The AFI-Intel Enhanced Television Workshop. July, 1999.
"Enhanced Television: A Historical and Critical Perspective"

This White Paper has been commissioned by the AFI-Intel Enhanced Television Workshop for distribution to participants of its 1999 activities, and on its Web site. The purpose of the paper is to provide technical and historical background for the television and creative community who are not principally concerned with technical issues. Feedback on this paper may be sent to enhancedtv@afionline.org.

For further information about the Workshop and the topic, go to one of the following Web sites: www.afionline.org/etv or www.developer.intel.com/drg/dbt/index.htm.

INTRODUCTION

Many television producers, technology, and media companies as well as "new media" enthusiasts today are turning their attention to an emerging medium called "Enhanced TV".[1] "eTV" for short, this medium may transform mass media like television and the Internet. For that to happen, changes must first come to the creative and production processes and business models supporting them.

Enhanced TV uses certain technologies from the Internet to deliver graphical and informational elements on the same screen as a video program. Once transmitted over the air or via telephone wires and cables, these components are televised on top of video programming viewed on traditional TV sets, computers, and on other video-ready digital products.

Members of the television and related creative businesses are, therefore, curious if this high-tech upgrade will make their television production work more difficult to produce or more expensive to fund. Should they bother? The appeal, which seems to be drawing this community to the new medium, is the opportunity to build more creatively dynamic programming, to reach a global audience, and to build new revenue streams. In particular, opportunities for electronic commerce can generate significant financial support as it has for the Internet. Furthermore, the availability of communications technologies in this environment could, ultimately, reinvent the way producers conceptualize shows as well as the way viewers experience them.

As of 1999, there is a great deal of speculation about whether enhanced TV will succeed and, if so, in what form. Will enhanced TV become an underlying foundation upon which a new form of television can become an active experience rather than a passive one...or will it go the way of prior experiments?

This paper has been commissioned by the AFI-Intel Enhanced TV workshop to provide members of the creative community with a context for ongoing training and collaboration. Intel and the AFI believe that the creative community will make an enormous contribution to the evolution of this new medium, because it is the creatives who understand the audience and methods to reach those audiences with compelling content.

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[1] Underlined words are terms defined in the Enhanced TV glossary. In some cases, a more detailed history is available.

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The challenge of this white paper is to present enhanced TV in its context historically and abstract a few lessons from this and current experience. The hope is that content producers who are excited about developing new programming and methods to support this new medium will enhance their understanding of where enhanced television has come from, where it is going.

What is "Enhanced TV"?

Enhanced TV has certainly generated a lot of "buzz", but still remains controversial. The ultimate question is will it allow two powerful technologies from the world of television (broadcast video) and the Internet (the Internet Protocol and the Hypertext Markup Language "HTML") to merge? Enhanced TV is, for the purpose of this paper two things: 1) the ability to transmit Hypertext Markup Language (HTML) data and files to an analog TV , set-top box, personal computer, digital television, or some other capable device; and 2) the media form of which Web- interactivity can take place on top of broadcast video. In order to understand why these technologies have found a possible interrelationship, let's look at first how enhanced TV elements appear on the screen, the types of content and applications that will exist in this environment, and then the technology behind it through a historical evaluation. Towards the end of the paper, there will be a short investigation into emerging platforms and observations from those working in the field.

How it Looks and Feels

To the viewer, "enhancements" appear as graphical and sometimes purely informational elements on the screen overlaying a video broadcast. Often these are opaquely colored and cover the video broadcast in part or are transparent or semi-transparent. Specific reoccurring elements are icons, banners, labels, menus, information about the program, data you can print, open text fields in which you can insert your email address, or forms to fill out in order to buy a product. If the producer has done her or his job adequately, these enhancements will be relevant to the television programming beneath it.

To understand what this looks like, visualize the way semi-transparent banners with scores and statistics printed on them sometimes overlay basketball games or golf tournaments on TV now. Another good example is how details about a music video will appear in the lower left-hand corner of the screen on MTV. Some readers may be familiar with the graphics and text displayed on the TV when setting up a Nintendo, PlayStation, or Sega game. Here, players navigate graphical or textual elements with a keyboard or joy stick to select the difficulty of the game or learn about its rules. A final good example, but slightly different, is the Prevue/TV Guide Channel carried on most cable and digital broadcast satellite (DBS) systems. Here, the video screen is reduced to one corner of the screen while the viewer browses or watches a TV schedule go by. Rather rudimentary in its creativity, producers hope the use of enhanced TV technologies will help make this a greater creative opportunity and more pleasurable and interesting for the viewer.

To navigate and participate in such enhanced television broadcasts, viewers can use the buttons on the remote control, type commands or words with a wireless keyboard on certain systems, or use the mouse if experiencing eTV via a computer. Depending upon the network, the software on the set-top box, or if you're also connected to the Internet, the viewer will receive access to an electronic programming guide (EPG); a special TV-online service containing links to local information; or applications like email, games, home banking, and community message boards, and many applications to come.

The Promise of a New Medium

Many people are excited about eTV because it could really provide the underlying foundation for rich media television programming and services to exist on a mass scale. Essentially, what was and is still currently a passive, linear, absorbing-only viewing experience for millions of people around the world can now become a participatory, non-linear viewing and communications medium as well. This last part is crucial.

For example, it is well-observed that many people go online while watching TV to chat in real-time or send email to others about the show. In an enhanced TV context, people will certainly want to gossip, talk about their own interpretations, communicate directly with the show's characters or producers, engage in group-forming for loyalty clubs, collaborate with others on games, and much more. Ultimately, this may encourage and eventually require television producers to create shows, which consider the group and not the individual or the mass audience as a viewer unit.

