

# E-learning and Student Management System: toward an integrated and consistent “learning process”

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## Keywords

E-learning, integrated student services, Student Management System, University Portal

## 1. EXECUTIVE SUMMARY

Almost all Italian universities are using E-learning. However, there are still problems preventing universities from a wide scale use of E-learning methodologies, even if there have a good potential.

Today every University runs many different applications and systems that provide online services to students and that, as a result, need to work using consistent student data. In this scenario Back Office activities become critical and require great effort and time to be achieved: the alignment of student data, new enrolments, test/exams subscriptions, classes and groups through all these applications is crucial for the success of all the student services, including E-learning systems. For this reason the implementation of an E-learning platform in big Higher Education Institutions could become complex as there are many different internal rules, processes and information to deal with.

Experiences and cooperation with Italian universities have pointed out that the main problems are: Self made approach (bottom up), Long time and high costs of production, Learning process lack of consistency, IT costs and governance issues.

### 1.1. Integrated Approach

CINECA, as a University Consortium that develops a wide range of IT solutions for university management, has been addressing the development of E-learning solutions in a broad vision. Following this, CINECA has developed a strategic and integrated approach.

Firstly, in order to simplify and quicken the content production CINECA projected a system called L2L (Live to e-Learning) for quicken the production, organization and presentation of learning contents.

Secondly, the CINECA approach provides the technologies to integrate the E-learning platform with the CINECA/Kion Student Management System used in 68 out of 97 Italian universities. An orchestrator layer, based on a “service oriented” approach, align data about students, teachers, courses, curricula and tests from the Student System to the E-learning platform.

### 1.2. Main benefits

- **Innovation.** The CINECA E-Learning Solution offers a strategic and integrated approach that addresses all the most important issues identified: production performances, “learning process” consistency, IT management and integration, costs containment.
- **Pedagogy.** This approach aims at integrating all the different new teaching methods in a more coherent path. Content distribution and fruition is easier thanks to the integration with the university portal. Students perceive a more consistent and uniform learning process.
- **Technology.** The goal is to provide a complete solution for addressing all the IT issues; data integration, interoperability, federated services.

## 2. CINECA: E-LEARNING AND STUDENT SYSTEMS OVER YEARS

CINECA was founded in 1969 as an Interuniversity Consortium to provide computing services for scientific research. Over time it has expanded its range of activities to support Higher Education institutions and the Italian Ministry of University and Research in all key sectors of Information and Communication Technology. Today CINECA has become both the largest high performance computing center in Italy (and among the most important worldwide) and the point of reference for ICT systems and services for Higher Education institutions in Italy.

For this reason e-learning and all the different technologies that can support education processes have become an important area of interest and development since the beginning of CINECA's activities.

### - E-learning

CINECA has started to provide support for Italian Universities in the *Technology Supported Learning* during the '80s (when this topic was also known as "Computer Based Education") with a centralized E-learning service based on PLATO. Yet, the first complete e-learning service was developed in 1999. As a consortium of universities, CINECA could leverage the domain expertise guaranteed by its members to better understand the needs of this area. Today CINECA offers an heterogeneous and integrated set of E-learning services addressed to Universities, Ministries, Public bodies and Private sector creating new partnerships and enforcing the existing ones. Furthermore, CINECA has been taking part for many years to European projects focused on this topic: some examples are the projects called Avatar@School, Revit, AVC@SL.

However, E-learning is only one of the IT services offered to Universities, as CINECA provides as well administrative applications (Student, Accounting, HR and Research management), hosting, networks, communication systems and portals.

### - Administrative applications for Universities

Since the 1980's CINECA has supported Italian universities in the transition to administrative decentralization. The first administrative applications were the systems for managing university personnel and accounting. The Student Management System (ESSE3) was born in 2000 developed by Kion, a CINECA owned company. This system has widespread and today more than 60 Italian universities use it.

In 2005 CINECA has set in motion a new integrated information system for universities, called U-GOV, which channels into a single systemic vision the current CINECA software solutions so far offered.

### - University Portals

At the same time CINECA started to develop federated University Portals, integrating and orchestrating the services provided by all the different applications and systems using cutting-edge "enterprise" technology for the modelling and the managing the universities' business process.

This long experience in academia allows CINECA to understand how the complete integration of data and processes is crucial for the success of services provided for students.

## 3. BACKGROUND: E-LEARNING LACKS OF A STRATEGIC APPROACH

Almost all Italian universities are using E-learning, offering online courses and contents. Yet, despite Universities and professors admit that E-learning has a great potential to improve learning quality and results, there are still problems preventing universities from a wide scale use of E-learning methodologies.

