Connecting across disciplines and borders to the European Open Science Cloud

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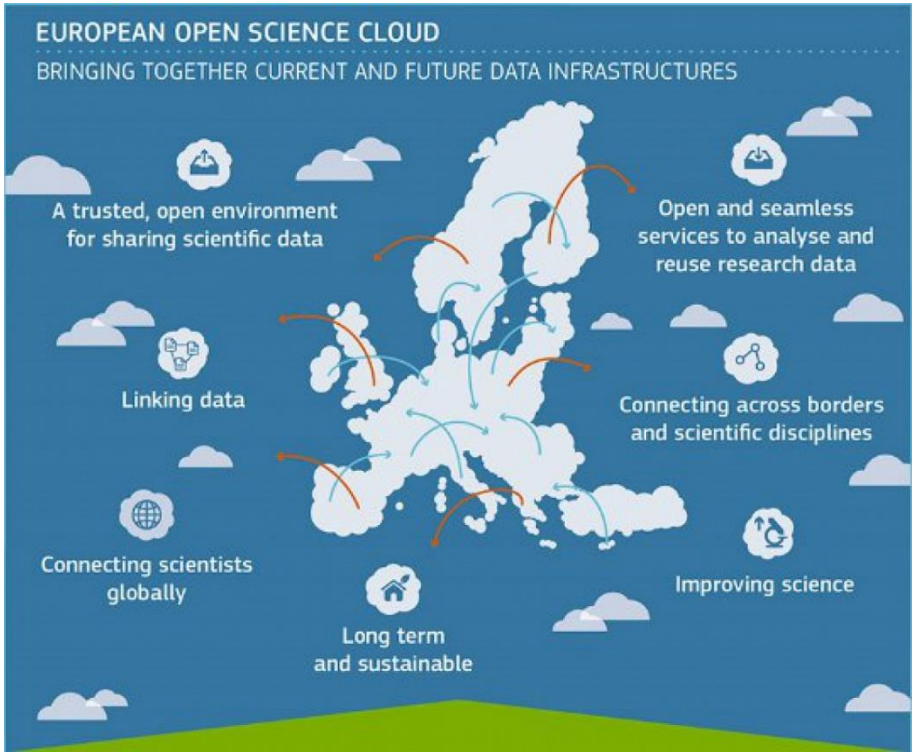
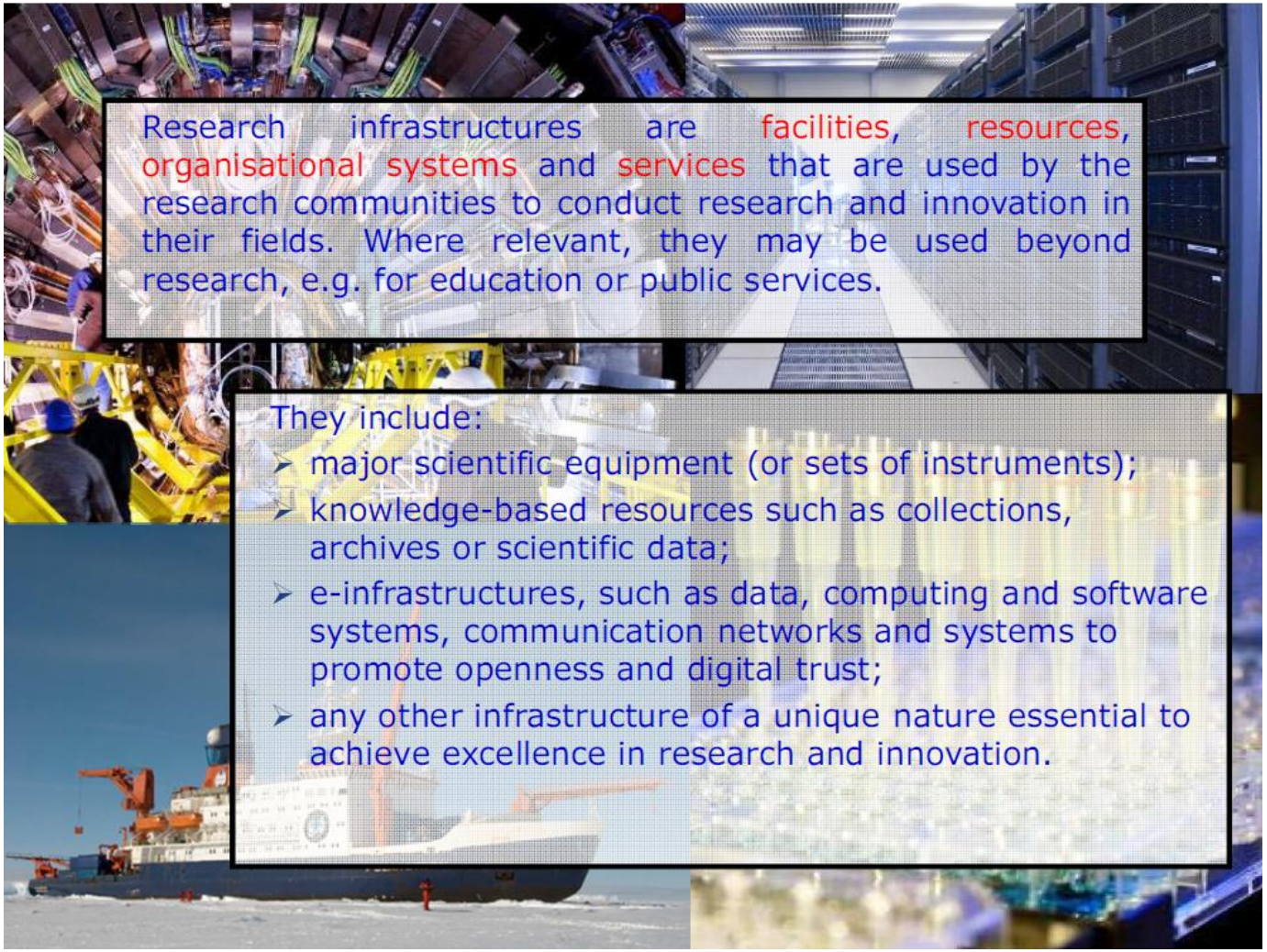
European Open Science Cloud

