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GIGAS Persistent Testbed Business Model
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References:

Short Description:
This document defines Business Model for a Meta-Testbed, a Persistent Interoperability Testbed (PIT) and a Persistent Test Harness to support European interoperability development activities in the field of geospatial problems.
Keywords:
Persistent Interoperability Testbed, Business Model

History:

Version	Author(s)	Status	Comment
001	Johannes Brauner (TUD), Matthias Mueller (TUD)	initial	Alpha version
002	P.G. Marchetti (ESA), A. Biancalana (ESA)	Input on GMES	Contribution from ESA
003	Matthias Mueller (TUD), Johannes Brauner (TUD)	draft	The draft business model
004	Matthias Mueller (TUD), Johannes Brauner (TUD)	final	Structure revision (three separate business models) including input from 5th GIGAS meeting.

1 Aim and Scope

The GEOSS INSPIRE and GMES Action in Support (GIGAS) project seeks to carry out a Support Action (SA) aiming at a rapid adoption of standards, protocols, and open architectures in support of INSPIRE, GMES, and GEOSS initiatives. GIGAS will identify and define what is needed to enable a full integration of the architectures of the three initiatives via a consensus.

As one GIGAS interoperability tool outlined in GIGAS Deliverable D2.4 – List of tools and Contribution, this document conducts an analysis of existing interoperability testing activities and drafts business models (including recommendations for the design, management and implementations) for European persistent interoperability testing that serve as permanent testing environments for present and future interoperability activities conducted by the European interoperability community. It is based of the identified and analysed technological gaps and the interoperability and standard development requirements resulting from the first iteration of the GIGAS process (Loop 1) including a comparative study for existing testing facilities in GEOSS, INSPIRE, GMES and OGC. Additionally, the business model incorporates the real world experiences from the existing AGILE/EuroSDR/OGC Persistent Testbed for Research and Teaching in Europe (PTB).

Derived from the conclusions of this comparative study the need for three different types of testing arises:

- **SDI Meta-Testbed**

  The Meta-Testbed is a portal to provide an overview about GIGAS and external European and international SDI related testing initiatives.

- **SDI Persistent Interoperability Testbed**

  The aim of a Persistent Interoperability Testbed is to provide a (persistent) infrastructure (basic services, security mechanisms …) to allow running testing initiatives, which are divided into pre-operational SDI testing initiatives and SDI research testing initiatives.

- **SDI Persistent Test Harness / Compliance Testing**

  Whereas within the Persistent Interoperability Testbed *new* service interface specifications and standards can be developed, existing and near operational implementations of services and data can be tested in the Persistent Test Harness check their compliance with standards and fitness for operational usage. This testing may be contemplated by a process to deliver specific compliance or quality certificates.

The document is part of the activities of GIGAS Work Package 3 (Convergence and Outreach). It represents the deliverable D3.5a (GIGAS Persistent Testbed Business Model), which drafts the final deliverable D3.5b.

This section introduces into the topic and outlines such a persistent testbed and the definition of a business model. Section 2 motivates the need for a persistent testbed by analysing existing testing activities and testbeds among GEOSS, INSPIRE, GMES and beyond. Sections 3 to 5 represent the concrete business models for the identified testing foci. Section 6 gives a conclusion.

1.1 Definition Business Model

The business models for the different testing activities resemble a classic business model commonly known in the world of economy. It defines certain roles for the testbed governance and different testbed user types (the “customers”). Infrastructure components are described, which offer a certain value to the users. It is described how this value is generated and achieved and how it is funded.

In particular the outlined business models follow more or less this structure:

- Roles and users
- Infrastructure
    - Core capabilities
    - Partner network
    - Offering / value proposition
- Customer care
    - Distribution channels (how to acquire new participants)
    - Customer relationship (how customer loyalty is achieved, how the customers are supported)
- Required Resources
    - Cost structure
    - Revenue

1.2 List of Acronyms

Acronym	Description
EC	European Commission
EU	European Union
FP	Framework Program
GEOSS	Global Earth Observation System of Systems
GIGAS	GEOSS INSPIRE and GMES Action in Support
GMES	Global Monitoring for Environment and Security
INSPIRE	Infrastructure for Spatial Information in the European Community
ISO	International Organization for Standardization
LPIS	Land Parcel Information System
OASIS	Organization for the Advancement of Structured Information Standards
OGC	Open Geospatial Consortium

Acronym	Description
W3C	World Wide web consortium

2 Motivation for Persistent Testing Activities

Current SDI related testing activities and testbeds usually focus one of these five topics:

A) Standards development

B) Research beyond existing standards

C) Compliance and performance checking

D) Prototyping for operational products

E) Demonstrating best practices

The development of standards (Topic A) requires exhaustive testing of service interfaces and schemas for data exchange. These testbeds are typically operated by standardisation bodies like the OGC.

Besides standards driven testbeds, there is also an emerging need within the research communities for pilot implementations and the exchange of prototypes in order to evolve interoperability concepts beyond existing standards (Topic B). Current SDI research testbeds are rather isolated and lack a joint coordination in the meaning of a shared service and data pool. The proposed PIT addresses these issues by offering a one-stop coordinated testing environment. An effort in this domain is the AGILE/EuroSDR/OGC Persistent Geospatial Test-Bed for Research and Teaching in Europe (PTB).

Testbeds for compliance checking (Topic C) are mainly dedicated to industry requirements and provide testing tools (test suites) and courses to determine to which degree a candidate product or implementation fulfils the specifications of a standard or directive (e.g. in terms of functional fulfilment, performance, capacity, etc.). The OGC Compliance & Interoperability Testing & Evaluation (CITE) Initiative allows compliance checking of services and applications implementing OGC standards. In the context of INSPIRE, the compliance testing can also refer to the Quality of Service or data schema compliance; similar indicators might be developed to allow for compliance checking concerning the upcoming requirements of GEOSS and GMES.

Prototyping for operational products (Topic D) mostly involves industry testing activity before a new product is declared stable and offered to the customers or the public.

