

# SEVENTH FRAMEWORK PROGRAMME



## GREEK INTEROPERABILITY CENTER

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A set of Practical Guidelines for Interoperability

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## LIST OF TERMS AND ABBREVIATIONS

B2B	Business to Business
B2G	Business to Government
BPEL	Business Process Execution Language
BPMN	Business Process Modelling Notation
CCTS	Core Components Technical Specification
CRM	Customer Relations Management
DE	Digital Ecosystems
EC	European Commission
EDI	Electronic Data Interchange
eGIF	e-Government Interoperability Framework
EI	Enterprise Interoperability
eID	Electronic Identification
EIF	European Interoperability Framework
ERP	Enterprise Resource Planning
ESB	Enterprise Service Bus
EU	European Union
GIC	Greek Interoperability Center
laas	Interoperability as a Service
ICT	Information and Communication Technology
IEEE	Institute of Electrical and Electronics Engineers
ISO	International Organization for Standardization
IT	Information Technology
OASIS	Organization for the Advancement of Structured Information Standards
PA	Public Administration
PEGS	Pan European eGovernment Services

SaaS	Software as a Service
SCM	Supply Chain Management
SME	Small Medium Enterprise
SOA	Service Oriented Architecture
SOAP	Simple Object Access Protocol
UBL	Universal Business Language
VAT	Value Added Tax
WSDL	Web Service Description Language
WSMO	Web Services Management Ontology
XML	eXtensible Markup Language

## EXECUTIVE SUMMARY

Interoperability is defined as the ability of two or more systems or components to exchange information and to use the information that has been exchanged. The advances in Information and Communication Technologies, the cross-border service provision as a result of EU integration, the competitiveness in a globalized world and the tendency for better administration services to business and citizens contribute in huge interest and advances in the Interoperability domain. Variations of interoperability are applied to engineering, health, telecommunications and software.

Main target groups of stakeholders for this Interoperability Guide are the **Public Sector**, **Enterprises** and **Citizens**. The Guide offers a set of practical guidelines for achieving Interoperability, suitably designed for each one of the aforementioned stakeholders, aiming that way to facilitate and enhance the communication and cooperation among them.

As far as **Public Sector** is concerned, special attention should be paid over **eGovernment** and the following achieving of Interoperability in the provision of electronic public services. eGovernment is about using the tools and systems made possible by Information and Communication Technologies to provide better public services to citizens and businesses. ICTs are already widely used by government bodies, just as in enterprises, but eGovernment involves much more than just the tools. Effective eGovernment also involves rethinking organisations and processes, and changing behaviour so that public services are delivered more efficiently to the people who need to use them.

As far as **Enterprises** are concerned, it is important to focus on the conditions that will ensure the creation and establishment of the so-called “**Digital Ecosystems**”. Digital Ecosystems aim at providing to small and micro enterprises ICT applications and services which improve their efficiency, business integration and synergies within EU territories, but also enabling their integration of local value chains within the global market. These applications and services are tailored on small and micro enterprises local needs and are formed by the dynamic integration of several components, which are provided by different organisations scattered around Europe. In this way Europe industries will, maintain and enlarge its knowledge and capacity to develop and to deploy ICT applications and services.

In the future, the business environment will comprise a diversity of continuously evolving “**ecosystems**” of enterprises, within and across which enterprises will collaborate as well as compete with one another. Enterprises, both big and small, will be able to do business seamlessly, adapt to changes in the environment dynamically, and exploit new opportunities rapidly by harnessing the full potential of software and related IT services. **Enterprise Interoperability** of enterprises will be a utility-like capability that enterprises can invoke on the fly in support of their business activities. Specific IT functions will be delivered as services that are cheap, fast, reliable, and without major integration efforts.

This Interoperability Guide provides a brief analysis of the EU Initiatives for the systematic adoption and standardization of Interoperability among the EU Member-States, presenting the **European Interoperability Framework** (EIF), as well as the

idea of the **eGovernment Interoperability Framework (eGIF)**, along with the eGIFs of some selected Member States. Simultaneously, it provides a glimpse of the Research Landscape in the aforementioned domains – eGovernment, Digital Ecosystems and Enterprise Interoperability – in terms of ongoing research projects and also summarizes the main findings and strategy of the research in each domain.

Decision makers on interoperability issues should bear in mind that EU Legal Framework is constantly evolving over the years in order to provide better coverage of the various issues related to electronic transactions. Additionally, National Legal Frameworks are catching up quickly with the guidelines set by EU Directives. However exceptions occur in the case of specific categories of issues or specific countries.

In the field of research, today the EU Research Landscape on Interoperability appears quite multidisciplinary and extended dividing interoperability research over three distinct research clusters – namely **eGovernment** and **CIP Operations**, **Digital Ecosystems** and **Enterprise Interoperability**. Hitherto research efforts in all three domains have yielded specific results on how to approach interoperability issues in the scope of each domain, providing architectures about eGovernment service provisioning, standards for legal knowledge representation and reasoning, new models for providing interoperability as a service, Web 2.0 technologies and mashup systems for providing new services, eID and eProcurement infrastructures.

# 1 Introduction

## 1.1 Scope of the Guide

The **objective** of the G.I.C. Interoperability Guide is to provide a volume of concise and comprehensive information on Interoperability that can help its targeted audience, mainly managers, IT managers, decision makers of enterprises, policy makers of governments and citizens, to design their strategies, find solution tactics on specific interoperability problems and generally benefit from the Interoperability aspects in their everyday communications and transactions. For this purpose, the Interoperability Guide will comprise, during its **six versions**, material on Interoperability from a multitude of sources:

- **Research results** from ongoing projects and initiatives in EU and international level, focusing on the specific sub-domains and applications of Interoperability.
- **Deliverables and Reports** from projects, initiatives, standardisation bodies and institutions on various issues that impact the Interoperability domain.
- National, EU and global **Best Practices** and **Strategies** on specific areas of the Interoperability domain that describe how key Interoperability issues/problems have been tackled effectively by enterprises and governments.
- Reports on **standards from international organisations**, working groups and standardisation bodies on existing and emerging key technological approaches in the various domains associated with interoperability.
- Legal and Statutory **Framework documents**, reports and white papers that affect the Interoperability domain or shape specific areas of business/governmental practice where Interoperability has a major impact.

In order to make the previous material comprehensive also to readers with limited knowledge on the Interoperability domain, the Guide incorporates declarative definitions in plain terms on the subjects it engages in its various versions and concludes by providing a set of straightforward recommendations to enterprise decision makers and government policy makers.

*The present Interoperability Guide aims at providing information and support to all stakeholders, **Enterprises, Public Sector Bodies** and/or **Citizens**, who are interested in establishing and using interoperability services, aligned with the corresponding European ones, in their everyday communications and transactions. Therefore, it offers general and **practical guidelines** for the aforementioned stakeholders, contributing that way to the convergence of interoperability services and tools and providing the suitable foundations for successfully achieving Interoperability in all sectors.*

## 1.2 Structure of the Document

The Interoperability Guide is structured as following

**Chapter 1**, entitled «**Introduction**», explains the scope of the G.I.C Interoperability Guide and presents the structure of the present document.

**Chapter 2**, entitled «**The importance of Interoperability**», explains why it is so crucial to achieve Interoperability among the various Information Systems of each one of the various sectors of Enterprises and Public Administrations, as well as how citizens will benefit from the establishment and use of Interoperable services in their everyday transactions with enterprises and Public Administrations.

**Chapter 3**, entitled «**Attempts towards achieving Interoperability: EIF and eGIF**», presents the international attempts towards achieving Interoperability, the international experience over Information Systems Interoperability and all the standards, frameworks and modelling procedures of existing organisations, committees and communities, that provide the necessary guidelines that each stakeholder should follow in order to successfully achieve interoperability.

**Chapter 4**, entitled «**Interoperability Domains**», aims in familiarizing with the various levels of interoperability, explaining each level separately and outlining the most significant aspects of each level that every stakeholder has to bear in mind.

**Chapter 5**, entitled «**The Stakeholders**», identifies the different categories of stakeholders interested in Information Systems Interoperability, describes each one of these categories, presenting their positions, their tasks, their interests and their objectives, outlining the special aspects of Interoperability that each one of these categories should focus on.

**Chapter 6**, entitled «**Guidelines to each stakeholder**», gives a set of practical and useful directions, targeting to the special tasks, interests and needs of each category of stakeholders, outlining the guidelines that have been proved to be effective from the international experience and the research findings, as well as the recommendations of the Greek electronic Government Interoperability Framework.

## 2 The importance of Interoperability

### 2.1 What is Interoperability

IEEE broadly defines Interoperability as “the ability of two or more systems or components to exchange information and to use the information that has been exchanged<sup>1</sup>”.

Although the above definition clearly views interoperability from a technical, systems engineering, sense, however this does not preclude it from being examined also in a broader sense, taking into account specific scientific or technical domains or particular social, political, and organizational factors that impact system to system performance and therefore interoperability.

Having said that, the following variations of the interoperability definition can be found in literature, in respect to the specific scientific domain they apply to:

**Engineering.** Apart from the former one IEEE provides also two more complimentary definition for interoperability that apply specifically in the engineering domain:

1. The capability for units of equipment to work together to do useful functions.
2. The capability, promoted but not guaranteed by joint conformance with a given set of standards, that enables heterogeneous equipment, generally built by various vendors, to work together in a network environment.

**Health.** In the domain of electronic health (eHealth) the European Commission proclaims interoperability should enable the integration of heterogeneous systems, allow secure and fast access to comparable public health data & patient information located in different places over a wide variety of wired and wireless services<sup>2</sup>. Proportionally, the US Department of Health defines Interoperability as the ability to exchange patient health information among disparate clinicians and other authorized entities in real time and under stringent security, privacy and other protections.

**Telecommunications.** In the telecommunications domain interoperability is defined as the ability of systems, units, or forces to provide services to and accept services from other systems, units or forces and to use the services exchanged to enable them to operate effectively together. The condition achieved among communications-electronics systems or items of communications-electronics equipment when information or services can be exchanged directly and satisfactorily between them and/or their users. The degree of interoperability should be defined when referring to specific cases<sup>3</sup>.

**Software.** According to ISO/IEC 2382-01, interoperability is defined as follows: "The capability to communicate, execute programs, or transfer data among various functional units in a manner that requires the user to have little or no knowledge of the

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<sup>1</sup> Institute of Electrical and Electronics Engineers. IEEE Standard Computer Dictionary: A Compilation of IEEE Standard Computer Glossaries. New York, NY: 1990.

<sup>2</sup> European Commission, Communication on a European eHealth Area Com (2004) 356

<sup>3</sup> Federal Standard 1037C, entitled Telecommunications: Glossary of Telecommunication Terms

unique characteristics of those units"<sup>4</sup>. In software, the term interoperability is used to describe the capability of different programs to exchange data via a common set of exchange formats, to read and write the same file formats, and to use the same protocols. In the preceding definition of interoperability in the software domain the phrase “user of a program” can also be another program.

All the foregoing definitions approach interoperability within the scope of a specific scientific domain. However, taking also into consideration social, political, organizational and business parameters, we come across the following definitions of interoperability, that apply to the entrepreneurial and governmental domains, which are the main focus of this Interoperability Guide (they are presented more analytically in a next chapter)

Enterprise Interoperability	eGovernment Interoperability
Technical Interoperability	Semantic Interoperability
Organisational Interoperability	Business Process Interoperability
Legal Interoperability	

In fact, interoperability is often confused with other, related concepts. It can be therefore a useful exercise to observe explicitly **what interoperability is NOT:**

- **Interoperability is not Integration**, which is a means of changing loosely coupled systems to turn them into more tightly coupled systems.
- **Interoperability is not Compatibility**, which is more about the interchangeability of tools in a particular context
- **Interoperability is not Adaptability**, which is a means of changing a tool, adding additional capabilities as needed even on an ad-hoc basis, whereas interoperability refers to inherent capabilities

It is also worth noting that interoperability is neither ad-hoc, nor unilateral (nor even bilateral) in nature. Rather, it is best understood as a *shared value of a community*.

The final point to be made about interoperability, from the definition standpoint, is that it is also a quality that could be broken down into a series of quantifiable characteristics (metrics) which could be assessed (measured) separately, as the need arises.

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**Interoperability is currently considered to be the most important feature of software systems among different organizations that cooperate, communicate and exchange data and information. Achieving interoperability is crucial in order to ensure increased productivity and efficiency in automated services for Public Administrations, Businesses and citizens.**

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<sup>4</sup> ISO/IEC 2382-01, Information Technology Vocabulary, Fundamental Terms

## 2.2 Historical Overview and Political Context of Interoperability<sup>5</sup>

Since the 1960s, many companies developed in-house computer systems and internal networks to streamline business functions. Still, the speed in which a business could respond was determined by the communication link between the company and its customers. That communication link consists of the postal service and the telephone, and remains a slow and costly process even today. Some business executives were working on methods to shortcut the conventional communication link. Electronic communications was a prime consideration in circumventing the paperwork/telephone problems. It soon became clear that linking up to other business electronically had one major initial problem, information format.

The Electronic Data Interchange (EDI) emerged in the 1960s when the railroad industry sought a way to speed up and automate business communications between remote computer systems and to eliminate the high cost of sending paper documents by snail mail. However, the concept did not fully take hold industry wide until the 1980s when standards were introduced to define data exchange and when it became apparent that business-to-business (B2B) computer-mediated communications would require all parties to adopt a common protocol for purchase orders, advance shipping notices (ASN), and other pertinent documents. As a result, several technical committees have developed protocols governing such exchanges, which channelled through value-added networks (VANs) carrying these exchanges became collectively known as EDI.

Transportation, finance, insurance, and other industries have heavily leveraged EDI and proprietary communications lines to conduct business. Also, major manufacturers, such as automotive original equipment manufacturers (OEMs) and consumer packaged goods (CPG) companies have embraced EDI and mandated that their suppliers do the same. However, implementation of the technology has initially caused many a headache particularly in smaller companies.

The emergence of various XML based data standards during the last decade promised to solve the main drawbacks of traditional EDI-based technologies like very specific expert knowledge, non flexibility, expensiveness and complexity. Instead, the numerous XML based languages that have emerged during the last years even increased the complexity inherent to Enterprise Application Integration (EAI) and data mapping.

Since 2000, there have been massive changes in the overall direction of Application Integration in general and EAI in particular. A vast number of interoperability standards and frameworks have arisen in the light of fulfilling the need of automated collaboration. Some frameworks provide architectural guidelines that support the interoperability of inter-enterprise systems, such as the RosettaNet Framework, the OAG Integration Specification, and FIPA's architecture and associated set of specifications for distributed, communicating software agents. Among the most well-known is ebXML, a set of specifications supported by OASIS and UN/CEFACT, and proposed by a large group of businesses, government standards committees and academics to enable a well structured electronic business framework. Almost every established industry sector has set up organisations that have developed sector

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<sup>5</sup> Greek Interoperability Center, Deliverable D6.1 Interoperability Guide, Issues 1,2,3

specific specifications for business-to-business (B2B) transactions within the industry, such as ODETTE in automotive, CIDX in chemical, GS1/UCC in retail and PIDX in petroleum. On the technical side, the Service Oriented Computing paradigm and Service Oriented Architectures (SOA) have emerged as an evolutionary step from Object and Component based approaches, with the promise to overcome the deficiencies of past solutions, real or perceived.

From a policy point of view, the i2010 Strategic Framework recognises the importance of Interoperability. This Framework is the logical link between the high-level goals of the Lisbon Strategy and more operational ICT-related actions. The i2010 Framework recognises that “businesses are getting productivity gains from ICT but still face a lack of interoperability, reliability and security, difficulties to reorganise and integrate ICT into the workplace and high cost of support”. Interoperability is explicitly identified as one of the key bottlenecks that should be tackled by i2010 in order to create a single European information space and make the European Union more competitive<sup>6</sup>.

Interoperability has also been recognised as a key research area by the FP7 – ICT Work programme (Area 1.3), the European Commission Enterprise Interoperability Research Roadmap<sup>7</sup>, as well as the IDABC eGOV Research Roadmap<sup>8</sup> and the FP6 eGovRTD2020 Project e-Government Research Roadmap<sup>9</sup>.

Furthermore, the role of interoperability of organisations and systems has been recognised by the European Commission through the creation of the European Interoperability Framework<sup>10</sup> (EIF) and the respective e-Business Interoperability Framework<sup>11</sup> (eBIF) as evolving tools for guiding administrations and industries. From a national viewpoint, the Greek Digital Strategy<sup>12</sup> recognizes interoperability as a core pillar towards the Information Society of 2013, while latest IDABC reports underpin this thesis stating that interoperability is a vital issue in Greece.

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<sup>6</sup> The i2010 Strategy Framework, [http://ec.europa.eu/information\\_society/eeurope/i2010/index\\_en.htm](http://ec.europa.eu/information_society/eeurope/i2010/index_en.htm)

<sup>7</sup> European Commission Enterprise Interoperability Research Roadmap, [http://cordis.europa.eu/ist/ict-ent-net/ei-roadmap\\_en.htm](http://cordis.europa.eu/ist/ict-ent-net/ei-roadmap_en.htm)

<sup>8</sup> IDABC, <http://ec.europa.eu/idabc/>

<sup>9</sup> eGovRTD2020 Project,

[http://www.egovrtd2020.org/EGOVRTD2020/navigation/work\\_packages/wp4\\_roadmapping/D41](http://www.egovrtd2020.org/EGOVRTD2020/navigation/work_packages/wp4_roadmapping/D41)

<sup>10</sup> European Interoperability Framework, <http://ec.europa.eu/idabc/servlets/Doc?id=19528>

<sup>11</sup> eBusiness Roadmap: addressing key eBusiness standards issues 2006-2008,

<http://www.cen.eu/cenorm/businessdomains/businessdomains/iss/activity/ebusfinal.pdf>

<sup>12</sup> Greek Digital Strategy 2006-2013, <http://www.infosoc.gr/infosoc/en-UK/sthnellada/committee/default1/top.htm>

## 2.3 Why do we need Interoperability

Today, escalating economic and societal demands, along with the continuous advancements in Information and Communication Technologies (ICT), set a growing agenda for enterprises and governments and challenge the capabilities of their underlying technical infrastructures to support them effectively in their effort to adopt new models of operation – such as the paradigms of eBusiness and eGovernment – that will enhance their competitiveness and efficiency.

In the business domain, novel business practices such as the paradigm of electronic transactions (eTransactions) are constantly taking up momentum. Worldwide the number of stakeholders, from 10person Small-Medium Enterprises (SMEs) to global 2000 companies or local and regional administrations to national and federal governments, who are currently in the process of implementing eTransaction infrastructures, is ever growing. Proportionally to Porter's statement in 2001 that it was not a question for enterprises whether or not to move to the Internet but when and how to do it in order to create new value, today the "silver bullet" decision for businesses and organisations does not lie any more in the dilemma of adopting or not ICT enabled eTransaction and collaboration practices but how to integrate them as quickly and effectively as possible to their operation to achieve the biggest possible benefits.

Despite though the willingness of stakeholders to proceed to such networked enterprise paradigms and although technical solutions to enable e-transactions have been thoroughly justified during the last years their adoption and application into the everyday business practice by enterprises still remains limited. Technical and business characteristics of the proposed solutions, such as inflexible workflows, predefined formats for the exchanged data, predefined business and legal rules, exchange of business information through third party systems, use of proprietary technologies and inability to be readily set up and deployed act as the main inhibitors for the potential users. This renders current solutions costly, rigid and difficult to adapt to meet the requirements of evolving enterprise.

The past decade has seen significant advances to Enterprise Interoperability, particularly those related to ICT infrastructure aspects. For example, the Internet (and browser technology) has facilitated the search for information, and the exchange of information among enterprises. It has also contributed to the creation of new business models of Enterprise Interoperability. In addition, a number of software suppliers (e.g. IBM, Microsoft, Oracle and SAP) have gained a de facto ascendancy in the enterprise software market, contributing to the integration and efficiency gains of enterprise functions. However, questions remain about the impact and significance of these vendor-based solutions to Enterprise Interoperability. More than a decade after Enterprise Interoperability issues have been raised and discussed within various communities, interoperability is still a problem for enterprises. Islands of interoperability persist. Integration projects remain complex and expensive. The business case for interoperability is often not apparent to potential adopters of Enterprise Interoperability solutions, particularly for SMEs. Various technologies and tools resulting from research lack follow-up beyond (further) research. Large question

marks remain as regards the “value” and “impact” of the myriad of initiatives undertaken within the research lab, promoted by technology providers, or organised around groupings of companies.

Today Enterprise Interoperability reaches all enterprises at national and international level and constitutes a thriving research domain from all aspects – technical, entrepreneurial, societal and political. Lack of interoperability appears as the most long lasting and challenging problem for enterprises and governmental organizations. It emerged from proprietary development or extensions, unavailability or oversupply of standards, and heterogeneous hardware and software platforms. To meet their business objectives, enterprises need to collaborate with other enterprises: for many enterprises, doing business globally has become critical to their survival, while others (mainly governmental organizations and SMEs) discover new opportunities by focusing their business in a local setting. The situation has become more critical and important through new business paradigms like extended enterprises and networked organisations that require organizations to work together to achieve further benefits. Therefore, today an organization’s competitiveness is to a large extent determined by its ability to seamlessly interoperate with others.

In trying to characterize the current problem space for Enterprise Interoperability, EU’s Enterprise Interoperability Research Roadmap identifies the following relevant dimensions where Interoperability arises as an issue of high importance for contemporary enterprises.

- Managing more rapid change/innovation
- Adapting to globalisation
- Large integration/interoperability costs
- Difficulties in decision making (e.g. when to interoperate with other enterprises)
- Lack of business case for Enterprise Interoperability
- A change in the model of collaboration towards open innovation.

In the governmental domain, whereas in the last decade the main task of eGovernment initiatives focused on just the vertical integration aspects of the public sector’s service provision, nowadays, fully integrated, both vertically and horizontally, one-stop, electronic services are gradually becoming a reality, or they are considered, at least, a feasible goal. Such services are called Pan European eGovernment Services (PEGS), which means cross-border public sector information and interactive services, either sectoral or horizontal, i.e. of cross-sectoral nature, provided by European public administrations to European public administrations, businesses, including their associations, and citizens, including their associations, by means of interoperable trans-European telematic networks<sup>13</sup>.

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<sup>13</sup> Article 3b of the Decision 2004/387/EC of the European Parliament and of the Council on 21st of April 2004

The main issues that arise regarding the provision of such services by national public administrations have to do with the complexity, the multiplicity and the diversity of public sector's organisations. Considering the added complexity of procedures, information needs and systems, technologies used, legal frameworks, language and other special regional needs between the European Member States and the thousands of front and back-office systems which have to be taken into account in order to achieve this, the need for inclusive e-Government Interoperability Frameworks (eGIFs) becomes apparent. The interoperability challenge is becoming gradually even a more urgent matter, as the need for modernisation in the public sector has led to many small-scale projects that have not been based on any interoperability standards, which means that the information and the services they provide are not easily accessible by, or compatible to, information systems, technologies or business processes in other public-sector organisations, or even other offices within the same organisation.

An Interoperability Framework describes the way in which organisations have agreed, or should agree, to interact with each other, and how standards should be used. In other words, it provides policies and guidelines that form the basis for selection of standards<sup>6</sup>. It may be contextualised (i.e., adapted) according to the socio-economic, political, cultural, linguistic, historical and geographical situation of its scope of applicability in a specific circumstance/situation (a constituency, a country, a set of countries, etc).

In an effort to promote the provision of Pan European eGovernment Services, EU published in 2004 the 1<sup>st</sup> version of the European Interoperability Framework<sup>14</sup> – for which recently put on consultation a 2<sup>nd</sup> draft version<sup>15</sup>. In this context, many Member States already have or are in the process of developing their own National Interoperability Frameworks, (NIF's) addressing interoperability issues arising within their own country, across internal borders, between national agencies, departments, government bodies, etc. These national frameworks are complementary to the European Interoperability Framework, yet they should be compatible with it. The EIF and the NIF's complement one another in the sense that the EIF is concerned with PEGS at EU level, whereas the NIF's are concerned with both PEGS and non-PEGS, but only at the national level.

All the more the high-priority nature of achieving interoperability in the cross-border, cross-sector domain becomes evident. To implement pan-European eGovernment services, the public sector must confront many challenges, some of which are quite daunting. The realisation of interoperability, especially of the cross-border and cross-sector type, is now recognised as being a key factor in securing these objectives.

Summing up, some of the most important challenges that modern public administrations have to face have interoperability as one their core dimensions, specifically:

- Rapid advances in ICT, including several paradigm shifts, have transformed the landscape in which administrations, businesses and citizens interact with

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<sup>14</sup> <http://ec.europa.eu/idabc/en/document/3473>

<sup>15</sup> Revision of the EIF and AG, <http://ec.europa.eu/idabc/en/document/7728>

one another to an unprecedented degree. As a result, citizens and businesses are demanding ever more and better services from their governments.

- At the political level, advancing EU integration has placed dramatically increased emphasis on the cross-border aspects of eGovernment service provision, PEGS.
- Globalization is creating an ever more integrated and competitive environment for EU businesses and workers, resulting in increasing economic pressures which have been followed by major priority shifts in EU policies putting interoperability as one of the key achievements (e.g., the Lisbon agenda, eGovernment 2005 Action Plan, i2010 Strategy Framework, etc.)
- Administrations are consequently under tremendous political pressure to streamline their activities, modernize their infrastructure, and integrate their activities all intended to provide better, faster, cheaper services to businesses and citizens; eGovernment programs have accelerated tremendously and moved to centre stage.

Collectively, these forces have tremendously increased the importance of interoperability in all its aspects.

## 2.4 Focus of the Guide

As it comes out from the previous analysis Interoperability is a vast domain; there is almost one definition for every scientific domain and several sub-definitions for the various sub-domains of Enterprise and eGovernment Interoperability. Consequently an effort to “squeeze” such a broad domain of knowledge in one single report in order to provide an all-inclusive guide would be futile and at best would render the document elaborate, lengthy, verbose and finally useless for its potential audience.

Making use of the fact that according to the G.I.C.’s description of work this Interoperability Guide will be published in six version, it was chosen that each version of the Guide would focus on a specific aspect of Enterprise and eGovernment Interoperability with the objective to provide a set of comprehensive reports and straightforward recommendations on this aspect of Interoperability that could be used by decision makers and policy makers in enterprises and organisations.

As the Interoperability domain quite extended and multilateral the Interoperability Guide adopts the refinement of Interoperability into the sub-domains of organisational, technical, semantic and also legal interoperability in order to concentrate on a specific theme in every section.

Figure 1: Focus of the current and the previous versions of the Interoperability Guide series of publications.

## 3 Attempts towards achieving Interoperability: EIF and eGIF

### 3.1 European Policy for Interoperability

- **i2010<sup>16</sup>**: European Commission's strategic policy framework laying out broad policy guidelines for the Information Society and the media in the years up to 2010. It contains a specific action line on Interoperability.

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<sup>16</sup> [http://ec.europa.eu/information\\_society/eeurope/i2010/index\\_en.htm](http://ec.europa.eu/information_society/eeurope/i2010/index_en.htm)

- **IDABC<sup>17</sup>**: IDABC stands for Interoperable Delivery of European eGovernment Services to public Administrations, Businesses and Citizens. It is an EC initiative that uses the opportunities offered by Information and Communication Technologies (ICT) to encourage and support the delivery of cross-border public sector services to citizens and enterprises in Europe, to improve efficiency and collaboration between European public administrations and to contribute to making Europe an attractive place to live, work and invest.
- **FP7<sup>18</sup>, CIP<sup>19</sup>**: The Framework Programme for Research and the Competitiveness and Innovation Programme, contain specific actions for Interoperability.
- **National policies**: Almost all European Member States have national policies for interoperability in eGovernment (NIFs – National Interoperability Frameworks).

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<sup>17</sup> <http://ec.europa.eu/idabc/>

<sup>18</sup> <http://cordis.europa.eu/fp7/dc/index.cfm>

<sup>19</sup> [http://ec.europa.eu/cip/index\\_en.htm](http://ec.europa.eu/cip/index_en.htm)

## 3.2 EIF

### 3.2.1 Goals and Objectives

In June 2002, European heads of state adopted the eEurope Action Plan 2005 at the Seville summit. It calls on the European Commission “to issue an agreed interoperability framework to support the delivery of pan-European eGovernment services to citizens and enterprises”. This framework would address information content and recommend technical policies and specifications to help connect Public Administration Information Systems across the EU. The Action Plan also stipulated that the Framework would “be based on open standards and encourage the use of open source software”.<sup>20</sup>

Therefore, the **European Interoperability Framework**<sup>21</sup> (**EIF**) has been designed to support the pan-European delivery of electronic government services. The EIF document represents the highest-ranking module of a comprehensive methodological tool kit for implementing pan-European eGovernment services. Since then, it has been further developed parallel to the progress and the emerging requirements of pan-European infrastructures and services.

An **Interoperability Framework** can be defined as a set of standards and guidelines that describes the way in which organisations have agreed, or should agree, to interact with each other. An interoperability framework is, therefore, not a static document and may have to be adapted over time as technologies, standards and administrative requirements change.

The European Interoperability Framework defines a set of **recommendations** and **guidelines** for eGovernment<sup>22</sup> services so that public administrations, enterprises and citizens can interact across borders, in a pan-European context.

The **objectives of the European Interoperability Framework** are:

- To **support** the European Union's strategy of providing user-centred eServices by facilitating the interoperability of services and systems between public administrations, as well as between administrations and the public (citizens and enterprises), at a pan-European level.
- To **supplement** national interoperability frameworks in areas that cannot be adequately addressed by a purely national approach.
- To help achieve interoperability both within and across different policy areas, notably in the context of the **IDABC programme** and any other relevant Community programmes and initiatives.

The European Interoperability Framework shows how services and systems of administrations throughout Europe should interrelate in order to serve, supplement and enrich each other with a view to providing pan-European eGovernment services.

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<sup>20</sup> [http://europa.eu.int/information\\_society/europe/2005/all\\_about/action\\_plan/index\\_en.htm](http://europa.eu.int/information_society/europe/2005/all_about/action_plan/index_en.htm)

<sup>21</sup> <http://ec.europa.eu/idabc/en/document/3473>

<sup>22</sup> In the Communication “The role of Government for Europe's future”, COM (2003) 567 final of 26 September 2003, eGovernment is defined as the use of information and communication technologies in public administrations combined with organisational change and new skills in order to improve public services and democratic processes and strengthen support to public policies.

To achieve this, it needs to complement National Interoperability Frameworks by providing a multilateral framework with a pan-European dimension. In doing so, it also creates benefits such as economies of scale and the re-use of knowledge and resources, whilst ensuring that each Member State is given the maximum level of independence.

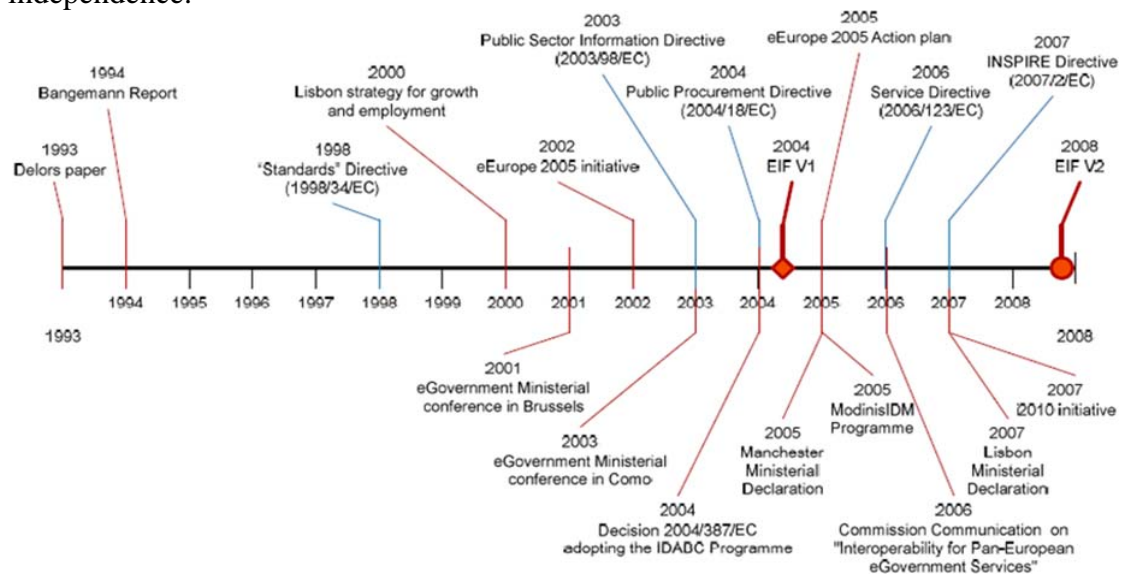


Figure 2: Historical background of the European Interoperability Frameworks

In particular, the **European Interoperability Framework** should:

- Address the **pan-European dimension of interoperability** and provide an answer for the following questions: What is interoperability? Why is interoperability needed at the pan-European level? What are the implications of interoperability from the pan-European and national perspectives?
- Provide a **description of the elements** that have to be addressed for the interoperability of pan-European eGovernment services.
- Identify reference information that provides **additional guidance** on interoperability issues.
- **Support** the pan-European eGovernment projects and the related activities to be launched, notably in the context of the IDABC programme.

In so doing it will:

- Lead to the identification of a number of actions to be carried out by the Member States and the EU Institutions and Agencies in order to achieve Interoperability.

### 3.2.2 Guidelines to the stakeholders

The target audiences of the EIF are **the managers of eGovernment projects** in Member State administrations and EU bodies. Member State administrations should use the guidance provided by the EIF to add a pan-European dimension to their national eGovernment interoperability frameworks, thus enabling pan-European

interoperability. European Institutions and Agencies<sup>23</sup> should use the European Interoperability Framework for their operations with each other and with citizens, enterprises and administrations in the EU Member States.

The EIF focuses on **supplementing**, rather than replacing, national interoperability guidance by adding the pan-European dimension. In order to operate at pan-European level, a Member State administration must therefore already have a national interoperability framework or equivalent technical strategy for the delivery of eGovernment services in place<sup>24</sup>. The EIF can then provide the pan-European layer to the national framework.

However, the recommendations and guidelines of the Framework and related documents, such as the IDABC Architecture Guidelines, are **mandatory for pan-European projects** carried out in the context of the IDABC programme.

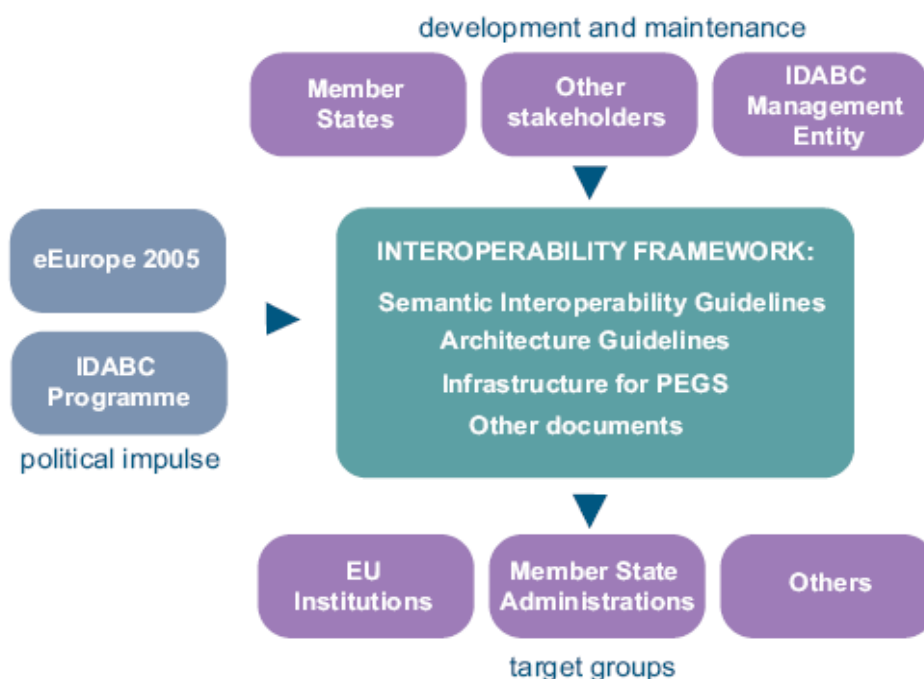


Figure 3: European Interoperability Framework Stakeholders

<sup>23</sup> Proper account should nevertheless be taken of the sometimes “sui generis” nature of the European Institutions with regard to the Member State Administrations: The principle of “extraterritoriality” applies to many areas of the Institutions’ dealings with national administrations, which might require particular attention in such issues as handling data exchanges.

<sup>24</sup> The institutions are governed by explicit and separate regulations concerning such matters as personal data protection and public access to information, rather than being covered by the provisions in law of a particular Member State.

### 3.3 eGIF: The idea of an eGovernment Interoperability Framework

Modern joined-up government demands **joined-up ICT systems**. Interoperable systems working in a seamless and coherent way across the public sector hold the key to providing better services, tailored to the needs of the citizen and business and at a lower cost<sup>25</sup>.

Clearly defined policies and specifications for interoperability and information management are also a key to staying connected to the outside world and aligned to the global information revolution. The e-GIF provides these. It is a fundamental framework policy for the e-Government strategy.

Government information resources are not only of value in themselves. They are valuable economic assets, the fuel of the knowledge economy. By making sure the information we hold can be readily located and passed between the public and private sectors, taking account of privacy and security obligations, we can help to make the most of this asset, thereby driving and stimulating our economy.<sup>26</sup>

#### **eGovernment Interoperability Frameworks (eGIFs) at a glance:**

- ✓ **eGIFs are sets of standards and guidelines for achieving eGovernment Interoperability at Organisational, Semantic and Technical level**
- ✓ **eGIF's exist in most European Member States, at various levels of completion**
- ✓ **IDABC maintains the European Interoperability Framework (a meta-framework for eGovernment Interoperability)**

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<sup>25</sup> e-Government Interoperability Framework Version 6.1,  
[http://www.umic.pt/images/stories/publicacoes/eGIF%20v6\\_1%281%29.pdf](http://www.umic.pt/images/stories/publicacoes/eGIF%20v6_1%281%29.pdf)

<sup>26</sup> Cabinet Office, Office of the e-Envoy, e-Government Interoperability Framework, Version 6.0, 30 April 2004

## 3.4 eGIF – The Greek case

### 3.4.1 Objective

The **Greek electronic Government Interoperability Framework**<sup>27</sup> (Greek e-GIF) defines standards, specifications and rules for the development and deployment of web-based front and back office systems for the Greek Public Administration, at National and Local Level, which will accelerate the development of electronic collaboration of public agencies, for the delivery of high quality and secure one-stop e-government services to businesses, citizens and other public bodies. The Greek Interoperability Framework is in conformance with the European Interoperability Framework (EIF) and applies best practices from relevant international standardisation bodies.

### 3.4.2 Greek e-GIF Building Blocks

The Greek e-Government Interoperability Framework consists of the following building blocks:

- The **Certification Framework** for Public Administration Sites and Portals, which specifies the directions and standards to be followed by the public agencies at central or local level, when designing, developing and deploying e-government portals of the Public Administration and supporting e-government services.
- The **Interoperability and Electronic Services Provisioning Framework**, which defines the basic principles and the general strategy to be followed by the public agencies, when developing e-government Information Systems. It also provides organisational and semantic interoperability guidelines, as well as the technical specifications and standards that should be used for the communication and the efficient exchange of information between e-government systems, aiming to the provision of integrated and interoperable e-government services.
- The **Digital Authentication Framework**, which sets the standards, the procedures and the technologies required for the registration, identification and authentication of the e-government services users, including citizens, businesses, public authorities and civil servants. It, also, aims at creating an integrated and coherent set of policies, regarding Digital Certificates and Public Key Infrastructures.
- The **Documentation Model for Public Administration Processes and Data**, a practical guide which defines the notation, the rules and the specifications for the design, implementation and documentation of the Public Administration processes, documents and electronic data exchange messages.

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<sup>27</sup> <http://www.e-gif.gov.gr>

- The **interoperability registry prototype**, a web-based repository of service and document metadata, services process models in BPMN, standardised XML schemes for mostly used governmental documents based on UN/CEFACT/CCTS standards, as well as codelists for the most common information elements within governmental service provision in Greece.

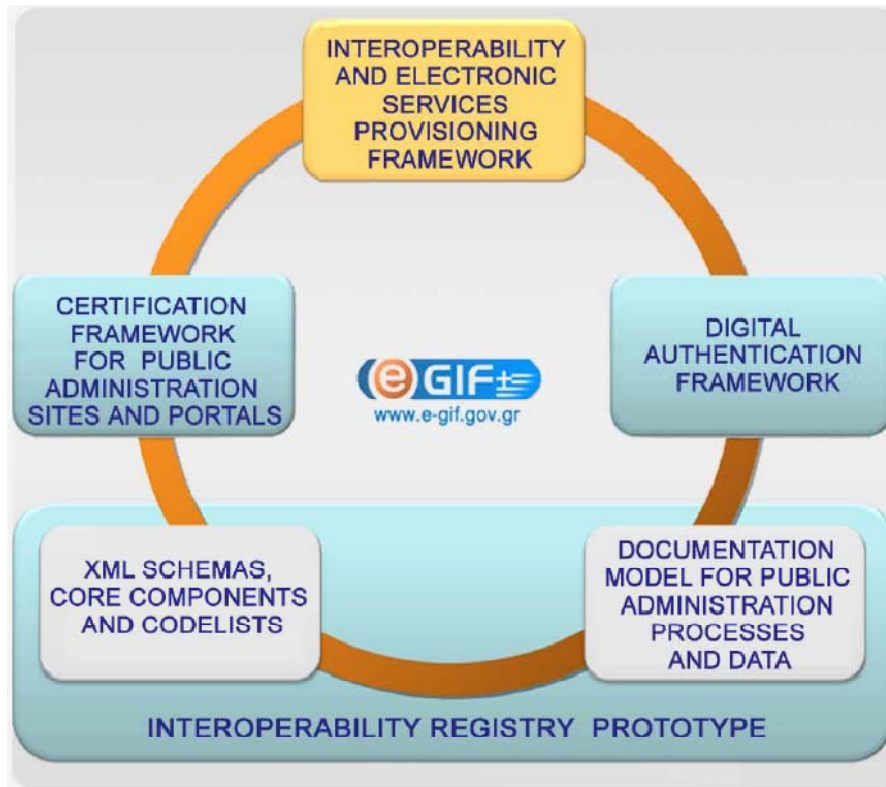


Figure 4The Greek electronic Government Interoperability Framework

The Greek e-GIF is supplemented by conformance checklists that support the assessment of infrastructures against the framework and training material for Public Administration Officials and e-Government Practitioners.

## 4 Interoperability Domains

In general, interoperability means the ability of information and Communication Technology (ICT) systems and of the business processes they support to exchange data and to enable the sharing of information and knowledge.

Enterprise Interoperability is the ability of two or more organisations to cooperate at **organisational, semantic and technical level**, with the use of Information and Communications Technologies, achieving a high level of automation.

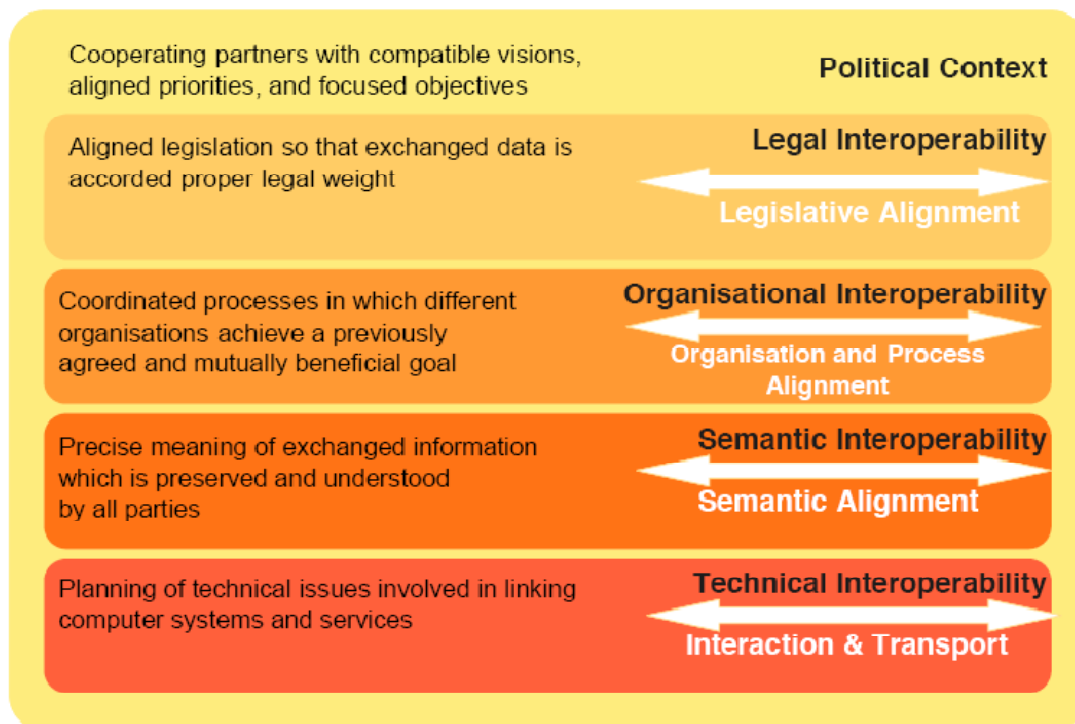


Figure 5: Interoperability Domains

## 4.1 Policy

The establishment of a new European Public Service is the result of a direct or indirect action at **political level**, i.e. of new bilateral, multilateral or **European agreements**. If the establishment of a new service is the direct consequence of new **EU legislation**, the scope, priorities and resources necessary for the establishment and operation of the service, should be foreseen when the legislation is adopted<sup>28</sup>.

However, political support and sponsorship must also be ensured in cases where new services are not directly linked to new legislation but are decided upon, in order to provide better, more user-oriented public services.

Likewise, it is necessary to ensure political support for **cross border interoperability efforts**, facilitating cooperation between public administrations<sup>29</sup>. In order for such cooperation to be effective, all stakeholders involved must share visions, agree on objectives and align priorities. Actions at the cross-border level can only be successful if all Member States involved accord sufficient priority and resources to their respective interoperability efforts, progress towards agreed goals, within agreed timeframes.

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<sup>28</sup> European Interoperability Framework for European Public Services (EIF), Version 2.0, <http://ec.europa.eu/idabc/en/document/7728>

<sup>29</sup> The ISA programme is an example of such political support.

## 4.2 Legal Interoperability

Among the other definitions, the European Interoperability Framework in its 2<sup>nd</sup> (draft) version<sup>30</sup> introduces also the dimension of **Legal Interoperability**. Legal interoperability involves the appropriate **synchronization of the legislation** in the cooperating EU Member States and countries so that electronic data originating in any given country is accorded the proper legal weight and recognition wherever it needs to be used in other countries.

Each public administration contributing to the provision of a **European Public Service** works within its own national legal framework. While the Internet makes it easy to physically publish and access information, sometimes, the **incompatibilities between legislation in different Member States**, make working together more complex or even impossible, even in cases where such legislation is the result of the transposition of European directives into national law. Legal initiatives may be needed to remedy such situations.

The legal aspects that constrain and influence how information can and should be made available and used, include laws related to copyright, content regulation, privacy, freedom of information, telecommunications regulation, e-commerce and trade practices. Activities which may be legal in one context or jurisdiction may not be permitted in another.

Therefore, when exchanging information between Member States in the context of the provision of European Public Services, the legal validity of such information must be maintained across borders and the data protection legislation in both originating and receiving countries must be respected.

The same applies for the cross-border **electronic transactions among enterprises** of different Member States, where legal and regulatory requirements relating to access to information and to the security and confidentiality of information, often arise.

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<sup>30</sup> Revision of the EIF and AG, <http://ec.europa.eu/idabc/en/document/7728>

### 4.3 Organizational Interoperability (processes)

Concerning **Public Administrations** and **Enterprises** in different Member States, this aspect of interoperability deals with how organisations will be able to collaborate in order to achieve their mutually agreed goals. In practice, organizational interoperability is established through the integration of **business processes** and the related **exchange of information**.

**Organisational interoperability** is concerned with defining business goals and modeling business processes for the seamless collaboration of organizations, both administrative bodies and enterprises that wish to exchange information, but may have different internal structures and processes. Moreover, organisational interoperability aims at addressing the requirements of the user community by making services available, easily identifiable, accessible and user-oriented<sup>31</sup>.

#### 4.3.1 Business Process Alignment

In order for different Administrative Entities and Enterprises to be able to work together efficiently and to effectively provide European Public Services and Electronic Transactions, respectively, they may need to **align their existing business processes** or even to define and establish new business processes.

Aligning business processes to contribute to European Public Services and eTransactions, implies documenting them, in a **commonly agreed way**, so that all public administrations and enterprises contributing to the delivery of European Public Services and eTransactions, respectively, will have a global view of the compounded business process and understand their role in it.

#### 4.3.2 Change Management

Since the delivery of a European Public Service is the result of the collective effort of a number of collaborating parties that produce or consume parts of the service, setting appropriate **change management process** is critical to ensure the accuracy, reliability and continuity of the service delivered to other public administrations, business and citizens.

The same need for Change Management Process applies in the case of the eTransactions among the various Enterprises among the different Member States.

#### **Organizational Interoperability is all about:**

- ✓ **Business Processes alignment, targeting collaboration between organisations, units and systems**
- ✓ **Proper setting and training of organisational units for collaboration**

<sup>31</sup> <http://ec.europa.eu/idabc/servlets/Doc?id=19529>

#### 4.4 Semantic Interoperability (definitions)

**Semantic interoperability** enables organisations to process information from external sources in a meaningful manner ensuring that the precise meaning of exchanged information is understood and preserved throughout the various exchanges among the various communicating parties and any other applications that were not initially developed for this purpose. It thus enables systems to combine received information with other information resources<sup>32</sup>.

Beyond the ability of two or more computer systems to exchange information, semantic interoperability is the ability to automatically **interpret the information** exchanged meaningfully and accurately in order to produce useful results as defined by the end users of both systems. To achieve semantic interoperability, both sides must defer to a common information exchange reference model. The content of the information exchange requests are unambiguously defined: what is sent is the same as what is understood<sup>33</sup>.

A starting point for achieving semantic interoperability is the establishment of sector-specific sets of **data structures** and **data elements** that can be referred to as semantic interoperability assets. Once these are established, the cooperating organisations will need to agree on the meaning of the information to be exchanged. The semantic interoperability level encompasses both of the following aspects:

- **Semantic Interoperability** is about the meaning of information elements and the relationship between such elements. It includes the development of the vocabularies used to describe information exchanges, and ensures that information elements are understood in the same way by communicating parties.
- **Syntactic Interoperability** is about describing the exact format of the information to be exchanged via grammars, formats, and schemas.

Achieving semantic interoperability in the European context requires at least:

- Agreed **processes** and **methodologies** for developing semantic interoperability assets
- Sector-specific and cross-sectoral communities to agree on the use of semantic interoperability assets at EU level (sector-specific & cross-sectoral elements).

#### **Semantic Interoperability is all about:**

- ✓ **Common definition of terms, across organisations, units and systems**
- ✓ **Common definition and standardisation of exchanged information (e-invoice, e-VAT, etc)**

<sup>32</sup> Revision of the EIF and AG, <http://ec.europa.eu/idabc/en/document/7728>

<sup>33</sup> <http://en.wikipedia.org/wiki/Interoperability>

## 4.5 Technical Interoperability (systems)

This aspect of interoperability covers the technical **aspects of linking information systems**. It includes aspects such as interface specifications (open interfaces), interconnection services, data integration services and middleware, data presentation and exchange, accessibility and security services.<sup>34</sup>

While public administrations have specific characteristics at the political, legal, organisational and partly at the semantic levels, interoperability at the technical level is not specific to public administrations. Therefore, technical interoperability should be ensured, whenever possible, via the use of either standards endorsed by recognised standardisation organisations or technical specifications made available by industry consortia or other standardisation fora.

### Technical Interoperability is all about:

- ✓ **Standards for systems architecture (how the interoperable system is designed)**
- ✓ **Standards for systems interconnection (communication, web services, service discovery)**
- ✓ **Standards for information storage and retrieval (formats,etc)**

Solving technical interoperability started long ago before computerized system begins to dominate our daily life. In the past interoperability was concerned with the technical level to guarantee physical interoperability. The goal is to achieve compatibility between systems being "plugged" together. On the second level it is necessary to obey to the same protocols as a prerequisite for further interoperability. This is the system level and related to interconnectivity. On the operational level we focus the Data-/Object model interoperability to enforce exchangeability of information. The basics for classification have been developed around 1998 within LISI the Level of Information Systems Interoperability<sup>35</sup>.

Level	Interoperability	Semantic
Operational	Data-/ObjectModel Interoperability	Exchangeability
Systems	Protocol Interoperability	Interconnectivity
Technical	Physical Interoperability	Compatibility

Figure 6: Technical Interoperability Domain

<sup>34</sup> Revision of the EIF and AG, <http://ec.europa.eu/idabc/en/document/7728>

<sup>35</sup> [http://www.qualipso.org/sites/default/files/D3.1.1B\\_TECHNICALINTEROP\\_SOTA\\_V2.1.pdf](http://www.qualipso.org/sites/default/files/D3.1.1B_TECHNICALINTEROP_SOTA_V2.1.pdf)

## 5 The stakeholders

### 5.1 Introduction

Nowadays, the interaction between systems is absolutely essential to achieve business continuity. There is a need to exchange and share services and resources smoothly. In order for this to happen, the establishment of Interoperability aspects and services among these systems is crucial for the better servicing of the **Interoperability Stakeholders**.

There are various categories of stakeholders interested in Interoperability. On the one hand, there are the **Enterprises** and the whole **Public Administrations** that are mainly interested in adopting and implementing Interoperability Infrastructures and Services. On the other hand, there are the **Citizens** and all the other bodies that interact with the Public Administrations, mainly, as well as the Enterprises, in general, and benefit in various levels and ways from the establishment of Interoperable Infrastructures and the provision of Interoperable Services.

#### 5.1.1 Where is Interoperability needed

##### Among different organizations

*For example:*

- ✓ Between **eBusiness** systems (e.g. eOrdering / eProcurement) of a seller / buyer environment
- ✓ Between back-office systems of **Public Administrations** (e.g. Taxation / Social Benefits applications)
- ✓ Between two organisations at **process level** (e.g. the Banks should communicate with the Ministry of Finance, before issuing a loan)

##### Among different systems of the same organisation

*For example:*

- ✓ Between **front office** and **back-office** systems
- ✓ Between two **back-office** systems of the same organisation
- ✓ Between two units of the same organisation **at data level** (e.g. the definition of the medical file in two different hospital departments)

##### Among subsystems of the same system

*For example:*

- ✓ An **ERP system** should collaborate with the **CRM system** of an organisation.
- ✓ The **Taxation subsystem** should collaborate with the **Pensions subsystem**, in the Ministry of Finance back-office

Interoperability is both a **prerequisite** for and a **facilitator** of the efficient delivery of **European Public Services**. Interoperability addresses the need for<sup>36</sup>:

- **cooperation** between public administrations aiming at the establishment of public services
- **exchanging information** between public administrations to fulfil legal requirements or political commitments
- **sharing and reusing information** among public administrations to increase administrative efficiency and reduce administrative burden on citizens and businesses

**Leading to:**

- ✓ Improving **public service delivery** to citizens and business by facilitating the one-stop shop delivery of public services
- ✓ Reducing costs for public administrations, businesses and citizens through efficient and effective delivery of public services
- ✓ Achieving **more rapid** and **less expensive** services among public sector organizations
- ✓ Achieving more efficiently **corporate objectives** among the parts of a business
- ✓ Achieving better **communication and exchange of data** and information among the systems of cooperating firms or agencies
- ✓ Establishing **cooperation** among **data systems** and **business processes** of heterogeneous, but cooperating businesses and organizations

**What each one of the stakeholders has to do:**

- ✓ **Make a diagnosis of the situation in organizations and systems**
- ✓ **Specify a set of guidelines that should be followed**
- ✓ **Implement the best practices for achieving interoperability in e-Government and E-Business**
- ✓ **Be aware of the services provided and insist on their rights for cooperation, openness and transparency**

<sup>36</sup> European Interoperability Framework for European Public Services (EIF), Version 2.0, <http://ec.europa.eu/idabc/en/document/7728>

## 5.2 Enterprises

### 5.2.1 Introduction

According to the Enterprise Interoperability Research Roadmap<sup>37</sup>, Enterprise Interoperability is a relatively recent term that describes a field of activity with the aim to improve the manner in which enterprises, by means of Information and Communications Technologies (ICT), **interoperate** with other enterprises, organisations, or with other business units of the same enterprise, in order to conduct their business. This enables enterprises to, for instance, build partnerships, deliver new products and services, and/or become more cost efficient<sup>38</sup>.

In a proportionate way to the IEEE definition of interoperability<sup>39</sup>, Enterprise Interoperability is the ability of an enterprise to interact with other organisations, to exchange information and to use the information that has been exchanged. It should be noted therefore that in this context, interoperability is not only a property of ICT systems, but also concerns the **business processes** and the **business context** of an enterprise.

#### Other definition approaches:

- ❖ A widely shared understanding of Enterprise Interoperability (EI) refers to the capability of two organisations to cooperate in doing business together by using a **high level of automation**<sup>40</sup>
- ❖ Enterprise Interoperability is the ability of two or more organisations to cooperate at **organisational, semantic and technical level**, with the use of Information and Communications Technologies, achieving a high level of automation<sup>41</sup>.

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<sup>37</sup> [ftp://ftp.cordis.europa.eu/pub/ist/docs/directorate\\_d/ebusiness/ei-roadmap-final\\_en.pdf](ftp://ftp.cordis.europa.eu/pub/ist/docs/directorate_d/ebusiness/ei-roadmap-final_en.pdf)

<sup>38</sup> European Commission Enterprise Interoperability Research Roadmap, [http://cordis.europa.eu/ist/ict-ent-net/ei-roadmap\\_en.htm](http://cordis.europa.eu/ist/ict-ent-net/ei-roadmap_en.htm)

<sup>39</sup> Institute of Electrical and Electronics Engineers. IEEE Standard Computer Dictionary: A Compilation of IEEE Standard Computer Glossaries. New York, NY: 1990

<sup>40</sup> Interop VLAB Scientific Agenda, 2008

<sup>41</sup> [gic.epu.ntua.gr/Portals/GIC/KeyTerms\\_190608\\_YC2.pdf](http://gic.epu.ntua.gr/Portals/GIC/KeyTerms_190608_YC2.pdf)

### 5.2.2 VSEs, SMEs

Small and medium sized enterprises (SMEs), who need to specialise in niche activities in order to raise their own added value, particularly have to **combine forces** in order to compete jointly in the market<sup>42</sup>.

For some enterprises, doing business globally has become critical to their survival, while others discover new opportunities by focusing their business in a local setting. Small and medium sized enterprises (SMEs), who need to specialise in niche activities in order to raise their own added value, particularly have to combine forces to compete jointly in the market. Today, an enterprise's competitiveness is to a large extent determined by its ability to seamlessly interoperate with others.

Today, an enterprise's competitiveness is to a large extent determined by its ability to **seamlessly interoperate** with others. As ICT-enabled collaboration becomes a decisive tool in the struggle for competitive advantage, Enterprise Interoperability has become a strategic necessity in all industries. It has also increasingly become a key feature of the business fabric of all innovation ecosystems. The i2010 Strategy Framework has explicitly identified interoperability as a key bottleneck that should be tackled.

#### SMEs must collaborate in order to survive

Moreover, Enterprise Interoperability can increase the capability of SMEs to **join new markets**<sup>43</sup>. However, there are huge differences between SMEs and large enterprises. These differences include:

- ✓ the benefits of interoperability are not self-evident
- ✓ the entry barriers for SMEs to join collaboration networks and enter new markets remain high
- ✓ the fear of losing control through collaboration and interoperability is paramount, given the SMEs' lack of "clout" and negotiation power
- ✓ the time, effort and expenses needed to make use of IT is disproportionate to the size and scope of their operation; and finally
- ✓ SMEs are extremely diverse entities for which a one-size-fits-all solution would not be appropriate.

<sup>42</sup> Enterprise Interoperability Research Roadmap, Final Version (Version 4.0), 31 July 2006

<sup>43</sup> Report of European Commission Consultation Workshop on Enterprise Interoperability Research, 10 January 2006, Brussels, page 40-42, [ftp://ftp.cordis.europa.eu/pub/ist/docs/directorate\\_d/ebusiness/20060110\\_report.pdf](ftp://ftp.cordis.europa.eu/pub/ist/docs/directorate_d/ebusiness/20060110_report.pdf)

### 5.2.3 Enterprise IT Managers

#### *IT Technology and Enterprise IT Managers*

The past decade has seen significant advances of the IT Technology that concern and may be applied for the establishment of **Enterprise Interoperability**. Numerous architectural frameworks and sector specific specifications have arisen from the standardisation arena. Technologies like **Service Oriented Computing** and **Service Oriented Architectures** (SOA) have emerged as a major evolutionary step, with **Web Services**, **Grid Services** and peer-to-peer (**P2P**) services comprising the major trends. This has been joined by developments in Semantic Web Services, Enterprise Modelling, as well as other modelling and process languages to describe business processes and their executions. Today, the market is saturated with technology-based solutions that claim to support interoperability for enterprises, with several commercial middleware solutions among the most prominent.

The SME issues point to a more fundamental problem about the **role and exploitation of IT** in the enterprise's process of innovation. **Full alignment** between technical capability and business need is **still largely missing**. Considerations of business needs are secondary to those of technical capability in many IT initiatives. Collaboration between networking enterprises remains largely dependent upon specific IT solutions. This implies **IT as a barrier** to, rather than a facilitator for, collaboration and innovation.

Envision a future in which the business environment will comprise a diversity of continuously evolving **“ecosystems” of enterprises**, within and across which, enterprises will collaborate as well as compete with one another. Enterprises, both big and small, will be able to do business seamlessly, adapt to changes in the environment dynamically, and exploit new opportunities rapidly by harnessing the full potential of software and related IT services.

Interoperability of enterprises will be a key feature within each ecosystem, and across the ecosystems. From an IT perspective, interoperability will be a utility-like capability that enterprises can invoke on the fly in support of their business activities. Specific IT functions will be delivered as services that are cheap, fast, reliable, and without major integration efforts. **IT will become a routine** and not a problem. It will be a transparent and invisible part of the business operation<sup>44</sup>.

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<sup>44</sup> <http://ec.europa.eu/idabc/en/document/7728>

#### 5.2.4 Enterprise Managers

The high-ranking executives of the Enterprises are responsible for defining the **strategy**, the fundamental **principles** and the **directions** to be adopted for efficient e-Business service delivery among enterprises and to the citizens and other bodies. Business executives of the VSEs and the SMEs, deal with the management and optimisation of the e-Transaction processes, as well as other organisational and operational issues, relevant to the allocation of roles and responsibilities for the support of e-Business services.

**To meet their business objectives, enterprises, both big and small, need to collaborate and establish cooperation agreements with other enterprises.**

## 5.3 Public Sector

The establishment of Interoperability among the various Public Bodies in the provision of Public Services to the Citizens is expected to have many **positive outcomes**, both for the Public Sector and for the Citizens, as well:

### For the Public Sector

- ✓ Reduction of administrative costs for providing services to citizens and businesses
- ✓ Increased transparency in service delivery
- ✓ Better use of existing systems and infrastructures

### For the citizens that use Public Sector Services

- ✓ Reduction of the total time required to perform a service
- ✓ Reduction of services cost, in terms of time and money
- ✓ Ability to provide services every hour and day (24 x 7)

#### 5.3.1 eGovernment Interoperability

European Commission defines **Electronic Government** (eGovernment) as the use of ICT in public administrations combined with organisational change and new skills in order to improve public services and democratic processes, and strengthen support to public policies<sup>45</sup>.

In this scope, **eGovernment Interoperability** is defined as the ability of Information and Communications Technologies (ICT) systems and of the business processes they support to exchange data and to enable sharing of information and knowledge<sup>46</sup>.

#### **eGovernment Interoperability is:**

- ✓ **A key factor for the provision of true one-stop eGovernment Services**
- ✓ **Enabling all the Public Administration stakeholders, enterprises and citizens**
- ✓ **Decomposing into organisational, semantic and technical aspects of systems and administrations**

#### 5.3.2 Public Sector IT Managers

ICT executives of the Public Administrations and Companies, such as e-government project contractors and software vendors, as well as ICT service providers and ICT

<sup>45</sup> European Commission, 2003, 'The role of eGovernment for Europe's future' Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions, Brussels, 26.9.2003, COM(2003) 567 Final.

<sup>46</sup> IDABC 2004. European Interoperability Framework for pan-European eGovernment Services. Luxembourg, European Communities.

consultants, are responsible for designing and developing e-government portals and information systems

### 5.3.3 Public Sector Managers

High-ranking executives of the Public Administration and the Private Sector are responsible for defining the strategy, the fundamental principles and the directions to be adopted for efficient e-government service delivery to businesses, citizens and other public authorities. Business executives of the Public Administrations, deal with the management and optimisation of the administrative processes, as well as other organisational and operational issues, relevant to the allocation of roles and responsibilities for the support of e-government services.

### 5.3.4 Public Sector Local Administrations

Public Sector Local Administrations should focus on developing and establishing Interoperability, following the corresponding recommendations of eGIF and international experience, in order to

- Overcome their **introvert character**
- Achieve a high level of **homogenization**, as regards the ergonomic and functional aspects of e-government portals
- Reduce bureaucracy and utilize reliable channels for the delivery of e-government services
- Promote the interoperability between Public Bodies on a **legal, organisational, operational and technical aspect** for the provision of integrated e-government services
- **Reduce the development cost** of Public Administration Information Systems through the reuse of software components and the exploitation of existing e-government services

### 5.3.5 Citizens

Government-to-Citizen (abbreviated G2C) is the communication link between a government and private individuals or residents. Such G2C communication most often refers to that which takes place through Information Communication Technologies (or ICTs), but can also include direct mail and media campaigns. G2C can take place at the federal, state, and local levels.<sup>47</sup>

Concerning the delivery of interoperable e-business and e-government services to citizens, citizens should assess the quality of these services by taking into account the expected service delivery time, the access to e-government and e-business services through multiple channels, the difficulty in searching and retrieving of information for e-government and e-business services and finally, they always seek for a high level of quality, reliability, credibility and transparency, when using e-government and e-business services.

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<sup>47</sup> <http://en.wikipedia.org/wiki/Government-to-citizen>

## 6 Guidelines to each stakeholder

### 6.1 Enterprises<sup>48</sup>

#### 6.1.1 VSEs, SMEs

There are Four Pillars of the **Modelling Method** that have to be followed and defined in detail by the Enterprise Modellers of both VSEs and SMEs:

- ✓ **Modelling Framework:** What needs to be modeled in the scope of a project with both abstraction (level of detail) and description levels?
- ✓ **Modelling Technique:** Which description language, corresponding graphical notation and meta-model definition that contain modelling rules (e.g. how modelling constructs can be linked together)?
- ✓ **Model-related Mechanisms and Tools:** Which tools that will allow modellers to manipulate models with the help of modelling rules checker, quality-check scripts, productivity-enhancing functions, transformation tools, publishing or import/export mechanisms shall be adopted?
- ✓ **Modelling Approach:** Which further organizational issues regarding the modelling activities within a project need to be clarified? When does a modelling activity take place? Who is in charge of which modelling activity? What is being used for that modelling activity (model types and modelling constructs)?

**Describe the current AS-IS situation in the involved enterprises and recognize the points that can be facilitated or re-engineered through the platform under development.**

Enterprise Modellers should also adopt **common modeling guidelines** regarding:

- ✓ **Process Identification & Modelling** by creating private business processes, specific business documents, roles and rules. All this information is specific for the particular end user, country and system
- ✓ **Extraction of Public Views** for public processes, data and rules which are needed for the collaboration with other parties. This information is still end user, country and system specific
- ✓ **Harmonization & Generalization** that produces generic and country/user independent models. These models are the fundamental in order to enable interoperability between countries and systems

If there are processes that concern several areas and departments in the enterprise, it is very important to have representatives of all these departments in the modeling

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<sup>48</sup> GENESIS, Enterprise Application Interoperability - Integration for SMEs, Governmental Organizations and Intermediaries in the New European Union, Deliverable D11.4, Best Practices Guide, 30 November 2008

activities in order to guarantee a complete coverage of the process. Thus, organizational techniques, such as **interviews, workshops, questionnaires and on-site observations**, should be considered when identifying and analyzing business processes.

**Define in detail the change management processes, the roles involved and the permissions allowed to the modellers.**

Enterprise modellers should use a **modelling tool** which provides graphical description or information capture features and implements the Enterprise Architecture Framework selected for the project.

They should also conform to the **BPMN notation** at **two levels**:

- The visual appearance of the BPMN graphical elements
- The semantics of the BPMN elements

The entire modeling procedure should be organized and conducted **in discrete phases** supported by corresponding modeling workshops, for example:

- **Phase 1:** Focus on capturing Private Business Processes.
- **Phase 2:** Create Public Business Processes using an appropriate modelling notation (BPMN). Filter out those parts of the processes that have some kind of connection to entities outside of the company like other companies, governmental bodies or banks.
- **Phase 3:** Abstract and re-model the Public Business Processes to form abstract Collaboration Processes in BPMN notation. These will be the basis for creating executable models (i.e. in BPEL).

**Define appropriate mechanisms for transitioning between “generic” and “specific” process views and decide on the level of detail (or abstraction) by which all processes will be described. This is not an easy part since there the process/subprocess/task terms often are overlapped and may lead to confusion.**

**Avoid automating all the transactions of an enterprise at once.** Create instead an evaluation framework in order to pilot the solution to a limited set of processes and then start expanding it (spiral approach).

**Don't** model processes at different level of abstraction and use own custom terminology in each one.

**Avoid** laying emphasis on describing the workflow of a process and neglect the description of rules and documents.

#### Further points to keep in mind:

- ✓ Keep in mind that the BPMN notation is periodically **being revised** and in order to use the latest version of the Business Process Diagrams philosophy, the interested modellers should be updated.
- ✓ Process Modelling of the as-is situation shall guide the **business process re-engineering efforts**. When it comes to process transformation for governmental organizations, methodologies, like the Standard Cost Model (SCM), should be taken into account.

**Standards, methodologies are always good to be followed (also as a starting point). Major innovations and improvements come when you go beyond these.**

### 6.1.2 Enterprise IT Managers

#### **What to do when cooperating with a Public Body during the development of an eGovernment Project**

##### **During the design phase**

- ✓ Design the project, following open source design architectures and standards
- ✓ Choose from the eGIF Framework the rules that concern the services and the functions that this project should offer
- ✓ Apply all the mandatory rules of the Framework and check for the applicability of the non-mandatory ones
- ✓ Document the reasons for any non-mandatory rules in the Framework that cannot be applied to the project
- ✓ Search in the Public Processes Management System existing solutions concerning the description of services, documents, data and encodings
- ✓ Model the services and the data by providing analytical descriptions along with the relevant metadata
- ✓ Notify the Framework of the descriptions of new services, documents, data and encodings

##### **During the implementation phase**

- ✓ Extract from the Public Processes Management System the necessary XML schemata for the description of documents and services
- ✓ Study from the Public Processes Management System how to call the web services and ask for access permission the corresponding bodies that offer these web services
- ✓ Develop the services that the project is designed to offer in a way that they could also be used by other entities as well
- ✓ Notify the Framework of the new services provided by the project

##### **During the operational phase**

- ✓ Monitor business and legislative changes and adjust the corresponding functions and services of the project
- ✓ Notify the Framework of any alterations

### **Further recommendations concerning Data Modelling**

- ✓ Evaluate and **use existing standards** such as the OASIS Universal Business Language (UBL), the UN/CEFACT Core Component Technical Specification (CCTS) and the W3C XML schema.
- ✓ **Reuse available libraries** of Components, i.e. the “GENESIS Common Library” (GENESIS CL), the “UBL Common Library” (UBL CL) and the “UN/CEFACT Core Component Library” (CCL) in order to create a new Reusable Business Information Entity.
- ✓ Create a **common repository** of information modelling building blocks for all the business documents that have been modelled.
- ✓ Design **modular, extensible and flexible** XML Schemas that shall allow users not only to use predefined templates but also to customize / extend these templates according to their needs in compliance with a customization procedure.
- ✓ In the XML Schema design phase, **create namespaces** and comply with the naming and design conventions issued by UN/CEFACT NDR.
- ✓ Adopt or **develop standard codelists** for the most common values appearing in business documents that shall be reused by all stakeholders.
- ✓ Define appropriate mechanisms for transitioning between “generic” and “specific” documents and XML Schemas.

**Define in detail the change management processes, the roles involved and the permissions allowed to the modelers and use an iterative approach in the data modeling. Start with the most important/mandatory information. Try to enrich it in next iterations with less important information for the users.**

**Create a methodology** and use one single **modelling environment** that includes three types of modelers:

- ✓ **Business Users** who deal with business documents on a daily basis can identify the documents, the context of use and provide a basic description of information entities, as well as some metrics about the utilization of the documents (e.g. size, processing time).
- ✓ **Business Analysts** further detail documents by using the CCTS compliant artefacts (BBIes, ABIEs, ASBIEs, and CDTs). They should be skilled in Business Information Modelling according to the CCTS approach.
- ✓ **IT Specialists** create XML Schemas for the documents and develop adapters for a proper exchange of data between diverse IT systems and the GENESIS platform.

In this way, there is one unique entry point for gathering information about a business document rather than having separated descriptions in different tools or different files formats, which would lead to redundancies or inconsistencies.

Further points to keep in mind:

- ✓ Keep in mind that the UN/CEFACT CCTS and its Naming and Design Rules are **periodically under revision** and that the UN/CEFACT CCL is regularly updated, so the evolution at the premises of such a core components-based data modeling approach needs to be taken into account.
- ✓ Semantic annotators in the XML Schemas that transform XML data from a Web service message into a semantic model shall gain momentum through the **W3C Specification of SAWSDL** (Semantic Annotations for WSDL and XML Schema) in the near future.
- ✓ XML Schemas and / or the UN/CEFACT CCTS shall define **mechanisms for automatically handling** specific fields that are computed by the application of an algorithm.
- ✓ A methodology for examining the **compliance** of a specific XML Schema to the standardized generic XML Schema shall be foreseen and assess automatically, (with the help of appropriate validators), the points of non-conformance.



Figure 7: Interaction with the Greek e-GIF

#### 6.1.2.1 Recommendations concerning Architectural Design

Opt for a **centralized architectural approach**:

- ✓ when **monitoring service execution** is an **important** issue. There is one single instance (the hub) which is in charge of orchestrating services; it has the previously agreed services choreography definition available and can efficiently monitor the message exchange between the various involved parties

- ✓ where **fault detection** needs to be **as less complicated as possible**. In the case of the hybrid approach, monitoring and fault detection/ removal can be less complicated than in the fully decentralized approach as the hub has the global choreography available and may act as supporting institution
- ✓ when **security issues** are of **vital importance**. Authentication and authorization of users, tracking of user behavior, reliable messaging as well as information integrity can only hardly be realized without a coordinating institution (e.g., a central hub). Also, the assurance of seamless interoperability across company borders is simplified through the existence of a central entity.

**BUT:**

Opt for a **decentralized architectural approach** when features such as processing time, use of system resources and scalability are of importance.

- ✓ As parts of the initial choreography can be completed in parallel, the overall processing time for all stakeholders is reduced
- ✓ Decentral approaches are highly scalable as they allow users to independently find partners, negotiate and finally deploy service orchestration definitions independent from a central instance which may be overloaded otherwise.
- ✓ Large business process scenarios can run in parallel and on different machines without acquiring significant resources at the hub.

**Monolithic, centralized architectures that focus only within the enterprise, and not on business partners and customers, are worthless. Novel Hybrid architectural models need to be adopted in order to make real the loosely coupled enterprise, and push for an increasing capability to collaborate among all kinds of applications.**

In such models **semantic interoperability precautions** need to be taken to achieve:

- Decentralized service orchestration and execution but still through a central support for the initiation and negotiation of the actual service composition.
- Peer processes can be modelled and generated centrally with the help of the UMM-based choreography design interface, whereas execution is conducted decentrally, thereby allowing for simultaneousness and improving the overall system scalability.
- Monitoring of the business processes, fault removal as well as security mechanisms can be deployed more easily in this setting than in a mere peer-to-peer approach, while end-point complexity remains comparatively low.

**DON'T opt for a decentral architectural approach when complexity and risk of errors need to remain low, because:**

- In the case of decentral service orchestration, the negotiated choreography scripts must be available at each of the client applications and must be interpreted and compared to the actual flow sequence simultaneously by all involved parties, thereby increasing complexity and the risk for errors.
- In a highly decentralized setting, many different repositories as well as locally installed modelling interfaces need to be updated and reconfigured in case of changing requirements.
- In decentral approaches induce the need for a significant “footprint” on the client side. As registry, modelling and negotiation functionality, template repositories and BPEL generation tools need to be installed decentrally,

**Especially in case of SMEs, such local installations may represent major hurdles to the quick adoption among a wide mass of users.**

**DON'T opt for a decentral architectural approach** in systems where fault detection and removal is needs to be seamless and straightforward. Specific resilience protocols must be developed and employed to discover and appropriately react on malfunctions of any of the involved parties. In case one service does not respond as expected, other peers need to interrupt their “process pieces” and restart them at the proper process state of completion as soon as the conflict has been resolved.

**A fully centralized approach in systems that need to be robust 24/7 available and 100% failure-free should be avoided.**

One disadvantage of the centralized approach concerns the risk of a single-point-of-failure: In case of a server malfunction, the overall business process has to be stopped. In case an error occurs in the decentralized approach, peers may be able to localize the erroneous service provider and continue the process without it.

Modern enterprises need to **align into virtual alliances**, while responding effectively and swiftly to competitive challenges. SOA is emerging as a dominant technological

approach addressing the requirements of service requesters, providers and service brokers, regarding loosely coupled, standards-based, and protocol-independent distributed computing and offering ways to achieve the desired levels of business integration effectively, mapping IT implementations more closely to the overall business process flow.

**Novel approaches regarding service composition are emerging.** Keep your attention on event-driven service composition which constitutes quite a promising approach.

**Future ESBs** will provide a multitude of features apart from supporting the technologically-based orchestration and execution of known underlying services. Such capabilities include:

- Advanced approaches in service orchestration (e.g. implementing event-driven or rule-driven service orchestration).
- “Intelligent” routing of underlying services based on underlying semantics and rules, service compensation in case of service failover or low quality.
- Provisioning, integrity and security of message exchange.
- Service management, service description/publication/discovery functions that extend conventional SOA using emerging semantic-oriented standards (SA-WSDL, WSMO, Micro-WSMO, WSMO-Lite, OWL-S, etc)

#### **6.1.2.2 Recommendations concerning Open Source Technologies**

Currently, **open source technology frameworks** are quite progressed in order to support the implementation of an eTransaction platform to the full extent.

It is recommended to:

- ✓ Struts as a web application framework
- ✓ Spring for an application container, transaction and fault handling
- ✓ Hibernate for data mapping and as a persistence framework
- ✓ Castor and OSK also for data mapping
- ✓ Mule ESB for Inter-process communication
- ✓ Acegi as a security framework
- ✓ Jasper report for reporting

When choosing open source technologies to implement the several part of an eTransactions platform opt for technologies with a **high level of maturity, broad and active user community and a high level of integration among them.** This will ensure robustness, existence of alternative implementations and interoperability.

In implementing eTransaction systems never opt for immature and community agnostic technological approaches irrespectfully of the level of functionality or the benefits they envisage. The low level of adoption and visibility of the technology raises the **risk of potential deadlocks** in the implementation procedure and low interoperability among the platform components.

Open source technologies and corresponding open source technologies development tools are constantly becoming more integrated. On the basis of common standards different (in terms of origination) **open source technologies for business process management, service composition and execution, inter-process communication, data transformation, security** will be able to be used as a coherent technological stack for the implementation and deployment of eTransaction environments. Additionally, all the more open source development environments adopt open and emerging standards such as BPEL, SA-WSDL and SBVR.

### *6.1.2.3 Challenges for consideration<sup>49</sup>*

#### **The ISUs**

We use the term Interoperability Service Utility (ISU) to denote this overall system. The ISU is envisaged to provide interoperability as a technical, commoditised functionality, delivered as services.

Value-added functionalities, for which customers would be willing to pay a premium, would flow above the ISU. Conceptually, the ISU constitutes the next “layer” of open cyberspace, sitting atop the Internet and the Web. The implicit proposition is that interoperability as a technical functionality is a public good – the ISU is available for all to use, exploit and build upon. Accordingly, the ISU would be particularly useful and attractive for SMEs and start-up companies. The ISU Grand Challenge is concerned with exploring the ISU design principles, potential services, business case and ownership issues, and potential regulatory implications.

#### **Web Technologies for Enterprise Interoperability**

There is no doubt that the Web will in time become a basic building block of future enterprises. The focus is on value creation through the delivery of novel and improved services by these next-generation solutions. The proposed research areas are

- ✓ **Enterprise Interoperability Operating System (OS)** for enabling client-side application delivery,
- ✓ **“Mash-up” technology solutions** for building derived services based on combined distributed content databases of third parties,
- ✓ **Web Service Logic Execution Environment (SLEE)** solutions for minimising system integration costs of heterogeneous elements in different enterprises, and
- ✓ **Web community solutions** that ensure that benefits are accrued to the appropriate transacting parties.

The next phase enabled by Enterprise Interoperability is the sharing of knowledge within a **Virtual Organisation (VO)** to the mutual benefit of the VO partners. Here, **Knowledge-Oriented Collaboration** addresses two primary needs identified by

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<sup>49</sup> D6.1, Interoperability Guide, 2nd edition, 1st version, Greek Interoperability Center, National Technical University of Athens, 15 February 2009

enterprises in successfully forming and exploiting VOs, namely rapid and reliable formation of collaborative consortia to exploit product opportunities, and the application of enterprise and VO knowledge in operational and strategic decision making in VOs, leading to enhanced competitiveness and profitability. To this end, nine research areas are identified. These research areas focus on knowledge to set up and operate VOs, and on sharing knowledge within a VO.

The potential value of Enterprise Interoperability goes beyond the technical domain to much broader developments in business, the economy, and the society. Therefore, Enterprise Interoperability must leverage those developments in order to maximise the value. To do so, Enterprise Interoperability critically needs to be established on a **more solid and rigorous base of science and, specifically, scientific principles.**

Therefore, it is crucial to create the necessary Science Base for Enterprise Interoperability, by combining and extending the findings from other established and emerging sciences. These include, subject to further investigations,

- ✓ Systems/Complexity science,
- ✓ Network science,
- ✓ Information science,
- ✓ Web science,
- ✓ Services science,
- ✓ Economic science, and
- ✓ Social sciences.

The science base is expected to comprise a new set of concepts, theories, and principles derived from established and emerging sciences; and associated methods, techniques, and practices for solving Enterprise Interoperability problems.

### 6.1.3 Enterprises Managers

In order to identify and describe legal rules in such a way that they can be efficiently modelled, the steps sited below should be followed:

- ✓ The **focus is always on the transactions** to be incorporated in the system.
- ✓ For each transaction **identify the legal framework** (laws, decrees, acts, etc) that are associated with it.
- ✓ For each piece of legal framework **try to identify passage(s)** that affect specific aspects of the transaction (fields of application), for example
  - Flow of the business processes involved – i.e. specific decision points that affect the outcome.
  - Content of the exchanged documents – i.e. mandatory and optional fields.
  - Roles – responsibilities and obligations – of the engaged parties.
  - Specific requirements that have to do with security, authentication, accountability, protection of privacy, etc both in the manual and electronic way of conduct.
  - Specific requirements for infrastructures – i.e. electronic signatures, trusted third parties, digital certificates, bandwidth, information systems, etc
- ✓ **Analyze the identified passages** and state the legal rule(s) that stems from them by providing:
  - A clear phrasing.
  - A condition/ event that triggers the rule into effect (if possible)
  - The accompanying actions on that the rule occurs during its application

Find distinct fields of application for each of the actions that the rules brings about that can associate them with processes and / or documents – for example points or decisions in the process flow of a transaction, content of the exchanged documents, responsibilities and obligations of the engaged parties in a transaction, constraints for specific actions or necessary infrastructures.

Also, remember:

**Have a clear understanding on the viewpoint on legal rules, which aspects are covered and which are left out by the model and try to eliminate the degree of subjectivity into the procedure.**

**Express legal rules in a clear and straightforward phrasing after having taken into consideration all the pertinent passages of the framework and all their relevant interpretations.**

Implement electronic transactions that meet the most rigid European legal requirements in terms of document storage, electronic signatures, recognition of Certification Authorities (CAs, or CSPs - Certification-Service-Providers - in EU terminology) and time-stamping procedure, for example, as any other solution would risk being invalid in stricter countries.

Don't confuse the domain of discourse of legal rules with the one of business rules: Every issue that stems from the underlying legal and statutory framework may constitute a legal rule whereas issues that drive from the enterprise's policy although they may related to the legal and statutory framework they constitute business rules.

**Don't state a legal rule simply by citing the passage of the framework from which it is derived since this leaves significant margins for multiple interpretations.**

Legal Information Bases and Registries in the direction of MetaLex shall gain momentum for storage of the formal definitions and interpretations of executable legal rules and frameworks in the near future.

Promising standards for describing Rules – and effectively Legal Rules – are rapidly emerging, keep your eyes on SBVR (Semantics of Business Vocabulary and Business Rules), RIF (Rule Interchange Format), and PRR (Production Rule Representation) and their degree of acceptance by the scientific and business community in creating rules' vocabularies and ontologies.

## 6.2 Public Sector

In order to render the several services and systems of the various administrations throughout Greece, able to interrelate in order to serve, supplement and enrich each other, with a view to providing pan-European eGovernment services, a set of standards and guidelines that describes the way in which organisations have agreed, or should agree, to interact with each other, is important to be formed. Such a set, is the so-called interoperability framework.

**Member States Public Administrations should use the guidance provided by the European Interoperability Framework (EIF)** in order to introduce a pan-European dimension into their own interoperability frameworks and administrative infrastructures and therefore, enable interoperable pan-European eGovernment services. Also, adherence to the EIF should be mentioned in all Member States national interoperability frameworks.

### 6.2.1 Underlying Principles of European Public Services<sup>50</sup>

The eEurope Action Plan 2005 as well as the Decisions of the European Parliament, the Council and the Commission have adopted and promoted a set of general principles which should be respected for any eGovernment services set up at a pan-European level.

Accordingly, the most significant considerations and recommendations of the European Interoperability Framework are based on the principles that are being presented below:

#### 6.2.1.1 User Centricity

Public services are provided to serve the needs of citizens and businesses. More precisely, those needs should determine what public services are provided and how public services are delivered.

Generally speaking, citizens and businesses will expect:

- Access to user friendly services in a secure and flexible manner allowing personalization and with full respect of privacy
- To provide any given piece of information only once to the government;
- To access a single contact point even when multiple administrations have to work together in order to provide the service
- Multichannel delivery allowing access to services anyhow, anywhere, anytime

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<sup>50</sup> <http://ec.europa.eu/idabc/en/document/7728>

### **6.2.1.2 Inclusion and Accessibility**

The use of ICT should create equal opportunities for all citizens and businesses due to open, inclusive services that are publicly accessible without discrimination.

Inclusion aims to take full advantage of opportunities offered by new technologies to overcome social and economic disadvantages and exclusion. Accessibility aims at ensuring people with disabilities and the elderly access to public services so they can experience the same service levels as all other citizens.

Inclusion and accessibility have to be considered throughout the whole development lifecycle of a European Public Service regarding design, information content and delivery.

Inclusion and accessibility usually encompass multichannel delivery. Traditional service delivery channels may need to co-exist with new channels established using technology, giving citizens a choice of access.

Inclusion and accessibility can also be furthered by the capability of a system to allow a third party to act on behalf of citizens who are unable, either permanently or temporarily, to directly make use of public services.

### **6.2.1.3 Security and Privacy**

Citizens and businesses must be assured that they interact with public administrations in an environment of trust and in full compliance with the relevant regulations, e.g. on privacy and data protection. This means that public administrations must guarantee that the privacy of citizens and the confidentiality of information provided by businesses are respected.

Within the necessary security constrains, citizens and businesses should have the right to verify the information administrations have collected about them and to decide whether this information may be used for purposes other than those for which it was originally supplied.

### **6.2.1.4 Simplification of Administrative Processes**

Businesses compile large amounts of information, often solely because of legal obligations, which is of no direct benefit for them and not necessary for achieving the objectives of the legislation imposing the obligations. This creates a considerable administrative burden<sup>51</sup> that can be expressed as a cost incurred by businesses.

It is also widely recognised that there is a high redundancy in information to be provided by citizens to public administrations. Repeated requests by different administrations for the same information place a similar administrative burden on citizens who waste time compiling data and filling in forms with the same information over and over again.

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<sup>51</sup> [http://ec.europa.eu/enterprise/admin-burdens-reduction/faq\\_en.htm](http://ec.europa.eu/enterprise/admin-burdens-reduction/faq_en.htm)

When establishing European Public Services, eliminating the request for unnecessary or redundant information may require reorganisation and reengineering efforts in the public administration's backoffices.

