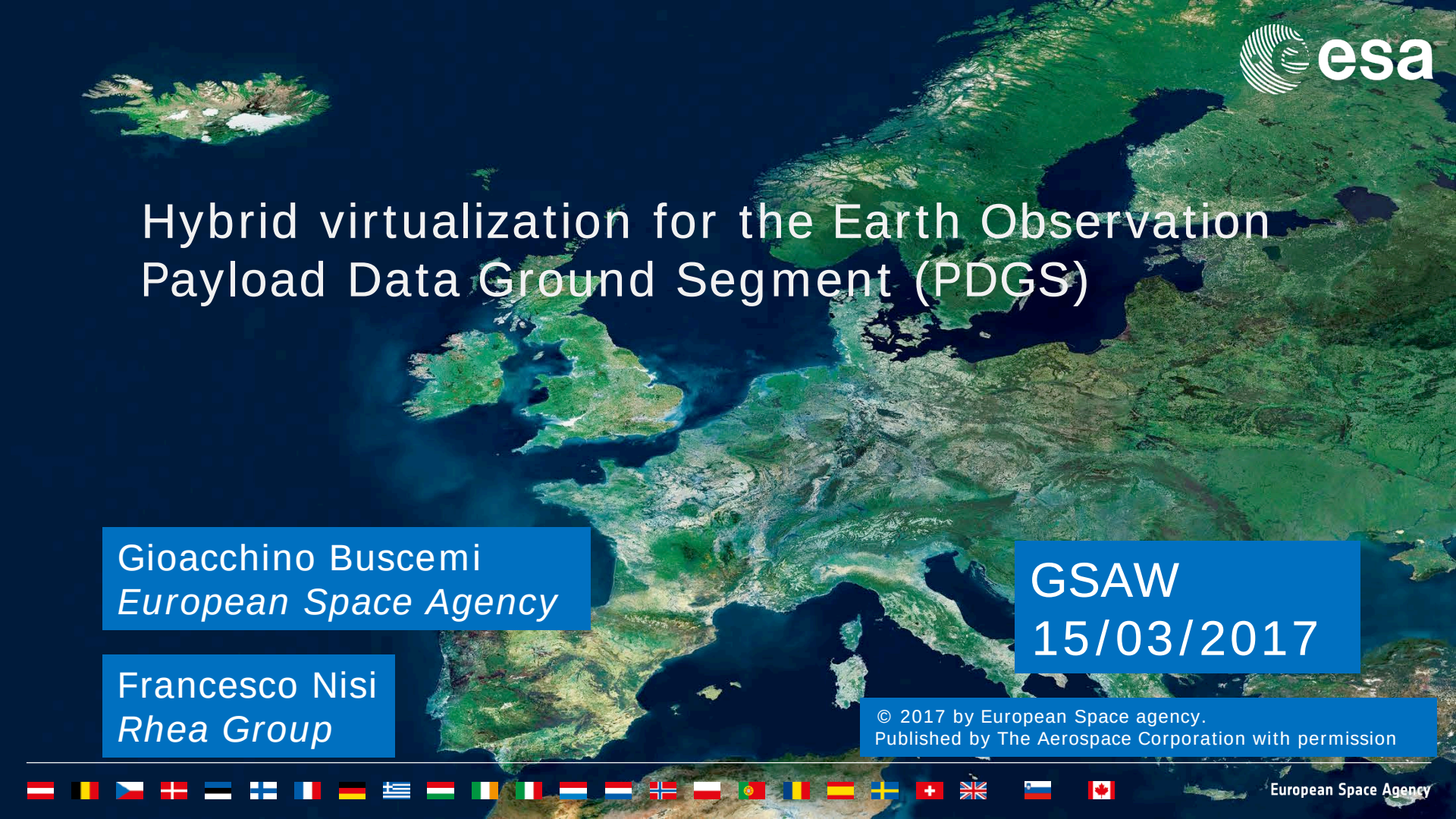


Hybrid virtualization for the Earth Observation Payload Data Ground Segment (PDGS)

Gioacchino Buscemi
European Space Agency

Francesco Nisi
Rhea Group

GSAW
15/03/2017

ESA’s eye on earth

ESRIN, in Frascati, Italy, is ESA’s center for Earth Observation where operations and exploitation of Earth Observation satellites are managed.

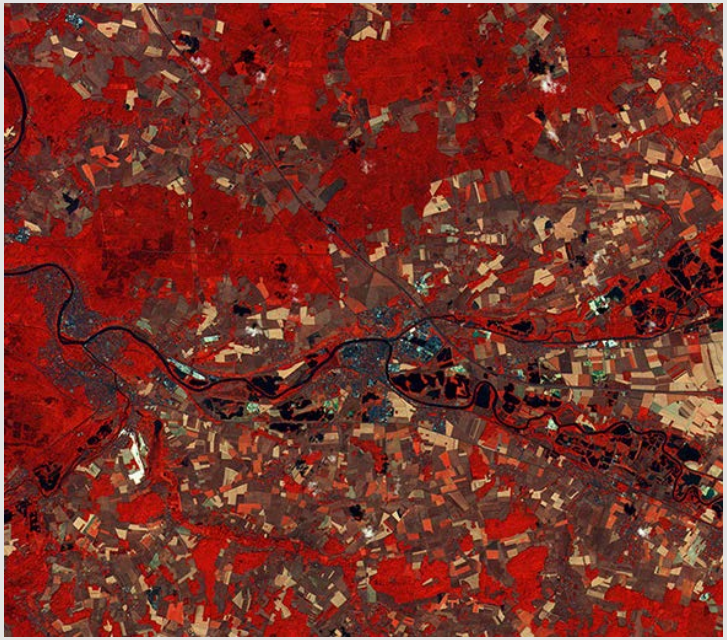
The world’s largest database of environmental data for both Europe and Africa is managed from ESRIN.

Pioneers in Earth observation

ESA has been dedicated to observing Earth from space ever since the launch of its first meteorological mission, **Meteosat-1** in 1977.

ERS-1 (1991–2000) and **ERS-2** (1995–2011) providing a wealth of invaluable data about Earth, its climate and changing environment.

Envisat (2002–12) the largest satellite ever built to monitor the environment, it provided continuous observation of Earth's surface, atmosphere, oceans and ice caps.



