

Macromedia® Flash for iTV CDK



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Macromedia® Flash for iTV CDK

By Tonya Grochoske, SpinTV

Interactive Television, What Is It?

Interactive TV covers a variety of technologies — cable and satellite set-top boxes, game consoles, electronic program guides, personal video recorders such as ReplayTV™ or TiVo, “walled garden” formats where programs are framed by additional information and shopping opportunities, video-on-demand and enhanced TV programs that offer in-depth experiences — as well as the base capability to browse the Internet on a television.

Interactive television gives television producers and Web professionals new exciting opportunities to evolve the traditional television experience by offering viewers more reasons than ever before to interact with their favorite shows or access specific content conveniently without leaving the comfort of their couch. iTV incorporates some form of connection with standard television viewing, usually through a set-top box. A set-top box typically sits on top of a television just like a VCR. The user can access this extra TV functionality through a wireless keyboard or a remote control.

The content designer faces a difficult task when confronted with the graphical limitations of the television set. The Content Developer Kit outlines these limitations and presents current accepted formats. Content should be designed to follow the recommendations detailed. Fortunately, many of the resolution and color limitations will be eliminated as digital TV sets become more prevalent.

Different types of iTV

There are different types of interactive television, the 3 most notable today are TV-on-PC (1 screen), Synch to Broadcast (2 screen), and the Set-Top Box connected to TV (1 screen). Each type has its pros and cons for the end-user as well as the Network operator. As iTV evolves, we will begin seeing, not only a stronger focus on multi-platform development, but multi-type development as developers harness newer technologies that focus on reusability and dynamic content transformation.

As these newer technologies mature, content developers need to be educated on what works, and why, and develop for platforms that are readily available and deployed today. Television is evolving, and content developers are the key to TV's new look and feel.

TV-on-PC

The TV-on-PC solution enables the end-user to view enhanced content directly from a personal computer. This solution requires the TV-tuner computer hardware that typically fits in a PCI or AGP slot. It's used to receive and view the TV broadcast signal on your computer.

Synchronized-to-Broadcast (SyncTV)

Is defined as watching a program on TV and simultaneously using a computer to interact in some way with the program's Web site, or the program advertiser's Web content.

Set-top Box

In general, the Set-Top Box is an electronic device that sits on top of your TV set to allow interactive, informational content and video to work together through the middleware platform. Set-top boxes are becoming as media-robust as the average desktop PC with video-on-demand (VOD), MP3 jukebox, smart home and network functions, local and Internet gaming and broadband Internet access.

When developing for a Set-Top Box, you will need to decide between developing an iTV application or Web content for surfing on TV. Television programming content consists of several types of genres that an iTV application can take advantage of:

- **Taped: Scripted**
Episodic: ER
Sitcoms: Friends
- **Taped: Unscripted**
Documentaries: Nova
News/Magazines: Dateline
- **Live: Scripted**
Awards Shows: The Academy Awards
Special Events: Rose Bowl Parade
- **Live: Unscripted**
Sports: Monday Night Football
Live News: Breaking Events

Web programming also focuses on certain types of valuable iTV surfing genres:

- **Advertising & Commerce:** A TV commercial offering the ability to purchase instantly.
- **Personal Web Site:** Everyone has one these days. Accessing a friend or family member's personal Web site for viewing online photo albums or other creative personal interactions.
- **Commercial Web Site:** Every TV network has one, along with most companies in the world. Wouldn't it be convenient to access a TV-compatible version from your couch when they advertise, "for more information go online" from your TV set?
- **Informational:** Make sure any information you post on a Web site for viewing on TV has a purpose. TV viewers don't waste time and will move on if the information provided isn't convenient and valuable.

A New Set of Standards for iTV Content Creation

Interactive enhancements can be as simple or as rich as you choose to make them. Designing and developing interactive television is very similar to Web design and development in that you design for a specific platform using pre-set protocols from a governing standards body. Some middleware platforms contain proprietary extensions to these standards that cause cross-platform content display complications, as is seen between PC and Macintosh® systems or Internet browsers, Netscape® and Internet Explorer.

Using a common set of standards to create iTV content ensures that those programs can be broadcast and delivered to viewers using equipment and services developed to comply with these standards.

Television Standards

There have been about 14 different broadcast standards in use at different times throughout the world. Today, excluding DTV (digital TV), three basic systems serve the vast majority of countries:

- NTSC (National Television System Committee)
- SECAM (Sequential Color And Memory)
- PAL (Phase Alternating Line)

In the U.S., the National Television Standards Committee (NTSC) standards have been established for over 50 years, and a show produced to NTSC standards will be compatible for all TV sets and broadcast stations throughout North America. In Europe, Africa and Asia, Phase Alternation by Line (PAL) is similarly enforced.

According to the FCC-mandated timetable, by 2006, all Standard Definition TV (SDTV) stations in the U.S. will be phased out in favor of DTV (digital television) stations. At that time, the present TV channels (SDTV) are scheduled to go off the air and the spectrum space will be reassigned to services such as wireless phone carriers. Other standards within the industry include: The Advanced Television Systems Committee (ATSC), and for digital television, the European Telecommunications Standards Institute (ETSI).

Note: (See Table 2 Screen Comparison Chart for specific differences in these standards)

Interactive Television Standards

One of the major driving forces behind interactive TV is the convergence of Internet technologies with television. As a result, many of the standards that have been proposed in this area are derivative of Internet protocols, such as HTML, JavaScript™, and Macromedia® Flash. The OpenCable consortium has recently released the Open Cable Application Platform (OCAP), which has a core presentation engine based on an HTML browser with extensions for interactive TV. The Advanced Television Enhancement Forum (ATVEF) has produced a standard set of HTML extensions that have been adopted by OpenCable, as well as some of the key software providers such as Microsoft® and Liberate®. The OCAP and a similar specification from the DVB consortium called the Multimedia Home Platform (DVB-MHP), provide a common framework for developing iTV applications.

ATVEF

The Advanced Television Enhancement Forum (ATVEF), similar to the World Wide Web Consortium (W3C), was formed to define a single public standard for producing and delivering interactive television content. Their goal is to address the gap between content and technology by providing specifications to deliver Enhanced and Interactive TV programming over multiple platforms. The Society of Motion Picture and Television Engineers (SMPTE) has clarified and incorporated the ATVEF specification into the SMPTE DDE-1 specification. The ATVEF, as with the W3C, has not endorsed the use of Macromedia® Flash™ technologies – though, the majority of the iTV platforms support Macromedia Flash at various levels. With the wide support of Macromedia Flash, eventually, these revolutionary vector-based technologies will become a part of the standard.

iTV content requires a certain amount of discipline and understanding of Web development technologies, but a quick overview of the ATVEF Enhanced Content Specification 1.0 will start you on the way.

