EOSC Architecture and Interoperability guidelines

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Dissemination level: Confidential

Landscape and Service Composability

Overarching concepts

Landscape & EOSC Architecture Working Group
End-to-end service composition
EOSC Interoperability Guidelines & Interoperability Framework

Landscape

- Analysis of past work on EOSC Architecture
  - EOSC Pilot Service Architecture
- Commission Staff Working Document on the implementation roadmap for the European Open Science Cloud (EOSC)
  - ‘Architecture’ Action Line
- EOSC Architecture WG
  - EOSC-hub representative part of the WG
  - proposes the technical framework required to enable and sustain an evolving EOSC federation of systems
  - EOSC interoperability layer: include standards, APIs and protocols that will facilitate interoperable services

End-to-end composition of services

- Fostering service composability to create new added-value solution for research
  - Promote the adoption of standards
  - Perform service integration activities

- Typical service combinations
  - Re-using federation services to implement basic features (AAI, monitoring, accounting)
  - Adopt common services to better exploit compute, storage and data resources (EGI Cloud Compute, EUDAT B2FIND, INDIGO Orchestrator)
  - Create new scientific workflows as combination of more services

EOSC Interoperability Guidelines

- Technical Interoperability Guidelines in terms of suggested EOSC standards and interfaces/APIs
  - lower the barriers to allow services to interact and work together
- Benefits:
  - scientists can rely on well-established (e.g. from e-Infras) and EOSC-compliant services for implementing the basic features
  - federated and common services can interoperate (e.g. AAI or accounting services from different initiatives)

- Interoperability guidelines as implementation of the EOSC interoperability layer (--> EOSC Architecture WG)
  - based on existing community practices, well-known standards and interfaces
  - adoption should not be forced but as a natural consequence of the advantages for a service

Service composability - Samples

EOSC Technical Support enables integration working with the community

EGI FedCloud + DODAS Analytics + EGI Check-in

Standard adoption reduces the cost of the integration work

Developer

DODAS thematic service

Solution of integrated services can be **reused** in similar use cases

Service already interoperable thanks to the adoption of a common standard (OGC WMS).

CREODIAS DATA HUB[1] + Sentinel Hub[2] + B2Access

OGC WMS OGC WMS

EOSC Technical Support can support community for the integrated usage

Developer

New workflow for scientific analysis

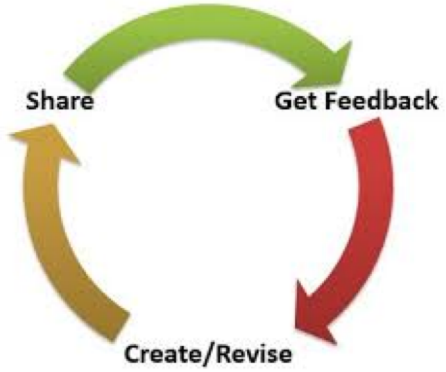
EOSC Technical Architecture

The approach

Reference architecture
Define the EOSC Building Blocks
EOSC Technical Architecture
Access Enabling and Federation Tools Building Blocks
Common service Building Blocks
Thematic services Building Blocks
Technical Roadmap

Define the Building Blocks of the EOSC architecture

- Identify **EOSC architecture building blocks** for Access Enabling and Federation, Common and Thematic services
- Define **EOSC architecture building blocks**
  - Common approach for all service categories
  - Mapping the features to **Technical Specifications** including High-level architecture & Interoperability guidelines
- Iterative approach to identify building blocks and improve the technical specification
  - Start from the most relevant use cases
  - Define the technical specification and get feedback
  - Involve external people with expertise in the area



