Fault Tolerant Controller Configurations for SCSI

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Overview

– Common Fault Tolerant Controller Configuration for SCSI Today
– Features and Drawbacks of Today’s Configurations
– What Metrics of Fault Tolerance are Important to Customers?
– Why Standardize Fault Tolerant Controller Configurations? How?
– Options for Standardization & Conclusions
Common Fault Tolerant Controller Configurations For SCSI Today

- Many System Customers today want high availability with their storage
- Controllers are part of the system, and must be made highly available using redundancy techniques
- Redundancy Techniques include:
  - Active + Hot Standby...
  - Active + Active...
Common Fault Tolerant Controller Configurations For SCSI Today

A typical Fault Tolerant Controller Configuration:

A typical Dual Controller Configuration with two Controllers sharing access to attached devices, in this case with 3 buses being shared between the controllers.

This definition does NOT specify how the controllers are attached to the host or to the devices with parallel SCSI buses.
Fault Tolerant Controllers add new details to access of host data by:

- allowing varying attachment to the host computers
  - with more than one host port per controller
  - with controllers attached on different host buses
Fault Tolerant Controllers add new details to access of host data by:

- Allowing various types of access to devices
  - by the shared topology to the devices between the controllers
  - by use of protocol policies such as Reserve & Release in SCSI.
Common Fault Tolerant Controller Configurations For SCSI Today

- Fault Tolerant Controllers add new details to access of host data by:
  - Allowing Failover of device control from a failed controller to the survivor
    - without host operating system support
    - with host operating system support
  - Allowing Failback with and without host operating system support.
Common Fault Tolerant Controller Configurations For SCSI Today

A block diagram of a controller incorporating all possible attributes:

- **Host Bus 1**
- **Host Bus 2**
- **2 Host Ports per Controller**
- **Shared device ports**

2 Host ports allows for:
- a) hot/standby controller w/o host
- b) active/active w/o host support but w/one host port idle until failover.
- c) active/active w/ host support but with all ports active

Attachment two two different host buses enhances system availability but REQUIRES host support
Common Fault Tolerant Controller Configurations For SCSI Today

Current solutions in industry for the typical configurations shown include:

- Vendor Unique host operating system support for single port per controller and/or multi-host bus attachment (Failover can be manual or automatic)
- Target Failover with 2 host ports per controller (2nd idle until failover). Failback can be automatic or manual.
- Target Failover with one host port, assuming hardware can act as >1 target.
Features and Drawbacks of Today’s Configurations

Features:

- Highly Available Storage achieved
- Single host port controllers with or without host support reduce product costs
- Multi-host port controllers without host OS support achieve redundancy more simply.
Features and Drawbacks of Today’s Configurations

- Non-Standard Implementations leading to possible interoperability problems on different platforms in the same system.
- Cost
- Failover Time is not bounded by several techniques used.
- Some techniques used don’t adequately abort I/O’s on failed controllers.
What Metrics of Fault Tolerance are Important to Customers?

- Active-Active Configurations to achieve greater availability with their overall system/cluster, as well as performance of two controllers accessing shared data.
- Failover/Failback time is critical in production environments.
- They want it for free...
Why Standardize Fault Tolerant Configurations in SCSI?

- To Reduce the cost of Solutions
- Because of the convergence of standards on many different interconnects that will have SCSI RAID controllers (FibreChannel, SSA, FAST 20 SCSI) coupled with customer desires of fault tolerance & interoperability with all their system boxes/software.
Why Standardize Fault Tolerant Configurations in SCSI? How?

- To generalize the number of controllers in a fault tolerance configuration as well as the type of access allowed by hosts.
- Increase speed of failover from current techniques.
- Generalize the possible system topologies supported in simple terms.
Why Standardize Fault Tolerant Configurations in SCSI? How?

**HOW:**

- Support in SCSI for ‘Registration’ of multi-controller configurations sharing device access. This would be contained within ‘conspiring’ controllers and readable by all attached hosts.

- Support in SCSI for ‘Supported Behaviors’ of Controllers during failover/failback to meet the needs of different system topologies and operations.
Options for Standardization

- Addition of Mode Page definition(s) in the Standard Controller Commands document.
  - To ‘register’ all controllers in a fault tolerant configuration as well as LUNs being served by each controller
  - TO ‘register’ behavior or controllers during failover/failback

- Additional ASC/ASCQ’s for Failover/Failback Events
Options for Standardization

- A combination of a new SCC mode page and additions to the Exception handling page(s) in SCSI-3.
- Inquiry data additions for Controllers to give the ‘registration’ information (yuk).
Conclusions

- Controllers in Fault Tolerant Configurations are becoming widespread.
- Many solutions to support for these configurations exist.
- Standardization would generalize the problem and solution as well as give Operating Systems MUCH more control and visibility of attached storage subsystems.