Tools for Job Rotation integrating access to vocational training

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ABSTRACT. This paper presents a Job Rotation management tool, and the method in which the architecture of Grid/Web Services can compose a knowledge Grid to facilitate access to vocational training courses, and, in this way, provide an integrated solution for both employers and employment seekers. The Job Rotation tool is implemented as an online e-service, that brings together training policies and employment policies. This tool not only assists businesses in finding employee training resources, but it also helps them by filling in the positions of the employees who are being trained. The aforementioned positions are temporarily covered by people who are unemployed. All transactions take place automatically through the service. Without human intervention, the qualifications of the fill-ins are matched to the needs of the companies, and several recorded criteria are considered before the final choice is made. It is a win-win strategy, where all parties involved (the unemployed who state their interest, and the companies that accept to employ them) are benefited. The Grid/Web Services architecture provides up-to-date and verified information, directly from the offering organizations, reducing, in this way, administrative costs for the Job Rotation e-service.

KEYWORDS: *Grid/Web services architecture, Job rotation, Unemployment*

Introduction

Modern society, as shaped by universal economy, has entered a phase where knowledge is a competitive advantage for those that can acquire it. One of the many strategies that businesses adopt, in order to remain competitive, is life-long training. However, the criticism on the training offered nowadays is that it only slightly improves the employees' qualifications. In addition, many employers (especially in small enterprises) are unwilling to invest in training, for fear that it will interfere with their production. Unemployed individuals, on the other hand, are rarely immediately operational to fulfil the needs of a company, and, generally, their training is often insufficient or irrelevant to the production

procedures of many established companies.

In order to assist companies to overcome these obstacles, and proceed to re-skilling their employees, as well as to help unemployed individuals enter the labour market, the Job Rotation e-service presents an online service. The Job Rotation model is a matching tool that replaces departing trainees with unemployed individuals who have stated an interest. The model is accompanied by a search and advice module, that matches the needs of the company with the proper vocational training offered.

Job Rotation provides the unemployed with on-the-job training, while they replace training employees in companies. Simultaneously, companies are offered the choice of presenting their employees with the opportunity to promote their skills and education, and become valuable assets to their employers, without risking production. The Job Rotation e-service (implementing the Job Rotation model) is a tool that helps low-skilled people enter the labour market, and obtain real work experience. Moreover, by filling in those positions, the tool enables companies to enhance their employees' skills, without holding up production.

In addition to the aforementioned benefits, the integrated Grid/ Web Services Job Rotation system has the additional advantage that it offers up-to-date information on training courses, tailored to the needs of the employees, and their companies.

The innovation of the system is the implementation of the Job Rotation model, and its integration into Grid and Web Services technologies. To the best of the authors' knowledge, no similar Job Rotation e-service has been so far implemented in Europe, though other possible formulas for replacement exist, such as temporary employees or subcontracting.

The main advantages of the system introduced is that it brings together all parties involved (unemployed individuals, companies, employees, and training institutions) and attempts to motivate them to participate in rotations, by planning and co-ordinating the agreed substitutions. However, this can only be achieved by offering up-to-date information to the companies on vocational training courses that are suitable to their needs. The Grid/Web Services solution benefit is that it offers access to a wide range of vocational training courses, which are directly derived from the training institutions. In this way, companies are able to select among several courses, following the advice provided by the system, as

to which courses are more appropriate for their needs. The Grid/Web Services architecture is an independent platform that integrates information from different organizations offering vocational training. The rest of this work is organized as follows: Section 2 presents literature relative to the context of the application, as well as the definition of Job Rotation and the Job Rotation e-service; Section 3 describes the architecture and the technology involved in the proposed environment; Section 4 presents the integration of the Grid/Web Services into the Job Rotation model; Section 5 presents some initial results; finally, Section 6 summarizes, concludes and outlines further work.

Relevant work and methodology

Relevant work

Job Rotation is a widely spread model and there are many relevant projects, implemented mostly in Scandinavian countries. Job Rotation is related to training and employment policy. For this reason, projects including the application of the Job Rotation model are credited under the ADAPT program (ADAPT, 2006) and, more recently, under the EQUAL program. The EQUAL Initiative is a laboratory for new ideas, within the European Employment Strategy (EQUAL, 2007).

