A Grid Platform for the European Civil Protection e-Infrastructure: the Forest Fires use scenario

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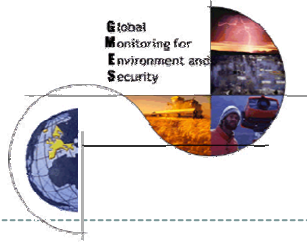
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Outline

- Rationale and Context
- The CYCLOPS Architectural Framework
- User Scenario
  - Wild Fires Risk Assessment
  - RISICO application
- G-RISICO prototype
- Lessons Learned and Conclusions

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RATIONALE AND CONTEXT

Rationale

- European Commission GMES initiative aims to establish a European capacity for Global Monitoring for Environment and Security. This requires:
  - to **gather and use all available data** and information in support of sustainable development policies;
  - to **provide services** to enable decision makers to better anticipate or mitigate crisis situations and management issues related to the environment and security
- The European Civil Protection (CP) was recognized as one of the most important GMES service categories.

- **An Europe-wide cooperative platform for supporting GMES and CP applications should be considered a mid-term objective to enhance the CP emergency management**

Towards an e-Infrastructure for Civil Protection

- Civil Protection and GMES applications:
  - require a strict integration with operational and research infrastructures providing resources and knowledge useful in the full cycle of emergency management;

  - involve many different actors (civil protection systems, public authorities, local administrators, research agencies, etc.) that need to share information and services in a coordinated and effective way;

- Earth system sciences require to scale from specific and monolithic systems (data-centric) towards independent and modular (service-oriented) information systems.
  - Data providers
  - Model providers
  - Integrators

- **The proposed e-Infrastructure for European Civil Protection should be built taking into account the existing solutions for distributed systems and interoperability**

Scientific and Technological Context

- The Grid paradigm is a recent approach to the problem of providing the coordinated sharing of resources (computing, storage, communication) needed by the so-called Virtual Organizations (VOs);

- Many different European and International initiatives in the context of Earth Observation and Earth Sciences have proposed and adopted standard solutions based on Web Services architectures;

- **The proposed e-Infrastructure for European Civil Protection should integrate Web Services and Grid architectures**

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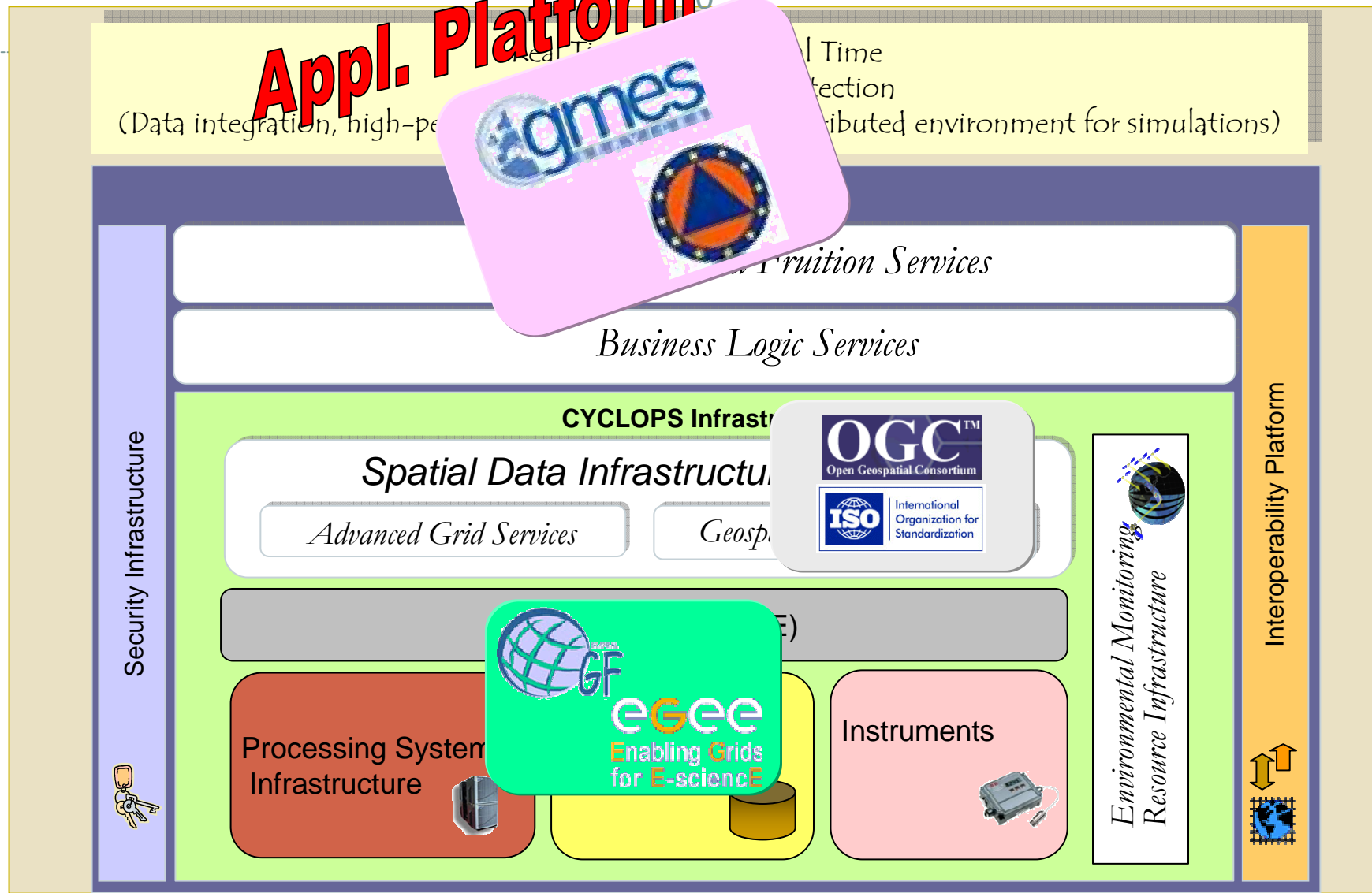
THE CYCLOPS ARCHITECTURAL FRAMEWORK