Experiences and cooperation with Italian universities have pointed out that the main problems are:

- **Self made approach (bottom up)**

Just single teachers or small group of teachers use E-learning. Even if open source is enabling the use of such services, many of them have started in small projects within single departments.

- **Long time and high costs of production**

The use of open source resources allows to reduce set up costs. Anyway there are still problems due to high costs for content production, course creation, maintenance and delivery (especially large scale delivery). This fact has a key role in slowing down the adoption of E-learning.

- **Learning process lack of consistency**

Today there are a lot of new opportunities for improving the learning methods: portals, E-learning, social networks, blogs, virtual worlds. Nevertheless these new systems still have a limited role in the learning process because of difficulties in changing habits and integrating traditional and innovative methodologies. Universities continue to consider the traditional classes as their core activity. Hence the learning process is not perceived by students as a uniform and consistent path.

- **IT costs and governance issues**

These days, the number of technologies and platforms for delivering services to students has strongly increased. Many data useful to E-learning (i.e. courses, students, tests, ..) are already managed in other systems and need integration, synchronization and consistency. E-learning system, Student Management System (SMS), portal and all the other applications that support online communication/services must be implemented coherently in every institution.

#### **4. CINECA'S APPROACH: FOCUS ON STUDENT SERVICES INTEGRATION**

The combination of these issues cause an objective integration problem with an increase cost of management. In order to strengthen the role of e-learning and online courses Universities need to remove these obstacles which are slowing the growth of new quality services.

CINECA is supporting this progression improving the methodology and the IT technologies involved. This evolution is leaded through the following points:

- **Wide and inclusive approach.**

CINECA aims at offering a strategic and broad approach that addresses all the most important issues identified: production performances, "learning process" consistency, IT management and integration, costs containment.

- **Focus on student services integration: processes and data**

E-learning needs to be integrated with the other student services and courses in order to express its potential. This means that the e-learning system must communicate, share data and services, with the other applications involved in this process, that is to say the Student Management System (SMS) and the University Portal.

The CINECA goal is to provide a complete solution for addressing all the IT issues; data integration, interoperability, federated services, uniform interface design. Hence CINECA aims at supporting the integration of all the different new teaching methods in a more coherent path. Content distribution and fruition is easier thanks to the integration with the university portal. Students perceive a more consistent and uniform learning process.

This is the only way the "e-learning curriculum" can be incorporated in the "traditional curriculum" putting a "blended learning process" into practice.

- **Enable massive production of content and cost advantages**

As e-learning need to be strongly supported to achieve its goals, production of contents must be simple and massive, preserving quality and "learning goals". Content's quality must be standardized both within the e-learning system and to the other traditional methods.

- **Services for every project step**

This image shows the steps of an E-learning implementation project.

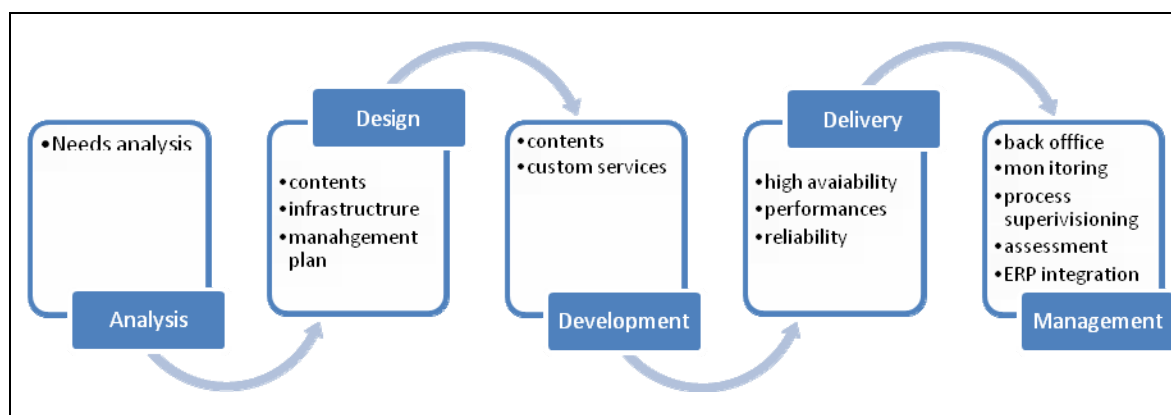


Figure 1. E-learning project steps.

CINECA aims at providing support services, consulting and technical assistance in each of these steps, as each project group includes different skills both technical and pedagogical.

## 5. THE CINECA E-LEARNING SOLUTION

Following this vision, CINECA has developed a strategic and integrated approach in order to address the significant issues presented above.

