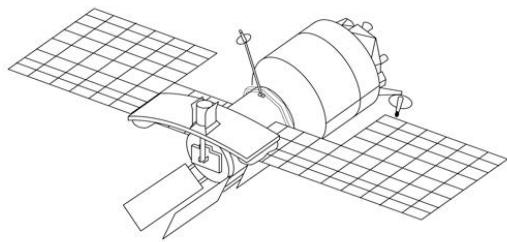




BEYOND Ground Segment Facility The Hellenic Sentinel Data Hub (Mirror Site)

- **Dr Haris KONTOES**
- National Observatory of Athens
- **Dr Xenofon Tsilimparis**
GRNET (GEANT)



www.beyond-eocenter.eu





The 1st Collaborative Ground Segment (Mirror Site) for Sentinel satellite missions was signed between ESA and NOA on 12 May 2014



Activity in the framework of the
COPERNICUS PROGRAM
The **EUROPEAN EARTH OBSERVATION FLAGSHIP PROGRAM (EU/ESA)**
<http://www.copernicus.eu/>

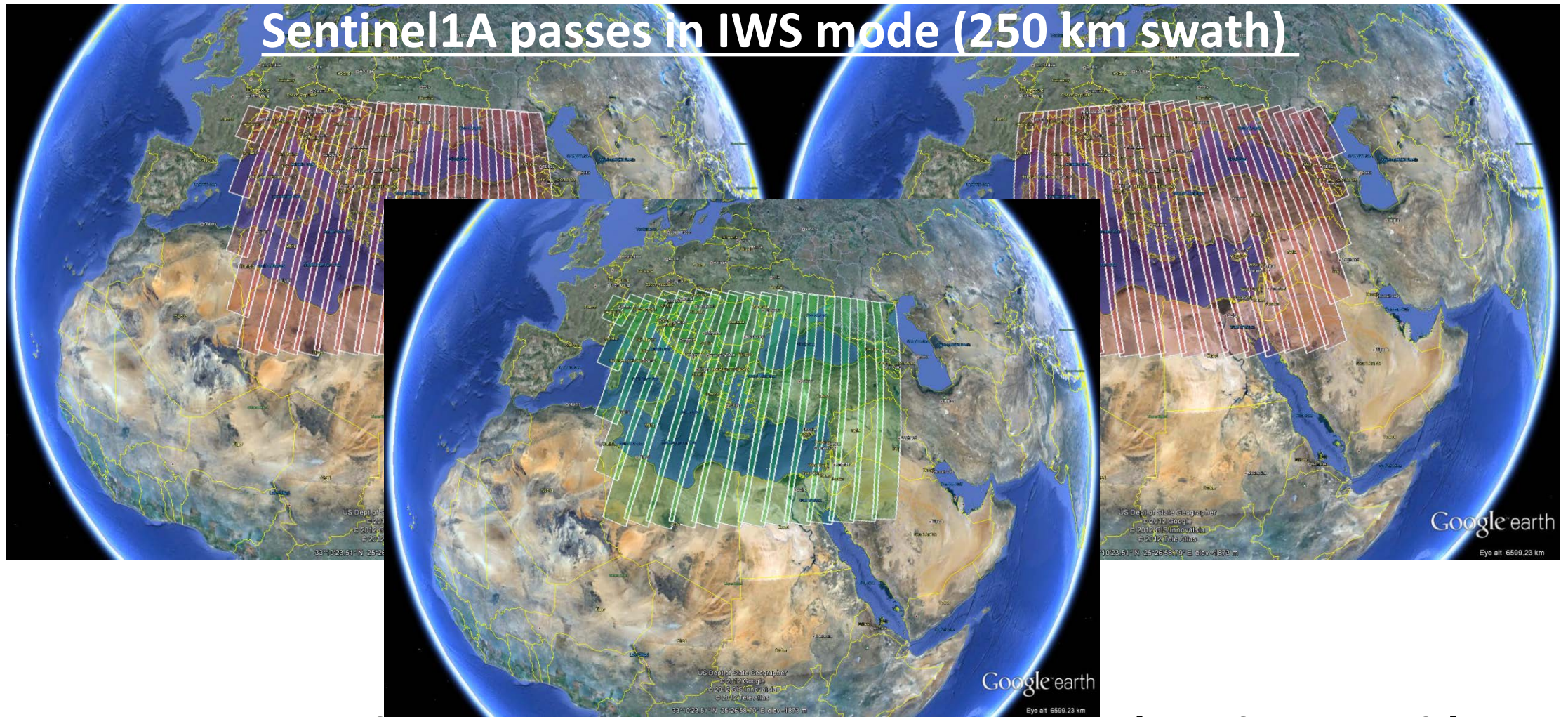




OFFICIAL ANNOUNCEMENT OF
HELLENIC MIRROR SITE
ATHENS: 28 MARCH – 5 APRIL 2015

LINK:
[HTTP://SENTINELS.SPACE.NOA.GR](http://sentinels.space.noa.gr)

- Built up an additional pick up point (**Mirror Site**) of Sentinel data at the premises of the **National Observatory of Athens (NOA)** in collaboration with the **Greek Research and Technology Network GRNET S.A.** the Greek Partner of the GEANT network.
- **Disseminate Sentinel data and higher level Copernicus products** to the End User & Scientific communities mainly at national level, but also to neighboring South Eastern Mediterranean and Balkan countries on the basis of the existing and/or future transnational needs and cooperations.
- The whole project is in line with the ongoing initiatives and strategic objectives for building at NOA a Center of Excellence for EO based monitoring of the Environment and Natural Disasters and processing of Space Data.



ESA has developed a prototype software, the Data Hub System (DHuS), with the scope to:

- Allow Collaborative Partners to centrally access Sentinel data through a dedicated Hub

NOA → ESA's Collaborative Partner for the use of DHuS software

At NOA/GRNET:

- Computational Infrastructure facilities for downloading and storing Sentinel Data, processing of the data, and running the dedicated Coll GS applications. **Action Completed in June 2015**
- A complete set of software tools for the systematic data download and organized storage, as well as distribution of data via a Web interface is available and is under operation by the users. **Action Completed in May 2015**
- Archiving Infrastructure facilities for physical storage of Sentinel data at the premises of NOA are expected to be available for installation, configuration, and final operation. **Action to be Completed in November 2015**

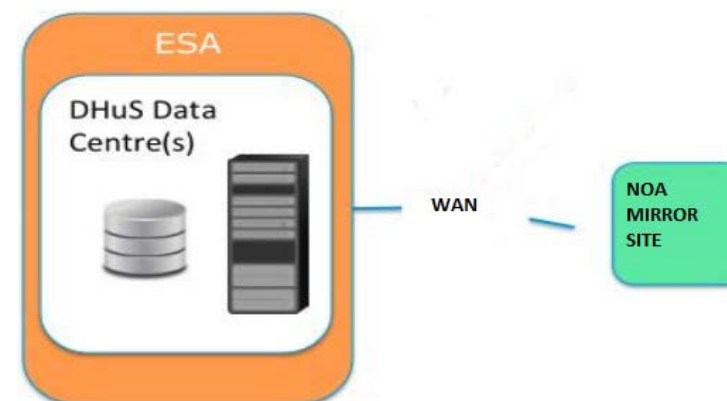
- HighSpeed optical links owned by GRNET/GEANT, are used to connect ESA's Data center(s), with NOA's Mirror Site computational infrastructure
- A set of Virtual Machines (VMs), hosted by the Greek Research & Technology Network (GRNET), are configured and ready for use

OS: Ubuntu Linux 14.04 LTS, 64 Bit.

CPU: 12 CPU's per VM.

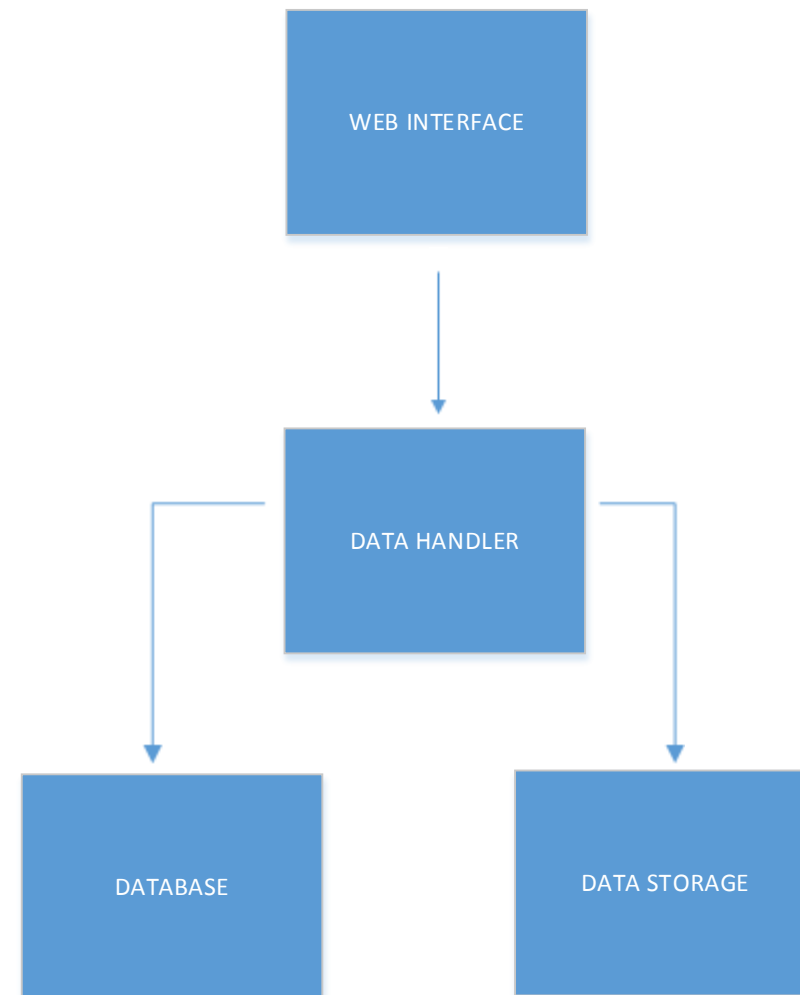
RAM: 24 GB per VM.