DVB-MHP

Digital Video Broadcasting, or DVB, is a complete digital television system that encompasses the multimedia home platform, or MHP. DVB-MHP, considered the European standard, has recently been adopted by CableLabs® in the U.S.

The Multimedia Home Platform (MHP) defines a generic interface between interactive digital applications and the terminals on which those applications execute. This interface decouples different provider's applications from the specific hardware and software details of different MHP terminal implementations. It enables digital content providers to address all types of terminals, ranging from low-end to high-end set top boxes, integrated digital TV Sets and multimedia PCs. The MHP extends the existing, successful DVB open standards for broadcast and interactive services in all transmission networks, including satellite, cable, terrestrial and microwave systems.

Table 1: iTV Standards Comparison Chart

Technology	ATVEF 1.1	AOLTV (Liberate®)	Liberate TV Navigator™ Standard 1.2.x	Microsoft® TV Advanced	MSN®TV (WebTV®)	Moxi Media™ Center	Nokia® Media Terminal (OST)	OpenTV® Mosaic	World-gate
Markup Language	HTML 4.0	HTML 3.2	HTML 3.2	HTML 4.0	HTML 4.0	N/A	HTML 4.0	HTML 4.0	HTML 3.2
Scripting Language	JavaScript™ 1.1	JavaScript 1.1	JavaScript 1.1	JavaScript 1.2 Microsoft TV JavaScript	JavaScript 1.2	N/A	ECMA - 262 Revision 3	JavaScript 1.4	JavaScript 1.1
Cookie Support	Not Defined	Y	Y	Y	Y	N/A	Y	Y	N/A
Frames Support	Not Defined	Y, non-traditional	Y, non-traditional	Y, non-traditional	Y, non-traditional	N/A	Y	Y	N
Dynamic Tables	N	Y	Y	N	N	N/A	N	N	N
CSS	Level 1	N	N	Mix of Level 1 Level 2	Mix of Level 1 Level 2	N/A	Level 1	Mix of Level 1 Level 2	N
Macromedia® Flash™	3.0	3.0	4.0	4.0	4.0	5.0	5.0	5.0	N
PNG	Y	Y	Y	Y	Y	N/A	Y	Y	N
JPEG	Y	Y	Y	Y	Y	N/A	Y	Y	Y
GIF	Optional	Y	Y	Y	Y	N/A	Y	Y	Y

Table 1: iTV Standards Comparison Chart

Audio Support	AU, WAV (Optional)	WAV AIFF AIF AU RMF MIDI MID RAM	WAV AIFF AU	MIDI MOD RMF AIFF WAV AU MPEG-1 (layers 1,2,3), MP3 (MPEG-2 layer 3)	Windows Media™ Audio 7, Microsoft Audio 4.0(up to 22 kHz), ACELP by Sipro Labs, MPEG audio layer 1, MPEG audio layer 3	N/A	MP3 WAV	N/A	N
Video Support	Not Defined	N	N	ASF ASX MS Audio MPEG-4 ACELP MP3	Windows Media Video 1, Windows Video 7, ISO-MPEG-4.3, ISO-MPEG-4.2	N/A	Real Player (Version N/A)	N/A	N

* N/A – not available

TV Device Considerations

Computer Screen vs. TV Screen

Resolution of a computer screen is adjustable, from 640 x 480 up to 1280 x 1024. The display dimensions and visible clarity, as well as the resolution of a computer screen is flexible, limited only by its hardware circuitry.

In contrast, a standard television's resolution is limited by the signal it receives. The picture resolution of NTSC analog TVs are always 640 x 480, this ensures that a program is properly aired and within its allocated signal. A horizontal resolution of 640 pixels yields 525 scan lines necessary to transmit a TV signal (483 lines for the viewable picture, and 42 lines for the VBI – where closed-captioning and iTV triggers are written). This standard resolution also matches the 4:3 aspect ratio used to encode video at 30 frames per second. PAL resolution has more information per frame (625 lines) and runs at 25 frames per second.

Compared to standard television (NTSC and PAL), high definition television (HDTV) has twice the luminance definition - vertically and horizontally - and is 25 percent wider. The HD aspect ratio is 16:9. The 16:9 ratio is much closer to the average wide-screen image shown in movie theaters. The biggest difference, and the greatest appeal of HD, is its clarity.

Table 2: Screen Comparison Chart

SYSTEM	NTSC	PAL	HDTV*
Aspect Ratio	4:3	4:3	16:9
Resolution (pixels)	640 x 480	720 x 576	1920 x 1080
Total Lines (per frame) /Field rate (Hz)	525/60	625/50	1125/60
Frame Rate (per second)	30	25	24

*HDTV is only one of the many Digital Television Standards available.

While it is possible to see the lines that make up standard television pictures, HDTV lines are not at all noticeable (See Figure 3). The fine-grained HD picture contains five times more information than does the standard television picture and is accompanied by multi-channel, CD quality sound.

These resolution differences also account for the distance from the screen that content is viewed at, computers (1-3 feet) and television (12 feet).

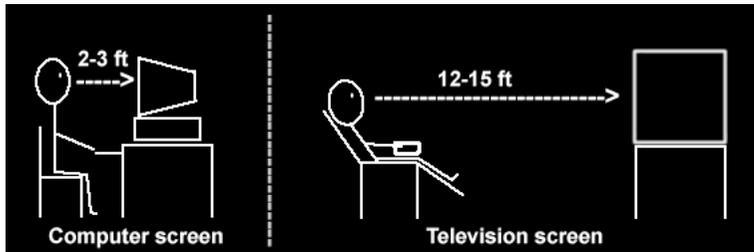


Figure 1: Distance-from-screen comparison. (Image courtesy of SpinTV, Inc.)

TV Device Processor and Connection Speed

Most devices compare roughly to a 133-MHz Pentium®. The newer advanced set-top boxes have better equipped processors and increased memory. An Internet connection, typically used as a back channel for delivery of content or viewer responses, normally consists of a phone modem (56K) or other connection, such as DSL, if the device is equipped.

