

# Macintosh SCSI: Description (2 of 2)

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TOPIC ----------

This is the second part of a two-part article on the Small Computer Systems Interface (SCSI) used in Macintosh computers.

DISCUSSION ----------

Concurrent bus activity

SCSI uses 'smart' controllers which can enhance bus usage so that initiators as well as targets can contend for the bus (which is why arbitration is needed in a multiprocessor environment). A target system, through its control unit, may contend to re-establish a connection with an initiator that has requested the target to perform some task. The target system's control unit can relinquish the bus so the unit and the system can make better use of the time a it takes to respond to a command from an initiator. Subsequently, once the peripheral is ready to interact with the initiator again, the control unit can contend for the bus. After winning arbitration, the control unit reselects the initiator by raising the proper control lines. In this way, devices like tape drives and printers can temporarily disconnect when their buffers are full, allowing other operations to continue at the same time. This parallel activity is called MULTITHREADED I/O.

Message stage functions

A system must support the full SCSI implementation in order to send messages on the bus. This MESSAGE phase is necessary for setting up local conditions (ie., synchronous data transfer, etc..) for the following COMMAND stage.

The 'Identify' message establishes the physical data path between an initiator and a target. During this process, the initiator's processor on the SCSI bus (called the Host) saves a set of pointers that describe the current buffer location in the Host's memory. If the target then chooses to disconnect to perform its command or task, the saved pointers define the same buffer location when the target re-establishes the connection to the initiator. If either the target or the initiator cannot support messages, the target goes directly to the COMMAND phase. In this case, the target cannot disconnect until the data exchange is complete.

Command stage functions

The SCSI commands provide for many system tasks. The Enquiry command, for example, permits the SCSI system to determine the configuration of I/O processes without having the entire system on the bus go through a system definition regeneration. The I/O device responds to the Enquiry command by telling the initiator what type of device the I/O unit is and how to communicate with it. If the system software implements an Inquiry command as part of its initial booting process, the host can identify the characteristics of all the devices on the system at that time, eliminating a great deal of operator intervention and overhead.

Other commands allow peripheral control units to assign block numbers to the peripherals they control. The Logical Block Addresses (LBAs) usually refer to a single physical sector of a peripheral; however, they may also be part of a physical block or multiple physical blocks. A collection of contiguous logical blocks is known as a Logical Unit (LUN). A LUN can refer to a part of a peripheral (for example, one disk in a multi-disk drive), a single peripheral, or a group of peripherals, depending how the control unit is set up. This means that a control unit needs only to specify a LUN and LBA instead of a drive, cylinder, head, and sector address when addressing a random-access drive.

Data transfer modes

Data transfers between selected devices may be in either asynchronous or synchronous mode. Synchronous data transfer must be specified by both bus users during the command mode, otherwise data transfer mode defaults to asynchronous mode. During asynchronous mode, the REQ(request) and ACK(acknowledge) bus-control signals control the data pacing on a byte-by-byte basis between the two units, with a maximum data rate of 1.5 Mbytes/second. Synchronous data transfers involve a series of REQ commands and data without the immediate receipt of corresponding ACK signals, allowing a faster data transfer rate of up to 4 Mbytes/second. ACK signals sent by the receiving device are used to verify individual data byte transfers, with a pre-established offset between the actual transfer of a specific data byte and its acknowledged receipt. This REQ/ACK offset is part of the synchronous data transfer control agreed to by both parties beforehand.

Sources of further information:

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