Summary of T10 Activities
to ISO/IEC SC 25 / WG 4

John Lohmeyer, Chair T10 Technical Committee
June 23, 2006

T10's principal physical interface work is the Serial Attached SCSI (SAS). The SAS architecture leverages Serial ATA (SATA). SAS uses a drive connector that is compatible with the SATA drive connector. Subsystem vendors can develop products that use either kind of disk drive: SATA for cost-sensitive applications and SAS for enterprise-class applications that need the highest reliability and highest performance storage devices available.

The SAS architecture uses serial point-to-point links with circuit switches (called expanders) to provide fan-out to a large number of storage devices. The SAS expanders are relatively inexpensive because they do not attempt to store and forward packets. Instead, a full-duplex connection is established between the source device and destination device; then packets are routed through the connection with minimal FIFO buffering. SAS expanders can also be used with SATA drives to greatly increase the number of SATA drives accessible on a computer system.

While SAS can support thousands of devices, it is intended for applications that require at most 10s of meters of distance, typically called "attached storage".
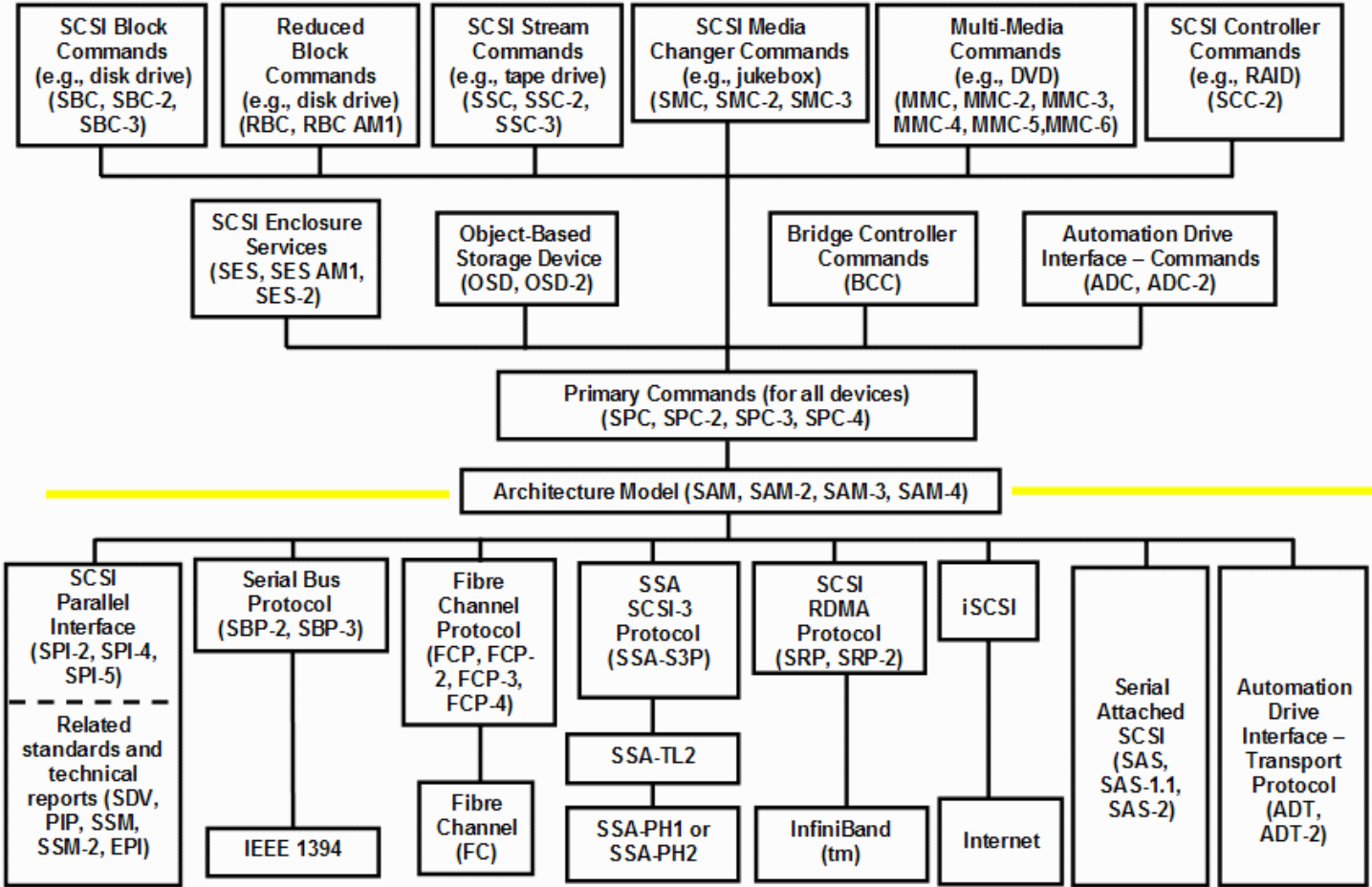
The first ANSI SAS standard was published in 2003 (ANSI INCITS.376-2003) and SAS-1.1 (ANSI INCITS.417-2006) was published in June 2006. Both of these standards support 1.5 Gbit/sec and 3.0 Gbit/sec signaling rates. Multiple connections between two devices may be simultaneously used to increase throughput. These are called wide links. The main enhancements in SAS-1.1 were transport-layer retries to better support tape devices and a new compact connector option.

