Wouldn't it be nice if …

- ✓ … all my data, tools, and resources were available in one place?
- ✓ … I didn't spend 50% of my project resources trying to access (EO) data?
- ✓ … ICT (storage, compute, and network) was completely free?
- ✓ … my funding scheme fit pay-per-use (instead of capital investment)?
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- ✓ … I could make my stuff available to others while retaining IPR?
- ✓ … access to data or resources didn't depend on my nationality, affiliation, or participation in a particular project?
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- ✓ … I could collaborate easily with colleagues, also in other disciplines?
- ✓ … I could rapidly test out a new idea? With my peers? And publish the result?
- ✓ … I could get fast, crowd-sourced validation of my results?
- ✓ … I could use my own data and tools with everything else?

ESA Action on Thematic Exploitation Platforms

A presentation to EO Open Science 2.0
ESRIN, 14 October 2015

tep
thematic exploitation platform

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Background

The **data available on the state of the planet is growing in precision, volume, velocity, variety**, and **value**, determining a sharp change to the complexity of scenarios for data exploitation, as well as to the support required by the communities exploiting them

As part of ESA Ground Segment Evolution Strategy, the Earth Observation Programme Directorate is coordinating the development of complementary concepts to meet the corresponding **challenges** and **opportunities**

Including **EO exploitation platforms** – collaborative environments aimed at delivering the resources and capabilities required for users' exploitation work - the **'place' where exploitation work is done**

In this context **ESA is currently implementing six Thematic Exploitation Platforms on European footing**, in support of six thematic communities:

- **Coastal, Forestry, Geohazards, Hydrology, Polar,** and **Urban**
- And the seventh, **Food Security**, possibly to commence shortly

⇒ In a wider context, a start of longer term activity

The EO Data Challenge

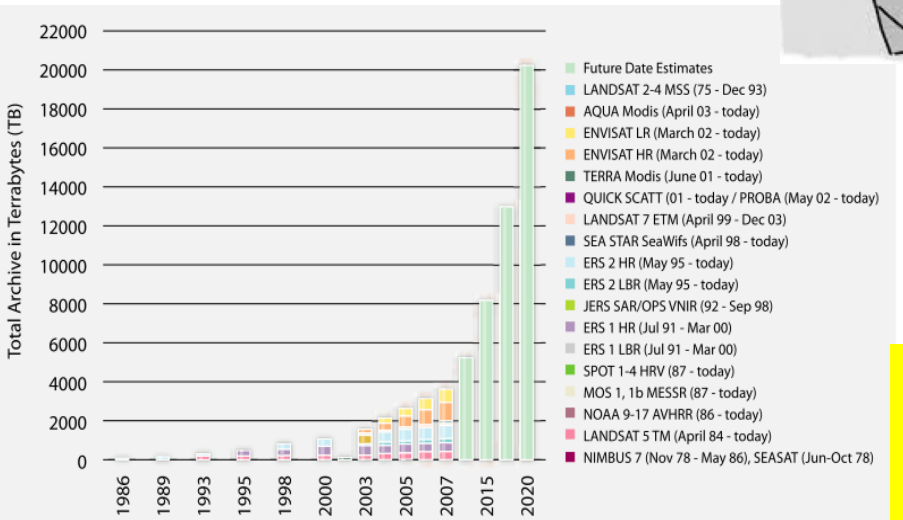
To handle (and to afford) the increasing **volume**, **velocity**, and **variety** of data required for data-intensive exploration while considering also its **veracity** and **value**

Climate data example

- 50 PB estimated 'available' by 2016; 350 PB by 2030
- "Climate data are dramatically increasing in **volume** and **complexity**, just as the users of these data in the scientific community and the public are rapidly increasing in number"

Sentinel data example

- TB-range per day; PB-range per year



PERSPECTIVE

Climate Data Challenges in the 21st Century

Jonathan T. Overpeck,[1]* Gerald A. Meehl,[2] Sandrine Bony,[3] David R. Easterling[4]

Climate data are dramatically increasing in volume and complexity, just as the users of these data in the scientific community and the public are rapidly increasing in number. A new paradigm of more open, user-friendly data access is needed to ensure that society can reduce vulnerability to climate variability and change, while at the same time exploiting opportunities that will occur.

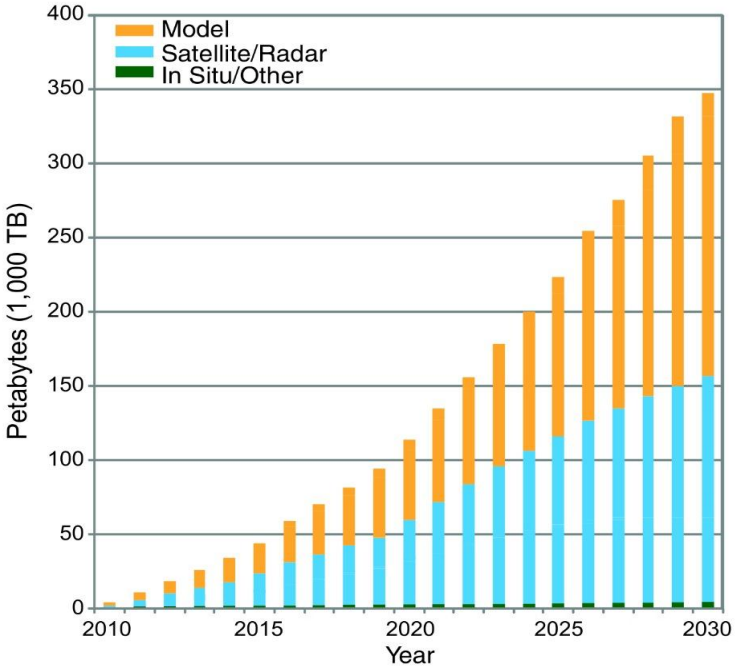


Fig. 2. The volume of worldwide climate data is expanding rapidly, creating challenges for both physical archiving and sharing, as well as for ease of access and finding what's needed, particularly if you are not a climate scientist. The figure shows the projected increase in global climate data holdings for climate models, remotely sensed data, and in situ instrumental/proxy data.

- More users, much larger (and more heterogeneous) data sets, generated at higher speeds
- As data volumes increase; so do resource requirements

⇒ **Technical challenges; affordability …**

The EO Data Opportunity

Fear has funded many 'Big Data' projects – terms like "deluge", "tsunami", "explosion" abound.

