US006282573B1

(12) **United States Patent**
Darago et al.

(10) **Patent No.: US 6,282,573 B1**
(45) **Date of Patent: Aug. 28, 2001**

(54) **COMPUTER ARCHITECTURE FOR MANAGING COURSEWARE IN A SHARED USE OPERATING ENVIRONMENT**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/553,572**

(22) Filed: **Apr. 19, 2000**

Related U.S. Application Data

(62) Division of application No. 09/272,221, filed on Mar. 18, 1999.
(60) Provisional application No. 60/079,302, filed on Mar. 25, 1998.

(51) **Int. Cl.**[7] **G06F 15/16**; G06F 12/14
(52) **U.S. Cl.** **709/229**; 709/217; 713/201
(58) **Field of Search** 709/204, 207, 709/217, 225, 229, 227; 370/260, 264, 265; 340/825.5; 713/200, 201

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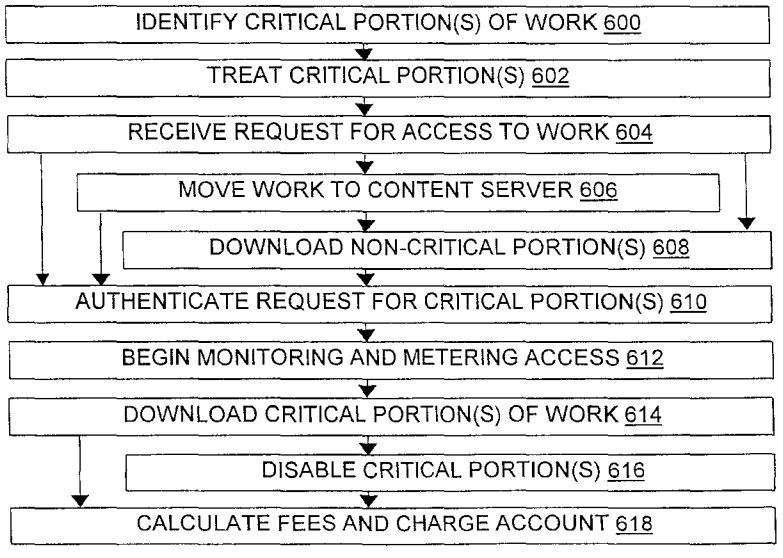
(57) **ABSTRACT**

Methods, devices, and systems are provided in a multi-level computer architecture which provides improved capabilities for managing courseware and other content in a shared use operating environment such as a computer network. In particular, the invention provides a commercial networked instruction content delivery method and system which does not exclude synchronous sharing but is focused on asynchronous sharing. Security in the architecture provides content property holders with the ability to know how many minutes of use an individual made of licensed material and with increased certainty that their material cannot be used, copied, or sold in usable form unless lo and until a user site is connected or reconnected to a minute-by-minute counter which is located off the premises of the user. This security link helps protect software and other works which are being sold or licensed to an individual, organization, or entity, and creates income opportunities for owners of such content.

37 Claims, 4 Drawing Sheets



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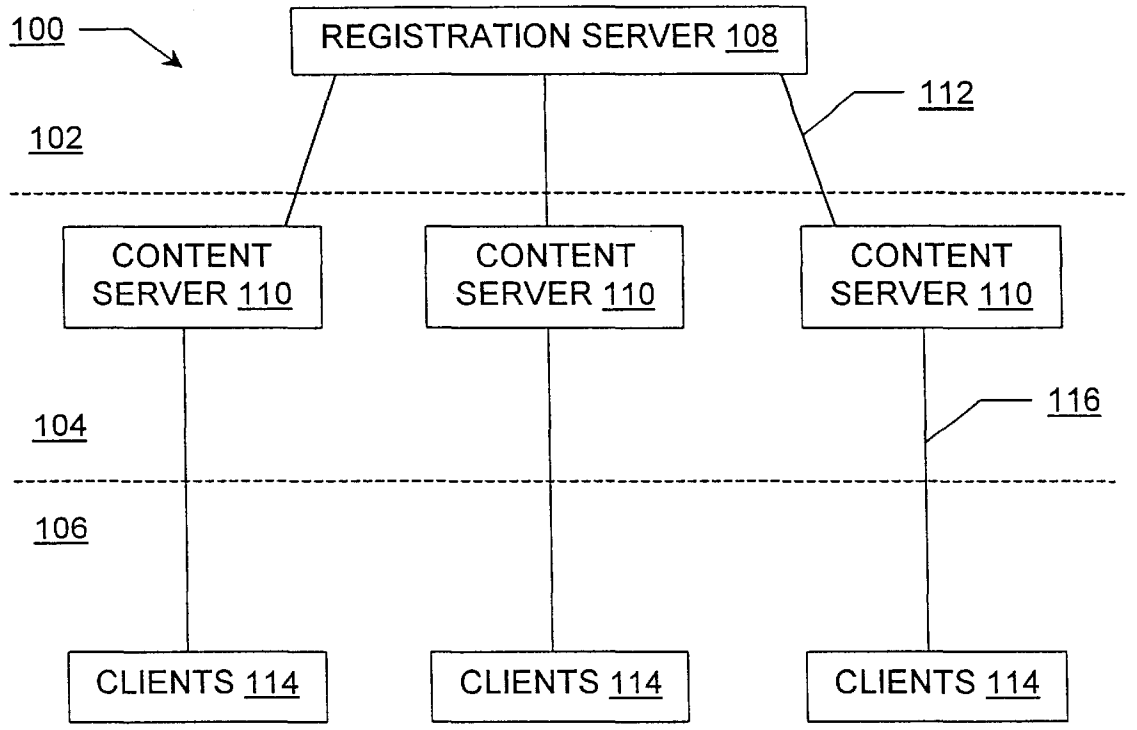
100
REGISTRATION SERVER 108
112
102
CONTENT SERVER 110
CONTENT SERVER 110
CONTENT SERVER 110
116
104
106
CLIENTS 114
CLIENTS 114
CLIENTS 114

FIG. 1

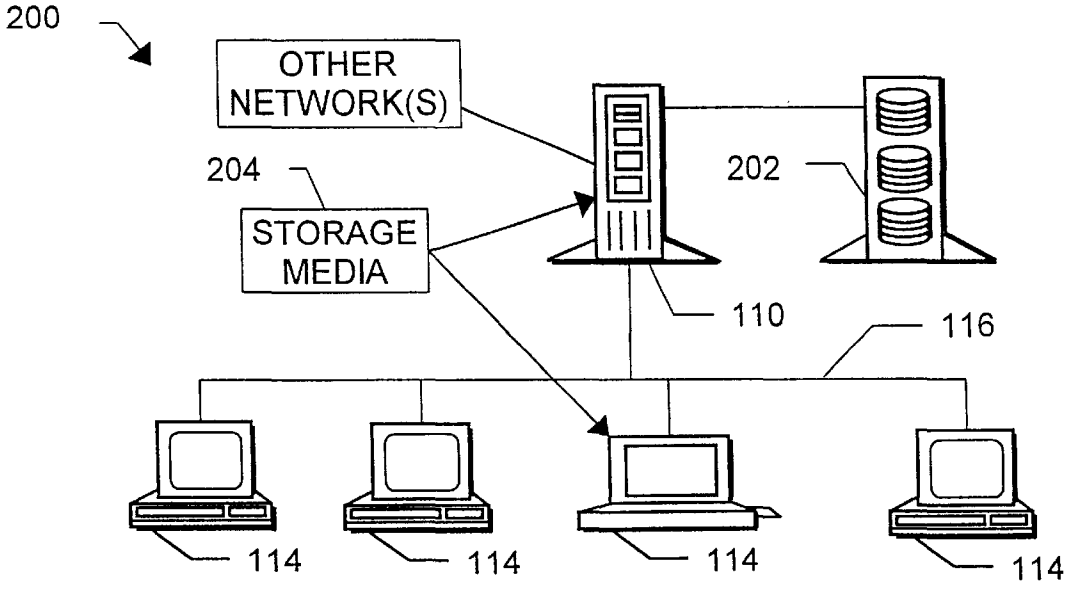
200
OTHER NETWORK(S)
204
STORAGE MEDIA
202
110
116
114
114
114
114

FIG. 2

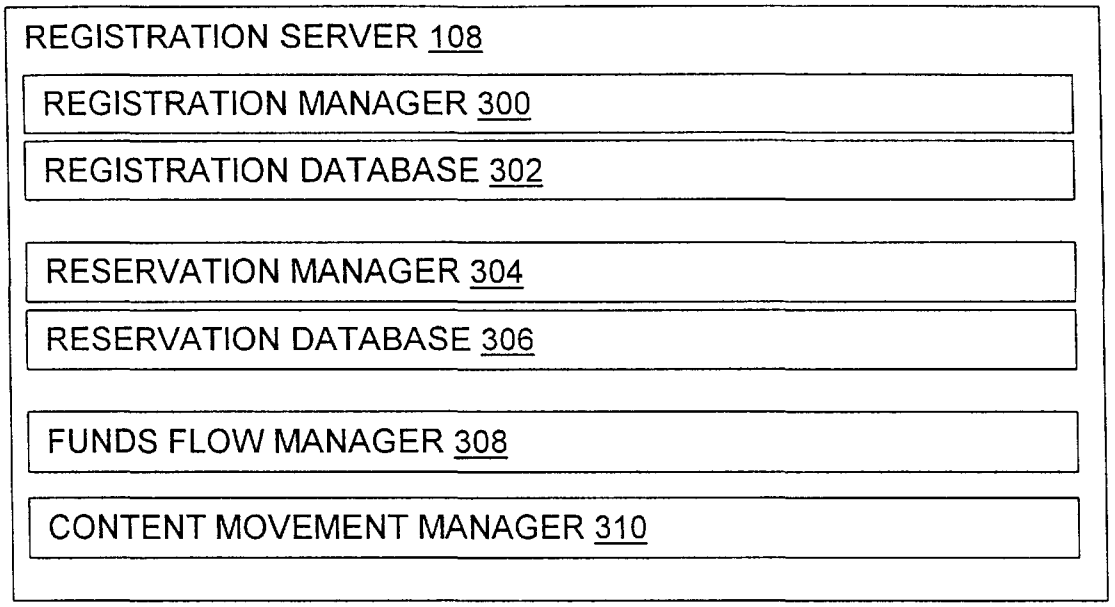
REGISTRATION SERVER 108
REGISTRATION MANAGER 300
REGISTRATION DATABASE 302
RESERVATION MANAGER 304
RESERVATION DATABASE 306
FUNDS FLOW MANAGER 308
CONTENT MOVEMENT MANAGER 310

