

**APPARATUS FOR COMPILING AND MAINTAINING INFORMATION FOR
USE IN ROUTING AND TRANSMITTING CONTENT
TO A MACHINE VIA A NETWORK**

5 The present invention relates to apparatus for compiling and maintaining information for use in routing and transmitting content to a machine via a network, and to a computer-readable medium for controlling a computer system which routes and transmits content to a machine via a network.

10 Computers have the capability to provide massive amounts of educational and entertainment information by way of the Internet. Currently, on-line systems offer a variety of different services to users, including news feeds, electronic databases (either searchable by the user directly on the on-line system, or downloadable to the user's own computer), private message
15 services, electronic newsletters, real time games for play by several users at the same time, and job placement services, to name a few. However, today, most on-line communications occur merely through text. This currently stands in great contrast to the audio/visual presentation of the alternative electronic medium, television. However, it is expected that as multi-media's incessant
20 growth continues, audio/visual programs will proliferate and text will become less and less dominant in the on-line environment.

 Even though these programs will be introduced, the Internet, will remain essentially user unfriendly due to its very massiveness, organization, and
25 randomness. Simply stated, there is no order or direction in the Internet. Specific pieces of information can be very hard to find, and it is even harder to put that piece of information into a meaningful context.

 Television, on the other hand, has been criticized for being a passive
30 medium. Television has always been something you watched, not something you do. Whilst interactive television systems have increased the level of user interaction, and thus, provided greater learning and entertainment opportunities, vast information resources such as databases are inaccessible from such a medium.

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 The present invention seeks to close the gap between video

programming and the vast information resources of the Internet.

According to a first aspect of the present invention there is provided apparatus for compiling and maintaining information for use in routing and transmitting content to a machine via a network, the apparatus comprising:
5 means for receiving information for use in generating a user profile;
means for specifying, based on the information received, a machine, an address associated with the machine, and user-profile information for use in determining a type of content to transmit to the machine; and
10 means for storing the user-profile information in an hierarchical attribute value pair data structure.

In an embodiment, the apparatus further comprises:
means for specifying attributes of a user associated with the user-profile
15 information; and
means for specifying in a hierarchical structure, hierarchical relationships among at least two hierarchical attributes.

The apparatus may further comprise means for specifying information
20 which identifies the user.

Preferably, the apparatus further comprises means for specifying information identifying at least one preference of the user.

25 In an embodiment, the apparatus further comprises means for specifying an indication of a directory for providing instructions for routing the content.

In an embodiment, the apparatus further comprises means for dynamically changing the user-profile information in the hierarchical structure
30 based upon updated information.

Preferably, the apparatus further comprises one or more of means for querying a user in order to obtain the user-profile information, means for transmitting content to the machine for a particular service based upon the
35 user-profile information, and means for dynamically updating the user-profile information.

The present invention also extends to a computer-readable medium containing programming instructions for controlling a computer system which routes and transmits content to a machine via a network, by:

- receiving information for use in generating a user profile;
- 5 specifying, using the information, an identification of a machine, an address of the machine, and user-profile information for use in determining a type of content to transmit to the machine; and
- storing the user-profile information in an hierarchical attribute value pair data structure.

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For example, the instructions may further include:
specifying attributes of a user associated with the user-profile information; and
specifying relationships among the attributes in a hierarchical structure.

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In embodiments, the instruction of specifying attributes of a user associated with the user-profile information may further comprise specifying additional information identifying the user, and/or specifying information identifying preferences of the user, and/or specifying information identifying a
20 room to which the user is assigned for a chat service, and/or specifying information which identifies members of the room for a chat service, and/or specifying an indication of a directory for use in providing instructions for routing the content.

25 Preferably, the instructions further comprise dynamically changing the user-profile information in the hierarchical structure based upon updated information.

In an embodiment, the instructions further comprise querying the user in
30 order to obtain the user-profile information.

Preferably, the instructions further comprise transmitting content to the machine for a particular service based upon the user-profile information.

35 Preferably, the instructions further comprise dynamically updating the user-profile information.

Apparatus of the invention may be used with systems which combine broadcast television programming and/or video programming which appears on a VHS or Beta tape, CD-ROM, DVD or other medium, or particular content from the Internet, or video programming at a video server (hereinafter "video programming") with the Internet. With such systems consumers receive more information in a more efficient manner than with either television or the Internet alone. Consumers not only can see a news report on television, but they can also read pertinent information about the report, as well as explore related information about the story.

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Such systems can create a more intimate relationship between the viewer and the program. A user may solve problems or perform virtual experiments on the Internet site that a teacher is discussing in an educational television program. Similarly, a consumer may solve problems that fictional characters in a television program must solve. In both cases, the consumer is an active participant in the process, rather than a passive observer.

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Instead of an undirected and unfocused exploration of Internet sites, by synching specific Internet pages to the video signal, such systems put the Internet in context. Television program producers can decide what additional information to offer their audience.

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An additional advantage is that consumers do not have to search through the literally hundreds of millions of pages on the Internet to find appropriate material. The material has already been filtered by the program producers and delivered to the consumer automatically.

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Such systems can change the nature of advertising. Since additional information is given to consumers automatically, the act of purchasing a product seen on television can be streamlined. A consumer can be given the choice of buying a product instantly using the two-way capabilities of such systems.

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In addition, users can take advantage of the two-way capabilities of the Internet to respond to polls, to send e-mail or to link to additional sites. For example, a viewer watching a television news program, may receive a stream

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of Web pages which provide additional, specific information relating to the news content.

5 The video programming and corresponding Internet pages can be viewed on personal computers equipped with a television card, or by use of a television set and JAVA enabled PC.

10 Recently, several media companies joined to create a system for linking the Internet and television on the personal computer, called "Intercast". In this system, content is to be provided simultaneously with the TV video signal. This system, however, requires that stripped down Web pages be sent in the vertical blanking interval (VBI) of the video signal, using up to three scan lines limiting effective bandwidth to approximately 28.8 kbps. The approach requires specialized hardware to both insert the Web pages into the VBI and extract
15 these codes at each PC. Thus, the complexity and cost of the PC is increased. Because the Web pages are transmitted with the video signal, the Intericast system is not a true "two-way" system, but merely a one way "piggyback" system. In addition, the Intericast is an analog video product, and thus, cannot handle digital video data.

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The systems which are described herein and which are used with the present invention, on the other hand, are much more flexible, but less complex. The systems support either analog or digital television broadcasts without
25 broadcasters or end-users having to alter their existing systems, thus enabling broadcasters to reach a wide audience within a short time.

The Web pages are not forced into the very limited bandwidth of the vertical blanking interval (VBI). Instead, merely eight fields of line 21 of the VBI are used to deliver the relevant Internet Web page addresses to the PC. These
30 addresses are called "uniform resource locators" (URLs). The system then directs the particular Web browser to retrieve the identified Web pages from the Internet. Upon receipt of the particular Web page(s), the system syncs the Web page(s) to the video signal, and at the appropriate time, presents the Web pages on one portion of the computer screen with the television signal shown in
35 a window on another portion of the screen.

Member broadcasters enter the Internet through a member account, and will be provided with a graphical user interface for pre-scheduling Internet addresses, or URLs, for transmission to users at particular times of day. This interface could also be used to transmit real time live transmissions of URLs to users at the same time as a broadcast. The URLs are stored in a "Link File" for later transmission over the Internet to the user at the broadcasters entered time, which corresponds to the broadcast time of an associated program. The timing of URLs could be determined in advance or can be sent out live. This eliminates the need to place the URLs in the VBI, and also allows the broadcaster to store more than one Link file for transmission to users in different time zones, for example. Further, more than one broadcaster could access the same master schedule if desired, and add or delete certain URLs to personalize the program for their local audiences. Also, personalization can be taken to the single user, or to a small group of users, by having the system send a different stream of URLs to each user, depending on the unique user profile. Thus, the personalization feature allows each user to receive information uniquely relevant to their interests, demographics, or history.

