

Platforms of Distance Learning Support — the Analysis and the Compatibility —

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The report analyses best known commercial e-learning platforms of IBM, WebCT and BlackBoard producers. These platforms are powerful instrument for distance learning support and are basic fragment for modern computer systems which are oriented to using of last decisions of information technologies in education. The report is based on the research at the National Institute of Multimedia Education in August 2004. As a basis of information sources are selected: consultations with representatives of BlackBoard in Japan; WebCT in Japan, UK and Germany; IBM in Japan and Ukraine; materials of the WebCT training in Japan; BlackBoard and IBM presentations in Japan; technical documentation and demo-versions of e-learning platforms; really installed e-learning platforms; Internet materials.

Keywords

e-learning, e-learning platform, virtual university, distance learning, distance course

Introduction

The necessity of the report is dealt with two main aspects:

- distance learning support in line to virtual university organization;
- development of recommendations for correct e-learning platform selection.

As a rule, a virtual university may to consolidate ready to use distance courses from different developers into a common bank of courses. Unfortunately, different e-learning platforms have no a complete compatibility and a migration of distance courses from one platform to other and vice versa is not always possible. In this situation there's a best way to develop a computer educational system which has possibilities to work with distance courses from any developer. From one side it means a selection universal e-learning platform with a lot of special assets for a migration of any distance course. From other side it means a selection several independent e-learning platforms which have possibilities to do the same. It is obvious, that a main criterion which needs to be used is current International standards of distance learning, i.e. SCORM.

A second aspect is selected in connection with a wide mass distance learning using, a fast evolution of distance learning during last years and a fast complication of e-learning platforms and information technologies, which are used for development of these platforms. All above increases a cost of distance learning in line to hardware and software support, procedures of installation and services, and requires high qualified technical specialists, distance courses designers and tutors. A correct e-learning platform selection for any company who would like to start distance learning is not too simple. Moreover, this selection can bind a company-buyer and a company-seller by a lot of different financial engagements, including a complete dependence from a company-seller. A bad selection of e-learning platform may give negative results in line to e-learning platform scalability, a possibility to use distance courses of other developers, a cost of e-learning platform service and so on.

Objectives

The report is oriented to an investigation of the best known e-learning platforms:

IBM Lotus LearningSpace Forum (ver. 3.x), IBM Lotus LearningSpace (ver. 5.x), IBM Lotus LearningSpace Learning Management System (LMS) (ver. 1.x), IBM Lotus Workplace Collaborative Learning (WCL) (ver. 1.x-2.x), We-

bCT Campus Edition (CE) (ver. 4.1), WebCT Vista (ver. 3.0), BlackBoard (ver. 6.x) in line to following activities:

- software architecture;
- public access to documentation;
- quality of documentation;
- convenience of installation, setup and service;
- reliability of exploitation;
- effective recovering assets;
- possibility to work independently;
- availability of a fast and effective distance courses back-up;
- possibility to work off-line;
- availability of instrument for distance courses design and courses migration between different e-learning -platforms;
- level of e-learning services;
- e-learning platform scalability;
- distance courses management;
- compliance with International standards of distance learning support;
- level of technical and methodic accompaniment of e-learning platform;
- pricing policy.

The Analysis of e-Learning Platforms

Following labels are used below in the connection to distance learning terms and in the connection to e-learning platforms classification:

CMS-Content Management System, LMS-Learning Management System, LCMS-Learning Content Management System, where:

- CMS: software that streamlines the process of designing, testing, approving, and posting content on web pages;
- LMS: software that automates the administration of training events. The LMS registers users, tracks courses in a catalog, and records data from learners; it also provides reports to management. LMS is typically designed to handle courses by multiple publishers and providers. It usually doesn't include its own authoring capabilities; instead, it focuses on managing courses created by a variety of other sources,
- LCMS: software that allows to manage both the administrative and content-related functions of training. LCMS combines the course management capabilities of LMS with the content creation and storage capabilities of CMS.

IBM Lotus LearningSpace Forum (versions: 3.x) e-Learning Platform.