FIG. 3

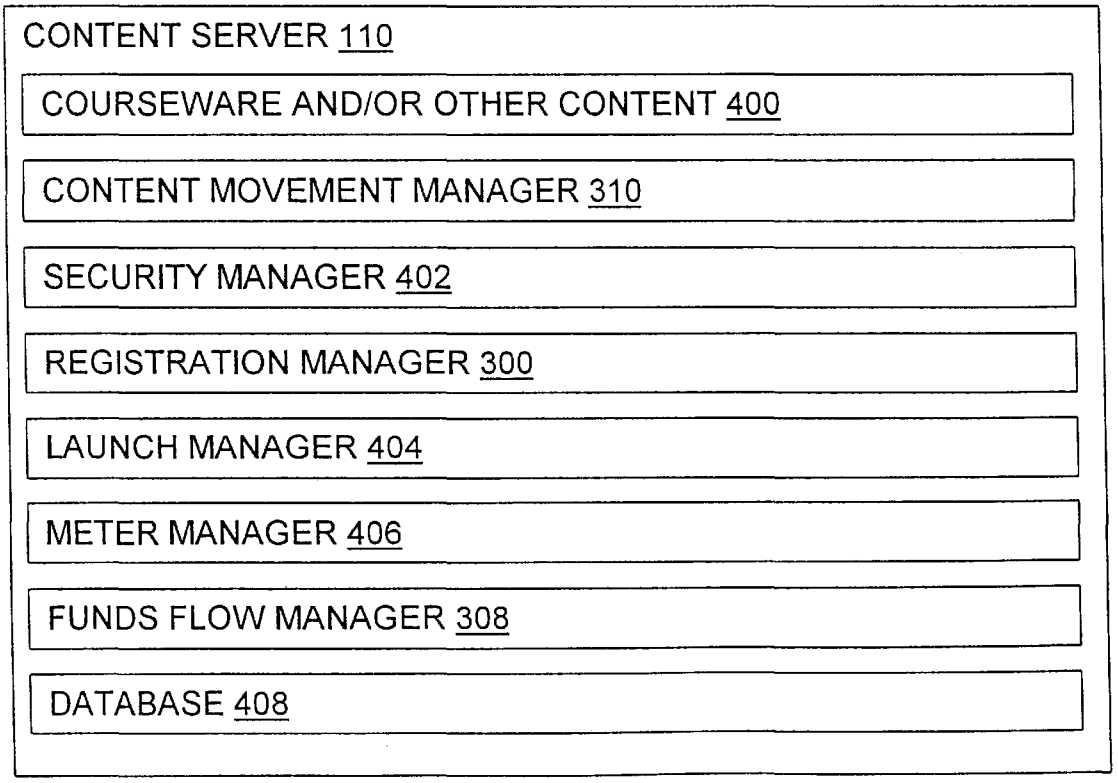
CONTENT SERVER 110
COURSEWARE AND/OR OTHER CONTENT 400
CONTENT MOVEMENT MANAGER 310
SECURITY MANAGER 402
REGISTRATION MANAGER 300
LAUNCH MANAGER 404
METER MANAGER 406
FUNDS FLOW MANAGER 308
DATABASE 408

FIG. 4

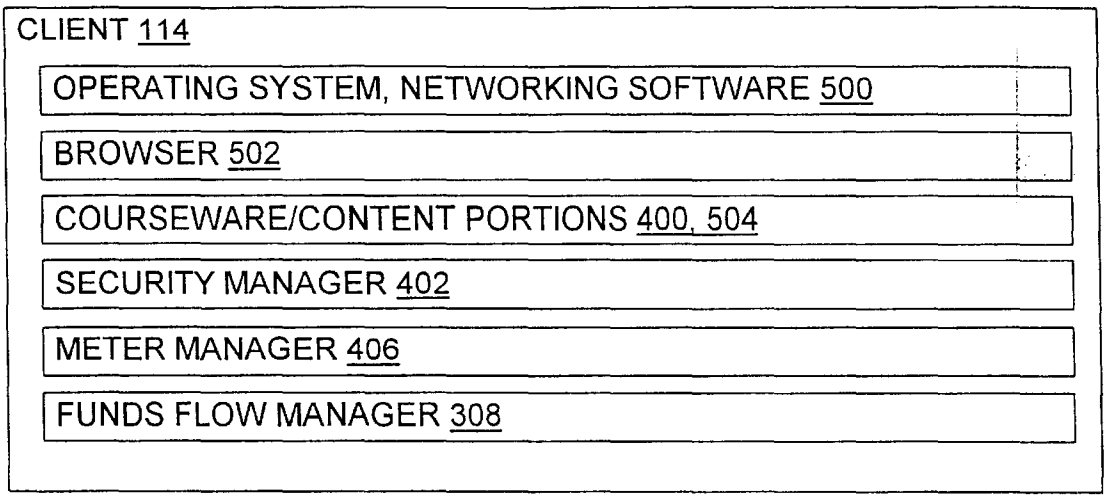
CLIENT 114
OPERATING SYSTEM, NETWORKING SOFTWARE 500
BROWSER 502
COURSEWARE/CONTENT PORTIONS 400, 504
SECURITY MANAGER 402
METER MANAGER 406
FUNDS FLOW MANAGER 308

FIG. 5

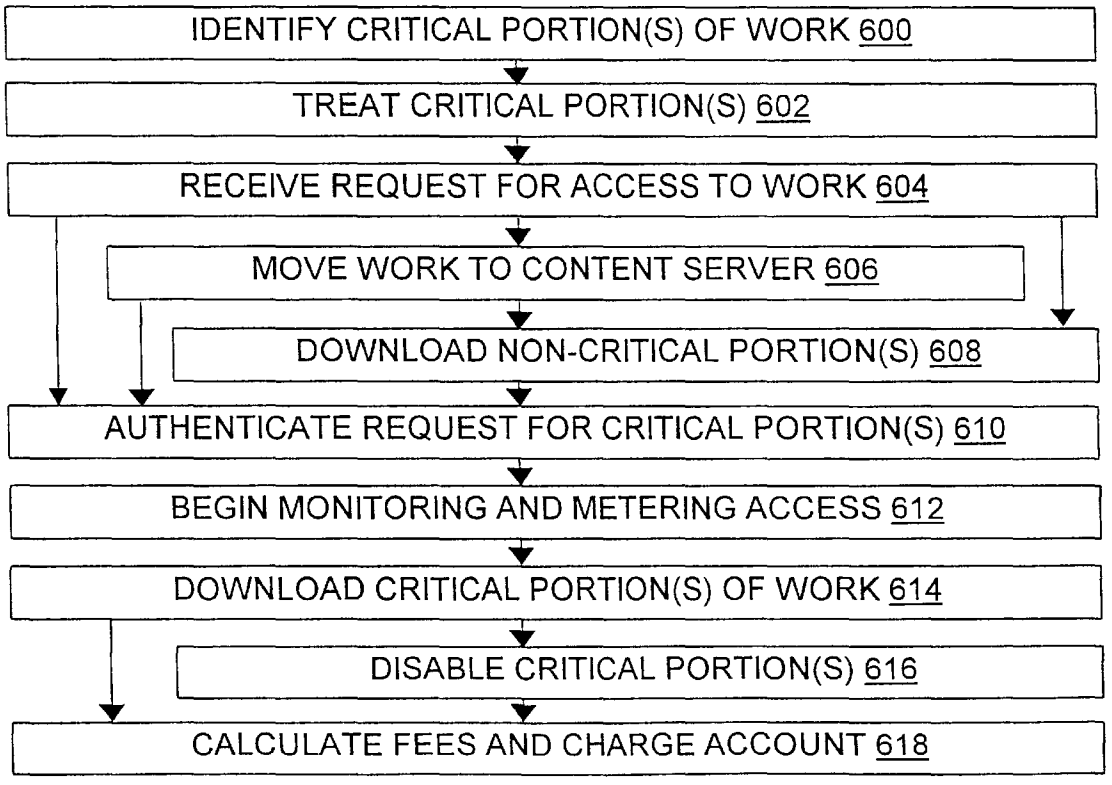
IDENTIFY CRITICAL PORTION(S) OF WORK 600
TREAT CRITICAL PORTION(S) 602
RECEIVE REQUEST FOR ACCESS TO WORK 604
MOVE WORK TO CONTENT SERVER 606
DOWNLOAD NON-CRITICAL PORTION(S) 608
AUTHENTICATE REQUEST FOR CRITICAL PORTION(S) 610
BEGIN MONITORING AND METERING ACCESS 612
DOWNLOAD CRITICAL PORTION(S) OF WORK 614
DISABLE CRITICAL PORTION(S) 616
CALCULATE FEES AND CHARGE ACCOUNT 618

