

SCO OpenServer Product Family Release 5

scsi(HW)

scsi – small computer systems interface

Description

ad- Adaptec 154x, 154x emulation, 164x SCSI host adapter device driver

alad- Adaptec 294x (7870 chip) SCSI host adapter device driver

arad- Adaptec 274x (7770 chip) SCSI host adapter device driver

ciha- 386/486 CBUS SCSI host adapter device driver

dptr- DPT RAID SCSI host adapter device driver

efp- Olivetti ESC-1, ESC-2, and EFP host adapter device driver

eiad- Adaptec 174x EISA SCSI host adapter device driver

fdha- Future Domain Corp 1650, 1670, 1680, 600, 700 SCSI host adapter device driver

hf- IBM Hardfile SCSI host adapter device driver

mdac- Mylex Disk Array device driver

ncr- NCR 53C710 MCA SCSI host adapter device driver

spad- Adaptec 152x SCSI host adapter device driver

sumo- NEC Storage Plus SCSI-AT (SUMO) host adapter device driver

tmcha- Future Domain Corp TMC 845, 850, 860, 885 (950 chip) SCSI host adapter device driver

wdex- Western Digital 7000ex SCSI host adapter device driver

wdha- Western Digital 7000 SCSI host adapter device driver

The Small Computer System Interface (SCSI) is a specification of a standard interface to peripherals such as hard disks, CD-ROMs, and tape drives connected via the SCSI bus. The specification also includes the command set to control the interface. From the point of view of the host computer SCSI provides device independent access to

data; the SCSI interface handles the details of how the data is physically stored on peripheral devices.

The SCO modular SCSI interface provides a number of standard device drivers for SCSI peripheral devices (CD-ROM, tape, floptical, and disk) and for SCSI host adapter cards. The interface establishes a clearly defined protocol between the peripheral driver tier and the host adapter driver tier.

This description is primarily based on the SCSI-1 standard. The proposed SCSI-2 standard maintains backward compatibility with SCSI-1, and allows for increased data transfer rates, a 16 or 32-bit data bus, an extended command set, and a larger number of supported peripherals.

Basic SCSI operation

The SCSI-1 bus is an 8-bit parallel I/O data bus with 9 control lines. Data transfer rates of up to 5 megabytes per second are possible using a synchronous handshaking protocol. The single-ended bus configuration allows a cable length of up to 6 meters; the differential configuration allows up to 25 meters.

A SCSI host adapter controller provides the interface between the host computer bus and the SCSI bus. It mediates requests from the host computer to access peripheral devices; it sends these in the form of Command Descriptor Blocks (CDBs). The host adapter also passes back data and status messages received from the peripherals. Several host adapters may be present on the same host computer; each adapter is identified by its *host adapter number*.

Usually, the host adapter acts as an initiator; it requests that a target controller perform an operation. While an initiator and target are communicating, the bus is unavailable to any other device.

A target can temporarily disconnect from an initiator if the operation will take some time (for example, rewinding a tape or moving a disk head). This allows the initiator to connect to a different target. When the first target has completed its task, it tries to reselect the initiator. As soon as the host adapter is free to respond, it arbitrates between the controllers that are requesting service from it. The adapter selects the controller with the highest priority as its new target.

Up to eight controllers can be connected to a SCSI 8-bit wide data bus, and up to sixteen controllers can be connected to a 16-bit bus. Each controller is assigned an ID number in the range 0-7 on an 8-bit data bus, or 0-15 on a 16-bit bus. The ID number is also referred to as a *SCSI ID*, *target ID*, or *controller number*. One of the controllers must be the host adapter which is usually assigned ID 7.

There are two types of controller other than host adapter controllers:

- Bridge controllers can handle up to eight peripheral devices. These devices are addressed by their *logical unit number* or LUN in the range 0-7.

- Embedded controllers within a single peripheral device; their LUN is usually 0, though they may choose to ignore any attempt to select a different LUN that is specified within a CDB.

SCSI addresses

A SCSI peripheral device is uniquely identified by its SCSI address:

- the host adapter number of the SCSI bus to which the device is connected
- the number of the bus (for host adapters that support more than one SCSI bus); the primary bus is bus 0, the secondary bus is bus 1, and so on
- the controller ID on the bus
- the device LUN

SCSI device drivers

The following peripheral device drivers are supported:

Driver name (xnamex)	Driver handle (prefix)	Device supported
Sdsk	Sdsk	hard disk
Sflp	Sflp	floptical
Srom	Srom	CD-ROM
Stp	Stp	tape

Supported SCSI host adapter drivers are listed in the file */etc/default/scsihas*.

Configuration of SCSI host adapters and peripherals

SCSI host adapters are configured using entries in [mdevice\(F\)](#) and */etc/conf/sdevice.d/xnamex* (see [sdevice\(F\)](#)).

