Intercast^{TM} Technology

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1. Abstract

This document provides an overview of the Intercast[TM] technology and provides additional technical details on how to develop and deliver Intercast content to PC viewers. Intercast technology combines the best of two worlds: Television programming and highly interactive web content. The combination of these two mediums creates an entirely new interactive user experience. Intercast technology's excellent hybrid characteristics, coupled with the merged TV and Web content, engender an entirely new user experience. Intercast technology delivers new uses and new users for the PC.

Readers can find additional details on the Intercast technology at www.intercast.org and at www.intel.com/drg.

2. Intercast Technology: The PC in the Home

Personal computers are rapidly becoming as essential in homes as they are in businesses. Powerful, popular, and a rich source of information and entertainment, the home PC is well on its way to becoming as ubiquitous a fixture as the TV and the telephone. In fact, the growth of PC sales to home consumers is quickly outpacing the growth in sales of television sets (AIM Report, 1996), and statistics reveal that 37 percent of all U.S. households own at least one PC (International Data Corp., 1995).

A parallel trend is evident in the explosive growth of the Internet and the increasing number of consumers who have access to the array of information and entertainment it offers. Worldwide, the growth in Internet users is expected to reach 140 million by 1998 (MIDS, 1996). In the United States alone, 44 million households are projected to have access to the Internet's World Wide Web by 1999 (Jupiter, 1996).

Statistics such as these make it clear that consumers, who already rely on the home PC for communication, education and fun, are also harnessing its power to explore the widening avenues of information open to them.

Indeed, the latest market research reveals that consumer behavior is changing dramatically as alternative technologies emerge for delivering entertainment and information to the home. For example, a recent national study shows that U.S. consumers used their home PCs for personal purposes an average of 11.4 hours per week in 1996, compared to 8.5 hours in 1995 (Odyssey, L.P., 1996). Further analysis of this research indicates that U.S. households with access to the Internet and online services are the most likely to take time away from television to use their home computers.

This convergence around the PC motivated Intel Corp. to develop Intercast technology. Simply stated, Intercast technology lets broadcasters combine web pages with their existing television programming to create an integrated TV and Internet experience that is delivered through the broadcast signal to home PCs. The broadcast web pages are viewed on the PC along with the associated television programming, providing consumers with more meaningful and immediate access to information and entertainment. Because the broadcast pages are created using HTML (HyperText Markup Language), the authoring language of the World Wide Web, they can also include hyperlinks to the Web, offering additional information to consumers who have Internet access.

Built on prevailing broadcast and Internet standards and designed for the existing infrastructure, Intercast technology enables a dynamic and inexpensive new digital medium for home "infotainment" that consumers of all ages will find engaging.

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PC Growth vs. TV Growth in U.S. Homes (millions)

120
100
80
60
40
20
0
1994 1995 1996 1997 1998 1999
• • TV Growth ▬ PC Growth
Source: AIM Report 1996

U.S. Households with Web Access (milions)

50
40
30
20
10
0
1994 1995 1996 1997 1998 1999
44 Million
Source: Jupiter 1996
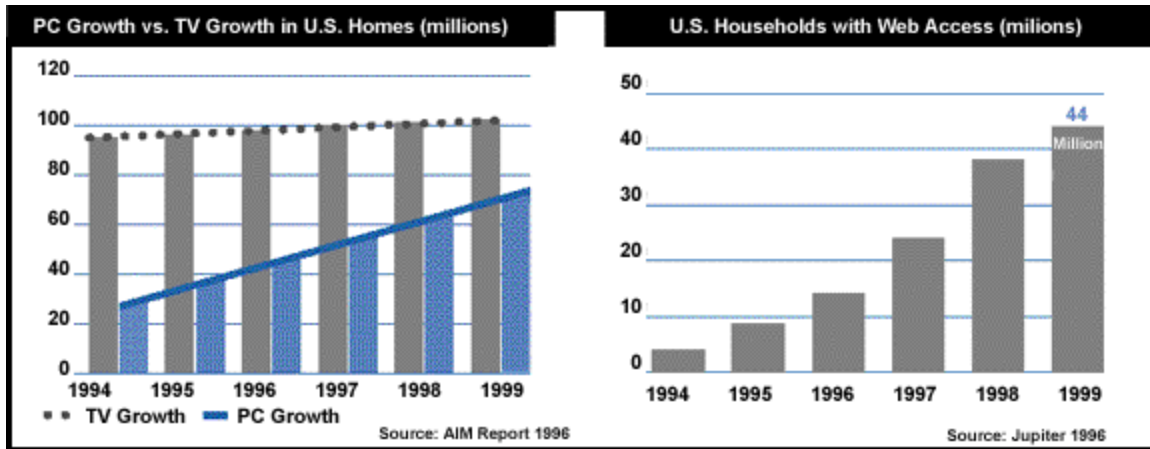
Figure 1. The number of U.S. households with PCs and the number of U.S. households with Web access are rising sharply.

3. Intel Intercast Technology: An Overview

Intel Intercast technology makes it possible for home PCs to receive HTML-formatted web pages and streaming data (such as a stock ticker) along with regular television programming. The Intercast medium involves two key pieces: the broadcaster front-end that sends Intercast content, and the home PC that receives it.

Broadcasters, cable TV companies, networks, and television producers take advantage of the Intercast medium by embedding data associated with their programming within the Vertical Blanking Interval (VBI) portion of a conventional television signal. To receive Intercast programming, the consumer must have a PC equipped with the appropriate enabling software and hardware (Figure 2). In addition, the consumer must be in an area where the Intercast content is passed through by the local cable operator or broadcast affiliate. (Check http://www.intel.com/iaweb/intercast/index.htm to determine availability in your area).

Intercast programming in the form of web pages is created by content providers, then integrated into the broadcasted program using software tools based on Intercast technology. The web pages are then received by the PC and cached, or intelligently stored, on the PC's hard drive. Hundreds or even thousands of pages of information can be stored in this way using just a fraction of the capacity of today's typical 1GB hard drive. For example, assuming a typical 40K web page and 25MB of hard disk space set aside for cached pages, the user could store 625 pages. (More information on how cached pages are handled is included later in this document under the section titled "The Intel Intercast Viewer Software.")

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System Configuration and Production Process

Figure 2. Intercast content is transmitted from the broadcaster site and received at home PCs.

Using Intel Intercast technology, consumers can interactively browse the cached pages, just as if the pages were being retrieved from the Internet.

Today's high-performance PC—based on Intel Pentium® and Pentium Pro processors—serves as the platform for Intel Intercast technology. The digital storage c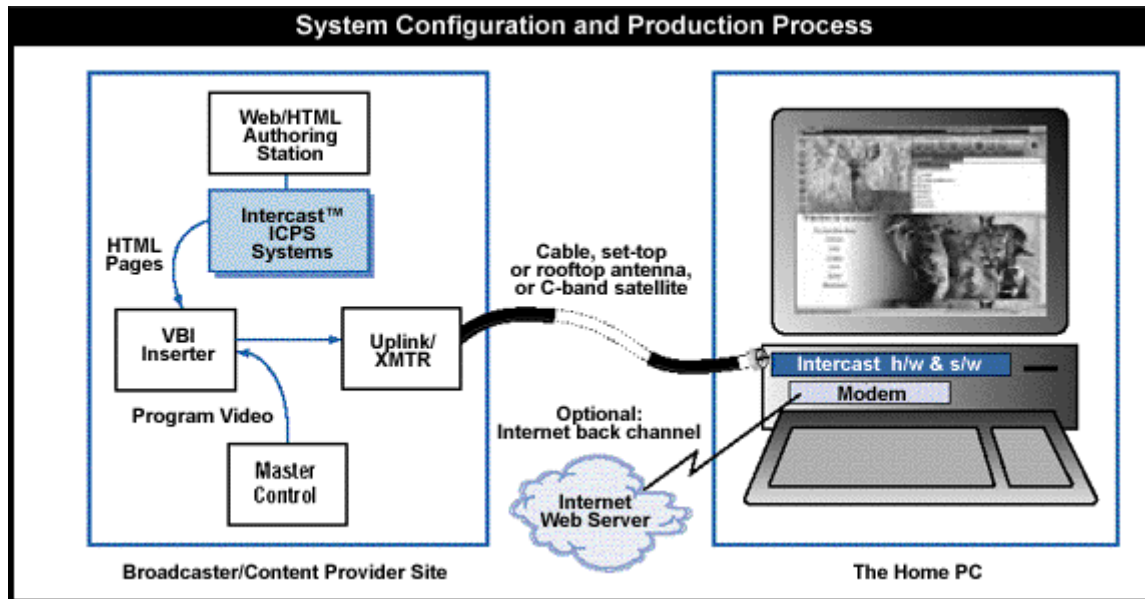apability of the PC compensates for bandwidth not available today, allowing users to browse broadcast web pages on their PCs rather than requiring them to log on to the Internet.

The key advantage of using broadcast technology is that the web information can be accessed at the speed of the hard drive rather than the speed of a modem, and retrieving the information from the disk costs nothing. This is particularly important when one considers that today's Internet infrastructure makes it impossible for a television-sized audience to dial in to the same website during a program. With Intel Intercast technology, information from that website is broadcast with the television programming, giving all users immediate access.

Because it is written in HTML, the Intercast content broadcast with the television signal appears to a consumer as typical web pages, exactly as if he or she were accessing the Web. These broadcast web pages might also include embedded hyperlinks to related information on the Internet. Using a modem and any direct Internet connection, users of Intercast technology-enabled PCs can click the hyperlinks to move between television programming and Internet sites directly related to that programming.

Intel Intercast technology-enabled PCs are available today from a select number of PC manufacturers. These systems feature pre-installed software and hardware that allows consumers to receive Intercast programming. Add-in boards as an upgrade for late-model Pentium processor-based PCs are also available. (More specifics on system requirements are included in the section titled "Receiving Intercast Programming on the Home PC".)

