The Domino-E Webinar Series: Unlocking the Future of Earth Observation

Webinar Session 1: The Domino Architecture
A New Era of Earth Observation

19.03.2025, 10:30 - 12:00 CET

DOMINO

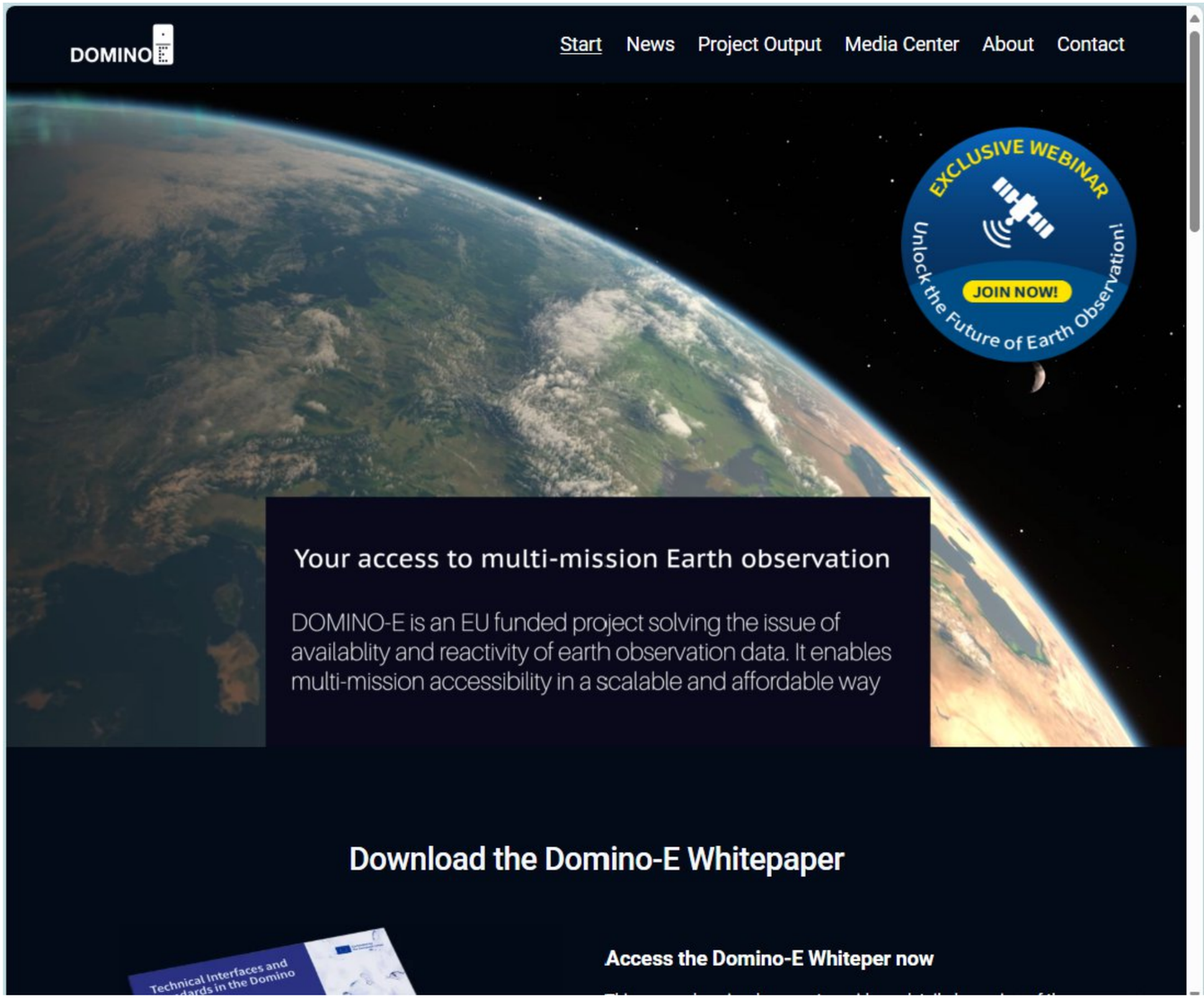
www.domino-e.eu

Co-funded by the European Union

At a Glance

The Domino-E project

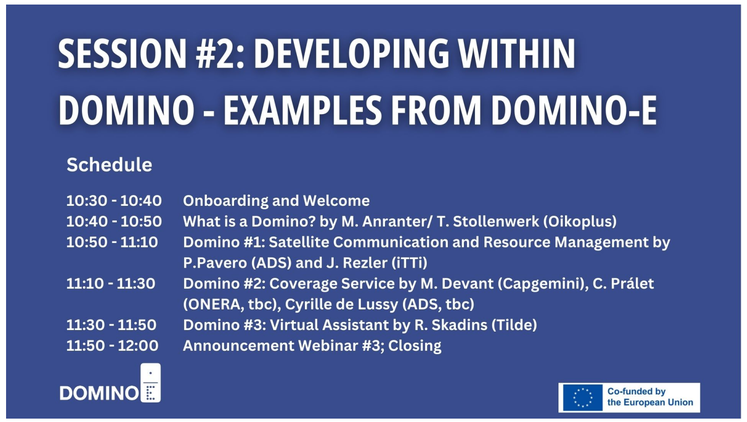
- Aims to revolutionize satellite operations through open architecture and advanced technologies
- A collaborative project bringing together 7 partners from 5 countries
- Funded under Horizon Europe, the EU's key funding program for research and innovation



