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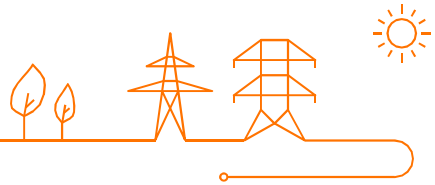
iCAROS Taskforce workshop : design and implementation of phase 1

Date: 07/10/2020

AGENDA

1. Introduction – agenda – [9:30 – 9:40]
2. Design fine tuning for phase 1
   - ‘real-time’ activation of redispatching energy bids – [9:40 – 9:55]
   - iCAROS terminology + Level of exchange of information for outage planning, scheduling & redispatching – [9:55 – 10:10]
   - Schedule update in case of storm risk – [10:10 – 10:20]
3. Update implementation for phase 1
   - Impacted exchanges with external parties & time-line implementation of phase 1 – [10:20 – 10:40]
   - Presentation of future communication concept with external parties – [10:40 – 11:00]



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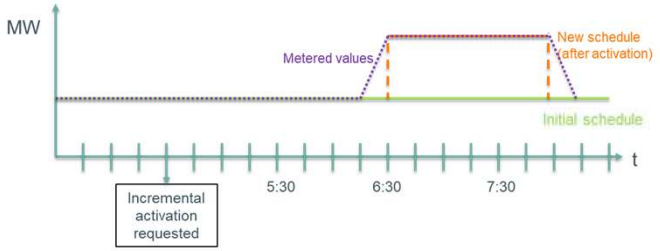
Real-time activation of Redispatching Energy Bids

Date: 07/10/2020

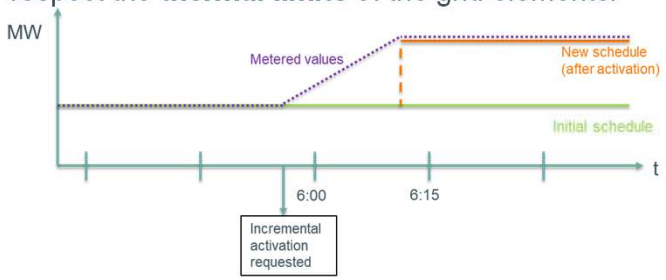
Context

Remedial actions (among which redispatching actions) can be taken **preventively** (i.e. before the contingency occurs) or **curatively** (i.e. after the contingency occurs).

In case of **preventive** actions, the redispatching activations are usually requested **well ahead** of real-time (e.g. up to one to two hours before real-time).



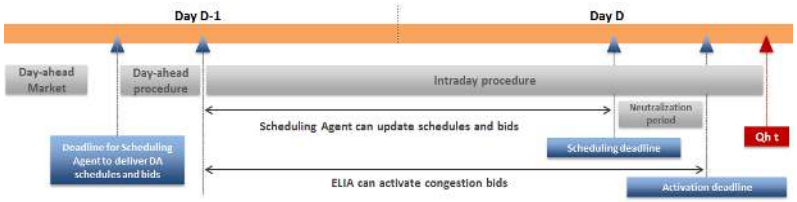
In case of **curative** actions, the redispatching activations are requested **in real-time** and **need to be executed within 15 minutes** in order to respect the **thermal limits** of the grid elements.



Current design

The **current design** focuses on redispatching actions that are activated **preventively**, well ahead of RT:

- Elia can only activate a Redispatching Energy Bid till the activation deadline, which is **at least 15' before the start of the MTU*** for which the bid is activated;



This means that an activation request sent at 5:55 can no longer impact the MTU between 6:00 and 6:15

➔ Need to clarify the design for **curative** activations of Redispatching Energy Bids

* MTU = market time unit = one given 1/4h in Belgium

Reminder - definitions

Presented during the last iCAROS taskforce on June 16 2020*

Redispatching $_{\textbf{baseline}}$ (MW) = the last valid Daily Schedule of the Delivery Point DP_{SU} for quarter hour qh, at the moment of the activation of the Redispatching Energy Bid

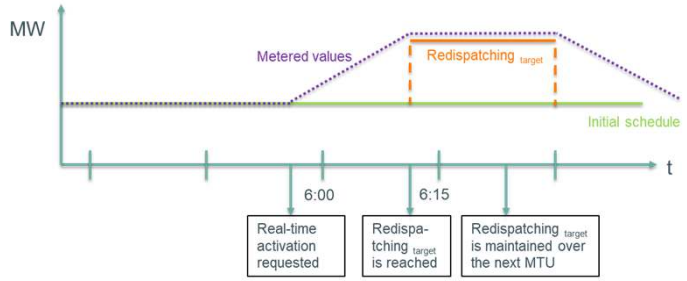
Redispatching $_{\textbf{requested}}$ (MW) = the value (i.e. volume) of the redispatching activation

Redispatching $_{\textbf{target}}$ (MW) = Redispatching $_{\text{Baseline}}$ + Redispatching $_{\text{requested}}$

* Note that the wording “Congestion” was replaced by “Redispatching” to align with the wording of European regulations

New proposal[1] : introduce the concept of 'real-time' activation

- A 'real-time' activation is an activation that can be requested **at any time** by Elia and which implies an **immediate reaction** of the activated Technical Facility since the Redispatching $_{target}$ should be reached at the latest **15 minutes after the activation request is sent** by Elia.
- In case of 'real-time' activation, Redispatching $_{target}$ will, by default, be **maintained over the next MTU**. The 'real-time' activation will then either stop, or be further **prolonged by Elia**.



- All the Redispatching Energy Bids of which the activation delay does **not exceed 15 minutes** are **eligible for 'real-time' activation[2]**

[1] Only valid for iCAROS phase 1 : the extension of this concept for smaller units will be assessed during the preparation of iCAROS phase 2.

[2] This is required for grid security reasons since congestions are local problems. However, given the limited number of occurrences of 'real-time' activation (5-10/year), the impact of these 'real-time' activations on the way Technical Facilities are operated is deemed limited.