FIG. 6

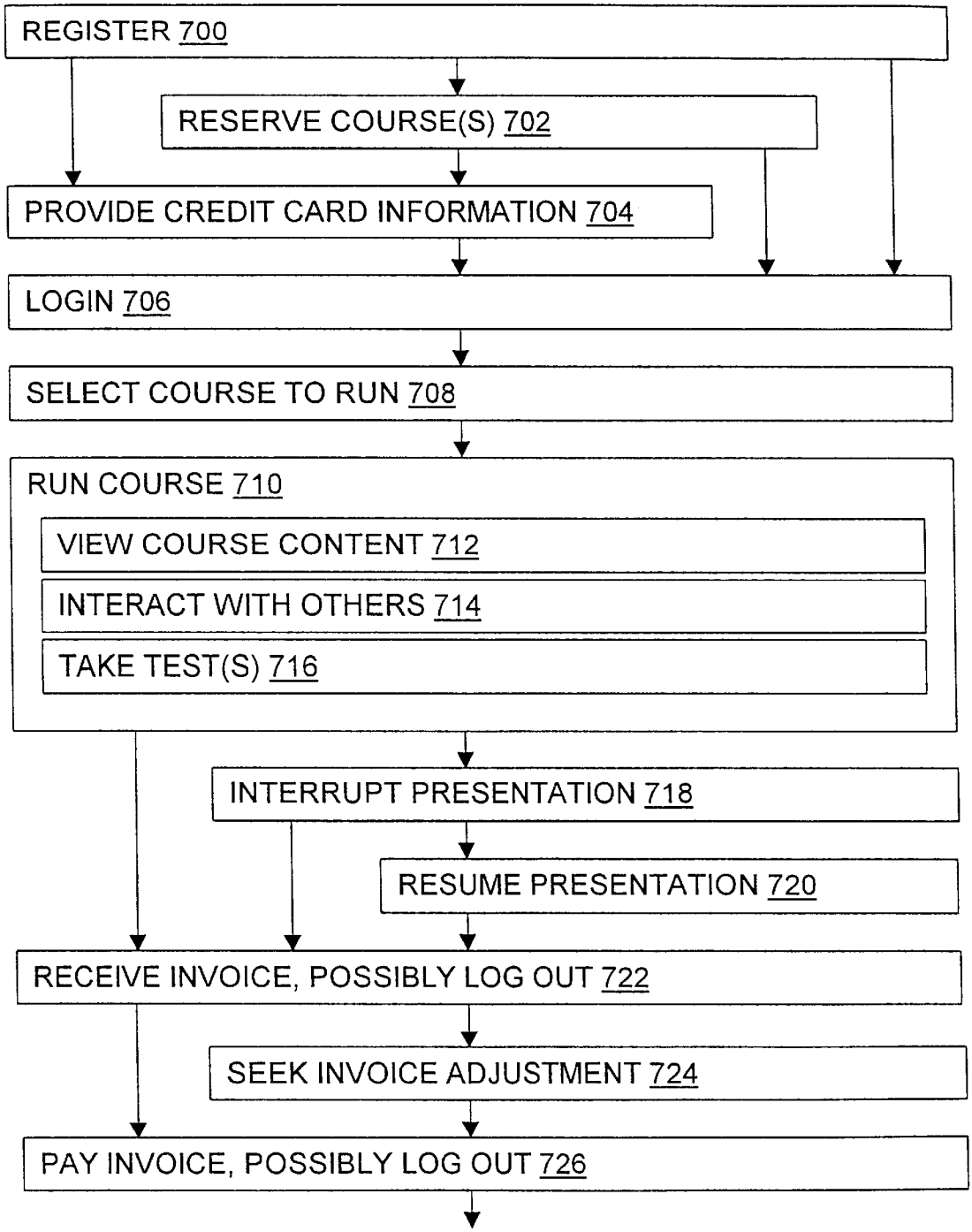
REGISTER 700
RESERVE COURSE(S) 702
PROVIDE CREDIT CARD INFORMATION 704
LOGIN 706
SELECT COURSE TO RUN 708
RUN COURSE 710
VIEW COURSE CONTENT 712
INTERACT WITH OTHERS 714
TAKE TEST(S) 716
INTERRUPT PRESENTATION 718
RESUME PRESENTATION 720
RECEIVE INVOICE, POSSIBLY LOG OUT 722
SEEK INVOICE ADJUSTMENT 724
PAY INVOICE, POSSIBLY LOG OUT 726

FIG. 7

COMPUTER ARCHITECTURE FOR MANAGING COURSEWARE IN A SHARED USE OPERATING ENVIRONMENT

RELATED APPLICATIONS

This application is a division of U.S. patent application Ser. No. 09/272,221 filed Mar. 18, 1999.

The present application claims priority to U.S. patent application Ser. No. 60/079,302 filed Mar. 25, 1998 ('302 application).

FIELD OF THE INVENTION

The present invention relates to content delivery over a large computer network, and more particularly to a computer network architecture which integrates management components such as a reservation system, a funds flow system, a metering system, and a security system for preventing unauthorized use of courseware and other content.

TECHNICAL BACKGROUND OF THE INVENTION

More and more paintings, pictures, books, songs, other performances, texts, diagrams, recordings, video clips, and courses utilizing them for instructional purposes and/or entertainment are becoming available in machine readable forms. In particular, many computer-assisted lessons, training materials, and other instructional courses include works which can be protected under intellectual property laws, such as visual works, audio works, texts, examinations, simulations, and other works. Some sensory works experienced while using computers, such as the physical motions performed with a flight simulator, may also be protected. Still other computer-aided sensory experiences are foreseeable but not yet commercially implemented, such as smells that could enhance a fire fighting course or a course on the detection of illegal drugs. These will also benefit from protection.

"Computerized training", "computer-assisted instruction", "computer-aided learning", "web-based training", "intranet-based learning", "web courses", "virtual university", "computerized curriculum delivery system", "courseware delivery system", "instructional management system", "interactive educational method", and similar phrases are used by various people in various ways, but each of these terms refers to efforts to use computers to help educate students. As used here, "students" are not necessarily traditional students enrolled in high schools, colleges, universities, and the like, but are rather people who receive instruction through courseware. Courseware may be used by traditional students, but it may also be used by employees of Government agencies and corporations, for instance.

To better understand the present invention in the context of existing computer-assisted educational efforts, it will helpful to understand certain distinctions, including without limitation the following:

- Course authoring vs. course content delivery;
- Stand-alone computer-based training vs. networked instruction;
- Synchronous sharing vs. asynchronous sharing;
- Commercial systems vs. academic systems; and
- Technical vs. legal means for securing intellectual property.
- Courseware vs. other content

Authoring vs. Delivery

Many uses of computers to facilitate education focus on providing authoring tools and authoring environments. For instance, tools for authoring include tools for reformatting text into HTML format and adding, hyperlinks; tools for integrating audio and/or video content with text content; and tools for creating interactive forms to obtain information from students and provide appropriate responses. In short, authoring tools help instructors create courseware content.

By contrast, delivery tools help deliver courseware to students. In the case of "web-based training", "intranet-based learning", and "web courses", delivery tools typically include TCP/IP networks and web browsers. Computer workstations themselves may also be viewed as delivery tools, particularly when the courseware is written to be used on a stand-alone computer rather than being delivered over a network connection.

Many existing approaches to computer-aided teaching include both authoring and delivery components. However, the problems and solutions associated with authoring are not necessarily the same as those associated with delivery. The present invention is concerned primarily with delivery as opposed to authoring.

Stand-alone vs. Networked Instruction

Many computer-based training systems do not require a network connection in order to function. All necessary courseware content is stored on a computer disk, CD-ROM, or other medium which is directly accessible to the computer being used by the student, making it unnecessary to send any content over a network connection. The tools and techniques for managing courseware content in such stand-alone systems are basically the same as the tools and techniques for managing application programs, operating systems, and other types of software installed on user workstations, namely written licenses, disk copy-protection schemes, license serial numbers, and the like.

By contrast, network-based training approaches either take advantage of a network connection if one is available, or else they require such a connection. Different network-based systems use the network in different ways. Sometimes courseware content is stored on a server and delivered over the network to users as needed. In some cases, part or all of the content is stored on the local network node but licensing is enforced through a server. For instance, the content stored locally might be encrypted, and the decryption key might be available only from the server and then only after the user is authenticated. Some network-based educational systems allow students to interact with one another and/or with the instructor through email or chat rooms. Some systems administer tests by having the student send test answers to a server, which grades the test and notifies the student of the results. Some systems provide instructors with access over the network to a database of administrative information such as student grades and a list of the students who have viewed a given lesson. Of course, many systems combine one or more of these features and some also use networks in other ways.

The present invention is concerned with network-based courseware delivery systems, as opposed to stand-alone courseware delivery systems.

Synchronous vs. Asynchronous Sharing

Networked courseware delivery systems may share content between multiple users synchronously or asynchronously. With synchronous sharing, users and/or instructors exchange information in a real-time or interactive way. Examples of synchronous sharing include telephone conversations, video conferencing, and chat rooms. By

contrast, asynchronous sharing involves an exchange of information in which the participants expect substantial delays, or they involve a one-way flow of information rather than an exchange. Examples of asynchronous sharing include downloading a previously created multimedia presentation, listserv exchanges, and Usenet postings. Email does not fit neatly in either category, because it can be either synchronous or asynchronous in practice.

Some aspects of the present invention are concerned with asynchronous sharing, and in particular with asynchronous delivery of previously created courseware content. However, other aspects of the invention are concerned with synchronous information exchanges, such as funds transfers.

Commercial Systems vs. Academic Systems

As noted, some courseware students attend traditional institutions of higher education. In many cases, those students pay for their use of courseware by paying tuition to the institution. If the institution is not the owner of the courseware, the institution then makes separate arrangements for payment to the owner. Likewise, students who are employees of a government agency or corporation generally receive access to courseware through their employer without personally making arrangements to pay the courseware owner directly. In either case, at the time a student sits down to actually use the courseware it may be necessary to authenticate the student to the system but it is not necessary for the student to provide a credit card number or similar payment mechanism. For convenience, courseware management systems which do not require direct payment from students are referred to herein as "academic systems".

By contrast, in "commercial systems" some provision must be made for funds transfer before a student is given full access to courseware content (although a demo might be available at no charge). For instance, each student may be required to provide a credit card number, to pre-pay for access by giving cash or a check to an attendant, or to provide individual billing information if credit is being extended.

The present invention is concerned primarily with commercial courseware delivery systems as opposed to academic courseware delivery systems.

Technical vs. Legal Security

As time passes, personal computers and other computational devices are able to record into machine readable form more and more complex presentations or experiences. For example, personal computers in the 1980's mainly manipulated words, numbers, and characters; in the 1990's manipulation of icons, images, audio and video has become commonplace. The next step may include widespread use of motion, as in simulators, and perhaps smell or other additions. As the complexity of the process needed to place these words, images, and other sensory experiences into machine readable form increases, the value of computer software that presents these experiences increases. This increases in turn the value of a security system which enforces courseware license agreements.

Intellectual property rights are provided by copyright and other laws to encourage creative effort by artists, authors, and other people who create paintings, photographs, animations, musical works, instructional texts, and other works. These works can be stored, presented, and utilized in many ways. With the increasing availability of powerful computers, many works that were traditionally available on paper, canvas, or tape are now stored in computer hard drives and computer RAM (random access memory), and are displayed on computer monitors such as cathode ray tube screens and liquid crystal displays.

Early computers provided minimal technical security means. On early personal computers, for instance, typing, "copy *.*" would direct the computer to copy every file or program in a directory. Further simple keystrokes, such as "copy C:/*.* A:/*.*" would direct the computer to place the new copies in a new physical location, perhaps copying everything from a disk directory in drive C to a portable disk in drive A. Even today most personal computers routinely provide an environment that makes it relatively easy to copy electronic information in the form of files.

Of course, technical means are not the only way to protect intellectual property rights; legal tools in the form of license agreements are widely used. Perhaps the most widespread license agreement is a single Workstation agreement. In exchange for a license fee or an outright purchase price, a set of disks or a CD-ROM containing digitized works and/or executable code is transferred to the purchaser, often with books and/or instructions on paper. Sometimes the works are transferred over a network such as the Internet in digital form. The purchaser is typically informed that the code or information may be used an unlimited number of times on a single workstation or other computer.

This approach worked fairly well in the day of the stand-alone personal computer. It does require that the producer of the code or other protectable work place some trust in the buyer, since the buyer often could copy the code or information onto more than one computer. The barriers were mainly legal, not technical. In locations where intellectual property was not a well-established and respected concept, widespread copying of information and executable code reduced income and profits to producers of computer based information and applications by diverting income and profits to illicit "factories" which reproduced computer disks and CD-ROMs without permission from the rightful owner.