Bandwidth connections do experience data jams, and as the world turns, so does our attention. TV viewers are just as likely to exit the experience if load time is not considered. Here are some important optimization rules to follow:

- A single content page should be no larger than 30K .
- Use compressed Web graphics such as GIF, JPG and PNG.
- Avoid using animations. If using Macromedia® Flash™, be sure to conserve resources so as not to leave looping scripts or unnecessary ambient animations. Avoid intensive visual effects such as large masks, extensive motion, alpha blending and complex vectors.
- Consider HTML frame sets when constructing pages to avoid redrawing and reloading the same elements.

iTV Middleware

Middleware is the layer of software between the operating system, hardware and the applications. This arrangement allows portability of applications, since they write to a middleware that can be ported to multiple boxes and operating systems. Middleware represents the logical abstraction of the middle and upper layers of the communications software stack used in the set-top box. Today's iterations of middleware include OpenTV®, PowerTV®, WebTV® /Microsoft TV, MediaHighway and Liberate®.

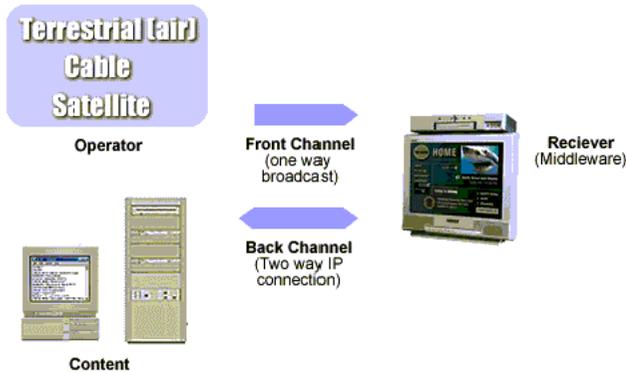


Figure 2: Diagram showing an abstract role of the middleware during the delivery, receiving and interaction of an interactive television experience. (Image courtesy of SpinTV, Inc.)

Planning & Producing iTV

The Key Ingredient

The key ingredient in creating a reliable, convenient and exciting interactive television experience is, of course, planning and production.

Quick Reference - Planning Considerations

Always make sure you know beforehand what is to become of any iTV content after it has been created and how this content will be used and maintained; this will help in the entire creative process when planning and developing the enhancements.

- **Purpose:** Know the purpose behind why interactivity will best suit your show. If providing a Web site for TV, is it offering anything in return to the user and, does it add to the user's experience? Is it convenient?
- **iTV Content Types:** Consider what type of iTV is needed. iTV content types include documentaries, educational shows, games, sports, news and weather shows, shopping and e-commerce, dramas and sitcoms, personal or commercial Web sites and of course, commercials and advertising.
- **Enhancement Types:** Consider what types of enhancements elements you would use, including Internet links, constant elements and synchronous elements.

- **iTV Content Formats:** Think of your content format, whether taped or live, scripted or unscripted, TV mode or Web mode.
- **Reusability:** Consider how your show can be utilized and reutilized to its fullest.
- **Delivery Platform:** Choose what platform on which to present your show by considering your audience, budget, time and resources and type of iTV solution.
- **Maintenance and Analysis:** The iTV content has launched successfully and it's a hit, what now? One of the key things that is mysteriously never mentioned in the planning processes is, what happens after the product is completed? What is needed if the TV show is to go into syndication after it's premiere run and the iTV content information needs to stay updated season after season? What and who are the resources to provide fresh content, analyze iTV polling or take care of the iTV commerce transactions? These are all considerations that need to be thought of at the beginning and re-evaluated.

Differences in Broadcast and iTV production

To ensure the planning process saves you time, you will need to have a basic understanding of some of the differences between broadcast and iTV production.

Table 3: Differences between Broadcast and iTV production

	Broadcast Production	Interactive TV Production
Pre-Production	Concept Development Pitch Story Concept Planning the shoot Storyboard Schedule and Budget	iTV Concept Development iTV Storyboarding iTV Visual Design & Mocks Basic scripting iTV Elements iTV Schedule and Budget
Production	Call Sheets The Shoot	Art Production HTML Development Advanced scripting iTV Elements Testing the Build
Post-Production	Off-Line On-Line Sweetening Layback	Assembling the Show Testing the Build Encoding the Triggers Testing the Encoding Deployment

Equipment Recommendations

To get started creating iTV content, the minimum you will need is a personal computer, an HTML editor, a graphics editor, along with any middleware-specific tools. This set up also works well for multimedia artists who design Web content but are not necessarily responsible for coding and testing.

Hardware Recommendations

- Television set with properly connected set-top box
- Personal computer (2 or more) with 166-megahertz (MHz) CPU or faster
- 32 megabytes (MB) of RAM or more
- CD-ROM
- Hard disk drive (2-GB or more)
- Internet connection through a 56-Kbps modem or Ethernet connection to a local area network (LAN)

Optional Hardware

- **ITV Trigger Data Encoder:** Mixed Signals Technologies or Norpak Corporation
- **Platform Specific Hardware:** Microsoft TV, Liberate®, OpenTV®, etc.
- **Video Recorder**
- **Modulator**
- **2 Editing Decks**
- **Miscellaneous iTV Hardware:** Chyron, Mixed Signals Technologies or Norpak Corporation
- **Color Printer**

Software Recommendations

- **Operating Systems:** Windows® 98, 2000, NT® 4.0, XP or Macintosh®
- **HTML Editor:** Macromedia® Dreamweaver® or HomeSite™
- **Graphics Editor:** Macromedia Fireworks®
- **Animation Editor:** Macromedia® Flash™
- **Database Software:** Microsoft® Access or Oracle SQL®
- **Internet Service Provider or Web Server:** Microsoft Internet Information Server or iPlanet
- **Netmanage® Software** (If HTML editor does not have Netmanage functionality): CuteFTP or FTP Voyager

Optional Software

- **ASP, JSP, ColdFusion® Editor:** Macromedia® UltraDev™ or Jrun™ Studio
- **Server Software:** ColdFusion and JRun
- **Advanced Graphics Editor:** Macromedia FreeHand®
- **Firewall Software**
- **iTV Trigger Creator Software:** Mixed Signals Technologies, TwoWayTV
- **Middleware Development Software:** SpinTV Studio Suite Kit, Liberate® TV Emulator™, Microsoft TV Simulator, MSNTV (WebTV) Viewer, OpenTV Software
- **Platform Specific Software:** Microsoft TV, Liberate, OpenTV®, etc.

iTV Design Guidelines

Television Broadcast Signal

iTV improves your television experience. Therefore, the television show and the enhancements must be evenly integrated to provide a seamless transition between traditional full-screen television and interactive television.