In the years 2002-2004, the project *SOS-MX* (AMU Nordjylland, 2003) has found innovative ways to achieve equal distribution of genders in recruitment, especially for workers in the social and health sector. In addition, the project established equality strategies as mainstream policies, by means of plans and tools developed, which promoted the elimination of gender inequalities and, at the same time, rectified recruitment difficulties in this sector.

During the same period, the Vasco da Gama project (Oxford Insight A/S, 2003) developed and identified examples of new forms of good practice, in the interplay between immigrants or refugees, enterprises, and agents in change within the public sector, to secure the best opportunities for integrating immigrants or refugees into the Danish society, tough employment in private and public enterprises.

Finally, the project *Faktor 2007* (AMU-Center Nordjylland, 2006), which started in 2005 and continues to this day, aims to strengthen the care and welfare areas, in order to effectively face the dramatic

changes in the field. The basic assumption is that focusing on adjusting the uneven gender proportion of labour in the sector will create the conditions for positive dynamics in the transformation process. As far as the current research work is concerned, there is no Job Rotation e-service in Europe, involving Grid/Web Services technology in its architecture and/or being capable of providing up-to-date information on vocational training offers.

Job Rotation

Job Rotation is a tool that promotes both training and labour market activities. It provides employees with paid leave to participate in supplementary training, while they are being replaced in their jobs by unemployed people, who in turn receive a period of on-the-job training (Janssens, 2001). Figure 1 shows a very simple example of a Job Rotation model.
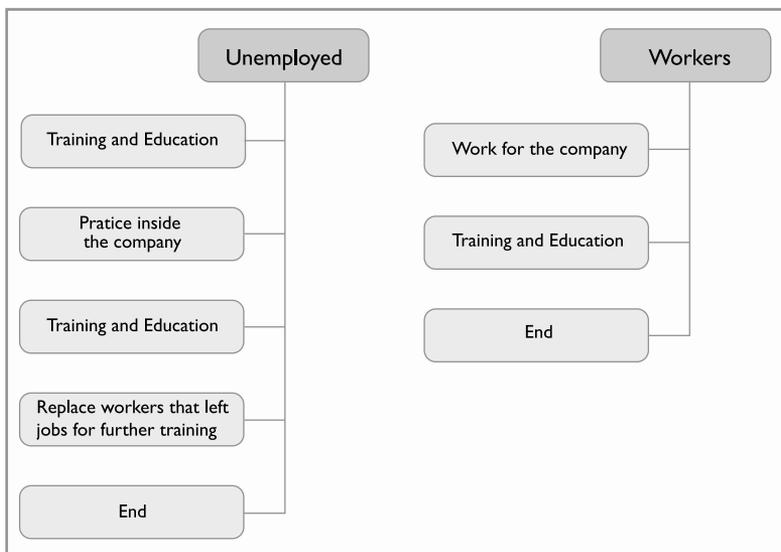
Further than this definition, other forms of the Job Rotation model are recorded, like rotations of the employees between job positions inside a company (Eriksson, Ortega, 2004). Moreover, this paper deals with the Job Rotation model that replaces employees, who temporarily depart for training reasons, with trained unemployed. One of the most important elements of Job Rotation is that it offers many advantages to parties involved - employees, employers, syndicates, unemployed individuals, and

modulation authorities, in the market and society.

Today, through governmental incentives for employment, huge funds are spent on passive policies that should become energetic. The idea of Job Rotation offers opportunities not only to companies, but also to unemployed and first-time job seekers. It is an energetic measure for fighting unemployment, while, at the same time, it refreshes the existing personnel of the companies, offering them improvement in quality, and greater productivity through proper re-skilling. According to *An Employer's Guide* from WEA (WEA Job Rotation, 2007), more than 3.000 companies all over Europe have participated in Job Rotation. Almost 90.000 employees have received training and 20.000 unemployed people have been trained as substitutes and re-entered employment.

By improving companies' capacity to offer life-long learning to their employees, and offering precious real work experience to unemployed people, the Job Rotation service brings together the interests of employers, employees and unemployed individuals. Job Rotation has been described as a win-win strategy, where all parties involved are benefited (Job Rotation, 2003).

