RESEARCH STRATEGIES FOR AN ADVANCED GRID E-INFRASTRUCTURE FOR CIVIL PROTECTION APPLICATIONS

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Outline

- CYCLOPS Project Overview
- CYCLOPS Activities
- Research Strategies

CYCLOPS Overview

- CYCLOPS:
  - CYber-Infrastructure for CiviL protection Operative ProcedureS

- Main Goal:
  - *to bridge the gap between Grid and GMES communities making **Civil Protection people be aware of the services provided by Grid** infrastructures, and, at the same time, letting **Grid researcher to be aware of Civil Protection specific requirements** and service enhancement needs.*

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CYCLOPS Overview

- Instrument:
  - FP6 – SSA
- Duration:
  - June 06 – December 08
- Partnership:
  - Civil Protection Agencies
    - ANPC (PT),DDSC (FR), DPC (IT), Pr. Chania (GR)
  - Scientific and Technological Centres
    - CNR (IT), EMA (FR), INFN (IT), TEI (GR), UMINHO (PT)
- Main Outcomes
  - **Research Strategies** and **Innovation Guidelines** for a European CP e-Infrastructure

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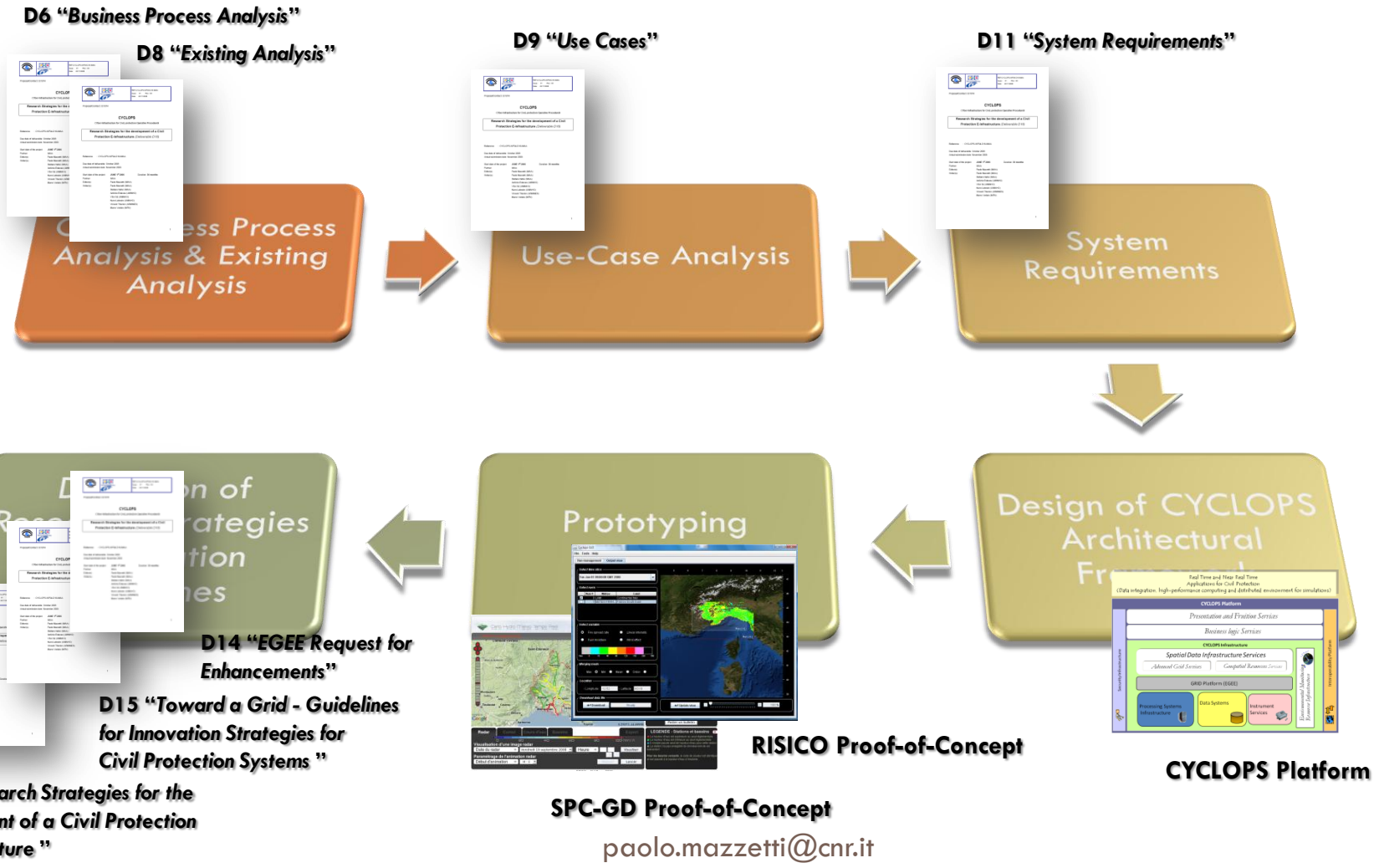
Methodology