Embodiments of the present invention will hereinafter be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a diagram of a system receiving and decoding video signals at a subscriber location,

Figure 2 is a diagram showing an alternative system for decoding uniform resource locators at a server site and then transmitting the URLs to the subscriber stations via the Internet,

Figure 3 is a flow diagram of the basic software design of systems as in Figures 1 and 2,

Figure 4 is a diagram showing another system for directly transmitting URLs over the Internet to a user at a broadcaster's entered time without encoding the URLs into the VBI,

Figure 5 is a diagram of a system including a digital cable box,

Figure 6 is a diagram of a system including a digital TV,

Figure 7 is a diagram of a user interface illustrating a playlist,

Figure 8 is a sample display provided to a student of a lesson,

Figure 9 is a diagram of a system having distributed community servers,

Figure 10 is a diagram of a logical structure of a donut for implementing

user-profile information in accordance with the invention, and

Figures 11A, 11B and 11C show a flow chart of a process for generating and implementing donuts specifying user-profile information.

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Video Programming System and Method

Figure 1 illustrates an embodiment of a computer based system for receiving a video program along with embedded uniform resource locators (URLs) which direct a user's computer 16 to address locations, or Web sites, on the Internet 20 to retrieve related Web pages. These Web pages correspond to the video presentation. The particular video programming can be delivered in analog, digital or digitally compressed formats (e.g., MPEG2) via any transmission means, including satellite, cable, wire, television broadcast or sent via the Web.

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The video programming is preferably created at a centralized location, for example, as content creation 4 indicated in Figure 1, for distribution to subscribers. Program creation may be accomplished by any appropriate means. After a video program is created, uniform resource locators are embedded, for example, into the vertical blanking interval of the video programming by the URL encoder 8, shown in Figure 1. The URLs are encoded onto eight fields of line 21 of the VBI. Line 21 is the line associated with close captioning, among other things. However, the URLs could also be embedded in other fields of the VBI, in the horizontal portion of the video, as part of the audio channel, in any subcarrier to the video, or if digital, in one of the data fields.

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Although Figure 1 shows the video with URLs over the same transmission line, the URLs can be sent down independently of the video program on a data channel. In this embodiment, the URLs can be forwarded to the remote sites either prior to initiation or during the program. Preferably, the URLs have associated time stamps which indicate to the subscriber stations when, during the video program, to display the particular Web pages addressed by the URLs. Alternatively, the user can select when to call the particular Web pages for display with the video program.

The particular information in line 21 is not part of the visual part of the program, and thus, is not perceptible to the human eye, thereby making it ideal to send data information to the users. While the bandwidth capacity of line 21 is limited, because the system transmits only the uniform resource locators (URLs), and not full Web pages, there is more than enough capacity. Furthermore, no additional hardware is necessary at the PC 16 to implement the elements of the present invention. Thus, the present invention has the additional advantages of being very efficient and takes advantage of conventional hardware.

Once the video program is created, it can be transmitted to user sites over any transmission means, including broadcast, cable, satellite, or Internet, and may reside on video servers. Furthermore, the video program, with or without embedded URLs, can be encoded on a VHS or Beta tape, DVD or other medium.

Preferably, each receiver station comprises any Intel x86 machine (preferably a 486 processor, pentium processor, etc.), an Apple Computer, UNIX or any other type of standard computer workstation. The local PC 16 is preferably connected to either a cable and/or broadcast television connection or to a local VCR or other video source. At each subscriber site, the local personal computer 16 preferably receives the cable transmission by cable connection on the back of the personal computer 16. The video/audio program can then be processed for display on the computer screen using any conventional PC card capable of displaying NTSC signals on a computer monitor, such as a WinTV card. In addition to the cable connection, however, in the present invention there is also an Internet 20 connection created concurrently with the cable connection.

The Internet 20 connection can be via high-speed line, RF, conventional modem or by way of two-way cable carrying the video programming. The local PC 16 has

Internet access via any of the current ASCII software mechanisms. In one embodiment, at each subscriber home, an associated local URL decoder 12 receives the cable video television program, as shown in Figure 1. The local URL decoder 12 extracts the URLs, preferably embedded in the vertical blanking interval, with the use of any conventional VBI decoder device. The URL decoder 12 may be either a stand-alone unit or a card which is implemented into the personal computer 16.

In another embodiment shown in Figure 2, the uniform resource locators (URLs) are encoded into the video in the same manner as described above. Again, the URLs are preferably encoded onto eight fields of line 21 of the VBI, but may also be sent independently of the video. In this embodiment, the URL decoder 24 is located at the server site, as opposed to the subscriber location. When the decoder 24 receives the video program signal, it strips out the URL codes on line 21 of the VBI and delivers these codes independently to an Internet server 28. The URL code is then subsequently delivered over the Internet 20 to the user PC 16. Simultaneously, the video is broadcast over conventional broadcast or cable transmission means 36 to the user's personal computer 16.

Another embodiment of the system, shown in Figure 4, does not depend on, or even use, the VBI. In this embodiment, the system will run an online service over the Internet 20. This service will be in the form of an Internet Web site 62 that provides a user-interface to a database 78 and to one or more associated data servers 90. The service will provide member-accounts to TV broadcasters 66 who sign up to use the system of the invention in conjunction with their broadcasts. Each member broadcaster will enter the service at their computer 70 through Web browser software 74 using their member account by entering various identification and password information. Once within their account, the member will be provided with a graphical user interface for pre-scheduling URLs for transmission to users 118 over a direct Internet connection 94 at particular times of day. The same user interface, or a variation on it, can be used by broadcasters for live transmission 82 of URLs to users at the same time as a broadcast 86.

For example, one example of this interface might be a scheduling calendar (daily, weekly, monthly, yearly) in which the broadcaster 66 may allocate time periods which coincide with their broadcasts 86, and during which they will send out URLs to their

users to link to Web pages. For each time period (for example, a particular hour long period during the day) determined by the broadcaster 66 to be a broadcast period (a period during which they want to transmit URLs that correspond to a television show being broadcast from their TV broadcast facility 110 to the external TV 114 of the user 118 at that time), the broadcaster 66 may then enter a series of URLs into an associated file ("Link File") for transmission over the Internet 20 at that time. This Link File might have a user interface such as a spreadsheet, table, or list, or it could be simply a tab-delimited or paragraph-delimited text-file. As an example, each of the records in the Link File consists of a data structure which could contain information such as:

(<timecode>,<URL>,<label or title>,<additional information>,<additional information>,...)

The above data structure is just one example. The records in the Link File preferably specify the time, Internet address (i.e. URL), label (such as an associated name), and some optional additional information, for each Web page the broadcaster 66 desires to launch during a show.

When a broadcaster 66 modifies their calendar and/or the Link File associated with any given time period(s) in their calendar, this information is saved into the database 78 that is attached to the site 62. Each broadcaster 66 may maintain multiple calendars in the database 78 if they broadcast in different time zones, for example.

The database 78 provides the Link File records for upcoming time periods to a server 90, which may be one server or a distributed network of server programs on multiple computers across the network, to be utilized for scaling to large national or global audiences. The server 90 provides the Link File records, including the URLs, to the user's personal computer 16, which is connected via a network. Examples of possible networks include the public Internet 94, a direct private network, or even a wireless network.

