

Use Case Analysis

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Technical Note**Use Case Analysis for the Common Architecture****COMMENTS and ISSUES**

If you would like to raise comments or issues on this document, please do so by raising an Issue at the following URL <https://github.com/EOEPCA/use-case-analysis/issues>.

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TBD.

1. Introduction

1.1. Purpose and Scope

This document presents the use cases relevant to the Common Architecture.

1.2. Structure of the Document

TBD

1.3. Reference Documents

The following is a list of Reference Documents with a direct bearing on the content of this document.

[EP-UC]

EO Exploitation Platforms - Use Cases, ESA-EOPSDP-TN-17-049, Issue 1.0, 15/12/2017

[EP-FM]

Exploitation Platform - Functional Model, ESA-EOPSDP-TN-17-050, Issue 1.0, 30/11/2017

1.4. Terminology

The following terms are used in the use case descriptions.

Term	Meaning
Platform (EP)	An on-line collection of products, services and tools for exploitation of EO data
User	An individual using the EP, of any type (Admin/Consumer/Expert/Guest)
Admin	User with administrative capability on the EP
Consumer	User accessing existing services/products within the EP. Consumers may be scientific/research or commercial, and may or may not be experts of the domain
Expert	User developing and integrating added-value to the EP (Scientific Researcher or Service Developer)
Scientific Researcher	Expert user with the objective to perform scientific research. Having minimal IT knowledge with no desire to acquire it, they want the effort for the translation of their algorithm into a service/product to be minimised by the platform.
Service Developer	Expert user with the objective to provide a performing, stable and reliable service/product. Having deeper IT knowledge or a willingness to acquire it, they require deeper access to the platform IT functionalities for optimisation of their algorithm.

Term	Meaning
Guest	An unregistered User or an unauthenticated Consumer with limited access to the EP's services
Discovery	User finds products/services of interest to them based upon search criteria.
Products	EO data (commercial and non-commercial) and Value-added products and made available through the EP. <i>It is assumed that the Hosting Environment for the EP makes available an existing supply of EO Data</i>
Value-added products	Products generated from processing services of the EP (or external processing) and made available through the EP. This includes products uploaded to the EP by users and published for collaborative consumption
Processing Service	A non-interactive data processing that has a well-defined set of input data types, input parameterisation, producing <i>Processing Results</i> with a well-defined output data type.
On-demand Processing Service	A <i>Processing Service</i> whose execution is initiated directly by the user on an ad-hoc basis.
Systematic Processing Service	A <i>Processing Service</i> whose execution is initiated automatically (on behalf of a user), either according to a schedule (routine) or triggered by an event (e.g. arrival of new data).
Processing Result	The <i>Products</i> produced as output of a <i>Processing Service</i> execution.
Interactive Application	A stand-alone application provided within the exploitation platform for on-line hosted processing. Provides an interactive interface through which the user is able to conduct their analysis of the data, producing <i>Analysis Results</i> as output. Interactive Applications include at least the following types: console application, web application (rich browser interface), remote desktop to a hosted VM.
Interactive Console Application	A simple <i>Interactive Application</i> for analysis in which a console interface to a platform-hosted terminal is provided to the user. The console interface can be provided through the user's browser session or through a remote SSH connection.
Interactive Web Application	An Interactive Application for analysis provided as a rich user interface through the user's web browser.
Interactive Remote Desktop	An Interactive Application for analysis provided as a remote desktop session to a VM hosted on the exploitation platform. The user will have access to a number of applications within the hosted OS. The remote desktop session is provided through the user's web browser.
Analysis Result	The <i>Products</i> produced as output of an <i>Interactive Application</i> analysis session.
Execution	The act to start a <i>Processing Service</i> or an <i>Interactive Application</i> .
Visualisation	To obtain a visual representation of any data/products held within the platform - presented to the user within their web browser session.
Processing	A set of pre-defined activities that interact to achieve a result. For the exploitation platform, comprises on-line processing to derive data products from input data, conducted by a hosted processing service execution.

Term	Meaning
Algorithm	A self-contained set of operations to be performed, typically to achieve a desired data manipulation. The algorithm must be implemented (codified) for deployment and execution on the platform.
Code	The codification of an algorithm performed with a given programming language - compiled to Software or directly executed (interpreted) within the platform.
Software	The compilation of code into a binary program to be executed within the platform on-line computing environment.
Analytics	A set of activities aimed to discover, interpret and communicate meaningful patterns within the data. Analytics considered here are performed manually (or in a semi-automatic way) on-line with the aid of <i>Interactive Applications</i> .
Development	The act of building new products/services/applications to be exposed within the platform and made available for users to conduct exploitation activities. Development may be performed inside or outside of the platform. If performed outside, an integration activity will be required to accommodate the developed service so that it is exposed within the platform.
Workspace	A user-scoped 'container' in the EP, in which each user maintains their own links to resources (products and services) that have been collected by a user during their usage of the EP. The workspace acts as the hub for a user's exploitation activities within the EP
Terms & Conditions (T&Cs)	The obligations that the user agrees to abide by in regard of usage of products/services of the platform. T&Cs are set by the provider of each product/service.