Any SCSI peripheral that you wish to access must be configured by an entry in the [mscsi\(F\)](#) file; the [mkdev\(ADM\)](#) options **cdrom**, **flopti**, **hd**, and **tape** provide a means of doing this automatically for each host adapter.

Changes to *mscsi*, *mdevice*, and */etc/conf/sdevice.d/xnamex* will only take effect if the kernel is relinked using [link_unix\(ADM\)](#) and the machine rebooted.

Boot time configuration of SCSI

The **adapter=** bootstring allows you to override the default kernel configuration for a given host adapter. Similarly, the **periph=** bootstring enables you to select a different boot device from the default (see [boot\(HW\)](#)).

Minor device numbering scheme

The minor device numbering scheme for SCSI hard disk drives is the same as the standard minor device number scheme for non-SCSI disk devices (see [hd\(HW\)](#)).

The minor device numbering scheme for SCSI tape drives is described on [scsitape \(HW\)](#).

The minor device numbering scheme for SCSI CD-ROM drives is described on [cdrom \(HW\)](#).

The minor device numbering scheme for SCSI floptical drives is described on [floptical \(HW\)](#).

The SCSIUSERCMD ioctl request

The [ioctl\(S\)](#) request, **SCSIUSERCMD**, is used to pass any SCSI command to a target device; examples are mode sense, mode select, and block reallocation requests. The **ioctl** argument *arg* points to the **scsicmd** structure that holds the Command Descriptor Block for the request.

SCSIUSERCMD and the **scsicmd** structure are defined in `<sys/scsicmd.h>` as follows:

```
#define SCSIUSERCMD      (('D'<<8)|64)  /* compare ioctl list in dio.h */
#define SCASICMDLEN      12

struct scsicmd {
    faddr_t data_ptr;          /* pointer to user data read or written */
    ulong  data_len;          /* length of user data at data_ptr or 0 */
    ushort is_write;          /* data i/o direction: 0 read, 1 write */
    uchar_t cdb[SCASICMDLEN]; /* command description block (0 padded) */
    uchar_t host_sts;          /* to be returned upon completion */
    uchar_t target_sts;        /* to be returned upon completion */
    uchar_t cdb_len;          /* used for vendor specific commands */
};
```

SCSIUSERCMD requires that an effective user ID of 0 (zero) be set on the user process calling **ioctl**.

Diagnostics

The following error messages may be displayed on the console. See [messages\(M\)](#) for general information about kernel error messages, including a list of generic device driver errors.

aha -- Adaptec AHA-1X40 SCSI host adapter driver

These messages may be produced if either the Adaptec AHA-1540 or AHA-1640 host adapter is installed.

WARNING: aha: Adapter *m* detected SCSI reset, status=0x*n*, intr=0x*vector*

An unexpected host adapter reset was detected.

WARNING: aha: Adapter *m* unexpected MBI status 0x*n*
AHA-1X40 cmd : *o*
AHA-1X40 sense : *p*

The incoming mailbox is in an unexpected state after an interrupt.

WARNING: aha: Port 0x*m* failed to go idle, status=0x*n*, cmd=0x*o*

Register *m* on the host adapter indicated that a command had still not been completed after R_LIMIT cycles in a spin loop.

WARNING: aha: Port 0x*m* internal failure 0x*n*

The host adapter failed to be recognized on initialization.

dpnr -- DPT RAID SCSI host adapter driver

WARNING: dpnr: Adapter *n* does not support BusMaster DMA

The adapter has not been set to support DMA.

WARNING: dpnr: Host adapter *n* timeout, resetting

The host adapter timed out and had to be reset.

WARNING: dpnr: Port 0x*m* internal failure, status=0x*n*

Self test detected an error on a host adapter register.

eiad -- Adaptec AHA-1740 EISA SCSI host adapter driver

NOTICE: eiad: No soft reset interrupt pending, status=0x*m*
AHA-1740 cmd : *n*
AHA-1740 sense : *o*

No interrupt was pending when adapter interrupts were to be cleared.

WARNING: eiad: Adapter *m* hard reset failure, port 0x*n* = 0x*status*

Hard reset of the adapter failed.

WARNING: eiad: Adapter *m* soft reset failure: port 0x*n* = 0x*status*

Clearing pending adapter interrupts failed.

WARNING: eiad: Unexpected interrupt status 0x*n*

An unexpected interrupt was received.

fdha -- Future Domain Corp SCSI host adapter I/O module driver

CONFIG: fdha: Out of jobs (FDH SCSI_JOBS = *n* exceeded)

Too many SCSI commands were pending to be dealt with.

NOTICE: fdha: Non-existent adapter *m* (only *n* adapters)

The specified host adapter (*m*) could not be found.