Job Rotation in general:

- boosts company productivity by increasing quality, and allowing them to adapt more easily to technological changes.

- improves employability by educating the unemployed to real market needs, and offering them invaluable job experience.

The Job Rotation e-service

The Job Rotation e-service (Figure 2) deals with the management of the Job Rotation activities. On the one hand, it substitutes SMEs' staff with trained unemployed individuals, and, on the other hand, it suggests and offers training courses for the same staff. The e-service coordinates, monitors and reports on the achieved rotations.
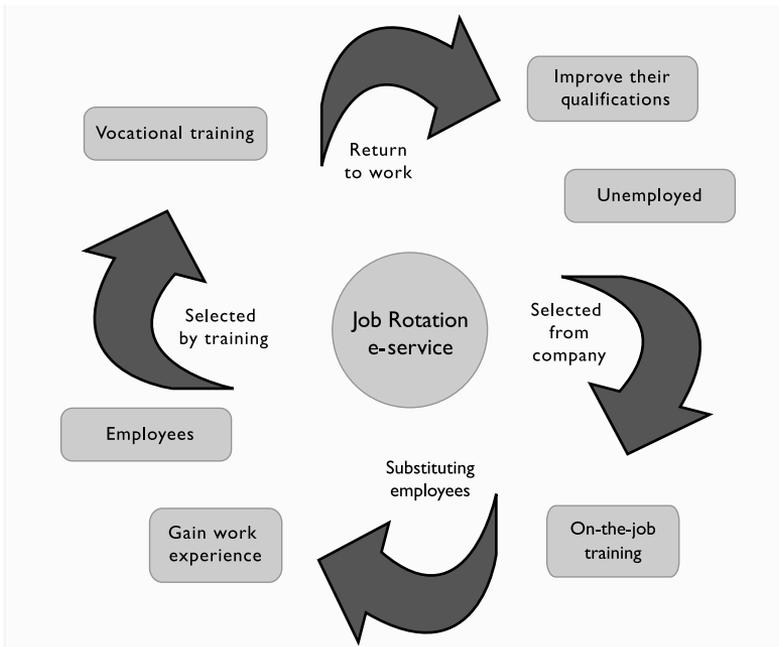
The enterprise uses the e-service to submit the full description of the Job Rotation vacancy offered, the applicable working sector that the position is related to, the area where the enterprise premises are located, the required level of experience of the unemployed, his/her characteristics, the first and last date of the rotation, special training that should be followed before the acquisition of the job position, work schedule, the address of the job place, and the salary offered for this period.

The unemployed individual, on the other hand, uses the e-service to build a work profile, selecting from a list of available working sectors the ones that are suitable for him/her, the area he/she is interested to work in, educational information, and other parameterized data that will facilitate the system to make the best matches. Anyone can understand the difficulty and cost required, in order to administrate such a service, due to its complexity and the number of different users involved:

- **SMEs and micro enterprises**: the concept of the system is directed towards providing specialized Job Rotation services from a wide pool of training subjects and unemployed. This is not restricted to SMEs, but any company interested in training

their personnel, and replacing them while they are trained, can participate.

- **Unemployed**: the unemployed are given a chance to work part-time, or even on a regular basis, by covering the vacancies created by the training needs of companies, in order to maintain competitiveness for their employees and firm.

- **First-time job seekers**: these are young people, who have considerable difficulty in entering the labour market. The system deals with this problem by integrating these people into a real working environment, while counteracting their potential devaluation of their skills and competences.

- **Training organizations**: this category of users involves universities offering postgraduate studies, colleges, and other private training institutions, which offer specialized education to SMEs' employers, and proper education to unemployed, in order to be flexible, and ready to fill the vacancies created.

- **System's experts**: these experts play a very important role in the system, since they have up-to-date and profound knowledge of the market. They analyze each case individually, and advice the SMEs' managers or Human Resource Departments on the training courses that are available and suitable to their enterprises. Of course, if the SMEs have already decided the training that their employers should obtain, the role of the system is reduced to finding the proper unemployed individuals to replace them.

This is the reason why this work seeks to exploit the benefits of the Grid/Web Services technology for minimizing administration costs, and maximize efficiency of the Job Rotation e-service.

