

**To:** T10 Membership  
**From:** Gene Milligan, Seagate Technology <[gene\\_milligan@notes.seagate.com](mailto:gene_milligan@notes.seagate.com)>  
 George Penokie, IBM <[gop@ibm.us.com](mailto:gop@ibm.us.com)>  
 Lawrence J. Lamers, Adaptec, Inc. <[ljlamers@ieee.org](mailto:ljlamers@ieee.org)>  
**Subject:** Packet Protocol Extensions  
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This proposal presents extensions to the existing packet protocol that address concerns about the granularity of the CRC interval and the bus turnaround effect on write operations. The extensions work as a compatible extension of the existing packet protocol.

### CRC Interval

The proposal is to add a CRC interval to the L\_Q Information Unit. This extension defines use of CRC intervals in the associated Data Information Unit. The CRC interval specifies the number of bytes transferred before a 4-byte CRC is transferred. This allows the granularity of the CRC interval to be less than a Data Information Unit size, (e.g., a sector size for disk drives), so that reasonable Data Information Unit sizes (e.g., 2048, 4096) can be preserved. This also keeps the overhead of L\_Q Information Unit in line with expectations.

A Data Information Unit contains zero or more CRC intervals and may contain a runt CRC interval if specified by the data length. This allows the data transfer to be validated in smaller chunks so that it can be moved to memory or media without buffering the whole Data Information Unit. A CRC interval of zero indicates that the CRC occurs at the end of the Data Information Unit. The last four bytes of a packet shall be CRC bytes. The CRC Interval shall only be valid for Data Information Unit transfers.

The proposal adds a 4-byte extension to the L\_Q information unit, increasing the size to 24 bytes.

**Table 38 SPI L\_Q Information Unit**

Byte	Bit 7	6	5	4	3	2	1	Bit 0
0	Type							
1	Reserved							
2	Reserved							
3	Tag							
4	Logical Unit Number							
11								
12	Reserved							
13	Data Length							
15								
16	Reserved							
17								
18	CRC Interval							
19								
20	CRC							
23								

The TYPE field is defined in table 39.

Table 39 – TYPE

Codes	Type	Description
01h	Command	Sent by an initiator to indicate a SPI command information unit shall immediately follow this SPI L_Q information unit. Indicates the initiator shall not send any more SPI command information units during the current connection. The DATA LENGTH field shall be set to 20.
02h	Multiple Command	Sent by an initiator to indicate a SPI command information unit shall immediately follow this SPI L_Q information unit. Indicates the initiator has another SPI L_Q information unit and SPI command information unit during the current connection. The DATA LENGTH field shall be set to 20.
04h	Data	Sent by a target to indicate a SPI data information unit may immediately follow this SPI L_Q information unit. A data length of zero is not allowed.
05h	Data Stream	Sent by a target to indicate one or more SPI data information units may immediately follow this SPI L_Q information unit. Restricted to write operations. A data length of zero is not allowed.
08h	Status	Sent by a target to indicate a SPI status information unit may immediately follow this SPI L_Q information unit. A length of zero in the data length field shall indicate no SPI status information unit shall follow the SPI L_Q information unit (see 11.4.5).
All others	Reserved	Reserved

~~The PADBYTES field specifies the number of pad byte(s) the next information unit contains.~~

~~A valid byte(s) bit (VBYTE) of zero indicates the pad byte(s) of the next information unit contain pad byte(s) of 00h. A VBITE of one indicates the pad byte(s) of the next information unit contain valid information.~~

The DATA LENGTH field contains the length in bytes of the following information unit. The data length shall not include the CRC bytes nor the pad bytes if any. (see illustrations). The target shall not set the data length to a value that exceeds the maximum burst size as defined in the disconnect-reconnect page (see 11.8). ~~indicates that no SPI data information unit or SPI status information unit follows.~~

The CRC Interval field contains the length in bytes of the user data sent before a CRC is transferred. The pad bytes are not included in the CRC Interval. The CRC interval shall be a multiple of two (i.e. odd numbers are not allowed).

### Streaming write operations

Streaming write operations allow a target to stream Data Information Units on a write operation to eliminate the bus turnaround at the end of each Data Information Unit by allowing a single L\_Q Information Unit to transfer multiple Data Information Units.

All the Data Information Units sent during a single stream shall be of the same size. The stream shall only be stopped on Data Information Unit boundaries by a phase change.

The Data Information Unit stream ends when the initiator detects a phase change. If an initiator detects a REQ after the last transfer of a Data Information Unit and the DATA OUT phase continues to exist the next Data Information Unit shall be transferred.

If the initiator is not going to transfer the next Data Information Unit it requests a disconnect by asserting the ATN ~~at least a negotiated offset value number of words~~ prior to the end of a Data Information Unit and continues to transfer the current Data Information Unit until complete. In the event of a Data Information Unit size smaller than the negotiated offset value the target is allowed to continue the stream operation across two Data Information Units but not three. A one Data Information Unit stream is allowed.

The offset count is ~~not~~ required to be zero at the end of a Data Information Unit if a subsequent Data Information Unit follows for the same I\_T\_L\_Q nexus.

### Streaming read operations

Streaming read operations are not condoned in this standard.

Interval Data Information Unit - Transfer Length = one 512-byte block

L_Q=04h DL=512 Interval=0	512 Bytes User Data	4 crc
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Notes:

- 1) The DL= is the byte count of the actual user data transferred in the packet.
- 2) The Interval= is the byte count of the user data in the interval and must be divisible by 2.
- 3) Pad bytes for the interval and the packet are determined by the hardware automatically.

