# Learning GRID

**A newsletter from the Kaleidoscope Learning GRID SIG**

**Newsletter #1: July 2004**

**Deliverable D 12.2.3**

**Prepared for the European Commission under Contract No. NoE IST-507838 as a deliverable from**

**Task:** 12.2: Networking and Dissemination
**Date of issue:** 30/06/2004
**Version:** 1.0
**Distribution:** public

**In this Issue:**



## Editorial

Welcome to the first issue of the Learning GRID Special Interest Group newsletter.

The Learning GRID SIG is focused on investigating how one of the most relevant technologies, namely the GRID (that is the sixth highest IT investment priority for 2004), will allow to implement future learning scenarios.

Actually, no-one really knows how we learn! However, we do know that some characteristics and approaches are more likely to be effective in formalized and structured educational programmes. Traditionally, the formally structured learning takes place in a variety of situations and contexts. The classroom or lecture theatre, the library, the laboratory, the field trip, training "on the job", and the tutorial or small discussion group are all examples of formal learning situations.

In recent years, there has been a growing political pressure across Europe to provide wider access to education and to reduce costs, while maintaining or improving the quality of learning, and these traditional contexts are now too expensive and seen as barriers to wider access. Information and Communication Technologies (ICT) have therefore been extensively promoted as the only feasible way forward for "education providers".

Unfortunately the current generation of "e-Learning solutions", which has arisen in response to political pressure, has adopted the rather narrow pedagogic paradigm of "information transfer", which features the teacher as someone who selects particular pieces of information and makes them available to students on the Web. This approach very conveniently gives the surface impression that ICT is being put to good use. However, there is no evidence that this approach to technology enhanced learning is in anyway effective. It has been adopted simply because it is an easy way to use the Web's basic

So, the question remains – how do we provide better access while maintaining or improving quality of learning through the use of ICT? The Learning GRID SIG will contribute to the achievement of a breakthrough in European (e)-learning and training practices through the definition of the learning services concept and their deployment through GRID technologies. Learning Services will be consumed in dynamic Virtual Communities based on communications and collaborations where learners, through direct experiences, create and share their knowledge in a contextualised and personalised way. Furthermore, it will illustrates the flexibility and power of this approach by showing how traditional learning situations can be abstracted and treated as metaphors for supporting future learning scenarios through the dynamic combination of services to suit particular contexts.

The newsletter format has been conceived in order to reach two important objectives: increasing the awareness about GRID technologies, and, of course, as SIG activities and knowledge dissemination tool both for the Kaleidoscope community in particular and for the Learning community more in general.

This first issue is naturally not free from young faults and is open to all improvements of content and form. We trust on the contribution of SIG members and Kaleidoscope community in this direction.

Enjoy your read.

**Pierluigi Ritrovato**
Learning Grid SIG Coordinator

# GRID for Dummies

**Featured Article by Giuseppe Laria**

***Grid computing is going to become the next generation Internet, promising to give users access to distributed resources regardless to the geographical location. This is a great advance with respect to the current capabilities of the Web. In the following we provide a brief sketch of the Grid concept evolution.***

### Resource sharing: the hobbyhorse in computer science

The concept leading the research on Grid technologies is not new. In fact, the collaboration and sharing of resources in a geographically distributed environment is an idea arisen since the origin in the computer science domain. In 1968s, Taylor and Licklider published a paper about "The computer as communication device" and they sketched a visionary scenario about the possibility to use computer as advanced device to set up virtual collaborative environment. They foresaw that in few years their vision should have got reality.

In that period the Arpanet saw the light, the embryo of current Internet, established in 1968, as a nuclear attack-proof military communication system, and it was followed by academic tool linking computers around the world. Next the World Wide Web came, in the 1990s, bringing to the connection of million of home and office computers exchanging info, that is the Internet as it is known today.

Anyway the WWW is not enough to enable Taylor's vision but, meanwhile, another technology has been emerging and, in the next years, we will be living a revolution that will change our life because all people will be able to easily access to unlimited resources connected through Internet. We can say that future is about to become present, now.

That is a revolution with respect to the current idea of Web and it was compared [1] with the social revolution induced by the diffusion of electrical power grid. For that reason, the infrastructure, that will bring this transformation, has been known with the term "GRID".
The computer industry has the habit of talking in terms of 'waves' of computing technology. In its history, we can identify few waves of significant technologies that have made, over the years, a significant impact on industry and, as the time goes by, on society: mainframe computer, personal computer revolution, networked PCs, client/server computing architecture, thin client computing, the Internet. The next wave will be represented by GRID and it will be the Tsunami of the waves.

### The evolution of Grid concept

In the beginning GRID was synonym of meta computing concept and its development was driven by the increasingly request of computing power from the science community in order to face more and more complex simulating problems e.g. in the field of molecular biology, physics, weather forecast,…

For that reason GRID was named *computational Grid*, and this term referred to an infrastructure for synergistic use of high performance networking, computing and advanced software to provide access to advanced computational capabilities regardless of the location.

According to this first vision, in 1998 Kesselman and Foster attempted a first definition of the GRID [1]: "*A computational grid is a hardware and software infrastructure that provides dependable, consistent, pervasive, and inexpensive access to high-end computational capabilities*".

Now the combination of technology trends and research advances are leading the emerging of a new vision in the field of Grid: Grid is more and more synonym of infrastructure to manage "coordinate resource sharing and problem solving in dynamic, multi-institutional virtual organizations" and in fact the Grid definition was refined [2]: *"The sharing that we are concerned with is not primarily file exchange but rather direct access to computers, software, data, and other resources. This sharing is, necessarily, highly controlled, with resources providers and consumers defining clearly and carefully just what is shared, who is allowed to share, and the conditions under which sharing occurs. A set of individuals and/or institutions defined by such sharing rules form what we call a Virtual Organization".*

### The introduction of the Service Oriented Architecture (SOA) for the Grid: the OGSA model

The evolution of Grid concept was marked by the adoption of the service oriented approach in designing grid architectures.

