Author: Rod DeKoning/Kyle Robison
        NCR Corporation

92-130r2

Date: October 16, 1992

Subject: Synchronization Status and Errors

ABSTRACT:

In a disk array application, the array controller needs a mechanism to determine the status of spindle synchronization and to allow accurate problem reporting when a loss of synchronization occurs. When a master drive is logically downed and hot swapped or when a redundant initiator fails and must be hot swapped, the status of the synchronization is currently difficult if not impossible to attain. Also, currently there is no mechanism for a drive to report the cause of the problem when a loss of synchronization occurs.

ISSUES:

The following concerns/questions have arisen that do not seem to be adequately addressed in the SCSI-2 standard Rev. 10h. In reviewing these issues please keep in mind that this information can be obtained from each drive manufacturer, but there is currently not enough formal standardization in the implementations across all vendors to allow a complete array controller/host driver design that will accurately report sync spindle changes/problems for all SCSI drives.

    A)   Currently, the initiator must maintain a "current state" for each drive to know which drives are/are not synchronized. If power to the initiator is lost, there is no way to determine the synchronization status since the drives will not re-report the sync spindle unit attentions.

    B)   When loss of synchronization occurs, there is no indication of the cause. (Is no sync pulse being received or does a drive/controller malfunction prevent the drive from being able to synchronize to the reference signal

    C)   There is no specification for what is reported if 2 masters are selected. This can be caused by an initiator problem or improper cabling.

PROPOSED CHANGES FOR SCSI-3

Management of sync spindle changes by an initiator would be simpler and more complete if changes were made in the SCSI-3 standard to address the concerns listed above. The following proposal is intended to address these concerns:

Proposed are additions/changes to SCSI-2 Rev. 10h shown below.

Section 8.3.1.3 Drive Status Page - Send Diagnostic

The drive status page allows the initiator to query the drive regarding operational status of the drive. The format of the drive status page -- SEND DIAGNOSTIC is shown in Table ???.   The drive status information is returned in the drive status page -- RECEIVE DIAGNOSTIC RESULTS.

Table ? - Drive Status Page - SEND DIAGNOSTIC

Bit Byte	7	6	5	4	3	2	1	0
0	Page Code (41h)							
1	Reserved							
2	(MSB) Page Length (08h)							
3								(LSB)
4 – 7	Reserved							
8 – 11	Reserved							

Section 8.3.1.4 Drive Status Page - Send Diagnostic

The drive status page allows the initiator to query the drive regarding operational status of the drive. The format of the drive status page -- SEND DIAGNOSTIC is shown in Table ???.   The drive status information is returned in the drive status page -- RECEIVE DIAGNOSTIC RESULTS.   The drive status is reported in the drive status page - RECEIVE DIAGNOSTIC (Table ???)

Table ? - Drive Status Page - RECEIVE DIAGNOSTIC

Bit Byte	7	6	5	4	3	2	1	0
0	Page Code (41h)							
1	Reserved							
2	(MSB) Page Length (n-4)							
3								(LSB)
4 – 5	Reserved							
6	Reserved				Synchronization		RPL	
6	Reserved					SSIS	SSIE	SSSL
8 – 47	Reserved							
	Vendor Specific							
48 – n	Reserved							

Table 61 - Synchronization Status

Status	Description
00b	Synchronization status reporting is not supported or the status cannot be determined
01b	Spindle is synchronized with the reference signal
10b	Spindle cannot synchronize with the reference signal or no reference signal is present
11b	Spindle is in process of synchronizing with the reference signal

The Synchronization Status field is used to report whether or not the spindle has synchronized with the reference signal or to report that the synchronization is in progress. The definitions of values in this field are shown in Table ???.

If the logical unit has not been selected as a master, master control, or slave or if the reporting of synchronous status is not supported, the synchronous status shall be set to 00b.

If no reference signal is being received but the logical unit is currently a master, slave, or master control, the synchronization status will be set to 10b.

Once the reference signal is received, the logical unit shall begin its internal synchronization, attempting to match the drive's spindle speed to the reference signal. During this time, the synchronization status shall be set to 11b. The amount of time required to achieve synchronization is not defined by this standard.

If the logical unit is unable to synchronize to the reference signal, the logical unit shall set the synchronization status to 10b. The sense key shall be set to UNIT ATTENTION, the additional sense code shall be set to RPL STATUS CHANGE.

Once the logical unit successfully synchronizes to the reference signal, if the synchronization signal is lost due to a loss of the reference signal or a malfunction, unit attention conditions shall be generated for all initiators and the synchronization status shall be set to 10b. The sense key shall be set to UNIT ATTENTION. If the logical unit has successfully achieved synchronization and then loses synchronization while executing an I/O process and no other error occurs, then the target shall return CHECK CONDITION status. The sense key shall be set to RECOVERED ERROR if the logical unit is able to complete the I/O process or HARDWARE ERROR if the logical unit is unable to complete the I/O process. The additional sense code is set to RPL STATUS CHANGE for these cases.

The rotational position locking (RPL) field shall be returned as the current value found in the Rigid Disk Geometry Page (Table 173).

A synchronous spindle invalid signal (SSIS) bit of one indicates that the synchronous spindle signal received by the drive was invalid or not recognized by the drive as a valid synchronization signal. An example of this event is the receipt of synchronous signals from multiple masters. An SSIS bit of zero indicates no signal is present or a valid synchronization signal is being received.

A synchronous spindle internal error (SSIE) bit of one indicates that the synchronization spindle electronics has detected an internal failure and the spindle is not synchronized with the synchronization signal. An SSIE bit of zero indicates no internal electronic failure has been detected by the drive.

A synchronization spindle signal loss (SSSL) bit of one indicates that the drive detects receiving no synchronization signal. An SSSL bit of zero indicates that a spindle synchronization signal is being received.

The above three synchronization status error reporting fields, SSIS, SSIE, and SSSL, are used to indicate error conditions of a drive set to master or slave spindle synchronization mode using the Rigid Disk Geometry Mode Select page RPL field. A drive not set as master or slave shall report zero in these fields.