3.1 Understanding the VBI

Intel Intercast technology uses the Vertical Blanking Interval (VBI) portion of a conventional television signal to transmit associated data. In the United States, the VBI refers to the 21 horizontal lines of a National TV Standards Committee (NTSC) video signal that separate

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the two fields comprising a single television frame. (Similar standards exist in other countries.) In technical terms, the VBI is the point in the analog video signal at which the beam is in retrace and the intensity of the signal is zero—in other words, "dead time" in the signal. In more familiar terms, the VBI commonly appears on the television screen as the "black band" between frames when a TV image loses vertical hold and "rolls."
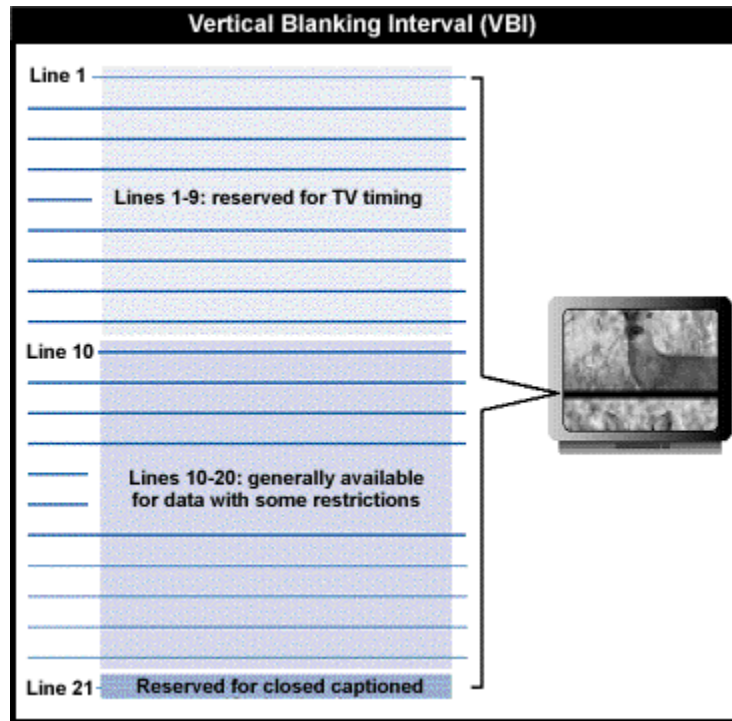
Figure 3. Intercast content uses the VBI portion of a conventional television signal.

During the VBI portion of the video signal, a limited amount of data can be inserted into the signal. Broadcast stations typically modulate the signal with data during the VBI. In the United States, for example, line 21 in the VBI is reserved for transmitting closed-captioning for the hearing-impaired. Lines 1 through 9 in the VBI are used by television receivers for video signal synchronization, and according to FCC regulations that allocation cannot be modified. Other lines in the VBI are sometimes used at times to transmit station identification, local time and Nielsen ratings information.

Essentially, up to 10 lines of the VBI are available per TV channel for inserting data, which can then be transmitted as an integral part of the television signal (see Figure 3). The throughput of each VBI line, with forward error-correction, is roughly equivalent to the data transfer capability of a 9600bps modem (approximately 4.3 megabytes per hour). The North American Basic Teletext Service (NABTS) is the U.S. standard that defines how data is encoded.

The data inserted into the VBI and broadcast along with the television signal using Intel Intercast technology can be picked up by a set-top or rooftop TV antenna, cable connection, or standard C-band satellite dish.

3.2 Taking Advantage of Standard HTML Format

HTML is ideally suited to creating associated data for VBI insertion because it is applicable to a wide range of content (text, video, images, programs) and supports a broad array of embedded data types. Broadcasters can use a familiar, standard HTML authoring tool set to

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generate web pages related to TV programs, then take advantage of Intel Intercast technology to integrate the HTML-formatted text and graphics with television video.

HTML provides the additional advantage of allowing content providers to include URLs (Universal Resource Locators) that can point to any website on the Internet with the broadcast HTML pages. Consequently, a user with a modem and Internet connection can be directed to a website to gather additional information or order merchandise.

4. Intercast Technology as a Hybrid Application

Intercast technology is a good example of a hybrid application in three important ways:

1. Content is pushed to the client in a transparent fashion. Broadcasters transmit Intercast content to the Intercast technology-enabled client PCs in a direct and transparent way. The user is not involved with the content delivery nor does the user request (pull) specific data. Intercast technology represents a true push hybrid technology.
2. Intercast technology clients cache the pushed content locally on the user's PC. This enables the user to experience rich multimedia delivered by the high performance and highly capable multimedia client PC. In addition, the user can choose to view content concurrently to the broadcast TV program or review the content in more detail at a later time.
3. Lastly, through the Intercast technology's back channel modem the user can access and receive real-time data off of the Web. This enables the user to experience both push (Intercast broadcast) and pull (user browse) models on a PC, providing the user with a great spectrum of flexibility in usage choices.

These hybrid characteristics coupled with the merged TV & Web content engender an entirely new user experience. Intercast technology delivers new uses and new users for the PC.
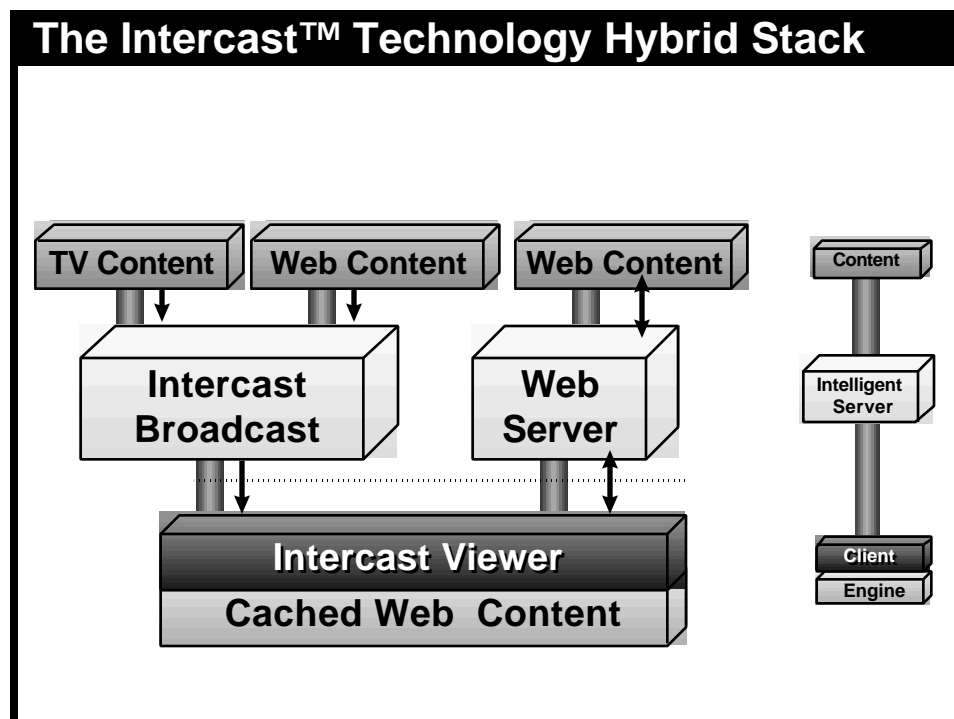

Figure 4. The Intercast Technology Hybrid Stack

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Intercast technology hybrid application stack as shown breaks into four segments:
1. Internet based content
2. Intelligent server & coordinator
3. Intelligent client & coordinator
4. Client engines and local rich content

Note that for Intercast technology, the source content is provided from both TV and web content (<u>Internet based content</u>). The delivery process merges the content together and then broadcasts (<u>intelligent server & coordinator</u>) content to the Intercast viewer (<u>intelligent client & coordinator</u>). The cached web content delivers a rich user experience by using the high performance media engines on the client PC (<u>client engines and local rich content</u>).

5. Creating Intercast Technology Content: An Overview

The Intercast medium offers content providers a powerful mechanism for enhancing the programming they offer to their audience. Furthermore, Intercast programming represents a way for broadcasters to deliver the Internet experience that viewers are demanding, while taking advantage of their strengths in television programming.

Enormous potential exists for content providers to sharpen their competitive edge, increase audience share, and retain customer loyalty by creating and sending Intercast content that offers consumers a variety of innovative and interactive "infotainment" options. For example:

- Receiving more in-depth information on a given program topic
- Getting "behind-the-scenes" information on their favorite programs
- Taking part in polls and surveys
- Competing in contests
- Ordering merchandise or tickets to events
- Participating in chat sessions that attract viewers with similar interests or tastes in entertainment
- Taking advantage of new avenues in advertising, such as linking to the advertiser's website to get more detailed information about products, where to purchase them, and so forth

The following sections explain how content is generated and prepared for sending to Intel Intercast technology-enabled PCs.

5.1 Originating Intercast Content

Intercast content can originate as new web pages created specifically for television airing, or it can derive from existing web pages already posted on the Internet. Because web pages created for use as Intercast programming are essentially the same as those created for the Internet, standard HTML authoring tools can be used. As Figure 4 illustrates, newly created Intercast content is typically generated at an HTML authoring station in a content provider's creative department.

The Intercast content consists of the following: "pages," each a single HTML-format web page and the resources associated with it; "page sets," a hierarchical unit of web pages dedicated to a single topic or intended for a specific programming segment; and "packages," which include all page sets to be transmitted during a given program.

5.2 Inserting Intercast Content in the VBI

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Content providers can insert Intercast programming in the VBI via three methods: manual airing, automatic airing, or laying to tape.

5.2.1 Manual Airing Method

The manual method of airing Intercast content can best be illustrated by the manner in which NBC used the technology in its coverage of the 1996 Summer Olympics in Atlanta. NBC created a variety of web pages for several Olympic events in advance of the broadcast using its standard HTML authoring stations and tools.

