Cloud Solutions for Educational Systems: an Important Step for Sustainable Development

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It is obvious that in our society the smarter represents the use of new technological solutions to make the world work efficiently. Educational system help define a society's long term health and prosperity, educating workers and leaders of tomorrow. The use of smart solutions efficiently in our educational systems is an important part of innovation, evolution and future development. To prepare students for a business environment and help them to gain the skills and knowledge, our educational system needs to become more instrumented, interconnected and intelligent. From this point of view, all over the world, several changes exist. We can improve this by using cloud solutions.
Keywords: *Big Data, Open Data, Knowledge, Local Development, Smart City, Smart Development*

1 Introduction

Using smart systems to support teaching and to deliver education and training is one way to make some change.

This solution will add new dimensions in educational activities and the graduated students will contribute to the success of their communities.

The implementation of smart educational systems focuses on the efficient use of existing infrastructure and on modernizing it where is necessary. This approach is considered essential during an economic crisis when funds needed for education are insufficient. But most importantly, a smart education policy should redirect learning on the two key components of any education system: students and teachers.

Applications for a smart educational system:

- data systems that collect, integrate, analyze and present information on key performance factors such as presence, knowledge and assessment criteria for school transfers;
- education cluster - to involve all stakeholders in the educational preparation of future generations;
- using cloud computing in university each student can access the most advanced educational content, software and computing resources and storage;
- energy efficiency, green schools and green sites;
- solutions that facilitate inclusiveness and encourage collaborative decision-making among students, faculty, staff, citizens, and public/private partners and help effectively harness the efforts of talented people to solve problems and create value.

To improve the quality and performance of educational system is recommended to involve all interested parties to implement efficiently smart educational systems.

Using a smart educational system, according to the latest data published by IBM in 2010 [1], teachers can analyze students' data electronically - from academic results, to information regarding mobility and attendance.

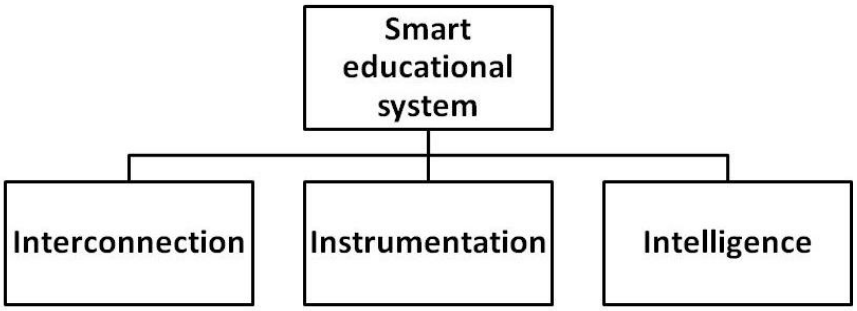

Fig. 1. Smart educational system

A smart educational system, figure 1, is based on three elements:

- instrumentation - accumulation of necessary data;
- interconnection - sharing different technology resources used in education;
- intelligence - making decisions that enhance the learning process.

An educational system instrumented allows collecting and submitting accurate data such as attendance, grades, projects, essays and involvement in different activities. These can provide relevant information on:

- the student evolution;
- university insights and processes;
- the educational elements that need intervention and improvement;
- the elements that give best results and must be extended on other parts of the system.

At the moment and for the near future, efficient interconnection is achieved through cloud computing systems. Also, the use of mobile learning applications represents a current and future trend [2].

Cloud computing requires a large and complex network of servers that provide users with both storage, computing power as well as software applications, using only the usual web browsing devices.

In this way costly investments in equipment, administration processes and personnel are eliminated.

2 Cloud Computing

Using technologies provided by cloud computing [1], students can access advanced educational content, software services, computing power and storage resources at any time.

Based on an anytime, anywhere premise a student can access the same cloud resources from any infrastructure.

The cloud can provide services that enable stakeholders of the educational process to follow students' academic achievements, their attendance and other reports.

These solutions can be used to identify deficiencies in learning and give those interested the information they need to collaborate with students and teachers.

Smart distributed systems based on cloud computing provide high quality distance learning opportunities for students localized in different parts of the country and beyond.

