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MEMO

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To: Members of X3T9.2 and Parties interested in SCSI-2

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Subject: Broadcast Capability for SCSI-2

The asynchronous event notification suggestions previously advanced by Mr. Bob Snively, Mr. Gary Stevens and myself all propose one to one communication. This method has serious disadvantages when used for power up notification. This paper proposes a simple broadcast scheme to be used as a power up notification method.

There are two distinct types of situations when a SCSI-2 target device needs to initiate communication with an initiator/host. The first of these is to notify the host of abnormal situations that may cause the host to take action. Examples of this type of event include imminent power down or overtemp conditions, operator media removal or other device control panel state changes, and errors encountered during the execution of commands which do cacheing and those started with an immediate option (eg. Write Filemarks and Rewind from the command set for sequential devices). In these cases the number of hosts to be notified can be limited to those which have initiated commands to the device or to the initiator of the particular command that ran into difficulties. For instance, an operator spin down request report could be limited to those hosts from which a Prevent Media Removal command was received.

The second type of situation where an unsolicited target to host communication is necessary is power up. The factors that distinguish this from the situations discussed above are lack of prior knowlege of the system configutation and the necessity of notifying all devices. At power up time a device will not have had a chance to get prior permission to send a notification so will send to all possible devices. With the 250 mS selection timeout and 4 devices on the bus there will be 28 selections for power on notification, of these 16 will go unanswered. This results in 4 seconds of wasted bus time. This assumes that all devices participate in the notification protocol. (The average for 2 thru 8 devices is 2.75 seconds.) This might not be so bad except that it occurs when the host is attempting to boot up the

system.
A type of broadcast selection is proposed to answer the problems of power up notification. The broadcast procedure is to:

- Arbitrate for the bus,
- Assert all data bits except the broadcasting devices' ID bit,
- Assert select and hold this state for 20 mS,
- Briefly assert Busy prior to releasing Select and the data lines to ensure an orderly transition to bus free.
- Release the bus.

By setting all the data bits on the bus except that corresponding to the broadcasting device, the common SCSI interface chips of all the other devices will see a possible selection. The firmware of these controllers will note the existence of the broadcasting device and will not otherwise respond to the broadcast. (SCSI-1 devices will not respond to this selection because more than two bits are set.)

The 20 mS hold time is an arbitrary period designed to enable this procedure to complete without too much wasted bus time and to allow initiators to note the ID of the broadcasting device. The normal initiator response to a broadcast from a device would be to issue an Inquiry command. This could be done with a high probability of getting a quick response.

In many systems the devices should delay their broadcast for a period sufficient to allow the host system to become initialized sufficiently to be able to use this information. Agian an arbitrary time constant is needed. This is somewhat more difficult to decide. The value should be less than 5 or 6 seconds after a cold start or the system may be percieved as slow to come up in human terms.

The proposal for this delay period is designed to allow the a host to boot up without interference while allowing the device to be added to the system later. Devices initiate their broadcast protocol based on power up and reset conditions. Hosts that need to know the system configuration can initiate a broadcast sequence by all bus devices by creating the reset condition after they have initialized sufficiently. This protocol is based on the assumption that devices can tell the difference between a power up and a reset condition. The rules proposed are:

- Cold start. Each device shall begin continuous attempts to gain the use of the bus in order to execute the broadcast sequence no sooner than 5 seconds and no later than 6 seconds after application of power.

- Reset. Each device shall begin continuous attempts to gain the use of the bus in order to execute the broadcast sequence no sooner than 250 mS and no later than 500 mS after the reset line is released.

Given these rules, a SCSI-2 host will know that when Bus Free is seen at least 6.3 seconds after power up, all the SCSI-2 devices which implement broadcast will have reported. (5% has been added to the 6 second maximum from the Cold Start rule above to allow for timing variations between devices.) Similarly, when Bus Free is seen at least 600 mS after a reset condition, all the SCSI-2 devices which implement broadcast will have reported.

To implement the proposed broadcast mechanism, additions to a number of sections of the SCSI-2 spec are required. The primary reference would be a new section inserted after 5.1.5 RESELECTION.

4.7.17 Broadcast Hold Time (20 milliSeconds)

The recommended minimum time a device implementing a BROADCAST phase shall hold the SCSI BUS with SEL asserted and the DATA BUS according to the definition of the BROADCAST phase. This period shall be from the release of BSY until its reassertion.

5.1.6 BROADCAST Phase (Optional)

BROADCAST is an optional phase which allows devices to notify all the other devices present on the SCSI bus that the device generating the BROADCAST phase is operating and will respond to a valid SELECTION.

In order to notify other SCSI-2 devices via a BORADCAST, a device will arbitrate for control of the bus. Upon winning ARBITRATION, the device will have BSY, SEL and its ID bit on the bus. (The timing requirements of the Arbitration Phase apply.)

The BROADCAST initiator shall set the DATA BUS to a value which is the exclusive OR of its SCSI ID bit and 0FFh. The initiator shall then wait a minimum of two deskew delays and release BSY.

This bus state shall remain asserted for the Broadcast Hold Time (20 mS). At the end of this period, the initiator shall assert BSY, then wait at least a bus settle delay, then release SEL and the DATA BUS. Following a further bus clear delay plus a bus settle delay the BROADCAST initiator shall release BSY allowing the SCSI bus to go to the BUS FREE phase.

5.1.6.1 Broadcast Protocol

SCSI-2 devices which implement broadcast shall create the BROADCAST phase following initial application of power and following Reset conditions. Each such device shall begin continuous attempts to Arbitrate for the use of the bus in order to execute the BROADCAST phase no sooner than 5 seconds and no later than 6 seconds after application of power. Each such device shall begin continuous attempts to Arbitrate for the use of the bus in order to execute the BROADCAST phase no sooner than 250 mS and no later than 500 mS after the RST line is released.