Best practise testing usually applies existing operational standards based products in real world scenarios. The main goals are to identify gaps for further developments and to help users by developing best practise strategies on how to use final products most efficiently.

In the following sections existent testing activities are examined to create a motivation for a persistent research testbed.

2.1 Existing Geospatial Interoperability Testbeds and Pilot Projects

In this section, the testing foci (Topic A – D, see above) are analysed by means of the different existing testing activities among GEOSS, INSPIRE, GMES, OGC and the already existing AGILE/EuroSDR/OGC Persistent Testbed for Research and Teaching (PTB).

2.1.1 INSPIRE

The INSPIRE initiative currently does not run any test beds. However, there are some related testing initiatives that aim to develop applications grounded within INSPIRE. One example is the quality assurance framework for Land Parcel Information Systems (LPIS), developed by the EC[1]. There are also initial efforts to set up a GMES / INSPIRE interoperability testbed operated by Runder Tisch GIS e.V. and Technische Universität München.

2.1.2 GEOSS

The GEO (Group on Earth Observations) work plan identifies five topics for building an integrated GEOSS: Architecture, Data management, Capacity Building, Science and technology, and User Engagement. Currently, there are two pilot projects: The Architecture Implementation Pilot (AIP) and the Interoperability Process Pilot Project (IP3). While AIP develops and pilots components for the GEOSS Common Infrastructure and the broader GEOSS architecture, IP3 contributes to the GEOSS Architecture by exercising core GEOSS components and processes.

2.1.3 GMES

- gmes space componenent
- gmes service projects (geoland, etc.)

Overall the Service Support Environment (SSE) (see 2.1.4) has been used as a testbed for the HMA standardisation process as well as for service prototyping, demonstration and testing.

In the context of the HMA standardisation following additional infrastructure has been exploited:

The HMA branch has been created on the Open Geospatial Consortium's TEAM Engine in order to be able to modify it to add the SOAP binding support and improve the error reporting mechanism.

Additionally the executable tests for the HMA proposed standards have been developed using OGC's Compliance Test Language (CTL) Best Practice OGC 06-126r2. The scripts are at the moment in the OGC

[1] http://marswiki.jrc.ec.europa.eu/wikicap/index.php/Main_Page

repository[2] under the “HMA” Project; they will be passed under an OGC public project as soon as they are finalized.

A number of service endpoints have been made available for testing the HMA reference implementations, which are documented on the HMA Join and Share wiki[3].

Figure 1 gives an overview of the elements used or referenced within the HMA persistent testbed. To keep the figure simple, the interaction with the other initiatives GEOSS and INSPIRE is not indicated, as well as it is not indicated the exploitation of OGC interoperability programs and testbed initiatives.

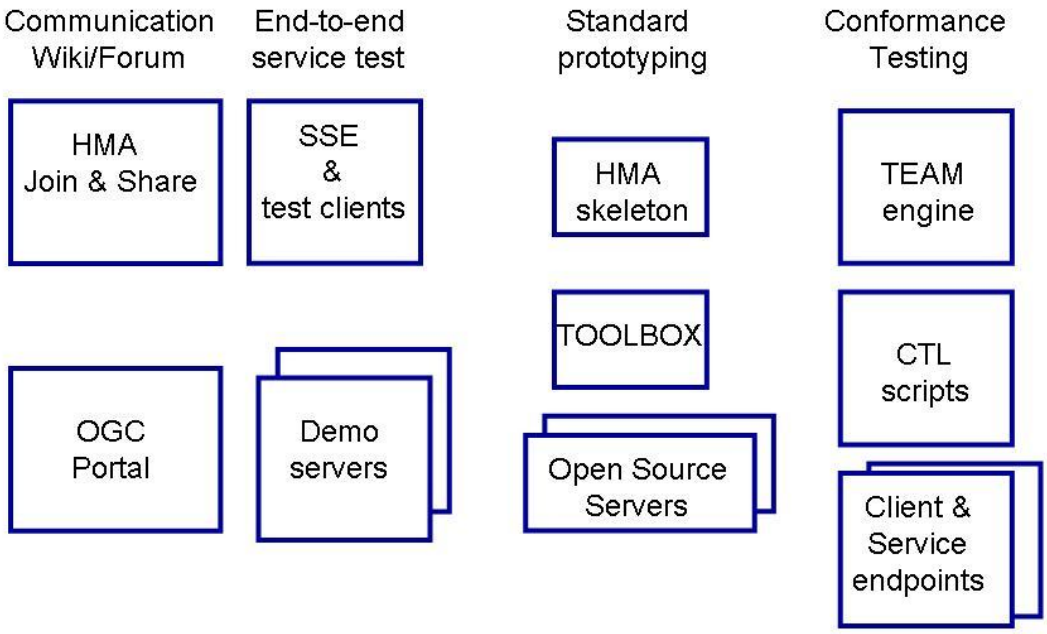

Figure 1. HMA Persistent Testbed

[2] http://www.opengeospatial.org

[3] http://wiki.services.eoportal.org/tiki-index.php?page=HMA-T+Service+endpoints+for+testing+and+demonstration&highlight=endpoints

2.1.4 Service Support Environment (SSE)

The SSE is a prototypical real-time on-line EO B2B platform to host Earth Observation (EO) Services. It allows data providers to register their services and allows end users to explore, compare and request the data according to their needs. SSE claims to facilitate the definition and prototyping of services on a neutrally managed, open and distributed platform. The SSE environment decreases the development effort through the support service prototyping and demonstration processes, allowing designing automatically executable workflows. In this way SSE streamlines both the time to get the EO data and that to deliver the service to the end-user.

2.1.5 OGC Interoperability Program

The OGC Interoperability Program aims to develop, test demonstrate and promote the use of OpenGIS Specifications. The following descriptions are taken from the OGC website:

Test beds are fast-paced, multi-vendor collaborative efforts to define, design, develop, and test candidate interface and encoding specifications. These draft specifications are then reviewed, revised, and, potentially, approved in the OGC Specification Program.

