FP6 – Priority 2.3.2.9
Improving Risk Management
Integrated Project

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1 THE OASIS PROJECT

1.1 Introduction

The OASIS Project addresses the Strategic objective 2.3.2.9, "Improving Risk Management", of the second call for tender of the European Commission FP6 Information Society Technologies program.

A few years ago, it appeared that civil protection organisations had not benefited as much as other professionals from the new information technologies (IT).

In many EU countries, the situation is now evolving but this evolution is conducted at national level and in a great number of cases at regional level.

On the other hand, disasters do not necessarily respect national borders and have often trans-boundary consequences. Thus interoperability is a key factor to allow actors involved in emergency operations, possibly belonging to different regional or national authorities, to work jointly on the same event.

The objective of OASIS is to define and develop an IT framework based on an open and flexible architecture and using standards which will be the basis of a European Emergency Management system. This Command and Control system aims to support the response operations in the case of large scale as well as local emergencies.

1.2 Objectives of the project

OASIS is intended to facilitate the cooperation between the information systems used by civil protection organisations, in a local or international environment. It will take advantage of the wide experience of the different OASIS partners both in the Civil Protection domain as well as in the Military domain. For example, a major achievement would be to allow responders from different countries to exchange information, even if they do not speak the same language, as it can be done between armies from different countries, due to the work performed in the NATO environment.
The main goals of OASIS are:

- To provide an IT framework which can be used at the different levels of the Civil Protection organisations in Europe, compliant with existing standards,
- To provide inside this framework an initial set of applications which will cover the main needs that are identified by the end-users who help to define OASIS,
- The capability to replace one component developed for OASIS by an existing component which follows the OASIS defined standards,
- The capability to benefit from the services offered by the OASIS framework in order to add new components inside this framework.

The output of the OASIS project will be:

- The description of an open architecture, largely based on a list of interfaces, either already existing or proposed by OASIS,
- A set of OASIS services, which are the major components required by a disaster and emergency management system.

This OASIS framework (the OASIS architecture and the associated standards) will allow the user community either:

- To keep their existing components, but a reasonable adaptation should allow them to communicate with the other OASIS-compliant components,
- Or to adopt the OASIS components which suit their needs.

1.3 The global picture

The following picture describes a view of the global architecture of OASIS, showing the relationships between the different sub-projects (SP). It emphasises the functional interfaces of the system. The components which are included are only examples.