A *service* is a network-enabled entity that provides some capability. Service oriented architectures (SOA) aim to provide the shared organising principles that underpin the collaborative operation of services in open dynamic distributed systems. Service-oriented architectures focus on how services are described and organised to support their dynamic, automated discovery and use at run-time.

The Open Grid Services Architecture (OGSA) [3] integrates key Grid technologies with Web Services mechanisms to create a distributed system framework for integrating, virtualizing, and managing resources and services within distributed, heterogeneous, dynamic "virtual organizations.

To this end the main issue to be faced is standardization so that different entities that make up such environment can be discovered, accessed, allocated, monitored, accounted, billed, orchestrated even if they come from different independent vendors. OGSA addressed the need for standardization by defining a set of core interfaces and behaviours addressing basilar aspect in Grid based Virtual Organization. Typical considered concerns (but they are not restricted to them) are: identification and authentication; Policy management and negotiation; Service discovery; Service Level Agreement negotiation and monitoring; Virtual organization creation; membership and inner communication management; Orchestration of services collection.

OGSA defines the interaction semantics and however, while it is prescriptive on matters of basic behaviour, it does not place requirements on what a service does or how it performs that service. In other words, OGSA does not address issues of implementation programming model, programming language, implementation tools, or execution environment.

In practice, the services defined following OGSA live within a specific execution environment or hosting environment. A particular hosting environment defines not only implementation programming models, programming languages, development tools, and debugging tools, but also how an implementation of a service meets its obligations with respect to the service semantics. OGSA can therefore be viewed as an architecture reference model for service oriented Grid systems.

In order to support this reference model a Working Group of GGF has been established, the OGSI (Open Grid Service Infrastructure) WG, that in June 2003 delivered the final version of OGSI specification [4]. It defines mechanisms for creating, managing, and exchanging information among entities called Grid services. Succinctly, a grid service is a web service that conforms to a set of conventions (interface and behaviours) that define how a client interacts with it. These conventions, and other OGSI mechanisms associated with Grid service creation and discovery provide with the controlled, fault-resilient, and secure management of the distributed and often long-lived state that is commonly required in advanced distributed applications. The OGSI provides technical details providing a full port type based specification of the above interface and behaviours.

The services defined in the frame of OGSA had to be built on top of OGSI, but this January a new event have come to bring a new wave in the frame of Grid world: the announcement of the Web Service Resource Framework (WSRF).

### The last evolution: from OGSI to WSRF

The emerging of WSRF [5] has opened a new phase in Grid research area, in fact, even if the general concepts formalized with the OGSI specifications are still valid, WSRF represents the final convergence between Grid Service and Web Service worlds.

WSRF is not a revolution but an OGSI refactoring led by the observation that OGSI concepts appeared to be very relevant even from the Web Service vendors' viewpoint but they wouldn't have ever provided support to OGSI as it was defined.

The main result of this refactoring is that the Web Service community has been providing a strong support for Grid infrastructure. This will facilitate adoption of WSRF within commercial Web Service tooling.

In fact with WSRF, Grid Service and Web Service are not going to be diverse entities but they simply provide additional specifications to the existing ones related to Web Services in order to manage typical concepts arisen from the OGSI WG.

The coming of WSRF is to be considered a new opportunity for Grid community, in fact, even if an additional effort will need in order to migrate from existing OGSI based system towards WSRF, the new scenarios, which are going to be opened in terms of widely diffusion of Grids as enabling technology for upcoming on demand market, are largely satisfactory to justify this effort.

### References


[1] "The Grid: Blueprint for a New Computing Infrastructure", I.Foster, C.Kesselman
[2] "The physiology of the Grid", I.Foster and al.
[3] Open Grid Service Architecture v1.0, https://forge.gridforum.org/projects/ogsa-wg/docman/
[4] Open Grid Service Infrastructure specification, version 1.0, June 27, 2003
[5] http://www.globus.org/wsrf/#relevant

# Research Projects Focus: ELeGI

***ELeGI – European Learning Grid Infrastructure is an EC FP6 Integrated Project (23 partners from 9 EU countries). It has the ambitious goal to develop software technologies for effective human learning. With the ELeGI project we will promote and support a learning paradigm shift. A new paradigm focused on knowledge construction using experiential based and collaborative learning approaches in a contextualised, personalised and ubiquitous way will replace the current information transfer paradigm focused on content and on the key authoritative figure of the teacher who provides information.***

***www.elegi.org***

We have chosen a synergic approach, sometimes called "human centred design", to replace the classical, applicative approach to learning. With consideration of humans at the centre, learning is clearly a social, constructive phenomenon. It occurs as a side effect of interactions, conversations and enhanced presence in dynamic Virtual Communities: experimental research concepts integrating new powerful developments of services in the Semantic GRID, the leading edge of currently available and future ICT technologies, with highly innovative and powerfully significant scenarios of human learning.

The ELeGI project has three main goals:

**Goal 1.** To define new models of human learning enabling ubiquitous and collaborative learning, merging experiential, personalised and contextualised approaches.

**Goal 2.** To define and implement an advanced service-oriented Grid based software architecture for learning. This will allow us to access and integrate different technologies, resources and contents that are needed in order to realise the new paradigm. This objective will be driven by the pedagogical needs and by the requirements provided by the test-beds (SEES) and informed by the experience gained through implementing the demonstrators.

