INTERNATIONAL STANDARD

ISO/IEC 14776-411

First edition
1999-09

Information technology – SCSI-3 Architecture Model (SCSI-3 SAM)

Technologies de l'information – Modèle d'architecture SCSI-3 (SCSI-3 SAM)

Reference number
ISO/IEC 14776-411:1999(E)

Numéros des publications

Depuis le 1er janvier 1997, les publications de la CEI sont numérotées à partir de 60000.

Publications consolidées

Les versions consolidées de certaines publications de la CEI incorporant les amendements sont disponibles. Par exemple, les numéros d'édition 1.0, 1.1 et 1.2 indiquent respectivement la publication de base, la publication de base incorporant l'amendement 1, et la publication de base incorporant les amendements 1 et 2.

Validité de la présente publication

Le contenu technique des publications de la CEI est constamment revu par la CEI afin qu'il reflète l'état actuel de la technique.

Des renseignements relatifs à la date de reconfirmation de la publication sont disponibles dans le Catalogue de la CEI.

Les renseignements relatifs à des questions à l'étude et des travaux en cours entrepris par le comité technique qui a établi cette publication, ainsi que la liste des publications établies, se trouvent dans les documents ci-dessous:

- **«Site web» de la CEI***
- **Catalogue des publications de la CEI**
  Publié annuellement et mis à jour régulièrement (Catalogue en ligne)*
- **Bulletin de la CEI**
  Disponible à la fois au «site web» de la CEI* et comme périodique imprimé

Terminologie, symboles graphiques et littéraux

En ce qui concerne la terminologie générale, le lecteur se reportera à la CEI 60050: *Vocabulaire Electrotechnique International* (VEI).

Pour les symboles graphiques, les symboles littéraux et les signes d'usage général approuvés par la CEI, le lecteur consultera la CEI 60027: *Symboles littéraux à utiliser en électrotechnique,* la CEI 60417: S*ymboles graphiques utilisables sur le matériel. Index, relevé et compilation des feuilles individuelles,* et la CEI 60617: *Symboles graphiques pour schémas.*

* Voir adresse «site web» sur la page de titre.

Numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series.

Consolidated publications

Consolidated versions of some IEC publications including amendments are available. For example, edition numbers 1.0, 1.1 and 1.2 refer, respectively, to the base publication, the base publication incorporating amendment 1 and the base publication incorporating amendments 1 and 2.

Validity of this publication

The technical content of IEC publications is kept under constant review by the IEC, thus ensuring that the content reflects current technology.

Information relating to the date of the reconfirmation of the publication is available in the IEC catalogue.

Information on the subjects under consideration and work in progress undertaken by the technical committee which has prepared this publication, as well as the list of publications issued, is to be found at the following IEC sources:

- **IEC web site***
- **Catalogue of IEC publications**
  Published yearly with regular updates (On-line catalogue)*
- **IEC Bulletin**
  Available both at the IEC web site* and as a printed periodical

Terminology, graphical and letter symbols

For general terminology, readers are referred to IEC 60050: *International Electrotechnical Vocabulary* (IEV).

For graphical symbols, and letter symbols and signs approved by the IEC for general use, readers are referred to publications IEC 60027: *Letter symbols to be used in electrical technology*, IEC 60417: *Graphical symbols for use on equipment. Index, survey and compilation of the single sheets* and IEC 60617: *Graphical symbols for diagrams.*

* See web site address on title page.

INTERNATIONAL STANDARD

ISO/IEC 14776-411

First edition
1999-09

Information technology – SCSI-3 Architecture Model (SCSI-3 SAM)

Technologies de l'information – Modèle d'architecture SCSI-3 (SCSI-3 SAM)

PRICE CODE V

For price, see current catalogue

CONTENTS

Object Definitions

Figures

Tables

INFORMATION TECHNOLOGY – SCSI-3 Architecture Model (SCSI-3 SAM)

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

International Standard ISO/IEC 14776-411 was prepared by Joint Technical Committee ISO/IEC JTC 1, Subcommittee SC 25, *Interconnection of information technology equipment.*

Introduction

This International Standard defines generic requirements, which govern SCSI-3 implementation standards, and implementation requirements that apply to all SCSI-3 devices. Implementation requirements specify behavior in terms of measurable or observable parameters pertaining to an implementation. Generic requirements are transformed to implementation requirements by an implementation standard.

