Preface

INTRODUCTION

Over the last decade, the needs of educational organizations have been changing in accordance with increasingly complex pedagogical models and with the technological evolution of online learning environments, with very dynamic teaching and learning requirements. In particular, these needs involve extending and moving to highly customized learning and teaching forms in a timely fashion. Each educational organization would need to incorporate its own pedagogical approach, target a specific learning goal, and utilize its specific resources. Educational organizations’ demands also include a cost-effective integration of legacy and separated learning systems from different institutions, departments and courses, which, in turn, should be implemented in different languages, supported by heterogeneous platforms, and distributed worldwide.

In addition, modern online learning environments must provide advanced enablement for the distribution of learning activities and the necessary functionalities and learning resources to all participants, regardless of where these participants and resources are located, and whether this location is static or dynamic. The aim of newest learning environments is to enable the learning experience in open, dynamic, large-scale, and heterogeneous environments. As a result, ubiquity and pervasiveness have become essential requirements to support formal and informal learning and to allow all learning community members, from a variety of locations, to cooperate with each other by means of a large variety of technology-enhanced equipment. To this end, mobile learning have come to play a major role in this context by taking advantage of the extensively used mobile and wearable technology to provide anywhere, anytime learning.

Unfortunately, in literature regarding this topic, there is an important gap of appropriate software infrastructure to build the emergent and complex e-learning systems that meet the current mobile learning needs and pedagogical models. In order to fill this gap, the latest findings in this field are presented in this book.

MAIN CONTRIBUTIONS OF THIS BOOK

This book presents solid architectural solutions for the development and adoption of the next generation of mobile learning systems in terms of non-functional requirements, such as scalability, flexibility, availability, security, interoperability, and the integration of different, heterogeneous, and legacy learning systems. To address these complex issues, several chapters propose powerful and pervasive technolo-
gies, such as Grid, distributed and wireless infrastructure. Ubiquity and pervasiveness are especially relevant in this context in order to provide not only anywhere anytime learning but also unconscious learning. The book provides an extensive background and novel solutions to meet these demanding requirements as key aspects to support the current and next mobile communities of learning practice and pedagogical models.

Some authors also point out the importance of adaptivity, personalization, and usability as well as knowledge management in mobile learning so as to greatly stimulate and improve the m-learning experience. There are key evidences of the benefits from leveraging these features by adapting the formal and informal learning process to both current pedagogical models and mobile participants’ needs and preferences. To this end, a complete management of contextual information and application of advanced context-awareness techniques are suggested. The so-called “social software” referring the use of Web 2.0 and related technologies, such as Web-semantic and ontologies, are also considered in this context for the provision of customized and dynamic learning (e.g., adapting the learning content in different formats and with different technologies).

The last section of the book provides a set of relevant case studies for implementation and evaluation purposes of the previous mobile learning architectures proposed. The aim is both to show the architecture’s impact on the m-learning process and to provide useful guidelines to targeted designers of mobile learning systems. Furthermore, last two chapters present interesting study cases that explore aspects of the quality learning by using mobile technologies and the potential of m-learning to engagement in learning and develop strong learner identities.

Overall, the book contributes with the following:

- State of the art and latest research findings in software architectures, computer science, and mobile technology used to support complex, distributed, mobile online learning systems.
- Worldwide best practices and case studies as for the development and use of architectural solutions for emergent m-learning systems.
- Theoretical frameworks, platforms, and architectures adopting ubiquity and pervasiveness to support the latest pedagogical models found in formal and informal mobile communities of learning practice.
- Experimental results from real m-learning practices by using complex systems and applications built upon solid software architectures.
- Provision to business, academic, and research communities with a base text that could serve as a reference for software architects and developers, as well as computer sciences undergraduate/graduate courses.

**ORGANIZATION OF THE BOOK**

The 17 chapters of this book are organized as follows:

- Section 1: *Architectures, Frameworks, and Platforms for Mobile Learning Systems* provides a detailed overview of research projects emerged involving solid software and hardware infrastructure for developing mobile learning systems.
• Section 2: Technological Advances in Support for Mobile Learning shows the latest technologies to support and enhance mobile learning, such as grid computing, Web 2.0, and ontology-based and context-aware systems.
• Section 3: Architecture Applications and Case Studies on Mobile Learning Practices describes a set of specific experiences in mobile learning settings mostly by using software systems built upon the aforementioned architectures, platforms and frameworks.

Section 1: Architectures, Frameworks, and Platforms for Mobile Learning Systems

Chapter 1 (Developing Tools that Support Effective Mobile and Game Based Learning: The COLLAGE Platform by Chryssafidou, et al.) presents an EU-supported e-learning project aiming at investigating the impact of mobile and game-based learning on formal and informal learning. In this context, two main aspects of the project are addressed: adaptation to the user and content authoring.

Chapter 2 (Designing an Architecture to Provide Ubiquity in Mobile Learning by Carmona-Murillo, et al.) describes a flexible context-aware architecture based on mobile technologies that seamlessly integrates various wireless technologies into a platform to develop mobility services for learning environments as well for other environments.

