Earth Observation within SpaceGRID

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Presentation Outline

- Earth Observation and GRID

- Earth Observation and SpaceGRID

- What EO Users want/need

- A possible GRID Infrastructure for EO

- EO Prototyping Activities

- GRID and Future EO G/S

Earth Observation and GRID

- **Distributed Computing**
  - Integration of data from various instruments and missions
- **High-Throughput Computing**
  - Interferometry …
- **On-Demand Computing**
  - Generation of EO user products…
- **Data-Intensive Computing**
  - Archive data re-processing, climate modeling
- **Collaborative Computing**
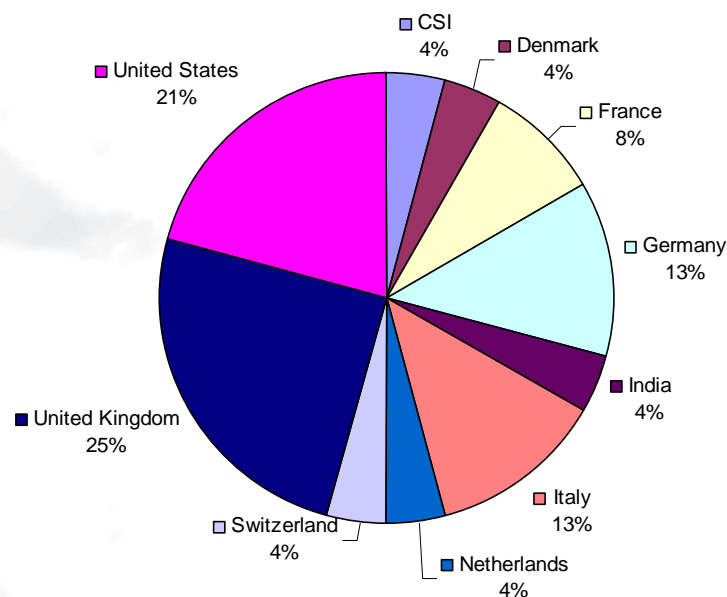 - Scientists application interactions, Instrument cal/val …

Earth Observation and
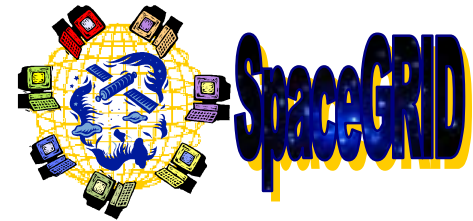
- Concerning EO, SpaceGRID study aims to:
  - identification of user requirements for EO applications -> verify how GRID can satisfy EO req's
  - identification of infrastructure requirements for seamless access to distributed EO data, applications and resources -> verify GRID applicability on EO infrastructural needs
  - definition of a possible infrastructure architecture for EO applications over GRID -> suggest acceptable paths to use GRID for EO applications and services
  - implementation of a demonstrator -> typical EO problem addressed using GRID
  - study a future GRID-based EO Ground Segment -> suggest acceptable paths to use GRID for EO Ground Segment

What EO Users want/need

- A questionnaire was sent to about 700 PI's that submitted ENVISAT AO and CAT-1 projects

- About 5% answered

Geographical distribution of answers

CSI 4%
Denmark 4%
France 8%
Germany 13%
India 4%
Italy 13%
Netherlands 4%
Switzerland 4%
United Kingdom 25%
United States 21%