There are a couple of methods to use when working with the TV signal. The first is to overlay or layer elements over the full-screen TV signal. This is effective when presenting additional information without resizing the television broadcast. Another method is to embed the TV window within an HTML-page surrounded by the enhancements.

iTV Cross-Platform Design Rules

Browser platforms are moving further away from the desktop PC to TV, mini-laptops, PDAs and telephones, and require true cross-platform design. Convergence (access to Web content from different Internet appliances) becomes a principle factor in Web design, it should be understood that convergence can only be established when fundamental divergences between the PC and other Internet appliances are taken into account.

Table 4: Design Focus - Understanding the User

	Audience	Use or Objectives	Attitude	Place and Posture	Required skills	Navigation	Presentation
PC	One person educated, 10 to 60 years old	Work, gather information	Goal-oriented and active	Home or work, seated in chair close to monitor	Basic computer knowledge	Keyboard, mouse or other pointing device	Archived and real-time information
TV	Multiple viewers, mixed class, all ages	Fresh news, leisure activity	Relaxed, passive, and convenient	Home, seated in sofa across the room	None	Remote control (no pointing device), optional keyboard	Archived and real-time information

TV Screen Dimensions

The challenge of designing interactive television content lies in fitting all of the information you want within the confines of broadcast television's screen dimensions. Because some interactive services do not support scrollable pages, it is essential that iTV content fit within the iTV design area. Additionally, middleware providers have their own specific design dimensions to follow.

By following these general rules a site can be effective on all platforms:

- Avoid using graphics and layouts that require wide screens to display properly.
- Make content displayable within 544 horizontal pixels. North America systems (using the NTSC television standard) typically display Web pages in a fixed 590 x 380 screen space. Pages may scroll vertically (but should not horizontally). Page elements should be placed in consideration of these boundaries.
- Try to make short pages fit the 380-pixel boundary. Users can find it frustrating to scroll down and find possibly only an extra sentence or two for their trouble.
- Choose a layout that does not rely on fixed widths, but rather arranges itself as a percentage of the screen. Combined with generous amounts of white space, this technique lets a site take advantage of larger displays without compromising itself on smaller ones.
- Be aware that the relative blurriness of the TV screen (compared to a computer monitor) washes out the finer detail in graphics.
- Avoid embedding critical information, such as links or navigational elements, in small images.

TV Aspect Ratio

NTSC/PAL video, or the standard video you see on TV, is built at a 4:3 pixel ratio. This means that for every four horizontal pixels, there are three vertical pixels. If you want to build your content at a wider aspect ratio, for instance 16:9, to make it more cinematic looking, you will need to either crop off the edges when you go to video, or letter box the image by adding black bars to the top and the bottom.

To avoid distortion of the TV Signal, the NTSC/PAL 4:3 aspect ratio should be honored. If you are creating content for HDTV, then a 16:9 ratio should be used.



Figure 3: Comparison of aspect ratio and screen resolution. Note: PAL screen resolution is slightly larger than NTSC. (Image courtesy of Electronic Pictures Corp.)

Macromedia® Flash™ movies are resolution independent. This means they can be scaled as big or small as you want without any loss of image quality. So movie size is not an issue in converting to video. What does matter, however, is the aspect ratio. If you have built your movie at a 4:3 ratio, you can export it to the appropriate platform-specific size.

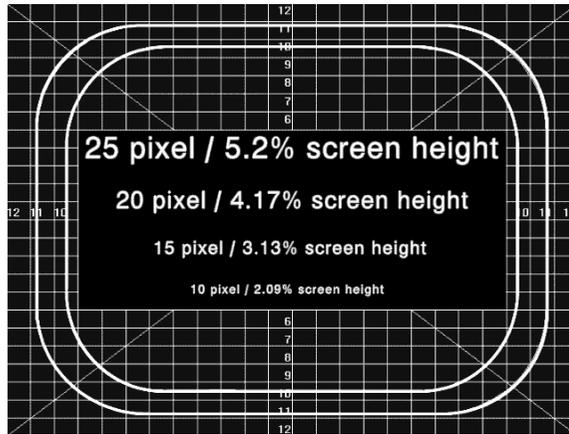


Figure 4: Illustrates text size as a measure of pixel sizes versus screen height. (Image courtesy of Nokia® Corporation)

iTV Overscan and Action/Title Safe Areas

The visible image on a computer monitor extends fully to the edge of the screen, so even when a movie is played full screen, the entire image is visible. On a television set, approximately 10-20% of a television image is lost due to overscan. While this amount varies from TV to TV, there is a standard set of two guides you can use to make sure the important parts of your movie remain visible on any television set. The outer guide is called action safe. Important actions should take place within this area. The inner guide is called title safe. Any text on the screen should take place within this area. Set-top box and middleware platforms understand this and require developers to stay within certain resolution guidelines.

In television production, the action safe and title safe areas need to be considered when producing the lower third titles and full screen graphics. These same issues must be considered when designing the interactive elements. It is recommended that a 16-pixel margin be considered around the page because it is aesthetically pleasing and it ensures that older TV sets with rounded corners will not cut off critical content.

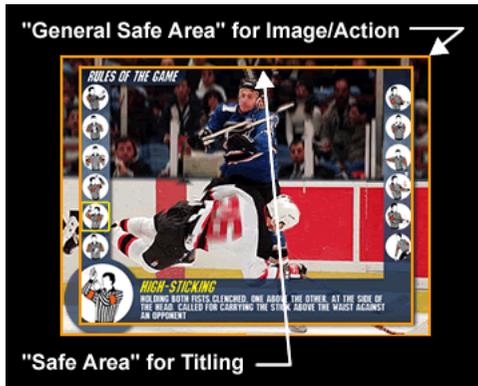


Figure 5: Safe Area Diagram of “iTV Sports Rules Application” by SpinTV. Notice the important elements of the interface stay within the safe area to ensure the viewer’s TV screen doesn’t hide anything from the viewer.

HTML & iTV

Specification 1.1 of the Advanced Television Enhancement Forum (ATVEF, now SMPTE) defines HTML 4.0 as the current standard for building interactive TV content. However, not all iTV platforms fully support the proposed standard. A majority of these platforms support a subset of the specification that is comparable to HTML 3.2. Using HTML tags that the platform supports along with the industry-standard will ensure that your content or application will be rendered as you intended.