At a Glance

The Domino-E Webinar Series

Date & Time: 19.03.2025; 10:30 – 12:00 CET

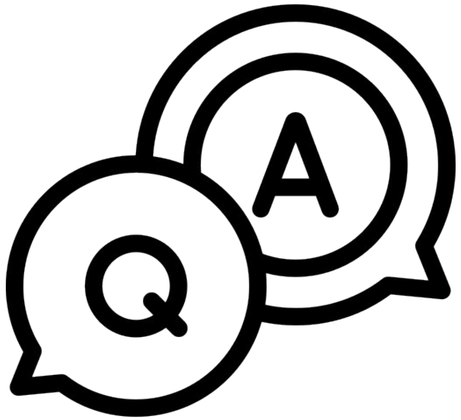


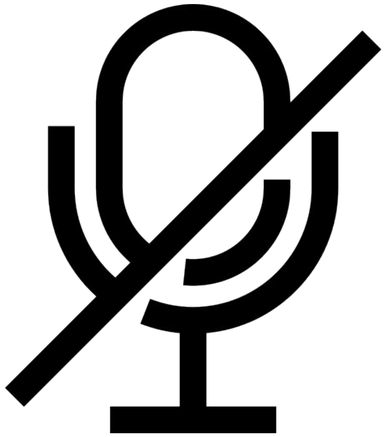
Date & Time: 25.03.2025; 10:30 – 12:00 CET

Date & Time: 31.03.2025; 10:30 – 12:00 CET

Housekeeping

Interaction & Recording





Introduction

Session 1: The Domino Architecture
A New Era of Earth Observation

DOMINO

www.domino-e.eu

Co-funded by
the European Union

Introduction: Session 1

What is to come?

Federated Earth Observation Systems

Domino architecture

Earth Observation

EO ground segments

DOMINO vision

Future of Earth Observation

State-of-the-Art EO mission management

Innovation

Domino-E

Opportunities in Space

Co-funded by the European Union

Introduction

What is to come?

Federated Earth Observation Systems

Domino architecture

Earth Observation

EO ground segments

DOMINO vision

Future of Earth Observation

State-of-the-Art EO mission management

Innovation

Domino-E

Opportunities in Space

SESSION #1: THE DOMINO ARCHITECTURE - A NEW ERA OF EARTH OBSERVATION

Schedule

10:30 - 10:45	Onboarding and Welcome
10:45 - 11:00	History and State-of-the-art for EO mission management by J. Vinuesa (ADS)
11:00 - 11:15	Introduction to the Domino Vision by J. Vinuesa (ADS)
11:15 - 11:55	Federated Earth Observation Architecture; Interview and Q&A with D. Novak (ADS)
11:55 - 12:00	Announcement Webinar #2; Closing

DOMINO

Co-funded by the European Union

History and State of the Art for EO Mission Management

Jean-Francois Vinuesa (Airbus Defence and Space)
Michael Anranter (OIKOPLUS GmbH)