Family of EOSC compliant services per Block

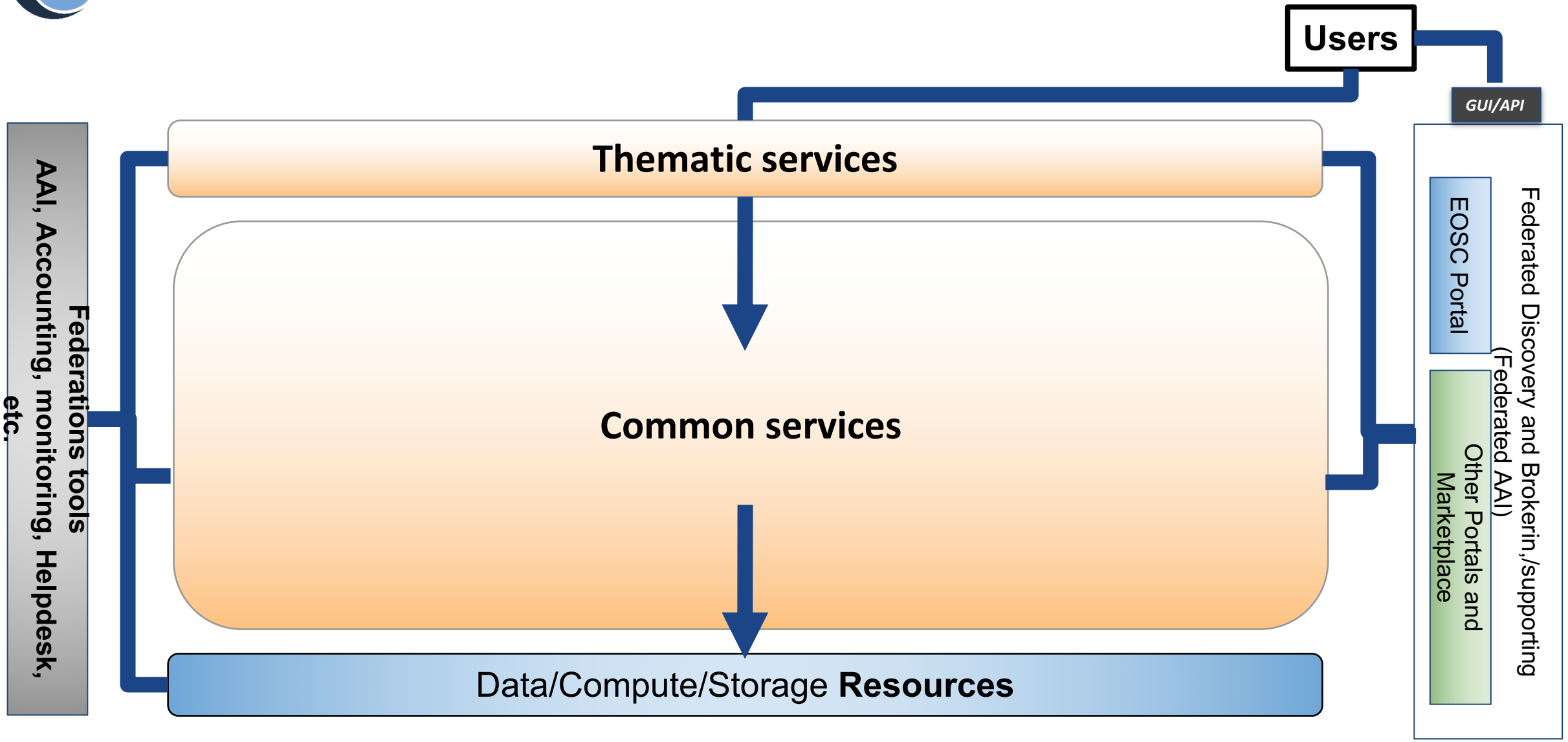
- Services in a Building Block
  - Follow the EOSC technical specification
  - Are able to interoperate
- Examples:
  - AAI services compliant with the AARC Blueprint
  - Monitoring/Accounting systems able to exchange/share information

Building Block

Technical specification template per Block

- **Introduction**
  - *Short description of the building block highlighting its main functions*
- **High-level Service Architecture**
  - *Reference architecture of the building block highlighting the interfaces towards the other building blocks*
  - *It does not refer to any specific service*
- **Adopted Standard**
  - *List with references of the main adopted standards and protocols/API*
- **Interoperability guidelines**
  - *Describe how similar services can be made interoperable with this macro-feature*
- **Examples of solutions implementing this specification**
  - *Services compliant with this specification*

EOSC Technical Architecture - Functional view



Access Enabling and Federation Services

Access Enabling and Federation services

- Building block as any key acc
to operate the F e.
  - Leveraged o xperiences from large European e-infra ucture to identifies the needed s vices
  - Part of the E C Hub Portfolio

Technical specifications for each of these services

Hub Portfolio
AAI
Helpdesk
Accounting
CMDB
Monitoring
Order Management

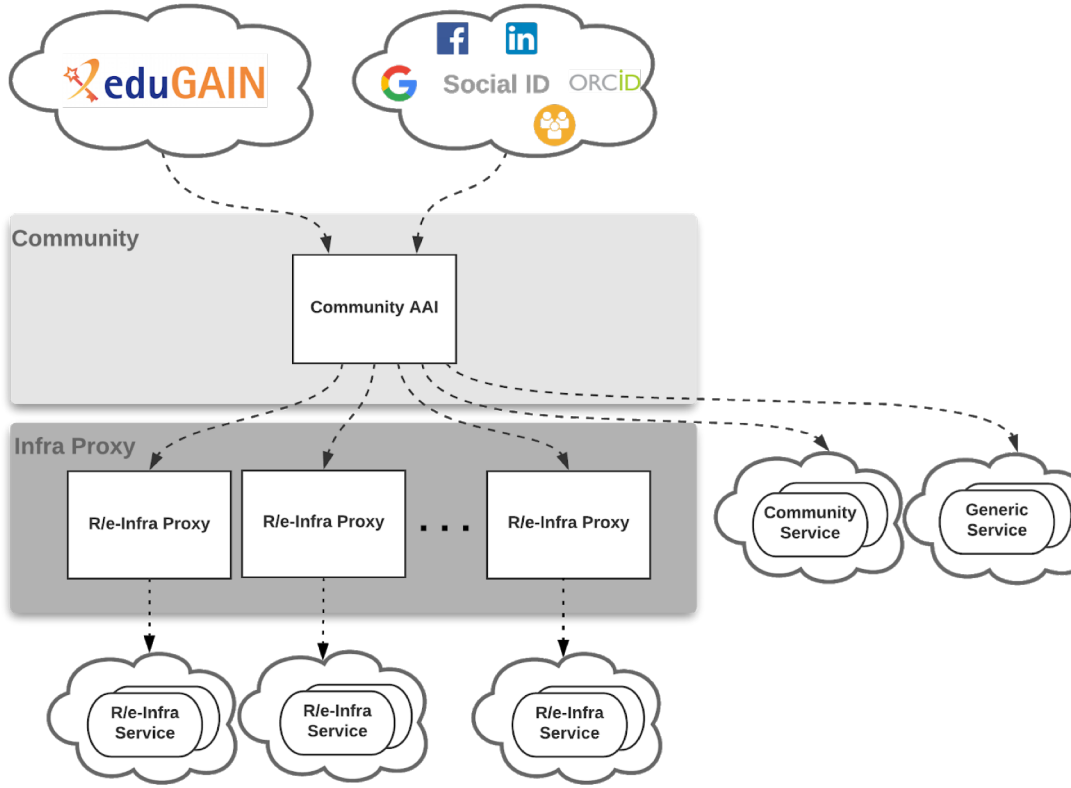
Hub Portfolio
EOSC Portal
Operations portal
Service Portfolio Management Tool
Collaboration software & platforms
Messaging
Security Monitoring

