

Testing Cloud Computing for Massive Space Data Processing Storage and Distribution with Open Source GEO-Software

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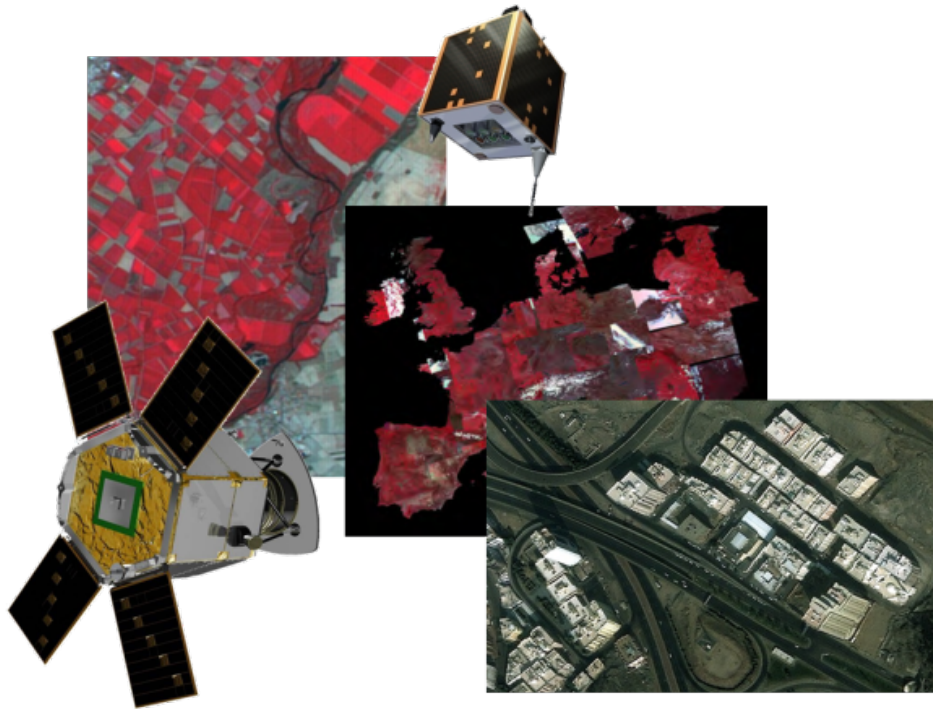


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FOSS4G-E 2014 July 16

Outline

- Introduction
- The GEO-Cloud Experiment
- Preliminary Results
- Conclusions
- Acknowledgements



1 Introduction

Introduction

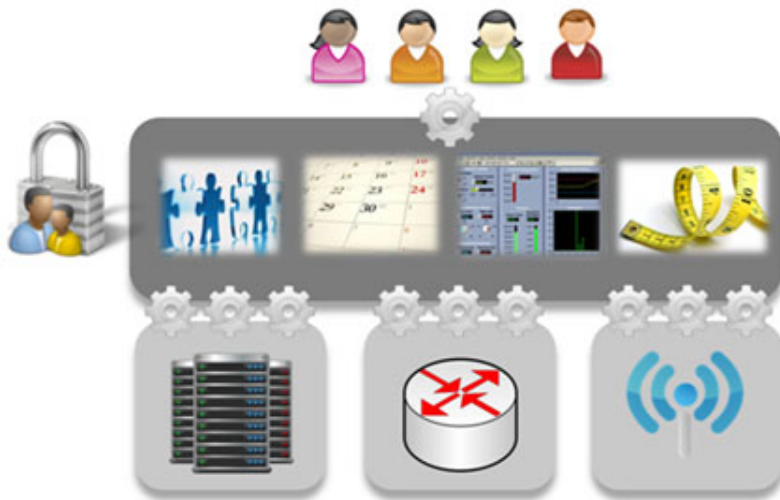
- The Organization
 - Technology branch of Elecnor Group
 - >500 employees
 - Markets: *Aeronautics, Aerospace, Defense, Transport, Energy and Environment, ICT and Security.* (www.deimos-space.com)



Introduction

- The Fed4FIRE Project

- Integrated Project under European Union's FP7, Future Internet Research and Experimentation (FIRE)
- Coordinator: iMinds
- 29 partners
- Scope and objective: Federation of Future Internet European Facilities for innovative experiments (<http://www.fed4fire.eu/>)



Introduction

- The GEO-Cloud Experiment

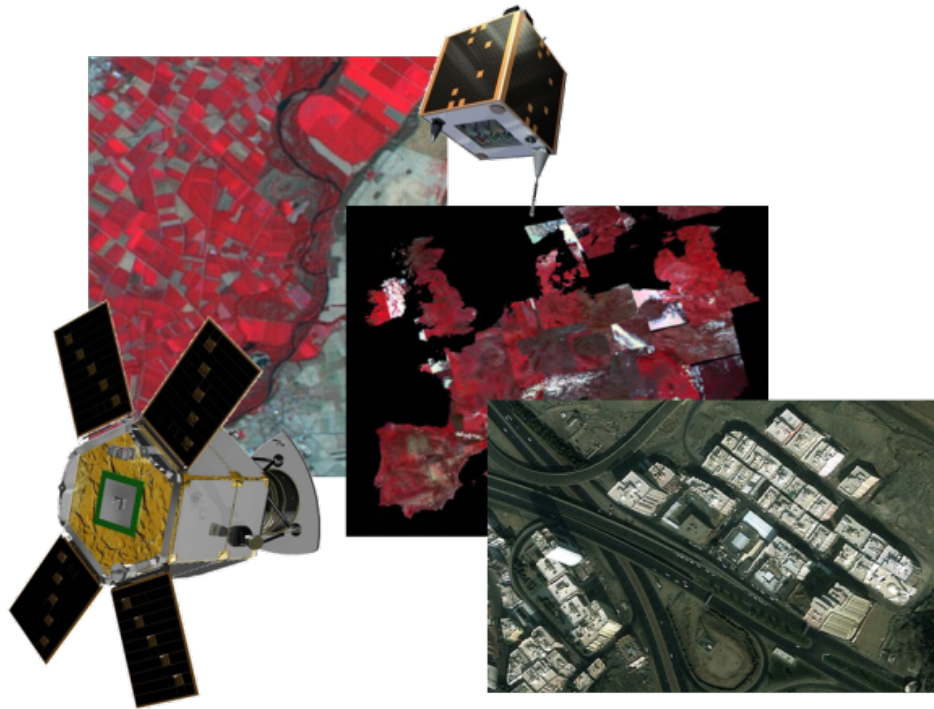
- Uses several federated testbeds: PlanetLab, BonFIRE and Virtual Wall.
- Main Objective: Implementation of a realistic and complete Earth Observation system to validate if cloud computing offers viable solutions to manage big data.