And **challenges** must be addressed:

⇒ ***How (on earth!) can we continue to do what we already do?***

Old context, wrong question !

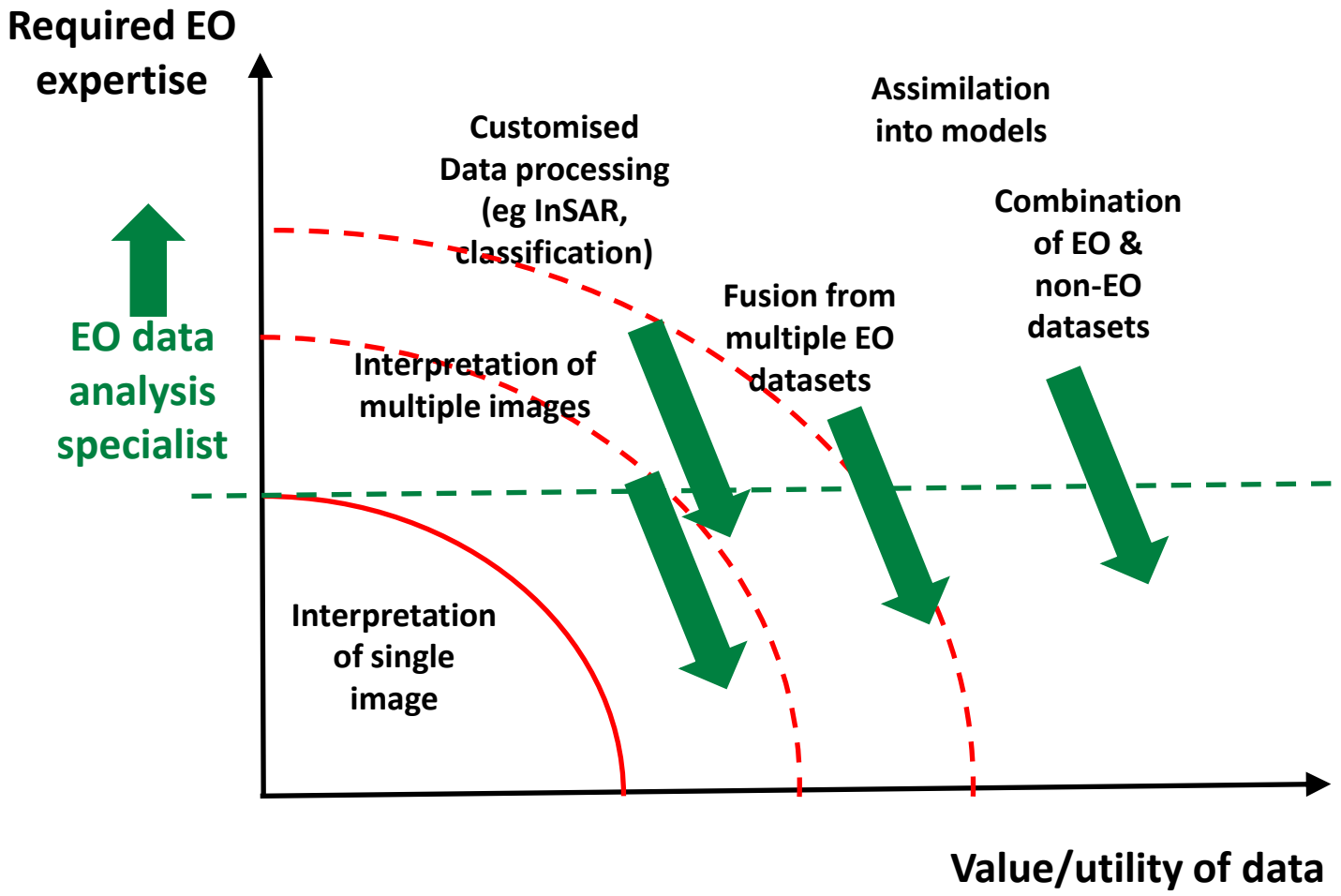
The **opportunity** is apparent:

- ✓ ESA Earth Explorers, Copernicus, Meteorological and National missions provide an **unprecedented flow of high quality and variety of global data on the state of our planet**
- ✓ Combined with long-term EO archives, in-situ networks and models there is a **unique opportunity for insight into how our oceans, atmosphere, land and ice operate and interact as part of an interconnected Earth System**
- ✓ Add paradigmatic **evolution in technology**; increased **technology literacy** and evolving expectations among users; social and cloud computing; Science 2.0, …
- ✓ And new funding approaches such as **pay-per use, cost-sharing,** etc…