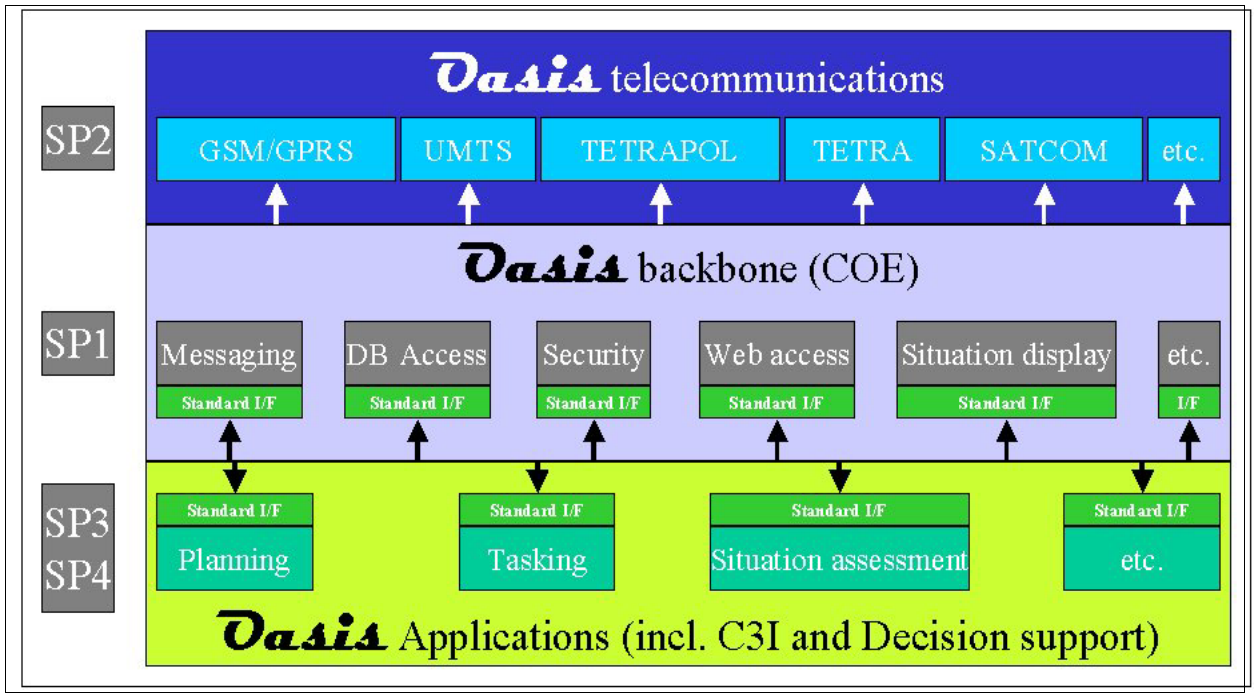

Figure 1: The global OASIS picture

2 THE DISASTER AND EMERGENCY GLOBAL CONTEXT AND OASIS

2.1 The Disaster and Emergency Management (DEM) cycle

A simple approach to look at the disaster management cycle is provided below. This model shows how the phases neither fit neatly together nor follow an exact sequence. For instance, reconstruction does not wait until restoration has been completed. There is considerable overlap and it can be difficult to know precisely in which phase a particular activity is assigned.

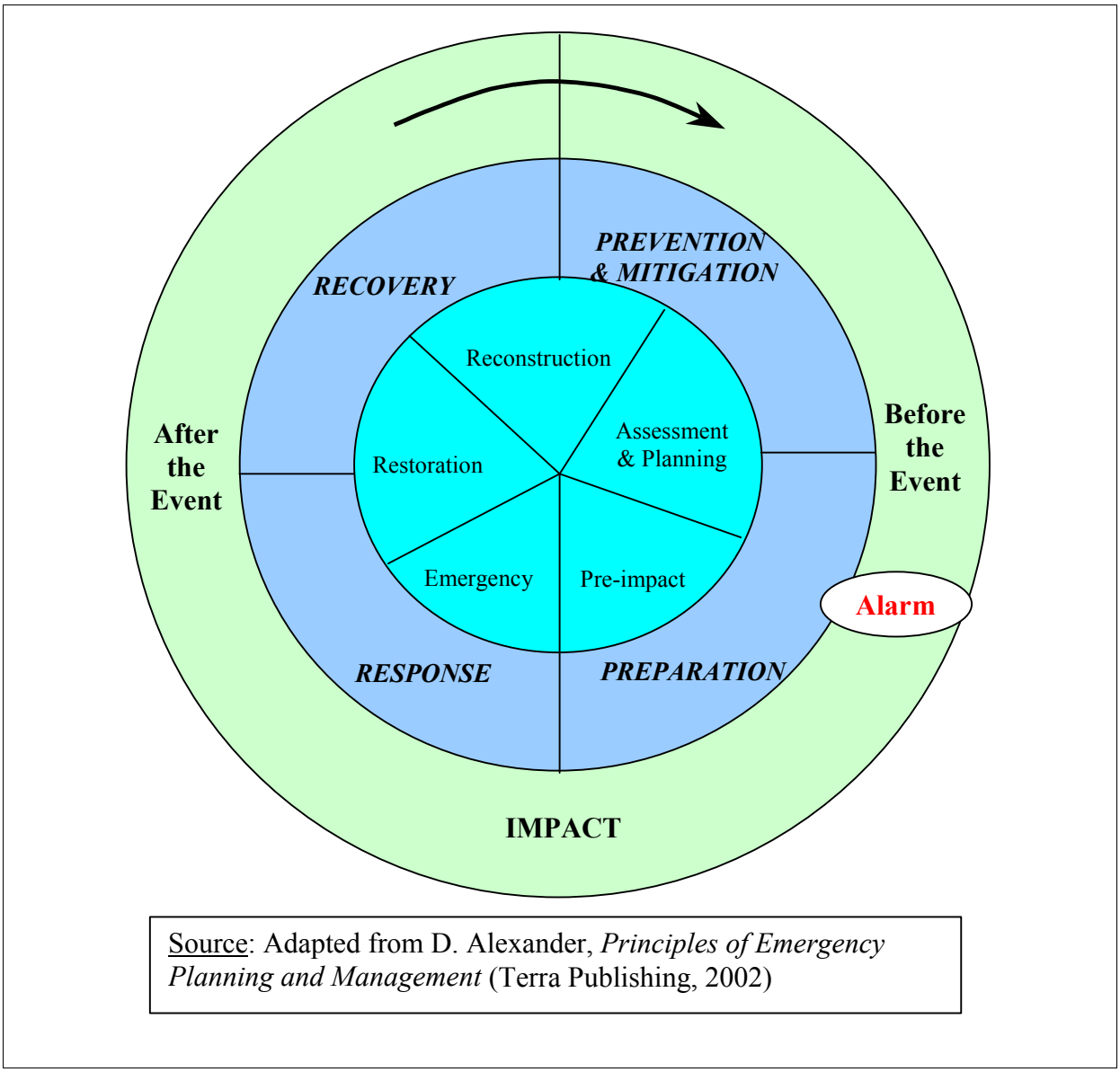

Figure 2: The Disaster and Emergency Cycle

These phases of the disaster and emergency cycle consist of:

Prevention and mitigation	Prevention includes those measures that are aimed at impeding the occurrence of a disaster or preventing such an event having harmful effect on a community. Mitigation comprises all actions designed to reduce the impact of disasters. They can be divided into: • Structural or physical measures (eco-structural measures, engineering solutions, strengthening of buildings, construction of flood defences, etc.) • Non-structural measures (urban planning, insurance, legislation, control of land use, training in disaster and emergency management, public education, etc.)
Preparation	Preparation consists of actions taken when disaster is anticipated or impending in order to ensure a rapid and more effective response. Unlike prevention and mitigation measures they are generally short term
Response	Response relates to the emergency operation activities conducted during the impact of a disaster and the short-term aftermath. The main emphasis is on the saving of human life but it also encompasses the protection of assets, the supply of vital goods and services, and protection of the environment. Public warning can be classified as a response measure whereas early warning instruments could either be considered as part of the preparation phase or the response
Recovery	Recovery is the process by which communities return to a normal level of functioning. In the initial stages of this process the emphasis is on the restoration of basic services and facilities. However, in the long run, the impact of reconstruction is crucial; agencies involved at this stage should ensure that vulnerabilities are reduced without simply reproducing the existing risk. Several activities are included in this process: • Damage assessment and post-disaster review • Restoration of key infrastructure and essential services • Rehabilitation of persons, of livelihood • Reconstruction, replacement infrastructure and buildings

Within the phases described a number of activities may occur:

Assessment and Planning	A number of tasks performed by a variety of stakeholders may be • Risk assessment, identification of threats and vulnerabilities • Horizon scanning for potential hazards • Evaluation and monitoring of resources • Review and development of emergency plans and procedures • Prevention measures through land-use planning, legislation • Review of critical infrastructure • Training and exercise of plans • Testing of equipment • Evacuation planning • Public awareness (planning and campaign)
Pre-impact activities	These activities may include • Organising resources (e.g. food, water, etc.) • Inventory of defences (e.g. antidote, vaccine or sandbags) • Mobilisation of personnel • Provision of vehicles and equipment • Distribution of protective equipment • Public awareness (before impact), practice Early Warning Systems • Evacuation • Training and exercising
Emergency	These operations may include • Search and rescue, fire fighting, decontamination, etc. • Implementation of plans • Evacuation • Warning • Immediate relief activities covering basic needs (shelter, water, food and medical care) • Organisation and coordination of response (rendezvous points, casualty bureau, triage, etc.) • Survey and assessment of damage • Investigation and collection of evidence • Forecasting on the development of the Disaster • Management of resources, assessment of financial resources and needs • Provide temporary public utilities
Restoration	These activities comprise • Survey and assessment of damage • Provide and secure temporary public services, facilities and infrastructure • Management of resources, assessment of financial resources and needs • Planning for reconstruction

Reconstruction	These actions may include: • Construction of permanent housing • Full restoration of all services, infrastructure an facilities • Complete resumption of the pre-disaster state and development • Planning for future development

It is important to note that the DEM cycle can be used to describe the development of situations in which :

- The phases and the activities may take place either sequentially or simultaneously; this explains the redundancy in the functions described in each of the activities;

- Pre-impact activities may not take place for example in an earthquake, when the onset of the crisis is sudden;

- The definition of impact can differ; famines for instance do not really have a moment in time that can be referred to as impact;

- Some functions may be encountered in various activities; the redundancy in the tasks reflects the difficulty in clearly defining the activities themselves;

- A responder may undertake a series of tasks which are in different phases of the DEM cycle.

2.2 OASIS role in the DEM cycle

As contracted under the FP6 by the European Commission, OASIS activities encompass only a part of these phases. Its main focus is on the response phase. The system will support the whole spectrum of emergency activities but also provide assistance in some of the pre-impact and restoration activities. Other EU ICT projects deal with other phases of the disaster and emergency cycle and their finding will be linked to the OASIS system.