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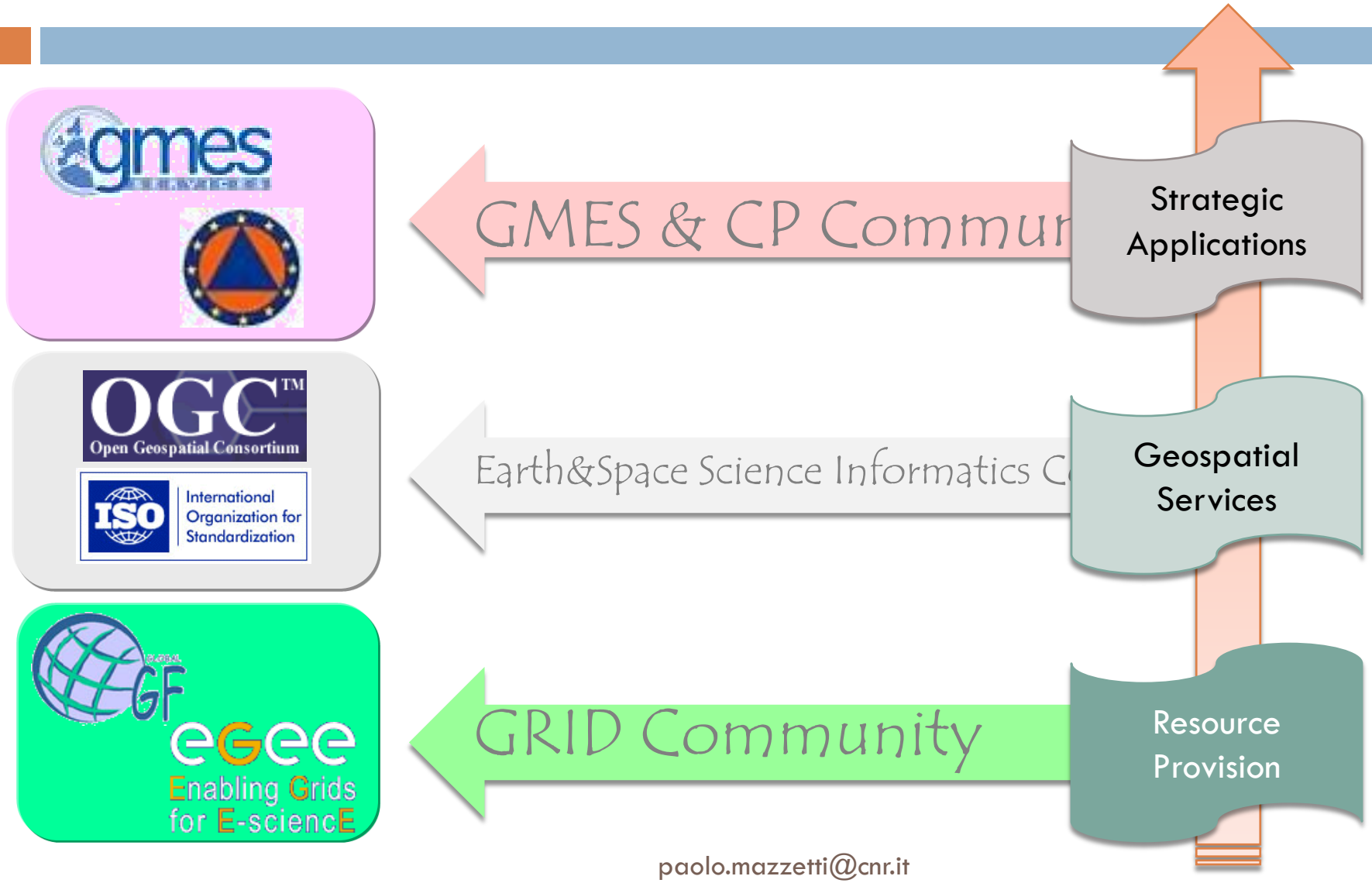
Communities Interoperability