**Goal 3.** To validate and evaluate the software architecture and the didactical approaches through the use of SEES and demonstrators. The project will build extensively on advanced work already done, creating new learning environments rather than creating new learning resources per se.

**Project Vision: Advancing Technology Enhanced Learning in Europe**

The overall aim of the project is to radically advance the effective use of technology-enhanced learning in Europe through the design, implementation and validation of a pedagogy-driven, service-oriented **software architecture** based on GRID technologies for supporting ubiquitous, collaborative, experiential-based, contextualised and personalised learning. Previous projects that have set out to improve learning through novel technologies have often failed to leave any significant mark because they did not give priority to the social, economic and technical perspectives of the key human actors. So, while the development and use of appropriate technology must be pedagogically driven, at the same time those involved in the formulation and evaluation of pedagogy must be made aware of, and shown by demonstration, state-of-the-art technological possibilities. We address this pervasive learning issue by explicitly listing the roles that actors play in the learning process and illustrate with reference to future learning scenarios. This provides us with a focus for formulating requirements in terms of didactical models, learning resources, services, quality of service, and usability for end-users. It also provides a clear reference for the technical context of the project – an open and flexible software architecture for creating learning environments that accommodate the roles implied by the new learning possibilities and that demonstrate state-of-the-art technology-enhanced learning.

**Pedagogical Goals and New Learning Modes**

In order to support the implementation of new learning modes related to ubiquitous, collaborative, experiential, contextualised and personalised learning, it is necessary to promote a paradigm shift in the general approach to teaching and learning.

Currently, teaching and learning practices are based mainly on the *information transfer* paradigm. This focuses on content, and on the key authoritative figure of the teacher that provides information. Teachers' efforts are mainly devoted to find the best way for presenting content in order to transmit information to learners. This "product - teaching oriented view" finds its perfect technical mirror in the "page oriented approach to the Web" where the goal is to produce more and "better" static pages for the consumption of interested students. Learning is then considered to be an activity which helps teachers to produce, and students to consume, multimedia books on the Web. This paradigm has been popular in earlier e-Learning projects, not because it is effective, but because it is easy to implement with basic Internet facilities and it does not require any change in the traditional roles of the actors.

The information transfer paradigm is well understood and well supported by existing e-Learning practice. In order to advance effective learning we will promote another paradigm that focuses on the learner and on new forms of learning. In our approach the learner has an active and central role in the learning process. Learning activities are aimed at facilitating the construction of knowledge and skills in the learner, instead of the memorisation of information. Information transfer will still obviously exist in the new paradigm, but only as a simple component, not the main goal. Accordingly we can say that the new paradigm subsumes the old one in its displacement.

Knowledge construction occurs through new forms of learning based on:

- the understanding of concepts through direct experience of their manifestation in realistic contexts (i.e. providing access to real world data) which are constructed from sophisticated software interfaces and devices, and represented as services;
- "social learning" – active collaboration with other students, teachers, tutors, experts or, in general, available human peers, by using different kinds of collaboration technologies, including enhanced presence.

In this approach collaboration is considered as a complex conversational process that goes far beyond a simple information exchange. In order to support such a "ubiquitous conversational process", one must consider the social context where the learning process occurs. Accordingly we do not consider the learner's ability in an abstract way, but relate it to a specific situation (the context). In this ambit the term "ubiquitous" does not refer simply to "anytime / anywhere", but more generally to the ability to support multiple diverse learning contexts and automatically adapt to them.

As we consider human learning as a social process, collaboration implies community membership, it means working together, providing added value, sharing and executing tasks in order to reach a common goal. Learning is no longer an isolated activity – it implies mutual trust, shared interests, common goals, commitments, obligations, exchanging of services, a genuinely proactive, motivated behaviour.

In order to foster these new approaches to learning we will create dynamic contexts where the learner "achieves" knowledge and skills in an active way instead of simply storing information. Communities will have the right to identify their goals, in terms of knowledge and skills to be acquired, instead of just asking an authority to define a curriculum for them. Goals will therefore genuinely correspond to needs, and be highly dependent on the local culture and its priorities.

According to this new learning paradigm we consider *realism* as the cornerstone of the learning environment. For example, highly realistic virtual scientific experiments have only recently become possible through use of advanced technology. Innovative aspects include the definition of a standard didactical model for the achievement and representation of such experiments. In this type of model a learner is immersed in a specific context, which through appropriate simulations, develops active learning processes with progressive abstraction levels, leading to the construction of their knowledge in a dynamic way. In this learning mode the student can also receive the support of the other users (collaborative aspects) and from the comparison with them, they can build a new "mediated" knowledge.

To complement this freedom in knowledge construction, we allow the definition of personalised and individualised learning paths. This means that in a specific context we need, from one side, to create learning conditions that are adequate for a learner's preferences (individualised learning) and, from the other, guarantee that the learner will reach a cognitive excellence through different learning paths according to their skills and knowledge. Accordingly, we will study and define specific models for representing knowledge that take the learners preferred learning styles into account. A beneficial result of allowing learners the right to construct their own knowledge is that richer and more diversified learning contexts can arise, necessitating the dynamic integration of different kinds of information and communication technologies. The dynamics of intertwined, controlled and secure construction and use of subsequent versions of our systems, by skilled as well as unskilled human actors, and of the services enabling them, constitutes our methodological approach for successful adaptive technology-enhanced solutions.