Impact of this new proposal on rules for settlement, activation control, correction of BRP perimeter, etc.

Introduction of a **new notion** – 'pro rata' approach:

Redispatching $_{\text{to be supplied}}$ = Redispatching $_{\text{requested}}$ * Period of activation during a given MTU / MTU duration

Where :

- Redispatching $_{\text{requested}}$ (MW) = value (i.e. volume) of the redispatching activation
- Period of activation during a given MTU = { End of the MTU – Start of the real-time activation for the first MTU of a 'real-time' activation; 15 minutes otherwise
- Start of the real-time activation = time at which the activation request is sent + 15 minutes

  Example : real-time activation request sent at 05:55 → start of real-time activation = 06:10

➔ Redispatching $_{\text{to be supplied}}$ = Redispatching $_{\text{requested}}$, except for the first 1/4h of a 'real-time' activation where a 'pro rata' approach applies

All the existing rules for settlement, activation control, correction of BRP perimeter, etc. (presented during the last iCAROS taskforce) remain valid, provided that Redispatching $_{\text{requested}}$ is replaced by Redispatching $_{\text{to be supplied}}$ in the formules.

Feedback and follow-up

Feedback, comments and suggestions on presented design fine tunings are kindly requested by sending it to Caroline.Bosschaerts@elia.be **and** Raphael.Dufour@elia.be by 21st October 2020.

Follow-up via next iCAROS taskforce on February 26th 2021.

iCAROS Program Manager
Viviane Illegems

Design architect outage planning, scheduling, redispatching
Caroline Bosschaerts – Raphaël Dufour

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Back-up slides

Back-up slide – rules for remuneration

Remuneration =

$$\sum_{activation\ duration} \text{time unit x Redispatching}_{\text{to be supplied}} \text{ x Redispatching Energy Bid price}$$

Back-up slide – rules for control of redispatching activation

$$Penalty = \sum_{\substack{non\ compliant \\ time\ units}} MAX\ (0; time\ unit\ x\ Redispatching_{\ missing\ MW}\ x\ Penalty\ price)$$

Where:

- Redispatching $_{\text{missing MW}}$ = Redispatching $_{\text{to be supplied}}$ – Redispatching $_{\text{supplied}}$
- Redispatching $_{\text{supplied}}$ (MW) =
  - Max (0;min(– Pmeasured[1] – Redispatching $_{\text{Baseline}}$;Redispatching $_{\text{to be supplied}}$)) **in case of incremental activation**
  - Min (0;max(– Pmeasured –Redispatching$_{\text{Baseline}}$;Redispatching $_{\text{to be supplied}}$)) **otherwise**

[1] *Pmeasured is defined as "The difference between gross offtake and gross injection, measured at a Delivery Point." Net injection into the Elia Grid is therefore considered as a negative value.*

Back-up slide – rules for BRP perimeter correction

Elia will correct the perimeter of the BRP with the value of the energy to be supplied (Redispatching $_{\text{to be supplied}}$) as long as the BRP and the SA are the same actor (iCAROS phase 1), instead of directly evolving towards the LT vision foreseen in the iCAROS design (i.e. correction with the value of Redispatching $_{\text{supplied}}$).

SA = BRP

BRP perimeter corrected with Redispatching $_{\text{to be suplied}}$

Split of SA and BRP roles

BRP perimeter correction to be confirmed

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iCAROS Terminology
Outage planning, Scheduling & Bidding obligation

iCAROS Taskforce

Date: 07/10/2020

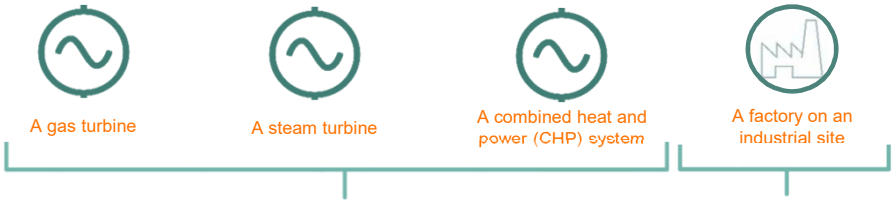
Technical Unit

Device or aggregation of devices connected directly or indirectly to the synchronous electrical network that produces and/or consumes electricity.

A Technical Unit can be :

- A Power Unit (PU)
- A Demand Unit (DU)

Examples :



Technical Facility

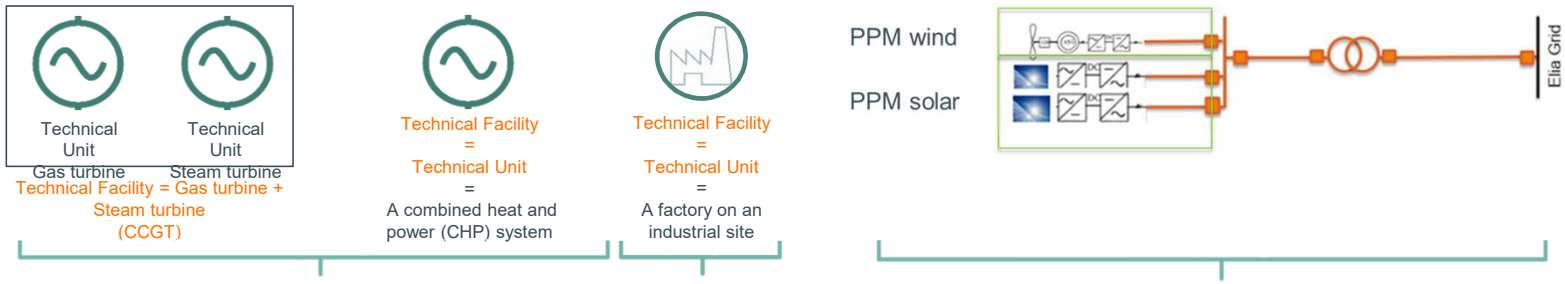
Complete set of Technical Unit(s) which are operationally linked and which, combined together in one or several operating modes, can consume or generate electricity on its own.

