Serial DS-Link Technology
For Disk Interconnect and Routing

X3T9.2 SCSI Committee
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Who is SGS-THOMSON?

- Fifteenth-largest semiconductor manufacturer.
  Second-largest in Europe.
- Number 1 world-wide smart power supplier.
- Number 3 world-wide EPROM supplier.
- Over 17,000 employees.
  17 production locations.
SGS-THOMSON Experience
with Disk Drive Silicon

- Servo/Actuator control.
  Combo chip that does both functions.
  Family of lower integration chips also available.

- Read/Write channel chips.

- Embedded control microprocessors/microcontrollers.
  ST8, ST9 & ST10 Microcontrollers (1 - 30 MIPS).
  ST18 DSP Microcontroller (10 MOPS).
  Transputer microprocessors with serial comm. 

SGS-THOMSON Experience
with Serial Interfaces

- 20 Mb/S Link developed for T414 transputer in 1984.
  Links provide interprocessor communication path.

- Installed base of 1 million transputers worldwide.

- Links used in Mission-critical applications.
  Tomahawk cruise missile.
  CERN Nuclear Lab data logging.

- Links supported by family of crossbar and parallel adaptors.

- Experience put to work in the new DS-Link for the T9000 transputer.
DS-Link Overview

- Full-Duplex 200 Mb/S Point-to-Point Serial I/O Channel.
  18.8 Mb/S unidirectional payload bandwidth.
  32.8 Mb/S bidirectional payload bandwidth
- Multiple "Virtual Channels" can be multiplexed on single link.
- "Interval Routing" header allows:
  32 x 32 dynamic crossbar switch for radial architectures.
  Through-router in two-port interface for daisy-chain.
- Minimal Buffering requirements due to low-level flow control

Virtual Channels

- Multiple channels can share a single physical link by interleaving packets from each active channel.
- Longer messages are split up into a sequence of 32 byte packets.
- A 1 or 2 byte header is prepended to each packet so the message can be reconstructed properly on the receiving end.
- Header values are statically defined for a given system.
Virtual Channels
Across Physical Links

- Process A (send)
- B (receive)
- C (send)
- A (receive)
- B (send)
- C (receive)

Three "virtual" channels multiplexed on one physical link

Bit Level Protocol

- Two signals in each direction, Data and Strobe. (DS-Link)
  Strobe changes whenever Data does not.

- Receive clock is XOR of Data and Strobe.
  Clock is 1/2 baud rate, giving full bit time for skew tolerance.
  Receiving is Autobaud, no PLL needed.

Data: 0 0 1 1 1 0 1 0
Strobe: 

Parity Bit "Data" Flag
Parity Bit "Control" Flag
Connector for external connection of DS-links

Modular, on 6mm pitch;
10 pins on 2mm pitch;
Shielded, Latched, Polarized;
Robust, Ergonomic;
Leading GND pin.

Connectors being developed by AMP, Fujitsu, Harting and McMurdo, with informal cooperation and original requirement spec. from INMOS.

Routing Capabilities of SCSI DS-Links

- Virtual channels cleanly separate communication between logical units of device.
- Can support both daisy-chain and radial topologies.
- Scalable number of drives or controllers without modifying architecture.
- Allows flexible system that can dynamically reconfigure upon failure or system upgrade.
- DS-Links could form routing core for other serial and parallel interfaces.
Two-Port Through Routing Node

- Two link ports for redundancy or daisy-chain.
- Through router will pass packets from either direction not matching defined routing interval.
- Virtual Channel Processor will reconstruct packets into message stored in local memory.

C104 Dynamic Crossbar Switch

- 32 input links, 32 output links connected via full crossbar.
- Interval routing used to determine output link.
- 32 simultaneous packets possible. Any number of active messages messages possible.
- Separate control link sets up intervals and other parameters.
- Wormhole routing avoids store and forward delays, large buffers.
  Routing latency < 0.5 µS.
C104 Permits High Capacity, Fully Connected Networks

Network bandwidth of 525 MB/S.

Every device can talk to every other device.

C104's can be cascaded.

Low End Loop Disk Array

Host Interface  Local Memory  Processor

Link DMA Interface

Link UF
Disk Drive

Link UF
Disk Drive

Link UF
Disk Drive

Link UF
Disk Drive

Link UF
Disk Drive
DS-Link Macrocell Implementations

- Basic token-level DS-Link VHDL description available today.
  Also available as macrocell.

- Several T9000 support chips being implemented in SGS-THOMSON's ISB24000 channelless gate array.

- Possible Variants:
  16 x 16 crossbar,
  Fixed 8 channel, 2 port, VCP and parallel memory I/F.

- Custom variants or design license encouraged.
DS-Link as Routing Core for Serial SCSI

- Strengths are routing capabilities, low latency per message, and low port cost.
- Converter chips can be developed to connect to alternate physical layers, GPP will run across all.

Licensing Strategy

- DS-Links are covered under US and British patents.
- SGS-THOMSON is currently entering into licensing agreements.
Conclusions

- SGS-THOMSON has 10 years experience with serial interfaces.
- DS-Links can compliment emerging serial standards.
  Especially well suited for routing cores in serial I/O subsystems.
- SGS-THOMSON willing to produce silicon to support serial SCSI-3
  and other serial standards.

An Invitation

The INMOS Division of SGS-THOMSON invites you to see a demonstration
Of the New

200 Mbit/S Serial DS-Link Technology
For Disk Interconnect and Routing

Monday, April 27, 9:00 PM - 10:00 PM, Royal Tam Room.
Tuesday, April 28, 12:00 PM - 1:30 PM, Mountain Center 2.
Wednesday, April 29, 12:00 PM - 1:30 PM, Mountain Center 2.
Other times by appointment.

Refreshments will be provided.