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APOSDLE: Advanced Process Oriented Self-Directed Learning Environment

Integrated Project

IST – Technology enhanced Learning

Publishable Executive Summary

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Dissemination Level

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Imprint

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Publishable Executive Summary

Advanced Process-Oriented Self-Directed Learning Environment

Project Objectives

In a world of rapid change and continuous technological innovation the economy of the European Union relies on the ability of their knowledge workers to learn efficiently and especially to apply new knowledge effectively within their work processes.

The goal of the APOSDLE project is to enhance knowledge worker productivity by supporting informal learning activities in the context of knowledge workers' everyday work processes and within their work environments.

The key distinction of the APOSDLE approach as compared to more traditional (e)Learning approaches is that APOSDLE will provide integrated ICT support for the three roles a knowledge worker fills at the professional workplace: the role of Learner, the role of Expert, and the role of Worker. Chiefly, this support will be provided within the work environment, and not in a separate learning environment. It exploits synergies between learning and knowledge management by reusing content not originally intended for learning. It will utilize contextualized communication for knowledge transfer, and ease the burden on experts for these tasks. Finally, it will be based on knowledge sources available within an organization – specifically business space, (e)Learning systems, and knowledge management – and not require a switch to a new system.

The outcome of APOSDLE will be in-depth understanding of workplace learning (within the APOSDLE scope). Based on this understanding a methodology and reference architecture for the support of workplace learning within computational environments will be created. In order to ensure the general applicability of this outcome we will use an application-driven approach to cover the needs of three different organizations: a network of SMEs, a public organization, and a large corporation. Their needs and constraints provide APOSDLE with the necessary guidance to develop informal learning processes, contextualized collaboration methods, and work support.

The prime deliverables of the APOSDLE project will be the domain-specific APOSDLE Environments embedded into the application partner organizations. Using these environments, we aim to demonstrate and evaluate the benefits of seamless integration of learning and working in the professional workplace.

Work Performed and Results Achieved

Work-Integrated Learning: Insights and a Conceptualization

The APOSDLE project has continued to work on the initial vision of work-integrated learning. Results of two empirical studies offer deep insights into how knowledge workers work, learn and collaborate at their workplaces. After the first set of studies carried out last year looked at the learning episodes and bottlenecks encountered, this years study more directly addressed the access to information spaces and the use of media in the learning and collaboration process. Media Richness Theory provided one

of the backbones of this study that was carried out as a large scale scenario driven survey that was answered by over 100 knowledge workers in knowledge intensive businesses across Europe.

Based on these insights and on the broad expertise in the APOSDLE consortium, a conceptual architecture for the APOSDLE approach of work-integrated learning was delivered which includes an extensive state of the art review. This architecture for the first time brings together all diverse conceptual elements and theoretical underpinnings relevant for the APOSDLE approach. The document spans areas from the learning sciences, user context determination, competency-based systems, semantic technologies, knowledge management, performance support systems, associative retrieval, user profile services, and contextualized collaboration. Taken together, this conceptual basis addresses the major challenges of learning *real-time*, with *real content*, and in the *real computational environment*.

The Second APOSDLE Prototype: Integrating Working, Learning and Collaborating

The conceptual architecture was transformed into an integrated software system in a large-scale, distributed and innovation-driven software design and development process. Integrating these diverse ideas and heterogeneous software systems has been a major challenge for the project consortium. Nevertheless, an integrated prototype was delivered at the end of year 2 which contains all major aspects of work-integrated learning and which was designed to be evaluated in real workplace settings.

The second APOSDLE prototype presents itself as a set of desktop widgets which are designed to allow for high degrees of flexibility and work-integrated support. These widgets include a context selector, a resource widget that presents resources from the corporate memory relevant for the current context, an expert widget that presents experts relevant for the current context, a global search, and a main widget which presents the current selected or detected context and possible learning goals (see Figure 1). A learning event browser shows the learning goals in the context of prerequisite learning goals. A context monitoring daemon runs in the background, picks up low level system interactions, and attempts to determine which task it is that the user is currently working on.

