Abstract
This document describes zBoost™, recent Enginuity enhancements to the VMAX product line which improve performance and delivers full compatibility with High Performance FICON

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Introduction

This document describes VMAX zBoost, a no charge microcode upgrade that improves performance of FICON attached VMAX 40K systems up to 60% while also delivering full zHPF support and response time reductions to both the VMAX 20K and 40K arrays. zBoost demonstrates EMC’s commitment to protecting customers’ investments in EMC’s mainframe storage solutions.

Users of the IBM System z platform demand high I/O throughput rates and low response times for the mission critical applications that support their businesses. EMC has a long history of delivering value to these environments in terms of reliability, availability, and performance. This commitment continues with the announcement of the zBoost for VMAX.

EMC is a leading global supplier of mainframe attached storage, with a twenty year history of supporting the world’s most demanding financial services, insurance, and government mainframe sites. Over this period of time EMC has continually invested significant R&D resources into mainframe storage, recently surpassing $1bn in cumulative investment at its dedicated mainframe labs in Hopkinton, Massachusetts. The heritage of EMC Symmetrix, which carries into the VMAX product, is that of a mainframe storage array, built like the mainframe itself for high availability, high performance environments.

Overview

The zBoost is a no-charge Enginuity upgrade that can be applied non-disruptively to any VMAX 20K or 40K containing FICON interfaces. It delivers significant performance enhancements and includes full zHPF compatibility with support for the following additional zHPF features:

- List Prefetch
- Bi-Directional support
- Format Writes
- BSAM/QSAM/BPAM support

zBoost improves the maximum IOPS by up to 60% on the VMAX 40K, and these performance improvements are realized when using either a single port or both ports on the two-port FICON adapter. On the VMAX 40K zBoost reduces I/O response times by up to 40%, while on the VMAX 20K response time is reduced up to 10%. On both models response time improvements are seen at all I/O rates across a variety of workloads.

As a result of implementing zBoost, VMAX 40K FICON configurations can support more I/O on a given engine configuration, or require fewer FICON engines than would otherwise have been required for a given workload. This can result in a reduction of total cost of ownership by reducing the footprint of VMAX configurations, extending the life span of existing VMAXs, or through realization of improved performance.

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1 zHPF is a chargeable feature on VMAX, part of the Mainframe Essentials bundle
In addition, response time improvements will be realized during I/O bursts which previously could have saturated the FICON adapters and resulted in queuing delays. This reduction in queuing can improve both response time and batch run times.

zBoost performance improvements apply to both standard and zHPF FICON channels.

**FICON Emulation Enhancements: VMAX 40K and 20K**

zBoost contains several improvements in the design of the FICON emulation:

- Improved pre-fetching on sequential reads
- More efficient global memory access utilizing larger internal buffers
- Multi-record global memory accesses for reads and writes

These changes result in lower response times throughout the entire range of I/O rates on both the 20K and 40K VMAX models, as shown in in the performance section below.

Full compatibility with zHPF on VMAX is now delivered via zBoost. This includes:

- List Prefetch and Bi-Directional support. These features enable a single I/O to efficiently access discontiguous extents on a volume. This results in improved performance; for example, in DB2 when accessing indexes with poor cluster ratios (disorganized index scans).

- Format Write commands. This capability improves performance of utilities, such as DB2 load, reorg, index rebuilds and restores by enabling channel programs employing format writes to deliver large amounts of data in a single I/O.

- Exploitation of zHPF by the BSAM, QSAM, and BPAM access methods.

**IBM Copy Services Compatibility Enhancements**

zBoost also contains support for the following IBM Copy Services compatibility features:

- PPRC Soft Fence.
  
  This feature prevents customers from accidentally accessing the original PPRC primary volumes after a Hyperswap or PPRC Primary failure occurs.

- Non-Disruptive State Save (NDSS).
  
  NDSS is intended for capturing diagnostic information on demand within the control unit when certain problems occur in GDPS/PPRC and GDPS/XRC environments.
**VMAX 40K Performance Improvements**

zBoost will benefit VMAX 40K configurations where FICON front end capacity is a bottleneck. Simply put, zBoost adds additional processing capacity to the FICON emulation instance on the VMAX 40K. This additional processing capacity can be exploited by a single port, up to the saturation point of the FICON processor, or by employing both ports on the adapter card instead of using only one port. The largest performance improvements will be realized as a result of this change, which applies only to the VMAX 40K.

Figure 4 below illustrates that with zBoost enabled IOPS and response time benefits are seen regardless of whether a single port or both ports are used on the FICON adapter:

![Figure 1: zBoost equivalent IOPS and response time benefit when using one vs. two ports](image)

Most importantly, zBoost provides both additional FICON IOPS for workload growth (or to absorb workload peaks) and reduced response times at across all I/O rates, as figure 5 illustrates:
Finally, batch run times can be reduced since zBoost provides a higher I/O rate as well as reduced response times for large block batch workloads as seen in figure 6 below:
VMAX 20K Performance Improvements

The FICON emulation enhancements delivered by zBoost improve VMAX 20K response times by an average of up to 10% across a variety of workloads. Figure 7 below illustrates the reduction in response time observed on the 20K across the entire range of I/O rates in a sequential write workload.
Implementation Considerations

Since zBoost will ‘open up’ the I/O processing capacity of the FICON adapters it is important for existing customers employing SRDF/A to ensure the SRDF/A bandwidth is capable of supporting additional write I/O that may be presented to SRDF adapters. Performance modeling of this additional workload should be done and additional SRDF adapters and/or link bandwidth should be provisioned if required prior to enabling the zBoost feature. This analysis will avoid SRDF/A drops due to insufficient SRDF/A resources resulting from latent write demand released as a result of performance improvements.

SRDF/S bandwidth should also be evaluated to ensure SRDF/S does not constrain the throughput benefit of zBoost due to insufficient SRDF/S capacity.

Conclusion

In addition to the performance benefits of increased IOPS and reduced response time, the reduction in FICON port requirements provides additional flexibility to add SRDF connectivity or reduce engine counts in mainframe configurations. Peak workloads can now be absorbed without the need to add engines to the configuration.

zBoost is an enhancement that is designed for easy deployment and will yield significant performance benefits and configuration savings. EMC performance specialists have modeling...
tools which have been updated to reflect the capabilities of zBoost. As with any configuration change, a detailed analysis using user supplied data should be performed prior to implementation.