BonFIRE

**Virtual
Wall**



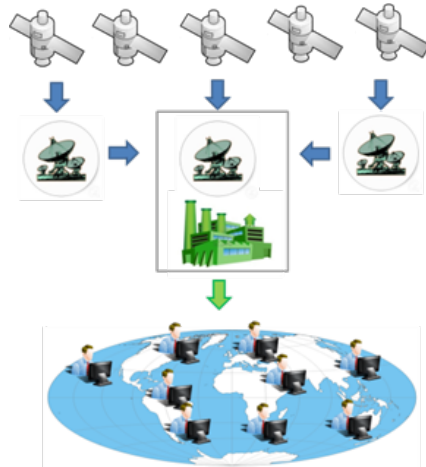


The GEO-Cloud Experiment

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The GEO-Cloud Experiment

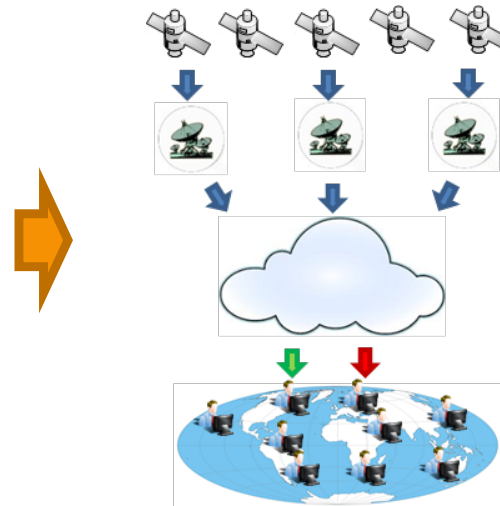
Traditional Data Centers on Premises



Earth Observation Big Data

- ✓ Difficult to Process
- ✓ Difficult to Store
- ✓ Difficult to Distribute
 - ✓ Not Flexible
- ✓ Applications Limited
 - ✓ Expensive
- ✓ Completely Controllable

Complete EO System in Cloud



Earth Observation Big Data

- ✓ Flexible
- ✓ Scalable
- ✓ On Demand
- ✓ Globally Accessible
 - ✓ Data Fusion
- ✓ New Applications
- ✓ High Added Value

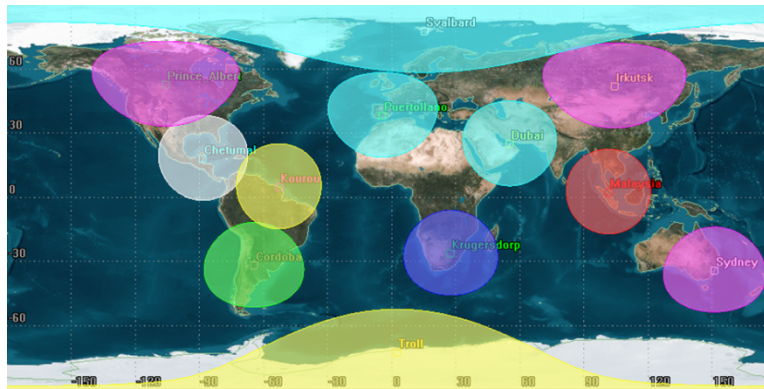


Viable Solution?

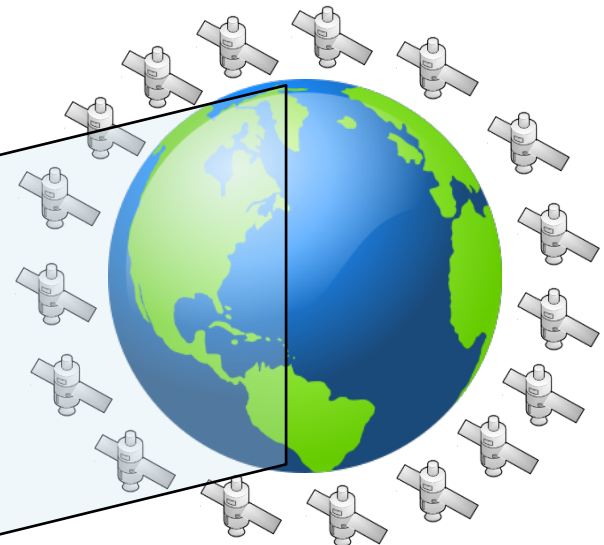
The GEO-Cloud Experiment

- Space Mission

- Daily coverage of the World surface with satellite images.
- Resolution 6.7m
- Swath 160km
- Generation of 20TB daily
- Transfer of data into the cloud