Over the last year, T10 has been actively defining SAS-2, which will define a 6 Gbit/sec signaling rate, while continuing to support the lower signaling rates. SAS-2 will also define zoning and will consider defining a bandwidth aggregation mechanism.

Another significant T10 activity related to SAS is a project to map SCSI commands to ATA commands, called SCSI / ATA Translation (SAT). This is a software layer standard that will enable operating systems to use their SCSI protocol stack with SATA disks in a standard way. T10 is completing development on the initial SAT standard and has begun working on a SAT-2 project.

T10 also spends significant effort on the SCSI architecture, protocols, and command sets. Almost all modern I/O interfaces, including SCSI, SAS, Fibre Channel, SSA, IEEE 1394, USB, iSCSI, and ATAPI (ATA) use these standards.

The Figure below shows the relationship of these standards. With the exception of IEEE 1394, Fibre Channel, InfiniBand (tm), iSCSI, and the Internet, all of the standards shown are assigned to T10. A detailed status summary is included, below.

| SCSI Block Commands (e.g., disk drive) (SBC, SBC-2, SBC-3) | Reduced Block Commands (e.g., disk drive) (RBC, RBC AM1) | SCSI Stream Commands (e.g., tape drive) (SSC, SSC-2, SSC-3) | SCSI Media Changer Commands (e.g., jukebox) (SMC, SMC-2, SMC-3) | Multi-Media Commands (e.g., DVD) (MMC, MMC-2, MMC-3, MMC-4, MMC-5,MMC-6) | SCSI Controller Commands (e.g., RAID) (SCC-2) |

| SCSI Enclosure Services (SES, SES AM1, SES-2) | Object-Based Storage Device (OSD, OSD-2) | Bridge Controller Commands (BCC) | Automation Drive Interface – Commands (ADC, ADC-2) |

Primary Commands (for all devices) (SPC, SPC-2, SPC-3, SPC-4)

Architecture Model (SAM, SAM-2, SAM-3, SAM-4)

| SCSI Parallel Interface (SPI-2, SPI-4, SPI-5) — Related standards and technical reports (SDV, PIP, SSM, SSM-2, EPI) | Serial Bus Protocol (SBP-2, SBP-3) | Fibre Channel Protocol (FCP, FCP-2, FCP-3, FCP-4) | SSA SCSI-3 Protocol (SSA-S3P) | SCSI RDMA Protocol (SRP, SRP-2) | iSCSI | Serial Attached SCSI (SAS, SAS-1.1, SAS-2) | Automation Drive Interface – Transport Protocol (ADT, ADT-2) |

IEEE 1394

Fibre Channel (FC)

SSA-TL2

SSA-PH1 or SSA-PH2

InfiniBand (tm)

Internet

SCSI Standards Architecture

(See http:www.t10.org for the latest SCSI Standards Architecture diagram and the latest project status summary.)

