

# HPC in the Cloud Era

HPC User Forum

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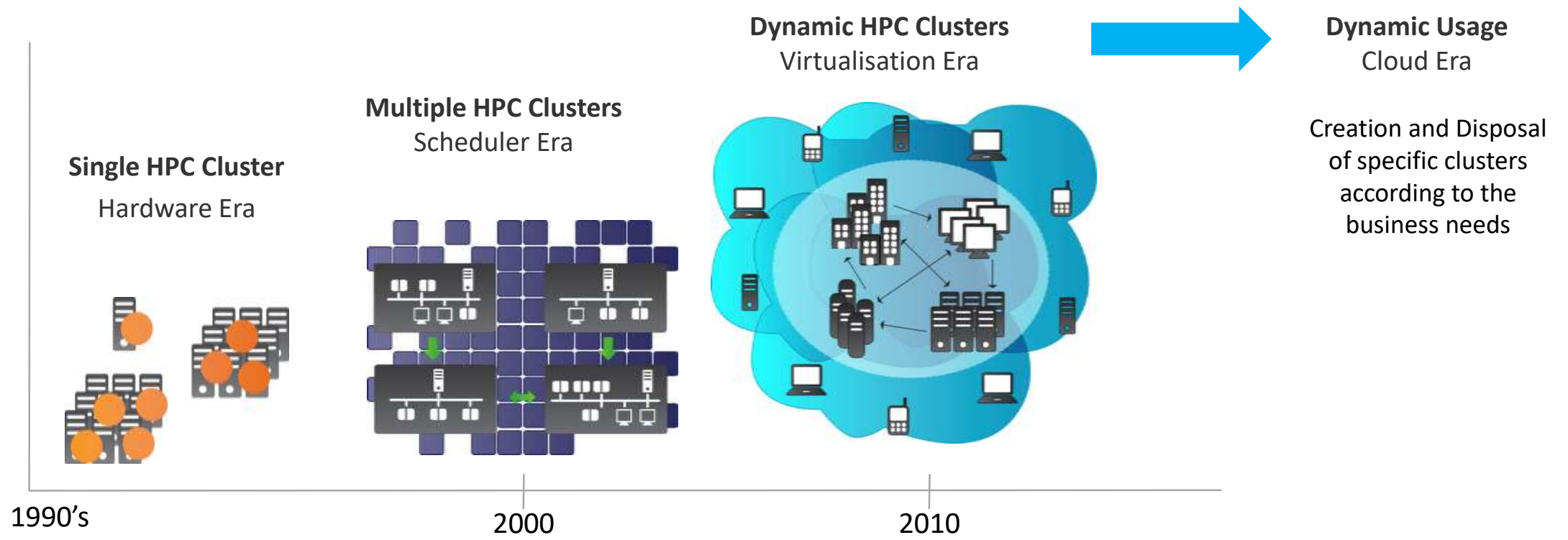


# Clusters, Grids and Clouds



Scope of sharing

On-prem clusters tend to be deployed and maintained for few years



# What's the uniqueness of the Cloud?



## **The Scale**

Almost unlimited resources

## **Pay-as-you-go**

Running 1000 jobs in parallel costs the same as running one job at a time

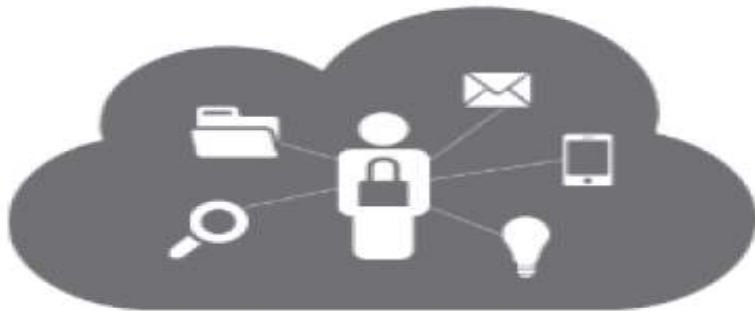
## **Create and Dispose**

Lifecycle of a HPC system OnPrem is 3+ years vs the time to execute a job

## **Match the Architecture to the Job!**



# Public, Private & Hybrid Clouds



## Private

- Single tenant implementation
- Owned and operated by IT organization
- Define your own data management policies
- Self-service and automation capabilities provide new agility



## Hybrid

- Combination for Private & one or more public clouds
- Allows IT organizations to become brokers of services



## Public

- Multi-tenant implementation
- Owned and operated by Service Provider
- Bound by multi-tenant data management policies
- Similar self-service and automation capabilities as Private Cloud

\* ) **Others:** Inter-Cloud: interconnecting multiple cloud service providers  
Community Cloud: shared by several organizations with shared concerns (Grids?)

# What is a HPC Cluster?



## Access Portal and WebServices APIs

Tailored to specific users, applications and business processes of a Company

Pre/Post Analysis

Enterprise Applications

ISV Applications

Resource Manager (LSF/PBS/GE/SLURM/Torque)

Remote Visualization

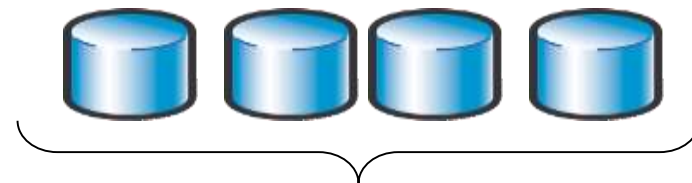
MPI, Parallel, Serial, ...