It's designed (1999 year) as CMS client-server e-learning platform under Lotus-Notes (ver. 5.x) database management system for a support distance learning no more than several thousands students. The platform may be installed on Linux or Windows NT, Windows 2000 server operational systems under Lotus-Notes Domino server support. A client part, as a rule, is installed on Windows operational system. A Lotus-Notes client is required for courses design and management of students. A Lotus-Notes administrator is required for administration of the platform, and a Lotus-Notes Designer is required for a custom courses design. The platform has built-in instrument for courses design, management and administration. This instrument is Lotus-Notes Client, Designer and Administrator. An access of students to distance courses is realized via web browsers or via Lotus-Notes Client. There are no limitations for a type of web browser. The platform is oriented to asynchronous regimes of distance learning. Synchronous regimes may be included using a separate software product IBM Lotus SameTime. The platform is Java Script/Lotus Script oriented. It has a good scalability using possibilities of Lotus-Notes Domino server, high reliability and simple backup instruments for fast separate archiving of distance course. The platform may be installed on a server, on a local workstation and has instrument for replication of course from a server to a workstation and vice versa. The platform may be extended to LCMS, using possibilities of Lotus-Notes system and Domino server, which has own web server, own post server and a lot of additional assets for Internet based services design. In this case a Lotus-Notes specialist is required for a development of special data-bases under Lotus-Notes database system. The platform has possibility to work with 24 different languages. A full public access to documentation and complete description are available. Additional consultations via IBM forum also are possible. A custom design of distance course is possible using custom libraries of LearningSpace Forum which are completely opened for a designer. Courses have a high protection on a level of Lotus-Notes database management system. Any application may be used as assets for course design in Lotus-Notes Client/Designer environment, including MS-Office, different Adobe packages, Macromedia, etc.

Current shortcomings of the platform: non complete accordance to International standards of distance learning, no instrument for distance course transferring to HTML for-

mat, bad possibilities to access distance course off-line, old-fashioned interface of distance courses, exams and quizzes are built without sequencing. Lotus-Notes specialists are required for the platform serving.

A price of the platform is based on Lotus-Notes Domino server licenses. A license is granted for a temporal using during a course access and is cleared when this access is terminated. A price of one license is USD.15. A price of one IBM SameTime license is USD.20. Additionally, a price of Lotus-Notes Domino Enterprise server (ver. 5.x) – USD.3,000, a price of Lotus-Notes Client – USD.178, a price of Lotus-Notes Designer – USD.987, a price of Lotus-Notes Administrator – free.

IBM Lotus LearningSpace (versions: 5.x) e-Learning Platform.

It's designed (2001 year) as LMS client-server e-learning platform under IBM DB2 or Oracle or MS SQL server relational database management systems for a support no more than 10,000 students. The platform may be installed on Windows NT, Windows 2000 server operational systems the only. It's divided into two separate parts: Lotus LearningSpace Core and Lotus LearningSpace Collaboration. A client part is absent. All instructions may be realized using web browsers. There are no limitations for a type of web browser. The platform is oriented for distance courses management and administration. It has a primitive instrument for a design of course assessments and has simple assets for different course announcements, which may be inserted to a ready to use course and has no built-in instrument for distance courses design. Macromedia products (Macromedia Flash, DreamWeaver, AuthorWare) or IBM Knowledge Producer (can be purchased separately) are recommended as instruments for courses design. An access of students to distance courses is realized via web browsers. The platform is oriented to asynchronous and synchronous regimes of distance learning. Synchronous regimes are included using IBM Lotus LearningSpace Collaboration module, which is based on IBM Lotus SameTime 2.5 technology. The platform has a good scalability and a high reliability. It must be installed on servers the only. The platform has a possibility to work with 24 different languages. A full public access to documentation and complete description are available. Additional consultations via IBM forum also are possible. A complete description of software architecture of the platform is available. A limited custom design of distance course is possible. Courses have a protection on a level of IBM DB2 or Oracle or MS SQL database management sys-

tems. It is possible to migrate AICC compatible and IBM Lotus LearningSpace Forum courses into the platform.

Current shortcomings of the platform: non complete accordance to International standards of distance learning (only AICC compatible), bad instruments for distance courses archiving (on a level of main database archiving the only), bad built-in possibilities for course assessment design (there are no a separate container with test questions for a separate course), bad possibilities for a designer to work off-line; bad possibilities to recover distance course after crash; bad possibilities to recover management after crash; no possibilities to use UNIX.

A price of the platform is based on server licenses. A license is granted for a temporal using during a course access and is cleared when this access is terminated. A price of one license is USD.38.