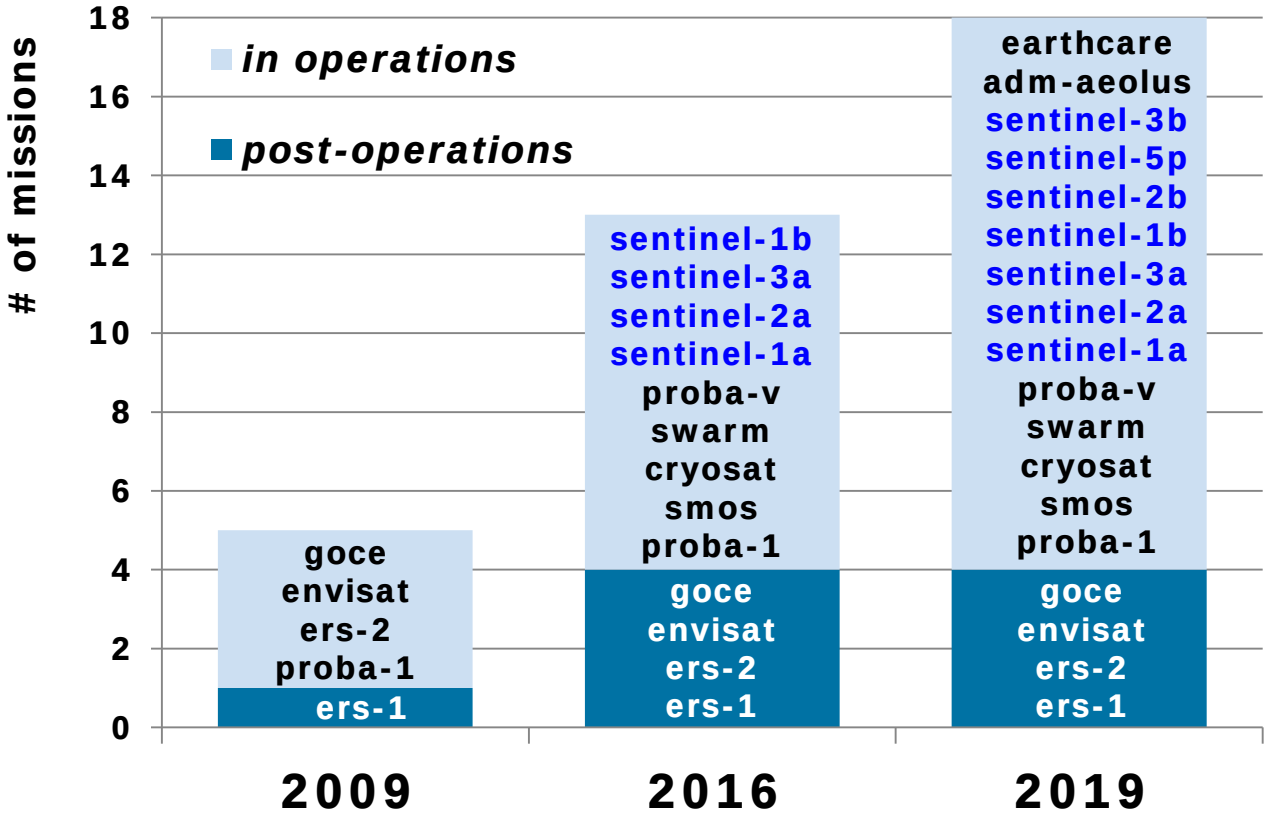
Global monitoring for a safer world

Copernicus: an Earth observation programme for global monitoring for environment and security.

Led by the European Commission in partnership with ESA and the European Environment Agency, and responding to Europe's need for geo-spatial information services, it will provide autonomous and independent access to information for policy-makers, particularly for environment and security issues. ESA is implementing the space component: developing the **Sentinel** satellite series, its ground segment and coordinating data access.

ESA has started a **Climate Change Initiative**, for storage, production and assessment of essential climate data.