Architecture and technology

Service architecture

The front end of the Job Rotation service is divided into two sections: the public informative section, and the restricted access to Job Rotation services. The data manager module acts as a regulator of the knowledge, and allows or restricts access to data, in accordance to the security policy of the Web server module's security manager. Transactions are made with the use of XML

documents, while the knowledge management system allows the management of any type of files.

The Web server module is the TCP/IP network engine of Job Rotation, and a data storage system. In addition, this module deals with issues, such as user rights and RDBMS. The Web front end has a user-friendly GUI, that enables users to access information and knowledge, regarding Job Rotation offers. End users communicate with the system through the HTTP protocol, and with SSL sessions, if secure connections are required. The front end communicates with the Web server through ASP pages.
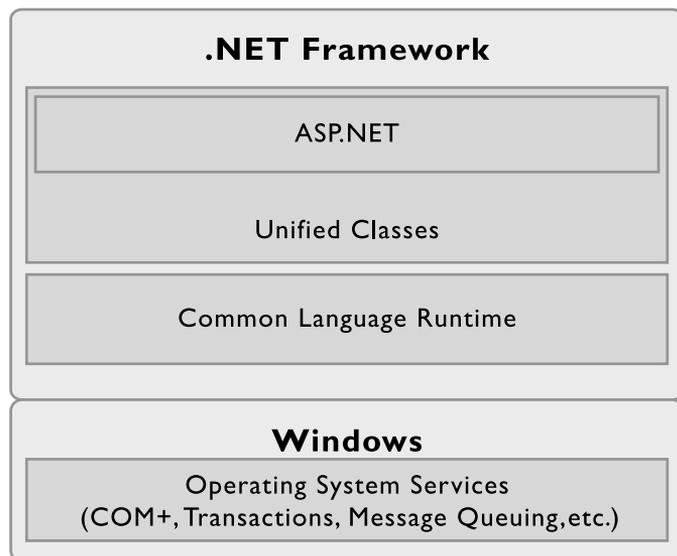
The system uses the state-of-the-art Internet technologies and protocols, for the development and presentation of the Web portal, as well as communication of its components. The main set of technologies utilized is:

- **Presentation layer**: developed in HTML and HTML forms. In order to improve the presentation's level efficiency and attractiveness, and also allow offline work, HTML pages have been enhanced with programming units, written in JavaScript, and executed locally by the user's browser.

- **Application layer**: the application logic that is included in objects (components), written in Visual Basic or C++, running into the environment of the Windows 2003 Server. The intermediate between the user interface (Web pages and forms) and the application logic (the components) are the Active Server Pages (ASPs). Each ASP is an individual programming unit, written in a scripting language (for example, VBScript or JavaScript) and executed by the Microsoft Web server Internet Information Server (IIS). ASPs can be referenced by the user interface (for instance, a browser) as any other normal HTML page. Upon request, the ASP is executed by calling the proper components, assembling the output (in XML or directly to HTML) and sending this output to the client who made the request. Components and ASPs can be distributed across different application and Web servers, respectively, improving the application scalability, when new users are added.

- **Data layer**: the data layer has been developed in the Microsoft SQL Server 2000. SQL Server 2000 is an integrated RDBMS providing management of many different types of data (structured information, binary large objects etc.). Changes to

the data are made by stored procedures, which ensure that no unsafe changes are made. Microsoft IIS with Web classes is used to organize the presentation of the data - selecting what to display, creating the HTML pages, and invoking stored procedures, according to commands conveyed by the user.

As a platform for the development of the service, the .NET Framework has been used, an application model, and a number of main technologies for the simplification of the development and the future exploitation of available XML services. The Microsoft .NET Framework (Figure 3) offers the necessary infrastructure for the development of XML services, that are visible to the programmers and the external users.

Figure 3. The .NET Framework

.NET Framework

ASP.NET

Unified Classes

Common Language Runtime

Windows

Operating System Services
(COM+, Transactions, Message Queuing, etc.)

The .NET Framework exploits the best elements of the COM (the Component Object Model of Microsoft) and combines them with the best elements of the Loosely Coupled XML Web Services. The result is a dynamic Web components system, that offers scalability, security and reliability.