Through instrumented and interconnected solutions the educational systems will become smart.

North Carolina State University provides computing lab resources to schools and colleges throughout the state via a central service. Students, faculty and teachers are able to receive a customized image of the content and applications to meet their learning need [7].

The benefits of the intelligent educational systems from students can be:

- understand student attendance patterns;
- gain a complete view of student progress;
- quickly identify students at risk;
- identify strategies to help student to find a job;

On the other hand, for the system the benefits can be:

- accelerate innovation;
- accelerate knowledge creation;
- accelerate economic impact of science with powerful tools for researchers.

Cloud computing is a model for delivering

Internet-based information and technology services in real time.
It allows users to see the services while the infrastructure that delivers these services remains transparent (or in the "cloud").
More importantly, cloud computing can focus the power of a lot of number of computers on one problem, allowing researchers to find patterns and make discoveries faster than ever and help build a smart educational system and a smarter planet.
Cloud computing refers to the use and access of multiple server-based computational resources using digital network (Figure 2) (WAN, Internet connection using the World Wide Web, etc.).
In cloud the users may access the resources using a computer, netbook, tablet, smart phone, or other device. Cloud applications are provided and managed by the cloud server and data is also stored remotely in the cloud configuration [8].
The cloud server maintained all processing and users don't download and install applications on their own device or computer.

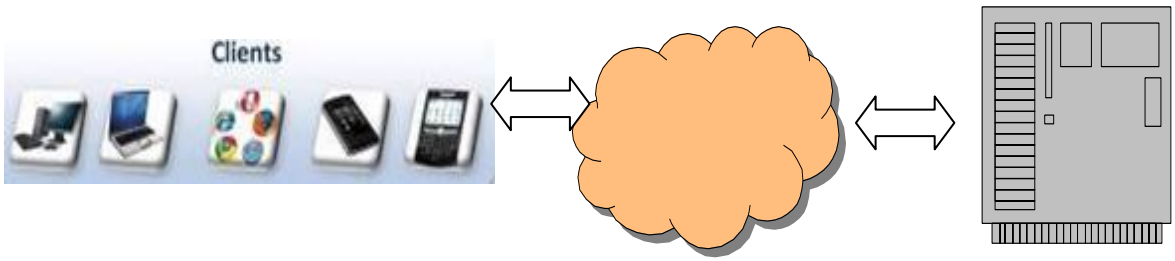

Fig. 2. Cloud computing

Cloud computing models are [6]:

- Private cloud. The cloud infrastructure is used only by an organization;
- Community cloud. In this situation the cloud infrastructure is shared by several organizations;
- Public cloud. The cloud infrastructure is made available for a group;
- Hybrid cloud. The cloud infrastructure is a result of two or more cloud solutions.

Cloud Computing applications are mainly intended to help companies and individuals to stretch resources and work smarter by moving everything to the cloud [5].
IBM announced their Academic Skills Cloud in February 2010. The suite was initially available to IBM's Academic Initiative members at 20 colleges and universities across the United States.
Participants are able to access and use IBM software in their classrooms and labs without having to install the products on their own systems. In [4] is noted that IBM's version of the cloud for college students will eventually be extended to additional schools in IBM's network of Academic Initiative partners, which is comprised of 9,000 faculty members at more than 4,500 universities worldwide.
The Solution for Cloud Computing from IBM includes IBM System z hardware, Tivoli software and IBM services that can be used to accelerate the business value of workloads, to improve the educational systems and the health systems.
Cloud computing offers the ability to standardize and centralize services for reduced costs and increased opportunity for innovation.
IBM System Z is a platform for cloud computing. A dynamic computing infrastructure [9] like IBM System Z is virtualized, available, secure, energy efficiency, operationally efficient and we can say a key component of a cloud.
We can say that cloud computing is a growing trend, particularly in higher education.
The term cloud computing for education simply refers to the delivery of resources over the internet as opposed to hosting and operating those resources locally on a college or university's own network. With cloud computing we can make a virtual computer lab.
Essentially, a virtual computer lab takes pro-

grams running on college hardware and beams the images to any computer desktop across the internet, giving students the ability to create and save work as though the programs were running on their own hard drives [3].

