To: T10 Technical Committee
From: Rob Elliott, HP (elliott@hp.com)
Date: 12 March 2005
Subject: 05-074r1 SPC-3 SPC-4 SES-2 SMC-3 Command requirements

Revision history
Revision 0 (18 February 2005) First revision
Revision 1 (12 March 2005) Incorporated comments from March CAP WG - keep SCCS support for SES-2 and clearly add it to SMC-3.

Related documents
04-313r1 Mandatory REPORT LUNS support (Dave Peterson, CNT)
ses2r10 - SCSI Enclosure Services - 2 revision 10
smc2r07 - SCSI Media Changer Commands - 2 revision 7
spc3r21d - SCSI Primary Commands - 3 revision 21d

Overview
1. SCSI Controller (SCC) commands (VOLUME SET, SPARE, REDUNDANCY GROUP, MAINTENANCE) are allowed on logical units with almost all peripheral device types, including standalone enclosure services (SES) and independent medium changers (SMC), so the SCC commands need to be listed in their command tables.

2. SMC's attached model says the hosting logical unit would be the data transfer element for the media changer, but a standalone SES does not make sense as a data transfer element - it defines no commands dealing with media. The MCHNGR bit in standard INQUIRY data should be required to be set to zero in SES-2 for standalone SES logical units.

3. REPORT LUNS should be marked as mandatory in SES-2 and SMC-3 as requested by 04-313r1 (already incorporated in ses2r10). Update the opcode table in SPC-3 to match SES-2 and update the opcode table in SPC-4 to match SMC-3.

4. The new REPORT/SET PRIORITY and REPORT/SET TIMESTAMP commands should be optional for both SES-2 and SMC-3.

5. Clearer rules are needed regarding how independent media changers set the MCHNGR bit in standard INQUIRY data. This bit affects whether MOVE MEDIUM ATTACHED and READ ELEMENT STATUS ATTACHED are supported (possibly in addition to MOVE MEDIUM and READ ELEMENT STATUS), so the WG decided it is supposed to be set to zero in independent medium changers that have no need for the ATTACHED versions of the commands.

6. Clearer rules are needed regarding how standalone SES logical units set the ENCSERV bit in standard INQUIRY data. The WG discussed making it zero to align with SMC-2. However, SES-2 already has wording stating that both standalone and attached SES set the ENCSERV bit to one. SCC-2 also works that way with the SCCS bit. So, SES-2 is left alone and SMC-3 will be the only one that does not set its parasite bit in a standalone/independent logical unit.

Suggested changes to SPC-3
D.3.1 Operation codes

Mark A0h REPORT LUNS as mandatory in the E - ENCLOSURE SERVICES DEVICE (SES-2) column.

D.3.2 Additional operation codes for devices with the MCHNGR bit set to one
Remove the "M" mandatory entry in the E - ENCLOSURE SERVICES DEVICE (SES-2) column for:
    a)   A7h (MOVE MEDIUM ATTACHED)
    b)   B4h (READ ELEMENT STATUS ATTACHED).

D.3.3 Additional operation codes for devices with the EncServ bit set to one

No change.

Suggested changes to SPC-4
D.3.1 Operation codes

Mark A0h REPORT LUNS as mandatory in the M - MEDIA CHANGER DEVICE (SMC-3) column.

Suggested changes to SES-2

4.1.2 Standalone enclosure services process

An application client may address the enclosure services process as a logical unit having the peripheral device type of enclosure services (i.e., 0Dh) (see the INQUIRY command in SPC-3). The commands for this peripheral device type are described in clause 5.

Standalone enclosure services processes shall set the ENCSERV bit to one in the standard INQUIRY data.

The application client uses the SEND DIAGNOSTIC command and its control-type diagnostic pages to set various indicators and states within the enclosure domain, allowing the enclosure to provide the most appropriate environment for the other SCSI devices contained within it. Similarly, the application client requests information from the enclosure services process using the RECEIVE DIAGNOSTIC RESULTS command and its status-type diagnostic pages to examine various status and warning information available from the enclosure. ~~Standalone enclosure services processes shall set the ENCSERV (enclosure services) bit to one in the Standard INQUIRY data to indicate that they are capable of transporting enclosure services information.~~ The diagnostic pages and page formats are defined in 6.1.

[new para] The Enclosure Services Management mode page (see 6.3.2) may be implemented by a standalone enclosure services process.

