

## Piloting e-Learning for the EGEE project

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### Introduction

The provision of training and induction is a core activity of the EGEE project (<http://public.eu-egee.org/>). Current training activities (EGEE NA3 Objectives) are predominantly delivered through scheduled events at distributed locations across Europe. Despite essential, the activities represent one of feasible means for training. The training is accessible at specific time and location junctures based on the arbitrary availability of trainers. These junctures do not necessarily correspond to the availability and requirement of intended learners who are based at dispersed geographical locations, and engaging in various works or projects in different subject domains. The delivery mode in which trainers engage synchronously with learners during class time, would only be effective if learners could grasp the intended learning outcomes in the same pace. This is often not the case since learners have different skills and needs due to project and knowledge background; some may need additional explanations and more reflective times and reference resources to grasp a particular concept.

E-learning can broadly be defined as learning facilitated and supported through the use of information and communication technologies. It has the potentials to enhance the EGEE training requirements. For example, the provision of appropriate e-learning resources such as audio-visual presentations and electronic reference resources allows training to be delivered online, in an asynchronous (self-paced) mode and persisted beyond the training schedule. E-learning also facilitates other training approaches such as *situative* pedagogy which focuses on social practice and dialogue through the use of communication and collaborative working technologies.

See “Using a Virtual Learning Environment” (JISC InfoKit) for additional scenarios.

This document details a preliminary assessment on the use of e-learning as a means for delivering the NA3 objectives. It also proposes a plan for a pilot project to develop e-learning resources and services.

### Virtual Learning Environments and Service-Oriented e-Learning

Given its broad definition, e-learning represents a multitude of feasible practices ranging from the use of electronic communication facilities such as email, discussion boards, chat, instant text messaging, video conferencing to specialised tools for online assessment and activities scheduling. The practices may also be feasible in various *connection* modes as determined by different networking and hardware topology, as well as *structural* modes relating to the ways with which e-learning services and tools are organised, aggregated and made available to learners within a learning environment (Wilson 2005).

Whilst *ad hoc* structural modes may be feasible through basic and often homegrown portals (websites) developed by technology-savvy trainers, the use of both commercial and open source virtual learning environments (VLE) has become prevalent, insofar as a centralised and supported infrastructure served by collective organisational resources. A VLE typically integrates a wide ranging e-learning facilities organised in fixed environment and structural modes. It allows some degree of customisation such as switching off/on tools (c.f. dynamic sequencing of learning activities). It also provides a cost-effective and practical means of implementing a range of e-learning facilities. From administration perspectives, it is also easier to support technologies on the same technological platform and from a small number of product vendors. See “Managing for Sustainability” (JISC InfoKit) for further description.

However, the adoption of a VLE should be assessed with respect to a paradigm shift in how applications are being developed for e-learning. There is an increased adoption of service-oriented and distributed computing technologies such as web services and the Grid (JISC 2004b, Gaeta *et al.* 2003). The service-oriented approach associates with the *small pieces loosely joined* principle (Weingberger 2002). It typically derives web services from functional decomposition (unbundling) of legacy and monolithic VLE systems. The approach also decouples data sources and services from their application front-ends and allows them to surfaces in extrinsic application contexts. Diverse and more flexible approaches to e-learning, particularly those of a cross-organisational nature can be facilitated through custom-built infrastructures that are based on the different composition (structural modes) of the unbundled web services along with any newly developed services. Instead of being technology-led, the development of e-learning can thus be based on the needs and demands of learners. Course developers can select the only e-learning services that are relevant to their course and learners.

There are pros and cons for adopting VLE and service-oriented approaches (Siemen, 2004, Wilson 2005). The debate related to the approaches is ongoing e.g. a recent session at a conference (<http://careo.elearning.ubc.ca/wiki?SmallPiecesLooselyJoined>) which discussed the different categories on the use of instructional technologies. The same discussion also purports a holistic approach to *combine* the use of VLE and service-oriented e-learning since there is no such thing as "one-size-fits-all" VLE; it is also impractical to build services from scratch. It claims both approaches are converging. For example, VLE vendors may provide application and web services interfaces which can be further developed for service-oriented contexts, while e-learning derived from web services may result in common technology (service) composites served in similar environments due to various factors such as similar underlying pedagogy, institutional and business constraints.

Recommendations:

- Adopt an approach combining the use of a VLE (if required) with other service-oriented applications
- Off-the-shelf products considered for this pilot should either be service-oriented or at least "service-orientable", i.e. providing application interfaces for further service-orientation development.

## **Developing e-Learning Resources and Courses**

Related NA3 objective:

- To produce a portfolio of training material and courses from introductory to advanced user material.

