Integration workshop

26/11/2020

(EMERGENCY DRONE)AI

DRONE[AI] solution for Humanitarian & Emergency situations

Agenda

- Introduction
- Project motivations, scope and goals
- How does it work?
  - Overall system
  - Integration with the emergency.lu platform
  - The AI side of it, creating and testing a new model
  - The processing side of it configuration of the processing chain
  - Demonstration of the currently implemented experimental solution
- Wrap-up and next steps

Introduction and rules of engagement! (1/2)

Drone[AI] is an integrated solution designed to support the assessment operations using the images captured via drones thanks to Artificial Intelligence capabilities.

This project is a **Proof of Concept** in order to confirm the interest in buidling such integrated solution together with the emergency.lu solution.

This workshop is an important step in order to collect comments, observations, reactions or any other feedbacks to better define the actual requirements.

- This project is not intended to deliver an operational service
- This project is supported by:

esa European Space Agency

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Introduction and rules of engagement! (2/2)

What we will discuss:

- Project scope, ambitions and motivations
- Integration with mission operations
- Technical implementation
- emergency.lu possible integration
- Collaboration with other services

What we will not discuss:

- How to start using the service

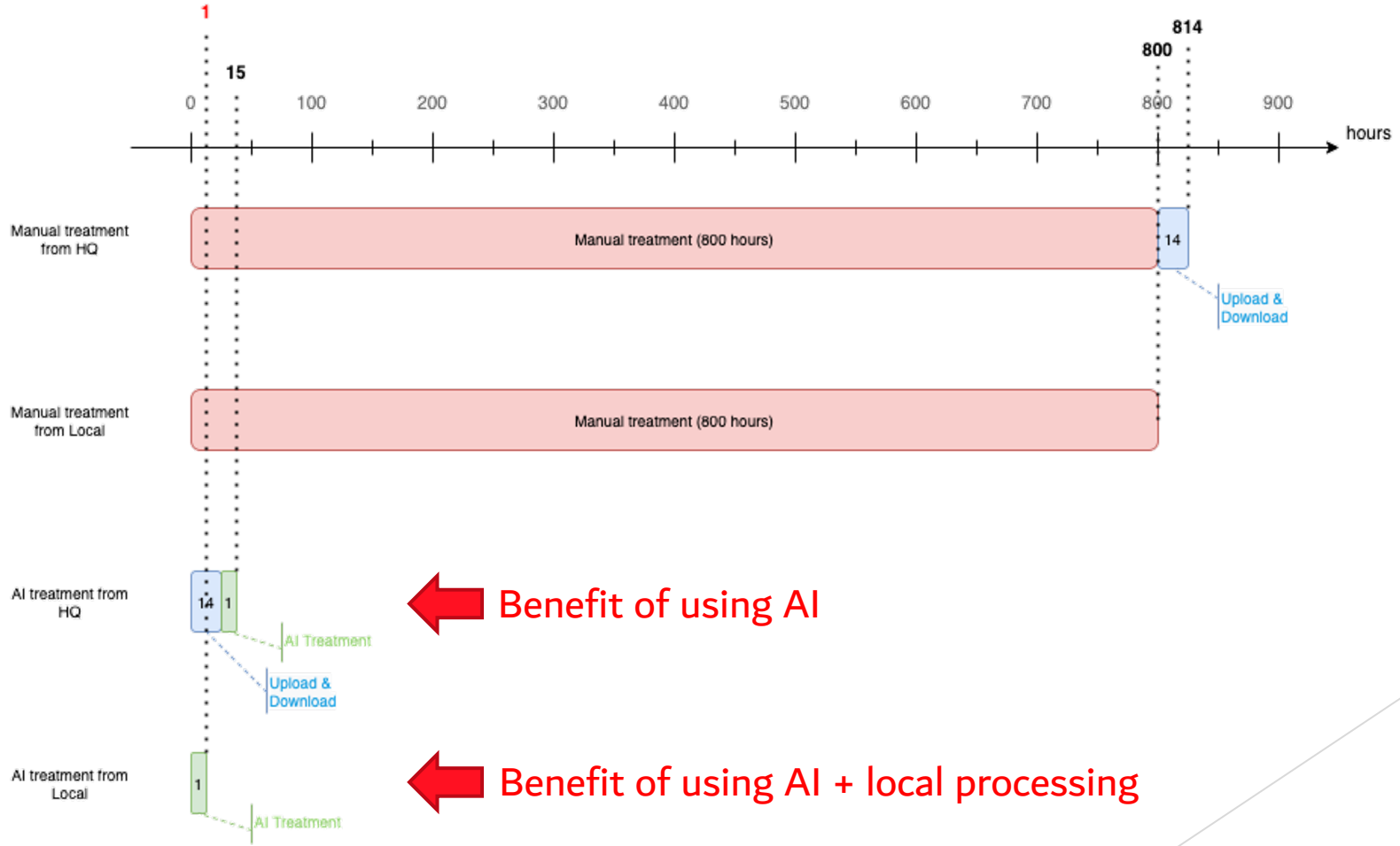
Interactive workshop, please ask question during the presentation

- Feel free to ask question at any moment: there is no stupid question in such workshop!

Project motivations, scope and goal

Starting point

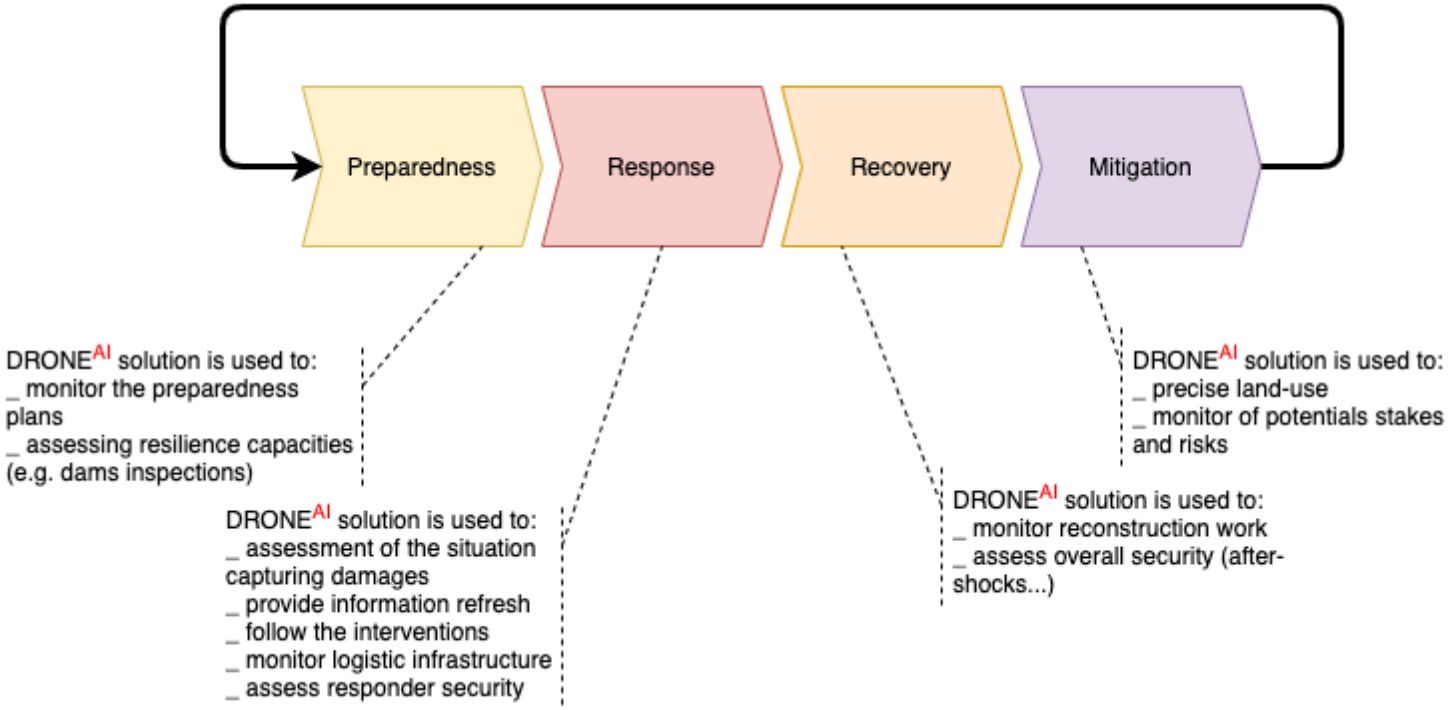
Hypothesis: a drone captures 20 mins of video at 1080p resolution using H264.