#### **6.2.1.5 Transparency**

Citizens and businesses should be able to understand administrative processes. They should have the right to track administrative procedures that involve them, and have insight into the rationale behind decisions that could affect them.

Transparency also allows citizens and businesses to give feedback about the quality of the public services provided, to contribute to their improvement and to suggest the implementation of new services.

#### **6.2.1.6 Preservation of Information**

Records<sup>52</sup> and information in electronic form held by administrations for the purpose of documenting procedures and decisions must be preserved. The goal is to ensure that records and other forms of information keep their legibility, reliability and integrity over time and can be accessed taking into account security and privacy.

In order to guarantee long-term preservation of electronic records and other kinds of information, certain formats should be selected so as to ensure long-term accessibility, including preservation of associated electronic signatures and other electronic certifications, such as mandates.

For information sources owned and managed by national administrations, the preservation is a purely national matter. For European Public Services and for information that is not purely national preservation becomes a European issue and the necessary "preservation policy" has to be foreseen.

#### **6.2.1.7 Openness**

Within the context of the EIF, openness is the willingness of persons, organisations or other members of a community of interest to share knowledge and to stimulate debate within that community of interest, having as ultimate goal the advancement of knowledge and the use thereof to solve relevant problems. In that sense, openness leads to considerable gains in efficiency.

Interoperability involves the sharing of information and knowledge between organisations, hence implies a certain degree of openness. There are varying degrees of openness.

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<sup>52</sup> As defined by the MODEL REQUIREMENTS FOR THE MANAGEMENT OF ELECTRONIC RECORDS

(MOREQ: <http://ec.europa.eu/idabc/servlets/Doc?id=16847>) a record is Document(s) produced or received by a person or organisation in the course of business, and retained by that person or organisation. Note: a record may incorporate one or several documents (e.g. when one document has attachments), and may be on any medium in any format. In addition to the content of the document(s), it should include contextual information and, if applicable, structural information (i.e. information which describes the components of the record). A key feature of a record is that it cannot be changed.

Specifications, software and software development methods that promote collaboration and the results of which can freely be accessed, reused and shared are considered open and lie at one end of the spectrum while non-documented, proprietary specifications, proprietary software and the reluctance or resistance to reuse solutions, i.e. the "not invented here" syndrome, lie at the other end.

The spectrum of approaches that lies between these two extremes can be called the openness continuum. European public administrations need to decide where they wish to position themselves on this continuum with respect to the issues discussed in the EIF. The exact position may vary, on a case-by-case basis, depending on their needs, priorities, legacy, budget, market situation and a number of other factors. While there is a correlation between openness and interoperability, it is also true that interoperability can be obtained without openness, for example via homogeneity of the ICT systems, which implies that all partners use, or agree to use, the same solution to implement a European Public Service.

#### **6.2.1.8 Reusability**

##### **Re-use is the key to the efficient development of European Public Services.**

Re-use means that public administrations confronted with a specific problem seek to benefit from the work of others by looking at what is available, assessing its usefulness or relevancy to the problem at hand, and decide to use solutions that have proven their value elsewhere. This implies that public administrations must be willing to share with others their service components. Re-use and sharing naturally lead to collaboration, i.e. working together towards mutually beneficial and agreed common goals.

For the specific case of Open Source Software, the European Commission has set up the Open Source Observatory and Repository (OSOR)<sup>53</sup> and developed the European Union Public Licence (EURL)<sup>54</sup> to assist, among others, public administrations to share and re-use open source software components and/or to collaborate on their development and improvement.

#### **6.2.1.9 Technological Neutrality and Adaptability**

Public administrations should focus on functional needs and defer decisions on technology as long as possible in order to avoid imposing specific technologies or products on their partners and to be able to adapt to the rapidly evolving technological environment. Public administrations should render access to public services independent of any specific technology or product.

#### **6.2.1.10 Effectiveness and Efficiency**

Public administration should ensure that solutions serve businesses and citizens in the most effective and efficient way and provide the best value for taxpayer money.

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<sup>53</sup> <http://www.osor.eu/>

<sup>54</sup> <http://ec.europa.eu/idabc/eupl>

There are many ways to take stock of the value brought by public services solutions, including consideration such as return on investment, total cost of ownership, increased flexibility, reduction of administrative burden, increased efficiency, reduction of risk, transparency, simplification, improvement of working methods as well as recognition of public administration achievements and competencies.

#### **Key aspects to remember for achieving Interoperability**

- ✓ **Infrastructure:** Are the services of the Administration with the necessary technological infrastructure?
- ✓ **Procedures:** Are the processes of administration the appropriate structure and interface to use ICT?
- ✓ **Access:** Do citizens and businesses have adequate access to computing and communication tools?
- ✓ **Skills:** Are executives of Public Administration and Local Government and the people the necessary skills?

#### **6.2.2 Public Sector IT Managers**

Concerning the implementation of the **electronic Government Interoperability Framework**<sup>55</sup> and according to the recommendations of this framework, Public Sector IT Managers should bear in mind the following directions:

##### **When developing Public Administration information systems**

- ✓ Assist the development of standards-compliant products, services and applications
- ✓ Promote the reuse of common codelists, vocabularies, process models and data schemas, resulting in better quality and lower cost products and services
- ✓ Promote the standardization of Calls for Tender requirements, for the development of Public Administration information systems

##### **When developing a web site**

- ✓ Make all the suitable actions in order to ensure the availability of the site
- ✓ Ensure the accessibility to the content of the Web Site
- ✓ Make the necessary actions that would facilitate its content navigation
- ✓ Ensure a friendly appearance checking the suitability of its graphics and visual effects

##### **When developing an information network, based on open source models and architectures**

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<sup>55</sup> <http://www.e-gif.gov.gr>

- ✓ Choose technological models from eGIF and document your selection
- ✓ Ensure the security and the reliability of the information system
- ✓ Find and develop from eGIF documents, data descriptions and services
- ✓ Develop suitable interfaces for interoperable communication with other systems
- ✓ Apply suitable user authentication methods
- ✓ Apply suitable procedures for login and user authentication in electronic services
- ✓ Manage properly user authentication data considering rules of eGIF
- ✓ Protect user private data

Concerning **Semantic Interoperability**, IT Managers of Public Administrations should focus on the development of

- ✓ Promotion of **data modeling** and development of common "data forms" and common XML templates for Public Documents and exchanged information, based on international standards and taking into account the agreed core eGovernment data elements
- ✓ Common Data Dictionaries

According to the **international experience**, IT Managers of Public Administrations should also focus on

- ✓ Implementation of **interoperability standards** to projects and information and communications products and contribution to shaping the Framework for Interoperability
- ✓ Adoption of the **European Interoperability Framework** in
  - the development of new information systems
  - the **reorganization** of existing **processes** and
  - the development of **data formats** across the whole Public Sector
- ✓ Development of **Interoperability Infrastructures** for the integrated management of services and the development and provision of Web Services offered from Public Administrations and Business
- ✓ Promote **Process Modeling** and **Process Re-engineering** to reduce Weightlifting Managing and streamlining of services, while adapting the legal framework

### 6.2.3 Public Sector Managers

Concerning the implementation of the **electronic Government Interoperability Framework** and according to the recommendations of this framework, Public Sector Managers should bear in mind the following directions:

#### **When monitoring**

##### The development of a Web Site

- ✓ Define procedures for managing and supporting the operation and then, assign roles
- ✓ Acknowledge the target audience that would be interested in the Web Site's content and services and then, try to satisfy its needs
- ✓ Ensure that the content of the Web Site is correct, updated and understandable
- ✓ Be sure to provide the greatest possible number of integrated electronic services
- ✓ Be sure to make publicly available the services that the Web Site offers

##### The development of an Information System

- ✓ Be sure to **adjust the legal framework** that governs the performance of each service in an environment of e-government
- ✓ For each service, **be aware** of the points of contact with citizens and businesses, as well as the prerequisite documents from other agencies or organizational units of the Public Administration
- ✓ Be sure to disengage the final recipient of a service from a number of administrative processes, by **finding and providing** all the prerequisite administrative documents
- ✓ Describe and publish **comprehensive services** supported by the system
- ✓ Be sure to select an appropriate method of **user identification**
- ✓ **Evaluate** the confidentiality and relevance of the data involved in the provision of electronic services
- ✓ Acknowledge the **legal obligations** on the management of data
- ✓ Choose the appropriate **legal framework** in e-Government based on the assessment of data

##### Other recommendations:

- ✓ Develop new services and products with high added value and competitiveness at international level
- ✓ Training and certification of knowledge management in the specification and development of systems for the Public Sector, based on new standards
- ✓ Development and operation of central pilot systems which offer services of a completely new level of quality (examples in Greece: ERMIS, TAXIS-NET)
- ✓ Development of Infrastructures that measure the Quality of Service (QoS) on a daily basis, throughout the whole Public Services (models evaluation and

impact assessment, based on realistic facts): "If you cannot measure it, you cannot manage it"

- ✓ Concerted action Education and Management Skills of the staff of the Public Sector
- ✓ Emphasis on promotion of new services for civilian use and to reduce the digital divide. It is a pity to recreating a climate of exclusion of "digital lagging"

#### 6.2.4 Public Sector Local Administrations

General guidelines to achieve **Organisational Interoperability**:

- ✓ **Follow the services:** The requirements for pan-European eGovernment services should be jointly determined by the participating administrations via a demand driven approach<sup>56</sup>.
- ✓ Define **Business Interoperability Interfaces (BII)** through which their business processes will be able to interoperate to contribute to the delivery of a European Public Service
- ✓ Public administrations should document their business processes and agree on how these processes will interact
- ✓ Public administrations collaborating on the provision of European Public Services should define rigorous change management processes in order to ensure continuous delivery of such services

General guidelines to achieve **Semantic Interoperability**:

- ✓ Public administrations should support the establishment of both **sector-specific** and **cross-sectoral communities** aimed at facilitating semantic interoperability and should encourage the sharing of results produced by such communities through national and European platforms

**Public administrations should agree on the standards and specifications to be used to ensure technical interoperability when establishing European Public Services.**

**At front-office level, technical interoperability aspects should be considered for the following fields:**

- ✓ Data presentation and exchange
- ✓ Accessibility - Interface design principles
- ✓ Multi-channel access
- ✓ Character sets
- ✓ Collective authoring
- ✓ File type and document formats

<sup>56</sup> see the 20 core services of eEurope service map

- ✓ File compression

**And at back-office level, technical interoperability aspects should be considered for the following fields:**

- ✓ Data integration and middleware
- ✓ XML-based standards
- ✓ EDI-based standards
- ✓ Web Services
- ✓ Distributed Application Architecture
- ✓ Interconnection services
- ✓ File and message transfer protocols
- ✓ Message transport and security
- ✓ Message store services
- ✓ Mailbox access
- ✓ Directory and domain name services
- ✓ Network services

**Security aspects to be considered,** concern all layers:

- ✓ Security services
- ✓ General security services
- ✓ PKI
- ✓ Web service security
- ✓ Firewalls
- ✓ Protection against viruses, worms, Trojan horses and e-mail bombs

### 6.3 Citizens - Others

e-Government is essentially about government better serving the needs of the citizen. The e-GIF is an enabling framework for delivering the services seamlessly and coherently. The government welcomes and encourages citizens to provide comments, suggestions and innovations that may help it to improve information access and service delivery. The website <http://www.govtalk.gov.uk> is available for these consultations.

One of the most important key changes that are required across government channels in order to focus on citizen and business needs, is the engagement of citizens and businesses in a more active and complete way, in the design and delivery of public services, establishing principles that underpin a coordinated multi-channel approach to government delivery and a move to making e-services the primary channel for information and transactional services.<sup>57</sup>

Concerning the citizens, **Public Sector and Enterprises should**

- Improve satisfaction by offering high quality government and e-business services and by reducing the expected service delivery time
- Enable access to e-government and e-business services through multiple channels
- Allow easier search and retrieval of information for e-government and e-business services
- Enhance citizen trust by providing high level of quality, reliability, credibility and transparency, when using e-government and e-business services

And respectively, **citizens should always make the right actions and movements in order to ensure their abovementioned rights when using e-business and e-government services.**

Citizens and businesses will judge the quality of public services they receive by each contact they have with a public sector employee or organisation and in comparison to the services offered by the private sector. Citizens and businesses will be able to judge relative performance, creating more challenges for government to provide services that meet the standard of the best of the private sector.

#### **Three eGOV Interoperability Rules to Remember:**

- ✓ **Target organisational and semantic aspects first: Technical standards exist already**
- ✓ **Follow the services: Build your guidelines around the actual, most common services**
- ✓ **Enable all stakeholders (public administrations) and allow for constant evolution and change**

<sup>57</sup> [http://www.hm-treasury.gov.uk/d/pbr06\\_varney\\_review.pdf](http://www.hm-treasury.gov.uk/d/pbr06_varney_review.pdf)

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