The scope of e-learning resources would be diverse as the intended learners have different technical skills and background knowledge, as well as the wide-ranging topics related to the Grid. The resources may also be targeted at external (non-grid) user groups and formal training such as the MSc e-Science Course. Hence a scoping assessment is recommended to review the nature of training within the EGEE and wider context, to determine the scope of e-learning resources.

The EGEE training team has produced a range of training materials organised in 37 modules and 5 courses. Typically, these training materials are resultant from the presentations (PowerPoints) of the training events (<http://egee.nesc.ac.uk/schedreg/index.html>). These materials, in the current forms, are too abstract to underpin online training as they are only meant to be supplementary to the training events which involve detailed explanation and instructional guidance from the trainers. The use of such presentation materials often results in learners asking for further clarification (JISC 2004a).

Based on the Mayes Framework on learning with technology (Mayes and Fowler 1999), e-learning resources and courses can be grouped in different categories, according to the three levels of learning activities which support learners understanding of new concepts:

*Primary* – providing information in didactic/transmission mode, learners exposed to new concepts through training sessions and accessing online content:

- Presentation slides and handouts
- Instructional and narrative text e.g.:
  - NCESS tutorials (<http://www.ncess.ac.uk/resources/tutorials/>)
  - GridCafe (<http://gridcafe.web.cern.ch/gridcafe/>)
- Lectures, audio-visual resources, e.g.:
  - Synchronous collaborative tools (<http://www.voxwire.com/kolabora/emerge/>)
- References including external websites, books, articles and journals, in the form of resource lists mapped to individual modules.

*Secondary* – allowing learners develop a better understanding of the new concepts and skills by undertaking tasks and assessments mediated by some level of discussion and feedback:

- Practical
- Formative assessment

*Tertiary* - allowing learners to use the concept and skills in applied contexts such as developing grid middleware for a new subject area; involving extensive two-way dialogue and collaboration among peer learners and trainers, “It is only at the level of Tertiary Courseware where there is two-way dialogue that learning can occur” (JISC InfoKit):

- Project – software development
- Thesis writing
- Learner presentation of the concept

A set of e-learning resources can be derived from a process of augmentation and repurposing the existing training materials. Given the finite period available for the pilot, it would initially be useful to develop primary resources, particularly as self-paced and reference resources underpinning training at secondary and tertiary levels.

In a longer term, it is important not to focus solely on primary resources, as learning also occurs at higher levels. Indeed most recent e-learning initiatives had mainly focused on the development of primary resources and treated learners as “content canister”. This approach is neither effective nor representative of e-learning as it neglects the essential computer-mediated human interactions. Hence, the EGEE pilot should prioritise on developing good primary resources for a specific subject area (e.g. grid middleware such as gLite) and in a longer term explore resources spanning all three levels of activities. This means providing more hands-on practical, assessment and dedicated training for specific project contexts.

A focus should be given to the reusability and granularity of each e-learning resource as individual units of studies so that they can be reused across different systems and aggregated in different contexts in course structures predetermined by trainers or custom course based on learners individual needs (*associative vs. constructive pedagogy*).

Recommendations:

- Undertake a scoping assessment of existing e-learning initiatives and resources from EGEE partners and NeSC related organisations.

- Develop resources for primary-level learning activities, focus on gLite courses
- Explore and plan for resources for secondary- and tertiary-level learning activities
- Resources should be reusable across different course contexts and based on interoperability standards

### Scoping e-Learning Services

NA3 objectives:

- To use this (training) material to train a wide variety of users both internal to the EGEE consortium and from external user groups from across Europe who will make use of this infrastructure
- To engender team spirit across the EGEE activities

The E-Learning Framework (ELF - <http://www.elframework.org>) is an emerging initiative to build a common service-oriented approach for e-learning. It has produced a framework which identifies a range of services ascribed to e-learning and a typical VLE. The services are categorised in two levels of functional granularities - *learning domains* and *common*.

*Learning domain services* provide higher-level of functional granularity and can be realised via application that aggregates the use of *common services* which identify the underpinning, sharable cross-domain support services. See JISC (2004b) report for further description of the services. The framework also maps each service to the existing or emerging technical standards and interfaces to encourage the adoption of standards and interoperability among the service components.

