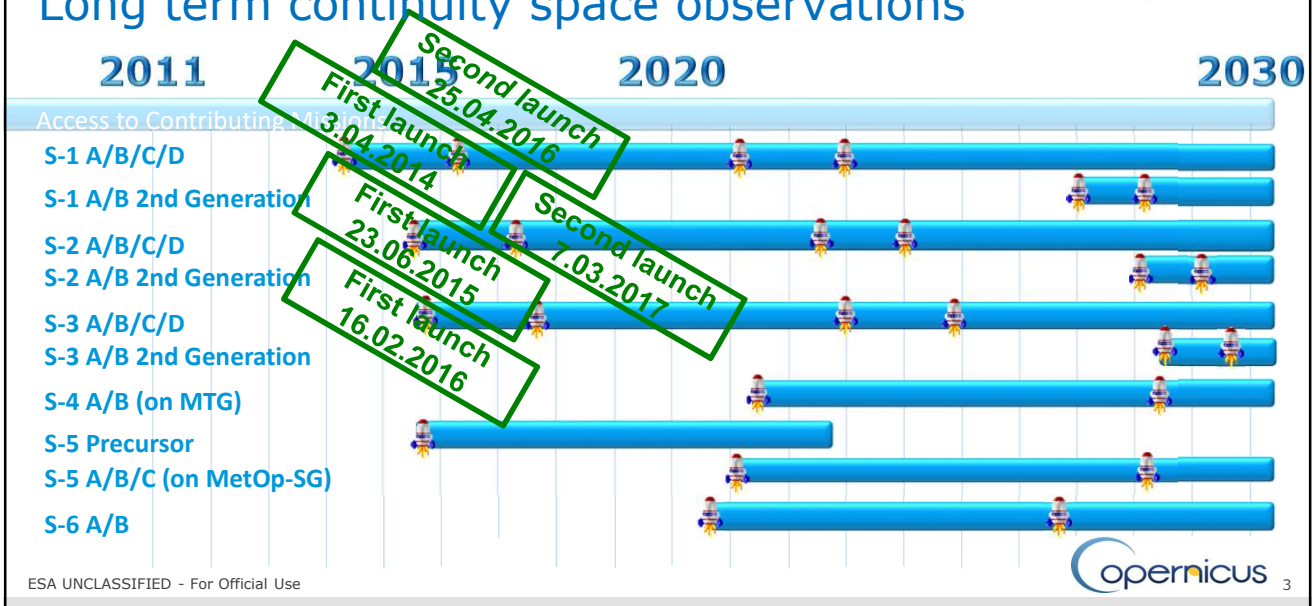
Sentinels for monitoring: Sen4CAP and DIAS

Benjamin Koetz
European Space Agency, Earth Observation Directorate

Sentinels for Agriculture Monitoring

Copernicus Space Component

Long term continuity space observations



Sentinels – World Class EO Systems

Reference missions: Class leading data quality

Requirement	Description	Measured performance
Absolute geolocation (without ground control points)	The geo-location uncertainty shall be better than 20 m at 2σ confidence level (without Ground Control Points).	< 11 m at 95.5% confidence (baseline 02.04)
Multi-spectral registration	The inter-channel spatial co-registration of any two spectral bands shall be better than 0.30 of the coarser achieved spatial sampling distance of the two bands at 3σ confidence	0.3 pixel at 99.7% confidence
Absolute radiometric uncertainty	The absolute radiometric uncertainty shall be better than 5% (goal 3%).	B1 to B12, excl. B10: < 5%±2%
SNR	The Signal-to-Noise Ratio (SNR) shall be higher than specified values (see Table 2-6 in this document)	All bands compliant with > 27% margin

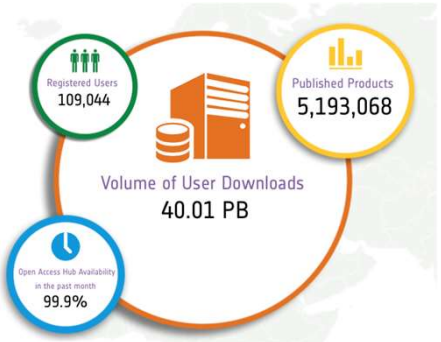
Reliable Data Quality – Prerequisite for Agricultural Monitoring

