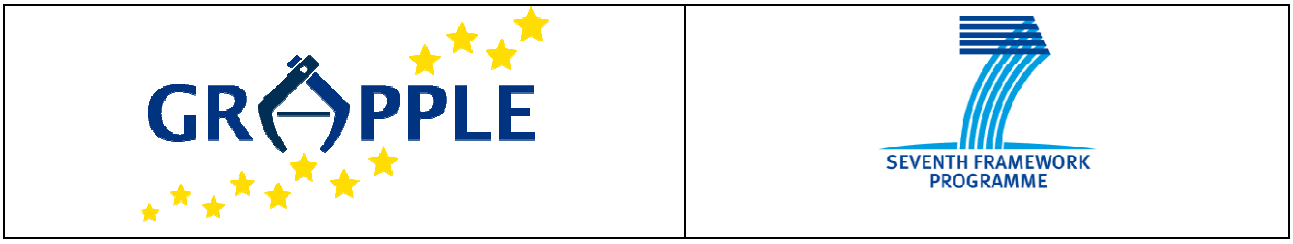

GRAPPLE

D10.4 Version: 1.0

Second training delivery for corporate GRAPPLE-users and start of full deployment

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Abstract: According to the technical annex, this training deliverable contains materials from the GRAPPLE-documentation that helps to implement, use and maintain GRAPPLE facilities in corporate settings and corporate learning management environments. Based on the overall training program in deliverable D10.2, the second version of training offerings will present new developed features and services of the GRAPPLE learning solution. It will prepare users for the general usage of the system in corporate environments.

Keyword list: Corporate training, training requirements, corporate LMS-environments & components, GRAPPLE-extensions, LMS-integration

Summary

The aim of the GRAPPLE-project (www.grapple-project.org) is to develop, provide and deploy a technology-enhanced learning (TEL) environment that guides learners through a life-long learning experience, automatically adapting to their personal preferences, prior knowledge, skills and competences, learning goals and the personal and/or social context in which their learning actions takes place. GRAPPLE is not limited to a certain application domain and covers the implementation and application of GRAPPLE solutions within corporate settings and learning infrastructures, such as professional learning management systems (LMS).

Based on a comprehensive training framework, designed in a previous deliverable D.10.2, this second version extends the theoretical baseline of D.10.2 and contains materials from the GRAPPLE-documentation that helps to implement, use, maintain and evaluate GRAPPLE-facilities in corporate settings as well as its technical integration in LMS. The progress of the GRAPPLE-project and the availability of its recent research outcomes and solutions the qualification of corporate user groups is geared towards the provision of applied knowledge of the technical and non-technical aspects. The understanding and usability of the different GRAPPLE-tools is also included as well as their contribution to the provision of personalised adaptive learning material for vocational trainings.

Authors

Person	Email	Partner code
Gunnar Martin	gunnar.martin@iwi.dfki.de	DFKI
Silke Balzert	silke.balzert@iwi.dfki.de	DFKI
Dominikus Heckmann	dominikus.heckmann@dfki.de	DFKI
Volker Zimmermann	volker.zimmermann@im-c.de	imc
Patrick Pekczynski	patrick.pekcynski@im-c.de	imc

Table of Contents

Tables and Figures

List of Figures

List of Tables

List of Acronyms and Abbreviations

ALE	Adaptive Learning Environment
CAM	Conceptual Adaptation Model
CRT	Conceptual Relationship Type
DM	Domain Model
D.x.x	Deliverable
GALE	GRAPPLE Adaptive Learning Environment
GAT	GRAPPLE Authoring Tool
GCC	GRAPPLE Conversion Component
GEB	GRAPPLE Event Bus
GRAPPLE	Generic Responsive Adaptive Personalised Learning Environment
GRAPPLE-IdP	GRAPPLE-Identity Provider
GUI	Graphical User Interface
GUMF	GRAPPLE User Model Framework
GVIS	GRAPPLE Visualisation
HCI	Human Computer Interaction
I/S	Information Systems
Java EE	Java Enterprise Edition (former: J2EE)
LMS	Learning Management System
Shibboleth-IdP	Shibboleth-Identity Provider
Shibboleth SP	Shibboleth Service Provider
TEL	Technology-enhanced Learning
VR	Virtual Reality
WP	Work Package
XML	Extended Markup Language

1 Training approach

1.1 Training strategy and structure

The goal of the **GRAPPLE-projects** is to develop, provide and deploy a technology-enhanced learning (TEL) environment that guides learners through a life-long learning experience, automatically adapting to their personal preferences, prior knowledge, skills and competences, learning goals, social and/or professional context in which their learning actions takes place. Due to the context, GRAPPLE is not limited to a certain application domain and covers the implementation, application and evaluation of GRAPPLE-solutions within educational and corporate settings and supporting I/S-infrastructures, such as professional learning management systems (LMS).