One feature of the above embodiment is that one or more broadcasters 66 may utilize the same schedule in the database 78 for their own broadcasts 86 or during the same broadcast. For example, a network broadcaster may develop a master schedule and various affiliate broadcasters may subscribe to that schedule or copy it (in the database) and add or delete specific URLs in the schedule for their local audiences or unique

programming. This scheme enables affiliates to insert URLs for local advertisers or local subjects into a sequence of more general URLs provided by their network broadcaster 66. In other words, the affiliate can add links that ride on the network feed and then redistribute it to their local audiences.

5 This embodiment can also enable personalization in the form of unique series of URLs specific to each user's unique profile, which is directly sent over the Internet 20 to each user's specific client software 106. This can be achieved from the broadcaster 66 to each individual user 118, or to particular collections of users. To accomplish personalization, the service may send a different stream of URLs to each user's client
10 software program 106. The stream of URLs sent would depend on a user profile stored in the database 78 or the client software program 106, a user profile which is built on demand or over time for each user 118 based on criteria such as the location of the user, choices the user makes while using a client software program 106, or choices the broadcaster 66 makes during a broadcast 86, or automatic choices made by an algorithm
15 (such as a filter) residing on the service 62. Personalization enables each user to receive URLs which are uniquely relevant to their interests, demographics, history, or behavior in the system.

System Operation

20 Once the URLs have reached the personal computer 16, system operation is similar for all of the embodiments diagramed in Figures 1, 2, and 4.

In one embodiment, a JAVA enabled browser 98 as well as specialized software 106 for performing part of the method of the present invention are installed on the computer 16. The JAVA enabled browser 98 allows the computer 16 to retrieve the Web
25 pages 102 and is preferred software, since it is platform independent, and thus, enables efficient and flexible transfer of programs, images, etc., over the Internet 20. The specialized interface software 106 (hereinafter, "client software"), attached as Appendix A, acts as an interface between the video programming and the Internet functions of the present invention. The client software 106 retrieves URLs from the video program (embodiment of Figure 1) or directly from the Internet connection (embodiments of
30 Figures 2 and 4), interprets these URLs and directs the JAVA enabled browser 98 to retrieve the particular relevant Web pages 102, and synchronizes the retrieved Web pages

to the video content for display on the user's computer 16, as shown in Figures 3 and 4 and explained in more detail below.

In one method, the URLs are encoded and embedded into the video signal by inserting them into the vertical blanking interval (VBI), as mentioned above.

5 In another embodiment, the URLs are entered by member TV broadcasters 66 along with specified times for transmitting the URLs to the user. At the appropriate times, the URLs are sent directly over the Internet to the user's PC 16 via the client software 106 over a direct point-to-point or multicasting connection.

10 One method of the present invention has the capability to detect identical URLs sent directly after one another which causes the browser not to fetch URLs in these particular cases. As shown in Figure 3, once the URL code is received at the computer, the client software 106 first interprets the URL and determines in step 42 whether the particular URL has been received previously. If it has already been received, the next received URL is interpreted for determination of prior receipt. If the particular URL has
15 not been detected before, the software checks for misspelling in step 46 and any other errors, and if errors exist, corrects these particular errors. Once again, it is determined whether the URL has been previously detected. If it has, the next URL is accessed in step 38. If the URL has not been detected, the specific URL is added to the URL list in step 54. The specific URL is then sent to the Web browser, preferably a JAVA enabled
20 browser 98. Upon receipt of the URL, the browser 98, in step 58, will access the Web site address 122 (Figure 4) indicated by the URL and retrieve the cited Web page(s) 102 via the Internet.

25 Viewers can view the integrated presentation in the following manner. As mentioned above, the video signal is processed and displayed on a video window on the PC screen using a WinTV card, for example. The corresponding audio is forwarded to the audio card and sent to the PC speakers.

30 The actual retrieved Web pages 102, referenced by the URL, are optionally time stamped to be displayed on the computer screen when predetermined related video content is displayed in the video window, thus, enlightening and enhancing the video presentation by providing in-depth information related to the video content thereto. Another section on the screen is also preferably used to represent an operational control

panel. This control panel provides a list of the URLs that have been broadcast and correspondingly received by the computer 16. This control panel is updated to add a URL code each time a new URL code is received by the PC 16. This list gives the subscriber the flexibility to go back and retrieve particularly informative or interesting Web pages that have already been displayed earlier in the program, or alternatively, to print them out for future reference. Furthermore, the list could include URLs referring to Web pages not displayed with the broadcast program, but that provide further information on a certain topic of interest to the viewer.

An exemplary implementation of the present invention can best be understood with reference to an example. A viewer can begin watching a musical video featuring a new band, for example. As the video is received by the PC 16, URLs are either being received with the video signal or are being received directly via the Internet 20 or another data channel, and are being interpreted by the client software 106. Upon direction and command, the JAVA enabled browser 98 retrieves particular Web pages 102 from Internet 20 Web sites identified in the URLs. These Web pages 102 will then be displayed on the video screen at particular times. Thus, for example, while the viewer is watching the music video, biographical information on the band can also be displayed adjacently to the video window. Web pages 102 could also include an upcoming concert schedule, or even audio clips of the band's music may be downloaded from the Internet 20. As another example, a user could be watching a program relating to financial news. While the narrator is shown discussing high tech stocks, Web pages corresponding to detailed financial performance information on high tech stocks, environment and characteristics can be displayed with the video on the computer screen. If the personalization features are included, Web pages associated with a particular user's stock can be fetched and displayed on the computer screen with the video program. When the program narrator switches to a discussion on the weekly performance of the Dow Jones, Web pages presenting related financial performance information can be simultaneously displayed. Thus, it is evident that the present invention profoundly enriches the viewing and learning experience.

It is understood that there can exist alternative embodiments for use with the present invention. For example, the user can view the interactive program using a

television set 114 or other display monitor in conjunction with the display screen of the personal computer 16. In this embodiment, the relevant Web pages are shown on the personal computer 16 while the video program is displayed on the television monitor 114. In this alternative embodiment, a cable set top box receives the television program from the multichannel cable. The personal computer 16 also receives the video program from the multi-channel cable and extracts the URLs, embedded in the vertical blanking interval of the video signal or directly transmitted 94 over the Internet 20. The client software 106 extracts the URLs and retrieves the particular Web pages as described above. The Web pages are then synchronized with the particular video frames and presented to the user. It is understood that a hyperlink may exist on the Web site that will allow the user to automatically load the client software and call up the specific television channel referenced in the Web site. For example, someone browsing the Internet 20 may come upon a major television network's Web site. They scroll to an interesting story then click on an hyperlink to turn on the software which tunes the TV window to the network to enhance the information residing at the Web site.

Furthermore, instead of receiving the video program from a transmission means, the video program can be addressed directly from the user site if the video program, with or without embedded URLs, is stored on a VHS, Beta, DVD or other medium. In this embodiment, the user PC 16 and/or television 114 are connected to a VCR, DVD player or other appropriate device.

Figures 5 and 6 show two alternative embodiments for use with the present invention. For example, the user can view the interactive program using a television set 18 or other display monitor in conjunction with a digital cable box 140, as shown in Figure 5. In this embodiment, the digital cable box 140 performs the functions of the personal computer 16 shown in Figures 1, 2 and 4. In the embodiment shown in Figure 5, the client software is stored in memory in the digital cable box 140. In one embodiment, the digital cable box 140 includes two tuners, thus allowing both the Web Page and the Video program to be simultaneously viewed on the same screen. If Video and Webstream, however, are carried on one channel, then only one tuner is necessary.