One event for which web pages were developed was diving. Just before the diving event, the production person downloaded potentially appropriate web pages from the authoring station to the Intercast Air Station. During the actual broadcast, the production person viewed the event along with other viewers nationwide. When an event occurred, for example, a new diver approaching the board, the producer used the Air Station to select and transmit a web page containing the bio of that athlete.
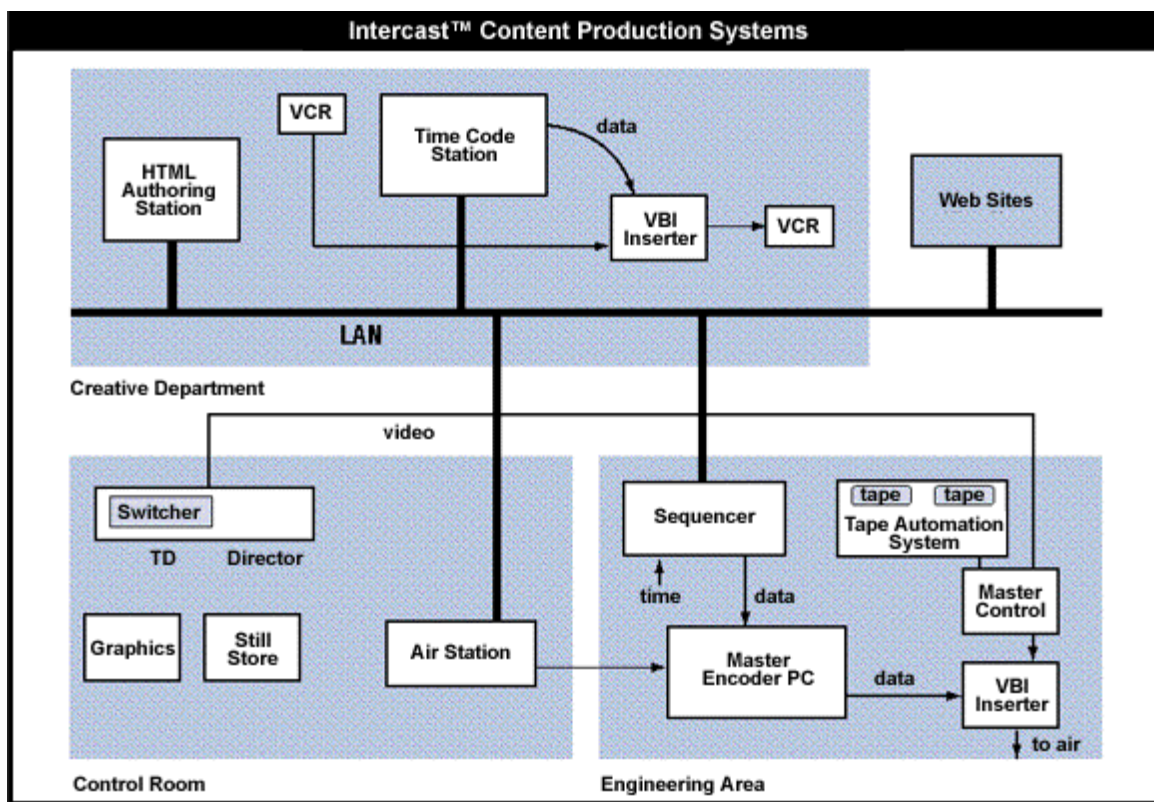
Figure 5. Broadcasters use various production tools to add Intercast content of programming.

Another application conducive to the manual airing method is news. Prior to a news broadcast, a web page author could use the authoring station to create pages appropriate to the evening news broadcast. Just before the show aired, a production person, typically sitting in the control room, would download the appropriate pages from the authoring station to the Air Station. Then, when a new news segment began, for example, a news segment on Iraq, the production person could use the Air Station to select and transmit a pre-composed web page containing a map of Iraq.

After the operator sends the pages from the Air Station, they flow via a computer network to the Master Encoder PC, which is typically located in the engineering area. The Master

Encoder adds protocols and sends the data to the VBI inserter. The VBI inserter, an off-the-shelf device, performs the actual insertion of the web data into the TV signal's VBI.

5.2.2 Automatic Airing Method

The manual airing method described in the preceding section is typically used when a program is live and the video content is aired at times not precisely known in advance. In instances when the timing of video programming is planned in advance, the web pages can be sent based on time of day. That is, the web pages can be marked with a time tag and sent at specified times.

Two software applications, the Time Code Station and the Sequencer, provide this function for Intel Intercast technology. The Time Code Station essentially makes it possible to associate a time tag with a page. Once time-tagged, pages for a program are imported into the Sequencer, which monitors time of day and sends the correct web pages automatically as the specified hour arrives.

For illustration purposes, consider NBC's *Homicide: Life on the Street* program, which airs at the same time each week. If the show begins at 10 p.m. Friday, a production person could look at the tape of the episode in advance of airing and determine that, for example, one web page should air at 5 minutes into the show, a second should air at 10 minutes into the show, and so forth. The production person would import those pages into the Time Code Station (where the time tags are associated with the pages) by dropping the pages onto a timeline. Once this process is complete for the show, the operator generates a "package" that includes all the pages earmarked for that particular episode, along with their respective time tags. This package is later imported into the Sequencer. When importing a package for a show, for example *Homicide*, the operator of the Sequencer specifies that the package should start to run at 10 p.m. Friday. The Sequencer later transmits the pages at the preset times specified in the package.

Note that during typical operation, the Sequencer will be loaded with many packages. Specifically, there may be one package for the *Homicide* show, additional packages for other programs, and still more packages for commercials.

As was the case with the Air Station, data from the Sequencer is sent to the Master Encoder PC and then to the VBI inserter for airing.

If a broadcaster has web pages on its actual Internet website that are appropriate for Intercast content, the Sequencer can also be programmed to "grab" certain pages from the website at specified times and send them to viewers using the Intercast technology. Note that the use of this method makes it unnecessary to time-tag the pages using the Time Code Station.

5.2.3 Tape Method

In the preceding example, the Sequencer typically is located in an engineering or production area and needs to be programmed on a regular basis. As an alternative, Intercast content can be placed on videotape, resulting in a tape that contains both the audio/video content and the Intercast content. Consequently, a broadcaster need only play the tape on air to transmit the audio, video, and data content. This simplifies operations for the on-air production staff, who play the tapes per normal procedures. This process requires, of course, that the Intercast content be added in post-production.

The post-production process is similar to the steps outlined earlier for *Homicide*. The pages are authored on a standard HTML authoring system and time-tagged on the Intercast Time Code Station (described in the "Automatic Airing Method" section). However, a recording device (VCR) and VBI inserter are also needed to place the content on tape.

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After time-tagging the web pages on the Time Code Station, the operator activates the "Lay to Tape" function on the Time Code Station. This causes the playback and record machines to roll. The Lay to Tape software then starts to monitor timecode coming from the playback machine. When the given time is reached, it sends the web page marked with that time tag to the VBI inserter which places the web page data in the video signal. The resulting video signal with the web page data is then recorded. This process is similar to that used to add closed-captioning to videotapes.

6. Receiving Intercast Programming on the Home PC

With support from Intel, several PC manufacturers are already shipping systems pre-loaded with hardware and software that allow consumers to receive Intercast programming. Also, add-in boards that offer this capability as an upgrade for existing Pentium processor-based PCs can be purchased today in computer stores throughout the United States. Additional add-in board makers have announced plans to offer retail upgrades. These boards plug into the PC's PCI bus and include the Intel Intercast Viewer software. Updated information about these products can be posted at www.intercast.org.

The Intel Intercast Viewer software is a Microsoft Windows* 95-based application that requires a Pentium processor-based system equipped with the hardware and software specifications outlined below.

6.1 System and Infrastructure Requirements

Minimum system requirements for the Intel Intercast Viewer software include the following:

- 90MHz (minimum) Pentium processor with PCI bus; 133MHz recommended
- 16MB RAM
- 15MB available hard disk space to install application; plus user-definable cache for storing broadcast web pages (default configuration, 25MB)
- 1MB VRAM (2MB recommended)
- PCI 2.0-compliance
- Standard CD-ROM audio port
- Video capture capability with VBI decoder and TV tuner
- Windows 95 operating system

Infrastructure requirements for using the Intel Intercast Viewer software are as follows:

- PC must be connected to a rooftop or set-top antenna, a cable TV connection, or a C-band satellite dish
- Consumer must be in an area where Intercast programming is available **
- Optional: A modem and an Internet connection are required to access the Internet or take advantage of hyperlinks contained in the broadcast pages that take users to related websites

**To receive Intercast programming, consumers must be in an area where the local cable operator or broadcast affiliate passes the Intercast content on the VBI as part of the TV video signal. Consumers should check with their cable operator and/or network affiliate to confirm the availability of Intercast programming.

6.2 The Intel Intercast Viewer Software

The Intel Intercast Viewer software is launched just like any other application from the Windows 95 desktop. A scaleable application, the Viewer software can be run in TV only mode, in Browser only mode, or in TV plus Browser mode.

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The Viewer application's user interface (Figure 5) divides the screen window into three panes.