Certain types of programming, thus, will fare well in this environment --- perhaps documentaries, news, sports, game shows, children's and nature programming, talk shows, music videos, business formats, and even situation comedies. It seems possible that the enhanced TV environment will also spawn distance learning programming, business and town hall meetings, as well as personal TV channels if public access is enabled in this way. In the near future, video cameras will certainly be built in to the TV set permitting the "Video Phone" phenomenon to occur when all networks are upgraded.

The emergence of a new medium, in addition, also opens the door to the possibility of breakthrough applications, which take advantage of the unique features of that medium in ways not initially apparent. In the computer world, such breakthroughs are often termed "killer apps," or applications, because they come to define and indeed drive the entire platform. Email and the Web browser were examples of "killer" applications that appealed to so many people that the Internet grew exponentially. What will those killer app(s) be for enhanced TV? Some speculate it might be video-on-demand or home shopping,

The other part of this equation, of course, is how to make enhanced television economically feasible for the industry and affordable for the viewer. For example, production budgets on projects today are already in the double-digit thousands to the hundreds of thousands of dollars. Before long, these budgets will increase over time as technology improves and audiences demand more functionality, more shows ,and possibly more of the shows to be enhanced. In order to pay for that, companies are already building business models that reflect complex revenue sharing arrangements between producer, set-top box vendor, software provider, network, shopping vendor, ISP, cable provider – the list goes on and on. The greatest revenues may come from the viewers, themselves. Subscriptions to the service or the ability to make direct purchases will be offered in most cases; but, it is still unclear what combination of the above will become a winning strategy. Before embarking on eTV production, therefore, it is important to construct a business model that can expand over time as the industry grows.

The Potential of Ecommerce

Making money with enhanced TV programming is a real possibility, no doubt. We've seen in the last two years that ecommerce over the Internet is making billions of dollars and that's at primarily 'narrowband' speeds of PC and modem. Once eTV can be viewed on television sets around the world via satellite, broadcast via the digital signal, and sent via cable systems, billions who do not already have a computer, but who might accept a free set-top or afford a low-priced computer, will get access to programming. In the end, sharing the wealth created by these transactions will probably be enormous. Or, the lack of it will drive the new medium to failure; but this is doubtful. If it is successful, new investments will be made in programming and fresh ideas in communication and business will form.

Placing Things in Context

This paper attempts to provide an understanding of the emergent enhanced television landscape consisting of its historical and industrial developments, its emergent current technologies and practicing players, new content, production, and business models evolving today. An effort is made to illuminate the above issues which remain unresolved and of concern. The hope is that this overview will enable a greater understanding for the potential of the medium.

EVOLUTION: Early experiments pave the way

Years before television was invented, people spoke as if film, radio, and the telephone would some day converge. Sound familiar? Terms like “Radiovision” and "Telephone Eye” were used to express a future device that might provide an integration of services. Although the electronic transmission of pictures is what they got, the idea that these technologies could be combined into one device has always been a dream. Today we talk about PC-TV convergence or about different types of video/teleconferencing to mean something similar, but not exactly. Inventing the real medium of enhanced television took many years of hard work and exploration. Like anything, it required innovation and failure before the right discoveries paved the way. The earliest exploration “enhanced” TV was a show called “Winky Dink”.

“The video that turns your TV into a toy!”

Some people may remember “Winky Dink” - a program first broadcast in October of 1953 in black and white on CBS. Created and hosted by future “Joker’s Wild” game show host, Jack Barry, “Winky Dink” featured the adventures of a cartoon character named Winky Dink and his dog Woofer. The simply drawn character was a small boy (voice-over by Mae Questal of “Betty Boop” fame) with ragged hair who appeared on a TV set next to Barry and talked to kids in the studio. During the program, Winky Dink went on dangerous adventures and got into a lot of trouble. In order to save him from his perils, Barry sold thousands of Winky Dink Kits containing sheets of transparent plastic and several crayons so kids, when prompted, could place the plastic on the TV monitor and draw a bridge or rope from which Winky Dink could escape. At the end of the program, kids would connect the dots at the bottom of the screen to find a secret word. Cheap by today’s standards, the kits cost $.50 a piece by mail or for $2.95 at toy stores. Ultimately, the show was a big hit and Barry kept it going for many years. This early show is still remembered today by the very people building this emerging industry. In fact, a company selling new kits called “Winky Dink and You” from Hollywood Ventures at $19.95 a piece says most of the people buying the kits are those who remember the show from their youth. In the kit, you get a 30 minute video with 3 cartoons, magic screen, wipe-away “woobie” and 5 magic crayons. You can buy them via their Web page at http://www.bennysmart.com.

But, not all early TV innovations were of this nature. In one case, use of un-exploited technology would enable better communications via the TV and lead to an important discovery still with us today.

Closed Captioning and the Vertical Blanking Interval

Work done to develop closed captioning would truly pave the way to the discovery of how to use the Vertical Blanking Interval (VBI). A highly unused portion of the analog television signal, today the VBI is used to broadcast closed captioning and HTML data at high speeds to television sets, set-top boxes, and TV tuner cards on a personal computer. Originally, the VBI was not intended as a way to send captions to deaf or hard-of-hearing audiences. It came about because the National Bureau of Standards funded early experiments, in cooperation with ABC, to send out exact time information over the signal. Fortunately, this experiment failed to provide needed results so ABC suggested text captions, instead. Their experiments throughout the 70’s on programs like the “Mod Squad” led to engineering partnerships with the Public Broadcasting Service (PBS). With PBS, they developed early in-room decoders to interpret the VBI signal and display captioning on the screen. But, it wasn’t until public television station, WETA, broadcast and encoded this data successfully on line 21 of the VBI that closed captioning became possible on a mass scale. Now, television was a personal communications device for a special segment of the population. By 2001, estimates say closed captioning will be available on every television set made.