Static, dedicated IPv4 and IPv6 addresses



3Level Architecture

- **Web Interface Level 1st:** the user interaction level
- **Data Handling Level 2nd:** The set of scripts that downloads and organizes data
- **Database Level 3rd:** storing metadata and systemwide events
- **Data Storage Level 3rd:** physical storage of data



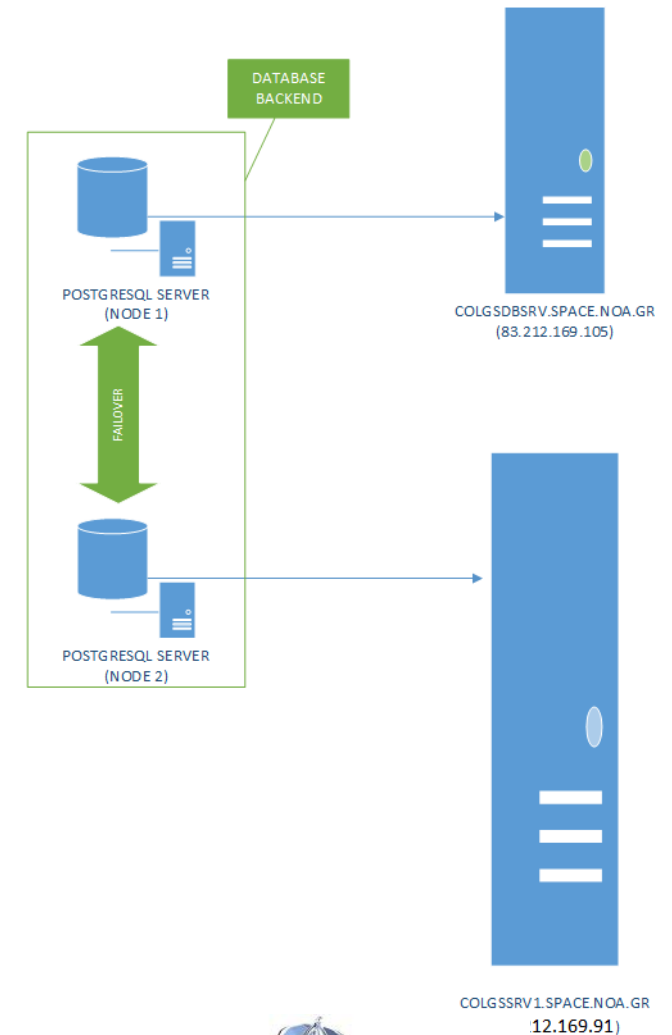
➤ Utilization of 2 Database Servers

- ✓ Main DB
- ✓ Backup DB

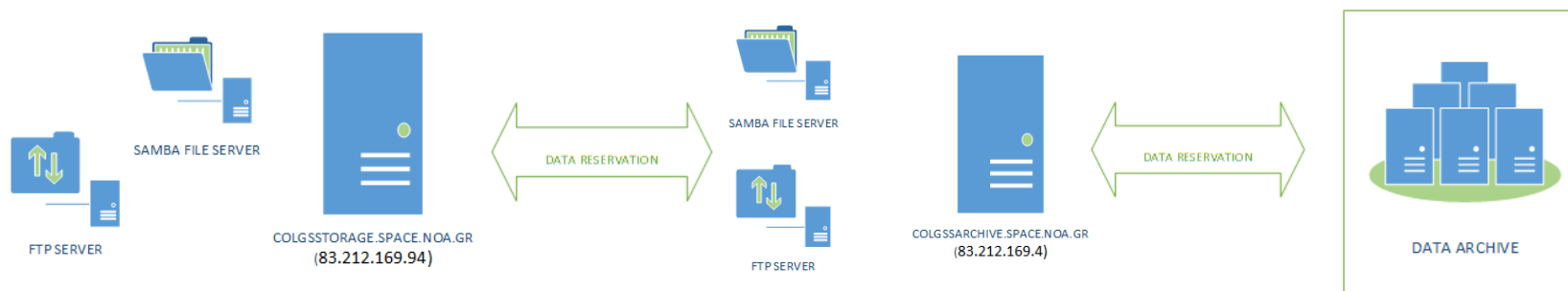
➤ PostgreSQL 9.3

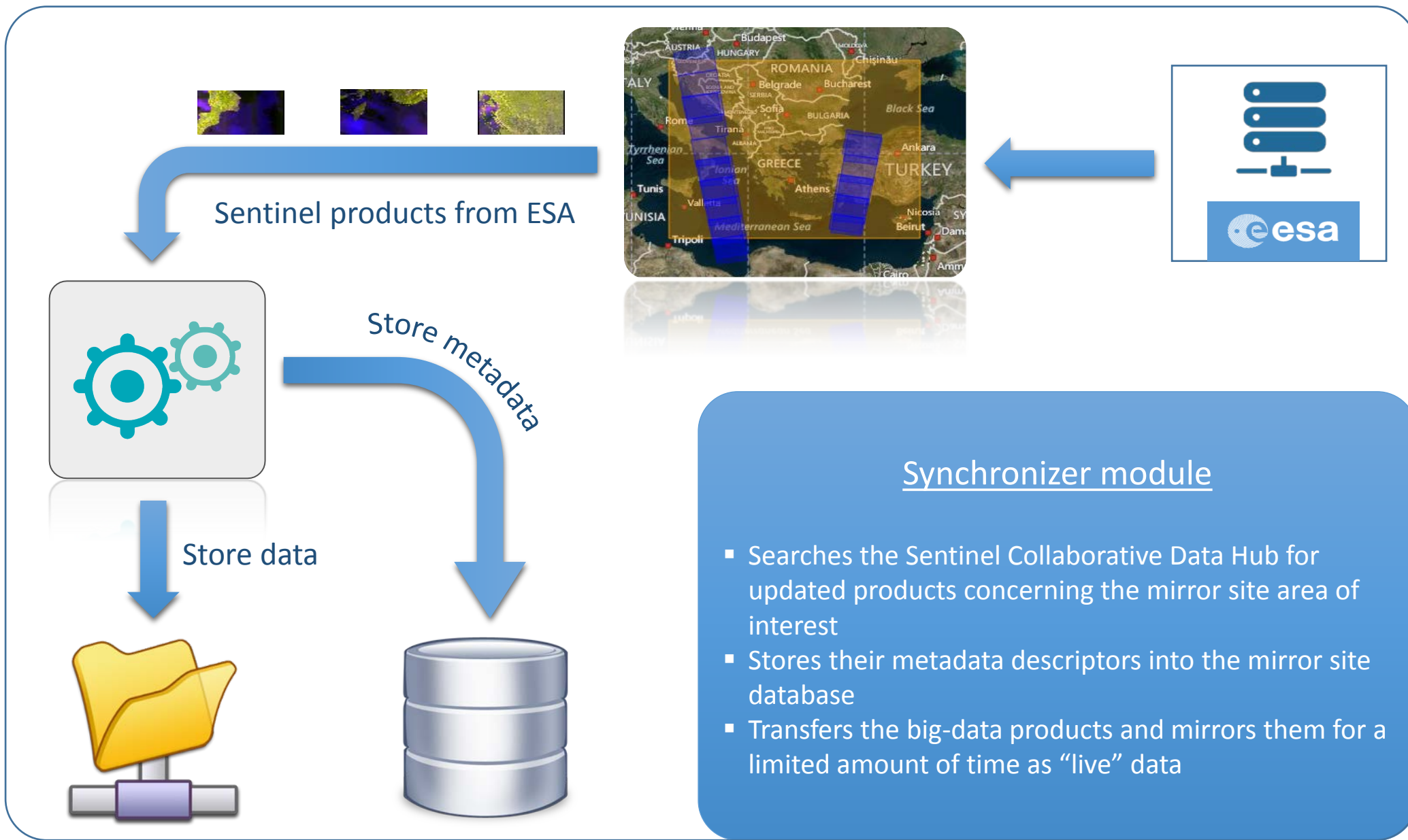
➤ Data Base scheme easily expandable

➤ Organized in cluster for achieving automatic failover, loadbalancing etc



- **Week Storage:** data of the week are kept in a high performant, small storage capacity virtual machine (VM)
- **Month Storage:** data of the month are transferred and kept in a second level storage, in a larger storage capacity VM
- **Year Storage:** older than one month data will be stored at NOA premises in a Hard Disk/Tape Library archiving facility





Downloader module

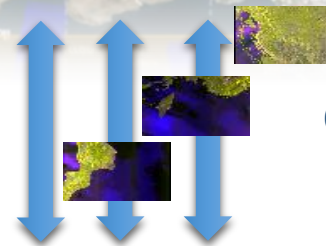
- Gathers the Mirror Site user requests posed through the GUI in the form of orders (i.e. collections of products).
- Concurrently downloads products that are not lying in the local storage.
- Informs users for the availability of the big data products in order to download them via the Mirror Site facilities and its Web GUI.



