Mobile Learning Environment (MoLE)  
Science & Technology (S&T) Technology & Transition (N11-06)

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Introduction

The purpose of this NICOP is to facilitate the research, development, testing and evaluation (RDT&E) portion of the MoLE CWP project required to ensure a successful transition of the resulting prototype mobile learning capability to a permanent Program of Record, in this case JKDDC. This will maximize the benefit to the US Government, and fully leverage the contributions of the multinational participants. It will consider (a) established guidelines for RDT&E, (b) guidelines for quality management in RDT&E projects, (c) the use of mobile devices to address science and technology (S&T) requirements, and (d) the goals and objectives of the Mobile Learning Environment (MoLE) Project.

Background

The technical architecture presented in this document represents the many iterations of research and development to support a full-featured mobile learning suite. Running in conjunction with Cross Platform research, this architecture takes into account the different layers of technology utilised to build the overall system; from the app which runs on the device, to the backend server responsible for delivering content and collating tracking and learner data.

Goals and objectives

The Project covered five key areas of work, all of which add benefit to the project goals and requirements of the MoLE CWP project:

- Create a reference architecture which enables JKDDC to support effective mobile learning content
- Investigate the technical implications of the mobile content and evaluation requirements
- Design and develop technical solutions to deliver mobile learning content within DoD constraints
- Test and evaluate the technical solutions selected for permanent transition to DD J7 JCW architecture (New Funding Addition)
- Publish key information, including Final Research Report on transition and technical roadmap
Key outcomes

Current Beneficiaries

JKO

JKO is an enterprise portal product for the delivery of learning by the Joint Knowledge Development and Distribution Capability (JKDDC) program. JKDDC was established by the US Office of the Secretary of Defense and works with the US Department of Defense and militaries of other nations as well as intergovernmental and interagency partners to provide training for them.

JKDDC has utilised the mobile applications and content management capability developed during the period of research to build ‘JKO Mobile’. This capability - now available through both the Apple and Android public application stores internationally - augments the existing JKO online capability with a mobile channel. Launched in September 2012 JKO Mobile delivers mobile learning content to thousands of mobile users from affiliated military organisations of several nations and already allows several key training courses to be undertaken entirely through a mobile device.

To build JKO Mobile, JKDDC augmented the capabilities developed during the period of research in the following ways:

- Extending user authentication: An interconnect to an enterprise authentication system was developed so mobile users access and rights could be controlled centrally.
- Connection to an LMS: An interconnect to JKDDC’s JKO enterprise learning management system (LMS) was developed to allow user progress to be managed centrally.
- Extended Mobile Application API: To allow JKDDC’s many course authors to provide learning content for JKO Mobile the API was extended to add more detailed progress and state tracking, which were synchronised to the content management system. Tools were also offered to allow interactive learning content (developed in HTML) to store complex structured data between user sessions.
- Mobile Application Plug-in architecture: An architecture was designed and implemented to allow the capabilities of the mobile applications to be extended in the event advanced learning content required it. This was first used by a course that required speech recognition functions.
- News Publishing: To support JKDDC’s communications requirements the mobile applications and content management system were augmented to allow the publishing and distribution of news items alongside learning content.
- Content Management System Workflow: Within the content management system a user hierarchy and workflow were added to the creation of users and the publishing of learning content and news. Role-based access control now enables fine-grained control of both administrative and mobile user actions.
Project narrative and deliverables

During the period of research, the project created three distinct technical resources that are available for re-use and further development:

1. A mobile application framework consisting of:
   a) mobile applications (for iOS and Android mobile operating systems) for the storage and display of mobile learning content in a range of open formats; and
   b) an application programming interface (API) describing how interactive content (produced in HTML) may interact with the application.

2. A web-based content management system for the storage and management of learning content, plus the associated standards for 'packaging' and meta-data describing learning content.

3. A 'mobile evaluation layer' for surveying user feedback through the mobile applications during the period of research by:
   c) presenting users with contextually-relevant questions during use of the mobile applications; and
   d) collecting and collating evaluation data in a central repository, including techniques for associating multiple evaluation responses from a single user and allowing evaluations to be undertaken 'offline' (without cellular or Wi-Fi internet access) for asynchronous transfer to the repository.

Items 1 and 2 have been prepared and released as Open Source libraries on which future commercial or academic development can take place, benefiting from the 'learning infrastructure' that was created.

The final solution is constructed from a number of components – some required (the on-device player app), some optional (authoring environment) and some content dependent. The diagram below outlines the high-level view of the different components which comprise the m-Learning solution architecture.
Key to the final architecture and underpinning the entire infrastructure is the server based m-Learning services. Comprising of both a web based portal and a series of RESTful services it can act as a stand-alone mobile content repository and data tracking / collation service. However in some cases, it is important to allow organisations to leverage existing investment on Learner Management Systems (LMS) to be able to provide broader integration capabilities including user authentication, tracking data synchronisation and reporting.

The architecture presented here caters for not only such integration, but achieves it in a way in which the service is not locked into any particular type of LMS or protocol by providing a flexible Application Programming Interface (API) and custom extension points. Ultimately this makes integration with virtually any existing system easily achievable.

By following guidelines and extending the provided endpoints, it is possible for the LMS to communicate with the mobile server using a standard RESTful web services protocol.
Conclusion

The project team did a detailed analysis of available technologies to develop a scalable and cloud deployable infrastructure. This infrastructure ultimately has the potential to support many hundreds of mobile users browsing and downloading learning content.

Moving forward and as part of the transition process, this infrastructure is now in production and continues to be developed to incorporate new features. Key to its flexibility is the documented API allowing not only us to develop mobile learning applications but also third parties who may want to leverage from the extensibility of the provided online catalogue.

As part of this nicop deliverable and to compliment the information contained in this document, a number of online resources have been made available. These are:

- [https://github.com/tribal-mlearning](https://github.com/tribal-mlearning) - Central GitHub repository containing source code for the cross platform mobile apps (Android and iOS) and links to further online technical documentation.

- [http://omlet.m-learning.net/docs](http://omlet.m-learning.net/docs) - Direct link to further online technical documentation.

- [http://omlet.m-learning.net/login](http://omlet.m-learning.net/login) - Access to an example online content repository (i.e. the course catalogue). A number of sample courses have been uploaded which demonstrate specific mobile app functionality.