This deliverable pre-defines a (vocational) training for the introduction, implementation and usage of the **GRAPPLE-developments within corporations,** both, from an organisational and a technological perspective. This is a deliverable corresponding to the "second documentation and training for GRAPPLE-users" in higher education organisations [see: D.9.4]. The design, deployment and deployment of training units, modules and contents cannot be seen as a stand-alone deliverable, or respectively, as a self-sustaining learning action. The **qualification of corporate user groups** assumes a deeper understanding of the projects' developments and application scenarios that are aligned to the (recent) research outcomes and the (specific) requirements of the application domain. The deliverable is therefore based on a comprehensive **training framework**, originally designed and introduced in the "first training delivery for corporate GRAPPLE-users and start of full deployment" [see: D.10.2]. The framework shown in Figure 1 provides a target group-oriented, 360°-view on GRAPPLE and describes the project and its outcomes from a:

- **General perspective** that clarifies the essential terminology and ensures a common understanding of adaptation and personalisation as well as personalised adaptive hypermedia for learning purposes in corporate settings. The contents are mainly derived from the project management- (WP 12), the deployment- (WP 10), and the evaluation framework work package (WP 8).
- **Conceptual perspective** that focuses on the transfer of (theoretical and practical) knowledge about the adaptation-principles, -concepts and -methodologies used in GRAPPLE and are connected to the research findings of WP 1 (Adaptive Methods), WP 2 (User Modelling) and WP 3 (Authoring Concepts).
- **Systems´ perspective** that provides (behaviour-related) information on the technical system architecture and especially the design of GRAPPLE-services and interfaces between the GRAPPLE-components based on existing standards for learning technology (WP 5) as well as their interaction within distributed IS-environments (WP 7).
- **Environmental perspective** that deals with structural issues of the GRAPPLE-system architecture and the GRAPPLE-adaptive learning environment (WP 4; 6). It pinpoints the realisation, implementation and maintenance of the GRAPPLE-solutions within the corporate LMS-infrastructure landscape.

The basic idea of the framework is to **structure** and explain GRAPPLE from a non-technology-oriented (top-down) to a technology-oriented view (bottom-up), and vice versa. Additionally, the differentiation between the three layers (I.) adaptation concepts and methodologies, (II.) applications and functionalities, and (III.) adaptive learning environment (ALE) allows the grouping of training contents into mono-thematic modules (horizontal view) as well as the allocation, configuration, deployment and offering of fitting trainings to heterogeneous target groups (vertical view).