What EO Users want/need

- Distributed access to distributed Resources (data/services/network/computing/storage)
- High flexibility, to foster data fusion and assimilation (meteo, models, global changes, etc.)
- Portal enabling easy and homogeneous accessibility
- Virtual Organisation (VO) Management
- Collaborative work
- Seamless integration of Resources and processes (Web Services!)
- Reliable application infrastructure, kind-of QoS
- Avoid unauthorised access to/use of Resources
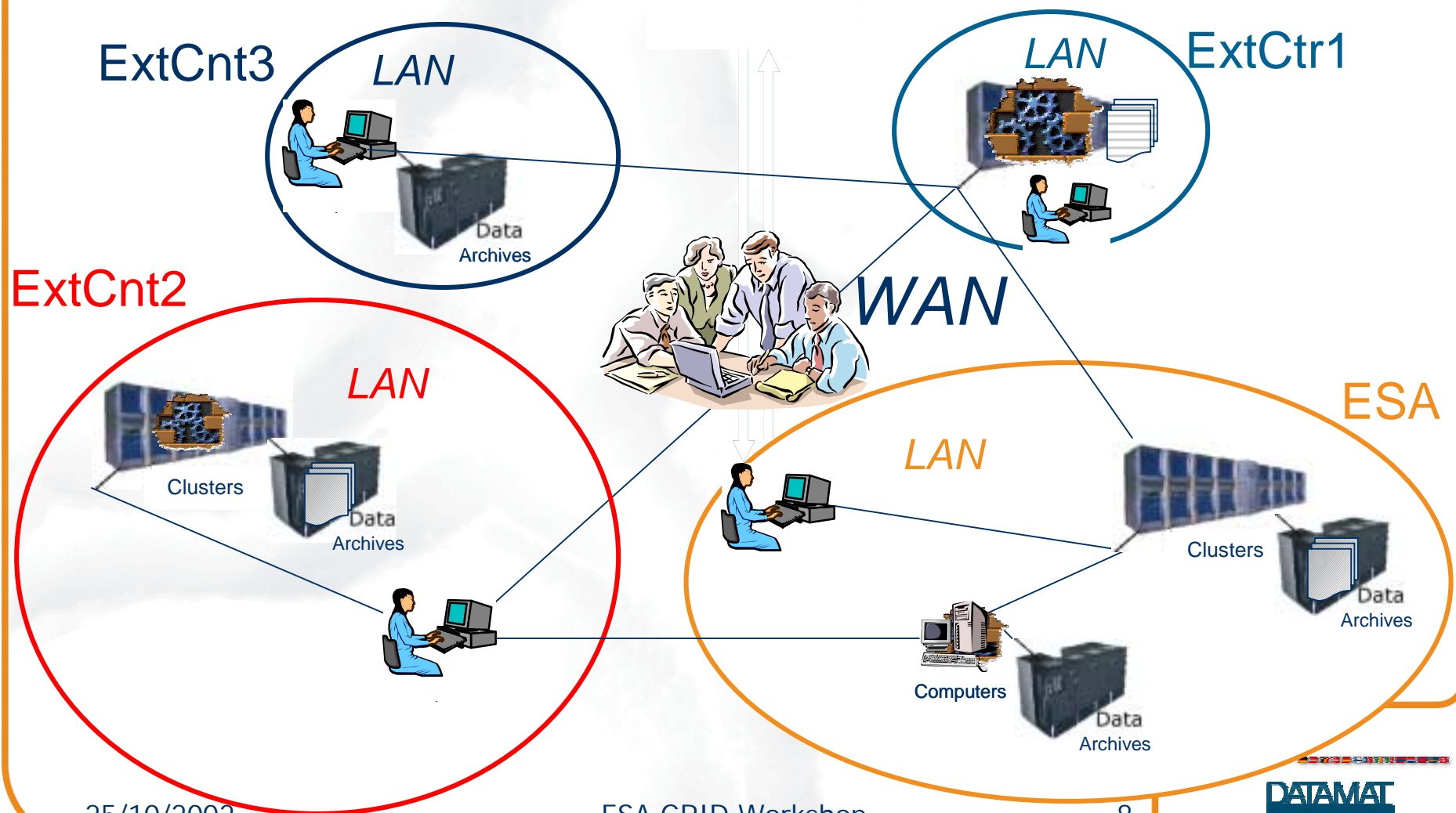- Enough bandwidth (> 100Mb/s)