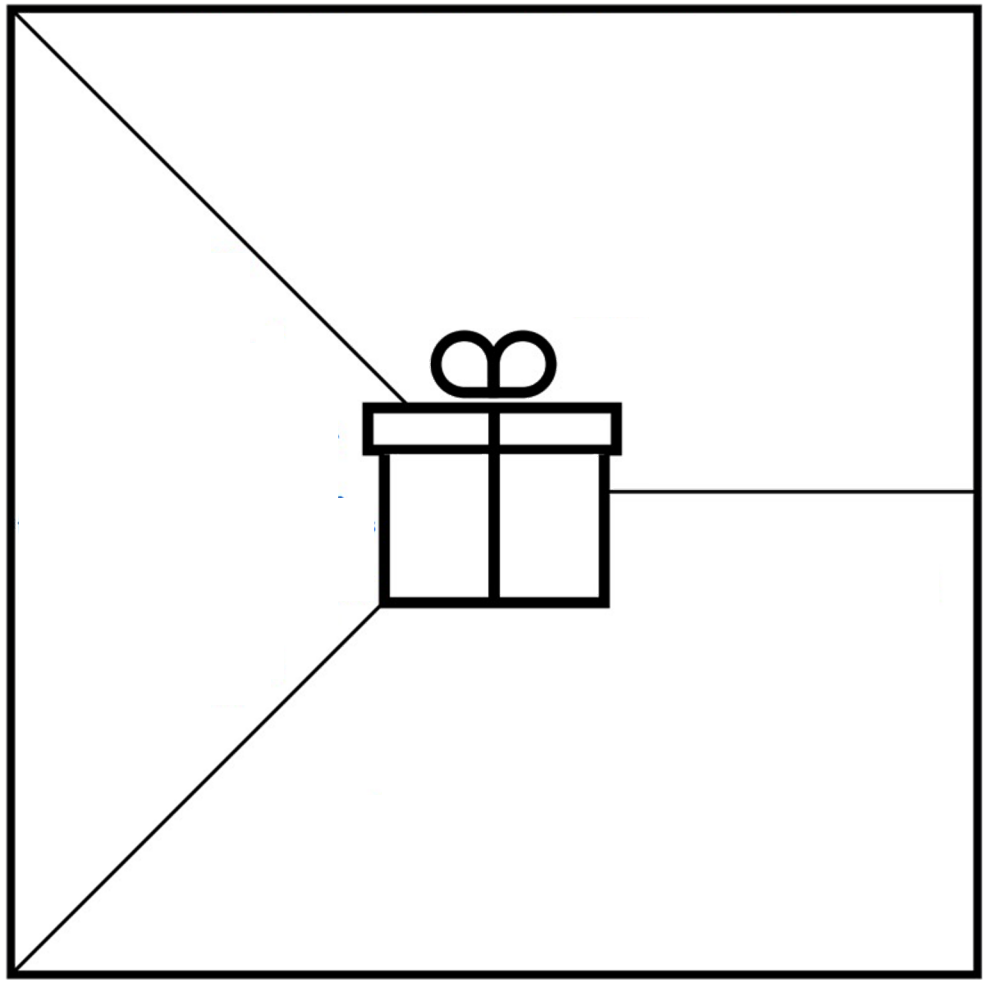
Benefit of using AI

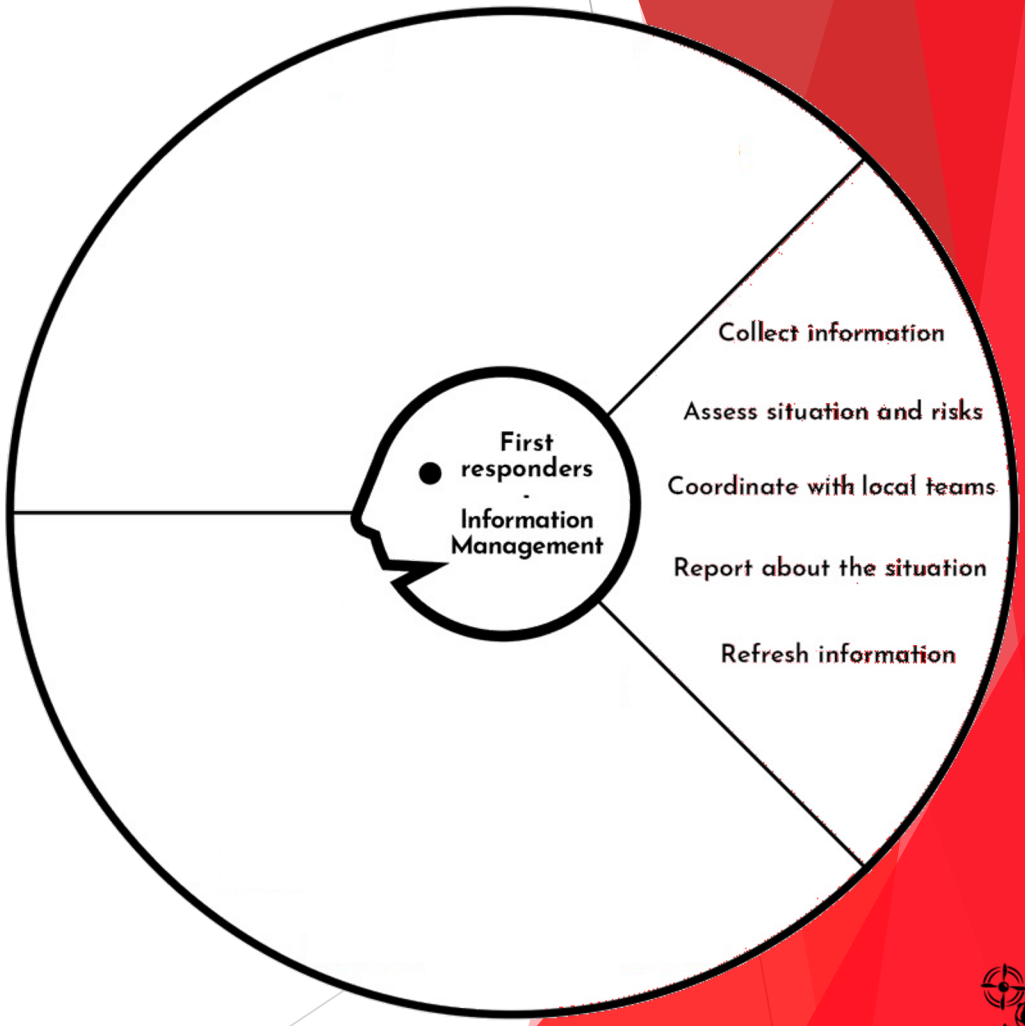
Benefit of using AI + local processing

Needs and pains analysis (1/2)

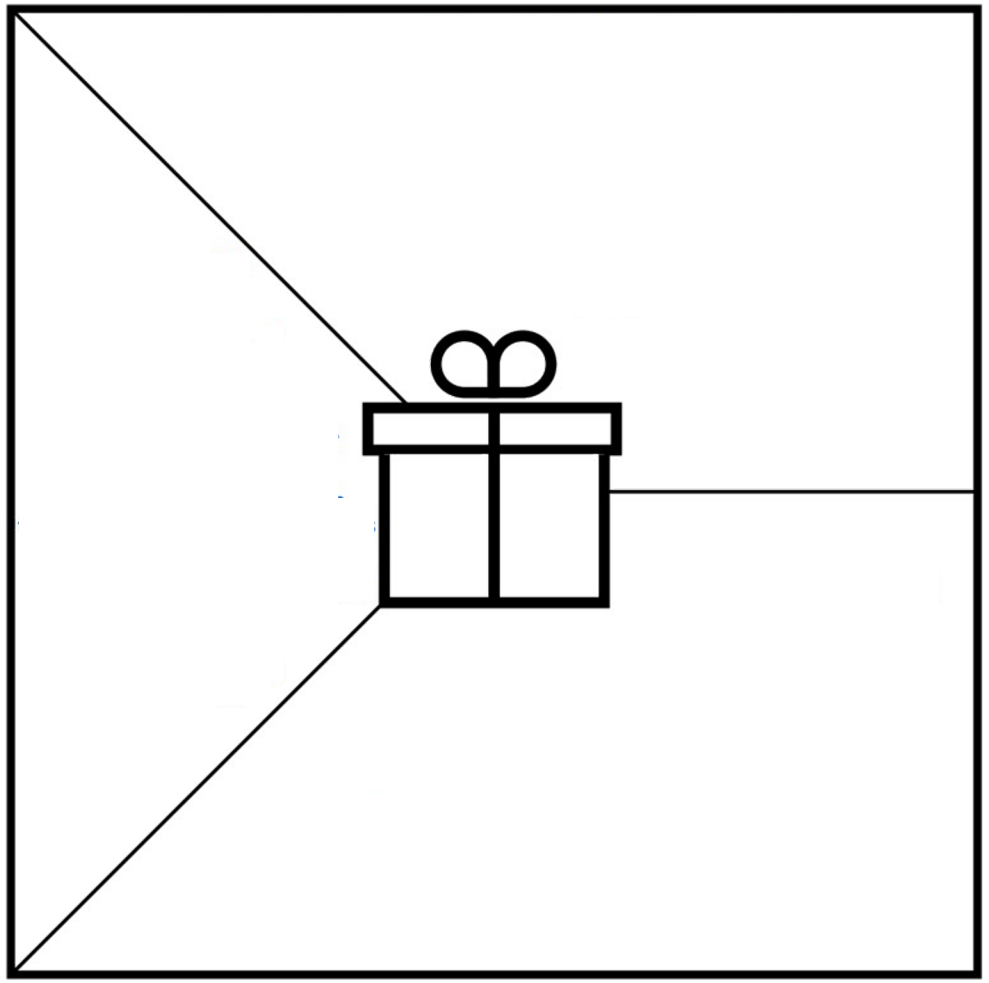


Needs and pains analysis (2/2)