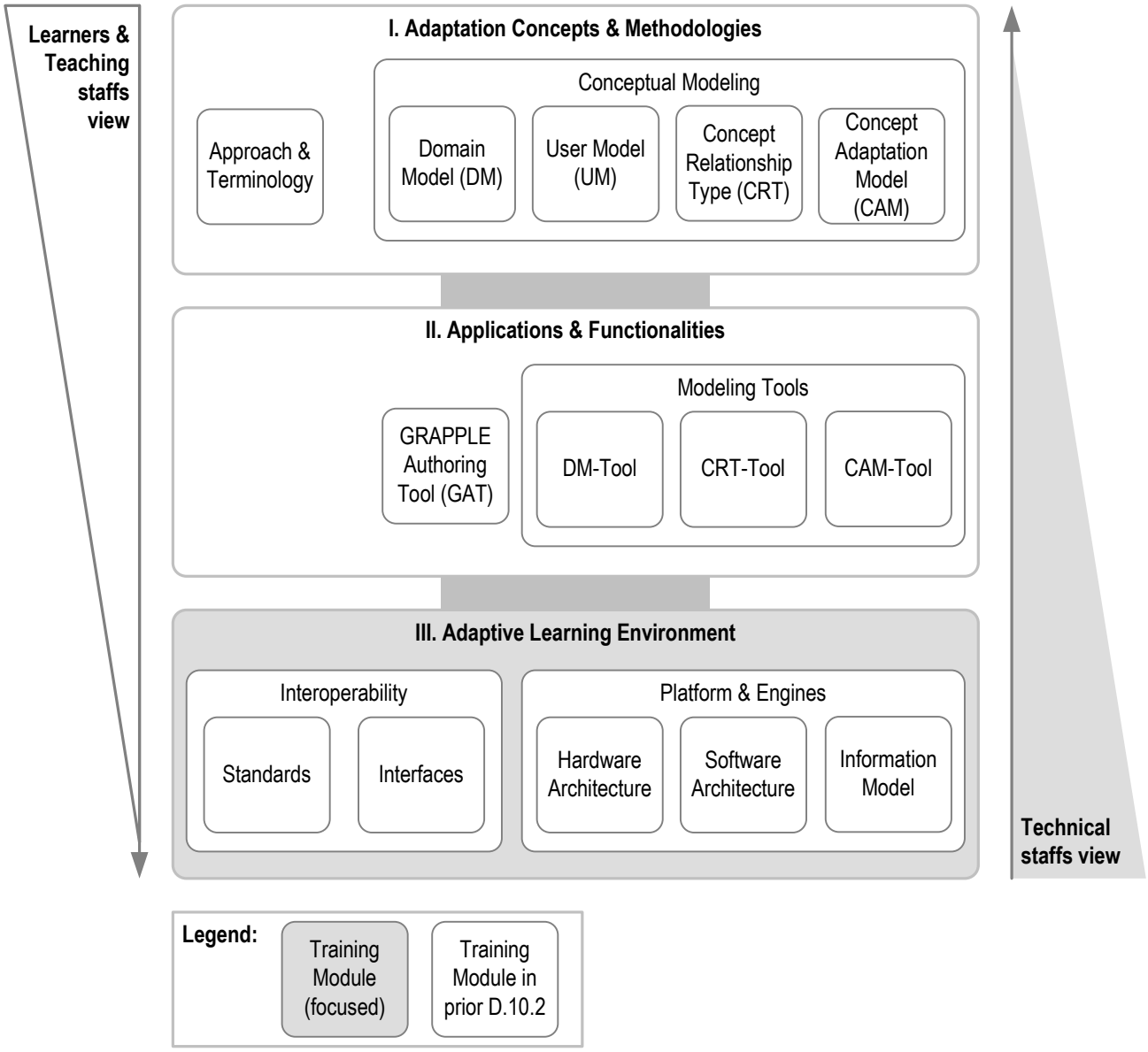

Figure 1: Training curriculum for corporate GRAPPLE-users

1.2 Training objectives and contents

The **corporate user groups** of GRAPPLE can be classified into learners and staff. While learners are the receivers or end-users of personalised adaptive learning solutions, staff is the overall term for people who are responsible for the dynamic content design, course development and deployment of adaptive learning materials (teaching staff) as well as for the technical implementation and support of the learning infrastructures (technical staff).

Regarding their organisational roles and rights, members of the **learner-class** are only allowed to access and use the contents and to add, change or delete their own (personal) settings and preferences within the supporting infrastructure. Key aspects of their training cover the accessibility, usability and personalisation of adaptive hypermedia content [see: Table 1]. In terms of applied human computer interaction (HCI) they will be able to understand the basic adaption-principles, -concepts and -methodologies and will be qualified to operate the graphical user interface (GUI) including its core-functions. Due to their restricted permissions, a deeper understanding of technical aspects, like system interaction, -architectures or -environment, is not necessary.

Table 1: Training plan for corporate GRAPPLE-users (Module I)

GRAPPLE-training unit on "Adaption Concepts & Methodologies"	
Module I.A	Approach & Terminology
Content	▪ GRAPPLE-project and -approach, ▪ Adaptation and personalisation, ▪ Adaptive Hypermedia, ▪ Adaptive Learning Content. ▪ Business Scenario (e. g. Business English Course).
Objective	Common understanding of GRAPPLE and clarification of the terminology, and the theoretical and practical benefits of adaptive hypermedia learning contents.
Target Group	All
Prerequisite	None
(Re)Sources	Project-slides and dissemination material
Module I.B	Conceptual Modelling
Content	▪ Domain-Model (DM), ▪ User-Model (UM), ▪ Concept Relationship Type (CRT) ▪ Concept Adaptation Model (CAM)
Objective	Theoretical knowledge about the conceptual models including their: ▪ subject and functionality, ▪ purpose for/impact on the development (authoring) of adaptive learning contents.
Target Group	Staff (Teaching-Staff focused)
Prerequisite	Module I.A (recommended)
(Re)Sources	Scientific papers, lectures and talks, research deliverables.

Compared to the learners, members of the **staff-class** also need to know about the fundamentals of GRAPPLE (here: general information) mentioned in Table 1, but their organisational duties and tasks require an in-depth knowledge of the concepts, processes, tools and techniques as well as the structure and information models of technical environment (build-time) and the behaviour of the systems involved (run-time). Analogue to the assignment of tasks to the different staff groups, the **teaching staff** is primarily interested in the creation/authoring-, publishing- and tutoring-processes

of adaptive hypermedia content and information that support their professional advisory activities [see: Table 2].