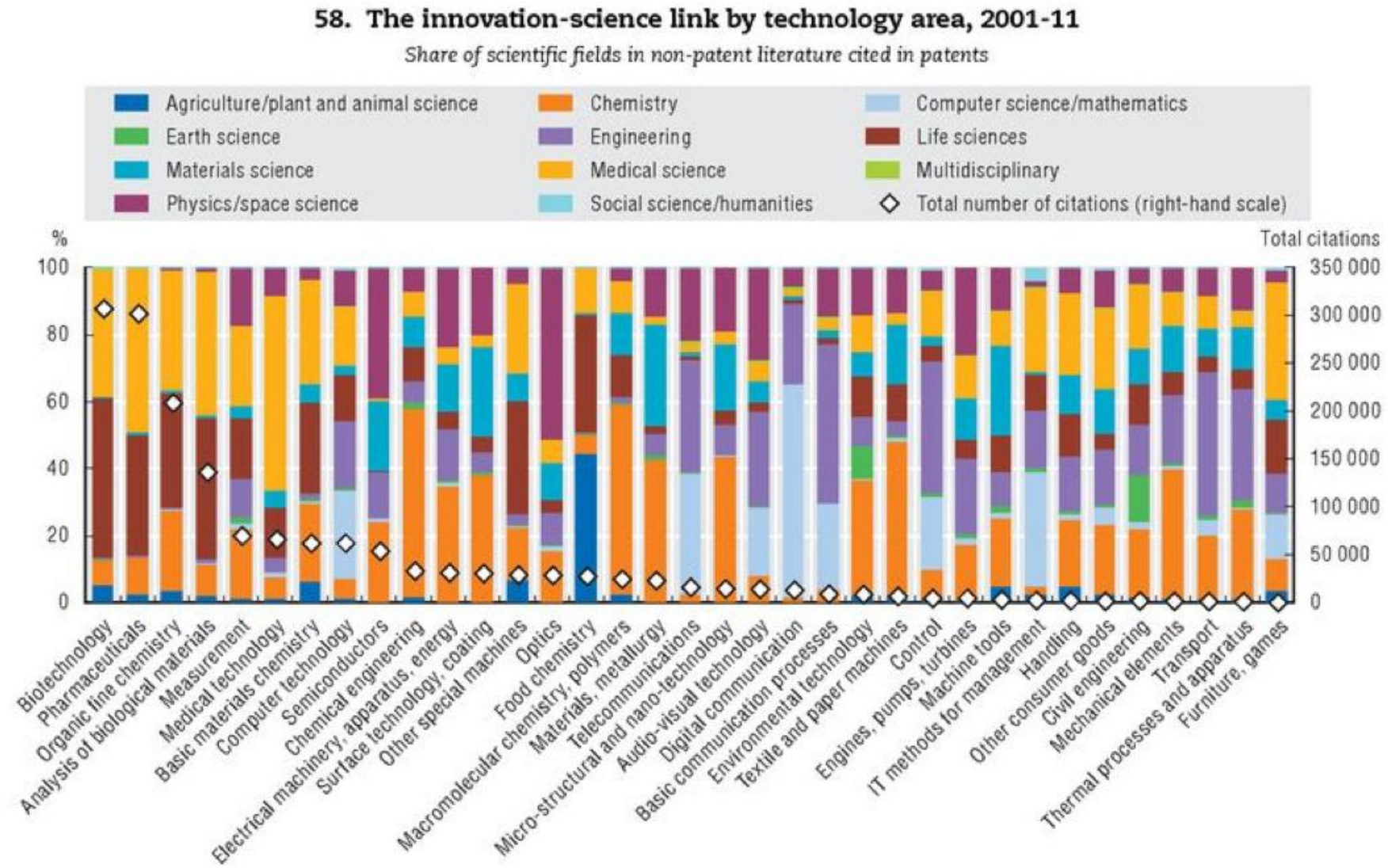
So **seize the opportunity**:

⇒ ***What can we do now that we weren't able to do before?***

The Use Opportunity: Encouraging wider use of EO – democratization of information access