Many technical protection schemes were developed to combat the ability of the market to reproduce information without payment to the owner. Some "copy-protection" schemes made it difficult to make copies, regardless of the legitimacy (e.g. for unauthorized resale versus for proper backup) of the copies.

Other schemes defined zones of control on a CD-ROM and made a "key" necessary to read the zones. For instance, if a CD-ROM had 600 megabytes of information on it, a person might buy the legal right to see, view, or use 100 megabytes for $50.00. Information would be available in the first 100 megabyte zone regarding the contents and cost of information in the second or third 100 megabytes. For an additional fee or fees, the viewer could obtain the key to additional segments of the CD-ROM. For instance, a second $50 might buy the right to use the second 100 megabytes and a third $50 fee might permit the use of the third 100 megabytes.

A problem with this approach (and with copy-protection schemes) is that once a single purchase has been made of all the information, or access to all the information on the disk or CD-ROM has been obtained once, the information could be reproduced at will. An unauthorized factory could produce thousands of copies to be resold with no benefit to the rightful owner of the intellectual property.

Similar problems exist with the site license approach to protecting intellectual property. A licensed site such as a corporation or a government agency obtains the right to use a program or digitized information from the intellectual

property owner, and is given a set of disks, CD-ROMs, or file-server-based copies of the licensed work for authorized internal use. The intellectual property owner relies upon the corporation or agency not to share the information or program outside the bounds of the license. But the major tool for enforcing the license agreement was not technical. Instead, it was respect for the law and the agreement. Unfortunately, some corporations and even some government agencies were staffed, at least in part, by people willing to take home a copy of the software or other licensed work and share it or sell it to an illegal copying factory.

Under a common relationship between works of intellectual property and the Internet, users view courseware and other information for free. The information is shared for free because providing the information helps the work's owner sell a product, or saves the owner money by reducing technical support costs, for example. In the research community, huge sets of information are regularly exchanged via file transfer protocol or other digital means. Similarly, information in courses can be made available on the web, and can be viewed via a browser.

The present invention relates to protecting content both by technical means and by legal mechanisms. Although some information may be shared for free within a system according to the invention, much of the information available through the inventive system is provided only in exchange for license fees or the like paid by students or their employers.

Courseware v. Other Content

Those of skill in the art will recognize that many of the comments above apply not only to coursewvare, but also to other types of digital content, including without limitation musical recordings, visual images, and the like. Such content may appear as components of multimedia courseware, but it may also be distributed independently of courseware and/or for purposes other than education. As used herein, "content" includes both courseware and other kinds of digital content.

Additional Considerations

In addition to the considerations above, certain trends are worth noting. Many courses are available on the web, yet in general the more attractive the course is (visually, in activity, motion, video, sound, and so on), the more time it takes to refresh the computer screen at the user's workstation. To reduce download time, more and more bandwidth is requested. Users go from a POTS ("plain old telephone system") line, to an ISDN line to a T1 line, with increasing costs at each stage. However, the cost of computer storage is dropping rapidly. As most machine readable classes remain less than a gigabyte in size, the cost of forward storing a machine-readable class to the personal computer owner wishing to take the class is dropping rapidly.

As the speed of market developments in the computer industry increase, the delay and cost of obtaining legal remedies increase, and the technical ease of copying and distributing electronic information increases dramatically with the interconnections available via the Internet, improved tools for managing courseware are needed.

As discussed above, a wide range of computer-assisted educational features and capabilities have been explored, at least to some extent. However, existing approaches have been less successful at combining these features and capabilities into an architecture which securely and effectively shares commercial courseware. Accordingly, it would be an advancement in the art to provide an improved computer architecture for sharing commercial courseware and other content over a network.

BRIEF SUMMARY OF THE INVENTION

The present invention provides improved capabilities for managing courseware and other content in a shared use operating environment such as a computer network. In particular, the invention provides a commercial networked content delivery method and system which does not exclude synchronous sharing but is focused on asynchronous sharing.

One method of the invention operates in a network containing a registration server, a content server connected to the registration server, and several client work-stations connected to the content server. After a user registers with the registration server and requests access, the content server authenticates the request and serves the content to the client workstation for presentation to the user. Content may be moved by the system between content servers in response to actual or anticipated user requests; users may reserve courses for later viewing. If the target content server lacks room to receive the incoming content, the system makes a recommendation to the local administrator as to which content should be deleted from the content server in order to make additional room.

Courseware and other content managed by the system may contain one or more "critical portions" which have been treated to prevent their unauthorized use and thereby enhance the protection of intellectual property rights in the content by technical means. For example, the treating step may insert disabling code into an executable portion of courseware, may encapsulate the critical portion in a database table, may compress the critical portion, and/or may encrypt the critical portion. In addition, the content server and/or client workstation may disable use of a critical portion if an expected security handshake is not received. Caching and other disk writes at the client may also be disabled to prevent a permanent copy of the critical portion from being created at the client. To take advantage of low cost telephone connections, part or all of the content may be downloaded to the client workstation one or more hours before serving the critical portion.

The system also monitors the connection between content server and client, and meters use of the content so that the user pays only for actual use. Pre-existing works can be metered without being modified. In some cases, however, a metering security module is injected by linking or recompilation into the machine readable form of a work that contains legally protectable intellectual property. Adding the metering security module alters the system, such as by inserting disabling code, so that the system will not play or display the content unless the metering security module is operating. "Playing" a work includes displaying it, executing it, digitally manipulating it, or otherwise performing an act governed by the license agreement or by relevant intellectual property law. Unless the metering security module is engaged and authorizes the use, a monitor will not display certain protected words or images or motion images, speakers will not play certain protected sounds, motion simulators will not perform certain protected motions, and so forth.

The user receives an invoice for use of the courseware or other content. A local administrator can be authorized to adjust invoices in response to user requests. For instance, the administrator may determine that the user did not finish viewing the course in question, or accidentally started the

wrong course, and then reduce the charges on that basis. If the user previously provided a credit card payment authorization to permit payment by credit card, a funds flow manager makes appropriate adjustments to the credit card charges.

In short, the architecture of the present invention provides improved security, efficiency, and convenience for the management of courseware or other content in a shared operating environment such as a network or a collection of loosely coupled networks. For instance, additional security is provided by separating registration information from content, by identifying and treating critical portions, and by monitoring the connection over which content is supplied to a client. Convenience and efficiency are provided by optional early downloading, by reservation capabilities, and by a combination of automatic and local administrator control. Additional features and advantages of the present invention will become more fully apparent through the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

To illustrate the manner in which the advantages and features of the invention are obtained, a more particular description of the invention will be given with reference to the attached drawings. These drawings only illustrate selected aspects of the invention and thus do not limit the invention's scope. In the drawings:

FIG. **1** is a diagram illustrating a network architecture according to the present invention, including a registration server, several content servers, and several clients.

FIG. **2** is a diagram further illustrating a portion of the network architecture of FIG. **1**, including a content server and several clients.

FIG. **3** is a diagram further illustrating a registration server.

FIG. **4** is a diagram further illustrating a content server.

FIG. **5** is a diagram further illustrating a client of a content server.

FIG. **6** is a flowchart illustrating methods of the present invention, including steps for providing enhanced security to protect intellectual property rights in critical portions of content.

FIG. **7** is a flowchart illustrating methods of operation in the present invention, from the point of view of a courseware user.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention relates to methods, systems, and configured storage media for managing courseware and/or other content in a shared use operating environment. Courseware includes digital instructional and/or entertainment content in the form of software, digitized sounds, digitized images, digitized motion paths, digitized chemical compounds, and other works which can be transmitted over a computer network for presentation to a user and which contain intellectual property that is protectable by copyright, patent, trade secret, trademark, trade dress, moral rights, common law rights, contract, and/or other sources of legal authority. Courseware is sometimes referred to herein as a "course" or "class" or "work" or "content", "content" and "work" are used interchangeably to describe material of which courseware is just one example. Specific examples of courseware and other content are given to illustrate aspects of the invention, but those of skill in the art will understand that other examples may also fall within the scope of the invention.

A shared use operating environment is an environment in which more than one person can use content, without necessarily sharing a specific copy of that content, with the assistance of a computer network or a collection of coupled networks. As used here, "network" includes local area networks, wide area networks, metropolitan area networks, and/or various "Internet" networks such as the World Wide Web, a private Internet, a secure Internet, a value-added network, a virtual private network, an extranet, or an intranet.

Overview of the Architecture

FIG. **1** illustrates generally an architecture **100** of a shared use operating environment according to the present invention. The architecture **100** includes at least three levels which are defined according to the functionality and data that are present and/or intentionally omitted from each level. Those of skill in the art will appreciate that the levels may be being named differently in various embodiments, but for clarity they are referred to herein as a registration server level **102**, a content server level **104**, and a client level **106**.

The registration server level **102** includes at least one registration server **108**. The functionality and data associated with the registration server(s) **108** are described in detail below. At this point, it is sufficient to note that each registration server **108** includes a remote registration manager and a registration database for new user registration, and that each registration server **108** is free of courseware or other deliverable content that is managed by the architecture **100**. In particular, courseware is not stored on the registration server **108**.

The content server level **104** includes at least one content server **110**. For clarity of illustration, three content servers **110** are shown, but an embodiment of the invention may include one or more servers **110**. Each content server **110** is linked by a link **112** for network communications with a registration server **108**. In an embodiment containing a single registration server **108**, such as the embodiment illustrated, each content server **110** thus has a network connection **112** (or may readily obtain such a connection) to that registration server **108**. In embodiments containing more than one registration server **108**, different content servers **110** may communicate over one or more network links **112** with one or more of the registration servers **108**. Each network link **112** may involve a dedicated link, a virtual circuit, a tunnel through one or more intervening networks, or one or more other types of network communication links known to those of skill in the art.

Each content server **110** contains courseware and/or other works managed by the architecture. Like the registration server **108**, a content server **110** may also contain data which is not managed by the architecture and which is thus of no concern here unless it interferes with operation of the system **100**. Each content server **110** serves the managed content for presentation to registered users, that is, users who have previously been registered with the registration server **108**. At a minimum, registration provides users with a unique user name or user ID; it may also coordinate a password or otherwise manage access control. With the possible exception of registration for free demonstrations, which may be available in some embodiments, registration also obtains billing or payment information such as the user's credit card information, purchase order, and/or sponsor identity.

The registration server **108** and the content server(s) **110** may be implemented with a combination of computer hardware (e.g., disk or other non-volatile storage, RAM or other

volatile storage, one or more processors, network interface cards, supporting I/0 equipment) and computer software (e.g., operating system software, networking software, web browser software, and inventive software as described herein). In particular, suitable software for implementing the invention is readily provided by those of skill in the art using the teachings presented here and programming languages and tools such as Java, Pascal, C++, C, CGI, Perl, SQL, APIs, SDKs, assembly, firmware, microcode, and/or other languages and tools. A given computer may host several content servers **110**, or it may host several registration servers **108**, but a content server **110** and a registration server **108** may not reside on the same computer because that would violate the requirement that registration servers **108** not contain courseware.