Additionally, a price of IBM DB2 Enterprise Edition (ver. 7.2) one server license – USD.400, IBM Lotus-Notes Domino Application Server (ver. 5.09) for IBM SameTime – USD.1,000. A price of IBM Knowledge Producer is established separately after purchasing of licenses of IBM Lotus LearningSpace 5.x.

IBM Lotus Learning Management System (LMS) (versions: 1.x) e-Learning Platform.

It's designed (2002 year) as LCMS client-server e-learning platform under IBM DB2 or Oracle or MS SQL relational database management systems for a support no more than 100,000 students. IBM WebSphere Application Server is used as the platform application server. The platform may be completely installed on Linux or Windows 2000 server operational systems. The platform takes advantage of IBM WebSphere technologies, making it J2EE-based. A client part is an off-line learning client for an access to a distance course without Internet connection. All instructions are realized via web browsers. There are no limitations for a type of web browser. Other ways that the LMS platform and IBM Lotus LearningSpace 5.x differ include the following new features: resource management, LDAP support, off-line learning client, customizable user interface, report generation. The platform has an instrument for distance courses design: IBM LMS Authoring Tool. An advantage of it is to make sequencing – different ways for distance course learning, including return student back inside a course fragment and other features in line to a possibility of a student to learn course material and make test assessments. An access of students to distance courses is realized via web browsers. The platform is oriented to asynchronous

and synchronous regimes of distance learning. Synchronous regimes are included using IBM Lotus SameTime 3.x technologies. The platform has a good scalability and a high reliability. It must be installed on servers the only. The platform has possibility to work with 24 different languages. A full public access to documentation and complete description are available. Additional consultations via IBM forum also are possible. Courses have a protection on a level of IBM DB2 or Oracle or MS SQL server database management systems. The platform is AICC and SCORM compatible.

Current shortcomings of the platform: bad setup documentation for an installation of the platform; large server resources for a work are required; IT-specialists of high qualification are required for setup and serving.

A price of the platform is based on server licenses. A license is granted for a temporal using during a course access and is cleared when this access is terminated. A price of one license is USD.60.

IBM Lotus Workplace Collaborative Learning System (WCL) (versions: 1.x-2.x) e-Learning Platform.

It's designed (2003 year) as LCMS client-server e-learning platform as a part of a separate IBM product: IBM Lotus Workplace, under IBM DB2 Enterprise Edition relational database management system. It's oriented to support more 100,000 students in distance learning. The platform is a part of IBM e-learning portal which combines e-mail, calendaring, instant messaging, e-learning, document management, and team workplace. IBM WebSphere Portal, IBM WebSphere Application Server, IBM DB2 Enterprise Edition and IBM Lotus-Notes Domino are the applications servers that make up the platform. The platform based on J2EE and IBM WebSphere Portal and can be extended with multiple standard-based integration points into other systems using portlet architecture. About 100 portlets ship with WebSphere Portal there are hundreds more available from IBM free of charge. The platform may be installed on Linux and Windows 2000 server operational systems. A client part is an off-line learning client for an access to a distance course without Internet connection. All instructions may be realized using web browsers. There are no limitations for a type of web browser. The platform has: resource management, LDAP support, off-line learning client, customizable user interface, report generation, Skills Management and Career Development features. Skill Manager can use the skills dictionary to define the skill levels required for various jobs and automatically assign training require-

ments to build those skills. The platform has an instrument for distance courses design: IBM WCL Authoring Tool. An access of students to distance courses is realized via web browsers. The platform is oriented to asynchronous and synchronous regimes of distance learning. Synchronous regimes are included using IBM Lotus SameTime 3.x technologies. The platform has a good scalability and a high reliability. It may be installed on servers the only. The platform has possibility to work with 38 different languages. A full public access to documentation and a complete description are accessible. Additional consultations via IBM forum also are possible. Courses have a protection on a level of IBM DB2 database management systems. The platform is AICC and SCORM compatible.

Current shortcomings of the platform: unknown.

A price of the platform is based on server licenses. A price of one license is USD.22.

Additionally, a price of separate parts of IBM Lotus Workplace (ver. 1.1) is following: IBM Lotus Workplace Messaging 1.1 – USD.29/user, IBM Lotus Workplace Team Collaboration 1.1 – USD.89/user, IBM Lotus Workplace Web Content Manager 1.1 – USD.49,999/processor. A price of IBM WebSphere Portal – USD.13089.