6.2.1 The TV Viewing Area

At the top left is the TV viewing area, which can be resized when the user is in TV only mode. Along the left side of the TV viewing area is a set of buttons used to control various TV functions.
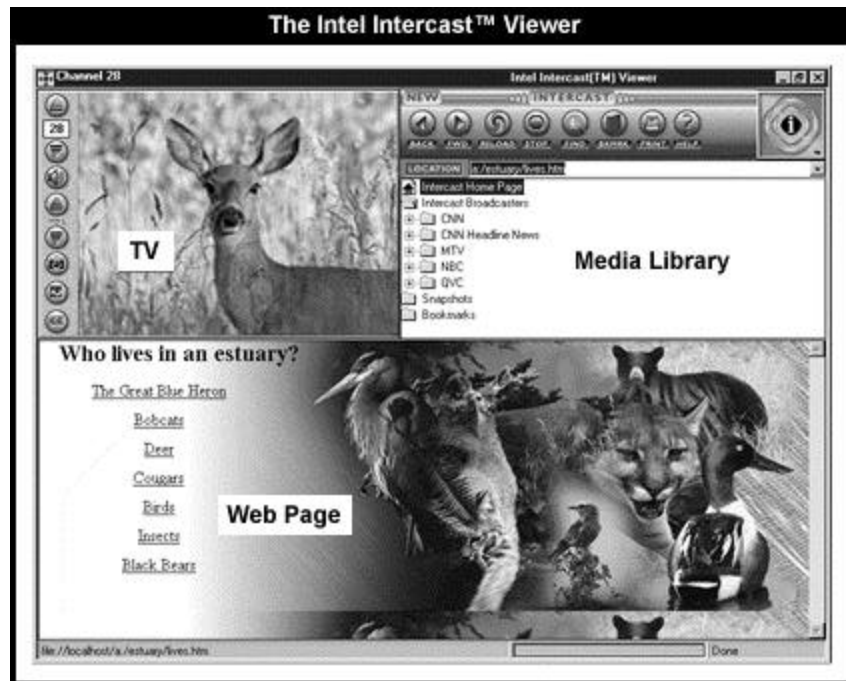
Figure 6. The Intel Intercast viewer is an easy-to-use application.

The control buttons, which are activated using the mouse, affect the following functions:

*   *Channel selection.* The two top buttons allow the user to change the channel; one button moves the channel selector forward, and the other moves it back. The current channel selection is displayed between the two buttons.
*   *Mute.* The mute control button allows the user to turn the sound off instantly.
*   *Volume.* The volume control button allows the user to adjust the volume level up and down.
*   *Snapshot.* When activated, the snapshot button takes an instant picture of the current image displayed in the TV window and automatically stores the image in the Media Library (see Figure 5).
*   *Stock ticker.* When the user is tuned to CNN, stock ticker information scrolls continuously on the title bar. When the stock ticker control button is activated, the user sees a table of all the stock ticker information that she/he decided to capture into this file, which can then be ported to any other application for further analysis. The application supports full NYSE, AMEX, and NASDAQ stock feeds (subject to at least 15 minutes of delay) provided by S&P Comstock, a unit of Standard and Poors.
*   *Closed-captioning.* This control button operates as a toggle, allowing the user to turn closed-captioning on or off. In addition, the Viewer software allows the user to set an alert based on close-caption text/information.

6.2.2 The Media Library

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The top right pane of the Viewer application window displays the Media Library. As each web page is broadcast, it is cached on the user's hard disk. The user can see its title displayed in the Media Library and its location on the hard drive displayed in the top right pane's "Location" area.

The size of the cache reserved for storing web pages can be modified by the user. However, the Viewer application defaults to 25MB. When the cache content reaches the size limit, new web pages overwrite older pages using a FIFO (First In, First Out) algorithm. In addition, a provider of Intercast content can tag an expiration time or date to a given page. If the user wishes to keep certain pages of interest in the cache (Media Library), those pages can be marked using a software command.

The Viewer application organizes the incoming information by channel and saves it in such a way that the user can easily peruse the stored web pages. Clicking entries in the Media Library's expandable list brings up the saved pages, Snapshots, and Bookmarks, which are organized using a file folder metaphor.

A row of iconized buttons controls Media Library functions:

- *New.* When this button lights up, the user clicks it to receive a new broadcast web page.
- *Intercast.* The Intercast banner, directly above the Media Library control buttons, indicates whenever a broadcaster, for example, CNN or NBC, transmits Intercast content.
- *Back.* The user clicks this button to return to a previously viewed web page.
- *Forward.* This button is used to return to the current web page after the user has recalled an earlier page. (This function is available only after using the Back function.)
- *Reload.* The reload button refreshes the web page that is displayed.
- *Stop.* This button allows the user to cancel a web page that is appearing on screen.
- *Find.* The find button makes it easy to locate a specific program, episode, or web page title stored in the Media Library's Broadcasters folder.
- *Bookmark.* The bookmark button enables the user to create a reusable shortcut to any web page desired.
- *Print.* When clicked, this button outputs the displayed web page to a printer.
- *Help.* The user presses the right mouse button to activate help.

6.2.3 The Web Page

The third pane across the lower half of the Intel Intercast Viewer window displays the broadcast web pages that are being received. Underlined text or graphical images on a page indicate a hot link to another page that has been previously sent and cached on the user's hard disk, or to a related page that may exist elsewhere on the Internet. Clicking these local or external hyperlinks takes the user directly to the appropriate page.

In addition to using the software interactively as described above, the consumer can use the Intel Intercast Viewer like a stand alone browser to access the World Wide Web. To do so, the user simply types the desired URL in the "Location" area, and the software will take the user to the website or page selected, independent of whatever TV programming is visible in the viewing window.

7. Intercast Programming Available Today

A growing number of television networks already supply Intercast content. The following sections describe how some content providers are presently using Intel Intercast technology to enrich consumers' television watching experience.

7.1 CNN

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Intercast programming is available on CNN (Cable News Network) 24 hours a day, seven days a week in the form of the CNN *News Digest*. *News Digest* complements CNN's award-winning television news coverage, providing viewers with updates every half hour on the top stories from around the globe. News Digest also provides hypertext links so users with an Internet connection are just a click away from more in-depth information on a particular story on CNN Interactive's website (www.cnn.com).

CNN also uses Intel Intercast technology to offer users a personalized stock-tracking feature based on S&P Comstock stock data.

7.2 MTV

MTV (Music Television, a Viacom network) has also adopted Intel Intercast technology to enhance programming during its prime-time MTV offerings, as well as on M2, a new 24-hour music channel that will feature Intercast programming 24 hours a day, seven days a week.

7.3 NBC

NBC is enhancing the appeal of its popular program offerings, such as *Dateline: NBC*, NFL games and *Homicide: Life on the Street*, by transmitting relevant Intercast content with the respective program's video content. For example, Intercast programming associated with the prime-time police drama *Homicide,* such as clues to the identity of the murderer or FBI files on various suspects, engages users of Intel Intercast technology-enabled PCs more fully in the plot by allowing viewers to solve crimes along with the detectives on screen.

During the fall 1996 season, NBC delivered Intercast programming during select National Football League games each week, using the technology to illustrate key NFL plays and deliver game statistics, athlete bios, and other information related to the game. And, NBC supplemented the television broadcast of the 1996 Olympics with more than 85 hours of Intercast content, confirming that the new medium is proven and reliable.

7.4 QVC

QVC, the 24-hour cable network focused on shopping, is using Intel Intercast technology to broadcast web pages that provide descriptions and graphics related to the item being sold on-air. In addition, QVC will allow viewers of its Intercast programming to order the on-air item by clicking a link that connects to QVC's website. The enhanced product information is available around the clock, every day of the week.

7.5 WGBH

WGBH, a provider of programs for the national Public Broadcasting System, is broadcasting Intercast content with its popular NOVA program in the Boston area.

8. Content Potential is Virtually Unlimited

Intel Intercast technology enables broadcasters to send rich content over the air, then augment it with links to the World Wide Web at their discretion. The following examples outline some of the ways in which the Intercast medium could be used to enhance the information and entertainment value of television programming.

8.1 News

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- When special events occur, for example, the Oklahoma City bombing trial, PC users could stay informed by viewing supplementary Intercast content about the day's witness testimonies, court disruptions, or legal reviews.
- Using the alert feature and closed-captioning, users could define key word alerts, for example, Iraq or Kurds, that would automatically notify them of a news story containing the key word.
- Broadcasters could create chat links that let users discuss controversial issues, take part in political debates, or televote.

8.2 Education and Edutainment

- A political science student watching election coverage could receive a broadcast web page with a biographical sketch on a certain Congressional representative. A URL within the web page could link the user in real time to the website for that representative.
- Children watching an educational show could participate in interactive activities or practice exercises and later check their responses against an answer key.

8.3 Sports

- Sending a "scoreboard" with the broadcast of an NFL game would let users access the current score or a wide variety of statistics at their convenience.
- Broadcasters covering the semifinals at Wimbledon could send statistics or biographical information that high-light individual players' achievements.
- Broadcasters could transmit rule books specific to the sport that viewers are watching.

8.4 Lifestyles

- PC users tuned into a cooking show could watch the entree being cooked and at the same time receive related information, such as the recipe, menu suggestions, or complementary wines.
- Pictures and information about a favorite character in a daytime TV drama could be simultaneously viewed in the web browser window by users when the character appears in the TV viewing window.
- Movie connoisseurs could receive background information on characters, actors and actresses, apparel or other set items, directors, special effects, or even similar movies.

8.5 Music

- Intercast content associated with a music video could allow the user to receive the lyrics of a song that the artist is performing, sheet music, or brief "audio clips" of new releases.
- The user could click a button to bring up a snapshot of the CD cover or a list of other titles on the release. An "Info" button might point to an Internet music shopping service, where the user could purchase the CD. A "Tickets" button could display a list of the performer's upcoming concert tour dates.

8.6 Advertising

- the user to examine, for example, Saturn's home page, while watching a commercial for the Saturn coupe. Further, a hyperlink to the advertiser's website would let users with Internet access transparently connect to the site, where they could get additional information, inquire about local dealerships, or fill out a response form for a rebate program.

8.7 Children's Programming

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- Sports broadcasters could offer "trading cards" for children to print out.
- Broadcasters could send alphabet sheets, workbooks, coloring books, or instructions for home experiments.

