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Watch Out Computing Here Comes HDTV! FREE

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Watch out computing— here comes HDTV!

The United States is on the threshold of establishing a new standard for high-definition television (HDTV). The HDTV standard will have a huge impact on the world of computing and visualization because it will lead the consumer-electronics industry to develop low-cost, standardized, high-performance display and computing technologies. Low cost will allow us to use high-performance systems far more widely than we do today, and standardization will enhance interoperability.

Although early models of HDTV cameras and displays have been available for many years, work toward a U.S. transmission standard began in 1987, when the FCC established the Advisory Committee on Advanced Television Service. The systems considered used either analog technologies or hybrid analog/digital approaches, which offered modest improvement in resolution and picture quality or required multiple television channels for transmission.

In early 1990, the FCC announced a preference for a simulcast strategy that achieved true HDTV performance in a single television channel and could be simultaneously transmitted with low power in the same frequency band as existing NTSC television service. The simulcast challenge led to the announcement of four competing all-digital systems: DigiCipher, Digital Spectrum Compatible HDTV, Advanced Digital HDTV, and Channel Compatible DigiCipher. The four digital systems and one analog system were tested during 1991 and 1992. After analyzing the test results, the Advisory Committee recommended that a digital system be adopted for the United States and that the four digital systems be competitively retested or merged into a single system by their developers. In 1993, the former competitors (AT&T, David

Sarnoff Research Center, General Instrument, Massachusetts Institute of Technology, North American Philips, Thomson Consumer Electronics, and Zenith) joined to form the Grand Alliance and began a final collaborative phase of the standards process. The Grand Alliance HDTV system is currently being constructed, draft standards documents are being written, and verification testing is planned for late 1994.

The Grand Alliance HDTV system uses MPEG-2 data compression to squeeze a high-resolution digital image into a data rate that can be transmitted in the bandwidth of a conventional TV channel. MPEG-2, an international standard for compression of digital moving images, breaks each image into blocks, analyzes the blocks to effectively generate interpolants between images, and computes the differences between the interpolants and the actual frames. The differences are further compressed by discrete cosine transform and run-length encoding and combined into data packets for transmission.

Because digital techniques are used for compression and transmission, HDTV receivers, cameras, and VCRs will be packed with digital signal-processing circuitry and memory and thus will become more interoperable with computers.

The Grand Alliance HDTV system is very flexible; it provides two picture formats and multiple frame rates in a widescreen 16×9 aspect ratio. The picture formats are 1280×720 and 1920×1080 . Both formats have square pixels (like computers), and both are progressively scanned at either 24 or 30 frames/s. At 60 frames/s, the data rate allows 1280×720 to be progressively scanned, while 1920×1080 must be in-

terlaced. The design of the Grand Alliance HDTV system decouples the transmitted

picture format from the actual display device, allowing receiver manufacturers to use displays that span a range of cost and performance.

The layered system architecture and multiple-format approach of the Grand Alliance HDTV system will encourage a greater diversity in consumer products than would a more narrowly defined system. HDTV receivers will likely be manufactured with a variety of displays, sizes, resolutions, and functions. Low-cost models may serve in traditional "entertainment television" uses, while high-end models with progressive scan displays and embedded computing capability may serve as home multimedia devices and information-highway terminals.

The underlying technology of HDTV, computers, and communications is converging rapidly. Although designed to meet the performance and cost requirements imposed by terrestrial wireless and cable broadcasting, the Grand Alliance HDTV system will be interoperable with computers and communications networks. The design decisions made by the Grand Alliance—such as using square-pixel formats and the MPEG standard—will simplify the interconnection of HDTV consumer equipment with computers and data networks. In entertainment, education, and computing applications, the impact will be revolutionary. A detailed technical description of the Grand Alliance HDTV System can be accessed at grand-alliance@sarnoff.com.

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