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T10 Technical Committee Project Status Summary  (June 23, 2006)
(See the abbreviation key at the end)
            BSR      Proj                      Next      Target   Dist. in
Proj Name   Number   Number       Status       Action    Date    Mailing  Rev. PL/Editor
---------- ---------- ------- ------------------ ------------ --------- -------- ---- ----------------
                      P R O J E C T   P R O P O S A L S

                      D E V E L O P M E N T
ADC-2                 1741-D  in development     to INCITS   Nov 06   2006_4  05a  Suhler / Entzel
ADT-2                 1742-D  in development     to INCITS   Nov 06   2006_3  02   Suhler / Entzel
BCC                   1528-D  in development     to INCITS   Nov 06   2004_5  00   Rob Elliott
FCP-4                 1828-D  in development     to INCITS   Sep 07   2006_3  00   Dave Peterson
MMC-6                 1836-D  in development     to INCITS   Sep 07           __   (open)
OSD-2                 1729-D  in development     to INCITS   Nov 06   2004_6  00   Ralph Weber
SAT-2                 1826-D  in development     to INCITS   Jan 08           __   Mark Overby
SAM-4                 1683-D  in development     to INCITS   Nov 06   2006_4  06   George Penokie
SBC-3                 1799-D  in development     to INCITS   Nov 08   2006_3  05   George Penokie
SES-2                 1559-D  in development     to INCITS   Nov 05   2006_3  15   Rob Elliott
SMC-3                 1730-D  in development     to INCITS   Nov 07   2006_3  02   Banther /
                                                                                  Snelder
SPC-4                 1731-D  in development     to INCITS   Nov 09   2006_4  05a  Ralph Weber
SSC-3                 1611-D  in development     to INCITS   Nov 07   2006_3  02a  Dave Peterson
SAS-2                 1760-D  in development     to INCITS   Nov 06   2006_3  04   Rob Elliott
SDI                   1740-D  in development     to INCITS   Nov 07   2005_2  00   Rob Elliott

                      T 1 0    A P P R O V A L
MMC-5                 1675-D  res T10 LB cmnts   T10 aprvl   Sep 06   2006_3  03   Bill McFerrin
SAT                   1711-D  res T10 LB cmnts   T10 aprvl   Jul 06   2006_1  08   Johnson /
                                                                                  Sheffield
                      I N C I T S    A P P R O V A L