A Technical Facility can be :

- Synchronous Power Generating Module (SPGM)
- Power Park Module (PPM) per primary energy source, i.e. the aggregation of all the components of the Power Park Module (as defined in NC RfG*) supplied from the same source of primary energy
- Demand Facility (DF)
- Energy Storage Device (ESD)

NEW

Examples :

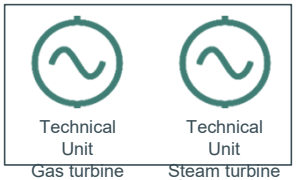


* Network code on Requirements for Generators : PPM = *a unit or ensemble of units generating electricity, which is either non-synchronously connected to the network or connected through power electronics, and that also* ***has a single connection point to*** *a transmission system, distribution system including closed distribution system or HVDC system*

Operating Mode

Any subset of Technical Units, being part of the same Technical Facility, that can generate or consume electricity on its own.

Examples :



Technical Facility = Gas turbine + Steam turbine (CCGT)

Operating modes:
- gas turbine working in open cycle
- gas turbine and steam turbine working in combined cycle
- …

Technical Facility = Technical Unit = A combined heat and power (CHP) system

➔ Only one operating mode

Outage Planning, Scheduling and Bidding obligation

Current design

- The Outage Planning, Scheduling and Bidding obligations are defined on the level of Technical Facilities ('Asset' level in the design note).

  Examples:

  - A PGM or an ESD with an installed capacity of more than 25MW should communicate DA and ID MW schedules to Elia
  - A cross-border relevant PGM with an installed capacity of less than 25MW should communicate availability plans according to the default European calendar for outage coordination

- The Outage Plans, Schedules and Redispatching Energy bids are exchanged at the following levels:

	Outage plan	Schedule	Redispatching Energy Bid
Technical Facility	Default	Default	Default
Technical Unit	When Technical Facility consists of several Technical Units connected to the ELIA grid via different connection points	When Technical Facility consists of several Technical Units connected to the ELIA grid via different connection points	
Operating Mode			When Technical Facility consists of several Technical Units connected to the ELIA grid via different connection points*

* See design finetuning presented in the iCAROS taskforce of March 11th 2020

New proposal

- The Outage Planning, Scheduling and Bidding obligations **remain** defined on the level of Technical Facilities.

  But beware that the definition of Technical Facility slightly defers from the definition of 'Asset' mentioned in the design note, since it refers to the notion of PPM per primary energy source and no longer to the general notion of PPM as defined in the RfG.

  E.g. A solar PPM with an installed capacity of more than 25MW should communicate DA and ID MW schedules to Elia

- The Outage Plans, Schedules and Redispatching Energy bids are exchanged at the following levels[1]:

	Outage plan	Schedule	Redispatching Energy Bid
Technical Unit	Default	Default	
Operating Mode			Default

The impact of this new proposal is very limited :

- Most of the Technical Facilities only consist of 1 Technical Unit and have 1 possible Operating Mode : in this case, this new proposal does not have any impact on the way the information is exchanged between the OPA/SA and Elia
- For Technical Facilities[2] consisting of several Technical Units connected to the ELIA grid via different connection points : no impact of this new proposal
- Only Technical Facilities[2] consisting of several Technical Units connected to the ELIA grid via one connection point are impacted by this new proposal, but it allows :
  - ✓ Simple rules that are the same for each Technical Facility
  - ✓ Technical Facilities consisting of several Technical Units to bid their flexibility by Operating Mode, hence better reflecting their costs/activation delays/etc.
  - ✓ Using the data exchanged in the context of asset coordination for Transparency purposes, hence reducing the number of communication channels

[1] This default rule is also valid for CDS-connected Technical Facilities
[2] Including CDS-connected Technical Facilities

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Schedule update in case of storm risk

Date: 07/10/2020

Closer look on the iCAROS design – Amendments to schedules in Intraday

(reminder from the iCAROS design notes)

The Scheduling Agent **must inform ELIA without delay of any schedule modification** of an asset for quarter-hour in the permitted periods. Unless in the cases described below, the schedule amendment **does not require approval of ELIA**. ELIA will therefore allow the generators to grasp the opportunities in the Intraday market, regardless of whether the asset is located in a zone with or without congestion risks. ELIA will **analyze the impact of the schedule amendment** and if the circumstances require it, **activate flexibility on the asset or on another asset in the zone to reduce congestion risks.**

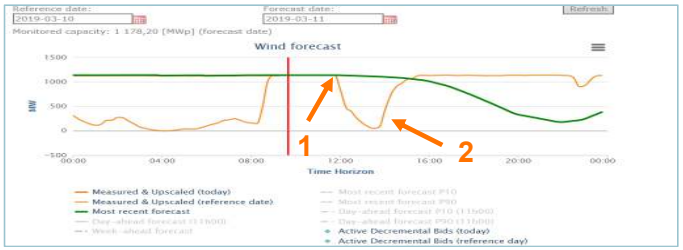
In the following cases the schedule amendment must be **requested to ELIA for approval**:

- A schedule amendment in the **opposing direction of an earlier requested activation** of flexibility for redispatching on the concerned asset for the concerned period;
- A schedule amendment **in violation of a Must-Run or May-Not-Run agreement** with ELIA;
- A schedule amendment in the **incremental direction** on an **offshore** PPM and for a forecasted or ongoing **storm event.***