8.8 Chat Sessions

- Pointers to servers on the Internet, sponsored by the content provider and its advertisers, could designate electronic meeting points for discussions spurred by TV content— whether it's Melrose Place, Crossfire or Star Trek. Discussions could occur during regular programming and be highly interactive.

9. Intercast™ Content Management Software

9.1 Introduction and Overview

This section provides an introduction to the Intercast Content Management Software(ICMS), also known as the Intercast "Broadcast Site" or "Head-end" system. The ICMS system takes previously authored content (web pages, associated files such as .GIFs, and what are called "billboards") and inserts it into the outgoing television broadcast signal at the appropriate time.

Customers on the receiving end may view the content on PC's which are equipped with appropriate Intercast hardware and software and connected to either an antenna or standard television cable.

The first step in the production process is to author the HTML content. Authors may create the content using any tools they choose. Once created, the HTML content is transferred to one of several ICMS systems which, under manual or automatic (time-activated) control, send the content to a standard device known as a "VBI Inserter". The VBI inserter then immediately places the HTML data in the video signal. The video signal containing the HTML data is then transmitted on-air or recorded onto video tape. An overview of the process is shown below in Figure 6.
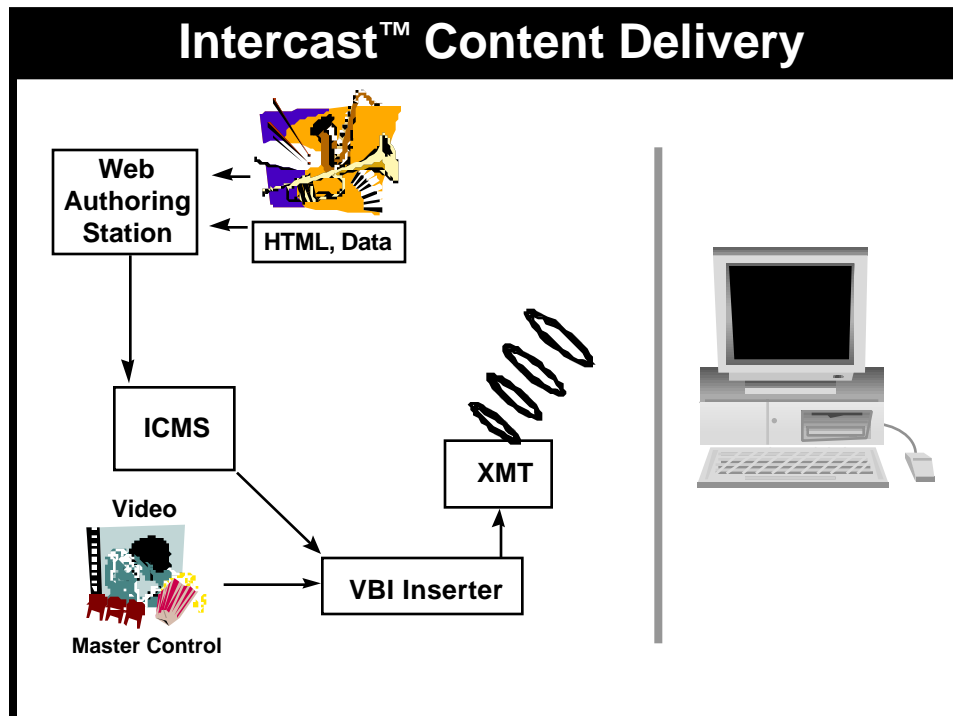

Intercast™ Content Delivery

Web Authoring Station

HTML, Data

ICMS

Video

Master Control

VBI Inserter

XMT

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Figure 6. The Intercast Technology System Overview

9.2 Content Authoring

The first step in the process, the creation of the HTML content, is done independently of the Intercast ICMS systems. The HTML pages, JPG / GIF files and other associated files are created using the same tools as those used for creating content for the World Wide Web. Developing Intercast content does not require any special authoring tools; however, delivering content for Intercast technology requires some unique considerations. In particular, the broadcaster must synchronize the delivery of web content related to a specific program. Therefore, the broadcaster must pre-send the web content prior to the desired viewing time. In order to do this, the broadcaster must consider the size of the content and available bandwidth. These two factors affect when the broadcaster needs to send the content. In addition, the content developer should recognize that viewers may join the program mid-stream or change channels during the program. In either case, the viewer may not receive all the content for a specific set of web pages. Each of these issues is discussed below in more detail.

9.2.1 Backchannel

The developer may want to consider whether their content assumes the presence of a back channel modem. Strictly speaking, Intercast technology does not require a modem, but the user experience is significantly enhanced if it is present. The modem also extends and strengthens the hybrid application model applied to Intercast technology. Since Intercast uses a one-way, broadcast connection to the viewer, if the viewer has no Internet connection, HTML elements requiring communication back to a web server will not function. So, for example, server-based CGI scripts will not operate without a back-channel.

Taking this into consideration, if an author chooses to develop content which does *not* require a back-channel, the content should be complete and compelling by itself and not contain any HTML elements which require interaction with a website. Conversely, if an author decides to assume that a user does have an active Internet connection, items such as CGI scripts and URLs referring to any site on the Web could be included in the Intercast pages.

9.2.2 Size

The developer needs to monitor Intercast content file size to ensure synchronized delivery of the content. The delivery time depends specifically on file size and the available bandwidth (number of VBI lines available). To ensure successful delivery of all content, the developer should minimize file sizes as much as possible.

9.2.3 Bandwidth

The next consideration is bandwidth. Intercast content, as mentioned above, is transmitted in the TV signal, or more precisely, in the "Vertical Blanking Interval" (VBI) of the TV signal (to be described in more detail below). Depending on the number of VBI "lines" reserved for Intercast transmissions by the TV station, the throughput could range from about 9,600 baud (for one line of VBI) to 28,000 baud (for three lines of VBI). Some stations could allocate even more than three lines of VBI for use. Given this bandwidth consideration and the fact that the content needs to be received by the viewer in a timely manner, the transmission of large files should be avoided, unless sufficient time to download is provided in advance of use.

9.2.4 Incomplete Page Set Transmission

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Additionally, the developer should consider how the user experience changes if certain page sets do not appear. This may occur when the user changes channels or joins a program midway through an Intercast content transmission. In either case, not all of the page sets will arrive on the client PC. The developer should consider ways to ensure a cohesive and consistent experience in the case of missing page sets. Therefore, the content developer should develop their web page content to support continuity if particular page sets do not arrive because the viewer joined late or changed channels.

9.2.5 ActiveX/Java Support

Currently, Intercast technology does not support ActiveX controls or Java applets. A future release of the Intercast viewer and authoring tools will provide this support.

9.2.6 Viewing

Design content that the user can easily view using the smaller Intercast viewer web window. Avoid requiring the user to scroll down through the Intercast viewer web window to view the entire page contents. This is not a requirement, but does make the Intercast technology viewing experience more enjoyable.

The Intercast technology SDK discusses the treatment of all the issues listed above in greater detail. For information on the SDK see : developer.intel.com/ial/intercast/

9.3 Inserting Content into the VBI

A VBI Inserter, described above, is the device used to place data on specific lines of the VBI. In its basic configuration, an inserter has an "input video", "output video," and a "data input" port. And so, for example, a person responsible for the VBI inserter can program it to "take the data coming in on the Data Input port and insert that data onto VBI lines 12, 13 and 17 of the video signal." In the USA, the format (speed, voltage, etc.) of the data as it appears in the TV signal is specified by the North American Basic Teletext Service (NABTS) standard. In other parts of the world, World Standard Teletext (WST) signaling is used.

The more VBI lines allocated for Intercast content use, the greater the amount of data which can be transmitted per second. The broadcast facility management determines the number of VBI lines allocated to particular Intercast content transmissions.

By law, certain lines in the 10-20 range may not be used for data. For example, line 19 is reserved for the standard TV "ghost canceling" signal. Also, line 21 (which technically is not a part of the Vertical Blanking Interval) is also used to transmit closed captioning data.

Because of the high speed of NABTS VBI data, that data (including Intercast data) cannot be recorded by standard consumer VCR's such as VHS. (Note that closed captioning, however, since it has a much slower data rate <u>can</u> be recorded on consumer VCR's.) More expensive consumer recorders, depending on the manufacturer, <u>may</u> be able to record NABTS data. Almost all professional and broadcast tape machines, if properly configured, <u>are</u> able to record and playback NABTS (and therefore Intercast) data.

9.4 "Pages," "Page Sets," and "Packages"

Understanding the concept of Pages, Page Sets, and Packages will help explain some of the details of the ICMS systems. See Figure 7.
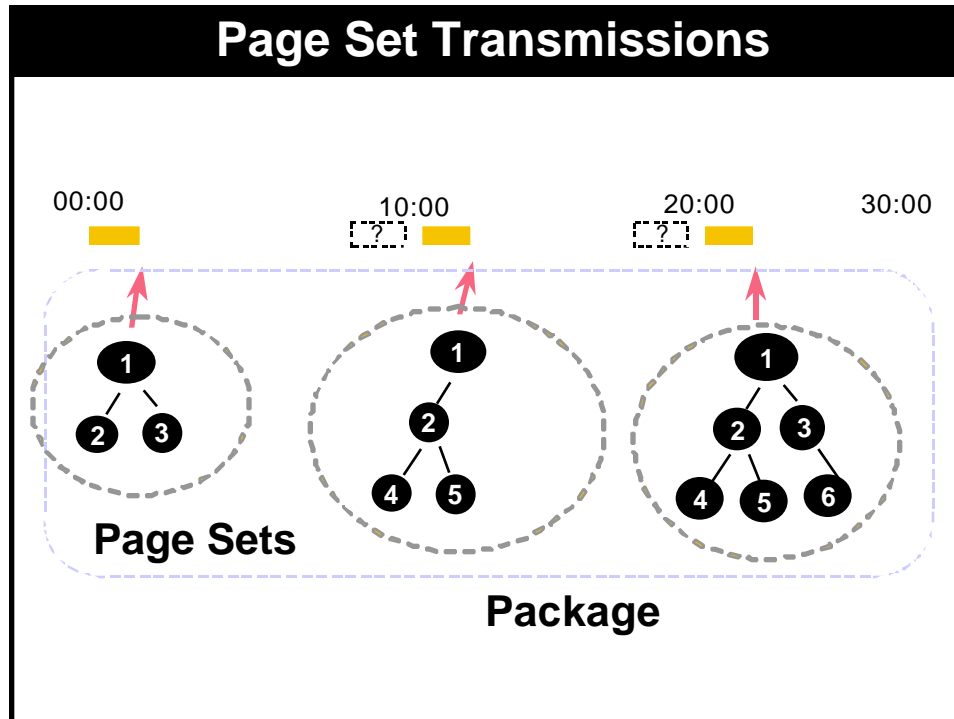
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Figure 7. The Intercast Content Management Software Package Overview

A "Page" refers to an HTML page along with its required resources (GIF files, JPG files, etc.). A "Page Set" is a hierarchy of pages typically built around a single theme and typically referring to a particular scene or segment of a television show. A "Package" consists of all of the page sets for a single show.