Pilot Projects apply and test OpenGIS specifications in real world applications using standards based commercial off-the-shelf (SCOTS) products that implement OpenGIS Specifications. Pilot projects help users understand how to best implement interoperable geoprocessing that meets their requirements for application, spatial data, and geoprocessing service sharing. These projects also help identify gaps for further work.

Interoperability Support Services are designed to help organizations with open, standards based architecture.

Interoperability Experiments are brief, low-overhead, formally structured and approved initiatives led and executed by OGC members to achieve specific technical objectives that further the OGC Technical Baseline.

OGC Network™ is a window onto the dynamic, constantly changing geospatial web as described by the OpenGIS® reference Model (ORM). Multiple communities of interest for research in geospatial interoperability are supported, and persistent demonstration capability is provided.

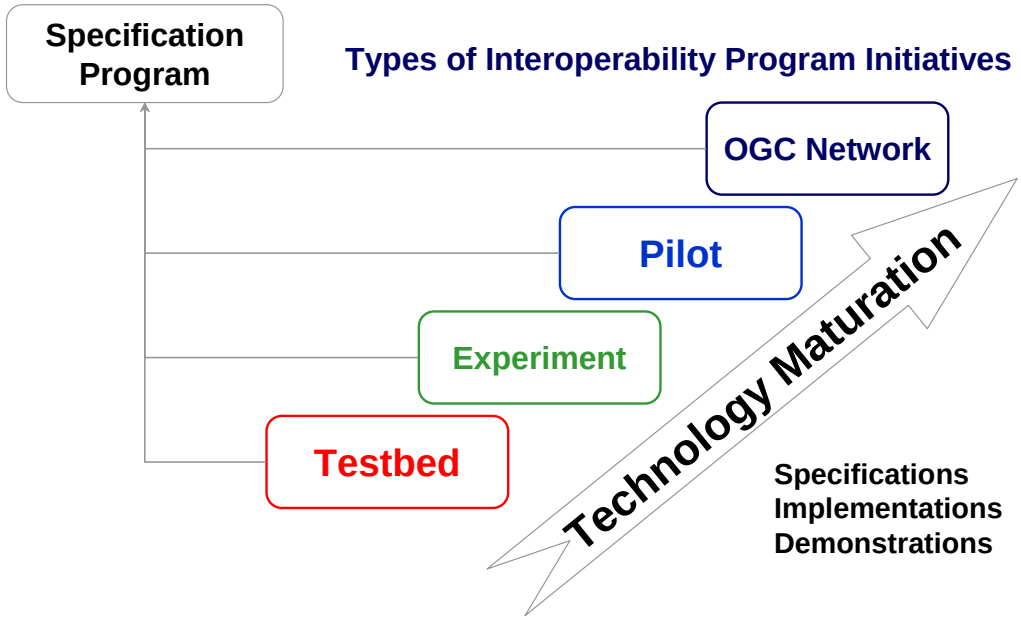

Figure 2. Technology maturation in the OGC Interoperability Program

The technological maturation in the OGC Interoperability Program is shown in Figure 2.

2.1.6 AGILE/EuroSDR/OGC European Persistent Geospatial Testbed for Research and Teaching in Europe (PTB)

In 2007, an AGILE/EuroSDR/OGC workshop on persistent geospatial testbeds concluded the necessity to establish a persistent geospatial testbed established within the European research community. The objectives proposed for this initiative were:

- To provide a research platform for collaborative European research in geospatial interoperability,
- To aid the assessment of the current standards for geospatial interoperability in terms of research compatibility, completeness, consistency, ease of use and extensibility
- To provide an environment for teaching standards and techniques for geospatial interoperability
- To provide a resource to AGILE/EuroSDR/OGC for the coordination of research requirements as well as definition, testing, validation and development of open standards

That testbed should be distributed and comprise data, web services, hardware, software, tools and human resources, and be based upon both ISO/OGC geospatial standards and other appropriate IT standards (e.g. from W3C and OASIS).

Over 30 organisations from across Europe indicated that they wished to participate in the PTB. The organisations included National Mapping and research agencies and local/regional government bodies as well as academic institutions. The positive response also included the EU Joint Research Centre at Ispra. The activities were not open to commercial organisations.

Neither the magnitude nor institutional breadth of response had been anticipated and a pragmatic approach forward was needed in the absence of funding. At a December 2007 meeting in Stresa, Italy, (in conjunction with the OGC Technical Meeting) it was agreed that the first phase of the test-bed should be progressed through the development of a small number of discrete Use Case implementations. The services developed in these Use Cases would be published and made remotely accessible to participating members. The first phase was to successfully implement and demonstrate interoperability between selected member laboratories. The next phase would then start to link these with further Use Cases (i) to facilitate collaboration across organisations on SDI / INSPIRE related research challenges and (ii) to demonstrate increasingly rich application scenarios through the chaining of the Use Case services. These Use Cases would also be developed to provide exemplars for teaching of students.

The formal consultation exercise was not carried-out but feed-back was received from several Workshops and meetings where the project was discussed. This feed-back indicated that the focus on a standards-based persistent interoperability test-bed and software platform for research, teaching and demonstration was relevant to the European SDI as defined by INSPIRE as well as to other European and international programmes such as GMES and GEOSS. As a standards-based platform adopting a service-oriented and web-services based architecture, the PTB potentially offered a powerful basis for research group collaboration. By encouraging harmonisation and sharing of data and services it could also aid innovation and productivity in research and efficiency in the knowledge transfer process.

A key objective in 2008 was the goal of integrating the PTB activity more closely with European national and EU programmes and especially INSPIRE. Linked to this objective is the need to secure adequate financial under-pinning for the PTB initiative so as to support project-management and coordination of the current Use Cases and to allow future sustainable development. A significant development in the context of these objectives is the establishment of cross-linkages with two major new EU funded projects: GIGAS and ESDIN (eContent*plus*). As the importance of the European INSPIRE[i] activities grow the relevance of the PTB also increases to the EuroSDR research programme (mainly Commission 4 (Data Specifications) and 5 (Network Services)).