The objective of the Microsoft .NET Framework is to ease the development of Web applications. It is constituted by the following three modules:

- The Common Language Runtime (CLR)

- A hierarchical set of class libraries

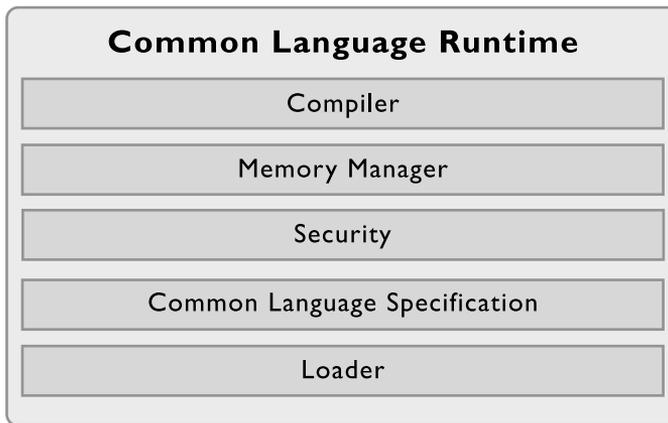- A version with Microsoft Active Server Pages components, called Microsoft ASP.NET.

The CLR (Figure 4) is created over the services of the operational systems. It is responsible for the execution of the application, and it ensures all application assemblies, manages the memory, secures the integration of the language, and so on. It is also responsible for the runtime of all those services that facilitate the production of code, while it improves the reliability of the application. Figure 5 shows the architecture of an e-service.
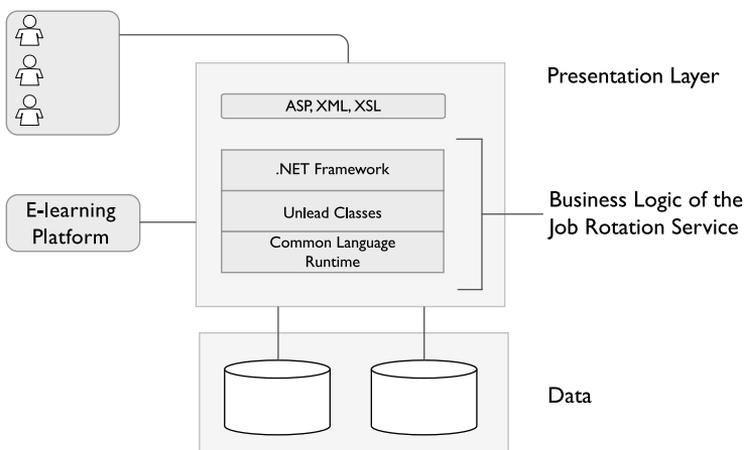
Grid technologies

Grid technologies support the sharing and coordinated use of diverse resources in dynamic "virtual organizations" (VOs) - that is, the creation, from geographically and organizationally distributed components, of virtual computing systems, that are sufficiently integrated to deliver desired Quality of Service (QoS) (Foster et al., 2001).

The Grid idea emerged initially as a model that combines the resources of many separate computers, connected by a network (usually the Internet) to solve large-scale computation problems.

Web Services, as a new, interoperable and effective way to provide functionality over the Internet, caused a new centre of attention to the Grid technology, to Grids build on Web Services (Grid/Web Services).

Following this approach, a Grid can be defined as a layer of networked services, allowing users single sign-on access to a distributed collection of compute, data and application resources (Gannon et al., 2002).

The above led to the development of The Open Grid Service Architecture (Foster et al., 2002) that defines standard mechanisms for creating, naming and discovering transient Grid service instances, provides location transparency and multiple protocol bindings for service instances, and supports integration with underlying native platform facilities.

The Open Grid Services Architecture also defines, in terms of Web Services Description Language (WSDL) interfaces and associated conventions, mechanisms required for creating and composing sophisticated distributed systems, including lifetime management, change management and notification.

Web Services

The term Web Services describes an important emerging distributed computing paradigm, that differs from other approaches, such as DCE, CORBA, and Java RMI, in its focus on simple, Internet-based standards to address heterogeneous distributed computing. Web Services define a technique, describing how the software components can be accessed, as well as methods for accessing these components, and discovery methods that enable the identification of relevant service providers. Web Services are programming language - programming model - and

system software-neutral (Foster et al., 2002).