Cineca E-learning suite is composed of modular software components based on open source & commercial products, tested and integrated by CINECA and grouped in two different stages:

1. **Content production and delivery.** Firstly, in order to simplify and quicken the content production CINECA projected a system called L2L (Live to e-Learning) that aims at producing, storing and delivering a massive quantity of contents.
2. **Integration with Students Management System (SMS) and Portal.** Secondly, the CINECA approach provides the technologies to integrate the E-learning platform with the CINECA/Kion Student Management System and the CINECA University Portal solution.

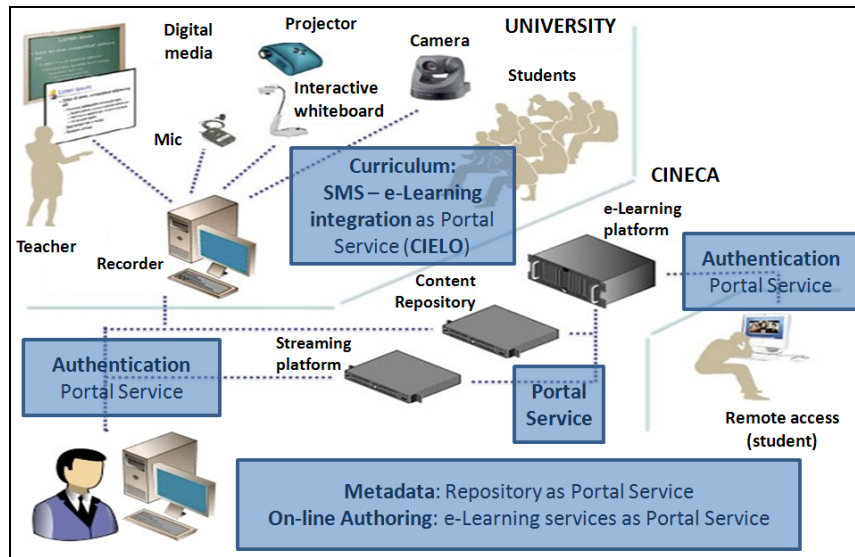


Figure 2. The CINECA E-learning Solution.

This system, integrating data from the Student Management System and aiming at supporting a massive production and delivery of contents, can be easily adopted by all the units of the university.

## 5.1. Content production and delivery

The L2L system is composed of three layers:

- a. **Face to face lectures recording system**, with post production functions and metadata management

Lessons and traditional courses are the most important resource of knowledge. For this reason students usually try to record lessons using tape recorder or digital player. They want to double check information, to better understand topics, issues and languages, to see again difficult lessons or lectures that they couldn't attend.

The L2L (Live to e-Learning) system actually starts from the recording of real traditional lessons in order to produce digital learning objects (video, audio, slides, documents, ...). Therefore it aims at building a wide repository of content and at amplifying courses impact and value.

Using and enhancing a huge quantity of content means to easily find them to simply search and through them. For this reason in the post production stage L2L system has an improved metadata management function that add automatically metadata to contents. In a second step, authors can check and add further metadata, cut and paste video and audio files, add or link other contents, surveys or tests. Hence contents can be easily produced, organized, browsed and searched.

However, the lectures recording system is only one of the different content production methods, and it actually aims at starting and generally addressing the online content production. Universities can either chose their own content production procedures.

- b. **Unique content repository** (usually located in CINECA)

All the digital contents (no matter whatever they have been produced) are uploaded in a unique repository that can be accessed by the E-learning platform (open source or proprietary) and by the University Portal.

Firstly, this approach leverages the central management of content versioning and access/authorization. Secondly, the repository exposures a set of services that makes easier the reuse of contents in different systems (i.e. WebTV service, E-learning platform, portals ...). Finally, contents can be easily shared for specific research projects between universities (harvesting and reuse).

c. **E-Learning platform** (learning management system, open source or commercial)

The E-learning platform chosen by the University (open source or business) is completely managed by CINECA. CINECA helps the University to select the system, to project the learning processes, to install, customize and maintain the software.

When necessary, CINECA follows the data import/export from previous systems, develops customized applications or *ad hoc* integration modules in order to enhance the learning data and resources of the University.

These are the main benefits:

- The university can start and handle a massive production of content
- Content production is cheaper, “reusing” and enhancing real lessons
- Content production preserve quality and “learning goals”
- Content production is also quicker and easier, so teachers have more time for other activities
- Distribution, searching and browsing of content is simpler and more powerful thanks to a unified metadata management.
- Metadata simplify fruition: students can easily find “key information” in the e-portfolio and in each lecture.

Thanks to this solution, the university can start and handle a massive production of content. Content production is cheaper, “reusing” and enhancing real lessons. Content production is also quicker and easier, so teachers have more time for other activities. Distribution, searching and browsing of content is simpler and more powerful thanks to a unified metadata management.