NOTICE: fdha: Unexpected reselection device id=*m* lun=*n* error

NOTICE: fdha: Unexpected SCSI reselection device id=*m* lun=*n* error

One of the peripheral devices made an unexpected reselection.

hf -- IBM Hardfile SCSI host adapter module driver

WARNING: hf: Adapter *m* unexpected intr state 0x*n*

An unexpected interrupt was received.

WARNING: hf: Adapter BUSY bit not reset

The adapter could not be reset.

WARNING: hf: hfintr - Too many soft error retries (*n*)

Three soft error retries are allowed before continuing.

WARNING: hf: hfintr - Too many sense request retries (*n*)

Three sense request retries are allowed before continuing.

WARNING: hf: hfpresent - Timeout on SCSI bus *m* RESET cmd=0x*n*

The SCSI bus took too long to reset while testing the adapter.

WARNING: hf: *hf_msg*

***hf_msg* can be one of the following sense error messages:**

16 bit Card Slot Address Range Exceeded
8032 Internal Peripheral fail
8032 ROM Test failed
Adapter Buffer Check Retry
Adapter Busy
Adapter Hardware Error
Adapter Hardware Failure
Adapter Micro Detected Error

Adapter Retry Invoked
Additional Status Available
Assign Rejected Command in Progress on Device
Assign Rejected SCSI Device Already Assigned
Attachment Buffer Defective
Check Condition (Error)
Command Aborted (by system)
Command Aborted by Adapter
Command Completed with Failure
Command Interface Reg. empty
Command Interface Reg. full
Command Not Supported
Command Rejected Adapter Diagnostic Failure
Command Rejected Buffer Test with Buffer Enabled
Command Rejected SCSI Device Not Assigned
Condition Met/Good (No error)
Data Flow Ctlr chip failed
Device Busy (Error)
Device Dependent Status avail.
Device Not Initialized
DMA error
Format Rejected Sequence Error
Global Command Time-out
Good Status (No error)
Hardware failure on soft reset
Immediate Command Complete
Intermediate/Cond Met/Good
Intermediate/Good (No error)
Interrupt Request active
Invalid Command / Parameter
Invalid Command rejected
Invalid Device for Command
Invalid Parameter in SCB
Invalid SCSI Phase Sequence
Local RAM test failed
Long Record Exception
Major Exception Occurred
Mandatory SCSI Message Rejected
Maximum LBA Exceeded
Missing or defective fuse
No Error
No error - cold reset complete
No error - warm reset complete
Reservation Conflict (Error)
SCB cmd complete with success
SCB cmd complete, OK + retries
SCB Command Completed OK
SCB Command Completed with retry
SCB Ended (No error)
SCB Halted (Error / End Chain)
SCB Interrupt Queued
SCB rejected
SCB specification check
SCSI Bus Reset Occurred
SCSI Interface Fault
SCSI interface test failed
SCSI Selection Time-out
Short Length Record
Short Record Exception

Soft reset successful
 Software Sequencing Error
 System Interface Check Retry
 System Interface ctrl chip fail
 Unexpected SCSI Bus Free

WARNING: hf: readpos - Unknown board address 0x*n* in POS slot *n*

The board address *n* of a host adapter was invalid for its slot position *n*.

WARNING: hf: Sense failed

Sense request has totally failed.

PANIC: hf: hf_immediate_cmd - Unknown cmd=0x*n*

The driver encountered an unknown immediate command to the host adapter of a specified logical unit.

PANIC: hf: No response from adapter ha=*m* after vector *n* interrupt
 hf: on scsi ctrlr *o*, id *p*

After receiving an interrupt, the driver timed out waiting for the host adapter.

SCSI -- Small Computer Systems Interface driver

CONFIG: No *Stype* SCSI devices configured (unit *n* missing)

No configuration information existed for a given SCSI device.

CONFIG: Only *m* *Stype* SCSI devices configured (unit *n* missing)

No configuration information existed for a given SCSI device.

NOTICE: *Stype*: Error
 on [reading/writing] SCSI *device_type*
 [dev *major|minor*]
 (ha=*host_adapter* id=*controller* lun=*logical_unit*)
 [block=*block_number*]
 NOTICE: *Stype*: *sensemsg*
 NOTICE: Status: host=*host_status* target=*target_status*,
 : Key: *key code qualifier*

The output *sensemsg* is one of the following sense error messages:

Command aborted: Command sent before previous one was completed
 Command aborted: Drive detected a SCSI parity error
 Command aborted: Drive received an 'initiator detected' error
 Command aborted: Drive received an illegal message
 Command aborted: Host sent abort message
 Command aborted: Message phase unexpected
 Command aborted: Phase sequence unexpected
 Command aborted: SCSI selection/reselection error occurred