Table 2: Training plan for corporate GRAPPLE-users (Module II)

GRAPPLE-training unit on "Applications & Functionalities"	
Module II.A	GRAPPLE Authoring Tool (GAT)
Content	▪ GAT and GAT-components, ▪ authoring and editing processes, ▪ basic functionalities of GAT-GUI and special GAT-features, ▪ interaction with specific modelling-tools, ▪ Demo course creation.
Objective	Applied knowledge about GAT and its usage for the development and publishing of adaptive learning content following an integrated domain-, pedagogy- and adaptive strategy.
Target Group	Staff (Teaching-Staff focused)
Prerequisite	Module I (recommended)
(Re)Sources	Tool documentation and handbook. Installed tool for practical use and demo course creation (e. g „Business English Course").
Module II.B	GRAPPLE Modelling Tools
Content	▪ DM-Tool, ▪ CRT-Tool, ▪ CAM-Tool, ▪ Refined demo course.
Objective	Applied knowledge about the embedded GRAPPLE-modelling tools and their rules-based usage for the development of alternating and adaptive learning paths or adaptive behaviour.
Target Group	Staff (Teaching-Staff focused)
Prerequisite	Module II.A (recommended)
(Re)Sources	Tool documentation and handbook. Installed tools for practical use.

Unlike the learners, the main focus of the **technical staff** is on system implementation-, integration-, service- and support-related trainings [see: Table 3].

To avoid redundancies, it has to be mentioned, that members of corporate user groups, especially learners and teaching staff, have already been trained on major topics from the modules I and II. Instead of repeating, or re-designing the existing contents and scenarios, this deliverable will put more emphasis on open issues, needed to carry out the qualification processes of the technical staff. As a consecutive, second training unit it also contains materials from the GRAPPLE-documentation (e.g., requirements analysis (D.10.1); technical descriptions (D.7.5)) that extends the theoretical and practical baseline of D.10.2, including the conducted in-house seminars and helps to implement, use, maintain and later, to evaluate the GRAPPLE-facilities in corporate settings.

Table 3: Training plan for corporate GRAPPLE-users (Module III)

GRAPPLE-training unit on "Adaptive Learning Environments"	
Module III.A	Interoperability
Content	▪ Interoperability standards and specifications for learning technology, ▪ Information models of learning technology standards, ▪ Interface diagrams and gateways, ▪ Interchange formats and web-services.
Objective	Definition and design of standardised interoperability services and formats.
Target Group	Staff (Technical-Staff focused)
Prerequisite	Module I (recommended)
(Re)Sources	Documentation and implementation guidelines of interoperability standards and specifications.
Module III.B	Platforms & Engines
Content	▪ LMS and ALE(-components), ▪ Adaptation engine, ▪ Soft-/Hardware architecture, ▪ GRAPPLE-Information model.
Objective	Implementation guideline of the technical GRAPPLE-solutions including extended adaptation services and components for professional LMS-infrastructures in corporations.
Target Group	Staff (Technical-Staff focused)
Prerequisite	Module I (recommended)
(Re)Sources	Handbooks, user manuals and implementation guidelines.

The next chapter details the integration procedure and guidelines through the realisation process of a GRAPPLE-extended, personalised adaptive LMS-environment.

2 Adaptive Learning Management Systems

2.1 Learning Management Systems and GRAPPLE-extensions

Figure 2 illustrates a common design principle of recent learning management systems (LMS). It can be understood as a comprehensive software architecture that consists of several (system) components with underlying (software) applications, including their relationships [Milius 2002, 165-169]. In terms of software engineering and software design, LMS follow a so called component-based framework approach [Pree 1997, 7].

Like other kinds of standard software, each component of the **LMS-framework architecture** is specifically designed for reuse and can be run on any operating systems, networks, programming languages, and hardware [Sommerville 2001, 64f.; Pawlowski, Adelsberger 2001, 59f.; Soeffky 2001, 100f.; Hansen, Neumann 2005, 86]. This means professional LMS are no individual (software) solutions, developed for the support of a given operating scenario and its specific processes, tasks and functions. Hence, it is possible to customise the LMS depending on requirements and the number of components and application needed is flexible and can vary [Milius 2002, 165f.].

LMS provide a variety of functionalities and tools to create, organise, hold, manage and conduct learning offers and to capture user data in (e.g., monitoring, tracking) but they do not support any adaption processes needed to carry out adaptive learning or to realise personalised adaptive learning paths. Especially functionalities for the essential communication of user model data are missing.

