Stretto di Messina

Concessionaria per la progettazione, realizzazione e gestione del collegamento stabile tra la Sicilia e il Continente Organismo di Diritto Pubblico
(Legge n° 1158 del 17 dicembre 1971, modificata dal D.Lgs. n°114 del 24 aprile 2003)

EurolinK

PONTE SULLO STRETTO DI MESSINA

PROGETTO DEFINITIVO

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GE0015_F0

Unità Funzionale	GENERALE
Tipo di sistema	TECNICO
Raggruppamento di opere/attività	ELEMENTI DI CARATTERE GENERALE
Opera - tratto d'opera - parte d'opera	SISTEMA INFORMATIVO GEOGRAFICO PER IL PONTE SULLO STRETTO DI MESSINA
Titolo del documento	ARCHITETTURA GOOGLE EARTH ENTERPRISE INTEGRATA NEL WORK SITE MANAGEMENT

CODICE: C G 3 7 0 0 P R X D G T C 0 0 G 0 0 0 0 0 0 0 0 0 3 F0

REV	DATA	DESCRIZIONE	REDATTO	VERIFICATO	APPROVATO
F0	20/06/2011	ACCETTAZIONE SDM PROT.0523 DEL 12/05/11	F. DAFFINÀ	F. VOLPE	M. FERRI

NOME DEL FILE: GE0015_F0 revisione interna: 00

INDEX

1 Introduction

1.1 Scope of the document

Scope of the document is to provide a preliminary proposal for the architectural design of the Worksite Management System (WSMS), subsystem of the Management and Control system (MACS) dedicated to the geospatial data management, that includes a Google Earth Enterprise (Fusion and Earth Server) platform and trying to explain the possible interfaces, protocols and data exchange formats allowing the full integration with all the others components.

1.2 Acronyms and definitions

DB Database	
EDHS	Electronic Document Handling System
GE Google	Earth
GEE	Google Earth Enterprise
GE EC	Google Earth Enterprise Client
GIS	Geographic Information System
ISO	International Organization for Standardization
IT	Information Technology
MACS	Management and Control System
OGC Open	GIS Consortium
SDI	Spatial Data Infrastructure
WSMS	Worksite Management System

2 Google Earth Enterprise

2.1 Technical Details

Google Earth Enterprise takes the same processing and serving infrastructure that's used at Google to build and serve Google Earth and Google Maps to millions of users and brings it to own organization's data, allowing rapid, secure and easy viewing of published data, through the Google Earth Enterprise Client or through a browser using the Google Earth Plugin API or Maps API.

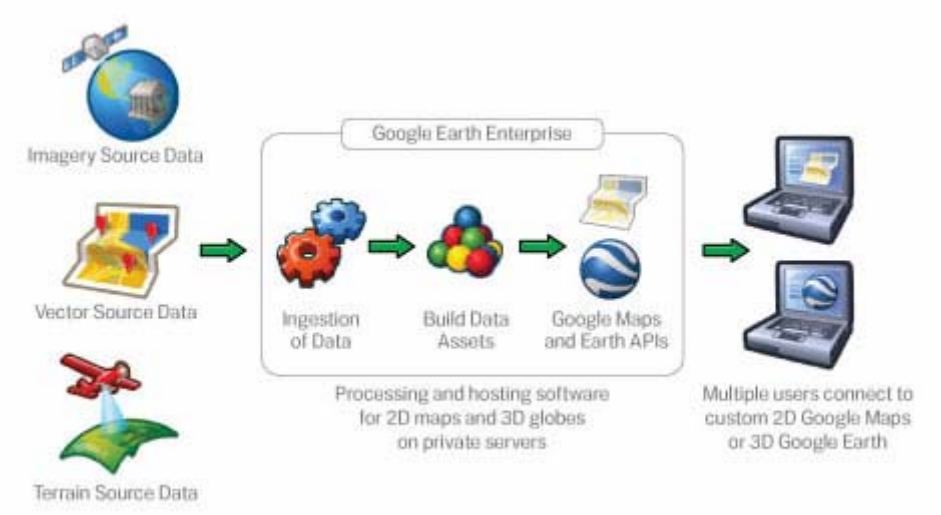

Figure 2.1 - GEE global schema

Supported Platforms	▪ Latest distributions of Ubuntu, Redhat, and SuSE
Supported Data Format	▪ Standard vector data formats including shapefiles, tabfiles, gml, kml, CSVs ▪ Standard imagery formats including GeoTIFF, IMG, JP2, MrSID ▪ Standard terrain formats including DTED, SDTS DEM, ASCII DEM, IMG, GeoTIFF

2.2 Google Earth Enterprise software

The Google Earth Enterprise software is comprised of two distinct software packages that work together to build and host the company's private Google Earth globes and Google Maps.

