

# SSA DC-IV NEO Fireball Information System

ESRIN, 02/02/2016  
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# ToC - Agenda

- Introduction
- Project review
- Technical review
- Lessons learned & way forward
- Questions/AOB



# Introduction

# Context

- SSA : Space Situational Awareness
- Predict and assess the risk
  - due to man-made space debris objects,
  - potential impacts of Near-Earth Objects (NEOs),
  - and the effects of space weather phenomena on space- and ground-based infrastructure.
- ESA SSA program composed of three segments
  - SWE : Space Weather
  - NEO : Near-Earth Objects
  - SST : Space Surveillance and Tracking

# Context

- DC-IV WP-NEO: Fireball, Impacts and Atmospheric Explosions Database
- Fireball :
  - A bright meteor with an apparent visual magnitude of -4 mag. or brighter.



# Objectives

- Develop a fireball database to be included in the NEO Web portal
- This database should contain fireballs with a magnitude larger than -10
- Observations starting from 01/01/2010

esa space situational awareness European Space Agency

ESA SSA SST SWE NEO 07-Nov-2012

NEO Home  
Risk Page  
Search for Objects  
Priority List  
Close Approaches  
Orbit Visualizer  
Physical Properties  
Comets  
Discovery Statistics  
Image Database  
**Fireball Database**  
Additional Information  
Service Description  
Public Outreach  
Gallery  
Definitions & Assumptions  
FAQ  
Links  
Contact us  
System Status  
Services Administration  
EARN  
Image Upload  
Subscribe to Services

Fireballs and bright meteors are small-sized (typically centimetres to metres) NEOs which actually hit the Earth but burn almost completely in the atmosphere leaving long bright trails. Some of the original material can survive the heat caused by the friction and reach the ground as meteorites. Their study can give important clues on the small-size distribution of the NEO population.

The NEO Segment SBDC Fireball Database is currently in preparation: once it will be completed it will provide a comprehensive entry point to relevant information (time, location, brightness, images, videos, etc.) on observed fireballs and meteors.

All events observed since 1 January 2010 having visual magnitude brighter than  $m=-10$  will be included.

For the time being please address to the following sites:

IAU Meteor Data Center  
<http://www.astro.amu.edu.pl/~jopek/MDC2007/>

ESA Research and Science Support Department Meteor Research Group  
<http://www.rssd.esa.int/index.php?project=METEOR&page=Index>

International Meteor Organization - Fireball Data centre  
<http://www.imo.net/fireball>

NASA's All Sky Fireball Network  
<http://fireballs.ndc.nasa.gov/>

IMAGES

<http://neo.ssa.esa.int/web/guest/fireball-database> [07/11/2012 16:50:30]





# Project review

# DC-IV consortium

- DC-IV overall consortium



- WP-NEO organisation





# Capgemini at a glance

Ever since it was founded 48 years ago, Capgemini has been at the forefront of helping companies to transform themselves, by combining innovation and competitiveness. Today we compete in the Champions League of global players. How did we get there? Thanks to several unique capabilities that make all the difference:

**Almost 180,000 team members<sup>(1)</sup>**  
in more than 40 countries

Revenues<sup>(2)</sup>  
**€10.573 billion**  
Net result<sup>(2)</sup>  
**€580 million**  
Net cash<sup>(3)</sup>  
**€1.218 billion**  
Free organic cash flow<sup>(2)</sup>  
**€668 million**

## Expertise in six strategic sectors

Consumer products & retail, distribution & transportation / Energy, utilities & chemicals / Financial services (Insurance and banking) / Manufacturing / Public sector / Telecom, media & entertainment

**A promise** that expresses our brand philosophy  
**People matter, results count.**

## 7 strategic alliances

EMC<sup>2</sup>, HP, IBM, Microsoft, Oracle, Salesforce.com, SAP

## A wide range of cutting-edge expertise for all our clients

Consulting <sup>1</sup> / Local Professional Services <sup>2</sup> / Application Services <sup>3</sup> / Other Managed Services <sup>4</sup>

## 7 values shared since the company's creation in 1967

honesty / boldness / trust / freedom / team spirit / modesty / fun



## A unique way of working

The Collaborative Business Experience<sup>TM</sup> <sup>5</sup> and Rightshore<sup>®</sup> <sup>6</sup>