The client software retrieves URLs from the received video program, directly from the Internet connection 20 or via a separate data channel, interprets these URLs and

directs the Web enabled browser to retrieve the particular relevant Web pages, and synchronizes the retrieved Web pages to the video content for display on the television 18, as shown in Figure 5. In this embodiment, the relevant Web pages are preferably shown in one frame of the television 18 while the video program is displayed in another frame. Alternatively, the web page can replace the video program on the display.

In this alternative embodiment, the digital cable set top box 140 receives the television program from the multichannel cable. The URLs can be encoded into the digital program channel using MPEG1, MPEG2, MPEG4, MPEG7 or any other compression video scheme. Alternatively, the URLs can be transmitted to the digital cable boxes 140 from an Internet server 148. The digital cable box 140 decodes the URLs from the digital video signal or directly transmitted over the Internet 20. The client software decodes the URLs and retrieves the particular Web pages as described above. The Web pages are then preferably synchronized with the particular video frames and presented to the user.

As with all the embodiments described above, instead of receiving the video program from a transmission means, the video program can be addressed directly from a local video source 144 if the video program, with or without embedded URLs, is stored on a VHS, Beta, DVD or other medium. In this embodiment, the digital cable box 140 is connected to a VCR, DVD player or other appropriate device.

Figure 6 discloses an embodiment where a digital TV 152 is the remote reception unit. In this embodiment, the digital TV 152 performs the functions of the personal computer, shown in Figures 1, 2 and 4, and the digital cable box 140 shown in Figure 5. In the embodiment shown in Figure 6, a processor means and memory are incorporated into the digital TV 152. Further, the client software and Web browser software are implemented into memory in the digital TV 152. All of the functions described above with reference to the other embodiments are performed in a similar manner by the digital TV 152 embodiment.

Although the digital cable box/TV 140, 18 and digital TV 152, shown in Figures 5 and 6, are incorporated into the embodiment of Figure 1, in substitution for the PC 16, they also could be substituted for the PC 16 shown in Figures 2 and 4.

The user can view the video and web content on one screen (in two windows), or with the video on one display screen and the Web content on a separate display monitor. Alternatively, the user can access the video or web content separately. Thus, the user can branch from video to web content and vice versa.

5 The present invention is well-suited to the education environment. In this embodiment, students and teachers access one or more Web servers. The software components include instructor and student user software, authoring software and database assessment software. In one such embodiment, an instructor uses content creation software on a personal computer to easily integrate into their curriculum current
10 information published on the Web, through an easy to use interface 156 such as that shown in Figure 7. The instructor creates a playlist (i.e. linkfile) 160, the playlist 160 comprising a listing of Web pages, text notes and questions. The Web sites and questions are set forth in a predetermined order and can be assigned times. Preferably, the URLs identifying the Web site and time stamps are sent automatically to the desktop of each
15 student in the virtual community, either during playback of a pre-recorded program or during a live event.

At each of the student workstations, the program is directed by the playlist 160. In other words, the playlist 160 provides the structure for the program. At predetermined times as dictated by the playlist 160, the browser will go fetch and display a Web page
20 in a frame on the computer screen. Because program events can be set up in this manner at predetermined times, the entire program and playlist can be prerecorded and stored in a Web database for later access by students.

A significant advantage of an embodiment for educational applications is that the students and the instructor can be located anywhere, as long as they are all connected to
25 the Web. Because a server is essentially controlling the program, the instructor output comes from the server and the student workstations get automatically updated by the Web server.

This educational embodiment integrates Web content and other media with collaborative groupware functionality to create an interactive environment for students
30 and teachers. In this embodiment, the student can receive a traditional video lesson through a frame in his or her Web browser, or from a television. Simultaneously, the

present invention provides separate frames, an example of which is shown in Figure 8, in the browser displaying: (1) Web pages 176 automatically delivered to each student's desktop with information or exercises that complement the video presentation; (2) a chat dialogue frame 168 for conversing with the instructor and/or other students online; and (3), an interactive playlist 164 of Web pages and questions comprising the lesson.

In the student interface of Figure 8, each student can perform a virtual experiment during a physics lesson to learn about gravity, for example. Further, the students are conversing with one another and the instructor in the chat dialogue frame 168. They may also send Web pages to one another and provide answers to questions from the teacher via the chat dialogue frame 168 of the student interface 176. With the chat feature, students may break into subgroups for collaborative learning. Whenever a student in the group sends a message, the message is sent to the Internet server 20 and every other student in the subgroup receives and views the message in their Chat dialogue frame 168.

The instructor, however, may retain control over the chat feature. For example, the instructor can terminate the chat feature or web pushing to terminate unruly on-line conversations or the sending of Web pages by students.

Unlike conventional distance learning systems, systems consistent with the present invention are more powerful by allowing the instructor to freely and conveniently exercise almost any type of testing strategy. The instructor can test students using a combination of the Chat dialogue feature and Web pages. For example, multiple choice questions and short answer questions can appear in the Chat window 168. Essay questions, requiring longer answers, become Web pages. As mentioned above, students can perform virtual experiments on-line. Once the instructor's personal computer receives student answers, student scoring can be presented to the instructor in any format including tables, charts, diagrams, bar graphs, etc. The instructor, thus, can analyze the results and has the capability of providing real-time feedback to the students.

Students can also receive individualized feedback via branched interactive audio, video and/or graphics responses. For example, the workstation may branch to a particular audio response, preferably prerecorded in the instructor's own voice, based on the student response to a multiple choice question. In this embodiment, a plurality of potential audio responses are made available at the student's workstation according to any one of the

methodologies set forth in U.S. Patent No. 5,537,141, entitled DISTANCE LEARNING SYSTEM, herein incorporated by reference. Alternatively, personalized video, audio and graphics segments can be delivered and displayed to the student based on a student answer or personal profile in the manner set forth in U.S. Patent No. 5,724,091, entitled
5 COMPRESSED DIGITAL DATA INTERACTIVE PROGRAM SYSTEM, herein incorporated by reference.

Responses to student answers can be more substantive based on the memory feature of the system. The memory feature is an algorithm that selects an interactive response to the user based not only on the student's current answer selection, but also his
10 or her previous responses, as discussed in the aforementioned applications. The algorithm, preferably stored in memory at each student's workstation and under processor control, merely selects an output interactive response based on student responses. As another example, if a student gets three answers in sequence right, he or she receives a more difficult question. If, however, the student misses one or more of the three
15 questions, he or she receives an easier question.

In another embodiment of the present invention, a system is described capable of handling the education requirements of several schools in an efficiently designed network. The system shown in Figure 9 solves the problems inherent in attempting to service large numbers of users, the most obvious obstacles being the issues of load and performance. In this embodiment shown in Figure 9, communications servers 180
20 distribute and route messages across a LAN, WAN and the Internet. Referring to Figure 9, in the center of the diagram is the Group Database server. Surrounding the database server are several Com Servers 180, each serving an area 192. Surrounding each Com Server 180 are squares representing user stations 188. The Communication Servers 180
25 are organized in node relationships with one another.

Each node is responsible for serving an Area 192. An Area 192 is defined as a Virtual location serviced by a single Communications Server 180 (or "Com Server"). An Area 192 may be a single school, an office, or may consist of several actual physical locations. The defining characteristic of an Area 192 is that messages sent from one
30 member of an Area 192 to another need not be routed outside of the servicing Com Server 180.

