

3. At what point is the interface between the broadcast plant (at SDTI) and Common Carriers (DS-3)?

Summary

While stations must be aware and plan for the redistribution of their signals to various outlets, the functional equipment and the interfaces required are virtually identical to functions that have already been identified and documented. No additional standards were identified that require further development.

Audio Plane

Introduction

The study was done from the point of view of an Affiliate station that receives network and other external feeds, and produces some of their own (audio) program material. Three different types of station are covered. 1) those with an existing digital audio (AES3) capability 2) those with stereo analog facilities 3) those whose only interest is passing on the audio derived from an incoming ATSC transport stream.

The results of the study allow for 1) production and distribution of ATSC 5.1 channel audio 2) downmixing of 5.1 channel audio to 2 channel audio for NTSC compatibility or use in two channel analog plants 3) the audio pass through concept is treated later under "issues we missed". It was assumed that sufficient buffering and/or time stamping facilities are in place to ensure that the audio is in sync with its associated video at the output of any process.

Methodology description

The audio layer map development group assumed that there was a digital audio infrastructure. This allows the plant to carry the multichannel signals via multiple AES3 pairs. Alternately, methods of encoding the multichannel signal and multiplexing the associated metadata into a signal that can be carried on a single AES3 pair have been proposed. This encoded/multiplex concept has been included in the Map, as it lessens the load on the digital audio infrastructure and provides a path for the audio metadata. Separate metadata paths are shown on Audio layer of the Map, as the metadata is crucial to the operation of the audio decoders in the home receiver. Metadata authoring blocks are also included to indicate the importance of function, even though they do not process the audio. The stereo analog signal paths and equipment were not included on the Map because they were felt to be legacy items.

The group examined the Top Down Map dated 6/4/98 to determine if all essential functions were all accounted for, and modified the Map as necessary and/or refined the functions of various blocks.

Findings

The collaboration of the audio group resulted in the identification of a number of areas that required additional functionality and interfaces to be documented. While the carriage of audio metadata was given a significant amount of attention, it is assumed that metadata should have its own routing layer. To facilitate delivery of audio metadata, connections should be included between all audio decoders and signal routers. Similarly, paths from the routers to the AC-3 encoders should be made to deliver the metadata.

Consideration was given to insure that both the simulcast service and the creation of contribution content was fully enabled. To facilitate the simulcast service, direct paths should be included from the demultiplexers for the HDTV service to the SDTV router. To facilitate contribution content, utility audio encoders and decoders should be included in the station along with appropriate connections to the router infrastructure. These connections should also include analog-to-digital and digital-to-analog conversion capabilities. The Microwave RX and Demod boxes were changed to Demod and Demux, to match the copper and optical laser feeds and to make its outputs match the others in function. With these changes, the demuxers can feed an audio contribution coded stream directly to the router.

The drawing also needed to identify and document functions and interconnections for embedded audio service. Appropriate monitoring capabilities must also allow preview of the downmix, as well as the ability to preview and modify audio metadata.

In a joint session with the Video group, the concept of a native format for the audio was dismissed. It does not apply to audio because the "up-conversion" process is not applicable to audio. Once multiple channels are downmixed to fewer channels, there is no process for deriving the original individual channels. See the Multiple Video Format report for a complete discussion.

Strawman Implementation

The reference map (See Attachment D) contains the audio and metadata interconnections that are required to handle both 5.1 channel and two channel audio. The decision to handle the multichannel audio in an encoded form was based on the need for an audio metadata path and the reluctance to add enough layers to the routing system to handle six or more discrete channels of audio. The flexibility of the ATSC audio system depends on having the correct metadata transmitted to the receiver. The ideal place to generate the metadata is during the post production process. Affiliate stations have to receive this data, or if they are originating any programming, they have to produce the appropriate metadata for it. In both cases, they generally have to be able to read, modify and rewrite the metadata.

There are sets of default values⁴ for the metadata parameters that can be used by stations that don't (yet) have the facilities to transport metadata and are restricted by a two channel analog audio infrastructure.

The audio delays that may be necessary to maintain (lip) synchronization between the audio and video portions of the program are not shown on the Reference Map because the need for them depends on the "native format" of the video signal and characteristics of the associated video equipment. This does not affect the interfaces between audio devices, as the delays can be added "in line".

Issues Pending

- There is currently no path on the Audio Plane Map for the distribution of AC-3 coded audio. While it is not recommended that AC-3 be used for distribution due to possible multi-generation coding loss and potential difficulty in editing, it may be useful to recommend a short-term solution that could be used until multichannel digital audio infrastructures are more common. Any solutions

⁴ Although it is not shown in the Reference Map, the most universal solution is to label all mono, stereo and Dolby Surround encoded material as being "2/0" (two front channels only) Dolby Surround (Lt, Rt) encoded and to assign a fixed "dialnorm" value to it. The value of the dialnorm parameter can be established by careful consideration of the station's audio processing procedures and some experimentation. This approach violates the whole ATSC audio system philosophy and should be discouraged, but it can be used as a short term measure.

proposed will have to consider the wide range of operational practices that will be developed during the introductory phases of a DTV service.

- It was suggested that the Audio Group consider the carriage of other data, such as caption data, within the audio path. Other than the discussion noted in the data services section, this issue has not been addressed.
- Since the authoring and editing of audio metadata are new functions, it was not clear how broadcast facilities will handle these functions. The group is making recommendations based on functional considerations but without practical operational input. It is suggested that IS/S1 undertake an effort to define the operational requirements for the authoring and transport of metadata. This effort could also develop the basis for a communications protocol that can be disseminated to providers and users of the metadata.

Conclusions

Considering that

- a release or distribution format for DTV programming will have to carry six audio channels
 - and that the affiliate's audio distribution system should carry both a six channel and a two channel (either stereo or Dolby Surround encoded) sound track for NTSC release
 - and that a signal path for the metadata has to be provided
 - and that the Affiliate stations are unlikely to significantly expand their audio distribution systems then
1. Some form of Contribution quality audio coding scheme is needed in order to be able to use the existing audio distribution infrastructure for ATSC audio.
 2. These conclusions are reinforced by the statements in the "Different Approach for Audio" paragraph of the Multiple Video Format report.
 3. The transport mechanism of item 2 should also provide a path for the metadata needed to make the ATSC audio system full functional.

Control Plane

Introduction

The data and control areas have been among the last to be recognized and developed in the design process for DTV and in the "transition to digital" in the industry as a whole. Early work concentrated on video and audio issues and recognition of the significance of metadata; it has not been until relatively recently that the critical need for an integrated control plane design as part of the move to DTV was generally understood.

In order to permit broadcasting in DTV with the same flexibility and capability that currently exists in analog television broadcasting, a large number of commands, parameters, and responses must be passed among devices, going far beyond current designs which accomplish only relatively basic machine control. For example, it has been estimated that changing format from a single HDTV program stream to multicasting several SDTV program streams can require changes to as many as fifty parameters in the encoder and multiplexer subsystem alone, with several such control salvos potentially required to fully transition from one mode to the other. All these parameter changes must be precisely synchronized in their execution if a seamless transition is to be presented to the viewer.