EO Missions Overview



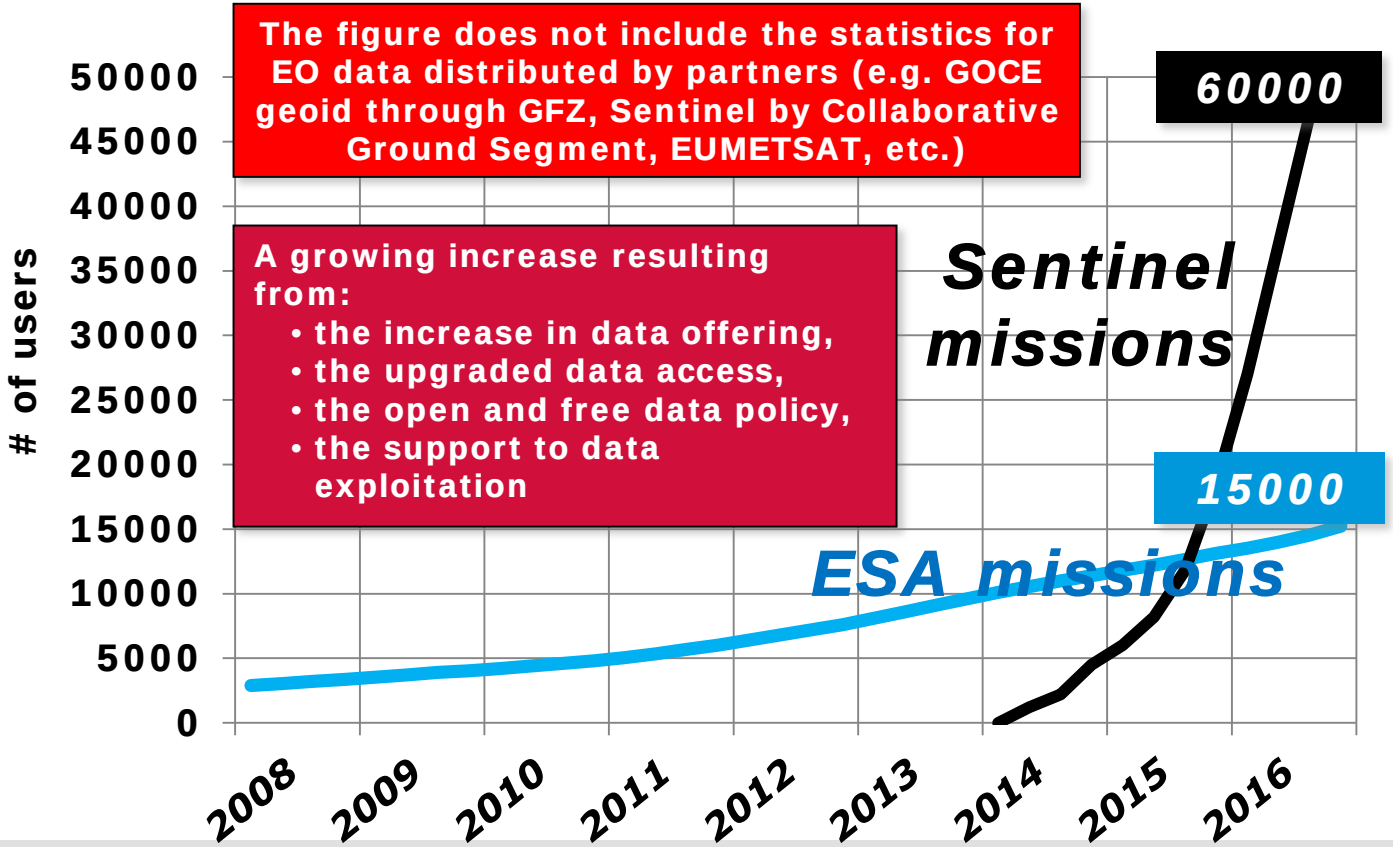
+ Third Party Missions

Landsat, Aura OMI, Cosmo-Skymed, DEIMOS, GOSAT, RapidEye, Radarsat ….

+ development of PDGS for future missions

https://earth.esa.int/
http://www.copernicus.eu/

EO missions growth



ESA EO PDGS 10 Year ago

Dissemination:
1. Physical media
2. Distributed Internet Access (one per site)
3. Satellite-based Multicast

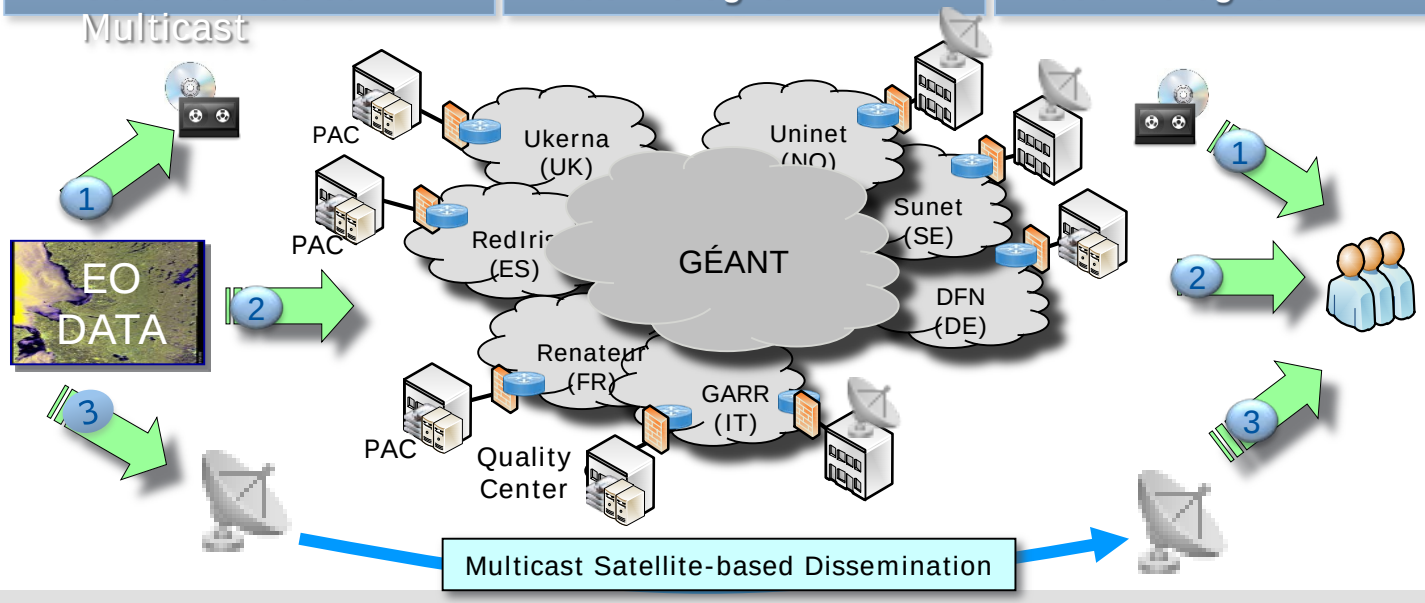
Processing:
- Local Processing (mainly L0)
- Physical servers with heterogeneous technologies

Network
- Circulation via Internet VPNs
- LAN at remote sites with heterogeneous technologies

Security:
- Local security per site
- Firewall based security perimeter
- No events correlation

Archiving:
- Archives at PAC sites
- No archive uniformity

General:
- No end-to-end KPI
- Based on academic networks (no SLA)

