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To: Members of X3T9.2

From: Paul Boulay  
4135 Limberwood Court  
Colorado, Springs, CO 80920  
(719) 531-6945 Fax (719) 576-0402

Subject: Location of LBA Zero on Audio CD Media.

Ref: SCSI-2 Rev. 10c, Section 13.1.1.

The CD-ROM section defines the location of logical block address zero as MSF address 00/02/00 (0 minutes, 2 seconds, 0 frames). Unfortunately, this definition conflicts with the actual start of some audio disks. This arises because the standard document for CD Audio does not specify the precise starting point of the first track. However, it does specify that the initial pause shall be 2 to 3 seconds. The objective of this note is to suggest an implementation for CD-ROM devices so that the audio commands result in consistent operation.

Most CD-ROM devices use the table of contents data read from the media to qualify a read or play operation. This is required in the case of a play operation because the noise that results from playing data can be very uncomfortable. The table of contents (TOC) gives the starting address of tracks within 1 second. Generally, this is sufficient to check for a valid starting address, however, there is one case which is troublesome. That is a disk where the TOC identifies the starting address of the first track as a value greater than the nominal 00/02/00 MSF value. That may well be an accurate indication of the starting address. If this is so, then what should a SCSI-2 implementation do with a PLAY AUDIO command with a starting LBA of 0?

There are several options:

- (1) For such a disk abandon the 00/02/00 equals LBA 0 mapping and use some other location as the position of zero. Given this choice there seem to be two possible values to be chosen for zero:
  - (1a) Set LBA 0 to the value given in the TOC for the start of the first track, or,
  - (1b) Set LBA 0 to the actual location of the beginning of the first track.
- (2) Keep the current 00/02/00 equals LBA 0 assignment and suggest some reasonably consistent handling of the troublesome PLAY AUDIO at LBA 0 situation. Such a play command could be handled in a number of ways:
  - (2a) Reject the command with ILLEGAL REQUEST if the requested address translated to MSF comes up with a value less than the TOC address for the starting address of the first track. A user program could avoid the check condition by having first done a READ TOC command.
  - (2b) Seek to the requested address and acquire a Q-channel frame to check for audio vs. data. If data terminate the command otherwise start playing. Note that this may result in playing a few seconds of silence prior to the start of the actual audio program material. If the command is issued with the immediate option this seek and check operation might add 1 or 2 seconds of delay prior to the command complete.
  - (2c) Check that the mode of the first track is audio via the TOC, if so accept the command (and if immediate mode issue command complete) and start a play at the requested location -- even if this results in playing several seconds of silence.
  - (2d) Check for an audio first track via the TOC as (2c) above but

"correct" the starting address using the TOC information so that only for a starting address prior to the TOC starting address of the first track the actual starting address for this play would match the first track TOC data.

- (2e) Check the TOC and correct as above (2d) but use the actual location of the start of the first track as the zero point for this command.

I prefer option (2c) because it is most compatible with the current SCSI-2 document, because it is reasonable for a device to implement, and because it avoids spurious ILLEGAL REQUEST check conditions. By the way, I'd recommend that any CD-ROM device monitor the Q-channel control field during an audio play operation to be sure that data areas are not being played.

I don't like option (1) because it creates an interoperability problem with current devices for the sake of a very small number of audio disks. In addition option (1a) assumes that the TOC data is accurate and this may not be so for all CD disks. Option (1b) gets away from assuming the TOC is accurate but it adds up to a second to every new disk spin-up.

Option (2a) is not unreasonable, however it seems to me that sending a check condition in this case is unnecessary and might be unexpected by much current driver software.

Likewise (2b) could be made to work but seems unnecessarily complicated and the delay introduced might not be expected by the device driver. I believe that this cautious approach is not needed because this situation should only occur on all-audio disks. (i.e., ones that are not subject to the somewhat tighter requirements of ISO 10149, the successor to the "Yellow Book".)

Options (2d) and (2e) are really just disguised versions of option (1) - change the location of LBA 0. But they lead to an implementation that is, in a sense, non-linear. (For instance a play for ten seconds starting at zero might well overlap a play starting beyond ten seconds.)

If the SCSI-2 standard were open to "editorial" changes I would suggest an implementors note be added immediately after the second paragraph on page 13-2 as follows:

IMPLEMENTORS NOTE: Some CD\_ROM media, especially all-audio disks, may have the first track starting address a few seconds later than MSF address 00/02/00. When this is the case the area between the location of LBA 0 at 00/02/00 and the actual start of the user area of the first track will be encoded as pause/silence and should be played if the first track is an audio track and treated as a transition area if the first track is data.