A Cloud for research data in Europe

- **Vision** -" EOSC will provide 1.7m EU researchers an environment with free, open services for data storage, management, analysis and re-use across disciplines"
- **Roadmap** for implementation (6 pillars: architecture, data, services, access&interface, rules, governance - March 2018)
- **Funding** (EU and MSs investment)
- **Member States support** (Council Conclusions May 2018)
- **Governance framework**: Executive Board, Governing Board and Stakeholders Forum -November 2018
- A framework of **Commons** to organize a consistent system of **RIs and e-Infrastructures**



Research infrastructures in the EOSC ecosystem



Source: DG RTD

Tapping into the full potential of Data

European Commission

Examples

Astronomy

- (Open) Astronomical Data - essential infrastructure in the ASTRONET European Roadmap of astronomical infrastructure)
- Observatory archives -Data is Reusable for most Virtual Observatories (European VO project supporting the coordination of VO activities in Europe e.g. Astronomy ESFRI RI Cluster ASTERICS)
- Very large surveys, Value-added databases e.g. CDS (RI in the French National RI Roadmap)
- Publications, Modelling data

The Astronomical Virtual Observatory: Building an international data sharing framework

Astronomy has been a pioneer of Open data sharing, and remains at the forefront. Jointly using data from different instruments or gathered at different times is at the core of the discipline's science process, another driver being to optimize the science return of investments in the observatories. The disciplinary interoperability framework is defined at the international level by the IVOA and widely used by data providers world-wide. It is almost invisible to astronomers but underlies some of the most used tools.

The discipline established the International Virtual Observatory Alliance (IVOA http://www.ivoa.net) in 2002 to develop its interoperability framework at the international level. It is fully operational and continuously updated to deal with evolving requirements. The IVOA is a global alliance of national Virtual Observatory (VO) initiatives, plus Europe and ESA. It progressively developed the standards necessary to Find, Access and Interoperate data, which have been taken up by archives of space and ground-based telescopes and major disciplinary data centres.

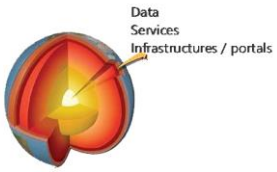
The VO is an interoperability layer to be implemented by data providers on top of their data holdings. It is a global, open and inclusive framework: anyone can "publish" a data resource in the VO, and anyone can develop and share a VO-enabled tool to access and process data found in the VO. The IVOA Registry of Resources counts more than 100 "authorities" providing at least one VO-enabled resource. Small teams who want to share their knowledge can either provide their data through a data centre or develop a data resource that they manage and declare it in the IVOA Registry of Resources.