**Meeting the Technical Challenge: The GRID technology**

In order to support ubiquitous, collaborative, experiential and contextualised learning in dynamic virtual communities a learning environment should provide the following features for learners:

- Collaboration; Socio-constructivist: group working should be routinely supported as well as the more traditional model of the solitary learner – this includes support for self-organising online communities who share common educational goals
- Experiential; Active Learning: learning resources should be interactive, engaging, and responsive – active learning and

knowledge formation should be emphasised above simple information transfer

- Realism: real-world input should be easy to incorporate, as should simulations, ranging from simple interactive animations to immersive VR
- Personalised: students should find themselves at the centre of their online environment, with their individual needs addressed - the quality of the learning experience should be continually validated and evaluated
- Ubiquity and accessibility:
- wider, more flexible access to educational resources should be provided, often referred to as "anytime/anywhere" learning.
- multiple different types of devices, interfaces, and network connection types should be supported where possible
- Contextualised; Adaptive: appropriate learning contexts may be naturally be short-lived, as well as the more traditional static situations such as the classroom and the library – this calls for dynamicity in the creation of contexts

The pedagogical goals outlined above have highly demanding technical requirements, many of which are also the concerns of distributed systems research. Group working implies shared interactive resources, necessitating both concurrency control and awareness of others activities. Active learning requires interactive resources, many of which will only be engaging if they are suitably responsive – a quality of service (QoS) issue that depends on many components of a distributed system – the low-level infrastructure (hardware, OS, network), the middleware and the interface software. Concurrency control and interactive responsiveness can make conflicting demands on a system. Real world input, such as live stock market prices, or remote sensing data, makes a network connection mandatory, and this again raises QoS issues such as fault detection, masking and tolerance for the learning environment. Accessibility, as in anytime/anywhere, requires availability, which may be supported through replication of resources, but this creates further tensions with responsiveness and concurrency control due to the need to maintain state across replicas. Accessibility also means adapting to available capabilities. Accessibility also means supporting special needs of the individual, such as disabilities. More generally, the individual user should be recognised and catered for, and this personalisation requires semantic tagging and profiling that can be difficult to formulate, both conceptually and in terms of machine representation. Standards efforts have been particularly slow in addressing this problem. Finally, contextualisation requires a move from the traditional view of an online learning environment as a stable long-lived entity (e.g. during the lifetime of a teaching module) – to one where the environment may evolve and change much more frequently, perhaps even several times a day – a dynamicity that is alien to current e-Learning products.

We believe that these technical requirements can best be addressed by building on the open distributed service model that has evolved as part of the Grid - why start from scratch if there is already a suitable and established base? The Grid a consolidation of selected distributed systems research output from the last twenty years.

The Grid was originally designed for e-Science and was primarily concerned with supercomputing applications, but the framework it engendered to realise effective sharing of distributed heterogeneous resources (OGSA: the Open Grid Services Architecture) is now being applied to many other areas, especially enterprise computing and e-Commerce. Reciprocally, by progressing Grid technologies for learning, we will also contribute towards the advancement of the open Grid service model itself. We see the use of the Grid to support a paradigm shift in pedagogy to advance effective learning as a natural step in the recent historical progress of technology enhanced learning: Internet -> Web -> Grid.

OGSA leverages open standards including W3C, and provides an holistic view of Grid computing based on the concepts of 'Services', 'Distributed Collaboration' and 'Virtual Organisation'. At this point, new learning scenarios enter the picture: the user-centred, contextualised and experiential based approaches for ubiquitous learning imply the full exploitation of location-transparent access to distributed services such as simulation environments, real-world input, 3D visualisation systems and digital libraries, in the framework of a Virtual Organization. This allows a transition from current content-oriented e-Learning solutions towards a user-centred, collaborative model.

The next generation of Grid solutions will increasingly adopt the service-oriented model for exploiting commodity technologies. Its goal is to enable as well as 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) These efforts are sometimes referred to as the "Semantic Grid".

In summary, our proposal seeks to develop an OGSA compliant service oriented software architecture and realise a corresponding prototype infrastructure in order to support effective learning environments which exemplify the new paradigm.

**Methodology: Test-Beds and Demonstrators**
Having described the overall objectives, the pedagogical goals and how we aim to meet the technical challenge, we now outline the methodology for the realisation and validation of ELeGI project. We have selected a particular set of demonstrators and test-beds representing scientific, social, economic and cultural cognate areas that include both formal and informal learning scenarios. The key difference between test-beds and demonstrators is that demonstrators already exist in non-Grid compliant forms, as relatively mature and well understood exemplars of the types of pedagogy ELeGI wishes to support, whereas testbeds are principally new departures, designed to test the ELeGI approach from conception to implementation and evaluation.

**Testbeds: Service Elicitation and Exploitation Scenarios**
As we are working towards a service-oriented architecture we refer to the test-beds as Service Elicitation and Exploitation Scenarios (SEES). The purpose of the SEES is to develop and gain insight into the processes involved from formulating pedagogic requirements to the implementing environments that meet these requirements. The following SEES, which are described in detail in the RTD section, are planned:

- Informal Learning
  1) Alphabetisation for Durable Development
  2) Learning and Training of Researchers in Organic Chemistry
  3) e-Qualification by Open Universities
- Formal Learning
  1) Master in ICT with remote teaching and tutoring activities (in collaboration with Carnegie Mellor University)
  2) Physic course in the Open University