- In the context of the FP6 Project CYCLOPS (*Cyberinfrastructure for Civil Protection Operative Procedures*) an architectural framework has been proposed and evaluated.

- CYCLOPS workplan:
  1. Use case selection and analysis
  2. System requirements definition
  3. System architecture definition
  4. Proof-of-Concept prototyping

Civil Protection applications requirements

- Civil Protection and GMES applications/systems have specific requirements:
    1. to access infrastructure, run models and search information in a <u>real-time (RT) or near-real-time (NRT) way</u>
        - privileging time of response instead of accuracy
    2. <u>to control sensors networks and acquisition systems</u> and modify their acquisition strategy and processing chain
    3. <u>to share geospatial information</u> that has complex characteristics:
        - Huge amounts of remotely-sensed observations, which are multidimensional and frequently updated
    4. To implement the <u>strict data policy and the security requirements</u> typical of dual systems (civil/military);
    5. To <u>interoperate</u> with existing infrastructures (SDI, security, e-gov, e-business, …);
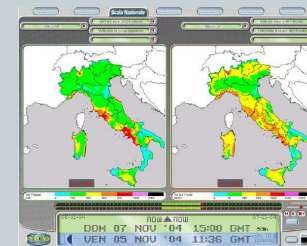
The CYCLOPS Architectural Framework

Appl. Platform

(Data integration, high-pe... Real Time ...tection ...ributed environment for simulations)

gmes

...Fruition Services

Business Logic Services

CYCLOPS Infrastr...

Spatial Data Infrastructu...