The VO is used daily by the world-wide astronomical community through the tools which build on it to access data, although most users do not realize this.

The first step was the definition of a standard for observational data called Flexible Image Transport System (FITS) in 1979. This includes data and metadata, allowing data Reuse. FITS is maintained under the auspices of the International Astronomical Union. Early precursors of remotely accessible data services were also developed, the IUE satellite database (1978-1996) and the first added-value services of the Strasbourg astronomical data centre (CDS) in the early 70's. A common identifier for publications was agreed upon in 1989. Data centres, academic journals and observatory archives began to provide services on the web from 1993, and to link them together into a navigable network of online resources using the existing standards.

Around 2000, it was decided to go further and to build an interoperability framework allowing seamless access to data, the astronomical Virtual Observatory.

Data providers increasingly use VO building blocks in their systems, in addition to building the interoperability interface. The VO framework is customized for their own needs by planetary sciences and astroparticle physics, and by the Virtual Atomic and Molecular Data Centre. The IVOA registry of resources is adapted to Materials Sciences by a RDA Working Group.



Source: FAIR Data Expert Group Final report

Tapping into the full potential of Data

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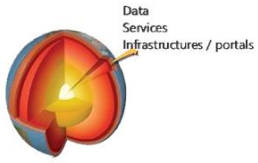
Earth observation

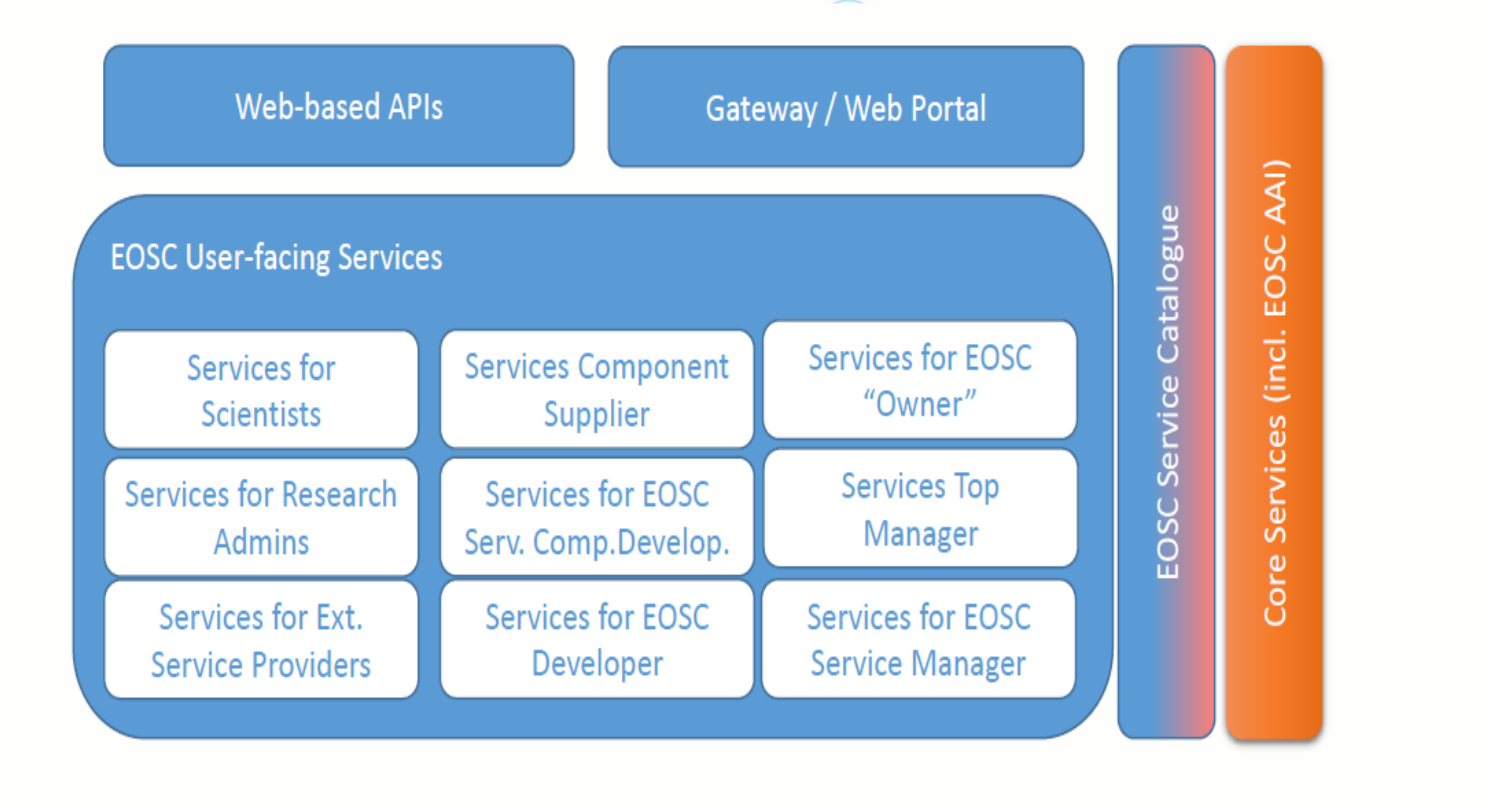
- COPERNICUS Scientific data (E.g. ESFRI Project ACTRIS, and the ESFRI Landmarks IAGOS and ICOS ERIC data are used by COPERNICUS Atmosphere Monitoring service (CAMS); EMODnet and linked Copernicus Marine Service (CMEMS) for operational oceanographic services; EuroGOOS, SeaDataNet/ SeaDataCloud); ESFRI Landmarks ICOS ERIC, IAGOS, EURO-ARGO ERIC and the ESFRI Project ACTRIS in COPERNICUS
- Global Earth Observation System of Systems (GEOSS) data –ESFRI Landmarks EPOS and Lifewatch ERIC in GEOSS
- WMO – World meteorological Organisation - ESFRI Projects ACTRIS and the ESFRI Landmark IAGOS