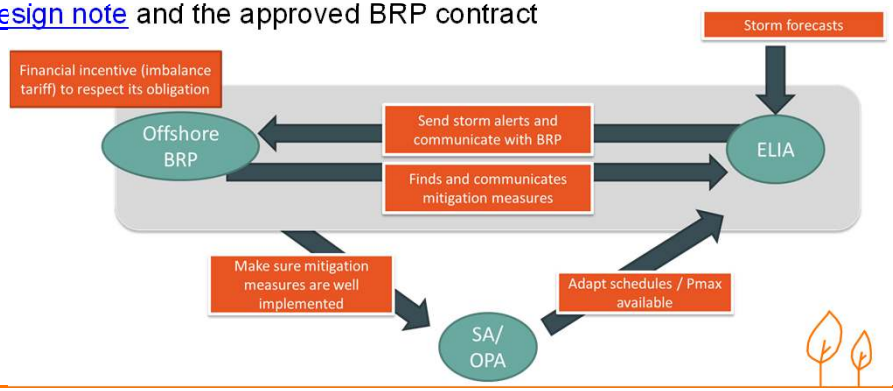
** This latter case was not yet mentioned in the iCAROS design notes of 2018 but has been integrated and validated in the context of the offshore integration design note (2019)*

Schedule update in case of storm risk – Storm mitigation procedure

- **Storm in the North Sea** might trigger substantial imbalances in the Belgian control area
  1. **Cut-out**: drop/decrease of the power production of offshore wind parks due to too high wind speed
  2. **Cut-in**: offshore wind parks start producing power again at (almost) the same time (at the end of the storm)



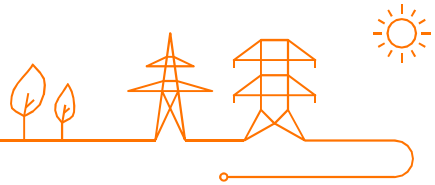
- A specific **storm mitigation procedure** needs to be followed to ensure the security of the system as described in the design note and the approved BRP contract



Schedule update in case of storm risk – Cut-in phase

- Pursuant to article 252 of the Federal Grid Code, the **cut-in phase** of an Offshore Power Park Module following a forecasted (or ongoing) storm event **must be approved by Elia**, **and coordinated by the Parties**
- As described in the T&C SA, the current process to handle cut-in phase of offshore wind parks foresees that:
  - The SA provides a new schedule of an offshore park for the restart of the power production after the storm
  - This **new schedule needs to be validated** by Elia to coordinate the cut-in phase in order to ensure the security of the system during this phase

As the cut-in phase after a storm in the North Sea needs to be coordinated, a schedule amendment in the **incremental direction** on an **offshore** PPM for a forecasted or ongoing **storm event** must be **requested to ELIA for approval**



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High-level proposal timeline for implementation & testing for Go-Live Phase 1 iCAROS

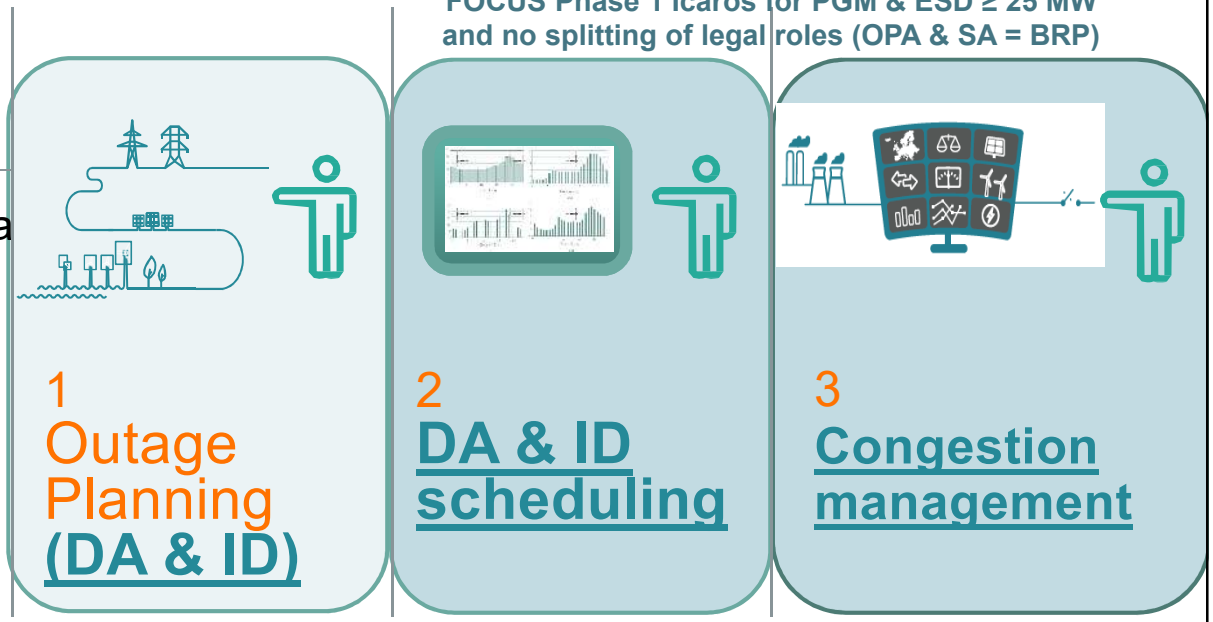
Date: 07/10/2020

iCAROS = Integrated Coordination of Assets for Redispatching and Operational Security

FOCUS Phase 1 Icaros for PGM & ESD ≥ 25 MW and no splitting of legal roles (OPA & SA = BRP)

Business Scope

Exchange of operational data [from LT to realtime]