# Capgemini Mission Critical Systems – Space Unit

**250+ dedicated engineers on Space  
& ATM programs**



**30+ experience-years in Space  
domain**



**Prime locations: Toulouse,  
Bayonne**



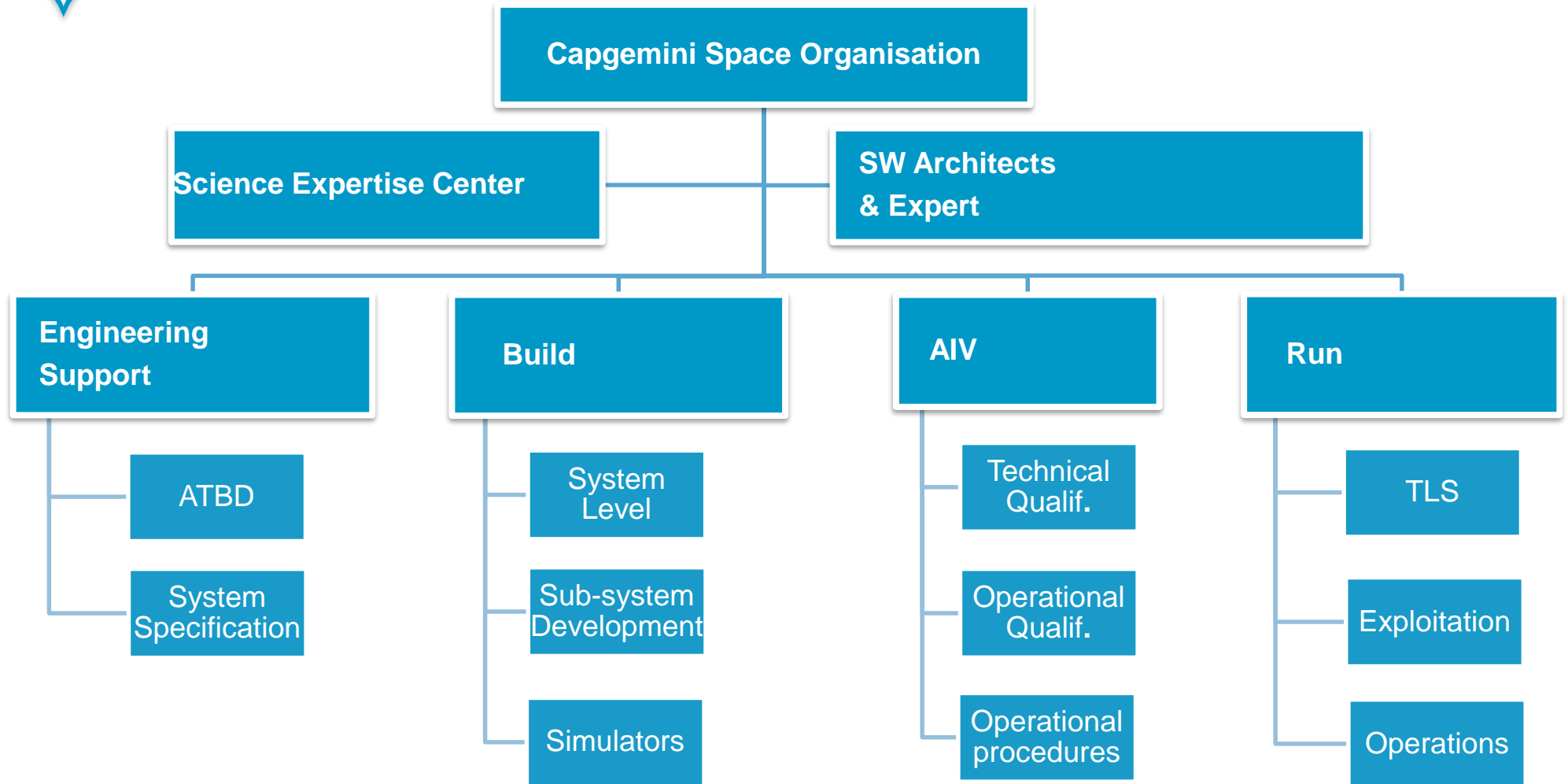
**Innovative solutions**



**Science expertise center**



# Capgemini Mission Critical System- Space Unit



# DC-IV consortium

- GMV overall management of the DC-IV activity
- Capgemini lead of the WP-NEO
  - All development phases
- Support from GMV in NEO work domain related activities
  - Mainly requirements engineering and design phases



# Tools & methods

- Use of ESA Software development environment :
  - DOORS for requirements
  - HP Quality Center for test management
  - Sharepoint for information exchange
  - Rational Change
- Capgemini Continuous Integration Platform
  - Maven, SVN, checkstyle, PMD, JUNIT, Hudson, Sonar, Findbugs ...
- ECSS standards for traceability
- SCRUM/Agile for flexibility

# Schedule

Milestone	KO Schedule	Final date	Delay (months)
Kick off meeting	12/11/2012	12/11/2012	0
Software requirements review	15/01/2013	23/07/2013	6
Preliminary Design Review	15/03/2013	22/10/2013	7
Critical Design Review	Not planned	25/02/2013	----
FAT Test readiness review	27/10/2013	01/04/2014	6
Acceptance review 1	31/10/2013	05/09/2014	11
OSAT Test Readiness Review	07/01/2014	01/10/2014	9
Acceptance review 2	13/01/2014	31/10/2014	9

- In the end 9 months delay with initial schedule.



# Schedule

- SWRR : 6 months delay due to contractual issues. All DC-IV activities were put on hold between January 2013 and Mai 2013.
- CDR : not part of initial planning and requirements
- FAT : delayed in order to FAT testing of the Fireball database in the latest version of the NEO portal (Single Sign-On functionality).