LAN/WAN Data Management

2D and 3D OpenGL/DirectX

Batch Applications

Distributed Data Management



Multiple Clusters

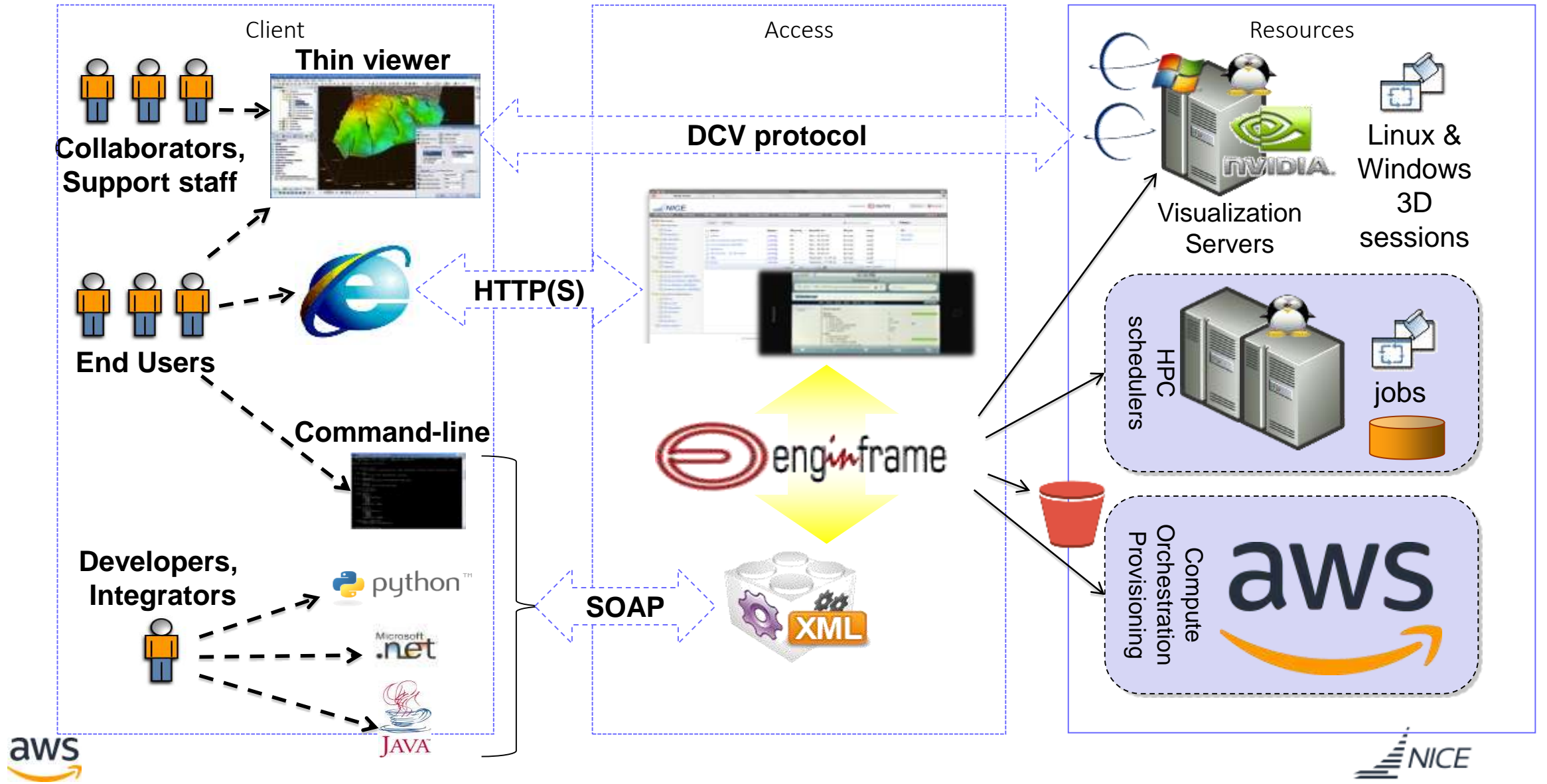
LAN/WAN Distributed Data

LAN/WAN Distributed and Heterogeneous

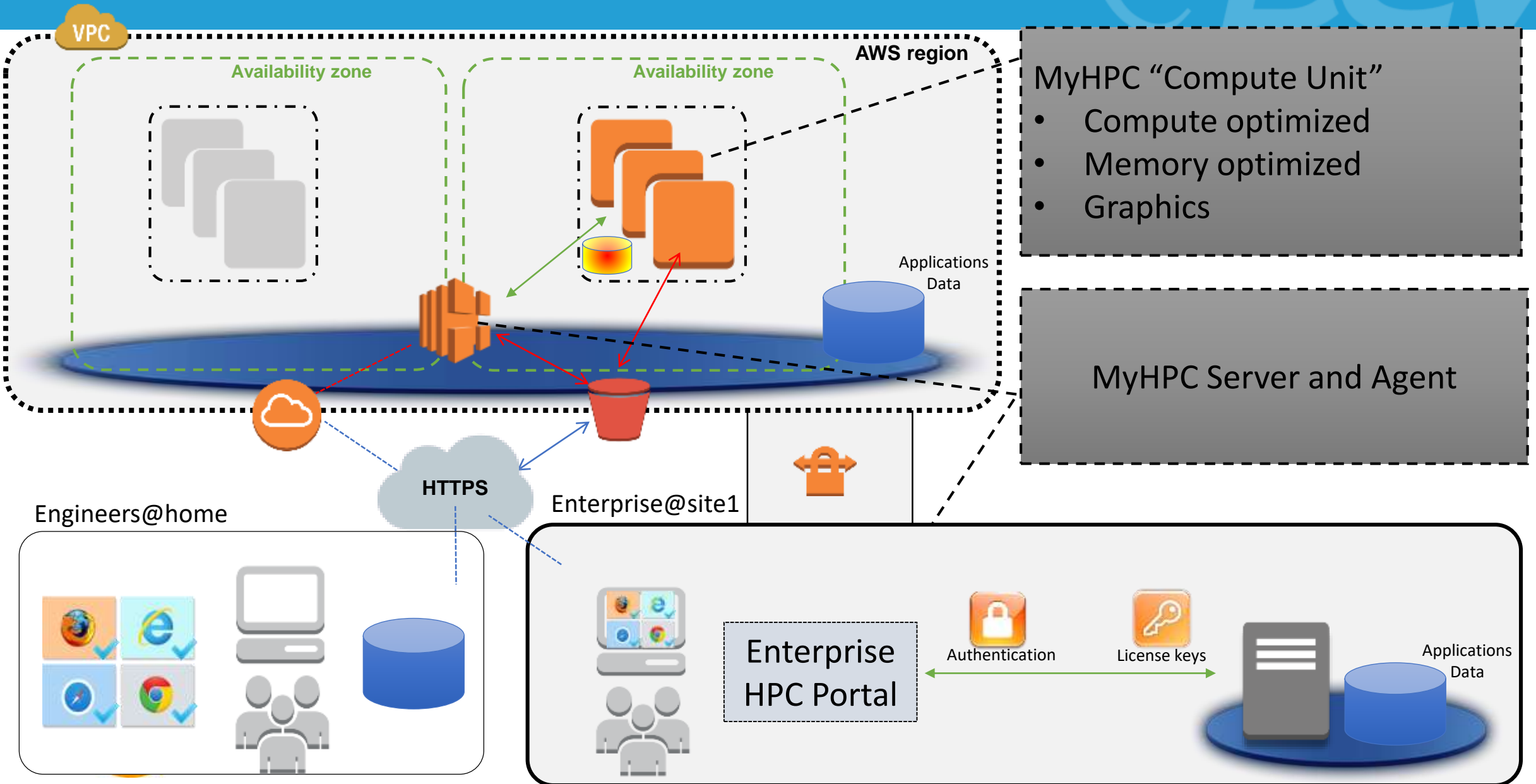
Monitoring  
Provisioning



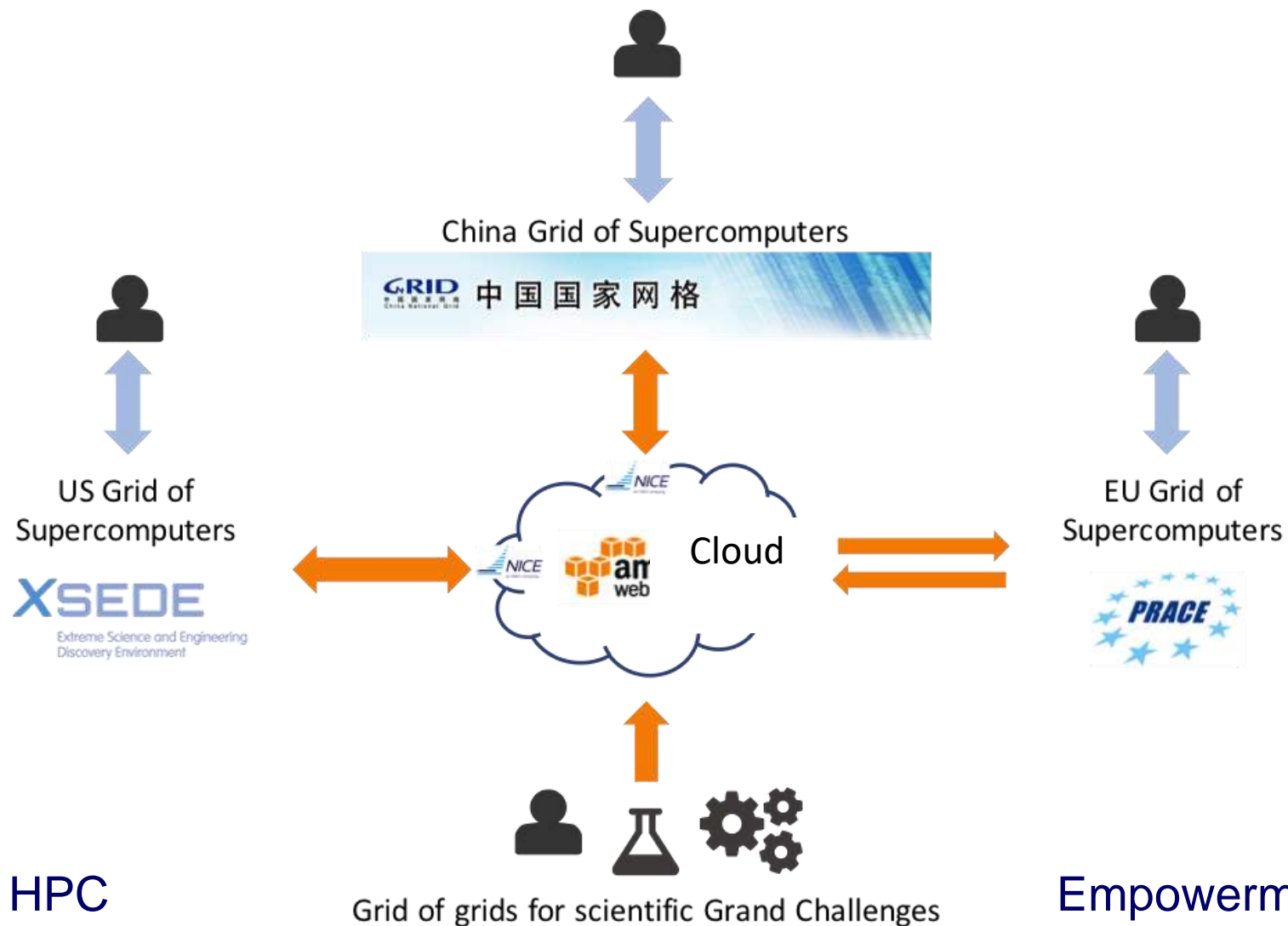