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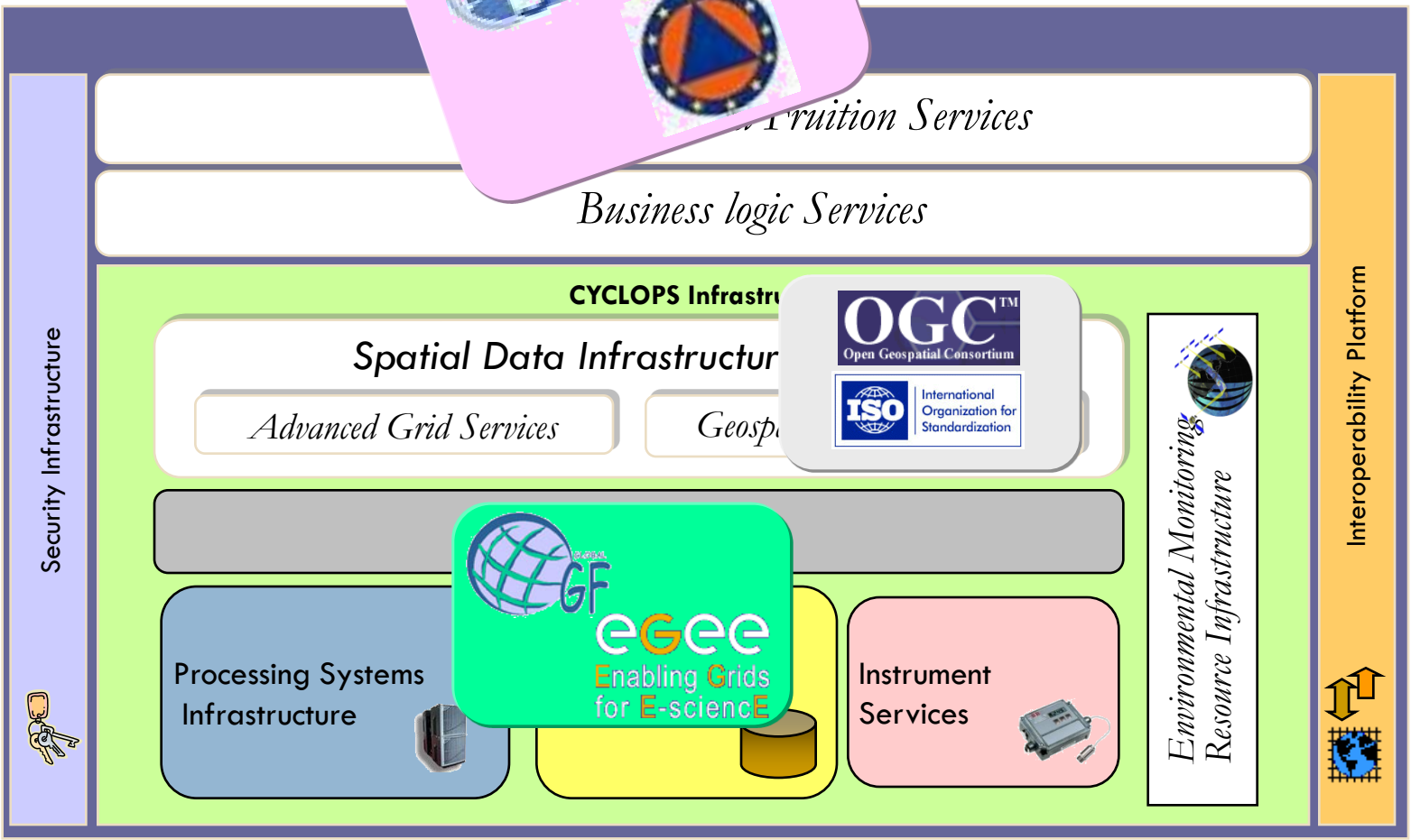
CYCLOPS Architectural Framework