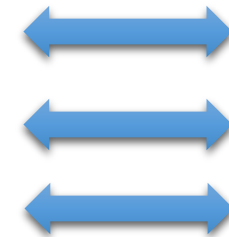
Concurrently store data



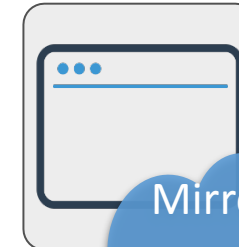
Concurrently update metadata



Concurrent download of Sentinel products from ESA

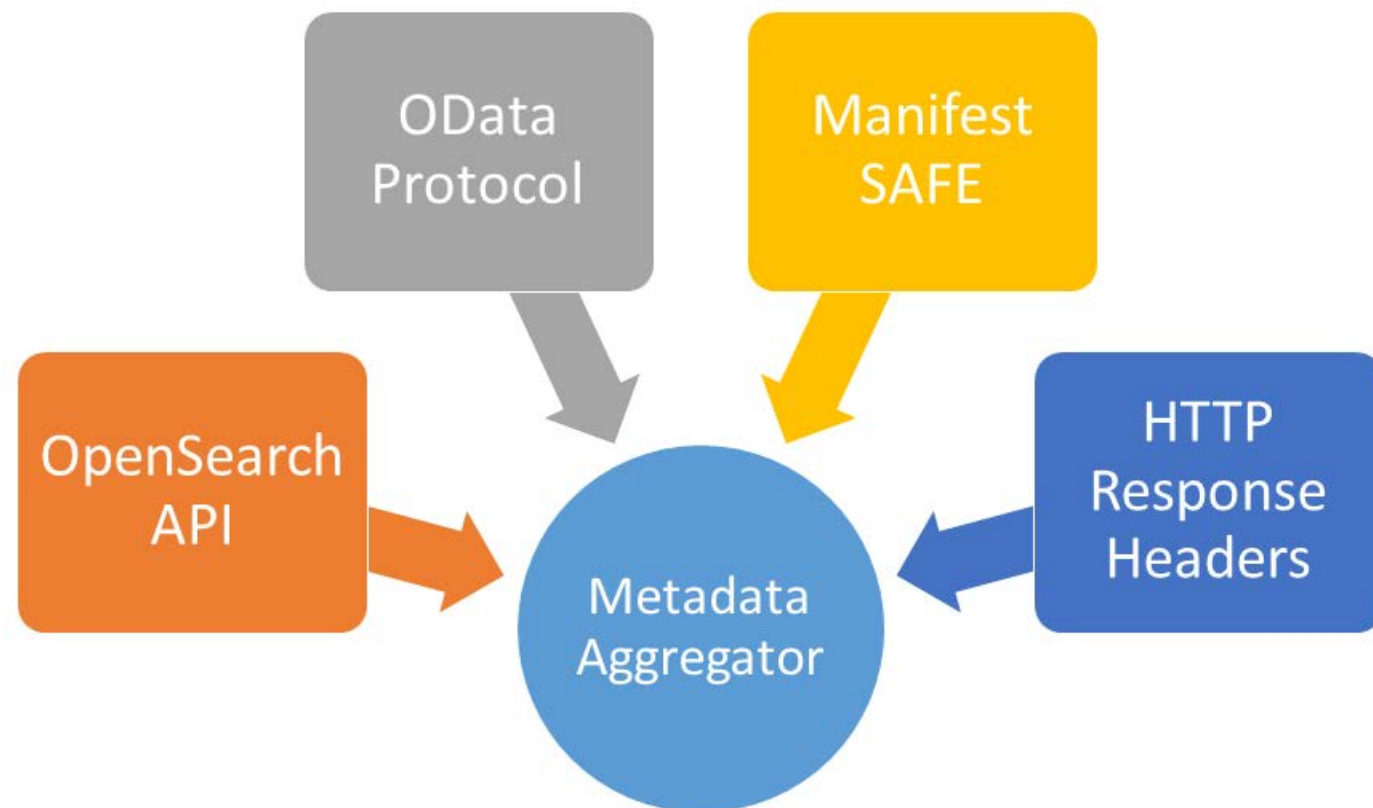


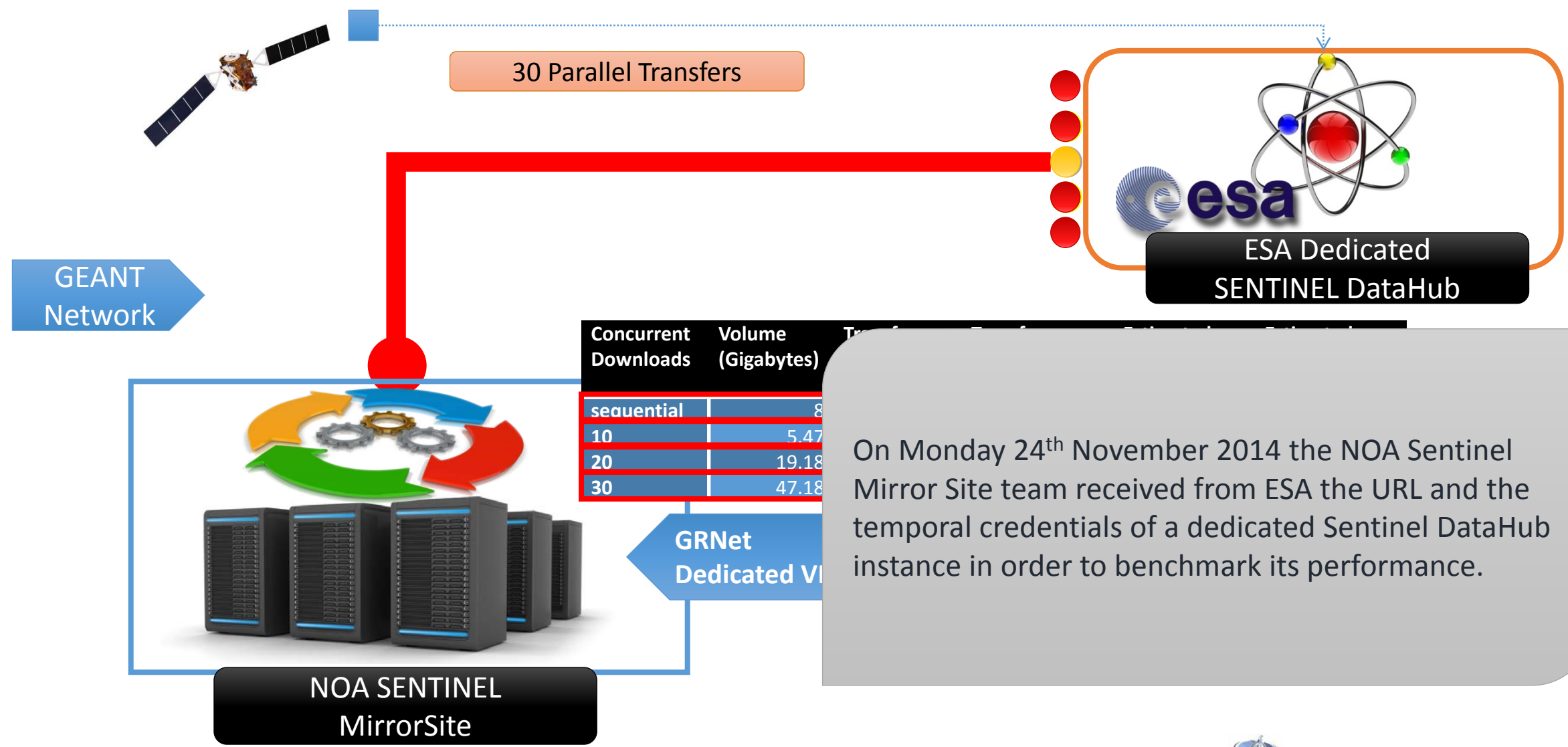
Requests of users for Sentinel products



Mirror site users interacting with the GUI

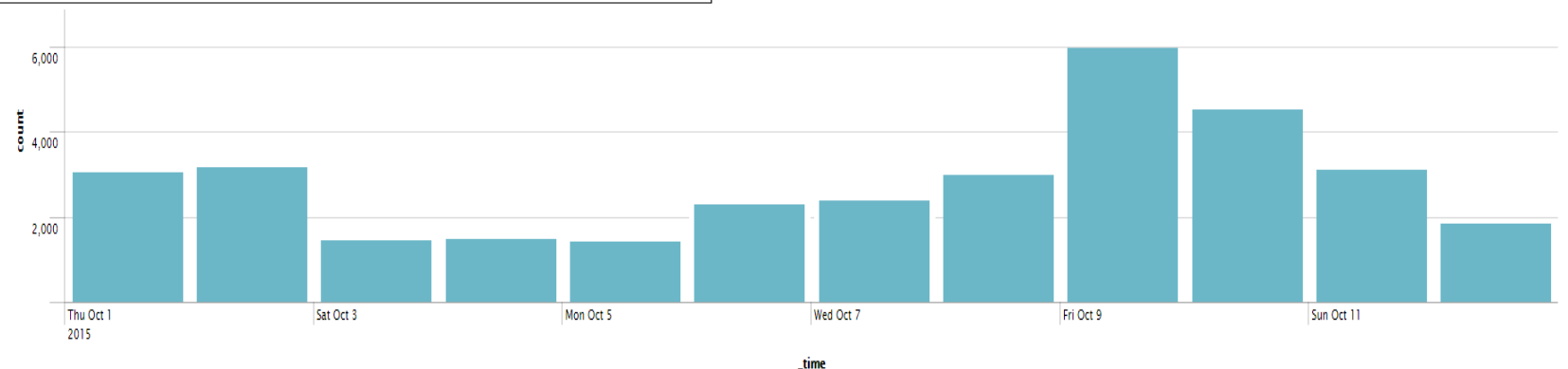
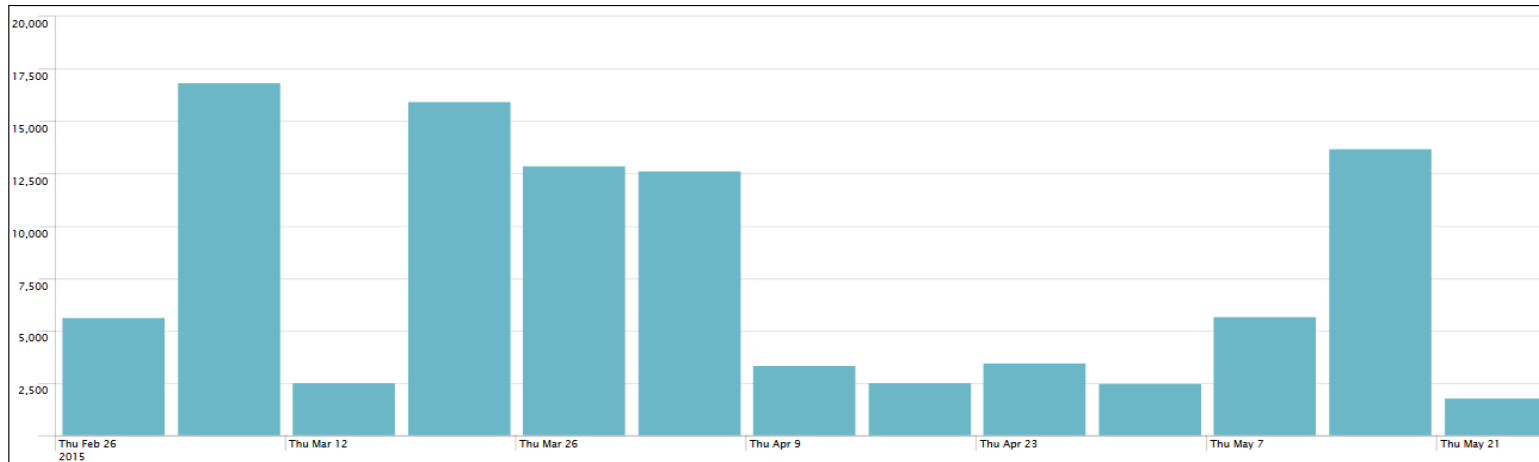
- Four steps in order to aggregate all the metadata for a Sentinel product:
 1. Get metadata through the ESA's OpenSearch API.
 2. Get metadata through the ESA's OData protocol.
 3. Get metadata from the Product's manifest file in SAFE format.
 4. Use HTTP Response headers.
- Parse metadata.
- Rename metadata.
- Catalogue metadata.



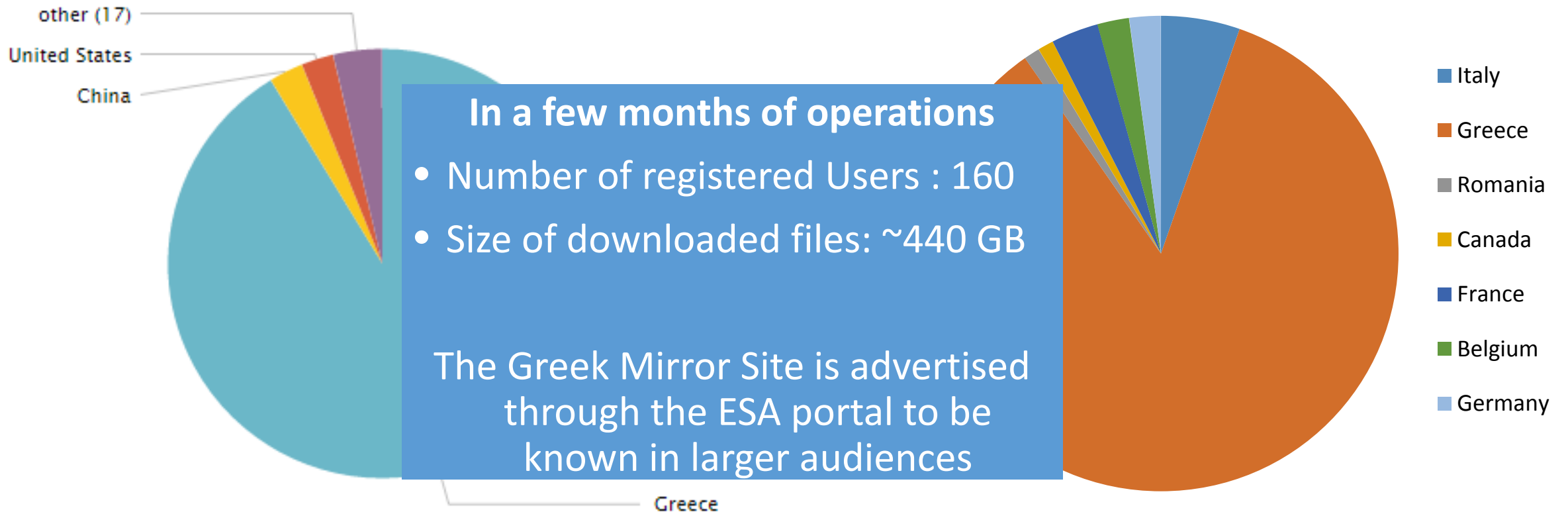