An example: AAI

Standards

Standard	Short description	References
Security Assertion Markup Language (SAML) 2.0	OASIS standard for exchanging authentication and authorisation data between parties.	https://www.oasis-open.org/standards#samlv2.0
OAuth 2.0	Standard for authorisation that enables delegated access to server resources on behalf of a resource owner	"The OAuth 2.0 Authorization Framework", RFC 6749, https://www.rfc-editor.org/info/rfc6749
OpenID Connect 1.0	Identity layer on top of the OAuth 2.0 protocol. It enables Clients to verify the …	"OpenID Connect Core 1.0", https://openid.net/specs/openid-connect-core-1_0.html
X.509	ITU-T standard for a public key infrastructure (PKI), also known as PKIX (PKI X509)	https://www.rfc-editor.org/info/rfc5280 https://www.rfc-editor.org/info/rfc3820
		ietf.org/html/rfc4

Technical specification ready for public comments



High-level Service Architecture

Interoperability Guidelines

Common Services

Building Blocks in Common Services (1/2)

- In Common Services, a building block is a technical function that
  - offer added value on top of the EOSC resources (computing, storage, etc.)
  - can be adopted by multiple thematic services
- Examples of building blocks
  - IaaS VM/Container management, Cloud Orchestration, metadata management, making scientific artefacts FAIR, etc.
  - A macro-feature can be offered by one or more generic services
- Number of relevant building blocks in Common Services can be huge
  - Different technical areas
  - Need to prioritise
    - Starting from the most relevant for users -> use cases requirements

Building Blocks in Common Services (2/2)