Appl. Platform

Real T… l Time
…tection
(Data integration, high-pe… …ibuted environment for simulations)



Proof-of-Concept

- To evaluate the Architectural Framework and to guide the following studies some PoC have been realized.

- Porting/refactoring of CP applications for selected use-cases:
  - Wildfires risk assessment
    - **G-RISICO** (from RISICO application used by the Italian CP)
  - Flash-flood risk management
    - **G-ALHTAIR** (from the SPC-GD system of the French CP)

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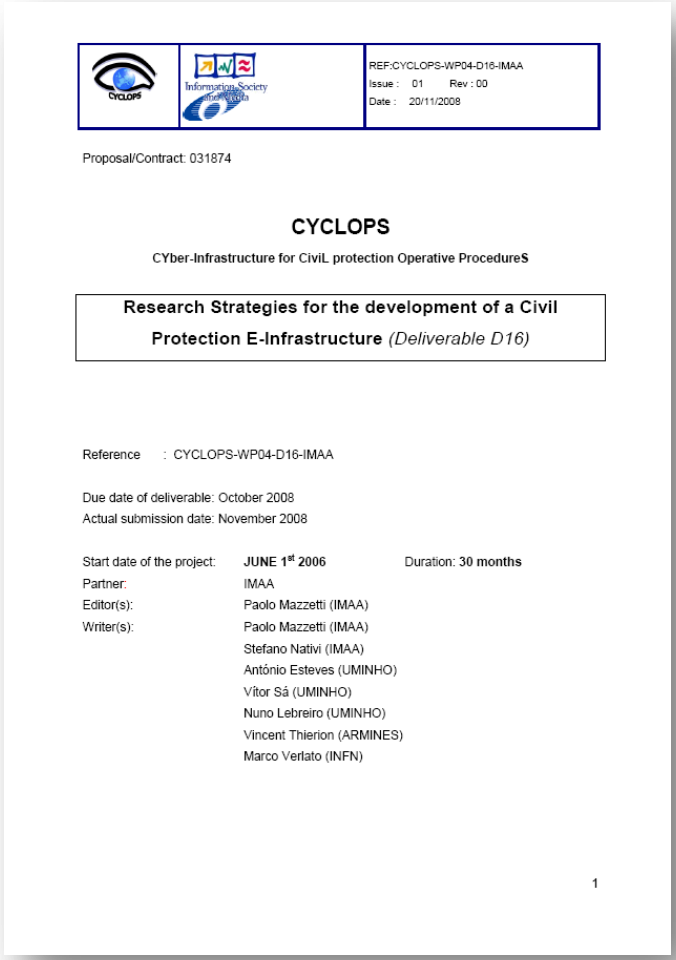
Research Strategies

Target audience:

Research activities and funding decision-makers

Methodology:

1. Civil Protection Systems analysis
2. Use cases analysis
3. Architectural framework definition
4. Prototyping
5. Identification of main research themes and topics



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CYCLOPS

CYber-Infrastructure for CivIL protection Operative ProcedureS

Research Strategies for the development of a Civil Protection E-Infrastructure *(Deliverable D16)*

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Partner: IMAA
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Research Themes and Topics

Research Theme	Research Topics
Grid Infrastructure Enhancement	Real-Time and Near-Real-Time support Job Prioritization Advanced Job Management Grid Architecture for CP Applications
Advanced Middleware for CP Applications	Grid-enabled Geospatial Data Sharing Services Grid-enabled Processing Services Sensor Services for CP Applications Event-based Services
Security and Data Policy	Data Policies for CP Applications Security Services to Support CP Data Policies
Civil Protection Applications Enablement	Parallelization Strategies for CP Applications Application Design Simulation and Forecast Model Workflow
Interoperability	Grid Infrastructures Interoperability Interoperability with INSPIRE, GEOSS, GMES Initiatives Interoperability Standards for Risk Business and Application Logic

Grid Infrastructure Enhancements

- Open Issues
  - Current Grid infrastructures are designed to satisfy requirements different from CP applications ones.
- Main Research Topics
  - Real-Time and Near-Real-Time support
    - CP applications typically privilege time-of-response instead of accuracy
  - Job Prioritization
    - Grid should allow to define job scheduling in order to assign special rights to CP applications for using available grid resources
  - Advanced Job Management
    - Having runtime information from jobs running in the Worker Nodes permits to reduce unnecessary wait time
  - Grid Architecture for CP Applications
    - In order to implement CP applications in a pre-operative or operative context high infrastructure availability is required

Advanced Middleware for CP Applications

- Open Issues
  - Complex CP applications should be built using a set of services utilizing the underlying Grid infrastructure and exposing high-level functionalities according to the SOA approach
- Main Research Topics
  - Grid-enabled geospatial data sharing services
    - CP applications require to discover, access, publish and visualize geospatial data characterized by great heterogeneity (in terms of dimensionality, size, spatial/ temporal resolution and extent, rate of update, and type of content)
  - Grid-enabled Processing Services
    - CP applications require to process geospatial data at different levels: from simple data extraction and transformation, to the implementation of algorithms for information extraction up to the implementation of complete decision support systems.
  - Sensor Services for CP Applications
    - CP application require to access acquisition systems (single sensors, sensors networks and airborne and satellite-based remote sensing systems) for observation and planning
  - Event-based Services
    - To support different applications models and in particular to support RT/NRT applications the enabling infrastructure should be able to provide event notification to reduce the delays in the transmission of the meaningful information.

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Security and Data Policy

- Open Issues
  - In the context of CP applications, security is one of the main issues. Typical CP business processes are characterized by complex data policies and trust relationships.
- Main Research Topics
  - Data Policies for CP Applications
    - The great heterogeneity of data policies in the domain of CP ad GMES applications require specific studies aiming to define a CP/GMES data policy model.
  - Security Services to Support CP Data Policies
    - The CP complex data policies and trust chains pose strict requirements in terms of security services (authentication, access control, integrity, confidentiality).

Civil Protection Applications Enablement

- Open Issues
  - To fully exploit the capabilities of an advanced e-Infrastructure, CP applications should be designed and implemented taking into account some principles.
- Main Research Topics
  - Parallelization Strategies for CP Applications
    - To gain benefits from the parallel-computing capabilities provided by the Grid, CP applications must be split in multiple jobs. Possible strategies depend on the characteristics of the parallelized applications and implemented models.
  - Application Design
    - CP applications should be designed to provide the maximum amount of information possible at a given time - incremental vs. nothing-or-all (e.g. pyramidal encodings).
  - Simulation and Forecast Model Workflow
    - CP applications might be implemented as a workflow of simulation and forecast models exposed as services.