More background can be found at the PTB website: http://plone.itc.nl/gitestbed[4]

2.2 Conclusions

The above analysis shows that existing testing activities and testbeds are either limited in scope (content wise) or offer only a finite timeframe for testing. Due to these constraints they show no diversity in content and prevent a collaboration among the heterogeneous research and industry communities (a few exceptions exist nevertheless) and therefore limit the possible synergetic effects which are usually possible and strong in interdisciplinary testing. The possibilities for knowledge, expertise and experience sharing are limited. A sustainable long-term availability of interoperability testing results (either in form of concrete Web Services or

[4] Most valuable documents are:

- http://plone.itc.nl/gitestbed/phase-1-documents/PTB-background-and-future-directions-proposal.pdf
- http://plone.itc.nl/agile_old/Conference/2009-hannover/pdfs/31.pdf

knowledge) is prevented. Testing is mostly funded by industry and therefore restricted to a certain scope. New ideas which do not offer profit at first glance are usually excluded or ignored by these activities.

A demand for an integrated testbed which incorporates all the different testing foci as described at the beginning of this section might be at hand. However, recent discussions in the GIGAS consortium and an analysis of the results of WP-2 showed that an integrated approach might be no solution at all, because the gap between testing for new developments and standards is too wide to incorporate compliance checking which aims for (sometimes even legally mandated) standard compliant certification.

Therefore an approach based on three key aspects (see Figure 3) is proposed:

- A **Meta Testbed** which acts as an umbrella portal for all testing activities.
- A **Persistent Interoperability Testbed** (the maturation from research to pre-operational interoperability testing).
- A **Persistent Test Harness** to test for service interface and data standard compliance (including certification as the final step in a product maturation process).

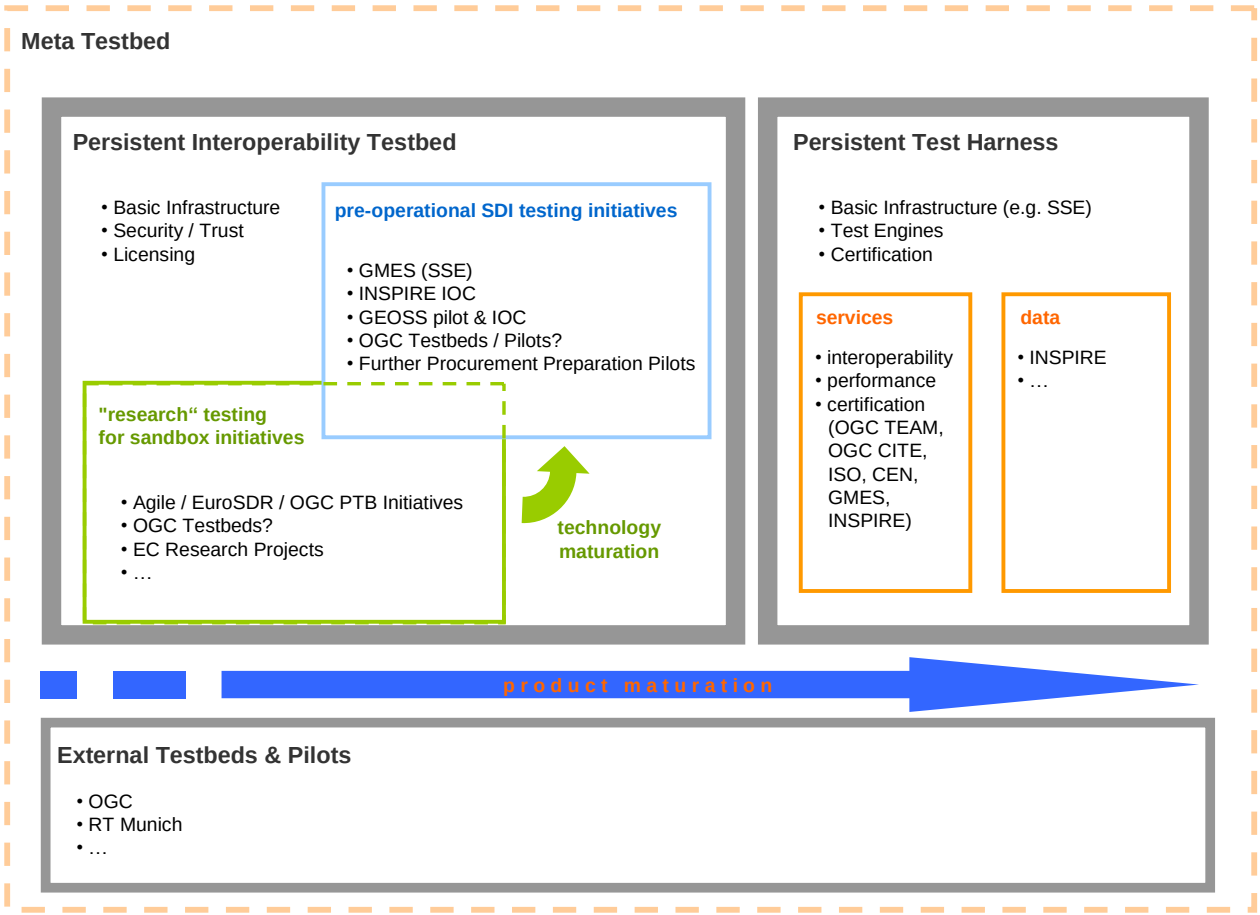

Figure 3. Proposed approach for an integrated testing.

The **Meta-Testbed** for SDI interoperability testing forms an umbrella for all testing activities (including testing beyond the scope of the three GIGAS initiatives). No real testing is carried out in the Meta-Testbed. Think of it more as a query able web portal that provides an overview and background information about all ongoing testing activities.