To overcome these difficulties, GRAPPLE extends LMS by authoring tools and adaptive interactive components that enable educators (here: teaching staff) to provide adaptive learning material to the learners and support the content creation-, import-, assignment- or extraction processes as well as the definition of proper adaptation strategies for the content and learning related activities. Figure 3 shows the **global GRAPPLE-architecture** that describes the interaction, or communication between the LMS and the different GRAPPLE components.[1] Its main components are:

- The **GRAPPLE Authoring Tool (GAT)** is a comprehensive toolset for the development of personalised adaptive learning material. It consists of (1.) a domain model authoring tool (DM-tool) for the creation and conceptual representation of an application domain or course, (2.) a concept relationship type authoring tool (CRT-tool) for defining types of pedagogical relationships between concepts and their associated adaptation, and (3.) a conceptual adaptation model authoring tool (CAM-tool) for defining the pedagogical structure of a course.
- The **GRAPPLE Adaptive Learning Environment (GALE)** is the core engine to provide adaptive courses to the learners, based on their specific foreknowledge, course prerequisites, preferences and device(s) used. It is a generic and extensible adaptation engine that compiles or translates the conceptual structures created in GAT into concrete adaptation rules and performs the adaptive course delivery.

To achieve a link between LMS and GALE a generic framework was defined and implemented consisting of:

- The **GRAPPLE Event Bus (GEB)** ensures an asynchronous communication between components. It is used by all components in order to pull user data from one component to another or to push broadcast updates to interested parties.

[1] Please note, that the architecture or some of its main elements are the results (requirements) of a series of interviews and of a series of conducted workshops and in-house training with potential users from academia and industry. The related deliverables can be found in the GRAPPLE-documentation.

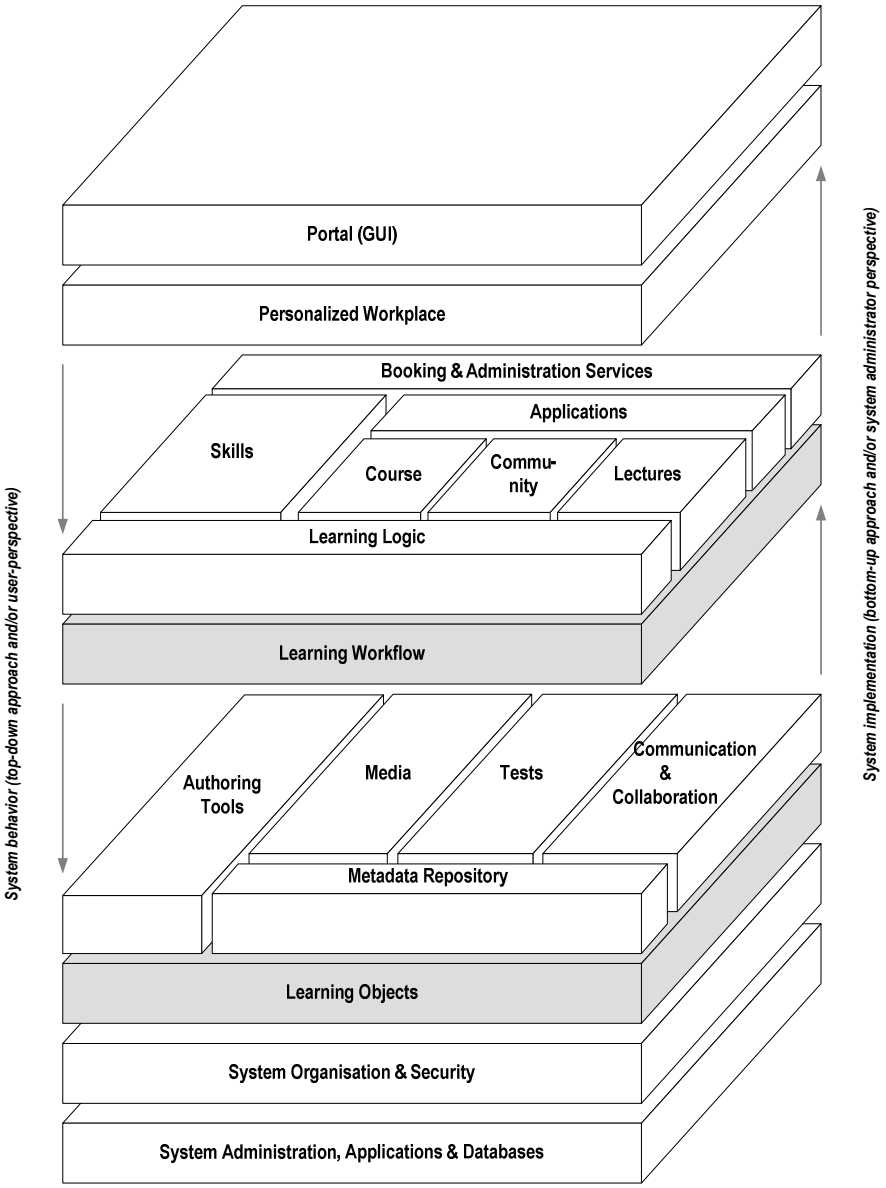

Figure 2: LMS-architecture [Milius 2002, 166]