The client level **106** includes at least one client workstation **114**, and typically includes multiple workstations **114**. Each client workstation **114** is connectable to a content server **110** by a client-server network communications link **116**, such as a local area network link. At some point, each client workstation **114** is able to present, to at least one registered user, courseware and/or other content which is served over the link **116** by the content server **110**. The content may be conventional content, or it may be modified by treating critical portions as described herein, or it may be a combination of untreated and treated works. Although clients **114** are referred to as workstations in deference to the expected typical situation, it will become clear that laptops and other computers may also serve as clients **114**.

Registration servers **108**, content servers **110**, and clients **114** are further illustrated in FIGS. **3**, **4**, and **5**, respectively. However, before describing those three Figures the relationship between content servers **110** and clients **114** is discussed with reference to FIG. **2**, and the relationship between registration servers **108** and content servers **110** shown in FIG. **1** is described in greater detail.

A Network of Content Servers and Clients

FIG. **2** further illustrates one of many possible client-server networks **200** suitable for use according to the invention. The network **200** includes one content server **110** and four clients **114**. Other suitable content-server-client networks **200** may contain other combinations of content servers **110**, clients **114**, and/or peer-to-peer nodes which perform as content servers **110** and/or clients **114** according to the invention; with appropriate software, a given computer may function both as a client **114** and as a server **110**. The computers **110**, **114** connected in a suitable network **200** may be workstations, laptop computers, disconnectable mobile computers, uniprocessor or multi-processor machines, mainframes, so-called "network computers" or "lean clients", personal digital assistants, or a combination thereof. Nonvolatile storage **202**, printers (not shown), and other devices may also be connected to the network **200**.

The network **200** may include communications or networking software such as the software available from Novell, Microsoft, Artisoft, SCO, and other vendors, and may operate using TCP/IP, SPX, IPX, and other protocols over connections **116** that include twisted pair, coaxial, or optical fiber cables, telephone lines, satellites, microwave relays, modulated AC power lines, and/or other data transmission "wires" known to those of skill in the art. The network **200** may encompass smaller networks and/or be connectable to other networks through a gateway or similar mechanism.

As suggested by FIG. **2**, at least one of the computers **110**, **114** is capable of using a floppy drive, tape drive, optical drive, magneto-optical drive, or other means to read a storage medium **204**. A suitable storage medium **204** includes a magnetic, optical, or other computer-readable storage device having a specific physical configuration. Suitable storage devices include floppy disks, hard disks, tape, CD-ROMs, PROMs, random access memory, and other computer system storage devices. The physical configuration represents data and instructions which cause the computer system to operate in a specific and predefined manner as described herein. Thus, the medium **204** tangibly embodies a program, functions, and/or instructions that are executable by computer(s) to assist content management generally, and license enforcement in particular, substantially as described herein. As used herein, "executable" includes "interpretable"; executable code thus includes compiled code as well as codes like Java byte codes or interpreted BASIC statements.

A Network of Registration Servers and Content Servers

As noted, the network **200** involves at least one content server level **104** computer and one or more client level **106** computers **114**. Some of the characteristics of the network **200** may also apply to networks, such as that shown in the upper two-thirds of FIG. **1**, which involve the registration server level **102** and the content server level **104**.

For instance, the computers **108**, **110** may be workstations, uniprocessor or multiprocessor servers, mainframes, or a combination thereof such as a cluster. Nonvolatile storage such as a disk array and/or other devices may be connected to the computers **108**, **110**. The computers **108**, **110** may be linked by communications or networking software such as the software available from various vendors and may operate using TCP/IP and/or other protocols over connections **112** that include data transmission "wires", as described above. The computers **108**, **110** may likewise be part of a network which encompasses smaller networks and/or is connectable to other networks. Finally, the computers **1 08**, **110** may be capable of using a drive or other means to read a configured storage medium **204**.

One example of a network **200** suitable for a metered security relationship is a network holding several thousand machine readable courses. A conventional approach charging one fee for unlimited use of each machine readable course by a single personal computer **114** or a single location (e.g., a corporation or agency) would be prohibitively expensive. In an embodiment according to the invention, the secured courseware or other content can be shared by various users, and each minute of use is counted and billed to the user or to the sponsor of the user (e.g., the corporation or agency employing the user). Unlimited use is not required, and the license fee is reduced accordingly.

Registration Server

FIG. **3** further illustrates a registration server **108**. The registration server **108** includes at least a portion of a registration manager **300** and of a corresponding user registration database **302**. Collectively, the manager **300** and the database **302** form a registration module which provides at least unique user IDs and user password support. The registration module may also obtain and store in the database **302** information such as the identity of a corporate or government sponsor that employs the user, and the user's email address for use in notifications of upcoming services or events.

The proposed user ID and password are checked against existing registration information in the database **302** to make

certain they are unique throughout the architecture **100** embodiment. This provides security to users so that charges for services will be valid and services cannot be stolen by an unknown or duplicate user and then charged to the wrong user ID. Of course, users must still be careful to keep their own password information confidential and to choose passwords which are not simply a copy of their username or other easily guessed information. User login and authentication tools and techniques familiar to those of skill in the art may be used.

Security is enhanced by making all new registrations go through the registration server **108**. New user registration information is processed on the registration server **108**; user registrations cannot be created by any content server **110**. The updated registration database **302** is replicated in a read-only format to content servers **110** so they can recognize registered users, but a new user registration cannot be created directly on a content server **110**. One advantage of this approach to users is that they need not repeat registration information each time they log onto a client **114**. Registration database **302** replication may be performed using Oracle 8.0 enterprise software or other familiar means.

As illustrated in FIGS. **3** and **4**, in one embodiment of the architecture **100** a portion of the registration module resides on each registration server **108** and a portion resides on each content server **110**. Other embodiments may distribute registration module functionality differently between the three levels **102**, **104**, **106**, subject to the appended claims. Those of skill in the art will readily implement the registration manager **300** based on commercially available tools and languages such as C++ or Java and the description given herein. The database **302** may likewise be implemented as an Oracle database or in another familiar database format. In one embodiment, Java software in the registration manager **300** is used to write new user registration information to an Oracle database **302**.

The registration server further includes a reservation manager **304** and a reservation database **306**. Collectively, the manager **304** and the database **306** form a reservation module which permits registered users to reserve courseware or other content. In combination with the funds flow system described herein, the reservation module allows a user to book a guaranteed seat, a classroom, or another service, secure in the knowledge that it will be held for them until the specified time. In some embodiments, the funds flow system will charge users for such guaranteed resource reservations regardless of whether the resource is actually used, because the resource was kept unavailable for use by others. The reservation module can present a user with a menu or a schedule of courseware presentation events in various classrooms or other locations. It can also tell the user whether a given courseware event or piece of content is available at a given time and whether a particular work is already scheduled for use at that time.

Other embodiments may distribute reservation module functionality differently than shown between the three levels **102**, **104**, **106**, subject to the appended claims. In one embodiment, the reservation module includes commercial off-the-shelf scheduling software provided by AC&E Ltd. of Chantilly, Va.; in other embodiments, other scheduling software may be used. The reservation manager **304** may also be implemented using, commercially available tools and languages such as C++ or Java and the description given herein. The database **306** may be implemented as an Oracle database or in another familiar database format.

The illustrated registration server **108** also includes at least part of a funds flow manager **308** which manages content usage payment information. As illustrated in FIGS. **3–5**, in one embodiment of the architecture **100** a portion of the funds flow manager **308** resides on each client workstation **114**, a portion resides on each content server **110**, and a portion resides on each registration server **108**. Other embodiments may distribute funds flow management functionality differently between the three levels **102**, **104**, **106**, subject to the appended claims.

The funds flow manager **308** accepts payment information such as a purchase order number or a credit card authorization. If payment is to be made by credit card, the funds flow manager **308** places a hold with the credit card provider or bank before the courseware and/or other content is presented. In connection with sending the user the final invoice, the funds flow manager **308** contacts the bank to transfer funds from the user's account or the sponsor's account to the service provider's account or the content owner's account.

The funds flow manager **308** makes customer interactions with the system **100** faster and more effective. For example, upon first using the system **100**, the user may provide a billing code such as a corporate purchase order number or credit card number. Once this information is accepted by the funds flow manager **308**, the user may make it the default payment option to be applied when logging out after future service purchases.

The funds flow manager **308** may also provide a custom menu to users. For instance, the system **100** may be configured so that only courses approved by a particular entity are displayed if the user identified that entity as its sponsor while signing on. If this same user wishes to see other courses, the user may log out and then login again as an individual client, after which all courses available for individuals (whether employed by the sponsor in question or not) will be displayed as possible selections.

The illustrated registration server **108** also includes at least part of a content movement manager **310** which moves courseware and/or other content to content servers **110** in response to actual or anticipated requests from users for access. As illustrated in FIGS. **3** and **4**, in one embodiment of the architecture **100** a portion of the content movement manager **310** resides on each content server **110** and a portion resides on each registration server **108**. Other embodiments may place all content movement management functionality at the content server level **104**.

The content movement manager **310** interacts with scheduling software such as the reservation module and a launch manager **404** which is discussed below. When a user selects courseware and/or other content for use at a given location, the scheduler determines whether the content is already resident on a content server **110** at or near the requested location. This determination may be made by reference to a database which tracks content locations, or by making an inquiry to the local content server(s) **110**.

If the content is not resident at the desired location, the scheduler places a call to the content movement manager **310**. The content is automatically packaged for shipment from another content server **110** by FTP (file transfer protocol) or other familiar means, with appropriate encryption and/or compression. The source content server **110** may be a typical content server **110** as described above, or it may be a master content server **110**. Each master content server **110** serves primarily as a content repository for other content servers **110**, as opposed to serving primarily as a source of content for directly attached clients **114**.

The content movement manager **310** checks with the target content server **110** to determine whether sufficient disk

space is available to receive the incoming content. If there is not enough space, the content movement manager **310** makes a recommendation to a local administrator regarding which content to delete to make room for the incoming content. The recommendation may be based on various factors, including storage requirements and which courseware at the target server **110** was used most recently or is scheduled for use. For instance, if a course has not been used for several months and has not been reserved, the content movement manager **310** is more likely to recommend that it be deleted than if it was used more recently or has been reserved. In one embodiment, the content movement manager **310** cannot delete content; only the local site administrator can.