On Monday 24th November 2014 the NOA Sentinel Mirror Site team received from ESA the URL and the temporal credentials of a dedicated Sentinel DataHub instance in order to benchmark its performance.

- **Hits/visits per week of operation:** The Hellenic Sentinel Data Hub attracts a considerable number of visitors.



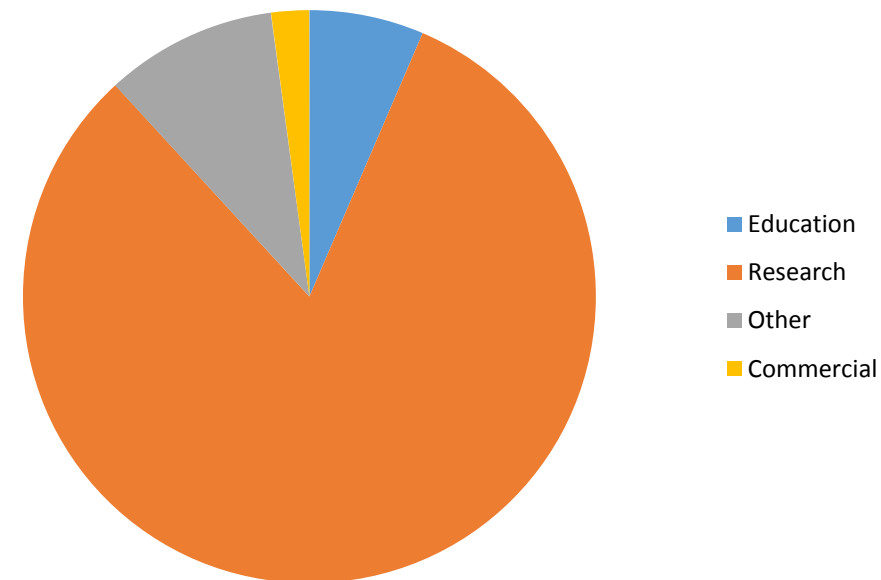
- Spikes were detected **during** and **after** events where the Mirror Site was presented and promoted (e.g. Space Expo).



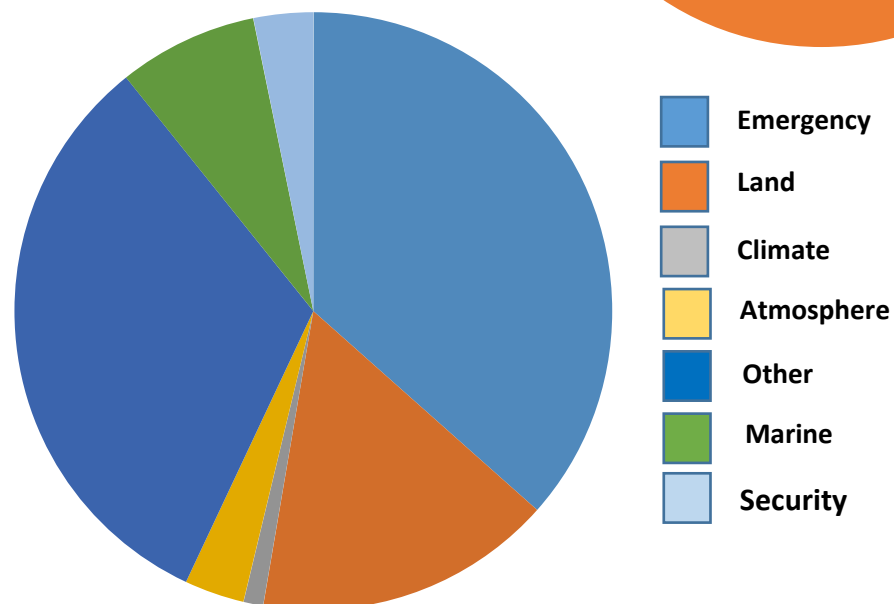
- The distribution of IP addresses accessing the Mirror Site indicates that most visits come from the Greek domain, while there is a considerable number of international visitors

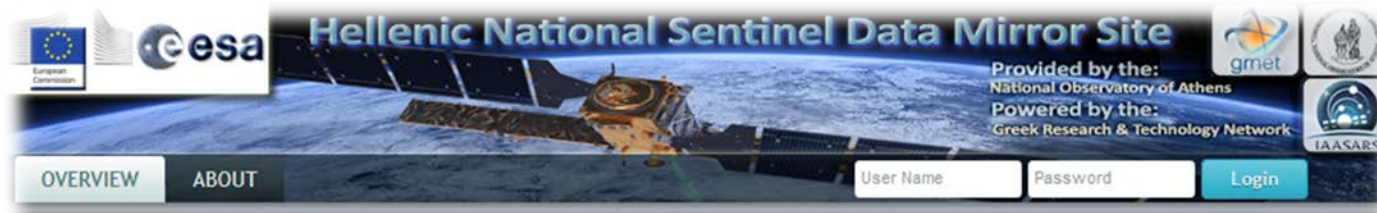
- Most registered users are from Greece but also a number of European and non European countries (France, Belgium, Italy, Romania, Germany, Canada, etc).