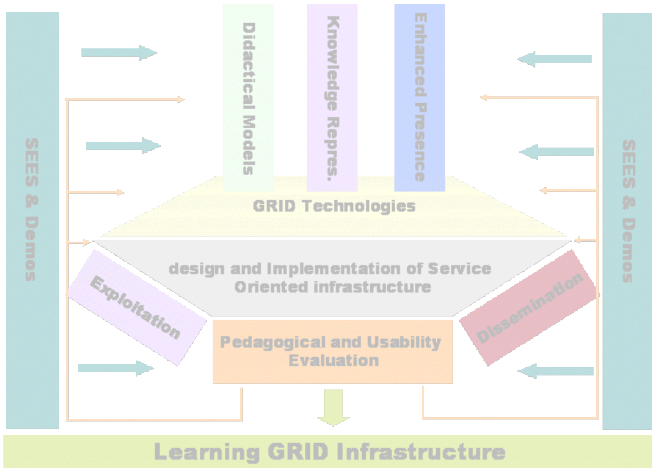
**Demonstrators**
Demonstrators differ from SEES in that they are based on the advanced prototypes which have adopted approaches congruent with the new paradigm, and where the pedagogical issues are already well understood. The purposes of the demonstrators are:

1) To provide evidence of the benefit coming from the adoption of didactical models based on socio-constructivist contextualised approach and to demonstrate the effectiveness of Grid technologies for implementing these didactical models.
2) to understand the engineering issues involved in implementing/porting existing solutions as OGSA-compliant software and services
3) to configure and customise these environments, for demonstrating effectiveness of specific research aspects
4) To prepare advanced contents for these environments
5) to provide working systems to elicit feedback and provide reference points within the project
6) to act as "demonstrators" in support of publicity, dissemination and training activities

The demonstrators have been selected in order to maximise the benefits of the development work in that there is already a working non-Grid version. The three demonstrators planned are:

- Virtual Scientific Experiments for teaching high level mathematical courses.
- Learning Environment for Accountancy and Business Finance
- Learning Environment for Mechanical Engineering

**The Overall Approach**
The picture below shows the organisation of the RTD activities and the relations existing among them.




***Pierluigi Ritrovato***
***ELeGI Scientific Coordinator***

## Research Projects Focus: Diogene

***Diogene is an EC project aimed at the realisation of a distributed virtual organisation for the provision of learning services. It implements state of the art and innovative features and, despite the fact that it is based on Web-Service technology,***

***it provides a migration path toward a GRID environment.***

Diogene [1] is an EC funded project aimed to design, implement and evaluate with real users an e-learning Web brokering environment for ICT individual training able to support learners during the whole cycle of the training, from the definition of objectives to the assessment of results through the construction of custom designed courses.

The e-learning system that is under development in the frame of the Diogene project uses state-of-the-art technologies like metadata and ontologies for knowledge representation and management, fuzzy learner modelling, intelligent course tailoring and includes a set of innovative features like dynamic learning strategies, Semantic Web openness, Web services for Learning Objects handling and IPR management, Curriculum Vitae maintenance and searching facilities, free-lance teachers support and assisted Learning Objectives definition [2].

The Diogene scenario is modelled as a **Virtual Organisation** (VO) strongly based on the use of Web Services. The Diogene VO is populated by entities offering and consuming services. Such entities are grouped in four categories: users (humans that provide and consume services), organizations (physical entities that as software components provide and consume services), utility components (software components embedding the technology assuring the architecture integrity) and accessor components (software components providing the access from outside to the Diogene VO and from the Diogene VO to outside).

### Diogene Users

Diogene Users can be grouped into the following main categories (it is important to note that the same physical user can play different roles in Diogene so it can belong to more of the following categories).

- **Learner**: is a student registered in the Diogene VO. He/she acquires knowledge through learning experiences provided by Diogene specific learning services.
- **Expert Learner**: is a skilled Learner with regard to some topics. He/she can offer mentoring support to other learners about such topics usually for free.
- **Freelance Tutor**: is a professional tutor offering his/her specialized mentoring support to learners about specific topics usually under the payment of some price.
- **Skill Searcher**: is an enterprise manager interested in hiring certified staff. He/she performs queries on skill repositories.

Diogene includes further sets of users like Content Providers, Knowledge Managers and Administrators.

### Diogene Organisations

Organizations of different type offer services with respect to the specifications of the Diogene VO and collaborate for the realisation of their own services. The kind of organisations supported by Diogene are summarised in the following list.

- **Publishing Houses** (PH). They store training content and provide remote access to it. They provide search and retrieval functions on the local repository via metadata-based queries.
- **Web Catcher Agencies** (WA). They are able to extract training content directly from Web and Semantic Web. Through a keyword-based text categorisation algorithm they are able, where absent, to automatically extract metadata from textual learning objects ad to link them to structures maintained by the KA.

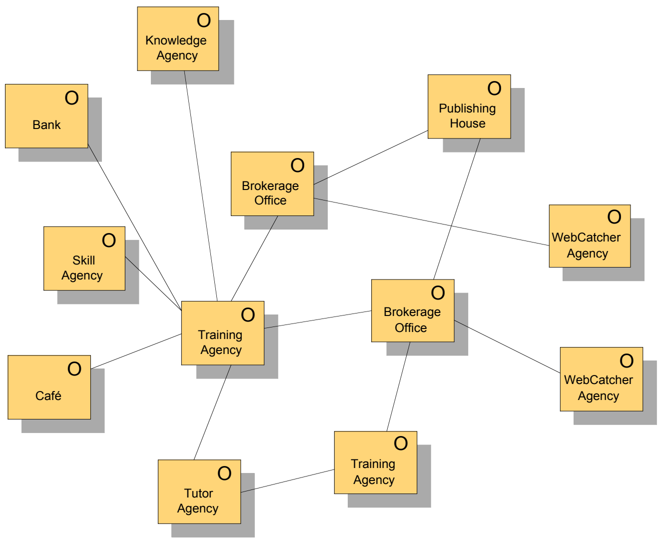



**FIGURE 1.** Interactions among Diogene Organisations.

- **Tutor Agencies** (TG). They work as entry point for freelance tutors; they manage the freelance tutor archive (containing tutor models) and provide searching facilities on such archive.
- **Brokerage Offices** (BO). They research, prepare and provide training offers for learners on demand, based on customisation information (learner model, learning strate-

gies, price, learning goals). They collaborates with PH and WA in order to retrieve didactical material that best fit the customisation requests. They collaborate with TG to retrieve and provide freelance tutors that best fit learner needs.