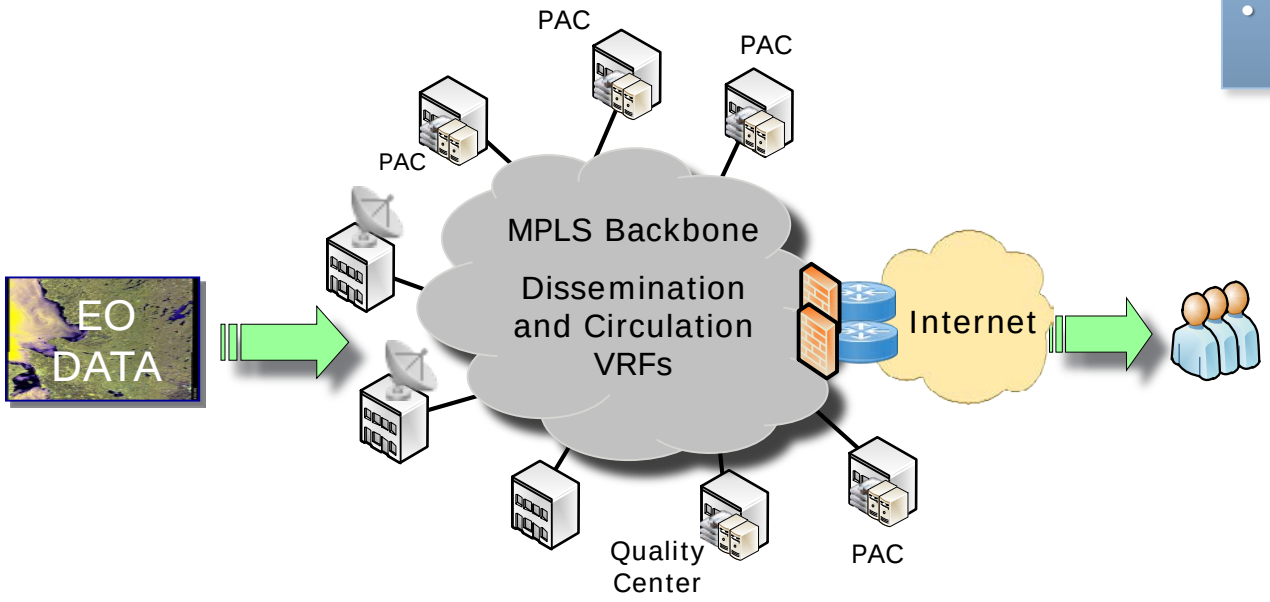


ESA EO PDGS 5 Year ago

Dissemination:
- Centralised Internet Access
- Local DMZ at each site

Processing:
- Local Processing
- Physical servers

Network
- Circulation via MPLS
- LAN at remote sites with heterogeneous technologies and ownership/management
- WAN Service Level Agreement with commercial provider

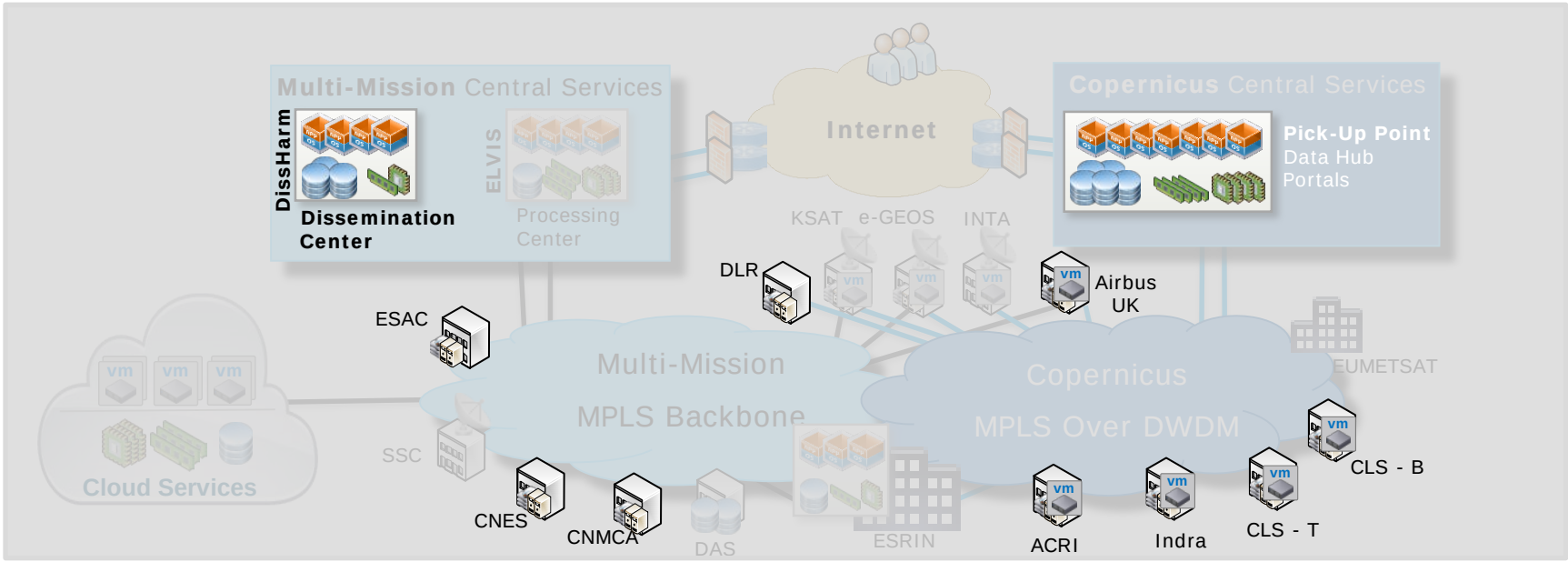


Archiving:
- Archives at remote sites
- Long Term Data Preservation (post-operations missions)

Security:
- Security Team (Insourced)
- Local Event monitoring
- No correlation, coordination, collaboration

