The GIGAS Methodology

Pier Giorgio Marchetti

European Space Agency
Earth Observation Programme
Ground Segment Department

pier.giorgio.marchetti@esa.int

GIGAS Methodology

- Objectives
  - Make analysis
    - simple and affordable with a limited amount of resources
    - involve participation from different actors: managers, architects, engineers, scientists
  - Deals with systems of systems
    - Built independently from each other
    - Long running programmes with independent schedules
    - Typical questions
      - Where establish synergy?
      - If and what to merge?
      - How to build interfaces?

GIGAS Methodology

- GIGAS has developed a detailed methodology to document architecture, process and consensus mechanisms for each initiative
- This methodology has been used as the basis for examining requirements, architectures and standards applied on the systems in order to provide an evaluation of them in terms of business, enterprise, information and engineering and technology architecture, as well as their strategic alignment
- The purpose of GIGAS is not to make studies within each initiative, this is already in the scope of the initiatives and any information can be found inside the initiative documents
- GIGAS is expected to make a cross-initiative study, each feature or architectural aspect is analysed not only on a single initiative but across the three initiatives.

GIGAS Approach

- The approach proposed by GIGAS is based on three steps:
  - Technology watch
  - Comparative analysis
  - Shaping of initiatives and standards
- The above steps will be repeated twice (in two loops) during GIGAS lifetime but can be repeated multiple times after the project conclusion if a persisting infrastructure is established
- This presentation concentrates on the methodology for technology watch, comparative analysis and shaping via recommendations

GIGAS Methodology: RM-ODP

- Enterprise viewpoint: A viewpoint on the system and its environment that focuses on the purpose, scope and policies for the system.
- Information viewpoint: A viewpoint on the system and its environment that focuses on the semantics of the information and information processing performed.
- Computational/service viewpoint: A viewpoint on the system and its environment that enables distribution through functional decomposition of the system into objects which interact at interfaces
- Engineering viewpoint: A viewpoint on the system and its environment that focuses on the mechanisms and functions required to support distributed interaction between objects in the system
- Technology viewpoint: A viewpoint on the system and its environment that focuses on the choice of technology in that system

- Specific templates have been created for each viewpoint based on the RM-ODP definitions
- All the different initiatives, projects, standards have been described using the same templates allowing a uniform modeling and a simple comparison

GIGAS Methodology: Enterprise Viewpoint

Enterprise Viewpoint Template

- Summary table with project/initiative general features
- High Level Requirements
- Context/Use Cases

Example SANY Summary Table

5.2.1 SANY Enterprise Viewpoint

Aspect	Description
Context	SANY is an Integrated Project (contract number 0033564) co-funded by the Information Society and Media DG of the European Commission within the RTD activities of the Thematic Priority Information Society Technologies"
Start and End Date	1.9.2006 – 30.08.2009 (probably extended to 31.12.2009)
Home Page	http://www.sany-ip.eu
Summary	The European Commission (EC) and the European Space Agency (ESA) have established a joined Global Monitoring for Environment and Security (GMES) initiative. Sensors Anywhere Integrated Project (SANY) will contribute to this initiative by improving the interoperability of in-situ sensors and sensor networks, and allowing quick and cost-efficient reuse of data and services from currently incompatible sources in future environmental risk management applications. SANY pursues five major objectives: 1. Specify a standard open architecture for fixed and moving sensors and sensor networks capable of seamless "plug and measure" and sharing (virtual networks), applicable to all kinds of in-situ sensors, classical and ad-hoc sensor networks, virtual sensors (sensor-like software), roving and airborne sensors, and ensure interoperability between ground and in-orbit sensors. 2. Develop and validate re-usable data fusion and decision support service building blocks. 3. Assure a reference implementation of the architecture, i.e. an on-demand environment for accessing the GMES information and services is operational as GMES building block in 2008. 4. Assure the new architecture is generic and provides added value for end users. 5. Assure the outcome of SANY is accepted by end users and international organisations and contributes to a future standard applicable to GMES.