– **Training Agencies** (TA). They provide the basic environment for learning experiences and tutoring activities. They are responsible for the delivery of courses and for the provision of course management and execution functions. They maintain learner models and are able to provide (on demand) course offers by exploiting services offered by BO.

– **Knowledge Agencies** (KA). They maintain and manage knowledge structures (concept dictionaries and ontologies) for the whole Diogene Network.

– **Café** (CA). They support social interactions, mentoring and information exchange by providing users a set of collaborative synchronous and asynchronous facilities. They are able to automatically arrange groups among users of registered TA by individuating and grouping learners with similar needs and/or profiles.

– **Skill Agencies** (SA). They provide search engine capabilities on Learner Models Databases of registered TA in order to let third parties interested to hire certified staff to find qualified professional (with respect to privacy requirements). They maintain, moreover, statistics of requests in order to rank required competencies.

– **Bank** (BA). It's a singleton organisation that executes and logs transactions information occurred inside the Diogene VO. It interacts with an e-commerce engine to execute transactions involving real payment processes.

More instances of the same Organisations live inside the VO. The various instances stand on different hosts and are managed (administered) by different users. Figure 1 depicts some interactions between Diogene organisations.

Following the principles of the Convergent Architecture, Diogene Organizations can manage Processes, Resources and other Organizations. Resources live encapsulated within the Organizations and collaborate with them to accomplish their own tasks. Resources can also be used as containers for the information exchanged between organisations. Resources can manage its own data and other Resources.

Processes express and are realised by the collaboration between Organisations or by the collaboration between Organisations and internal Resources. Processes can create and use Resources and can use other Processes.

### Utility and Accessor Components

Utility Components have no business-domain relevance but embed the technologies that explicitly assure the Architecture integrity. The Diogene VO includes the following two singleton components.

– **Authentication Agency**: it provides all services for the registration and authentication of users of the whole Diogene VO. After authentication, it releases a token that must be used as a ticket to access and be authenticated in all VO services.

– **Diogene Services Registry**: it includes Diogene White Pages (containing information about services offered by organisations), Yellow Pages (organizing services in categories) and Green Pages (including information about how to execute services).

Accessor Components provide the access to the Diogene VO services and also the access through the Diogene VO components to external services. The only Accessor Component of the Diogene VO is the following.

– **Diogene Network Reception**: the entry point for all Diogene users. It provides features of user and organisation registration, it publishes characteristics and services offered by the Diogene VO, it provides administration features for the Services Registry.

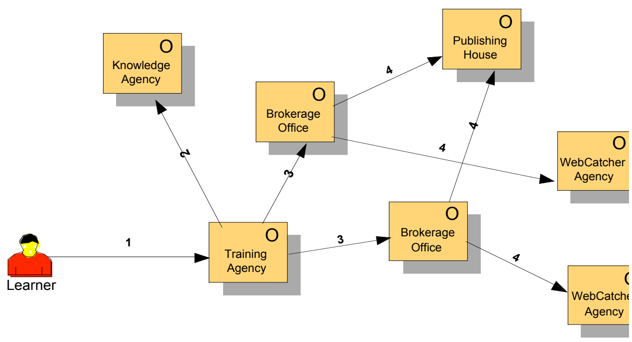



**FIGURE 2.** A Sample Scenario.

### A Sample Scenario

In figure 2 a Learner asks for a personalized training offer to his/her Training Agency (1) through its entry point (Training Agency web portal), starting from a concepts list that he/she wants to learn (Target Concepts).

Training Agency calls the Knowledge Agency (2) passing to it the target concepts in order to build the learning path, it will be composed of all concepts necessaries to the learner to reach the targeted concepts. Knowledge Agency builds the learning path using the owned knowledge structure, ontology and concepts dictionary, and the learner acquired knowledge.

Once the learning path is ready and fixed the best learning strategies for the learner the Training Agency calls the Brokerage Office (3) of the Diogene Virtual Organization in order to obtain the training offers to propose to the learner.

Each Brokerage Office starting from the data received by Training Agency (learning path, learning strategies, learner model, etc..) will prepare its own training offer. To do this the Brokerage Office calls the Publishing House (4) and the WebCatcher Agency (4) asking them for the list (list entry are the metadata that describe the single Learning Object, included the price) of available material, that best fit the Training Agency requirement.

**References**

[1] http://www.diogene.org.

[2] Capuano et al. An e-Learning Platform for SME Manager Upgrade and its Evolution Toward a Distributed Training Environment. Proceedings of the 2nd International LeGE-WG Workshop. Paris, France, 2003.

[3] Vergara et al. Diogene: a Training Web Broker for ICT Professionals. Proceedings of the 2nd International Conference on Multimedia and ICT in Education. m-ICTE 2003, Badajoz, Spain, 2003.

[4] Gaeta et al. DIOGENE: A service Oriented Virtual Organisation for e-Learning. Proceedings of the 4th International LeGE-WG Workshop. Stuttgart, Germany, 2004.