# HPCaaS Architecture



# MyHPC – Hybrid AWS/OnPrem deployment



# From «The Network is the Computer» To «The Cloud is the Network»

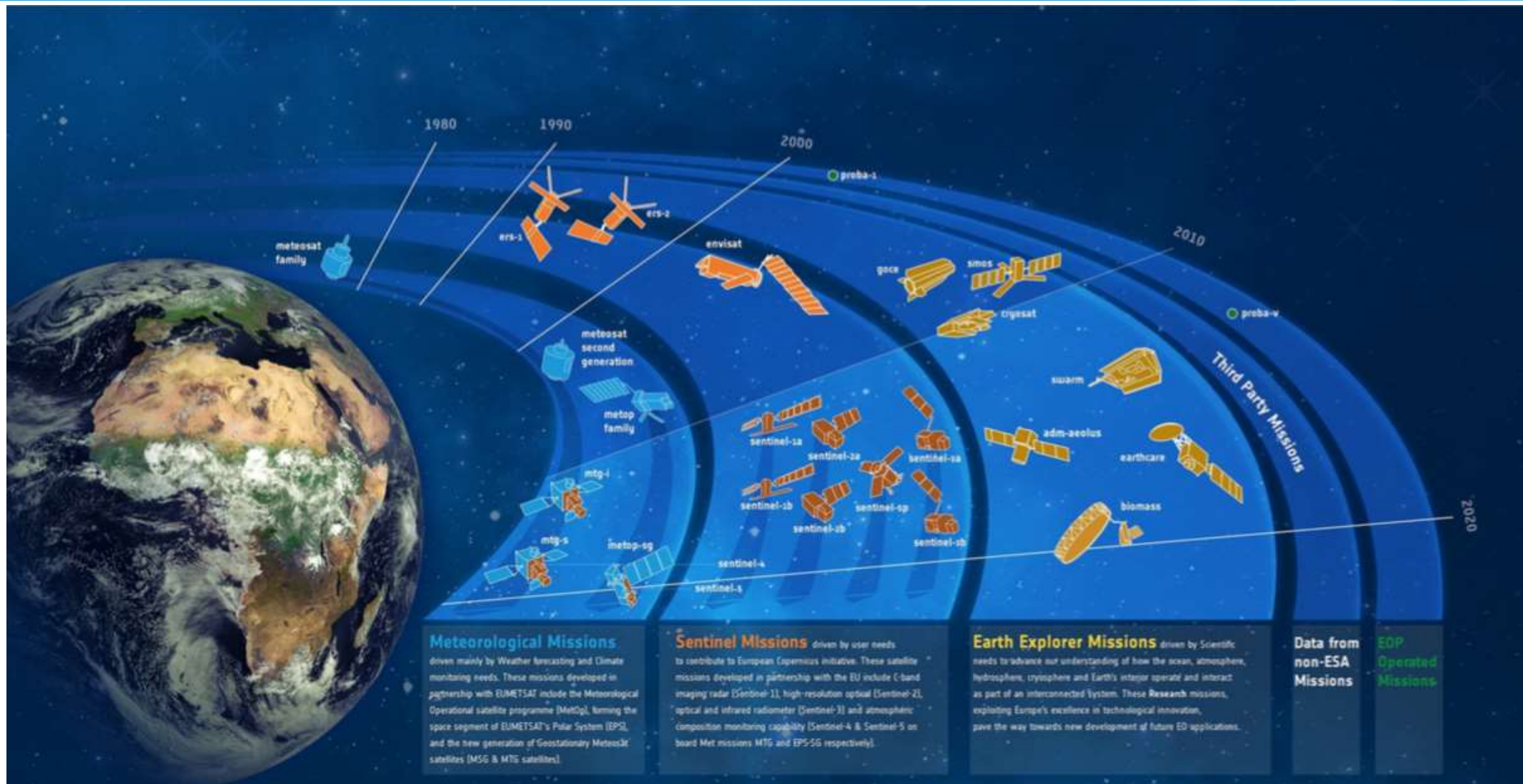


Democratisation of HPC

Empowerment of Organisations



# BIG CHALLENGE : BIG DATA in Orbit will enable a new generation of HPC applications



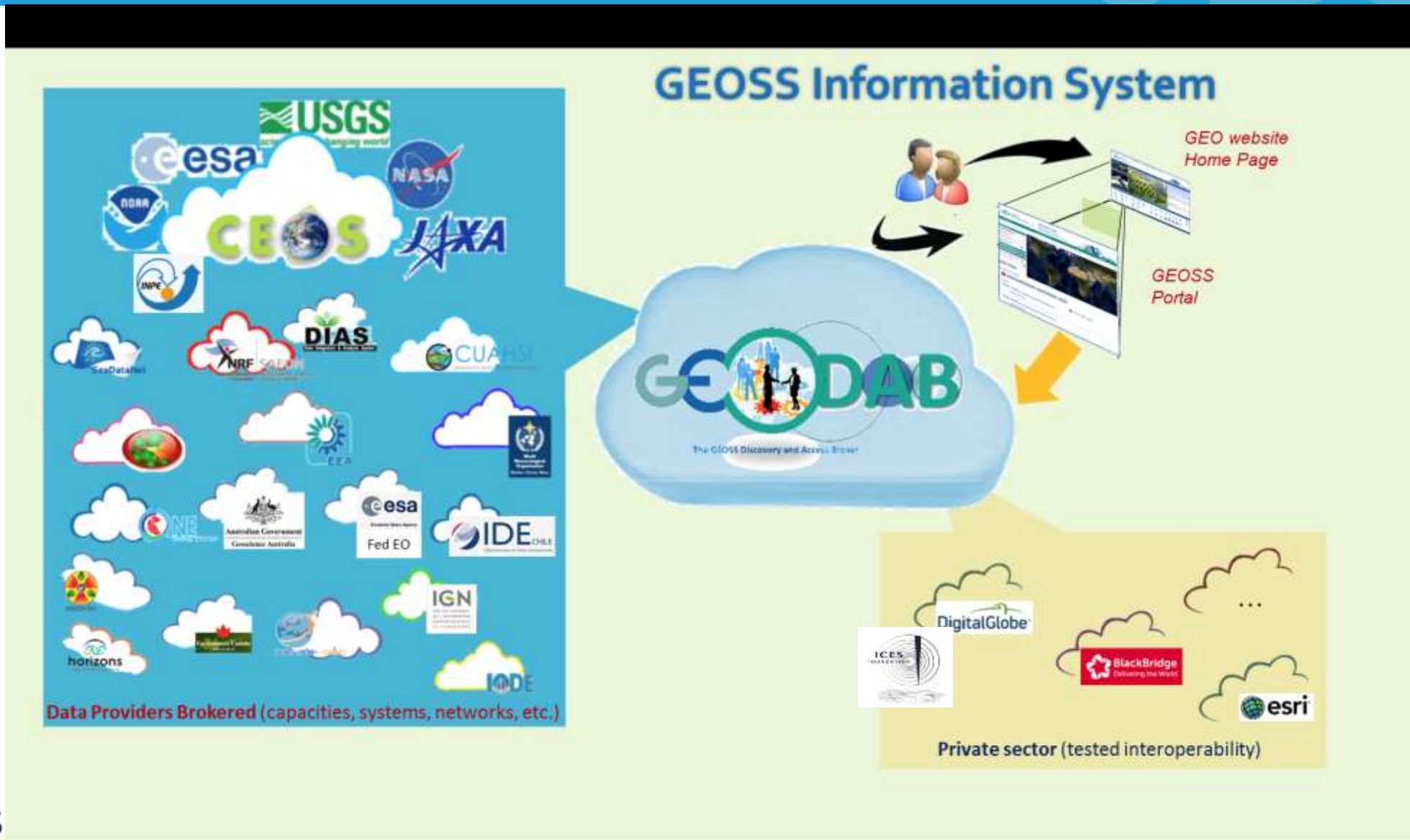
**Meteorological Missions**  
 driven mainly by Weather forecasting and Climate monitoring needs. These missions developed in partnership with EUMETSAT include the Meteorological Operational satellite programme (MetOp), forming the space segment of EUMETSAT's Polar System (EPS), and the new generation of Geostationary Meteosat satellites (MSG & MTG satellites).

**Sentinel Missions** driven by user needs to contribute to European Copernicus initiative. These satellite missions developed in partnership with the EU include C-band imaging radar (Sentinel-1), high-resolution optical (Sentinel-2), optical and infrared radiometer (Sentinel-3) and atmospheric composition monitoring capability (Sentinel-4 & Sentinel-5 on board Met missions MTG and EPS-SG respectively).