Advanced Grid Services *Geosp...*

OGC™ Open Geospatial Consortium

ISO International Organization for Standardization

Security Infrastructure

Interoperability Platform

Environmental Monitoring Resource Infrastructure

GF

eGee Enabling Grids for E-sciencE

Processing System Infrastructure
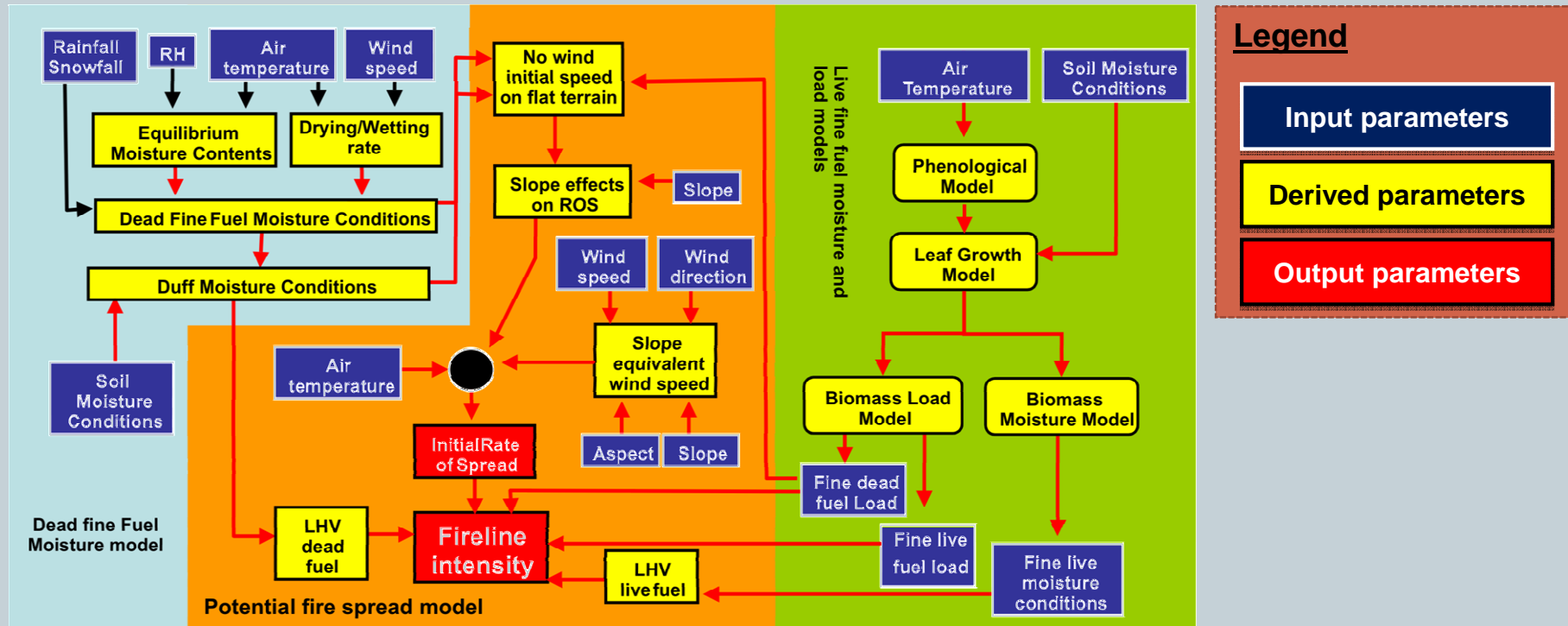
Instruments

THE WILD FIRES RISK ASSESSMENT USER SCENARIO

- RISICO is the application used by the Italian Civil Protection Department (DPC) for wild fires risk assessment
- It is designed and developed by the CIMA (International Centre for Environmental Monitoring) Research Foundation
- RISICO implements a wild fires risk assessment model (based on the Canadian Fire Weather Index – FWI) providing a daily potential fire danger
- It currently runs once a day providing 1km square risk maps over the entire Italy surface

RISICO Flow Diagram

- To test and evaluate the approach, a prototype has been developed:

  - Input and output data are accessed according to standards:
    - OGC WCS (Coverage Service) interface and protocol specification;
    - CF-NetCDF data format and encoding;

  - Processing is exposed as a standard service:
    - OGC WPS (Processing Service) interface and protocol specification;