Today, the government has deregulated the VBI signal and many broadcasters are teaming with two-way enhanced TV software systems like Intel’s Intercast, WebTV and Wink to provide graphical and informational enhancements to their subscribers. Bloomberg terminals, in fact, receive VBI data like news headlines and stock prices. Your cable set-top box receives its TV schedule information via the VBI.

Eventually, sending data through the VBI will cease when the digital signal becomes the broadcast standard; but, let's get to that later.

Broadcast, Cable, Satellite, the Internet, and Wireless

The history and evolution of the over-the-air broadcast, cable networks, satellite dishes, microwave wireless, and the Internet industries are too vast for the scope of this paper. Suffice it to say these video and data networks have and continue to operate in parallel to this day, but not for long. Soon, eTV technology may bring such integrated services into homes around the world. In order to understand how powerful that convergence might be, it is important to look at a few statistics. For example:

# of TV Sets	600 million – worldwide, 250 million + in the U.S., 200 million + in China
# of Cable Homes	67 million – homes in the U.S.
# of Computers	103 million - worldwide
# of DBS Homes	10 million - worldwide
# of Internet Hosts	44 million - worldwide
# of Internet Servers	3 million - worldwide
# of Internet users	160 million - worldwide
# of Web sites	4.4 million - worldwide
# of Web pages:	800 million - worldwide
# of emails	7.3 billion - sent per day in the U.S.

The rollout of the digital broadcast signal around the world, however, will probably be the most significant influence on the evolution of enhanced television. Before we can talk about digital television, however, let's consider the first real enhanced television trial: QUBE.

Trial and Error

QUBE TV, as it was called, was a significant achievement in the evolution of interactive television because it demonstrated that viewers within a community really wanted interactive enhanced programming. Originally a Warner cable franchise in Columbus, Ohio (this author's hometown), the then un-named system offered 36 channels - a large number even at that time – to subscribers without much programming on it. Subscribers did not want to pay for an empty service, of course, and began to sign off. In 1977, executives quickly recruited a team who would begin to develop 8 hours of programming for the service now being called QUBE, says Peggy Connor on "Media Central". Producers quickly latched on to the idea they could develop a two way system in order to attract more subscribers to the franchise. With help from Pioneer, the only two-way cable plant at the time, the QUBE team put together an end-to-end set-top box system featuring buttons subscribers could push to choose or vote during shows. It was an instant hit in town. The author, in fact, can attest that all the kids in Columbus wanted one - though most didn't have cable, yet. Early prototype ideas that came out of QUBE included home shopping, children's shows, a movie channel, and music videos, which became QVC, Nickelodeon, The Movie Channel, and MTV networks later on. Unfortunately, according to Connor, QUBE came to an end due to the fact that: 1) American Express, the investor partner, dropped out of the cable business; 2) other desirous Warner cable franchises stretched QUBE's ability to provide content; 3) subscribers figured out how to rig the boxes for free movies with a safety clip at the back; and 4) Warner's Atari division lost $1 billion in 1983. QUBE was soon sold to Viacom, Inc. and that's the end of that.

Although QUBE had a glorious start, and a messy ending, this interactive TV experiment proved there was not only interest in systems of this sort, but room for another. Post 1983, cable really took off and the basic set-top box began to appear in everybody's home.

REVOLUTION

Digital Technology Changes Everything

In the early 1980's, just when cable programming became serious competition for the film industry, Japanese representatives from NHK introduced High Definition Television technology to Hollywood called "NHK Hi-vision". This technology was clearly revolutionary because it was able to transmit better pictures and sound inside a wider screen – something the film industry was keen to provide. Unfortunately, the HDTV signal, as it came to be called, required 5 times (20 MHz) the bandwidth than an NTSC analog signal (6 MHz). In addition to usage of spectrum issues and compression problems, there were many incompatibilities with the present system.

For the next 16 years until 1996, however, the standardization debate raged on while Japan put a non-NTSC analog version of HDTV in place. Over 23 well-funded international proposals from corporations and educational institutions were submitted to the U.S. Federal Communications Commission. These proposals tried to answer: 1) Would an HDTV transmission be analog, a mixture of analog and digital, or purely digital? 2) How would the signal transmit: broadcast, satellite or, cable? 3) What part of the broadcast spectrum would HDTV occupy? 4) What video compression scheme would be used to fit a 20 MHz signal into a 6 MHz one ? Finally, in 1990, after much haggling, the FCC decided an HDTV digital signal would be simultaneously broadcast until analog phased out. In order to receive this signal, people would be required to buy either an integrated digital TV set, a digital set-top box , or digital TV tuner card to place inside their personal computers to properly interpret the signal. Eventually, four proposals seemed serious, but no one the winner. A suggestion was made to form a "Grand Alliance" between these contenders: AT&T, General Instrument, MIT, Philips, Sarnoff, Thomson and Zenith. Still after much discussion in 1996, the FCC adopted the Advanced Television Systems Committee (ATSC) Digital Television Standard based on an MPEG-2 compression scheme proposed by the Grand Alliance. It was that year, also that the Telecommunications Act was passed. In 1997 the FCC allocated pure digital spectrum, not analog or a blend, to broadcasters further requiring them to begin transmitting on a graduated schedule by 2006.

During that hashing out period, many important developments took place: 1) the cable industry became a powerhouse of programming and franchises around the country; 2) the PC revolution gave the television and film producing community suites of software tools to digitally edit and manage their work, especially those from Adobe and Macromedia and Avid. Out of this emerged the CDROM industry, which became the stalking horse for development of interactive multimedia applications. (Note: This was the first time the author of a digital product used the same machine to make the final product the consumer bought to play it.); 3) Satellite companies, eager to get a bigger piece of the market, introduced smaller 18 inch -- 3-foot diameter residential dishes into homes called Digital Broadcast Satellite (DBS). These dishes received transmissions of over 200 channels of digitally encoded NTSC broadcast signal to digital-to-analog decoder set-top boxes nationally and internationally; 4) A mix of analog and digital consumer electronics devices also appeared such as CD-ROMs, VCRs, camcorders, laser disks, and digital video disks.