Command aborted: Unexpected command phase
Command aborted: Unexpected data phase -possible DMA error

Copy aborted: Due to error on the source or destination device
Copy aborted: Host cannot disconnect

Drive not ready: Being loaded
Drive not ready: No media present
Drive not ready: Offline

Error rate warning

Hardware error: Failure during write operation
Hardware error: Media load/eject failed
Hardware error: Moisture detected
Hardware error: Track-following
Hardware error: Unexpected internal error

Humidity warning

Illegal request: Invalid bits in identify message
Illegal request: Invalid command
Illegal request: Invalid field in CDB
Illegal request: Invalid parameter list
Illegal request: Logical unit not supported
Illegal request: Parameter length error
Illegal request: Parameter page not supported

Medium error: Append error during write
Medium error: Blank tape - use tape erase command
Medium error: EOP/M encountered
Medium error: Incompatible medium installed
Medium error: Positioning error detected
Medium error: RAW retry limit exceeded
Medium error: Unrecovered read error

Unit attention: Drive failed power-on self test
Unit attention: Drive or bus reset
Unit attention: Log parameters may have changed
Unit attention: Mode parameters may have changed
Unit attention: Possible media change - you may need to repeat command

Write error: Media is write protected

NOTICE: Status: host=*n* target=*n*,
: Key: unknown

The SCSI sense block was found to be empty.

WARNING: SCSI boot option(s) ignored : Invalid host adapter parameters
WARNING: SCSI boot option(s) ignored : Invalid id and/or lun
WARNING: SCSI boot option(s) ignored : Unknown host adapter driver
WARNING: SCSI boot option(s) ignored : Unknown peripheral driver

These errors are reported at I/O initialization when they are read from the SCSI bootstrings.

PANIC: Unacceptable value for Sha_last_registered (*n*), in Sharegister

Could not register a host adapter as a bootable device.

spad -- AHA-1520 SCSI host adapter driver

WARNING: spad: Adapter 0 configuration error 0x*n*, base port 0x*n*

The host adapter could not be found at the given address.

WARNING: spad: Spurious interrupt
AHA-1520 cmd :*n*
AHA-1520 sense :*n*

An unexpected interrupt was received.

WARNING: spad_init: Adapter 0 initialization error 0x*n*, base port 0x*n*

The host adapter could not be initialized successfully.

sumo -- NEC SUMO SCSI host adapter driver

NOTICE: sumo: Spurious interrupt from device *drive* on vector *n*

No command was pending when an interrupt was received.

tmcha -- Future Domain Corp TMC SCSI host adapter driver

CONFIG: tmcha: Out of jobs (TMC SCSI_JOBS = *max* exceeded)

Too many SCSI commands were pending to be dealt with.

NOTICE: tmcha: Non-existent adapter *m* (only *n* adapters)

The specified host adapter (*m*) could not be found.

NOTICE: tmcha: Unexpected SCSI reselection device id=*target* lun=*n* error
NOTICE: tmcha: Unexpected reselection device id=*target* lun=*n*

One of the peripheral devices made an unexpected reselection.

wdha -- Western Digital 7000 SCSI host adapter driver

WARNING: wdha: Command 0x*m* not completed, no status: host=0x*n* target=0x0

Reports an uncompleted command.

WARNING: wdha: Command 0x*m* rejected, port=0x*n* status=0x0

Reports an illegal command.

WARNING: wdha: Selection timeout cmd=0xn

A command timed out without receiving an interrupt.

WARNING: wdha: Unexpected WDMBI status 0xn

The incoming mailbox is in an unexpected state after an interrupt.

WARNING: wdha: Unknown WDMBI status 0xn

The incoming mailbox is in an unrecognized state after an interrupt.

PANIC: wdha: No ccb available

The driver could not find an available command control block on attempting to start a SCSI job.

Warning

You should be familiar with the SCSI-1 standard and, if necessary, the SCSI-2 standard, before attempting to program the SCSI interface.

Files

/usr/include/sys/scsi.h

/usr/include/sys/scsicmd.h

/usr/include/sys/scsisup.h

SCSI interface header files

See also

[boot\(HW\)](#), [cdrom\(HW\)](#), [floptical\(HW\)](#), [hd\(HW\)](#), [link_unix\(ADM\)](#), [mdevice\(F\)](#), [mkdev\(ADM\)](#), [mscsi\(F\)](#), [sconf\(ADM\)](#), [scsidisk\(HW\)](#), [scsitape\(HW\)](#), [sdevice\(F\)](#), [tape\(HW\)](#)

System Administration Guide

Standards conformance

The `scsi` interface is conformant with:

Draft proposed ANSI standard X3.131-198X, Small Computer System Interface -- 2 (SCSI-II), 1990.

1 May 1995