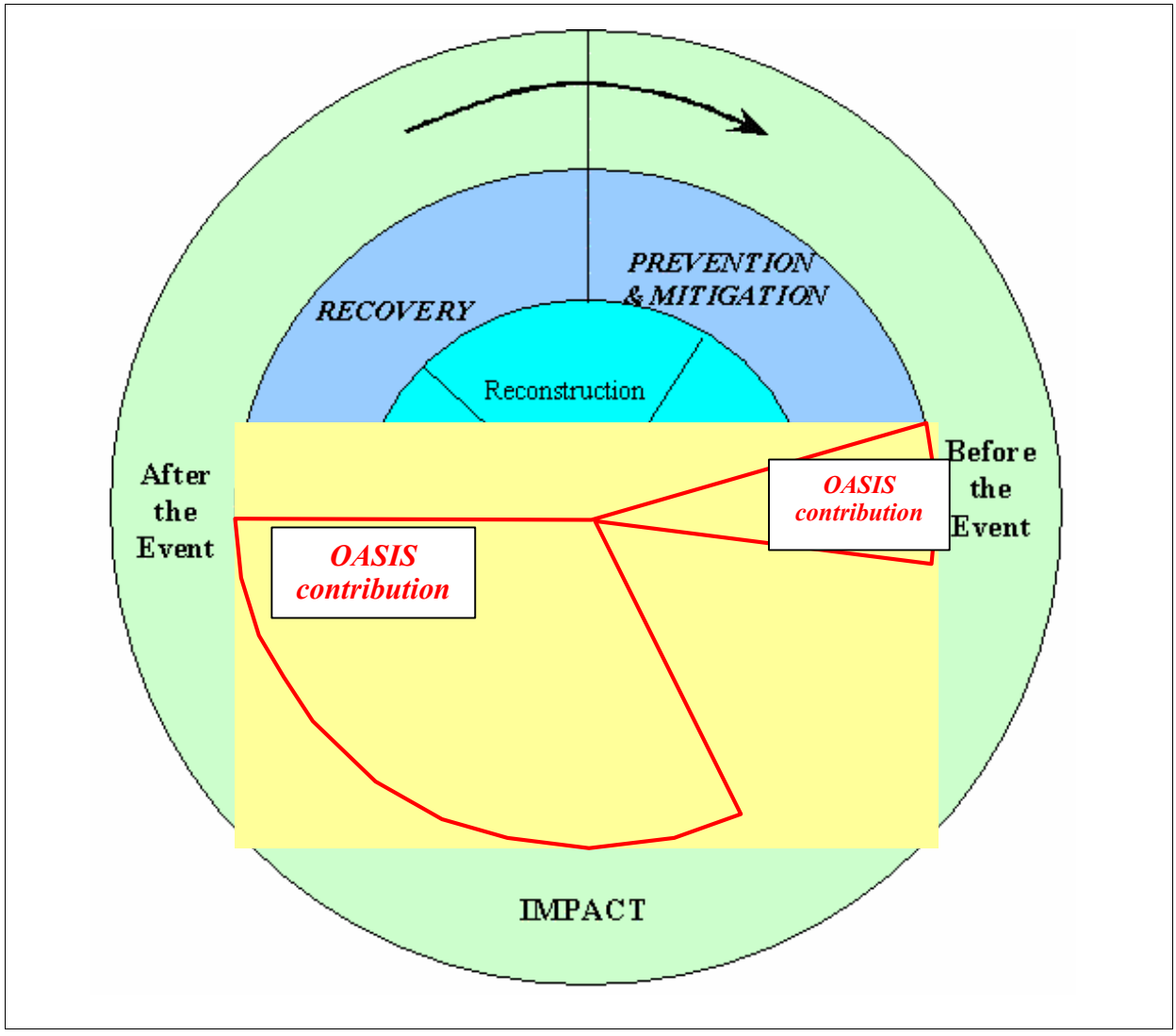

Figure 3: OASIS contribution to the disaster and emergency cycle

2.3 OASIS users and stake holders

There is a very large range of organisations which are involved during emergency operations. Amongst these organisations, some can be helped by information and communication systems, others are "customers" of the reports, of the decisions and / or of the elaborated information. Making a complete list of the users and stake holders is impossible, and is different in each country.
However, we can establish a list of entities which are potentially interested by the support that OASIS can provide. They are:

- Police
- Civil protection
- Fire fighters
- NGO such as the Red Cross, Médecins Sans Frontière, etc.
- Ambulance services
- Liaison officers of military organisations.

Inside these entities, there is again a large number of different users, according to their roles and to their hierarchical levels.

OASIS stakeholders have also a very wide spectrum of profiles.
There are three noticeable OASIS stakeholders:

1. The political authorities, which are the ultimate deciders when some strong decisions must be taken. They shall receive good synthesis of the situations, of the possible future scenarios, in order to have the appropriate elements for these decisions;
2. The media, which are hungry of information, which need to be provided with clear description of the event, of the operations, of the directives which shall be transmitted to the population;
3. The population itself, which is the ultimate target of the operations: it must be informed of the decisions which have been taken, for example when an evacuation is required.

3 THE MAIN CONSTRAINTS AND THEIR CONSEQUENCES

3.1 OASIS as a system of systems

In order to precise the global concept of the OASIS architecture, we need to start on an example where different organisations belonging to different regional or national authorities are cooperating together during an emergency. For example, we could have the following configuration (only 2 levels are used here, and 3 entities are participating: police, fire brigade and ambulances in the first "region", and police, fire brigade and civil protection in the second region).