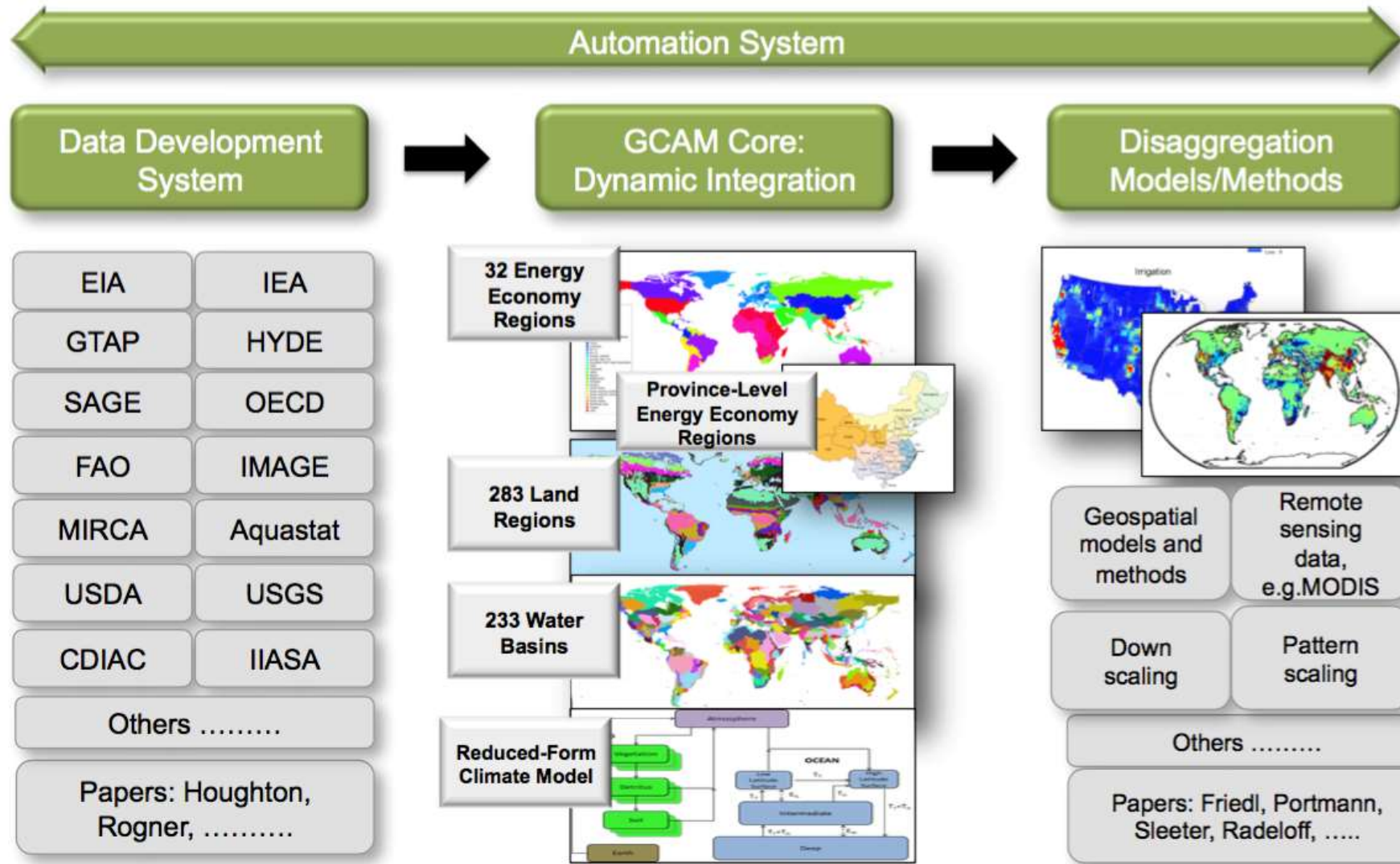
**Earth Explorer Missions** driven by Scientific needs to advance our understanding of how the ocean, atmosphere, hydrosphere, cryosphere and Earth's interior operate and interact as part of an interconnected system. These Research missions, exploiting Europe's excellence in technological innovation, pave the way towards new development of future EO applications.