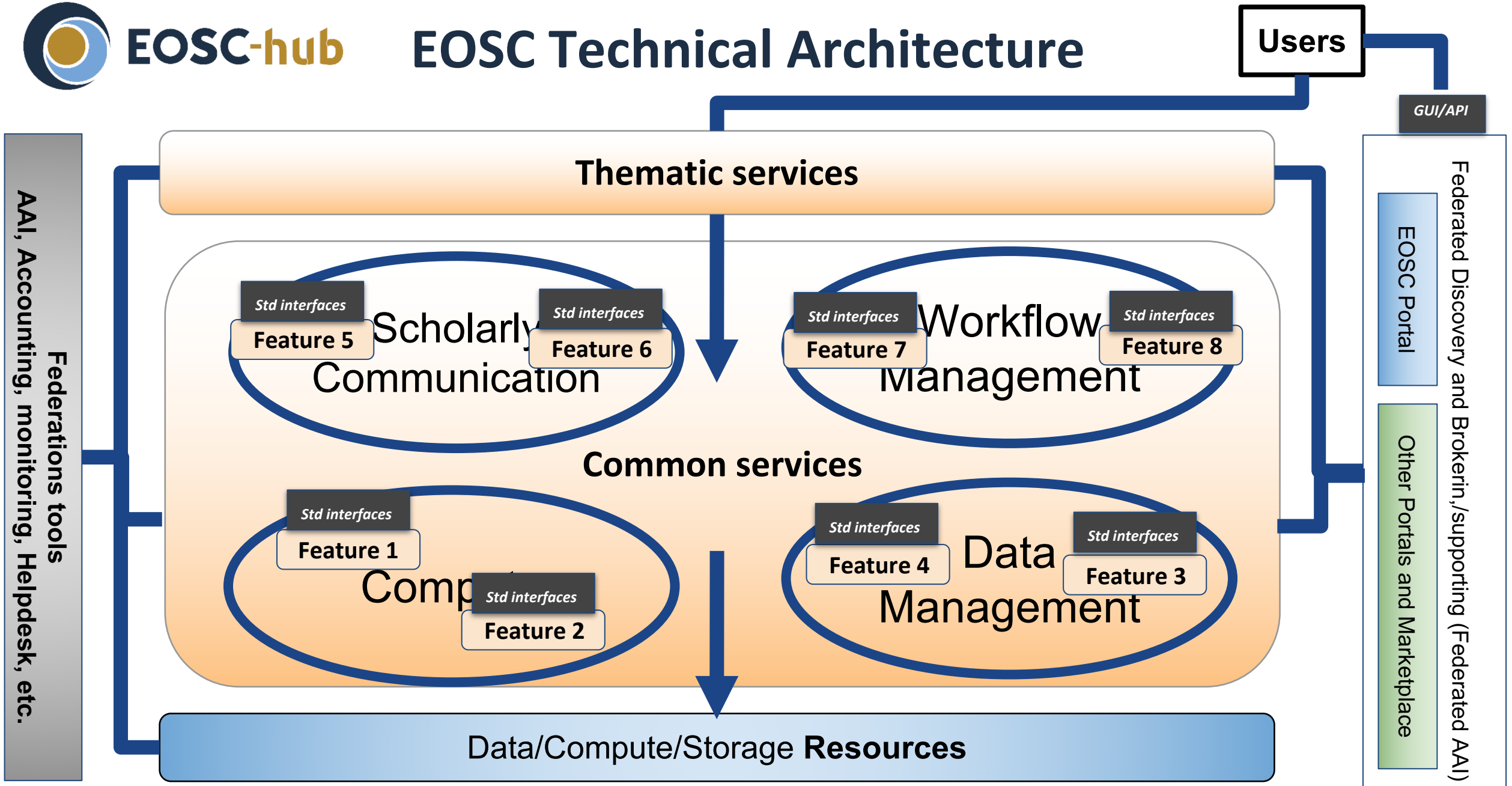
- Split the work leveraging on technical areas
  - EOSC-hub technical areas

Technical Areas
HTC/HPC Compute
Cloud Compute (inc Containerisation and orchestration)
PaaS Solutions
Workflow management and user interfaces and Data analytics

Technical Areas
Data Platforms for Processing
Data Publishing and Open Data
Data Preservation/Curation/Provenance
Metadata Management and Data Discovery

  - Other tech areas suggested by other initiatives
    - E.g. OpenAIRE suggested to add Scholarly Communication

EOSC Technical Architecture



Building Blocks per technical area

Technical Area	Building Blocks
HTC/HPC Compute	• Multitenant job submission • Multitenant container based job submission • HTC / HPC clusters on demand
Cloud Compute (inc Containerisation and orchestration)	• IaaS: VM Management • IaaS: Orchestration • IaaS: Containers
PaaS Solutions	• PaaS Solution for Cloud service automation and federation of hybrid Cloud resources

Building Blocks per technical area

Technical Area	Building Blocks
Data Platforms for Processing	• Transparent data processing using POSIX in distributed and hybrid cloud environment including Dockers and Kubernetes and Jupiter • Data Ingesting and movement for processing in hybrid cloud environment • Metadata Management in processing workflows • QoS based data access optimization and tight integration with preservation services • Authorization based on attributes from IdP • Results sharing and experiment repeatability • Distribution of software for the processing tasks
Data Publishing and Open Data	• Data Repository
Data Preservation/Curation/Provenance	• Data Preservation • Tracking of provenance metadata • Data Curation
Metadata Management and Data Discovery	• Data Discovery and Access • Metadata cataloguing and indexing • Annotation service

Building Blocks per technical area

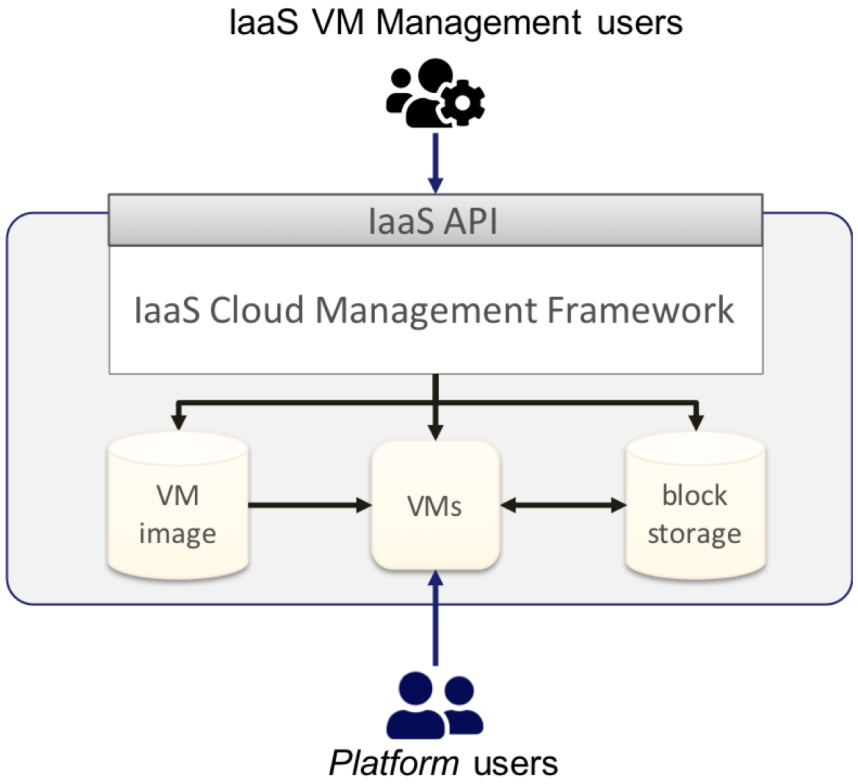
Technical Area	Building Blocks
Workflow management and user interfaces and Data analytics	• Portals • Big data analytics • ML/DL analytics services • Cloud based IoT Platforms interoperability
Scholarly Communication	• Data Management Plans • Digital Preservation • Overlay platforms: Peer-review • Anonymization • Aggregator • Broker • Entity Registry • Metadata validation • Annotation • Usage stats • VRE: RI Services for experiments