The software's performance depends on the strength of the student's Internet connection as opposed to the processing power of their computer, so even students with older computers can use advanced software without difficulty, explains [4].

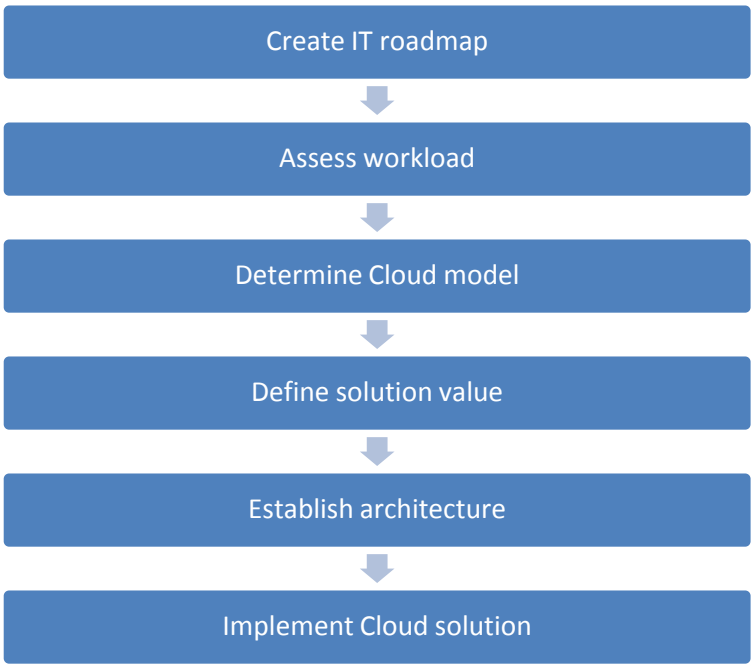

Fig. 3. Six steps for smart educational system

For a smart educational system (Figure 3) it is essential to implement a cloud solution. The first step for this is to generate the management plans for implemented a smart solution in educational systems.

3 Management Plans for a Smart Educational System

To implement a smart solution which is based by cloud represent an important step for development of our students and this will have a higher impact to quality and performance of educational system.

The objectives of this project are to [10]:

- use of the facilities of cloud solutions;
- improve of the educational system;
- collect, analyze and generate reports such as attendance, grades, projects, essays and involvement in different activities;
- identified the elements that need to be improve;
- offer the quality distance learning for students;
- help student to find a job;
- accelerate innovation and knowledge creation;
- reduce the cost;
- centralized management of data and applications.

Project environment consists of: project manager, team members, users (teacher, students, employees etc.), university management, authorities, suppliers and companies.

In figure 4 are the environmental elements identified and how they affect the project.

The analysis identified the following phases of the project Smart Educational System (SES):

- Project management - project management activities required are provided;
- Analysis - continue work on the study of the application domain, resulting in object models, dynamic and functional;
- Development - are refined the models which were made in the analysis phase, designed database and interface;

- Acquisition - is considering providing material resources, software and hardware and services required for system;
- Training - includes activities for staff training on the new IT solution and its benefits;
- Implementation - includes configuration tasks (Web, email, databases), application installation and data entry;
- Testing - based on test plans developed application verification and validation is performed;
- Pilot operation-information in the press release, pilot operation of the system, feedback from users and make necessary changes before the use of system.

