Date: September 30, 2003

To: T10 Technical Committee
From: Keith Holt (LSI Logic)
Subject: End-to-End Data Protection Information Field Ordering

Introduction

This document proposes that the data protection information field ordering in 03-176r5 be changed to match that found in 03-111r0. The proposed changes are illustrated in the last section of this document.

References

[1] T10/03-111r0, End-to-End Data Protection Proposal
[2] T10/03-176r5, Simplified End-to-End Data Protection Proposal
[3] T10/03-310r0, Straw Horse Proposal for T10/03-111r1, End-to-End Data Protection Proposal
[4] T10/03-307r0, SBC 32 Byte Commands for SBC 32 Byte Commands for End-to-End Data Protection

Overview

Revision 5 of document 03-176 introduced changes to data protection information field functionality and ordering. The changes provide fields with functionality similar to the data integrity fields in document 03-111r0, but the order of the fields within the protection block is different. The functionality and associated terminology in each document is as shown below in table 1.

Table 1 – Protection Field Descriptions

Protection Field Description	03-111r0 Field Name	03-176r5 Field Name
4-byte incrementing value [3]	REF TAG	DATA BLOCK REFERENCE TAG
2-byte fixed value	META TAG	DATA BLOCK APPLICATION TAG
16-bit CRC [1, 2]	GUARD	DATA BLOCK GUARD

Notes:

1. CRC uses 18BB7h generator polynomial.
2. CRC is calculated over the standard data block only. It does not include any protection fields.
3. See 03-307r0 for information regarding the base value for the reference tag.

The difference in field ordering between the two proposals is as shown below in table 2. In order to make comparison easier, the field names are abbreviated names based on the terminology in 03-176r5.

Table 2 – Protection Field Ordering

Field Order	03-111r0 Field Name	03-176r5 Field Name
First field	REFERENCE TAG	GUARD
Second field	APPLICATION TAG	APPLICATION TAG
Third field	GUARD	REFERENCE TAG

The evolution of the protection field definitions for 03-176 revisions is shown below in table 3 for reference. The field ordering for 03-111 has not changed. The definitions have not changed with the exception that 03-111r0 has an additional guard form, which has since been dropped. See 03-310r0 for details.

Table 2 – 03-176 Protection Field Definitions History

Field Order	03-176r0-r3 Fields	03-176r4 Fields	03-176r5 Fields
First field	32-bit CRC	2-byte fixed value	16-bit CRC [1, 2]
Second field	4-byte incrementing value	16-bit CRC [1, 3]	2-byte fixed value
Third field	N/A	4-byte incrementing value	4-byte incrementing value

Notes:

1. CRC uses 18BB7h generator polynomial.
2. CRC is calculated over the standard data block only. It does not include any protection fields.
3. CRC calculation includes the 2-byte application tag.

Changes to Document 03-176r5

4.0.2 Protected data

See figure 1 for the placement of the protection information.

Table 1 – Protected data block format

Byte/Bit	7	6	5	4	3	2	1	0
0	(MSB)	DATA BLOCK						
n								(LSB)
n + 1	(MSB)	DATA BLOCK ~~GUARD~~REFERENCE TAG						
n + ~~2~~4								(LSB)
n + ~~3~~5	(MSB)	DATA BLOCK APPLICATION TAG						
n + 46								(LSB)
n + ~~5~~7	(MSB)	DATA BLOCK ~~REFERENCE TAG~~GUARD						
n + 8								(LSB)

The data block shall contain user data.

The DATA BLOCK GUARD field contains the CRC (see 4.0.3) of the contents of the DATA BLOCK field. The default value for the DATA BLOCK field shall be a properly generated CRC (see 4.0.3)

The DATA BLOCK APPLICATION TAG field is set by the application client. The contents of the data block application tag are not defined by this standard. The DATA BLOCK APPLICATION TAG field may be modified by a device server if the APP_TAG_OWN bit is set to zero (see 4.0.45). If the APP_TAG_OWN bit is set to zero the default value for the DATA BLOCK APPLICATION TAG field shall be 0000h.

The DATA BLOCK REFERENCE TAG field is set to the least significant four bytes of the logical block address to which the data block is associated. The first data block transmitted shall contain the least significant four bytes of the logical block address contained in the LOGICAL BLOCK ADDRESS field of the command associated with the data being transferred. Each subsequent data block.s DATA BLOCK REFERENCE TAG field shall contain the data block reference tag of the previous data block plus one. The default value for the DATA BLOCK REFERENCE TAG field shall be the least significant four bytes of the LBA of the data block being written or formatted.