# Technical review

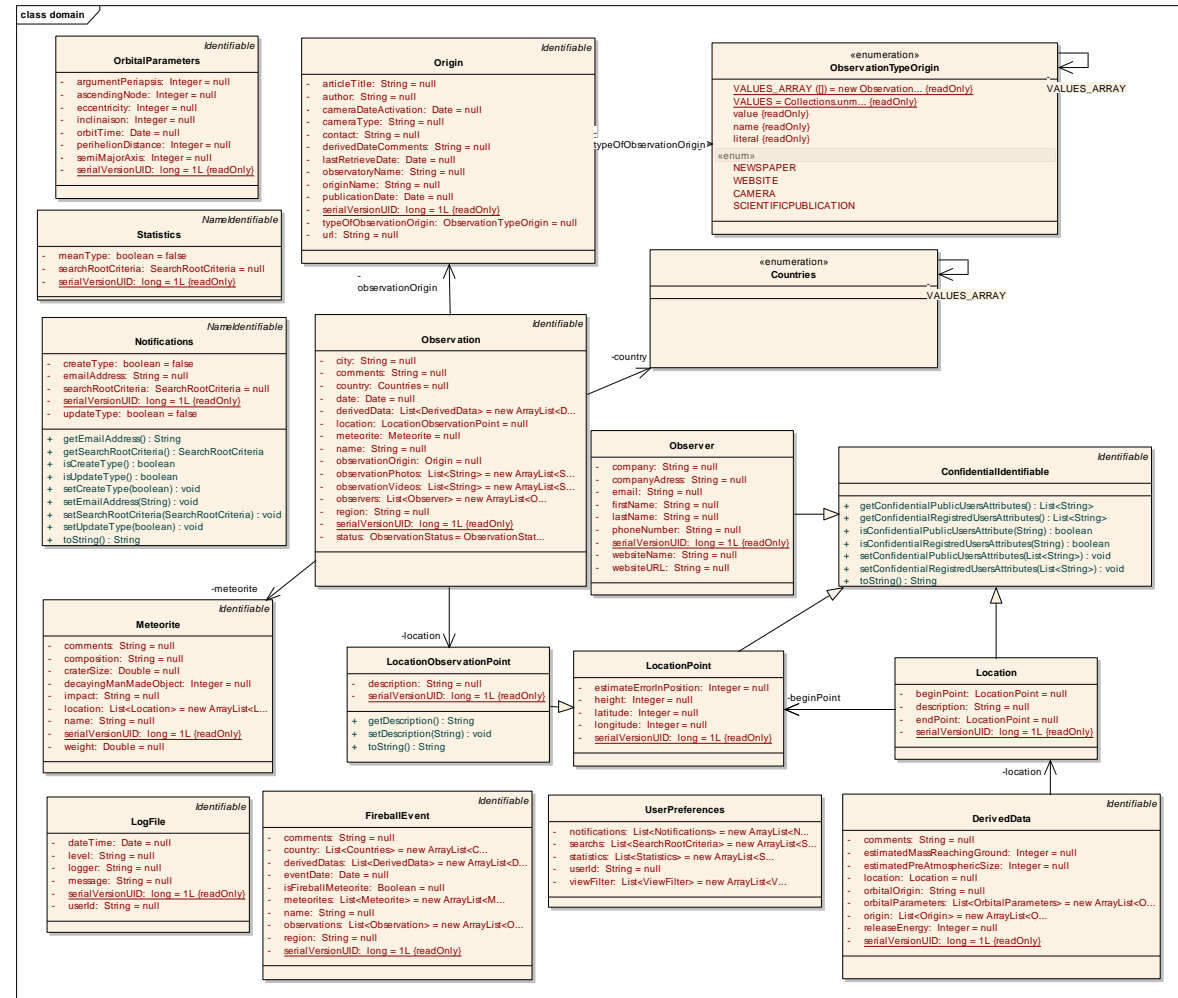
# Questions

- Which are the pieces of data available for a fireball ?
  - How to collect the data ?
  - How do we organize the data ?
  - Where to the data come from ?
- => Not that simple ...
- Iterative and pragmatic approach, discussion between Capgemini, GMV and ESA

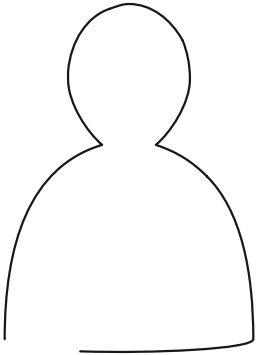


# Data model

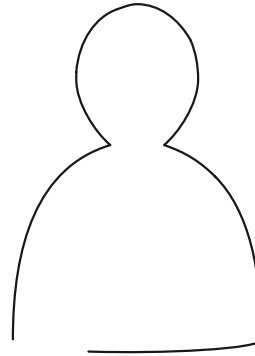
- Difficulty : define the data model, link the different data to the « objects »
- Identify optional and mandatory data
- Who may access data ?  
Some should not be available on the web to all visitors
- The data model was modified during all project phases



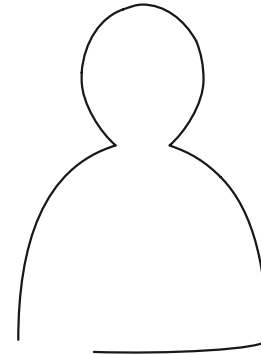
# Who and how ?



Operator : managing the database (NEO front desk operator)



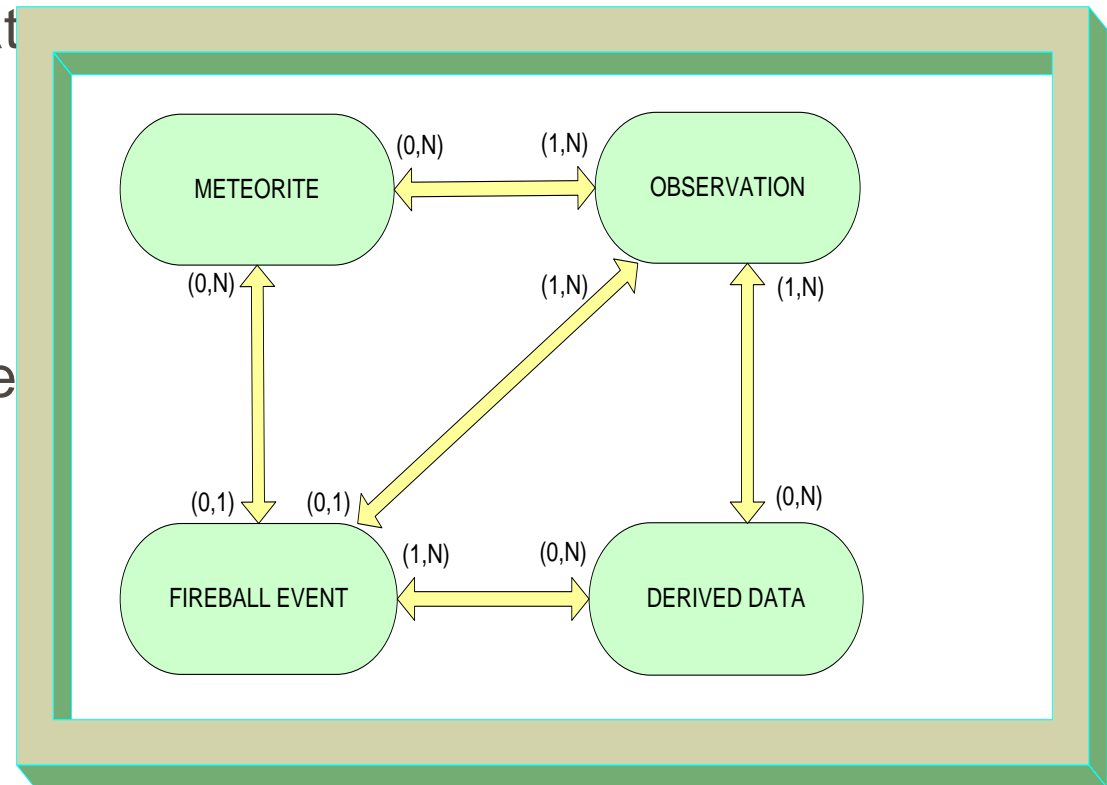
Registered user : may save search, statistics, access restricted information