An Area member is analogous to the frequently used term "user." For example, a "user" may be a student in the educational embodiment described above with reference to Figures 7 and 8.

5 The Distributed Communication System of Figure 9 shall permit the dynamic addition of Communication Servers 180 within a group with little or no administrative tasks as well as the addition of groups within an overall communications network. A Communication Server group consists of several defined Virtual Areas 192 (preferably, consisting of no more the 250 members each), each area 192 serviced by a single Com Server 180. This system shall allow members of one Area 192, or group to easily
10 communicate with members of another Area 192 or group without any configuration changes.

Generally, service of very large numbers of users has required large expensive servers and networks. As the user base increases, performance suffers and hardware must be upgraded to service the demand.

15 The Distributed Communication System of the present invention allows the same, relatively inexpensive machines to serve an ever-increasing user base. The technique by which this will be accomplished will be through the routing of messages from one server to another when necessary.

The method essentially follows the same core pattern as IP routing and DNS
20 lookups. If a message is for a member not belonging to the current Area 192 or group, the message shall be routed through the Distributed Communication System until its destination, or someone who knows the destination and can deliver the message, is found.

The destination will be cached so subsequent messages for that member or group may be more efficiently delivered.

25 Referring again to Figure 9, if a message is posted by member "A" and is intended only for the members of group 1 the message shall never leave Area 1 Com Server. However, if the message is intended for members of Area 1 and the members of Area 2, the Area 1 Com server forwards the message to the group database server 184. The message shall be broadcast to the members of Area 1 and tagged in the database 184 as
30 belonging to Area 2. The message is then routed to Area 2 and broadcast to Area 2 members. With this technique any member can potentially send a message to any other

member. If the Area Com server 180 does not recognize the destination, the message is forwarded up the line. Each Com server 180 does not need to know about any other server 180. Messages are routed until they delivered. If undeliverable, the original sender is notified.

5 New Areas 192 can be added on the fly. When a new Com server 188 is added to the network, it registers itself with the database application. Henceforth, any message destined for the new Area 192 can be routed properly without altering the other Area Servers 180.

10 This method and system works for global messages or for user to user messages. Furthermore, new Groups may also be dynamically added. Once added, each new Group Database Server 184 registers itself with the existing database servers 184. This distribution of load permits nearly unlimited expansion with existing software and hardware. Each server manages a finite number of members, cumulatively serving a growing community.

15 Users need not be informed as to the particular Com Server 180 they should connect to. Members are directed to a single URL. The selection of the server for user connection is determined by load balancing software. In this manner, the network may appear to be a global network of Servers or simply a local classroom.

20 The unique aspects of this architecture, using database servers as routing gateways, using techniques resembling IP routing and DNS lookup, enables this system to serve with minimum administration and configuration and with lower end, cost-effective hardware.

Donut Structure and Use

25 Another embodiment consistent with the present invention specifies a "donut" of dynamic, hierarchical, shared user-profile information. A donut may specify the following: user characteristics, viewing preferences, hobbies, and spending habits. The donut contains a user profile or acts as a key to a data repository containing it, and it may be stored in a file-type structure on a computer-readable medium such as a memory. The donut is accessed by browser programs, associated web server programs, and other
30 applications for use in routing content to the user's machine associated with the donut. The user machine may include a wide variety of devices such as, for example, a personal

computer, a television, a cable box, a satellite box, video game console, and a personal digital assistant.

Browser programs typically include a file created by a web server to locally store data and track web sites, identified by URLs, accessed by the user through the browser program. These files are referred to as cookie files, which contain a range of URLs for which they are valid. When the browser encounters the URLs again, it sends the corresponding cookie files to the web server identified by the URLs.

In the present invention, browsers may access a donut file or database structure storing donuts, and web servers may include files or other database structures for storing copies of the donut. The donut file for a particular user is typically stored only on the server but could be stored locally on the user's machine or on both the server and the user's machine. The donut thus implements a dynamic store of shared profile data that is exchanged between client and server, with the flexibility to collect and process that data in three ways: client-side evaluation, http-based server-side evaluation, and network-based server-side evaluation. The donut has an advantage over a cookie file in that the donut file is database driven and typically stored on a server, preventing a user from deleting or otherwise tampering with the donut file. Cookie files, in comparison, are stored locally on a user's machine. In addition, by storing a donut file on a server, a user may log onto a network from any machine and still access the user's donut file and receive content based upon the donut file.

A donut, more specifically, is an hierarchical attribute value pair data structure including a collection of crumbs. A crumb is the smallest unit of data corresponding to a meaning value pair associated with a particular donut. For example, a user's age would be a crumb associated with the user's primary donut. The donut data structure includes names plus associated crumbs. At the top level of the hierarchy, a top donut is associated with a user, a chat room, a network service, or other appropriate business entity or service. Each donut contains a set of crumbs and a set of sub-donuts.

A sub-donut is a donut associated with another donut rather than an external entity such as, for example, a user. An example of a sub-donut is a user's address. The user's address references the user's primary donut and is stored in a sub-donut, and the sub-donut contains crumbs for each piece of information in the address. Donuts are

stored with hierarchical relationships, meaning that a donut can have associated sub-donuts and the sub-donuts can also each have associated sub-donuts. The donut thus may have many levels of sub-donuts within its hierarchical structure.

Some donuts are owned by only one parent donut. Other donuts are shared among several or many parent donuts. These shared donuts profile a business entity, such as an individual program, that is common to all; an example includes members of the same chat room. This provides a way to identify a group of users for a chat service. Also, by sharing the donut a user need not enter a new profile for using different services; the services share and use the one donut.

Figure 10 is a diagram of logical structure 200 of a donut for implementing user-profile information. This structure may be stored on a computer-readable medium, such as a memory, for access by an associated machine. The term "donut" is used only as a label and refers to information residing on a server and accessible by a client for use in pushing or assigning particular content to the client.

Structure 200 uses database tables for storing and maintaining the user-profile information, which includes any type of information identifying a user or corresponding client machine. Structure 200 includes a user table 202, identifying a particular network user, and each user would typically be identified by a separate table. Table 202 may also include information identifying each user's name and an associated password and identification (ID). A directory table 204 maintains a directory listing of the network users.

A separate donut table 206 maintains user-profile information for a particular user. Donut table 206 is associated with the corresponding table 202 for that user and with the directory table 204. Donut table 206 is also associated with a donut hierarchy table 208, which identifies and maintains hierarchical relationships for table 206. Each donut table 206 may include an associated crumb table 212 for use in identifying and maintaining particular attributes for the user-profile information. An associated attribute table 210 stores and maintains the information for those attributes.

The user profile may contain a wide variety of information concerning user characteristics for use in determining content to push to a user. As further explained below, the content may include any type of information such as video, audio, graphics.

text, and multimedia content. Examples of content to be selectively pushed to the user based upon the user-profile information include, but are not limited to, the following: advertisements; player profiles for sporting events; music or other audio information; icons representing particular services; surveys; and program suggestions. Also, when a video program provides different video streams for different camera angles, such as a sporting event, the particular camera angle may be chosen based upon the user profile. In addition, particular drama presentations provide different video streams for various plot changes, and a video stream for a particular plot to be displayed to a user may be chosen based upon the user profile.

The surveys may involve selectively transmitting questions to a user based upon the user's donut. The user's answers to the questions may be used to further update the donut. As an example of survey content, consider an automobile manufacturer as an advertiser that has determined that the answers to ten questions, asked in a specific order, are vital to determining how the manufacturer is going to market to a particular user. In this example, the server or network uses the donut to maintain what questions have been answered and which have not been answered. The donut can be utilized to determine which of the ten possible questions should be pushed to the user when the network determines, according to a particular schedule, that it is time for the manufacturer's survey to be pushed to the user.