When a resource is selected, a resource viewer displays documents and highlights all parts of the document which were found to be relevant. This resource viewer also includes annotation functionality, which lets users annotate parts of documents with concepts from a domain ontology and a description of the instructional role they play (such as being an example or a definition) (see Figure 2). Selecting a learning goal displays learning events and episodes which can be consumed. A learning event is composed of a generic instructional template which is filled with material from the underlying infrastructure. A learning episode is composed of a set of related learning events that should be consumed in a specific order (such as learning a definition, learning an example etc.).

Cooperation processes in APOSDLE are supported by a cooperation wizard which guides cooperation partners through a cooperation process, from a request, to the actual cooperation, to a reflection of the cooperation (see Figure 3). Different cooperation tools (such as telephone, email, text messaging, audio/video messaging and cooperative authoring) are available and are integrated in APOSDLE via a cooperation framework. The cooperation event is contextualized by allowing all cooperation partners to share their context information (such as current tasks, learning goals and resources viewed). Completed cooperation events can be stored in a cooperative authoring space (based on a Wiki) and used for reflecting on these events.

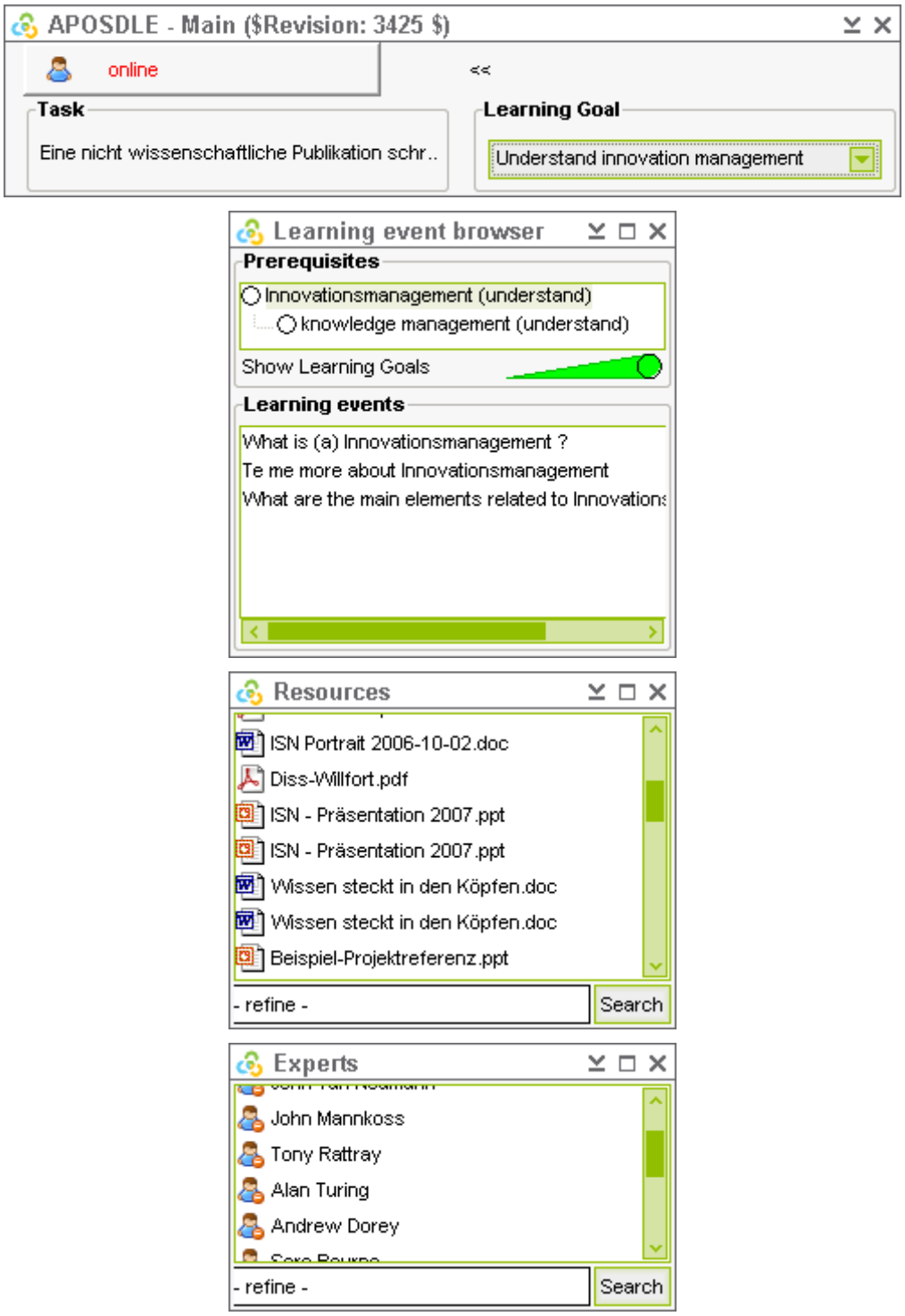

Figure 1: APOSDLE Desktop Widgets

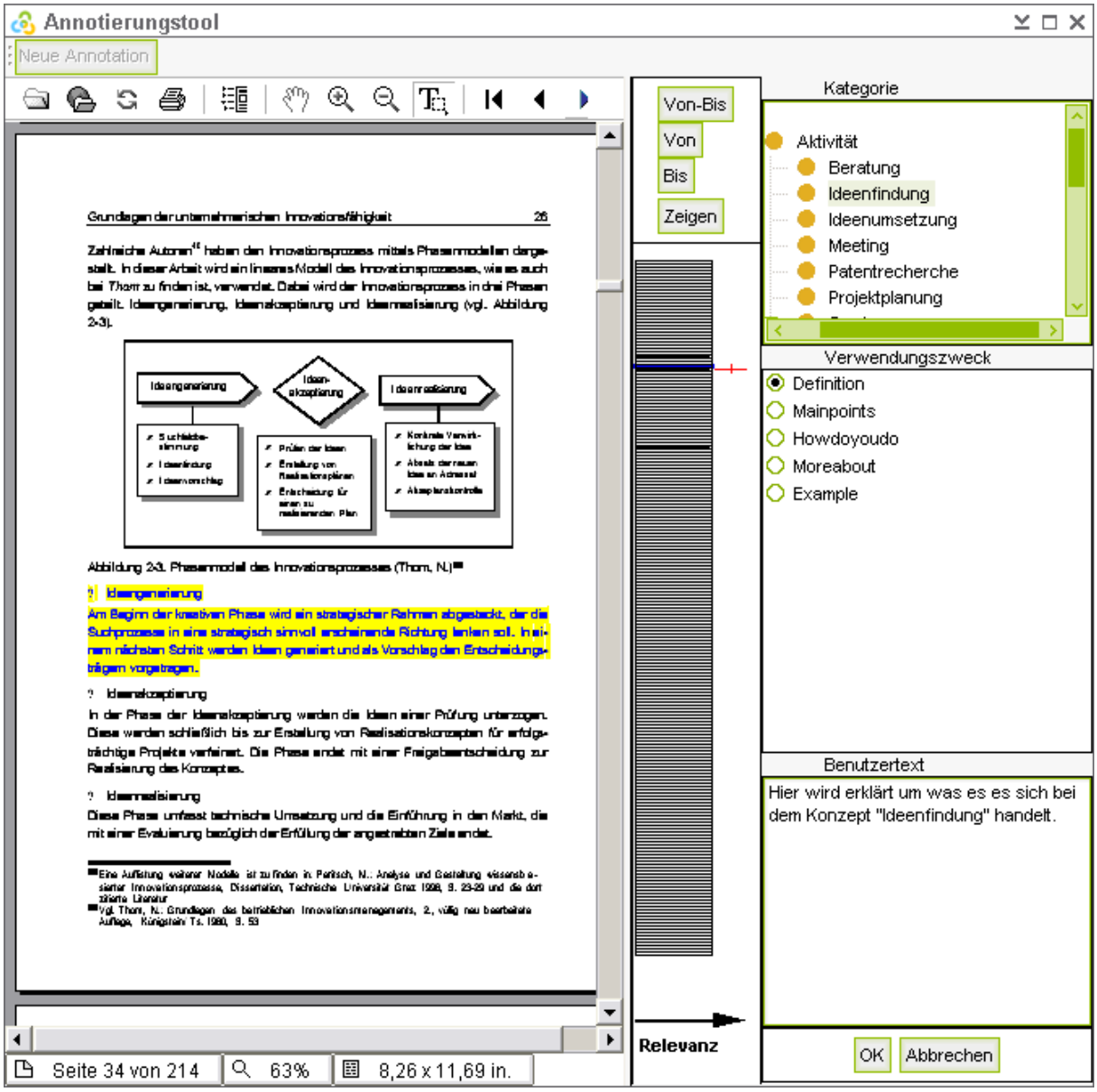

Figure 2: APOSDLE Resource Viewer and Annotation Tool

Figure 3: APOSDLE Cooperation Wizard

Technological Infrastructure: A set of Innovative Semantic Services

To realize many of the functionalities described above, the APOSDLE tools make use of a number of innovative services. Knowledge Discovery and Extraction algorithms provide similarity measures for textual documents, discover important domain concepts and instructional roles of certain material, and extract textual information from multi-media sources. These services support retrieval of documents and also manual annotation.