Monthly Data Quality reports:
https://sentinels.copernicus.eu/web/sentinel/missions/sentinel-

JRC New sensors benchmark report on Sentinel-2B&A:
https://g4cap.jrc.ec.europa.eu

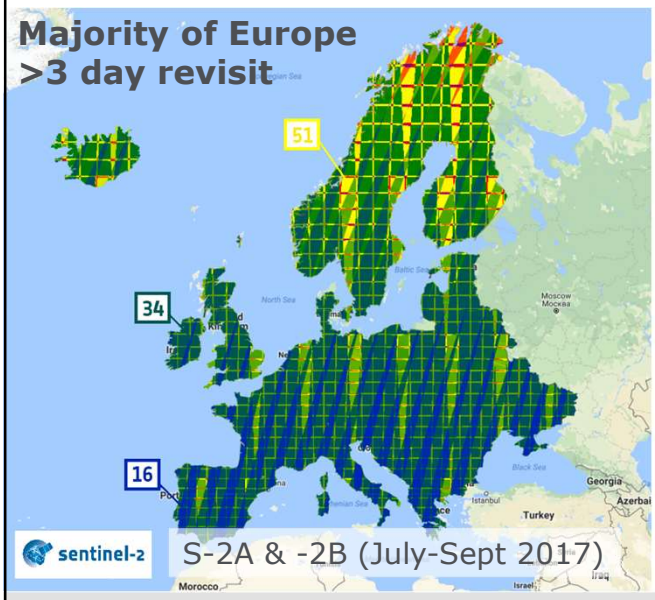
S1 >4 TB daily

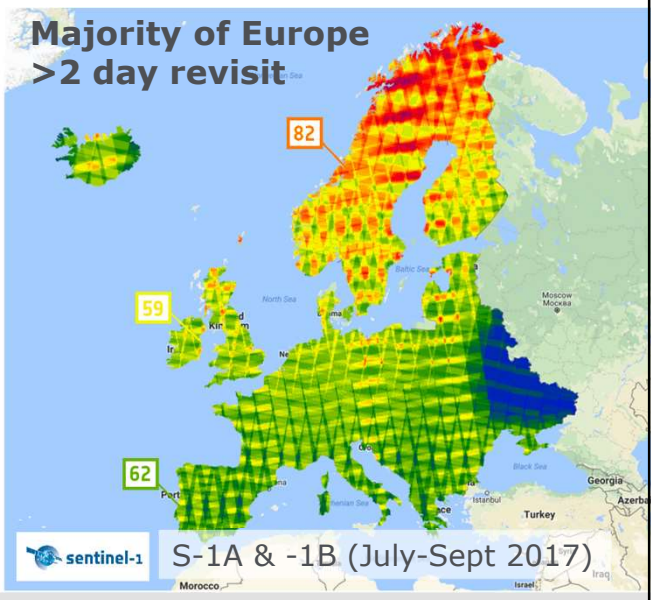
S2 >1.7 TB daily



Status 28th November 2017

Sentinels for Agricultural Dynamics





European Space Agency

sen4cap

common agricultural policy

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ESA | 28/11/2017 | Slide 6

European Space Agency

Sen4CAP: R&D for Common Agricultural Policy

Sen4CAP Objectives:

- Provide evidence how Sentinel derived information can support the modernization and simplification of the CAP **in the post 2020 timeframe**
- Provide **validated algorithms**, **products**, **workflows** and **best practices** for agriculture monitoring relevant for the management of the CAP

Sen4CAP Implementation:

- Collaboration with DG-AGRI, DG-GROW, and national Paying Agencies
- Responding to the request from DG-AGRI & DG-GROW


EUROPEAN COMMISSION

Brussels,

Subject: Cooperation between the European Commission and the European Space Agency (ESA) on the follow-up of the CzechAgri study

Dear Mr Aschbacher,

Both ESA and the European Commission have an interest in promoting and supporting the development of Earth Observation (EO) use and related capacity in Agriculture.

We have taken great interest in the results of the CzechAgri study that was jointly initiated in December 2015 by ESA, DG JRC and SZIF (Czech Paying Agency) and successfully implemented thanks to ESA funding and a technical steering involving DG AGRI.