1.5. Glossary

The following acronyms and abbreviations have been used in this report.

Term	Definition
EO	Earth Observation
EP	Exploitation Platform
SSH	Secure Shell
VNC	Virtual Network Computing

2. Use Cases

Each use case is presented in the following sub-sections.

See [\[EP-UC\]](#) and [\[EP-FM\]](#) for more information.

2.1. User accesses Platform services

As a User, I want to be able to access the services of the system within the context of my user profile. I want to identify myself with the same unique identifier that I use on other platforms (e.g. email address or GitHub ID etc.). I should be directed to register or login if that is required to access the requested resource.

1. Admin logs in on the EP
 2. Admin configures the access policy of the EP services
 3. Guest successfully accesses unprotected services
 4. Guest is denied access to protected services
 5. Guest registers as a platform user with an existing (external) identity
 6. Unauthenticated Consumer/Expert is denied access to protected services
 7. Consumer/Expert logs in on the EP
 8. Consumer/Expert successfully accesses protected services
-

2.2. Consumer discovers and visualises products

As a Consumer I want to search for Products of all types by specification of textual and faceted search criteria. I want to be able to incrementally narrow my search with more criteria clauses. For each Product in the search result I want to get more detailed information that describes the product, its usage terms and costs, and visualise the data graphically. Having discovered a product of interest I may 'save' it to my Workspace, download it, or use it as input to further exploitation activities.

Figure 1 illustrates discovery of EO data products using the EO Browser system.

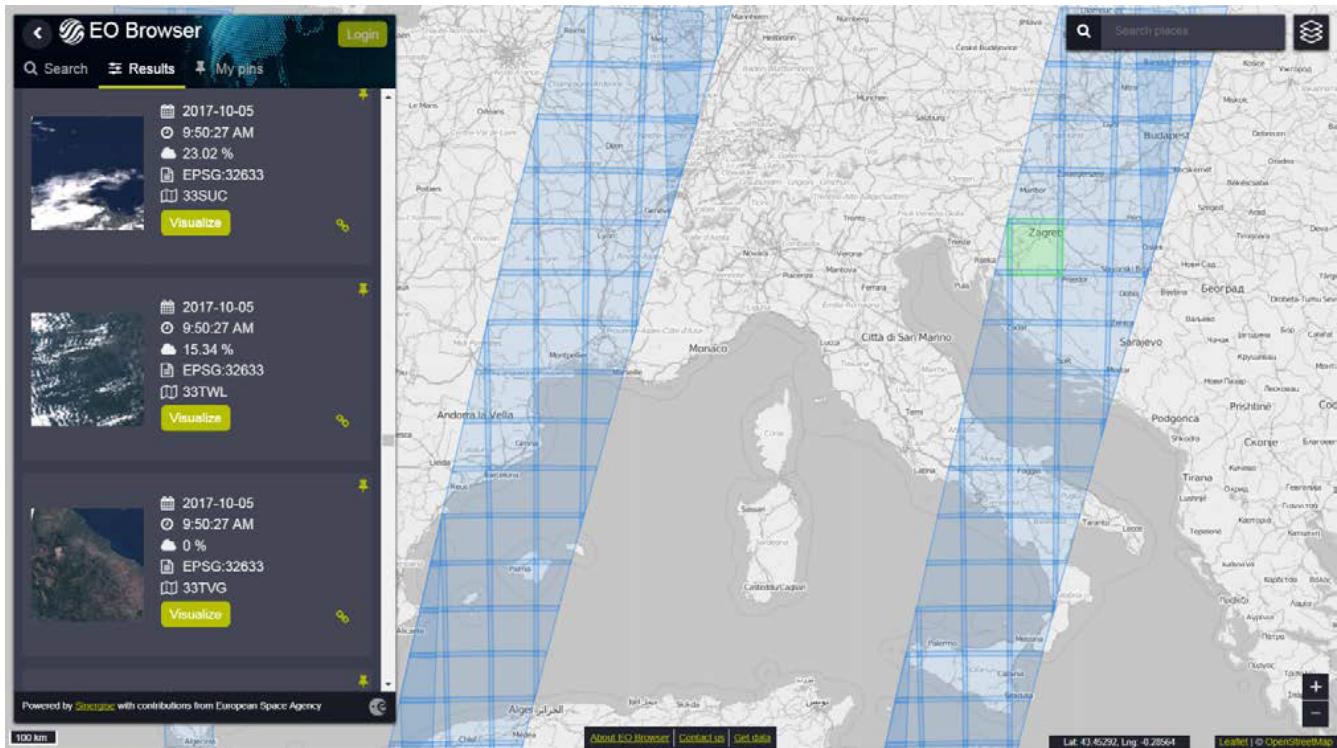


Figure 1. Product Discovery - EO Browser (<http://apps.eocloud.sentinel-hub.com/eo-browser/>)

Figure 2 shows custom visualisation of a Sentinel-2 EO data product.