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4.1.3 Attached enclosure services process

An application client may also be able to address the enclosure services using a logical unit with some other peripheral device type (e.g., a block device) as a transport for enclosure services information. Such peripheral devices have a communications connection to the attached enclosure services process defined outside this standard (e.g., the ESI interface in SFF-8067). The attached enclosure services process is not accessible as its own logical unit; it transports the standard enclosure services information through the addressed logical unit.

The device server shall set the ENCSERV (enclosure services) bit to one in the standard INQUIRY data (see SPC-3) to indicate that it supports an attached enclosure services process, which may or may not be currently attached.

Such devices shall use the same SEND DIAGNOSTIC and RECEIVE DIAGNOSTIC RESULTS commands and page formats used by a standalone enclosure services process, but otherwise support the peripheral device model specified by their peripheral device type value. ~~Such a device server shall set the ENCSERV (enclosure services) bit to one in the standard INQUIRY data (see SPC-3) to indicate that it supports an attached enclosure services process, which may or may not be currently attached.~~

[new para] An application client determines whether an enclosure services process is actually attached to the device by using the RECEIVE DIAGNOSTIC RESULTS command to request a Configuration diagnostic page (see 6.1.2). If the device server is not able to communicate with an enclosure services process, the device server shall return CHECK CONDITION status as described in 4.8.

The Enclosure Services Management mode page (see 6.3.2) may be implemented by a logical unit that allows access to an attached enclosure services process.

5 Commands for enclosure services peripheral devices

The commands for standalone enclosure services processes (i.e., logical units with the peripheral device type of enclosure services (i.e., 0Dh))(see 4.1.2) are shown in table 4.

Table 4 — Commands for enclosure services peripheral devices (part 1 of 2)

Command name	Operation code [a]	Type [b]	Reference
ACCESS CONTROL IN	86h	O	SPC-3
ACCESS CONTROL OUT	87h	O	SPC-3
CHANGE ALIASES	A4h/0Bh	O	SPC-3
INQUIRY [g]	12h	M	SPC-3
LOG SELECT	4Ch	O	SPC-3
LOG SENSE	4Dh	O	SPC-3
MAINTENANCE IN	A3h/00h - 04h A3h/06h - 09h	X [e]	SCC-2
MAINTENANCE OUT	A4h/00h - 05h A4h/07h - 09h	X [e]	SCC-2
MODE SELECT (10)	55h	O	SPC-3
MODE SELECT (6)	15h	O	SPC-3
MODE SENSE (10)	5Ah	O	SPC-3
MODE SENSE (6)	1Ah	O	SPC-3
~~MOVE MEDIUM ATTACHED~~	~~A7h~~	~~X [f]~~	~~SMC-2~~
PERSISTENT RESERVE IN	5Eh	O	SPC-3
PERSISTENT RESERVE OUT	5Fh	O	SPC-3
READ BUFFER	3Ch	O	SPC-3
RECEIVE DIAGNOSTIC RESULTS [c]	1Ch	M	SPC-3
REDUNDANCY GROUP IN	BAh	X [e]	SCC-2
REDUNDANCY GROUP OUT	BBh	X [e]	SCC-2
REPORT ALIASES	A3h/0Bh	O	SPC-3
REPORT DEVICE IDENTIFIER	A3h/05h	O	SPC-3
REPORT LUNS	A0h	M	SPC-3
REPORT PRIORITY	A3h/0Eh	O	SPC-3
REPORT SUPPORTED OPERATION CODES	A3h/0Ch	O	SPC-3
REPORT SUPPORTED TASK MANAGEMENT FUNCTIONS	A3h/0Dh	O	SPC-3
REPORT TARGET PORT GROUPS	A3h/0Ah	O	SPC-3
REPORT TIMESTAMP	A3h/0Fh	O	SPC-3
REQUEST SENSE	03h	M	SPC-3
SEND DIAGNOSTIC [d]	1Dh	M	SPC-3
SET DEVICE IDENTIFIER	A4h/06h	O	SPC-3
SET PRIORITY	A4h/0Eh	O	SPC-3
SET TARGET PORT GROUPS	A4h/0Ah	O	SPC-3
SET TIMESTAMP	A4h/0Fh	O	SPC-3
SPARE IN	BCh	X [e]	SCC-2
SPARE OUT	BDh	X [e]	SCC-2

Table 4 — Commands for enclosure services peripheral devices (part 2 of 2)

Command name	Operation code [a]	Type [b]	Reference
TEST UNIT READY	00h	M	SPC-3
VOLUME SET IN	BEh	X [e]	SCC-2
VOLUME SET OUT	BFh	X [e]	SCC-2
WRITE BUFFER	3Bh	O	SPC-3

The following operation codes are obsolete:
   16h (RESERVE (6)), 17h (RELEASE (6)), 56h (RESERVE (10)), 57h (RELEASE (10))

All operation codes for enclosure services type peripheral devices not specified in this table are reserved for future standardization.