Interactive programs typically use fewer HTML pages and are designed to deliver specific informational choices to the viewer as effortlessly as possible. Creating interactive enhancements today is like building a slimmed down version of a Web site. Though many developers frown on this, this is not a bad thing. Television screams the K.I.S.S. (Keep It Simple Stupid) principle, due to the fact that the TV has been a passive medium and, as it evolves into more of an interactive experience, you will need to make sure that your HTML, as well as your graphics, are very simple.

Most of your visual design can be assembled and tested quickly using a WYSIWYG HTML editor; the two most popular editors among designers and developers today are Macromedia® Dreamweaver® and HomeSite™. If your design has more robust requirements, such as the use of a dynamic content server or connection to an external data source for XML documents or a database, Macromedia Dreamweaver® UltraDev™ is the next step. It provides the widest available support for dynamic content languages such as ColdFusion®, Java™ Server Pages, Active Server Pages, and recently, PHP through extensibility. Additionally, the SpinTV Studio Suite Kit offers iTV extensions for Macromedia Dreamweaver and Dreamweaver UltraDev to help streamline some of the required and tedious tasks involved in building iTV content.

Other WYSIWYG iTV editors include Chyron's Lyric iTV, Lyric iTV easily allows television professionals and iTV producers to maintain a consistent look and feel between television and iTV graphics. The Two Way TV Ark system provides an integrated solution for the development and broadcast of interactive content for digital television.

Macromedia® Flash™ & iTV

Macromedia Flash is not specified as an iTV industry standard, but leading iTV manufacturers and over a million developers world-wide currently support Macromedia Flash as the de-facto standard of vector graphics and animation.

Macromedia Flash Player

Macromedia Flash player is used to seamlessly view animated content created with Macromedia Flash, the professional standard for producing high-impact, vector base Web experiences as well as iTV. Macromedia Flash™ player is currently supported on the majority of set-top boxes albeit in a limited capacity. Leading platforms such as Liberate® and Microsoft TV now support Macromedia Flash 4.0 on their respective platforms. With other platforms you will usually find Macromedia Flash 4.0 version or higher, but these platforms are rapidly pushing to advance the player version amidst the growing demand for iTV content developers. Macromedia Flash has such a large viewer base that in a recent survey by NPD Research announced that 98.3% of all Web users today are able to view Macromedia Flash content without having to manually download or auto-download Macromedia Flash player. In fact, Macromedia Flash has grown so strong with the advent of the Internet that Macromedia has put together its own division to aid in ensuring that all current and future Internet devices will also be able to fully support the Macromedia Flash player.

Macromedia Flash Usage & Speed

Besides knowing what version of the Macromedia Flash Player the targeted platform supports, the processor speed is where you will need to start when considering using Macromedia Flash in a set-top box environment. Macromedia Flash enables Web sites to animate with striking visual effects that often require a small amount of data, often a few dozen kilobytes (KB) or less, adding only a few seconds to the download time for a Web page. A typical set-top box viewer receives data at a rate of about 2-3 Kbps. This being the case, Macromedia Flash is probably best used sparingly, and in conjunction with HTML. For example, you might use Macromedia Flash content in place of static images, GUI (Graphical User Interface) components like a button or a form field, or text headers and titles.

If Macromedia Flash is to be used in more of an application role with the possibility of multiple pages, seriously consider avoiding any type of scrolling through large amounts of text and graphics, which can be very processor-intensive. Instead, consider using the “deck stacking” system strategy used in building content for smaller devices such as PDAs. A “deck stacking” system (similar to a deck of cards) is often employed to display just the piece of information that's required at a particular time. The user can navigate content by flipping between pages, like cards in a deck. Using simple Macromedia® Flash™ frame actions to move forward and back in the timeline is a quick way to create a “stacked” experience and will help limit processor speed restraint concerns. If using Macromedia Flash in conjunction with Macromedia Generator™, the extensions for authoring this process can be automated and data-driven by using the Generator Multi Page List object and Replicate command, automatically creating almost ready-made “stacked” interfaces containing dynamic content.

Vector Graphics & Screen Sizes

The majority of iTV platforms will adjust your content to fit within a specified safe area. If your content exceeds this area, even by a pixel or two, the end result can be a very unpleasant and confusing viewer experience. A key advantage to using Macromedia Flash is that it's vector based. Any resolution changes to your content by the platform middleware, Macromedia Flash will simply adjust and resize accordingly to fit correctly within the limitations of the safe area. Take full advantage of this fact and use Macromedia Flash strategically when it comes to TV screen real estate, especially when targeting multiple iTV platforms.

Macromedia Flash Fonts and Text

Since TV screens and living room sizes vary, there is no standard font size for use on TV screens. As a general rule, however, you should use fonts that can be read from a distance of at least 8 feet while viewing a 19-to25-inch TV screen. Games generally use smaller fonts because people sit closer to the TV while using them.

When considering color attributes for text, remember that light-colored text on a dark background is much more readable on TV. The contrast between dark background and light text is easier on the eyes and the text tends to swim less on the screen.

Font choice is also an important design consideration to ensure your application will be readable. There are several 1-bit-friendly fonts from which to choose. Verdana®, a new font commissioned by Microsoft®, is designed to render well on bitmapped displays at all resolutions, which makes it well suited for smaller screens. One of the more popular typefaces is the Geneva font. You should also avoid typefaces with very thin lines, as these will tend to break up on video. Sans Serif fonts display better than Serif fonts for these types of screens. Serif fonts tend to lose their details on screens that aren't as sharp as computer monitors.

Keep in mind your original frame size (aspect ratio) when scaling text in a Macromedia Flash movie. If you are scaling your Macromedia Flash movie up 200%, you can start with a 9-point type. If you are reducing it to 50%, you should use 36-point type or greater.

Macromedia® Flash™ Animation

Whether you are using Macromedia Flash content for personal computers or set-top boxes, the rule of thumb is still the same; "A little goes a long way". Due to processor limitations, it's generally a good idea to avoid using large amounts of animation and motion tweening in a set-top box environment. A small Macromedia Flash animation downloads quickly and starts working before the user is even aware of it. Larger animations and sound take longer to download, irritating the user. However, sometimes animations are needed to convey a message, so if you have the horsepower, use it. By incorporating subtle but interesting ambient animations and keeping the file size small, you can help hold your viewers' attention and the more likely you are to have a positive impact on the overall iTV experience. What you want to avoid at all costs, are intensive visual effects such as large masks, extensive motion, alpha blending and complex vectors, for example (extensive gradients). You should also avoid static screens: TV viewers are just as likely to surf away from boring screens as they are from boring programs.