- The Hellenic Sentinel Data Hub is **popular** amongst the members of the **scientific community**



- **Emergency, Land, and “Other”** application domains are ranked between the main fields of Sentinel data use





OVERVIEW

The Hellenic National Sentinel Data Mirror Site is a web based system designed to provide EO data users with Search and Dissemination capabilities for the Sentinel products.

This current version is the first operational prototype developed under the current EU-ESA GMES / NOA agreement.

Detailed information on Sentinel products and Data Access mechanisms is available at <https://sentinel.esa.int/web>

References

- ▶ <http://www.copernicus.eu/>
- ▶ <https://sentinel.esa.int/>

NOA Sentinel Mirror Site GUI Provides a registration mechanism so that new users can obtain access to Catalogue Search and Order facilities

Register at the Hellenic National Sentinel Data Mirror Site. [REGISTRATION](#)

View the Hellenic National Sentinel Data Mirror Site User Manual.

<p>NOA Hellenic National Sentinel Data Mirror Site Team NOA Official: Prof. Kanaris C. Tsinganos, President of NOA Scientific Coordinator: Dr. Haris Kontoes, Research Director WebMaster: MSc. Themistocles Herekakis, Research Associate Development: MSc. Vassilis Tsironis, Research Associate Curator: Mr. Vaggelis Papakirikou, Research Associate</p>	 National Observatory of Athens	<p>Last Updated: 12 February 2015 Copyright © 2015 All Rights Reserved NOA Web Site: www.noa.gr IAASARS Web Site: www.astro.noa.gr Contact Us</p>
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Web Template created with Artisteer

OVERVIEW

The Hellenic National Sentinel Data Mirror Site is a web based system designed to provide EO data users with Search - Cataloguing - Order and Dissemination capabilities for the Sentinel products.

This current version is the first operational prototype developed under the current EU-ESA GMES / NOA agreement.

Detailed information on Sentinel products and Data Access mechanisms is available at <https://sentinel.esa.int/web/sentinel/sentinel-data-access>

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- ▶ <https://sentinel.esa.int/>

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National Observatory of Athens

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Web Template created with Artisteer.

...with the applied credentials users may login to access the Search – Order and Data access facilities

necessary their account is information

...the catalogue of queried products provides more information regarding the spatial coverage, the attributes and their order status.

.. and then by querying the desired date range and product attributes...

The screenshot shows the GUI interface with a map of the Mediterranean region and a data table. The map displays various satellite swaths over the area. The data table below the map lists queried products with columns for QLook, Platform, Level, Instrument, Prod.Type, Mode, Swath, Direction, Polarization, Start Date, Stop Date, Preview, and Order. The 'Order' column contains icons for 'In order', 'Remove from order', and 'Add to order'.

QLook	Platform	Level	Instrument	Prod.Type	Mode	Swath	Direction	Polarization	Start Date	Stop Date	Preview	Order
	SENTINEL-1	SAR Slice L0 product	SAR	RAW	IW		ASCENDING	VV	2015-01-27 17:22:33.294807	2015-01-27 17:23:05.694694		
	SENTINEL-1	SAR Slice L0 product	SAR	RAW	IW		ASCENDING	VV	2015-01-28 16:23:31.023506	2015-01-28 16:24:03.4235		
	SENTINEL-1	SAR Slice L0 product	SAR	RAW	IW		ASCENDING	VV	2015-01-27 17:20:53.293342	2015-01-27 17:21:25.693336		

In order

Remove from order

Add to order

Add to Order



The Cart preview page offers cart management facilities. Users can submit the present session's selected products thus creating a new order cart...

OID	Date Submitted	Date Expired	Status
Order with ID: 52	2015-02-20 17:48:19.823876	-	In Queue
Order with ID: 53	2015-02-20 17:49:25.721513	-	In Queue
Current Order	Submit when ready >>>	-	Submit Order

QLook	Platform	Level	Instrument	Prod.Type	Mode	Swath	Direction	Polarization	Start Date	Stop Date	Preview	Order
	SENTINEL-1	SAR Standard L1 Product	SAR	GRD	IW	IW	ASCENDING	VH	2015-01-26 18:40:40.810257	2015-01-26 18:41:05.809273		
	SENTINEL-1	SAR Standard L1 Product	SAR	SLC	IW	IW3	DESCENDING	VH	2015-01-26 05:35:55.487505	2015-01-26 05:38:12.801456		
	SENTINEL-1	SAR Standard L1 Product	SAR	SLC	IW	IW3	DESCENDING	VH	2015-01-30 05:03:02.825174	2015-01-30 05:03:31.134295		

3 entries

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National Observatory of Athens

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...and view the status of the previously submitted order cart. The status of the Sentinel products under the carts is depicted by a number of indicators.

CART

The product is located at ESA DataHub

The product is being downloaded

The product is corrupted

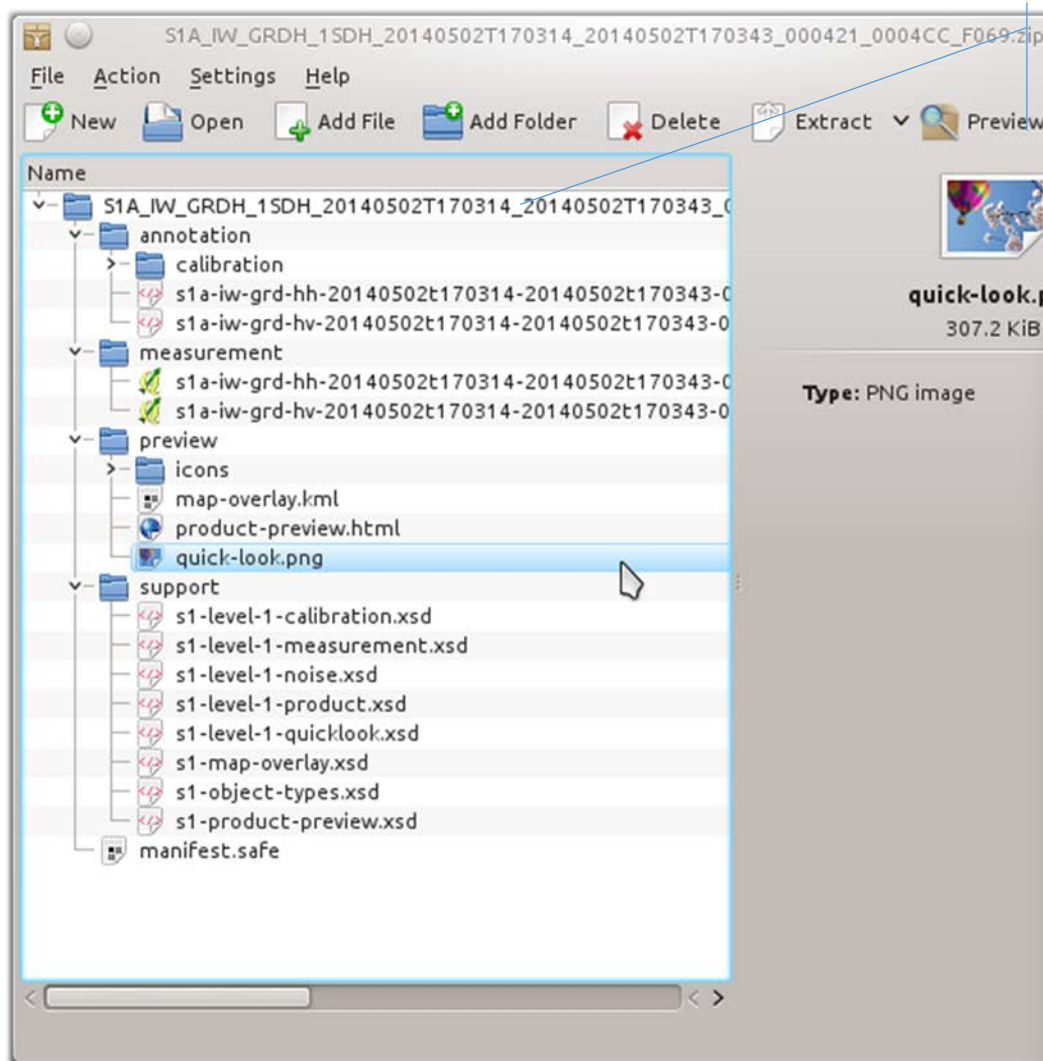
The product is ready to download

QLook	Platform	Level	Instrument	Prod.Type	Mode	Swath	Direction	Polarization	Start Date	Stop Date	Preview	Order
	SENTINEL-1	SAR Standard L1 Product	SAR	GRD	IW	IW	ASCENDING	VH	2015-01-26 16:40:40.810257	2015-01-26 16:41:05.809273		
	SENTINEL-1	SAR Standard L1 Product	SAR	SLC	IW	IW3	DESCENDING	VH	2015-01-26 05:35:55.487505	2015-01-26 05:36:12.801456		
	SENTINEL-1	SAR Standard L1 Product	SAR	SLC	IW	IW3	DESCENDING	VH	2015-01-30 05:03:02.825174	2015-01-30 05:03:31.134295		

CART

...the Hellenic Sentinel Data Hub user is free to download locally the available Sentinel products