Public users : you and me on the surfing on the web

# Database structure

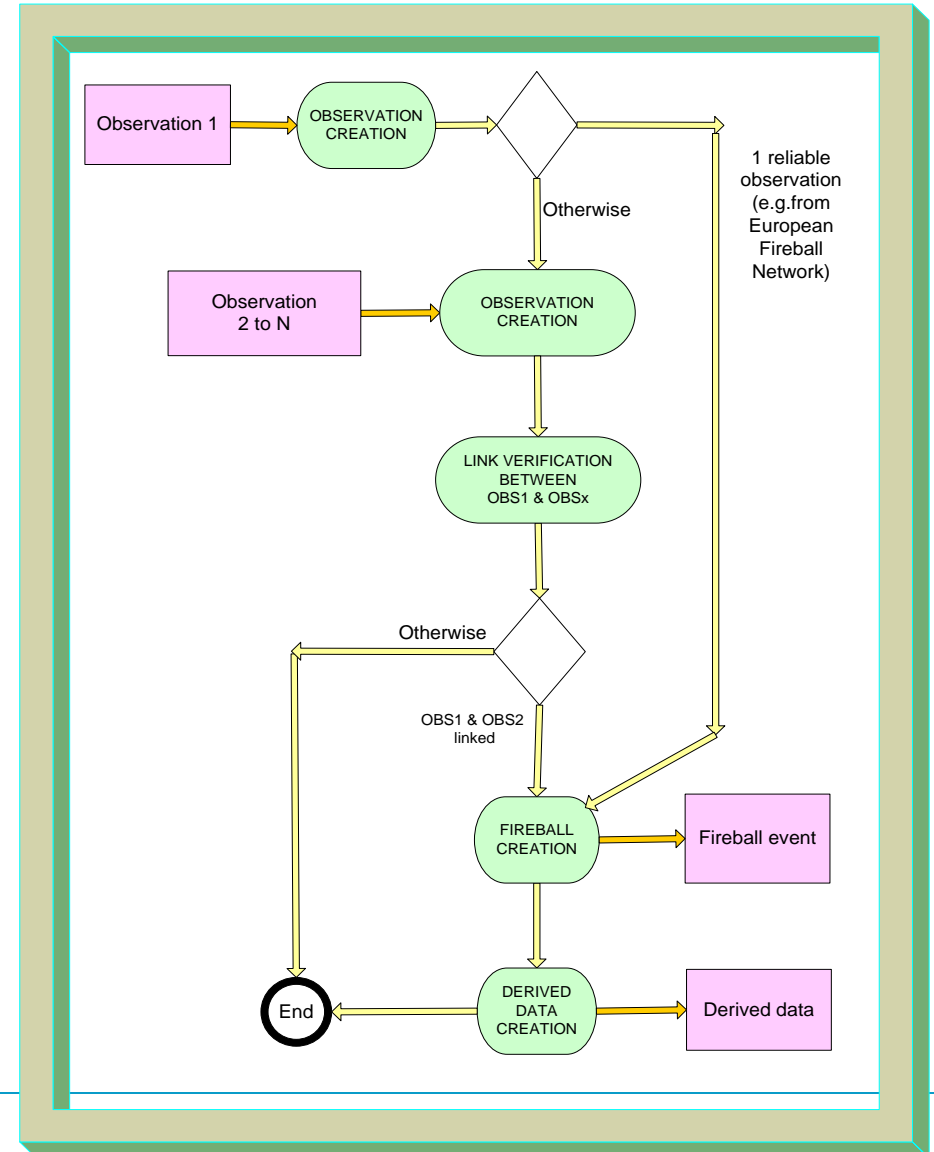
- Fireball event : describing what is considered as a fireball event;
- Observation; a reported observation of a fireball event.
- And derived data: data that are linked to the fireball that have been computed or derived.
- Meteorite: object found on ground linked to the fireball





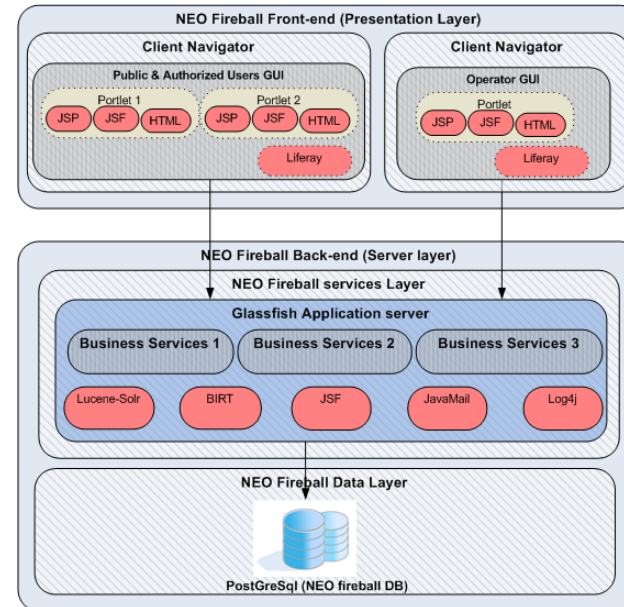
# Dynamical view

- The 'entry' data come from the 'Observations' which are the main group of data  
The other groups of data (fireball event and derived data) are created depending on the observation(s)
- A fireball event can be created if there is 1 created observation ;



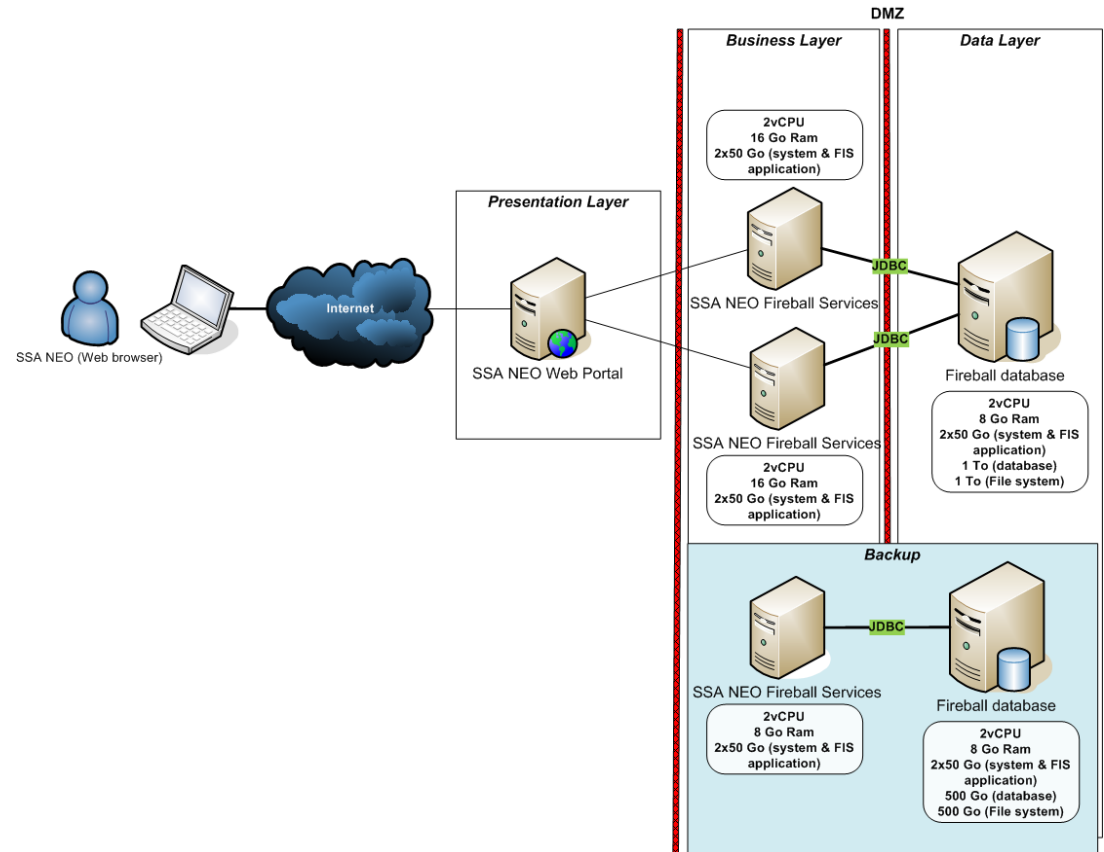
# Technical view

- Portlets integrated in Liferay portal
- Business services deployed in a glassfish application server
- Database on a mysql data server
- Search engine Lucene-Solr