**Nicola Capuano**
Diogene Project Coordinator

# Technology Watch

***This section presents Technologies and Standards related to the e-Learning GRID world. A brief description will be given together with a set of references" to be read" to articles and documents.***

## OGSA

The *Open Grid Service Architecture* (OGSA) leverages on Grid and Web Service technologies to define, within a Service Oriented Architecture, a set of core interfaces and behaviours that address key concerns in Grid systems, and to provide an open and extensible framework for distributed and highly collaborative applications in both e-science and e-business domains.

OGSA addresses the issues related to the integration of services across distributed, heterogeneous, dynamic Virtual Organizations (VO) formed from resources within a single enterprise and/or from external resource sharing and service provider relationships.

Key features of OGSA are:

- the *openness* of the architecture, where open means extensibility, vendor's neutrality, and commitment to a community standardization process;
- the *service orientation* and *virtualization*, where the first is related to definition of service interfaces and the identification of protocols that can be used to invoke a particular interface, and the second is related to the encapsulation behind a common interface of diverse implementation, so everything in this environment is a service.

Current efforts are related to the definition of a set of functional requirements as dynamic and heterogeneous environment support, resource sharing across organizations, data access and management, job execution, Quality of Service assurance and so on.

In order to satisfy these functional requirements, OGSA realizes the needs that a service has to address in order to become useful in e-science and e-business applications. Among these, two major needs are the stateful nature of a service and its flexible compositionality.

The first is related to the conversational and interactive features of the services that are required by real applications, and the second is coupled with the capability to build more complex services from simple ones.

To achieve these needs, OGSA complaint architectures relies on the interfaces and behaviours defined by the Web Service Resource Framework (WSRF), the recently proposed refactoring of the Open Grid Services Infrastructure (OGSI).

WSRF defines an approach for modelling, accessing, and managing state through the definition of "stateless services that act upon a stateful resource". These can be seen as services of an intermediary complexity between the pure stateful and conversational services and the truly stateless ones, thus allowing an easy composition without loosing the state management.

OGSA provides a new view of Grid computing based on the concepts of Service, Collaboration and VO allowing a transition from content oriented learning solutions towards contextualized, user centered and collaborative approaches.

These innovative approaches for ubiquitous learning imply the access to distributed services as visualization system, simulation environments, virtual laboratory and discussion group in the frame of a virtual organization.

**References**

[1]. Foster et. al. The Physiology of the Grid: An Open Grid Service Architecture for Distributed System Integration, 2002

[2]. Foster et. al. Open Grid Service Infrastructure (OGSI) Version 1.0, 2003

[3]. Foster et. al. The WS-Resource Framework, 2004

**Angelo Gaeta**

# Web Services

According to a Web Service Glossary of the World Wide Web Consortium (W3C), a Web Service (WS) is "a software system designed to support interoperable machine-to-machine interaction over a network. It has an interface described in a machine-processable format (specifically WSDL). Other systems interact with the Web service in a manner prescribed by its description using SOAP-messages, typically conveyed using HTTP with an XML serialization in conjunction with other Web-related standards."

More in general, the term Web Service also indicates a new emerging distributed computing paradigm based on Internet standards to handle the heterogeneity of the resources dispersed on the web. Among these standards, the most widely adopted ones are:

– Simple Object Access Protocol (SOAP), an XML based protocol intended for exchanging structured information in a decentralized, distributed environment;

– Web Service Description Language (WSDL), provides a model and a XML format for describing Web Services;

– Universal Description, Discovery and Integration (UDDI), web-based registries that expose information about a business or other entity.

Figure 1 depicts a minimal Web Services Architecture that set three roles and three operations. The three roles are the service provider, the service requester and the service registry. The objects acted upon are the service and the service description, and the operations performed by the actors on these objects are publish, find, and bind.

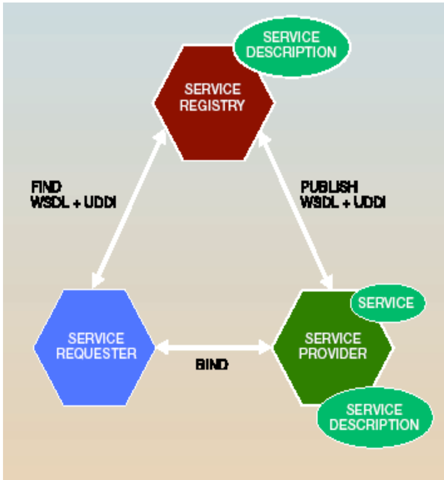



**Figure 1.** Web Service's roles and operations

A service provider creates a Web Service and its service description and then publishes the service in a service registry based on UDDI standard. Once a Web Service is published, a service requester may find the service via the UDDI interface. The UDDI registry provides the service requester with a WSDL service description and a URL (uniform resource locator) pointing to the service itself. The service requester may then use this information to directly bind to the service and invoke it.

Currently, there are many emerging standards and specifications from both the industrial and scientific worlds that cover several aspects related to web service paradigm, e.g. security (WS-Security), composition and coordination of services (WS-Choreography, Business Process Execution Language for Web Services – BPEL4WS), management of services (WS-Manageability).

Web Services can't remain indifferent to the impact of Semantic Web technologies. Recently, the W3C has created an interest group whose purpose is to study possible integrations of Semantic Web technologies into the ongoing Web Services standards. This will allow for semantically enriched discovery, composition and invocation of services.

**References**

[1]. Wall et al. Web Services Building Blocks for Distributed Systems, Prentice-Hall, Inc., 2002

[2]. Curbera et al. Business Process Execution Language for Web Services, Version 1.1, 2003

[3]. Berners-Lee T et al. The Semantic Web, Scientific American, May 2001

[4]. The UDDI technical white paper, 2000

**Angelo Gaeta**

## IMS Simple Sequencing

The IMS Simple Sequencing Specification defines a method for representing the intended behaviour of an authored learning experience such that any learning technology system can sequence discrete learning activities in a consistent way.