An example: Cloud IAAS VM Management

Standards & API

Standard	Short description	References
Open Virtualization Format (OVF)	Packaging format for software solutions based on virtual systems (VM image format)	OVF 2.1.1
OpenStack	OpenStack is an Open Source cloud operating system that controls large pools of compute, storage, and networking resources throughout a datacenter…	OpenStack API
Amazon EC2/EBS/VPS & AWS VPN	Provide management of Virtual Machines and associated block storage and network features	AWS EC2 API
Azure Virtual Machines/Disks/Vnet	IaaS VM management services from Microsoft Azure	Azure Virtual Machines API
Google Cloud Compute Engine	IaaS VM management service from Google Cloud Platform	Google Cloud Compute Engine API
OGF		pecification

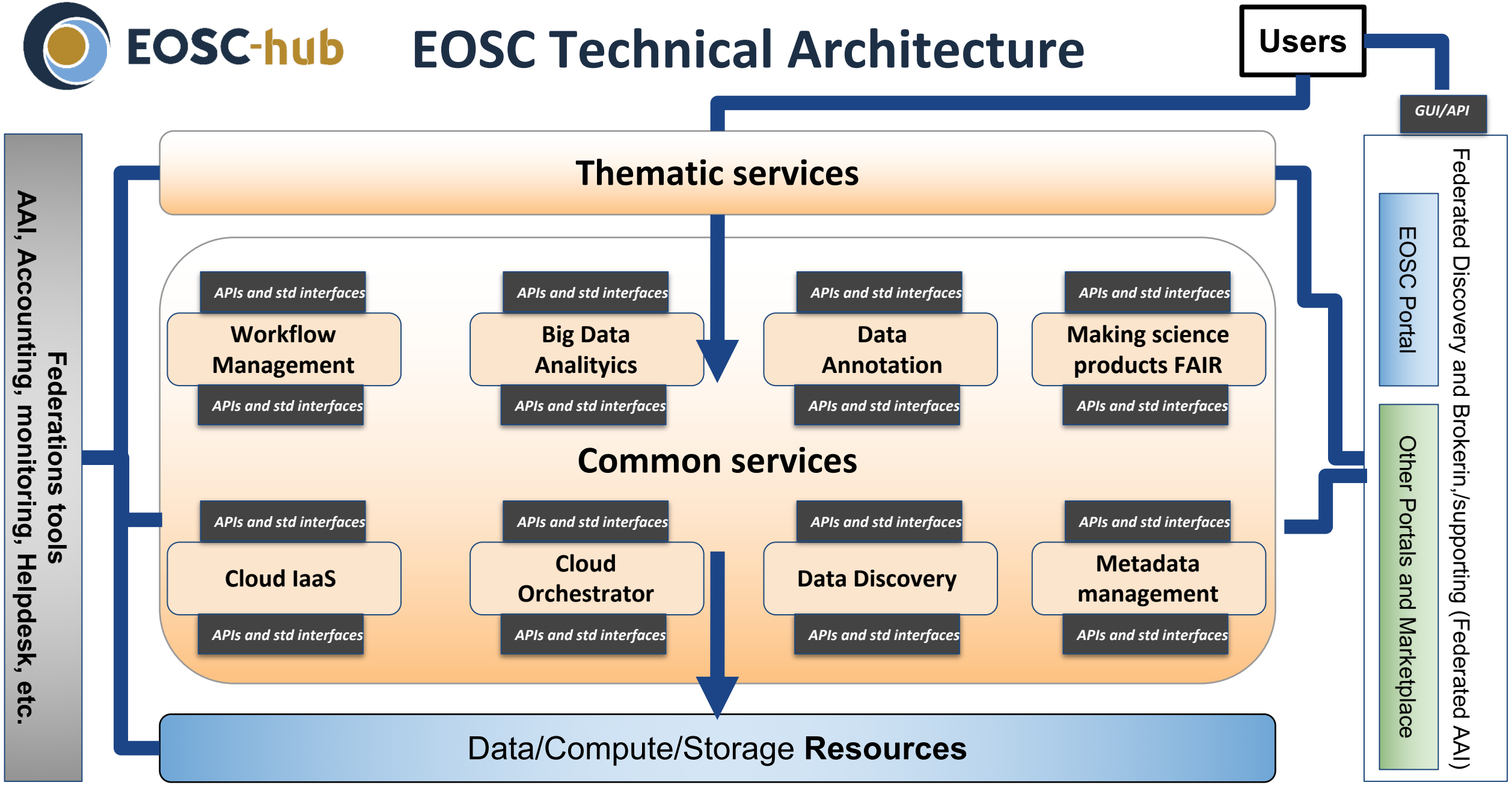
Technical specification ready for public comments