QLook	Platform	Level	Instrument	Prod.Type	Mode	Swath	Direction	Polarization	Start Date	Stop Date	Preview	Order
	SENTINEL-1	SAR Standard L1 Product	SAR	GRD	IW	IW	ASCENDING	VH	2015-01-26 16:40:40.810257	2015-01-26 16:41:05.809273		
	SENTINEL-1	SAR Standard L1 Product	SAR	SLC	IW	IW3	DESCENDING	VH	2015-01-26 05:35:55.487505	2015-01-26 05:36:12.801456		
	SENTINEL-1	SAR Standard L1 Product	SAR	SLC	IW	IW3	DESCENDING	VH	2015-01-30 05:03:02.825174	2015-01-30 05:03:31.134295		



...and inspect their content





New Collaborative Ground Segment Features

- The Hellenic Sentinel Data Hub boosts its popularity by allowing all members of the Greek Academic community (professors, students, researchers) to securely login via their academic credentials.
- The Hellenic Sentinel Data Hub has joined the GRNET's SSO Federation, which is based on **Shibboleth**.
- Enhanced security using secure http (https) connections



Shibboleth

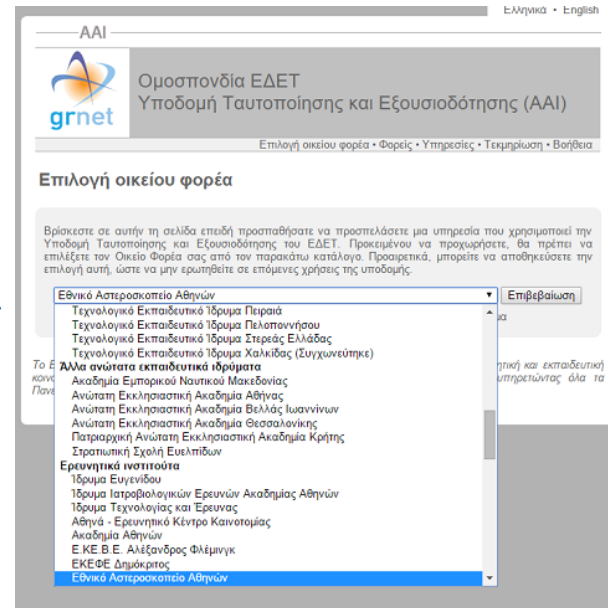
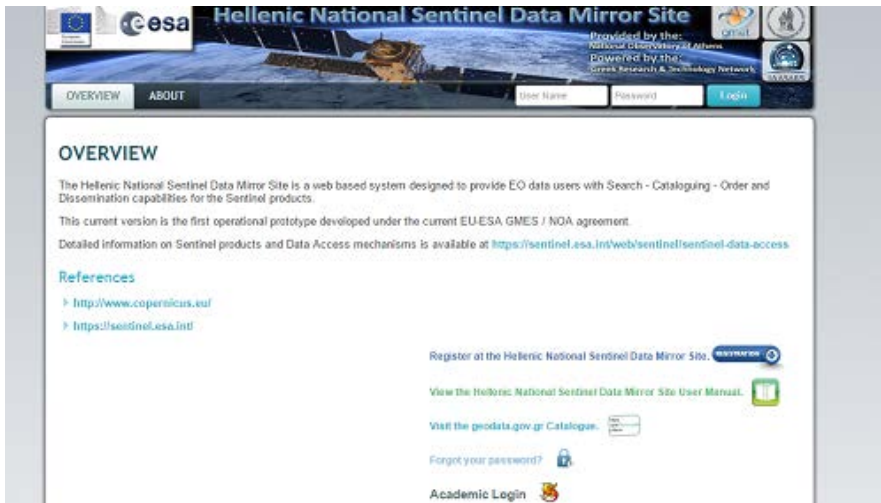
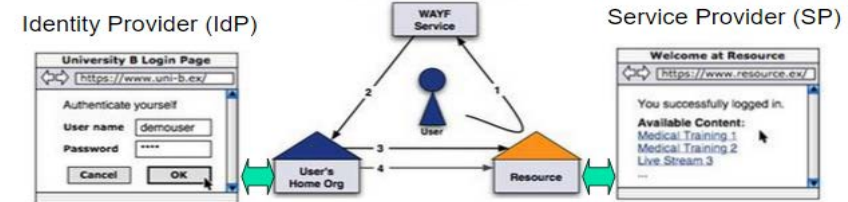
Main WAYF Server



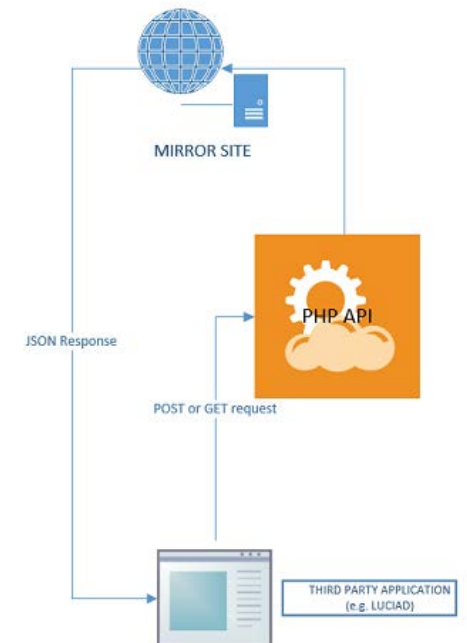
Identity Provider (IdP)



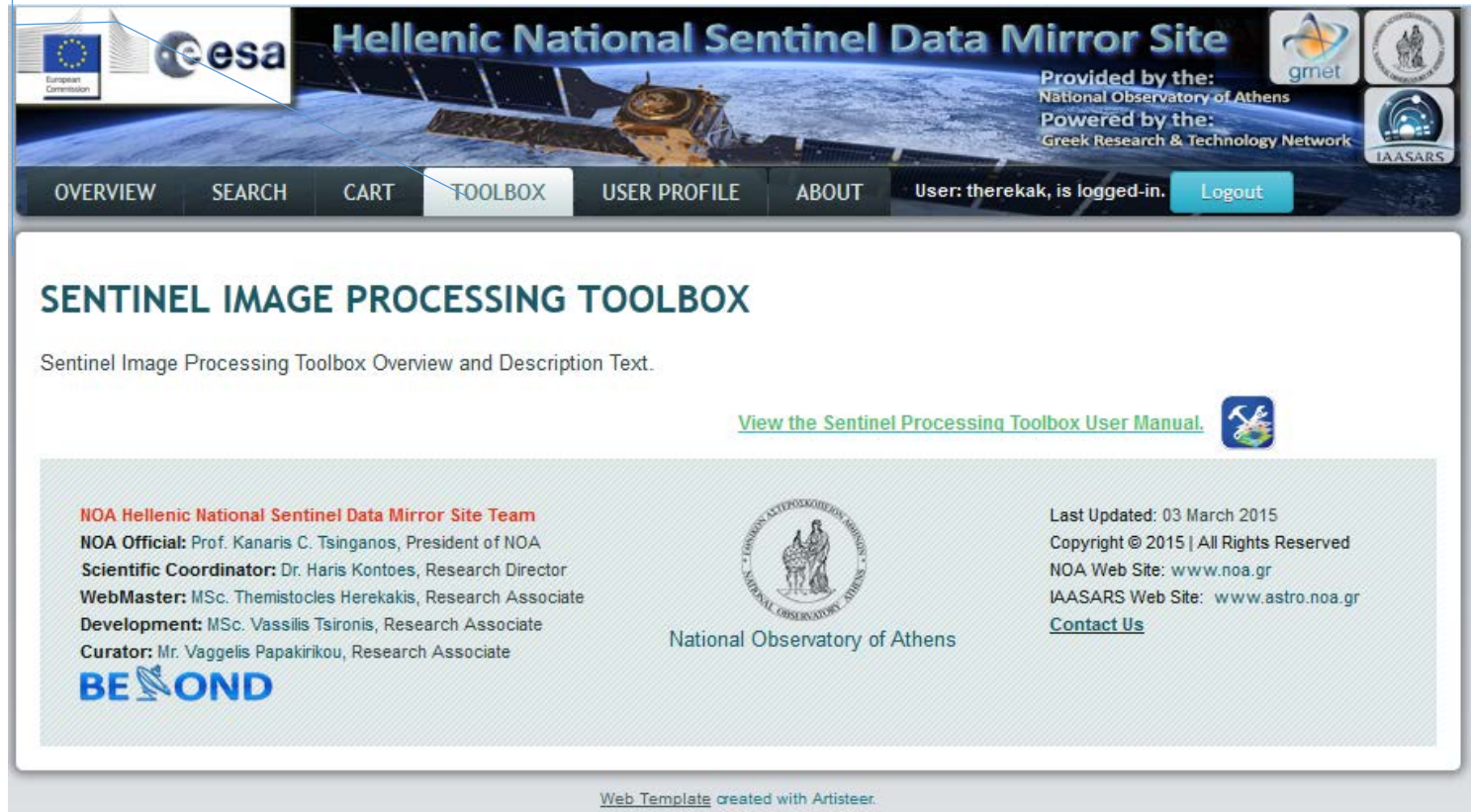
Service Provider (SP)



- The Hellenic Sentinel Data Hub also expands its functionality by exposing a simple API which can be used by third party applications and services.
- All basic functionalities (login, search, order fetching, downloading of already ordered items) can now be performed via HTTP POST and GET requests.



The SENTINEL Image Processing Toolbox application is accessible via the Hellenic Mirror Site and the “TOOLBOX” menu item.



SENTINEL IMAGE PROCESSING TOOLBOX

Sentinel Image Processing Toolbox Overview and Description Text.