Some embodiments of the architecture **100** include a backup registration server **108** which contains data mirrored from the primary registration server **108** shown in FIG. **1**. As usual with mirrored systems, the backup server **108** will generally be in a different physical location than the primary server **108**. Data mirroring tools and techniques familiar in the art may be used.

In addition to the functionality described above, the registration server **108** may provide advertising and other inducements for Web walkers and potential users of the system **100** to become familiar with the system **100**, and to register for services provided through the system **100**.

Content Server

FIG. **4** further illustrates a content server **110**. The content server **110** includes operating system software and networking software, such as Windows NT operating system software, UNIX or Linux operating system software, Ethernet or NetWare networking software, and/or other software discussed in connection with FIG. **2**.

Unlike the registration server **108**, the content server **110** contains courseware and/or other managed content **400**. The content **400** may take a variety of forms, including software, video, audio and other types of digital content. The content **400** may also be treated according to the present invention by identifying critical portions and providing enhanced security for those portions. Security for the content **400** as a whole is also provided by a security manager **402**, which monitors use of the content **400**. In the illustrated embodiment, a portion of the security manager **402** resides on each client workstation **114** and a portion resides on each content server **110**. In alternative embodiments, the security manager **402** may reside entirely on the content server **110** or entirely on the client **114**.

As illustrated, a portion of the registration manager **300** resides on the content server **110**. At the content server level **104**, the registration manager **300** only needs to recognize registered users and provide them with access to content **400**. New users are created at the registration server level **102**. In one embodiment, the registration manager **300** includes dynamic HTML and/or commercially available Oracle Web Application Server software, from Oracle Corporation of Redwood Shores, Calif. Use of the Oracle software may require that a portion of the registration manager **300** also reside on each client **114** and/or on the registration server **108**.

Critical portions of the content **400** may reside in database tables managed by the security manager **402**. For example, executable portions of content or synchronization information for coordinating audio and video in content may be stored in a database table. Database table names do not necessarily reflect content in the straightforward manner in which more typical content file names can reflect file content. Also, database tables may be difficult to access directly through the file system; it may be necessary to go through the database management software. Accordingly, placing content **400** in database tables tends to make it more difficult for unauthorized users to locate and use the content **400**.

In addition, when content **400** is moved between computers (be they clients **114**, servers **110**, or a mixture), critical portions of the content **400** may be divided between two or more data tables so that theft of any single data table will not provide satisfactory service. As a further precaution, in one embodiment the security manager **402** sends one or more critical portions of content (possibly in data table format) only to a client **114**'s volatile memory rather than sending all critical portions to nonvolatile memory such as a client **114** disk. Critical portions sent only to client **114** RAM may be scrambled or erased when the client **114** shuts down or is rebooted, making it even more difficult to make illicit copies of the content **400**.

Each illustrated content server **110** also includes a launch manager **404** for launching presentations of courseware **400**. The launch manager **404** coordinates initial activity such as course **400** selection by the user, any necessary course **400** movement to bring the course **400** to the server **110** using the content movement manager **310**, initializing security arrangements with the security manager **402**, making the network connection **116** if necessary, and initiating presentation of the course **400** by launching its executable portion or downloading it to the client **114**, for instance. In alternative embodiments the launch manager **404** functionality is part of a meter manager **406** or part of the security manager **402**.

The meter manager **406** meters content usage. In some embodiments, the metering manager also monitors the connection **116**; in other embodiments monitoring is performed by the security manager **402**. Regardless, the metering manager **406** keeps track of elapsed time as a measure of the user's use of the content. A portion of the meter manager **406** resides on each client workstation **114** and a portion resides on each content server **110**. The two portions of the meter manager **406** create a link which is carried over the connection **116**. That is, the metering link rides on top of an Ethernet or other conventional communications link.

In one embodiment, the meter manager **406** creates a start note (event) when courseware is successfully launched. The meter manager **406** will associate this start note with a corresponding end note within one minute (or other defined interval) of the time the user chooses to finish this course **400** presentation. The difference in time between launching the presentation and finishing or interrupting the launched presentation is the metered difference, which will serve as the basis for the invoice presented to the user or to the user's sponsor.

The meter manager **406** may track several open notes for a given client **114**, since clients **114** may use operating system software that allows several executables to run at the same time. Metering statistics may be administered using an Oracle database **408** or other database **40S** to provide system-wide statistics and system-wide information reports.

In one embodiment, meter manager **406** records are constructed in a format that allows their use in conjunction with a rate table, thereby allowing the funds flow manager **308** to create an invoice based on both the particular content **400** used and the elapsed time.

Every rate in the rate table may be associated with a destination account, such as the account of a content **400**

vendor or the account of a content-providing site **200** manager. The funds flow manager **308** supports automatic payment using familiar and industry standard credit card payment methods. The funds flow manager **308** accepts electronic billing information from the meter manager **406**, and accepts electronically stored payment information such as credit card numbers from the registration module.

The meter manager **406** and/or security manager **402** provide several security features. First, the client **114** desktop is disabled so that the user can only obtain service through the metered and monitored connection **116**. Second, each element of potential service such as multimedia content, executables, and courseware tests, is defeated so that its executable portion will not run even if it is located by an unauthorized user. The executables are modified to require security handshakes from the meter manager **406** and/or security manager **402** so the service **400** will not operate at all, or will operate for only a limited period of time, if the metered connection **116** or the meter manager **406** and security manager **402** are not present.

In one embodiment, the client **114** desktop will turn off if the meter manager **406** on the client **114** is not in touch with the meter manager **406** on the content server **110** on a minute-by-minute basis. For the convenience of the user and to ease administration of the system **100**, the meter manager **406** can be adjusted to invoke this "dead man's switch" at various time intervals other than one minute. An aggressive approach makes the workstation **114** freeze if a single minute passes with no contact. A more lenient approach may freeze functionality within five minutes after the connection is lost.

In one embodiment, the same polling software element in the meter manager **406** which triggers the dead man's switch also provides a periodic update to the database **408** that is used by the funds flow manager **308** for billing. Each minute that the polling function of the meter manager **406** returns a message from the client **114** to the server **110** indicating that the user ID remains active on the client **114**, the database **408** is updated to reflect an additional minute of use for billing purposes.

Polling updates each open request, such as each open courseware presentation. For instance, if in the first minute the user ID requests a login and then makes one open service **400** request, an open event is updated for this user ID in the database **408** table for the time elapsed. If the same user ID then requests a second courseware **400** presentation, each courseware **400** event ID is associated with the login by this user and this client desktop **114**, and two time events occur to update the database **408**. Thus, subsequent courseware or other service offerings which are opened in the client **114** browser **502** can be added to the time table in the database **408** using the same polling function. The polling function operates similarly for sequential (as opposed to concurrent) activity. If the user ID for a given login closes a courseware presentation **400** or other event ID but retains the login, then while the login time continues to update (enabling billing for use of the personal computer **114**), the first courseware **400** offering will end and a new courseware **400** offering can begin during the same login session.

Client

FIG. **5** further illustrates a client **114**. As noted above, the client **114** may be a client in the traditional server-client network sense (further configured to operate according to the invention), or the client **114** may be a node in a peer-to-peer network. The client **114** is always a client in the sense that it receives courseware **400** or another service from at least one content server **110**.

The client **114** includes operating system software and networking software **500** such as Windows 3.1, Windows 95, Windows 98, Windows 2000, or Windows NT software, Ethernet software, and/or other software discussed in connection with FIG. **2**.

The client **114** also includes a browser **502**, such as a Microsoft Internet Explorer or a Netscape browser, through which courseware and/or other content **400** is presented to the user. In addition, the registration module may be browser-based or Oracle-based and browser-transported, so that any client **114** which supports an Internet connection and a Web browser **502** can be used to contact the registration server **108** to create a new user registration.

As previously discussed, the client **114** receives courseware and/or other content **400** from the content server **110**. The content **400** may be provided in portions **504** which are defined in one or more of the following ways. First, portions **504** may be critical portions which have been treated for enhanced intellectual property protection as discussed elsewhere herein. Second, the portions **504** may be non-critical portions or a mixture of critical and non-critical portions, which are downloaded early in preparation for later presentation to the user. Early downloading may take advantage of the relatively low cost of telephone connections as opposed to other connections. Finally, content portions **504** may be a mixture of critical and non-critical portions such as episodes or chapters in a presentation, which are sent from the content server **110** to the client **114** in sequence as the user proceeds through the content **400** presentation.

Other components of the client **114**, including the security manager **402**, meter manager **406**, and funds flow manager **308**, are discussed elsewhere herein.

Methods Generally

FIGS. **6** and **7** further illustrate methods of the present invention. FIG. **6** illustrates generally intellectual property license enforcement methods of the present invention, while FIG. **7** illustrates operational methods of the system **100** from the perspective of a courseware user. Although particular method steps embodying the present invention are expressly illustrated and described herein, it will be appreciated that system and configured storage medium embodiments may be formed according to methods of the present invention. Unless otherwise expressly indicated, the description herein of methods of the present invention therefore extends to corresponding systems and configured storage media, and the description of systems and configured storage media of the present invention extends likewise to corresponding methods.

License Enforcement Methods

In describing FIG. **6**, an overview is provided first. Then the individual steps are revisited and discussed in greater detail. During an identifying step **600**, at least one critical portion of the content **400** is identified; courseware is one example of the "work" referred to in the corresponding section of the '302 application to which the present application claims priority. The critical portion is separated, encapsulated, encrypted, compressed, created and added, and/or otherwise treated to enable enhanced protection during a treating step **602**.

At some later time, a user requests access to the treated content **400** during a requesting step **604**. If the content is not

already present on a local content server **110**, it may be moved to such a server **110** during a step **606**. The non-critical portion of the content may be downloaded to the user's location during an optional early downloading step **608**.

The user's right to access the critical portion is verified during an authenticating step **610**, a metering and monitoring step **612** is started, and the critical portion is then provided to the user during a monitored downloading step **614**. If the ongoing or recurring monitoring step **612** detects a violation of the license, a disabling step **616** occurs to prevent or inhibit further use of the treated content. Total license fees based on the metering are calculated and charged during an accounting step **618**. Each of these steps will now be described in greater detail.

During the identifying step **600**, one or more critical portions of the content **400** are identified. The critical portions should be small enough for rapid treatment during step **602** and rapid downloading during step **614**, but critical enough to make most users pay the license fees charged during step **618** rather than use only the non-critical portions. In a multimedia course, for example, critical portions might include executable files or the answers to interactive tests. If the executable is large, critical portions might be part of the executable such as a jump table or a proprietary dynamically linked library file needed to perform I/O operations. Critical portions may be preexisting elements of the content **400**, or they may be created and inserted in the content **400**. For instance, handshake code may be added to an executable to require periodic successful handshakes with a server **110**; if the handshake fails, execution is aborted.

