Digital Set Top Box Connections:

By David Broberg © January 20, 2001

One of the first problems addressed by the OpenCable™ project at CableLabs® was the question of how to connect a digital cable box with a digital-TV. Providing connections to a digital-TV has been an ongoing question with some history going back as far as the late 1980's and the establishment of the EIA R-4.1 subcommittee. This committee wrestled with a variety of connection schemes and architecture assumptions well before the first digital-TV prototypes ever appeared in the market. Eventually, this group settled on the IEEE-1394 interface as the baseline for digital TV connections.

In the late 1990's a fundamental dispute within the group over the best way to provide user interface and command & control resulted in the split the group into two competing groups: the original R-4.1 group led primarily by Thomson Consumer Electronics and R-4.7 led primarily by Sony Electronics. The R-4.1 group believed that the application of the CE-Bus Standard for command and control was the best approach, with the transport of user interface and menus as bit-mapped graphics. The R-4.7 group favored the AV/C protocol for command and control with HAVi extensions for menus. The core 1394 standards allowed for the coexistence of such competing approaches and the plan was to let the market decide the winners.

About this time, CableLabs was launching the OpenCable project and was set on establishing a single interface standard for the connection between the DTV and the digital cable box. The thinking was that if CableLabs chose one of these approaches over the other, it might tip the market enough to guarantee a winner. This pending decision by CableLabs, created an urgency for compromise within the two competing EIA standards subcommittees. After several intense joint meetings, of the R-4.1 and R-4.7 groups a compromise was reached that was acceptable to both groups. The groups agreed to join forces and create a new subcommittee: R-4.8 (1+7=8). The plan was to join the bit-mapped graphics approach from R-4.1 with the AV/C command and control from R-4.7.

CableLabs announced an intent to standardize this approach through the SCTE-DVS process, and agreed to work jointly with the new CEA group to finalize the standard. The FCC also raised the pressure by demanding an industry standard for DTV connections by the end of the year. By the end of 1998, two simultaneous standards were developed, with the same primary authors contributing to both documents through a series of separate meetings. The EIA-775 Standards was successfully balloted in October of 1998 and the SCTE-DVS/194 Standard in December. One key distinction could be made between the two essentially identical standards; the SCTE version included copy protection while the EIA version did not.

In 1998, one of the first interfaces specified under the OpenCable project was the digital TV interface. The selection was the IEEE-1394 interface (Firewire™) with the addition of the 5C copy protection, bit-mapped graphics support and AV/C for command and control. This version of the interface was standardized by SCTE as DVS/194 (rev.1). At

the time, there were really no competing digital interfaces suitable for consumer use other than variations of the '1394 interface.

There were several technical and political reasons for this selection that were valid at the time. One key point that was often lost was the fact that the interface would permit the pass-through of compressed HDTV signals though a box that otherwise was unable to decode the HDTV formats defined by the ATSC for broadcasters. In 1998, digital cable boxes that were being deployed included MPEG-2 decoders capable of standard definition (SDTV) only. At the same time the very first prototypes of the high-definition capable MPEG decoders were showing up in ATSC receiver boxes with a significant cost penalty. Cable operators didn't want to run-up the cost of their digital cable boxes, to include the HDTV decoders and broadcasters desperately wanted to find a way that would ensure their HDTV signal would be delivered successfully through the digital cable system. The 1394 interface was the perfect answer. It allowed the cable operators to continue to build their boxes with SDTV decoders while providing a way for broadcasters HDTV signals to pass-through to in compressed format for decoding by consumer DTV receivers. The broadcast industry through the NAB joined with the cable industry through the NCTA in support of the 1394 interface to the FCC as the standard DTV interface.

Another major reason for selecting the 1394 interface was the need by the cable operators to be able to precisely deliver the graphics of any interactive applications to the display of the DTV. The bit-mapped transport mode added to the 1394 interface in both the EIA and SCTE standards allowed this functionality. This functionality was critical for the cable industry to enable every subscriber to be able to access every service that might be offered by the cable system. The inclusion of this functionality essentially provided a future-proofing of the set, making it critical to have on every product that operated with the digital cable plant.

But somehow, the Consumer Electronics industry wasn't happy anymore. Since the copy protection system was added to the cable version of the 1394 interface, the CE industry began to oppose the selection to the FCC through the filings of their trade association, which by then was called CEA.

In mid 2000, the FCC again acted on the cable compatibility issue and defined approved labels for cable-ready digital TVs. This ruling made the inclusion of the 1394 digital interface optional for two of the three categories of sets defined. By endorsing a the concept of cable-ready sets without the 1394 connector, the FCC essentially created a class of dumbed-down set that would not be able to access a myriad of new interactive services being developed or digital cable service.

In the mean time, another digital interface has landed in the limelight which promises to solve some of the problems with the 1394 approach. This DVI/HDCP interface takes a different approach and relies upon the transport of full bandwidth uncompressed images in digital form. The speed of such a digital HDTV signal is greater than 1.4 Gbps and exceeds the bandwidth capability of the current 1394 interface.