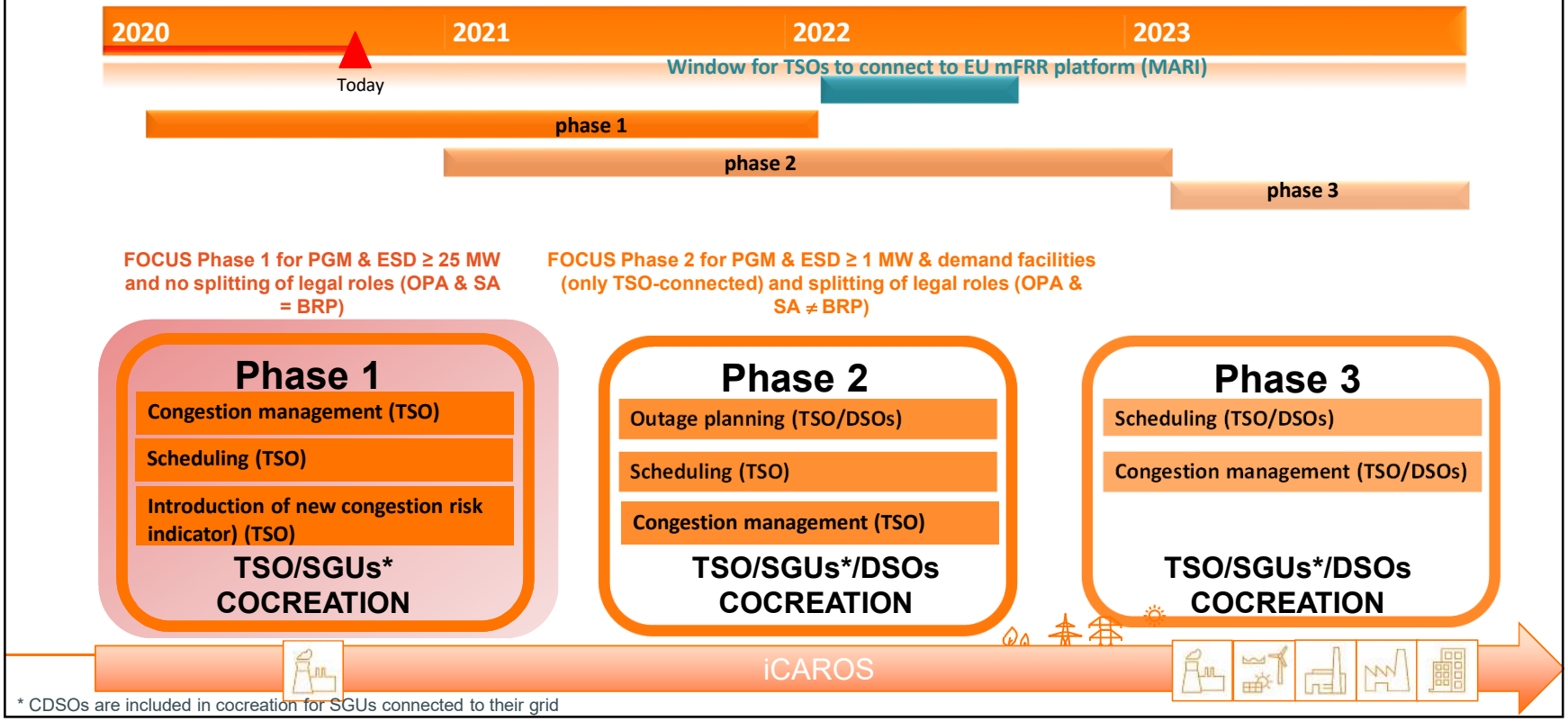
1 Outage Planning (DA & ID)

2 DA & ID scheduling

3 Congestion management

iCAROS phased implementation

→ Phasing reflects operational prioritization and is cocreated with SGUs & DSOs
→ no big bang but safeguarding operational robustness



* CDSOs are included in cocreation for SGUs connected to their grid

iCAROS phase 1: Interaction Scheduling Agent – Elia & Interaction Outage Planning Agent DA & ID - Elia