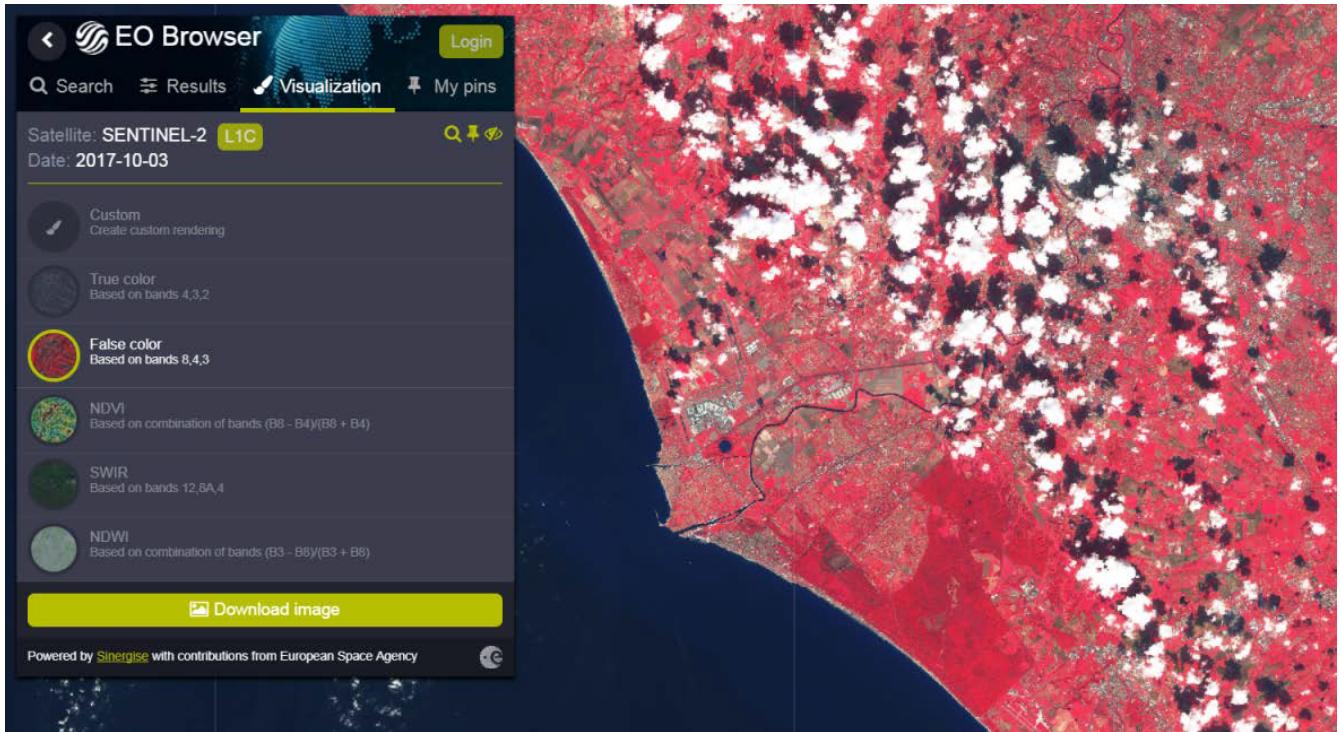


Figure 2. Product Visualisation - EO Browser (<http://apps.eocloud.sentinel-hub.com/eo-browser/>)

1. Consumer logs in on the EP
2. Consumer begins searching for products on the EP. The starting point is the full unfiltered product set that contains commercial/non-commercial EO data and value-added products
3. Optionally, the resultset is automatically filtered to include only those collections that the Consumer has right to visualise. *It may be the case that the EP chooses to make these 'unavailable collections' visible to the Consumer to publicise their existence*
4. Consumer filters the resultset by any combination of textual search terms, area of interest, time of interest, selection of collection(s) and selection of product facets
5. Consumer incrementally adjusts their search criteria to refine the filtered resultset
6. Consumer selects a product of interest; the EP checks they are authorised to access the product
7. Consumer views detailed metadata for the selected product
8. Consumer views T&Cs for the service and accepts terms if not already done so
9. Optionally, the Consumer 'saves' (a reference to) the product to their workspace
10. Consumer requests the cost for access/usage of the data
11. Optionally, the Consumer visualises the product with a graphical representation. *The Consumer is able to parameterise the visualisation interactively, e.g. specification of layers to view etc.*
12. Optionally, the Consumer downloads the visualisation results

NOTE

The use case does not mention the Guest user. It should be taken into account that an EP may choose to allow limited access to a Guest user, such as searching/browsing catalogues, before insisting on user login for exploitation activities. *This approach might be typical in order to allow a potential user discover EP capabilities before signing up*

NOTE

The use case does not consider the case where the Consumer is able to select sub-setting (spatial/temporal) of the data product itself, which might be typical of data accessible through a service such as OPeNDAP. *The extent to which this case should be considered for the EP is TBD*

2.3. Consumer uploads data to their workspace

As a Consumer I want to upload data into my workspace and specify the name and destination in the target EP. I would like to treat my uploaded data the same as other (existing) data available in the EP. This includes:

- Visualise the data in the platform
- Use the data as input to analysis activities, e.g. interactively or through processing services

Additionally, I would like to (optionally) publish the data so that it is available to other users, discoverable through the EP catalogue.