12 Ground Stations



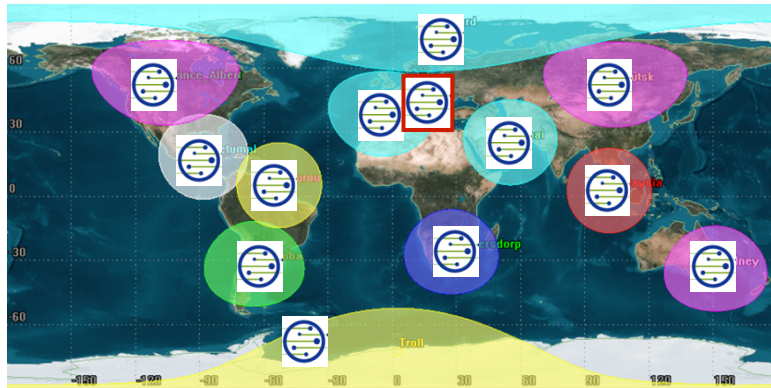
Constellation of 17 Satellites

The GEO-Cloud Experiment

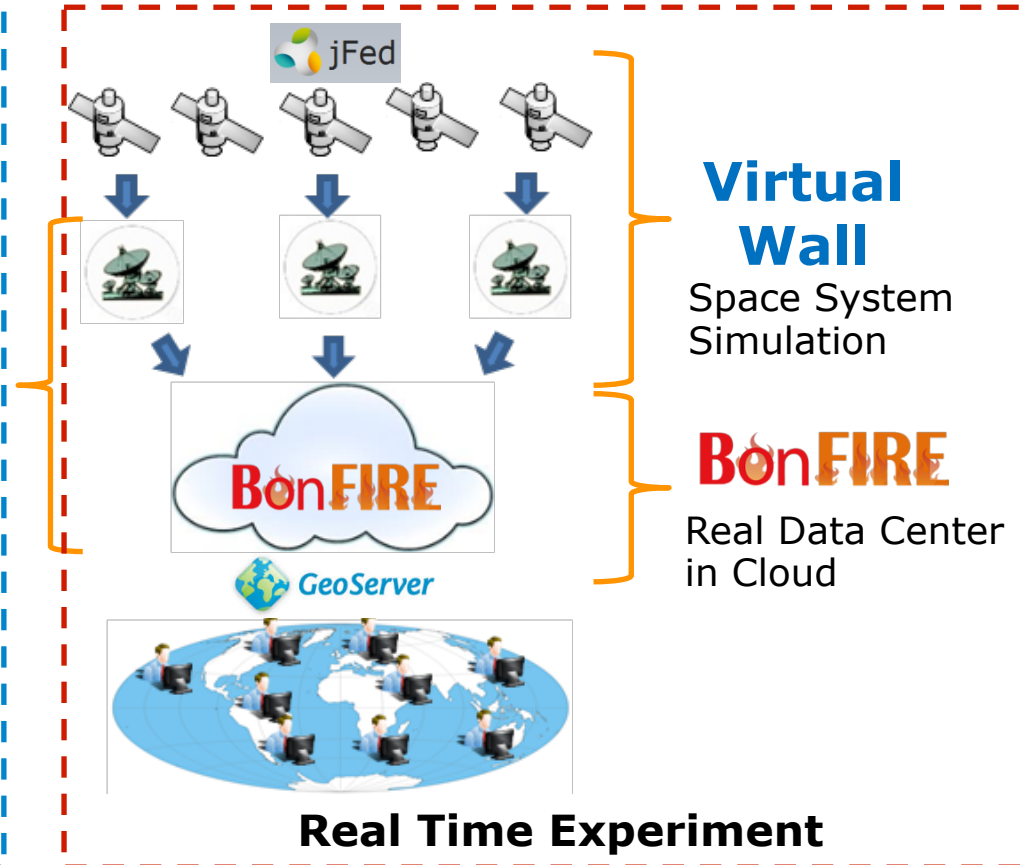
- GEO-Cloud in Fed4FIRE



Emulation of the network between Ground Stations and Data Center



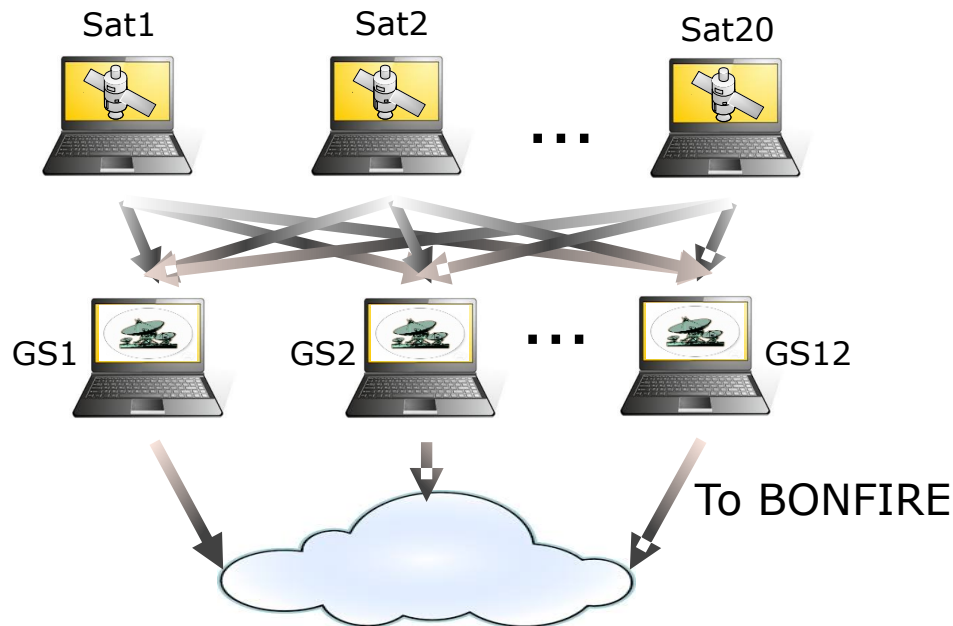
Off Line Experiment



The GEO-Cloud Experiment

- Virtual Wall

- Infrastructure to deploy virtual machines.
- Any topology network can be created.
- Controllability and monitoring (Bandwidth, Loss Rate, Latency).
- **Simulation** of the Space System (Satellites and Ground Stations).