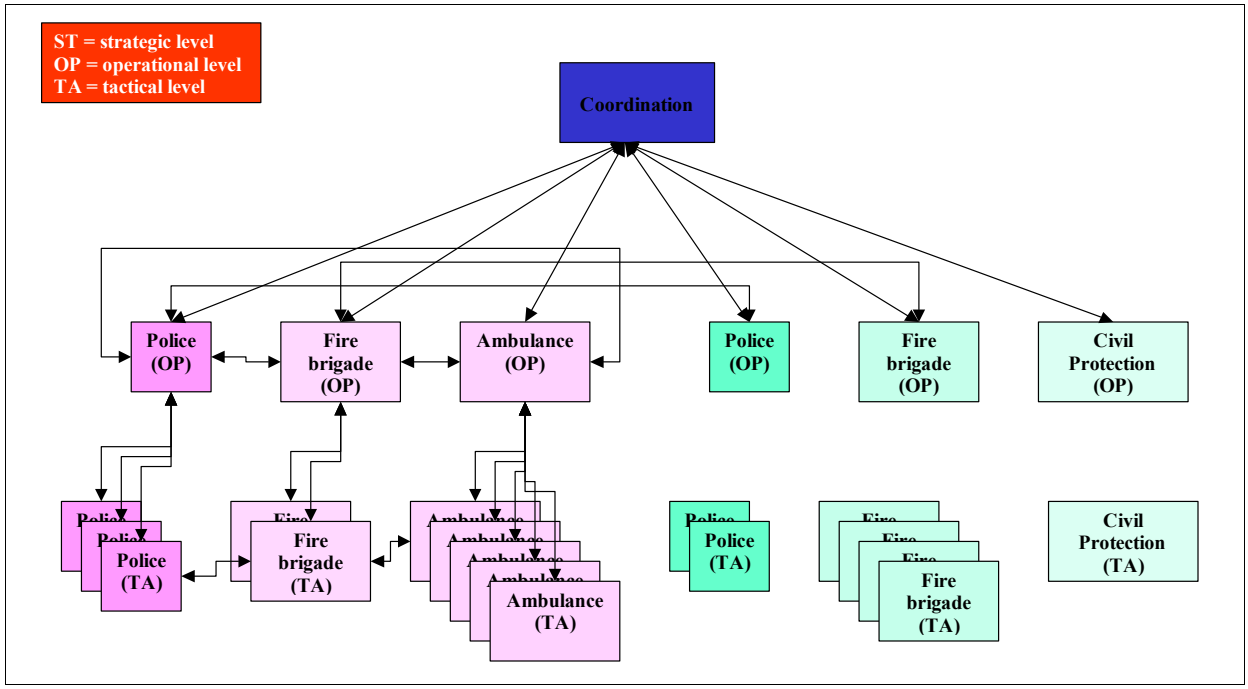

Figure 4: Example of a global DEM system

Each organisation has its own mission (maintaining the order for the police, rescuing the people and stopping the disaster for the fire brigade, evacuating the casualties for the ambulance and restoring the infrastructure for the civil protection).

All these organisations are working together, today mainly being side by side and having mostly voice discussions (by radio or being collocated), tomorrow (we expect) also by exchanging more digital information. The coordination level may be very structured or more informal, may be under the control of one specific organisation or as a more "consensual" group of authorities and rescuers. They all have information systems, some being only paper maps, pencils and human brains, some others being supported by computers and communication networks. They also receive or acquire information from external sources, such as meteorological information and forecasts. They disseminate also information, to external authorities or to the media for example.

In consequence, we can define the global Disaster and Emergency Management system as a "system of systems" being seen externally as in the following diagram:

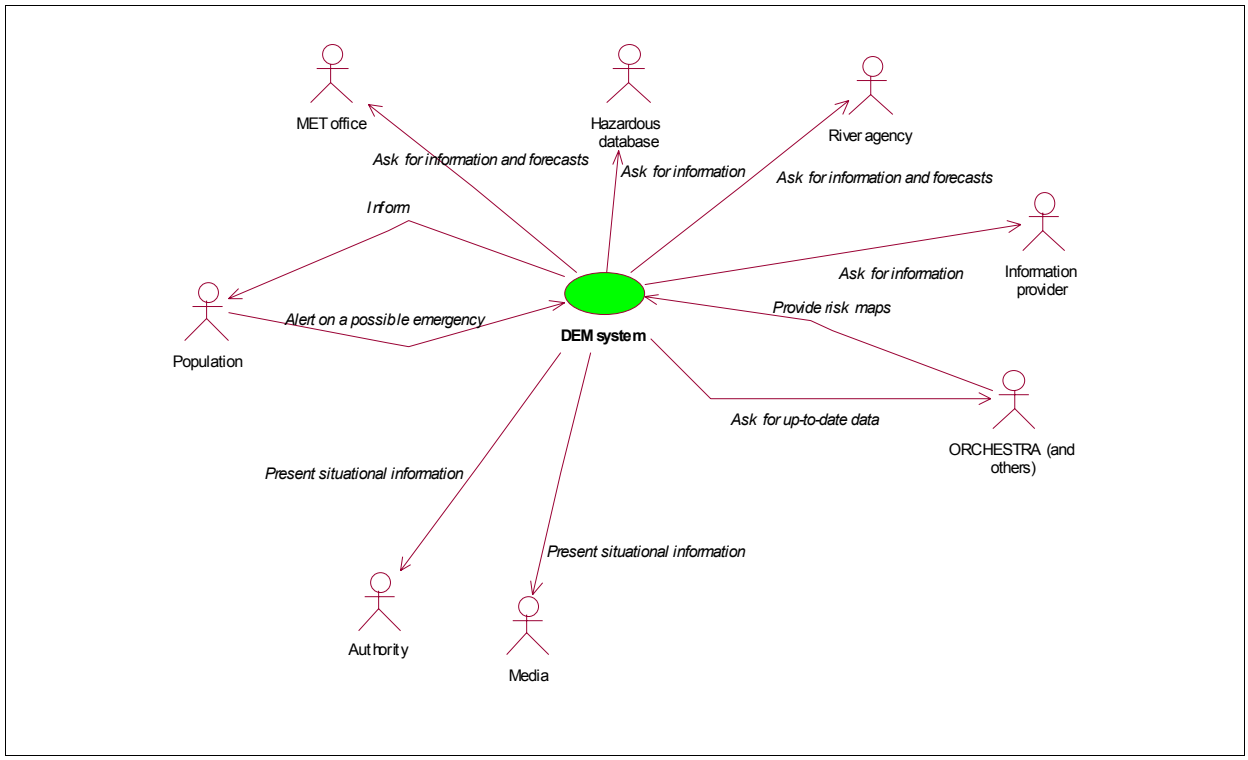

Figure 5: "Black box" representation of a DEM

Starting from this global view, we can come back to each instance of this "system of systems". Each of theses systems interacts with its own users, with the other management systems and with the external actors seen previously:

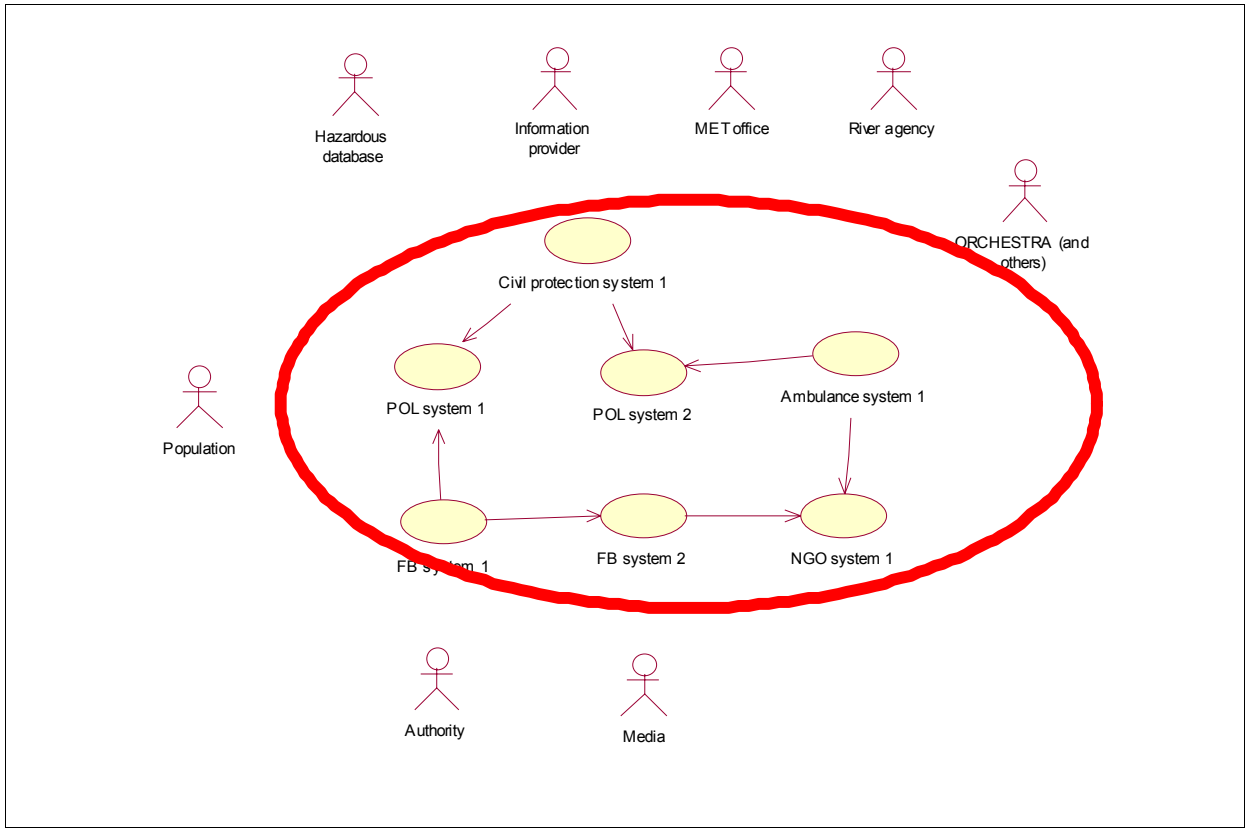

Figure 6: a DEM = a "system of systems"