In content **400** that contains no executable computer code, but merely contains audio, visual or other data, critical portions could be initialization or synchronization information, or particular text or images that convey important information to a user or provide important entertainment value. Two of the many possible examples include a final scene of a mystery in which the murderer is revealed, and a checklist summarizing the main steps in a diagnostic technique being taught by courseware **400**.

During the treating step **602**, critical portions of the content **400** are treated to restrict their unauthorized use. Possible treatments include creating and inserting security codes, separating pre-existing critical portions so they are not downloaded with the non-critical portions, encrypting critical portions, compressing critical portions with a proprietary method (which effectively combines compression and encryption), and/or encapsulating critical portions. One form of encapsulation places the critical portion in a database table, such as a relational database table in a commercial database format used by Oracle, Sybase, Informix, or another familiar vendor. This has the advantage of making critical portions easier for the system **100** to track, and the advantage of hiding critical portions from unauthorized discovery by file system tools that rely on filenames, such as directory listing and directory search tools.

The requesting step **604** may be performed using user login procedures, courseware and/or content selection tools such as menus, and network communication means and methods familiar to those of skill in the relevant arts, including those discussed above in connection with FIG. **1** and/or FIG. **2**. The user may also be asked for an account password, a credit card number, or similar guarantee that the license fees for use of the content **400** have been or will be paid. During the requesting step **604**, the user is also shown the license agreement terms and conditions, and is then asked to actively accept or decline being bound by the license agreement.

During a content moving step **606**, content **400** may be moved from another content server **110** (which may reside in another network **200** or which may be a repository content server **110** as discussed herein) to the local content server **110** which serves the client **114** that is being used (or that will be used) by the user in question. This is accomplished as described in connection with the content movement manager **310**.

Content **400** which requires significant download time can be loaded early during the step **608**, at least in part, to minimize the delay experienced by users. As the cost of telecommunications services has remained largely constant over time, while the price of memory and computational power have doubled in cost-effectiveness about every eighteen months, the invention allows one to reduce or eliminate the serving of machine readable classes in real-time over the web or the Internet or from a file server. Instead, content **400** is downloaded during step **608** using telecommunications connections which are slow but relatively inexpensive and often billed according to a flat rate rather than connection time.

For instance, knowing that tomorrow is the first day of class in a new course, the multimedia sound and images in the course **400** could be downloaded by students during the night before the course **400** is presented. Critical portions such as the executable code, audiovisual synchronization, or order of presentation could then be downloaded on an as-needed-and-still-authorized basis the next day during step **614**.

During the step **612**, a timing meter is started in cases where the license fee is not a flat per-use fee but is based instead on the connection time. Monitoring and metering may be separate steps in other methods according to the invention; monitoring is concerned primarily with preventing unauthorized use, while metering is performed as a basis for calculating license fees. Regardless, a system according to the invention starts monitoring the connection **116** to ensure that the use is still authorized and to prevent attempts to obtain a complete copy of the content which is not protected by treatment of critical portions. In particular, initial or further downloading of critical portions during step **614** is not allowed (because part of disabling step **616** occurs) if the monitoring step detects any of the following conditions:

1. The user logged in is not an authorized user (step **604** authentication failed);
2. The user site is not at an expected, authorized network **200** (IP or LAN or MAC or Ethernet and/or socket or port) address; or
3. The user site **114** failed to return an expected periodic security handshake value.

With further reference to the treating step **602** and the monitoring and metering step **612**, the present invention allows an intellectual property owner to insert a meter and/or security code into any information set, executable application, image, video, or other computer based work **400** containing intellectual property, and to require a permanent relationship between such works and the metering software **406** which is located on a machine **110** remote from the user site **114**. The relationship is preferably simple, lowering the processor and bandwidth requirements of the network communication path **116** between the metering server **110** and the user's site **114**. The relationship ensures in most cases that a copy of the work **400** will not be fully available except for licensed time periods and at licensed user sites.

In some embodiments, the content **400** has embedded in it a time stamp, a date stamp, a copy stamp, an Internet Protocol ("IP") address stamp, and/or code enforcing a requirement that the treated content only execute or display on the client **114** CRT when the computer **114** receiving the copy is in a recognized relationship with the computer **110** which sent the course. This relationship is via a POTS line **116**, or any telecommunications link **116** which provides constant or reliable presence.

A constant or reliable presence allows a handshake once per configurable time interval or configurable repeated event. The handshake verifies that the user computer **114** in contact with the server **110** is still the same user computer **114**, using its IP address or the IP address of its gateway and the password into the gateway required by its Internet service provider. On a local area network **200**, the handshake may use the LAN address.

In some embodiments, in addition to the consistent verification that the content **400** is resident on the same user computer **114** connected via the same Internet service provider gateway IP address, both the server **110** with the meter **406** and the computer **114** with the content **400** have identical "random" number Generators. These random or pseudo-random numbers must match each interval, or at least be in the same order (it is understood that the content recipient computer **114** may be hundreds of milliseconds away from the server **110** when a connection required for a course **400** travels over part of the Internet).

The random number pairing is once per client-server pair **114**, **110**; per work-station **114**; or per connection **116**, depending on the embodiment. In one embodiment, for example, each connection **116** spawned from a content server **110** will have the same random paired number set. One set runs on the server **110**, and the same set runs on each user computer **114** which is receiving the content **400** essentially simultaneously. To confirm that the sequence is the same, each computer **110**, **114** has a date/time stamp program **402** running, and each date/time stamp must agree at least once per minute. Thus, any computer **114** presenting a course **400** in this way must reset its date/time clock to agree with the content server **110** date/time stamp.

In addition to, or instead of, metering content executables, the present invention can also meter "data transfer executables". Examples of data transfer executables include applications used to operate or access video conferencing cards, network interface cards, CD-ROM controllers, fax systems, modems, and other data transfer devices that can be used in multimedia, audio, or video presentations. For instance, the use of codec (compression - decompression) software and/or hardware which is used to transfer audio or visual data between data formats can be metered according to the invention.

Such metering and authentication systems and methods allow any course **400** to be downloaded to the personal computer **114** of the person who will be taking the course **400**. The user's computer **114** may be located at the user's place of employment or at the user's home or at a training facility. An external hard drive can be rented with the course **400** and authentication software mounted. This hard drive can be connected to a personal computer **114** running Windows 95, Windows 2000, Windows NT, Macintosh, or other familiar operating system software, via comm port one or the like (WINDOWS 95, WINDOWS 2000, and WINDOWS NT are marks of Microsoft; MACINTOSH is a mark of Apple). Any personal computer user not needing additional hard drive space can simply make an FTP request, set up the request before going to bed, and find the course **400** (or most of it if critical portions are not available for early downloading) available in the morning. By having much or all of the course **400** available on his or her personal computer **114**, much or all of the course **400** will run at the speed of the backplane of that computer **114**, which is often substantially faster than an Internet or other network link **116** transfer rate.

In one embodiment, the only information going back and forth via the Internet or via a POTS line connection **116** to the server **110** will be handshaking such as repeats of the IP address of the gateway, pinging, and a stream of paired random numbers to authenticate that the content **400** was obtained from this server **110**. The name and password of the student will be sent each minute (or other predetermined interval) as well. Thus, each minute an IP address is sent, a name, a password, and a sequence of paired random or quasi-random numbers. In welt under one kilobyte of communication data, the content **400** will be authenticated for another interval of use. As noted, the present invention provides the ability to disable the courseware or other content **400** on the student's personal computer **114** whenever the link **116** with the content server **110** is broken or lost.

To assist in the apprehension of someone who attempts to violate the security system of the present invention, the security system will record where the copy was obtained. A series of copy locations hidden in the content **400**, or similar digital watermark information, maintain a record of IP gateway information, password information, and user ID information on how the copies were made, what order the copies were made in, and the time and date stamp of each copy of the content **400**. The information can be maintained in a circular buffer holding N records, with information for the N-plus-first copy being copied over the information related to the first copy so that the buffer file size remains the same.

User View of Operational Methods

FIG. **7** illustrates methods for operating the architecture **100** from the point of view of a user. During a registering step **700**, the user sits down at a client **114**, locates the service provider Web site which is hosted by the registration server **108**, and then provides registration information to the registration manager **300**. Suitable registration information may include, for instance, the user's name, address, sponsor, password (the password may also be generated by the registration manager **300** rather than be provided by the user), and payment information such as a purchase order number or credit card number.

The registration manager **300** verifies that the username and password are unique by checking the database **302**, and then adds a new user registration record to the database **302**. Finally, the registration manager **300** notifies the user that registration is complete. If a sponsor was identified by the user, the registration manager **300** optionally also notifies a course administrator at the sponsor by email.

During an optional reserving step **702**, the registered user reviews menus of available content and associated times and locations, and places one or more reservations with the reservation manager **304**. The reservation manager **304** verifies availability and enters the reservation, using the reservations database **306**. If a reserved course is subsequently canceled, some embodiments of the reservation manager **304** send a notice to the registered user by email.

During a payment authorizing step **704**, the registered user provides credit card information, and provided implicit

or explicit authorization to bill the credit card for services provided. As noted above, this step may be part of the registering step **700**. The payment authorizing step **704** may also be performed later, if the necessary information was not available at the time of beginning registration, for instance, or if the user wishes to identify a different credit card after initially registering.

More generally, the method steps illustrated in the Figures and discussed in the text may be performed in various orders, except in those cases in which the results of one step are required as input to another step. For instance, a user must be registered in order to view courseware **400** except to the extent that a particular embodiment provides demonstration courseware at no charge to unregistered users. Likewise, steps may be omitted unless called for in issued claims, regardless of whether they are expressly described as optional in this Detailed Description. For instance, users who are sponsored by a corporation or agency need not provide credit card information during a step **704**. Steps may also be repeated (e.g., running several courses), or combined (e.g., providing credit card information during registration), or named differently (e.g., running a course may be referred to as "receiving services").

During a login step **706**, a registered user logs into the content server **110**. The initial login step **706** may be performed automatically when the user first registers during step **700**. Later login steps **706** may be performed each time the user begins a new session at a client **114**. During the login step, the user provides a username and password to the security manager **402**, which verifies that the corresponding user record exists in the registration database **302** replica on the content server **110**.

In addition, if the user has indicated that payment will be by credit card, then the funds flow manager **308** checks the credit card and places a hold on the credit card for an amount which may depend on the prior history of the user, the user's sponsor, the courseware **400** requested, and similar information. In some embodiments, users are not allowed to complete the login process **706** unless the payment information provided by the user or by the user's sponsor has been accepted as valid by the funds flow manager **308**.

A user may wish to bill part of a sitting to one account, such as an individual account or a particular employer, and bill a second part of the same day's training to a second account. This may be achieved by logging in under the first account, receiving the first part of the desired services, logging out, and then logging in again with a different user ID and/or password before receiving the second part of the desired services.

