

SCIENTIFIC MICRO SYSTEMS

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Recommended sequence of commands that a software driver may perform on the SCSI bus ;

The following lists the sequence of events that is recommended to a software driver to execute at system power on or consecutive to a reset line condition on the SCSI bus.

Let us list some preliminary considerations : The operating system booting procedure may or may not be performed from a SCSI device. If it is from a SCSI device, one or several Read commands will be necessary. The time to boot may be critical to the user. The device from which the boot procedure is executed may only be ready to transfer data after a consequent delay needed to let the device execute the following functions; to be up to speed, have self-test executed as well as have self configuration performed. This delay may be up to several seconds.

Sequence :

Inquiry command :

The first command to issue, even to the bootable device, is the Inquiry command. This command shall be issued to all possible SCSI device IDs (up to 7) other than the initiator ID performing the commands. For each SCSI ID the Inquiry command shall be performed to all possible LUNs 0 through 7. The potential total number of Inquiry commands to perform is 56 (for 8 LUNs per 7 SCSI IDs). In reality less than 56 Inquiry commands are really performed if fewer than 7 SCSI devices are present on the bus. For those SCSI IDs which are not present, the selection will be aborted after the regular 250 ms SCSI delay. All LUNs not supported per SCSI ID will return a 7Fh byte as the first byte of the Inquiry data. The most important information at this point that the system needs is to discover how many devices and the type of devices attached to the SCSI bus. During this initial search, the system may choose the Allocation length in the CDB of the Inquiry command to be minimal (i.e. requesting the target to return only one byte, in order to find out with the first byte of the Inquiry data what is the type of device, disk versus tape versus optical disk etc..). The system may choose to perform the Inquiry command on all other devices after it has completed the Inquiry and Read(s) commands on the bootable device which SCSI ID and LUN may be set to a default value.

With the information returned by the Inquiry commands, the system creates a table which will be used to load the software driver overlay specific to each device type possible. The overlay for the booting device is

always resident partially or entirely in the computer. The other overlays may be resident in the booted operating system or recommended to be stored on the device from where the boot procedure is performed to allow easier upgrades or enhancements. As a remainder, the command set for a disk is different than for a tape, different than an optical disk etc.. Therefore, each device type needs its own overlay, its own set of commands, and will require from the system a different analyse of error report per device type.

Test Unit Ready command :

Once all logical units have been identified, the second command to perform may be the Test Unit Ready command. The system shall be aware that some devices may lie when reporting a successful ready status. Some targets may disconnect during this command, waiting for the device to be up to speed and ready to transfer data.

Some SCSI devices request to receive a SCSI Start/Stop command to become ready. In this case, the system may implement a Start/Stop command to be executed to any device in a non ready status. The system shall expect some devices to return an Illegal Request sense key for an invalid or unsupported command (Start/Stop Unit).

Some SCSI devices claim to be ready prior to be effectively ready to transfer data in anticipation to be ready when any following read or write command be issued.

Some battery powered devices turn off their spindle to save energy and turn on their spindle while receiving any command or while receiving a seek implied command. Hopefully those devices will still accept the Inquiry command to be performed. Issuing the Test Unit Ready command may be somehow irrelevant. How good a status can it be if there is no other commands to issue immediately thereafter. Some systems never issue this command and condition their decision on post status. All commands indicate if the device is ready or not. The only advantage of issuing this command for pre status checking is that the system will only set the SCSI pointers for a ready device.

The Inquiry data which is the information returned by the Inquiry command is stored in non volatile memory in the target device. It can be stored in a prom or stored on the medium, therefore the time to access the information may be fast in one case or device access time and seek time dependable on the other case.

Some systems perform the Test Unit Ready command instead of the Inquiry command as the first command to execute. The advantage is to speed up the process in finding the status of the entire SCSI bus. The Test

Unit Ready command is supposedly faster than the Inquiry command because it does not perform the Data In phase.

The disadvantage is that performing the Test Unit Ready command tells you how many devices are ready, but not what type they are. Once all Test Unit Ready commands have been issued to the potential 56 LUNs, the system would then issue the Inquiry command to those units in a ready status. This procedure is not recommended because the Inquiry command can be issued successfully to devices which are not ready. The number of devices found on the bus with the Test Unit Ready command is likely to be less than the number of devices found with the Inquiry command. The device configuration table in the system is therefore more accurate with one solution than the other.

It is absolutely recommended to issue the Inquiry command. Systems which do not implement this command expect each device on the bus to remain with a device type dedicated to a SCSI ID. Those systems do not allow any flexibility in reconfiguring the SCSI bus with different SCSI IDs nor allow changing the priority among devices on the bus. Those systems will also lack all the added information that CCS introduced, such as compliance level to SCSI, vendor ID, product name, version level which can be helpful to trace the history of the system, for compatibility issues, for taking advantage of customized features supported by some vendors.

Request Sense ;

In anticipation to have to issue a Request Sense command to acknowledge the Unit Attention sense key for all Luns possible, some systems perform the Request Sense command as the first command instead of the Inquiry command. Similar comments to this procedure can be applied than with the Test Unit Ready command.

The following recommended sequence of events are mainly addressing disk drives, but can be applicable, regarding the use of the Mode Sense and Mode Select commands but except with the Read Capacity command, to other devices.

Read Capacity ;

The first command to execute out of the software driver disk overlay is the Read Capacity to find out the total available capacity of the disk in number of user addressable blocks and the block size with which the disk has been formatted. If the Check Condition status is created by the target in response to this command because the drive has not been formatted, then the system shall issue the Mode Select command with the adequate drive parameters and issue the Format Unit command. This case is usually part of

a utility program but not necessarily part of the software driver overlay (but it can).

Mode Sense ;

Assuming the Read Capacity is completed with no Check Condition status, then it is recommended to the system to issue the Mode Sense command requesting the current values to be returned with the Page Code Field in the CDB set to 3Fh and with 256 bytes of allocation length. The target will return all the pages that it supports indicating the length of each page and the current values of the parameters inside the pages. The host system shall now analyze if the returned values of each page are the desired values. If yes, that LUN is ready for storing and/or retrieving data, without further setting necessary.

Mode Select ;

If not, the host system will have to issue a Mode Select command to set the parameters to the needed values. Prior to issue the Mode Select command, the host shall check if the target/LUN accept the parameters to be changed. The host system will then issue the Mode Sense command requesting the changeable values to be returned. There may be one or several Mode Sense commands issued. The host may request all or one page or some pages to be returned. The target/LUN will return fields set to one to indicate that parameters are changeable or set to zero when not changeable. The same procedure applies to bits. It is up to the host system decision to deal with undesired but not changeable parameters. Otherwise, when parameters are changeable, the host system shall issue the Mode Select command setting the requested fields and bits to the desired values and not changing the current values of other fields and bits.

SCSI Reset ;

Consecutive to a reset line condition, it is recommended to the system to issue the Inquiry commands for checking the entire bus, to issue the Mode Sense command to all existing LUNs checking that all parameters are set as expected, and to issue the Test Unit Ready command to find out if all devices are still in the same status.

Unit Attention Condition ;

Consecutive to a Unit Attention condition, it is recommended to the system to issue the Inquiry command checking the device involved, to issue the Mode Sense command checking that all parameters are set as expected, and issue the Test Unit Ready if necessary.