To: T10 Technical Committee
From: Rob Elliott, HP (elliott@hp.com)
Date: 7 July 2003
Subject: T10/03-223r1 SAS Changes from sas-r04 to sas-r05

Revision History
Revision 0 (23 June 2003) first revision
Revision 1 (7 July 2003) updated to include 4a to 5 changes

Related Documents
sas-r04 - Serial Attached SCSI revision 4
sas-r04a - Serial Attached SCSI revision 4a

Overview
A few comments were received on sas-r04 during the SAS public review timeframe and are corrected in sas-r05 and the revision for ISO ballot.

Changes from sas-r04 to sas-r04a
Page 4, 2.3 References under development

Fill in ISO xxx with the numbers T10 plans to use: 413 for SAM-3, 453 for SPC-3, 322 for SBC-2

Page 4, 2.3 References under development, Note 1

Change "this document" to "these documents"

Page 4, 2.4 Other references

Update names of SFF documents:

SFF-8470 was "Multi Lane Copper Connector", now "Shielded High Speed Multilane Copper Connector"

SFF-8482 was "SAS Plug Connector", now "Internal Serial Attachment Connector"

Pages 88, 89, 5.3.5 Signal characteristics at IR, CR, and XR, Table 26

SAS currently specifies 1200mV pk-pk as the maximum voltage for 1,5 Gbps internal signals. SATA has adopted the SAS external level of 1600mV pk-pk maximum for both 1,5 and 3,0 Gbps applications for external and backplane applications (Gen1x, Gen2x). Talking with people from various companies involved with both SAS and SATA PHY work, it would be possible to increase the SAS 1,5 Gbps level to 1600mV maximum to have consistency in both SAS and SATA specifications without significant hardware impact. I am concerned that SATA and SAS will be different if a 1600mV pk-pk SATA product at 1,5 Gbps for backplane applications is made available (Gen1x) and the SAS specification is not changed.

Bottom line: Can we take action to increase the SAS 1,5 Gbps maximum signal level to 1600mV pk-pk at this stage of the specification? It doesn't appear to be an issue from a hardware standpoint since SAS products will primarily target the 3,0 Gbps which are allowed to transmit at this level. Comments are encouraged.

Page 111, Table 43 - SATA speed negotiation sequence timing specifications

Change "32 768 OOBI to "1 310 720 OOBI".

The conversion from 880 usec to OOBI was done incorrectly from r03 to r04 - it's supposed to be 32 768 dwords, not 32 768 bit periods (OOBIs).

Pages 121, 125, 129 (6.7.3, 6.7.4, 6.7.5)

Fix hanging paragraphs (move text into 6.7.x.1 overview subsections).

Page 122, Section 6.7.3.3.3 Transition SP2:OOB_NoCOMSATimeout to SP3:OOB_AwaitCOMINIT_Sent

This should be to SP4:COMSAS

Page 211, 7.15.9.1 XL6:Open_Response_Wait state description

Delete "containing a higher priority OPEN address frame (see 7.12.3)."

Items c) and e) describe OPENs crossing before AIP, where priority matters.

Items d) and f) describe an OPEN after AIP, where priority doesn't matter.

The phrase that was supposed to be deleted - "containing a higher priority OPEN address frame according to the arbitration fairness comparison (see 7.12.3)" was only partially deleted from f) although it was fully deleted from d).

Page 223, 7.16.7.5 SSP_D state machine

Change Transmitted DONE (NORMAL) to Transmitted DONE (Normal) twice.

Change Transmitted DONE (CREDIT TIMEOUT) to Transmitted DONE (Credit Timeout) twice.

Page 257, 8.2.3.3.5 PL_PL2:Req_Wait connection management

Delete "If this state receives a Connection Closed confirmation, then this state shall send a Connection Closed message to the PL_OC state machine." and remove Connection Closed from figure 107 (page 254). That confirmation never reaches this state (PL_PM3 handles it).

Page 257, 8.2.3.3.5 PL_PL2:Req_Wait connection management

Delete "If this state receives a DONE Timeout confirmation, then this state shall send a Connection Closed message to the PL_OC state machine." There is no corresponding confirmation in the figure, as this was already moved to PL_PM3.

Pages 258, 259, 8.2.3.4.1 PL_PM3:Connected state description
Add "to the link layer" after "shall send a Close Connection request" two times.

Page 259, 8.2.3.4.1 PL_PM3:Connected state description

Change "Cancel Open" to "Close Connection" to match the figure.

Page 297, 9.4.5.2.4.1 MT_IP3:Receive state description

Change "not equal to 40h" to "not equal to 41h".

The preceding sentence references 41h and is correct.

Changes from sas-r04a to sas-r05

Page 3 2.1 Normative references (Table 1)
Change the name of T10 to "INCITS T10 Committee on I/O Interfaces - SCSI storage interfaces"
and T13 to "INCITS T10 Committee on I/O Interfaces - ATA storage interface"

Page 68 4.6.7.5 Expander route index order
Change "fanout expander device phy R" to "fanout expander device R phy A" to match the figure.