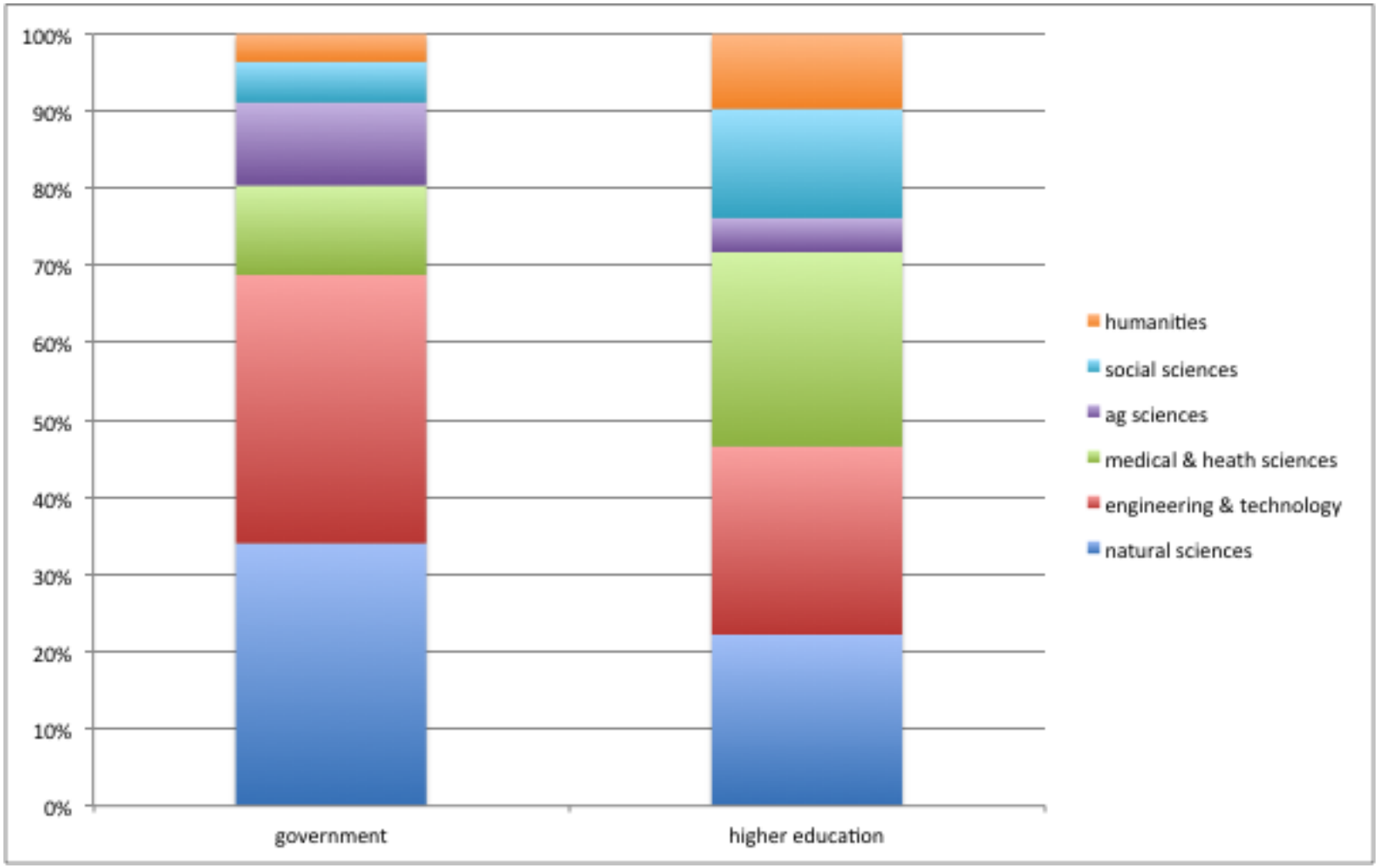


The Innovation Opportunity – innovation from Earth Science v other disciplines



Source OECD

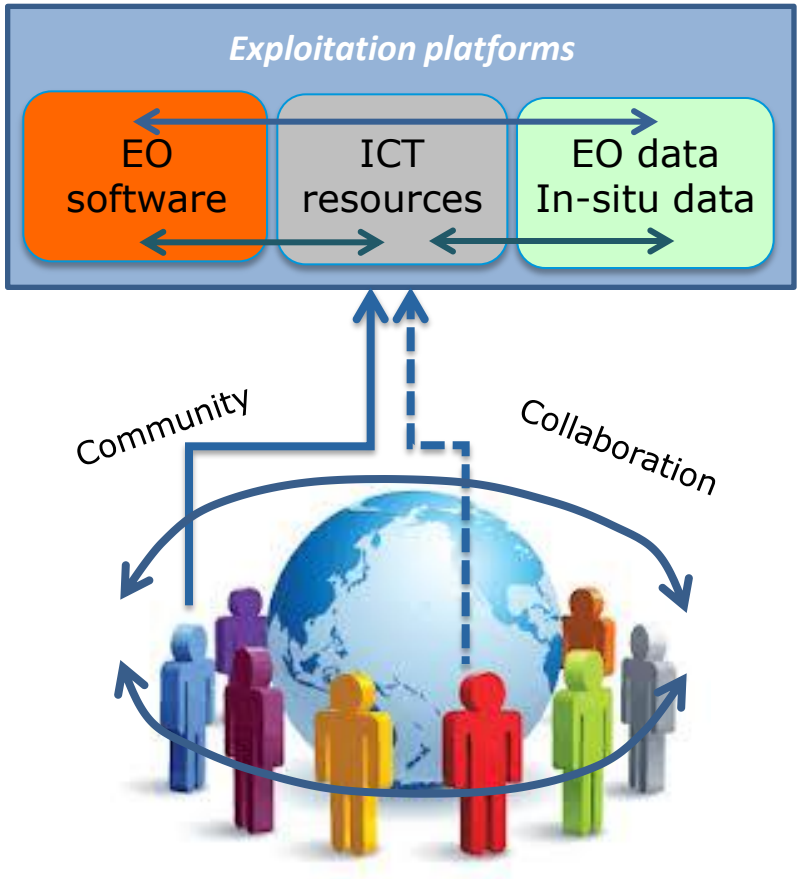
The Cross-Domain opportunity



Source OECD

Exploitation Platforms

"Move User activities to the Data"



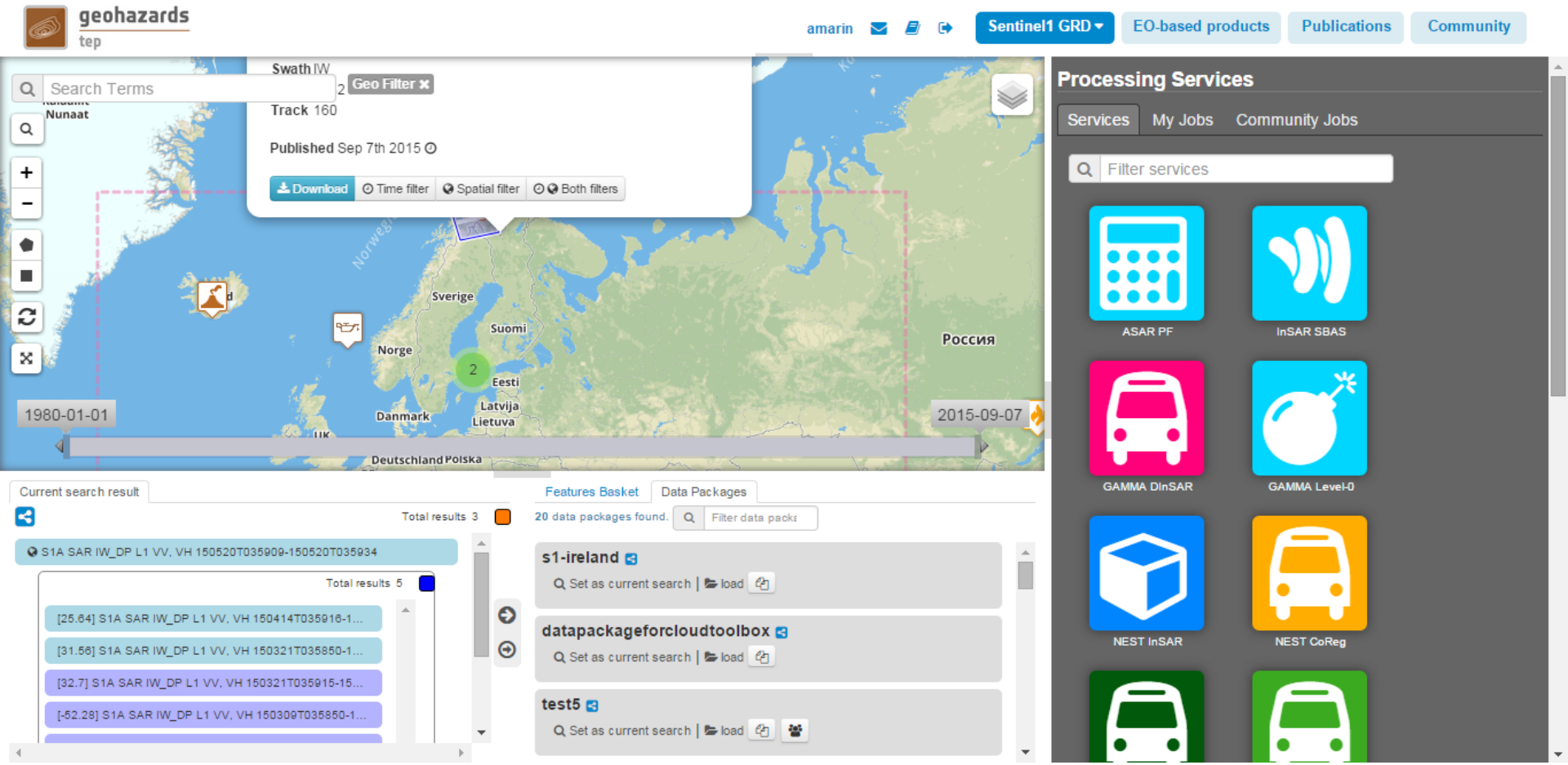
A complementary operations concept: users access a work environment containing the data and resources required, as opposed to downloading and replicating the data 'at home'.