Web Services (Figure 6) interact with applications, consuming them by exchanging messages in Simple Object Access Protocol (SOAP) format, while the contracts for the message exchanges that implement those interactions are described via WSDL interfaces (W3C Working Group Note, 2004).
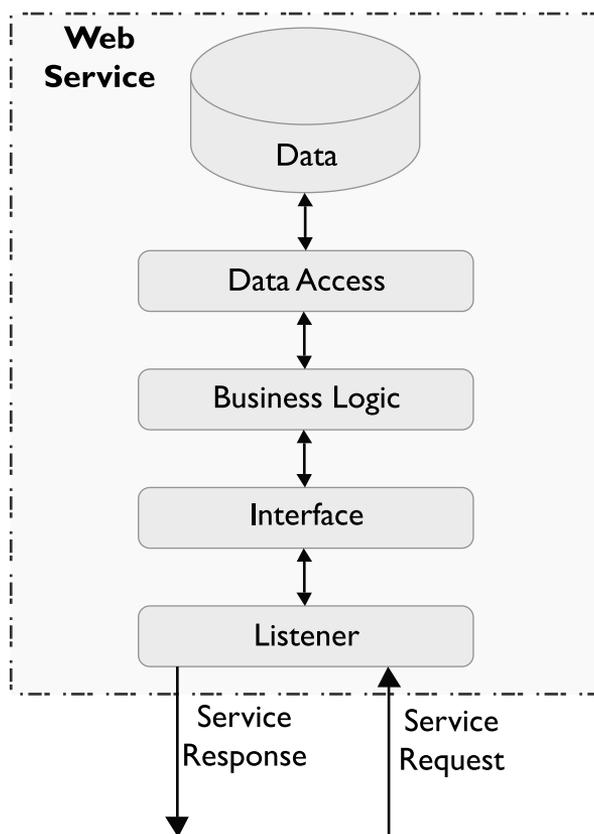
Integration

The integration of the Web Services, offering access to vocational training courses to the Job Rotation system, is accomplished through a Grid/Web Services architecture (Figure 7). The Web Services, constituting the Grid, are custom-made for Job Rotation purposes, performing a specific set of operations that offer, upon user request, up-to-date information on available Vocational training courses from different training organizations.

In order to set up this architecture, a Broker is required - machine that will host the Universal Description, Discovery and Integration (UDDI) directory - where all these Web Services under the Job Rotation Grid are registered, setting up a Job Rotation private UDDI registry. A Web Service must be registered to a UDDI directory, in order to be published and reveal its functionality to the world. UDDI is an XML-based standard for describing, publishing and finding Web Services. The UDDI can be hosted in the same server as the Job Rotation e-service or in another server on the Web. Service consumers can then interrogate the broker to locate a required Web Service, and use it to implement a business solution. The Job Rotation e-service acts as one of those service consumers, and uses all the Web Services registered to the UDDI registry.

Setting up the Grid, a Job Rotation specific WSDL (Grid-WSDL) should be developed for each Web Service to comply to. When each Web Service is discovered the Grid-WSDL XML-format protocol helps other systems that need its functionality understand how the interface takes place. WSDL describes how to access a Web Service, and not what the Web Service business logic is.

To utilize the Web Services functionality, a common language between these Web Services should be defined. XML/SOAP messages are used for exchanging information. SOAP is a lightweight protocol, intended to exchange structured information in a decentralized, distributed environment (Gudgin et al., 2003).

XML is the technology used with SOAP messages that form the requests and responses from a Web Service. A client invokes a Web Service by sending an XML/SOAP message, and then waits for a corresponding XML/SOAP response. Because all communication is in XML, Web Services are not tied to any one operating system or programming language.

The content of these messages complies with the general known standard describing Metadata for Learning Objects. Learning Object Metadata (LOM) is a common used standard from the IEEE, that can be easily used for communication of information for different learning objects.

Expanding LOM structure and creating Job Rotation-specific vocabularies will be investigated to make the identification of the most adequate vocational training courses more effective.