- **Google Earth Enterprise Fusion** combines all of own imagery, terrain, KML, and vector data into a Google Earth (3D) globe or a Google Map (2D).

- **Google Earth Enterprise Server Software** allows to host private or public globes or maps to be accessed via Google Earth clients or a Google Maps browsers.
- **Google Earth Enterprise Client** Like the familiar Google Earth client offers to the users a seamless, familiar interface that's easier to use than standalone GIS software.
- **Google Earth API** The Google Earth API gives to users the best of both worlds, allowing them to easily view 3D data in any browser.

Google Earth Enterprise Client is also available for mobile clients with that satisfy the following systems requirements:

- Supported Devices: Nexus One and Droid (utilizing 2.1 or later) ARMv7 instruction set
- SD Memory Card: 211 MB Minimum
- On Device Memory: 35 MB Minimum Free System Memory

Figure 2.2 - Google Earth EC on Android

2.3 Google Earth Enterprise utilisation in the "Ponte sullo stretto di Messina" project

As explained in the following schema, the GEE environment will provide the accessibility to geospatial data either through custom web application either through dedicated clients. The **GEE Fusion** will provide the processing engine, producing an optimized data streaming for large geospatial datasets (raster and vector) that are fixed or not require frequent update (background imagery, road network, …). The **GEE Server** will provide the access to data and the API to be managed and to implement custom functionalities. The integration of GEE with dynamic data sources (including also non EO data), using dedicated libraries, will allow the visualization, through GEE, of other data formats/services (es. OGC WMS).