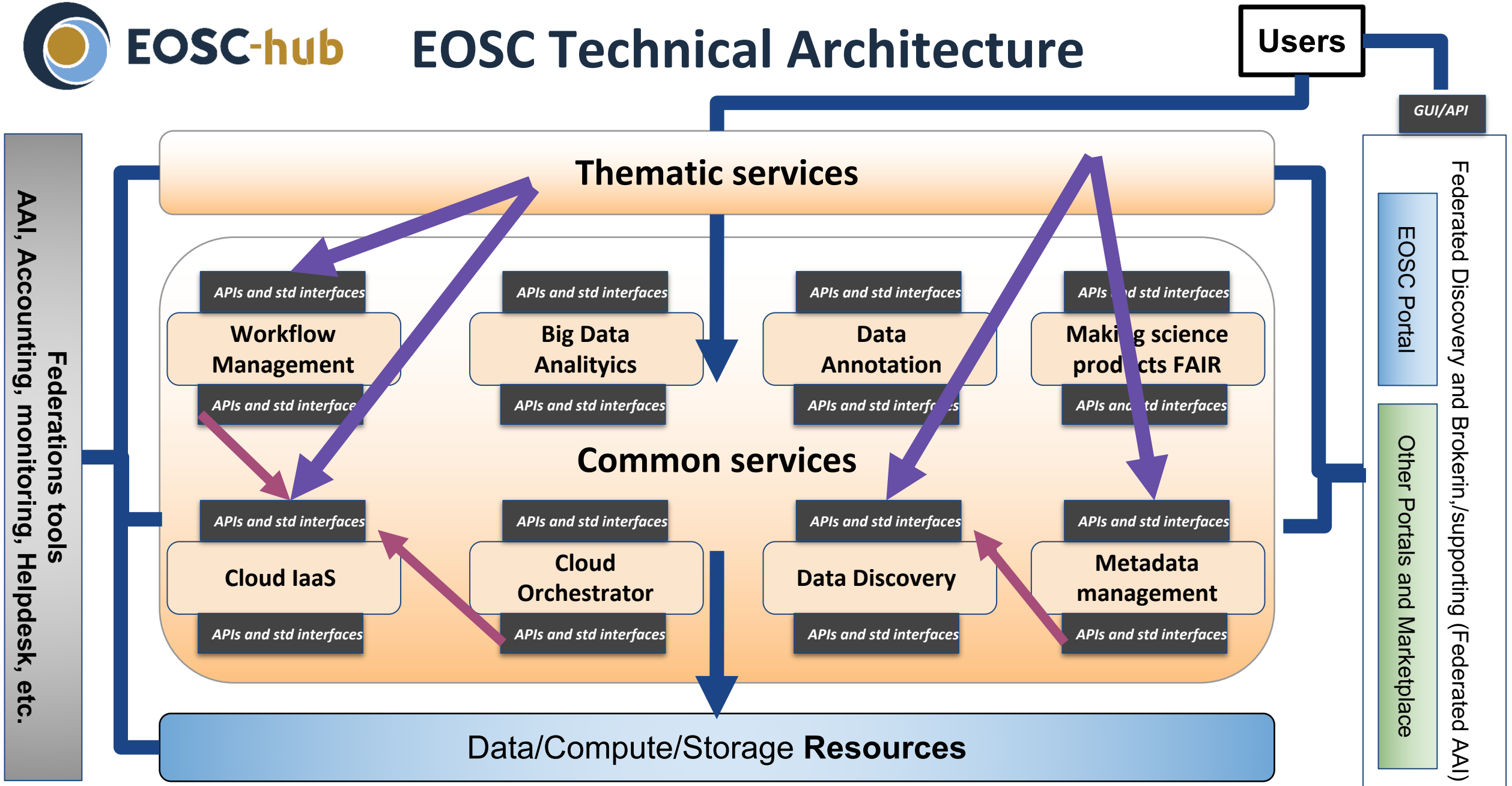
High-level Service Architecture

Interoperability Guidelines

EOSC Technical Architecture



EOSC Technical Architecture



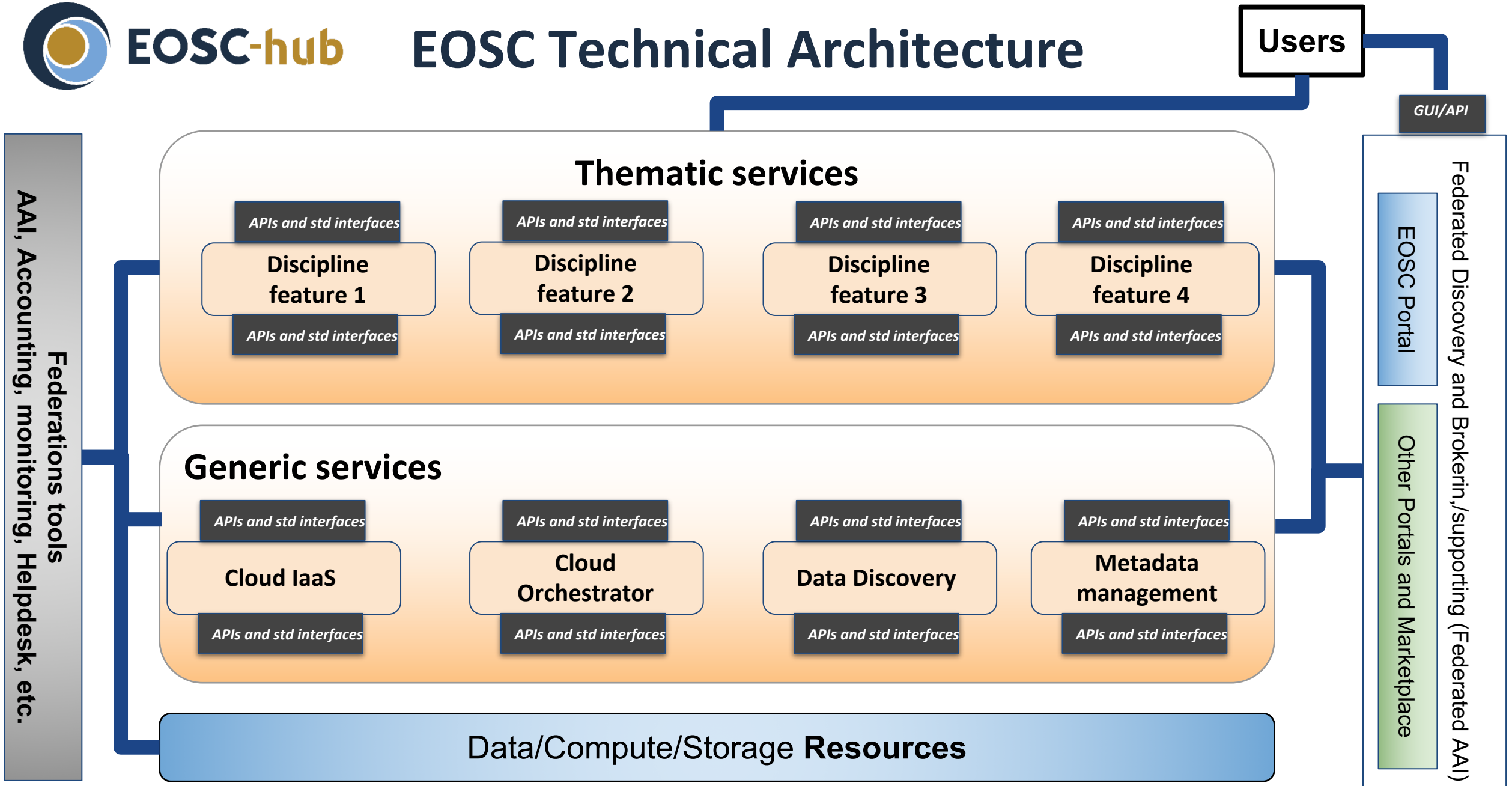
Thematic Services

Thematic services

- A building block in the Thematic Services is a technical function that
  - is discipline oriented
  - can be re-used in multiple thematic services within one thematic domain

- Discipline oriented building blocks need to be identified and specified by experts of disciplines
- EOSC-hub will start this effort with communities participating to the project
  - Community oriented projects need to be involved (e.g. Cluster projects)

EOSC Technical Architecture



Technical Roadmap

- Built to facilitate the service composition
  - Adoption of standards and participation to standardisation bodies (RDA, OGF, etc.)
  - Develop new solutions as result of integration activities
  - Fostering the integration of thematic services with federation and common services
- Enhance the EOSC-Hub access channels to improve
  - Discoverability, access and combined usage of services
  - See EOSC Portal in particular
- Establish and further enhance collaborations with other EOSC projects
  - OpenAIRE Advance, GNT4-3, ESFRI Clusters, regional and national projects, implementation projects, etc.