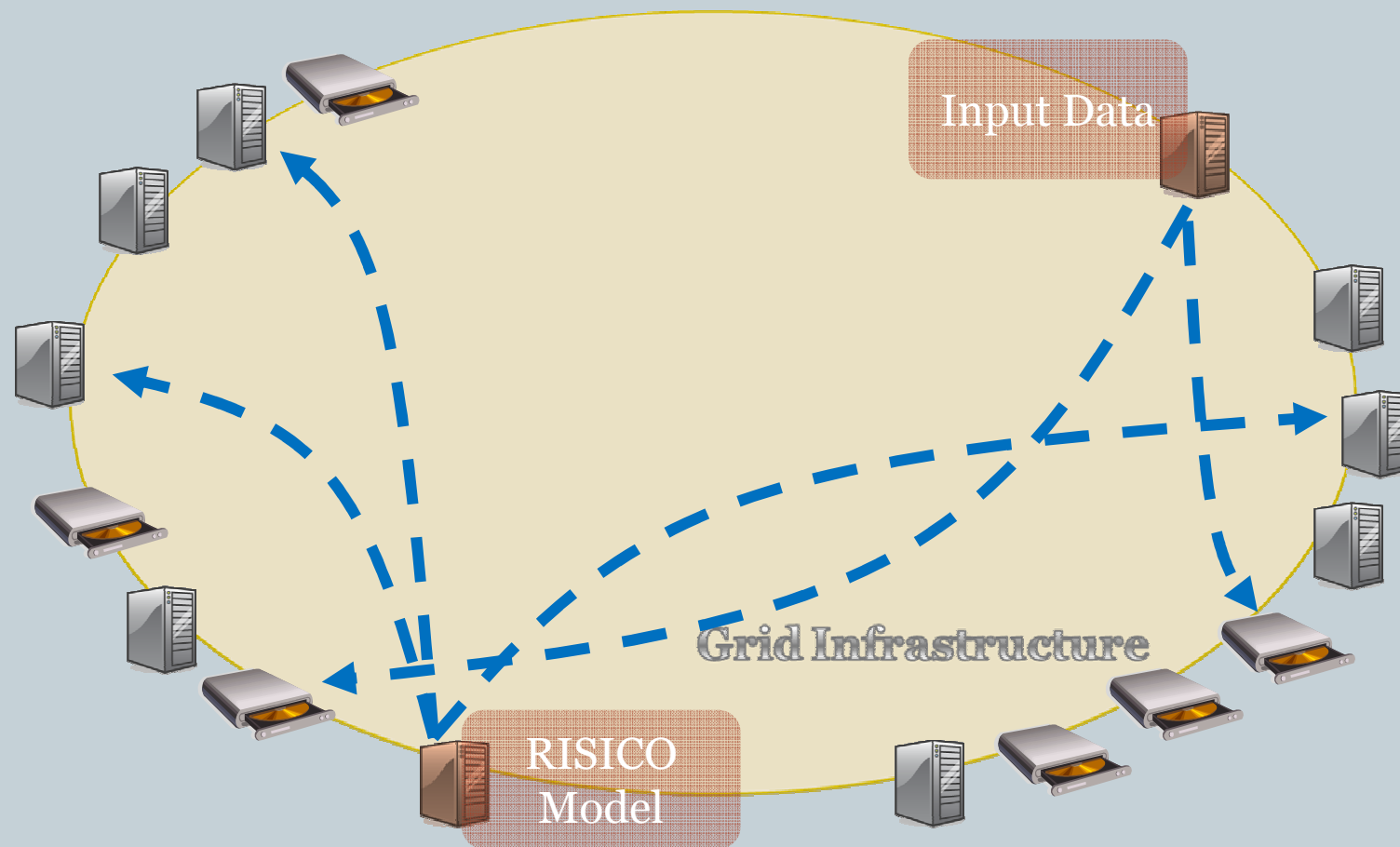 - Storage and processing are grid-enabled:
    - EGEE gLite middleware;