An associative retrieval service performs context-based retrieval based both on textual content of documents as well as semantic metadata attached. This service can both perform exact queries (such as for material of the type “example”) as well as fuzzy associative queries (such as expanding a query for a concept to include similar concepts).

The User Profile Services realize a set of functionalities for maintaining and analysing user-related information. It also provides inferences based on the usage history, such as ranking learning goals according to the user’s learning history and ranking cooperation partners based on history of past cooperations. This data is also provided in a User Profile Management Tool in which a user can get access, change and delete any of the collected information. Security and Privacy Enhancement Services ensure that users are authenticated and their access rights are strictly obeyed.

Semantic Models: An Integrated Modelling Methodology for Learning in Knowledge Work

Much of the intelligent services rely on semantic models which have to be provided for an application in a specific domain. This has the advantage that the software as such is generic and can be tailored to any suitable domain by exchanging the models. The APOSDLE system operates on three types of models which are tightly interconnected, a *domain model*, describing the learning domain, a *task model*, describing the tasks that need to be executed, and the *learning goal model* which provides the link between the two in order to realize work-integrated learning.

An integrated modelling methodology was created that describes the process of creating the three models in an interactive manner involving domain experts and knowledge engineers. The methodology is supported by a set of modelling tools, such as a semantic wiki or plug-ins for the ontology editor Protégé.

On a technical level, services give access to the models as if they were one single knowledge structure, even though they were written using very different conceptual and formal representations. This is achieved through a unifying schema specifically developed for the purpose of supporting work-integrated learning.

Application Driven Approach and Evaluation

To establish the requirements for APOSDLE we have used advanced requirements techniques including creativity workshops, scenario walkthroughs and measurable requirements techniques. These have been integrated together into a requirements process called RESCUE already applied to specify complex socio-technical systems.

