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To: T10 Committee (SCSI)

From: George Penokie (IBM)

Subject: Misc. SPI-3 technical changes

0.0.0.1 iuCRC transfers

The iuCRC shall be used to protect all SPI information units. The SCSI device that originates the SPI information unit sends the necessary pad field(s) and an iuCRC field appended to the end of each SPI information unit.

The target shall not change phases except at SPI information unit boundaries. If an initiator detects a phase change within a SPI information unit it shall consider any data transferred for that SPI information unit to have been transferred incorrectly. The initiator shall consider this condition a protocol error and respond accordingly.

0.0.0.2 SPI information unit format

During information unit transfers each DT DATA IN phase and DT DATA OUT phase contains of one or more SPI information units. A SPI information unit consists of data, status, command, task attributes, and/or nexus information followed by an iuCRC. The number of bytes transferred within a SPI information unit shall always be a multiple of four.

As a result of a SPI information unit always being an even number of transfers, the REQ and ACK signals are negated both before and after the transmission of the SPI information unit.

If the number of bytes in the SPI information unit is not a multiple of four the transmitting SCSI device shall transmit one, two, or three pad bytes before transmitting the iuCRC. If the number of bytes in the SPI information unit is a multiple of four the transmitting SCSI device shall not transmit any pad bytes. Regardless of the number of bytes in the SPI information unit the iuCRC shall be the last four bytes of the SPI information unit.

The value of the pad bytes is vendor specific.

Editors Note 1 - GOP: Put in above two sections to describe how DT + IU data protection works.

a) after a PPR negotiation causes an information unit transfer to be enabled or disabled.

Editors Note 2 - GOP: The above was added to force a bus free after a PPR when the state of packetized changes. (BG 4/19/99) This change requires a plenary vote. There is also a change required in the PPR message.

The procedure for a target to indicate it wants to release the bus is as follows:

a) The target shall change to a MESSAGE IN phase and issue a DISCONNECT/QAS REQUEST (0455h) message sequence, TASK COMPLETE/QAS REQUEST (0055h) message sequence, or a single QAS REQUEST (55h) message. The target shall assert REQ for a minimum of 16 ns for each byte of the message(s). The current initiator shall assert the ACK signal for a minimum of 16 ns in responding to each byte of the message(s). The target shall hold each of the message byte(s) for a

minimum of 33 ns after detection of the ACK signal being asserted.

NOTE 1 - The timing requirements are required to ensure that all the SCSI devices that have the QAS method enabled see the message bytes.

b) After the initiator negates the ACK signal for the QAS REQUEST message and if the initiator does not create an attention condition then the initiator shall release all SCSI signals within two system deskew delays after detecting MSG, C/D, and I/O signals false.
c) After detection of the last ACK signal being false ~~negated~~ and if there is no attention condition, the target shall release all SCSI signals except the BSY, MSG, C/D, and I/O signals and the target shall negate the MSG, C/D, and I/O signals within two system deskew delays.

Editors Note 3 - GOP: The ATN signal is not valid until the ACK signal is negated the above change and the change in a) below reflect the correction to this error. (from 2/1/99 BG note) This is a technical change and needs to be voted on.

Editors Note 4 - GOP: A comment was received that one system deskew delay is too short of a time and that it should be two deskew delays. I agree, two deskew delays is the usual amount of time this standard uses under these timing conditions. from 2/1/99 BG note) This is a technical change and needs to be voted on.

d) ~~The target shall wait for the SEL signal to be trueasserted~~.
e) If the target detects ~~After detection of~~ the SEL signal being true~~asserted~~, the target shall release the BSY, MSG, C/D, and I/O signals within one QAS release delay.

Editors Note 5 - GOP: The deletion of (d) and the changes to (e) are to make the steps clear. (BG 4/19/99)

f) After waiting at least a QAS arbitration delay from releasing the SCSI signals in step (c), if there are no SCSI ID bits ~~asserted~~ true the target shall transition to the BUS FREE phase.
g) After waiting at least a QAS arbitration delay from releasing of the SCSI signals in step (c), if there are any SCSI ID bits asserted the target shall wait at least a second QAS arbitration delay, if the SEL signal is not asserted by the end of the second QAS arbitration delay the target shall transition to the BUS FREE phase.

The procedure for an SCSI device to obtain control of the SCSI bus is as follows:

a) The SCSI device shall first wait for MESSAGE IN phase to occur with either a DISCONNECT/QAS REQUEST (0455h) message sequence, TASK COMPLETE/QAS REQUEST (0055h) message sequence, or a single QAS REQUEST (55h) message. When the SCSI device detects the ACK signal being ~~negated~~ false for the QAS REQUEST message and the attention condition is cleared it shall begin the QAS phase if allowed under the fairness algorithm.
b) The SCSI device shall wait a minimum of a two deskew delays after detection of the MSG, C/D, and I/O signals being ~~negated~~ false before driving any signal.
c) Following the delay in step (b), the SCSI device may arbitrate for the SCSI bus by asserting its own SCSI ID within a QAS assertion delay from detection of the MSG, C/D, and I/O signals being false~~negated~~.
d) After waiting at least a QAS arbitration delay (measured from the detection of the MSG, C/D, and I/O signals being negated) the SCSI device shall examine the DATA BUS.
A) If no higher priority SCSI ID bit is true on the DATA BUS and the fairness algorithm allowed the SCSI device to participate, then the SCSI device has won the arbitration and it shall assert the