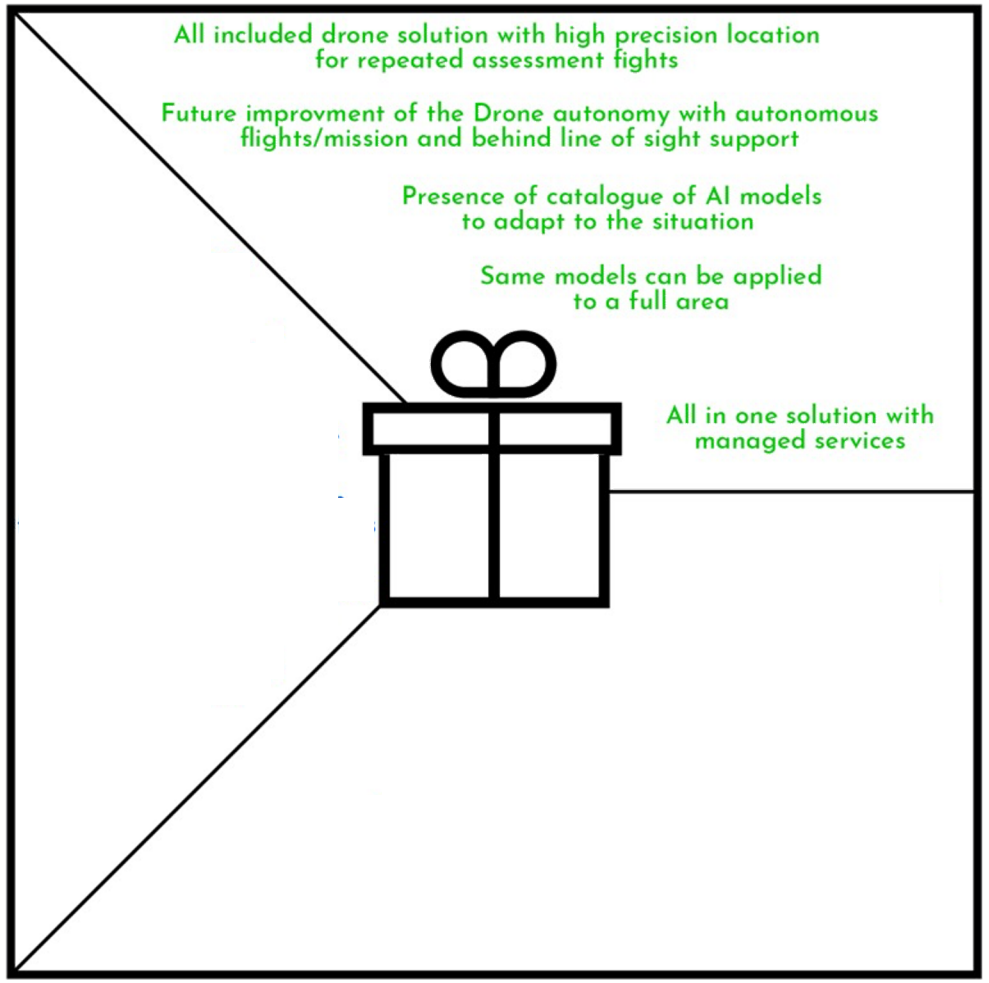




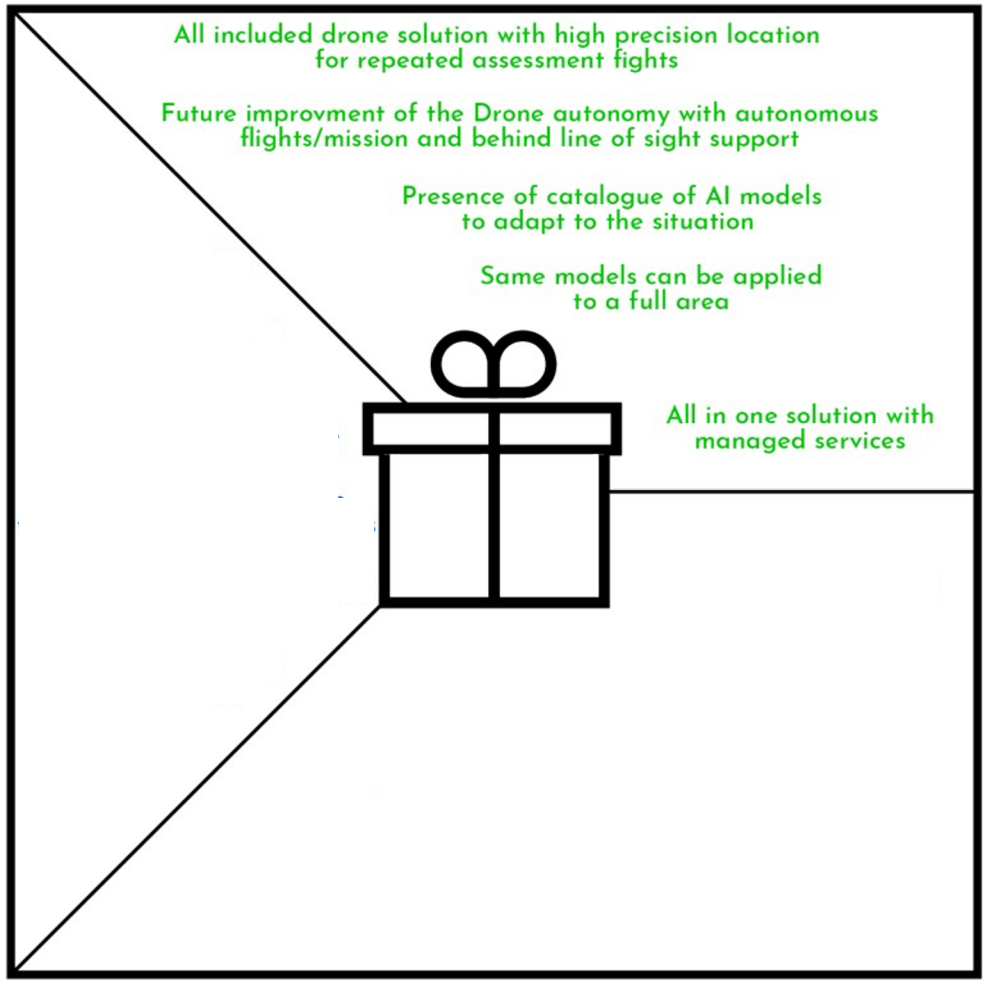
Needs and pains analysis (2/2)



Needs and pains analysis (2/2)



Needs and pains analysis (2/2)



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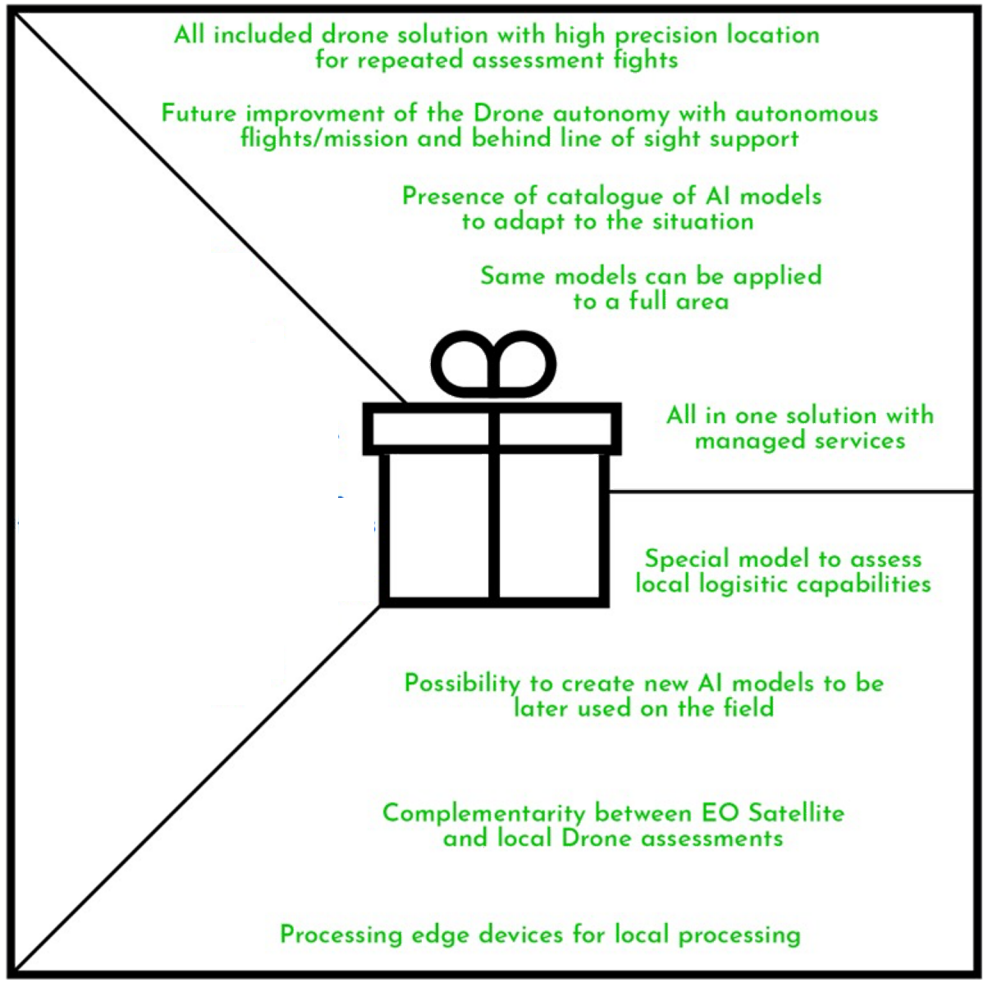
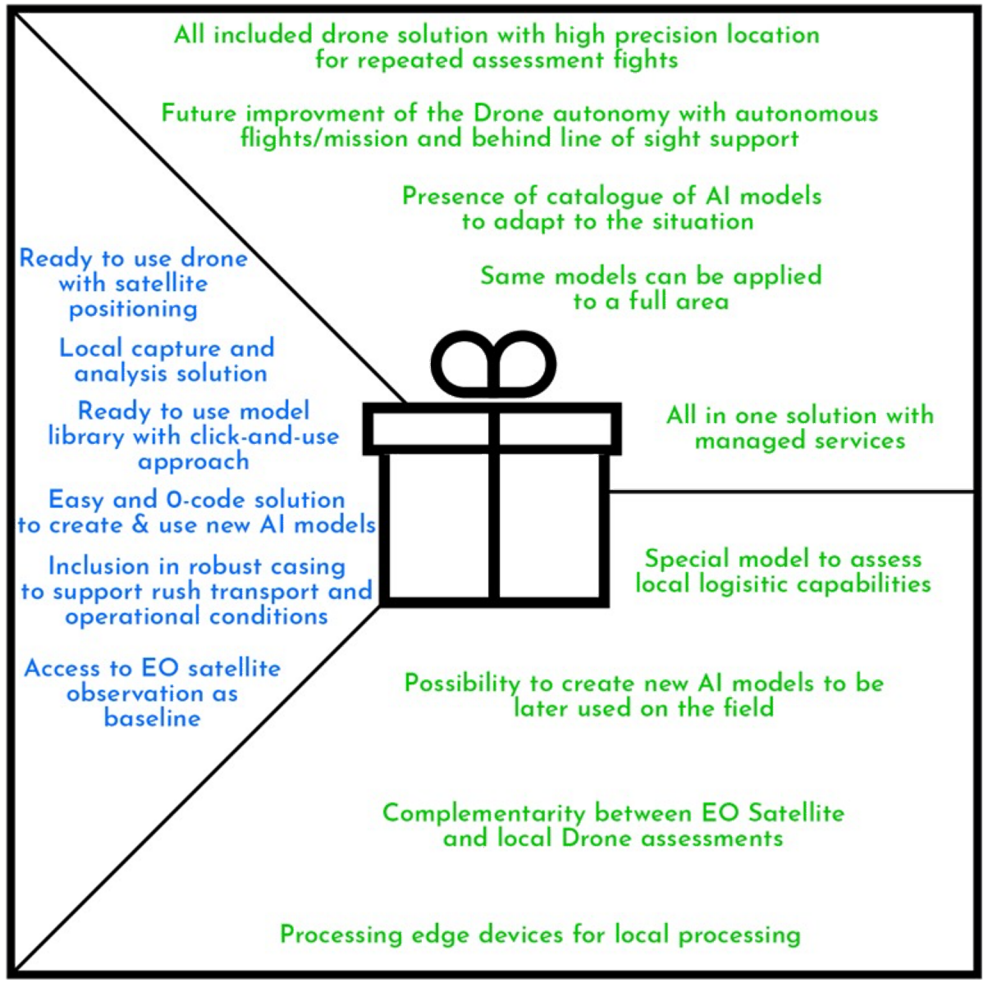


Needs and pains analysis (2/2)



Value proposition

Then, what Drone^{AI} should provide?

1. Deploy a flexible and easy solution to operate analytics solution based on AI and computer vision.

2. Propose a central solution for the creation and the management of the AI models.

3. Organize the dissemination of the created models on a Market Place like approach.

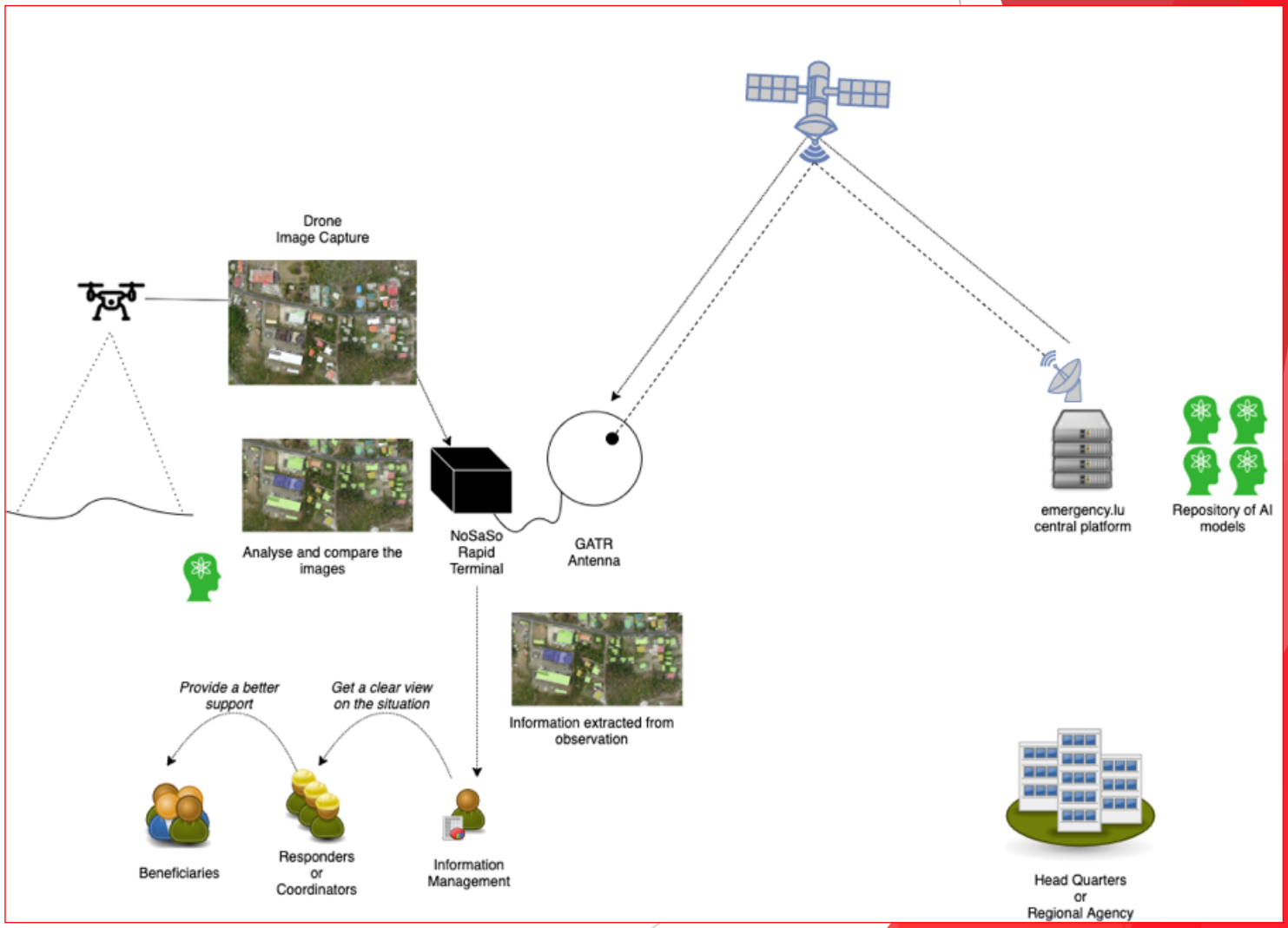
4. Support the organisations to create specific AI models and integrate them into vertical solutions.