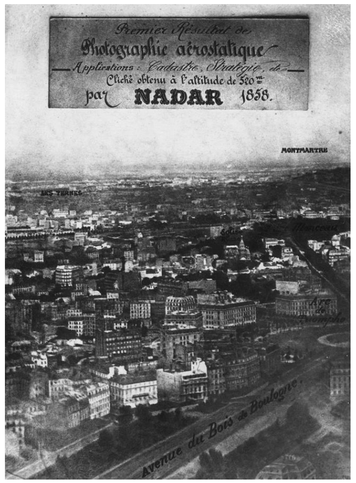
DOMINO

www.domino-e.eu

Co-funded by the European Union

The Early Days of EO

1858-1942

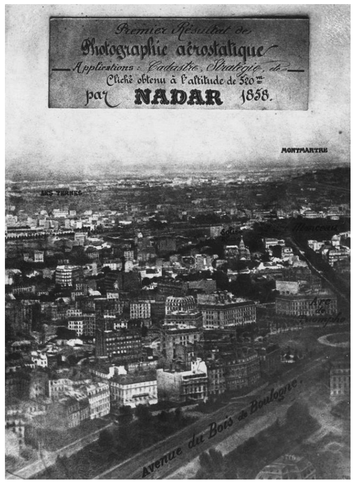


1858, Félix Nadar

Photograph taken from hot air baloon

The Early Days of EO

1858-1942



1858, Félix Nadar

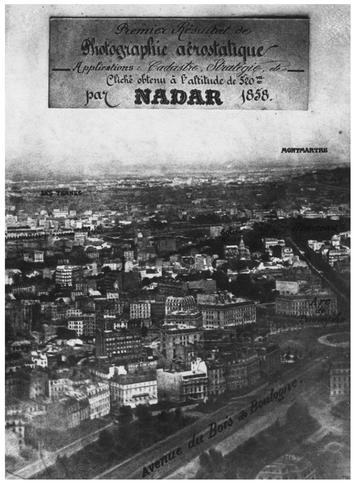
Photograph taken from hot air baloon

1906, George Lawrence

Photograph taken from kite

The Early Days of EO

1858-1942



1858, Félix Nadar

Photograph taken from hot air baloon

1906, George Lawrence

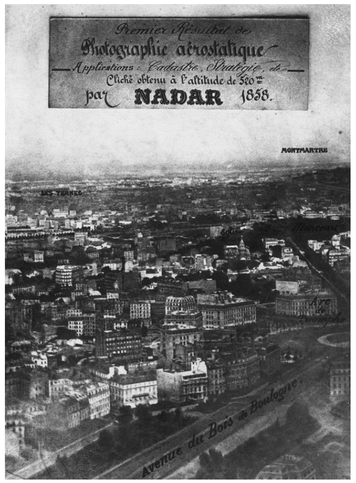
Photograph taken from kite

1907, Julius Neubronner

Pigeon photography

The Early Days of EO

1858-1942



1858, Félix Nadar

Photograph taken from hot air baloon

1906, George Lawrence

Photograph taken from kite

1907, Julius Neubronner

Pigeon photography

1942, n.n.

Photograph taken from airplaines

Space-based Earth Observation

24.10.1946

First photo of Earth taken from space.
Film: 35mm

Source: White Sands Missile Range/Applied Physics Laboratory

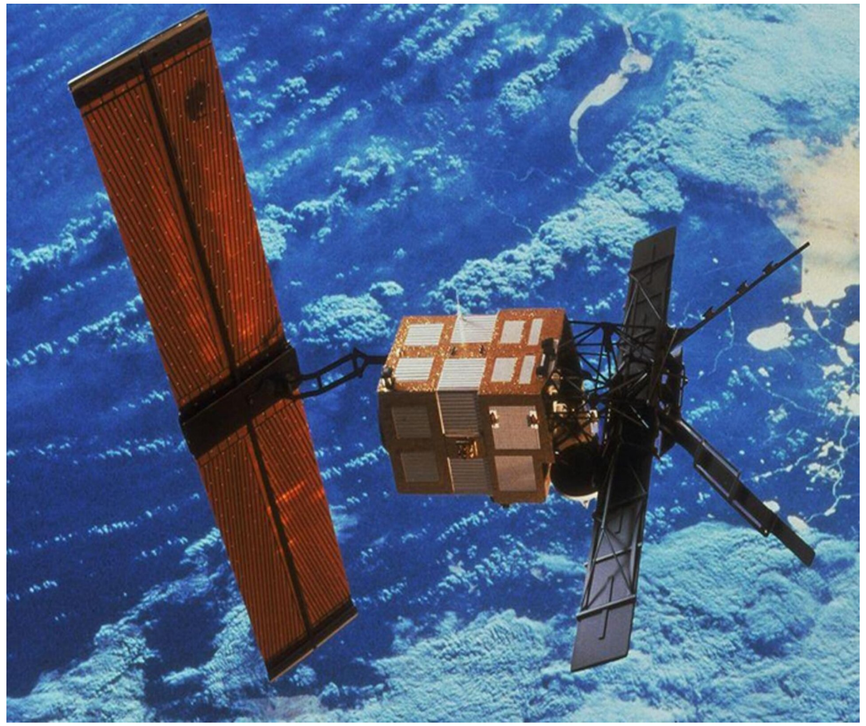
Sattelite-based Strategic Earth Observation since 1950’s

Selected EO programmes in chronological order

LANDSAT — NASA, 1972 - today. 1st civic acquisition of satellite imagery (for agriculture, cartography, geology, foresty, regional planning, surveillance, education)

SPOT Systéme Probatoire d’Obersvation de la Terre — CNES, 1986-2024. 1st European high-resolution commercial EO satellite.

ERS 1&2 European Remote Sensing Satellites — ESA, 1991-2011. Highlight: C-Band Synthetic Aperture Radar with 30m*30m resolution.



ESA, 2011. Url: https://www.esa.int/ESA_Multimedia/Missions/ERS-2/(result_type)/images

Current EO Missions

Selected satellite-based EO missions

Governmental EO Constellations

- Copernicus Programme (Sentinel 1, 2 and 3) — ESA
- Earth Observing System (Terra & Aqua Satellites) — NASA
- EarthCARE — ESA & JAXA
- Pleiades (ADS & CNES)

Next

- Copernicus Expansion Mission, ESA
- NISAR (NASA & ISRO)