## 5.2. Integration with Students Management System and Portal

Today every University runs many different applications and systems that provide online services to students and that, as a result, need to work using consistent student data. In this scenario Back Office activities become critical and require great effort and time to be achieved: the alignment of student data, new enrolments, test/exams subscriptions, classes and groups through all these applications, as the management of first level help desk, feedbacks and reporting, is crucial for the success of all the student services, including E-learning systems. For this reason the implementation of an E-learning platform in big Higher Education Institutions could become complex as there are many different internal rules, processes and information to deal with.

Usually, the *core* student information are managed and “owned” by the Student Management System: the course offering and the learning paths are detailed, students data are consistent and up-to-date, “business rules” are dynamically managed. In addition, many Universities need to provide different LMS (Learning Management Systems) to different academic units or courses.

This means that interoperability and web services between these heterogeneous systems becomes the heart of the matter and the solution that Universities need to pursue.

For this reason CINECA and Kion developed an integration/communication layer between the E-learning platform, the CINECA/Kion Student Management System and the University Portal. This orchestrator layer (called CINECA E-learning Orchestrator, or CIELO), based on a “service oriented” approach, align data about

- students
- teachers
- courses
- curricula
- tests
- authentication

from the Student System to the E-learning application. Communication and interoperability is founded on WS (web services) SOAP/XML, in addition CINECA developed a set of APIs between CIELO

and the CINECA Student Management System. CIELO unifies authentication management as well, based on LDAP (if possible) or on web services that can manage Single Sign On.

The CINECA E-learning Orchestrator is compliant with *IMS (Instructional Management Systems) Enterprise Specification*. These specifications aim at support interoperability between E-Learning Management Systems and ERP/Student Management Systems setting a group of rules to share student, courses and administrative data. This means that CIELO is flexible and can be used as interoperability layer between different systems compliant to these standards.

Hence, CIELO has been projected to maintain the Student System and the E-learning platform free and independent.

Thanks to this orchestrator layer, universities and telematic universities can use Student Systems to manage day-to-day work and data in an integrated environment with E-learning platforms. CIELO reduces the administration and management burden of these systems.

From the students and teachers point of view, users access the E-learning services through the university portal, in a single integrated system: data alignment, interface integration, single sign on based on Shibboleth. In the "my portal" private area, each student can manage his academic career, verify exams results and find his academic community resources (like E-learning contents, forums and more). Similarly, each time they complete an E-learning activity, results and credits are recorded in the Student Systems. Teachers have their own portal private area as well, with all their administrator functions (in order to modify contents, courses, ...). The perception of an integrated environment helps the final users in their surfing paths.

## 6. E-LEARNING SYSTEM "AS A SERVICES"

In addition to this approach, CINECA can provide some other choices and support services that simplify and strengthen the introduction of such systems.

Particularly, the **Application Service Providing** facility means that Universities can use the Content Repository and E-learning Platform "as a service" provided over a network. The backend issues of these applications are often underestimated by users, as there is a technical effort related to the software management and didactic effort related to the analysis and definition of *ad hoc* learning path.

The CINECA Data Centre Infrastructure guarantees hosting, flexibility, support, continuity, recovery, physical and electronic security.

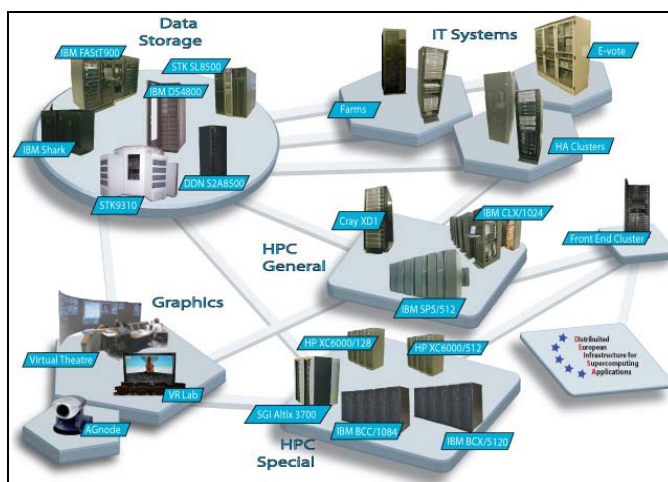


Figure 3. CINECA Hardware Infrastructure.

In this way the complexities and costs are lowered down. This also means that the E-learning platform is tested, integrated and consistent.

*E-learning and Student Management System: toward an integrated and consistent "learning process".*

## **7. The CINECA E-learning Solution at the Turin University**

During 2008 CINECA completed the development of all the components of this solution (the L2L architecture, the orchestrator layer between E-learning, Portal and Student System, ..).

The University of Turin is now implementing the CINECA E-learning Solution in the whole vision, including the integration with the University Portal and the CINECA Student Management System.