Data Information Unit - Transfer Length = two 512-byte blocks

L_Q=04h DL=1024 Interval=512	512 Bytes User Data	4 crc	512 Bytes User Data	4 crc
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Data Information Unit - Transfer Length = one 514-byte block

L_Q=04h DL=514 Interval=514	514 Bytes User Data	2 pad	4 crc
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Data Information Unit - Transfer Length = two 514-byte blocks

L_Q=04h DL=1028 Interval=514	514 Bytes User Data	2 pad	4 crc	514 Bytes User Data	2 pad	4 crc
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Data Information Unit - Transfer Length =600 bytes

L_Q=04h DL=600 Interval=0	600 Bytes User Data	4 crc
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The assumption is that for block devices the interval count would not be used for byte transfers.

Data Information Unit - Transfer Length =601 bytes

L_Q=04h DL=601 Interval=0	601 Bytes User Data	3 pad	4 crc
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Data Information Unit - Transfer Length = 512 bytes

L_Q=04h DL=512 Interval=400	400 Bytes User Data	4 crc	112 Bytes User Data	4 crc
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Data Information Unit - Transfer Length = 1024 bytes

L_Q=04h DL=1024 Interval=400	400 Bytes User Data	4 crc	400 Bytes User Data	4 crc	224 Bytes User Data	4 crc
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Data Information Unit - Transfer Length = 1025 bytes

L_Q=04h DL=1025 Interval=400	400Bytes User Data	4 crc	400 Bytes User Data	4 crc	225 Bytes User Data	3 pad	4 crc
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Data Information Unit - Transfer Length = 512 bytes

L_Q=04h DL=512 Interval=398	398 Bytes User Data	2 pad	4 crc	114 Bytes User Data	2 pad	4 crc
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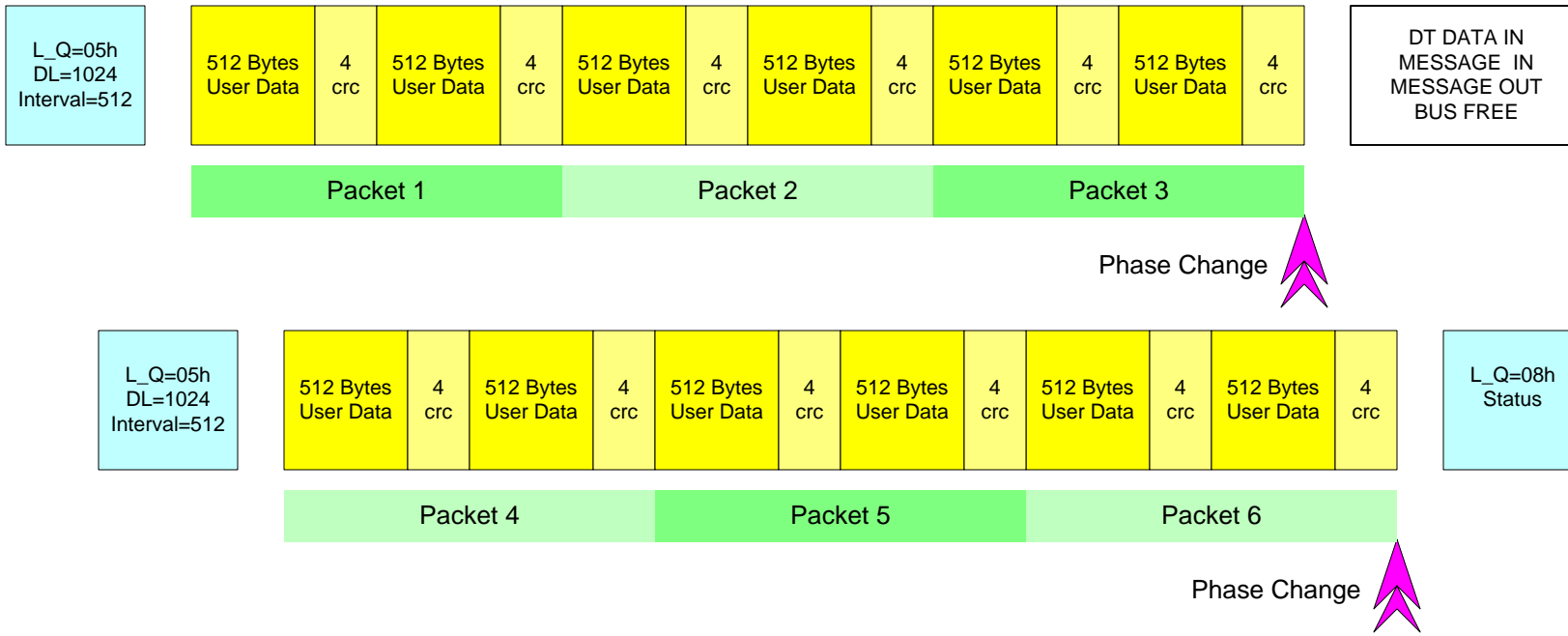
Data Information Unit - Transfer Length = 1024 bytes

L_Q=04h DL=1024 Interval=398	398 Bytes User Data	2 pad	4 crc	398 Bytes User Data	2 pad	4 crc	228 Bytes User Data	4 crc
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Data Information Unit - Transfer Length = 1025 bytes

L_Q=04h DL=1025 Interval=398	398 Bytes User Data	2 pad	4 crc	398 Bytes User Data	2 pad	4 crc	229 Bytes User Data	3 pad	4 crc
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Write Data Streaming - Transfer Length = twelve 512-byte blocks in two streams



Write Data Streaming - Transfer Length = 3699 bytes in two streams