[a] Some commands are defined by a combination of operation code and service action. The operation code value is shown preceding the slash and the service action value is shown after the slash.
[b] M = command implementation is mandatory. O = command implementation is optional. X = Command implementation requirements detailed in the reference.
[c] Enclosure services status-type diagnostic pages are transferred by the RECEIVE DIAGNOSTIC RESULTS command using the PF bit set to one.
[d] Enclosure services control-type diagnostic pages are transferred by the SEND DIAGNOSTIC command. Device servers are only required to accept a single diagnostic page in each command.
[e] If the sccs bit is set to one in the standard INQUIRY data (see SPC-3), these commands shall be supported as required by SCC-2. If the sccs bit is set to zero, these commands shall not be supported.
[f] If the MCHGR bit is set to one in the standard INQUIRY data (see SPC-3), these commands shall be supported as required by SMC-2. If the MCHGR bit is set to zero, these commands shall not be supported.
[g] In the standard INQUIRY data (see SPC-3), the MCHNGR bit shall be set to zero.

Editor's Note 1: REPORT LUNS marked mandatory as requested by 04-313r1. T10 only voted on that for SPC-3 but not SES-2. Should consider removing the SCC-2 and SMC-2 command support since they don't really make sense for a standalone SES peripheral device.

All the commands are described in the referenced standards. The diagnostic pages accessed by the SEND DIAGNOSTIC command and the RECEIVE DIAGNOSTIC RESULTS command are defined in 6.1. The elements accessed by some of the diagnostic pages are defined in clause 7. The format for the mode parameters and mode page accessed by the MODE SELECT commands and the MODE SENSE commands are defined in 6.3.

Suggested changes to SMC-3

2 Normative references

2.1 Normative references

The following standards contain provisions that, through reference in the text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below.

Copies of the following documents may be obtained from ANSI: Approved ANSI standards, approved and draft international and regional standards (ISO, IEC, CEN/CENELEC, ITUT), and approved standards of other countries (including BSI, JIS, and DIN). For further information, contact ANSI Customer Service Department at 212Ð642Ð4900 (telephone), 212Ð302Ð1286 (fax) or via the World Wide Web at http://www.ansi.org.

Copies of the following documents may be obtained from ANSI:

  a) approved ANSI standards;
  b) approved and draft international and regional standards (ISO, IEC, CEN/CENELEC, ITU-T); and
  c) approved and draft foreign standards (including BSI, JIS, and DIN).

For further information, contact ANSI Customer Service Department at 212-642-4900 (phone), 212-302-1286 (fax) or via the World Wide Web at http://www.ansi.org.

Additional availability contact information is provided below as needed.

Editor's Note 2: optional to include the table of standards bodies below

Table 5 shows standards bodies and their web sites.

Table 5 — Standards bodies

Abbreviation	Standards body	Web site
ANSI	American National Standards Institute	http://www.ansi.org
BSI	British Standards Institution	http://www.bsi-global.com
CEN	European Committee for Standardization	http://www.cenorm.be
CENELEC	European Committee for Electrotechnical Standardization	http://www.cenelec.org
DIN	German Institute for Standardization	http://www.din.de
IEC	International Engineering Consortium	http://www.iec.ch
IEEE	Institute of Electrical and Electronics Engineers	http://www.ieee.org
INCITS	International Committee for Information Technology Standards	http://www.incits.org
ISO	International Standards Organization	http://www.iso.ch
ITI	Information Technology Industry Council	http://www.itic.org
ITU-T	International Telecommunications Union Telecommunications Standardization Sector	http://www.itu.int
JIS	Japanese Industrial Standards Committee	http://www.jisc.org
T10	INCITS T10 SCSI storage interfaces	http://www.t10.org
T11	INCITS T11 Fibre Channel interfaces	http://www.t11.org
T13	INCITS T13 ATA storage interface	http://www.t13.org

2.2 Approved references

At the time of publication, the following referenced standards were approved.

ISO/IEC 14776-412, *SCSI Architecture Model - 2 (SAM-2)* [(ANSI INCITS.366-2003INCITS 366-2003)]

ISO/IEC 14776-312, *Information Technology - SCSI Primary Commands -2*

ISO/IEC 14776-342, *SCSI-3 Controller Commands - 2 (SCC-2)*(ANSI INCITS 318-1998)

2.3 References under development

At the time of publication, the following referenced standards were still under development. For information on the current status of the document, or regarding availability, contact the relevant standards body or other organization as indicated.