Following these promising results, it would be extremely useful to further explore - in close cooperation with the European Commission - the capabilities of the Copernicus Sentinels in view of the current works on the modernisation and simplification of the CAP, in particular in relation to the Integrated Administration and Control System (IACS). As you may know, technical solutions to improve and to make the IACS more cost efficient are high on the political agenda. A promising way forward is offered by the important potential of Sentinel/Copernicus for administration and control purposes, i.e. in a broader perspective than the current on-the-spot controls using remote sensing. Indeed, the ambition for the next programming period is greater, we also want the IACS to be a key tool in the delivery of enhanced environmental services and public goods.

With this letter, we acknowledge and welcome ESA's readiness to continue this effort by conducting two or three follow-up pilot studies to the CzechAgri project in preparation of the CAP 2020 reform together with the main stakeholders (DG AGRI, DG GROW and DG JRC) and the national Paying Agencies.

Mr. Josef Aschbacher
Director of Earth Observation Programmes
European Space Agency
Via Galileo Galilei
Casella postale 64
00044 Frascati - Italy

Sen4CAP project: Main Goals and Activities

- **Identify & specify EO products** suitable to increase the efficiency, traceability & reducing the costs of the IACS
- Develop **algorithms (ATBDs) along with open source code** for agricultural EO products based on Sentinel-1 & -2
- **Demonstrate and validate the agricultural EO products** up to national scale
- Assess **the utility of Sentinel products within IACS procedures** at EU and national level for a range of Paying Agencies representative for the heterogeneous agricultural practices, parcel sizes, landscape & climate in the EU
- Prepare and **facilitate the transfer of developed EO algorithms** and services to the national Paying Agencies
- Demonstrate benefits of **cloud computing capabilities**

Sen4CAP – Expertise, Technology & Collaboration

Paying Agencies & Farmers

DG-Agri, JRC, DG-Grow

EO Experts

Open Source

sen4cap common agricultural policy

Cloud Technology (DIAS)

Continuous Monitoring

Validated Performance

National Demonstration

Innovative Practices

CAP2020 Reform

Endorsement of Copernicus for Use within the CAP

Commissioner P. Hogan: "…already Paying Agencies using data of the Sentinels … ESA has launched a tender **Sen4CAP** which will provide us useful knowledge and further possibilities on how we use Sentinel data in the context of the CAP "