WebCT Campus Edition 4.1 (WebCT CE)

It's designed as CMS client-server e-learning platform under relational database management system (in WebCT CE terms – Global Database. There is no information about database architecture in the platform documentation), which is integrated into WebCT CE installation distributive. The database is build using Perl scripts. Apache Web server is used as an application server of the platform. WebCT CE is oriented to support distance learning in a separate university or other educational organization. It uses Java Servlet Technology. A client part is absent. All instructions are accessible via web browser. Types of compatible web browsers are described and any web browser can be checked using special utilities at WebCT web site. The platform supports asynchronous regimes of distance learning and partially – synchronous regimes (text chat, whiteboard). The platform has built-in instrument for distance courses design (limited functions) which is oriented to online work. An access of students to distance courses is realized via web browsers. The platform may be installed on Linux, Windows 2000, Sun Solaris operational systems. It must be installed on servers. The platform supports UTF-8 (Unicode) for different languages and works with about 650 world's languages. The platform is IMS and Microsoft LRN

compatible.

Free trial version of the platform for evaluation goals is available during 120 days. WebCT CE current pricing policy offers the option of 12-month or annual licenses with 6 tiers of incremental student accounts per server: 1-50 students – USD.335, 51-100 students – USD.670, 101-400 students – USD.1,335, 401-800 students – USD.1,670, 801-1600 students – USD.2,000, unlimited institutional license – USD.4,000. Additionally WebCT provides other services as options on a commercial base. These include hosting WebCT courses, offering faculty support, offering support of additional WebCT system administrators.

Currently WebCT has 47 customers in Japan. The platform is installed on 9,000 servers in Europe and other countries and supports about 9 million students and teachers in the World. It's installed on 90% of servers for Universities of Central Europe. There are 10 WebCT installations are in Russia and Ukraine.

Current shortcomings of the platform: there's no public access to description and documentation of the platform; no description of the platform architecture; no access to a description of database management system. All information and help are accessible only for registered users after licenses purchasing. Exams and quizzes are built without sequencing. There is no compatibility with SCORM standard.

WebCT Vista 3.0

It's designed as LCMS client-server e-learning platform under Oracle relational database management system and BEA WebLogic application server support. The platform is presented by WebCT as academic enterprise learning system. It can be mapped to all levels of organizational hierarchy, complementing and enhancing the workflow that occurs at each campus, department or faculty. Creation and deployment of distance courses are still the central features of WebCT Vista. However, distance course content can be shared among courses, departments, and for consortia, among institutions. Program administration, course design, and distance course instructions can be centralized or decentralized. The platform can be installed in distributed deployment (database server, applications server, load balancing), standalone deployment (Vista application runs on a single application server) and clustered deployment (multiple Vista application servers). WebCT Vista 3.0 may be installed on SPARC Solaris 8, Windows 2000 or Windows 2003 operational systems. It must be installed on servers. All instructions are accessible via web browser. Types of compatible web browsers are described and any web browser

can be checked using special utilities at WebCT web site. The platform has built-in instrument for distance courses design (limited functions) which is oriented to online work. An access of student to distance courses is realized via web browsers. The platform supports asynchronous regimes of distance learning and partially – synchronous regimes (text chat, whiteboard). Support of languages is not described. The platform is SCORM compatible.

Pricing policy is based on annual basis. A start cost of WebCT Vista 3.0 license is about USD.60,000.

Current shortcomings of the platform: there's no public access to description and documentation of the platform; no description of the platform architecture; no access to a description of database management system. All information and help are accessible only for registered users after licenses purchasing. There is incomplete font scaling and difficult printing for user; incomplete or missing support for IMS-QTI, IMS-CP and SCORM standards; not backwards compatible with WebCT 3.x platform (missing tools: no compile, English interface language only). There's a limited extensibility. End users can't make program custom 'components' or custom quiz types. Exams and quizzes are built without sequencing. There's very expensive platform.

