

# Mobile and nomadic user in e-learning: the Akogrimo case



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## Abstract

The diffusion of mobile devices in daily life is changing our life style. Access to services through these devices in a transparent and efficient way is the next future challenge. This phenomenon is going to effect all the domains of our life and learning activities will not be saved by these changes. The next generation of e-learning will be represented by mobile learning (m-learning). This consideration is justified by the observation that the next dimension of learning and training is the development of wireless communication and wireless learning in our society over the coming years. As such, future is wireless and it is clear that even in the e-learning domain there is an effort to put in place wireless solutions to replace the wired computer scenarios of today's e-learning. At the same time, there is a big effort to introduce enhanced learning approach, based on a paradigm that focuses on the learner and on new forms of learning: the learner will have an active and central role in the learning process and the learning activities will be aimed at facilitating learner's construction of knowledge and skills. The grid technologies can have a leading role in this approach since they are supposed to provide, in the next generation, the suitable features to achieve this vision.

Due to these premises the merging between mobile and grid technologies is a relevant challenge to be achieved because both technologies provide complementary features that can address the requirements of next generation e-learning application.

The result of Akogrimo project will be a platform based on both mobile and Grid technologies. This platform will be able to support different application domains and it will be validated through an e-learning application as well. This white paper describes a hypothetical m-learning scenario and how Akogrimo will support it.

SIXTH FRAMEWORK PROGRAMME

PRIORITY IST-2002-2.3.1.18



Information Society

*Grid for complex problem solving*

## 1. Summary

*This white paper provides a general view on Akogrimo. In particular, it focus on e-learning application and on the way Akogrimo can support futuristic scenarios related to e-learning. At this aim, the white paper contains a section explaining how the e-learning will migrate towards a m-learning generation that will focus on mobility and use of mobile devices. In section 3, a visionary scenario is presented, that is characterized by users' mobility and involved devices. Then, the white paper introduces the requirements of such a scenario and how the Akogrimo project will address those requirements. Finally, a brief business perspective about m-learning is presented.*

## 2. From e-learning to m-learning

Today, Internet and World Wide Web have enhanced learning activities providing a high degree of interactivity among geographically separated learners and teachers.

It is worth mentioning that Internet doesn't provide just another way to deliver learning contents, actually the potential is there to create learning environments that fit the needs of modern, diverse learners that are placed in the centre of the process by engaging them in purposeful activity, problem solving, collaborations, interactions and conversations.

The wide diffusion of Internet allows to maintain that e-learning is today the state of art for distance learning in Europe. Anyway technology development never stops, then new emerging technologies are supposed to be applied in the next future in order to provide innovative learning approaches. In fact, we

assist to the scouting of new technologies to supply new methods of learning and training, as well. This is a phenomenon we have often observed in the past and many times a learning revolution was expected when a new technology has been available.

The next generation of distance learning will be the mobile learning (m-learning).

Never in the history of technology in education has there been a technology with the universal penetration of mobile telephony. Not only this but mobile phones are technologies that citizens are used to carrying around with them everywhere. We have to take into account that it is estimated that today there are more than 0.5 billion data-enabled mobile handsets in use worldwide. These mobile handsets will create the first 'always on' generation of technologically enabled citizens who will spend the majority of their time in close proximity to Web access and e-applications. The purpose of next generation learning systems is to harness current and new technologies to provide new methods of learning and training that are available to all who wish to be part of the 'always on' generation.

Looking ahead, it will be crucial to achieve the merging of e-learning and m-learning providing pioneering approaches that will support new learning models based on ubiquitous, collaborative, experiential and contextualised learning.

It is here that Grid and Mobile technologies enter into the picture because they are supposed to provide the missing features to enable the new forms of learning.

The next generation Grid's goal is to enable as well as to facilitate the transformation of *Information* into *Knowledge*, by humans as well as – progressively – by software agents, providing the electronic underpinning for a global society in business, government, research, science, education and entertainment (semantic aspects).

Mobile technology will add ubiquitous and pervasiveness to the Grid potential, and in this vision it will not be only a medium to access the Grid, but the mobile devices will be part of the Grid itself that, in this way, will evolve towards a nomadic system.

It is worth mentioning that the environment of nomadic computing is very different from that of traditional distributed systems. In such an environment there is a variety of mobile workstations, handheld devices, and smart phones, which nomadic users use to access services in the Internet.

### 3. A visionary e-learning scenario

There is a group of students, all equipped with a 4<sup>th</sup> generation PDA, that for their Archaeology spring exam are working on the Field Trip project. During their activity they store information, experience, emotion, in terms of photos, video clips, text notes, audio comments, etc. The PDA, using the user profile and context dependent information automatically indexed these contents using appropriate metadata. The information collected by all students are sent via the appropriate network (the PDA will negotiate with the network service provider operative in that zone which kind of network communication will be used according to the

necessary bandwidth, price, etc.) to the Field Trip (FT) Grid service created by the course teacher for their project. The PDA will use user biometric data for secure access to Grid based virtual learning organisation and for data ciphering. The FT Grid service, orchestrating speech to text Grid services (provided by Company A) and advanced semantic tool for text interpretation virtualised as Grid services (provided by Company B), will analyse the student's information comparing them with the learning objective foreseen for the project experience and formalised in an ontology based knowledge representation (concepts to be learned, goals to reach, relationships, etc.). It summarises them from the learning point of view in terms of progress and weakness to the teacher. It stores all the information in a multimedia repository Grid service.