Sen4CAP partnership – European leading expertise

Consortium

UCL Université catholique de Louvain · ROMANIA · e-geos · SINERGISE · gisat

Steering

European Commission

DG Grow
DG Agri
DG JRC

esa Copernicus

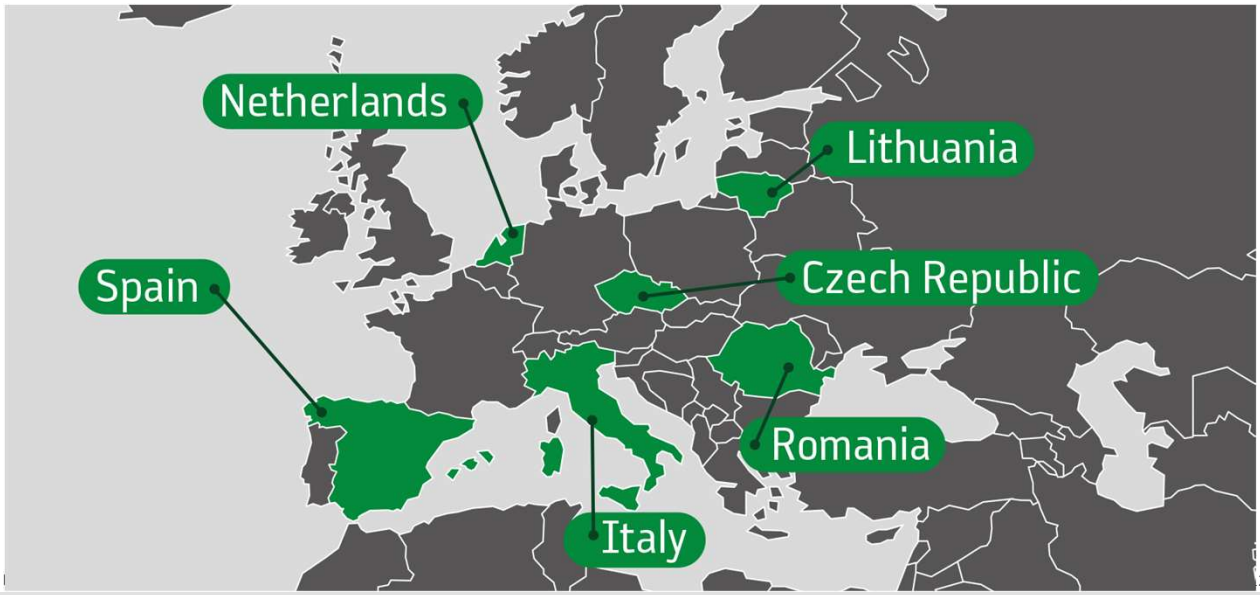
Champion users

- Conference of Directors of EU Paying Agencies
- Panta Rhei European Agriculture Paying Agency Platform
- Copernicus Agriculture Expert Group

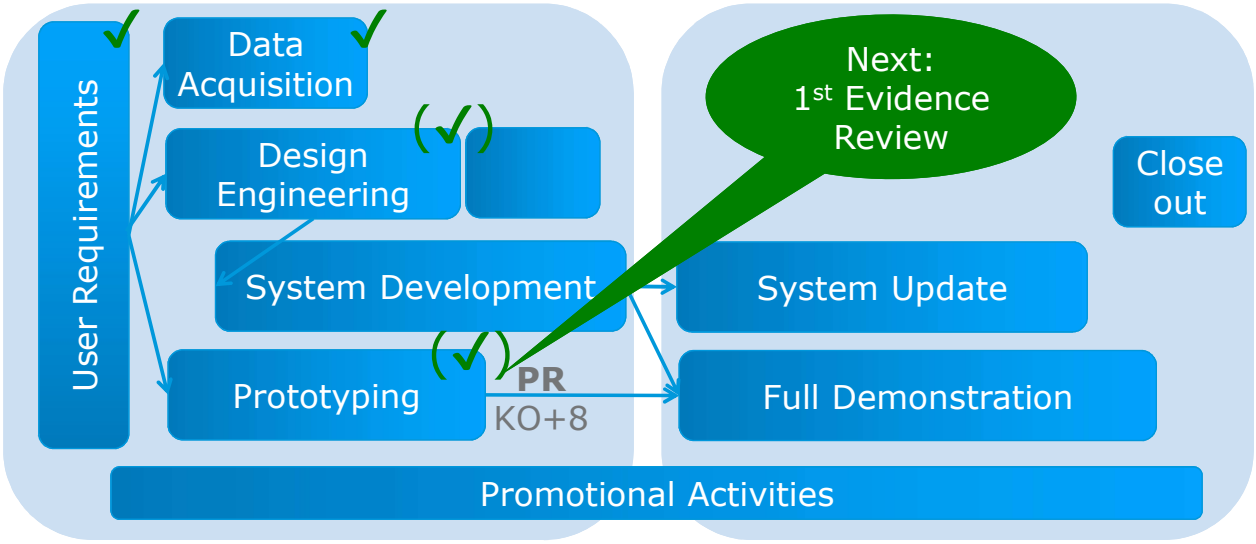
Selected National Paying Agencies

- Following criteria optimizing EU representativeness
- Selected together with the steering committee