A GRID Infrastructure for EO
Priorities

- Four functional areas identified as highest priority for an EO GRID infrastructure:
  - Access to Distributed Data and Algorithms
  - On-demand Processing
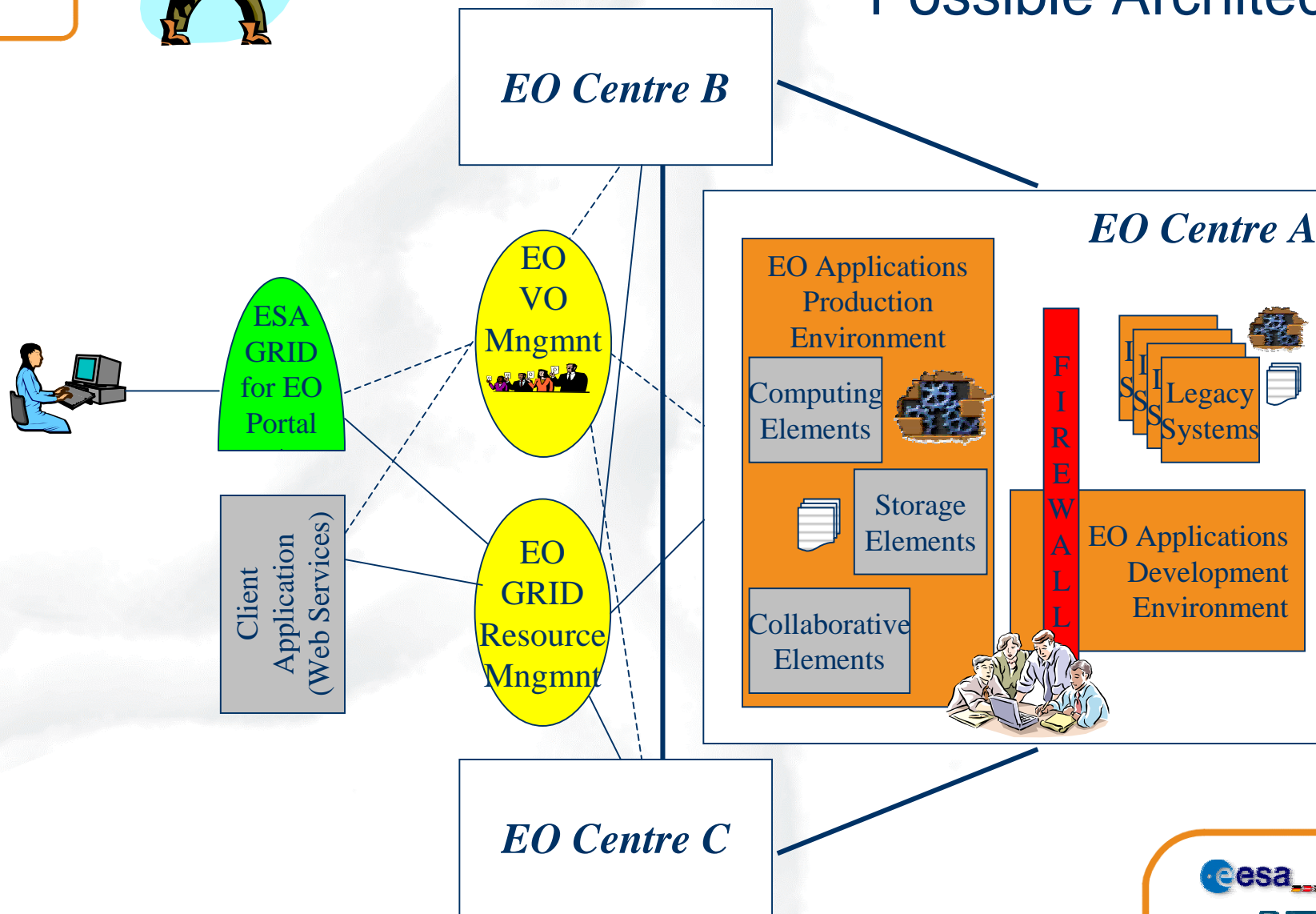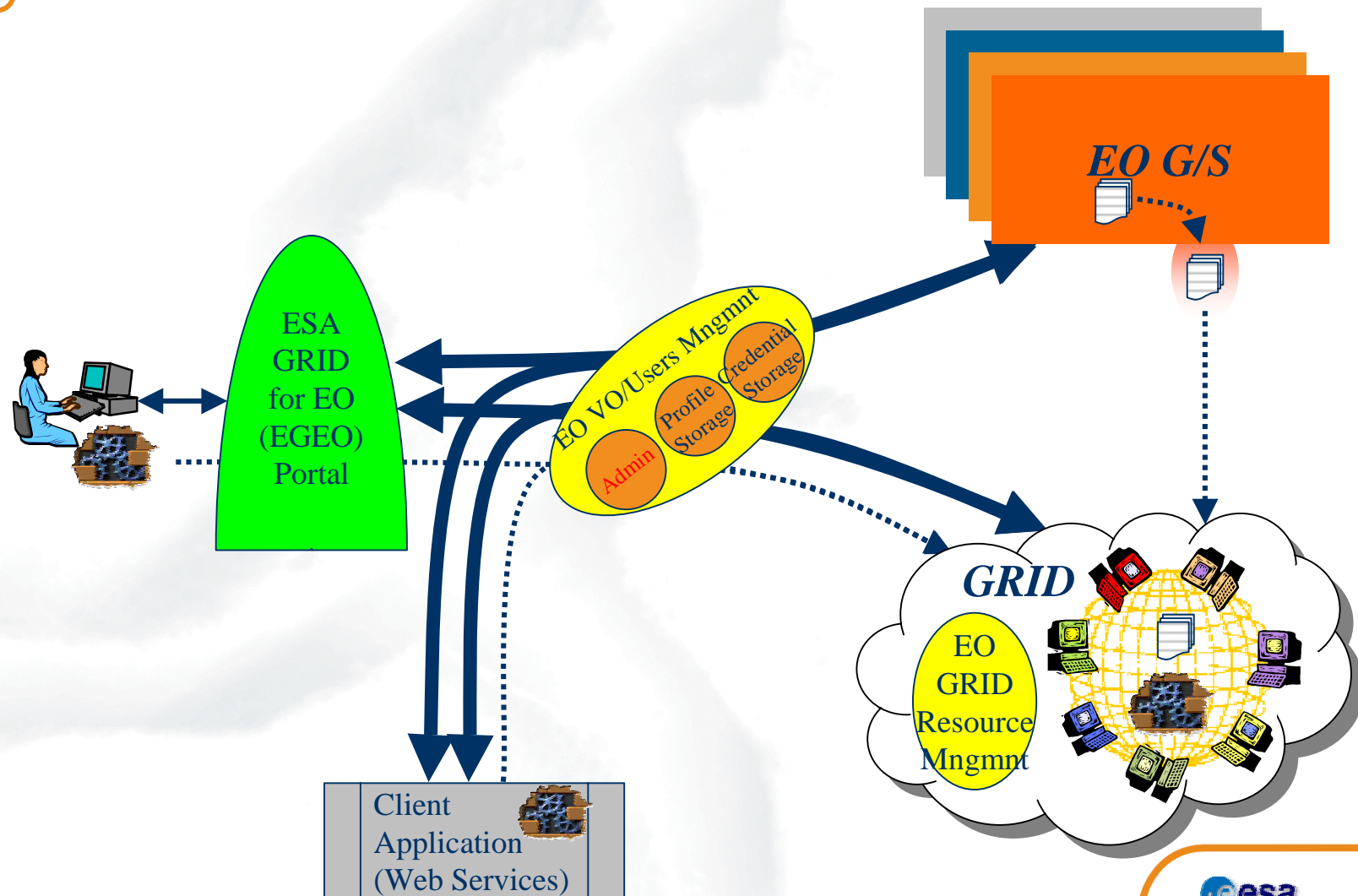 - Seamless integration with Web Services
  - Collaborative Work