But nothing was as influential as the arrival of the Internet and the television industry would feel the tremendous weight of it as more people got connected to it. A new digital era was beginning.

The Internet Makes Wide Interactivity Possible

The Internet was in parallel development to television ever since Leonard Kleinrock of the Massachusetts Institute of Technology (MIT) in 1961 wrote "Information Flow in Large Communication Nets" and J.C.R. Licklider of MIT (and soon to be head of ARPANET, the network that would become the first implementation of the Internet), in 1962 wrote about a "Galactic Network" of computers in several memos. But, it wasn't until much later in the early 90's that a distributed, interactive text, audio, and video environment seemed possible to the rest of the world.

Two innovations set the foundation: 1) in 1991 Englishman, Tim Berners-Lee, at the Swiss institute, CERN, posted his ideas for the World Wide Web to a small newsgroup, "alt.hypertext"; and, 2) in 1993 Marc Andreesen and company at the NCSA located on the campus of the University of Illinois at Champaign-Urbanna developed the first visual browser for the Internet called "Mosaic". Up until that time, navigation of the Internet was done through cumbersome, text-based menus and hypertext called "Lynx".

Once anybody with a computer could simply buy a modem, install some software, dial-up an Internet Service Provider from their computer, and use a browser to navigate to a Web address called a "URL", the Internet became a popular multimedium - one that has become ubiquitous today. Furthermore, this new multimedium was built upon technological standards such as the Internet Protocol and HTML, which enabled start-ups everywhere to begin developing and deploying standalone or shared Web-based applications and sites.

Examples of Internet applications:

Email	The exchange of text messages.
HTML authoring	Tools that create Web site documents.
Chat	Ability to talk to others in real-time.
Search engines	Web tool to look up words and sites on the Internet quickly.
Streaming media	Video and audio downloaded from the Internet.
Ecommerce suites	Tools which help create shopping on a site.
Auctions	Web tool enabling bids for products and services.
Web applications	Email hosting.

Ultimately, the Internet made and continues to make it possible for a large user base to create content the entire world can access.

In a dark corner

While everybody migrated to jobs at Web companies because "that's where the money was going", several singular projects in the San Francisco Bay Area continued to explore the possibilities of innovative TV in quite different ways. Most everybody thought they were crazy. One, Telemorphix, a small start-up that formed around 1992-1993, tried their luck on a 1 hour live broadcast show once a week called "21st Century Vaudeville". This show, which ran in San Francisco for 6 months and then in Boston on WMFP for a year, featured audience members who called in live via an 800 telephone number to become improvisational cartoon "actors" on the show. Each caller-viewer could choose from hundreds of characters or fax in one of their own, and then wait for their turn or talk to others via a party line in the "virtual green room". When it was the viewer's turn to appear, they talked into the telephone and their voice came out of the TV set which triggered the mouth of the character to animate (the mouth was pre-animated by the producers). Each character (Fork, the Punk, the Knucklehead, etc.) interacted with the cartoon host, "Jack" until he kicked them off. The effect was marvelous and drew a cult following. Unfortunately, the company suffered a financial catastrophe when the founder went through a divorce. Additional experiments like this and other start-ups experimenting with interactive television technologies such as the beleaguered NetChannel and Interactive Television Network (ITN) never got off the ground and suffered financial ruin.

CONVOLUTION

Trials and Products

Lessons learned from smaller and much larger enhanced TV trials in the mid 90's, however, helped a fledgling group of professionals around the country to learn exactly what consumers wanted and which technologies would actually work. Because of developments in the Internet and MPEG compression technology, large corporations, that could afford it, wanted to test multi-service, high-speed enhanced television systems on a wide basis in the field to see if interactive/enhanced television was possible. Trials of different scope were sponsored by a singular or a coalition of companies - sometimes from different industry sectors. In general, competitiveness and a belief that enhanced TV would be a lucrative industry drove these companies to explore such systems, methodologies, and business models. New services tested in the field included movies-on-demand (now called video-on-demand or "VOD"), local information services, interactive gaming, shopping, and education. These professionals say that it was what they learned about designing the user interface and how people made choices on the screen – a direct precursor to enhanced TV – which taught them the most. Many of those discoveries are being implemented today. In total, over 21 trials kicked off after 1993 when Source Media launched the Interactive Channel in Denton, Texas. Between 1994-1996, 17 more major telco or cable trials took place outside the U.S. It's not known how many more experiments were taking place around the country. Please submit your war stories to swedlow@itvt.com for inclusion here.

A small U.S. sampling:

Company	Name	Location	Technology	Services
Bell Atlantic AT&T	FutureVision TeleTV	Dover Toms River, NJ	Phillips set-tops nCUBE servers Switch Digital Video	Near VOD Pay-per-view Shopping
Bell Atlantic AT&T	Stargazer	Fairfax, VA	Stellar One set-tops nCUBE servers AT&T ADSL	VOD Internet
Time Warner	Full Service Network (FSN)	Orlando, FL	Fiber to curb	VOD, games, shopping, postal
TCI Microsoft	MS Network	Redmond, WA	General Instrument Hewlett Packard NEC	VOD, games
Cox Cable	no name	Omaha, NE	Zenith set-tops Hybrid Fiber Coaxial	VOD, NVOD transaction
Southwest Bell	Little Richard	Richardson, TX	Fiber to curb	VOD, games, 60 channels

Data provided by: S.Churchill

Although most of these trials would get cancelled, many "lessons learned", according to Daniel Levy, now director of program development at Wink Communications, an enhanced TV software developer, "still reverberate today." Launched on December 14, 1994 over fiber in over 4,000 homes made up of mostly family units, Time Warner's Full Service Network tested services like video-on-demand, shopping, games, an electronic programming guide, and interactive postal services. Not a free ride, by any means, customers were billed on a pay-per-use basis via their credit cards. All told, the project cost many millions of dollars – possibly up to 100 million.