**Data from non-ESA Missions** EOP Operated Missions

# BIG CHALLENGE : They start with Data Collection



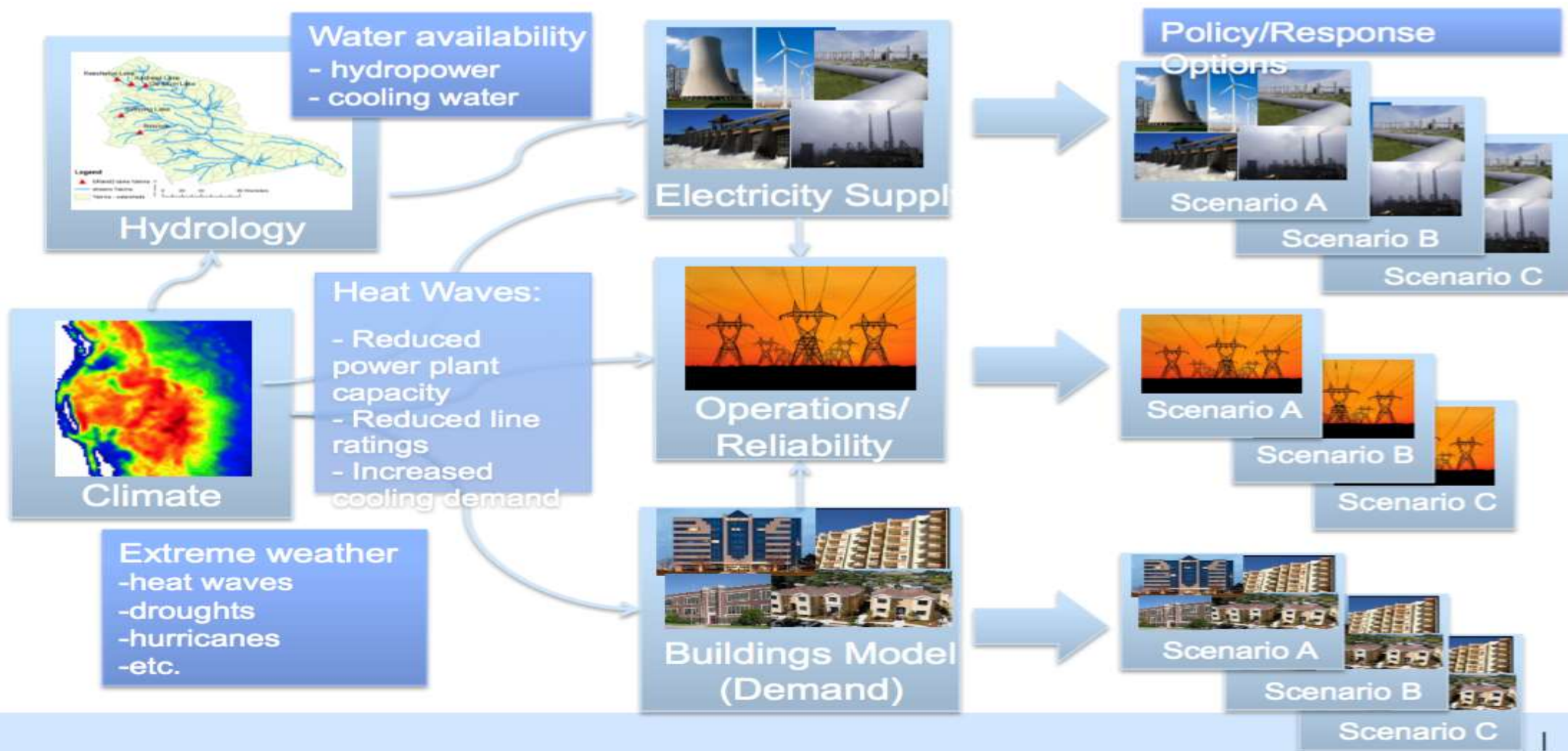
# Example Global Change Assessment Model (GCAM)



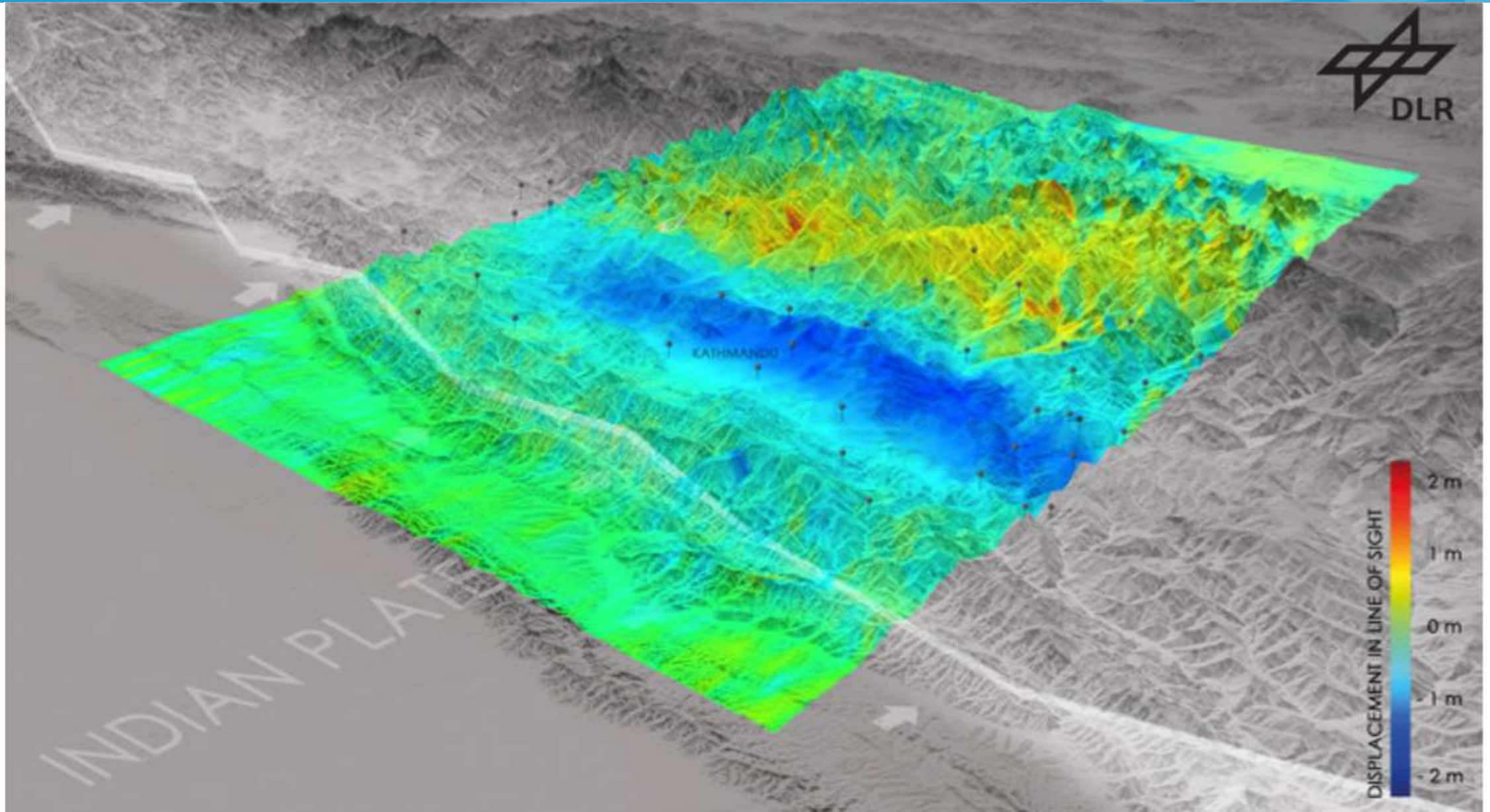
Mixing HPC and Cloud : GEOSS Example Data on S3 & Compute on National HPC Systems



