



Coffee Break:

Multi-path I/O – End to End High Availability and Performance

Redundant paths from hosts through storage support continuous operations.

Most IT administrators recognize the inherent value of RAID – by redundantly storing data you protect information from infrastructure failures and provide continuous access. Most storage devices support multiple SAN connections for performance and reliability, but in many configurations servers use only a single storage connection. This creates a single point of failure and potential performance bottleneck for I/O. Multi-path Input/Output (MPIO) is server software that extends redundancy to the entire I/O pathway in a SAN, delivering fault tolerance, high availability, and better performance.

Why MPIO?

Because most storage devices support multiple SAN connections for performance and reliability. MPIO provides multiple paths from servers to storage, delivering fault tolerance, high availability, and better performance.

MPIO Depends on Several Architectural Features:

- The storage array must be MPIO capable, with multiple interfaces that allow multiple concurrent connections to data.
- Storage must be redundant and hot serviceable.
- The hosts must have multiple connections into the SAN, plus MPIO software to create and manage the connections in a manner consistent with the operating system.
- Redundant, high-bandwidth network switches are required.

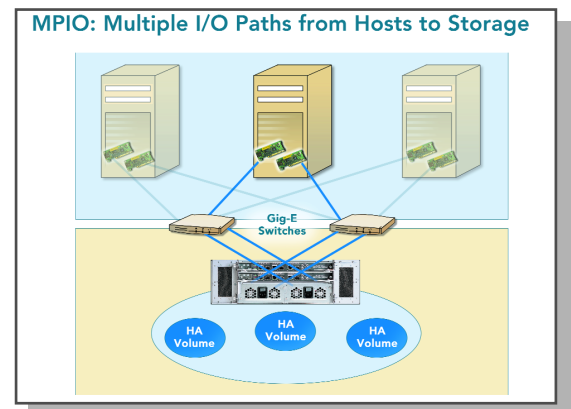
Safer, Faster, More Available

MPIO uses redundant connections to deliver high availability – having multiple host connections, multiple switches, and multiple storage interfaces eliminates all single points of failure, so data flow can continue despite any component malfunction. With a single connection or data path, any network component, switch, or storage failure results in work stoppage.

MPIO can also enhance performance – by concurrently using multiple data paths, applications gain throughput. MPIO on the host load balances I/O requests over the expanded host connectivity (with multiple NICs, TOEs, or HBAs) into the SAN. I/O travels over many paths simultaneously for improved performance and lower latency.

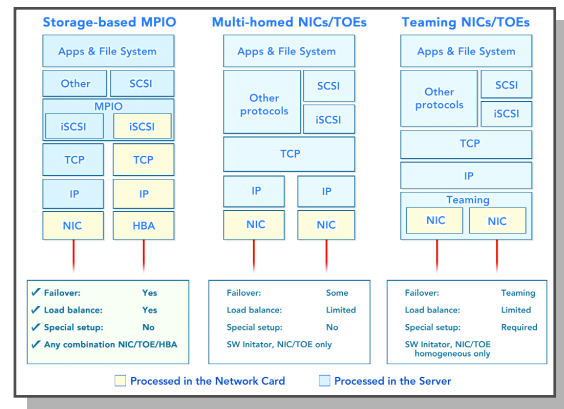
MPIO Choices

The two primary forms of MPIO are network-based and storage-based. Network-based MPIO offers failover and load balancing, but has configuration and operational limitations and requires special network setup. It only supports software initiators with NICs or



TOEs, not HBAs. Network and switch configurations are restricted, and certain network management features must be disabled. Since these solutions load balance using random I/O distribution with no awareness of link status, network operations are less efficient.

Storage-based MPIO offers a more powerful, flexible, and efficient solution, and works with any mix of NICs, TOEs, and HBAs. This method requires no special setup or network configuration – a host can leverage multiple connections to any number of storage devices. This solution also supports a rich variety of load balancing algorithms, including active-active, minimum queue, active-passive, fastest response time, etc.



Network-based MPIO delivers some failover and load balancing, but is more complex to set up and manage. Storage-based MPIO offers more advanced functionality with fewer restrictions.

SAN Path Balancing – An MPIO Implementation Challenge

In SAN configurations, many connections from host to switches feed into fewer connections from switches to storage. It is common for 10 hosts to be connected to a single storage array through the SAN; this can be a natural bottleneck. But with MPIO, you can manage the paths in both halves of your architecture – from server to switch and from switch to storage – eliminating the congestion.

For optimal operation, all network paths between the host and the storage must be balanced. Multi-path software on the host handles the host-to-switch connection, but how are the switch-to-storage connections balanced? In many solutions this is a manual task, which increases the administrative burden and decreases operational efficiency. It is also a job that is never complete, as workloads change constantly.

PS Series Arrays Adds Automation for MPIO Environments

PS Series arrays simplify multi-path management by automatically monitoring and load balancing I/O across multiple host and storage connections – online, continuously, without disrupting servers. Intelligent SAN balancing significantly improves the quality of load balancing, as path activity levels can be monitored and I/O loads shifted from heavily-trafficked to less congested paths. The result: optimal performance automatically throughout the entire data path; improved performance for all applications; and easier management. As you add arrays, automatic load balancing extends across all arrays for even better performance.

To view other Coffee Break Bulletins or to learn more about EqualLogic, visit us at www.equallogic.com.

MPIO – Helping You Get the Most Out of Your SAN

Multi-path I/O lets you enhance the performance and availability of your infrastructure in an iSCSI SAN. The PS Series arrays provide a redundant and hot serviceable architecture, automatic monitoring and load balancing, and the ability to scale on demand.