With enormous financial losses due to the fact that the technology simply cost more than the deployment could support, FSN closed down in 1997. “It was far too expensive, but we knew that going in”, says Levy - responsible for the service style guide. Contrary to public assumptions about the project, “We knew FSN would eventually become deployable much later on”, he says. “It wasn’t a wasted effort: we learned a lot.” When asked, Levy also points out certain things gleaned from the experience: 1) the service, itself, must be available free to the customer; 2) different tiered pricing models do not work.; 3) video-on-demand is a very popular application of the technology; and, 4) people really want simple interactive options. These things definitely foreshadow the eTV systems and emerging business models we have today.

As big corporate trials flared and failed, the Internet continued to grow rapidly. More and more people connected to the Internet and began expecting greater amounts of speed to access greater amounts of content and multimedia. Hundreds of TV-related products released to the market claimed to be “the” video solution which would enable the computer or Internet to unite with the TV. Terms like “PCTV”, “InternetTV”, “NetTV”, and eventually “WebTV” and others became the buzzwords in every magazine. Meanwhile, telcos returned to the labs to develop what they hoped would be their solution to pumping video data through the pipes, e.g. high-speed data networking technologies such as xDSL (where the “x” stands in for several variants such as A, H, S, & V). The cable industry began to explore and build high-speed hybrid fiber coax or fiber data technologies to bring their cable legacy systems up to speed. Today, new convergence companies such as AT&T BIS are beginning to invest in cable network upgrades to provide what has come to be called “broadband” services. Other well-established cable broadband firms today are Excite@Home, MediaOne, and RoadRunner. A serious competitor for consumer broadband dollars, the DBS industry (e.g. DirecTV and EchoStar) is seeking additional subscribers by promising more channels, a better “digital” picture, and VBI-driven interactive services such as an electronic programming guide and other enhanced television services on the way. Infrastructure providers like Cisco have also become active in working with the content community. All of this interest makes for a lively new medium in search of an audience.

SOLUTIONS

Enhanced TV-driven Services and Products

From 1995 on, a handful of companies around the U.S. developed different solutions for enhanced TV. Their work reflects many of the technologies and lessons learned from earlier work. Following, three companies below, Wink, WebTV, and Intel have successfully pioneered their own eTV platforms. Each continues to play an important role in the development of the eTV industry

One of the earliest out the door, **Wink** Communications was the first to use the term “enhanced broadcasting” as a way of differentiating itself from the bad hype surrounding the term “interactive TV”. Since those early, unknown years, Wink has become a constant name in the press and continues to deploy its software and backend systems in communities around North America.. Only recently, Wink announced deal with DirecTV, Japan, and Fox. In addition, Wink also recently received a $30 million investment from Microsoft and $10 million from billionaire investor, Paul Allen, to continue developing their platform. Wink offerings include a set-top, if necessary, a complete end-to-end (currently proprietary) software system including a special backend billing environment - which Allan Thygesen, senior vice president at Wink, says “was the most difficult thing to engineer”. Wink has made many partnerships with big branded media companies like MSNBC, the Discovery Channel, the Weather Channel, E! Entertainment Television, and more. The general philosophy at Wink is to present limited choices to the viewer to pare down the experience to the essential. HTML links via the VBI. When enhancements are available to the viewer, to an “i” icon on the screen appears. Wink also provides an electronic programming guide. For now, enhancements are relatively simple and often prepared via special Wink authoring tools by the content provider’s small team of producers. Wink prides itself, however, on it’s Wink Response Network, a sort of walled off interactive advertising system in which participating advertisers get immediate feedback or any revenue and data generated. The big challenge for Wink will be whether they will successfully move their system towards ATVEF-compliance.

WebTV premiered in October, 1996, with a plug and play set-top + online service. Grabbing the media and consumer's attention with low prices and access to the Internet from a couch, WebTV got in early and has successfully maintained an important position not only as a viable platform, but also as a platform which continues to develop the medium and the technology. Today, WebTV has an 800,000+ subscriber base, a bit of a cult following; a 1997 $400 million + investment from Microsoft; space on several vendor set-tops in the U.S., Europe and Japan; and has certain plans to appear on the Scientific-Atlanta Explorer 2000 advanced set-top box to be put place by new cable conglomerate, AT&T-TCI. WebTV also made a partnership with DBS provider, EchoStar, for a new, integrated set-top receiver, DISHPlayer, featuring their software. WebTV's system is a bit more complex than Wink's, however. For example, WebTV offers: a comprehensive "walled garden" online news and information service to the users, access to the Internet, banking and bill payment services, communications applications such as email, chat, as well as Web page building tools. In many ways, WebTV is a mini computing appliance and prices are coming down. Recently, WebTV partnered with First USA to provide secure transaction technology to the users. WebTV also offers several set-top products from which to choose including a WebTV for Windows 98 version. Producers of content over a WebTV box can use 3rd party tools such as Mixed Signals Technologies – the first commercially released enhanced TV software – or get advice about how to code their data by contacting various closed captioning organizations posted on their developer's Web page if they need help. HTML URLs are prepared by producers and sent via the VBI signal, currently.