→ An R&D scenario for data intensive exploration gradually complementing the traditional operations concept for the ground segment

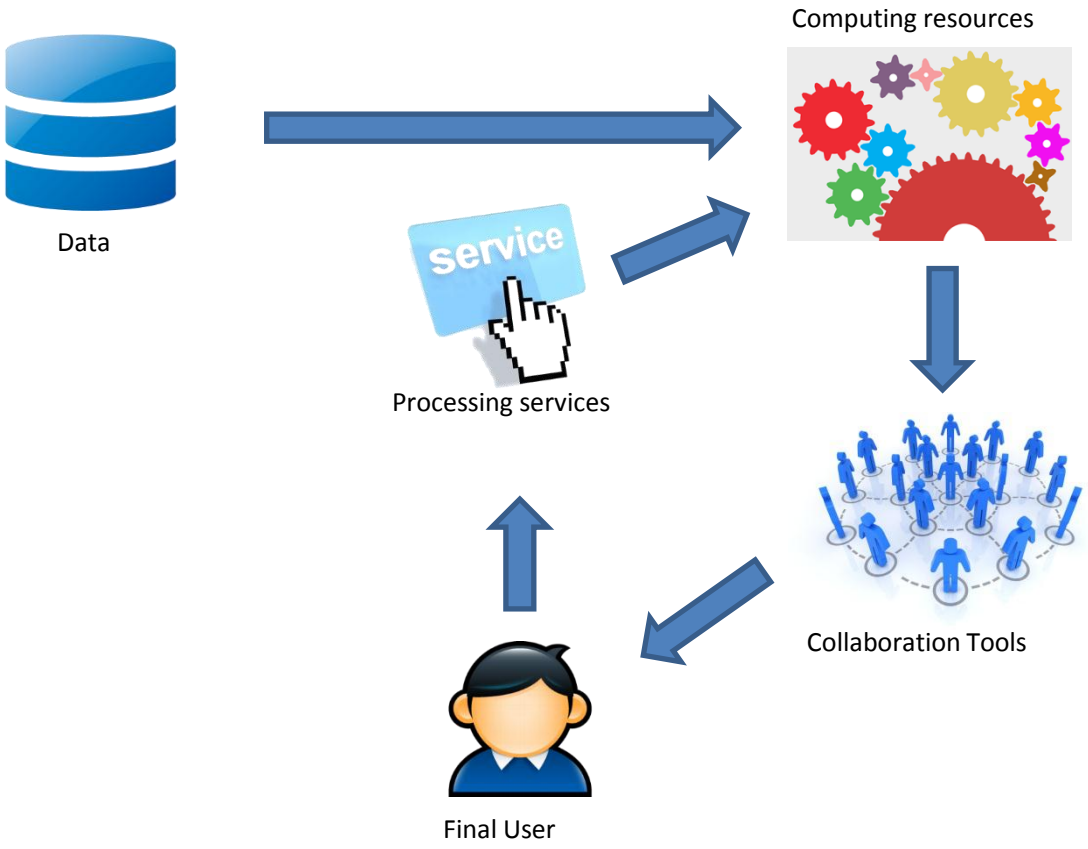
Exploitation platform (or community platform)
=
Virtual open and collaborative environment

bringing together:
- data centre (EO and non-EO data)
- computing resources and hosted processing
- collaborative tools (processing tools, data mining tools, user tools, …)
- development tools and test bench functions
- application shops and market place functionalities
- communication tools (social network) and documentation
- accounting tools to manage resource utilisation