Blue growth

- EURO ARGO data (Interoperability with EGI and EUDAT (ENVRI+), EMSO-ERIC data-seafloor and water-column
- Satellite, modelling and forecasting ; Copernicus marine data (free and open and accessible for the blue cloud)
- COCONET biological, geological, oceanographic and socio-eco data
- Sensor data -physical, geophysical, geological, biological and chemical parameters, biological species (SEADATACLOUD)
- Open data from Earth Observing satellites and the in-situ systems (ATLANTOS)



Portfolio of EOSC Services



Source: EOSC Pilot

Services from existing e-/research infrastructures

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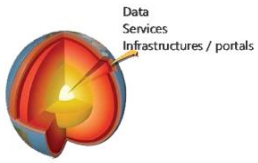
Examples:

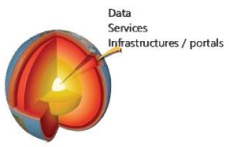
- **Copernicus services -** Several RIs in the Environmental domain are feeding in Copernicus (operational monitoring of the **atmosphere, oceans and land services**); Copernicus also provides **information services** (six areas: land monitoring, marine monitoring, atmosphere monitoring, emergency management, security and climate change)
- Euro**GEOSS services** tailored to e.g. water management, sustainable development, infrastructure and transport development, public health, disaster, biodiversity etc
- Extension of existing **PaaS (Platform as a Service) solutions** with integration of services from public and private e-infrastructures, including those provided by EGI, EUDAT, PRACE and Helix Nebula (INDIGO dataCloud**)**
- **Virtual Research Environment (VREs)** providing seamless access to data, software, services and computing resources E.g. VREs for sustainable growth in the marine and maritime sectors (BLUEBRIDGE), data processing, trend analysis, and satellite HPC for atmospheric global and regional models, data assimilation and processing of large volume of data (ACTRIS); scientific experiments in cooperative environments (LIfeWatch ERIC e-Infrastructure for Biodiversity and Ecosystem Research)



Infrastructures/portals

Examples:

- EURO ARGO RI major in situ infrastructure for the Copernicus Marine Environment Monitoring Service (CMEMS) and the European Marine Observation and Data Network (EMODnet)
- ESFRI Landmark EMSO ERIC (European Multidisciplinary Seafloor and water-column Observatory) portal
- SeaDataCloud (SEADATANET infrastructure)
- COCONET, ODIP, AtlantOS, EverEST platforms
- EuroGOOS - European component of the Global Ocean Observing System of the Intergovernmental Oceanographic Commission of UNESCO (IOC GOOS)
- ICSU World Data Centers (e.g. WDC for Marine Environmental Sciences Biogeochemistry, Circulation, and Life of Present and Past Oceans (Bremen University and the Alfred Wegener Institute for Polar and Marine Research (AWI)
- Data infrastructures e.g. ESFRI Project DiSSCo (Distributed System of Scientific Collections), the ESFRI Landmark ELIXIR (H&F), ESFRI Project MIRRI (Microbial Resource Research Infrastructure, H&F), e-Infrastructures for analysis and modelling (ESFRI Landmark LifeWatch ERIC, and the IA IS-ENES).
- BBMRI ERIC (Biobanking and BioMolecular Resources Research) Infrastructure
- (Euro)GEOSS infrastructure
- INDIGO open source data/computing platform