Intel's **Intercast** PC TV tuner card --- which came out in 1996 with the broadcast of the Summer Olympics featured on NBC that year --- found it difficult to gain buyers at first, but today is becoming more popular as PC users become desirous of enhanced broadband TV over their computers. One of the nice things about the Intercast system is that anybody can install the card and software, i.e, they don't have to wait for a cable deployment in their area. Content providers like CNN, CNBC, Lifetime, QVC, M2, Lifetime, and The Weather Channel have established relationships with the Intercast project. And because Intercast data programming exists in a computer environment and not on a set-top, content producers can develop more elaborate enhanced TV and interactive application presentations with Java and so on. For producers, Intel offers scheduling and presentation-transmission tools for simple planning and deployment of programming. Intercast is becoming friendlier with its competitors, however. Recently, Intel made a deal with WebTV to be compatible with that system. Watch out for Intel's set top box development group to roll out additional products for enhanced TV over broadband.

Below is a chart, of more prominent companies and their eTV technologies in context with the above five:

Generic Term	Platform Technology	Functionality	Sample Companies	Business Model
"Individualized TV"	Software on set-tops – proprietary.	Does not use HTML enhancements currently. Viewers can choose from several camera angles and smart TV ads. Via one path multi-cast.	ACTV	Cable subscription Advertising and transactions
"Hyper TV"	Proprietary software	Pushing URLs to TV programming.		
Digital to analog electronic programming guides	Cable, satellite set-tops and other special set-top box systems	Interactive access to TV schedules and info about programs. Data sent through VBI.	All	Part of the cable service. Advertising currently
Video on demand	Video servers	Streams MPEG video in broadband environment. May use eTV.	DIVA Intertainer	Subscription Advertising Transactions
DSTB – digital set-top box	Cable set-top needs operating system. Broadband set-top needs operating system	High-speed data and video interactivity (some will offer a smart card slot, additional ports, DVD, & lately one comes with a CD-ROM).	General Instrument, Scientific-Atlanta, many others Stellar One	Cable subscription Transactions
Streaming Video	Video servers	Streams videos on the Internet on-demand or in real-time.	nCUBE,	Free for now on the Web, sometimes requires a fee or subscription to Web site.
"personalized TV" also called "timeshifting"	Special set-top	Integrated digital hard drive records programs. Comes with special online service.	Replay TiVo	$700-1500 $500-$1000 for set-top $10-$200 for service per month
"Hypervideo"	Internet	Real-time authoring of streaming video featuring clickable images.	Veon	N/A yet
"Enhanced TV" "Channel Hyperlinking"	Software on set-tops Software at cable headend with simple set-top Has set-top, but really just software. Windows product needs tuner card. PC TV tuner card with software PCTV tuner card with software	Companies have different information services, applications, stylistic differences, and business models. Platforms interpret data sent through the VBI by broadcasters. Software interprets this data and presents enhancements on top of video or around like a Web page. Data is written in HTML. Down the road, the VBI won't be needed because of digital television. ** PC TV tuner cards do not enable email applications.	Wink Communications WorldGate WebTV Classic WebTV Plus WebTV Windows 98 WebTV DISHPlayer Intercast WaveTop	Free with cable subscription. Advertising, transactions. Less than $22 per month + cable subscription, ads and transactions. Box $49 + per month fee Box $99 + per month fee Box $199 + per month fee and subscription to EchoStar (all offer ads and transactions) Around $130 for card from different vendors. Ads and transactions. Free software with TV tuner card from different vendors.

RESOLUTION

A Need for Standardization

In a period of great confusion where new products and technologies seem to launch every day, it's no wonder people resolve to seek standards that might make things simpler and more robust. Surely, as each new platform mentioned above launched and deployed, an interest in eTV began to build. By the spring of 1998, it became clear to a few industry participants there was need for a standard specification to provide a common technological and development environment. In June, several representatives from leading companies founded the Advanced Television Enhancement Forum (ATVEF) to accomplish just that. Fourteen companies, in fact, invested in the commercial consortium becoming its "Founders" (e.g. Intel, Discovery, PBS, CNN, Microsoft, Sony, Tele-communications), and others. Since then, 65 additional companies have joined as "Adopters", including the American Film Institute. Over the last year, work preceded quickly on the specification and the latest draft (in 1.1 r26) has been finalized for first licensing.

Open Access vs. Forced Access

Another important, but in some ways, side issue seeking resolution before enhanced television can fully succeed, is something called "Open Access", or as opponents are calling it: "Forced Access". In short, this controversial issue pits old foes (local telecommunications providers and cable providers) against each other as each seeks to protect markets important to it. For example, local telecommunications providers want the cable providers to open their network franchises to competitive ISP services. This, they claim, is in line with the FCC mandate for choice in the industry and free access to Internet content. In contrast, the cable companies believe they have the right to retain control over their networks as they were the ones to invest billions of dollars to build them. Currently, there are many legal battles going on, which will determine the new media landscape for many years to come. AT&T and America Online are the most prominent opponents in this struggle, although there are many others on each side. It remains to be seen how and if this struggle will slow consumer access to enhanced TV services or not.

IRRESOLUTION

Continuing Challenges, Problems, and Risks

There are many challenges and risks, which still plague this emerging industry. Only by working in this field over time will they become apparent. Many issues continue to need attention, which, perhaps, can be addressed by the current AFI-Intel Enhanced TV Workshop. A list of them follows. It will be interesting to see the progress made a year from now at the AFI-Intel Enhanced TV Workshop 2000.

- Wider distribution of enhanced TV software or enabled set-top boxes.
- Better marketing of eTV to potential viewers/subscribers to get word out.
- Adopting and advancement of the ATVEF specification standard.
- More relationships with collaborators and business partners to build access and revenue.
- Continued improvement of the development of successful business models
- More tools and services for advertisers, content producers, and broadcasters
- Lack of production methodology necessitates training and higher budgets
- Bandwidth still a problem
- Budgets for video/enhanced data programming can be bigger than expected.
- Can't predict the presentation of the show until produced.
- Challenge to create billing system – too much focus on set top.
- Clicking to the Web takes viewers away from shows and advertising.
- Producers must spend a disproportionate amount of time on technology tools
- Not enough people have all production skills necessary.
- People may still remain passive.
- Some platforms still require big facility upgrade.
- Overly complex enhancement programming may overwhelm the user and show
- Size of video window and screen presentation always a challenge.
- Too few options for interactivity at the moment

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ENHANCED TV GLOSSARY

ADSL- Asymmetrical Digital Subscriber Line. ADSL is type of DSL that provides T1 rates or higher in the downstream (towards the customer) direction and 64 kbps or higher in the upstream direction.