BlackBoard 6.x

It's designed as CMS client-server e-learning platform under MS SQL server database management system support on Windows 2000 operational system or under Oracle support on Solaris. MY SQL database management system is supported also. The platform requires Apache web server software or Microsoft Internet Information Server software. The platform supports asynchronous regimes of distance learning and partially – synchronous regimes (text chat, whiteboard). The platform has built-in instrument for distance courses design (limited functions) which is oriented to online work. An access of student to distance courses is realized via web browsers. It supports a work with Building Blocks. Blackboard's Building Blocks initiative, announced in 2000, is an open set of API's and developer services for creating extensions to Blackboard. The company says the initiative allows easy integration of content from corporate content providers. As a rule, these applications include web page editors, file transfer mechanisms, toolkit for science courses (e.g. MathML editor), add-on modules. The platform supports SCORM 1.2, IMS Metadata 1.2.1, IMS Content Packaging 1.1.2 and Microsoft LRN 3.0 standards. The system includes tools to facilitate the migration of course content between different versions of the platform.

form.

Blackboard offers three levels of service, with a wide range of license prices. Level I contains the elements to deliver a course online. There are separate areas for the syllabus, course information and announcements, textbooks, lectures, assessments, assignments, resources, grades, and course statistics. Built-in tools for communication and collaboration include a discussion board, email, and a chat. Students can take notes in online notebook, check the class schedule on the calendar, turn in homework assignments using the Digital Drop Box, and do research using the integrated Academic Web Resources. For organizations that would like to offer a comprehensive online community, Blackboard offers larger, more expansive packages. Level II, the Community Portal System, is an extension of the Learning System. It adds modules that can integrate courses, communities, and administrative services online through one customizable Internet gateway. There is one entry point, or URL, to access courses as well as administrative and student services. Information needs to be uploaded only once, and users need only log in once to gain access to all the courses, services, announcements, and tools that pertain to them. In addition to courses, campuses can use Blackboard for teams, committees, clubs, departments, course catalogs, and more. Customers can also brand their online venue. Level III adds an administrative package tailored to running an academic campus. It allows web-enabled operation of student identification, dining services, campus commerce, building access, and business with off-campus merchants. Blackboard offers its products as installations or hosted on the application service provider (ASP) model.

Besides Blackboard learning system, Academic Portal system, Content Management System is planned to organize to provide the full academic suite to schools. By utilizing the academy suite, customers will be able to provide a fully integrated, learning environment for students.

Pricing policy of BlackBoard is built on annual basis. Learning System ML (Multilanguage) Basic is cost about USD.11,300 for 3,000 students enrollment. A price of Enterprise version, which allows integrations, customizations, load-balanced configurations, etc., will depend of the number of students in the department or campus and start from USD.38,000. Minimum annual fee for hosting will be about USD 7,500.

BlackBoard is served globally more than 3,000 institutions, 12 million users. In Japan there are about 30 institutions use Blackboard.

Current shortcomings of the platform: there's no public

access to description and documentation of the platform; bad description of the platform architecture; bad description of database management system. All information and help are accessible only for registered users after licenses purchasing. Exams and quizzes are built without sequencing.

Conclusions

1. *Software architecture.*

Preferable software architecture of modern e-learning platforms needs to provide: scalability on software and hardware levels, possibility to work independently, high level of reliability, simple user access to distance learning resources, and good management and administration. In line to above, there following aspects are selected in a development of e-learning platforms: J2EE technology, powerful database management systems and powerful web servers with a possibility to extend a system for different applications using. As a rule, last versions of commercial based e-learning platforms are oriented to IBM Lotus-Notes, IBM DB2, Oracle and Microsoft SQL server database management systems on Linux, Windows 2000 or Solaris operational server systems. There IBM WebSphere, WebLogic, Apache or Microsoft IIS are used as application servers. These platforms can manage distance learning in line to any separate organization or a campus.

2. *Documentation of e-learning Platform.*

Documentation with a detailed and high quality e-learning platform description and with a public access to all information sources about e-learning platform is required for a correct platform selection. Also technical and methodic accompaniment of e-learning platform is required. The best way is to have a trial version of e-learning platform for evaluation installation.

3. *Administrator Tool.*

A platform needs to have effective recovery assets, instruments for fast and independent courses backup and courses management and to support complete level of asynchronous and synchronous e-learning services.

4. *Authoring Tool.*

A platform needs to have effective instrument for distance course design with a possibility to work off-line, without Internet connection.

5. *Compliance to International Standards.*

A platform needs to be AICC and SCORM compatible and have all needed instruments for migration of distance courses of third party developers.

6. *Price.*

A platform needs to be non expensive with a possibility

to extend own resources.