TV Color

Although computer monitors have the ability to display millions of colors, many of us already design within the Web palette. The Web palette helps ensure that colors created on one computer system will look the same on others. This has allowed a greater level of consistency and predictability throughout the World Wide Web.

Broadcast imposes its own limitations on color, which are tied to the limits set by the video standard, NTSC and PAL. Both standards are defined by RGB values and colors typically appear brighter. Highly saturated colors (red, green, blue) do not translate well to TV. Until HDTV becomes widely adopted, we're stuck trying to get computer graphics to work on televisions that could be as much as 50 years old.

For reference, it's good to know that the reproduction of TV color involves the use of three different color spaces: Red-Green-Blue (RGB), Luminance-Chrominance (YUV), and Hue-Saturation-Brightness (HSB).

NTSC and PAL Color Limitations

NTSC legal colors have a compressed chroma (aspect of color by which a sample appears to differ from a gray of the same lightness or brightness) and luma (measure of brightness after gamma correction) range.

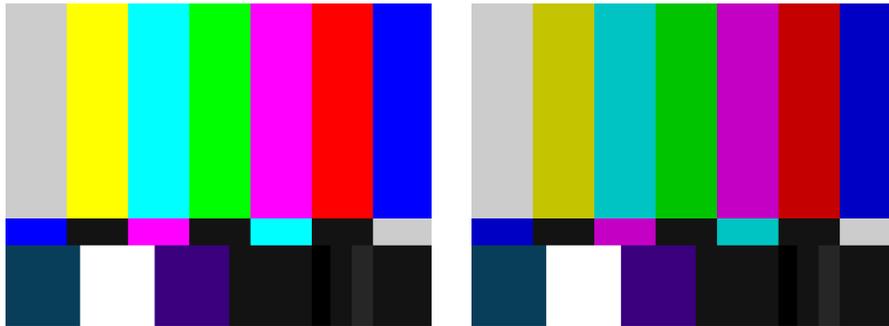


Figure 6: NTSC legal colors at 100% (left) and 75% compression (right). (Images courtesy of the Society of Motion Picture and Television Engineers.)

- RGB extremes should be avoided by a minimum of 15%.
- Blue is more permissive, yellow/red tends to bleed (worse than PAL).
- Keep saturation under 80%.
- Keep luminance under 80%.

NTSC color examples

- Full black is represented by R30, G30, B30.
- Full white is represented by R225, G225, B225, or R190, G190, B190.
- Desaturate primary colors by adding equal amounts of the other two values. For example, if one requires a deep blue, set B255, R70, G70 (R and G should not be 0).
- Combinations of 2 primaries work well. For example, combining blue and green to make cyan works well using the values of R70, G255, B255.
- Avoid colors with low luminance, e.g., colors where all RGB values >70.
- Pastels are typically safe.
- Background colors should compliment the graphical content (darker backgrounds are safer).

PAL typically manages color extremes and hues better than NTSC (yellows and reds appear extremely over-saturated and distorted on NTSC).

- RGB extremes should be avoided by a minimum of 10%.
- Blue is more permissive, yellow/red tends to bleed.

PAL color examples

- Full black is represented by R30, G30, B30.
- Full white is represented by R230, G230, B230.

Color guidelines for TV:

- Always test pages through a standard TV set.
- Avoid highly intense colors, such as full white or full red backgrounds as they tend to cause a “bleeding” visual imparity. Blues and greens work well, which is why they are widely used.
- Avoid “chroma-crawl.” It occurs when two high contrast colors are placed next to each other on a TV producing fuzzy images and text. Text is especially vulnerable.
- Use 90% saturation or less to keep colors from bleeding. Color bleeding occurs when highly saturated colors are placed near each other.
- Create readable background and text color combinations – try to strike a balance between comfort and contrast; which is both legible and easy to look at.
- Use a color-safe palette for the platform. Some graphic design software programs offer NTSC and PAL filters or converters as an effective way to adjust color. However, it is best to avoid using filters as they can make graphics appear muddy.

Fonts and Text on TV

Unlike Macromedia® Flash™, basic text in HTML is essentially formless. The way it appears is controlled by formatting elements within the page or an external style sheet, or, lacking either of these mechanisms, by the browser’s default settings. Some iTV systems perform transcoding of HTML content on a specialized server, in the client receiver, or a combination of both. These transcodings typically involve font substitution to a larger and more readable typeface, while retaining as much of the look and feel of the original page as possible.

The overall success of the process varies widely in terms of “scaling” and “arranging” the text by the iTV system. When “scaling” of the text is performed by the iTV system the text is rendered in a font roughly equivalent to 18-point Helvetica. Optimum font sizes for broadcast TV are between 16-20 points (HTML size 3-4). Use Sans Serif font and crisp, anti-alias to avoid jagged edges. Avoid fine detail line strokes or underline as they can become indiscernible. Embedded graphical text such as Macromedia Flash can be visually lost if created too small.

Also be aware of “Arranging” performed by iTV systems. When “arranging” occurs, the iTV system adjusts the wrapping of text elements to fit in the specified safe area by literally squeezing the text together. For this reason, fixed line breaks can make text hard to read. Moreover, since the text is displayed in a large font, text in narrow columns looks bad, with only one or two words per line.

TV Line Weight

A single line of video is actually made up of 2 sets of scan lines. Because of this, a horizontal line 1 point thick or less will flicker on video. It is visible for one set of scan lines and then disappears on the next. So all horizontal lines must be at least 2 points thick or greater to show up correctly. Vertical lines close to the edge of the screen tend to vibrate.

Graphics on TV

Graphic use should follow the same guidelines set forth in the color, font and line sections. Images should scale to fit within the TV screen limitations.

- Develop graphics at 72 dpi, the same as for a computer screen.
- Fine graphic details tend to “wash out” due to the relative blurriness of the TV screen.
- Finely detailed patterns and textures tend to flicker, especially if contrast is high.
- Avoid lossy compression files.
- Spliced images must have the appropriate HTML formatting to be displayed properly.

Navigating TV

When designing interactive content, it is important to create navigation controls that are easy to use and intuitive. Do not assume that the viewer will understand “standard navigation options” since many may not have experience using a computer or surfing the Web.

iTV navigation is similar to tabbing through a Web page on the PC. Viewers navigate between links, forms and functions using a remote control or an infrared keyboard.