Input Data

RISICO Model
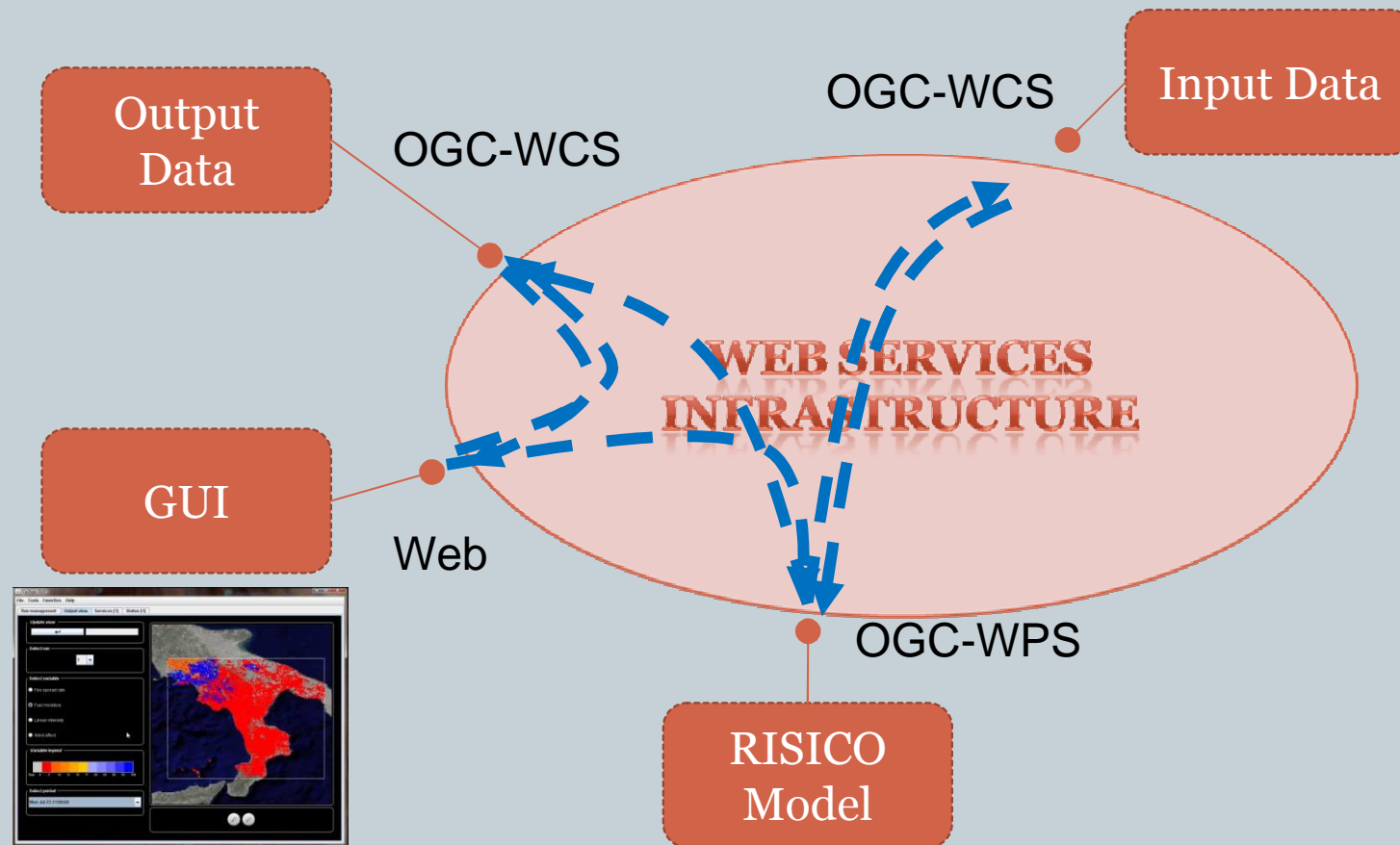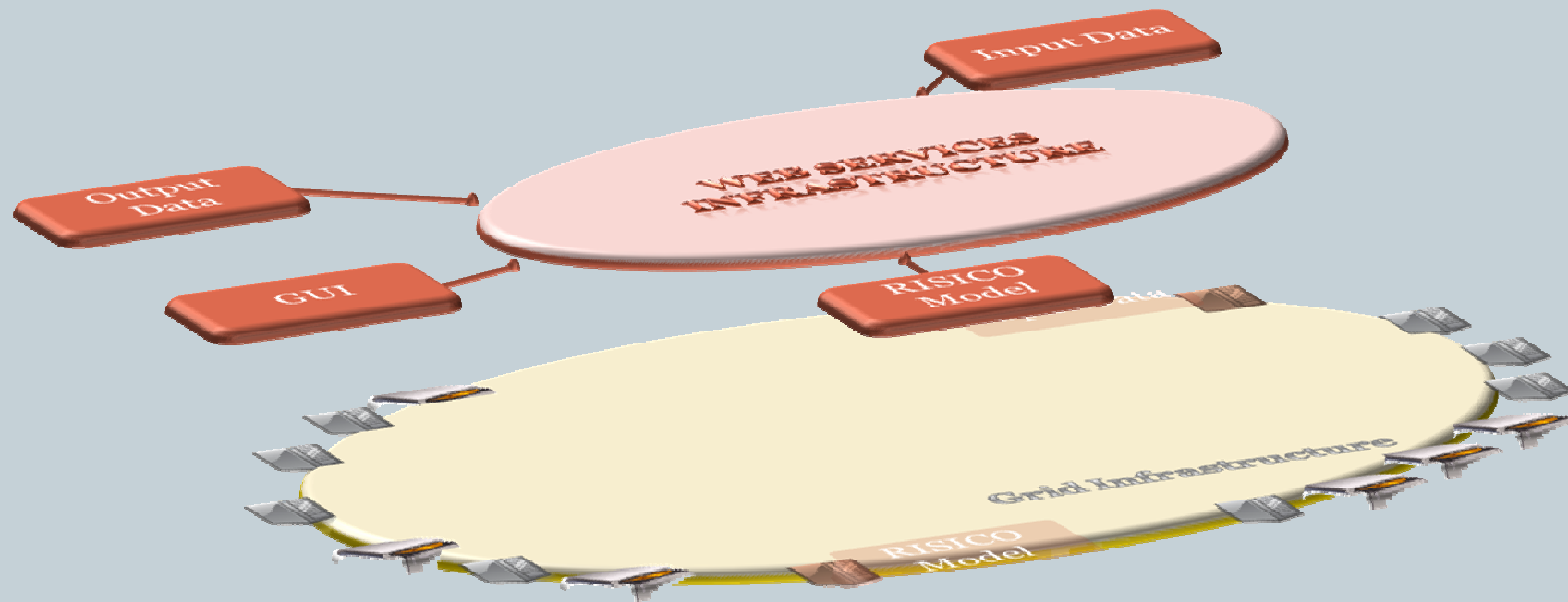
Grid Infrastructure