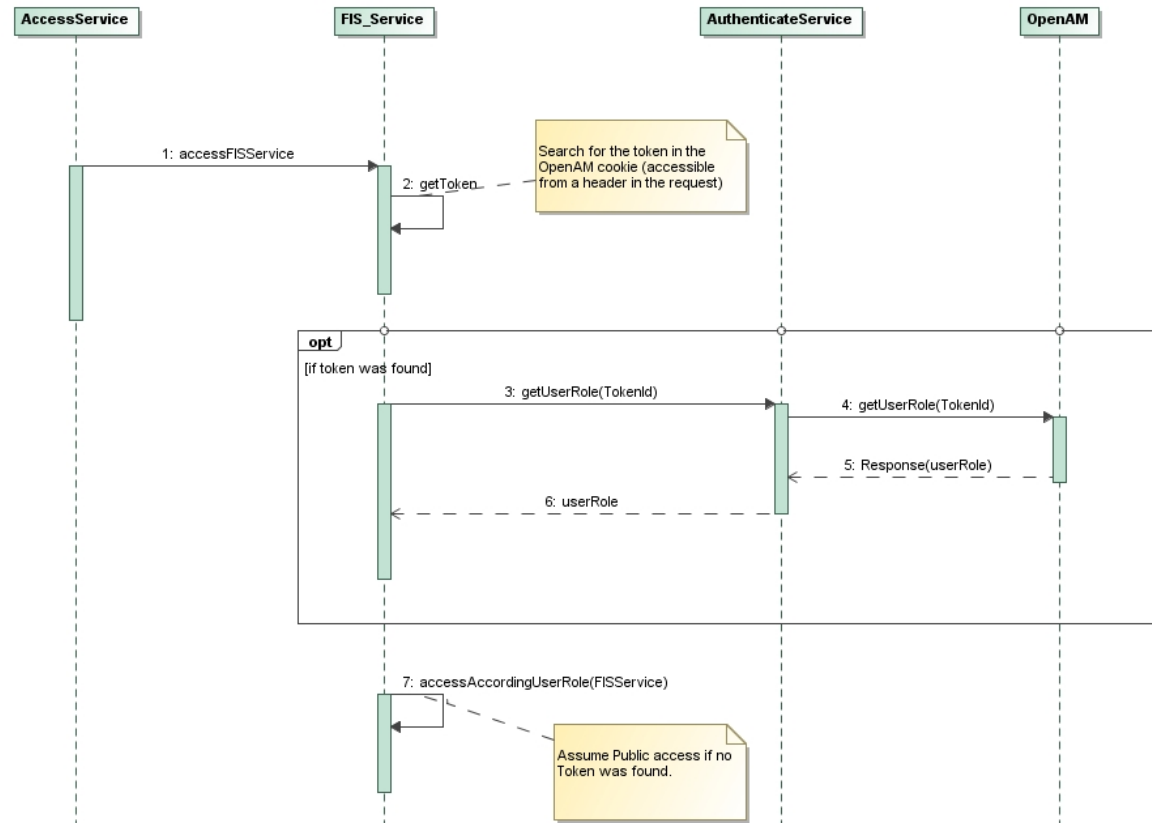
# Physical View

- All machines are virtual
- Load balancing is optional

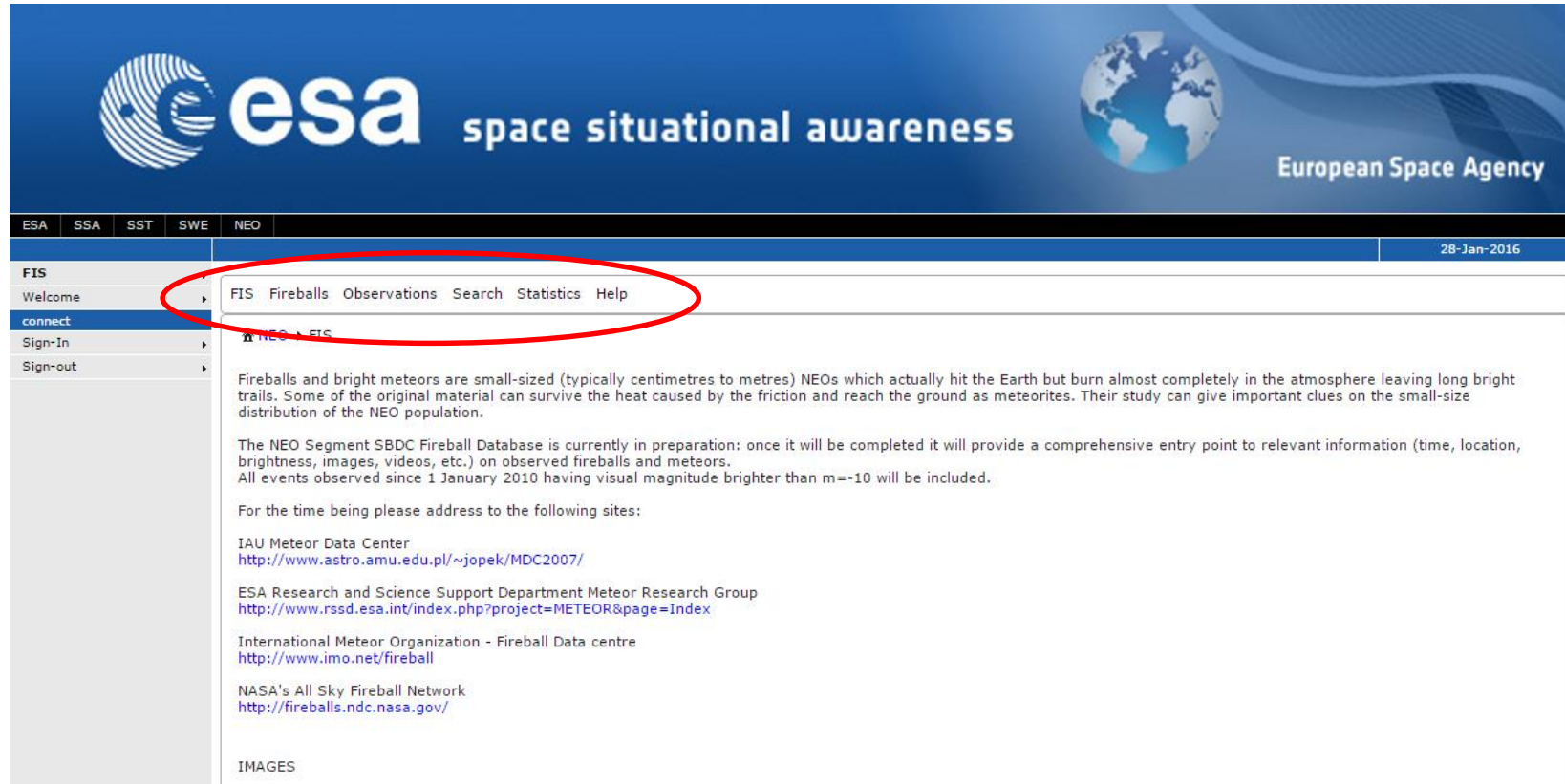


# Authentication

- Use of SSA Single Sign-On
- Restful interface



# Let's take a look



## ■ Menu for public users

# Accessing data

- Fireball example
- Navigation through breadcrumb

The screenshot displays the ESA Space Situational Awareness (SSA) web application. The header features the ESA logo and the text "space situational awareness" and "European Space Agency". A navigation bar includes links for ESA, SSA, SST, SWE, and NEO. The left sidebar contains a menu with "FIS", "Welcome", "connect", "Sign-In", and "Sign-out". The main content area shows a breadcrumb trail: "NEO > FIS > Fireballs > Fireball". Below the breadcrumb, there are tabs for "Summary", "Linked Observations", "Linked Derived Data", and "Linked Meteorites". The "Summary" tab is active, displaying a table of data for a fireball named "fireballtest".

Summary	
Name	fireballtest
Comments	this is a test
Region	lombardia
Were meteorites found?	true
Man-made object?	false
Max Brightness	null
Date	2015-01-21 00:00:00
Countries	FRANCE ITALY



# Search function

## ■ Free search :

FIS Fireballs Observations Search Statistics Help

🏠 NEO ▶ FIS ▶ Search

Criteria Result

▼ Search

Use \* or ? for any or one unknown character.

Indianapolis

Search

▶ Advanced search

Criteria Result

**FireballEvent**

Name	Comments	Region	Meteorite	Date	Actions
------	----------	--------	-----------	------	---------

Export table to csv

**Observation**

Observation Name	Region	City	Brightness (mag)	Comments	Observation Date	Actions
7434	IN	Indianapolis			2010-04-15 02:15:00	<a href="#">open</a>
7220	IN	Indianapolis			2010-04-15 02:04:00	<a href="#">open</a>
7349	IN	Indianapolis			2010-04-15 02:10:00	<a href="#">open</a>
7834	IN	Indianapolis/Castleton			2010-07-04 01:30:00	<a href="#">open</a>
8158	IN	Indianapolis			2010-09-04 09:50:00	<a href="#">open</a>