                      P U B L I C A T I O N

                      P U B L I S H E D
ADC        INCITS 403 1558-D  INCITS 403-2005    5 yr review 2010     2004_6  07   Suhler / Wideman
ADT        INCITS 406 1557-D  INCITS 406-2005    5 yr review 2010     2004_6  14   Suhler / Entzel
SCSI3 FCP  INCITS 269 0993-M  At INCITS to       INCITS aprvl Apr 06  1995_3  12   Bob Snively
                               reaffirm
FCP-3      INCITS 416 1560-D  INCITS 416-2006    5 yr review 2010     2005_5  04   David Peterson
MMC-2      INCITS 333 1228-M  INCITS PR to       end PR      4 Jul 05 1999_4  11a  McFerrin /
                               reaffirm                                            Roberts
MMC-3      INCITS 360 1363-D  INCITS 360-2002    5 yr review 2007     2001_6  10g  Bill McFerrin
MMC-4      INCITS 401 1545-D  INCITS 401-2005    5 yr review 2010     2005_3  05a  Bill McFerrin
OSD        INCITS 400 1355-D  INCITS 400-2004    5 yr review 2009     2004_5  10   Ralph Weber
RBC        INCITS 330 1240-M  INCITS PR to       end PR      4 Jul 05 1999_4  10a  McLean / Roberts
                               reaffirm
RBC AM1    INCITS     1240-M  INCITS 330-2000/   5 yr review 2008     2003_3  01   Ron Roberts
           330/AM1            AM1-2003
SAM-2      INCITS 366 1157-D  INCITS 366-2003    5 yr review 2008     2002_5  24   Ralph Weber
SAM-3      INCITS 402 1561-D  INCITS 402-2005    5 yr review 2010     2004_5  14   Ralph Weber
SBC-2      INCITS 405 1417-D  INCITS 405-2005    5 yr review 2010     2004_6  16   Rob Elliott
SCC-2      INCITS 318 1225-M  INCITS 318-1998    5 yr review 2008     1997_5  04   George Penokie
                               [R2003]
SDV        INCITS TR- 1378-DT INCITS TR-28-2002  5 yr review 2007     2001_6  08b  Lohmeyer /
           28                                                                      Gibbons
SES        INCITS 305 1212-M  INCITS 305-1998    5 yr review 2008     1998_1  08b  Bob Snively
                               [R2003]
SES AM1    INCITS     1212-M  INCITS 305-1998/   5 yr review 2005     2000_4  01   Rob Elliott
           305/AM1            AM1-2000 [R2003]
EPI        INCITS TR- 1143-TR INCITS TR-23-1998                       1998_4  16   Bill Ham
           23
FCP-2      INCITS 350 1144-D  INCITS 350-2003    5 yr review 2008     2002_6  08   Dave Peterson
SMC-2      INCITS 382 1383-D  INCITS 382-2004    5 yr review 2009     2004_1  07   Erich Oetting
SPI-2      INCITS 302 1142-M  INCITS 302-1998    5 yr review 2008     1998_3  20b  Ham/Penokie
                               [R2003]
SPI-4      INCITS 362 1365-D  INCITS 362-2002    5 yr review 2007     2002_3  10   George Penokie
SPI-5      INCITS 367 1525-D  INCITS 367-2003    5 yr review 2008     2003_1  06   George Penokie
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PIP        INCITS 368 1439-D  INCITS 368-2003   5 yr review  2008     2003_1  04   Zane Daggett /
                                                                                   Bill Ham
SPC-2      INCITS 351 1236-D  At INCITS to      INCITS aprvl Jul 06   2001_4  20   Ralph Weber
                              replace w/IS
SPC-3      INCITS 408 1416-D  INCITS 408-2005   5 yr review  2010     2005_3  23   Ralph Weber
SRP        INCITS 365 1415-D  INCITS 365-2002   5 yr review  2007     2002_4  16a  Cris Simpson
SSM        INCITS TR- 1414-DT INCITS TR-29-2002                       2001_6  05   Larry Barnes
           29
SSM-2      INCITS 369 1514-D  INCITS 369-2003   5 yr review  2008     2003_1  05a  Aloisi / Manildi
SSC-2      INCITS 380 1434-D  INCITS 380-2003   5yr review   2008     2003_4  09   Dave Peterson
S2TIB1                0375-T  Pub by Global     (none)                1995_1  E    George Penokie
S2TIB2                0375-T  Pub by Global     (none)                1995_1  E
SCSI CAM   INCITS 232 0792-M  At INCITS to      INCITS aprvl Apr 06   1995_3  12b  Bill Dallas
                              reaffirm