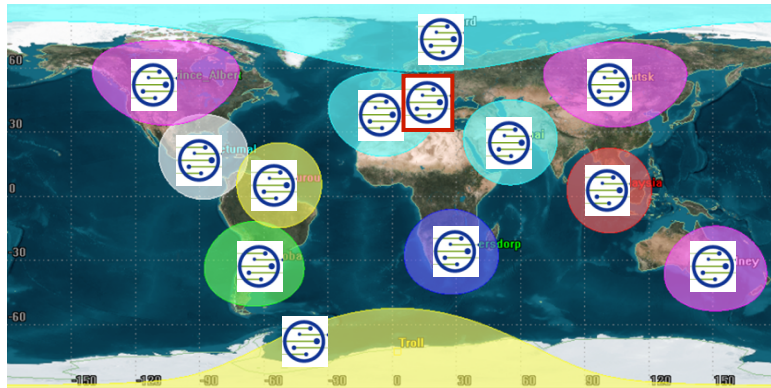


The GEO-Cloud Experiment

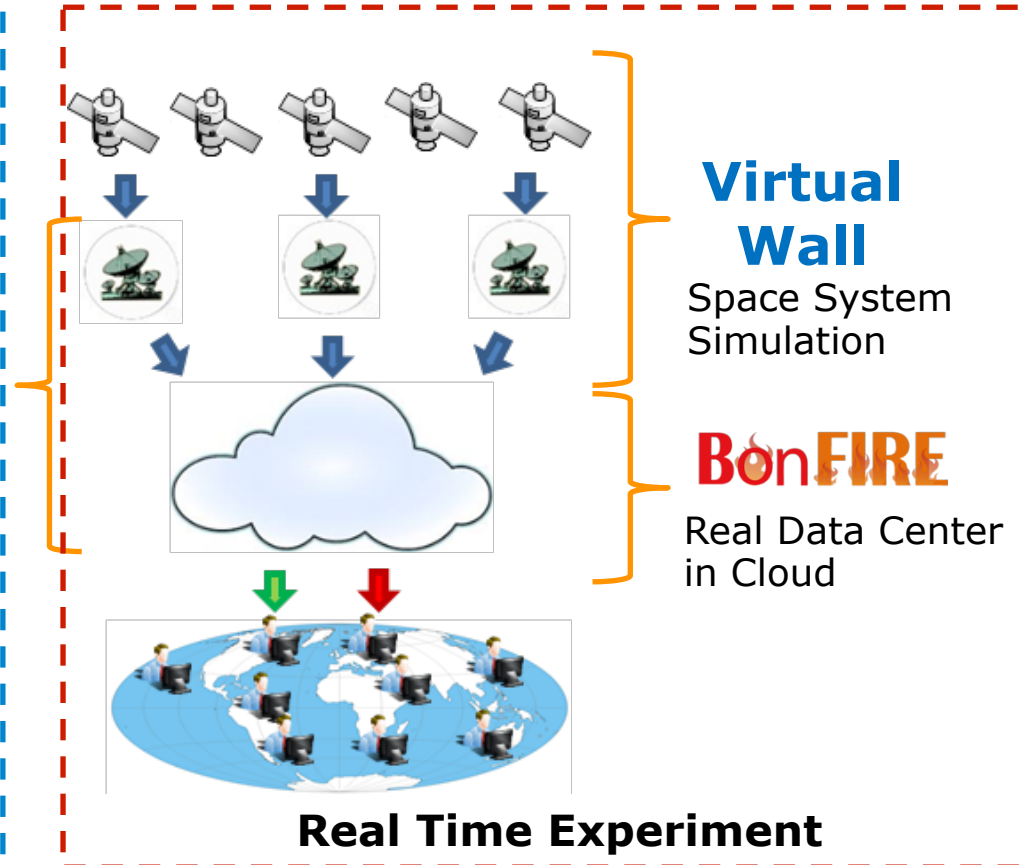
- GEO-Cloud in Fed4FIRE



Emulation of the network between Ground Stations and Data Center



Off Line Experiment

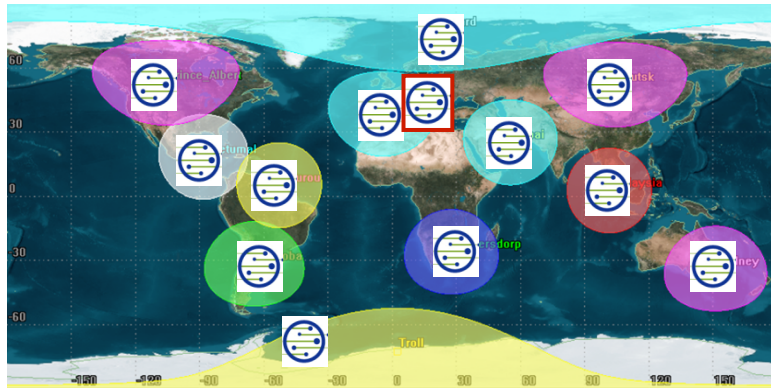


The GEO-Cloud Experiment

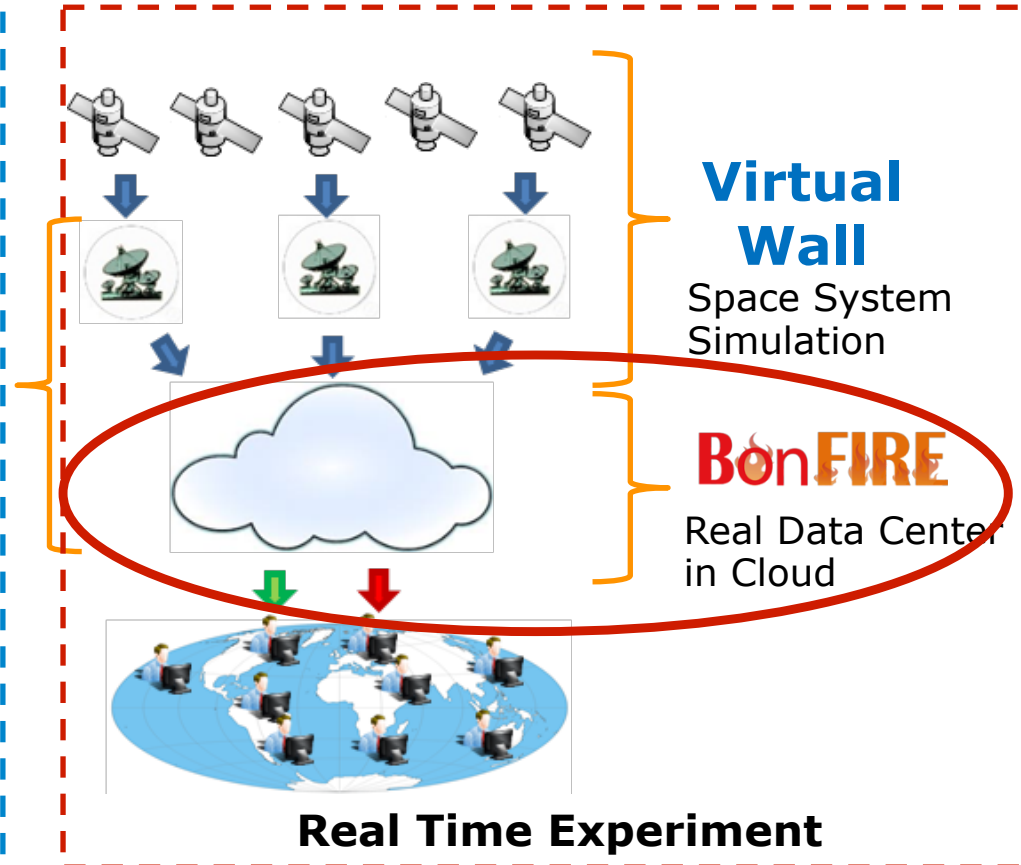
- GEO-Cloud in Fed4FIRE



Emulation of the network between Ground Stations and Data Center



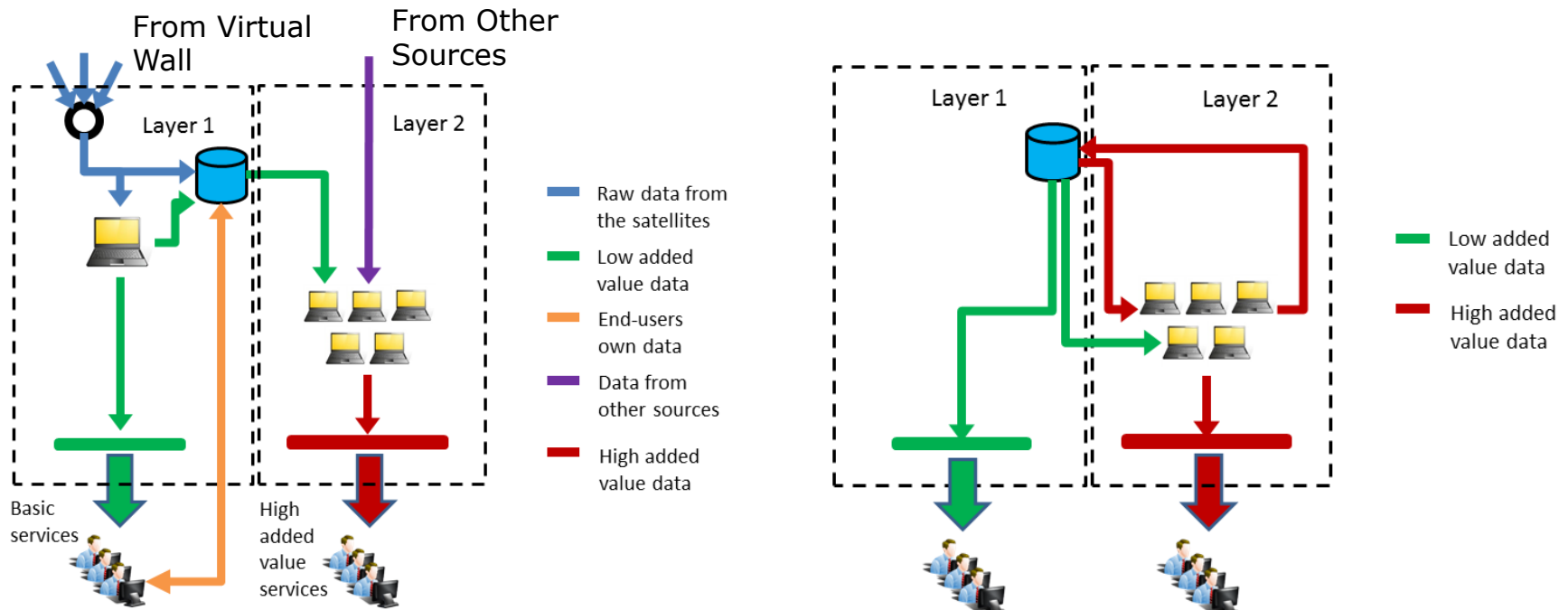
Off Line Experiment



The GEO-Cloud Experiment

- BonFIRE

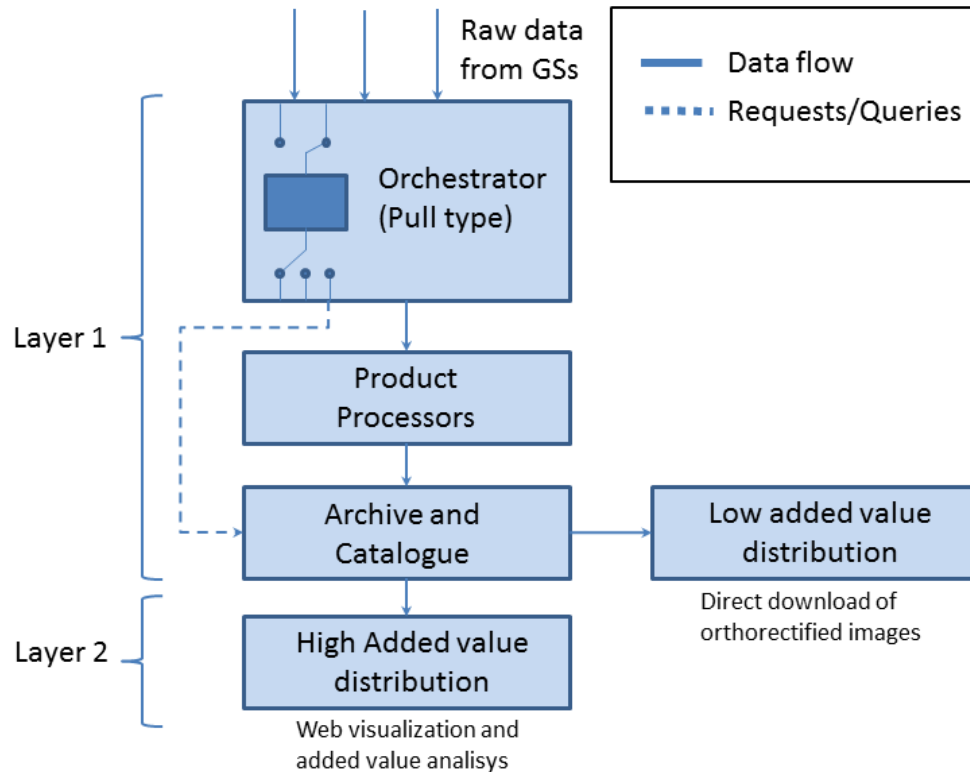
- Multi-cloud testbed
- Monitoring and controllability
- Implementation of a **real** data centre in cloud



