An integrated platform for learning, training, innovation and discovery for better SDI-based eGovernment

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In the search for new approaches to respond to the need for good professional and academic education in SDI-based eGovernment applications, e-Learning has proven to be a good alternative to traditional classroom education. e-Learning can play a crucial role in capacity building in this kind of applications in different countries. Several aspects of e-Learning are highly relevant for academic education. e-Learning supports student-centred learning approaches and knowledge exchange between students, students and teachers, from all over the world contributing to the global knowledge bases. In the same time e-Learning supports lifelong learning and continuous development of different professionals involved in the development of SDI-based eGovernment applications using geospatial information and geospatial technologies. High numbers qualified professionals are needed to implement and maintain sustainable systems and applications in domains such as environmental ecosystems and climate change (land, marine, biodiversity, atmosphere, etc.), urban ecosystems/environment (urban sprawl, transport, land use, etc.), in order to enumerate a few. Through e-Learning large numbers of persons can be reached and trained. e-Learning is a proper facilitator to manage this paradigm shift in education. e-Learning methods and tools have been introduced and are now playing an increasing role in education (FIG, 2010).

The major key trends in the field of education for the development of SDI-based eGovernment applications could be classified as follows: management skills, versus specialist skills; project organized education, versus subject based education; virtual academy, versus classroom lecture courses; lifelong learning, versus vocational training.

Besides the new requirements from a professional point of view the academic surveying education nowadays is affected by additional determining factors like levels of SDI’s implementation, globalization, demographic development, and new public management (FIG, 2010; OECD, 2005).

Higher education institutions and other institutions have been looking for new ways to respond to the changing professional field. As mentioned in (FIG, 2010), the following paradigm shift in academic education is taking place:

• From teaching to learning - traditional, subject-orientated teaching will be substituted by individual project-orientated and self-organized learning; teachers’ role is changing from presenters and instructors to facilitators, mentors, tutors, coaches, and consultants and even students.

• From timed and on-site lectures to time and site independent education - modern educational methods enable self-paced and self-directed learning with a high flexibility on time and site.

• From self-contained studies to life-long-learning - the increase of worldwide knowledge is estimated to be doubled within four years; the existing concept of self-contained study courses will be replaced by the concept of continuing professional development.
People have and get **COMPETENCIES** (combinations of knowledge, skills and abilities)

They apply these in the form of **BEHAVIOR** (actions, thoughts, feelings)

Their behavior produces **OUTPUTS** (products and services)

How this is done yields **RESULTS** (criteria for managing the prior steps)

Competency continuum (Source: US Dept of Labor)
An overview of some major e-Learning programs offered in the field of geo-information science and Remote Sensing (RS) identified some important aspects, as follows.

Most of the efforts towards the e-Learning development for better SDI-based eGovernment areas were focused on creating teaching materials and tutorials that presented implementation techniques used and information about data acquisition, storage and processing.

Taking a look on a list of existing projects there are some observations:

- most of the projects were focused on creating teaching materials and tutorials that presented implementation techniques used in geospatial information about data acquisition, storage and processing;
- few projects concerned with experimentation and extensibility;
- few projects deal with the resources necessary in the creation of ability to develop EO applications: repositories of data, old archives, previously experiments, how to access, what formats, etc.
- no projects involving the business rules and associated laws;
- fewer projects are however dealing with providing lessons on how to develop applications using new information technologies and communications, but also geospatial technologies. In general, each technology provider offers its users a lot of tutorials that illustrate better facilities products.

In the opinion of the authors, e-Learning programs that provide techniques and methods for developing applications based on knowledge gained from experience in using integrated heterogeneous data sources and processing chains appropriate technology products to solve their vital problems such as real time decision making on how to manage the natural resources, how to manage the groundwater management aspects in urban planning or real time decision making the as reaction to the appearance and/or preventing the consequences of natural phenomena missing from the market.

The architecture proposed here aims to fill this gap using the latest concepts in the field of Information Communication Technology (ICT) combined with the latest geotechnologies with the latest concepts and techniques in the field of geospatial information management. It is necessary to mention that with this general architecture we have the intention to provide an e-Learning platform concerning with experimentation in SDI-based eGovernment applications. The intention is to build an integrated platform for learning, training, innovation and discovery for better SDI-based eGovernment applications providing techniques and methods for developing applications in different domains based on experience in using technology and integrated heterogeneous data sources and processing chains appropriate technology products to solve their vital problems.

In this framework have been identified four axes of complexity endorsing the development as many research areas: complex nature of (geo)space; multiple actors and their different roles; evolution of spatial decision support; geovisual analytics and geovisualisation design, implementation, and use (technical and/or cognitive issues); existing projects and results.
Paradigm: Learning by Doing at Work Place

- an interactive learning platform having as tasks knowledge delivery and interaction;
- a service oriented learning platform;
- sustainable learning platform based on a development strategy according to the cost-effective interaction/expansion.
The figure shows the proposed architecture of a Platform for learning, training, innovation and discovery for better SDI-based eGovernment consisting from five horizontal and two vertical layers.

The security layer ensures the necessary authentication, authorization and auditing for the use of data and legitimate generic users.

The management and integration layer refers to the service composition that is required to design workflow, identify sources of data and link the processing components to enact the workflows and it is designated to automate the flow of data and information between the horizontal layers, ensuring that processed outputs from one layer to another are syntactically correct and handling change management that occurs at different layers. This layer connects the application layer ensuring that data maintains provenience and specific processes and they can be used for different analysis. In the same time at this layer it will be possible to implement the business rules and laws governing the shared use of data in different states, markets, organizations and collections of various data, applying decision making models including stakeholders’ engagement, citizen participation and political endorsement.