5. Provide an integration of the drone solution with the emergency satellite terminals.

Operational scenarios (1/2)
Local Assessment

Main challenges:
- Deploy the technical capability to provide the processing capabilities
- Deploy the AI models that can be applicable for this typical analysis
- Ensure the flexibility and easiness of the solution

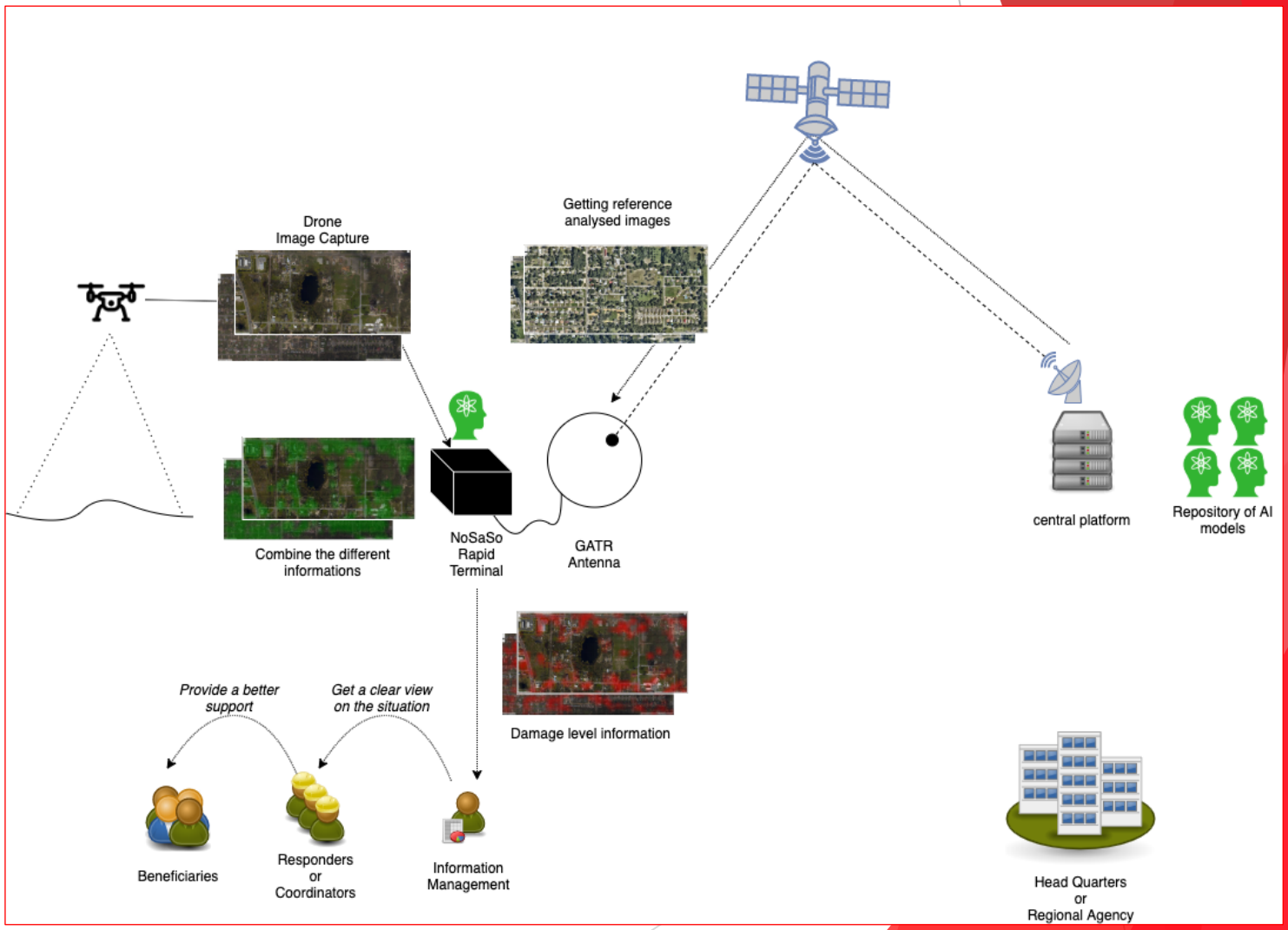
Initial KPIs:
- Qualitative: easiness of the solution
- Quantitative: models accuracy
- Quantitavive: number of models
- Quantitative: delay between capture & assessment information available



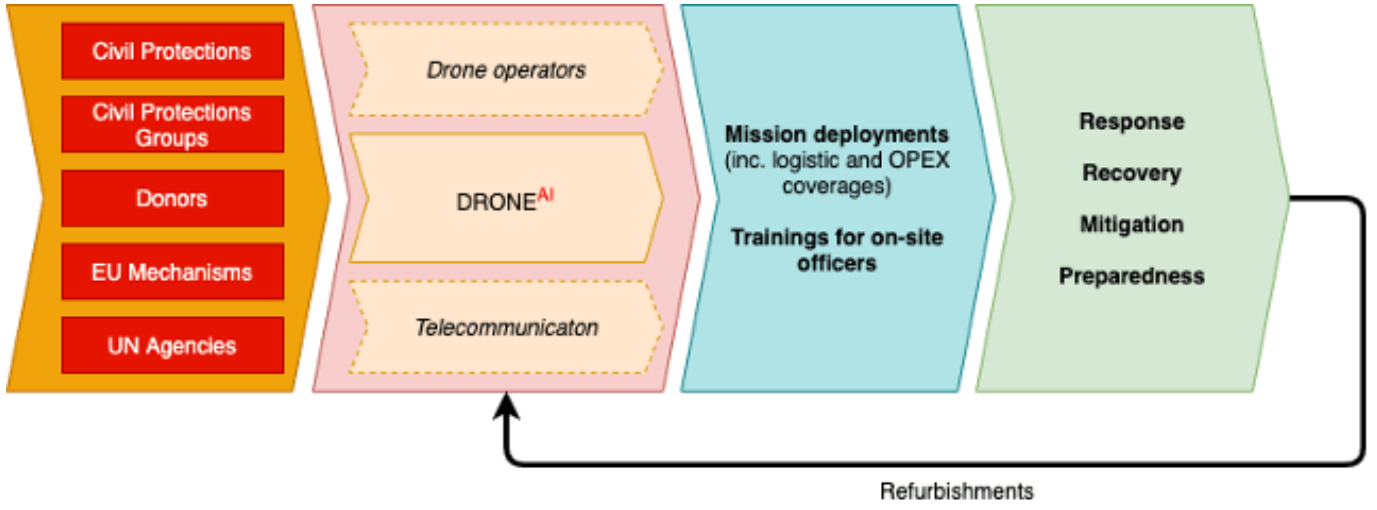
Operational scenarios (2/2)
Change detection

Additional challenges:
- Consider the access to (Very) High resolution EO images
- Apply comparable AI models on EO data
- Ensure the transmission of the reference information

Initial KPIs:
- Qualitative: easiness of the solution
- Quantitative: models accuracy
- Quantitavive: number of models
- Quantitative: delay between capture, assessment information available and the comparison with EO based information (reference)



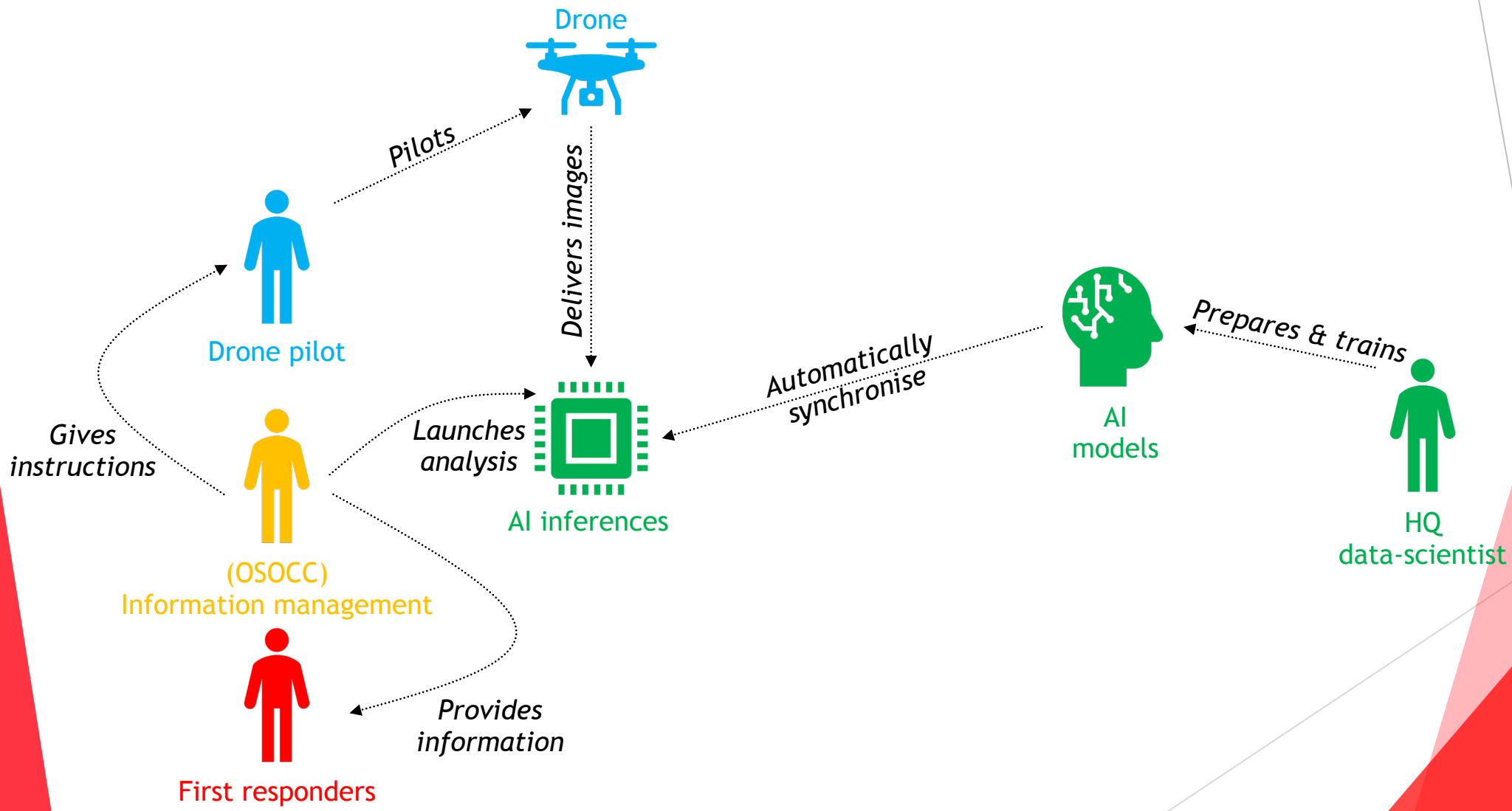
Global chain of actors in Drone^{AI}



Observations:

- Complex chain of actors
- Related to the type and location of emergencies
- Coordination is a critical point
- Coherence and compatibility between actors and operation phases (e.g. preparedness vs response)

Operational chain of actors in Drone^{AI} (1/2)



Operational chain of actors in Drone^{AI} (2/2)

HQ data-scientist

Drone pilot

(OSOCC) Information management

First responders

Max-ICS Drone^{AI}

Drone specific interface

Commander Drone^{AI}

Assessment portal

Not in Drone^{AI} scope

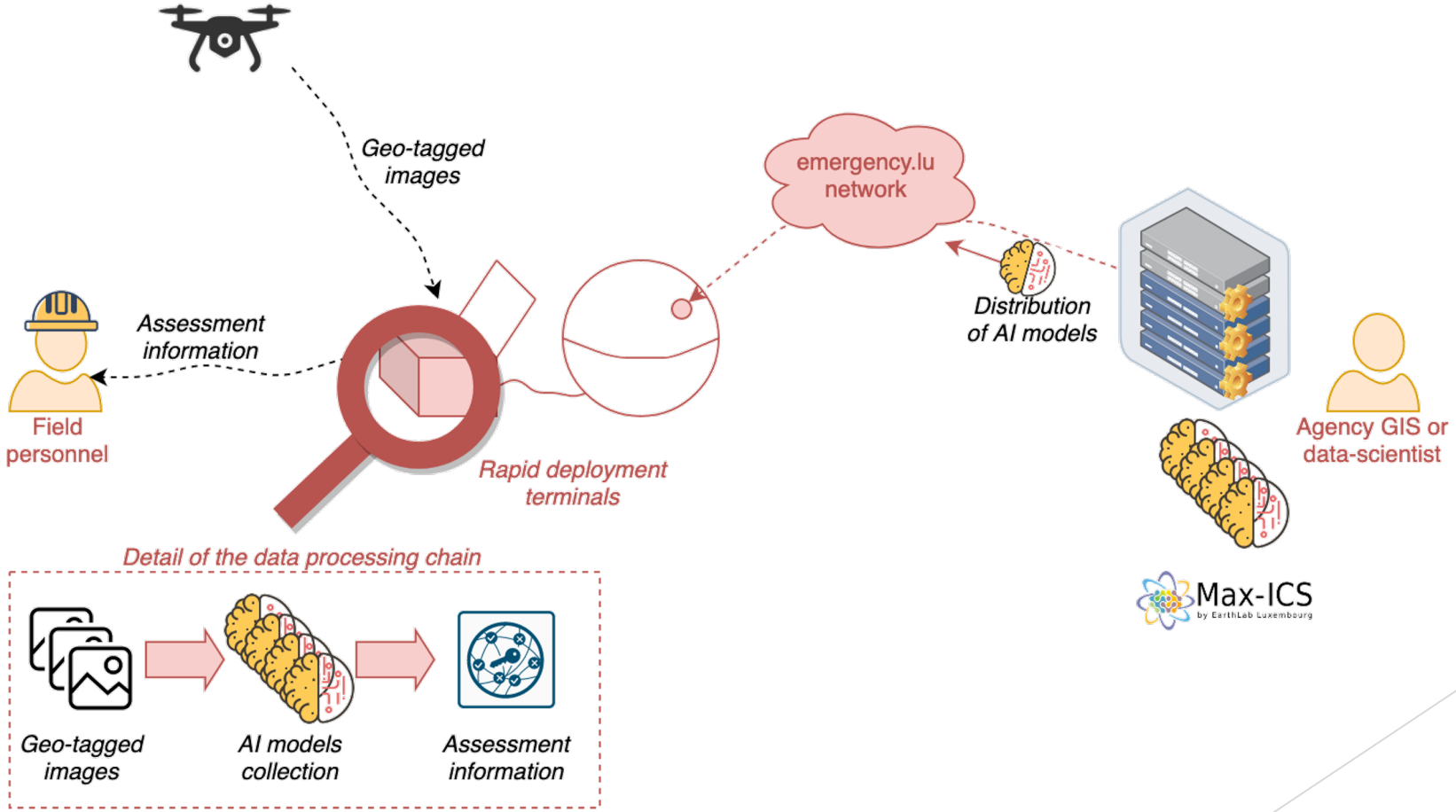
In Drone^{AI} scope

How does it work?

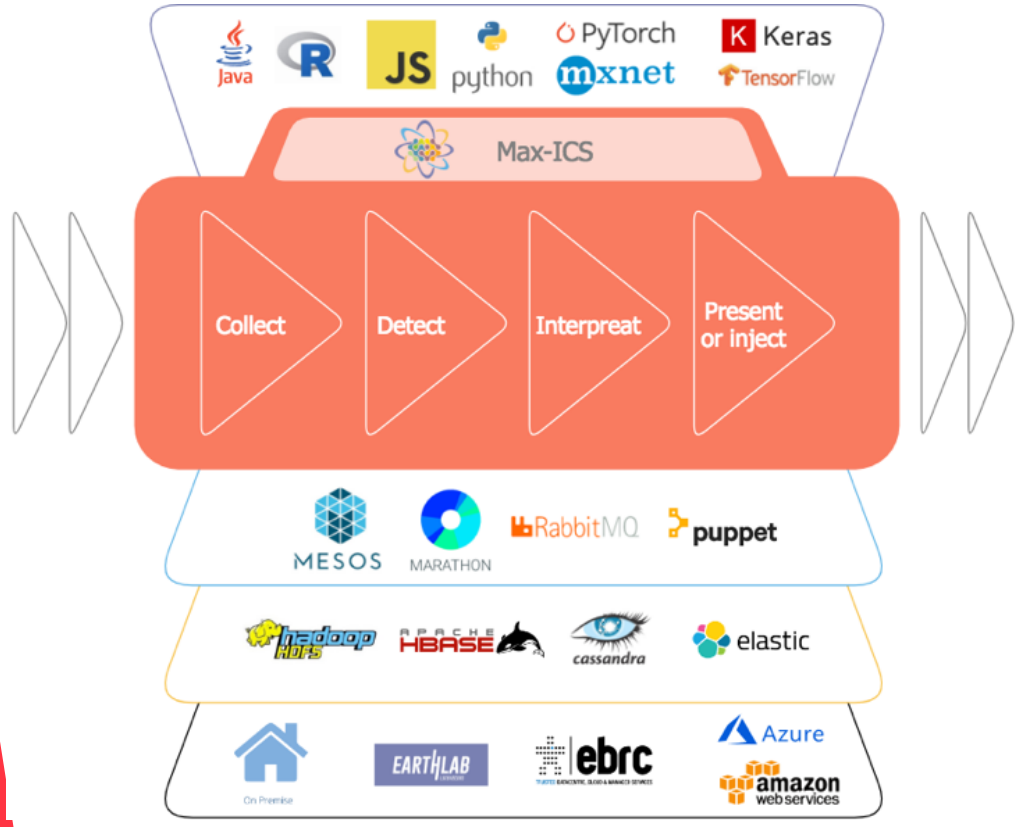
Technical part

Overall system

Processing chain and models



Overall system
Processing stack



- Rely on the existing Max-ICS solution
- Implement a dedicated processing pipeline to be deployed on Satellite terminal
- Integrate an edge processing device (nVIDIA AGX Xavier) within satellite terminal (NoSaCo)
- Use different AI models to ensure the flexibility of application

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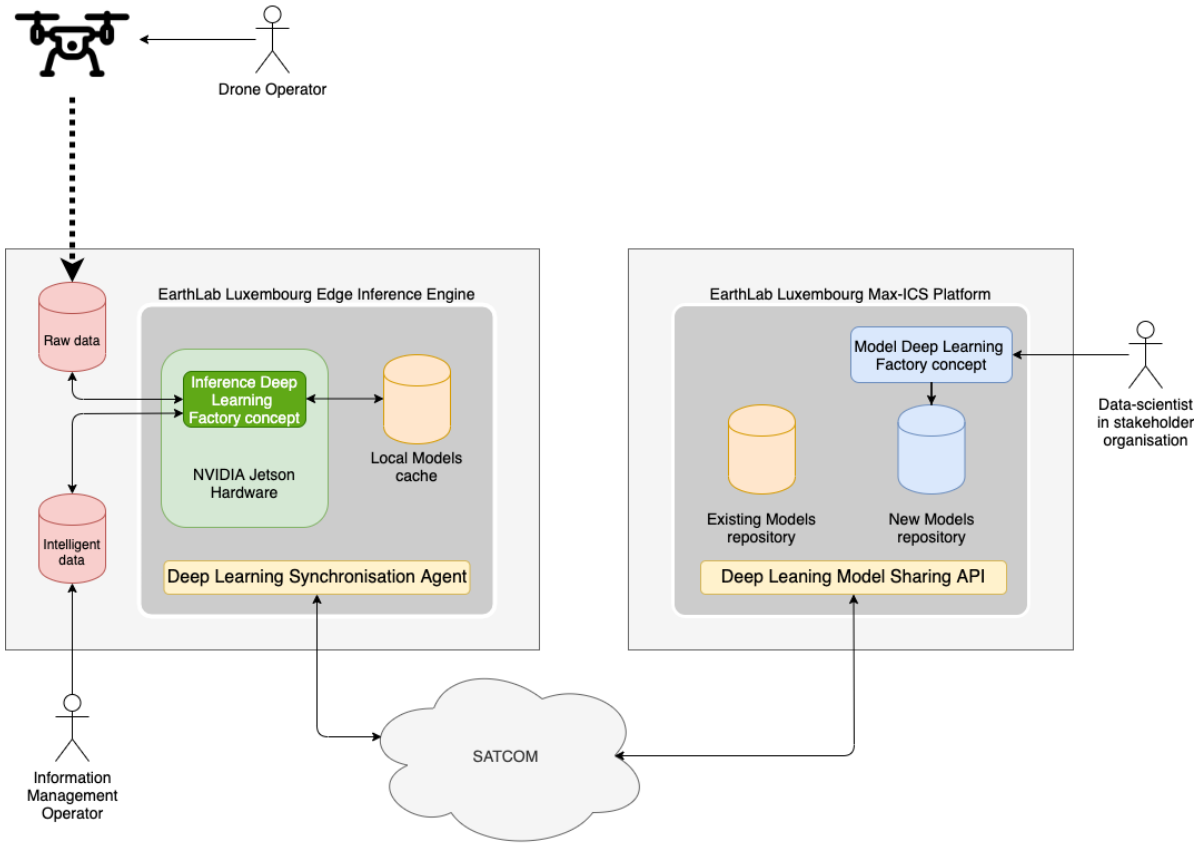
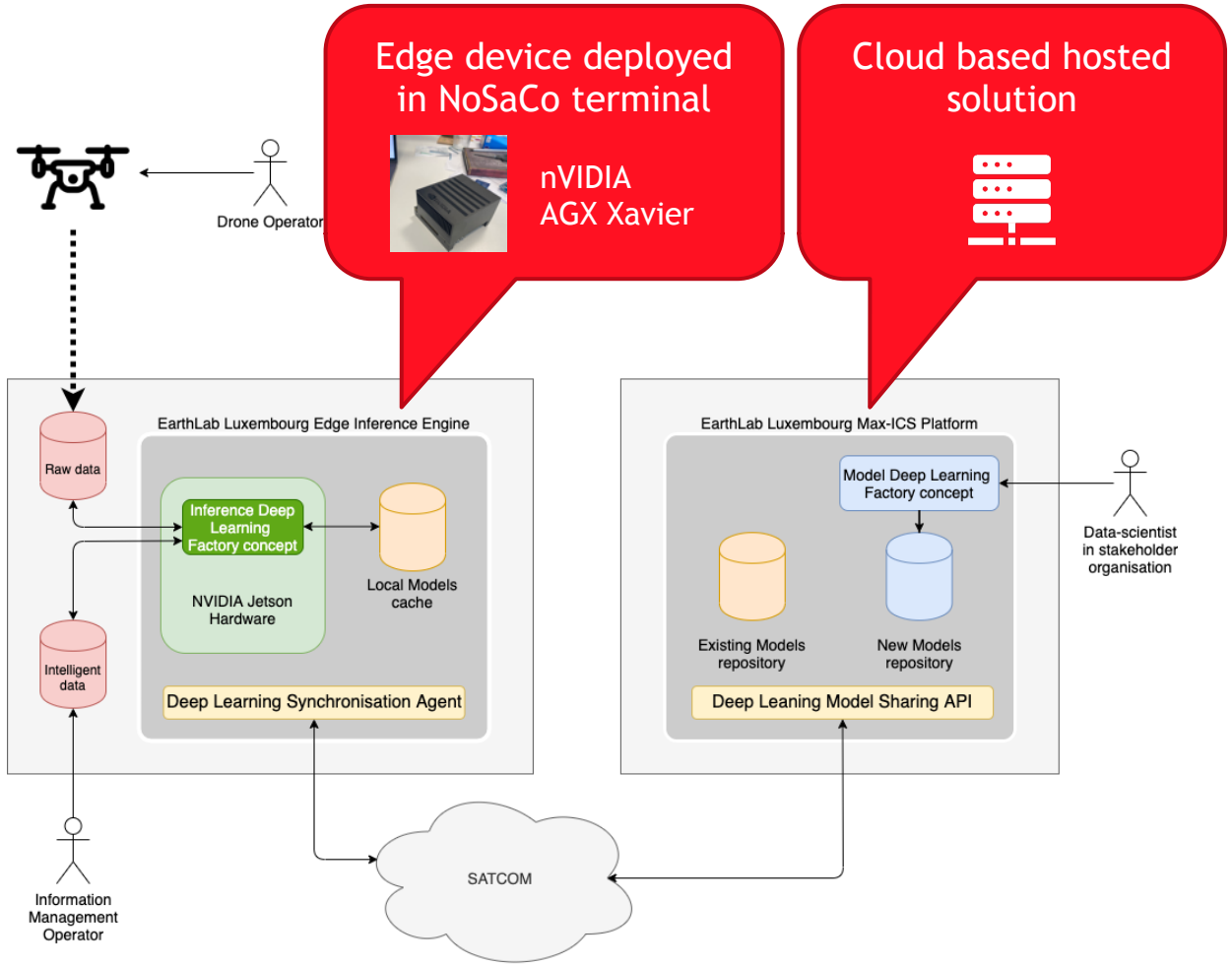
Overall system
Processing stack (1/2)