The GEO-Cloud Experiment

• BonFIRE

- Implementation with an Orchestrator which ingests the raw data into the cloud and automatically manages the transfer of data between modules

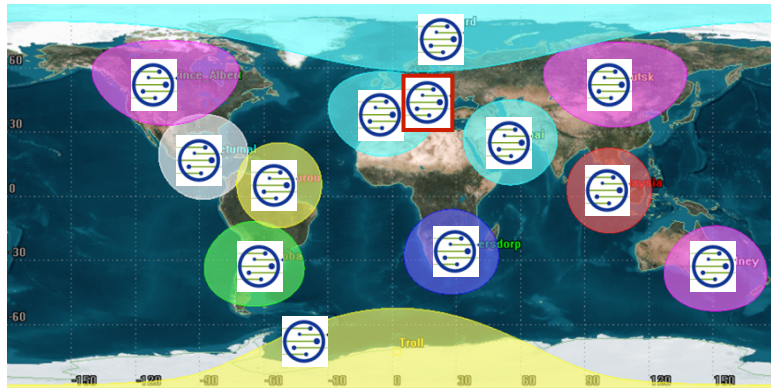


The GEO-Cloud Experiment

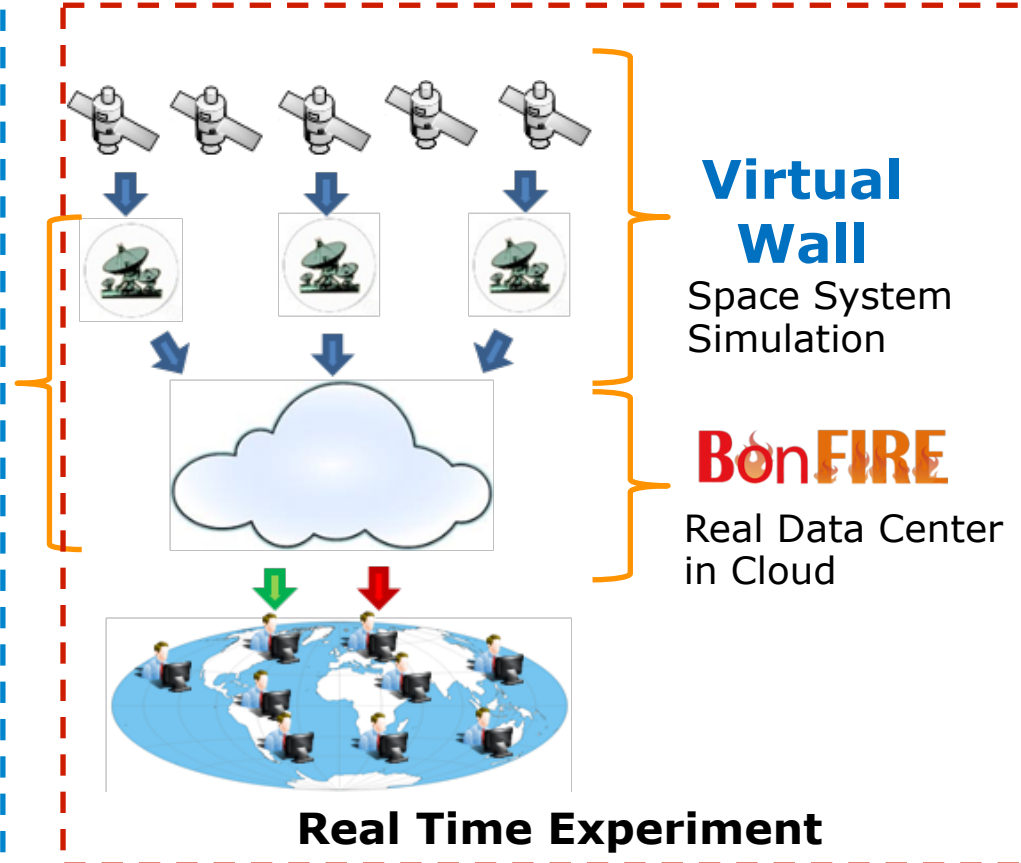
- GEO-Cloud in Fed4FIRE



Emulation of the network between Ground Stations and Data Center

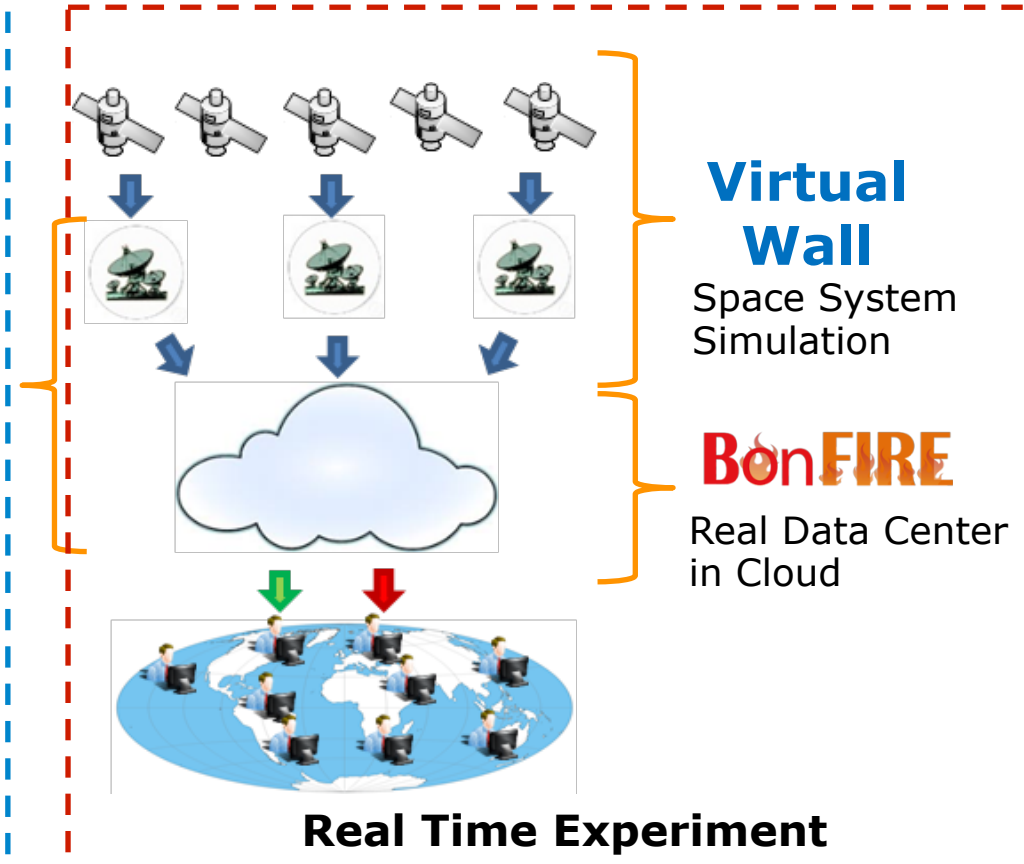
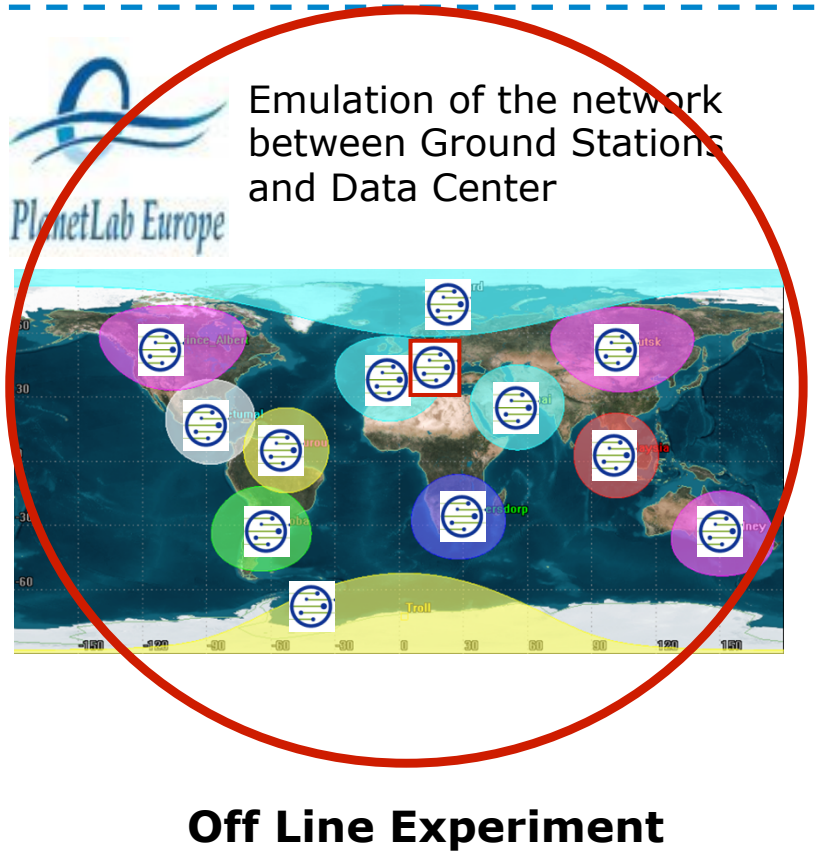