- Navigation is limited; there is no pointing device (mouse) which means right-click functionality is not available.
- Links should follow a left to right, top to bottom tab pattern
- Selected items should stand out visually (Remember, distance from screen rule).
- Use client-side image maps rather than server-side.
- Too much information or content hinders navigation (Follow the K.I.S.S. principle – Keep It Simple, Stupid).

Page links are converted to another form of display. Common practice has been to highlight (yellow box) each link on the screen one at a time, using the navigation control keys to sequence among the links. This same functionality is seen in Macromedia® Flash™ movies when using the tab key. For example, when the viewer clicks a directional arrow on their remote control or keyboard, a selection box appears around the navigation elements and moves to the next closest selection in the direction of the arrow button.

When combining both HTML and Macromedia Flash navigational elements on one page, make sure you take into consideration the smooth transitioning of focus from one element to another. When the user moves left, right, up or down there is an automatic selection hierarchy based on how your elements are placed on the screen from one another. For example, if you have a navigational menu bar with 4 buttons starting from left to right. For example, in Figure 6, below, the yellow highlight box will place its focus automatically on the far left button, “Tours”, when the page first loads since it is by default the top left navigation element on the page.

There are several ways you can use JavaScript™ to control the focus of navigational elements. First, set the focus automatically on a button when the page first loads. Second, use an ATVEF Trigger that activates JavaScript at specified times during a television program. For example, as the sports announcer talks about the tournament scores, an iTV operator can send an ATVEF Trigger and at the same instance trigger a JavaScript function, resulting in a focus on the score button for the user to click, which accesses the latest scores, as seen below.

Tip: If using ATVEF Trigger functionality, you can have a trigger call a JavaScript function that calls a Macromedia Flash object, resulting in the control of specified actions within Macromedia Flash.



Figure 7: Navigation highlight. (Image courtesy of SpinTV, Inc.)

Scrolling TV

Some interactive services do not support scrollable pages. As a result, if content extends beyond the visible boundary of the TV screen, that content becomes inaccessible to the TV viewer. It is important to think linearly when building Web sites or iTV applications for television viewing, similar to a slide show. You may have navigation elements for moving forwards and backwards or scrolling text elements, but not the entire page itself.

- Avoid or limit vertical (top to bottom) scrolling.
- Avoid horizontal (left to right) scrolling.

Note: Ninety percent of people reading a Web page do not scroll down. Only 10% of viewers will read all the information if content does not fall within the screen area. (Source: International Informatics Institute).

What are Triggers and why do I need them?

An excerpt from the book, *Producing Interactive Television* by Annesa Hartman, describes triggers best.

“Triggers are the synchronization component of your Enhanced TV show. They are real-time events occurring before or during a show’s interactive mode and can be triggered automatically or with user confirmation. Triggers most commonly:

- Invite the viewer “to go interactive” (requires user confirmation)
- Introduce new interactive elements during a show (can be automatic- or user-confirmed)
- Initiate the viewer out of interactive mode and back to full screen at the end of the show (a recommended, and usually required automatic trigger)

Trigger links that invite a user to go interactive contain a URL, among other data, that specifies the location of the Web elements. Trigger links made available during a show are executed through JavaScript™ functions. These scripts can perform such dynamic actions as changing the value of a stock quote, making a trivia question visible at a certain time, or returning a viewer to full-screen viewing mode.

The trigger process involves three parts: creating triggers, sequencing triggers, and encoding triggers. Triggers are easy to create and deliver by using proprietary tools such as Mixed Signals TV Link Creator and related hardware, the TwoWayTV Ark System, Norpak Corporation and other iTV vendors.

iTV Development Tips & Tricks

Caching: The cache object allows for the specified expiration of your content for both deployment and development purposes. To set a date for your content to expire, replace the date in the following code with the date you wish to have your content expire (remove) itself from the iTV system cache, then insert into the head of your HTML document:

```
<meta http-equiv="expires" content="Mon, 11 Feb 2002 09:13:56 GMT">
```

Some platforms do not empty the cache right away when making a lot of changes to a document during testing of your content on a set-top box. To ensure you are viewing the latest changes, you can insert the following code into the head of your HTML document while testing to reload/refresh the page when changes have been made:

```
<meta http-equiv="cache-control" content="no-cache">
```

!!WARNING!! The “No Cache” object is generally used for development purposes and should be removed before publishing a page for live use.

ATVEF Trigger Support: The Trigger Receiver object allows ECMA-script functions inside an HTML document to be called from ATVEF triggers embedded in the television broadcast signal. Some iTV middleware platforms already provide this object for you; some don't. To ensure that your content works on as many platforms as possible, insert the following code into the top of the HTML document:

```
<object type="application/tve-trigger" id="objReceiverObj">
</object>
```

In a frames-based set of content, the trigger receiver object is placed in the frameset page. JavaScript™ functions intended to be fired by triggers should also be placed in the main frameset page.

Pre-fetching: is generally used when presenting users a series of HTML pages sequentially. Specifying a link to the next page in the series allows that page to be loaded into memory as users are still reading the current page. This gives users a feeling of even faster network performance. To perform Pre-fetching, place the following code in the head of your HTML document, replacing the URL with yours:

```
<link rel="name" href="http://www.spin.tv">
```

Macromedia® Flash™ Overlay over TV: To overlay Macromedia Flash over the TV signal, you must set two properties:

- 1) In the <body> tag, add "background=tv:" and "bgcolor=transparent"
- 2) In the Flash <embed> tag, add "bgcolor=transparent"

The above solution may not work with all platforms, be sure to test your content to ensure your design is rendered correctly.

Macromedia Flash scripting and ATVEF Triggers: If using ATVEF Trigger functionality, you can have a trigger call a JavaScript™ function that calls a Macromedia Flash object, resulting in the control of specified actions within Macromedia Flash.

Conclusion

Almost every show or movie on television has an associated Web site. Viewers can either surf the associated sites on television while watching the program, this is called single-screen iTV. Or they can watch television and surf the Net on different screens at the same time, this is known as dual-screen iTV. Either way, television is undergoing an evolution. This is not just interactive television; this is a convergence of technologies that will change the way we interact with the world.

Important Terms

Action Safe: The video area in which important actions should take place.

Aspect Ratio: The number of pixels an image is wide compared to the number of pixels high. NTSC video is 4:3.

Overscan: A TV-specific phenomenon in which the image extends beyond the edge of the screen, making a certain portion of the image not visible.

Pixel Aspect Ratio: The shape of the pixel making up an image. The computer displays the pixel as square. NTSC video displays the pixel as rectangular, with each pixel taller than it is wide.