As an example, assume that a broadcaster will transmit Intercast content as part of a 30-minute crime show. Also assume that the first ten minutes of the program show the commission of the crime, the second ten minutes show the investigation of the crime, and the last ten minutes show the capture of the criminal. In this example, an Intercast author/producer might choose to create one page set for each segment. For example, the developer could create a page set for the first ten-minute segment (the "Crime Scene" page set), one for the middle ten minutes ("Investigator's Notebook" page set), and one for the final ten minutes ("Arrest" page set).

Once these pages and page sets are created, the author would use a simple ICMS tool, called the Intercast content "Package Generator", which runs on the authoring station, to gather all the required HTML pages and resources for all page sets into a single directory. The files in that single directory—all the files required for the program—are called the "Package" for that show. This entire package would them be transferred as a unit to other ICMS systems for scheduling and transmission.

As can be seen above, individual pages in page sets can be arranged in a hierarchy. When transmitted, the ICMS system sends the pages from the bottom level (lowest level in the hierarchy) upward. When received by the viewer's PC, the pages are put into a cache. The last file to be sent is the top file in the hierarchy. Once this top page is received, the viewer's system "triggers" this page into view.

Links between the pages in the hierarchy are file links. So, when the user clicks on a file link in the top-level page, the linked-to page is retrieved from the cache and immediately shown to the user. Because the page is cached on the hard drive, the response is nearly immediate (as opposed to retrieving a page from the Internet). As mentioned above, if the

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page author chooses to place an URL in the page, and the user has a back-channel connection, the page specified in the URL will be retrieved from the specified site on the World Wide Web.

9.5 Billboards

In addition to sending HTML pages, the ICMS systems can also transmit what is called a "Billboard." This is a small 64x64 bitmap which appears in the upper right corner of the Intercast technology user interface. (See the "BB" area of the PC screen in Figure 1.) The broadcaster can use the billboard area for any purpose, but it is most often used to display station or advertising logos.

In all of the explanations below, although not specifically stated, the mechanisms described for sending HTML content can also be used to send billboards.

9.6 The ICMS Systems and Production Methods

The ICMS system controls <u>when</u> to transmit Intercast content. The ICMS system supports several methods of transmission. Before describing the system, let us first look at a simplified layout of a typical Broadcast/ Content Provider facility as shown in Figure 8 below.

Typical Content Provider System Configuration
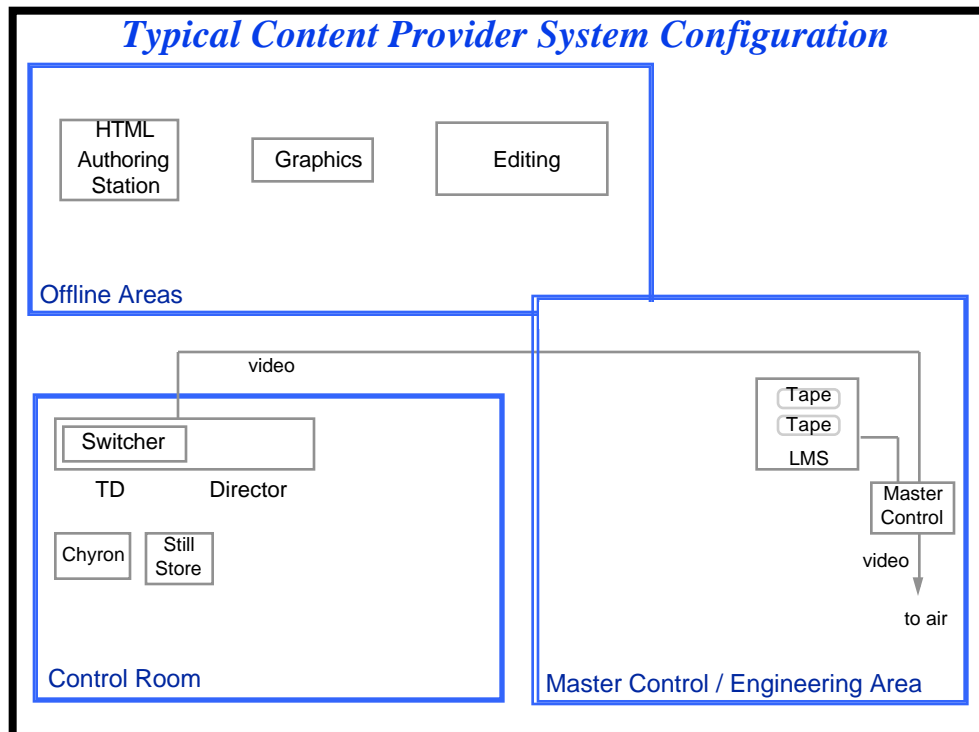
Figure 8. The Typical Broadcast/ Content Provider Facility

There is typically what could be called an "Off-line" area in which editing and graphics creation are performed. HTML content development for a station's website might also be performed in this area.

Another area is the "Control Room" where a live program is produced and brought to air. This room contains such tools as the "switcher," "still store," and "Chyron" which are operated live on-air.

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Another area could be called the "Master Control/Engineering area" which houses Master Control (the switcher which essentially makes the final selection of what is put on-air), possibly includes a robotic playback automation system (such as a Sony LMS), and usually includes a "rack area" which contains devices such as a VBI Inserter.

With this overview in mind, let us next describe the various transmission methods for Intercast technology, how they fit with current television production processes, and where the ICMS tools may be located in a television facility.

9.7 Manual Transmission Method

One method to transmit an Intercast Content Page Set is to simply select a page set with a mouse and send it immediately. This method is typically used on a live show in which you cannot know in advance what time the page set should be sent. This is called "Manual" transmission and is accomplished by the ICMS system called the "Air Station." The process flow is shown in Figure 9 below.
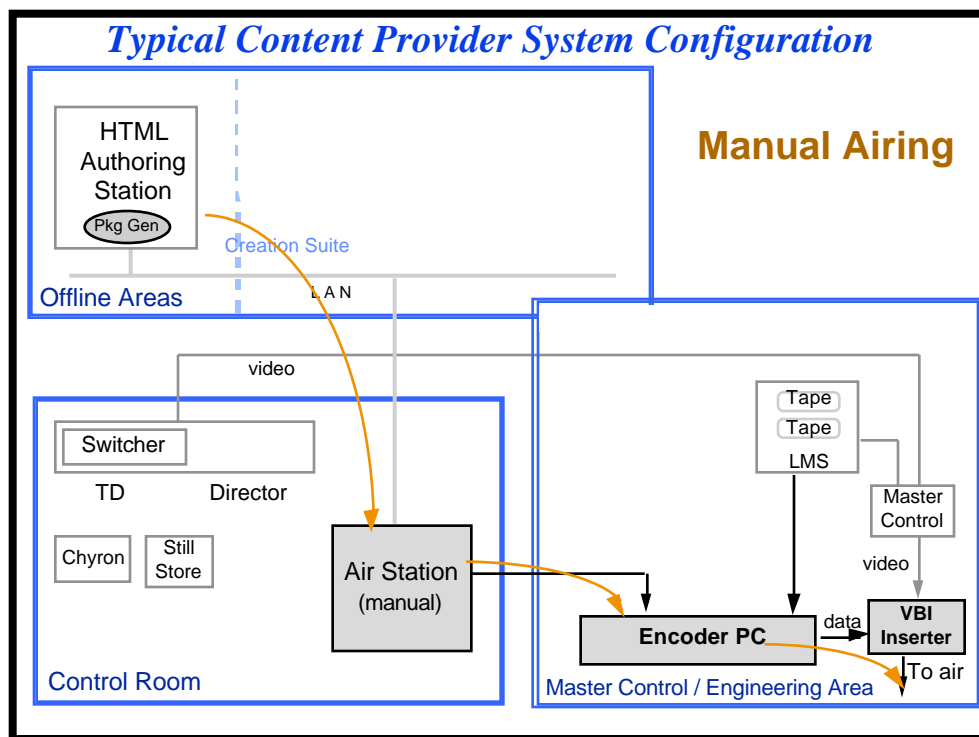

Figure 9. Intercast Content Manual Transmission Process

A more detailed description of the manual transmission method may best be given using an example—a live evening news program. Assume that, on the morning before the show, the tentative plan is to do news pieces on the following topics: the election, Bosnia, and a flood. Just like a graphics person might pre-compose some "over the shoulder" backgrounds during the day, the Intercast Content HTML author would compose page sets on each topic.

The author would then run the Intercast Content Package Generator on the authoring workstation in order to gather all HTML components (files) for all page sets into a Package. This package would then be placed in a directory with an intuitive name for future retrieval by the operator of the Air Station.