Finally, an application, that from a single point will give access to all this information from the registered Web Services, will be

developed. The application will enclose a smart search engine, that will communicate with the Web Services subscribed to the UDDI registry, and request information, according to the user needs. The results will be presented to the user, along with more information of the organization offering them. All the nodes described in the Figure 7 communicate with each other through a Transmission Control Protocol/Internet Protocol (TCP/IP).
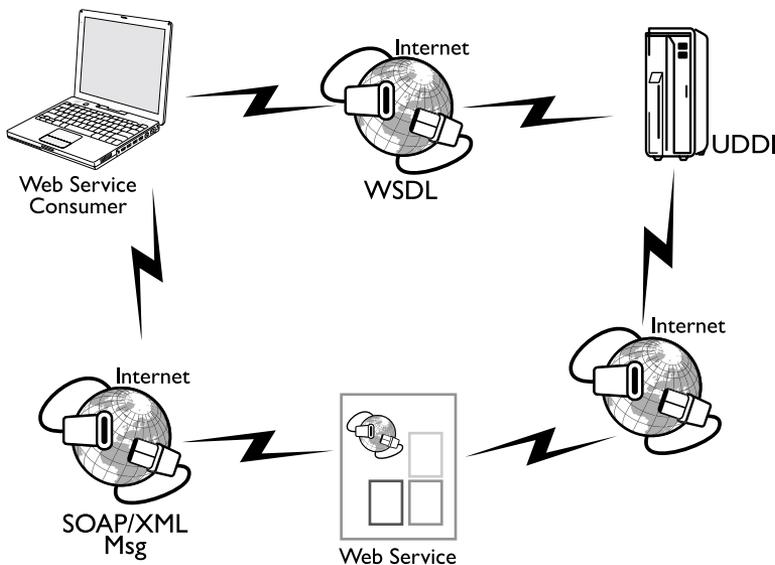

Figure 7. Description of the proposed architecture Web Service

The advantage of the described architecture is that the pool of available vocational training courses will grow rapidly, as each new organization that desires to join the Job Rotation Grid needs to follow some simple steps, in order to develop and register its own Web Service to the Grid's UDDI. Then, the Web Service will offer, upon request, information for the organization's courses, following the LOM standard.

Administration costs for the Job Rotation e-service are minimized, since the administrator needs to do little more than observing the successful integration of the new Web Service to the Grid.

Results

The Job Rotation service is a positive and cost-effective way for all parties concerned that:

- offers companies the ability to educate their employees lifelong, replacing them with suitable trained unemployed (re-skilling);

- provides employees with the time margin and the means to be educated, without disturbing their personal lives and work relations (lifelong learning);

- facilitates access to information on vocational training courses from heterogeneous sources;

- combats long-term unemployment by training unemployed, in real production procedures (access to e-learning);

- boosts productivity of SMEs by adopting new business models and organizational structures;

- reduces the gap between the qualifications offered and the qualifications required in the market;

- increases the availability of e-learning services for the unemployed and SMEs' staff.

Conclusion

The Grid/Web Services solution for Job Rotation e-services is a great opportunity to upgrade the role and efficiency of the Job Rotation model. It is a cost-effective and reliable way to offer accurate and up-to-date information on vocational training courses. It is also a great chance for the training organizations to promote their courses, and provide training relevant to the real job market needs. The proposed architecture is easy to implement, open to the integration of more and more Web Services of organizations offering vocational training, and easy to maintain and extend.

Future work that could utilize the advantages of the Job Rotation Grid can be identified in the fields of benchmarking vocational training courses, monitoring of the efficiency of vocational training, measuring the connection of the training offered to the real demands of the production, and to the creation of composite training courses from several training organizations.