European Commission

Thank you for your attention

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E-mail: EOSC-RTD@ec.europa.eu, corina.pascu@ec.europa.eu

What can be connected/integrated/federated/connected to the EOSC?

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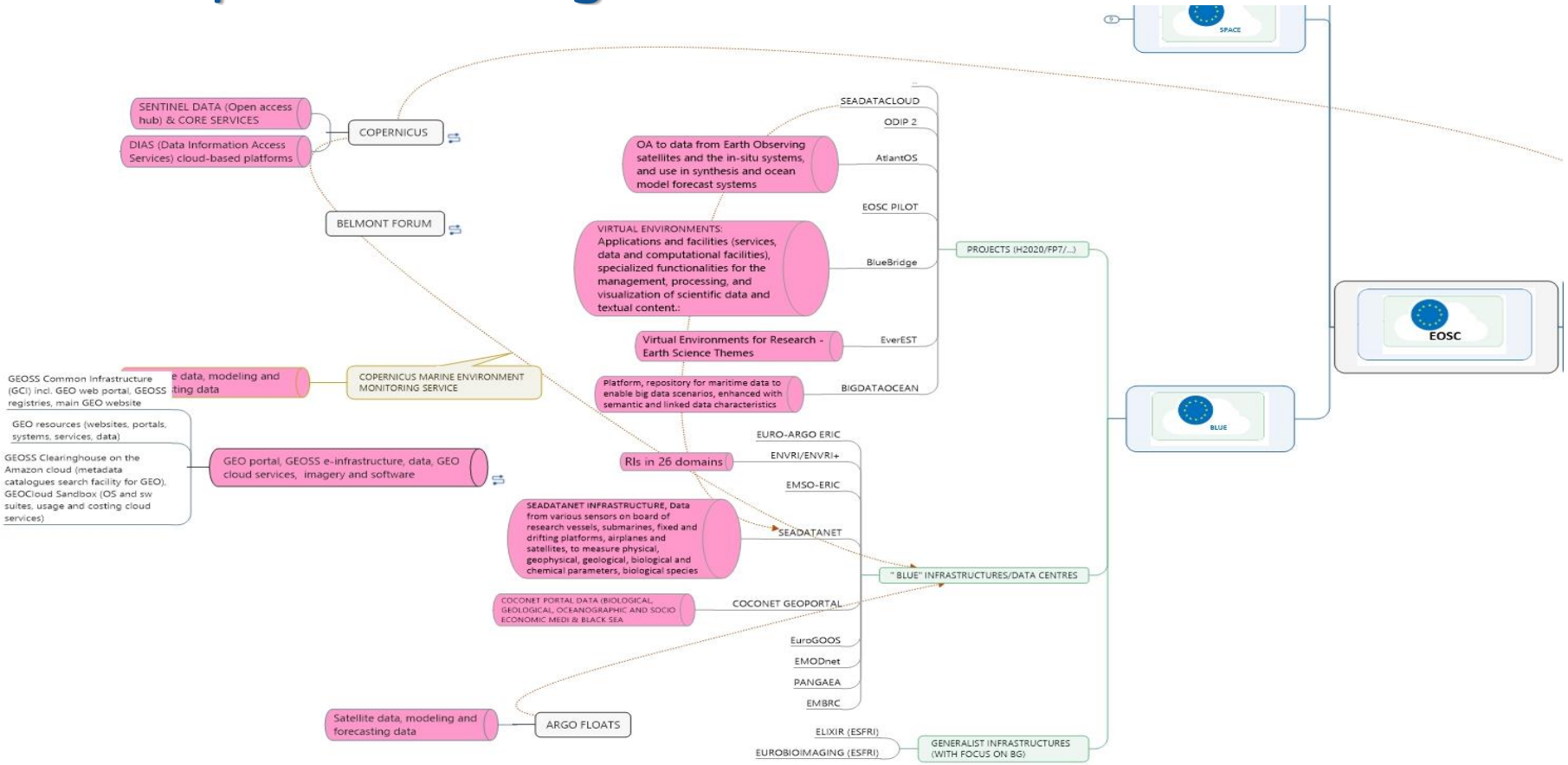
Example 1- "Blue" growth