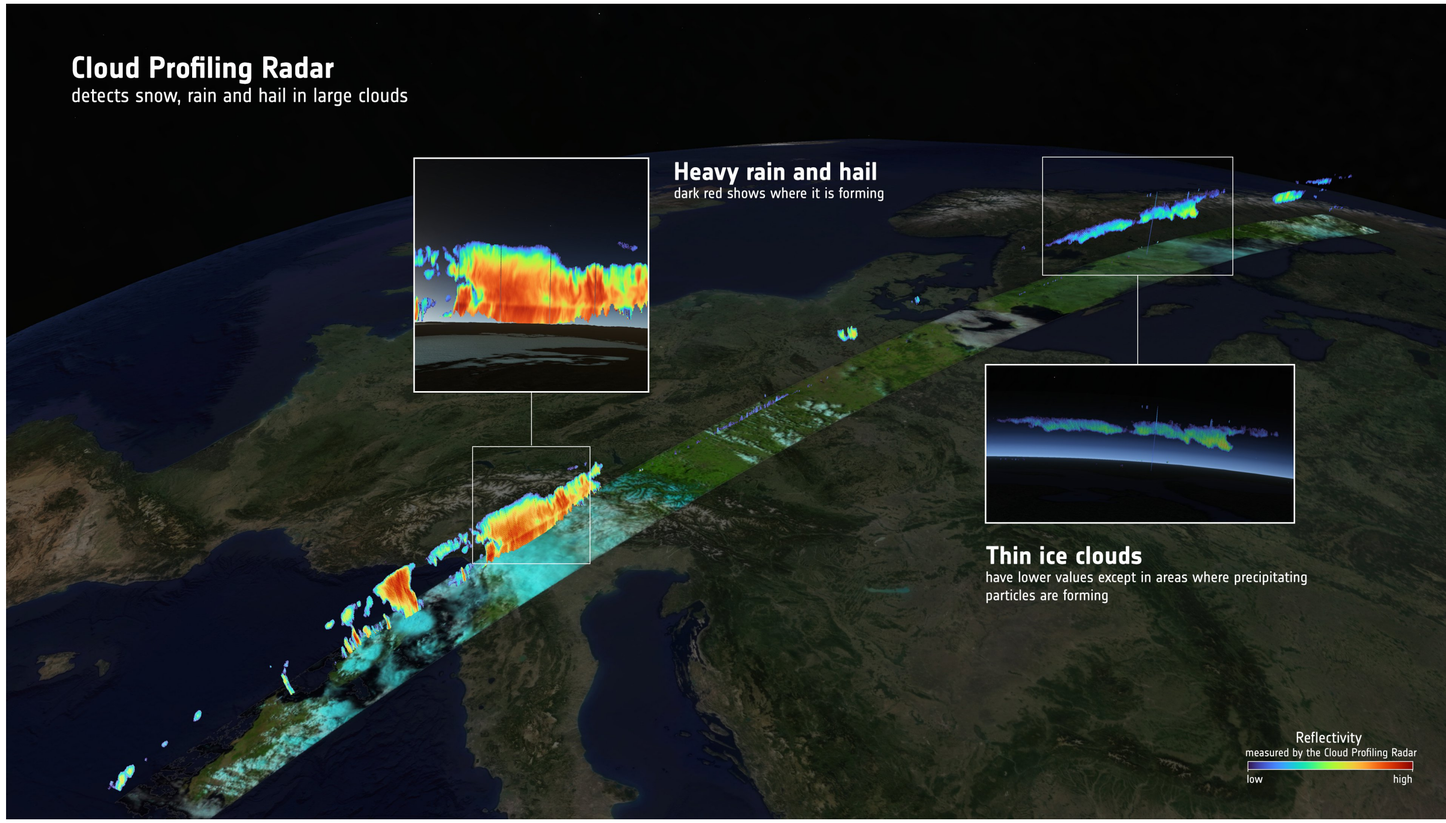


Photo: ESA, 2024. Url: https://www.esa.int/ESA_Multimedia/Images/2024/10/EarthCARE_s_cloud_profiling_radar_detects_snow_rain_and_hail

Current EO Missions

Selected satellite-based EO missions

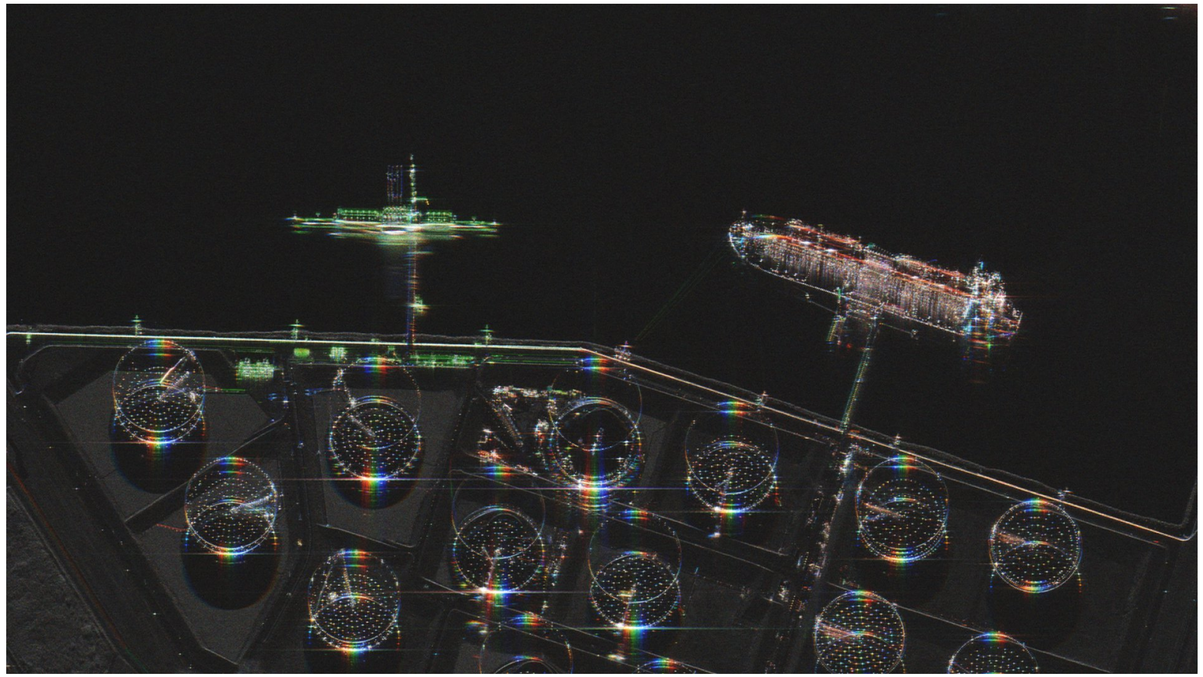
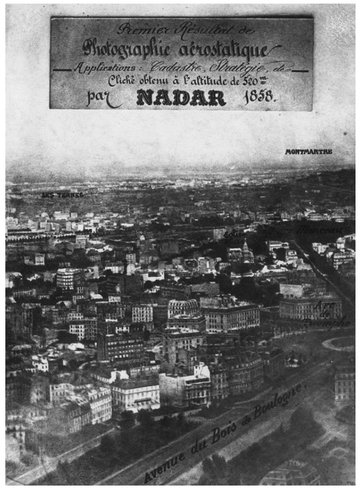