The **Persistent Interoperability Testbed** provides a (persistent) infrastructure (compromised of basic services, security / trust mechanisms, licensing, etc.) to allow conducting testing initiatives in a two-tier approach. *Research testing* has a life-span from approximately one to three years. Here the AGILE/EuroSDR/OGC PTB and the EC research projects activities take place, most likely complemented by fitting research-oriented OGC testbeds. As the technology resulted from actual research matures, *pre-operational SDI testing initiatives* are also carried out in the Persistent Interoperability Testbed. These activities usually take less time than research (about a half to one year duration). Prominent examples are the INSPIRE Initial Operating Capability Task Force (IOC TF) testing activities, GEOSS pilots, procurement preparation pilots and OGC pilots.

The **Persistent Test Harness** represents an environment to perform the final phase in the product maturation process in terms of interoperability: the certification of standard compliancy. The Persistent Test Harness provides a test suite for service interface and data compliance checking. No interoperability testing between components is carried out. The test suite only tests if a certain implementation fulfils all requirements of the according standard. Hence, the Persistent Test Harness activities only support interoperability indirectly. The most prominent existing example is the OGC Compliance & Interoperability Testing & Evaluation Initiative (CITE). This kind of testing activity will become more important in the future, e.g. as INSPIRE compliancy has to be certified in a more or less legal context.

The actual business models and recommendations for the different testing instruments follow in the next sections.

3 A Business Model for an SDI Meta-Testbed

3.1 Scope and Requirements

The SDI Meta Testbed is an instrument that 1) adds visibility to existing SDI testbed and testing initiatives and 2) facilitates cross-initiative knowledge exchange. It shall be a portal to browse both EC and non-EC initiatives (Fig. 3). Participation is completely voluntary. However, it is aimed that at least the EC initiatives are represented here.

The SDI Meta Testbed Portal is not restricted to certain user groups; the whole content of the Website is publicly available.

3.2 Infrastructure and Core Capabilities

The SDI Meta Testbed is a Web Portal that provides information on world wide SDI testbed and prototyping initiatives (in the following called “testbed initiatives”). The SDI Meta Testbed Portal provides tools to register and query information on these initiatives. The registration of testbed initiatives can only be done by

registered users, however, candidate initiatives can be suggested through a contact form or by email. The Meta Testbed also provides mailing lists and / or newsletters for each registered testbed initiative.

It is aimed to involve one contact person per testbed initiative as a maintainer for his initiative. This maintainer keeps the portal's database entry on his or her initiative up to date and is responsible for the mailing list and / or newsletters. These mailing lists and newsletters do not need to be dedicated to the Meta Testbed, but can forward the initiatives' publication channels.

The information in the Meta Testbed Portal is provided through a Wiki. The Wiki entries on the registered initiatives are either maintained by the Meta Testbed Administrator or preferably by a contact person from within the respective initiative.

Testbed initiatives are given a publication instrument to spread information about their project to a larger SDI community. They can present themselves through the Wiki at the SDI Meta Testbed Portal and keep contact with their peer group through newsletters and mailing lists. The Meta Testbed allows the establishment of new mailing lists and newsletters as well as forwarding existing one from the initiative's Web Platform.

Seekers are provided with a catalogue of world wide SDI testbed initiatives. They can use the Wiki as an entry point to browse information on the registered initiatives and are provided with contact details. As a user it is also possible to rapidly register to an initiatives mailing list or newsletter

3.3 Required Resources

Hosting Organisation; potential candidates JRC, OGC

Estimation of Annual Costs

We estimate an overall annual cost of 4 MM (plus overhead to cover basic office infrastructure) plus EUR 5.600 for additional expenses (hardware maintenance, travelling costs, etc.) to run the Meta Testbed. The following table breaks the **annual costs** down.

Personnel	**4 MM plus overhead to cover basic office infrastructure**
Meta-Testbed Facilitator (Senior SDI Staff)	4 MM
Additional costs	**5.600 €**
Web Platform	600 € (50 € / month)
Travelling costs and conference fees (Facilitator)	5.000 €

Estimation of Set-up Costs

We estimate no costs additional to the costs given above as set-up cost but an initial set-up period of 3 months.

4 A Business Model for a Persistent Interoperability Testbed (PIT)

The following sections describe the scope and the actual recommendations for a European Persistent Interoperability Testbed (PIT). This testbed comes close to the already existing PTB (see Section 2.1.6).

4.1 Scope and Requirements

Based on the study of existing testing environments and activities (see Section 2) and the outcome of the GIGAS project in general, the following requirements and motivational aspects for the PIT can be identified:

- The PIT generates a high added value for the GI research community by providing a reliable prototyping and testing environment.
- The provided possibilities and tools for collaboration and the resulting synergetic effects improve productivity among all (European) SDI interoperability development activities.
- The visibility of the PIT participants and the involved initiatives is increased and their work is even more transparent to the public.
- Prototypes, demonstrators and best-practise implementations can be persisted. Results from EU FP projects and tenders remain accessible in the PIT and therefore gain sustainability.
- The ad hoc availability of a complete testbed environment reduces costs for EU FP projects and tenders, as no new environment has to be set up for each project or tender. Test data services, data schemas, catalogues and trust functionality can be used from an existing resource.
- SDI standards and interoperability teaching is also supported by the persistent testing environment. The amount of additional resources for each teaching body is minimised.
- European voice in international standardisation bodies is strengthened by a consolidated European interoperability testbed (where new standards are developed and tested).

The outlined requirements represent the benefits for the European SDI interoperability community. A first outline of a PIT will be given in the next section.

4.2 Outline

The Persistent Interoperability Testbed (PIT) is an infrastructure that provides a resilient and sustainable testing environment for SDI interoperability research. It is made up of:

- A **persistent infrastructure environment** compromised of *matured* basic data and functionality providing services that minimises the effort to set up and test existing applications and services (e.g. WFS and WCS providing sample data, authentication/trust/security/licensing mechanisms, etc.)
- An environment for **research-oriented development** to allow for sandbox setups targeting the development and testing of new standards and Web Service interfaces
- An environment for **pre-operational SDI testing** activities encompassing more mature technologies

- A **service registry** that enables researchers to share and mutually use their prototypes within a persistent infrastructure
- **Collaboration tools** for the research community (such as mailing lists, knowledge base, etc.)