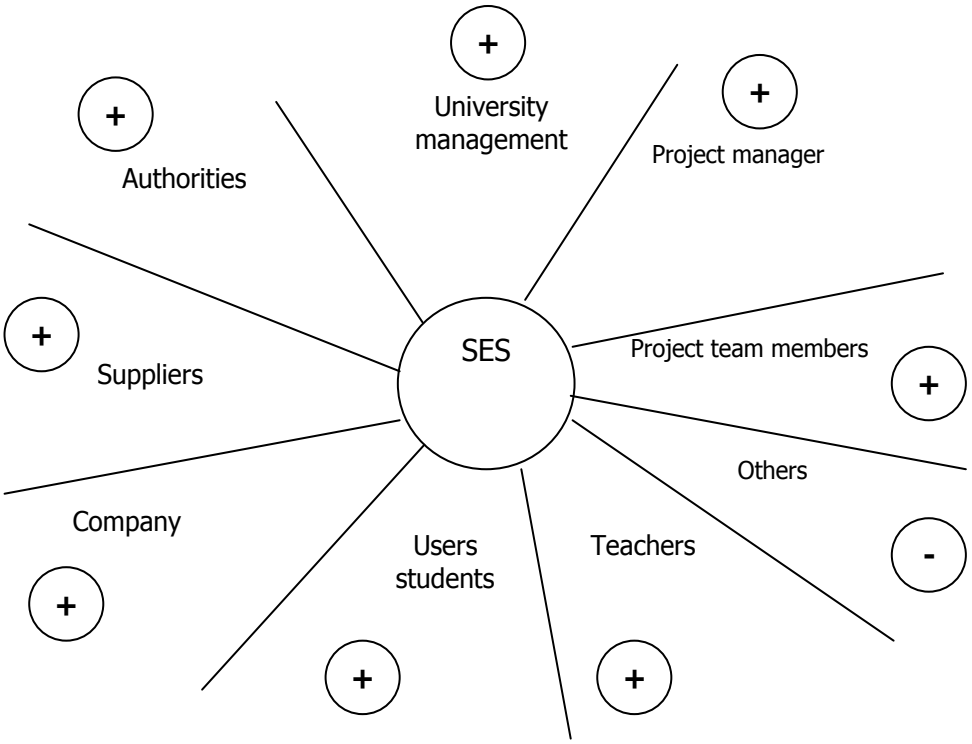

Fig. 4. SES Project Environment

Figure 5 presents the work breakdown structure (WBS) for the SES project.

Project milestones are events which mark important moments in the action. For the SES project were identified nine milestones presented in Table 1.

Table 1. Milestones plan for SES project

WBS Code	Milestone
1.1	Project started
2.6	Analysis finished
3.2.6	Software design completed
5.5	Development finished
6.5	Testing completed
7.6	Implementation completed
9.7	Functional system
1.6	Project finished