Sen4CAP Pilot Countries



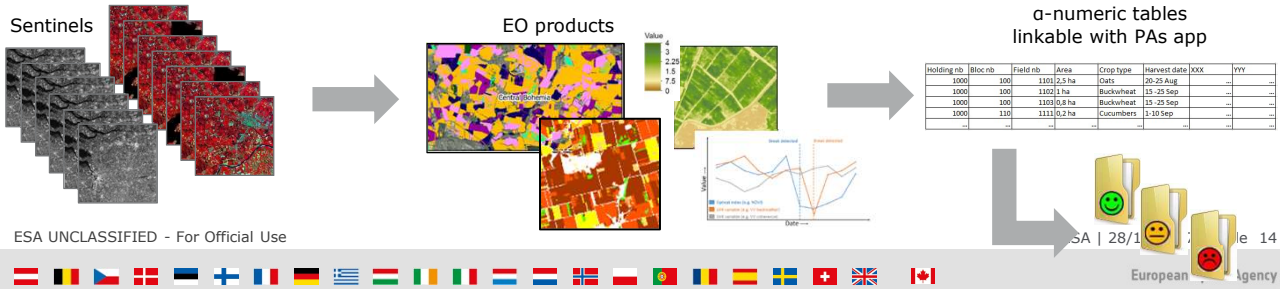
SEN4CAP – Time Planning & Status



User requirement consolidation

- Hosted by DG-Grow: Brussels, 2017 July 20th
- Interactions with PAs and Steering Committee
- Focus on decision making in IACS processes
  - PAs need information for deciding farmers' compliance
  - Agricultural parcel level, with declaration available to be crosschecked with thematic information => Sentinels to feed the « traffic light approach »

➔ **User Requirements defined at the level of concrete use cases**



Use cases to be demonstrated

Use case	Potential EO products
Crop diversification	Dynamic cultivated crop type map, Vegetation status indicator
Permanent grassland identification	Cultivated crop type map, Grassland mowing, Agricultural practices
EFA-Land lying fallow	Cultivated crop type map, Grassland mov… Agricultural practices (e.g. tillage, harves…
EFA-Catch crops	
EFA-Nitrogen-fixing crops	
Land abandonment	Cultivated crop type map, Grassland mov…
Interactive visualization	OGC services
LPIS update	cross-check c… ion status ind…
Claimless system	cross-check c… ion status ind…

Prototyping – Developing & Testing at EU level

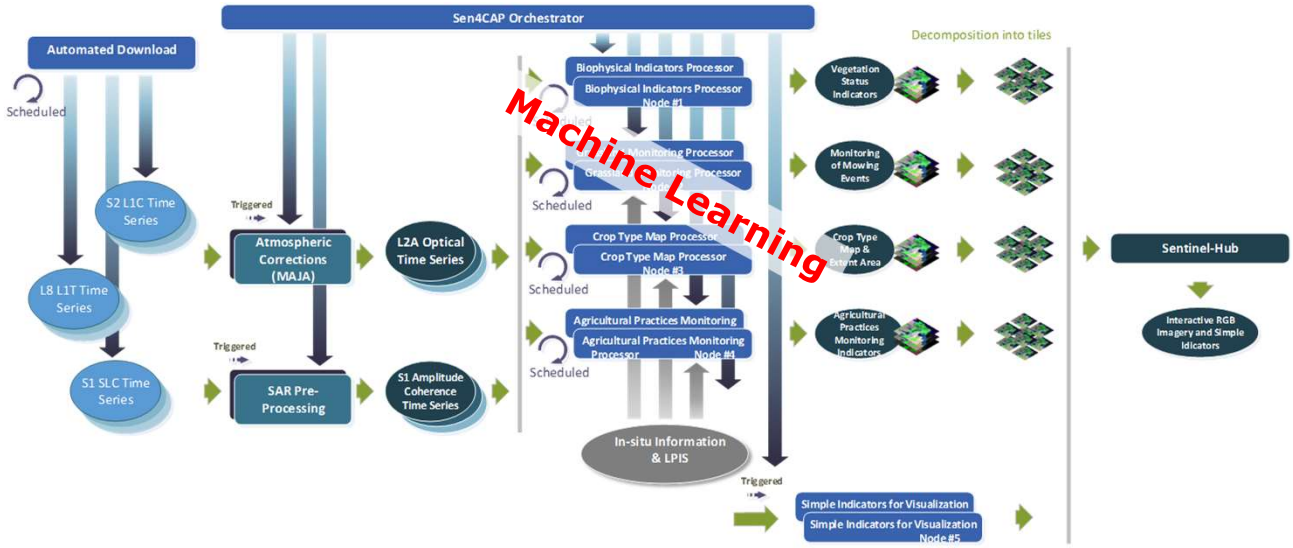
- **National S1 & S2 coverage for pilot countries** – Pre-processing of 100TB/year