These parts outlined above encompass a social (collaboration) and a technical (Web Services) infrastructure to support the European interoperability testing community.

A few definitions of the terms used above follow.

Persistent

Persistency in the context of this testbed means that the infrastructure has an unlimited life-span and does not end after a research project or certain testing activity. This does not include an unlimited availability of certain services, although a long-term availability is aspired for *matured* services (see the definition of technology maturation below).

Sandbox

The sandbox testbed does not only offer *stable* services which can be used as building blocks for a testing environment (e.g. basic data providing services offered by standardised interfaces such as OGC WFS), but allows the deployment of newly developed services or service types. This kind of service is developed in a sandbox environment.

Technology Maturation

Technology maturation describes the process from the implementation of new ideas to a final product. For the business model, it is used to distinguish between on the one hand *matured* services which are proved to be useful and well-accepted and offer a commonly agreed interface (e.g. OGC interface) and on the other hand *sandbox* services or service types which are newly developed or still under development. Once a new service or service type becomes stable, long-term availability is aspired to support the *persistent* character of the testbed.

4.3 Possible Usage Scenarios

Already out of GIGAS come to possible usage scenarios: The activities proposed by the Cross-Initiative Scenarios (GIGAS document number 159; part of Deliverable D2.2 Technology Watch Reports) and the research proposed by the GIGAS Research Agenda (GIGAS document number 166; represents Deliverable D3.4 GIGAS Research Agenda).

This Cross-Initiative Scenario describes two user-oriented scenarios suitable to demonstrate interoperability across the multiple initiatives of GIGAS. The PIT should act as the environment for these activities and provide a first best-practise example for successful foster interoperability testing among the initiatives.

The mid- and long-term research topics proposed by the GIGAS Research Agenda should as well be carried out in the PIT.

4.4 Roles

The following sub-sections describe a set of five different roles that can be identified on an abstract level as either *testbed users* (ad-hoc users, members and contributors) or *testbed governance* (steering committee and facilitator).

In an ideal case there is one PIT run in common by all initiatives represented in GIGAS

- CEN
- GEOSS
- GMES
- INSPIRE
- ISO
- OGC

Whether and how far each of the above mentioned initiatives is represented in the below given roles still has to be defined.

4.4.1 Ad-hoc User

As common PIT resources and components should be free to use (if not stated otherwise), the anonymous part of the community is characterised as an ad-hoc user. This role is useful for ad-hoc demonstration of interoperability benefits and concepts, especially for teaching purposes. It is also useful as the casual, low-overhead setups of testing environments.

4.4.2 Member

Testbed members appear are real persons and form the PIT community. In contrast to ad-hoc users, members can contribute to the testbed and actively take part in the interoperability research within the PIT.

4.4.3 Contributor

Testbed contributors are PIT members that add value and content to the testbed infrastructure or provide some service to the PIT community. The following contributions can be made to the PIT:

- Content
    - A component that is subject to interoperability research (e.g. a service or schema)
    - A component that can assess a subject of interoperability research (e.g. conformance or quality checks)
    - A component that facilitates the PIT operation

    (Preferably, the first two types of content should be provided in a strong relation for reasons of complementarities.)

- Support
    - Technical support
    - PIT maintenance
    - Support for PIT users in forums, wikis and mailing lists
- Hardware
    - Server infrastructure to run testbed components
- Financing
    - Financial support for other PIT contributions
    - Upkeep to sustain the PIT operation

4.4.4 Steering Committee

The PIT as a whole is governed by a steering committee. The committee is useful to perform the following tasks:

- Decide about PIT contributions
- Decide PIT guidelines
- Represent the PIT community in front of other bodies
- Report to the European Commission as the funding body about PIT activities
- Coordinate and initiate major research initiatives within the PIT
- Initiate research collaborations within the PIT

4.4.5 Facilitator

The facilitator acts as a proxy between the Steering Committee and the PIT users. The facilitator performs the followings tasks:

- Represent the PIT community in front of other bodies
- Coordinate and initiate major research initiatives within the PIT
- Initiate research collaborations within the PIT
- Provide assistance to PIT users
- Be the primary contact person within the PIT community

4.5 Testbed Users

The PIT intends to provide an added value not only to the research community, but also to standardisation committees and external bodies. Intended users of the PIT are:

- Research organisations
- Single researchers
- Educational institutes (e.g. universities)
- European Commission
- EU funded projects
- Standardisation organisations
- Industry partners

The primary target users of the PIT are on the one hand **research organisations** as well as **single researchers** and on the other hand **industry partners**. Second, the PIT is also designed for training and education purposes, supporting **institutes of education** as well as individual people seeking sources for **self education** in SDI subjects. Third, standardisation organisations like ISO, CEN and OGC can use the PIT for standards testing and development. Fourth, the **EC / EU and its funded organisations** are customers of the PIT as they gain state of the art SDI products through contributions as well as world wide influence in SDI development by introducing their research products to a large community.

4.6 Infrastructure

This section provides the core aspects in terms of infrastructure of this business model: What are the core capabilities of the PIT embedded in which network of partners and how the core capabilities are implemented.

4.6.1 Core Capabilities

The PIT core capabilities are listed as follows. The PIT shall:

- Provide a long term (=persistent) European interoperability testing platform for collaborative SDI testing
- Aid the assessment of the current standards for geospatial interoperability in terms of compatibility, completeness, consistency, ease of use and extensibility
- Provide a state of the art environment for teaching standards and techniques for geospatial data retrieval and processing in SDI
- Provide a resource to the GI community for streamlining research requirements and conducting interdisciplinary and interorganisational projects
- Contribute to the definition, testing, validation and evolution of open standards

- Ensure an instant visibility of research results
- Ensure a sustainable exploitation and application of research results
- Provide an environment for rapid prototyping (sandbox setup)
- Contain mature (operational) and sandbox (=experimental) components
- Provide means to assess the quality of SDI services and spatial data

These capabilities are elaborated and substantiated in Section 4.6.3.