ExtCnt3

LAN

ExtCtr1

LAN

Data
Archives

ExtCnt2

LAN

Clusters

Data
Archives

WAN

ESA

LAN

Clusters

Data
Archives

Computers

Data
Archives

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A GRID Infrastructure for EO
Possible Architecture

EO Centre B

EO Centre A

EO VO Mngmnt

ESA GRID for EO Portal

Client Application (Web Services)

EO GRID Resource Mngmnt

EO Applications Production Environment

Computing Elements

Storage Elements

Collaborative Elements

FIREWALL

Legacy Systems

EO Applications Development Environment

EO Centre C

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EO G/S

ESA GRID for EO (EGEO) Portal

EO VO/Users Mngmnt

Admin

Profile Storage

Credential Storage

GRID

EO GRID Resource Mngmnt

Client Application (Web Services)

EO Prototyping Activities
Actual Prototype

Application Staging

→ Data flow

GSs

Two main goals:

1. Demonstrate Application and Data staging from outside into the GRID

Resource Manager
- Application Manager
- JS
- RFT

(1) (2) (3)

EO Application Execution Client

CE
- Gatekeeper
- WN
- WN
- WN

(4)
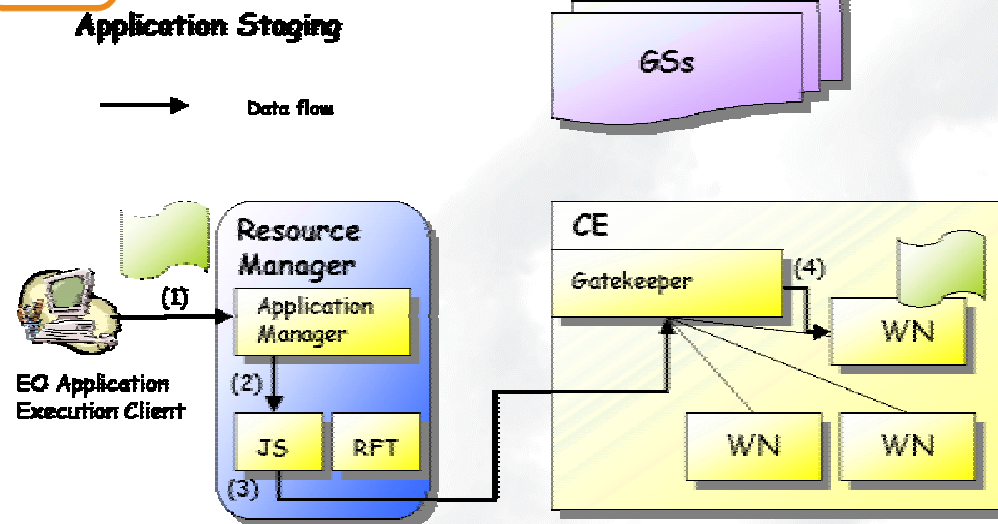
2. <u>Demonstrate it using the latest technology available: Open Grid Services Infrastructure (from Globus) and Web Services</u>

GS Data Transfer

Third Party Ftp GS-SE

------→ Control flow
────→ Data flow

GSs

ThirdPartyFtp

SE

URLCopy

Resource Manager
- Application Manager
- JS
- RFT

(1) (4) (2) (3) (5)