- The **GRAPPLE User Model Framework (GUMF)** represents the core user model ontology. It is in charge of storing, retrieving and sharing any kind of user model information between the components. Additionally, it takes care of issues of conflicting information reconciliation, privacy and trust, and a user-centric model representation that allows the learners to reflect on their own knowledge (progress).
- **Shibboleth** is being considered as a platform to provide the single sign-on facilities and proper user identification and authentication within the entire GRAPPLE-infrastructure and ensures an integrated presentation of LMS- and GRAPPLE-features.

The interaction of users with adaptive learning material (through GALE) and other activities (through LMS) results in large amounts of data that can be visualised for staff and learners in order to observe, monitor and better understand the learning processes and progress. Visualisation tools as part of the GRAPPLE-infrastructure are:

- The **GRAPPLE-Visualisation (GVIS)** monitors the progress of the single learner or classes and makes the data available to learners, tutors and teachers.

- **GRAPPLE-Additional Components**, like Virtual Reality (VR)- or Simulation-extensions, support special cases of authoring and adaptation processes such as the creation of VR-based learning material and simulated dialogs.

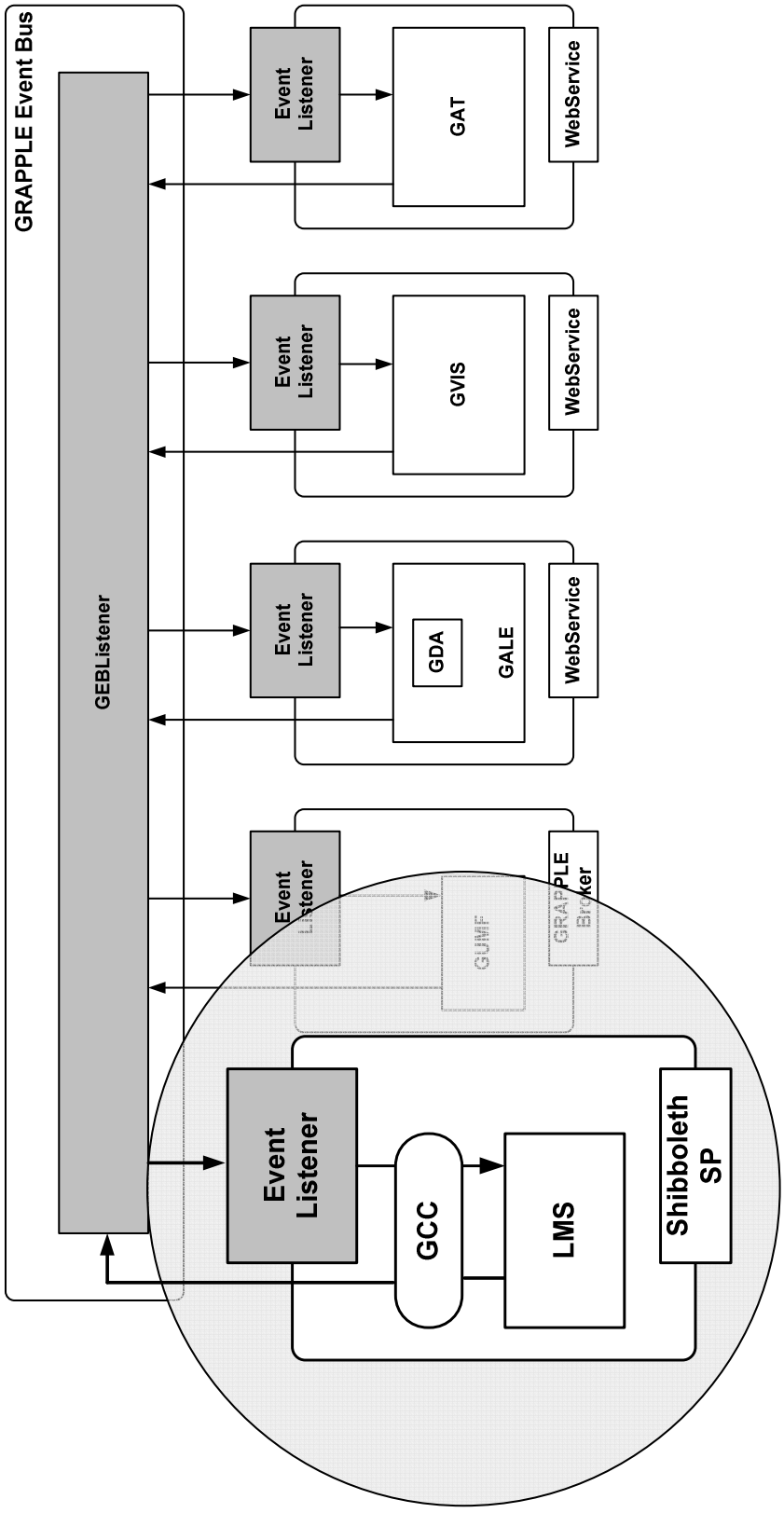

Figure 3: The global GRAPPLE-architecture

2.2 Application scenario

This section describes how an LMS can be integrated into the overall GRAPPLE-infrastructure. As depicted in Figure 3 (below) the integration of an LMS in GRAPPLE is a threefold task that needs (1.) a Shibboleth Service Provider (Shibboleth SP), (2.) an Event Listener and (3.) a GRAPPLE Conversion Component (GCC).

In order to authenticate a single user at the GRAPPLE-Identity Provider (GRAPPLE-IdP) an LMS must have an installed and configured Shibboleth software module facilitating the user authentication by a so called Shibboleth-Identity Provider (Shibboleth-IdP). A detailed, technical description of the implementation and configuration process of the Shibboleth software can be found in the final release and documentation of the “operational infrastructure” in deliverable D.7.5.

