
A DISTRIBUTED FLOOD VULNERABILITY & RISK MAP SERVICE: THE GENESIS 2000 PROJECT

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KEYWORDS: Disaster Management (DM), TENTELECOM, Geospatial Information, Internet services, Distributed frameworks

ABSTRACT

Disaster Management is considered as one of the emerging markets in Public Administration. The GENESIS 2000 project is meant to provide thematic information services to customers — such as the National or Regional civil protection information centres — via an Internet-based, flexible network infrastructure.

The information, adequately *integrated from different co-operating service providers throughout the network*, will be concerning the monitoring and survey (typically under form of geospatial information) of the geographical region of interest of each customer.

1 BUILDING GEOSPATIAL INFORMATION FRAMEWORKS

There is a growing movement in Information Systems technologies concerning Geospatial Infrastructures, i.e. large distributed heterogeneous systems able to federate different business entities (as both information providers and consumers) on a common ground of information exchange, using open systems standards. The objective is to stimulate the growth of a number of value-added services which nowadays are still trying to lead a way in the information marketplace, even if everybody says that this process is likely to be accelerated by the Internet and *e-commerce*.

The approach of the national and international organisations concerned by this process became interesting recently, where a common, almost implicit understanding pushed everybody to design and/or provide an infrastructure instantiated in the Disaster Management (DM) domain. Example of this behaviour are well present in the US, where for instance work at NIMA is taking shape in FEMA architecture, and OpenGIS is pushing towards the creation of a SIG on Disaster Management.

More concretely, key factors of success appear to be of three kinds:

- available *technology*,
- company *offering*, and
- *customer* relationship.

We will briefly discuss these factors in this introduction, to give a glance of which vision has been endorsed in the GENESIS 2000 project.

1.1 Technology: Enterprise Architectures

Enterprise Architecture is a recent term which ambitiously fosters a change of perspective in the domain of information system architecture design, where the new focus becomes the business of the customer and his own benefit (financial and operational). Moreover, an Enterprise Architecture not only takes into account the internal organisation structure of the customer business to design his information system, but also all the interfaces with other external organisations, that can potentially influence the customer service behaviour.

Such approach looks very promising for DM information systems, where the level of complexity of information can be very high and interactions with the field of operations are extremely relevant. Let's only think of the variety of expertise necessary to conceive an entire system: the different sensors and the historical archives, the processing and the associated networking to support the operational workflow, the services provided to the customer.

Other relevant aspects of Enterprise Architectures in the DM domain concern the management of local and regional information, according to different spatial and temporal scales, and the necessity to keep the infrastructures open to any useful exchange with new entities able to import added value, considering methods to verify the overall quality of the new services.

1.2 Offering: A Global Approach

Trends in US let us identify a “verticalisation” of the market of information, where companies try to provide everything from raw data to the final customer information service. As we saw in the previous chapter, the large spread in expertise make this hard even for very large corporations or organisations. The concept of “federation” of experts is becoming more and more adopted, where more or less open consortia try to consolidate around solid industrial realities. This difference in market approach is also driven for instance by the understanding of multiple relationships in the various disciplines (e.g. geology, hydrology, seismology) to vulnerability and risk evaluation. Moreover, market segments look to span from national and international organisations with large established budgets down to local civil protection units with yearly budget of the order of some Meuro.

A concrete European initiative, in parallel to FEMA and OpenGIS in US to sustain vigorously the Industry efforts, is represented by the IST Cross-Programme Action concerning the European Geospatial Information Infrastructure (EGII), which is expected to take form in year 2000.

1.3 The Customer: A Necessary Partnership

An analysis of the customer in the DM information systems domain can give an idea of the institutional complexity due to the complex hierarchy, the number of internal/external relationships, the positioning of the deciders in the organisations and information dissemination policies. To make it more complex, at European or global level all organisations are different.