ANALOG – Analog data is expressed in the form of continuously variable waves (e.g. amplitude or frequency of sound waves or electromagnetic waves). Susceptible to noise and are not easily compressible.

ARPANET- Advanced Research Projects Agency Network. DARPA was founded in 1957 in response to a successful launch of a Russian satellite. ARPANET was a project intended to maintain communications within the country via important government computers in the eventual threat of nuclear war.

ASPECT RATIO-The width-to- height ratio of the picture frame. TV broadcasts at a 4:3 (1.33:1) aspect ratio; digital TV will be broadcast with a 16:9 (1.78:1) ratio; and most feature films are shot in at least a 1.85:1 ratio.

ATM- Asynchronous transfer mode. A high speed data transmission and switching technique that uses fixed size cells to transmit voice, data, video which greatly increases the capacity of transmission paths, both wired and wireless.

BACKBONE – A fat pipe within a network. The term is relative to the size of network it is serving.

BANDWIDTH- 1. (broadcast) The range of frequencies available for signaling. The difference expressed in cycles per second (Hertz) between the highest an lowest frequency of a band - James Martin 1971. 2. (data wire) Analog telephone lines measure capacity in Hertz (the difference in the highest and lowest frequency in the channel). Digital channels measure capacity in bits per second. A T3 connection is approximately thirty times as fast as a T1 connection, which is 50 times as fast as a 28.8 modem, which is twice as fast as a 14.4 modem.

Broadcast:	6 MHz analog
Cable:	450 MHz analog signal
Cable modems:	up to 27 mps downstream - shared
Speed of Internet data:	14.4k – 26 Mpbs with VDSL
Speed of the VBI:	4 Mbps
Speed of digital signal:	19.2 Mbps

BROADBAND- A network capable of delivering high bandwidth. Broadband networks are used by Internet and cable television providers. For cable, they range from 550 MHz to 1GHz. A single TV regularly broadcast channel requires 6MHz, for example. In the Internet domain, bandwidth is measured in bits-per-second (BPS). See DSL.

CABLE MODEM- A device that permits one-way or two-way high speed data communication over a cable television system for purposes such as Internet access at speeds of around 1.5 MBPS. Download rate is 27 Mbps.

CABLE TELEVISION – The system network for the distribution of the television signal and now digital data by cable (co-axial, twisted pair or fiber optic).

DBS- Direct Broadcast Satellite. Satellites powerful enough (approximately 120 watts on the Ku-band) to transmit a signal directly to a medium or small receiving dish (antenna) at 18" and 3 feet in diameter. DBS does not require reception and distribution by an intermediate broadcasting facility and transmits directly to the end user.

DECODER - Term sometimes used for set-top box

DOWNSTREAM - Information path sent from the network to the user.

DSL- Digital Subscriber Line. Modem telecommunications technology that enables broadband, digital data to be transmitted over ordinary telephone line. DSL comes in many flavors, known collectively as xDSL, see ADSL, HDSL, SDSL ,VDSL.

DTV- Digital Television. A new broadcast standard recently approved by the Federal Communications Commission that will ultimately replace the analog television signal we receive today. DTV allows for high-resolution and wide screen presentation and will require new television receivers as well as new broadcast facilities. Because of the scope of this conversion, the changeover from analog to digital TV will be gradual and take place from 1998 – 2006.

EPG- Electronic Programming Guide. The channel selection device at the heart of the digital TV revolution. An essential, navigational device allowing the user to search for a particular program by theme or other category and order it to be displayed on demand. Ultimately, EPG's will enable the TV set to learn the viewing habits of its user and suggest viewing schedules.

HDSL- High bit rate Digital Subscriber Line. HDSL is a type of DSL that Transmits 2 Mbps bi-directional signals over one or two twisted copper pairs. HDSL is used in applications such as corporate Internetworking, video conferencing, and remote data center access.

HDTV- High-definition Television. A higher quality signal resolution using a digital format for the transmission and reception of TV signals. The HDTV provides about five times more picture information (picture elements or pixels) than conventional television, creating clarity, wider aspect ratio, and digital quality sound.

HEADEND- The electronic control center of a cable television system- generally located at the antenna site of CATV system. The headend takes incoming signals and amplifies, converts, processes, and combines them into a common coaxial or optical cable for transmission to cable subscribers.

HFC- Hybrid Fiber-Coaxial system. A local cable TV or telephone distribution network. An HFC consists of fiber optic trunks ending at neighborhood nodes, with coaxial cable feeders and drop lines downstream of the nodes.

HOST - Any computer on a network that offers services or connectivity to other computers on the network. A host has an IP address associated with it.

INTERNET SERVICE PROVIDER - Telecommunications companies that sell Internet access. Users either dial-up to an ISP server or have a broadband connection such as DSL. Once connected, they can branch out onto the Web

NVOD- Near Video on Demand. The service of providing a movie to subscribers on multiple channels and staggering its start time (for example every fifteen minutes). Subscribers can then tune in to the next available showing.

INTERFACE- A set of textual or graphical symbols that allow a computer user to communicate to underlying software. Computer Interfaces work in many ways. Some are text-based and communicate only in letters, numbers, and other keyboard symbols. Others are graphical and require the use of a mouse. Still others are touchscreen.