[View the Sentinel Processing Toolbox User Manual.](#)

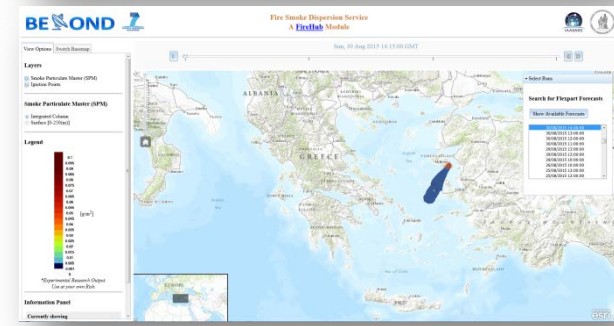
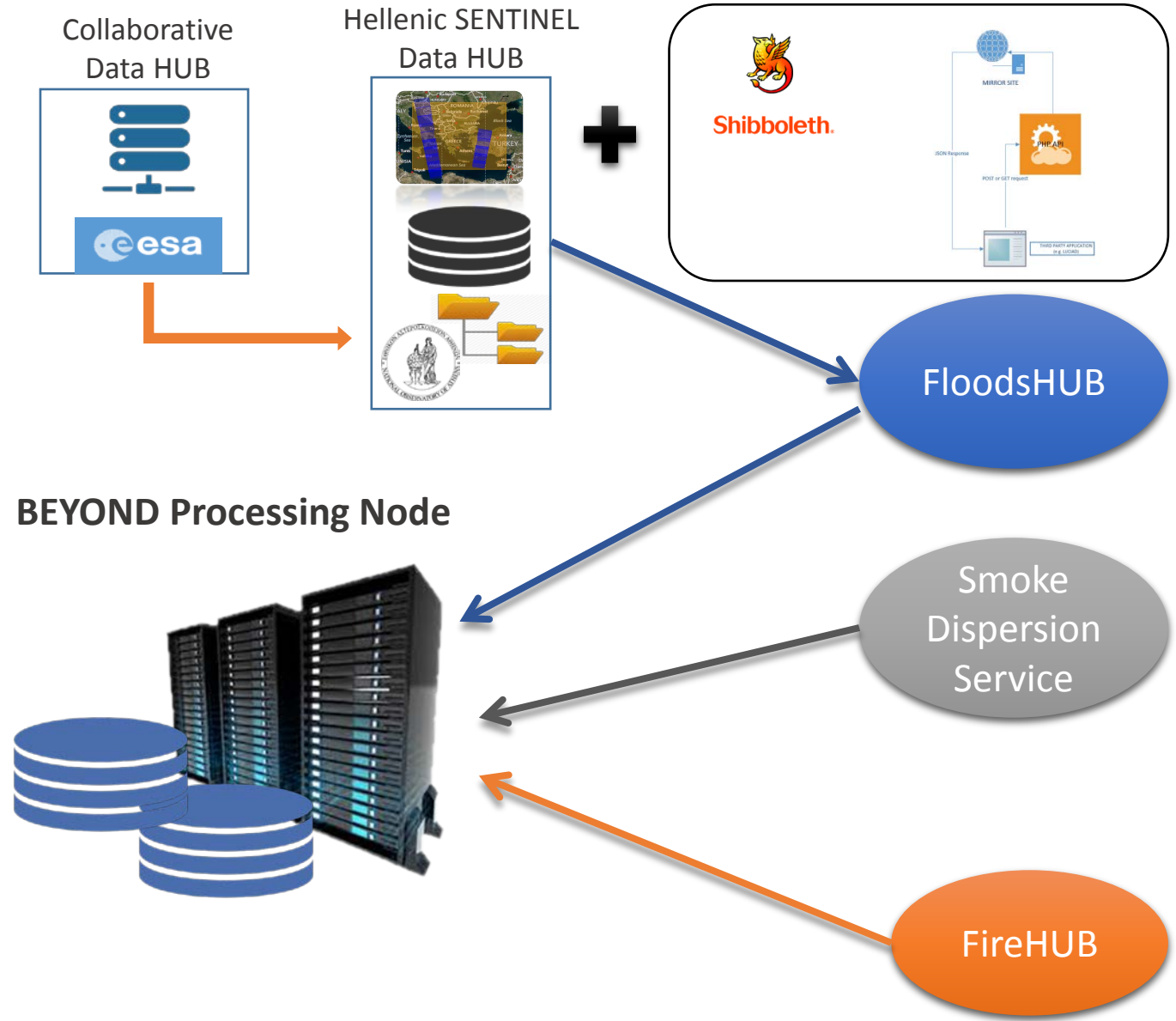
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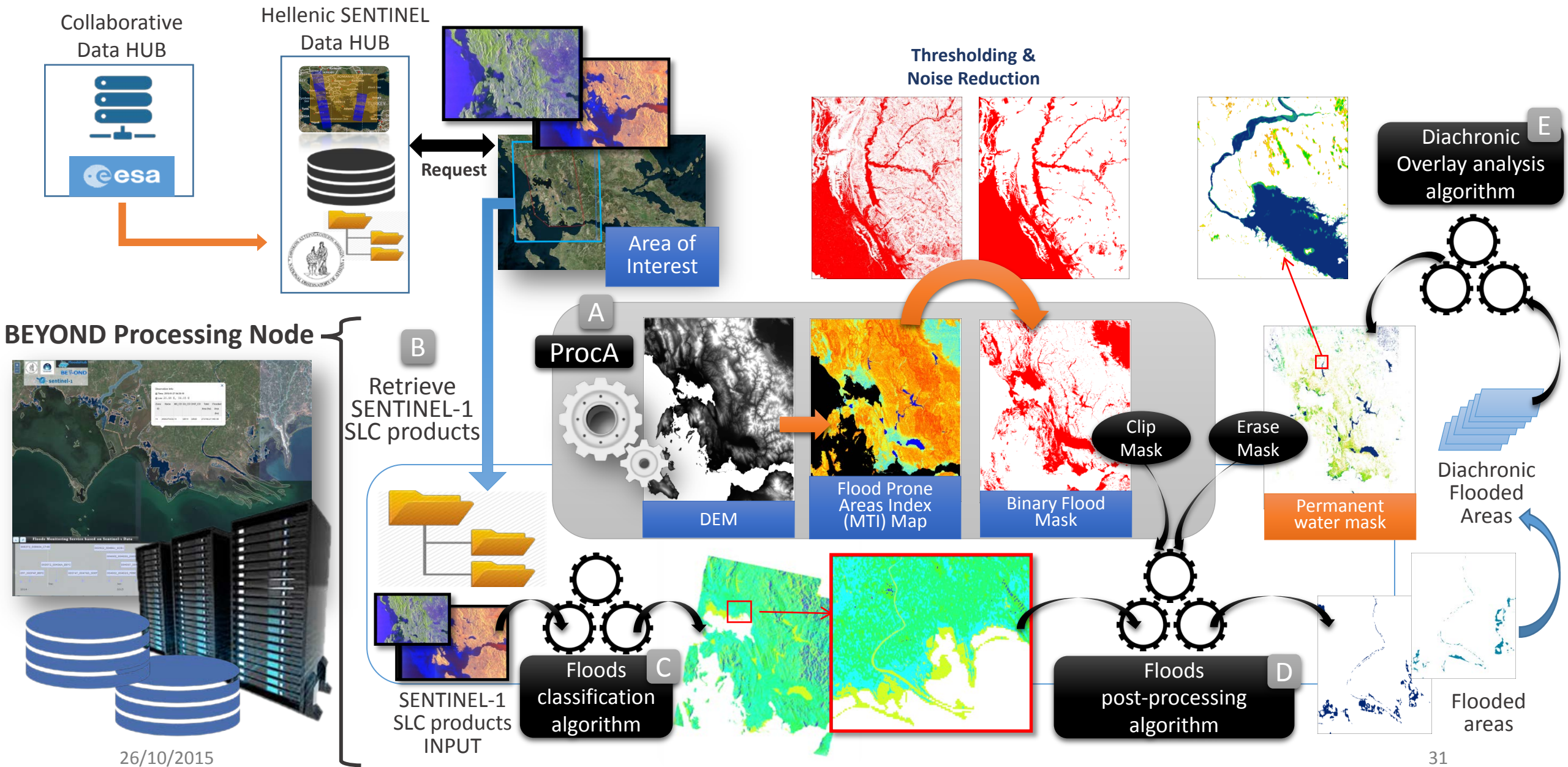
BEOND

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 NOA Web Site: www.noa.gr
 IAASARS Web Site: www.astro.noa.gr
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Web Template created with Artisteer.





➤ IAASARS has empowered its computational infrastructure with high-performance server hardware.