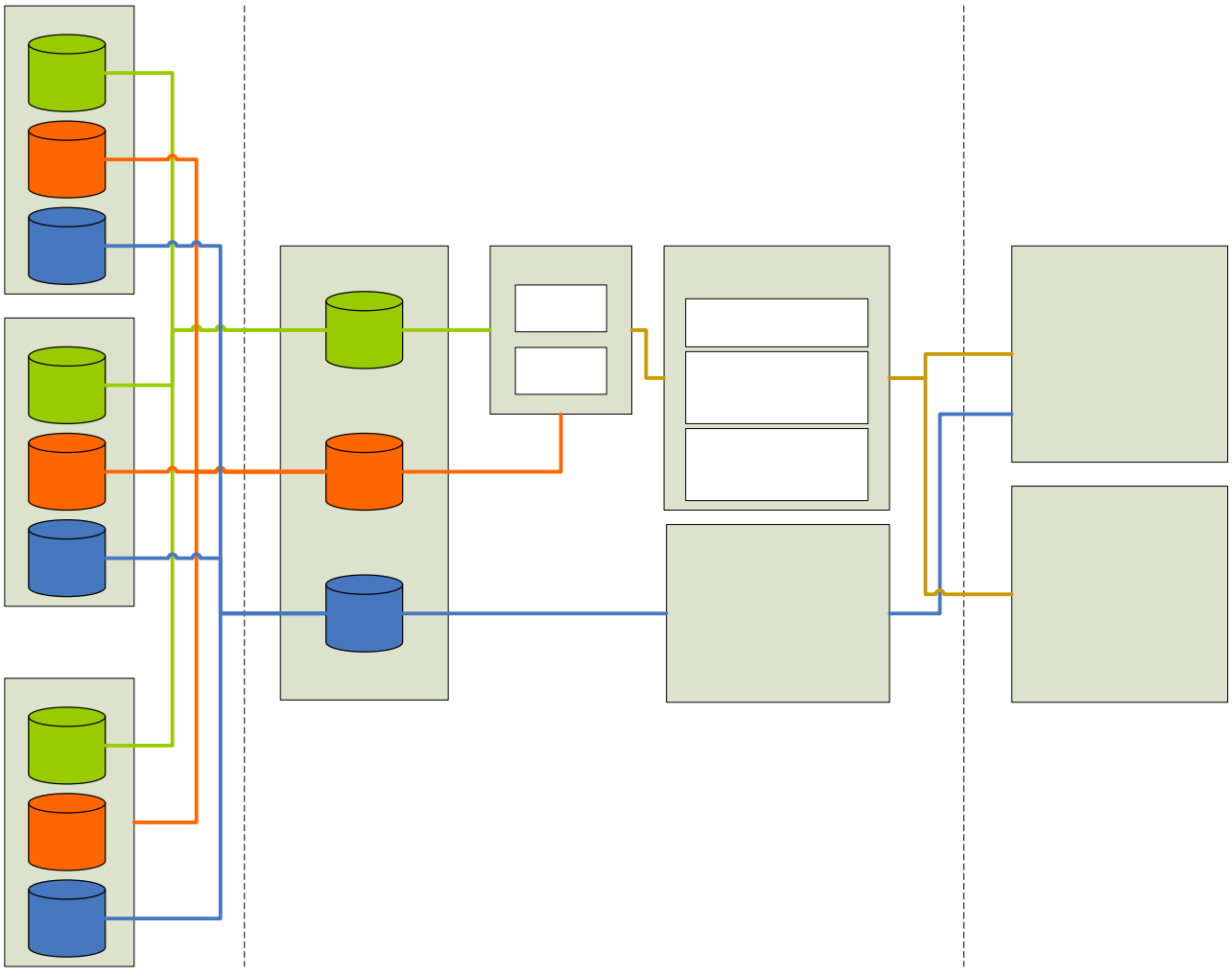

Figure 2.3 – General architectural design with the integration of GEE in an SDI

3 The Management and Control System (MACS)

3.1 Description of the global system

The Messina Strait Bridge, according the current Project Definitivo project phase, will be equipped with a Management and Control System (MACS) that enables the Bridge Operator to carry out the operation and maintenance of the Bridge structure and installation. The MACS will be a collection of controlling software applications that share data and interfaces in an full integrated environment, improving control and management operations. The subsystems to be integrated are:

- Monitoring (SCADA – described by the E&M design basis)
- Traffic Management System (TMS)
- E&M Control and Monitoring (EMC)
- Structural Health Monitoring System (SHMS)
- Safety and Anti Sabotage (SSS)
- Telecommunication (COM)
- Railway monitoring (RM).

3.2 Interfaces

The MACS interface will be a web portal and, above all for the geospatial data interaction in the context of the Worksite Management System, some dedicate GE EC clients; through them the users will access data and pull reports. The MACS will interact with its subsystems through a web services layer (in the following schema called “Integration and communication layer”) sharing data and functionalities. The MACS will share the SCADA Man-Machine-Interface in the form of a large Display Wall collocated in the Bridge Control Room.