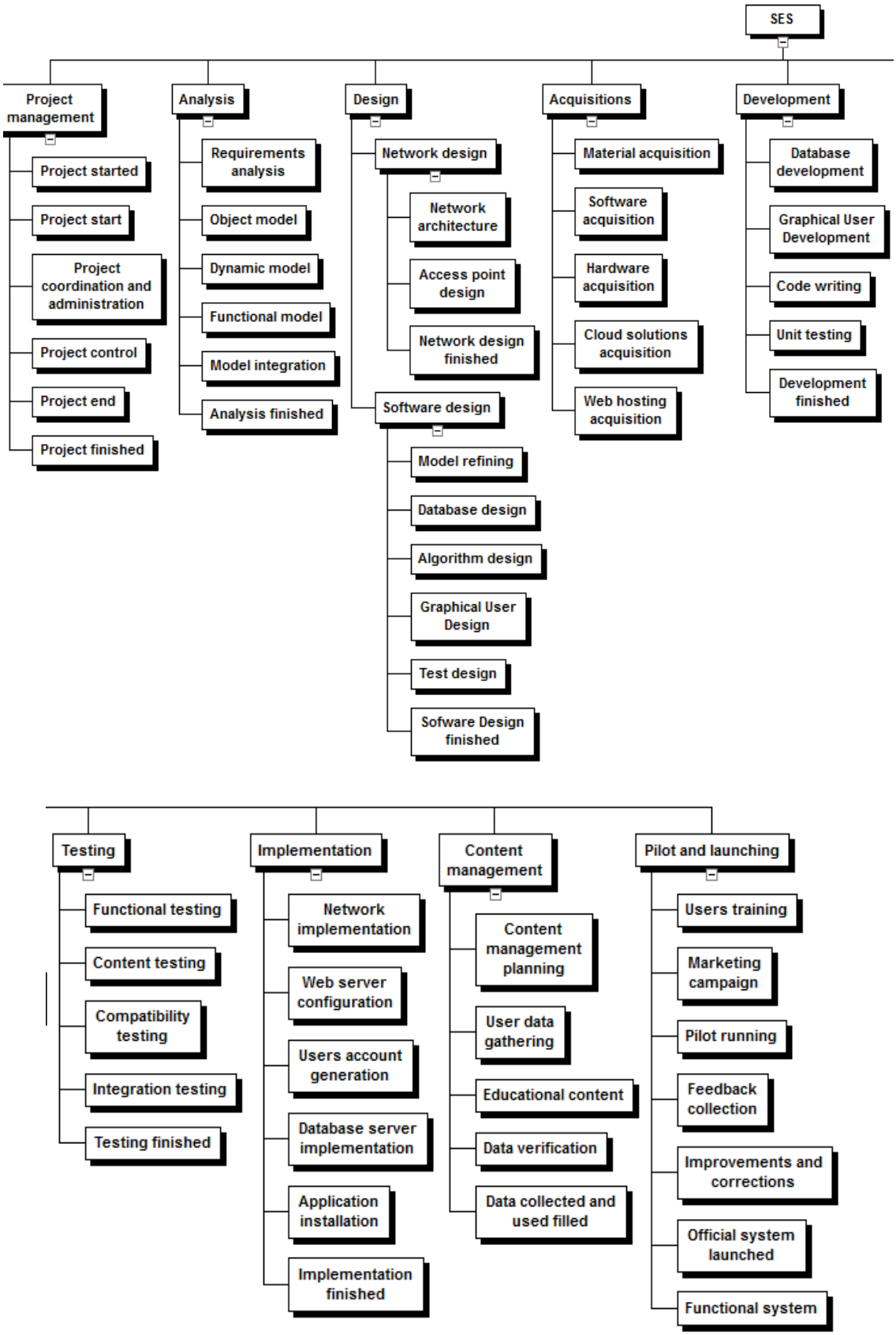

Fig. 5. SES Work breakdown structure

In the Annex 1 were made some useful estimates about project activities and were set

dependencies between them. The start date for the project was chosen as 02/09/2013 and all estimates from the Annex 1 refer to this.

In figure 6 is presented bar chart (Gantt chart) associated to SES project.