Scan Lines: Most video has 30 frames per second, each frame split into two sets of scan lines, or fields. The video monitor first draws field one, the odd set of scan lines (lines 1,3,5,7,etc.), then field two, the even set (lines 2,4,6,8,etc.).

Title Safe: The area in which all type must be placed.

Trigger: Real-time data events that arrive at a specific point in time during a broadcast, intended to activate specific enhanced content. Triggers appear as an icon or clickable text that, when selected, open to additional content. Transport A triggers travel over the VBI and typically includes a URL, a human-readable name, an expiration date and a script. Transport B triggers content to travel over the digital broadcast signal.

Vertical Blanking Interval (VBI): Comprises the first 21 lines of the television signal field and is the black stripe seen when a TV picture loses vertical hold and rolls. The TV receiver needs lines 1 to 9 of the VBI for timing set-up, but lines 10 to 20 are not allocated. Line 21 of the VBI is used to deliver closed captioning information and is now used for HTML data.

Walled Garden: Content that is designed specifically to be available to some subset of users, and not generally available through direct access to the Internet. America Online® is an example of a very successful walled garden. Certain iTV middleware solutions enable cable and satellite providers to create their own walled garden or “portal.”

List of References:

- ATVEF Enhanced Content Specification** Advanced Television Enhancement Forum, Boulder, CO. 2001. The specification is available for download at <http://www.atvef.com/library/spec.html>.
- Developing Interactive Television QuickStart™** Class Materials, Los Angeles, CA. 2000.
- Planning and Implementing Interactive Television QuickStart** Class Materials, Los Angeles, CA. 2000.
- AOLTV Developers Guide** AOL™ Publication. 2000.
- Bhargal S, Bodur M, McDermott D, et al. **Rich Media: Video and Sound in Flash**, StudioLab. Friends of ED, Birmingham, UK. 2001.
- Chambers M, Torrone P, and Wiggins C. **Macromedia Generator and Flash Demystified**, Peachpit Press, Berkeley, CA. 2001.
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- World Television Standards and DTV/HDTV Part I**; <http://www.cybercollege.com/tvp009.htm>
- iTV Standards, **We Interrupt This Program By Ray Shapiro**; <http://www.digitaltelevision.com/2001/interact/0502.shtml>

Support Tools

- 1 SpinTV Studio Suite Kit Version 1.0 for Dreamweaver® 4 and Dreamweaver® UltraDev™ 4 (\$49.95)
<http://www.spin.tv/>
 - 2 FlickerLab Safe Area Macromedia® Flash™ Template Located in the Goodies Folder
- Instructions:** Bring file into your Macromedia Flash movie for use in determining the edges of your critical action and where to place your text. Make the template a layer, then double-click the layer and select Guide. This will allow you to view the template from within your Macromedia Flash file, but prevent it from showing up once you have published the movie.

Additional Resources

Professional Organizations

Advanced Television Systems Committee (ATSC)

<http://www.atsc.org>

Advanced Television Forum (ATV Forum)

<http://www.atvforum.com>

Advanced Television Enhancement Forum (ATVEF)

<http://www.atvef.com>

Association for Interactive Media (AIM)

<http://www.interactivehq.org>

Cable & Telecommunications Association for Marketing (CTAM)

<http://www.ctam.com>

Corporation for Public Broadcasting (CPB)

<http://www.cpb.org>

Digital Video Broadcasting (DVB)

<http://www.dvb.org>

National Association of Television Program Executives (NATPE)

<http://www.natpe.org>

National Cable Telecommunications Association (NCTA)

<http://www.ncta.com>

National Center for Accessible Media (NCAM)

<http://ncam.wgbh.org>

Society of Motion Picture and Television Engineers (SMPTE)

<http://www.smpte.org>

Women in Cable and Telecommunications (WICT)

<http://www.wict.org>

World Wide Web Consortium (W3C)

<http://www.w3.org>

ITV News

CTAM - SmartBrief

<http://www.smartbrief.com>

Cahner's Broadband Week

<http://www.broadbandweek.com>

Broadcasting & Cable

<http://www.broadcastingcable.com>

Cablevision

<http://www.cablevisionmag.com>

TV Insite

<http://www.tvinsite.com>

[ITVT] News

<http://www.itvt.com>

iTV Report

<http://www.itvreport.com>

Nielsen Media Research

<http://www.nielsenmedia.com>

Paul Kagan

<http://www.kagan.com>

Smart TV & Sound Magazine

<http://smarttmag.com>

TV Meets the Web (UK)

<http://www.tvmeetstheweb.com>

Developer Groups

AOLTV Developer

<http://developer.aoltv.com>

Internet Appliance Design

<http://www.embedded.com/internet>

Liberate® PopTV (membership required)

<http://partners.liberate.com>

Internet.com - Web Developer Channel

<http://www.internet.com/sections/webdev.html>

ITV Insider

<http://www.itvinsider.com>

Java™ Digital TV Technology

<http://java.sun.com/products/javatv>

Macromedia Exchange

<http://www.macromedia.com/exchange>

Microsoft® TV Developer
<http://www.microsoft.com/tv>

MSNTV Developer (Formerly WebTV)
<http://developer.msntv.com>

OpenTV Developer
<http://www.opentv.com/services/developers>

Open Standards Terminal (Sponsored by Nokia)
<https://www.ostdev.net>

Ruel.Net
<http://ruel.net>

MSNTV Developer
<http://developer.webtv.net>

ITV Technologies

AOLTV
<http://www.aoltv.com>

Avid Technology
<http://www.avid.com>

Canal+ (French)
<http://www.cplus.fr>

Chyron Interactive
<http://www.chyronitv.com>

Discreet - frost product
<http://www.discreet.com>

ICTV
<http://www.ictv.com>

Intel ®- Digital Entertainment Initiative
<http://www.intel.com/ial/home/digentertain>

Liberate® Technologies
<http://www.liberate.com>

Microsoft® TV
<http://www.microsoft.com/tv>

Moxi™
<http://www.moxi.com>

Nokia® Media Terminal
<http://www.nokia.com/multimedia/mediaterminal.html>

Norpak Corporation
<http://www.norpak.ca>

OpenTV®
<http://www.opentv.com>

PowerTV®
<http://www.powertv.com>

Sky (British)

<http://www.sky.com>

Triveni™ Digital

<http://www.trivenidigital.com>

Two Way TV

<http://www.twowaytv.com>

Wink®

<http://www.wink.com>

Worldgate

<http://www.wgate.com>