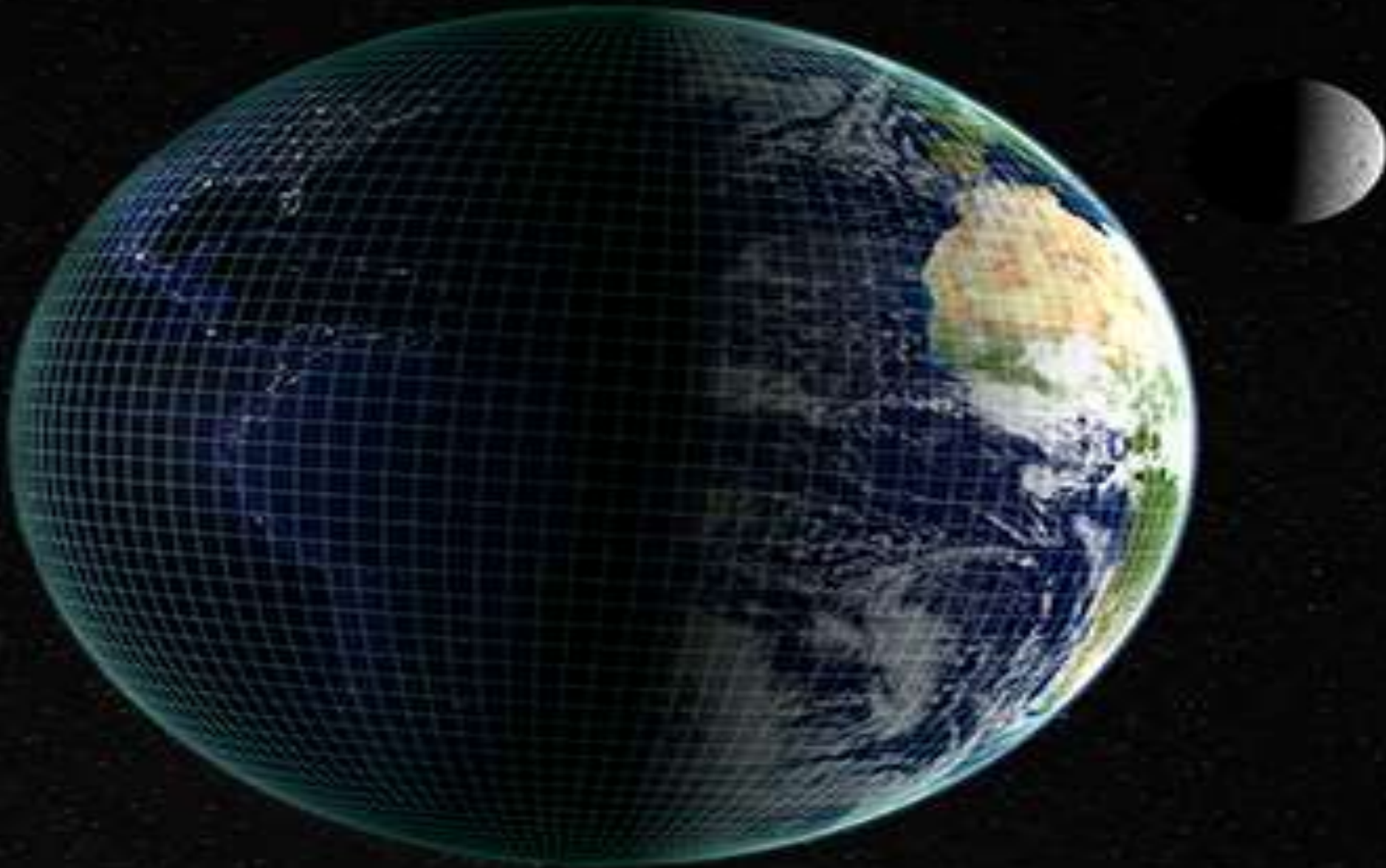
## Integrated analyses of impacts, vulnerabilities, and adaptation options



# Sentinel-1A: Nepal Earthquake IOT to Supercomputers for Urgent Computing



The real world is massively complex



YOU ARE NOW AT THE  
OBSERVATION DECK.  
PLEASE EXERCISE COMMON  
COURTESY AND DISABLE YOUR  
COMMUNICATORS AND OTHER  
HUMAN-INTERFACE DEVICES.



**Planetary  
Boundaries**

**Early Warning**

**Understanding**

**Monitoring**

**Attribution**



# **Towards a Planetary Management System**



**Citizen  
Observatory**



**Prediction**