Example SANY Su

	SANY inherits and extends the results of two high profile EC and ESA infrastructure projects; ORCHESTRA and MASS/SSE. All architecture specifications shall be publicly available and compatible with EU and ESA infrastructure initiatives, such as INSPIRE (standard interfaces with geospatial information) and Heterogeneous Missions Accessibility project (standard interfaces for EO Ground Segments). SANY specifications shall be validated by experts trough OGC technical committee and realised in three innovative risk management applications covering the areas of air pollution, marine risks and geo hazards.
Reference to architecture specification	SANY D2.3.2 Specification of the Sensor Service Architecture, accessible at http://www.sany-ip.eu
Source of Requirements	End-users and IT integrators of environmental sensor applications GMES users
Business rules (model),	Results are architecture, service and model specifications and pilot applications Individual exploitation plans by the SANY partners Common exploitation plan: no public information
Security rules	Access control mechanisms embedded in architecture, specification and implementation
Authority rules for privileges and permissions	none
Resource usage rules	pilot-specific
Transfer rules,	public specifications re-use of software components depending on partner
Domain rules	Closed consortium; advisory board with selected users
Important use cases	Registration/de-registration of (possibly mobile) sensors Access to sensor observations Support of multi-step fusion processes

Table 3: Enterprise Viewpoint of the SANY Project

3.5.2 SANY Information Viewpoint

Aspect	Description
Model name	Observation & Measurements (O&M) model
Category	basic model
Reference to specification	See standard reference
Standard reference	OGC Document 07-022r1, October 2007
Description	Describes a framework and encoding for measurements and observations. The aim is to define a number of terms used for measurements, and the relationships between them. It discusses observation, measurement, result, procedure, feature of interest, observed property, property type, coverage and related terms.
Format	UML, XML
Comment	Model is required specifically for the Sensor Observation Service and related components of an OGC Sensor Web Enablement capability, and also for general support for OGC compliant systems dealing in technical measurements in science and engineering.

Table 100: OGC Observation and Measurement Model (applied in SANY)

GIGAS Methodology: Service Viewpoint

3.4.3.5 Geographic processing services - spatial, thematic, temporal

Aspect	Description
Service name	Coordinate Operation Service
Category	OA Support
Reference to specification	OA Services Abstract Specifications OA Services Implementation Specifications see http://www.eu-orchestra.org/publications.shtml#OAspecs
Standard reference	
Description	The Coordinate Operation Service changes coordinates on features from one coordinate reference system to another (based on a 1-1 relationship). This includes operations on datum and projection. A Datum is used as a basis for defining a coordinate reference system and it specifies how the coordinate system is related to the earth. Examples are WGS84 and NAD1950. A projection is a method for depicting 3-dimensional data (the shape of the earth) in 2 dimensions. There are two principal variants of coordinate operations: • Coordinate conversion: An operation on coordinates that does not include any change of Datum. Examples of a coordinate conversion are a map projection between projected coordinates and geographic coordinates, or change of units such as from radians to degrees or feet to meters. • Coordinate transformation. An operation on coordinates that usually includes a change of Datum. The parameters of a coordinate transformation are empirically derived from data containing the coordinates of a series of points in both coordinate reference systems. This operation introduces errors, hence allowing derivation of error (or accuracy) estimates for the transformation.
Format	WSDL
Comment	

Table 96: Coordinate Operation Service

GIGAS Comparative Analysis

- Based on the outcomes of the previous Technology Watch, GIGAS undertakes a comparative analysis on solutions, requirements, architecture, models, processes and consensus mechanisms used by INSPIRE, GMES and GEOSS, taking into account the monitoring of FP6/FP7 research projects and the ongoing standardization activities

Catalogue/Metadata Comparative Analysis Information Viewpoint			
Feature	GEOSS	INSPIRE	GMES
Registry Model	ebRIM 3.0	ISO 19135 for existing registers (feature catalogue & glossary)	ebRIM 3.0
Dataset Metadata (GMES term.: Product)	Profile of ISO 19115	INSPIRE Profile of ISO 19115	Metadata Model & Encoding: EO Profile of GML Discovery information model: EO ebRIM EP
Series Metadata (GMES term.: Collection)	Profile of ISO 19115	INSPIRE Profile of ISO 19115	Metadata Model: Profile of ISO 19115 (OGC 07-025) Metadata Encoding: ISO 19139 Discovery information model: CIM ebRIM EP
Service Metadata	Profile of ISO 19119	INSPIRE Profile of ISO 19119	Metadata Model : Profile of ISO 19119 (OGC 07-025) Metadata Encoding: ISO 19139 Discovery information model: CIM ebRIM EP