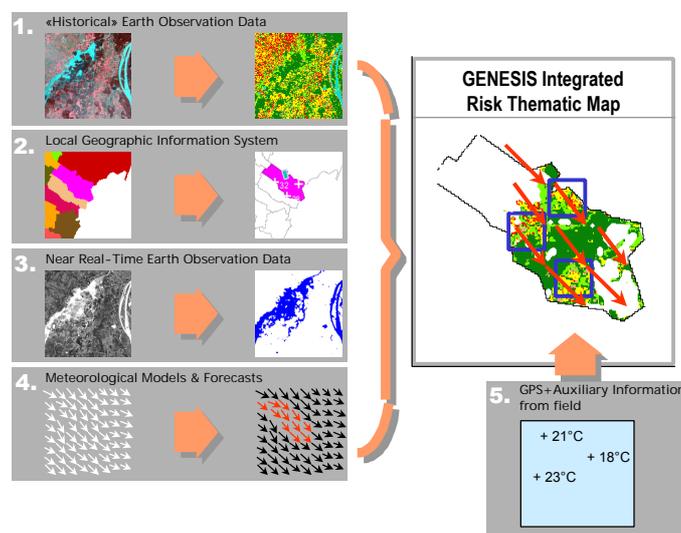
Nevertheless, a constructive customer relationship has to be the goal of every service provider, making leverage upon similarity with other Public Administration organisations, their intrinsic need of efficient response and the high quality of service required face to the elevated yearly expenditures. The building of public-private partnerships to finance such large projects has to be thoroughly investigated.

A project of DM information infrastructure appears hence to be a big challenge — and a large opportunity at the same time — for today’s Industry to modernise its approach to service integration, to revise marketing strategies and to face successfully complex customer organisations.

2 GENESIS 2000 OBJECTIVES

The GENESIS 2000 project is meant to provide thematic information services to customers — such as the National or Regional civil protection information centres — via an Internet-based, flexible network infrastructure. The main idea is to explore the viability of a distributed Geospatial Information framework tuned specially on DM services.

The information, adequately *integrated from different co-operating service providers throughout the network*, will be concerning the monitoring and survey (typically under form of geospatial information) of the geographical region of interest of each customer. In particular, the service contents will be continuously updated with the support of *Earth Observation (EO) satellites* bearing sensors of different kind — radar, optical high resolution and meteorological — integrated with data of other nature (e.g. ground meteorological radar, 3D terrain models, other local sensors data) and will be especially useful for the action of civil protection units operating in the field.



GENESIS 2000 Integrated Services

3 THE GENESIS 2000 PROJECT

The overall GENESIS 2000 service project will operate on a distributed basis, i.e. each provider will be responsible of a specific processing, with the goal of offering the most precise and updated information. The presented approach intends to provide an integrated solution framework for the support to the management of environmental threats considering an *open distributed infrastructure*, encompassing a network of organisations and services — from a regional to a national scale — connected in near real time.

One point of strength of such an open approach is that the customer will be able to get the best specialists for each specific application, and therefore *build the favourite service* — from a choice of available content providers — on ad-hoc high performances servers.

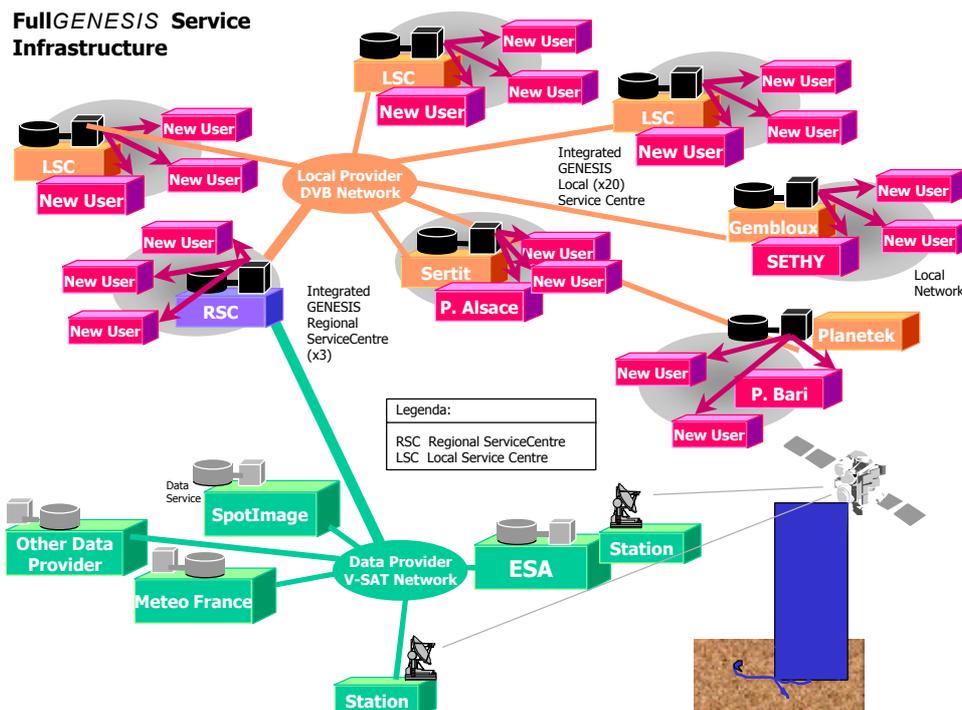
Another important result of having a *network* of specialised value added providers is the possibility to integrate different geospatial information normally available in different fields and use cross-correlation to get an even richer service. GENESIS 2000 will be able to support integration and processing of data from a number of different heterogeneous sources into *ready-to-use information*, creating a *specialised DM framework* for both national and local users, hence providing them with an extended *decision support network*.

A relevant part of the data used in GENESIS 2000 services will be earth observation (EO) imagery, able to provide continuous survey of large areas in a cost effective way. By the way, in order to adequately perform within the service infrastructure, these providers of very large data (>100 MB per image) have to be equipped with updated material for data handling and high speed transmission.

Hence, The deployed service will consist of a two-level network:

- a satellite-linked network of *Regional Service Portals (RSP)* to provide final customers and specialised service providers with medium-scale information, diffused after a first integration in a DVB dissemination scenario;
- a constellation of *Local Service Portals (LSP)*, e.g. corresponding to an institutional intervention area, to provide customers with more precise and detailed information on the near area, diffused by high speed and secure terrestrial and/or aerial links to the operating units. These links may be degraded seamlessly to common phone line Internet connections in case of budgetary reasons in some regions/countries.

Both the Local and Regional Centres will be based on the same open architecture concept belonging to ISIS, using advanced heterogeneous distributed systems technologies such as CORBA and Java, which will allow the complete integration of other local services (e.g. GPS localisation, accurate territory mapping), complementing adequately the whole information scenario. The exchange of information will be transparent to users, being based upon modern concept of Information Trading and implicit Service Binding.



4 GENESIS 2000 PRAGMATIC APPROACH

The GENESIS 2000 project needs a first feasibility & market study concerning several activities shortly described hereafter.

The first set of tasks will analyse the *customer process*, including a full understanding of which metrics the customer will use to evaluate the services, and a quantified evaluation of the potential GENESIS 2000 added value. On the basis of the results of these studies, the service specifications and consequent architecture will be outlined. The main results of this phase will be hence the Service Business Objectives and the Service Architecture.

A full Service Deployment Plan is also considered in the Project Deliverables, to correctly prepare the Project Deployment Phase.

Afterwards, two activities will be initiated in parallel, i.e.:

- the design & development of a GENESIS 2000 *pilot demonstrator*;
- a detailed GENESIS 2000 *marketing plan*.

4.1 GENESIS Demonstrator

To demonstrate the feasibility, a *full-size pilot service* will be assembled, integrating a Natural Disaster application and available communications means, in order to demonstrate the GENESIS 2000 benefits to the future potential customers. The pilot service will encompass a demonstration to the Civil Protection authorities in three different EU Countries. Each customer will be provided for the time of the pilot demonstration with receiving equipment integrated with their computing premises.