SCSI3 SAM  INCITS 270 0994-M  At INCITS to      INCITS aprvl May 06   1995_4  18   Charles Monia
                              withdraw
SCSI3 SBC  INCITS 306 0996-M  INCITS 306-1998   5 yr review  2008     1997_6  08c  open
                              [R2003]
SCSI3 GPP  INCITS TR- 0991-TR INCITS TR-16-1997                       1995_2  09   Gary Stephens
           16
SCSI3 SMC  INCITS 314 0999-M  INCITS 314-1998   5 yr review  2008     1998_1  10a  Erich Oetting
                              [R2003]
SCSI3 MMC  INCITS 304 1048-M  INCITS 304-1997   5 yr review  2007     1997_3  10a  Ron Roberts
                              [R2002]
SCSI3 SPC  INCITS 301 0995-M  INCITS 301-1997   5 yr review  2007     1997_2  11a  Ralph Weber
                              [R2002]
SCSI3 SSC  INCITS 335 0997-M  INCITS PR to      end PR       4 Jul 05 2000_1  22   Dave Peterson
                              reaffirm
SAS        INCITS 376 1562-D  INCITS 376-2003   5yr review   2008     2003_4  05   Rob Elliott
SAS-1.1    INCITS 417 1601-D  INCITS 417-2006   5 yr review  2010     2005_5  10   Rob Elliott
SBP-2      INCITS 325 1155-M  INCITS 325-1998   5 yr review  2008     1998_2  04   McLean/Johansson
                              [R2003]
SBP-3      INCITS 375 1467-D  INCITS 375-2004   5 yr review  2009     2003_5  05   Peter Johansson
SCSI-2     INCITS 131 0375-M  INCITS 131-1994   5 yr review  2009             10L  Larry Lamers
                              [R2004]
SSA-PH1    INCITS 293 1145-M  At INCITS to      INCITS aprvl Apr 06   1996_4  09c  Ham/Scheible
                              reaffirm
SSA-PH2    INCITS 307 1146-M  INCITS 307-1997   5 yr review  2007     1997_2  05b  Ham/Scheible
                              [R2002]
SSA-S2P    INCITS 294 1121-M  At INCITS to      INCITS aprvl Apr 06   1996_4  07b  John Scheible
                              reaffirm
SSA-S3P    INCITS 309 1051-M  INCITS 309-1997   5 yr review  2007     1997_2  05b  John Scheible
                              [R2002]
SSA-TL1    INCITS 295 0989-M  At INCITS to      INCITS aprvl Apr 06   1996_4  10b  John Scheible
                              reaffirm
SSA-TL2    INCITS 308 1147-M  INCITS 308-1997   5 yr review  2007     1997_2  05b  John Scheible
                              [R2002]
SMD-E      INCITS 91  0053-M  INCITS 91M-1987   5 yr review  2007                  open
                              [R2002]
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T10 Technical Committee Project Status Summary Abbreviation Key:

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 X3    = Obsolete name for INCITS       comp  = completion            cur   = current
 NCITS = Obsolete name for INCITS       res   = resolve/resolving     rev   = revision
INCITS = InterNational Committee for    LB    = Letter Ballot         #     = number
         Information Technology Standards pub = published             ng    = negative
 OMC   = Operational Management Committee aprvl = approval            prep  = preparation
 BSR   = Board of Standards Review (of ANSI) aprv = approve           cmnts = comments
 WG4   = Working Group 4 of ISO/IEC JTC 1/SC 25 dev = development     prj   = project
 ISO   = International Standards Organization SD3 = Project Proposal   fwd   = forward
MgtRev= INCITS management review        T10   = T10 Technical Committee doc  = document
1PR    = 1st Public Review              .1    = T10.1 Task Group (obsolete) TG = Task Group
2PR    = 2nd Public Review              CD    = Committee Draft (ISO)  rec   = recommend
TBD    = To Be Determined               DIS   = Draft International Stnd reaf = reaffirm
                                        NP    = New Project           w/dw  = withdraw
                                        IS    = International Standard rvis  = revise
                                        A/I   = ANSI/ISO/IEC (joint standard)
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