconditions	<ul style="list-style-type: none"> Composed bid executed in OAA
Test Case Description	<ul style="list-style-type: none"> The bid offer is sent from OAA to OTA/ODA
Postconditions	<ul style="list-style-type: none"> The bid offer has been successfully sent to the ODA/OTA Error Handling is validated
Comments	<ul style="list-style-type: none"> Message definition will be included in D5.3

3.2.53 TC - UIS - 03 Bid order

Author	Version	Test Case ID
Tecnalia	1.0	TC – UIS – 03
Test Case name	Bid order	
Application requirement	<ul style="list-style-type: none"> Assumed in UC5 to UC10 	
Use case scenario	<ul style="list-style-type: none"> Assumed in UC8 to UC10 UC5 to UC7 – Scenario 01 - Registry 	
Use cases	<ul style="list-style-type: none"> UCGrid 	
Preconditions	<ul style="list-style-type: none"> Bid selection executed in OTA/ODA 	
Test Case Description	<ul style="list-style-type: none"> The bid order is sent from OTA/ODA to OAA 	
Postconditions	<ul style="list-style-type: none"> Acquired information is verified Error Handling is validated 	
Comments	<ul style="list-style-type: none"> Message definition will be included in D5.3 	

3.2.54 TC – UIS – 04 Monitoring data

Author	Version	Test Case ID
Tecnia	1.0	TC – UIS – 04
Test Case name	Monitoring data	
Application requirement	<ul style="list-style-type: none"> FR.AP-M.1 	
Use case scenario	<ul style="list-style-type: none"> UC5 to UC7 – Scenario 4 UC8 to UC10 – Scenario 3 	
Use cases	<ul style="list-style-type: none"> UCGrid 	
Preconditions	<ul style="list-style-type: none"> The monitor action has received the monitoring data from the OS4ES 	
Test Case Description	<ul style="list-style-type: none"> The monitoring data is sent from OAA to OTA/ODA 	
Postconditions	<ul style="list-style-type: none"> The monitoring data has been successfully sent to the OTA/ODA Error Handling is validated 	
Comments	<ul style="list-style-type: none"> Message definition will be included in D5.3 	

3.2.55 TC – UIS – 05 Control command

Author	Version	Test Case ID
Tecnia	1.0	TC – UIS – 05
Test Case name	Control command	
Application requirement	<ul style="list-style-type: none"> FR.AP-C.1 FR.AP-C.2 	
Use case scenario	<ul style="list-style-type: none"> UC5 to UC7 – Scenarios 2, 3 and 5 UC8 to UC10 – Scenario 2 	
Use cases	<ul style="list-style-type: none"> UCGrid 	
Preconditions	<ul style="list-style-type: none"> The operate functional block has been executed in OTA/ODA 	
Test Case Description	<ul style="list-style-type: none"> The control command is sent from OTA/ODA to OAA 	
Postconditions	<ul style="list-style-type: none"> The control command has been successfully sent to the OTA/ODA Error Handling is validated 	
Comments	<ul style="list-style-type: none"> Message definition will be included in D5.3 	

3.2.56 TC – AA - 01 UC2 Energy management using VPP

Author	Version	Test Case ID
HUAS	1.0	TC – AA - 01
Test Case name	UC2 – Energy management using VPP	
Test Case Description	<ul style="list-style-type: none"> • UCVPP contract and main activity will be tested will be tested • The contract activity will be static for all the sub test cases • Sub test case #1: The A-plan for the day ahead is approved by the BRP and the flex order is identical to the A-plan • Sub test case #2: The A- plan for the day ahead is refused by the BRP so the flex order differs from the A-plan • Sub test case #3: The A-plan for the day ahead is approved by the BRP and the flex order is identical to the A-plan, but later on the BRP asks for a reschedule associated to the intra-day market (delivered before the intra day market closure) 	
Comments		

3.2.57 TC – AA - 02 UC4 Marketization of Balancing Group Management

Author	Version	Test Case ID
HUAS	1.0	TC – AA - 02
Test Case name	UC4 – Marketization of Balancing Group Management	
Test Case Description	<ul style="list-style-type: none"> • UCVPP contract and main activity will be tested will be tested • The contract activity is static as in the case of UC2 • The A-plan is approved by the BRP and the flex order is identical to the A-plan, but later on the BRP asks for a reschedule after the intra-day market closure. The procedure is the same as in UC2 - Sub test case #3, the difference is due to the reschedule delivery time 	
Comments		

3.2.58 TC – AA - 03 UC11 Dynamic Virtual Power Plant

Author	Version	Test Case ID
HUAS	1.0	TC – AA - 03
Test Case name	UC11 - Dynamic Virtual Power Plant	

Test Case Description	<ul style="list-style-type: none"> • UCVPP contract and main activity will be tested will be tested • The contract activity is static as in the case of UC2 • The A-plan is approved by the BRP and the flex order is identical to the A-plan, but later on a service that is being operated fails and it is replaced by the OAA due to the VPP reestablishment functionality
Comments	

3.2.59 TC – AA - 04 UC12 Demand response

Author	Version	Test Case ID
Tecnalia	1.0	TC – AA - 04
Test Case name	UC12 – Demand response	
Test Case Description	<ul style="list-style-type: none"> • UCFlex is tested entirely following the phases defined by used: plan, validate and operate 	
Comments		