1. ID Scheduling + DA scheduling

   Outage Planning DA + Outage Planning ID

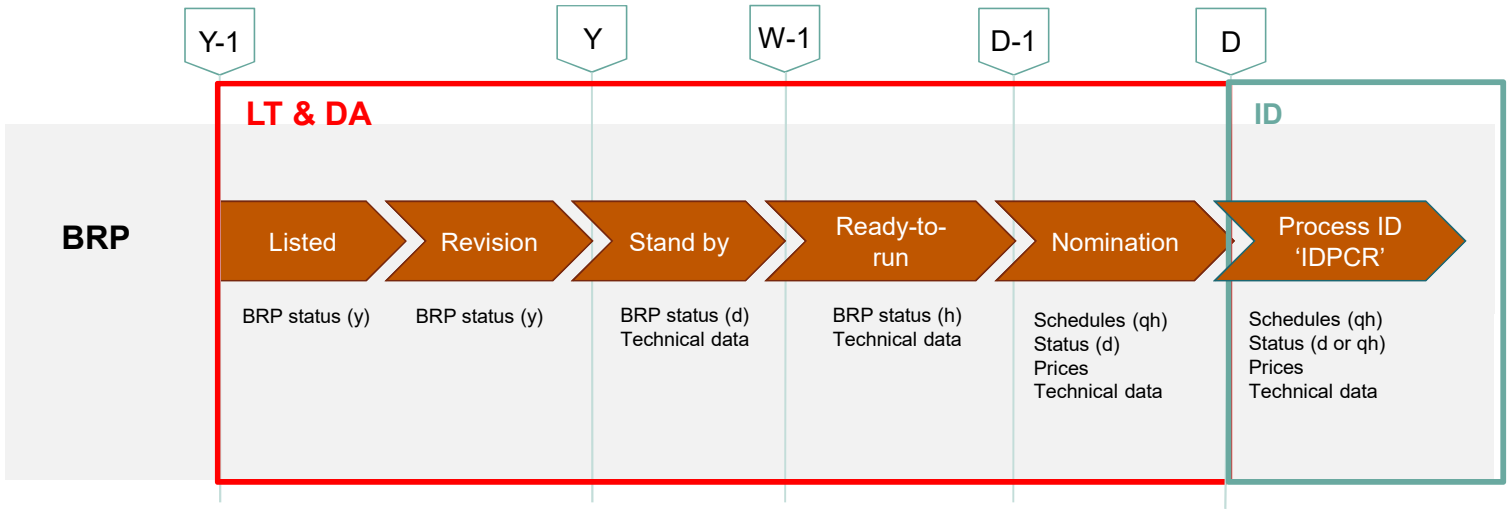
2. Congestion Risk Indicator

3. Bidding of Redispatching Energy Bids

4. Activation of Redispatching Energy Bids

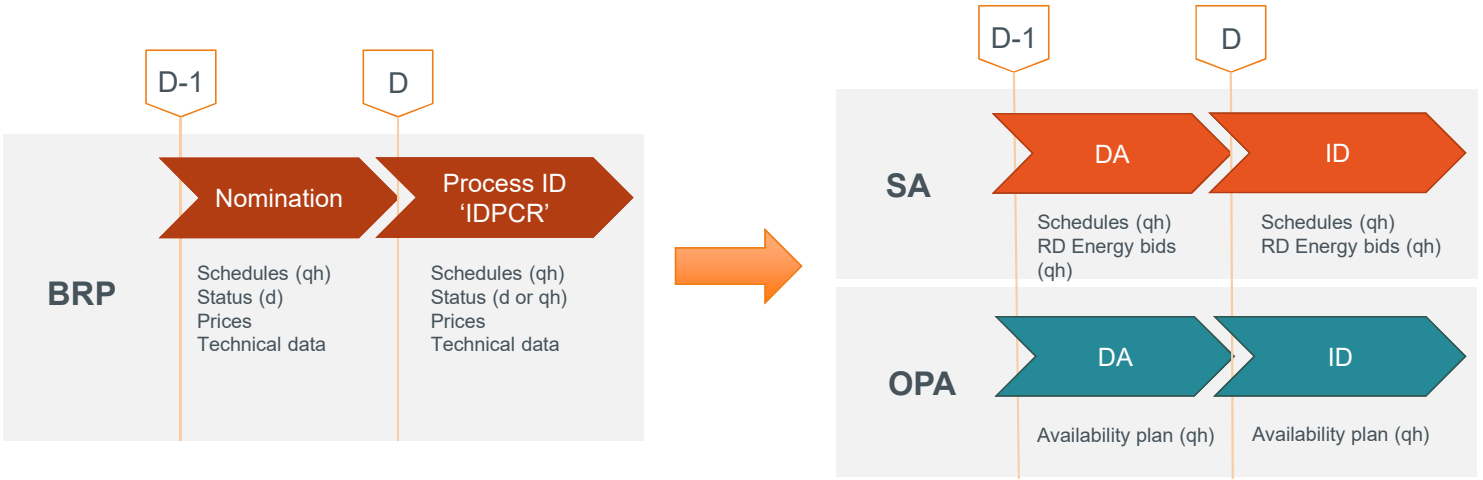
AS IS situation

Information flows



AS IS – TO BE phase 1 DA - ID

Information flows



Outage Planning Agent DA & ID

Current process

- Availability Status is delivered on unit level in DA on day
- Availability Status is delivered on Power Plant level in ID on day or quarter hour

Current interaction

- BRP sends DA Outage Planning Information to Elia
- Interface for DA Outage Planning: Via Excel file exchange
- BRP sends ID Outage Planning information to Elia via Probid application
- Interface for ID Outage Planning : BRP System to Elia System

Future process

- Availability Status on quarter hour
- level of schedule information exchange will be on Technical Unit level

Future interaction

- Outage Planning Agent sends DA & ID Availability to Elia via dedicated interface with new Outage Planning tool
- Interface: OPA System to Elia System (Objective to extend with User interface in iCAROS phase 2)

Under discussion

DA Scheduling

Current process

- Production Program delivered on unit level in DA

Current interaction

- BRP sends Schedule to Elia
- Interface: Via Excel file exchange

Future process

- DA Schedule
- level of schedule information exchange will be **on Technical Unit level**

Future interaction

- Scheduling Agent sends Schedule to Elia via new Scheduling application **(and vice versa)**
- Interface: SA System to Elia System (Objective to extend with User interface in iCAROS phase 2)

ID Scheduling

Under discussion

Current process

- IntraDay Production Program Request (IDPCR)
- Production Program delivered on Power Plant level in intraday (on unit level in DA)

Current interaction

- BRP sends IDPCR to Elia via Probid application
- Elia update of Production Program after activation or notification of Forced Outage
- Interface: BRP System to Elia System

Future process

- Intraday Schedule amendment
- Elia can send AD HOC request to return to schedule, in case a deviation of the Schedule might cause a significant grid security risk
- Level of schedule information exchange will be **Technical Unit**