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ISO/IEC 14776-413, *SCSI Architecture Model - 3 (SAM-3)*(T10/1561-D)

ISO/IEC 14776-453, *SCSI Primary Commands - 3 (SPC-3)*(T10/1416-D)

NOTE 1 - For more information on the current status of these documents, contact the INCITS Secretariat at 202-737-8888 (phone), 202-638-4922 (fax) or via Email at incits@itic.org. To obtain copies of this document, contact Global Engineering at 15 Inverness Way, East Englewood, CO 80112-5704 at 303-792-2181 (phone), 800-854-7179 (phone), or 303-792-2192 (fax), or see http://www.incits.org.

5 Media changer models

5.1 Independent media changer

An independent media changer is a device server that returns 08h (i.e., medium changer) in the PERIPHERAL DEVICE TYPE field (see SPC-2) of standard INQUIRY command response data.

Independent media changers respond to a LUN different from those used by a data transfer device. Communication with a data transfer device may use the same service delivery subsystem as the media changer device, or a different SCSI service delivery subsystem. Data transfer devices that are not SCSI devices are also permitted. Multiple data transfer devices may be attached to an independent changer.

If a data transfer device served by the media changer is a SCSI device, the data transfer device may be addressed on a SCSI service delivery subsystem though the same SCSI target port as the media changer but with a different LUN. The data transfer device may also be addressed through independent SCSI target ports and any LUN on the same or a different service delivery subsystem.

The READ ELEMENT STATUS command response data page for each data transfer element may provide the identity of the data transfer device serviced by a media changer device. This support is optional since a data transfer device is not required to be a SCSI device.

Independent media changers (i.e., logical units with the peripheral device type of medium changer (i.e., 08h)) (see 5.1) shall set the MCHNGR bit to zero in the standard INQUIRY data.

5.2 Attached media changer

An attached media changer is part of a device server that sets the MCHNGR bit to one in its standard INQUIRY data (see SPC-2). Attached media changers respond to the same LUN as a data transfer device that is not a media changer. In an attached media changer, the PERIPHERAL DEVICE TYPE field of standard INQUIRY data returns the type of the data transfer device.

Two media changer commands, READ ELEMENT STATUS ATTACHED and MOVE MEDIUM ATTACHED are added to the command set of the data transfer device. The other commands available depend on the model for the data transfer device.

6 Commands for media changer logical units

6.1 Summary of commands for independent media changers

The commands for independent media changers (see 5.1) shall be as shown in table 3.

Table 3 — Commands for independent media changers (part 1 of 2)

Command name	Operation code a	Type b	Reference
[not showing all rows]			
MAINTENANCE IN	A3h/00h - 04h A3h/06h - 09h	X e	SCC-2
MAINTENANCE OUT	A4h/00h - 05h A4h/07h - 09h	X e	SCC-2
RECEIVE DIAGNOSTIC RESULTS	1Ch	O/M c	SPC-3
REPORT LUNS	A0h	O M	SPC-3
REPORT PRIORITY	A3h/0Eh	O	SPC-3
REPORT TIMESTAMP	A3h/0Fh	O	SPC-3

Table 3 — Commands for independent media changers (part 2 of 2)

Command name	Operation code [a]	Type [b]	Reference
REDUNDANCY GROUP IN	BAh	X [e]	SCC-2
REDUNDANCY GROUP OUT	BBh	X [e]	SCC-2
SEND DIAGNOSTIC	1Dh	M	SPC-3
SET PRIORITY	A4h/0Eh	O	SPC-3
SET TIMESTAMP	A4h/0Fh	O	SPC-3
SPARE IN	BCh	X [e]	SCC-2
SPARE OUT	BDh	X [e]	SCC-2
VOLUME SET IN	BEh	X [e]	SCC-2
VOLUME SET OUT	BFh	X [e]	SCC-2
All operation codes for media changer type peripheral devices not specified in this table are reserved for future standardization. ~~Key~~ ~~M = command implementation is mandatory.~~ ~~O = command implementation is optional.~~			
[a] This command is defined by a combination of operation code and service action. The operation code value is shown preceding the slash and the service action value is shown after the slash. [b] M = command implementation is mandatory. O = command implementation is optional. [c] This command shall be supported if the ENCSERV bit is set to one in the standard INQUIRY data (see SPC-3) and may be supported otherwise.			