Information Technology Standards – a Viable Solution to Reach the Performance

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Abstract: - As nowadays the information systems are "the heart of a business", because "organizations are more dependent than ever on the reliable operation of their information systems"[1]. Therefore it is obvious that the need of the application of some standards in the Information Technology field is a very high one. As in any other industry, standards in Information Technology area contribute to support products reliability, enrichment and development of capabilities, besides project management tools as policies, rules, work procedures and software development methods and methodologies. In two words, the standards bring quality and *performance*. In this paper, we will proceed to the analysis, presentation and comparison of the current most important Information Technology standards, in the fields of *Information Technology Governance, Enterprise Application Integration, Geographic Information Systems, information systems testing* and *information security*.

Key-Words: - Information Technology standards, information systems performance, Information Technology Governance, Enterprise Application Integration, Geographical Information Systems, testing standards, information security

1 Introduction

Simply stated, the quality is very important. It contributes to the *performance* of the information systems.

Today most companies developing software products focus on quantity and not quality. This thing gives rise to a series of problems of the information systems used in companies or in state institutions. Usually, if an important error is not discovered during *testing phase*, the major risk is to be reproduced when the project is already implemented in production, bringing about substantial losses for the company or the institution the system belongs to, because "the continued growth in the use of information technologies for business purposes makes business organizations increasingly dependent on their information systems"[2]. On the other hand, the use of the mechanisms, methods, and models pertaining to the *Information Technology (IT) Governance*, *Information Technology (IT) security, Enterprise Application Integration (EAI)* fields or the use of the *information systems*, in the lack of some standards applied to the initial development, may lead to a "real failure" at the end of the project. That is why the use of some standards in the Information Technology (IT), regardless of the field in which the system is developed is absolutely necessary in order to obtain, in the end, a quality product.

Standards create concepts and use them to simplify, organize, manage and make the delivery process more efficient by reducing costs and increasing scope and quality.

2 Closer to… the *Performance* of the Information Systems

Due to the companies' need to gain *performance*, to be "on top" or at least to set such an objective, the application of some standards – be *IT Governance* or development of some "special" information systems specific to a particular economic sector, such as *Geographic Information Systems (GIS)* or *EAI* – has become a prerequisite in achieving success.

2.1 IT Governance Standards

The application of standards in the field of IT is closely linked to the concept of IT Governance. „IT Governance is a subset discipline of Corporate Governance focused on information technology (IT) systems and their *performance* and risk management."[www1]. In time, the concept of IT Governance has been assigned different definitions. Thus, the University of Tasmania defines IT Governance in the following way: „IT Governance is the strategic alignment of IT with the business such that maximum business value is achieved through the development and maintenance of effective IT control and accountability, *performance* management and risk management."[3], and the International Committee for Information Technology Standards (INCITS), CGIT1 Corporate Governance of IT has defined the concept of IT Governance on its site like this: "Governance of IT incorporates the mechanisms, methods, and models which ensure the conformance of IT to underlying and required policies, regulations, laws, and ethical guidelines."[www2].

"The primary goals of IT Governance are to assure that the investments in IT generate business value, and to mitigate the risks that are associated with IT."[www3] Therefore, the working principles (described by the IT Governance Institute (ITGI)) are easily to be inferred giving birth to the IT Governance concept: ensuring IT is aligned with the business; ensuring IT delivers value to the business; ensuring IT manages risk; ensuring IT manages *performance*; ensuring IT manages resources.

Under the above mentioned circumstances, it is obvious that the principles stated couldn't be put into practice without the help of some standards. At present, there is only one standard AS8015 in this field. AS8015 was proposed in 2005 by the de Australian Standard for Corporate Governance of Information and Communication Technology and adopted as ISO/IEC 38500 in May 2008.

ISO/IEC 38500:2008, Corporate governance of information technology can be applied to organizations irrespective of their size, including governmental administrations and non-profit organizations. „The framework comprises definitions, principles and a model. It sets out six principles for good corporate governance of IT that express preferred behavior to guide decision making: responsibility, strategy, acquisition, *performance*, conformance, human behavior. The purpose of the standard is to promote effective, efficient, and acceptable use of IT in all organizations by:

- assuring stakeholders that, if the standard is followed, they can have confidence in the organization's corporate governance of IT;
- informing and guiding directors in governing the use of IT in their organization;
- providing a basis for objective evaluation of the corporate governance of IT."[www4]

It is important to mention the fact that this standard is a guideline for good practices in the field of IT Governance but it does not state exactly how they should be implemented.

Except for the ISO/IEC 38500:2008 standard, there are also a number of good practices and methodologies which complete the ISO/IEC 38500:2008 standard and which can be consulted and followed by managers. Here are some of these practices and methodologies: "CobiT, ITIL, ISO 27001/27002, ISO 20000, Prince2, PMBOK, TOGAF, IT balanced scorecards, the Zachman Enterprise Architecture, IT portfolio management, IT dashboards"[www5].

2.2 Standards for EAI

By definition, EAI refers to "*the process of integrating multiple applications that were independently developed, may use incompatible technology, and remain independently managed*" (Integration Consortium). Within its two basic components, Business Process Integration (BPI) and Enterprise Information Integration (EII), EAI it's the most commonly and efficient approach in complex software development and "a strong and important issue when discussing about information systems efficiency"[4]. The software integration process requires a lot of resources to successfully accomplish objectives. As heterogeneous systems must inter-connect and inter-communicate as an integrated, complex, complete and coherent system, all systems parameters should interfere in order to assure compatibility and combined inter-operability.

EAI standards refer to methodologies, work procedures, guidelines and rules that must be applied in the process of information systems integration. They also refer to EAI best practices like XML based technologies, service oriented capabilities, used to standardize the exchange of information and business functionalities exposure between disparate systems.

Project resources like standards, architectural principles, independent existing software products, software integration experience, hardware and software technologies, time, people and money form some basic software integration process requirements.

Using standards, a common set of principles, rules and guidelines, lead the integration process from a heterogeneous information systems independence to complete and coherent integration, having as a result a fully reliable and complex integrated software product. Standards mean quality and efficiency; they create more performant and predictable software products, offering at the same time a tool for consistency, coherency, integrity, confidence and faster communication.

Software integration activities are strong related to standards usage. Disconnected information systems will be integrated by different development activities lead by heterogeneous teams, so using standards is a primary rule for efficient communication and integration prototype realization. Companies spend a lot of resources of annual IT budgets on integration. They need an infrastructure to link the explosion of new software applications and data sources, keeping pace with the volume of enterprise data, business partners, suppliers and customers.

Among the features that standards usage offers in the process of software information systems integration, the following can be included: increased productivity, allowing developers to reduce the demands and time of writing new code for the integration of two or more software products; ability to access real time information and support, regardless of platform used, including mainframe environments, different operating systems, hardware variety, target users, heterogeneous businesses having each of them distinct specific activities; optimization based on costs, allowing inter-connected enterprises to reduce time spent to unify search operations, reporting, integration between different information systems. Time spent on writing standards and unifying guidelines and rules leads to work quality, *performance* and efficiency, it allows customers to accelerate business integration processes, and developers to increase productivity in terms of supporting integration projects. Software integration standards and distributed capabilities also allow enterprises to access and integrate information in real time.

EAI standards are commonly used to fasten development of complex software projects, they improve development and deployment agility and offer conceptually appropriate solutions, open standards at any level, a complete independence between functionalities exposed as services. Besides software creation, EAI standards also fasten the process of software products delivery, through methodologies and practices used in software development lifecycle stages.

In terms of project management purposes and project coordination, EAI standards allow predictability, project planning and an easier management of project phases. Within iterations in integration process stages and also cross project milestones, all project resources respect the same principles of software delivery in order to obtain deliverables in time and budget. Project scope, budget and schedule are easily to maintain when working organized and based on standards, keeping at least the same quality target as the initial purpose. Many EAI projects exceed deadlines and schedule, on the one hand, and budget, on the other hand, so techniques to monitorize and predict terms of delivery become a necessity and EAI standards are one of the best practices to control the process.

2.3 Standardization in GIS

The most known standardization organization on the GIS field is the Open Geospatial Consortium (OGC). This is a not for profit organization who's mission is to develop publicly available interface standards [www7]. The second important standardization organization is ISO Technical Committee of Geographic Information/Geomatics ISO/TC 211.

OGC's standards are implemented in software by both GIS vendors and GIS open source community in their applications. The standards provide an open set of common abstractions for describing, managing, rendering, and manipulating geometric and geographic objects within an application programming environment, expressing geographical features, requesting geo-registered map images from one or more distributed geospatial databases.

The GIS systems work mainly with geospatial data and, in order to store this kind of information in one single column and to be able to work with it, one spatially-enabled database must have defined a special geometry object with several mandatory attributes and methods defined in the OGC standard "Application objects". The main methods defined by OGC for the geometry object are: GetCoordinateReferenceSystem(), GetBoundry(), GetDistance(), GetCentroid(). The database systems who provide extensions to support the management and analysis of spatial data in a relational database system have implemented the specifications from international standard ISO/IEC 13249 SQL/MM, discussed in details in paper [7].

The most used OGC's standards regarding the methods to store and visualize geospatial data (vector or raster data) are: Geography Markup Language (GML), Keyhole Markup Language

(KML), Style Layer Descriptor (SLD), Scalable Vector Graphics (SVG), Joint Photographic Experts Group (JPEG) , GeoTIFF (Geo Tagged Image File Format). A comparison of these standards is shown in table 1. GML is a standard for storing the geospatial vector data and it is used most of the times together with SVG or SLD which define how to visualize the data. KML is a standard which defines both how to store and how to display geospatial data. GeoTIFF and JPEG are standards describing how to store raster data, the main difference between them is that GeoTIFF does not need an auxiliary file for georeference, the information is simply stored in the header of the file.

	SLD	GML	KML	SVG	GeoTIFF	JPEG
OGC open standard	√	√	√	√	√	√
XML type file	√	√	√	√		
Stores geospatial 2D vector data		√	√			
Stores geospatial 3D vector data		√				
Stores geospatial raster data					√	√
Describe how to display geospatial data on the map	√		√	√		
Describe how to navigate on the map			√			

Table 1 - Comparison between main OGC's standards regarding geospatial data.

Other very important standards in GIS world are the Well Known Binary (WKB) and Well Known Text (WKT) representations for geometries, which are described in the international standard ISO 19125-1, "Geographic information- Simple feature access". The Well-known Binary Representation for Geometry (WKBGeometry) provides a portable representation of a geometric object as a contiguous stream of bytes [www7]. It permits geometric object to be exchanged between an SQL/CLI client and an SQL-implementation in binary form. Well-known text (WKT) is a text markup language for representing vector geometry objects on a map, spatial reference systems of spatial objects and transformations between spatial reference systems. Geometric objects that can be represented with WKT are: points, lines, polygons, TINs and polyhedrons [www1].

Regarding the mechanism of rendering the geospatial data from a data store into a map, OGC has defined the international standard for Web Mapping Services (WMS). In reference work [8], it is specified that the OGC's services are based on a set of standards that are popularly called RESTful web services. This means that all the queries are going to be simple HTTP GET requests, the service will be called using an URL prefix to which additional parameters are appended in order to construct a valid operation request. The reference standard defines three operations for a WMS: mandatory GetCapabilities and GetMap, and optional GetFeatureInfo. A GetCapability operation is a XML document showing what the server offers. Upon receiving a GetMap request, a WMS shall either satisfy the request, returning a map, or issue a service exception.

Due to the complexity of GIS software, there are a lot of defined standards in this field, but they can be mainly categorized as: spatial data standards, metadata standards, database standards, and web services standards.

3 When the *Performance* Is Seen as... Quality and Security...

In our days, we have to learn that for an IT project, it is not enough to satisfy only the requested requirements, but more claimed functionalities with a higher quality level. Knowing this, using *testing standards* is a must, especially since the considerations of validity and reliability typically are viewed as essential elements for determining the quality of any project. On the other hand, we can not talk about *performance* of information systems without *security*. But, security in the field of IT was and still is a controversial and current problem, because "cyber crime as well as threats [...] is costing organizations billions of dollars each year."[9]

3.1 Testing Standards

Testing is maybe one of the most important and complex phase from an IT project development.

Professional and practitioner associations frequently have placed this concern (testing phase of an IT project) within broader contexts when developing standards and making overall judgments about the quality of any standardized test as a whole within a given context.

One of the challenges facing software testers is an agreed set of document standards and templates for testing. Also known as the "IEEE 829 Standard for Software Test Documentation", is an IEEE standard that specifies an internationally recognized set of standards for test planning documentation. It state that: "*Test processes determine whether the development products of a given activity conform to the requirements of that activity and whether the system and/or software satisfies its intended use and user needs. Testing process tasks are specified for different integrity levels.[...]The documentation elements for each type of test documentation can then be selected.[...]This standard applies to software-based systems being developed,*

maintained, or reused (legacy, commercial off-the-shelf, Non-Developmental Items)".

The IEEE is divided in eight defined stages of software testing, each stage potentially producing its own separate type of document.

- *Test Plan:* A detail of how the test will proceed, who will do the testing, what will be tested, in how much time the test will take place, and to what quality level the test will be performed.
- *Test Design Specification:* A detail of the test conditions and the expected outcome. This document also includes details of how a successful test will be recognized.
- *Test Case Specification:* A detail of the specific data that is necessary to run tests based on the conditions identified in the previous stage.
- *Test Procedure Specification:* A detail of how the tester will physically run the test, the physical set-up required, and the procedure steps that need to be followed.
- *Test Item Transmittal Report:* A detail of when specific tested items have been passed from one stage of testing to another.
- *Test Log:* A detail of what tests cases were run, who ran the tests, in what order they were run, and whether or not individual tests were passed or failed.
- *Test Incident Report:* A detail of the actual versus expected results of a test, when a test has failed, and anything indicating why the test failed.
- *Test Summary Report:* A detail of all the important information to come out of the testing procedure, including an assessment of how well the testing was performed, an assessment of the quality of the system, any incidents that occurred, and a record of what testing was done and how long it took to be used in future test planning. This final document is used to determine if the software being tested is viable enough to proceed to the next stage of development.

Given this, one can say that a *standardized test* is a test that is administered and scored in a consistent, or organized, manner. Standardized tests are designed in such a way that the questions, conditions for administering, scoring procedures, and interpretations are consistent and are administered and scored in a predetermined, standard manner.

In addition, we could remind other useful testing standards as: *BS-7925-1 Software Testing – Vocabulary* (This standard gives terms and definitions to aid communication in software testing and related disciplines), *BS-7925-2 Standard for Software Component Testing* (it defines the process for software component testing using specified test case design and measurement techniques. This will enable users of the standard to directly improve the quality of their software testing, and improve the quality of their software products), or *IEEE 1008 Software Unit Testing* (for bidirectional parallel communications between personal computers and printing peripherals).

One of the main advantages of standardized testing is that the results can be empirically documented. Therefore, the test scores can be shown to have a relative degree of validity and reliability, as well as results can be generalized and replicated; another advantage is aggregation. A well designed standardized test provides an assessment of a typology of IT projects and which, when applied, will reflect the project value according to the general standardized quality requirements; but do not forget that a standard applied "cannot measure initiative, creativity, imagination, conceptual thinking, curiosity, effort, […], nuance…"(as Bill Ayers said).

3.2 Some Considerations About Information Security Standards

Following a survey conducted by Earnast & Young company on information security within a Romanian company involved in the field of IT, the findings were difficult to predict: only 53% of the organizations have business continuity plans in case of a possible security attack, while only 41% of the organizations are concerned about internal attacks on their systems, although it is known that currently the highest number of attacks comes from inside the company.

The International Organization for Standardization (ISO) and the International Electro-technical Commission (IEC), which represents a specialized international system for standardization at world level, "adopted" the standards with the best practices and methodologies in the field of information security.

"Information security is the process of protecting information. It protects its availability, privacy and integrity."[www11] Thus, for the companies that need to implement an information security management or to improve the usual security practices, the standard ISO/IEC 17799:2005 was adopted, which is known at present as *ISO/IEC 27002:2005* or *the Code of Practice for Information Security Management*. It "sets out the guidelines and general principles for organizations in order to initiate, implement, maintain and improve the information security management" [www12]. The standard *ISO/IEC 27002:2005* establishes the best practices and methodologies in the field of Information Security Management for the following

sectors: "security policy; organization of information security; management; physical and environmental security; communicational and operational management; access control; information systems purchase, their development and maintenance; continuous business management" [www12]. We have also to add the fact that this standard is concerned only with *information*: electronic files, paper documents, recordings (video, audio), communications and messages.

Another standard "adopted" by ISO and IEC is the ISO/IEC 27001:2005 standard or *Information technology - Security techniques - Information Security Management Systems (ISMSs) – Requirements*. This standard is also known as BS 7799-2:2002. It "establishes the requirements for an ISMS"[www12].

The ISO/IEC 27001:2005 standard belongs to the series of ISO/IEC 27000 standards. "The series provides best practice recommendations on information security management, risks and controls within the context of an overall ISMSs, similar in design to management systems for quality assurance (the ISO 9000 series) and environmental protection (the ISO 14000 series)."[www1] Also, this series of standards "is deliberately broad in scope, covering more than just privacy, confidentiality and IT or technical security issues. It is applicable to organizations of all shapes and sizes. All organizations are encouraged to assess their information security risks, then implement appropriate information security controls according to their needs, using the guidance and suggestions where relevant"[www1].

4 Conclusion

As nowadays the *information* which is "behind" the information systems in fact stands for *power*, it is normal "to safeguard" it very carefully. Without *information*, it is practically impossible for a company to cope with competition, it is impossible to achieve its set objectives, so "it is absolutely vital that information systems (IS) are properly assured from the very beginning, due to the potential losses faced by organizations that put their trust in all these IS"[11]. Therefore, the need for applying some standards of good practice and methodology in the field of the information technology is very high.

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