The specification defines the required behaviours and functionality that conforming systems must implement. It incorporates rules that describe the branching or flow of instruction through content according to the outcomes of a learner's interactions with content. The Specification was released to the public in March 2003.

The Simple Sequencing model is purposely neutral with regard to models of pedagogy and the use of instructional strategies, but it describes only fairly simple behaviours in order to limit the specification and especially conformance verification to a manageable scope.

The IMS Simple Sequencing Specification relies on the concept of learning activities. A learning activity may be loosely described as an instructional event or events embedded in a content resource, or as an aggregation of activities that eventually resolve to discreet content resources with their contained instructional events.

The activities are arranged as an activity tree. LMS sequencing behaviour is described in terms of traversing the nodes of the tree to determine which activity to deliver to the learner.

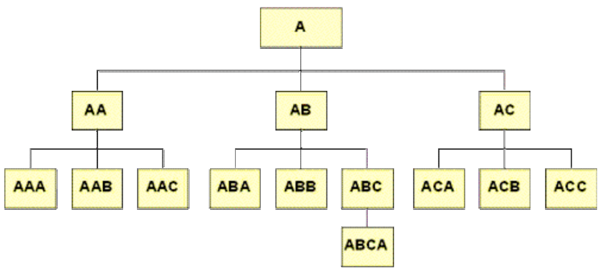



**Figure 2.** An example of Activity Tree

The Simple Sequencing Specification defines the canonical traversal of the activity tree as pre-order traversal. The default traversal path can be modified through the association of sequencing rules created by a learning designer. Sequencing rules are evaluated at runtime and can be conditional based on tracking status. Activities are always delivered one at a time and may have auxiliary resources associated with them.

**References**

[1] IMS Simple Sequencing Specification. http://www.imsglobal.org/simplesequencing

[2] Just Simple Sequencing. http://www.lsal.cmu.edu/lsal/resources/standards/ss/

**Nicola Capuano**

# News

**Angelo Gaeta**

## WSRF.NET 1.0

The Grid Computing Group of the University of Virginia announces the implementation of the Web Services Resource Framework (WSRF) on the Microsoft .NET platform. WSRF.NET includes implementations of the port types defined in both the WSRF and WS-Notification family of specifications.

Other features of WSRF.NET include support for multiple databases (e.g. MS SQL Server, MSDE, MySQL), an attribute-based programming model, integrated tools to perform port type aggregation, remote job execution capability and capability to program services in any .NET language.

## OGSA Use Case Document

The OGSA Use Case document has entered the 30d public comment period. It is important to the Global Grid Forum (GGF) process that people express their comment on the document.

The document entered the public comment period only contains the use case scenarios referred as "tier 1". Among the GGF documents, it is also available a working draft with other use case scenarios referred as "tier 2".

In this draft, there is a use case, "The Learning Grid", that covers the area of user-centered, contextualized and experiential based approaches for ubiquitous learning in the framework of a Virtual Organization.

The Learning Grid use case identifies a core set of services required by the presented scenarios specifying their functionalities and relationships.

## SCORM 2004

On January 30, 2004, the Advanced Distributed Learning (ADL) Initiative has released Sharable Content Object Reference Model (SCORM) 2004, formerly referred to as SCORM Version 1.3. The most significant change from SCORM Version 1.2 to SCORM 2004 is the addition of learning content sequencing capabilities as defined by the IMS Global Learning Consortium's Simple Sequencing (SS) specification to address the need for dynamic presentation of learning content based on learner performance.

SCORM is a collection of specifications adapted from multiple sources to provide a comprehensive suite of e-learning capabilities that enable interoperability, accessibility and reusability of Web-based learning content. SCORM aims to coordinate emerging technologies and commercial and public implementations.

SCORM defines a Web-based learning "Content Aggregation Model (CAM)," a "Run-Time Environment" (RTE) and a "Sequencing and Navigation (SN)" model for learning objects. The CAM defines how to aggregate, describe and sequence learning objects.

# Events

| When | What | Where |
|---|---|---|
| **August, 30 2004** | **GLS 04 – GRID Learning Services. To be held in conjunction with ITS 2004.**<br>**The workshop addresses the issues of integrating human and machine learning into models, systems, applications and abstracting them into theories for advanced Human learning, based on the dynamic generation of GRID services**<br>**The workshop is inspired by an EU Integrated Project ELeGI** | **Maceio, Brazil** |
| **August 23-24, 2004** | **GridSem 2004 - the 1st International Workshop on the Semantic Grid**<br>**The proposed workshop aims to foster international collaboration among the above areas of research and technological development with the aim to realize the vision of the Semantic Grid. The workshop is collocated with the premier European Artificial Intelligence Conference ECAI 2004 to emphasize the role of Artificial Intelligence techniques (e.g., knowledge representation, planning, learning etc.) in making progress in the above four areas and the ultimate realization of the Semantic Grid.** | **Valencia, Spain** |
| **August, 30 – September, 1 2004** | **ICALT 2004 – The 4th International Conference on Advanced Learning Technologies**<br>**The conference theme focuses on the crafting of such learning experiences enabled or mediated by technology that enacts authentic contexts for the learning and doing to take place.** | **Joensuu, Finalnd** |
| **September, 15 2004** | **European Grid Technology Days 2004.**<br>**The event is organised by the EC Unit F2 "Grid Technologies" and will be presented the IST-FP6 Grid Projects** | **Brussels, Belgium** |