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Sintesi

L'acquisizione continua di conoscenza da parte dei propri impiegati è ormai una necessità imprescindibile per il mantenimento della competitività da parte delle imprese; la strategia che garantisce un aggiornamento continuo delle proprie risorse umane è senza dubbio il lifelong training, formazione erogata per tutta la durata della vita professionale dei lavoratori. Tuttavia, moltissimi impiegati, specialmente nelle piccole imprese, esitano a investire in attività formative di aggiornamento, temendo che si rallenti la regolare produttività. Per quanto riguarda invece i disoccupati, la loro preparazione è spesso inadeguata per un immediato inserimento professionale all'interno di compagnie avviate.
Per assistere i disoccupati ad acquisire le competenze necessarie ad entrare nel mercato del lavoro, e per aiutare le imprese nel processo di riqualificazione delle competenze professionali, senza interrompere la catena produttiva, viene presentato il modello della "rotazione professionale", detto Job Rotation. Si tratta di uno strumento che promuove sia attività professionali che formative, sostituendo gli impiegati fissi, durante la frequenza del corso di formazione, con disoccupati che vengono formati sul campo. Il modello è implementato da un modulo online, detto Job Rotation e-service, che gestisce le attività legate al sistema delle rotazioni professionali, fornendo un doppio servizio di ricerca e di assistenza, che provvede sia a segnalare

alle compagnie i corsi professionali più adatti a migliorare le competenze necessarie per svolgere le mansioni richieste dalle aziende, sia a coordinare, monitorare e valutare le sostituzioni pianificate dei posti di lavoro momentaneamente vacanti. Affinché questo sistema risulti veramente operativo, il doppio prerequisito necessario consiste, da una parte, in una linea diretta che colleghi le istituzioni formative alle imprese, cosicché queste ultime abbiano la possibilità di scegliere, da un'ampia gamma di corsi professionali, quelli più adatti alle necessità interne, e dall'altra nell'opportunità che viene offerta ai disoccupati di entrare nel mercato del lavoro, tramite un tipo di formazione on-the-job, che possa permettere loro di acquisire competenze, senza che la catena produttiva ne risulti rallentata o addirittura bloccata. Tutte le transazioni hanno luogo automaticamente, tramite il suddetto servizio telematico delle rotazioni professionali.

In particolare, le imprese utilizzano l'e-service per inserire la descrizione completa del posto vacante a disposizione per la rotazione professionale, il relativo settore professionale, l'area in cui si trovano i locali dell'azienda, il livello di esperienza richiesto, la data di inizio e di fine rotazione, lo speciale addestramento che occorre seguire prima di occupare il posto, l'orario di lavoro, l'indirizzo e il salario offerto. I disoccupati, invece, utilizzano l'e-service per costruirsi un profilo professionale, scegliendo da un elenco di settori professionali disponibili quelli che risultano per loro più adatti, l'area professionale d'interesse, informazioni relative alla propria istruzione ed altri dati che, rispondendo a criteri ben precisi, possano aiutare il sistema ad effettuare gli abbinamenti migliori. Un servizio del genere è difficile e costoso da amministrare, sia per la sua complessità intrinseca che per i diversi utenti coinvolti. E' per questo che si cerca di sfruttare i vantaggi della tecnologia dei Grid/Web Services per ridurre al minimo i costi di gestione e incrementare il più possibile l'efficienza del Job Rotation e-service. Il vantaggio del sistema dei Grid/Web Services consiste proprio nella sua capacità di coinvolgere, con esito positivo, tutte le parti in causa, soddisfacendo sia i datori di lavoro che le istituzioni formative, da una parte, e motivando sia gli impiegati di ruolo che i disoccupati in cerca di un impiego, dall'altra.

L'architettura dei Grid/Web Services (suddivisa in tre livelli: livello della presentazione, livello dell'applicazione, livello dei dati) è una piattaforma indipendente, che offre adattabilità, sicurezza e affidabilità, capace di realizzare una vera e propria knowledge grid, in cui vengono integrate le informazioni sulla diversa tipologia di corsi professionali offerti dalle differenti organizzazioni, facilitando così l'accesso ai corsi di formazione da parte degli impiegati delle imprese.

L'innovazione del sistema consiste proprio nell'implementazione del modello del Job Rotation e nella sua integrazione all'interno delle tecnologie dei Grid/Web Services. In Europa, non esistono precedenti dell'implementazione del Job Rotation e-service, l'unico a utilizzare la tecnologia dei Grid/Web Services.

Stando ai dati forniti dalla WEA nel 2007, 3.000 compagnie in tutta Europa hanno aderito al modello del Job Rotation, quasi 90.000 impiegati hanno seguito un corso professionale di aggiornamento, e 20.000 disoccupati hanno usufruito di una formazione sul campo in qualità di sostituti, entrando o rientrando così nel mercato del lavoro.