Export table to csv

# Search

- Advanced search

FIS Fireballs Observations Search Statistics Help

NEO ▸ FIS ▸ Search

Criteria Result

Search

Advanced search

FireballEvent ☒

Observation ☐

FireballEvent Add ▾

region equals France ×

and isFireballMeteorite equals ☒ ×

FireballEvent observations Add ▾ Delete

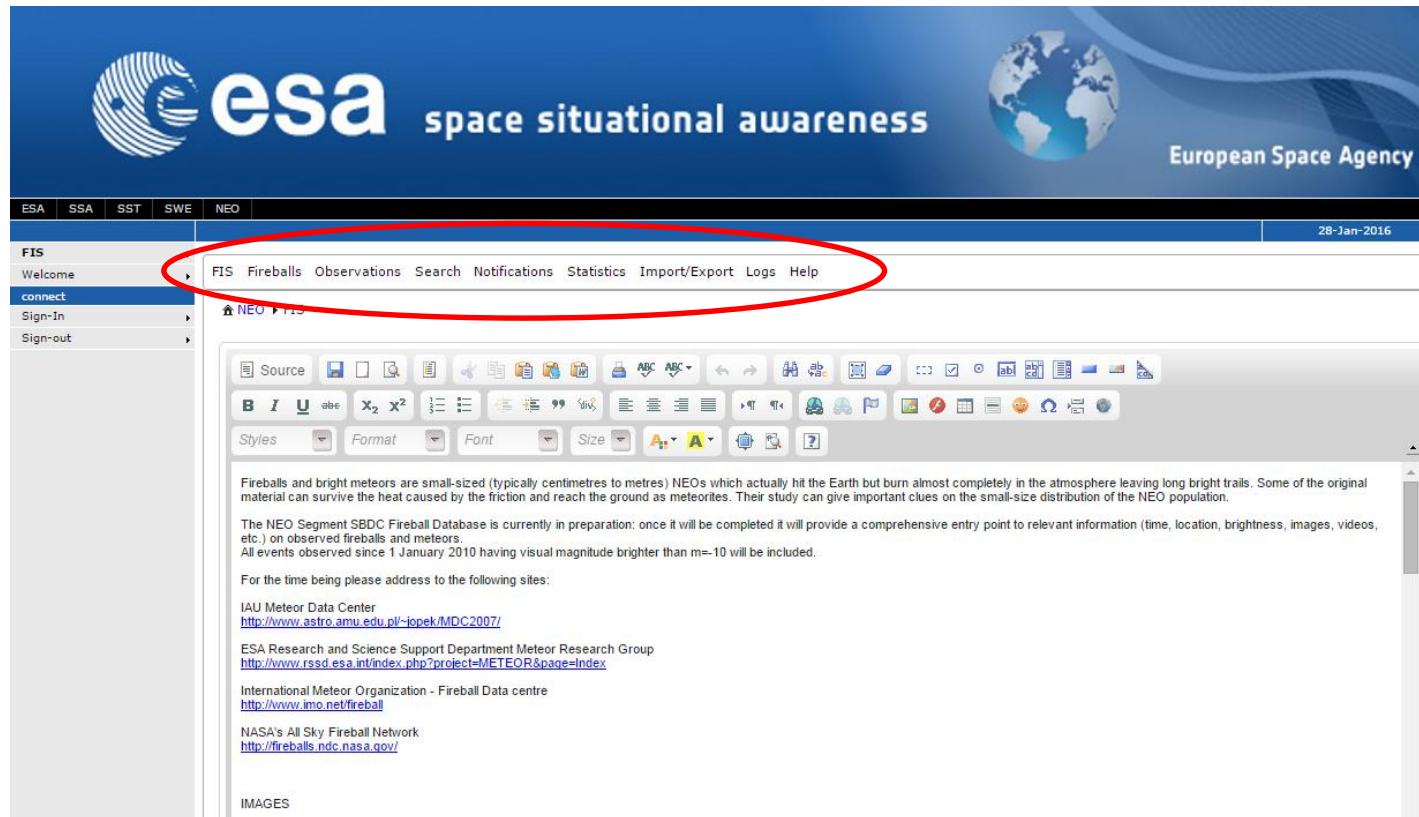
city equals Rome ×

or country equals Armenia ▾ ×

and brightness lt -12 ×

Search Reset

# Operator view



- Menu for operator
- Edit tool for the welcome page

# Operator

- Select observation tab

- Add new

ESA SSA SSF SWE NEO

FIS Welcome connect Sign-In Sign-out

FIS Fireballs Observations Search Notifications Statistics Import/Export Logs Help

NEO FIS Observations

Observation Name	Region	City	Brightness (mag)	Comments	Observation Date	Actions
testobs	Unknown	Rome			2015-01-21 00:45:00	open edit remove
test	Unknown	toulouse			2015-01-14 00:00:00	open edit remove
obs	unknown	toulouse			2014-11-19 07:00:00	open edit remove
6793	Reddingmairhead	Canalside			2014-03-12 14:56:42	open edit remove
7062	Warkworth	Roseneath			2014-03-12 14:56:42	open edit remove
7013	Guernsey	St.Peter Port			2014-03-12 14:56:42	open edit remove
7079	Wolverhampton	Perton			2014-03-12 14:56:42	open edit remove
7594	PA	Horsham			2014-03-12 14:56:42	open edit remove
7924	Basildon	Laindon			2014-03-12 14:56:42	open edit remove
7745	Lutherville	Brooklandville			2014-03-12 14:56:42	open edit remove

Export table to csv Add New

- Operator my edit and remove observations

# Operator

- Mandatory fields marked with (\*)
- Select different tabs and enter data

[FIS](#) [Fireballs](#) [Observations](#) [Search](#) [Notifications](#) [Statistics](#) [Import/Export](#) [Logs](#) [Help](#)