Photo: ICEYE, 2025. Url: https://www.iceye.com/hubfs/ICEYE_Rotterdam_zoom-in_2PR_webpage-1.png

Commercial Earth Observation Constellations:

- Planet Labs; large fleet of small satellites, providing HR imagery of Earth's entire landmass, supporting agriculture & disaster response)
- Maxar Technologies; offers VHR satellite imagery used in mapping, defense, and environmental monitoring
- ICEYE, specialises in synthetic aperture radar (SAR) satellites, delivering HR radar imagery for flood monitoring and maritime surveillance.
- AIRBUS, Pleiades Neo integrating optical and radar HR satellite imagery, daily coverage: 1.000.000 km²

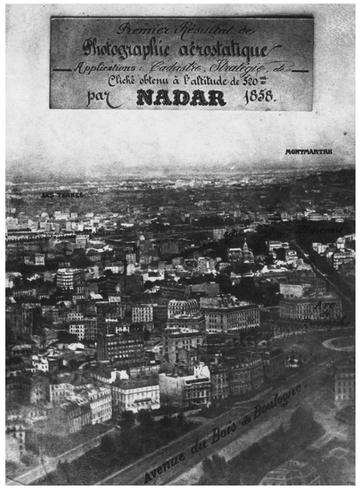
Recap: Disruptions since 1858



Weather reliability reduced.
Continuity through long-term missions.

AI-supported supported data collection and data analysis.

Recap: Disruptions since 1858

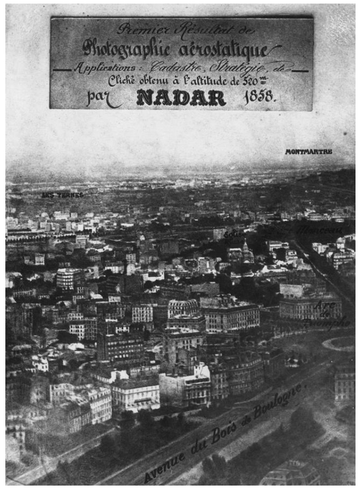


Weather reliability reduced. Continuity through long-term missions.

AI-supported supported data collection and data analysis.

Different wavelength imagery (visual imaging + active and passive remote sensing) for different applications.

Recap: Disruptions since 1858



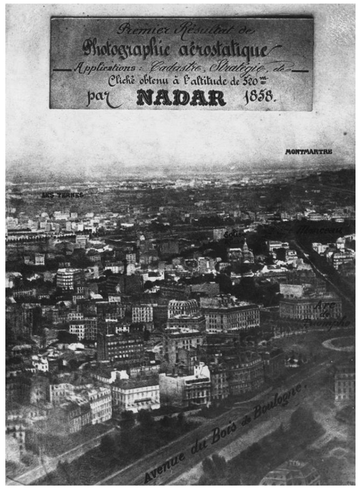
Weather reliability reduced. Continuity through long-term missions.

AI-supported supported data collection and data analysis.

Different wavelength imagery (visual imaging + active and passive remote sensing) for different applications.

Improved ability to control, co-ordinate and re-adjust data acquisition while assets remain in orbit.

Recap: Disruptions since 1858



Weather reliability reduced. Continuity through long-term missions.

AI-supported supported data collection and data analysis.

Different wavelength imagery (visual imaging + active and passive remote sensing) for different applications.

Improved ability to control, co-ordinate and re-adjust data acquisition while assets remain in orbit.

Equipment size, weight etc. have been drastically reduced.

Smaller, more efficient and durable equipment makes EO missions more affordable.