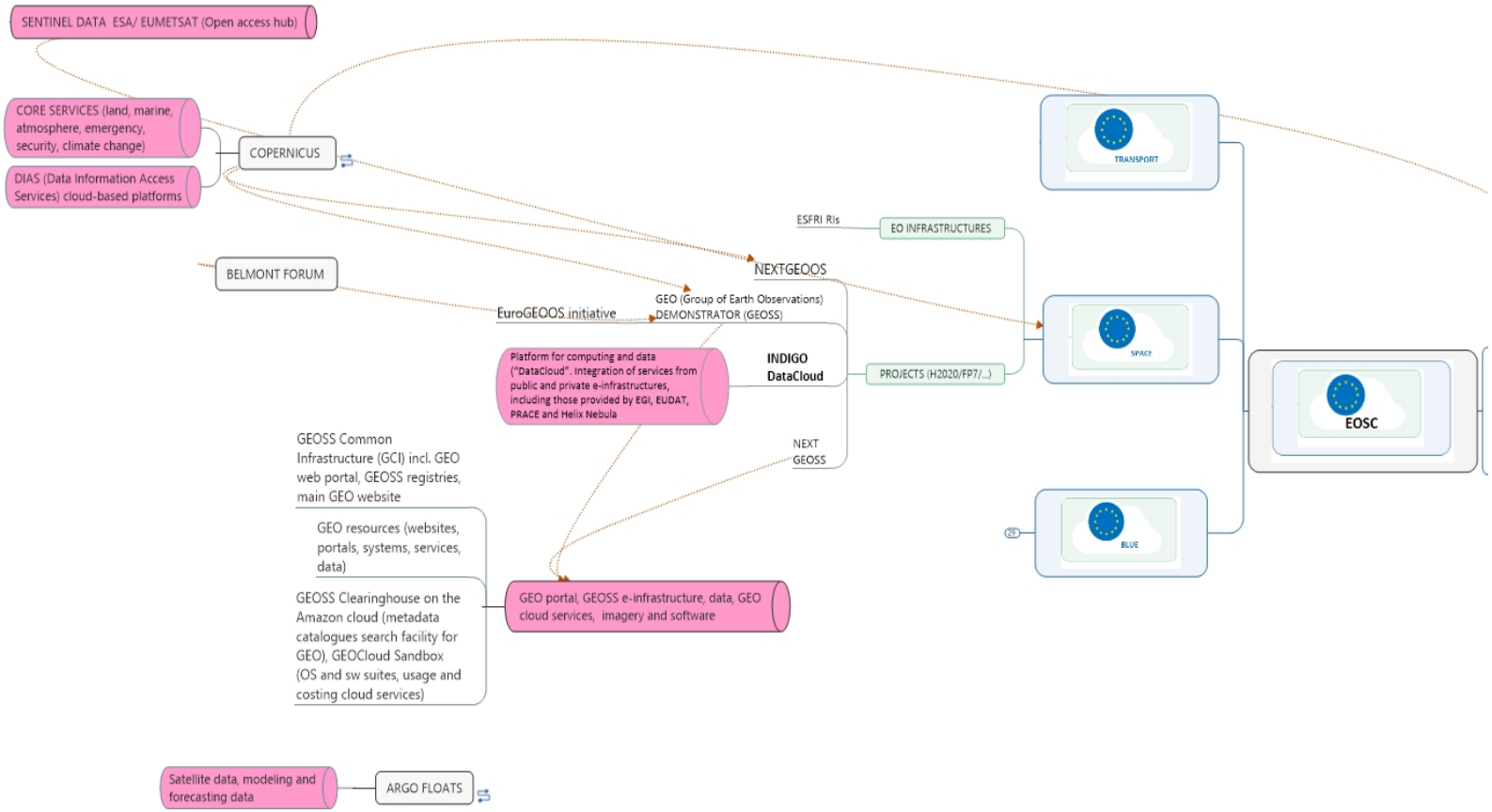


Source: RTD

What can be connected/integrated/federated/connected to the EOSC?

European Commission

Example 2- Earth observation



Source: RTD