Recommendations

1. IBM Lotus LearningSpace Forum (ver. 3.01-3.6) may be recommended as a base CMS for distance learning inside one separate educational organization with not great number of students (several thousands students). The platform provides basic asynchronous e-learning services and is not expensive.
2. IBM Lotus LearninSpace Forum (ver. 301-3.6) + IBM Lotus SameTime (ver. 2.5) may be recommended as a base CMS with a complete set of asynchronous and synchronous services for distance learning inside one separate educational organization with not great number of students (several thousands students). The platform is not expensive.
3. IBM Lotus LearningSpace (ver. 5.x) may be recommended as LMS for distance learning inside one separate organization with a number of students no more than 10,000. This platform provides complete set of asynchronous and synchronous services, but does not have an instrument for distance course design. The platform is not expensive.
4. IBM Lotus LearningSpace (ver. 5.x) + IBM Lotus LearninSpace Forum (ver. 301-3.6) may be recommend as LMS with complete set of all services and with an instrument for distance course design. The platform is not expensive.
5. IBM Lotus Learning Management System may be recommended as LCMS for distance learning inside one separate organization or a campus with a number of students no more than 100,000. This platform provides a complete set of asynchronous and synchronous services and has Authoring Tool for distance courses design. The platform is not expensive.
6. IBM Lotus Collaborative Learning may be recommended as e-learning portal for distance learning more 100,000 students. This platform provides a complete set of asynchronous and synchronous services, has a special Authoring Tool for distance courses design. The platform is not expensive.
7. WebCT Campus Edition 4.1 may be recommended as a base CMS for distance learning inside one separate educational organization with not great number of students (not more than several thousands students). The platform provides basic asynchronous e-learning services and selective synchronous services. The platform is expensive.
8. WebCT Vista 3.0 may be recommended as LCMS for distance learning no more than 10,000-100,000 students. This platform provides a complete set of asynchronous services and selective synchronous services. The platform is very

expensive.

9. BlackBoard (ver. 6.x) may be recommended as a base CMS for distance learning inside one separate educational organization with a number of students (not more than 10,000 students). The platform provides basic asynchronous e-learning services and selective synchronous services. The platform is expensive.

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OBJECTIVES

Computer systems for Education support which are oriented for using last decisions of Information Technologies. Establishment and management of Distance Learning Centers on a base of modern computer Internet technologies (complete hardware and software support). Client-server platforms of distance learning support. Design, teaching and administration of distance courses with Internet/Intranet access.

CERTIFICATES

- National Institute of Multimedia Education (Chiba-Chi, Japan, 2004)
- Specialist in Distance Learning Management (Sylvan Prometric Inc)-1999
- Network specialist in Novell (USIA)-1994
- Professor in Computer Science (NTUU- "KPI") -1985

- Doctor of technical sciences (NTUU- "KPI")-1976

PRACTICAL EXPERIENCES

2000-current

- Visiting Professor at the National Technical Institute of Multimedia Education (June 1, 2004- August 31, 2004)
- Deputy-Director (Ukrainian Institute for Information Technologies of National Technical University of Ukraine "Kiev Polytechnic Institute")
- Vice-Director (Ukrainian Distance Learning Center of National Technical University of Ukraine "Kiev Polytechnic Institute")
- Professor of Applied Mathematics Faculty (National Technical University of Ukraine "Kiev Polytechnic Institute")

遠隔授業支援プラットフォーム — 機能分析と互換性について —

ヴァчесラフ ヴァリユースキ

本資料では、商用のe-learningプラットフォームとしてよく知られているIBM、WebCTおよびBlackboard社製のプラットフォームの分析結果を記述する。これらのプラットフォームは遠隔教育支援システムとして有効であり、教育へのIT活用の基盤となるものの一つである。本内容は著者が(独)メディア教育開発センターでの客員研究員として滞在した2004年6～8月における調査結果である。本内容をまとめるにあたって、日本のBlackboard、日本・英国・ドイツのWebCT、日本・ウクライナのIBMのそれぞれの関係者へのヒヤリング、また日本のWebCT研修資料、BlackboardやIBMの日本における公表資料、e-learningの技術資料や実際のデモ機、およびWeb上の資料を参考にした。

キーワード

e-learning、e-learningプラットフォーム、ヴァーチャルユニバーシティ、遠隔教育、WebCT、BlackBoard