SEL signal.
B) If a higher priority SCSI ID bit is true on the DATA BUS (see table 27 for the SCSI ID arbitration priorities) or the fairness algorithm prevented the SCSI device from participating in QAS arbitration, then the SCSI device has lost the arbitration.
C) Any SCSI device other than the winner has lost the arbitration and shall release its SCSI ID bit after two deskew delays and within one QAS release delay after detection of the SEL signal being asserted. An SCSI device that loses arbitration may return to step (a).

e) The SCSI device that wins arbitration shall wait at least a QAS arbitration delay after asserting the SEL signal before changing any signals.

The SCSI ID bit is a single bit on the DATA BUS that corresponds to the SCSI device's unique SCSI address. All other DATA BUS bits shall be released by the SCSI device. The DB(P_CRCA) and DB(P1) are not valid during the QAS phase. During the QAS phase, DB(P_CRCA), and DB(P1) may be released or asserted, but shall not be actively driven false.

0.0.0.3 Command phase exception condition handling

If the target detects one or more parity error(s) on the command bytes received, it may indicate its desire to retry the command by switching to the MESSAGE IN phase and sending a RESTORE POINTERS message. The target shall then switch to the COMMAND phase to receive the original command.

If the target does not retry the COMMAND phase or it exhausts its retry limit it shall return CHECK CONDITION status and set the sense key to ABORTED COMMAND and the additional sense code to SCSI PARITY ERROR.

Editors Note 6 - GOP: The above section defines the command phase exception condition handling. A section like that is contained in all the other phase sections. Needs a plenary vote.

To create an attention condition during the SELECTION phase following a QAS, the initiator shall assert the ATN signal at least two system deskew delays before asserting the targets ID in the bus.

Editors Note 7 - GOP: The above is needed to tell how an attention condition is created when QAS is active. Needs a plenary vote.

0.0.0.4 Information unit transfer logical operations

SCSI devices using information unit transfers may transfer SPI information units for any number of I/O processes by using logical connects, logical disconnects, and logical reconnects.

SCSI devices using information unit transfers may receive several commands during an initial connection. This occurs when an initiator uses the multiple command option in the SPI L_Q information unit. For each SPI L_Q received with the multiple command type and last command type selected, a logical connection occurs and an I_T_L_Q nexus is formed. At the completion of each SPI command information unit a logical disconnect occurs.

Logical disconnects shall occur at the completion of any SPI information unit except the SPI L_Q information unit. At completion of those SPI information units the I_T_L_Q nexus becomes an I_T nexus. The I_T nexus remains in place until either the target does a physical disconnect or a SPI L_Q information unit is sent or received.

Editors Note 8 - GOP: Streaming will be another case where a logical disconnect does

not occur.

Logical reconnections occur on the successful transmission or receipt of a SPI L_Q information unit for an existing I/O process. The logical reconnection reestablishes the I_T_L_Q nexus for that I/O process.

Editors Note 9 - GOP: The above does not contain any technical changes, But it should be voted on anyway.

If a target does not have the resources to accept a SPI command information unit it shall examine and execute any task management functions and transfers all the remaining bytes of the current SPI command information unit but need not hold the transmitted information. After transferring all the SPI command information unit bytes the target shall change to a DT DATA IN phase and transmit a SPI L_Q information unit followed by a SPI status information unit with the status of TASK SET FULL.

If the initiator has more commands to send to the target it shall wait for the next physical selection before those remaining commands may be sent.

Editors Note 10 - GOP: May sure multiple commands are covered

Editors Note 11 - GOP: The above changes need to be voted on

One or more messages may be sent during a single MESSAGE phase, but a message ~~may~~ shall not be split between multiple MESSAGE phases.

Editors Note 12 - GOP: The above change looks to be what was intended. (BG 4/20/99) This will need a plenary vote. No vote needed as this change was voted in proposal 98-246r1.

If information unit transfers are enabled targets shall not transmit a PHYSICAL DISCONNECT message.

Editors Note 13 - GOP: Remove the PHYSICAL from the messages

Editors Note 14 - GOP: The above reflects the way packetized works but needs to be vote on.

An information units enable request bit (IU_REQ) of zero indicates that information unit transfers are to be disabled when received from the originating SCSI device and that information unit transfers are not supported when received from the responding SCSI device. An IU_REQ bit of one indicates that information unit transfers are to be enabled when received from the originating SCSI device and that information unit transfers are supported when received from the responding SCSI device. If the IU_REQ bit is changed from the previous agreement (i.e., zero to one or one to zero) as a result of a negotiation the target shall go to a BUS FREE phase on completion of the negotiation.

Editors Note 15 - GOP: The above was added to force a bus free after a PPR when the state of packetized changes. (BG 4/19/99) This change requires a plenary vote. There is also a change required in the PPR message.