Part of the ELF services overlap and correspond to frameworks from other sectors, including the emerging JCSR (JISC Committee For Supporting Research) e-research framework, (see JCSR roadmap), the JISC Information Environment Architecture, e.g. for cross-domain use scenarios:

- Facilitating tutorial (e-learning) involving the use of grid infrastructure (e-research)
- Searching reference resources and learning objects (e-learning) stored in existing digital libraries (information environment)

ELF should provide a basis for scoping the extent to which e-learning is applicable to the NA3 objectives. For example, identifying the relevant *service composites* (aggregation) for higher-level applications such as learning object authoring, collaborative working environment, content management, digital library and VLE! ELF currently exemplifies several sample service composites. For a pilot project, it would be pragmatic to derive service composites and reuse any interoperable system artifacts from all related cross-domain frameworks while appraising the current harmonisation efforts (Wilson, *et al.* 2004, Framework Scoping Study project)

The services should be scoped according to the pedagogy requirements (see below) and implemented in appropriate project phases. The pilot should initially focus on developing primary e-learning resources and a core set of services to facilitate resource access and consumption, e.g. providing a training digital library; the later stages may involve the development of secondary/tertiary resources and extended services, e.g. for collaborative working and communication related to additional pedagogical considerations.

Recommendations:

- Consider ELF learning domain and common services as a basis for scoping the pilot services related to EGEE
- Appraise the current development of frameworks harmonization
- Initial project phase should focus on facilitating core services for developing, accessing

- and consuming primary e-learning resources
- Scope and plan for extended services related to additional pedagogical considerations in subsequent project phases

### **Pedagogy Consideration**

The scoping of e-learning services should also be informed by the pedagogical imperatives, i.e. by considering the various rationales and feasible approaches to learning and teaching. The current EGEE training activities represent only one of many feasible training approaches which have been studied extensively by education practitioners. In particular, learning and teaching activities can be enhanced by observing the following three perspectives on the nature of learning:

- *Associative view* - learning through regular routines of organised activities often led by instructors; learners acquire skills progressively in small and logically-order steps, mastering prerequisites (e.g. XML, Schema) for more advanced composite skills (e.g. WSRF, WSDL). The EGEE training activities currently provide this type of learning in a fixed delivery mode. The evaluation should focus on how associative learning can be provided online and other physical delivery contexts such as university postgraduate courses.
- *Constructive view* - Learning through intellectual activities and processes of discovery, experimentation and reflection, focusing on new forms of understanding. Often led by learners who work at their own pace with reference materials and tutorials (e.g. computer programming) to develop deeper understanding of concepts (e.g. design patterns). It requires interactive and collaborative environments that encourage feedbacks among learners and trainers.
- *Situative view* - Learning through social practice and participation in communities of practice. This type of learning relies on dialogue within formal and informal settings and is empowered by positive sense of identity within the communities, e.g. a developer work (learn) for an open source project to develop new software by adapting a generic tool. The learning is motivated by personal/group positions within (often real-world) environments. It is therefore relevant to the "engender team spirit" NA3 objective. It also requires interactive and collaborative environments that encourage knowledge sharing and experiments.

For further details on the above perspectives, see Mayes and de Freitas (2004).

The JISC e-Learning and Pedagogy Initiative has produced a matrix tool based on the above views (Fowler and Mayes 2004). It identifies of sixteen feasible approaches for training and maps them to the generic activities typically ascribed to learning, e.g. *acquire skills, problem solving, expose to new concepts, theories and facts* etc. For each approach, the matrix also suggests the appropriate teaching operations and tools requirement. The matrix and the pedagogic approaches should be examined with views of how they can be used to enhance the current EGEE training, and which e-learning services could subsequently be adopted to facilitate the required improvements. The latter requires an extended mapping of the matrix against various e-learning services such as those under the JISC e-Learning Framework.

In addition to pedagogic approaches, there is a range of factors which determine how (and how well) training activities can be facilitated. For example, "provide feedback" - an operation common to trainer-led activities can be accomplished in a multimodal training environment, synchronously (e.g. face-to-face, videoconferencing) or asynchronously (e.g. email, forum). This means the same pedagogic approach can be implemented in different variations. The following is a non-exhaustive list proposed recently (Wilson 2005):

- *Interaction*: through web browser, mobile, personal digital assistant, audio-visual devices

- (off- and on-desktop)
- *Connection*: synchronous, asynchronous, always-on (broadband internet), always-off (CDROM), on-and-off (hotspots, dialup)
- *Structure of resources*: organisation of resources based on courses & modules, personalised resource lists, topics, dates
- *Structure of services*: organisation of services according to pedagogic approach, e.g. guiding learners towards a certain behaviour such as engaging in discussion for situative training
- *Instructional workflow*: static and dynamic sequencing of services and resources according to pedagogic approach, e.g. linear (unit listing), conditional (sequence activities based on learning outcomes), binary (switch on/off services).

#### Recommendations:

- Review the various training (pedagogic) approaches for a particular EGEE pilot course using Fowler & Mayes matrix
- Map the training approaches described in Fowler & Mayes matrix to ELF services
- If appropriate, specify how various training modes can be delivered (per pedagogic approach) by considering technology factors

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JISC: Information Environment Architecture

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