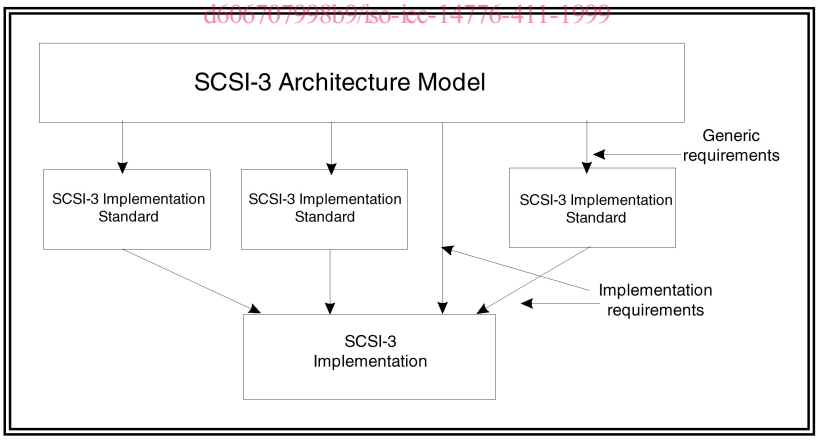

Figure 1 – Requirements Precedence

As shown in figure 1, all SCSI-3 implementation standards shall reflect the generic requirements defined herein. In addition, an implementation claiming SCSI-3 compliance shall conform to the applicable implementation requirements defined in this standard and the appropriate SCSI-3 implementation standards. In the event of a conflict between this document and other SCSI-3 standards the requirements of this standard shall apply.

Table 1 lists the set of ISO/IEC SCSI-3 standards and draft standards in existence at the time of publication. The SCSI-3 implementation standards governed by this standard are those in the Physical I/O, Protocol and Commands categories.

Table 1 – SCSI-3 Document Roadmap

Document Title	Document Categories			
	General	Physical I/O	Protocol	Commands
SCSI Common Access Method Standard (CAM)	9316-421			
SCSI Primary Commands Standard (SPC)				14776-311
SCSI Interlocked Protocol Standard (SIP)			14776-211	
SCSI Parallel Interconnect Standard (SPI)		14776-111		
SCSI Serial Bus Protocol Standard (SBP)			14776-231	
SCSI Architecture Model (SAM)	14776-411			
SCSI Common Access Method -3 Standard (CAM -3)	14776-423			
SCSI Block Commands Standard (SBC)				14776-321
SCSI Stream Commands Standard (SSC)				14776-331
SCSI Graphics Command Standard(SGC)				14776-391
SCSI Medium Changer Commands Standard (SMC)				14776-351
SCSI Fast 20		14776-121		
SCSI Controller Commands Standard (SCC)				14776-341
SCSI Optical Memory Card Reader/Writer (SOMC R/W)				14776-381
SCSI Fibre Channel Protocol (FCP)			14776-221	
SCSI Multi Media Commands Standard (MMC)				14776-361
SCSI Fibre Channel Protocol -2 (FCP -2)			14776-222	
SCSI Parallel Interface -2 (SP I-2)		14776-112		

This document consists of the following seven clauses:

Clause 1 describes the scope of this International Standard.
Clause 2 lists the normative references that apply to this International Standard.
Clause 3 specifies the definitions and notational conventions used by this International Standard.
Clause 4 defines the reference model for an SCSI-3 device.
Clause 5 specifies the model for processing SCSI-3 commands
Clause 6 specifies the task management functions supported by an SCSI-3 device.
Clause 7 specifies the rules for task set management.

INFORMATION TECHNOLOGY – SCSI-3 Architecture Model (SCSI-3 SAM)

1 Scope

This International Standard describes a reference model for the coordination of standards applicable to SCSI-3 I/O systems and a set of common behavioral requirements that are essential for the development of host software and device firmware that can interoperate with any SCSI-3 interconnect or protocol.

2 Normative References

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid standards.

ISO/IEC 9316:1995, Information technology – Small Computer System Interface-2.

3 Definitions and Conventions

For purposes of this standard, the following definitions apply.

3.1 Definitions

3.1.1 aborted command**:** An SCSI command that has been ended by aborting the task created to execute it.

3.1.2 ACA command**:** A command performed by a task with the ACA attribute (see 3.3 and object definition 6).

3.1.3 application client**:** An object that is the source of SCSI commands.

3.1.4 auto contingent allegiance**:** The condition of a task set following the return of a CHECK CONDITION or COMMAND TERMINATED status.

3.1.5 blocked (task state)**:** The state of a task that is prevented from completing due to an ACA condition.

3.1.6 blocking boundary**:** A task set boundary denoting a set of conditions that inhibit tasks outside the boundary from entering the Enabled state.

3.1.7 byte**:** An 8-bit construct.