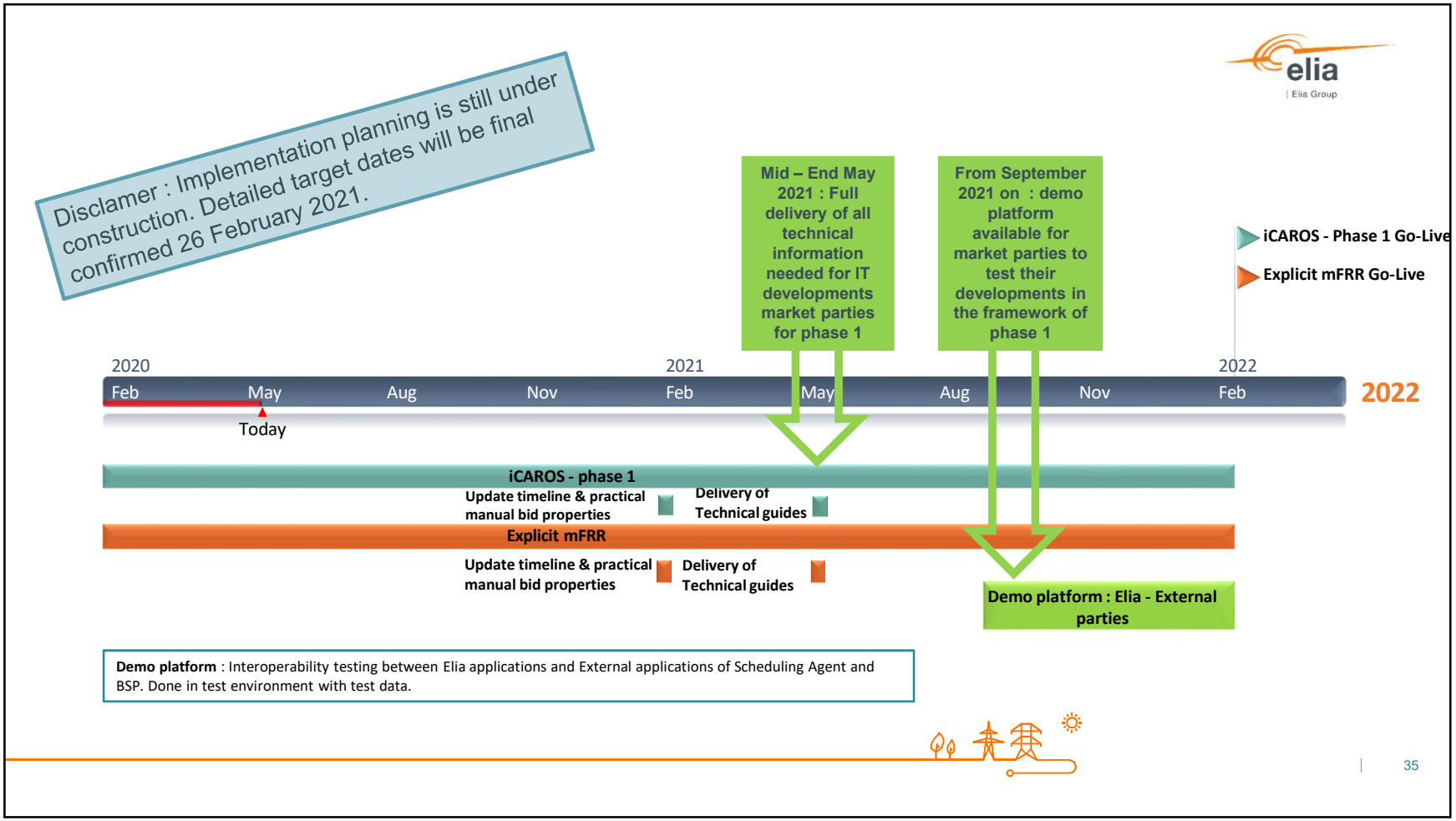
Future interaction

- Scheduling Agent sends Schedule amendment to Elia via new Scheduling application ***(and vice versa)***
- ***Elia sends to Scheduling Agent newly valid daily Schedule, including possible amendment after activation***
- Interface: SA System to Elia System (Objective to extend with User interface in iCAROS phase 2)

ID Scheduling

Future interaction

- Message format to be confirmed
- **Possibly** based on ENTSOe CIM: SCHEDULE DOCUMENT


Disclamer : Implementation planning is still under construction. Detailed target dates will be final confirmed 26 February 2021.
elia
Elia Group
Mid – End May 2021 : Full delivery of all technical information needed for IT developments market parties for phase 1
From September 2021 on : demo platform available for market parties to test their developments in the framework of phase 1
iCAROS - Phase 1 Go-Live
Explicit mFRR Go-Live
2020
2021
2022
Feb
May
Aug
Nov
Feb
May
Aug
Nov
Feb
2022
Today
iCAROS - phase 1
Update timeline & practical manual bid properties
Delivery of Technical guides
Explicit mFRR
Update timeline & practical manual bid properties
Delivery of Technical guides
Demo platform : Elia - External parties
Demo platform : Interoperability testing between Elia applications and External applications of Scheduling Agent and BSP. Done in test environment with test data.
35

Next steps

- **26/02/'21** : iCAROS taskforce fine-tuning workshop : Presentation of final timeline to MP's & manual 'bidding properties'
- Full delivery of Technical guides **mid - end May 2021**
- **03/06/'21** : iCAROS taskforce fine-tuning workshop : presentation of Technical guides
- **September 2021 – February 2022** [~5 months before Go-Live] period in which demo environment will be available for MP and test sessions will be organized

Disclamer : Implementation planning is still under construction. Detailed target dates will be final confirmed 26 February 2021.

Feedback and follow-up

Feedback, comments and suggestions on presented initial high-level proposal for implementation & testing timeline for Go-Live Phase 1 iCAROS

are kindly requested by sending it to Viviane.Illegems@elia.be by 21st October 2020.

Follow-up via next iCAROS taskforce on February 26th 2021.

iCAROS Program Manager **Viviane Illegems**
Design architect outage planning, scheduling, redispatching **Caroline Bosschaerts - Raphaël Dufour**

USERS' GROUP

Communication Layer - High Level Architecture proposal

Date: 07/10/2020

Communication Layer - High Level Architecture proposal

Disclaimer : For information and collect first feedbacks, detail scope will be final confirmed 26 February 2021.

Today

For historical reason - due to the market and technology evolution (some communications have been in place over 15 years):

- Communication is scatted depending the product (nomination, activation, bidding, …)
- Security protocols are not align (e.g. different tls versions, different way of authentication, …)
- Protocols are not align, not in adequacy with the paradigm which is use (e.g. http protocol for asynchronous scenario)
- Message content is not base on the market standard (e.g. Entso-e)
- Documentation is not centralized
- …

Tomorrow

We want to propose to our External Stakeholder a new communication layer :

- A central entry point
- A security standardization
- A new asynchronous pipeline base on open and standard protocol (AMQP)
- A synchronous pipeline will extend the communication layer when new scenarios justify it
- A communication base on the Entso-e Standard energy formats
- A central documentation repository

This communication layer will be propose at first via the iCAROS Program, and will evolve naturally with the **market evolution** and by opportunities.