INTERLACED SCANNING- The rectangular area of the TV screen is scanned by an electronic beam (raster) as it is deflected horizontally and vertically and creates an interlaced video display we see as the TV picture. Referred to as interlaced scanning because the raster skips every second line on the first pass and then fills in those lines on a second pass. The interlaced scanning system may result in a screen flicker.

IP - Internet Protocol. A protocol telling the network how packets are addressed and routed.

Mb or MEGABIT -10^6 bits of information (usually used to express a data transfer rate; as in, 1 megabit/second = 1Mbps).

MHZ- Megahertz - A frequency equal to one million Hertz, or cycles per second.

MPEG- Motion Pictures Expert Group - A proposed International Standards organization (IS) standard for digital video and audio compression for moving images. Responsible for creating standards 1, 2 and 4

MPEG-1 1/4 broadcast quality which translates to 352 x 240 pixels. Typically compressed at 1.5 Mbs.

MPEG-2 Similar to MPEG-1, but includes extensions to cover a wider range of applications. MPEG-2 translates to 704 x 480 pixels at 30 frames per second in North America and 704 x 576 fps at 25 fps in Europe. Typically compressed at higher than 5 Mbs. The primary application targeted during the MPEG-2 definition process was the all-digital transmission of broadcast TV quality video.

NTSC - National Television Standards Committee. The committee formed to determine the guidelines and technical standards for monochrome and color television. Also used to describe the 525-line, 59.95Hz color television
signal used in North America and several other parts of the world.

PAY-PER-USE – One pays a fee for every service, product, and download often on a tiered basis.

PERSONAL COMPUTER – PC for short. The device which enables anyone to compute, word process, or perform more complicated functions.

PROTOCOL- The "language" spoken between computers to help them exchange information. More technically, it's a formal description of message formats and rules that two computers must follow to communicate.

REMOTE CONTROL: Remote controls today serve as the front end warrior in the evolution of the TV. Today, they enable the viewer real ease-of-use and simplicity of control. Because of that and the wide adoption by the television industry, the addition of many more channels over cable and satellite, and the introduction of the universal remote, viewers can “channel surf” or become “couch potatoes” or when on the Internet users are “Web surfing” and are “mouse potatoes”. Will eTV explorers go “Web channeling” and become “couch mouses”? The first remotes were invented, in fact, by the German navy to help ram enemy ships in World War I. Later, in World War II, everybody used remotes to set off all kinds of bombs. In the 1940’s, the garage door opener remote was invented. In 1952, the first TV remote appeared and it was called, aptly, the “Lazy Bone”. Manufactured by a company called Venus (Note: Microsoft’s new set-top box project in China is called “Venus”), the Lazy Bone control came with a 10 foot or 100 foot cable. When clicked, a command would rotate the tuner inside the TV set and change the channel. Throughout the years other remote systems explored different technologies, but always seemed to encounter some problem. For example, light sensitive cells on the TV set were sensitive to sunlight, which would turn up the volume at random. Later, ultrasonics built into remote controls would cause dogs to bark when they came into the room. Eventually infrared (individual digital codes of light pulses) would become the standard today; however, they still don’t work when pointed at objects in between it and the TV set.

SDSL- Symmetrical Digital Subscriber Line. SDSL is a type of DSL that uses only one of the two cable pairs for transmission. SDSL allows residential or small office users to share the same telephone for data transmission and voice or fax telephony.

SPECTRUM- The range of electromagnetic radio frequencies used in transmission of voice, data and television.

STB – Set-top box. An electronic device that sits on top of your TV set and allows it to connect to the internet, game systems, or cable systems.

TERMINAL- A device that allows user to send commands to a computer that is somewhere else.

URL - Uniform Resource Locator. The address of a document or other resource available on the Internet by clicking a link. A URL has three components, the protocol ("http:"), server domain name ("intel.com"), and the file location on their server.

UPSTREAM - Information from the user to the Internet or network.

VBI - Vertical Blanking Interval- Part of the TV signal that is not used for video information and left available to transmit other data such as captions, Web pages, current stock market prices. Visually the VBI is the black stripe at the top and bottom of a TV picture and physically it constitutes 21 lines' worth of the total 525 lines transmitted per second in the NTSC TV signal. In detail, the Vertical Blanking Interval is a portion of the analog TV signal embedded inside two rectangular fields on the TV screen that are comprised of 262.5 imperceptible horizontal lines. Each line is made of 427 pixels that form the video images on the screen through a process called electron beam "interlaced scanning". The first 21 lines of each of the two horizontal fields (a black stripe - only seen when the picture loses its vertical hold and rolls) is called the Vertical Blanking Interval. In this interval, data of any kind can broadcasted, received by any TV set, and interpreted with special software if the TV set is hooked into a set-top box or the data is received by a TV tuner card on a computer. The first 9 lines of the VBI are used for timing information of the shows, but lines 10-20 are pretty much unused. Line 21, however, is used for closed captioning text and now in use for HTML data. See HTML.

VDSL- Very high bit rate Digital Subscriber Line. VDSL is a type of DSL that is primarily intended to be used as the last transmission system section in a network. VDSL can serve as the primary transmission element for video-on-demand (VOD) and Asynchronous Transfer Mode (ATM) applications over the existing infrastructure of twisted copper pairs in the local plant and used to carry multiple television channels, HDTV and ATM to the Home for interactive services (home banking, shopping, remote medical care).

VIDEO SERVER- The business end of a client/server setup, a server is usually a computer that provides the information, files, Web pages, and other services to the client that logs on to it. (The word server is also used to describe the software and operating system designed to run server hardware.)

VIDEOPHONE – This future device promises to incorporate real time video transmissions with telephony. Although this technology was promised and available many years ago, it has never been fully realized. Today, Internet Telephony or Cable Telephony may offer this service.

VOD- Video-On-Demand. The service of providing content through subscriber selection off a large menu of options, available to viewer at any time.

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