Off Line Experiment



The GEO-Cloud Experiment

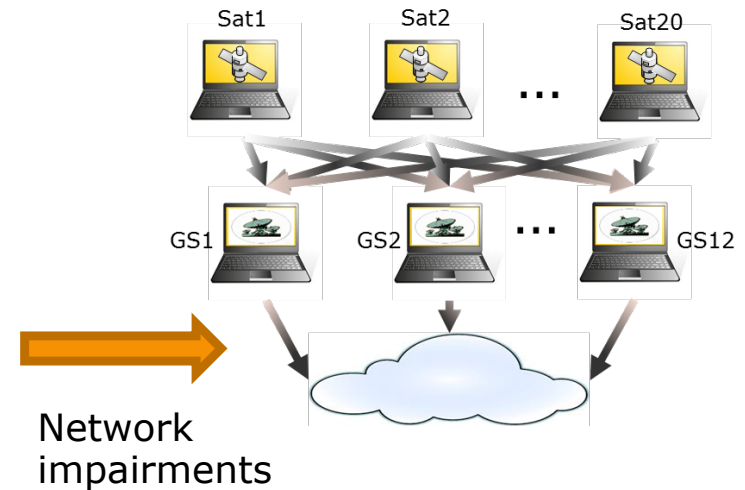
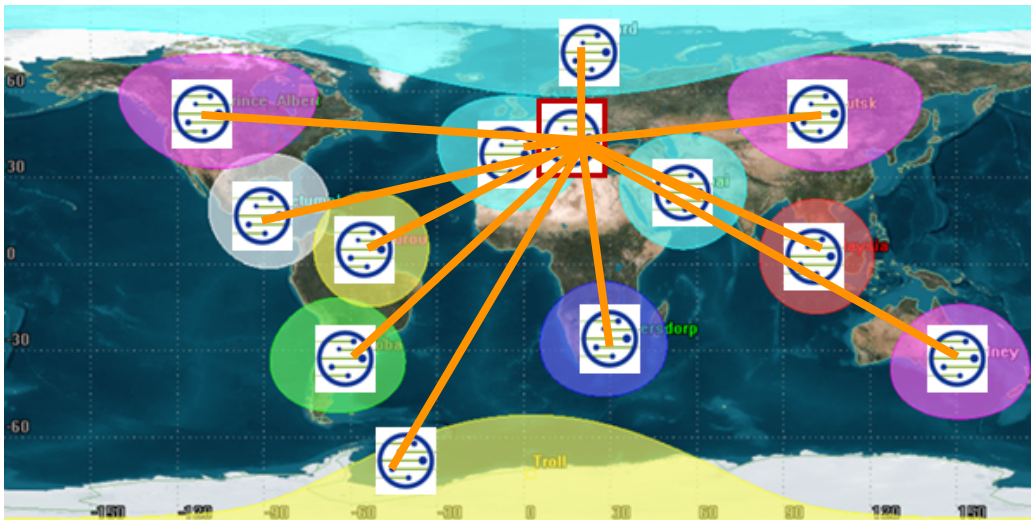
- GEO-Cloud in Fed4FIRE



The GEO-Cloud Experiment

- PlanetLab

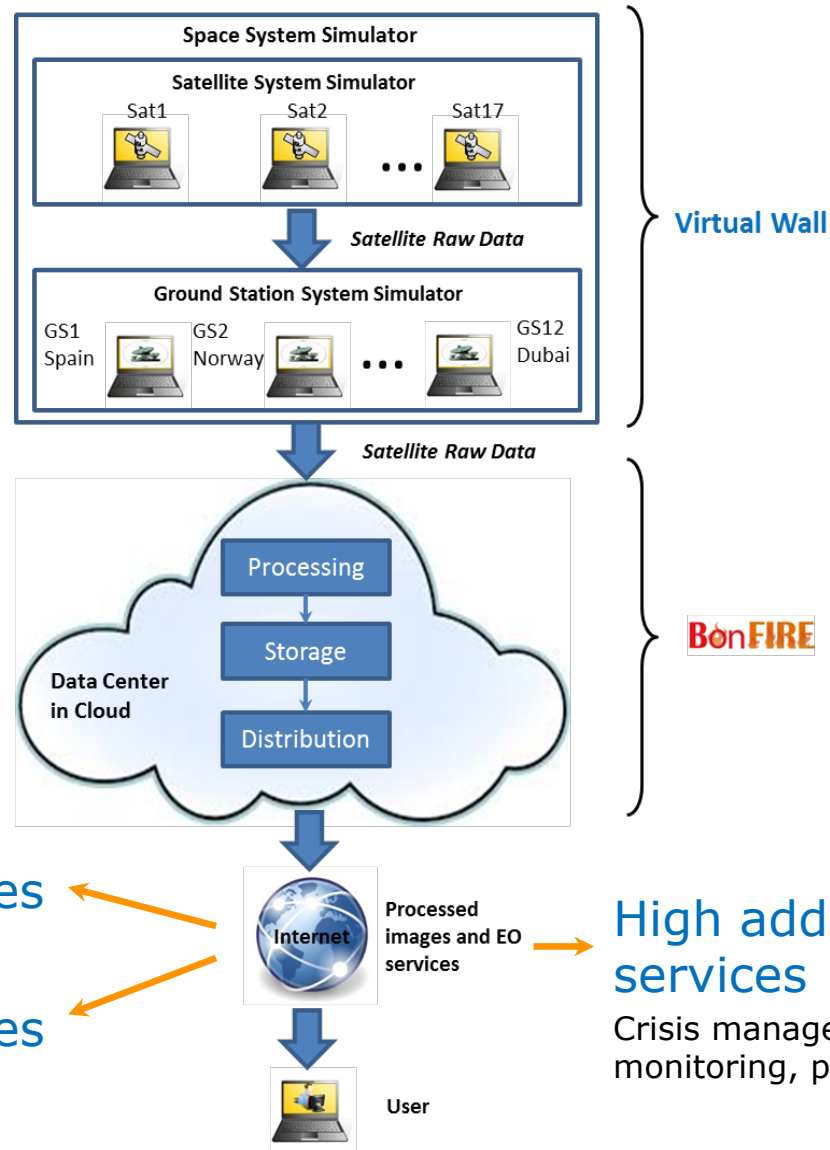
- It offers the possibility of testing real networks.
- **Emulation** in real environment
- Measurement of impairments of the networks tested: Bandwidth, Latency and Loss Rate.