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Prior to air time, the operator of the Air Station would access the file system of the authoring station (presumably over an internal LAN) and transfer the package (containing the election, Bosnia, and flood page sets) into the Air Station. Once the package is imported, the operator of the Air Station would see the individual packages on the Air Station's display. During the news program, when the topic of Bosnia is discussed, the Air Station operator merely uses the mouse to select the Bosnia page set and start the transmission of the data to the viewer.

After leaving the Air Station, the data flows into the Intercast Technology Master Encoder PC. The Master Encoder multiplexes (combines) the data streams from other Intercast technology devices elsewhere in the facility (for example other Air Stations) and adds necessary protocol bits (VIP -Vertical Indexing Protocol) to the data. It then sends the data to the VBI inserter. The VBI inserter is an off-the-shelf product from Norpak corporation which can place the data on any VBI line (chosen by the management of the facility) of the TV signal for transmission.

9.8 Automatic Transmission Method

Automatic transmission simply refers to pre-scheduled transmission of page sets based on time of day. This method can be used when the time for airing a page set is known beforehand. Example situations where this may be appropriate are documentaries and situation comedies where a previously-created videotape can be reviewed to determine the exact time in the program when a specific page set should be transmitted.

As mentioned previously, the creation of the page set is done using standard HTML authoring tools. Then time tags are added to the page sets via the Intercast Technology Time Coding Station. These time tagged page sets are then transferred to the Intercast Technology Sequencer which monitors time of day and transmits the page sets at the time specified in their time tags. The process flow is shown in Figure 10 below.
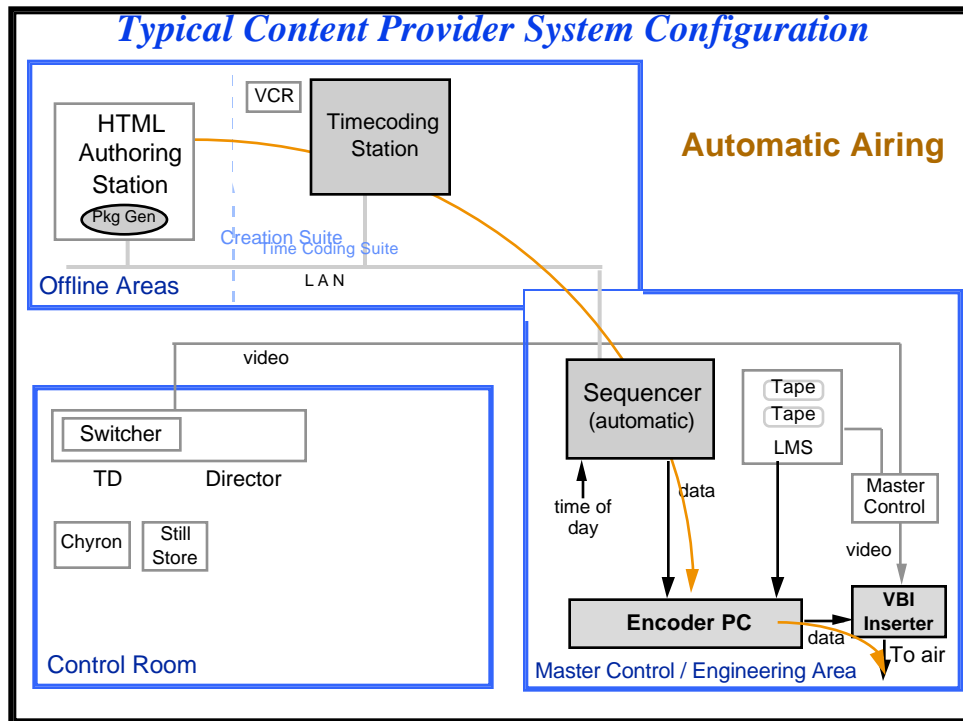

Figure 10. Intercast Content Automatic Transmission Process

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Therefore, four basic steps are required: (1) create the page sets in the authoring station, (2) run the "Package Generator" to gather the page set files into a "Package," (3) transfer the package into the Time Coding Station where each page set can be time tagged, and (4) transfer the package (with the time-tagged page sets) to the Intercast Technology device called the "Sequencer" which monitors time-of-day and transmits each page set at the appropriate time. This is illustrated in Figure 11 below.

9.8.1 Step 1: Time tagging step

Time tagging of the page sets is accomplished using the Intercast Technology Time Coding Station. Once again, the process is best illustrated by an example. Assume that Intercast content is to be produced for NBC's *Seinfeld* program. Also assume that there are three segments in the program: the "apartment segment," the "restaurant segment," and the "store segment". Finally, assume that the completed videotape of the program has been delivered to NBC, and NBC's next step is to prepare the Intercast content.

After viewing the tape, the HTML author (often at the direction of a producer) would perhaps decide to construct three page sets, one for each segment. After completing the pages and page sets, the author would then run the Intercast Content Package Generator (described above) to gather all file elements into a final Intercast Content "*Seinfeld* Package." After doing this, the author's job is finished, and the next step is to attach the time tags to the page sets.

To decide on the appropriate times to transmit each page set, the Intercast technology producer or Time Coding Station operator will typically view ("log") the *Seinfeld* episode to see the timing of the program. Let's say that the first segment (the "apartment" segment) runs from timecode 00:00 (minutes / seconds) to 10:00; the second segment (the "restaurant" segment) runs from 12:00 to 20:00 (note the two minute commercial break between 10:00 and 12:00); and the final "store" segment runs from 20:00 to 28:00. Assume that it makes sense to simply send the appropriate page set at the beginning of its corresponding video segment.

To associate a time tag with each page set, the operator of the Time Coding Station first imports the Intercast technology *Seinfeld* Package from the authoring station to the Time Coding Station. Once the package is imported, the operator would see a listing of the three page sets previously created by the author. To time tag each page set, the operator merely types in the desired start time (the time at which the operator would like the page set to appear on the viewer's screen) or drags the icon of the page set onto a 30 minute timeline representing the length of the show. Times may be changed by merely editing the desired start time or simply moving the start/end points for a given page set on the timeline. For those familiar with computer-based video editing products such as the Avid™ system, this process is similar to laying down tracks on an Avid Mediacomposer™.

It is important to note that the time tags as entered into the Time Coding Station are offsets from the beginning of the program. That is, rather than specifying that a page should be transmitted at 9:10 PM on Thursday, the operator specifies the time as 0:10—ten minutes into the program. As will be seen later, the absolute start time for the program will be entered into the Sequencer.

Note that to account for the two minute commercial break which occurs between 10:00 and 12:00, the operator of the Time Coding Station is provided with a special icon which specifically reserves time slots for advertisements on the Time Coding Station's display. The operators merely hand-enters the ad time slots or drags the "ad block" onto the timeline to account for this commercial time. The reason for specifically reserving this time slot will be explained in the Sequencer portion of this paper.

Finally, with all time tags entered, the operator re-saves the package.

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Therefore, to summarize, the fundamental purpose of the Time Coding Station is to import packages containing non-time-tagged page sets, place time tags on the page sets, and regenerate the package with time tagged page sets.

The next step in the process is to transfer the package (with time tags) from the Time Coding Station to the Sequencer. The Sequencer is described in the next section.

9.8.2 Sequencing Step

After the "Page sets" (in the "Package") are time tagged via the Time Coding Station, the package is transferred to another ICMS system called the Sequencer. The Sequencer monitors time-of-day and transmits page sets at the time specified in their time tag.

Many people are familiar with TV station automation systems such as the Sony LMS™. The LMS can be described as a large juke box of videotapes which is programmed to play certain tapes at specific times of day. For example, Viacom's "Nick at Nite" LMS is loaded with a several tapes including commercials and shows. It may be programmed, for example, to play the *Dick Van Dyke* tape at 10:00 PM, the Pepsi commercial at 10:06 PM, etc.

The Intercast Technology Sequencer can be viewed as an "Intercast Technology LMS." That is, Intercast Content "Packages" are loaded into the Sequencer, and the operator programs the Sequencer to, for example, "start the *Seinfeld* package at 9:00 PM."

The operator of the Sequencer might program it once per day with events for the next 24 hours. To do this, the operator imports Packages into the Sequencer (file transfer over the LAN) and specifies when each Package should start.

Continuing with the *Seinfeld* example, the Sequencer operator would import the time-tagged *Seinfeld* package from the Time Coding Station, and program the Sequencer to "play this *Seinfeld* Package at 9:00 tonight." As a result, at 9:00 PM, the Sequencer would open the *Seinfeld* package and look at the time tags on each page set in the package. Note that time tags on page sets are relative to the start of the show. Consequently, a page set with a 00:00 time tag would be transmitted at 9:00 PM plus zero offset which simply means 9 PM, and a page set with a time tag of 10:00 would be played at 9:00 PM plus 10 minutes offset or 9:10 PM, etc.

When the appropriate time comes and a page set is transmitted by the Sequencer, the data flows (via LAN) to the Intercast Technology Master Encoder PC (described above) which adds necessary protocol bits to the data and sends it to the VBI inserter for actual insertion into the TV signal.

As packages are imported into the Sequencer and the operator programs the start times, the Sequencer checks for overlap between programs. And so, if the *Seinfeld* package were programmed to play from 9:00 PM to 9:30 PM on Thursday, any attempt to place another program in this time slot would be prohibited, with one important exception. It was pointed out in the Time Coding Station section above that the operator could reserve slots for "ads". The reason for doing this during the time coding process is as follows: After the operator programs the Sequencer to "play the *Seinfeld* package at 9 PM", unless small blocks of time are reserved for ads, it would not be possible to, at a later time, import advertising packages into the *Seinfeld* time period. In the *Seinfeld* example, by reserving 10:00 to 12:00 as an "ad block" in the Time Coding Station, the Sequencer will permit an operator to drag a Pepsi commercial into this two minute block of time during the *Seinfeld* playback period.