The following figures provide implementation examples from the Hydrology TEP, <https://hydrology-tep.eu/>.

Figure 3 demonstrates the invocation of the 'Manage My Data' application.

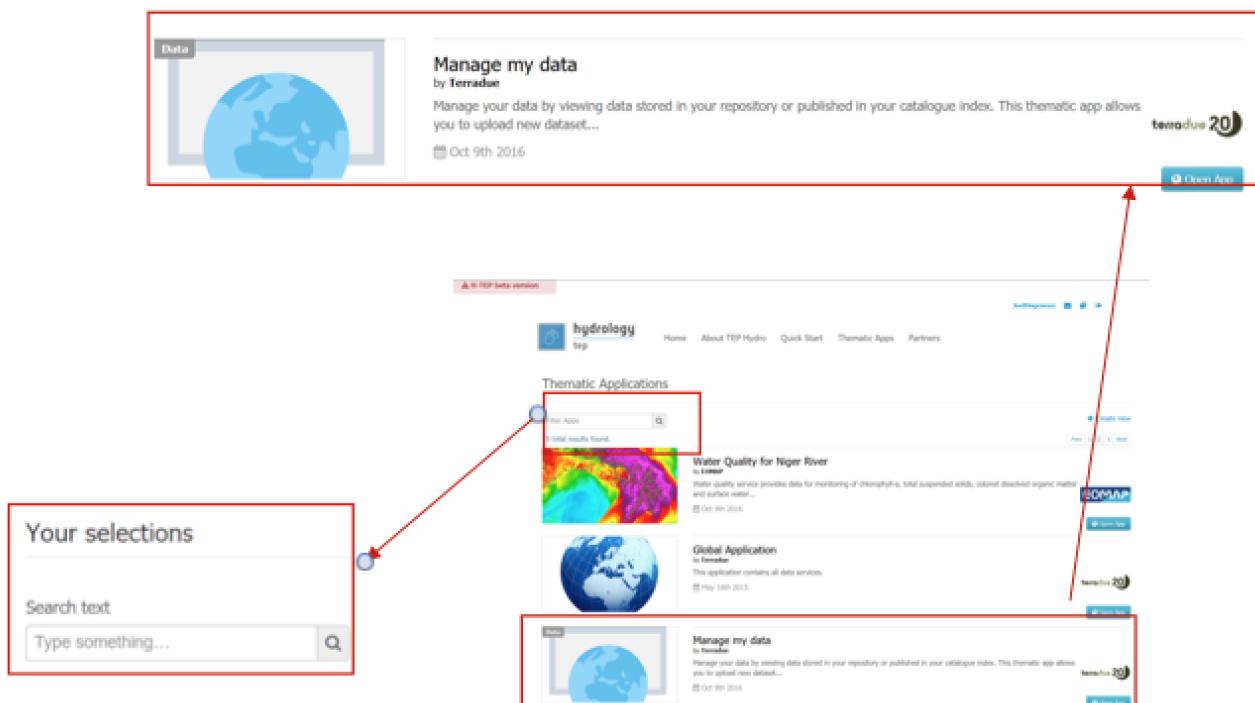


Figure 3. Manage My Data

Figure 4 illustrates the invocation of the data upload capability.



Figure 4. Workspace Upload

1. Consumer logs in on the EP
 2. Consumer navigates to their Workspace to be presented with data they have previously uploaded or 'saved'
 3. Consumer requests to upload new data - specifying appropriate metadata including the location to which the data should be uploaded
 4. Platform confirms the user's rights before accepting the request and ingesting the data into the user's workspace
 5. Optionally, consumer can view the details of any data in their workspace, including that which they have uploaded
 6. Optionally, consumer visualises their uploaded data and is able to manipulate and parameterise the view - with the possibility to download the result of their visualisation
 7. Optionally, consumer publishes the uploaded data in the catalogue - specifying all necessary metadata to support discovery
-

2.4. Consumer discovers and executes On-demand Processing Service

As a Consumer I want to list and search for commercial and non-commercial *Processing Services*, by specification of textual and faceted search criteria. I want to be able to incrementally narrow my search with more criteria clauses. For each *Processing Service* in the search result I want to get more detailed information, including a description and access to its execution manual. If I have not already done so, then any *Terms & Conditions* associated to usage of the processing service should be made clear to me, with the opportunity for me to accept the T&Cs before I am authorised to execute the processing service.