The GEO-Cloud Experiment

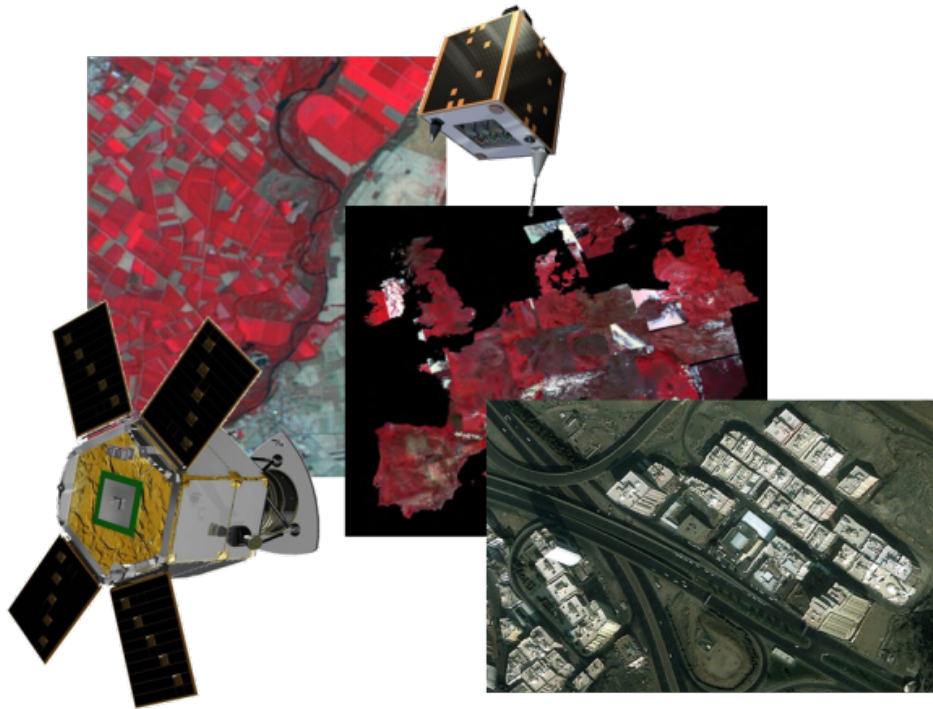
- Experiment

Processing Time?
Workload?



High added value services

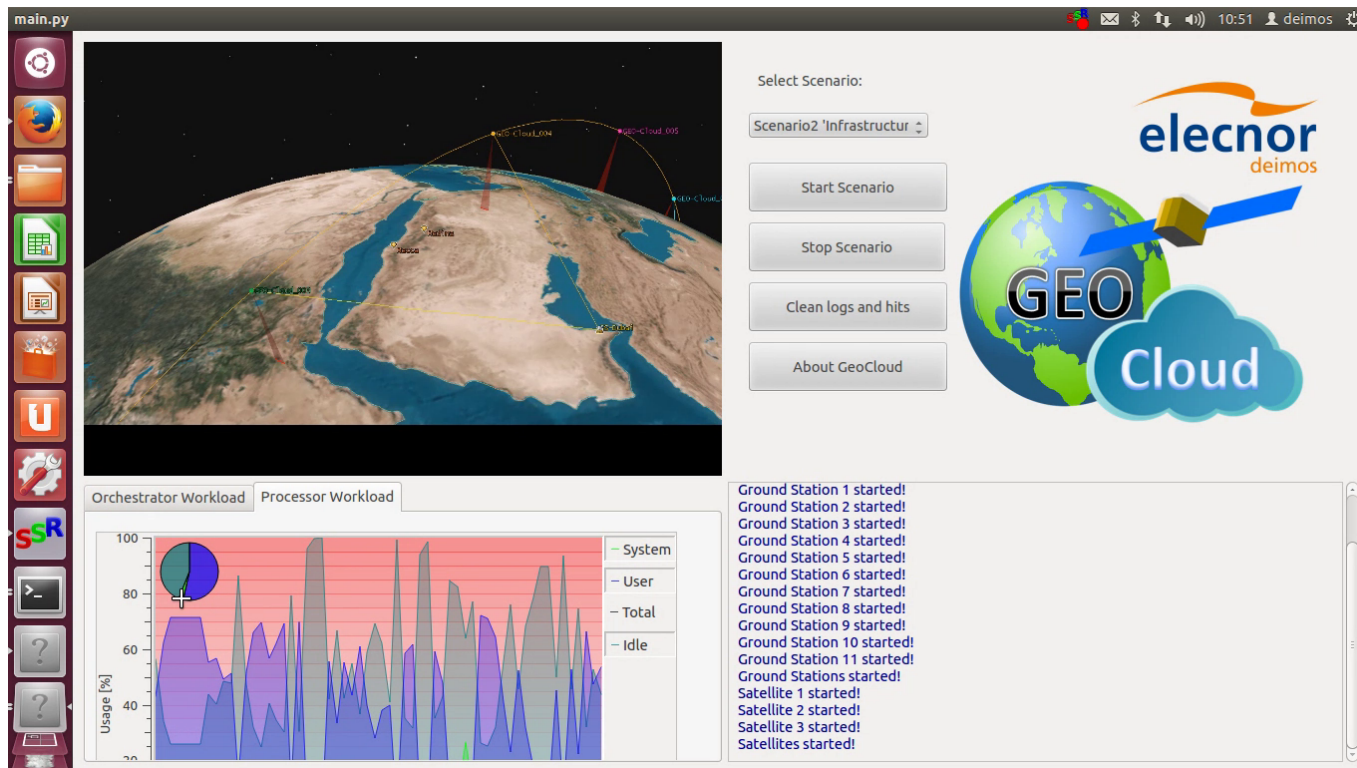
Crisis management, infrastructure monitoring, precision agriculture, etc.



3 Preliminary Results

Preliminary Results

- Graphical User Interface to control and monitor the experiment
- Scenario: Infrastructure monitoring – Railway Medina-Mecca
- Time from ingestion of data in the cloud until a user accesses a geolocated image with radiometric calibration: 8 minutes.



Preliminary Results

- Automatic archive and catalogue of satellite imagery.

GeoServer: Layer Preview - Mozilla Firefox

Experiment Details x GeoServer: Layer Pr... x

131.254.204.143/geoserver/web/?wicket:bookmarkablePage=:org.geoserver.web.demo.MapPreviewPage

Google

Logged in as admin. Logout

Layer Preview

List of all layers configured in GeoServer and provides previews in various formats for each.