9.9 Lay-to-Tape Method

This is the process by which Intercast content, rather than going directly to air via the Sequencer or Air Station, is placed on a videotape along with the primary video program

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material. For those familiar with placing closed captioning onto tape, this process is similar. Intercast content is prepared and time tagged, then the original program video tape is played-back through a VBI inserter (where the Intercast content data is added), and the combined video and data are recorded onto a new video tape. As a result, when the new tape is played back, both the video and Intercast content data will be played on-air.
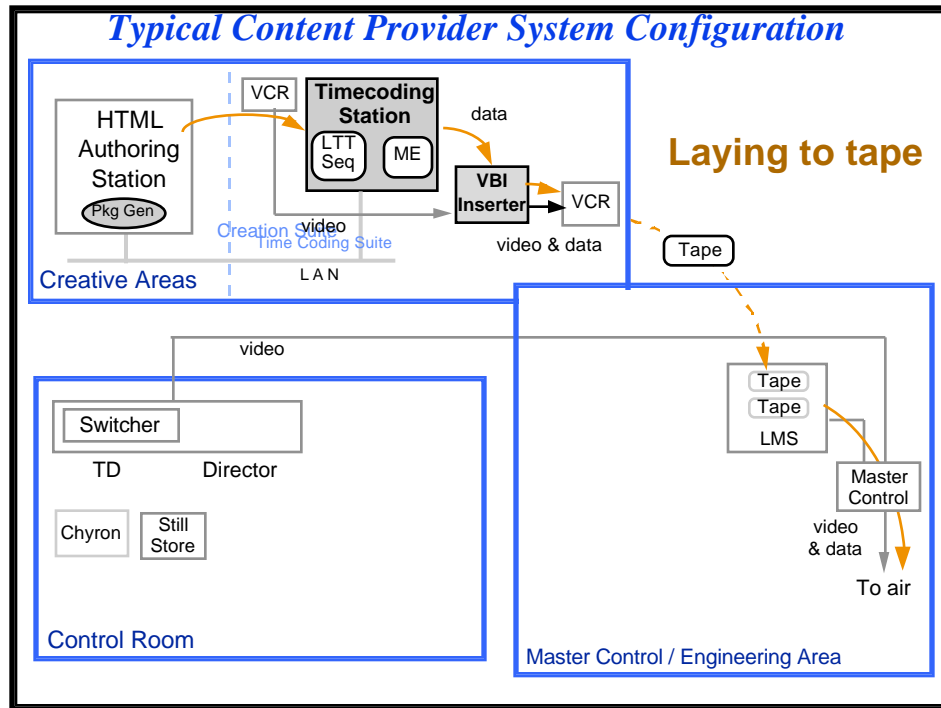
The process flow is shown in Figure 11.

Figure 11. Laying Intercast Content To Tape Process

Note that this method eliminates the need for the on-air Sequencer in the Master Control/Engineering Area. The staff in the Master Control/Engineering Area would find this advantageous since there is no change in routine for them. Since the data is placed directly onto the video tape by another group, the LMS operator (or equivalent) merely loads the tape into the LMS and plays it on the air as usual, with no regard to the Intercast content data. This method, however, creates an extra step for the people in the Off-line area since the data needs to be laid to tape.

In this configuration, a limited function Sequencer, called the Lay-to-Tape Sequencer ("LTT Seq" in the figure), is installed in the Time Coding Station. A version of Master Encoder software (labeled ME in the figure) is also installed in the Time Coding Station. Also, a playback VTR, a record VTR, and a product called V-LAN are required. V-LAN (not shown in the figure) is an off-the-shelf product which permits a PC to control a wide variety of professional tape machines via the PC's standard serial port.

In terms of production, the Laying to Tape method is similar to the Automatic method. The HTML pages are composed in the authoring station, and the page sets are time tagged in the Time Coding Station. The difference is that, after time tagging the pages, the Time Coding Station operator presses the "Lay-to-tape" button on the Time Coding Station. This causes the Time Coding Station, via the V-LAN product, to roll the record and playback VTRs. In addition, the Time Coding Station monitors SMPTE time code coming from the playback VTR. At the appropriate time offset into the program, the Time Coding Station sends the corresponding page set to the built-in Master Encoder which then sends the data

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to the VBI inserter for insertion into the video signal. The combined video and data signals are then recorded on the record VTR.

9.10 Website Grabber Method

In addition to the functions described above in the Sequencer section, the Intercast Content Sequencer also has the capability of grabbing pages from a website and transmitting them via Intercast technology. Specifically, the operator may program the Sequencer to "grab URL www.intel.com along with n levels of child pages and send them at 10 AM."

As a result, if you are already maintaining a website and wish to start transmitting Intercast content data with minimal additional authoring effort, you can use the Sequencer to grab your existing pages from your existing website, in many cases without change, and send them at specified times.
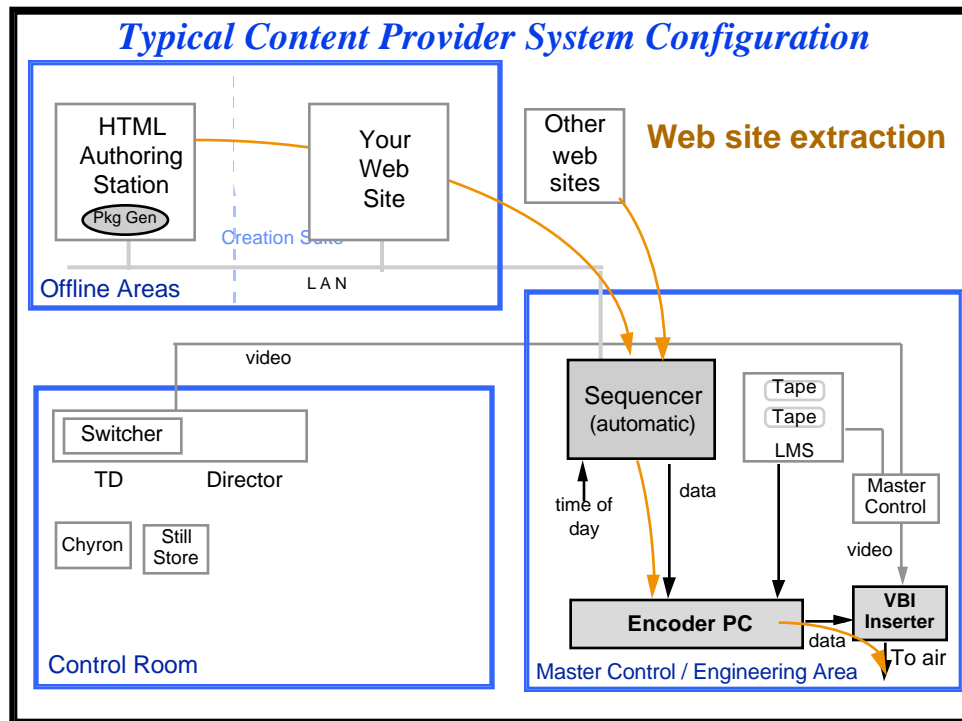
This is illustrated in Figure 12 below.

Typical Content Provider System Configuration

Figure 12. Website Grabber Process

9.11 Additional Automation Features

The ICMS systems also have the capability of interfacing with a limited number of station automation systems (including some versions of Sony LMS). This makes it possible to read an LMS play list and automate certain Intercast content programming functions. Contact Intel for additional information. http://www.intel.com/iaweb/intercast/

10. More Information

Appendix A lists a number of websites providing some excellent background information on the Intercast technology. Review these sites thoroughly to get a solid understanding of the technology, to understand the opportunities, and to identify who is participating.

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Appendix B lists several retailers for purchasing Intercast technology tuner cards and PCs..

If you'd like to get started developing Intercast technology web content, Intel's Hybrid Authoring Studio is a good place to begin. The Hybrid Authoring Studio (HAS) in Hillsboro, OR provides a complete Intercast technology web content development and authoring environment. This environment provides the developer with a complete end-to-end Intercast technology development environment. The HAS can also take this content and merge it with the video content to create a master betacam SP tape. This master tape contains the video plus all the web content inserted into the VBI signal. With this tape you are ready to broadcast Intercast technology content. See www.intel.com/drg for more information about the HAS.

11. Conclusion

Intercast technology combines TV and web content together and delivers an entirely new viewer experience. Intercast technology delivers the best of two worlds: TV and web content. It promises great opportunities for broadcasters, OEMs, software developers, and content developers. The technology is well tested and support continues to grow. As a hybrid application, Intercast technology pushes content to the local PC, provides a fast and transparent user experience, and delivers real-time access to Internet content, despite the limited bandwidth available to most PC owners via their 28.8 kbps modems.

Intercast technology represents an excellent opportunity for broadcasters, advertisers, content developers, and software developers to deliver rich, compelling, and interactive viewer experiences on a PC. Because Intercast technology requires no special authoring tools to develop content, content developers can begin creating Intercast content today. With the assistance of the Intercast Content Management Software SDK, developers can take web content and easily prepare it for distribution via an Intercast broadcast. Interested developers should contact Intel's Hybrid Authoring Studio to learn more about Intercast technology and the related development environment.

For additional information, please visit www.intel.com/drg, www.intercast.org, and www.intel.com/iaweb/intercast.

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Appendix A

A.1 Intercast technology URLs
- www.intercast.org
- www.nbc.com/intercast
- developer.intel.com/ial/intercast/
- www.intel.com/drg
- www.hauppauge.com/hcw/index.htm
- www.ast.com
- connectedpc.com/iaweb/intercast/demo0.htm
- Shockwave demo of Intercast technology
    - developer.intel.com/ial/intercast/PRODUCT.HTM
- Wavephore Hardware Developers Kit
    - www.wavephore.com
- www.quantex.com

Appendix B

B.1 Where to purchase Intercast technology products

- Best Buy
- CompUSA
- Microwarehouse
- QVC

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