Where we are Standing at: Contemporary EO Ground Segment Challenges

Fast & Reactive Image Acquisition

- Demand for higher-resolution and multi-wavelength images with larger amount of data
- Real-time or near-real-time imaging as a key goal, improved reactiveness and faster image acquisition
- Ground segments enabling higher payload capacities and faster data transmission and processing

Imgae: KJpargeter, 2025. Url: https://shorturl.at/sbzCM

Where we are Standing at: Contemporary EO Ground Segment Challenges

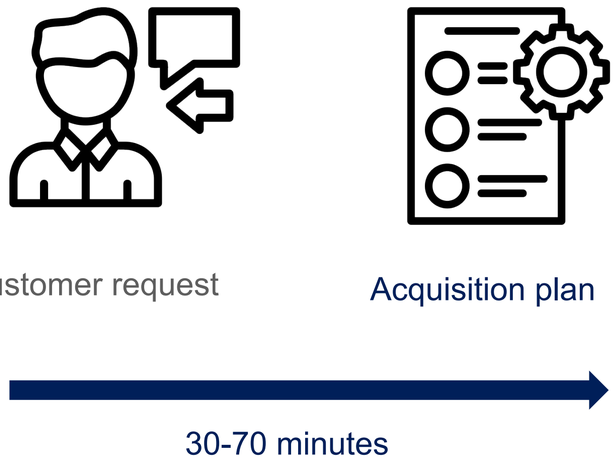
Affordable Image Acquisition

Imgae: Wirestock, 2025. Url: https://shorturl.at/cOWx4

- Decrease costs for mission planning, scheduling, and real-time data processing
- Automation to reduce manual tasks, lowering operational expenses and amount of consultancy needed
- Reduction of opportunity costs resulting from waiting times

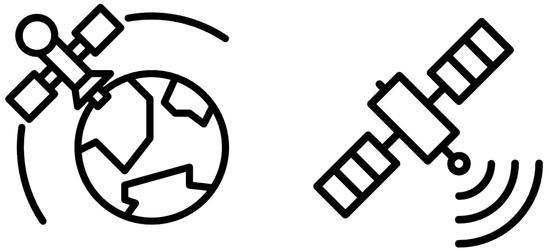
State-of-the-Art satellite-based EO Tasking Loop

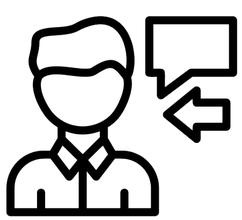
Identifying current restrictions

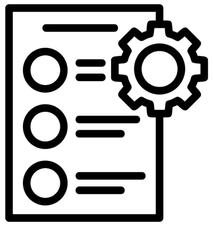


State-of-the-Art satellite-based EO Tasking Loop

Identifying current restrictions







Customer request

Acquisition plan

Acquisition plan upload

Image acquisition

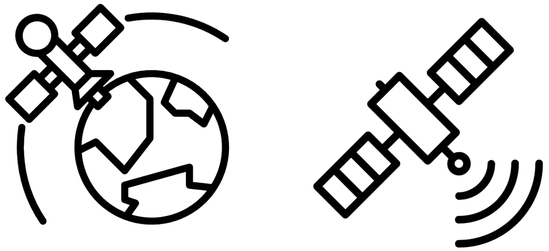
Data download

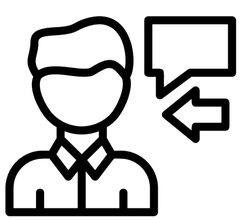
30-70 minutes

60 minutes

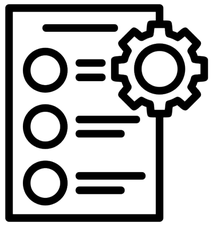
State-of-the-Art satellite-based EO Tasking Loop

Identifying current restrictions





Customer request

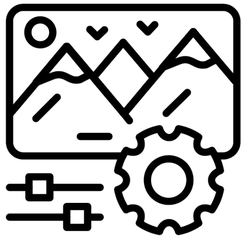


Acquisition plan

Acquisition plan upload

Image acquisition

Data download



Data processing

Result delivery

30-70 minutes

60 minutes

20-30 minutes

110- 160 minutes

The Domino Vision

Jean-Francois Vinuesa (Airbus Defence and Space)