This example further illustrates how individual advertising may be selected for particular users. The answers to the surveys may be used to provide a second level of information within an advertisement pushed to a particular user. The network may use demographic data in the user's donut, for example, to determine which advertisement and survey to push to the user. The user's answers to the questions in the survey may be used to push additional advertisements to the user or additional content for the advertisement already pushed. Also, the network can tailor a survey to a particular user by selecting additional questions for the survey, and an order of presentation of the questions, based upon the user's answers. Accordingly, the network can dynamically modify and update a user's donut to further fine-tune the processing of selecting particular content to push to the user based upon the user's donut.

An execution environment for donuts may be implemented with an easily programmed JAVA module, an example of which is provided in Table 1 illustrating template-based code, generated by a graphical user interface (GUI). This module may be implemented as an application program interface (API) on a user's machine for accessing the user's donut file on a server. If the user's machine does not contain such a module, the user's machine may download it as a JAVA Archive (JAR) file for local execution.

Table 1

```

import actv.nub.*;
public class PilotYankees implements Processor {
    public void process(Nub nub, Donut client, Donut action)
        throws NubException
    {
        if ( client.check("OWNS_PILOT") &&
            action.getValue("FAN_OF").equals("Yankees") ) {
            nub.change("content", YankeePilotChallenge);
        }
    }
}

```

The module in Table 1 can obtain crumb values from a donut service, branch on those values and other conditions, set existing crumb values, and create new crumbs as desired. Additionally, the module can interact directly with systems such as a distributed community network for additional functionality, including dynamic assignment to content and advertising push channels. An example of a distributed community network is disclosed in U.S. application of Craig D. Ullman, Michael R. Abato, Jeffrey M. Harrington, and Carl R. Duda, entitled "ENHANCED VIDEO PROGRAMMING SYSTEM AND METHOD FOR PROVIDING A DISTRIBUTED COMMUNITY NETWORK," application Serial No. 09/396693, filed 15 September 1999. The donut may be used with other types of networks as well.

A module processing a donut can execute in three modes: as an http servlet connected directly to a database for donut persistence; as a service responding to requests coming through a distributed community network and unconnected to a database for donut persistence; and on the client machine, which has direct access to user input, but uses the donut persistence by proxy through a distributed community network.

Figures 11A, 11B and 11C are a flow chart of a process 220 for generating and implementing donuts specifying user-profile information. Process 220 may be implemented in software modules on a machine such as a web server in the exemplary network described above. In process 220, a user attempts to log onto the network (step 222). In response, the server determines if a donut exists in the database for this user (step 224). If a donut does not exist (step 226), the server queries the user, receives a response to the query, and generates a donut for the user based upon the response, using exemplary database structure 200 (step 232). An example of a query is provided below. Otherwise, if a donut does exist for the user (step 226), the server queries the user in order to update the donut (step 228) and implements the updates to the donut, using exemplary database structure 200 (step 230). The queries may involve the server transmitting a series of questions to the user and receiving from the user replies to the question. The queries may also involve survey questions as described above. The server may require a response in order for the user to receive content from the network.

The server may optionally receive user-profile content for the user from another source. For example, a user profile may already exist for the user from another network-based system, and the server may receive that profile. Upon optionally receiving the other user-profile content, such as a pre-existing user profile, the server selectively incorporates the content into the donut (step 234). The server may base the incorporation of the pre-existing other user-profile content on particular criteria such as the types of content required for the user profile and when the pre-existing user profile was updated. In addition, the server may incorporate all of the content or only selected portions of it.

The server assigns the user to a team based upon the user's donut and saves an indication of the assignment in the user's donut (step 236). A team specifies a chat room for this user for a chat service; the donut information may be used with other network services as well. If the user already had a donut in the system, the server may use a pre-

existing room assignment as a default assignment, or assign the user to a new team, particularly if the user's donut has been substantially updated. The server stores the user's donut in the database and optionally transmits a copy of the donut or particular portions of it for storage on the user's machine (step 238). The user's machine, if it receives the donut, locally stores the donut or the updates to it.

After creating or updating a donut for the user, the server selects content for transmission to the user based upon the user-profile information stored in the user's donut (step 240). The selected content may be based upon particular criteria involving the user-profile information in the user's donut, and it may include a wide variety of types of information. The content may include networked content, meaning any type of information available via a Uniform Resource Identifier (URI) (step 254). A URI is a compact string of characters for identifying an abstract or physical resource. More specifically, URIs provide a simple and extensible means for identifying a resource, and a URI can be further classified as a locator, a name, or both. The specification of URI syntax and semantics is derived from concepts introduced by the World Wide Web global information initiative. URIs include, for example, URLs and Uniform Resource Names (URNs). A URL is a subset of a URI that identifies resources via a representation of their primary access mechanism, such as their network "location," rather than identifying the resource by name or other attribute of that resource. The term URN refers to a subset of URI that is required to remain globally unique and persistent even when the resource ceases to exist or becomes unavailable.

The selected content may also include video content (step 255); audio content (step 256); or any type of multimedia content (step 257). The multimedia content may include, for example, particular types of animations or slide shows selected for transmission to the user's machine based upon the user's preferences or characteristics as identified in the user's donut. The video and audio content may include, for example, particular video and audio advertisements potentially of interest to the user and selected for transmission to the user's machine based upon the user's identified preferences. The video, audio, or multimedia content may include content related to a chat room discussion among the user and other members of the user's chat room or team. It may also include content related to a program being viewed by the user. For example, if the

user views a sports program, the content may include statistics or videos of past sports programs between the same teams or players, depending on the user's identified preferences or interests as saved in the user's donut.

5 The selected content may also include a particular video stream, as identified above (step 258). In particular, several video streams captured from different camera angles may be available for a particular program. The server may select a video stream for display to the user based upon the user's stated preferences. For example, a user may have stated a preference for watching the quarterback during a football game and, therefore, a video stream following the quarterback is selected for transmission to the
10 user's machine. Another user may have expressed an interest in watching wide receivers, for example, and a video stream of the receivers is selected for transmission to that user's machine. Technology for providing multiple video streams of a program is disclosed in U.S. Patent No. 5,861,881, which is incorporated herein by reference.

15 The selected content may also include an executable object or application (step 259). For example, the server may transmit to the user a JAVA game or other types of electronic games based upon the user's preferences. The executable objects may also be used to dynamically push customized code to the user's machine while another application executes. In addition, selected executable objects may be used to facilitate electronic commerce transactions. In particular, identification of particular products
20 available for purchase may be transmitted to the user based upon the user's preferences, and an executable object can be used to provide a common electronic "shopping cart" where the user can drag and drop identification of products to purchase among multiple vendors. The electronic shopping cart saves an identification of the products, and potentially other information, for use in transmitting and executing a purchase request for
25 the products.

The selected content can include other types of content as well (step 260). Based upon the determination, the server pushes the particular content to the user's machine (step 242).

30 The server also monitors the user's activity in order to dynamically update the user's donut (step 244). The user's activity may involve any type of information relating to the user's interaction with the network or program content provided to the user. For

example, the server may detect the following: the rate at which the user selects or "clicks on" URLs to request particular content; which URLs the user selects; the amount of elapsed time the user has remained logged onto the network; the extent to which the user participates in chat room discussions; and any other such information.