I want to prepare the *Processing Service* for execution by specifying input data from within and outside the platform, and define any other parameters and configuration required to fully specify the job. Based upon my inputs I would like to get an estimation of the execution costs and time, before (optionally) initiating execution of the processing service. Having discovered a processing service of interest I may 'save' it to my Workspace, (which acts as a bookmark) - either with or without my parameterisation.

Having initiated execution of a *Processing Service*, I would like to monitor its progress (including any errors occurring), and have access to the results output at the successful conclusion. I would like to visualise my Processing Results graphically with custom visualisation parameters, and possibly download the results. Additionally, I would like to (optionally) publish the Processing Results so that it is available to other users, discoverable through the EP catalogue.

Figure 5 illustrates discovery and parameterisation of a Sentinel-2 Land Cover processor, from the Forestry TEP platform.

The screenshot shows the Forestry TEP platform interface. At the top, there is a navigation bar with links for 'forestry', 'Explorer', 'Manage / Share', 'Helpdesk', 'My Account', and 'Logout'. Below the navigation bar, the main area is divided into sections: 'Default Project' (with a '+' button), 'WORKSPACE' (containing 'LandCoverS2'), and a central map of Europe. The map highlights a specific area in the UK and Ireland with a green rectangle, indicating the 'Area of Interest'. The 'LandCoverS2' workspace contains a description: 'Calculate land coverage (a forest map) from Sentinel-2 data' and 'Land cover mapping using Sentinel-2 images, with image classification trained by Random Forest model. A core F-TEP service'. It also includes fields for 'Input data' (a zip file containing sentinel2://...), 'Reference data archive containing shapefile for image classification training' (a zip file containing yb_20170718T10452.x), and 'Class' (with an example 'E.g.: Class'). There is also a 'Target CRS identifier' field. At the bottom of the workspace section, there is a note about EPSG coordinate reference system identifier. The right side of the interface shows a 'RESULTS: SENTINEL2' panel listing four processing jobs with details like start and end times, sizes, and cloud coverage. The bottom of the screen shows a footer with page navigation and a copyright notice.

Figure 5. Processing Discovery - Sentinel-2 Land Cover processor (<https://f-tep.com/app/>)

Figure 6 illustrates the visualisation of processing results, from the Forestry TEP platform.

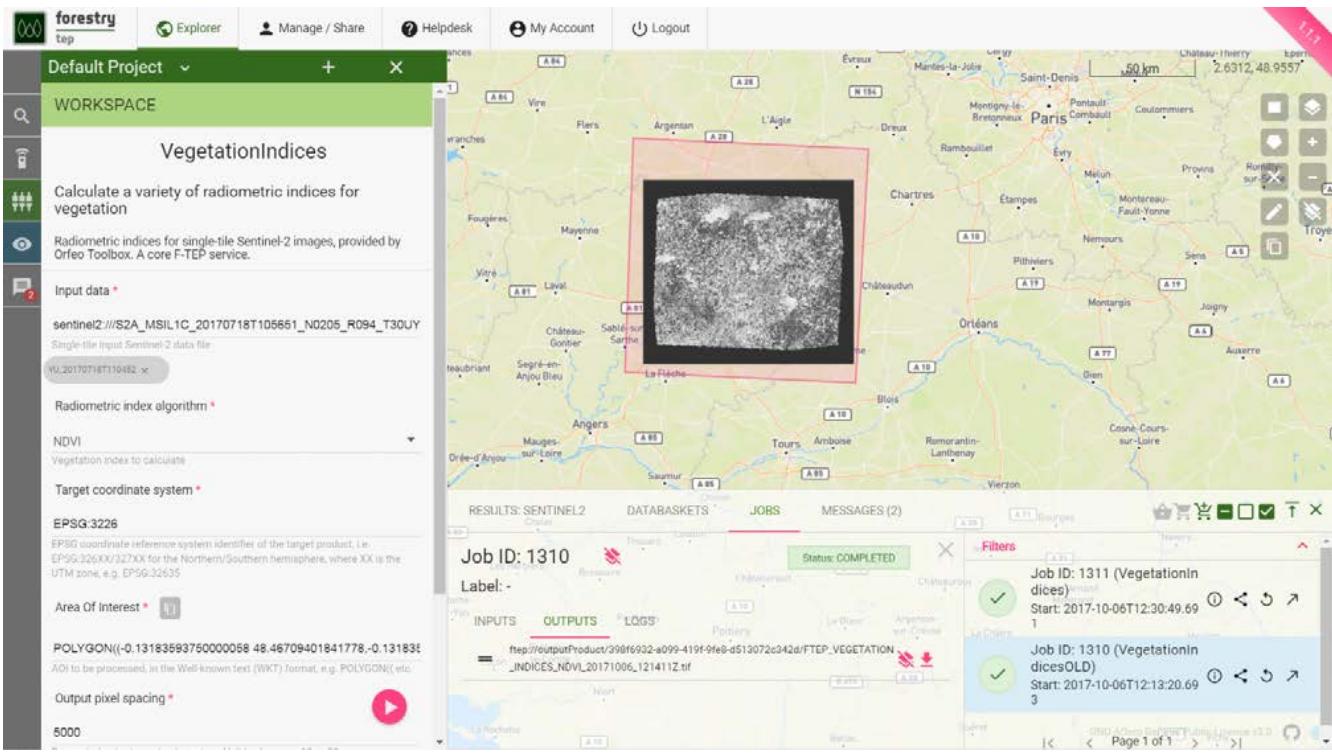


Figure 6. Processing Results (<https://f-tep.com/app/>)