DOMINO

www.domino-e.eu

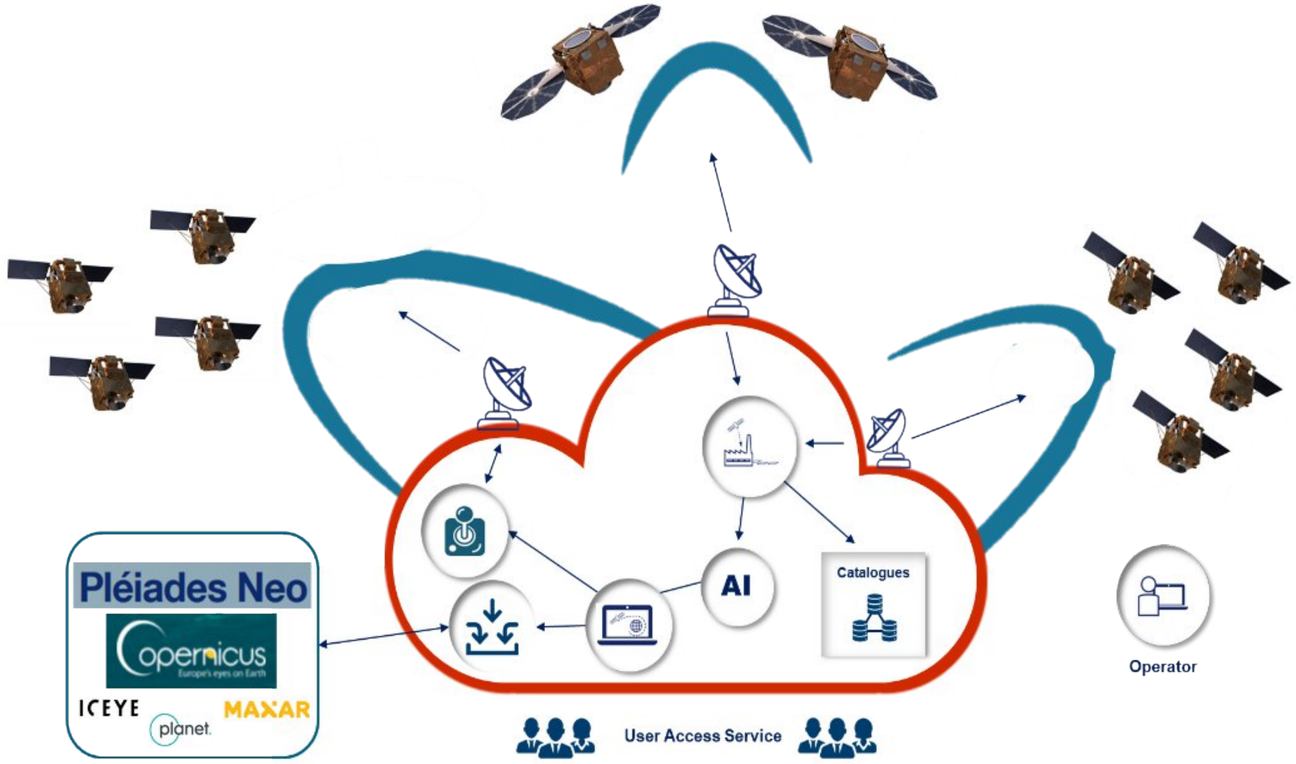
Co-funded by
the European Union

Why Domino?

Better solutions for customers and better profability for industries through a standardized modular architecture

Challenges to address:

- Space market is evolving fast with new comers
- Customer needs are evolving
- Future systems will be more complex and multi-missions
- Sovereignty and trustability on the system and the data
- Hybrid and public cloud costs and deployments
- Maximization of component reuse reducing costs, risks and schedules
- Low coupling between components to provide modularity and localize impacts, constraints and evolutions



Added Values of Domino Modular and Standardized Architecture

Better value proposition for clients

- Easier to set up the best industrial scheme
- Easier to provide the best technical solution against customer needs
- Less risky to implement evolutions on a complex system
- Increased confidence level
- Easier on CAPEX/OPEX calibration/decision

Derisked schedules if industrial schemes are complex

- Clearer sharing of responsibilities at the start of a program (gains during engineering and integration)
- Less risky engineering and IVV phases, fewer potential escalations
- Derisk development from supply chain
- More secured margins
- Focus on the content (performances) and not on interfaces

Incentivised investments

- Clear and stable technical conditions for the integration of E2E systems
- Facilitated product strategy and reuse maximization
- More accessible maintenance and evolution contracts for the client

What is a Domino?

Each Domino developer is in charge of providing a compliant implementation and architecture

A DOMINO provides a valuable SERVICE to any Earth Observation ground segment

A DOMINO:

- Autonomously produces outputs from a set of inputs
- Provides a define set of services
- Can be deployed on a cloud
- Is independent from other dominoes infrastructure
- Is accountable for its performances
- Is interchangeable by another implementation respecting the same interfaces

A DOMINO:

- Can be multi-missions or dedicated to one mission (Dominoes perimeter)
- Can integrate mandatory or optional functionalities (Dominoes optionality)
- Can be delivered as a service or as a product (Dominoes mode)
- Can be deployed as a unique instance or as a multi-instance component to meet performances and needs (Dominoes instances)

Co-funded by the European Union

Domino Architecture Guidelines

Answers industry needs in terms of reactivity and adaptability reusing existing building blocks

Mutual TLS
Full HTTPS
Oauth API
….

Security

Existing Standards

Standard Interface

Homogenous Guidelines

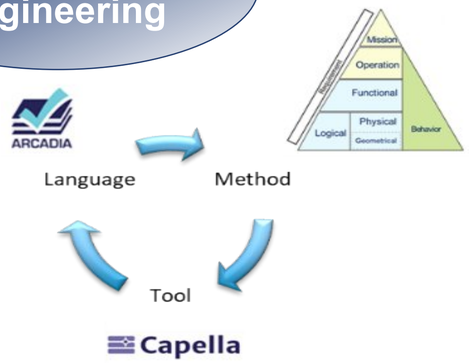
- Standard interfaces
  - CCSDS TC SPACE DATA LINK PROTOCOL (232.0-B-3)
  - CCSDS TM SPACE DATA LINK PROTOCOL (132.0-B-2)
  - ESA-AUXIP V1.2 interfaces
  - ESA-LTAIP V1.7 interfaces
  - ESA-PRIP V1.7 interfaces
  - ESA-XBIP V1.1 interfaces
  - OGC API Processes V1.0.0 interfaces
  - STAC API interface

Agility

Collaborative Work

Results are Public

Model-based Engineering



Industrial Point of View

Engineering Point of View

Modularity

Evolutive

Infra Agnosticism (cloud & virtualisation)

Domino baseline architecture is released under Apache V2.0 licence: https://domino-x.space/