The next level is represented by platform integration consisting from an ICT infrastructure based on SDIs frame of work that ensures cross-platform accessibility of heterogeneous sources of data and inter-institution collaboration.

In several papers has been highlighted the significance of cloud computing for the geospatial computing world by indicating a number of application areas where cloud computing is well suited, including the modelling of complex environmental applications, the fusion of existing preserved data and new sensor data for decision-making, enterprises, scientific and governmental storage and compute-intensive applications. In the same time it is mentioned that exchanging geospatial data between systems (clouds or user applications) is not sufficient rather it is also necessary to understand the meaning of data. For example the existence of thousands of spatial reference systems; various representations for spatial data including raster, vector, points and others; proprietary interfaces and vendor specific encodings also add to the complexities named semantic content management layer.

The application layer uses the outcomes from the management and integration and semantic content management layers in application domain specific tools and technologies such as modelling, simulation and thematic maps in order to perform the analysis specific in decision-making. On the other hand, at this layer is possible to discover and to learn to use existing tools and technologies in order to develop new components specific for application domains.

One of the strong requirements in achieving the aims of this approach is the understanding of the problem, the priorities and methods, algorithms, rules and procedures. Another refers to understanding the incompatibilities between various standards and processes.
Architecture’s Layers

Potential Domains

Security and Scalability

Business and Technical Processes

Management and Integration
To Discover

Entity
Sources of Data
Processing Data Tools
Type of Danger
Danger
Decision Making
Information for intervention
Geospatial Technology

State

To Obtain

Sources of Data Processing
Data Tools
Type of Danger
Decision Making
Information for intervention
Geospatial Technology

Effective experience in how to develop an application for fire prevention and reaction

Heterogeneous, fragmented, public, private, SDIs, collections of indicators, census, digital data collections, geospatial metadata, digital maps collections, standards

Free, company, open sources, in-house developed etc.

Interdisciplinary studies, techniques and algorithms, collections of indicators, digital data collections, history

Knowledge about danger, vulnerability, indicators, etc.

Knowledge about decision making, analysis, algorithms, tools and systems

Sources, formats, rules, collections, standards

Integrated, non-integrated, open sources, company, public or private, complying interoperability principles or not, complying with standards or not, chipper or expensive costs
Effective experience in how to develop an application for fire prevention and reaction
To Discover

To Learn To Use

To Obtain

Effective experience in how to develop an application for fire prevention and reaction

Associated technology and the plan for intervention(s)

Associated technology and protocols, standards, business rules

Associated technology and protocols for sending/receiving, standards

Methods, algorithms, decision making tools and systems

Technique and economic criteria and rules for establishing the appropriate technology to be used

Sources of Data

Processing Data Tools

Type of Danger

Danger

Decision Making

Information for intervention

Geospatial Technology

Symbology

Geospatial Technology

Geospatial Technology

Sources of Data

Processing Data Tools

Type of Danger

Danger

Decision Making

Information for intervention

Geospatial Technology

Symbology
Effective experience in how to develop An Application for fire prevention and reaction

Sources of Data
Processing Data Tools
Type of Danger
Danger
Decision Making
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Geospatial Technology

To Discover
To Learn
To Obtain

associated algorithms, technology and protocols, standards, business rules
documentation
associated technology and the plan for intervention(s)
technique and economic criteria and rules for establishing the appropriate technology to be used
Effective experience in how to develop an APPLICATION FOR RISK MONITORING based on geospatial technology provided by Intergraph Co on Smart Collaborative Platform.
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From the beginning we have to recognize that the general challenge of building/using a Platform for learning, training, innovation and discovery for better SDI-based eGovernment is an attempt to bridge the gaps between fragmented cross-thematic information by developing a cloud-based framework that facilitates data accessibility and storage across platforms and provides necessary on demand computational resources for required processing, simulation and visualization tasks. This platform aims to provide mechanisms for information’s integration necessary to solve the highly complex cross thematic impact challenges. On the other hand, the implementation of a Platform for learning, training, innovation and discovery for better SDI-based eGovernment architecture poses at least three challenges:
- The layered architecture provides flexibility in managing functionalities at individual layers. But, managing the complexity of various layers and integrating outputs from one layer to other in a (semi)automated process chain requires rigorous management of tasks at various layers and at this point it is necessary to learn more about management technics and ITC.
- To provide a Platform for learning, training, innovation and discovery for better SDI-based eGovernment based on LbD at work place paradigm for various stakeholders (e.g. citizens, research, scientific and policy making communities), enabling them to select multiple variables across various attributes and to extract corresponding harmonized information from a cloud infrastructure which could be used for various purposes such as simulations, providing and aggregating indicators and decision making support for policy development. In this regard, accessing data from different distributed repositories is required but usually, these distributed data sources may have different technological infrastructures including proprietary systems, desktop based systems, web services, grids, clouds, and non-standardized data models, which make this task more challenging and requires rigorous analysis for data accessibility, harmonization and transformation and compliance to policy requirements. For this reasons, and more another, our option focused on Intergraph Co. technology and experience in the technological kernel because more problems received a solution supported by appropriate tools and experience.
- To enable various stakeholders to visually design workflows, to compose and bind services for execution, to identify data sources and to execute these workflows in a cloud environment.

Conclusions

As implemented and groups of specialists/students will use the learning, training, innovation and discovery for better SDI-based eGovernment platform, various specific projects for different areas will be developed and evaluated. The users will be provided with new tools to access information and applications and the results will be assessed from the point of view of their compliance with standards.
Thank you for your attention!