Table 2 – Catalogue/Metadata Comparative Analysis - Information Viewpoint

GIGAS Comparative Analysis

The result of the Comparative Analysis includes:

- A list of recommendations (mainly) to GEOSS, INSPIRE and GMES to be expanded and processed in depth in the following shaping phase
- The identification of technological gaps to be explored in the following shaping phase
- Guidelines and objectives for the architectural approach within GIGAS
- Analysis on the schedules of the three initiatives and on the FP6/FP7 programs and standardization activities, with identification of key milestones or intervention points

GIGAS Comparative Analysis

- The draft recommendations are extracted, processed and refined on the basis of a critical analysis of the technology watch reports based on a set of criteria used to identify priorities:
  - Cost-benefit trade-off for interoperability
  - Governance
  - Schedule
  - Previous feedbacks from the initiatives
  - Long term perspective and global scenario

GIGAS Draft Recommendations: Types

- Testing
- Revising existing specifications/standards
- Further investigation about the subject
- Communication
- Submission for consideration as reference material
- Funding
- Research
- Governance/Political
- …

GIGAS Draft Recommendations: Addressed Entities

- Initiatives
  - INSPIRE
  - GEOSS
  - GMES (either GSC, FTS or both)
  - SEIS
- Standardisation Bodies
  - ISO
  - CEN
  - OGC
  - …
- GIGAS Consortium
- …

GIGAS Draft Recommendations: Syntax

REC-[topic-acronym]-[counter] [title of the recommendation]

- It is recommended
  - To [entity]
- [text of the recommendation]
- Rationale: [if any, text of the rationale]
- Dependencies : [if any, text of the dependencies]

GIGAS Draft Recommendations: Samples

REC-CAT-001 Cross-initiative scenario

- It is recommended to:
  - the INSPIRE, GEOSS and GMES stakeholders
- that they set up a cross-initiative scenario dealing with resource discovery in the context of climate change, with cadastral data obtained from INSPIRE and Earth Observation data obtained from GMES and GEOSS
- Rationale: One of the difficulties of identifying potential interoperability issues between the three initiatives is the lack of known requirements with regard to cross-initiative real-world interactions. Such a scenario would help create a concrete context for the interoperability issues identified in the GIGAS project.
  - Note: the JRC study on cross-catalogue interoperability could be used as input to define this cross-initiative scenario

GIGAS Draft Recommendations: Samples

REC-WMS-001 OWS SOAP Binding

- It is recommended to
  - OGC and ISO/TC211 and CEN TC287
- to support SOAP/HTTP-POST binding, according to INSPIRE Technical Guidance and related technical documents (e.g SOAP framework), in addition to KVP/HTTP-GET binding

- Draft Recommendation to FP7 Projects (GMES FTS, NESIS, …)
  - Adopt Service Oriented Architecture
  - Use SOAP and WSDL for service binding

GIGAS Draft Recommendations: Samples

REC-OM-002 SOS support in INSPIRE

- It is recommended that:
  - the INSPIRE CT and Network Service Drafting Team (DT NS)
- consider supporting the Sensor Observation Service (SOS) alongside WFS for the INSPIRE Download Service in relevant themes.
- Rationale: SOS is a more specialised interface than WFS for providing access to O&M-compliant data, and offers a further level of potential interoperability.
- Dependencies: The Download Service Implementing Rule is currently at stage […] – this recommendation depends on the future opportunities for its review.

GIGAS Draft Recommendations: Samples

Establish and support a European Standards Interoperability Forum within GEOS

- It is recommended that GIGAS drafts the Terms of Reference and Business Model for a European SIF
- Rationale: provide the European voice within SIF

Thank you for your attention

Links to targeted Initiatives, Organisations and Projects: