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In the matter of
Advanced Television Systems

Comments of
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The opinions expressed herein are those of the author only

Executive Summary

HDTV is a non-event. It has already been leapfrogged by successful digital video entertainment and a plethora of computer systems that bypass any proposed picture standard. The opportunity before the FCC is the abundance of spectrum made possible by digital radiation. The challenge is adjudicating a one billion bit per second public information resource, not in picking a pictorial winner. In short order, a multiplicity of software-decoded picture formats can co-exist, each suiting its market and constituency, from desktop computers to living room theaters. No regulatory jump start is needed for this to happen; it stems from the natural convergence of imaging and digital technology. If any single winner emerges, it will be through demand, not edict. More likely, a fertile breeding ground for diversity will result.

The FCC can perform a valuable public service by endorsing a digital radiation standard so as to permit the hardware investment in transmitters and receivers to proceed. Bit delivery is the key component, the meaning of the bits can change freely, continuously and dynamically.

Broadcasters should be encouraged to migrate to digital radiation via the fastest schedule possible both to allow wider use of the UHF spectrum and to free up VHF for other services. Their main fee is the cost of retiring existing analog channels. New digital spectrum can provide abundant resources for new distributors of entertainment and information.

Introduction

The issue before the Commission today has nothing to do with television and everything to do with the design of the digital information infrastructure in the United States and worldwide for the next 50 years. For more than ten years, my colleagues and I at the MIT Media Laboratory have researched and argued for the convergence of computing with television. It is now happening. Digital television is a consumer item for entertainment and a personal computer resource for production and expression. Television's pervasive presence is paving the information highway with broadband channels four to one thousand megabits per second wide and is thrusting it into every living room. Television is both entertainment and the last data type to fall to this digital revolution.

As an example, the DirecTV satellite broadcast system claims over one million receivers in American homes and ultimately will include a decoder built into PCs. This system alone has already rained almost as many television bits on this continent as there are air molecules in this room. And the price is dropping monthly.

Modern workstations from Hewlett Packard, Digital Equipment, and (soon) others now decode broadcast quality video in software. No expensive or special-purpose equipment is needed; it is quite literally built into the operating system. Even a standard is superfluous -- digital TV is no more cumbersome a resource than high quality text, graphics and sound.

This Commission must decide how to best propel a basic service, high quality broadcast television, into this digital future. At issue are what new services may exist, what system elements need be standardized, and which pieces can evolve fluidly and to suit new applications and technological opportunities. The goal is to create fertile turf: a digital land of opportunity for the public and the commercial entities that build businesses on it.

The UHF Opportunity

The FCC is at a watershed in the development of new uses for the radio frequency spectrum. The visionary decision to transform the backwaters of UHF into a digital medium carries the promise of substituting programmable, digital abundance for hardwired, analog scarcity. Instead of relegating almost one-half of the available spectrum below one gigahertz to taboo-laden dead-air, the FCC's ATV inquiry is opening a one billion bit per second, multi-purpose, multi-user information airway.

At existing television resolution, and with existing standards such as MPEG, this nets out to 200 television program channels per locality. Or 50 higher definition entertainment programs. The entire Washington Post, complete with illustrations and advertisements, takes no more than the blink of an eye to transmit; the text of a full-length novel is a mere cough. In a one gigabit channel, the entire work of Beethoven can flow by in less than an hour at CD quality or in one second as a digital score.

Even in six megahertz chunks, the 21 megabits per channel is twice the data rate of most local area computer networks, 21,000 times the rate of TV closed captioning or teletext.

The decision to use these bits for TV, HDTV, sound, data, or any mix thereof can be made on a millisecond not a millennium basis. All the news that's fit to radiate can fit into the quiet moments between the plays of an NFL football game, complete with an advertisement directed uniquely at each viewer. Both the computer and the family can tune in.

A Two Part Decision

The simple argument is that we can separate the ATV decision into two parts: how the bits are delivered and what those bits mean. The FCC has a valuable public interest mandate in adjudicating the method of delivery. Defining the modulation and radiation scheme impacts how much of the spectrum can be used, whether it is broadcast, cellular, one-way or two, local or nationally allocated and where equipment is sited. Such delivery decisions affect the hardware design of transmitters and receivers and are tied to the physics of radio propagation and the economic interests of the participants, including the consumers who buy the receivers. This is meat for standardization and grist for the FCC's mill.