<< < > >> Results 1 to 1 (out of 1 items) Search

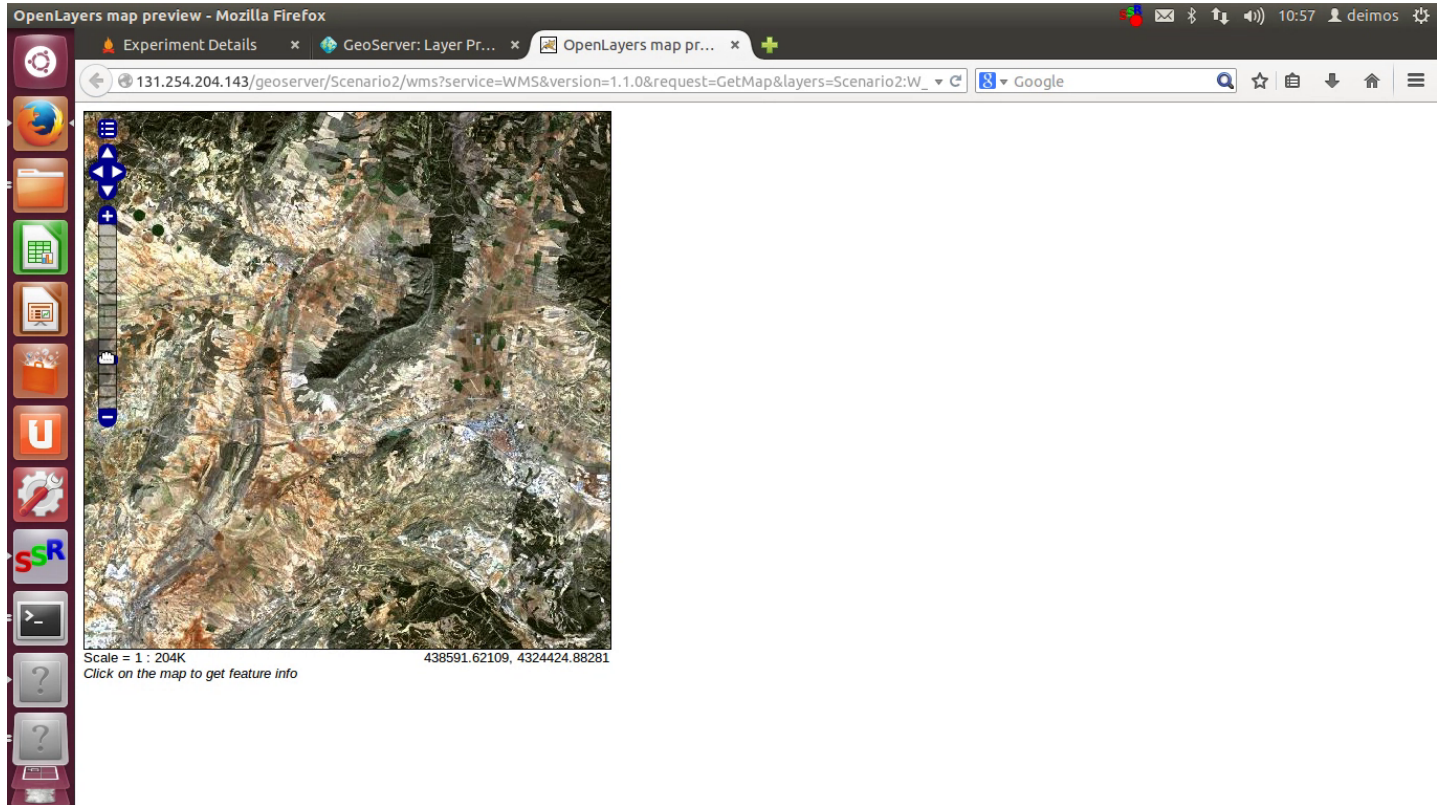
Type	Name	Title	Common Formats	All Formats
	Scenario2:W_GS2_SAT4_2_USEFULL_10:51:20:42_19-06-14	W_GS2_SAT4_2_USEFULL_10:51:20:42_19-06-14	OpenLayers KML	Select one

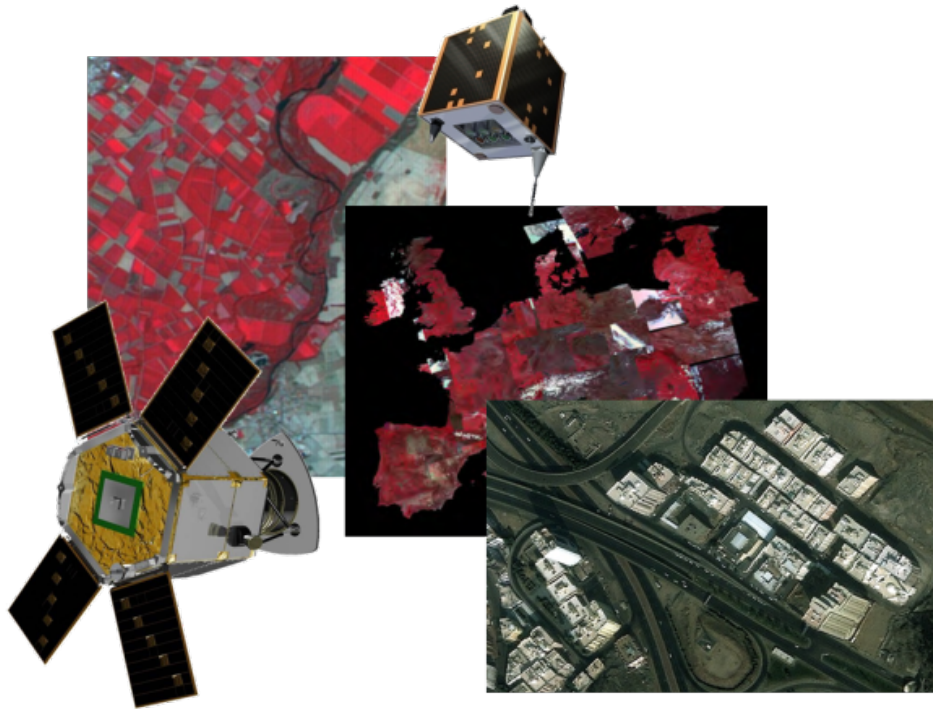
<< < > >> Results 1 to 1 (out of 1 items)

131.254.204.143/geoserver/web/?wicket:bookmarkablePage=:org.geoserver.web.admin.LogPage

Preliminary Results

- Instantaneous access to satellite imagery through the Internet.





4 Conclusions

Conclusions

- Experiment conclusions
 - Complete design and implementation of a complete EO system in Fed4FIRE
 - Reduction in the time from acquisition of data until its distribution to end users.
 - Automatic archive and catalogue
 - Internet access
 - First round of experiments in progress

Conclusions

- Benefits of using Fed4FIRE
 - Multi-testbed connectivity
 - Simulation environment accessibility
 - Emulation environment accessibility
 - Real infrastructures to test real developments
 - Controllability at all levels
 - Monitoring at all levels
 - Access to control and monitoring tools: NEPI, Jfed, BonFIRE web.

Acknowledgement

- This work was carried out with the support of the Fed4FIRE-project (“Federation for FIRE”), an Integrated project receiving funding from the European Union’s Seventh Framework Programme for research, technological development and demonstration under grant agreement no 318389
- It does not necessarily reflect the views of the European Commission. The European Commission is not liable for any use that may be made of the information contained herein.

Thanks for your attention

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