3.1.8 call**:** The act of invoking a procedure.

3.1.9 client-server**:** A relationship established between a pair of distributed objects where one (the client) requests the other (the server) to perform some operation or unit of work on the client's behalf.

3.1.10 client**:** An object that requests a service from a server.

3.1.11 command**:** A request describing a unit of work to be performed by a device server.

3.1.12 command descriptor block**:** A structure up to 16 bytes in length used to communicate a command from an application client to a device server.

3.1.13 completed command**:** A command that has ended by returning a status and service response of TASK COMPLETE, LINKED COMMAND COMPLETE, or LINKED COMMAND COMPLETE (WITH FLAG).

3.1.14 completed task**:** A task that has ended by returning a status and service response of TASK COMPLETE. The actual events comprising the Task Complete response are protocol specific.

3.1.15 confirmation**:** A response returned to an object, which signals the completion of a service request.

3.1.16 confirmed protocol service**:** A service available at the protocol service interface, which requires confirmation of completion.

3.1.17 current task**:** A task that is in the process of sending status or transferring command data to or from the initiator.

3.1.18 destination device**:** The SCSI device to which a service delivery transaction is addressed. See source device.

3.1.19 device server**:** An object, within the logical unit, that executes SCSI tasks according to the rules for task set management described in clause 7.

3.1.20 device service request**:** A request, submitted by an application client, conveying an SCSI command to a device server.

3.1.21 device service response**:** The response returned to an application client by a device server on completion of an SCSI command.

3.1.22 domain**:** An I/O system consisting of a set of SCSI devices that interact with one another by means of a service delivery subsystem.

3.1.23 dormant (task state)**:** The state of a task that is prevented from starting execution due to the presence of certain other tasks in the task set.

3.1.24 enabled (task state)**:** The state of a task that may complete at any time. Alternatively, the state of a task that is waiting to receive the next command in a series of linked commands.

3.1.25 ended command**:** A command that has completed or aborted.

3.1.26 faulted initiator**:** The initiator to which a COMMAND TERMINATED or CHECK CONDITION status was returned.

3.1.27 faulted task set**:** A task set that contains a faulting task.

3.1.28 faulting command**:** A command that completed with a status of CHECK CONDITION or COMMAND TERMINATED.

3.1.29 faulting task**:** A task that has completed with a status of CHECK CONDITION or COMMAND TERMINATED.

3.1.30 function complete**:** A logical unit response indicating that a task management function has finished. The actual events comprising this response are protocol specific.

3.1.31 hard reset**:** A target response to a reset event or a TARGET RESET in which the target performs the operations described in subclause 5.7.6.

3.1.32 I/O operation**:** An operation defined by an unlinked SCSI command, a series of linked SCSI commands or a task management function.

3.1.33 implementation**:** The physical realization of an object.

3.1.34 implementation-specific**:** A requirement or feature that is defined in an SCSI-3 standard but whose implementation may be specified by the system integrator or vendor.

3.1.35 implementation option**:** An option whose actualization within an implementation is at the discretion of the implementor.

3.1.36 initiator**:** An SCSI device containing application clients which originate device service and task management requests to be processed by a target SCSI device.

3.1.37 interconnect subsystem**:** One or more physical interconnects which appear as a single path for the transfer of information between SCSI devices in a domain.

3.1.38 in transit**:** Information that has been sent to a remote object but not yet received.

3.1.39 layer**:** A subdivision of the architecture constituted by subsystems of the same rank.

3.1.40 linked CDB**:** A CDB with the link bit in the control byte set to one.

3.1.41 linked command**:** One in a series of SCSI commands executed by a single task, which collectively make up a discrete I/O operation. In such a series, each command has the same task identifier, and all, except the last, have the link bit in the CDB control byte set to one.

3.1.42 logical unit**:** A target-resident entity which implements a device model and executes SCSI commands sent by an application client.

3.1.43 logical unit number**:** A 64-bit identifier for a logical unit.

3.1.44 logical unit option**:** An option pertaining to a logical unit, whose actualization is at the discretion of the logical unit implementor.

3.1.45 lower level protocol**:** A protocol used to carry the information representing upper level protocol transactions.

3.1.46 mandatory**:** Implementation of the referenced item is required to claim compliance with a standard.

3.1.47 media information**:** Information stored within an SCSI device, which is non-volatile (retained through a power cycle) and accessible to an initiator through the execution of SCSI commands.

3.1.48 object**:** An architectural abstraction or "container" that encapsulates data types, services, or other objects that are related in some way.

