SAS/SATA II
Multi-lane
Connector/cabling

Bill Bissonnette
SCD/SPD
08-Sep-2003
External vs. Internal Cabling Schemes

- Internal TX to RX matching is accomplished with different pinouts (same ball-out) on host vs. target
- Host and device ball-outs look the same

- External TX-RX matching accomplished with cable keying
  - Connector pin-outs & Si ball-outs are identical on both ends
  - Multilane cable has flipped keying for correct connection
- Host and device ball-outs look the same
Heritage of SATA Multi-lane

• SATA adopted SAS multi-lane for compatibility
  • Intent of SAS is to be interoperable w/ SATA

• SAS adopted FC for simplicity
  • Cables already exist – Why invent another one?

• FC adopted Infiniband scheme
  • Proven technology, cables exist
    • Eliminate TX-TX connection, but SAS/SATA II AC coupled

• Infiniband scheme for easy cable construction
  • But, no multi-lane vs. single lane pinout conundrum
Ball-out/Routing Requirements

• FR4 is very lossy, thus:
  • Minimal (zero at 3Gb/s) vias and no ‘cross-over’ routing
  • Vias add about 0.7pF depending on ground plane clearance
  • ICH5 allows 2 vias for 1.5Gb/s channels (SATA I)

• Ball-out & routing should be similar for multiple single lane and multilane usage models

• External connector scheme should allow simple (cheap) cables
  • No high-cost assembly requirements
  • Ideally would re-use current IB/FC/SAS cable constituants
Cable and Connector Construction (External)

• “Twin-AX” – 8 discrete differential pairs

• No lane ordering enforced in cable construction
Device #2 Single Channel Routing

Initiator/host

Xcvr 3

Xcvr 2

Xcvr 1

Xcvr 0

“S1”
Routing to Current 8470 Scheme

Device #2
Initiator/Host

Xcvr 3

Xcvr 2

Xcvr 1

Xcvr 0

Not pretty

“S1”

RX0+
RX0-
RX1+
RX1-
RX2+
RX2-
RX3+
RX3-
TX3-
TX3+
TX2-
TX2+
TX1-
TX1+
TX0-
TX0+
Device #1 Multi-lane Routing

Device #1 Initiator/host

Xcvr 0

Xcvr 1

Xcvr 2

Xcvr 3

TX+  TX-  RX+  RX-

TX+  TX-  RX+  RX-

TX+  TX-  RX+  RX-

TX+  TX-  RX+  RX-

“S1”

TX+  TX-  RX+  RX-

TX+  TX-  RX+  RX-

TX+  TX-  RX+  RX-

TX+  TX-  RX+  RX-

TX+  TX-  RX+  RX-
Proposed Pinouts

External Multi-lane proposal w/ SFF8470 Pin designations

Internal 4-lane pin

This end gets lopped off for 2-lane internal 2-lane
External X4 Scheme
Host to Expander

- Host/device ball-outs can be the same
- Lanes line up
External 4X Scheme
Host to HDDs

Device-side pinout can be defined like internal 4X to backplane

External Cable Assembly
External 4X Scheme
Host to Expander

Initiator

• Host/device ball-outs are same
Backup
• Lanes are swizzled end-to-end to line up
• Host/device ball-outs can be the same
• Supports 1X, 2X, 3X & 4X versions
• Cabcon suppliers saying, “Construction won’t be a problem.”
Internal Cable Assembly

Connector geographic pin designations swapped from 8470 connector designations, but essentially the same routing
Reference: Internal 4X Scheme
Host to Backplane

Lanes line up
Device side pin out different definition

Internal Cable Assembly
Extension to 12 Lane External

- Can designations for external change to align w/ lanes?
- Different connector keying for SAS/SATA?
  - SATA device to SAS host
  - No SATA host to SAS device

Intel Communications Group – Storage Components Division  Page 20