3.2.60 TC – AA - 05 UC8 Volt / Var Control – Dynamic

Author	Version	Test Case ID
Tecnalia	1.0	TC – AA - 05
Test Case name	UC8 - Volt / Var Control – Dynamic	
Test Case Description	<ul style="list-style-type: none"> • OAA is tested in the scope of UCGrid, when the service delivered by the DER resources is the AVC (automatic voltage control) offered to the DSO for dynamic voltage control 	
Comments		

3.2.61 TC – AA - 06 UC9 Volt / Var Control – Static

Author	Version	Test Case ID
Tecnalia	1.0	TC – AA - 06
Test Case name	UC9 - Volt / Var Control – Static	
Test Case	<ul style="list-style-type: none"> • OAA is tested in the scope of UCGrid, when the service 	

Description	delivered by the DER resources is the AVC (automatic voltage control) offered to the DSO for static voltage control
Comments	

3.2.62 TC – AA - 07 UC10 Volt / Var Optimization

Author	Version	Test Case ID
Tecnalia	1.0	TC – AA - 07
Test Case name	UC10 - Volt / Var Optimization	
Test Case Description	<ul style="list-style-type: none"> OAA is tested in the scope of UCGrid, when the service delivered by the DER resources is the AVC (automatic voltage control) offered to the TSO for volt/var optimization 	
Comments		

3.2.63 TC – AA - 08 UC5 Frequency Control – Primary Control

Author	Version	Test Case ID
Tecnalia	1.0	TC – AA - 08
Test Case name	UC5 - Frequency Control – Primary Control	
Test Case Description	<ul style="list-style-type: none"> OAA is tested in the scope of UCGrid, when the service delivered by the DER resources is the AFC (automatic frequency control) offered to the TSO for primary reserve 	
Comments		

3.2.64 TC – AA - 09 UC6 Frequency Control – Secondary Control

Author	Version	Test Case ID
Tecnalia	1.0	TC – AA - 09
Test Case name	UC6 - Frequency Control – Secondary Control	
Test Case Description	<ul style="list-style-type: none"> OAA is tested in the scope of UCGrid, when the service delivered by the DER resources is active power offered to the TSO for secondary reserve 	
Comments		

3.2.65 TC – AA - 10 UC7 Frequency Control – Tertiary Control

Author	Version	Test Case ID
Tecnalia	1.0	TC – AA - 10
Test Case name	UC7 - Frequency Control – Tertiary Control	
Test Case Description	<ul style="list-style-type: none"> OAA is tested in the scope of UCGrid, when the service delivered by the DER resources is active power offered to the TSO for tertiary reserve 	
Comments		

3.2.66 TC – AD - 01 UC8 Volt / Var Control – Dynamic

Author	Version	Test Case ID
Tecnalia	1.0	TC – AD - 01
Test Case name	UC8 - Volt / Var Control – Dynamic	
Test Case Description	<ul style="list-style-type: none"> The contract and operate activities of ODA are tested in the scope of UCGrid, when the service delivered by the DER resources is the AVC (automatic voltage control) offered to the DSO for dynamic voltage control 	
Comments		

3.2.67 TC – AD - 02 UC9 Volt / Var Control – Static

Author	Version	Test Case ID
Tecnalia	1.0	TC – AD - 02
Test Case name	UC9 - Volt / Var Control – Static	
Test Case Description	<ul style="list-style-type: none"> The contract and operate activities of ODA are tested in the scope of UCGrid, when the service delivered by the DER resources is the AVC (automatic voltage control) offered to the DSO for static voltage control 	
Comments		

3.2.68 TC – AT - 01 UC10 Volt / Var Optimization

Author	Version	Test Case ID
Tecnalia	1.0	TC – AT - 01
Test Case name	UC9 - Volt / Var Control – Static	
Test Case Description	<ul style="list-style-type: none"> The contract and operate activities of OTA are tested in the scope of UCGrid, when the service delivered by the DER resources is the AVC (automatic voltage control) offered to the TSO for volt/var optimization 	
Comments		

3.2.69 TC – AT - 02 UC8 Frequency Control – Primary Control

Author	Version	Test Case ID
Tecnalia	1.0	TC – AT - 02
Test Case name	UC8 - Frequency Control – Primary Control	
Test Case Description	<ul style="list-style-type: none"> The contract and operate activities of OTA are tested in the scope of UCGrid, when the service delivered by the DER resources is the AFC (automatic frequency control) offered to the TSO for primary reserve 	
Comments		

3.2.70 TC – AT - 03 UC6 Frequency Control – Secondary Control

Author	Version	Test Case ID
Tecnalia	1.0	TC – AT - 03
Test Case name	UC9 - Frequency Control – Secondary Control	
Test Case Description	<ul style="list-style-type: none"> The contract and operate activities of OTA are tested in the scope of UCGrid, when the service delivered by the DER resources is active power offered to the TSO for secondary reserve 	
Comments		

3.2.71 TC – AT - 04 UC7 Frequency Control – Tertiary Control

Author	Version	Test Case ID
Tecnalia	1.0	TC – AT - 04
Test Case name	UC10 - Frequency Control – Tertiary Control	
Test Case Description	<ul style="list-style-type: none"> The contract and operate activities of OTA are tested in the scope of UCGrid, when the service delivered by the DER resources is active power offered to the TSO for tertiary reserve 	
Comments		

References

- [1] «OS4ES, D4.2 Specification of DER Semantic Models and EMS Matching Algorithms».
- [2] «USEF; USEF specifications 2014-II».
- [3] OS4ES, «D1.2. OS4ES system architecture, component requirements and communication infrastructure,» 2015.
- [4] OS4ES; D1.1 OS4ES Requirement specification for an OS4ES.