During a selecting step **708**, the user may select one or more courses **400** to be presented at the client **114**. In some cases, the course selection will already have been made by the user's sponsor. Courses **400** may be selected using menus and/or other user interface tools and techniques familiar in the art, which contain course **400** description, cost, and availability data copied from the reservation database **306**.

During a step **710**, the course **400** is presented to the user at the client **114**. This involves sending courseware content **400** from the local content server **110** to the client **114** for viewing during a step **712** by the user. It may also include interaction between the user and other users and/or an instructor during a step **714**. Interaction may be provided, for example, by using email, chat rooms, live audio, arid/or live video carried over the network connection(s) **116**. In addition, during an optional step **716** the user may take one or more interactive tests or quizzes. These may be graded by courseware **400** which is resident on the workstation **114**, or the user responses may be transmitted to the content server **110** for grading there, with the results then being sent back to the client **114** and/or to the instructor.

Presentation of courseware during step **710** may be interrupted by a step **718** in response to a key press, mouse click, or other action by the user. For instance, the user may decide not to continue the remainder of the presentation **400** at the present time, or may wish to terminate this presentation and start viewing a different course **400**. The user may also simply want to take a temporary break, and then resume the presentation during a subsequent step **720**.

During a step **722**, the user receives an invoice for services rendered. This may be done in conjunction with a logout during step **722**, or logging out may be delayed until a step **726** in which the invoice is paid. From the system's point of view, once a user decides to log out, the meter manager **406** completes the database **408** time table for the user ID, including each event ID associated with each courseware offering, test offering or other service provided during the session. The funds flow manager **308** then uses the database **408** time table and the database **408** rate table to present an invoice on the computer screen in the browser **502**.

The user may accept or decline the stated invoice. If the user accepts the invoice, the funds flow manager **308** in the content server **110** communicates that acceptance to the funds flow manager **308** in the registration server **108**, which in turn contacts the bank to clear the hold previously placed during step **702**, **704**, **708** and have the bank apply the credit card charges to the user's card.

If the user declines the invoice, the user may seek an invoice adjustment during a step **724**. The local network **200** administrator tries to answer any questions the user has about the invoice and to obtain user acceptance of the invoice, possibly after an adjustment. The local network **200** administrator or other local site personnel are authorized to make adjustments to the bill during step **618**. A new invoice amount will then be passed to the funds flow manager **308** for credit card or other payment activity based on the payment terms presented during user registration and this particular session, and the results of any adjustment discussions.

Additional Comments on Security

In the architecture **100**, security may be provided in several ways including those expressly noted above. Allowing one and only one person to have a given user ID helps ensure that persons who use content **400** are properly billed for such use, as noted above. But in addition, the user ID and the credit card information help protect the reservation module. If reservations were available without a credit card hold or similar protection, a malicious user could reserve seats in a network **200** (or even reserve all seats in the entire architecture **100**) with no legitimate intent to use them. By requiring a credit card for reservation, the reservation module is protected because adequate credit must be available to pay for all reservations placed.

Because content is not stored on the registration server **108**, security precautions can be taken that might not otherwise be available. For instance, access to the home pace can be disabled so that outsiders cannot input messages or modify HTML code on the registration server **108**. Dynamically produced Web pages based on information provided by the user, and created by Oracle or similar software, are also

more difficult to modify than static HTML pages. Firewalls, encryption, and other means can also be used to protect credit card numbers of users in time-limited secure transactions without reducing security to allow continual courseware **400** usage from the same server **108**. In one embodiment, the registration server **108** exports credit card information to other servers with heightened security; once the export is complete, the credit card information is deleted from the registration server **108**.

SUMMARY

The present invention provides systems, devices, and methods for technical enforcement of intellectual property right agreements. A security enforcer is inserted into deliverable content, or a small but critical portion of the content is treated to make it unusable without authorization (unable to execute, for instance), or both treatments are performed. A relationship over time is created between a meter and the treated (secured) content; without the relationship, use of the content is hindered or disabled. The critical portion is never placed in a user's persistent (nonvolatile) storage, such as a disk or tape storage, or alternatively is never placed in persistent storage in usable (executable, runnable, viewable, legible, audible) form. At least part of the meter is remote from the user, being located on a network server **110** while the user uses a client computer **114**. The meter is made unique to the content server **110**, through the use of IP addresses, coordinated random numbers, and the like. The meter stops running, and the content stops being fully usable, if the client **114** is disconnected for longer than a predetermined period or if the security handshake fails for some other reason.

As used herein, terms such as "a" and "the" and item designations such as "client" are inclusive of one or more of the indicated item. In particular, in the claims a reference to an item means at least one such item is required. When exactly one item is intended, this document will state that requirement expressly.

The invention may be embodied in other specific forms without departing from its essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive. Headings are for convenience only. The scope of the invention is, therefore, indicated by the appended claims rather than by the foregoing description. All chances which come within the meaning and range of equivalency of the claims are to be embraced within their scope.

What is claimed and desired to be secured by patent is:

1. A method for managing content in a shared use operating environment, the shared use operating environment including a registration server, a content server connectable by a network link to the registration server, and a client workstation connectable by a client-server network communications link to the content server, the method comprising the steps of:

registering a user at the registration server, thereby characterizing the user as a registered user;

receiving at the content server a request by the registered user for access to content which contains at least one previously treated critical portion;

authenticating the request;

serving at least the critical portion over the client-server network communications link for presentation to the registered user at the client workstation; and

metering usage of the content by the registered user.

2. The method of claim **1**, further comprising the step of treating the critical portion, thereby enabling enhanced intellectual property right protection of the content by technical means.

3. The method of claim **2**, wherein the treating step comprises inserting disabling code into an executable portion of courseware content.

4. The method of claim **2**, wherein the treating step comprises encapsulating the critical portion in a database table.

5. The method of claim **1**, further comprising the step of monitoring the client-server network communications link.

6. The method of claim **5**, further comprising the step of disabling use of at least a portion of the content after an expected security handshake is not received.

7. The method of claim **1**, further comprising the step of presenting the registered user with an invoice for usage of the content.

8. The method of claim **7**, further comprising the step of allowing a local administrator to adjust the invoice presented to the user in response to a request by the user for an adjustment.

9. The method of claim **1**, further comprising the step of downloading at least one non-critical portion of the content to the client workstation at least two hours before serving the critical portion.

10. The method of claim **1**, further comprising the step of disabling caching and other disk writes to prevent a copy of the critical portion of the content from being created on nonvolatile storage at the client workstation.

11. The method of claim **1**, further comprising the step of obtaining a credit card payment authorization to permit payment by credit card for usage of the content.

12. The method of claim **1**, further comprising the step of reserving a particular piece of courseware content for a particular registered user.

13. A computer storage medium having a configuration that represents data and instructions which will cause at least a portion of a multi-level computer system to perform method steps for managing courseware in a shared use operating environment, the shared use operating environment including a server and a client connectable by a network communications link to the server, the method comprising the steps of:

receiving at the server a request by a registered user for access to courseware which contains at least one previously treated critical portion;

serving at least the critical portion over the network communications link for presentation to the registered user at the client; and

monitoring the network communications link to prevent unauthorized use of the courseware.

14. The configured storage medium of claim **13**, wherein the method further comprises the step of treating the critical portion, thereby enabling enhanced intellectual property right protection of the courseware.

15. The configured storage medium of claim **14**, wherein the treating step comprises inserting disabling code into an executable portion of the courseware.

16. The configured storage medium of claim **14**, wherein the treating step comprises encapsulating the critical portion in a database table.

17. The configured storage medium of claim **13**, wherein the method further comprises the step of presenting an invoice for usage of the courseware.

18. The configured storage medium of claim **17**, wherein the method further comprises the step of allowing a local administrator to adjust the invoice presented.

19. The configured storage medium of claim **13**, wherein the method further comprises the step of downloading at least one non-critical portion of the courseware to the client at least one hour before serving the critical portion.

20. The configured storage medium of claim 13, wherein the method further comprises the steps of metering usage of the courseware and charging for metered usage.

21. The configured storage medium of claim 13, wherein the method further comprises the step of disabling disk writes to reduce the risk that a copy of the critical portion of the courseware will be created on nonvolatile storage at the client.

22. The configured storage medium of claim 13, wherein the method further comprises the step of reserving with a guarantee a particular piece of courseware for a particular user.

23. A multi-level computer architecture for managing content in a shared use operating environment, the content containing at least one previously treated critical portion, the architecture including:

a registration server level including at least one registration server, each registration server comprising a remote registration manager and a registration database for new user registration, and each registration server being further characterized in that it is free of content managed by the architecture;

a content server level including at least one content server, each content server linked for network communications with a registration server, each content server containing content managed by the architecture, the content containing at least one previously treated critical portion, and each content server being further characterized in that it serves such content critical portions only for presentation to registered users, namely, users who have previously been registered with a registration server; and

a client level including at least one client workstation, each client workstation connectable to a content server by a client-server network communications link, and each client workstation being further characterized in that it presents to at least one registered user a content critical portion which is served over the client-server network communications link by the content server.

24. The computer architecture of claim 23, further comprising a security manager for preventing unauthorized use of the content.

25. The computer architecture of claim 24, wherein a portion of the security manager resides on each client workstation and a portion resides on each content server.

26. The computer architecture of claim 24, wherein critical portions of the content reside in database tables managed by the security manager.

27. The computer architecture of claim 24, wherein the security manager is further characterized in that it sends at least part of a critical portion of content only to a volatile client workstation memory rather than sending it to a nonvolatile client workstation memory.

28. The computer architecture of claim 23, wherein the registration server further includes a reservation manager and a reservation database which permits registered users to reserve content.

29. The computer architecture of claim 28, further comprising a funds flow manager for managing payment information, wherein the reservation manager, the reservation database, or both, operate with the funds flow manager to provide registered users with guaranteed content reservations.

30. The computer architecture of claim 23, further comprising a funds flow manager for managing content usage payment information.

31. The computer architecture of claim 30, wherein a portion of the funds flow manager resides on each client workstation, a portion resides on each content server, and a portion resides on each registration server.

32. The computer architecture of claim 23, further comprising a meter manager for metering content usage.

33. The computer architecture of claim 32, wherein a portion of the meter manager resides on each client workstation and a portion resides on each content server.

34. The computer architecture of claim 23, wherein the content comprises courseware.

35. The computer architecture of claim 23, wherein each content server further comprises a launch manager for launching presentations of courseware content.

36. The computer architecture of claim 23, wherein each client workstation comprises a web browser through which content is presented.

37. The computer architecture of claim 23, further comprising a backup registration server containing data mirrored from the registration server.

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