The **scope of this new communication layer** must **be defined** according the planning and the opportunity that will be defined by the iCAROS project team.

Communication Layer - Overview & needs

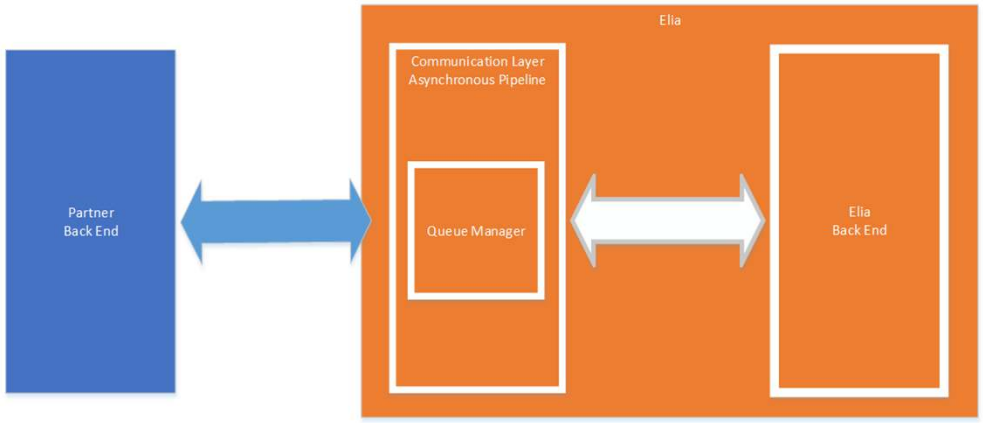
Disclaimer : For information and collect first feedbacks, detail scope will be final confirmed 26 February 2021.

Asynchronous Pipeline Overview:

- Base on AMQP Protocol
- Queue Manager is located at Elia Side, External Stakeholders do not need to host anything anymore
- Dedicated queues per External Stakeholder & per message types will be created
- Standard security protocol will be set in place

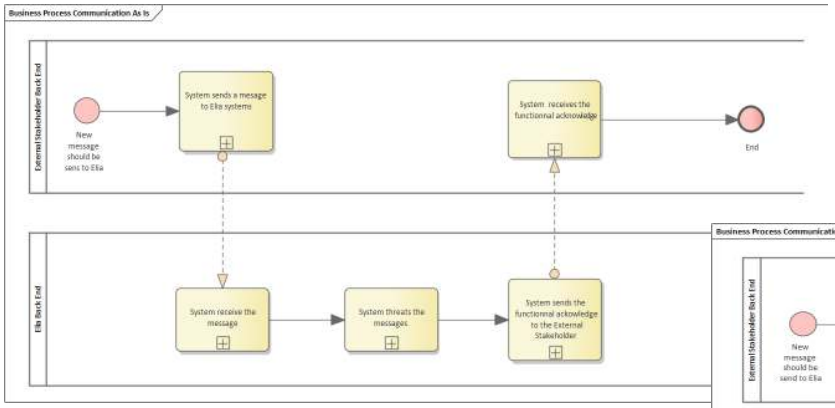
What is still needed :

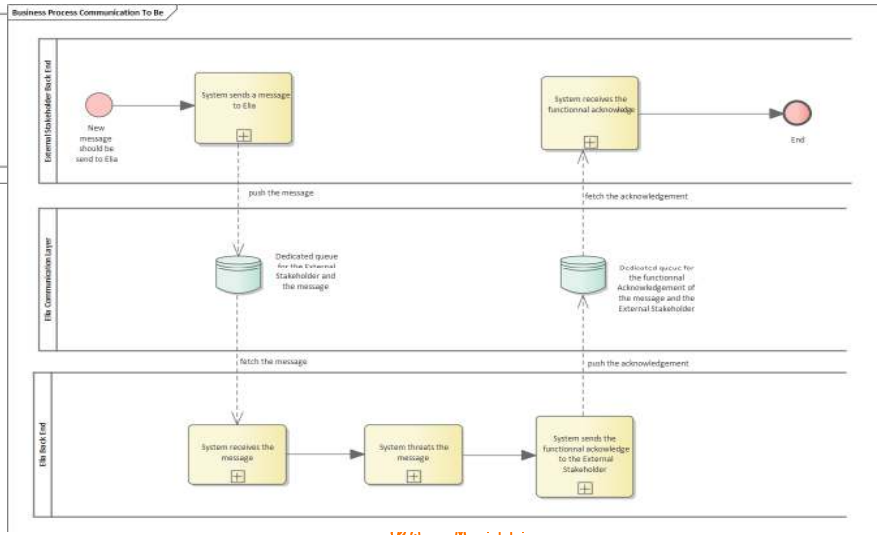
- A default behavior when message is not respond on time have to be foreseen
- A default behavior when the message can't be threat (e.g. not well format message)



Communication Layer - As Is / To Be – A short example

Disclaimer : For information and collect first feedbacks, detail scope will be final confirmed 26 February 2021.





* Same approach when Elia sends a message

Communication Layer - Conclusion

Disclaimer : For information and collect first feedbacks, detail scope will be final confirmed 26 February 2021.

Why do we propose this new communication layer ?

- To modernize the communication architecture between Elia and its External Stakeholders
- Reduce the requirements on our External Stakeholders : no need anymore to expose webservers to Elia
- Reduce the communication test phase between Elia and its External Stakeholders
- To reduce the availability needs from Elia on its External Stakeholders specially on non critical business process

What is next ?

- Definition of the Communication Layer scope (presentation during iCAROS fine-tuning workshop of 26 February 2021)
- Technical documentation of the Communication Layer (Mid – End May 2021)
- The technical documentation will be followed by a technical presentation (Solution & Technical IT Architect oriented) (presentation during iCAROS fine-tuning workshop of 3 June 2021)

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Thank you.