The second APOSDLE prototype has been prepared for five knowledge intensive domains, including simulation of aircraft lightening, innovation management, environmental consulting, the RESCUE requirements engineering process and statistical data analysis. The prototype is currently being deployed in workplace settings to undergo extensive formative evaluation. For this purpose, we have combined usability evaluation techniques with data capture techniques including on-line diaries and ethnographic observations using technology uptake frameworks to triangulate evidence for problems and successes during knowledge transfer when using APOSDLE.

Dissemination and Exploitation of Project Results

By conducting several market and competitor analyses, first industry focus groups and several industry tutorials, the project is beginning to explore the market potential and external requirements on solutions like APOSDLE. This will inform subsequent developments and help the consortium decide on a suitable business model for further exploiting project results.

In terms of dissemination to the external world, the project continues to be successful in creating visibility in the technology enhanced learning and knowledge management communities, especially by broad participation in the EC-TEL conference, and organization of the I-Know conference. Links to other EU projects and activities were established by founding of the Professional Learning Cluster (Pro-LC), and organization of and participation in several Prolearn events. A project website is maintained at http://www.aposdle.org.

APOSDLE Consortium

The APOSDLE consortium consists of 12 organisations from 7 different European countries, ensuring that the demands of the ambitious vision of the project can be met both in terms of complementary competences and in terms of broad access to different technologies and domains of application.

JOANNEUM RESEARCH, Austria

Know-Center, Austria

SAP, Germany

Technical University Graz, Austria

Fraunhofer Gesellschaft, Germany

University of Twente, Netherlands

City University London, United Kingdom

Fondazione Bruno Kessler, Italy

EADS France, France

isn - Innovation Service Network, Slovenia

ComNetMedia, Germany

Chamber of Industry and Commerce – Darmstadt, Germany

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