[NEO](#) ▶ [FIS](#) ▶ [Observations](#) ▶ [Observation](#)

Summary

Origin

Location

Linked Observer

Linked Derived Data

Linked Meteorite

Name \*

Country

Unknown ▼

Region

City \*

Brightness

Comments

Date \*

Type Of Observation Origin \*

▼

Fields marked '\*' are mandatory.

Photos

Add

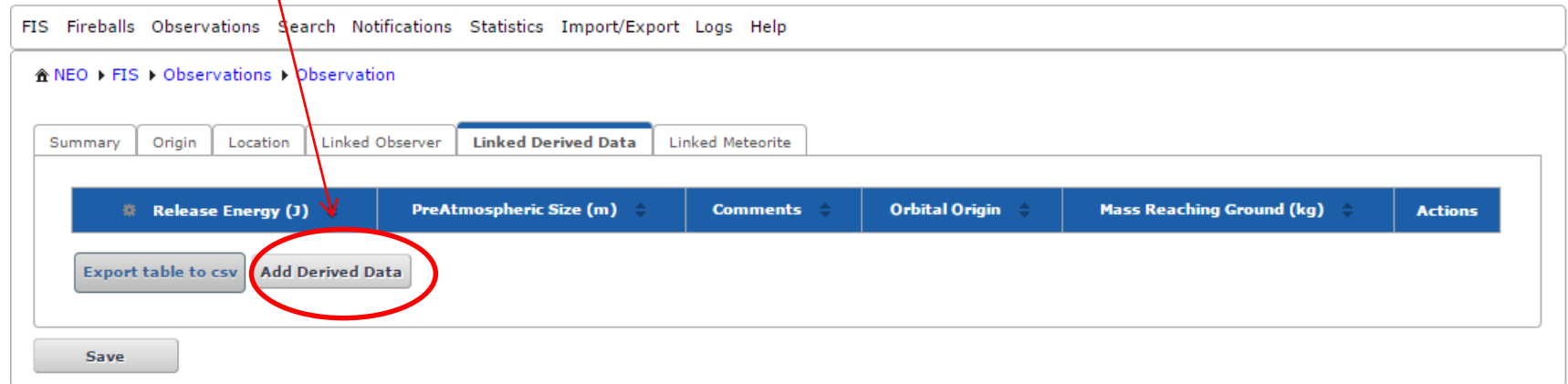
Videos

Add

Save

# Managing data

- Add derived data



The screenshot shows a web application interface for managing NEO data. At the top is a navigation bar with links: FIS, Fireballs, Observations, Search, Notifications, Statistics, Import/Export, Logs, and Help. Below this is a breadcrumb trail: [NEO](#) > [FIS](#) > [Observations](#) > [Observation](#). A tabbed interface below the breadcrumb has tabs for Summary, Origin, Location, Linked Observer, **Linked Derived Data** (which is active), and Linked Meteorite. The main content area features a table with columns: **Release Energy (J)**, **PreAtmospheric Size (m)**, **Comments**, **Orbital Origin**, **Mass Reaching Ground (kg)**, and **Actions**. Below the table are two buttons: 'Export table to csv' and 'Add Derived Data'. The 'Add Derived Data' button is circled in red, and a red arrow points to it from the 'Add derived data' text in the list above. At the bottom left of the interface is a 'Save' button.



# Managing data

- Add derived data

FIS Fireballs Observations Search Notifications Statistics Import/Export Logs Help

⚠ Value is required

NEO ▶ FIS ▶ Observations ▶ Observation ▶ Derived Data

Summary Location Linked Origins Linked Orbital Parameters

Release Energy \*  J ⚠ Value is required

Estimated Pre Atmospheric Size  m

Comments

Orbital Origin

Estimated Mass Reaching Ground  kg

Fields marked '\*' are mandatory.