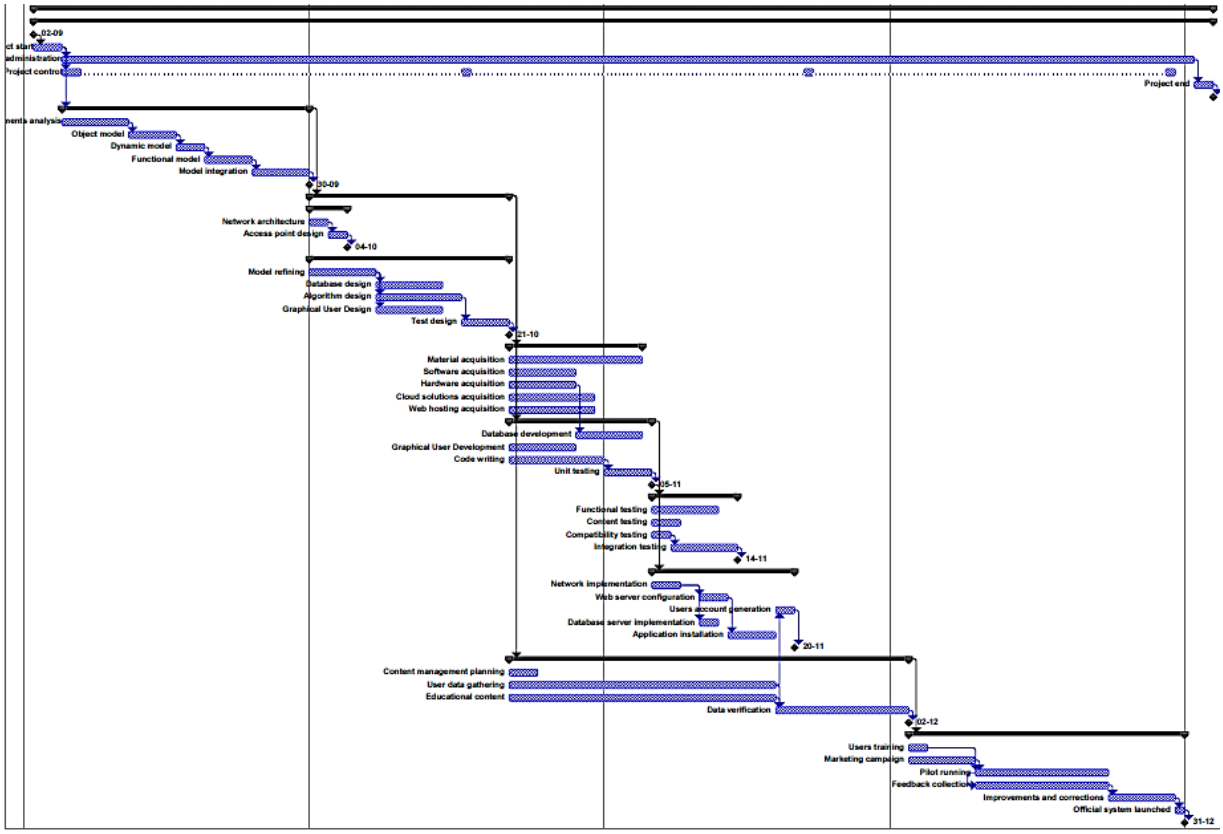

Fig. 6. Gantt chart associated to SES project

The smart educational system represents a real support for the perfection of the quality of our students because they will use the projects which are developed by the business environment. To improve the value and performance of educational system is it recommended to involve all stakeholders to efficiently implement modern technologies.

The development of smart educational systems depends on the development and the efficient use of the modern technologies. In many urban areas the infrastructure for the smart systems already exists, but it is not used to the real value.

5 Conclusions

This research emphasizes the need to implement a smart system for higher education. Smart educational systems will contribute to the development of partnerships between universities and businesses that operate in various industries such as construction, transport, communications, and information technologies.

Education is a fundamental element in every country's development, and consequently, smart education could be considered the most effective, reliable and modern method in personal and organizational development. Education is one of the fundamental components that generate solutions to economic problems. Well educated and skilled people are the key elements for creating, sharing, disseminating and using knowledge effectively. A good economy requires a smart education system which is flexible and promotes creative, critical thinking, innovation. This makes it essential to implement smart solutions in an educational system.

Acknowledgment

This work was supported from the European

Social Fund through Sectored Operational Programmer Human Resources Development 2007-2013, project number POSDRU/89/1.5/S/59184, "Performance and excellence in postdoctoral research in Romanian economics science domain".