Romania: 238.397 km²
S2: 2.4 TB + 6.9 TB

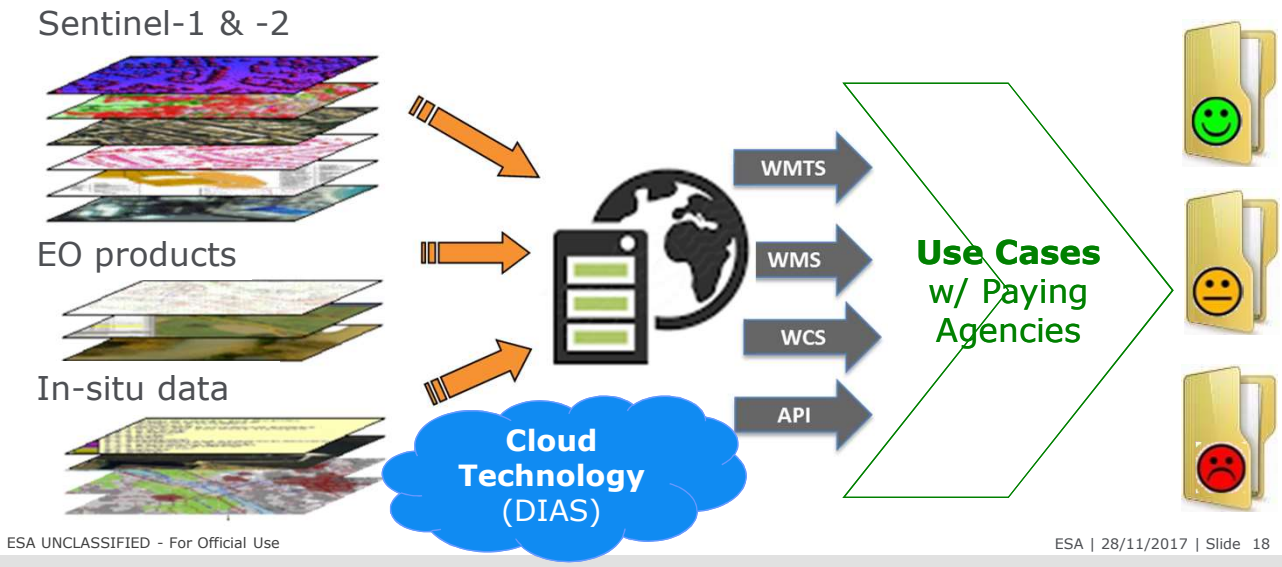
Netherlands: 41.543 km²
S1: 1220 scenes ≈ 6.7 TB

- **In-situ data sets shared by Paying Agencies**
  - LPIS/IACS datasets, subsidy applications, physical inspections, CwRS
- **Sampling heterogeneous EU agricultural landscape:**
  - LPIS types: Cadastral (IT, ES), Physical Block (NL, LI, RO), Farmers Block (CZ)
  - Field sizes: Minimum: RO & IT 72-85% < 1ha, Maximum: CZ 66% > 1ha
  - Landscape & climate: wide geographical range
- **➔ Algorithm Development, Benchmarking & 1st Validation**