What the bits mean, however, is a separate issue, one best left free to evolve continuously at the demands of the market and society. Within one existing UHF channel, those bits can carry one HDTV program via any of a number of potential compression schemes, four or five NTSC resolution programs (at higher quality than most consumers have ever seen at home), or those bits can become the Internet of the air, one of the National Information Interstate Highways. In fact, it is a daunting task to even consider monitoring and controlling what those bits represent either in form or content.

By simply stealing a few of those bits during an Apple Computer commercial, for example, one could download the entire new operating system. How can any agency determine which program the viewer tuned in to receive and whether that viewer has eyes or just a hard disk? An even if that viewer tuned in for the game, who can predict the screen on which he or she is watching it?

Standardizing Pictures

The Grand Alliance has done a remarkable job in endorsing and accepting an international picture compression standard for HDTV (MPEG-2). As a member of the MPEG committee since 1988, I support the standard and I can attest directly to its ability to efficiently deliver moving pictures from one place to another. I heartily endorse allowing the Grand Alliance system a place in this market. It should be allowed entry into the digital UHF band. But it need not be given exclusive title to it. Neither the technology nor the market demands it.

The era of fixed, single-purpose standards is fading. No market needs to be stimulated by endorsement of any one of them. Even the MPEG group now deliberates standardized building blocks instead of fully packaged systems or even linked families of them. It's fine to read the news on paper, but there is no need to require all publishers to use the same typeface.

Picture formats and encodings are software We are approaching an time when they are more a matter of momentary convenience rather than admin-

istrative edict. In two years, you won't be able to sell a video compression algorithm, you'll have to pay people to use it. It's value will be in the material encoded in it rather than the basic technology, and an author might well offer algorithm for free simply to promote its use. The situation is much like intenet browsers: the browser is free; the information obtained through it contains the value.

Debunking Myths

One picture standard or even a linked family of them is *not* necessary for advanced TV to flourish. New television pictures should play equally well on any screen, from the one in your pocket to the one on your wall. If any single one, such as the Grand Alliance's proposal dominates, then it will stand its on value and penetration, not on a legislative crutch.

Fixed picture formats are a holdover from an era of hardwired, single-purpose receivers. When television began, low-cost receivers drove designs. Each part of the system stressed the economic envelop. But we now have displays that run span a gamut from the living room receiver to desktop computer systems well beyond current HDTV quality. There is no single, definable TV set nor is it hard to map one picture format onto any other screen.

Broadcasters need not be funneled into one transmission format. If HDTV is a true panacea, then there is no need to regulate it at all. Broadcasters as well as alternative distributors will adopt it quickly. We need not make the existing broadcaster the guinea pigs for any particular format. We can let them make the same minute-to-minute decisions about transmissions as any other delivery channel.

Conclusions

The main opportunity before the Commission is digital radiation. HDTV is a small part of that. The larger picture is a dynamically evolving use of the bulk of the broadcast spectrum for services that range from audio to video to pure computer data. The economics dictates that we open the floodgates and let all forms of digital radiation compete and prosper. HDTV is a non-event in this scenario. To the extent that it is desired, it will emerge at its own rate. HDTV may prosper for medical images or for Sunday afternoon football. We need no mandate to let this happen.

The main goals in migrating to an all-digital UHF band are the diversity of its use and the abundance of channel capacity it provides. Broadcasters should be encouraged to go digital simply to free up restrictive allocations. Fixed HDTV standards are an unnecessary excuse. The value in advanced TV lies in the efficiency of a digital UHF band and the recovery of VHF for other services.

Biography

Andrew Lippman is associate director of the MIT Media Laboratory. He has researched digital television systems for over twenty years at the MIT Media Laboratory and currently directs a $2.2 million research consortium addressing *Television of Tomorrow*. This effort began in 1989 and has continuously focused on international, extensible formats for digital video. Before that, he organized a program entitled *Movies of the Future* that pioneered early techniques for digitally encoding a movie onto audio compact discs (CDs) and produced *scalable video* systems where picture size, quality, and resolution are decided dynamically at receiver. Lippman has been a member of the ISO/IEC MPEG working group since 1988 and helped develop the coding techniques as well as the requirements. The product of this group is an international standard that has been adopted by the Grand Alliance and ACATS for their US HDTV picture encoding.