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Interoperability

- Open Issues
  - An advanced e-Infrastructure for CP applications should be able to access valuable resources provided by external infrastructures.
- Main Research Topics
  - Grid Infrastructures Interoperability
    - Basic resources available through external Grid infrastructure should be accessed to increase computing power, storage space.
  - Interoperability with INSPIRE, GEOSS, GMES Initiatives
    - Several European and international initiatives have been started to address specific problems related to geospatial data sharing (e.g. INSPIRE, GEOSS, SEIS). The interoperability with GMES, INSPIRE and GEOSS compliant systems must be considered strict requirement for a e-Infrastructure for CP applications.
  - Interoperability Standards for Risk Business and Applications
    - Interoperability with existing CP systems for risk management is required.

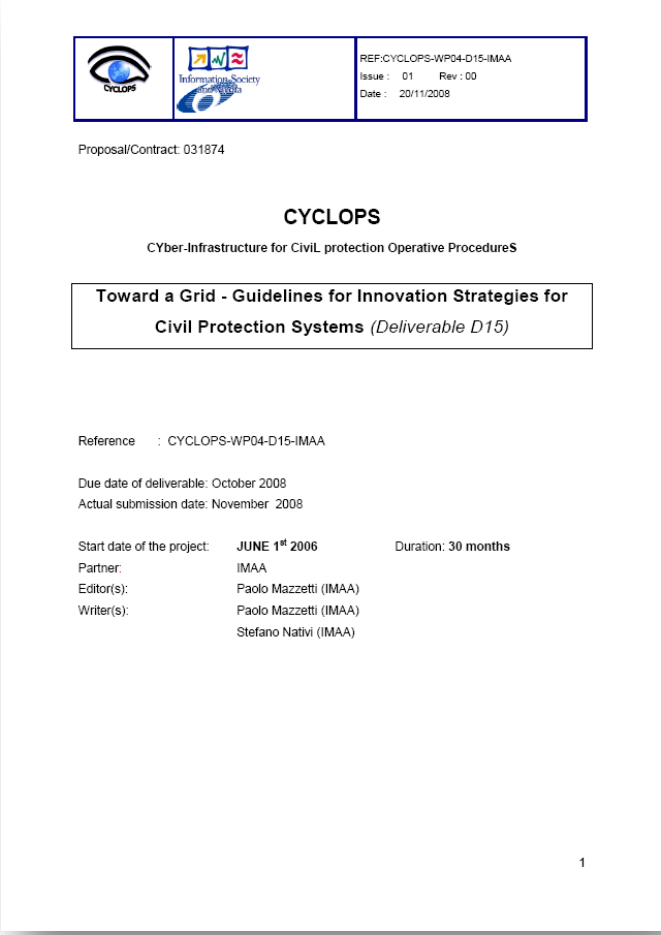
Innovation Guidelines

Target Audience:

CP innovation decision-makers

Methodology:

1. Civil Protection Systems analysis
2. Architectural framework definition
3. Prototyping
4. Identification of obstacles to innovation and possible solutions



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Toward a Grid - Guidelines for Innovation Strategies for Civil Protection Systems *(Deliverable D15)*

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Innovation Themes and Strategies

Innovation Theme	Main Obstacles	Strategies
Grid technology adoption	Support of legacy systems Lack of expertise in Grid technologies Integration of external resource providers Application refactoring required	Procurement Training Collaboration with expertise providers
Web Services SOA adoption	Support of legacy systems Lack of expertise in SOA Transition from application providers to service providers Application refactoring required	Procurement Training Collaboration with expertise providers
Standardization	Conversion to standards Standards multiplicity Lack of expertise on standards Standards often not profiled for CP/GMES applications	Procurement Training Collaboration with expertise providers Participation to standardization activities
Interoperability	Standard adoption Data and service policies unclear	Adaption Specific agreements
Security	Complex data policies and trust chains	Specific agreements

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Thank you for your attention!

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