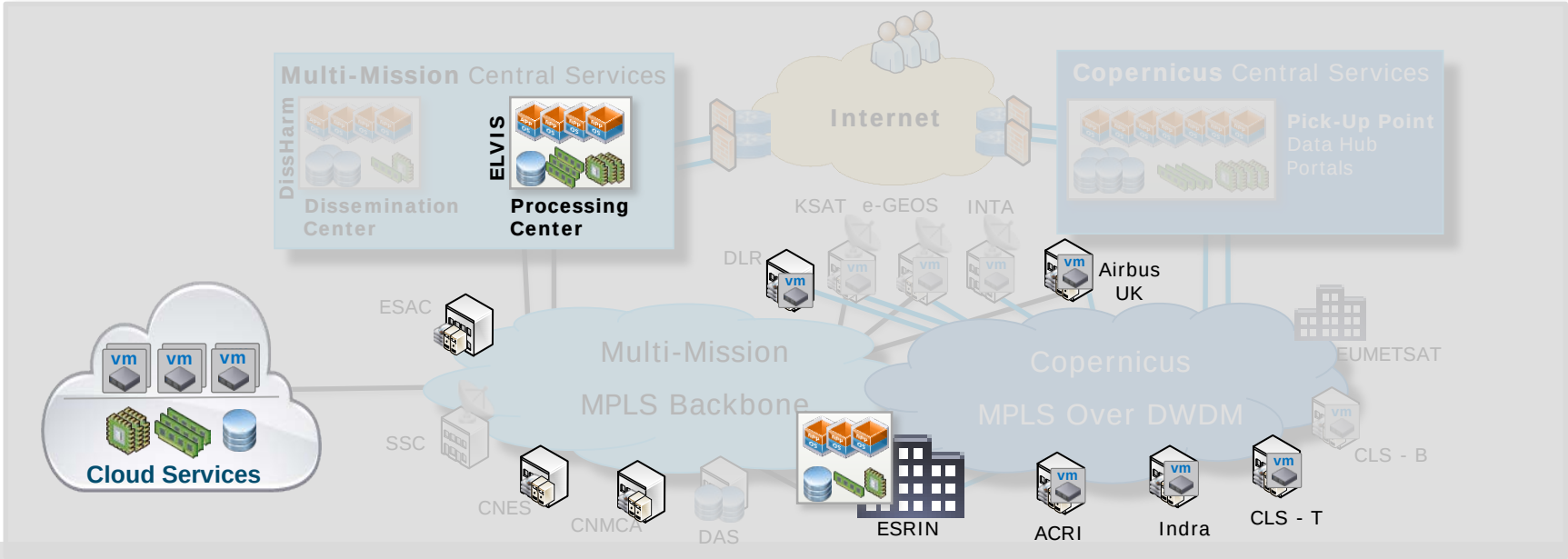
ESA EO PDGS Today
Dissemination

Dissemination (Mix of Virtual and Physical resources):
- Virtual Central Dissemination (DissHarm)
- Copernicus Dissemination Platform (Pick-Up Point)
- Local DMZ on remote sites



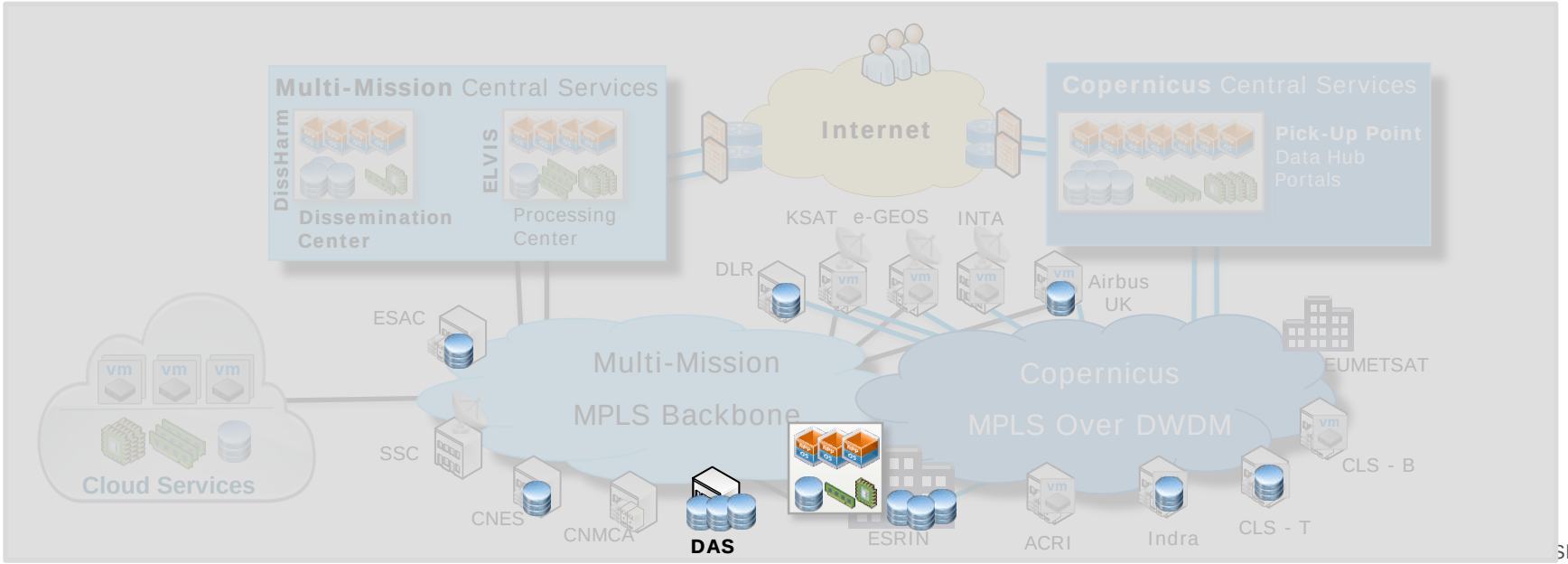
ESA EO PDGS Today
Processing

Processing (Mix of Virtual and Physical resources):
- Virtual Central Processing (ELVIS)
- Mixed local physical servers and local virtual solutions
- Private PaaS high performing infrastructure (Insourced ESA)
- Interconnected Public Cloud