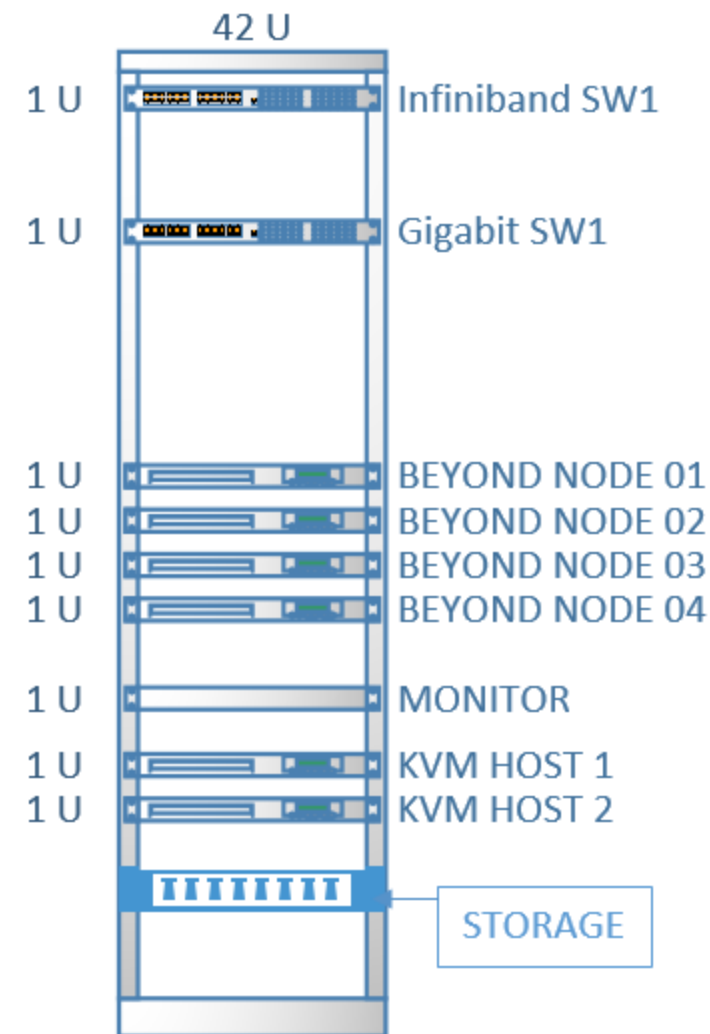
➤ BEYOND NODE 01-04:

- Model: Dell PowerEdge R620
- CPU: 2x Xeon 8 Core
- RAM: 64GB
- OS: Centos 6.6 Minimal

➤ PowerVault MD3400, 12G SAS, 2U-12 drive

➤ 2 KVM Virtualization Servers

- Model: Dell PowerEdge R815
- CPU: 2x AMD Opteron 6128
- RAM: 512GB
- OS: RHEL 6.0 64-bit (Dell pre-installed image)

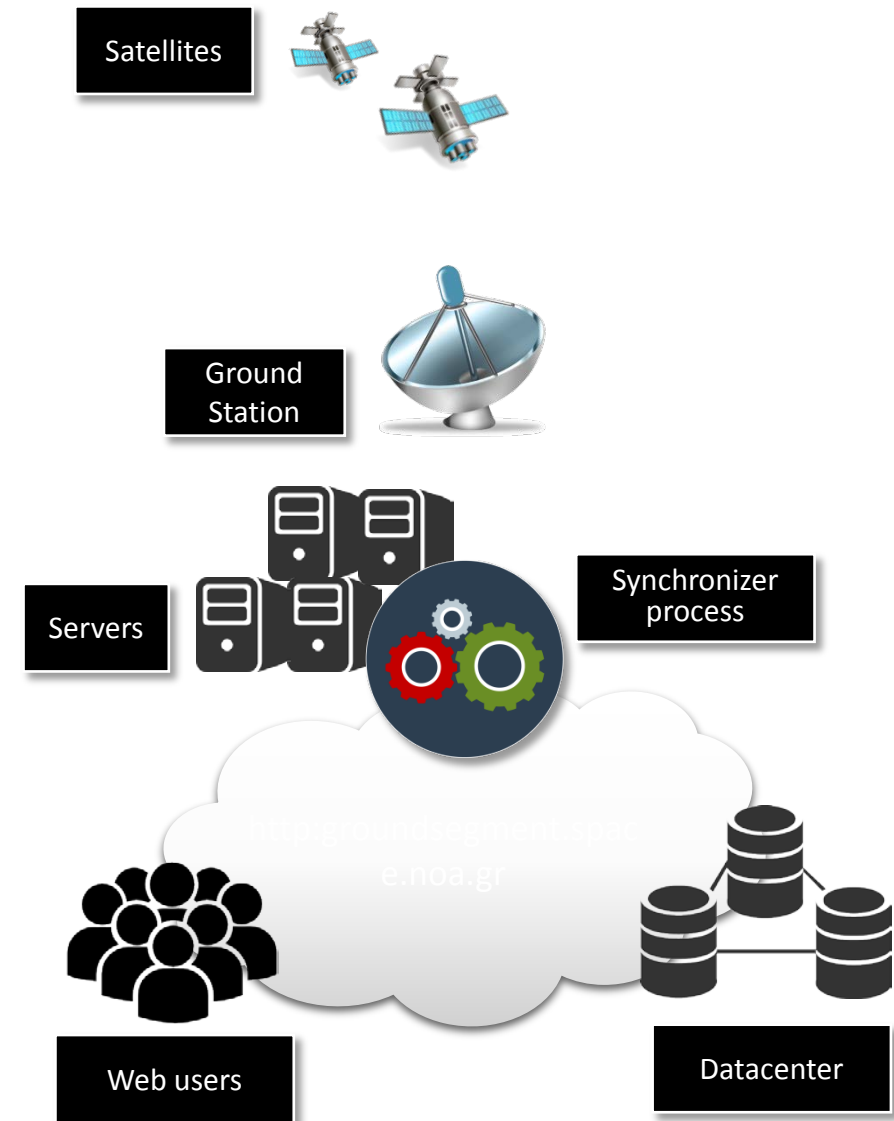


BEYOND's Complementary Ground Segment Facility

An introduction to complementary GS facilities for
Receiving, Cataloguing, Searching, Viewing &
Downloading data from contemporary satellites

- ▶ The ground segment architecture is based on the N-tier paradigm.
- ▶ The 1st tier comprises the ground station and the servers used for acquisition and processing.
- ▶ The 2nd tier comprises the datacenter and the backend processes used to extract and store metadata in the catalogues (e.g. Synchronizer process).
- ▶ The 3rd tier constitutes the frontend that is used to allow the users to search, view and download products. Ground Segment on the cloud!

Architecture



- Web-enabled graphical user interface (GUI).
- User friendly.
- Clean separation with backend functionalities.
- Home page:
<http://groundsegment.space.noa.gr/>

The screenshot shows the 'Ground Segment Data Hub' website. At the top, there is a header with the title 'Ground Segment Data Hub' and a login section with fields for 'USERNAME:' and 'PASSWORD:', and buttons for 'Login' and 'REGISTER'. Below the header is a large banner image with the text 'BEYOND Building a Centre of Excellence for EO-based monitoring of Natural Disasters'. The banner features a globe, a satellite, and icons representing various natural disasters like fire, volcano, and sun. Below the banner, there are two main sections: 'ABOUT GROUND SEGMENT' and 'SEARCH FOR DATA'. The 'ABOUT GROUND SEGMENT' section includes a small IAASARS logo and a text box stating 'This is the web application that enables users to retrieve data from ground segment.' with a 'READ MORE >' link. The 'SEARCH FOR DATA' section has a search box with a dropdown menu labeled 'Select Satellite: Select a Satellite' and a 'New Search' button. At the bottom of the page, there is a copyright notice 'Copyright © 2015 - All Rights Reserved - groundsegment.space.noa.gr' and a 'Last Updated: October 12 2015, 16:22:15.' timestamp.

User Interface – Introduction

- Select a satellite:

SEARCH FOR DATA

Select Satellite:

- Select a Satellite
- Aqua
- Terra
- NPP
- Metop-A
- Metop-B
- NOAA 18
- NOAA 19

face.noa.gr

Last Updated: October 12 2015, 16:22:15.

- Select an instrument:

SEARCH FOR DATA

Select Satellite:

Select Instrument:

- Select instrument...
- Moderate Resolution Imaging Spectroradiometer
- Atmospheric Infrared Sounder

Each selection generates next step's available options.

User Interface – A Search scenario (1)

- Select a Product:

SEARCH FOR DATA

Select Satellite:

Select Instrument:

Select Product:

- Select product...
- MODIS Raw Radiances in Counts 5-Min L1A Swath (2)
- MODIS On-Board Calibrator and Engineering Data 5-Min L1B (3)
- MODIS Calibrated Radiances 5-Min L1B Swath 1km (3)
- MODIS Calibrated Radiances 5-Min L1B Swath 500m (3)**
- MODIS Calibrated Radiances 5-Min L1B Swath 250m (3)
- MODIS Geolocation Fields 5-Min L1A Swath 1km (2)
- MODIS Aerosol 5-Min L2 Swath 10km (4)
- MODIS Clouds 5-Min L2 Swath 1km and 5km (4)
- MODIS Atmospheric Profiles 5-Min L2 Swath 5km (4)
- MODIS Snow Cover 5-Min L2 Swath 500m (4)
- MODIS Land Surface Temperature and Emissivity 5-Minute L2 Swath 1km (4)
- MODIS Gridded Vegetation Indices (NDVI & EVI) (4)
- MODIS Thermal Anomalies - Fires and Biomass Burning (4)
- MODIS Sea Ice Cover (4)
- MODIS Cloud Mask (4)
- MODIS Surface Reflectance; Atmospheric Correction Algorithm Products (4)
- MODIS Sea Surface Temperature (4)

pace.noa.gr 16:22

- Select a date range to search for products that became available (i.e. ingested) during that range:

SEARCH FOR DATA

Select Satellite:

Select Instrument:

Select Product:

From: To:

New Search

October 2015

Mo	Tu	We	Th	Fr	Sa	Su
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

pace.noa.gr 15, 16:22:15.

User Interface – A Search scenario (2)

SEARCH FOR DATA

rom

ORE »


Select Satellite:

Select Instrument:

Select Product:

From: To:

RESULTS:

Size (MB)	Product ID	Sat ID	Product Info		
	444	21	27424	Ingestion	2015-10-09 12:36:47.434357
				Sensing Start	2015-10-09 12:08:50.073
				Sensing Stop	2015-10-09 12:17:37.027
				Orbit	0
				Elevation	0
				Direction	D
				Location	OH
				Daytime	1

- The search function returns a list of the available products, alongside with useful info (metadata).
- Straight-forward download of the product.
- More features to come: more filter options, customized sorting, on the fly compress/download of multiple products etc.

User Interface – A Search scenario (3)

Thank you and
any questions?



The GS Facility