Annex 1. SES Project management plans

Task Name	Duration	Start	Finish	Predecessors
SES	**89 days**	**Mon 02-09-13**	**Thu 02-01-14**	
Project management	**89 days**	**Mon 02-09-13**	**Thu 02-01-14**	
Project started	0 days	Mon 02-09-13	Mon 02-09-13	
Project start	3 days	Mon 02-09-13	Wed 04-09-13	2
Project coordination and administration	84 days	Thu 05-09-13	Tue 31-12-13	3
Project control	83 days	Thu 05-09-13	Mon 30-12-13	3
Project end	2 days	Wed 01-01-14	Thu 02-01-14	4
Project completed	0 days	Thu 02-01-14	Thu 02-01-14	6
Analysis	**18 days**	**Thu 05-09-13**	**Mon 30-09-13**	**3**
Requirements analysis	5 days	Thu 05-09-13	Wed 11-09-13	
Object model	3 days	Thu 12-09-13	Mon 16-09-13	9
Dynamic model	3 days	Tue 17-09-13	Thu 19-09-13	10
Functional model	3 days	Fri 20-09-13	Tue 24-09-13	11
Model integration	4 days	Wed 25-09-13	Mon 30-09-13	12
Analysis finished	0 days	Mon 30-09-13	Mon 30-09-13	13
Design	**15 days**	**Tue 01-10-13**	**Mon 21-10-13**	**8**
Network design	**4 days**	**Tue 01-10-13**	**Fri 04-10-13**	
Network architecture	2 days	Tue 01-10-13	Wed 02-10-13	
Access point design	2 days	Thu 03-10-13	Fri 04-10-13	17
Network design finished	0 days	Fri 04-10-13	Fri 04-10-13	18
Software design	**15 days**	**Tue 01-10-13**	**Mon 21-10-13**	
Model refining	5 days	Tue 01-10-13	Mon 07-10-13	
Database design	5 days	Tue 08-10-13	Mon 14-10-13	21
Algorithm design	7 days	Tue 08-10-13	Wed 16-10-13	21
Graphical User Design	5 days	Tue 08-10-13	Mon 14-10-13	21
Test design	3 days	Thu 17-10-13	Mon 21-10-13	23
Software Design finished	0 days	Mon 21-10-13	Mon 21-10-13	25
Acquisitions	**10 days**	**Tue 22-10-13**	**Mon 04-11-13**	**15**
Material acquisition	10 days	Tue 22-10-13	Mon 04-11-13	
Software acquisition	5 days	Tue 22-10-13	Mon 28-10-13	
Hardware acquisition	5 days	Tue 22-10-13	Mon 28-10-13	
Cloud solutions acquisition	7 days	Tue 22-10-13	Wed 30-10-13	
Web hosting acquisition	7 days	Tue 22-10-13	Wed 30-10-13	
Development	**11 days**	**Tue 22-10-13**	**Tue 05-11-13**	**15**
Database development	5 days	Tue 29-10-13	Mon 04-11-13	30
Graphical User Development	5 days	Tue 22-10-13	Mon 28-10-13	
Code writing	8 days	Tue 22-10-13	Thu 31-10-13	
Unit testing	3 days	Fri 01-11-13	Tue 05-11-13	36

Development finished	0 days	Tue 05-11-13	Tue 05-11-13	37
Testing	**7 days**	**Wed 06-11-13**	**Thu 14-11-13**	**38**
Functional testing	5 days	Wed 06-11-13	Tue 12-11-13	
Content testing	3 days	Wed 06-11-13	Fri 08-11-13	
Compatibility testing	2 days	Wed 06-11-13	Thu 07-11-13	
Integration testing	5 days	Fri 08-11-13	Thu 14-11-13	42
Testing finished	0 days	Thu 14-11-13	Thu 14-11-13	43
Implementation	**11 days**	**Wed 06-11-13**	**Wed 20-11-13**	**33**
Network implementation	3 days	Wed 06-11-13	Fri 08-11-13	
Web server configuration	3 days	Mon 11-11-13	Wed 13-11-13	46
Users account generation	2 days	Tue 19-11-13	Wed 20-11-13	54
Database server implementation	2 days	Mon 11-11-13	Tue 12-11-13	46
Application installation	3 days	Thu 14-11-13	Mon 18-11-13	47
Implementation finished	0 days	Wed 20-11-13	Wed 20-11-13	48
Content management	**30 days**	**Tue 22-10-13**	**Mon 02-12-13**	**15**
Content management planning	3 days	Tue 22-10-13	Thu 24-10-13	
User data gathering	20 days	Tue 22-10-13	Mon 18-11-13	
Educational content	20 days	Tue 22-10-13	Mon 18-11-13	
Data verification	10 days	Tue 19-11-13	Mon 02-12-13	54,55
Data collected and used filled	0 days	Mon 02-12-13	Mon 02-12-13	56
Pilot and launching	**21 days**	**Tue 03-12-13**	**Tue 31-12-13**	**52**
Users training	2 days	Tue 03-12-13	Wed 04-12-13	
Marketing campaign	5 days	Tue 03-12-13	Mon 09-12-13	
Pilot running	10 days	Tue 10-12-13	Mon 23-12-13	59,60
Feedback collection	10 days	Tue 10-12-13	Mon 23-12-13	61SS
Improvements and corrections	5 days	Tue 24-12-13	Mon 30-12-13	62
Official system launched	1 day	Tue 31-12-13	Tue 31-12-13	63
Functional system	0 days	Tue 31-12-13	Tue 31-12-13	64

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