Add Derived Data

FIS Fireballs Observations Search Notifications Statistics Import/Export Logs Help

✔ Your request processed successfully

NEO ▶ FIS ▶ Observations ▶ Observation ▶ Derived Data

💡 Your request processed successfully

Summary Location **Linked Origins** Linked Orbital Parameters

Type Origin	Name	Pub Date	Article Title	Camera Type	Contact	Camera Date	Last Date	URL	Author	Comments	Obs Name	Actions
WEBSITE	AMS	2015-06-16 08:00:00				2015-06-15 00:00:00	2016-01-12 00:00:00				AMS	ⓘ

1 2 < > 5

Export table to csv Add New Origin

Add Derived Data

# Log view

FIS Fireballs Observations Search Notifications Statistics Import/Export Logs Help

NEO FIS Logs

User Id	Level	Logger	Date Time	Message	Actions
Joffrey	INFO	esa.ssa.neo.fis.portlet.bean.user.UserPreferencesBackingControllerBean	01/28/2016 16:44:40	Joffrey : Save data table settings with id:aceLogs	<a href="#">remove</a>
	WARN	esa.ssa.neo.fis.common.rest.FisRestTemplate	01/28/2016 16:44:40	POST request for "http://vm-ssa-liferay.ssa.esa:8081/openam_953/identity/attributes" resulted in 401 (Non-Autorisé); invoking error handler	<a href="#">remove</a>
Joffrey	ERROR	FIS-Portlet	01/28/2016 16:44:40	Joffrey : Error retrieving user properties. Session expired, please log in again.	<a href="#">remove</a>
	WARN	esa.ssa.neo.fis.common.rest.FisRestTemplate	01/28/2016 16:44:40	POST request for "http://vm-ssa-liferay.ssa.esa:8081/openam_953/identity/attributes" resulted in 401 (Non-Autorisé); invoking error handler	<a href="#">remove</a>
Joffrey	ERROR	FIS-Portlet	01/28/2016 16:44:40	Joffrey : Error retrieving user properties. Session expired, please log in again.	<a href="#">remove</a>
Joffrey	INFO	FIS-Portlet	01/28/2016 16:44:40	Joffrey : Your request processed successfully	<a href="#">remove</a>
	WARN	esa.ssa.neo.fis.common.rest.FisRestTemplate	01/28/2016 16:44:40	POST request for "http://vm-ssa-liferay.ssa.esa:8081/openam_953/identity/attributes" resulted in 401 (Non-Autorisé); invoking error handler	<a href="#">remove</a>
Joffrey	ERROR	FIS-Portlet	01/28/2016 16:44:40	Joffrey : Error retrieving user properties. Session expired, please log in again.	<a href="#">remove</a>
	WARN	esa.ssa.neo.fis.common.rest.FisRestTemplate	01/28/2016 16:43:31	POST request for "http://vm-ssa-liferay.ssa.esa:8081/openam_953/identity/attributes" resulted in 401 (Non-Autorisé); invoking error handler	<a href="#">remove</a>
Joffrey	ERROR	FIS-Portlet	01/28/2016 16:43:31	Joffrey : Error retrieving user properties. Session expired, please log in again.	<a href="#">remove</a>

1 2 3 4 5 6 7 8 9 10 10

Remove all



# Lessons learned & way forward

# General requirements

- Many general requirements applicable to all the WP
- Relevant to M&C system, less relevant to a web interface
  - Logs, ...
- FIS SRS written by Capgemini engineering team experienced on a system level
- => Adjust the priority given to general requirements with low added-value to users

# Integration & CFI

- The NEO web portal was not provided as a CFI
  - Requirement to have look & feel compliant with the existing portal
  - Discussion and iterations on the HMI on
    - Colors
    - Screen width
    - Button size and forms...
  - Technical solution for authentication not clear
  - Request : existing neo portal using the Liferay users management
  - Other request : Single Sign-On using the SSA OpenAM server.
- => Having the NEO portal at the beginning of the project would have saved time.

# Waterfall vs Agile

- Contractual baseline : waterfall with reviews
- Development method : Scrum Agile
- True Agile not compliant with the availability of ESA interfaces (TO and NEO domain experts)
- However: flexibility on both sides to adjust and change requirements during entire project (staying at iso-complexity)
- => Agile inside waterfall contract works well if both parties are constructive, mutual thrust needed
  - Capgemini experience also from other clients

# Future

- Ergonomic improvements based on user feedback ...
- Import function may be improved (create events, but operator appreciation needed somewhere in the process)
- Import data from other sources than the American Meteor Society
- System integration :
  - Import automatically observations from other websites
  - Create observations from reports from observers ?
  - Interface for (Public, Registered) users to submit online new observations ?



Questions / AOB



# Contact information

Insert  
contact  
picture

**Ole  
KVERNELAND**

Project Manager  
ole.kverneland@capgemini.com

Capgemini  
Toulouse

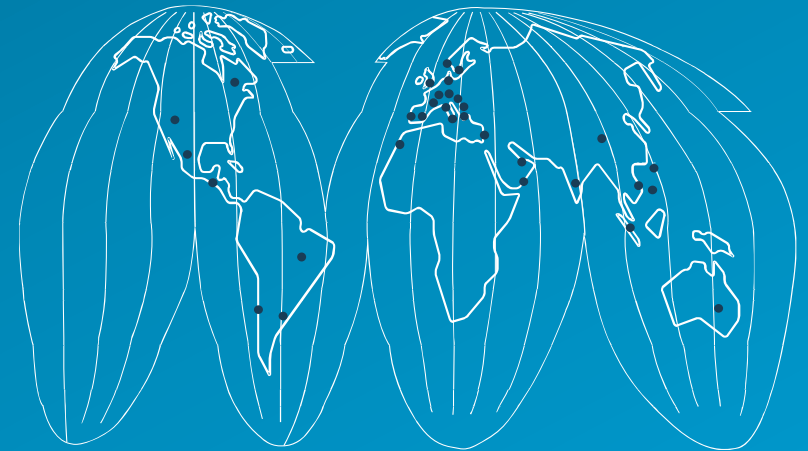
Insert  
contact  
picture

**Richard  
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Sales engineer  
Richard.barre@capgemini.com

Capgemini  
Toulouse

People matter, results count.



[www.capgemini.com](http://www.capgemini.com)