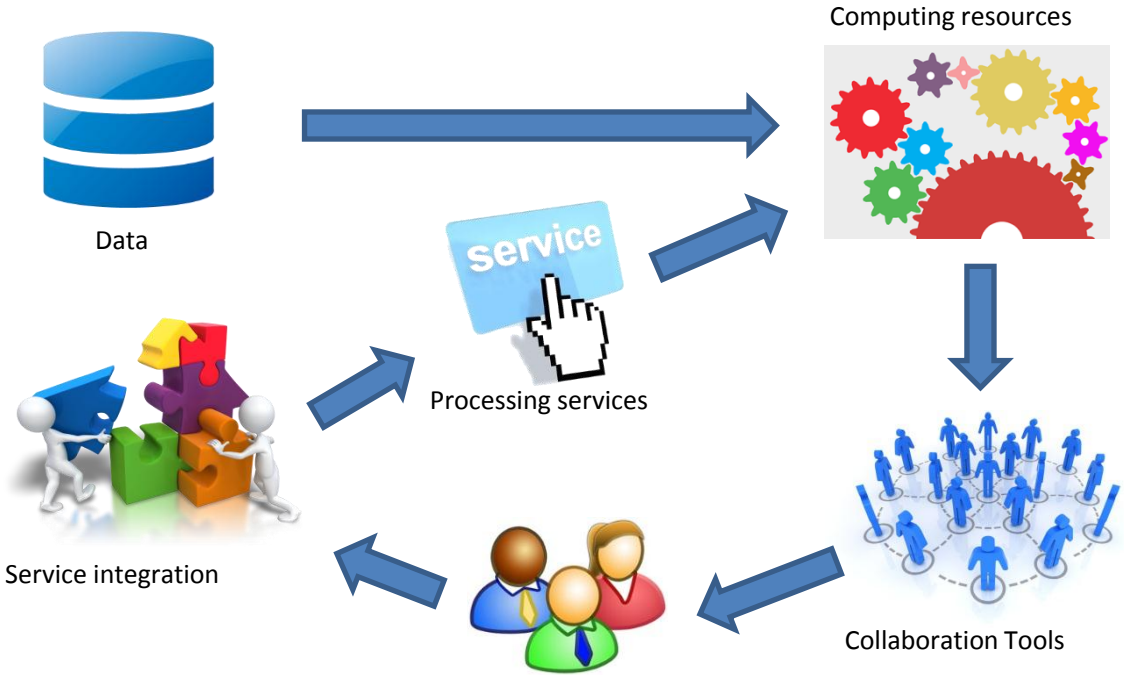
(Thematic) Exploitation Platforms



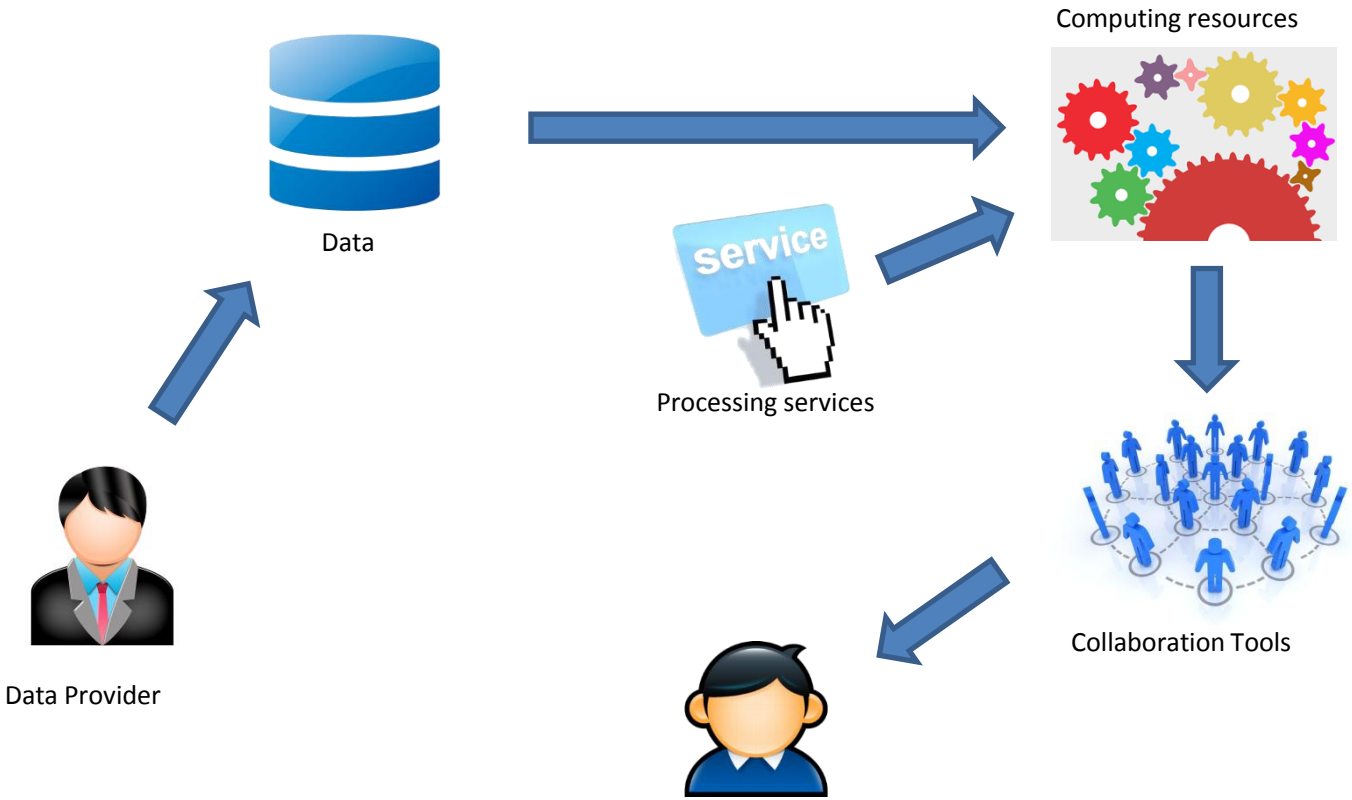
Exploitation Platforms
Canonical Scenario 1 ‘EO Data Exploitation’



Exploitation Platforms
Canonical Scenario 2 'New EO Service Development'



Exploitation Platforms
Canonical Scenario 3 ‘New EO Product Development’



Further Characteristics of (T)EPs

- **Open data, open access, open tools, open source**
- **Standards-based** – to ensure interoperability
- **Infrastructure independent** – to ensure cost effective infrastructure sourcing, avoid vendor lock-in, and allow reuse of public and commercial available ICT
- **Pay-per-use** – to avoid capital investment, contain costs, and allow for cost-sharing
- Cater also to **commercial providers** – to allow (affordable) access to commercial software, data, and infrastructure, when required
- **Secure IPR** – to ensure that users and providers retain intellectual property rights
- **Community and impact driven** – implement with deep participation of the scientific and application communities, to ensure user buy-in, relevance
- **Enable sustainability** – investigate funding and revenue models and sources to maximize the probability of economic sustainability of the platforms in operations phase

=> **Open and fair governance**:
"The TEP shall be open to registered users; i.e. not restricted by affiliation, nationality, or other characteristics, beyond what is imposed by policy agreed with data and IPR providers"

Types of Exploitation Platforms

Thematic* exploitation platform (TEP) → *Focusing on a geophysical theme (e.g. forestry)

Current ESA Thematic Exploitation Platforms (TEPs):

- **Geohazards**
- **Hydrology**
- **Urban**
- **Coastal environment**
- **Polar**
- **Forestry**

tep thematic exploitation platform

Under development (2015-2017) with ESA EOEP funds
Not intended to be operated by ESA

***Regional* (multi-thematic) exploitation platform**:

→ ***Focusing on a regional theme*** (e.g. West Africa)

Could be developed with ESA funds (no plans yet)
Not intended to be operated by ESA

Technological exploitation platform :

→ ***To assess new technologies to be rolled out to the exploitation platforms***

Could be developed and operated with ESA funds,
Could be shared with national space agencies

***Mission/Sensor* exploitation platform (MEP)**:

→ ***Tailored* to a particular mission/sensor community (e.g. an Earth Explorer user community)**

e.g. → **BIOMASS mission community (exploitation) platform**
Proba-V mission exploitation platform

To be developed with ESA EOEP funds,
To be operated with ESA EOEP funds (as part of mission operations)

Many similar activities also outside ESA

ESA Thematic Exploitation Platforms

tep
thematic exploitation platform

Pre-ops '16-17
Post-'17 under discussion

urban tep

DLR

Brockmann Consult

IT4I

gisat

terradue 2.0

polar tep

Polar View

British Antarctic Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

s[&]t

AWST
science software technology

CEMS

DMI

DTU | DTU Space
National Space Institute

c-core

FMI

Canadian Ice Service / Service canadien des glaces

International Ice Patrol

Hickling Arthurs Low
Innovation Policy Economics

forestry tep

VTT

VTT Finland
User Requirements

Prime Contractor

CGI United Kingdom
System Integration

Arbonaut Finland
Forestry Services

RAL United Kingdom
Processing System

Spacebel Belgium
Service Sustainability

CGI arbonaut Science & Technology Facilities Council Rutherford Appleton Laboratory SPACEBEL