For integration in the GRAPPLE-framework, the LMS has to be connected to the GRAPPLE-Shibboleth-IdP [see: Figure 4 (top)]. As soon as a certain user wants to access the LMS, the login screen is presented. After a click on the login panel, a popup window opens where the user is able to choose between the available connections and identity providers (here: GRAPPLE-IdP). Depending on the users´ decision, he will be automatically redirected to the authentication screen of the Shibboleth-IdP and after a successful authentication the personal LMS-homepage is presented to the user. The GRAPPLE-settings and functionalities are available now and can be directly accessed through the GRAPPLE-LMS-menu and -submenu [see: Figure 4 (middle)].

For example, the menu item “adaptive courses” offers the possibility to search for available adaptive courses on the configured GALE-instance, the menu item “GRAPPLE Event Sharing” allows the user to determine what user events shall be sent to the GRAPPLE-GEB. It is possible to select which events shall be shared and also what kind of information shall be sent to the GEB per event. In order to present an integrated solution the “GRAPPLE settings” section also contains a menu item “GRAPPLE Authoring Toolset” where the user can directly invoke the GRAPPLE-GAT, represented by GAT-user interface in Figure 4 (bottom). Finally, the user can decide which of these navigation points is made available to other groups of corporate GRAPPLE-users, like teaching-staff and learners.

As an example, a member of the teaching staff group can only have access to the “Tests/Quizzes” event and the GRAPPLE-GAT. If the teacher wants to create a course using adaptive material in the LMS, he uses the “Course Manager” menu item in the “Content Management” section to “create” a new course. Additional, course-related information such as a course description and start-/end-dates can be added to adaptive course-material via the “Contents” tab. Moreover, teachers also have the possibility to specify a learning path, called “Learning Logic” for the course stating that the students have to take a test first, which has to be completed and passed by the students before they are able to access the adaptive course material. These settings can be entered on the “Learning Logic”-tab of the course manager. Beside the definition of learning paths, the course manager can decide whether the GVIS component shall be enabled or not. In any case, the course can be assigned to and enrolled by the students using the “Participants”-Button in the LMS-course-manager.

When a student logs in, a personalised “homepage” is presented by the LMS where he can see a list of courses he is enrolled in (LMS menu item “My Courses”). The student can also see the GVIS widget and access additional information about his individual learning status. By clicking on the “Syllabus”-Button the student can start the course and follow the course material the teacher has defined previously.