EO Application Execution Client

CE
- Gatekeeper
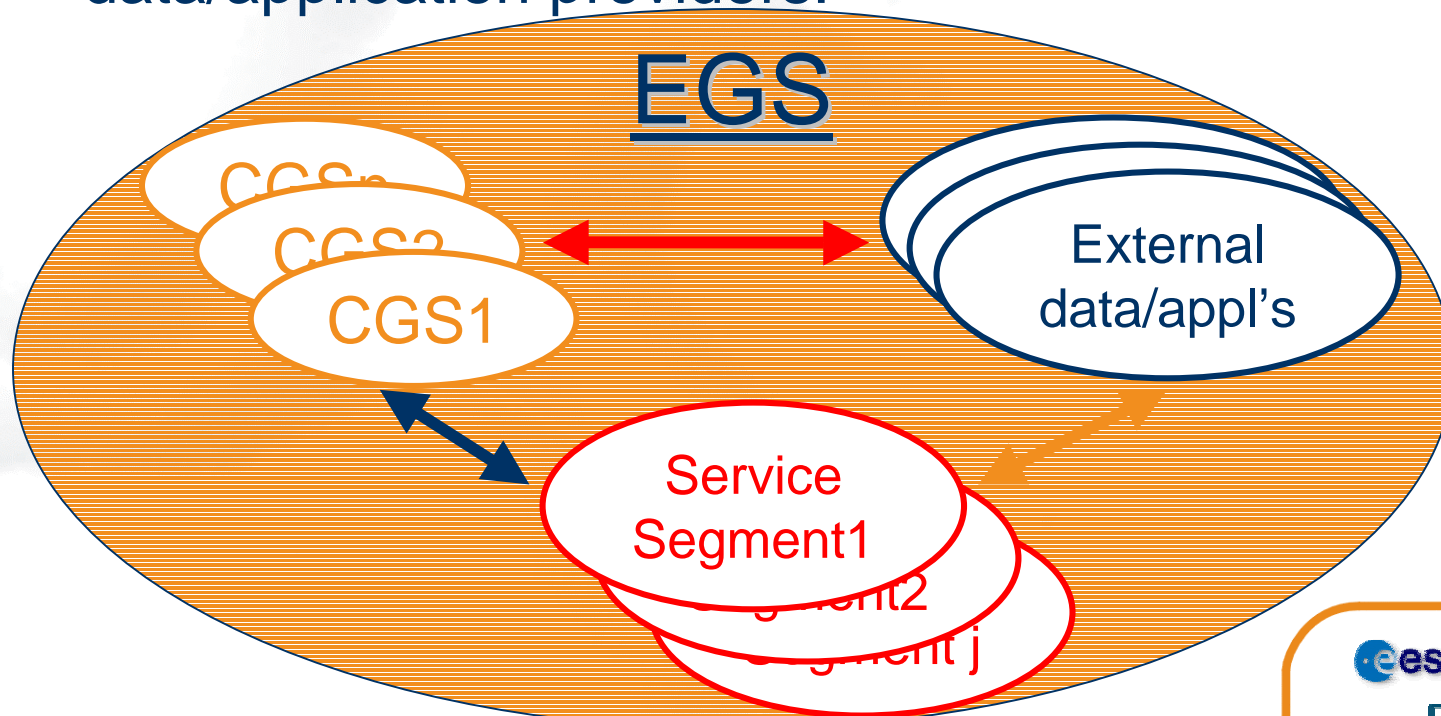- WN
- WN
- WN

(6) (7)

ESA GRID Worksh
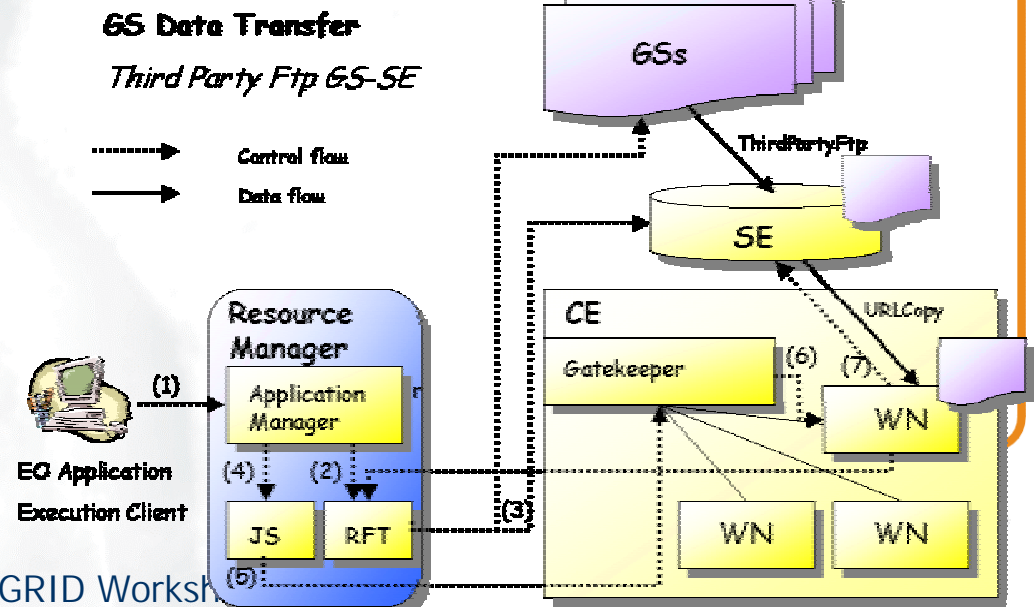
GRID and Future EO G/S
A new Ground Segment concept

- *Enlarged Ground Segments*
  - A "dynamic" composition of Core Ground Segments (CGS), Service Segments and external data/application providers:

EGS

CGSn
CGS2
CGS1

External data/appl's

Service Segment1
Segment2
Segment j

- **GRID** as enabling technology to transparently share data/products also in "proprietary" formats (e.g. from some CGS's or non-space data)

- **Web/Grid Services**-based to share/"sell" third-party services, taking etherogeneous CGS's data/products plus non-space data as input

- **Web/Grid Services**-based Workflow Management to offer on-demand end-to-end services, no matter how they are composed, where they are and who run them, including user own services to be staged on the grid