ESA Thematic Exploitation Platforms

coastal tep

ThalesAlenia Space

Catalysts software is our passion

planetek italia

TERRASIGNA

ACRI ST

cnes

DLR

CONSIGLIO NAZIONALE DELLE RICERCHE

ucc Coláiste na hOllscoile Corcaigh, Éire University College Cork, Ireland

Dublin City University Marine Research Station

hydrology tep

isardSAT

EOMAP

ALTAMIRA INFORMATION

terradue 2.0

TU Delft Delft University of Technology

deimos ENGENHARIA

SMHI

geohazards tep

terradue 2.0

INGV

ALTAMIRA INFORMATION

UNIVERSITÉ DE STRASBOURG

ENS

DLR

food security tep

in preparation

Some Targets

Meet the challenges; seize the opportunities

Provide **fast and affordable** access to large volumes/variety of EO and in-situ data and resources adequate for exploitation, to wider communities of users, worldwide:

- By **embracing the new data access paradigm** – from transferring Terabytes of raw data to moving Megabytes of results / products
- By **capitalizing on economy of scale** and new funding models (cost-sharing for massive resources, pay-per-use)
- By providing businesses (**including commercial products, software & data providers**, & ICT providers) with an environment where tailored data policies, software licenses and pricing models can be implemented in a secure and reliable manner
- By providing **new incentives (virtuous cycle) to providers** to give access to their resources at low cost (but high volume of transactions)
- By enabling **new types of data-intensive exploitation** and publishing across and within communities
- By **fostering collaboration** - remote sensing and instrument experts, thematic experts, and end users, cross-field
- By **instigating and enabling innovation**, in all aspects

Vision

In the short term, the TEP projects:

- Build new capabilities in European industry: Development and operations of, and service delivery on exploitation platforms
- Evolve global user communities: Use of advanced ICT and collaborative work environments in exploitation scenarios
- Evolve ground segment technology: R&D to meet the more advanced requirements of new EO data exploitation scenarios

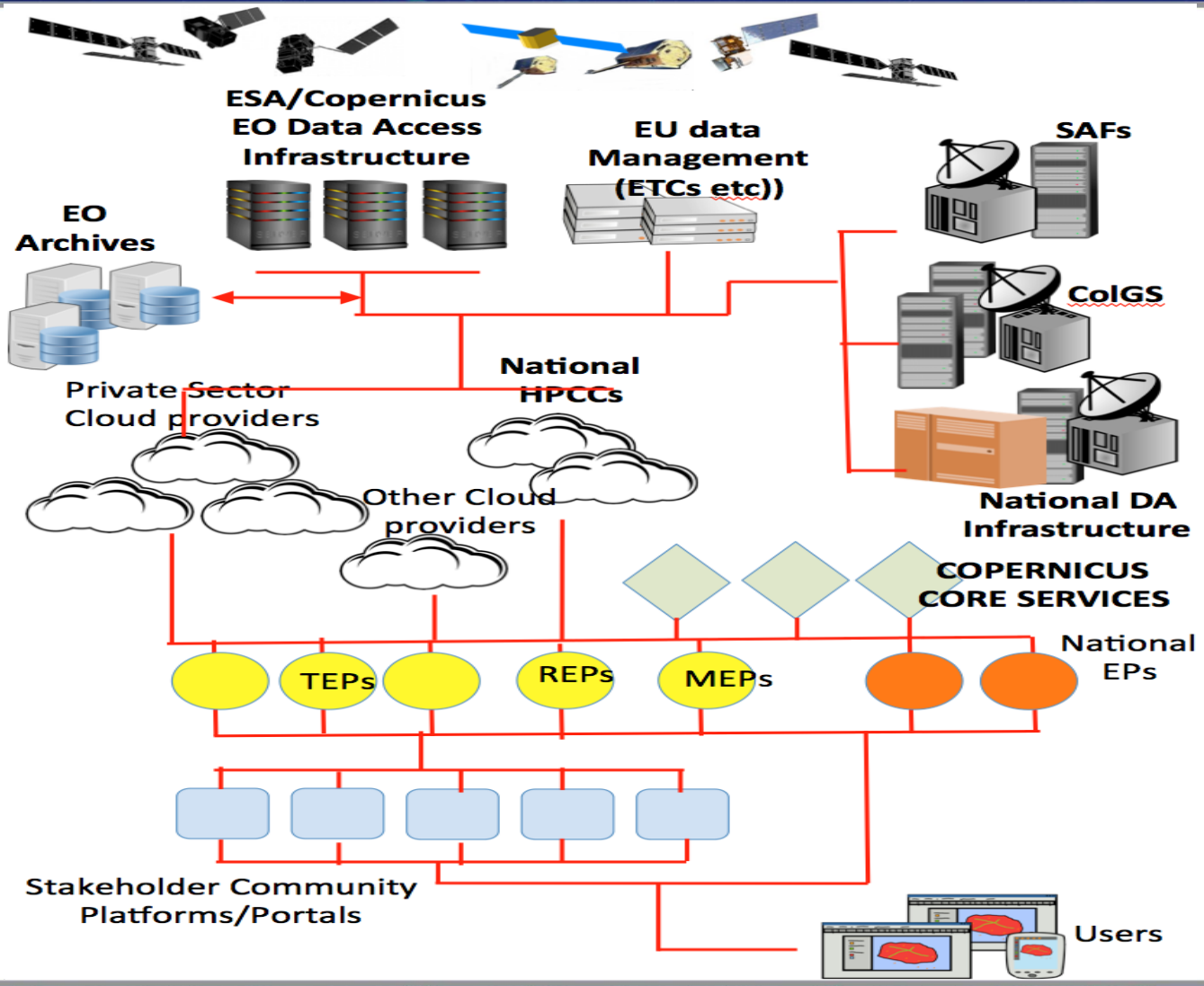
TEPs initiative is a **start towards a long term action**

- Sustainable long-term operations and continuous evolution is the target for all TEPs
- An embryonic **European ecosystem of ground segment and exploitation support capabilities**

A small part of a much larger long term vision aimed at establishing a capability, providing the support necessary for **exploitation scenarios in Europe**

⇒ **EO Innovation Europe**

Fit for purpose



Opportunities beyond single exploitation platforms

→ *A 'network' dedicated to EO innovation*

The best worldwide EO data asset

Europe EO

- *Operational public EO data (Sentinel, Meteo)*
- *Heritage EO data (e.g. Spot-1, Envisat)*
- *R&D EO data (e.g. Earth Explorers)*
- *Commercial EO data e.g. RapidEye, Deimos*
- *Airborne & in-situ data*