1. Consumer logs in on the EP
2. Consumer begins searching for *Processing Services* on the EP. The starting point is the full unfiltered set of *Processing Services* that contains commercial/non-commercial services
3. Optionally, the resultset is automatically filtered to include only those services that the Consumer has right to visualise. *It may be the case that the EP chooses to make these 'unavailable services' visible to the Consumer to publicise their existence*
4. Consumer filters the resultset by any combination of textual search terms and selection of service facets
5. Consumer incrementally adjusts their search criteria to refine the filtered resultset
6. Consumer selects a *Processing Service* of interest; the EP checks they are authorised to access the product
7. Consumer views the manual for the selected service in order to understand its required input data/parameters and the nature of its algorithm
8. Consumer views T&Cs for the service and accepts terms if not already done so
9. Optionally, the Consumer 'saves' (a reference to) the product to their workspace
10. Consumer searches the EP catalogue for input data of interest, by specification of spatial/temporal (and other) characteristics
11. Consumer selects the input data from their search results and/or from their workspace data
12. Consumer specifies the input parameters of the *Processing Service*
13. Consumer requests processing execution
14. The EP checks that the Consumer has the authorisation to launch the *Processing Service* and

access the specified data

15. The EP estimates the cost and duration of the processing and checks the Consumer has enough resources to execute the processing
16. Consumer is presented with the cost/duration estimation and confirms the processing
17. Consumer monitors the status of the processing (%completion, execution logs)
18. When the processing completes successfully the *Processing Results* are made available to the user in their *Workspace*
19. The Consumer's billing account is updated comensurate with the 'cost' of the processing
20. Optionally, the Consumer downloads the results
21. Optionally, the Consumer visualises the processing logs (e.g. for error inspection)
22. Optionally, the Consumer visualises the results and is able to manipulate and parameterise the view - with the possibility to download the result of their visualisation
23. Optionally, the Consumer publishes their results in the catalogue - specifying all necessary metadata to support discovery

NOTE

The use case does not explore how the user obtains/maintains a resource quota in the platform in order to 'pay' for their usage

NOTE

The use case does not consider the possibility of processing services for which the user requires a license key. This would have to be considered as an extension of this case.

2.5. Consumer discovers and executes Interactive Applications

As a Consumer I want to list and search for commercial and non-commercial *Interactive Applications*, by specification of textual and faceted search criteria. I want to be able to incrementally narrow my search with more criteria clauses. For each *Interactive Application* in the search result I want to get more detailed information, including a description and access to its execution manual. If I have not already done so, then any *Terms & Conditions* associated to usage of the *Interactive Application* should be made clear to me, with the opportunity for me to accept the T&Cs before I am authorised to execute the application.

Having started the *Interactive Application* I want to access the application user interface via my web browser, perform analytics accessing EO data, value-added products and other resources available on or outside the platform. I would like to export my Analysis Results (text, products, screenshots etc.) from the application into my EP workspace, allowing me to visualise and download the results. At the conclusion of my analysis session I would like to stop the application to ensure that I am not using unnecessary resources and/or incurring unwanted costs.

As a Consumer, I should be able to request a list of Interactive Application sessions that I currently have 'live' in the system - through which I can manage the sessions by rejoining or stopping as required.

Figure 7 illustrates listing and selection of an Interactive Application, from the Costal TEP platform.

The screenshot shows a web-based interface titled 'Service'. It lists four interactive applications:

Application	Description	Actions
SNAP	Sentinel Toolbox	<button>Start new</button> (play/pause/stop icons)
Ubuntu	Virtual Desktop	<button>Start new</button>
QGIS	Free and Open Source GIS	<button>Start new</button>

Figure 7. Interactive Application - Discovery and selection (<https://www.coastal-tep.eu/>)

Figure 8 illustrates the SNAP application running interactively in the user's web browser, from the Costal TEP platform.