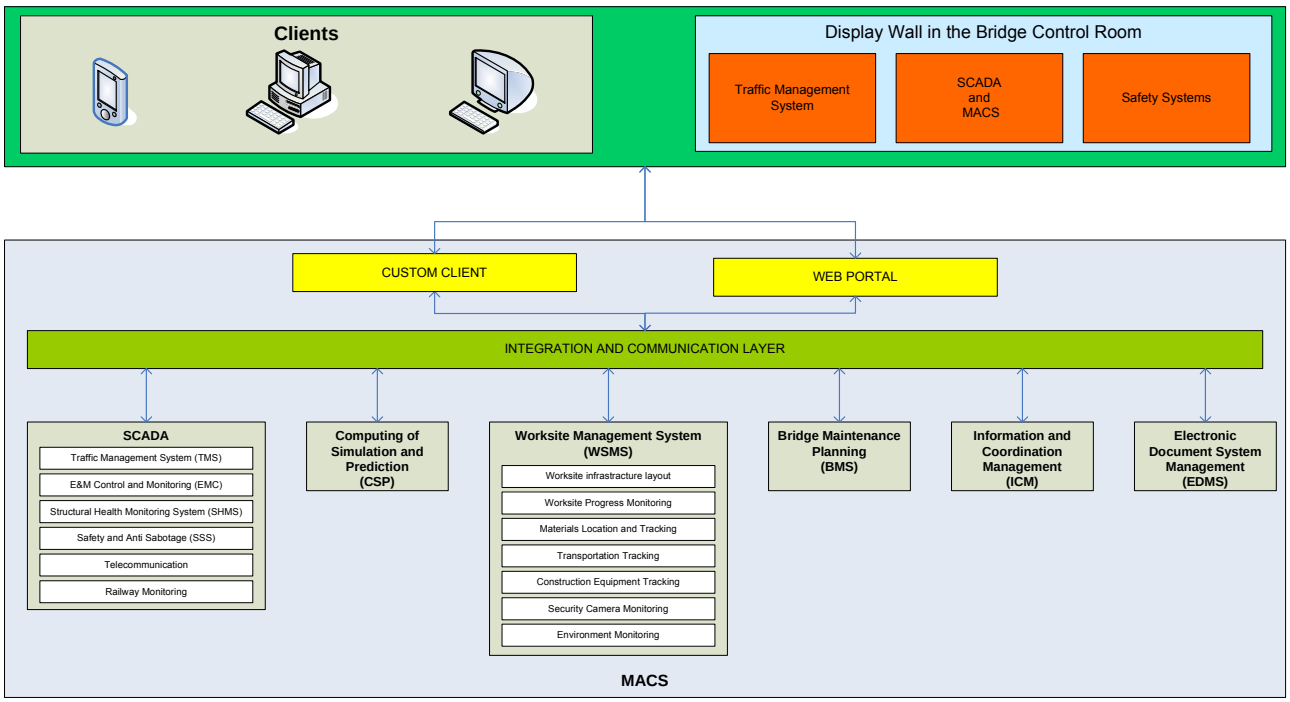

Figure 3.2 - MACS global schema

4 The Worksite Management System (WSMS)

4.1 Description of the subsystem

The WSMS system will monitor work, materials and equipment during the entire construction phase; its frontend consists of a GIS interface allowing visualization of data on a map, the usage of geospatial functionalities and interfacing a geo-database. This interface will be accessible trough a web portal and a dedicated client available for both desktop and portable computers based on mobile communications. The WSMS contains the following functional modules:

- Worksite infrastructure layout
- Work progress monitoring
- Materials location and tracking
- Transportation tracking
- Construction equipment tracking
- Security camera monitoring
- Environmental monitoring.