Ongoing design of Sen4CAP processing system



From EO products to compliance decision

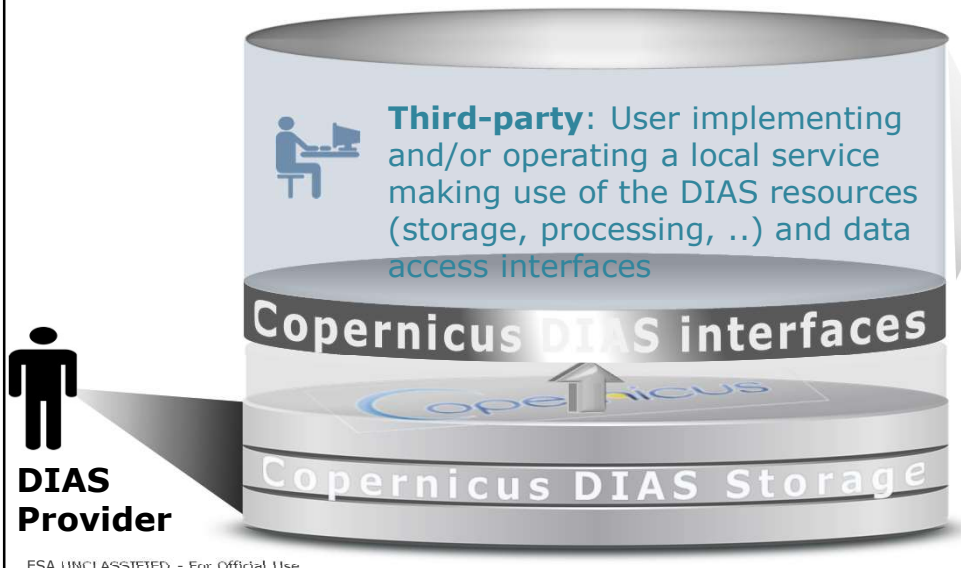


DIAS: Data Information Access Service
The Copernicus Cloud

DIAS Provider: In charge of DIAS Back-Office Services & Interfaces operations

Data Sources: Copernicus Data & Information, Sentinels Core Products, …

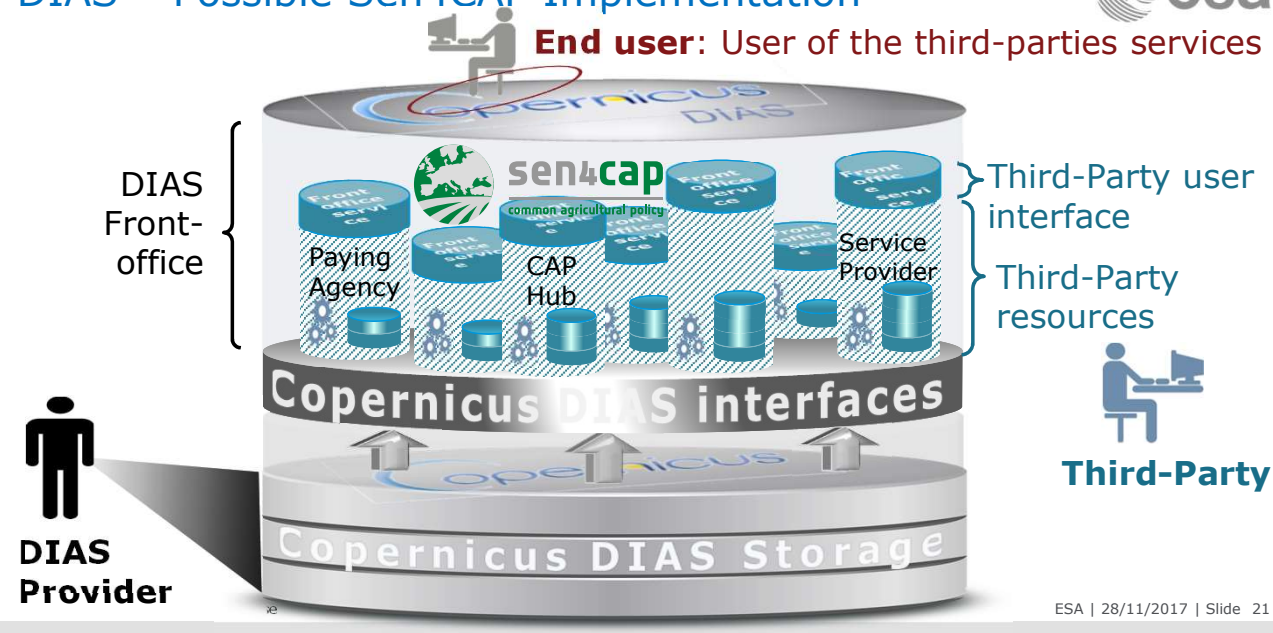
DIAS – Bringing the Applications to the Data



Provision of Front-Office Infrastructure is under Third-party responsibility

Note: processing is considered "local" whenever performed on an infrastructure virtually collocated with the data

DIAS – Possible Sen4CAP Implementation



Sen4CAP: An European Effort to prepare for CAP2020

- High quality, operational Sentinel data enables CAP monitoring approach
- Integration in PA operations for IACS implementation essential
- Sen4CAP tools will support automated, E2E monitoring at large scale
- Cloud computing on DIAS will allow for national to European up-scaling
- Open source approach for direct and customizable uptake & sharing

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http://esa-sen4cap.org