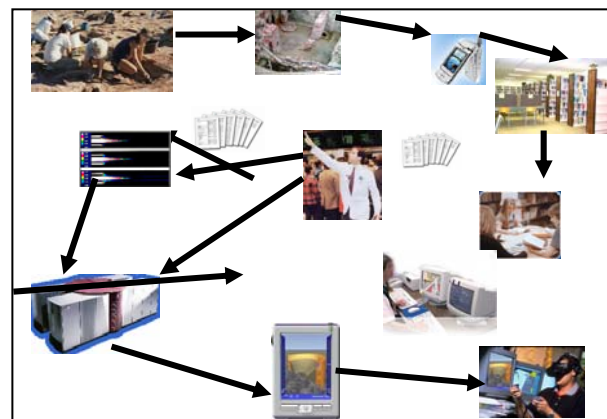


Figure 1 A technology enhanced field trip scenario

During the daily work in the field trip some collaborative sessions with other students in the school are needed in order to share their experiences. To this purpose the students collect with their PDA some photo of the field trip and other objects discovered and send them to the Virtual Collaboration Grid service asking to make them in 3D.

The VC Grid service invokes the high performance 3D modelling and rendering tools (provided by the High Performance Computing Centre of the University) in order to make the 3D reconstruction and rendering them.

#### 4. How Akogrimo supports m-learning scenarios

The depicted scenario envisages an environment that involves several distributed entities, and they can use both mobile (PDAs, laptop,...) and fixed devices (servers).

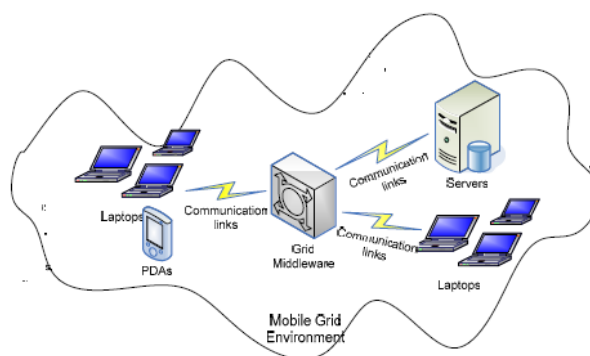


Figure 2 A technology enhanced field trip scenario

Akogrimo's goals are to provide a framework to manage this dynamic environment, which has the typical requirements addressed by Grid technologies, even if the framework requires additional features for supporting mobile users and resources.

Figure 2 presents the approach followed in Akogrimo. Such Mobile Grid Environment involves devices with mobility capability, communication links that support the (M)IPv6 protocols and an active Grid middleware acting as mediator between the client side devices and the service suppliers. The potentially mobile devices are not limited to act as interfaces only to Web enabled grid and application services. They rather provide clients which participating in the service workflow of the scenarios. For

instance, a Context Manager module is foreseen to provide information of the device capabilities and the location of the student so that various adaptations can be made at the execution phase. The Grid middleware is enriched with context awareness for the execution itself and provides an advanced functionality for the execution management of the data transfer (including their replication for efficiency reasons), the services monitoring and the resource status. Finally, the e-learning application side is also responsible for the business part of the scenario, meaning the workflows that enable the learning process and the formation and management of the Virtual Organization that includes all the parties of the e-learning visionary scenario.

#### 5. Conclusions: Business perspective

It has been estimated that the learning, education, and training industry is over USD 1 trillion per annum worldwide. Much effort is being spent on information technology and its integration within the learning environment. Institutional entity are spending much effort on multi-cultural learning resources and environments.

The learner includes home users, nomadic users, institutional users, children and adult users. The variety of learning environments includes standalone, classroom, networked, internet-based, nomadic, federated (groups of resources), distance, collaborative, asynchronous, synchronous, and so on. With all these environments and international participants the emerging of a new generation mobile Grid for distance learning will arise the

interest of at least four different target groups and potential users:

- The telecommunications industry;
- The e-Learning industry;
- Stakeholders and decision makers in vocational and education training (VET);
- Trainers, students and training organizations

The next generation of learning is of vital importance to stakeholders and decision makers in VET. The attractiveness of this learning vision is the capability of harnessing and sharing the almost universal availability of mobile devices to education and training. This widespread availability can be harnessed and exploited to provide access to training opportunities for those who otherwise might be at a disadvantage for geographic (wireless networks span the rural-urban divide), economic (mobile handsets are relatively inexpensive) or social reasons, but mainly to take in place innovative contextualised learning approach, where the learner “achieves” knowledge and skills in an active way instead of simply storing information. The *realism* will be the cornerstone of such a learning environment.

The needs, for the target groups identified above, is to be prepared for the next generation of learning and training. The development of a mobile grid infrastructure for the provision of nomadic learning will meet this need opening new scenarios for both the telecommunication industry and the developing e-learning.

## 6. References

[1] The Akogrimo project, website  
<http://www.mobilegrids.org>

[2] Report on socio economic environment  
(Akogrimo Deliverable 2.2.1)

[3] Validation Scenario (Akogrimo  
Deliverable D2.3.2)