EOSC-hub Liaison with external bodies

Collaboration with RDA
Other bodies

Collaboration with RDA

- Input for **FAIR Data Maturity Model WG**
  - EOSC-hub staff are involved in face-to-face/virtual meetings of this WG in order to provide their expertise and background on the assessment criteria for FAIR data that the WG is developing. Also to validate it against known use cases.
- EOSC-Hub WP10 representative has started following the work of the:
  - **"Software Source Code Identification WG Case Statement"**
- in the RDA11th Plenary (at Berlin), EOSC-Hub, FREYA, and OpenAIRE-Advance projects together organized a **"EOSC-related European Projects getting Global: Engaging with the RDA - RDA 11th Plenary BoF meeting"** with the aim:
  - to share the analysis of RDA activities done with the point of view of each of the three projects,
  - to identify new activities which would be interesting to propose in the RDA context,
  - to discuss RDA recommendations and outputs of interest,
  - to liaise with interested RDA members from all regions.
- Partners from Task 7.3 (ECAS) participated to: **"WG Array Database Assessment"**
- WP7 attended the co-located workshop, but without presenting.
- WP2.4 attended/contributed to a number of **health & privacy IG/WGs**

RDA and other bodies

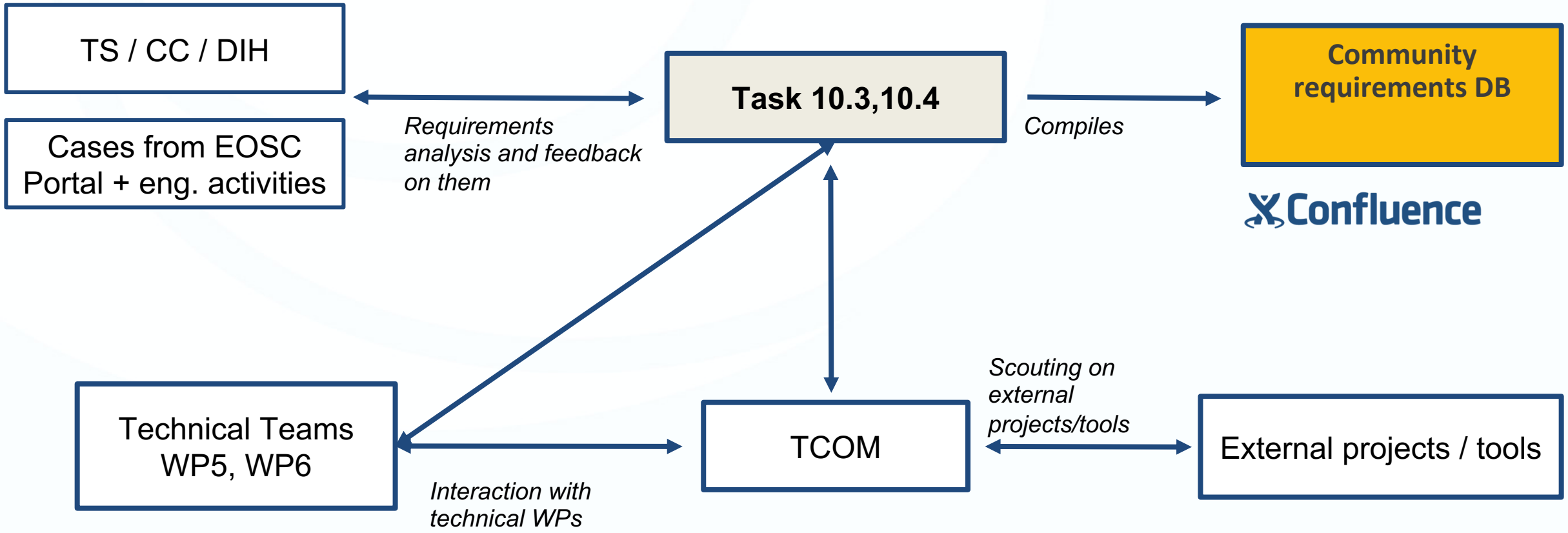
- "**Research Data Repository Interoperability**" WG
- "**Metadata**" IGs
- "**Sensitive Data in the Open Science**" WG
- "**Data Usage Metrics**" WG
- "**Data Management Plans** (DMP) Common Standards"
- Together with OpenAIRE: RDA WG "Make Data Count"
- Contribution to **TOSCA standard**: for the orchestration of Cloud services
- **OGC standard:** in the field of the Earth Observation cases
- Strict correlation with **AARCH** for the AAI implementation

EOSC-hub Technical Support

Users’ requirements gathering

Workflow for users' requirements gathering (T10.3/T10.4 to be completed)

Technical support is provided to all potential EOSC-hub users (internal and external) by T10.3 and T10.4 in collaboration with other technical work-packages (WP5, WP6, WP7)



Future plans

- Enhance the proposal for EOSC Technical Architecture
  - Feedback from relevant stakeholders
  - Liaison with EOSC Architecture WG
  - Organise a Workshop to present an enhanced version of the EOSC Technical Architecture
- Release the first set of EOSC Technical Specifications for external comments
  - Involve other key actors in the definition of the EOSC Technical Specifications
- Updated Technical Roadmap
- Continue the collaboration with RDA
- Continue Technical Support activities

Thank you for your attention!

Questions?

Contact

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