4.6.2 Partner Network

Further potential partners to support the PIT are:

- AGILE
- EuroSDR
- JRC
- Regional and national SDIs
- UNSDI

A strong linkage should be established to these organisations and initiatives, as they deal with the same problems and provide a huge amount of expertise and knowledge.

4.6.3 Offering / Value Proposition

The testbed provides **coordination and governance of geospatial interoperability research**, primarily settled in Europe. It acts as an **initiator and catalyst for SDI research** collaborations through the web platform and the PIT community. It also acts as a major **provider of content for SDI teaching initiatives**.

To achieve this, the PIT offers a unique combination of core capabilities being:

- A basic technical and social testbed infrastructure
- A central catalogue
- Some basic SDI services as a staring point for the sandbox environment
- A growing collection of SDI research products obtained in FP7 projects
- A Service Monitor with elementary means for service performance rating
- A platform for general collaboration, networking, presentation, project management support in geospatial research
- A PIT knowledge base
- Access control components and services for rights management QoS and the avoidance of exploitation

The **basic technical and social testbed infrastructure** comprises hardware, operational core software components and an internet presence to assist in building a social network in European SDI interoperability research. It also comprises the necessary personnel for the PTB initialisation and operation, namely the PTB facilitator, who is the integrating person between the testbed members, the testbed operator and the PTB partner network.

One major technical component is the **central PIT catalogue** which keeps track of all SDI services running in the distributed PIT environment. This catalogue can be either be browsed through the internet platform as well as accessed trough standardized, machine readable service interfaces.

The catalogue's content is complemented by a **service monitor** that keeps track of the SDI services in the PIT and provides some elementary performance information like availability and accessibility.

The PIT is initialised with a very **basic set of operational SDI services** that can be used to set up a simple sandbox for demonstration, teaching and a starting point for interoperability research and testing. By time, this content shall grow by the subsequent incorporation **of SDI related FP7 pilots and implementations**.

The central entry point into the PTB is a **web platform** containing forums, mailing lists and wikis. These tools shall facilitate collaboration, networking, presentation and cross-initiative project management in the geospatial research domain. The increasing amount of content and knowledge within the PTB is made available through a managed **knowledge base**. This knowledge base is an entry point to look up solutions and project results found trough the PIT. It also contains practical information on sandbox setups to lower the hurdles for new users.

By time, the PIT becomes a valuable resource for interoperability research and hopefully a prominent environment for sandboxing. The downside of this development is an increasing risk of performance drops or even abuse and exploitation. To recognize and avoid this, the core components are complemented by some basic means for **access control and QoS**. A very simple means to enforce access is the sharing of common firewall rules, the set up of privileges based on IP or MAC addresses and a central transactional database for access monitoring of the testbed services (who requests what at which volume).

4.7 Customer Care

"Customers" of the PIT are the users stated in Section 4.5. In this section target customers, possibilities for acquiring new customers (distribution channel) and means to generate user loyalty are described.

4.7.1 Distribution Channels

The testbed is mainly distributed through **its ad-hoc usage** via the **central web platform**. This website acts as an entry point for the **forums**, the **wikis** and the **mailing lists**. It also provides guidance through **HowTos** and a **central catalogue** for an ad-hoc usage of the PIT components. This platform also provides contact information to the **PIT Facilitator**, assisting users in getting involved and making contributions to the research community.

A very strong distribution channel can be the **EC funding policy**. Pilots and prototypes can be demanded to be deployed within the PIT, ensuring a constant amount of contributions.

Another major distribution channel is the **partner network**. PIT partners should have an interest in the enforcement of PIT usage within their institution. Using the testbed infrastructure whenever possible ensures the highest benefit in most situations.

The PIT is almost automatically distributed by **SDI teaching initiatives**. Students become immediately familiar with this environment and are expected to adhere to the PIT throughout their further career.

Last not least, it is important to promote the PIT at **conferences** and **university workshops** to quickly generate and sustain a research community.

4.7.2 Customer Relationship

An important role in customer relations holds the **PIT Facilitator** as the primary contact person (Chapter 3.1.5).

Besides, as most customers are settled within the scientific community, the PIT will be present at **conference and university workshops** as well as independent **PIT workshops**. This is the primary opportunity for a face-to-face meeting among PIT users.

As said before, there is an **internet platform**, containing forums, wikis, mailing lists and possibly a knowledge base containing best practice. In daily business, customer relations will take place using these media.

Additionally, participating organisations and the EC / EU shall be provided with an annual **Steering Committee Report**.

As the community is an important part of the PIT, the testbed should be managed transparent, subsidiary and democratic. Following this idea, customers are seen as partners in a joint research process, so customer relationship becomes partly self sustaining through the **PIT community**.

4.8 Required Resources

To assure the required funding, first, a cost structure and determinants of operational costs have to be analysed. Means to compensate this costs (be it money or in-kind contributions) have to be found. This is described in the following two subsections.

4.8.1 Cost Structure / Determinants of Operational Costs

The overall costs of the PIT can be divided into initial and operational costs. Both of them heavily depend on the chosen governance and hosting model. Thus, this business model draft cannot provide concrete numbers. However, it shall be stated that the cost arise from acquisition and upkeep of hardware as well as for personnel. These costs are likely to change during the testbed operation as the PIT is supposed to scale up permanently during its operation.

Some estimate could be provided by some of the initiatives in chapter 2 that are already running testbed initiatives at different scales.

The PIT is a distributed environment that heavily relies on contributions from its users. Thus, costs arise for the EC / EU as the initiator and operator of the core infrastructure as well as for each individual contributor.

From the **EC / EU perspective**, costs arise from:

- Initial setup (internet platform, basic components and services)
- Maintenance
- Core personnel

From the **contributor's perspective**, the costs arise from their specific kind of contribution, being one or more of the following items:

- In-kind contributions
- Contributed support services
- Financial contribution (obvious)

Estimation of Annual Costs

We estimate an overall annual cost of 12 MM (plus overhead to cover basic office infrastructure) plus EUR 23.000 for additional expenses (hardware maintenance, travelling costs, etc.) to run the PIT.