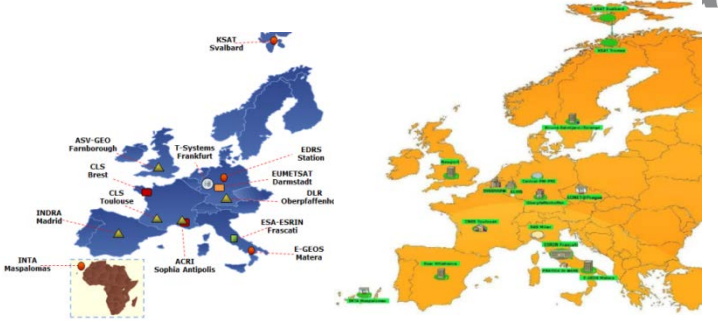
ESA EO PDGS Today
Archiving

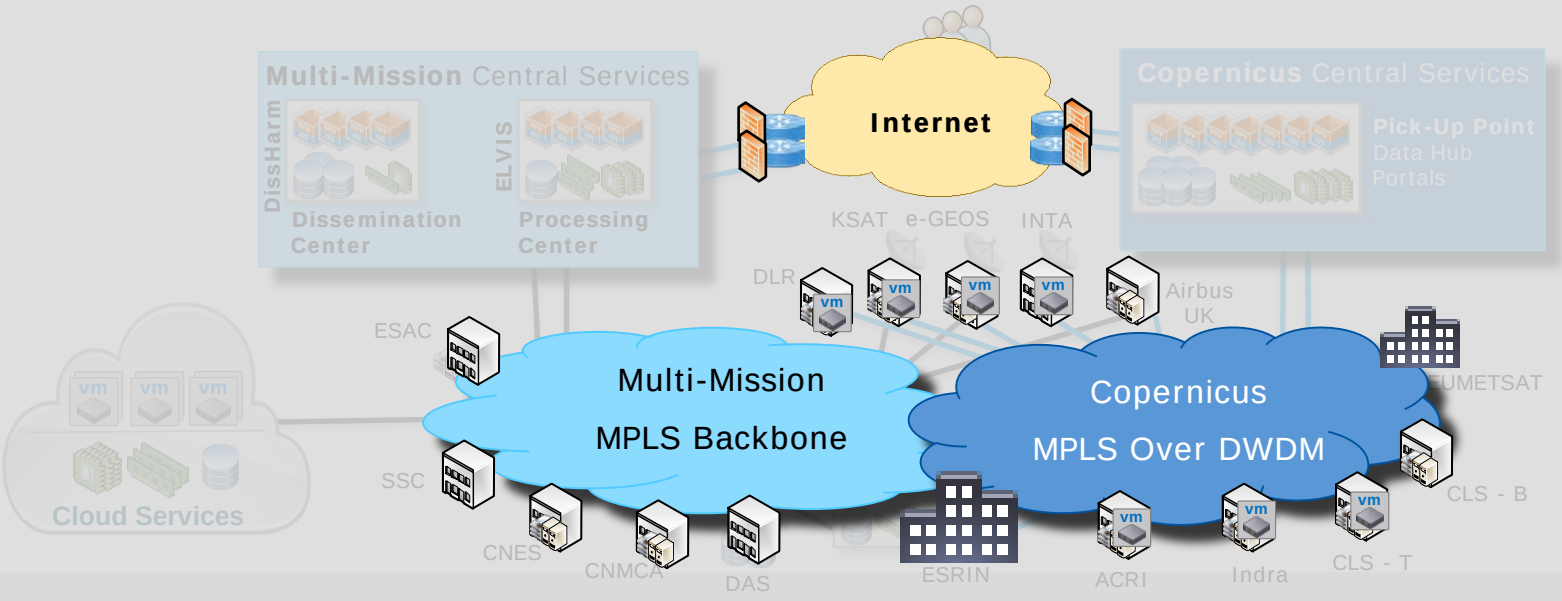
Archiving:
- Local LTA at PACs
- Data Archival Center (DAS)
- Cold Backup



ESA EO PDGS Today
Network

Network
- Two networks based on MPLS/DWDM up to 10 Gbps
- Central Internet break-outs
- LAN at remote sites with heterogeneous technologies and ownership





ESA EO PDGS Today

Security

EOP-G Security Framework

Security requirements

- Disaster Recovery & Business Continuity
- Secure Operations & Management
- Access control
- User classification
- Data classification
- Network policy
- Applications
- Systems

Secure operations management

- SECOPS
- Security organization

ESA EO PDGS Today

The Hybrid Virtual Model

Hybrid virtual Model based on:

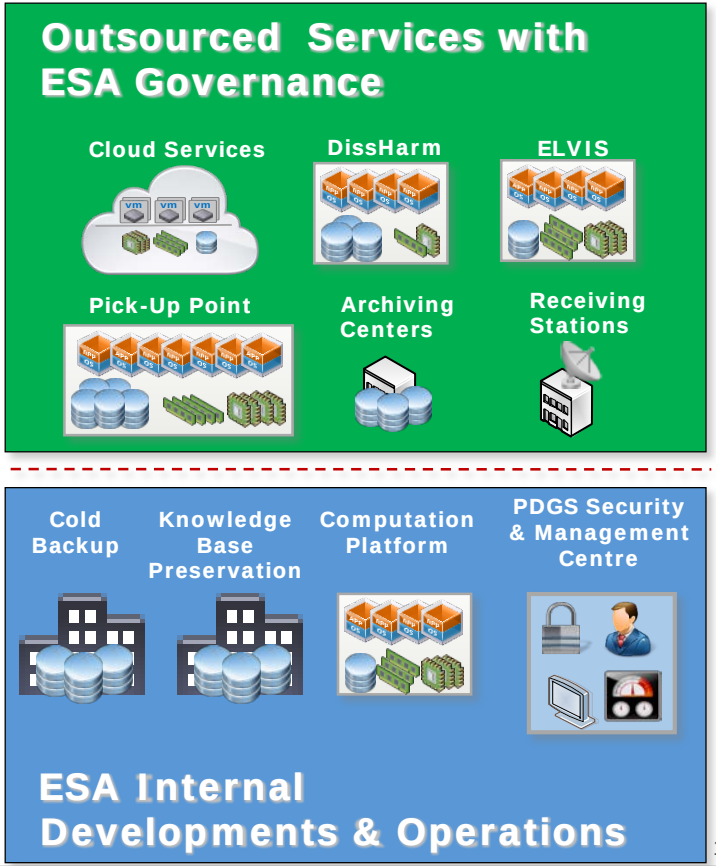
A set of outsourced services under **ESA governance** and following EO missions objectives:

- Virtual Hosting centres full managed by the contractor for processing, dissemination, archiving and acquisition activities
- Cloud Services for on demands needs

PLUS

Core infrastructure developed and operated by ESA:

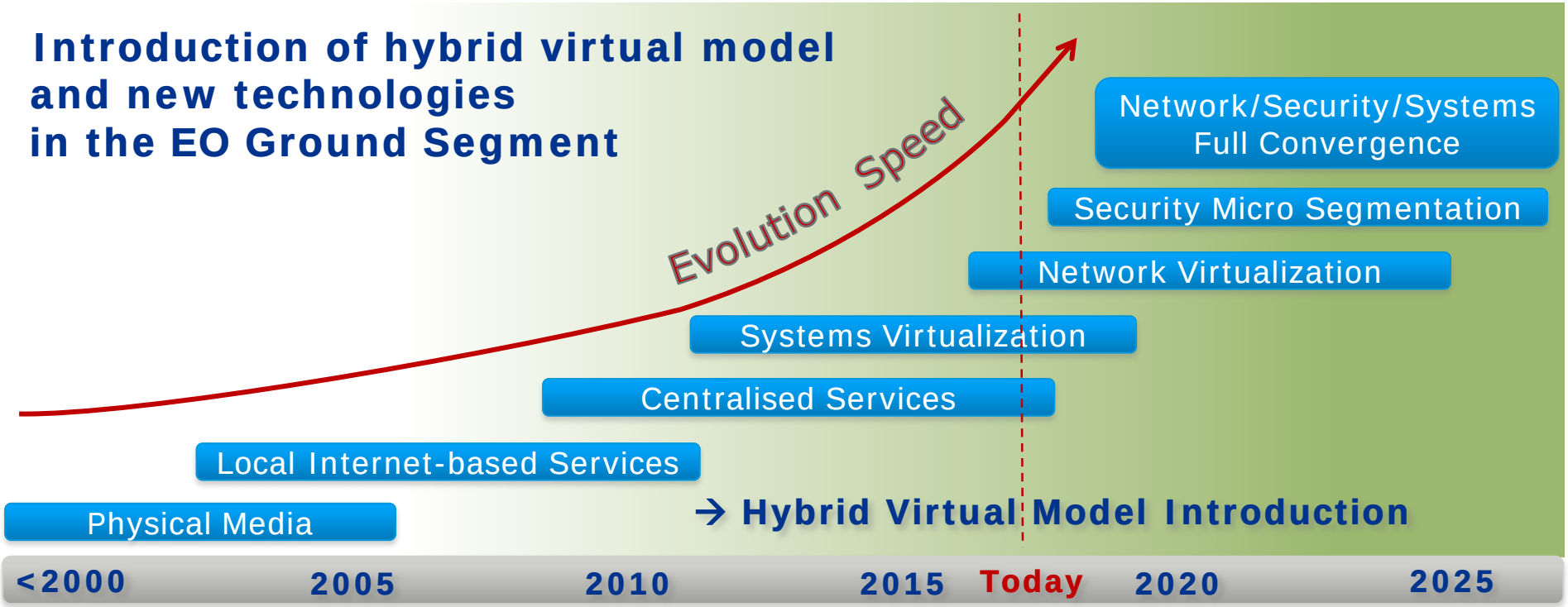
- Archiving core services
- Private computation platform
- Security & Management center



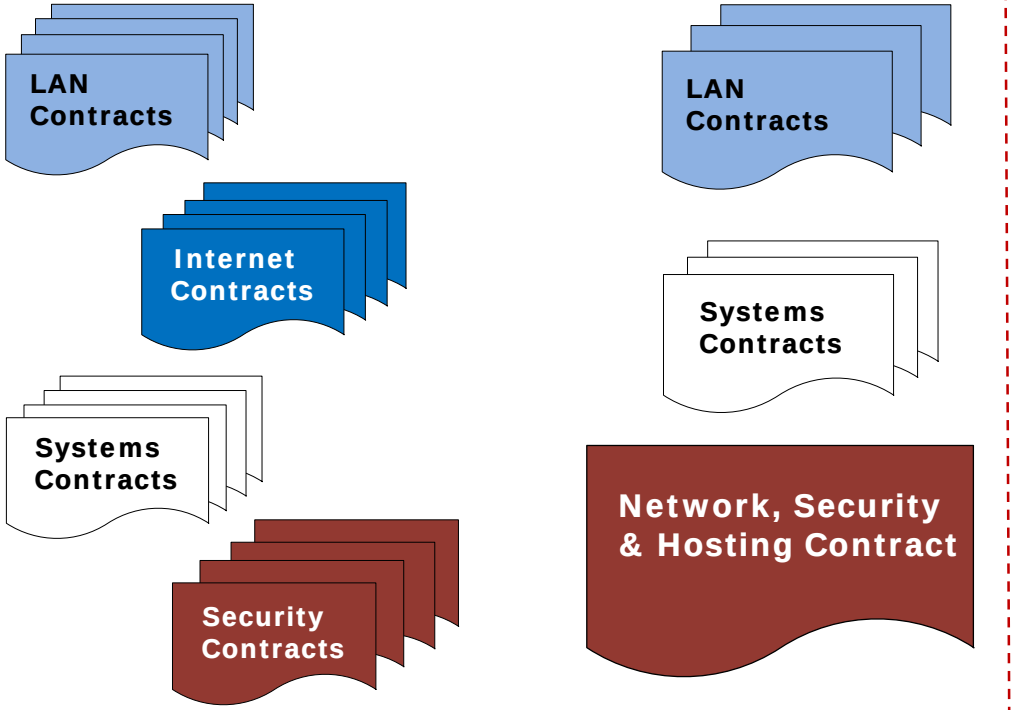
ESA EO PDGS Improvement Points

- Reduce PDGS functions dependencies on large number of service Contracts
- Harmonised platform and technologies (HW and OS)
- Evolve to Application Oriented approach
- Add capability of moving PDGS services from a location to another
- Improve and centralise End-to-End security and visibility
- Reduce complexity of development, operations and troubleshooting
- Reduce complexity of management, coordination and evolution
- Increase automation