5 The server also determines whether to update the user's donut based upon the monitored user activity (step 246). This determination may be based upon particular criteria related to the user's activity. For example, the server may store particular types of activity or thresholds for activity and compare them to the user's monitored activity, providing for an update when the user's activity matches the particular types of activity
10 or exceeds the thresholds. It may also be updated based upon survey questions. If the server has determined based on the criteria that the user's donut is to be updated (step 248), it dynamically updates the donut based on the user's activity, saves the updates, and optionally sends the updates to the user's machine (step 250). Otherwise, if the criteria have not been met, the server does not update the donut.

15 The server also detects whether the user has logged off the network (step 252). If the user remains logged onto the network, the server continues to select and push content to the user based upon the user's donut (steps 240, 242, 254-260), monitor the user's activity (step 244), and dynamically update the user's donut (steps 246, 248, and 250).

20 The following provides an example of use of a donut. During a program, the server sends a user, Bob Smith, a question which states, "Do you own a Personal Digital Assistant (PDA)?" Bob returns a "Yes" answer. The corresponding crumb includes the meaning value pair PDA=True, which is then sent via the Internet to a distributed community network, as identified above. This crumb is captured from the distributed
25 community network and stored in the database as a crumb in the sub-donut "Technology" under Bob Smith's donut. A copy of the crumb is stored locally in the client browser on Bob Smith's machine.

 Later in the program, the host of the television program is reviewing the latest PDAs. The producer of the program wants to send web content specific to all the users
30 on-line about PDAs. The producer pushes to all the users on-line a playlist item, as identified above, parameterized on whether a user has a PDA. Bob Smith's browser

receives the playlist item, which references his donut. The browser recalls the value pair PDA=True, and from the logic in the playlist item, determines that Bob should see in his browser a web page that offers a discount on a PDA upgrade, rather than a web page that offers the user the opportunity to buy a new PDA for the first time.

In addition to this route of the crumb and the decision making occurring on the client side, the same process can occur solely on the server side.

Table 2 provides an Extensible Markup Language (XML) code listing for an exemplary donut. Table 3 provides an XML code listing for an exemplary collection of donuts. In Tables 2 and 3 the indentation represents the hierarchical structure of the donuts.

Table 2

```

<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE htvuser SYSTEM "donut.dtd" []>

<htvuser name="Bart Simpson" uid="bart" pw="dude!">
  <donut desc="bart" id="bart">

    <crumb desc="email" value="barf@fox.net" />
    <crumb desc="ccn" value="amex 5592 3800 0165 1872 exp 01" />

    <donut desc="thebox">
      <crumb desc="style" value="rock" />
      <crumb desc="region" value="NE" />
      <crumb desc="fanof" value="Offspring, Limp Bizkit" />
      <crumb desc="sex" value="yes" />
    </donut>

  </donut>
</htvuser>

<!--
Client code can refer to:
  bart.ccn
  bart.thebox.region
  bart.thebox.fanof
  etc.
-->

```

Table 3

```

<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE teamlist SYSTEM "donut.dtd" []>

<teamlist>

  <donut      desc="team"
5             id="hot-sax-mets"
             shared="true"
             members="lisa,sally,lukas">
    <crumb desc="name"
      value="Hot Saxophonists Lusting after the Met's Shortstop" />
10    <crumb desc="team-homepage"
      value="http://home.springfield.net/~lisa/mitt-lusters.html" />
    <crumb desc="trivia-tries" value="22" />
    <crumb desc="trivia-correct" value="5" />
    <crumb desc="trivia-prizes" value="05" />
15  </donut>

  <htvuser name="Sally Brown" uid="sally" pw="beethoven">
    <donut desc="sally" id="sally">
      <crumb desc="email" value="sally@shulz.net" />
      <crumb desc="ccn" value="mc 5592 3800 0165 1872 exp 012" />
20    <donut desc="espn" subs="hot-sax-mets">
      <crumb desc="sports" value="skiing" />
      <crumb desc="agegroup" value="2-5" />
    </donut>
    </donut>
  </htvuser>
25 <htvuser name="Lisa Simpson" uid="lisa" pw="trane">
  <donut desc="lisa" id="lisa">
    <crumb desc="email" value="lisa@fox.net" />
    <crumb desc="ccn" value="visa 5592 3800 0165 1872 exp 02" />
30    <donut desc="espn" subs="hot-sax-mets">
      <crumb desc="sports" value="curling,wwf" />
      <crumb desc="agegroup" value="5-10" />
      <crumb desc="education" value="Springfield" />
    </donut>
  </donut>
35 </htvuser>
  <htvuser name="Lukas Dorigt" uid="duanne" pw="tomgirl">
    <donut desc="lukas" id="lukas">
      <crumb desc="email" value="lukas@aol.com" />
40    <crumb desc="ccn" value="amex 5592 3800 0165 1872 exp 00" />
    <donut desc="espn" subs="hot-sax-mets">
      <crumb desc="sports" value="baseball" />
      <crumb desc="agegroup" value="18-24" />
    </donut>
  </htvuser>

```

</donut>
</htvuser>

</teamlist>

- 5 Using the foregoing embodiments, methods and processes, the system of the present invention creates a synergistic experience combining the vast resources of the Internet with the presentation capabilities of television.

CLAIMS

1. Apparatus for compiling and maintaining information for use in routing and transmitting content to a machine via a network, the apparatus comprising:
5 means for receiving information for use in generating a user profile;
means for specifying, based on the information received, a machine, an address associated with the machine, and user-profile information for use in determining a type of content to transmit to the machine; and
means for storing the user-profile information in an hierarchical attribute
10 value pair data structure.
2. Apparatus as claimed in Claim 1, further comprising:
means for specifying attributes of a user associated with the user-profile information; and
15 means for specifying in a hierarchical structure, hierarchical relationships among at least two hierarchical attributes.
3. Apparatus as claimed in Claim 1 or Claim 2, further comprising means for specifying information which identifies the user.
20
4. Apparatus as claimed in any of Claims 1 to 3, further comprising means for specifying information identifying at least one preference of the user.
5. Apparatus as claimed in any of Claims 1 to 4, further comprising means
25 for specifying information identifying a room to which a user is assigned for a chat service.
6. Apparatus as claimed in Claim 5, further comprising means for specifying information identifying members of the room for the chat service.
30
7. Apparatus as claimed in any of Claims 1 to 6, further comprising means for specifying an indication of a directory for providing instructions for routing the content.
- 35 8. Apparatus as claimed in any of Claims 1 to 7, further comprising means for dynamically changing the user-profile information in the hierarchical

structure based upon updated information.

9. Apparatus as claimed in any of Claims 1 to 8, further comprising means
5 for querying a user in order to obtain the user-profile information.

10. Apparatus as claimed in any of Claims 1 to 9, further comprising means
for transmitting content to the machine for a particular service based upon the
user-profile information.

10

11. Apparatus as claimed in any of Claims 1 to 10, further comprising means
for dynamically updating the user-profile information.

15

12. Apparatus as claimed in Claim 11, further comprising:
means for monitoring activity of a user associated with the user-profile
information; and
means for updating the user-profile information based upon the
monitored activity.

20

13. Apparatus as claimed in Claim 12, wherein the monitored activity is at
least one of: a rate of clicking by a user, a Uniform Resource Locator selected
by a user, a network time for a user, and a time spent by a user in a chat room.

25

14. Apparatus as claimed in any of Claims 1 to 13, further comprising means
for selecting to transmit to the machine at least one of the following types of
information: information available via a Uniform Resource Identifier, video
content, audio content, multimedia content, a particular video stream and an
executable object.