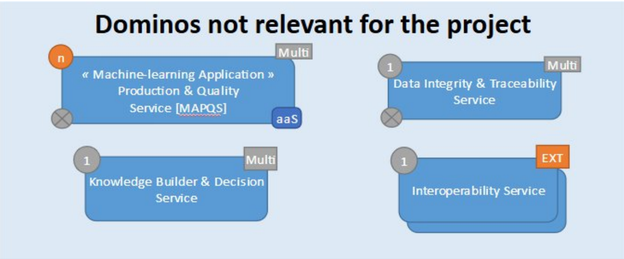
Co-funded by the European Union

Domino: the Next Ground Segment – A Ready to Start Architecture

Decrease time to market thanks to mature architecture and relying on existing Dominoes

Domino architecture agreed baseline T0

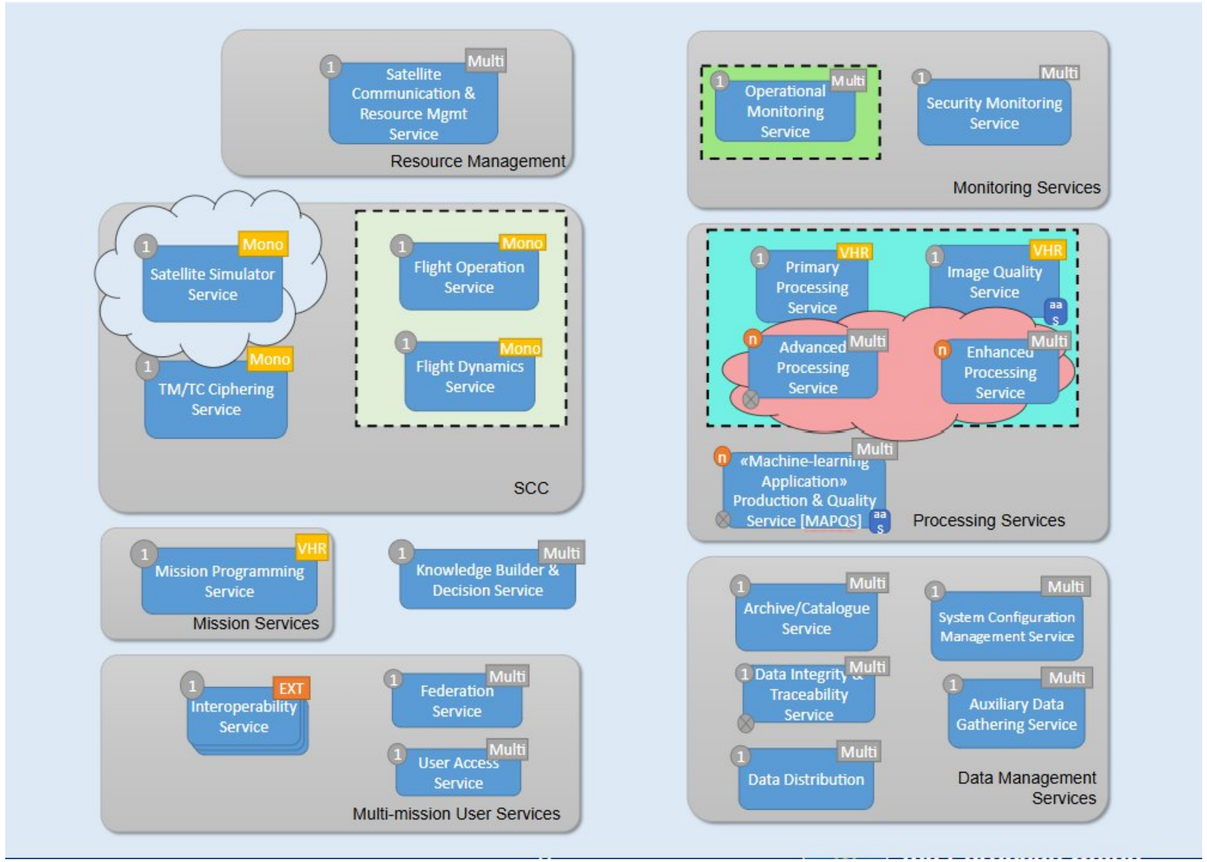
Instantiate Domino architecture for the project



Industrial Organisation

Ground Segment Deployment

Domino ground segment architecture



Federated Earth Observation Architecture – An Interview

Daniel Novak (Airbus Defence and Space)

Moderation:
Thomas Stollenwerk (Oikoplus)

DOMINO

www.domino-e.eu

Co-funded by the European Union

DOMINO

www.domino-e.eu

Co-funded by
the European Union

Outlook: Developing Within Domino – Examples from Domino-E

DOMINO

www.domino-e.eu

Co-funded by
the European Union

Upcoming Session: Developing Within Domino – Examples from Domino-E

Tuesday, 25.03.2025 - 10:30 to 12:00

- What is a Domino? Understanding the modular concept
- Satellite Communication & Resource Management – How automation optimizes satellite operations
- Coverage Services for Improved Data Quality – AI-driven solutions to enhance EO imagery
- Virtual Assistants in EO – Making mission tasking easier and more accessible

Scan and register on Eventbrite!

Thank you!

AIRBUS Capgemini iTTi

ONERA THE FRENCH AEROSPACE LAB TILDE gmv INNOVATING SOLUTIONS OIKO

DOMINO

www.domino-e.eu

Co-funded by the European Union