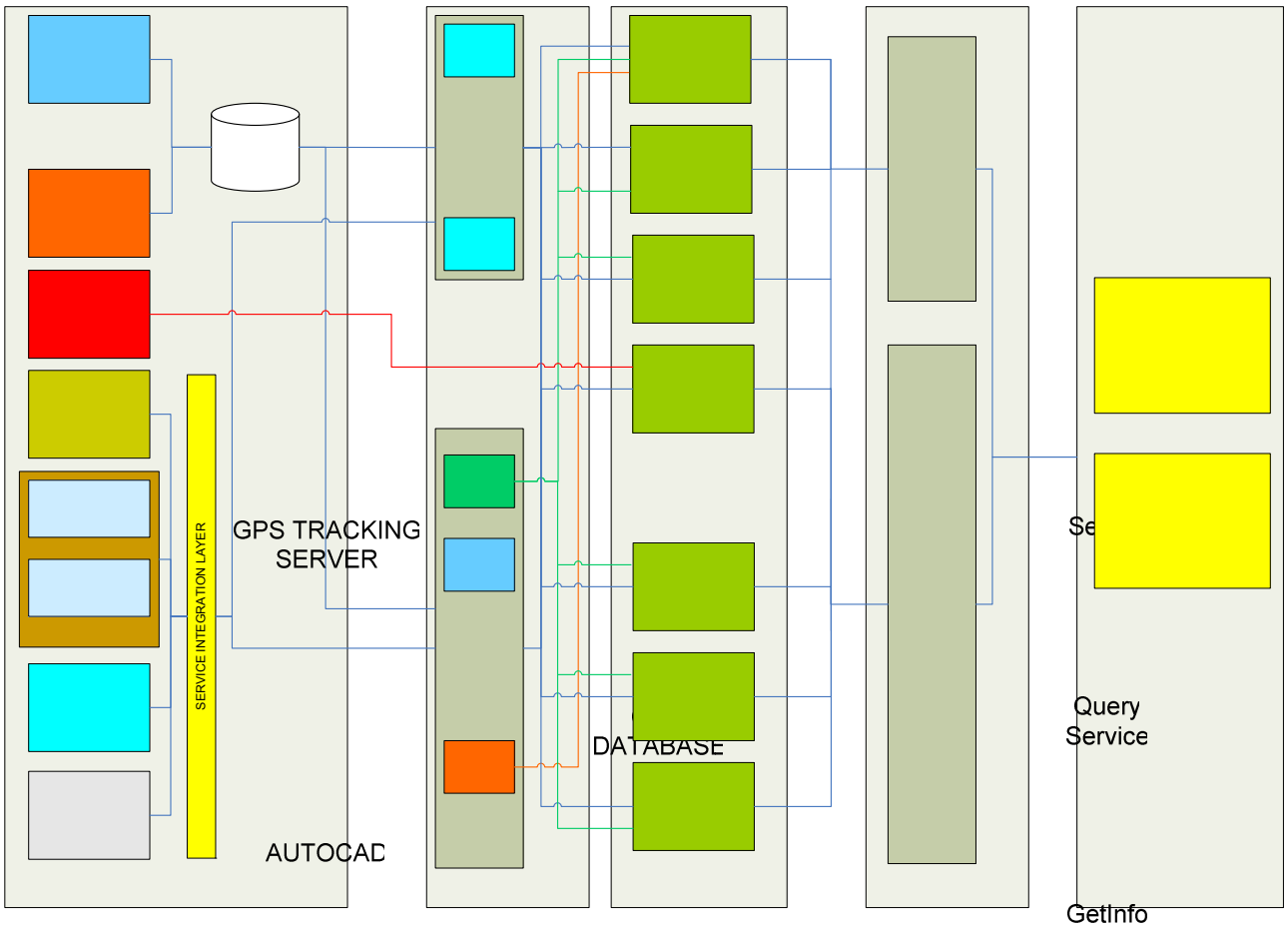

Figure 4.1 - architectural schema for WSMS

The **Datasource Layer** contains all the systems where the data are stored and managed; due to the heterogeneous nature of these information a **Service Integration Layer** is requested to harmonize, aggregate and providing the geospatial component (if requested also using a dedicated geo-database and unique identificators). The GeoDatabase plays an important role storing the positions of main elements and providing the necessary correlations with the other information by using unique features identificatos. The Service Integration Layer and the Geo Database are also used to retrieve the feature information (according the nature of the data sources).

The **Service Layer** is composed of two main modules:

- the Query Service: responsible to forward the getFeatureInfo requests to the right system and provide the retrieved information.
- Mapping Server & ETL: responsible to process/aggregate geospatial data – i.e. the time/spatial correlation of GPS messages to calculate the route – and to transform the EO data in OGC WMS/WMS services.

The **Subsystems Layer** contains all the WSMS subsystems managing their interfaces.
The **Delivery Layer** is responsible to manage the information provision to the end-users, providing the tools and the functionalities to deliver them in different formats; it is made up two main modules:

- Google Earth Enterprise: responsible of geospatial data delivery (a customization of the general architecture outlined in Figure 3).
- Reporting Server: responsible of the reports generation

The WSMS system can provide 2D and 3D environment and can provide data/services to different clients:

- Custom web applications: the best way to provide custom functionalities (applicable for 3D and 2D by using Google Earth API and Google Maps API), manage the information and allowing the integration with others systems.
- Dedicated standalone clients: using Google Earth EC (for desktop or ANDROID mobile devices), applicable only for 3D environments.

4.2 Description of the components

System	Functionalities					Input	Note
	Data Display	GetInfo	Search	Report	Feature editing		
Worksite Infrastructure Layout	X	X	X	X	X	Data from CAD system (using OGC WMS) Geodatabase for the position Drawn features by OGC WFS (to be stored into the geodatabase)	Requested custom simbology
Work Progress Monitoring	X	X	X	X		Data from CAD system (using OGC WMS) Work progress data from project management system Primavera SAP	Requested colour-scale 3D environment Manage aggregation

Materials Location and Tracking	X	X	X	X		SAP MM by feature_ID Related documents from EDHS Geodatabase for the position Transportation Tracking System (in case the material is moved through a veicle)	Link to related documents managed by EDHS Materials status management
Transportation Tracking	X	X	X	X		Last GPS position from the geodtabase/tracking server SAP	Produce track by time/spatial correlation of GPS messages
Construct Equipment Tracking	X	X	X	X		Last GPS position from the geodtabase/tracking server SAP	Produce track by time/spatial correlation of GPS messages Alarm if out of a specified bounding box
Security Camera Monitoring	X X		X			Geodatabase for the position Video streaming from the cameras	
Environment Monitoring	X X		X	X		Geodatabase for the position of the sensors Sensors	

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