- Local processing implemented as a Max-ICS treatment pipeline using the *Edge Inference Engine*.
- AI part implemented via the Max-ICS *Deep Learning Factory* concept
- Specific synchronisation mechanism to cache the Deep Learning models within the edge device

Overall system
Processing stack (2/2)



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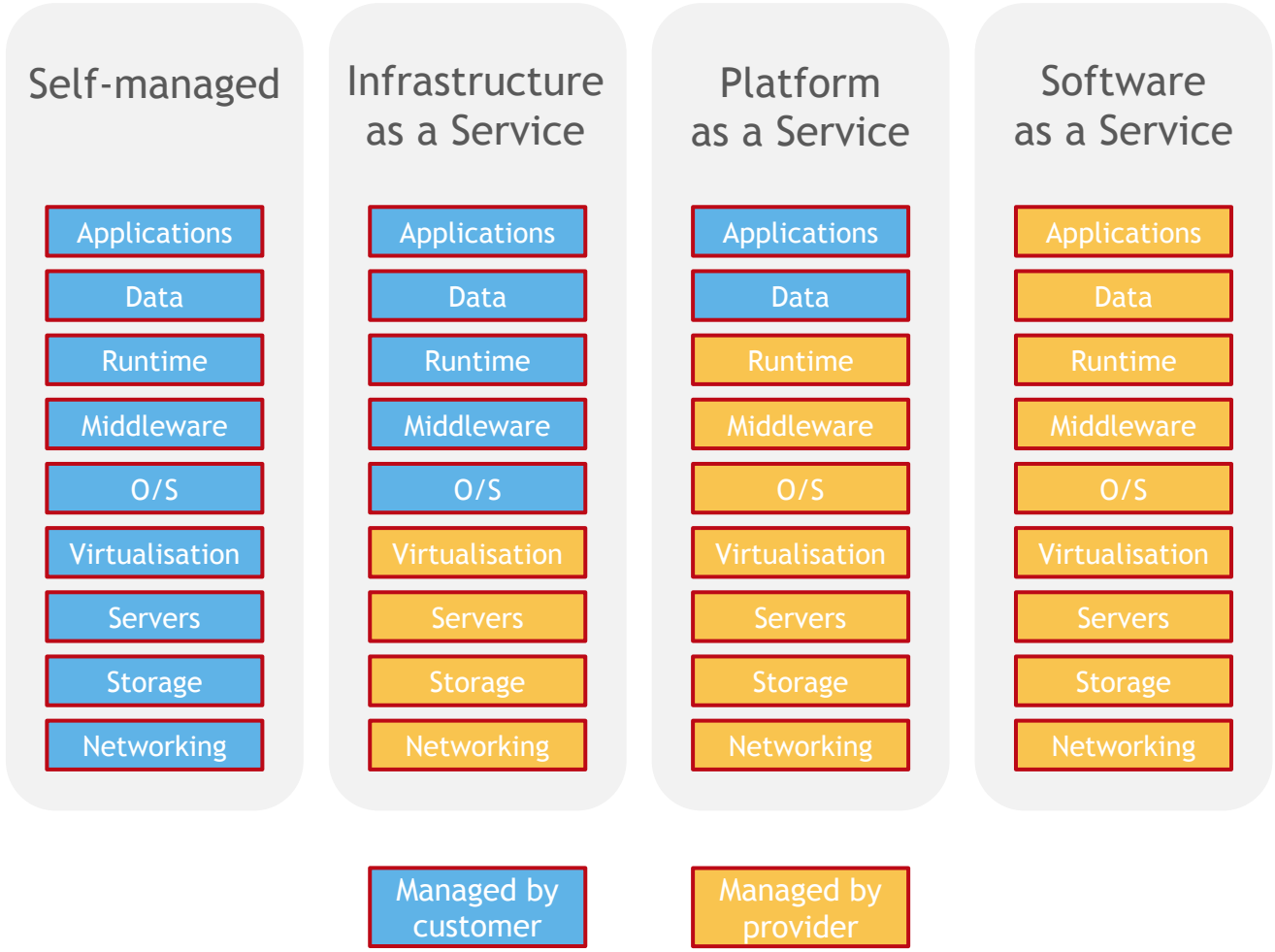
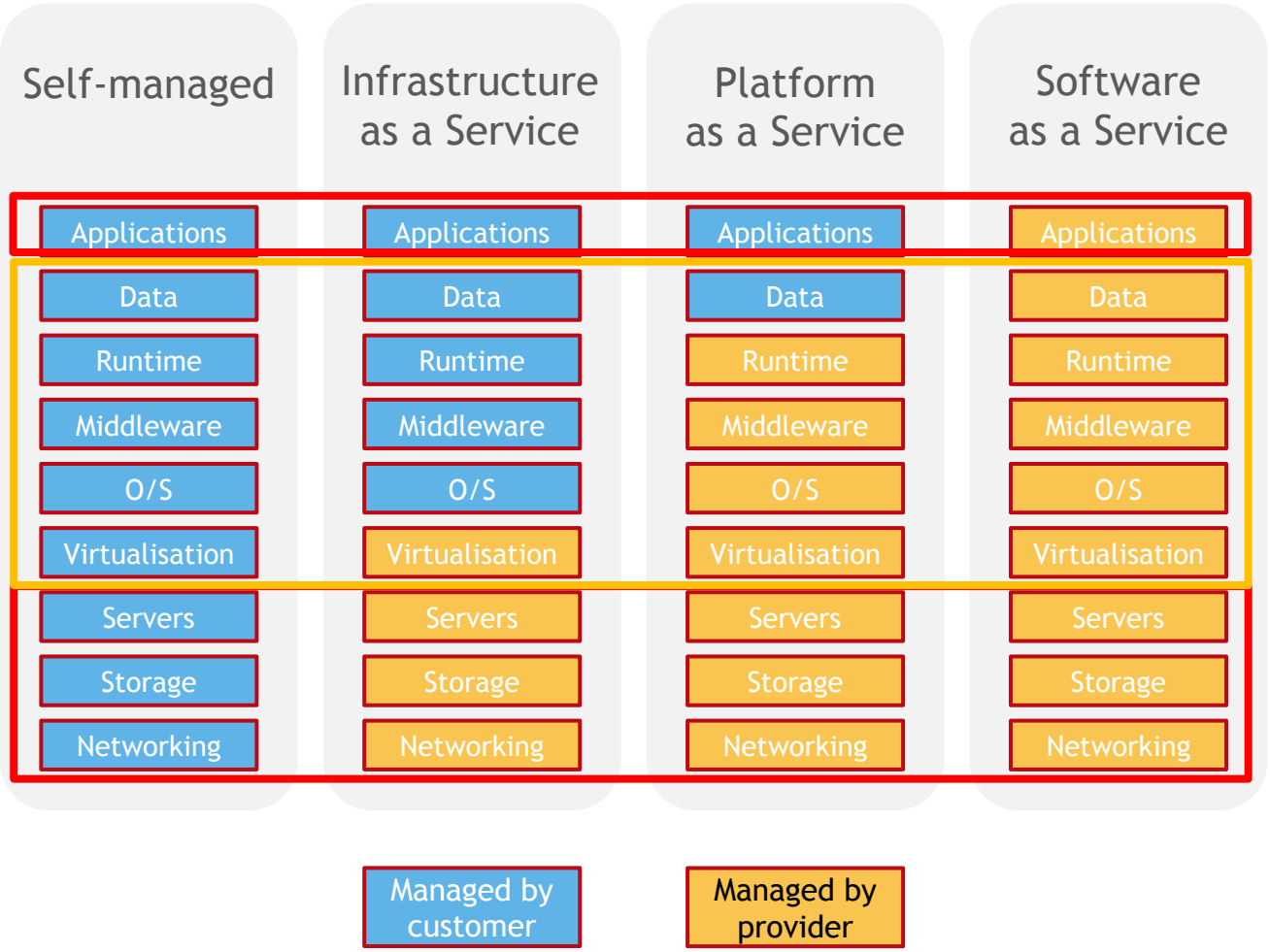
Introducing PaaS, IaaS & SaaS (1/2)