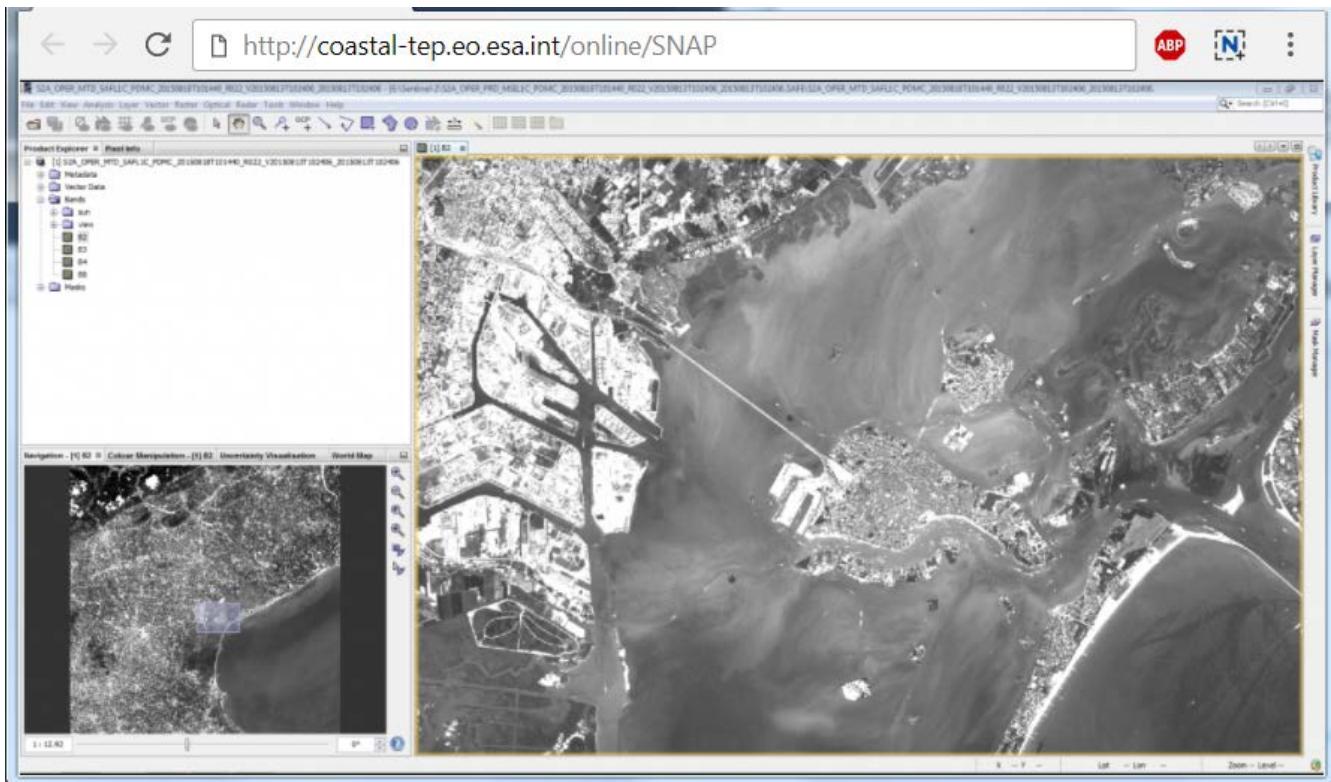


Figure 8. Interactive Application - SNAP running in web browser (<https://www.coastal-tep.eu/>)

1. Consumer logs in on the EP
2. Consumer begins searching for *Interactive Applications* on the EP. The starting point is the full unfiltered set of *Interactive Applications* that contains commercial/non-commercial applications
3. Optionally, the resultset is automatically filtered to include only those services that the Consumer has right to visualise. *It may be the case that the EP chooses to make these 'unavailable applications' visible to the Consumer to publicise their existence*
4. Consumer filters the resultset by any combination of textual search terms and selection of application facets
5. Consumer incrementally adjusts their search criteria to refine the filtered resultset
6. Alternative Flow: [Existing Session Selection](#)
7. Consumer views the description and execution manual for the selected application
8. Consumer selects an *Interactive Application* of interest; the EP checks they are authorised to access the application
9. Consumer views T&Cs for the application and accepts terms if not already done so
10. Optionally, the Consumer 'saves' (a reference to) the application to their workspace
11. Consumer searches the EP catalogue for input data of interest, by specification of spatial/temporal (and other) characteristics
12. Consumer selects the input data from their search results and/or from their workspace data
13. Alternative Flow: [Input Data Selection](#)
14. EP checks that the Consumer is authorised to access the data and has accepted the associated T&Cs - prompting for confirmation of acceptance as required

15. If applicable, the EP estimates the cost for the application/data, checks the Consumer has enough resources to cover this cost, and the Consumer is presented with the cost indication
16. Consumer accepts and starts the Interactive Application, which is presented to them in their web browser
17. The previously selected input data is made available within the execution context of the *Interactive Application*
18. Consumer uses the application to perform analytics using the input data
19. Optionally, the Consumer accesses additional data to be introduced into the analysis within the *Interactive Application*, (the EP checks rights/costs as required)
20. Consumer saves(exports their Analysis Results from the application to be saved on the EP, within their *Workspace*
21. The Consumer's billing account is updated commensurate with the 'cost' of the processing
22. Optionally, the Consumer downloads the results
23. Optionally, the Consumer visualises the results and is able to manipulate and parameterise the view - with the possibility to download the result of their visualisation
24. Optionally, the Consumer publishes their results in the catalogue - specifying all necessary metadata to support discovery

Alternative Flow: Existing Session Selection

Rather than discovering and starting a new application instance, instead they list existing 'live' sessions, that they can rejoin

- a. Consumer obtains a list of their current 'live' interactive sessions
- b. Consumer selects to rejoin an existing session

Alternative Flow: Input Data Selection

Rather than pre-selecting the input data before invoking the *Interactive Application*, it may be preferable (depending on the application) to make the input data selection from within the *Interactive Application*. The use case is not elaborated here in regard of this approach, but it should be ensured that the data access is made within the context of the user's access rights and associated billing considerations.