3.1.49 option, optional**:** Implementation of the referenced item is not required to claim compliance with an SCSI-3 standard. The implementation of an optional item shall comply with the standard.

3.1.50 peer-to-peer protocol service**:** A service used by an upper level protocol implementation to exchange information with its peer.

3.1.51 peer entities**:** Entities within the same layer.

3.1.52 pending task**:** A task that is not a current task.

3.1.53 physical interconnect**:** A single physical pathway for the transfer of information between SCSI devices in a domain.

3.1.54 port**:** Synonymous with "service delivery port".

3.1.55 procedure**:** An operation that can be invoked through an external calling interface.

3.1.56 protocol-specific**:** Implementation of the referenced item is defined by an SCSI-3 protocol standard (see 4.8).

3.1.57 protocol**:** The rules governing the content and exchange of information passed between distributed objects through the service delivery subsystem.

3.1.58 protocol option**:** An option whose definition within an SCSI-3 protocol standard is discretionary.

3.1.59 protocol service confirmation**:** A signal from the lower level protocol service layer notifying the upper layer that a protocol service request has completed.

3.1.60 protocol service indication**:** A signal from the lower level protocol service layer notifying the upper level that a protocol transaction has occurred.

3.1.61 protocol service request**:** A call to the lower level protocol service layer to begin a protocol service transaction.

3.1.62 protocol service response**:** A reply from the upper level protocol layer in response to a protocol service indication.

3.1.63 queue**:** The arrangement of tasks within a task set, usually according to the temporal order in which they were created. See "task set".

3.1.64 receiver**:** A client or server that is the recipient of a service delivery transaction.

3.1.65 reference model**:** A standard model used to specify system requirements in an implementation-independent manner.

3.1.66 request**:** A transaction invoking a service.

3.1.67 request-response transaction**:** An interaction between a pair of distributed, cooperating objects, consisting of a request for service submitted to an object followed by a response conveying the result.

3.1.68 request-confirmation transaction**:** An interaction between a pair of cooperating objects, consisting of a request for service submitted to an object followed by a response from the object confirming request completion.

3.1.69 reserved**:** The term used for bits, fields, signals, and code values that are set aside for future standardization.

3.1.70 reset event**:** A protocol-specific event which may trigger a hard reset response from an SCSI device as described in subclause 5.7.6.

3.1.71 response**:** A transaction conveying the result of a request.

3.1.72 SCSI application layer**:** The protocols and procedures that implement SCSI commands and task management functions by invoking services provided by an SCSI protocol layer.

3.1.73 SCSI Device**:** A device that is connected to a service delivery subsystem and supports an SCSI application protocol.

3.1.74 SCSI device identifier**:** An address by which an SCSI device is referenced within a domain.

3.1.75 SCSI I/O system**:** An I/O system, consisting of two or more SCSI devices, an SCSI interconnect and an SCSI protocol, which collectively interact to perform SCSI I/O operations.

3.1.76 SCSI protocol layer**:** The protocol and services used by an SCSI application layer to transport data representing an SCSI application protocol transaction.

3.1.77 sender**:** A client or server that originates a service delivery transaction.

3.1.78 server**:** An SCSI object that performs a service on behalf of a client.

3.1.79 service**:** Any operation or function performed by an SCSI-3 object, which can be invoked by other SCSI-3 objects.

3.1.80 service delivery failure**:** Any non-recoverable error causing the corruption or loss of one or more service delivery transactions while in transit.

3.1.81 service delivery port**:** a device-resident interface used by the application client, device server or task manager to enter and retrieve requests and responses from the service delivery subsystem. Synonymous with "port".

3.1.82 service delivery subsystem**:** That part of an SCSI I/O system which transmits service requests to a logical unit or target and returns logical unit or target responses to an initiator.

3.1.83 service delivery transaction**:** A request or response sent through the service delivery subsystem.

3.1.84 signal**:** When used as a noun, denotes a detectable asynchronous event possibly accompanied by descriptive data and parameters. When used as a verb, denotes the act of generating such an event.

3.1.85 source device**:** The SCSI device from which a service delivery transaction originates. See destination device.

3.1.86 subsystem**:** An element in a hierarchically partitioned system which interacts directly only with elements in the next higher division or the next lower division of that system.

3.1.87 suspended information**:** Information stored within a logical unit that is not available to any pending tasks.

3.1.88 target**:** An SCSI device which receives SCSI commands and directs such commands to one or more logical units for execution.

3.1.89 task**:** An object within the logical unit representing the work associated with a command or group of linked commands.

3.1.90 task abort event**:** An event or condition indicating that the task has been aborted by means of a task management function.