The information that flows between the different systems is the information which is needed to accomplish their missions: for example, the police at the operational level informs the other organisations of the restricted areas, or the traffic corridors which have been prepared, etc… These other organisations send to the police the lists of the teams which are participating to the rescue operations so that they will have the clearance to attain the emergency areas. These lists are then sent to the police tactical level teams, so that they will assist these teams when they arrive.

If we apply the "OASIS point of view" to this view of the DEM, we can define several levels for OASIS. At each level, the single OASIS systems are "stand alone" systems which may be interconnected on demand and according to the local and current conditions (some interconnections may be established permanently, but are always subject to be broken due to the consequences of a disaster).

Each of these systems is called an OASIS node. An OASIS node is the tool which supports a given agency at a given hierarchical level. Each OASIS node supports a precise mission.

We could compare each OASIS node to a "control room", as they may be deployed in an actual fixed control room, in a mobile shelter, or as a simple terminal in the hands of a rescuer in the field.

3.2 OASIS nodes inter-communications

As presented before, OASIS nodes may belong to entities which have different missions during an emergency, such as the police, the fire brigades, the civil protection, the ambulances and some non-governmental organisations. All these entities have access to the information that they need during the operations, and the nature of these information is extremely different. Obviously, the needs for information protection are also different. The police information systems often contain information about the citizens, about sensitive governmental and industrial sites, about potential threats, which must not be accessed in any way by non authorised persons and entities. Obviously the police have very strong requirements about the protection of the information contained in their systems, which lead to protect them and avoid as much as possible to give access to them by people who are not belonging to the police. On the other side, some non-governmental entities have very simple information systems with no sensitive data, and are much more willing to open their systems (in the worst case, in case of trouble, they can re-initialise completely their systems in order to restart in a clean environment).

The goal of OASIS is to allow these different entities to exchange information in order to be more efficient. OASIS needs to take into account the framework that these restrictions impose.

During the requirements phases, the need for interoperability (and communications in a broader view) has been often discussed with the responders that we met. This need is counter-balanced by several remarks that we need to take into account in the high level description of the architecture: These remarks are:

1. the global need for "security", which includes the protection of the sensitive information which is contained in some systems (information on citizens, on threats, on action or evacuation plans for example), the authentication of the organisations and persons which are exchanging information, the control of the information which is received and sent, etc…
2. the fact that sharing information means to provide and receive "added value" information, not the raw information which is stored in the databases of these systems. Each entity shall elaborate the information which they provide to the others, according to the respective missions of each organisation
3. during emergencies, the operational status of the networks is unpredictable, and we shall assume that no network or very slow networks could be available during the operations. However, the system should be able to take advantage of a large bandwidth which could also be available in other cases, allowing to provide additional services (teleconferences, telemedicine for example).

3.3 OASIS is not only a new system

As a result of the project, one important output will be the delivery of a pre-operational system, which shall provide all most important support services for the rescue teams (such as the capability to define missions, to follow their progress, to manage the resources, etc.) and which will implement the standard interfaces chosen or proposed by OASIS. This will allow the interoperability between all "OASIS compliant" nodes, which could be a "pure" OASIS and any other system which has been adapter to implement some or all OASIS standards.

Typically, an existing system will not be replaced by a completely new OASIS system: the users have invested a lot of efforts and money in the specification, in the development, in the training and in the deployment of their systems, and they will keep these systems because they are fully adapted to their needs. However, they may be interested to adapt them to the OASIS standards, as well as to benefit of some functions developed in the frame of OASIS which do not exist yet in their own system. Due to the important investments done for legacy

systems, these existing systems have a long life time (more than 10 years in many cases). This capability to collaborate with existing systems, to make them benefit of OASIS developments, to integrate OASIS and legacy systems in the same control room or in the field is very important for the future of the standards which are proposed by OASIS: if only the "pure" OASIS systems comply with the standards, these standards will not be adopted.

3.4 OASIS must communicate with external non-OASIS systems

As presented in section 2.2 (OASIS role in the DEM cycle), OASIS does not provide the complete support for all activities performed by rescue services: OASIS is focussed mainly on the response phase. Other activities are obviously extremely important and OASIS must take advantage of them. One very important example of cooperation is the use of risk maps which shall be prepared as a background task.
Also during the operations, OASIS will have to communicate with external systems. Updates or provision of new maps could be needed during the response phase, in order to have a more detailed view of the situation and of possible future scenarios. The reception of fresh meteorological information, of weather forecasts is often needed. Cooperation with river agencies is also often used. The consultation of services which provide expert advises in specific domains will also be required to help the responders.