Web Services and Grid integration

CYCLOPS Infrastructure benefits

- ## Web services interaction
  - Through OGC specifications
  - Interoperability with existing platforms
    - INSPIRE, GMES, GEOSS planned infrastructures
- ## Real time support
  - Through proper implementation strategy and gLite middleware
- ## Computing power available on-demand
  - Through gLite middleware
  - Resolution from 1 km to 100m
  - Processing time from 20'@1km to 5'@1km
  - Resolution indipendency
  - Multiple run

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The Prototype

- ## The G-RISICO prototype will be demonstrated during IberGrid
  - IberGrid CYCLOPS Session, Porto, 14th May 2008

- ## G-RISICO will be presented as demo application in the context of the OGC-OGF MoU
  - OGF 23 Barcelona, June 2008

Lessons Learned

- The OGC-WPS has some limitation to interact with complex applications. It should be enhanced for:
  - Application interaction (change state, pause/resume, stop, abort)
- To integrate the Web (synchronous) and the Grid (asynchronous) architectures a sub-layer of Grid advanced services is required for:
  - Notification
  - Resource priority management
- CP applications porting can be rather straightforward, but for a better effectiveness they should be redisegned in order to:
  - Optimize the parallelization task
  - Provide intermediate results (low resolution or incomplete) even if the processing is not complete (partial results)

Future Works

- G-RISICO prototype optimization
  - Reducing latency in job submissions

- G-RISICO evaluation

- Porting of the SPCGD application for Flash flood risk management (used by the French Civil Protection)

Conclusions

- An European e-Infrastructure for Civil Protection applications could improve emergency management providing data and models sharing, and collaborative work.
- The CYCLOPS Architectural Framework proposes an integrated architecture for Civil Protection applications:
  - Web Services SOA at higher layers for Data and Models Interoperability
  - Grid architecture at lower layers for basic resources coordinated sharing
- A first attempt of porting a complex CP application (RISICO) has been successful:
  - Interoperability with existing WS infrastructures (SDIs,…)
  - Reduced time of response; resolution independency
- More investigation needed for generic advanced services:
  - Notification
  - Parallelization strategies
  - Workflow

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THANK YOU FOR YOUR ATTENTION!