Hybrid Model Introduction vs EO ICT & Security Evolution Over Time



Hybrid Model Evolution



PDGS Converged Infrastructure

Outsourced with ESA Governance

one single provider

For Network, Security and Systems/OS infrastructure

+

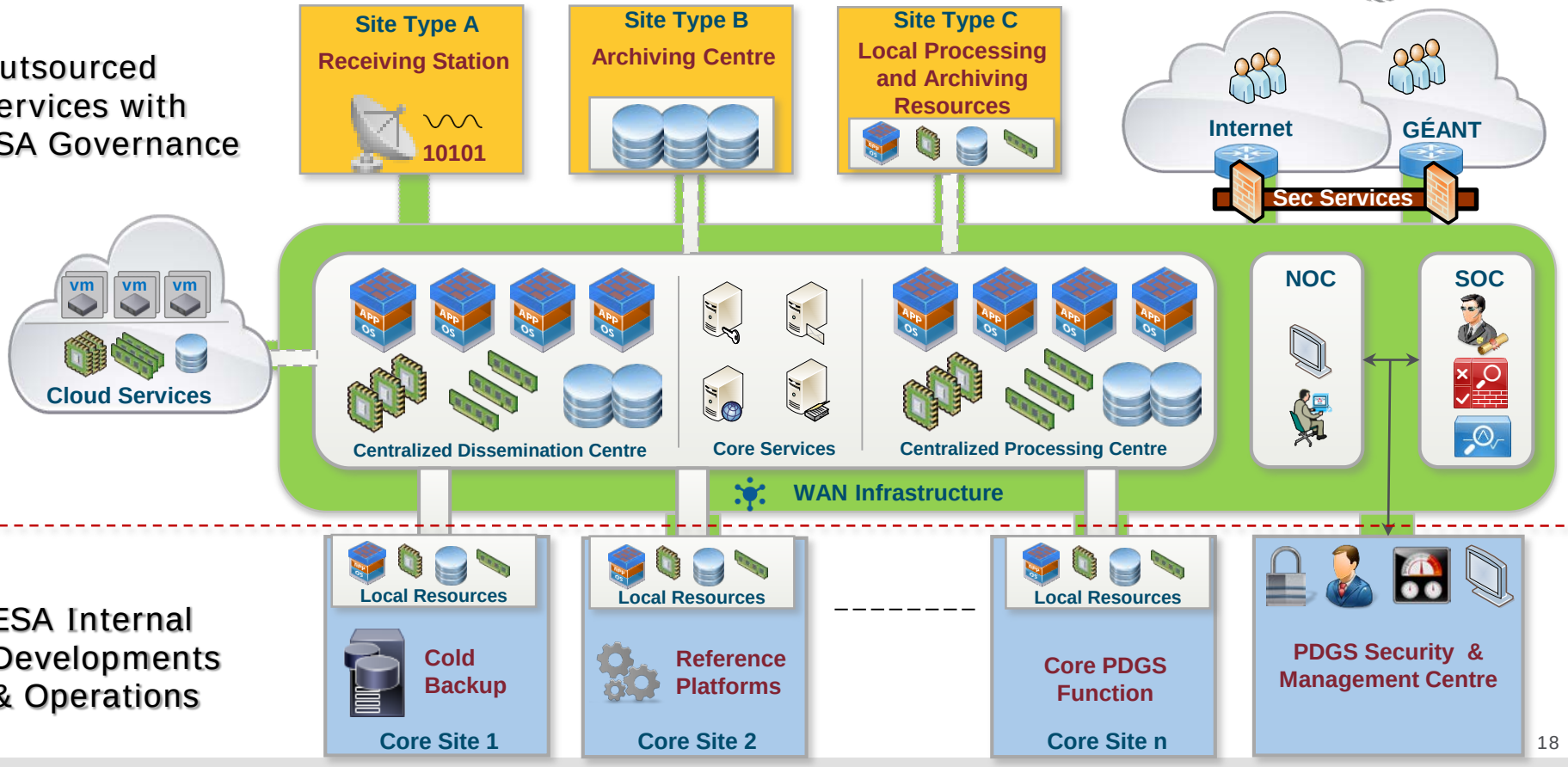
ESA Internal Development & Operations

- Core Services
- Security & Management Center

2005 2010 2015 Today 2020 2025

PDGS Converged Infrastructure Evolution

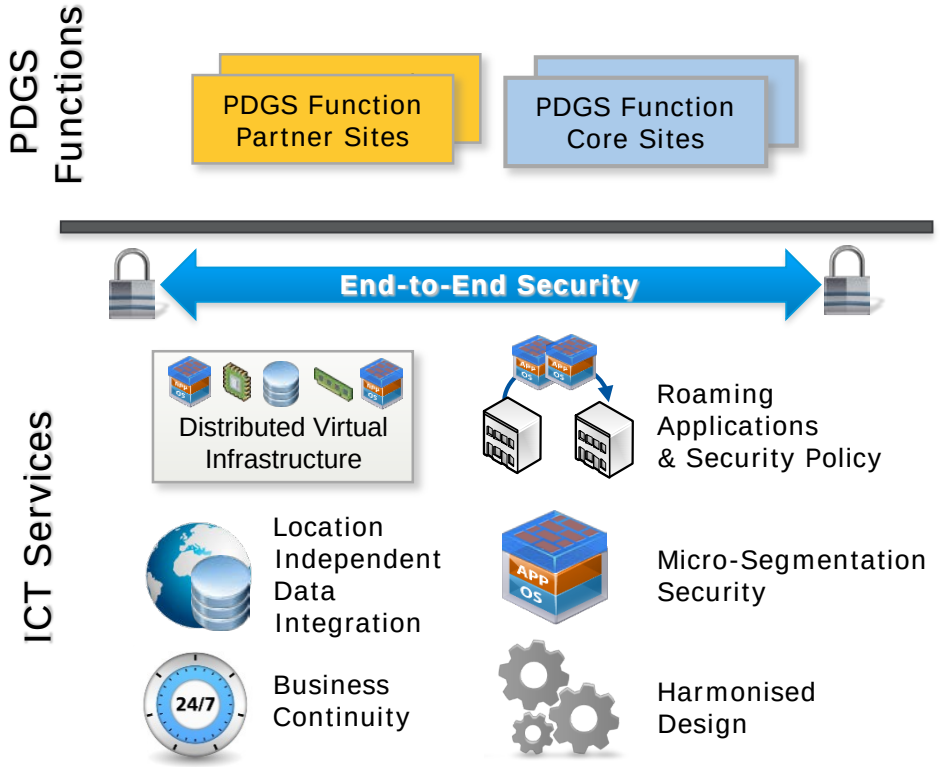
Outsourced Services with ESA Governance



ESA Internal Developments & Operations

PDGS Converged Infrastructure

Key Elements



Benefits:

- One single Integrated, common and horizontal infrastructure
- Standard design for the PDGS elements based on a common technical baseline
- High scalability for computing, storage and analytics
- Automatic move of services and applications from a facility to another
- Increased Security enforcement and automation on the whole infrastructure
- Easy PDGS function relocation/migration from a location/Provider to others
- Simple, intelligent, automated and secure

Conclusions

Hybrid Infrastructure model enabled ESA to get:

- Simplification
- More efficiency
- More Control
- PDGS flexibility and adaptation to the evolving PDGS Operations Scenarios
- Increased security

What's next:

- Continue with the digital transformation process
- Introduce network virtualization
- Move from HW-based security to application centric approach
- Automation
- Operations simplification and efficiency
- Improve Data Analytics capabilities for Big Data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