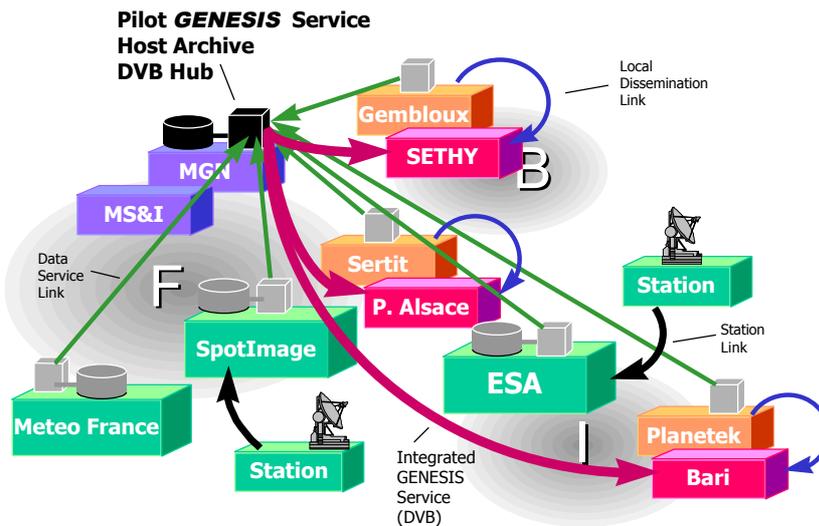
The information cycle will be demonstrated, eventually using simulations wherever appropriate, and the integration of geospatial multilayer products will be performed. It will include an integrated imagery server interconnected with heterogeneous data and service providers in an open architecture and the broadcast of the results via DVB to users.

Please notice that this medium will allow demonstration also to other interested institutional organisations with no additional cost, and the Industry partners will provide a certain number of extra reception equipment sets.

For flood management purposes, the customer will have access to the information layers updated in near real time integrated in *Vulnerability & Risk Maps (VRM)*, such as thematic cartography, plotting of floodable areas, soil humidity, moisture, and temperature from satellite data and meteorological forecasts.

Other potential complementary products are *Damage Assessment Maps*, containing a survey of the area hit by a natural event for the evaluation of the situation.

The customer will access to these service through a standard Internet connection, using a standard browser as Netscape Navigator or MS Explorer, with the possibility to obtain the same level of information either on a fixed workstation or on a portable PC connected to the GENESIS 2000 server, allowing broad access to large potential customer communities.



GENESIS Demonstration Architecture

4.2 GENESIS 2000 Marketing Plan

The other parallel activity will address a complete *GENESIS 2000 Marketing Plan*, containing a business scenario study and exploitation, and the consequent initialisation of actions at commercial and political level for fund rising. It is our opinion that, for this type of large projects, a strong and focused political purpose needs to be stimulated at all levels, and the adequate commercial support has to be deployed to get to the target.

The phase belonging to the EC financed project will have a duration of 15 months, and at its end a Final Report will be issued by the GENESIS 2000 Consortium, containing the synopsis of the results, a full evaluation of the feasibility of the project, and a concrete Action Plan for the phase 2, concerning the deployment of the services on the market.

This project phase will be run by an Industrial partnership created by:

- MATRA SYSTEMES & INFORMATION — as Project Co-ordinator — for the overall service integration and the server software for specific imagery content processing, reusing the Interactive Satellite Image Server (ISIS) developed in the frame of the DGIII ESPRIT work programme;
- ALENIA AEROSPAZIO, specialist of satellite service integration and in particular using DVB data broadcasting through the SKYPLEX/EuroSkyWay infrastructure.

To succeed in this preparatory phase of the Project, we intend to involve in the activities:

1. International & National data and service providers such as the European Space Agency (ESA) ESRIN (I) for SAR imagery, Spot Image (F) for high resolution optical SPOT imagery, and Meteo France (F) for meteorological data and forecast models, in charge of providing their specific knowledge on EO satellite operations and the extraction of basic thematic information;
2. National and Regional specialists to work on complementary fields for service contents specification and integration such as the University of Gembloux (B) working with SETHY for the WAMM project (DGXIII) for integration of hydrological models for flood forecasting, SERTIT Strasbourg (F) as expert in SAR data processing, and Planetek Italia (I, a SME) as an expert GIS service provider;
3. A selected set of potential GENESIS 2000 service customers, which have already a long partnership developed with the National and Regional specialists listed in the last point above, to facilitate interaction with the Consortium. These users are coordinated by the SETHY (B), and include also the SDIS Bas Rhin (F) and the Prefettura di Bari (I), covering different operational aspects related to the use of the information provided by GENESIS 2000.

To improve the project impact and the co-ordination at EU level, the study activities and the pilot demonstration will encompass services and entities operating over three EU Countries, and will take benefit of a number of available infrastructures, and experiences such as projects and studies which are or have been successfully performed by the Consortium members.