30

15. Apparatus as claimed in Claim 14, wherein the executable object is at
least one of: a game, a program for use in an electronic commerce transaction,
and an electronic shopping cart for use in an electronic commerce transaction.

35

16. Apparatus as claimed in any of Claims 1 to 15, further comprising means
for specifying the user-profile information for use in selectively transmitting
survey questions to a user.

17. Apparatus as claimed in any of Claims 1 to 16, wherein the address specified is of at least one device selected from a personal computer, a television, a cable box, a satellite box, video game console, a personal digital assistant, or a hand-held computer.

18. Apparatus as claimed in any of Claims 1 to 17, further comprising means for specifying a hobby of a user.

19. Apparatus as claimed in any of Claims 1 to 18, further comprising means for specifying a spending habit of a user.

20. Apparatus as claimed in any of Claims 1 to 19, further comprising means for specifying a viewing habit of a user.

21. Apparatus as claimed in any of Claims 1 to 20, further comprising means for specifying demographic information about a user.

22. Apparatus as claimed in any of Claims 1 to 21, further comprising means for specifying information concerning a Uniform Resource Locator viewed by a user.

23. Apparatus as claimed in any of Claims 1 to 22, further comprising means for utilising the user-profile information to transmit to the machine at least one of the following type of content: advertising content, sport content, music content, audio content, program suggestions, icons representing particular services, entertainment content, and education content.

24. Apparatus as claimed in any of Claims 1 to 23, further comprising:
means for selectively transmitting survey questions to the user;
means for receiving responses to the survey questions from the user;
and
means for updating the user-profile information based on the responses received.

25. A computer-readable medium containing programming instructions for

controlling a computer system which routes and transmits content to a machine via a network, by:

- receiving information for use in generating a user profile;
- specifying, using the information, an identification of a machine, an
5 address of the machine, and user-profile information for use in determining a
type of content to transmit to the machine; and
- storing the user-profile information in an hierarchical attribute value pair
data structure.

- 10 26. A computer-readable medium as claimed in Claim 25, wherein the
instructions further include:
- specifying attributes of a user associated with the user-profile
information; and
 - specifying relationships among the attributes in a hierarchical structure.

- 15 27. A computer-readable medium as claimed in Claim 25 or Claim 26,
wherein the instruction of specifying attributes of a user associated with the
user-profile information further comprises specifying additional information
identifying the user.

- 20 28. A computer-readable medium as claimed in any of Claims 25 to 27,
wherein the instruction of specifying attributes of a user associated with the
user-profile information further comprises specifying information identifying
preferences of the user.

- 25 29. A computer-readable medium as claimed in any of Claims 25 to 28,
wherein the instruction of specifying attributes of a user associated with the
user-profile information further comprises specifying information identifying a
room to which the user is assigned for a chat service.

- 30 30. A computer-readable medium as claimed in any of Claims 25 to 29,
wherein the instruction of specifying attributes of a user associated with the
user-profile information further comprises specifying information which
identifies members of the room for a chat service.

- 35 31. A computer-readable medium as claimed in any of Claims 25 to 30,

wherein the instruction of specifying attributes of a user associated with the user-profile information further comprises specifying an indication of a directory for use in providing instructions for routing the content.

5 32. A computer-readable medium as claimed in any of Claims 25 to 31 wherein the instructions further comprise dynamically changing the user-profile information in the hierarchical structure based upon updated information.

10 33. A computer-readable medium as claimed in any of Claims 25 to 32, wherein the instructions further comprise querying the user in order to obtain the user-profile information.

15 34. A computer-readable medium as claimed in any of Claims 25 to 33, wherein the instructions further comprise transmitting content to the machine for a particular service based upon the user-profile information.

20 35. A computer-readable medium as claimed in any of Claims 25 to 34, wherein the instructions further comprise dynamically updating the user-profile information.

36. A computer-readable medium as claimed in Claim 35, wherein the instruction of dynamically updating the user-profile information further comprises:

25 monitoring activity of a user associated with the user-profile information;
and
updating the user-profile information based upon the monitored activity.

30 37. A computer-readable medium as claimed in claim 36, wherein the monitored activity is at least one of: a rate of clicking by the user, a Uniform Resource Locator selected by the user, a time on the network for the user, and a time spent in a chat room by the user.

35 38. A computer-readable medium as claimed in any of Claims 25 to 37, wherein the specifying instruction further utilises the user-profile information to transmit to a machine at least one of: Uniform Resource Identifier, video content, audio content, multimedia content, a particular video stream, and an

executable object.

39. A computer-readable medium as claimed in Claim 38, wherein the executable object is at least one of: a game, a program for use in an electronic commerce transaction, and an electronic shopping cart for use in an electronic commerce transaction.

40. A computer-readable medium as claimed in any of Claims 25 to 39, wherein the specifying instruction further comprises specifying the user-profile information to selectively transmit survey questions to the user.

41. A computer-readable medium as claimed in any of Claims 25 to 40, wherein the specifying instruction further comprises specifying the address of at least one of the following devices: a personal computer, a television, a cable box, a satellite box, video game console, hand-held computer, and a personal digital assistant.

42. A computer-readable medium as claimed in any of Claims 25 to 41, wherein the specifying step further comprises specifying a hobby of a user.

43. A computer-readable medium as claimed in any of Claims 25 to 42, wherein the specifying step further comprises specifying a spending habit of a user.

44. A computer-readable medium as claimed in any of Claims 25 to 43, wherein the specifying step further comprises specifying a viewing habit of a user.

45. A computer-readable medium as claimed in any of Claims 25 to 44, wherein the specifying step further comprises specifying demographic information of a user.

46. A computer-readable medium as claimed in any of Claims 25 to 46, wherein the specifying step further comprises specifying information concerning a Uniform Resource Locator viewed by a user.

47. A computer-readable medium as claimed in any of Claims 25 to 46,
wherein the specifying step further comprises utilising the user-profile
information to select the content to transmit to the machine, at least one type of
content being selected from: advertising content, sport content, music content,
5 audio content, program suggestions, icons representing particular services,
entertainment content, and education content.

48. A computer-readable medium as claimed in Claim 32, wherein the step
of dynamically changing the user-profile information comprises:
10 selectively transmitting survey questions to the user;
receiving responses to the survey questions from the user; and
updating the user-profile information based on the responses received.

49. A computer-readable medium containing programming instructions
15 which control a computer system, the computer system being used to route and
transmit content to a machine via a network, by:
establishing a network connection to a machine;
accessing via the network, a hierarchical attribute value pair data
structure; and
20 transmitting information, via the network connection, which specifies an
identification of the machine in the data structure, an address of the machine,
and user-profile information for use in determining a type of content to transmit
to the machine.

25 50. A computer-readable medium as claimed in Claim 49, wherein the
instructions further comprise storing the data structure in a memory associated
with the machine.

51. A computer-readable medium as claimed in Claim 49 or Claim 50,
30 wherein the instructions further comprise storing the data structure in a memory
associated with a server connected via the network to the machine.

52. A computer-readable medium as claimed in any of Claims 49 to 51,
wherein the instructions further comprise dynamically updating the user-profile
35 information.

53. A computer-readable medium as claimed in claim 52, wherein the instruction of dynamically updating the user-profile information comprises:
monitoring activity of a user associated with the user-profile information;
and

5 updating the user-profile information based upon the monitored activity.

54. A computer-readable medium as claimed in any of Claims 49 to 53, wherein the instructions further comprise selecting, based upon the user-profile information for transmission to the machine, wherein the information is selected
10 from the group consisting of: information available via a Uniform Resource Identifier, video content, audio content, multimedia content, a particular video stream, or an executable object.