In the frame of the project, the efforts will be focussed on the interfaces with risk map providers which are working in parallel in the tracks of the INSPIRE and GMES European initiatives, such as the ORCHESTRA and WIN FP6 projects (other projects are also invited, such as the PREVIEW project and on-going projects developed under ESA contracts). Working groups are set-up in order to insure that the results of all these projects will converge and benefit to our users.

4 DESCRIPTION OF THE DIFFERENT PHASES OF THE PROJECT

The main OASIS phases are:

- Analyse the users requirements to define European generic system requirements,
- Specify and design a generic, interoperable and open system architecture which will allow easy deployment at every level of the action chain.
  The project will provide the definition of:
  - the system backbone (data bases, common operating environment and fully interoperable message handling system), supported by a reliable and secure communication network,
  - the deployable broad-band wireless communication network,
  - the command and control functions,
  - the decision support software modules.
- Implement these architectural concepts through the development of 2 versions of a pre-operational system,
- Validate and evaluate these 2 versions with users from different EU countries. The evaluation sessions will be performed in the frame of operational scenarios.

Progress of the project

- The project started on the 1st of September 2004 for a duration of 4 years.
- The Requirements phase is completed (March 2005)
- The Design phase will be carried out until end of October 2005.

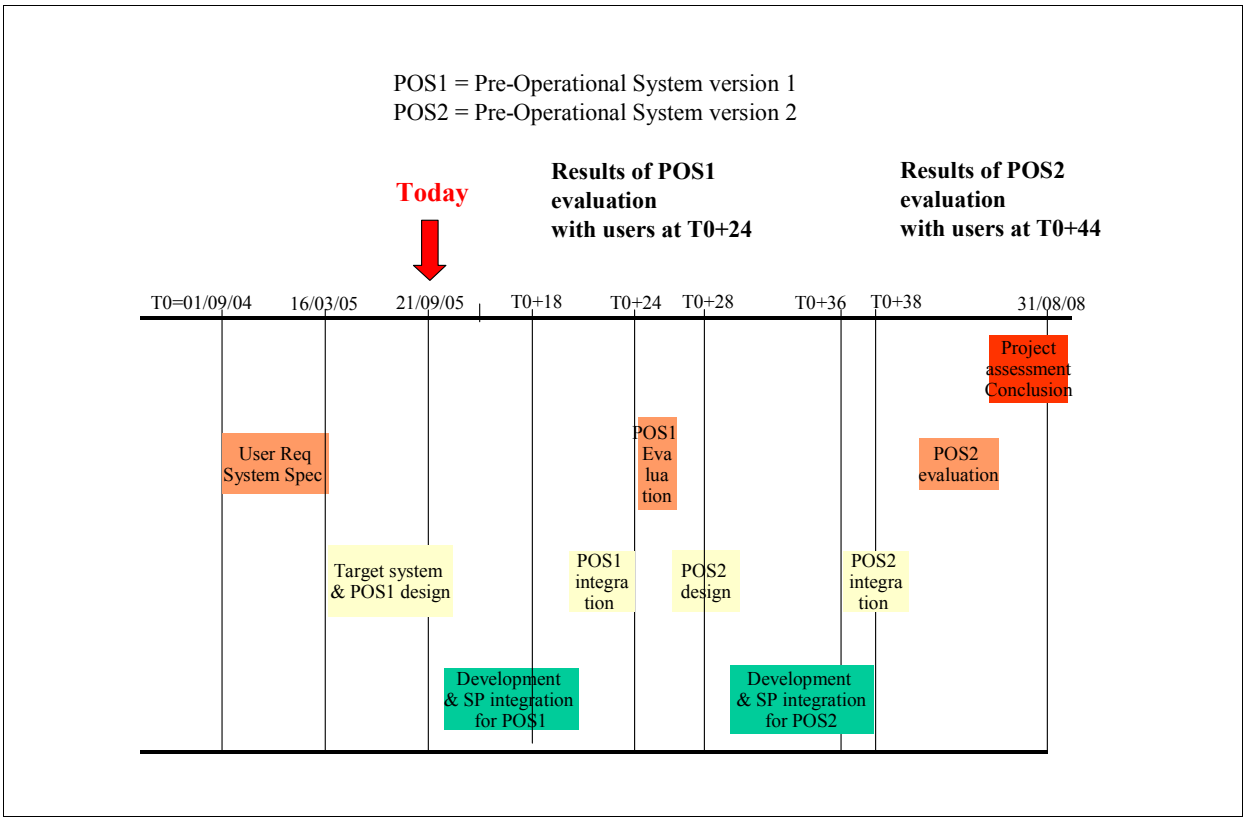

Figure 7: Overall project schedule