Introducing PaaS, IaaS & SaaS (2/2)



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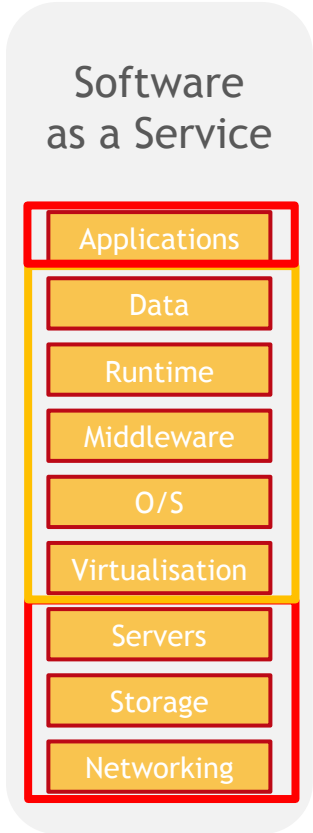
Flexibility and evolutions

Avoiding lock-in

- Possibility to implement specific pipelines to cover different requirements.
- Possibility to import datasets, to train specific models, to import existing deep learning Models.
- Capacity to run the solution on different hardware and cloud solutions (AWS, local device, private datacenters)



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The AI side of it

Deep Learning Factory concept (1/2)

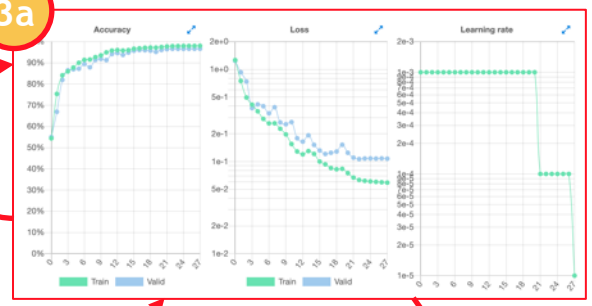
Dataset preparation

1

Train the model in chain

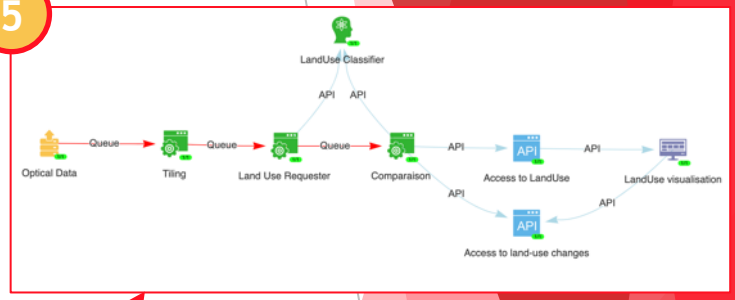
3a

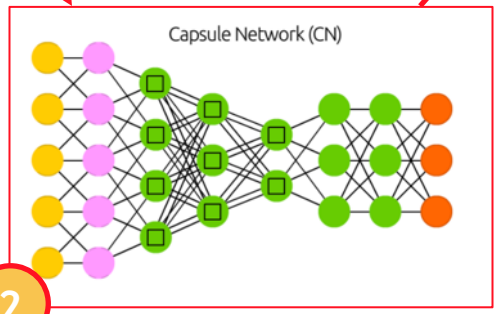
3b



Integrate the best models in processing chains

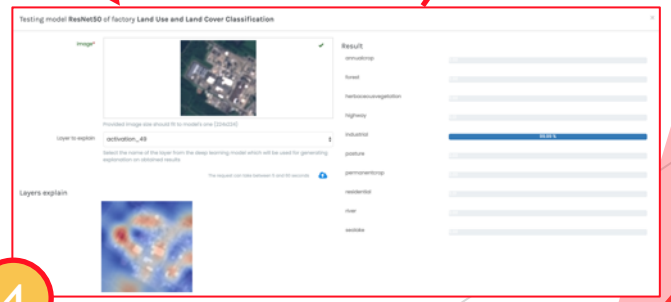
5





2

Manage models using integrated zoo

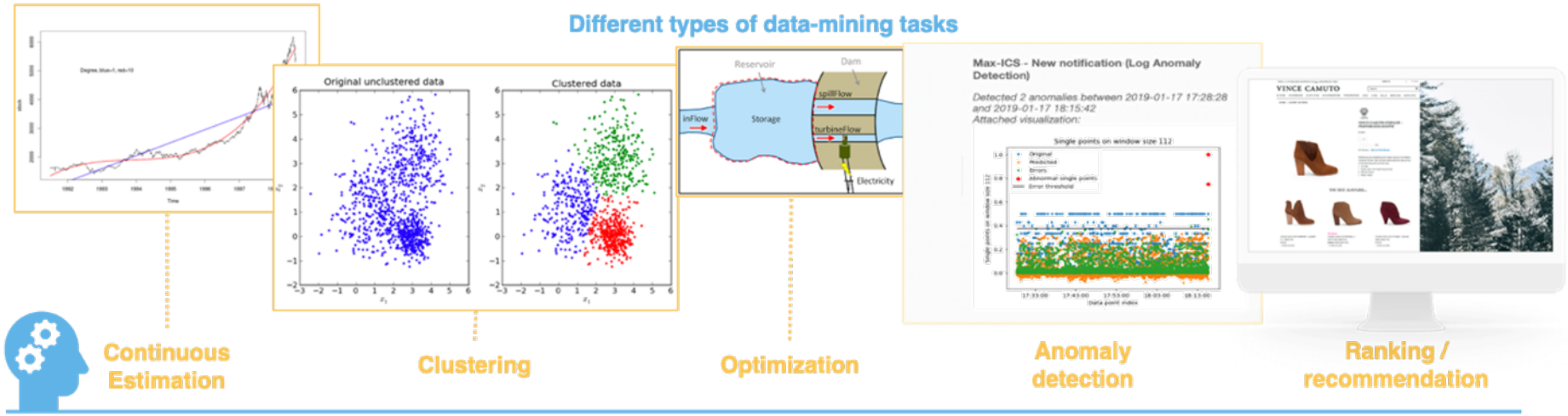


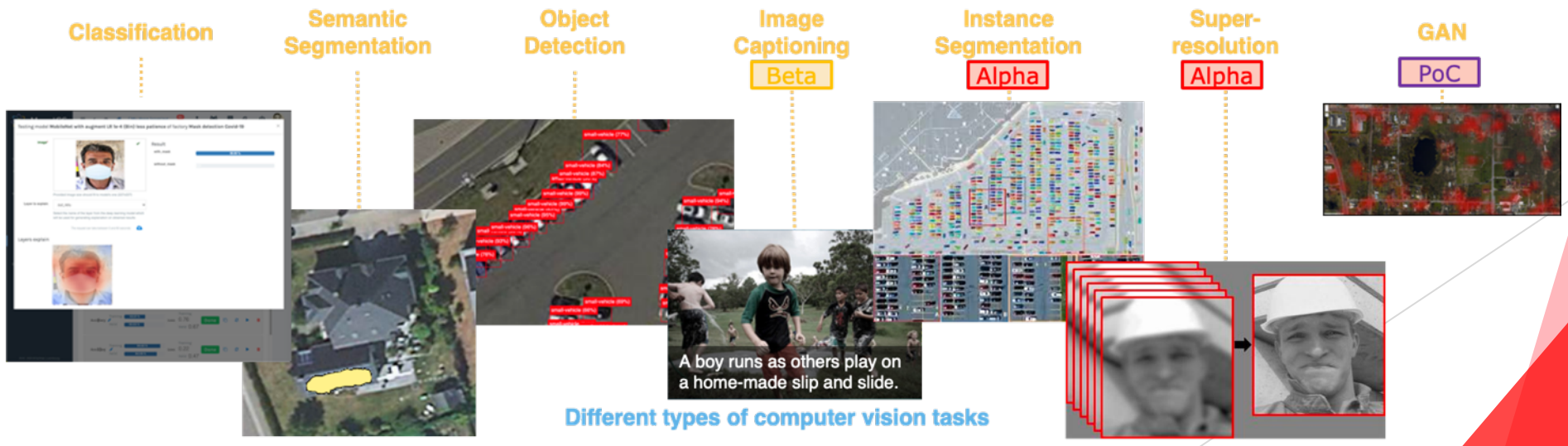
4

Test the models in one click

The AI side of it

Deep Learning Factory concept (2/2)





Building AI models

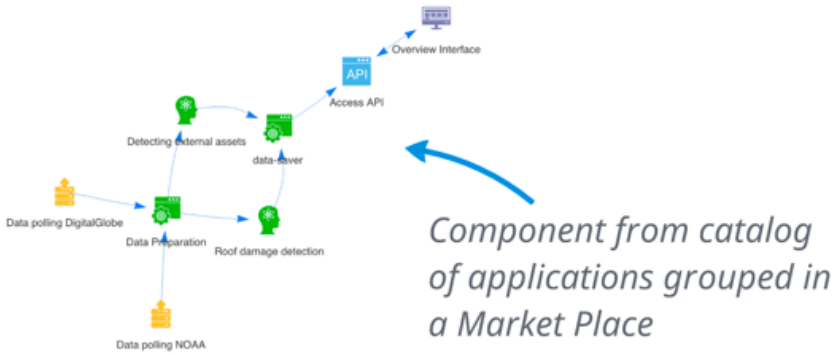
Demo part

Go to Max-ICS

The processing side of it

Pipeline integration (1/4)

Data treatment as simple as a drawing



Component from catalog of applications grouped in a Market Place

Define advanced data-treatments

Mix heterogeneous data

From Experimentation to Production in one click

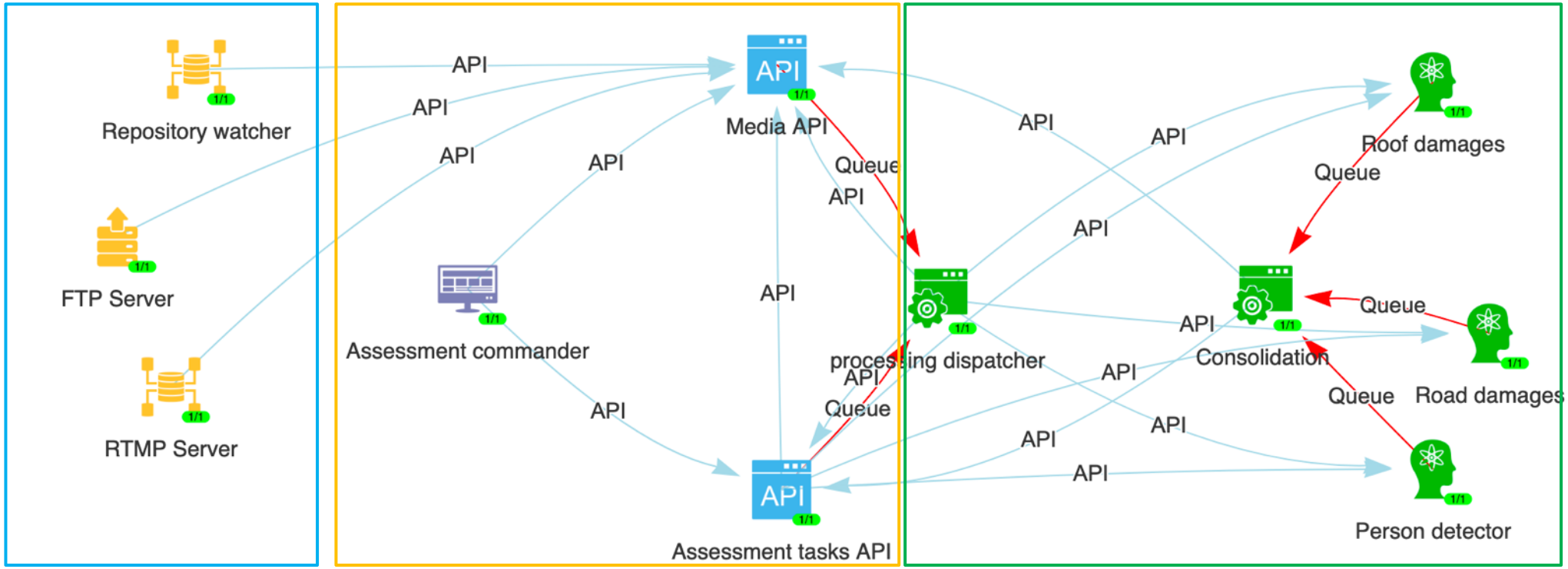
Max-ICS provides an integrated solution to design processing chains