2.6. Consumer analyses value-added product

This use-case is described in document [EP-UC]. However, it is seen as the same as use-case [Consumer discovers and executes Interactive Applications](#), just with particular emphasis on the inclusion of Value-added Products in the analysis, and perhaps with an associated set of specific tooling in mind (WebGIS, DataCube, etc.).

By way of illustration, [Figure 9](#) provides an example that uses PUMA WebGIS to combine value-added products with in-situ data, taken from the Urban TEP platform.

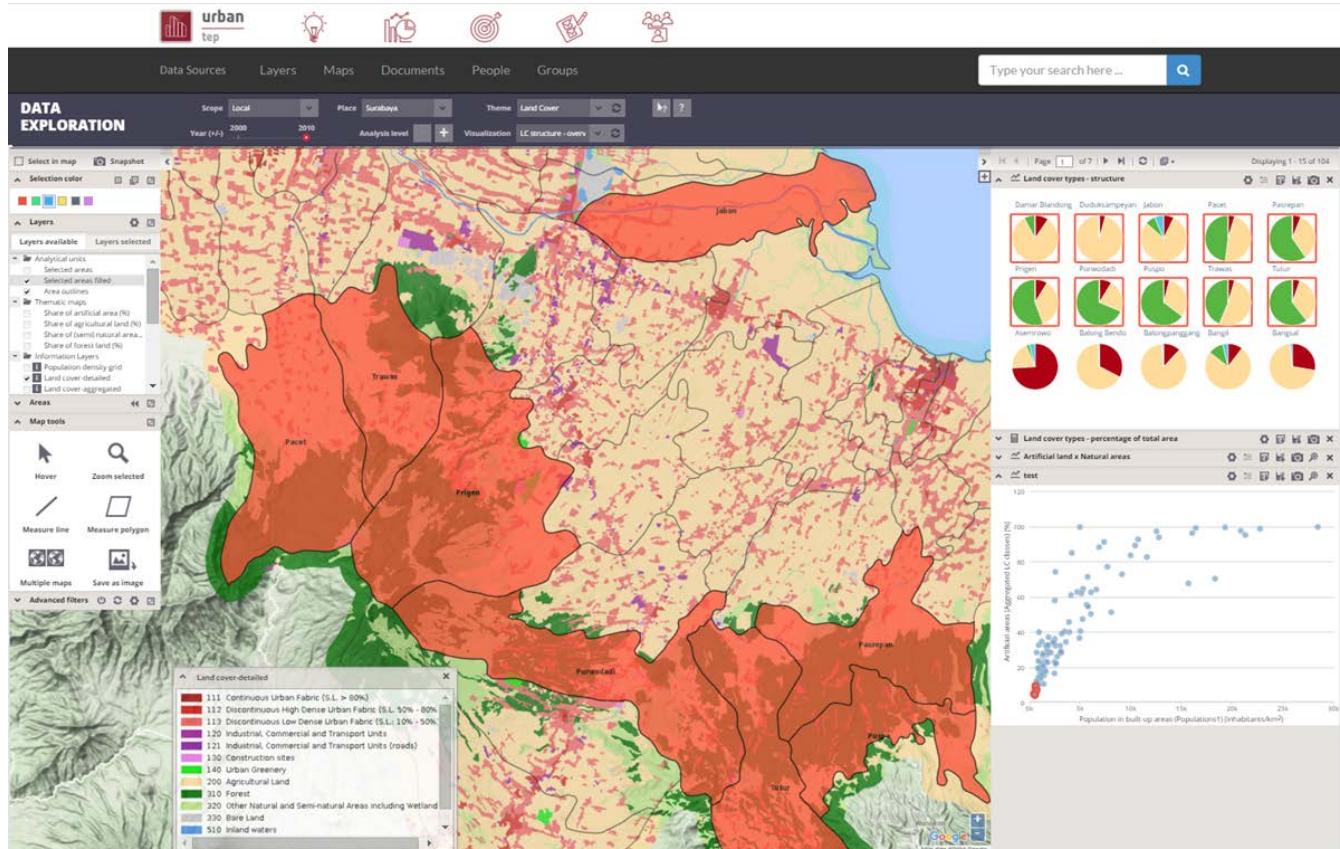


Figure 9. Value Added Products Analyses - PUMA WebGIS (<https://urban-tep.eu/>)

3. Functional Mapping

Identification of functional areas and their mapping to domain areas.