Increasing data volume & diversity

Evolving user expectations

"traditional" data delivery

"EO-Innovation Europe"
Network of Exploitation Capabilities
"Big Data"

Vivid global user communities

5 interconnected user groups

- *Users public services*
- *Users R&D remote sensing*
- *Users profit-making services*
- *Users geosciences*
- *General public, education, media*

Objectives of the network concept:

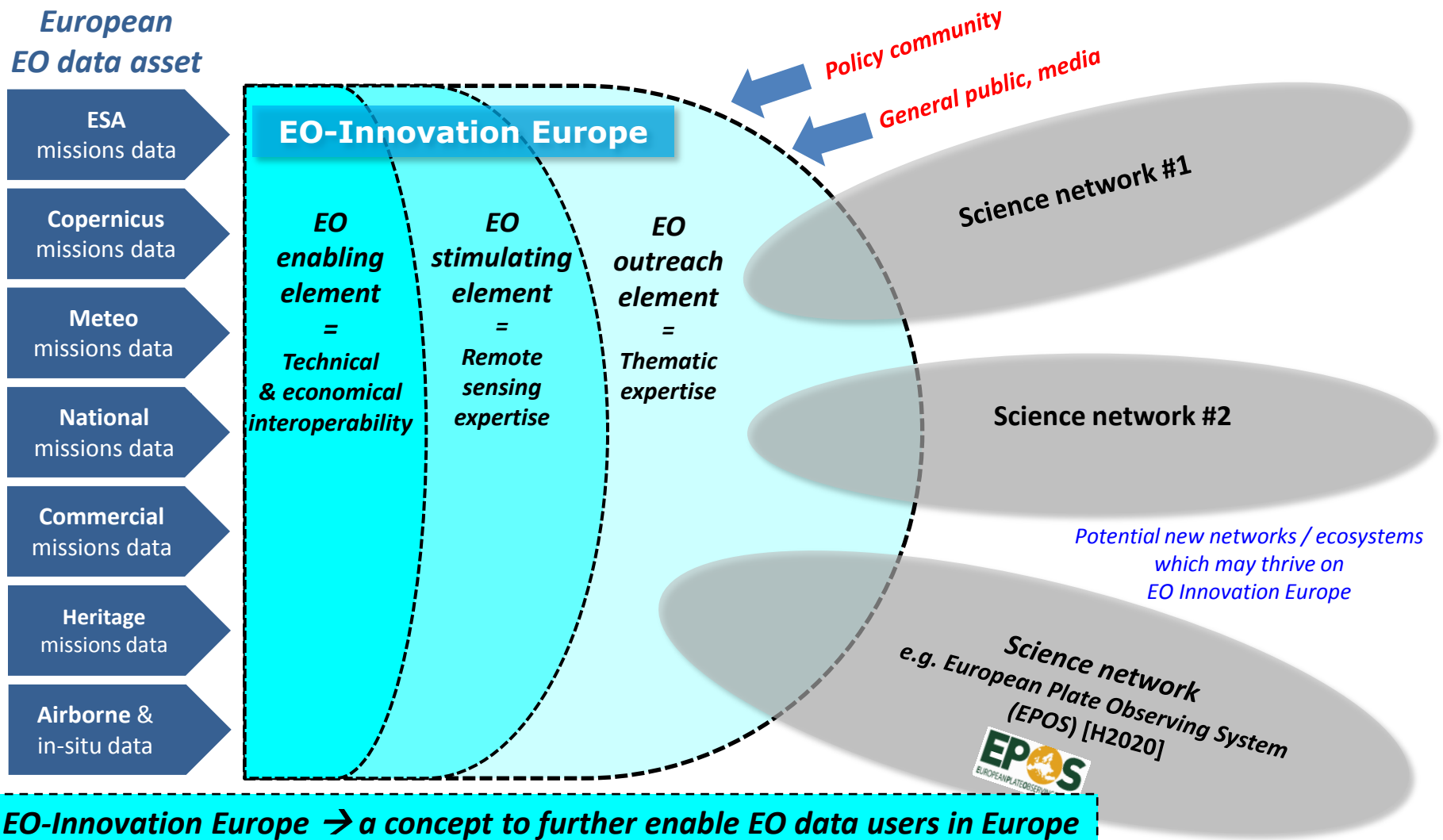
- ✓ *Enable large scale exploitation of EO data*
- ✓ *Stimulate innovation with EO data*
- ✓ *Maximise impact of European EO assets and preserving European independence*

How:

- ✓ *Interoperable/interconnected platforms around a core enabling element*
- ✓ *Open to multi-source funding initiatives*
- ✓ *Common governance rules*

EO Innovation Europe

→ *linked with large science networks and ecosystems*



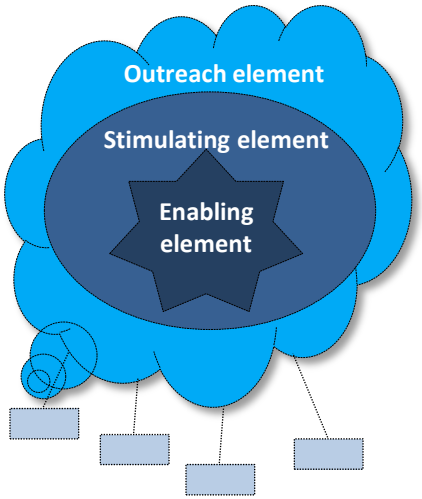
EO-Innovation Europe → a concept to further enable EO data users in Europe

EO Innovation Europe
→ *funding and enabling governance rules*

→ *open to multi-source funding initiatives*

EO-Innovation Europe is a key concept of the ESA EO Envelop Programme and provides a robust framework for "innovation and science" → an open concept, ***inviting initiatives of partners, at EC, national and industrial level***

→ *a common set of enabling governance rules*



- Open, non-discriminative access to platforms and resources
- Implementation approaches allowing EO Exploitation platforms to offer a mix of free services, sponsored services and paying services
- A clear and stable delineation of scope for institutional and commercial activities with a focus on encouraging commercial initiatives while making good use of existing capacities in the institutional domain where this is appropriate.
- Protection of IPR and data
- System and data security
- A clear level of commitment on business continuity
- A participative model for any evolution of the governance rules involving all stakeholders, including industry.

The EO-Innovation Europe values:

→ collaboration, sharing, networked governance, affiliation, "open for business"

Contact Information

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