The following table breaks the annual costs down.

Personnel	**12 MM plus overhead to cover basic office infrastructure**
PIT Facilitator (Senior SDI Staff)	6 MM
Web Platform Administration	3 MM
Catalogue and Basic SDI Services	3 MM
Hardware & Software (hosting costs)	**3.000 €**
Web Platform	600 € (50 € / month)
Catalogue, Monitor and Security	600 € (50 € / month)
Geodata Server	1800 € (150 € / month)
Workshops and Conferences	**20.000 €**
Hosting Workshops	2.000 €
Travelling costs and conference fees (Facilitator)	12.000 €
Travelling costs (Annual Meeting Steering Committee)	6.000 €

Estimation of additional Set-up Costs

We estimate additional installation costs of 6 MM (including overhead) and EUR 15.000 for additional expenses (hardware and software) to set up the PIT. We suggest a set-up duration of 6 months.

The following table breaks the set-up costs down.

Personnel	**6 MM plus overhead to cover basic office infrastructure**
Web Platform Set-up	2 MM
Catalogue and Basic SDI Services	4 MM
Hardware & Software (hosting costs during set-up)	**15000 €**
Initial License & Hardware Costs (Office Equipment, Catalogue, Monitor and Security, Geodata Server; however Open Source Solutions should be the preferable option)	15000 €

4.8.2 Cost Compensation / Revenue

The operation of the PIT is aimed to be cost neutral and self sustaining. Most of its components shall be operated by contributors. The cost compensation for contributors is generated through the provision of 1) a reliable testing environment, lowering the individual costs of each participant; 2) a nucleus for research activities and networking, providing an added value for each member.

The cost compensation mainly works through a **complementary cost / benefit situation**: The EC / EU finance the core components and profit from contributions by more efficient and effective research as well as more influence in standards development. On the other hand, contributor will have cost compensation by the ability to use other contributions and core components of the PIT. Working like this, the participation in the testbed is a win-win situation for all users.

However, especially in the beginning, there will be an overhead of upkeep for coordination and administration of the core infrastructure. It is also assumed that there is a certain amount of initial costs. To cover these costs, we suggest public funding by the EC / EU due to the settling of the PIT in FP7 and its benefits for European interoperability research. To obtain such funding, an impact study is probably needed.

It shall not be omitted that there is one group that benefits at no costs: the ad hoc user. In our opinion it is nevertheless useful to keep this role as a distribution channel and a first entry point for the PIT's use in teaching and education.

4.9 Risks and Issues

In executing the PIT, several risks can be expected. Two categories of risks have been identified: those directly related to the usage of the technical infrastructure and those related to the social infrastructure as described in Section 4.7. The social infrastructure related issues bear the greater risk:

- How to deal with a lack of acceptance (early failure, lack of contribution)?
- How shall persistence be guaranteed (and defined)?
- How to avoid “ad-hoc exploitation” by third parties?
- What happens if there is a lack of content diversity?
- When are components to be declared *mature*?
- (How) Shall dominance of few members be avoided?

To counter those risks, a wise steering committee and facilitation that are always aware of those risks are crucial. Equivalent important are fixed guidelines which all members and users should adhere.

Technical issues are present, but nevertheless bear less risk:

- Can the testbed be abused? (What is abuse?)
- How can 24/7 availability be guaranteed for PIT services and components?
- How to deal with unbalanced loads (a flood of requests, overload situations, …)?

The technical issues can mostly be tackled by an enlargement of the technical infrastructure or by access constraints.

As long as those social and technical issues do not arise, the basic principle to be as open as possible should not be deviated from.

4.10 Conclusions on a Persistent Interoperability Testbed

The proposed business model for a Persistent Interoperability Testbed was developed upon the following ideas.

The testbed should:

- Be an ecosystem for geospatial interoperability testing and research
- Be continuously developing and evolving
- Facilitate the setup of testing environments (e.g. sandboxes) for EC/EU studies and projects
- Provide means to persist SDI related services and components
- Be unlimited in time
- Be diverse in scope
- Be the primary environment to conduct and coordinate European geospatial interoperability testing research
- Be the primary environment to educate and train European SDI researchers
- Contain mature and experimental services and components

The testbed should not:

- Intend to develop a single product or specification
- Be dedicated to a single initiative
- Be restricted to a limited group of users

The PTB is the only candidate available so far which comes close to incorporate the proposed PIT. Unfortunately, it is currently unfunded and participation is only possible on a voluntarily base, beside the usual research activities. A concrete business model would support and advance the development of the PTB. Therefore, we hope that the PTB implements the Business Model developed in GIGAS at least in parts to show its viability to the EC to finally fund and implement an “official” European research testbed. The Business Model for the Persistent Interoperability Testbed was already developed in strong cooperation with the PTB.

5 A Business Model for the Persistent Test Harness

(To be finalized in the final deliverable 3.5a)

5.1 Scope

Existing and near operational implementations of services and data can be tested in the Persistent Test Harness to check their compliance with standards and fitness for operational usage. This testing may be contemplated by a process to deliver specific compliance or quality certificates.

5.2 Test Harness Requirements

5.2.1 From a GEOSS perspective

Services

(interoperability, performance, certification, …)

Data

5.2.2 From a GMES perspective

Services

(interoperability, performance, certification, …)

Data

5.2.3 From a INSPIRE perspective

Services

(interoperability, performance, certification, …)

Data

5.2.4 From a CEN perspective

Services

(interoperability, performance, certification, …)

Data

5.2.5 From an ISO perspective

Services

(interoperability, performance, certification, …)

Data

5.2.6 From an OGC perspective

Services

(interoperability, performance, certification, …)

Data

5.3 Roles

5.3.1 Certifier

5.3.2 Test Suite Creator

5.3.3 Certification Aspirant

5.4 Infrastructure and Core Capabilities

5.5 Required Resources

[i] http://www.inspire-geoportal.eu/