Chapter 3 (MobiGlam: A Framework of Interoperability and Adaptivity for Mobile Learning by Fatma Meawad and Geneen Stubbs) discusses the principles of the design and development of a framework that provides interoperability and adaptivity techniques by supporting ubiquitous and customized access to learning activities while keeping the institution’s pedagogical goals and regulations.

Chapter 4 (SW-Architecture for Device Independent Mobile Learning by Christ and Feißt) also proposes to increase the flexibility of mobile learning in terms of adaptation of the learning material to the specific device. An XML-based solution is proposed, which can offer the learning content in different formats as well as with different technologies.

Chapter 5 (A Ubiquitous and Pervasive Learning Framework: Linking the Learner, the Workplace, and the Education Institute by Carroll) reports on a mobile learning architecture adopting ubiquity and pervasiveness to support communities of learning practice. This approach provides customization and an engaging, learner created platform for the mobile generation.

Chapter 6 (A Mobile Service Platform for Trustworthy E-Learning Service Provisioning by Luo and Zhang) proposes a service grid-based platform to provide on-demand m-learning with trustworthy service provisioning and location information for tracking participants and managing on-line learning assets.

Section 2: Technological Advances in Support for Mobile Learning

Chapter 7 (Mobile Web 2.0: Bridging Learning Contexts by Cochrane) discusses the potential of wireless mobile devices and Web 2.0 to create social learning environments that bridge multiple learning contexts. To this end, several experiences of mobile Web 2.0 are presented and interpreted.

Chapter 8 (Mobile Grids: An Enabling Technology for Next Generation M-Learning Applications by Andronikou, et al.) explores mobile grid as an enabling technology for next generation m-learning applications aiming at making affordable to meet demanding non-functional requirements appearing in this context, such accessibility, availability, security, and performance.
Chapter 9 (Intelligent M-Learning Frameworks: Information and Communication Technology Applied in a Laptop Environment by Owen) discusses on the effectiveness of the use of ICT and mobility for learning and teaching blended m-learning. This study is supported by reporting on a specific m-learning course and by using laptop computers.

Chapter 10 (Integrating Ontology-Based Content Management into a Mobilized Learning Environment by Kismihók, et al.) presents an educational ontology-based solution for curricula, content, and a knowledge evaluation development, whose research is piloted into a mobilized learning management system.

Chapter 11 (Context-Awareness and Distributed Events in Mobile Learning by Boticki, et al.) incorporates contextual information and the use of distributed events to better adapt and disseminate mobile learning services to teachers and learners. An information system based on these technological advances and its application are presented.

Chapter 12 (‘Intelligent Context’ for Personalised Mobile Learning by Moore, et al.) also uses contextual information to personalize mobile learning systems. To this end, an extensive research study is presented focusing on related contextual technologies, such as ontologies and Semantic Web. As a result, a complete context reasoning ontology is presented and evaluated in a m-learning scenario.

Section 3: Architecture Applications and Case Studies on Mobile Learning Practices

Chapter 13 (Schools in Action: Pedagogical Evaluation of COLLAGE, a Case Study on Mobile and Location Game Game-Based Learning by Barajas, et al.) implements and evaluates the COLLAGE project presented in Chapter 1. To this end, several practical m-learning scenarios are examined. This provides useful guidelines to designers in developing COLLAGE sound m-learning systems.

Chapter 14 (Technical Evaluation of Wireless Communications in a Mobile Learning Architecture by Carmona-Murillo, et al.) shows a technical evaluation of the behavior of wireless communication in the mobile learning architecture of Campus Ubicuo described in Chapter 2. The results from a testbed involving several scenarios that offer mobile services through different networks are presented.

Chapter 15 (Supporting Mobile Access to VLE Resources through MobiGlam by Meawad and Stubbs) reports on the deployment and evaluation of a case study conducted in a virtual learning environment by using the MobiGlam framework introduced in detail in Chapter 3. The results are analyzed in terms of impact on the mobile access to the VLE and the framework’s usability.

Chapter 16 (Using Technology to Support Quality Learning for School Activities Involving Field Studies by Stewart, et al.) presents detailed samples of case studies of a funded project’s educational approach focused on supporting a range of school teachers in their use of mobile technologies to enhance learning. The evaluation results are shown in terms of quality student learning and considering the affordances of mobile technologies.

Chapter 17 (Exploring Learning Identities through M-Learning: Learning across Regional and Knowledge Boundaries by Wallace) analyzes a range of learning programs that have utilized m-learning to understand how people learn and develop strong identities. Also, it discusses on the potential to engagement in learning and learner identities in regional areas.
TARGETED AUDIENCE AND LAST WORDS

We expect the experimented and solid architectures and frameworks proposed in this book can fully support advanced learning practices and pedagogical goals from the era of distributed and mobile learning. Thus, the book’s targeted audience includes industry and software development companies involved in the generation of the latest online learning systems and applications, as well as educational institutions, which incorporate mobile learning into the very rationale of their pedagogical models.

Furthermore, we would suggest the theoretical models of these architectures to form part of the curricula of undergrad/graduate courses in the computer science degree, in particular those courses related to software architectures and software development techniques, as well as e-learning from a pedagogical perspective. Indeed, we truly believe the comprehensive view and illustrative examples and practices provided will make the book interesting for university teaching purposes.

We hope the readers find this book fruitful and help accomplish their goals. Enjoy the reading!

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