Page 69 4.6.7.5 Expander route index order

Change "edge expander device N phy A" to "edge expander device N phy B" to match the figure.

Page 119 6.7.1 SP state machine overview

The SP state machine doesn't discuss that a COMINIT received any time during OOB sequence
or speed negotiation sends it back to the initial state. The SATA state machines do mention this
global transition.

"The SP state machine shall start in the SP0:OOB_COMINIT state after:

a) a power on;

b) a hard reset; or

c) receiving a Management Reset request from the management layer (e.g., from the SMP PHY
CONTROL function in an expander device). "

Add to c): Receipt of a COMINIT in any state that does not have an exit transition triggered by
receipt of COMINIT should cause a Management Reset request.

SAS-1.1 will elaborate on this, better describing COMINIT escapes that are implied from most of
the states.

Page 155 7.2.5.9 NOTIFY (per 03-228r2)

Add: SAS target devices are not required to detect every transmitted NOTIFY.

Page 211, 7.15.9.1 XL6:Open_Response_Wait state description

Items c) d) e) and f), each of the phrases:

"and the source SAS address and connection rate of the received OPEN address frame are not
equal to the destination SAS address and connection rate of the transmitted OPEN address
frame"

have "source" and "destination" backwards, and should be:

"and the _destination_ SAS address and connection rate of the received OPEN address frame
are not equal to the _source_ SAS address and connection rate of the transmitted OPEN address
frame"

The introduction to G.6 is broken:

"Figure G.6 shows the condition which occurs when a higher priority OPEN address frame (B to
C) is received by a phy which has previously forwarded an OPEN address frame to a different
destination (A to B)."

should be:

"Figure G.6 shows a higher priority OPEN address frame (B to C) received by a phy which has previously forwarded an OPEN address frame (A to B) whose source (A) differs from the winning destination (C)."

The same goes for the G.7 introduction:

"Figure G.7 shows the condition which occurs when a higher priority OPEN address frame (B to A) is received by a phy which has previously forwarded an OPEN address frame to the same destination (A to B)."

should be:

"Figure G.7 shows a higher priority OPEN address frame (B to A) received by a phy which has previously forwarded an OPEN address frame (A to B) whose source (A) matches the winning destination (A)."

Also, add cross references to 7.15.9 from those paragraphs in G.6 and G.7.

These changes remove "the condition which occurs when" to keep pagination the same.

Page 321 10.2.8 SCSI power conditions

Move text into 10.2.8.1 SCSI power conditions overview (fix hanging paragraphs).

Page 321 10.2.8.1.1 SA_PC state machine overview (03-228r2)
Add:
"For transitions based on receipt of a START STOP UNIT command, if the IMMED bit is set to one the command may complete with GOOD status before any operation that occurs as a result of the value in the POWER CONDITIONS field completes."

Page 324 10.2.8.1.5.3 Transition SA_PC_3:Standby to SA_PC_5:Active_Wait

Page 324 10.2.8.1.5.4 Transition SA_PC_3:Standby to SA_PC_6:Idle_Wait

Page 326 10.2.8.1.7.4 Transition SA_PC_5:Active_Wait to SA_PC_6:Idle_Wait

Page 326 10.2.8.1.8.4 Transition SA_PC_6:Idle_Wait to SA_PC_5:Active_Wait

Change: (per 03-228r2)

For transitions based on a START STOP UNIT command, the command shall not complete with GOOD status until this state machine reaches ....

to:

For transitions based on a START STOP UNIT command with the IMMED bit set to zero, the command shall not complete with GOOD status until this state machine reaches...

Page 324 10.2.8.1.6.4 Transition SA_PC_4:Stopped to SA_PC_5:Active_Wait

Page 324 10.2.8.1.6.4 Transition SA_PC_4:Stopped to SA_PC_6_Idle_Wait

Change: (per 03-228r2)

The START STOP UNIT command shall not complete with GOOD status until this state machine reaches the SA_PC_1:Active state.

to:

If the IMMED bit is set to zero, the START STOP UNIT command shall not complete with GOOD status until this state machine reaches the SA_PC_1:Active state.

Page 325 10.2.8.1.7.2 Transition SA_PC_5:Active_Wait to SA_PC_1:Active
Page 326 10.2.8.1.8.2 Transition SA_PC_6:Idle_Wait to SA_PC_2:Idle
Change: (per 03-228r2)
a NOTIFY (ENABLE SPINUP) is received
to:
a NOTIFY (ENABLE SPINUP) is detected

Page 349 10.4.3.8 REPORT ROUTE INFORMATION function
Delete this duplicated sentence: "The ROUTED SAS ADDRESS field contains the SAS address routed by this table entry."