

Microsoft

Broadcast Technologies White Paper

Introduction to Broadcast Architecture

This paper provides an overview of what broadcast-enabled computers are, how they work, and what opportunities they offer.

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Overview of Broadcast-Enabled Computers

A *broadcast-enabled computer* is a versatile next-generation computer that blends television with exciting new forms of information and entertainment. It blurs the line between television, web pages, and computer content. Software running under Windows® 95 together with receiver cards allows broadcast-enabled computers to provide five new capabilities:

- Computer-driven versatility and power in choosing shows and planning television consumption. Broadcast-enabled computers display program guide information of many different sorts in a single form, where shows can easily be previewed, scheduled, and if appropriate paid for. Parents will particularly appreciate the flexibility with which they can place restrictions on what their children may watch.
- Digital display of digital television signals. Broadcast-enabled computers complete the path for delivering full-resolution digital picture and audio rather than converting digital signals to analog. Broadcast-enabled computers thus offer an incremental, flexible, and affordable migration path to higher resolution television.
- Television transformed into a multimedia experience. The combination of television with broadcast digital data offers a new world of entertainment possibilities.
- Marketing and delivery of digital goods and services to viewers by way of digital data broadcasts. Broadcast-enabled computers are designed to filter high-bandwidth broadcast data streams so as to extract and save whatever the viewer may have subscribed to, requested, or purchased. In combination with the broadcast-enabled computer's system security, this capacity provides a reliable and economical channel for selling digital goods and services. Such broadcast data channels today can deliver more than 10 gigabytes of data per day, and within a year they are projected to deliver more than 60 gigabytes per day.
- Potential for immediate viewer response. A low-cost, low-bandwidth modem *back channel*—the segment of a two-way communications system that flows from the consumer back to the service provider—permits viewers to react immediately to television program content and advertisements. Given the excellent security of broadcast-enabled computer systems, viewers can easily purchase goods and services from their living rooms.

These capabilities are achieved through a combination of hardware and software components that allows personal computers to serve as clients of broadband digital and analog broadcast networks. Following a standard client/server computing model, broadcast-enhanced computers in the home are equipped to act as “clients.” In other words, they serve as data tuners that receive and process broadcast streams provided to them by powerful “servers,” which are transmitters of all sorts.

A broadcast-enabled computer can easily be equipped with appropriate receiver cards and supporting software to receive broadcasts in virtually any format from almost any source. Whether the transmission is from a satellite, by cable, or by conventional terrestrial antenna, whether the signal is digital or analog, whether it is a video, audio, or binary data stream, broadcast-enabled computers are designed to accommodate it in a standard way using Windows 95. In fact, the same broadcast-enabled computer can receive almost any combination of sources and data types.

Almost all the technology and infrastructure needed to create broadcast-enabled computers is currently in place. In particular, broadcast-enabled computers rely on broadcast networks and a phone-line back channel that are inexpensively and reliably available in virtually every home today.

Broadcast-enabled computers are the most flexible and cost-effective path to television of the future. Not only do they have a lot to offer immediately, but also they support low-cost incremental steps to higher resolutions, growing back-channel bandwidth, increasing interactivity, and new multimedia forms of television. For viewers and content producers alike, broadcast-enabled computers provide

painless interim solutions at every stage of the path. Rather than becoming obsolete when new technology becomes available, they are designed to incorporate technological advances smoothly.

Broadcast-enabled computer software has been designed so that some simple, impressive combinations of television and information content can immediately be delivered in the form of web pages. Broadcasters can thus take advantage of standard web design tools, scripts built in the Visual Basic® programming system, and skills they already have to create multimedia television rapidly and easily. In the cases where web functionality is insufficient, programmers can readily take advantage of the power of the system software provided for the broadcast-enabled computer to write special-purpose applications.

The *Broadcast Architecture* presented in this kit enables existing broadcast networks, such as satellite or analog cable, to serve as carriers for video, audio, and data bound for broadcast enabled computers. The following sections review the components of the Broadcast Architecture:

- Broadcast Head End
- Client Hardware in the Home
- Broadcast Content
- Client Software

Broadcast Head End

Before any broadcast-enabled computer can receive television signals and data, the content must originate from one or more broadcast sources. Whether the data originates from a satellite transmitting information to receiver dishes or a cable office sending information over the cable network, content bound for the broadcast-enabled computer begins its journey from a head end.