Major added value items are:

- Simple easy to design solution
- Access to an internal Market-place of components to speed-up the development process
- Seamless integration of AI inference modules (for computer vision and data-mining)
- Directy deployed in a distributed big-data environment
- Cloud agnostic solution

The processing side of it

Pipeline integration (2/4)



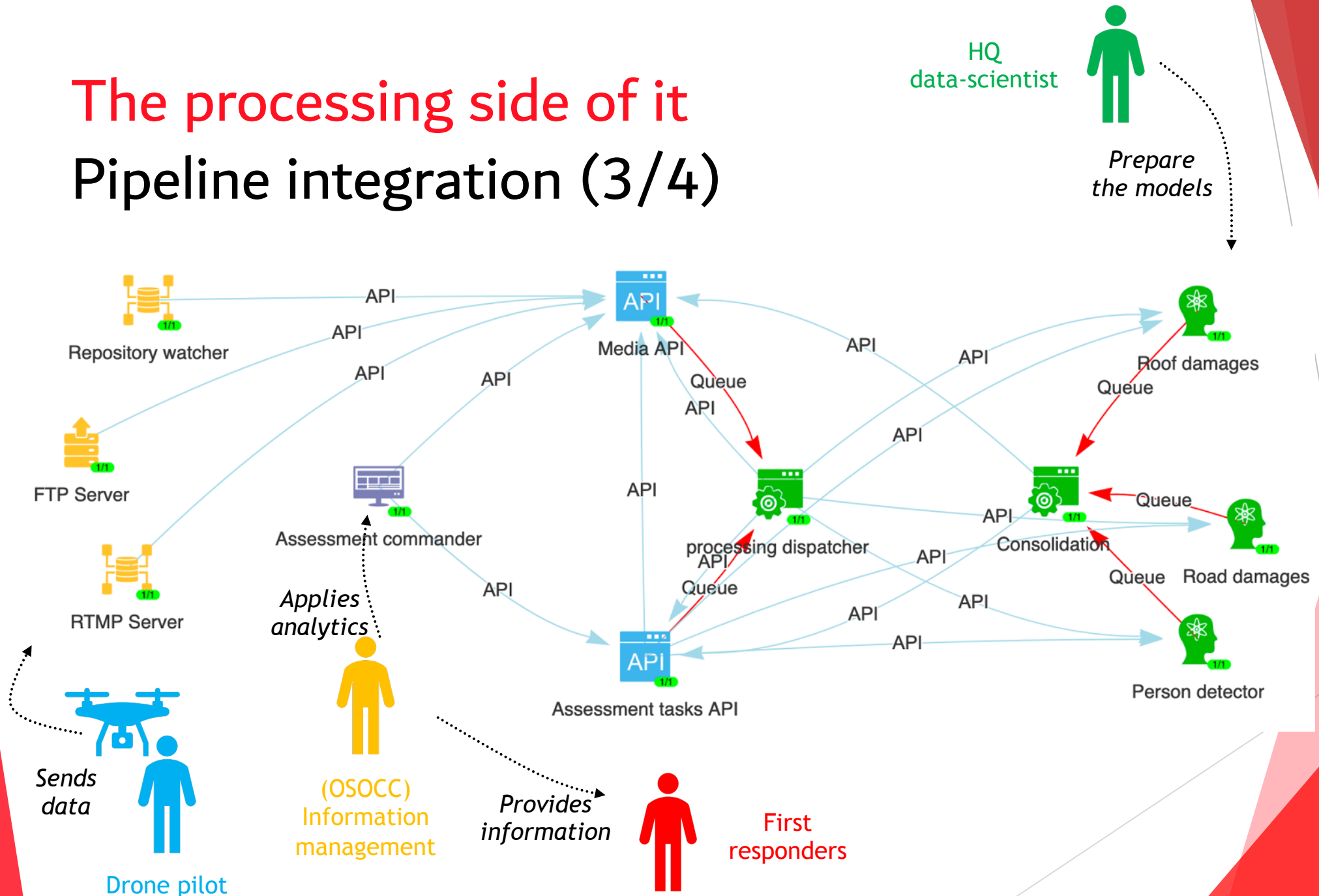
Data acquisition

User Interface and integration

Data processing

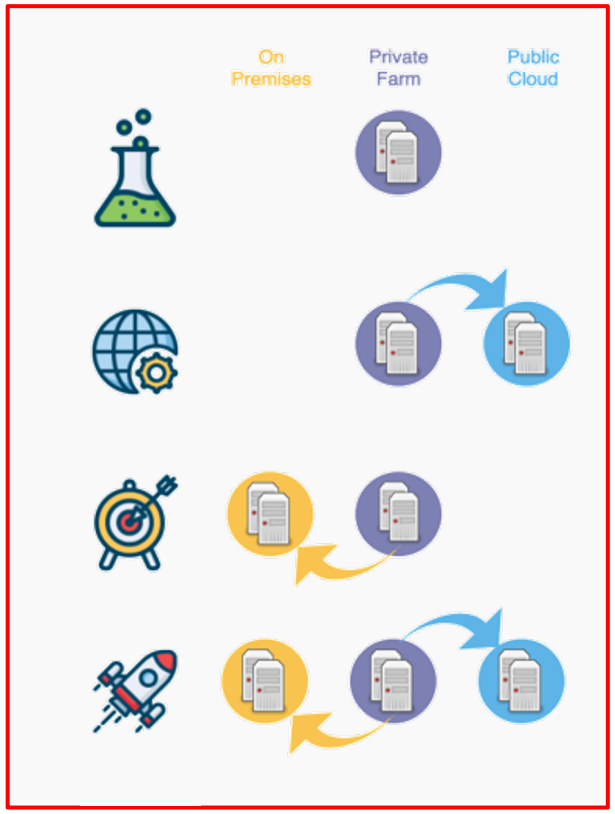
The processing side of it

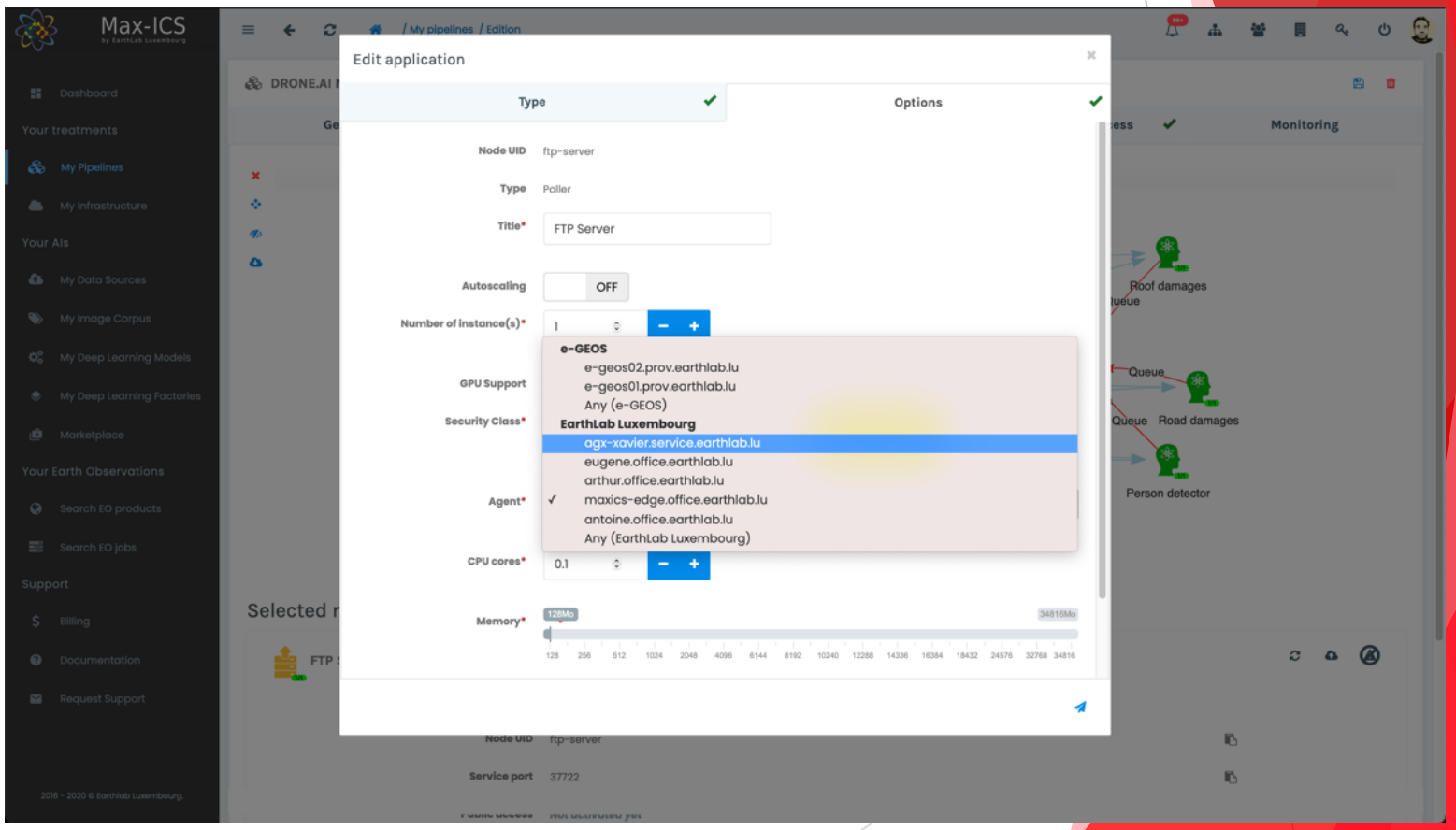
Pipeline integration (3/4)



The processing side of it

Pipeline integration (4/4)





Demonstration of the current implemented solution

Demo part

Go to Max-ICS

Got to Drone^{AI} UI

Wrap-up and next steps

Next steps

- We need your feedbacks concerning:
  - **The overall approach**
  - **The AI models that can makes sense in the different operations**
  - **The possibility to interract with your GIS and Data-science teams**
- Project next steps:
  - Integrate more interesting AI models
  - Integrate the solution within the emergency.lu terminals and network with emergency.lu partners
  - Prepare an external demonstrator with **Drone** and **Satellite connection**
  - Evaluate the applicability of Drone[AI] and other analytics solutions in emergency context

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SES beyond frontiers

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Thanks for your participation

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DRONE[AI] solution for Humanitarian & Emergency situations