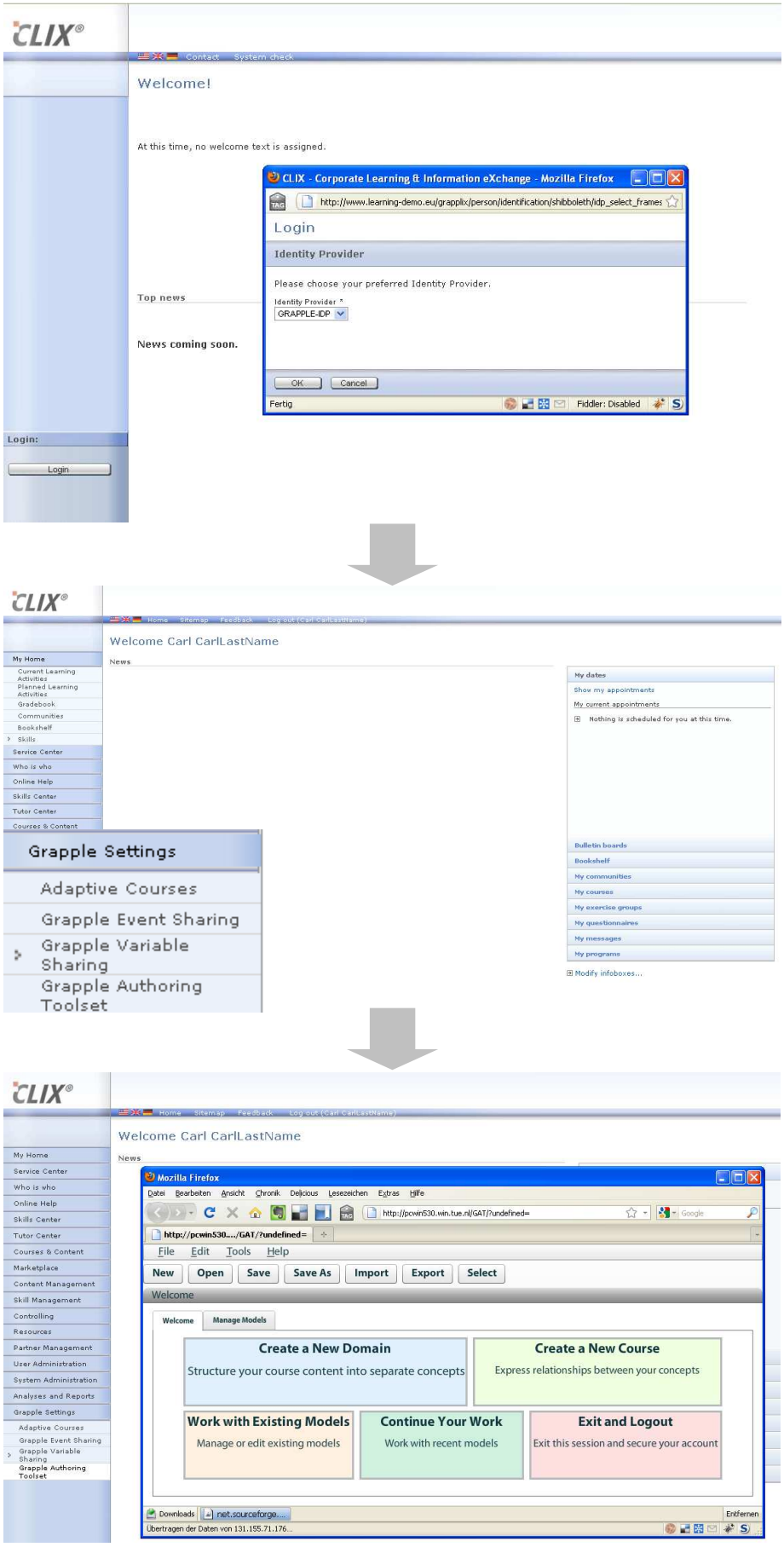

Figure 4: GRAPPLE-CLIX-prototype

3 Summary and outlook

Within this deliverable, a comprehensive training plan for the implementation and usage of the GRAPPLE-developments within corporations has been developed and introduced.

In conjunction with the progress of the GRAPPLE-project and the finalisation of its research outcomes, findings and solutions, the ongoing qualification of corporate user groups (esp. technical-staff) has been extended. It includes technical aspects as well as the usability of the GRAPPLE-authoring tools and their contribution for the development of personalised adaptive learning materials for vocational trainings through supporting LMS. The corporate trainings focus on the implementation of the GRAPPLE-solutions within the corporate infrastructure which extend traditional LMS or LMS-components and enables them to produce, exchange and run adaptive learning contents or to embed adaption rules or rule-based learning logics into existing courses. The system interaction between the different GRAPPLE-authoring tools and LMS as well as the technical integration of LMS-infrastructures and the Adaptive Learning Environment (ALE) completes the approach.

At this stage, the defined training modules and contents will also be deployed by events, like in-house seminars, and (specialised) workshops. Additionally, these events will be recorded in order to create online trainings and webinars on the different subjects and will be provided by the GRAPPLE-infrastructure.

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