In conventional television broadcasts, the analog signal received by the television set is broadcast from studios by powerful antennas. Individual television sets can receive the broadcast content at any time simply by being turned on and tuned to the appropriate frequency. With the Broadcast Architecture described in this kit, broadcast transmitters send many different kinds of content (video, audio, and arbitrary data), both analog and digital, through different types of broadcast networks (satellite, cable, and so on). People can then tune individual broadcast-enabled computers to receive the content in those broadcasts.

The components at the head end consist of various content server applications that obtain the data to be broadcast, schedule broadcast times, and pass the data to other components that manage data transmission. The Broadcast Architecture provides special data services to facilitate movement of content from the content server application to the point of broadcast. Bridge software handles sending the data to the broadcast hardware.

Client Hardware in the Home

Like any multimedia computer, a broadcast-enabled computer has a fast processor and bus, plenty of memory and hard drive capacity, a CD-ROM or DVD drive, a modem, a keyboard, a pointing device, and high-quality sound components. With advanced power-saving features, it is always on, silently monitoring broadcast channels 24 hours a day, ready to respond instantly at the touch of a button. Its operating system is Windows 95. It is usually connected to a large video monitor.

The broadcast-enabled computer has its own remote control that includes its pointing device. In addition, its keyboard is generally wireless and also includes television control keys. In both remote control and keyboard, the television keys are implemented using standard Windows 95 key codes.

Inside the broadcast-enabled computer's case are specialized cards necessary to receive, tune, decode, and display the large data streams received at speeds up to 30 megabits per second. These cards offload so much of the video and audio processing that playing full-screen television requires only a small portion of the CPU's capacity.

A modem attachment to the home telephone line can provide a secure and inexpensive back channel to head-end servers. Connected to a merchant server, the modem can let viewers make immediate purchases from advertisers and broadcasters.

Note, however, that a back channel is not necessary for viewers to interact with multimedia television shows. The computer by itself provides ample capacity for complex interaction. The back channel is necessary for communication and commerce, but not for viewers' active participation in the multimedia television experience.

Broadcast Content

Broadcasting data is a very efficient way to distribute information and applications. Analog and digital broadcast transmissions already reach over 90 million households in the United States—there were 95.9 million television households in the United States in 1995, according to *Digital Household Report* of August 31, 1996, the number projected to grow to 96.9 million by the end of 1996. Broadcasts will also reach more households overseas as international direct-broadcast satellite networks continue to proliferate.

Although television will occupy the bulk of broadcasts for the near-term future, many other goods and services can be delivered using existing digital channels, including the vertical blanking interval (VBI) within analog television signals. For example, the Broadcast Architecture on the client computer can automatically receive and display electronic program guide data such as that provided by StarSight and other companies.

In addition, viewers will be able to subscribe to a wide variety of digital broadcast services that incorporate news, stock quotes, software and games for sale or rent, and so on. A broadcast-enabled computer can continuously monitor data streams arriving over the broadcast channels 24 hours a day; it can automatically store the latest stock quotes, sports scores, local news and weather forecasts, software upgrades, and whatever other information the viewer subscribes to, without using a modem or Internet connection. Strong encryption makes such data streams suitable for delivering high-priced or confidential products.

Currently, broadcast digital data streams have capacities in the neighborhood of 1.2 gigabits per second, which translates into the transfer of more than 10 gigabytes every 24 hours. As these streams grow to around 6 gigabits per second in the relatively near future, they will be able to deliver over 64 gigabytes of information per day.

Broadcasts can also occur over less traditional channels. Broadcasting over a computer network to many different recipients at once is termed *multicasting*, in contrast to the usual practice of *unicasting*, which involves sending a separate copy of the message to each recipient. In a corporate context, multicasting can greatly reduce network traffic over intranets when compared to unicasting the same data to the same recipients. The broadcast-enabled computer is a perfect client for such multicasts both because of its high-bandwidth capabilities and because internally it handles all broadcast data as standard Internet Protocol (IP) multicasts.

Even without a back channel, television and digital data broadcasts can be synchronized and combined to deliver multimedia television, allowing viewers to interact on-screen with shows so as to play games, obtain supplementary information, express opinions, test their knowledge or skills, and so on. Content providers can use common tools for web site design to create enhancements for their shows, delivered as Hypertext Markup Language (HTML) pages.

With the addition of a back channel, viewers can interact not only with the computer but also more directly with broadcasters, advertisers, and other viewers. A secure back channel also offers an unprecedented opportunity to sell directly into people's homes, letting them purchase from the comfort of their couches.

Client Software

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