Lab Validation Report

EMC VPLEX Metro and Geo

GeoSynchrony 5.0 Updates

By Vinny Choinski with Brian Garrett

October 2011
Introduction

This ESG Lab report explores new hardware and software features that streamline and simplify EMC VPLEX management. It also examines how VPLEX Metro and Geo, combined with VPLEX Witness, can be used to create a collaborative and resilient infrastructure over distance.

Background

ESG research indicates several key priorities for data storage investment over the next twelve to eighteen months. Chief among these—and second only to data protection—are moves to purchase new SAN storage systems, improve storage management software tools, and implement storage virtualization.

Applications deployed on virtual machines sharing a virtual pool of networked storage are more mobile and available than those deployed on direct attached hard drives. Put it all together and it’s clear that forward-thinking IT managers are looking to combine the benefits of virtual server and virtual storage to increase the efficiency, flexibility, and security of their IT infrastructures.

Figure 1. Key Areas of Investment for Data Storage

Top 10 data storage infrastructure areas in which organizations will make the most significant investments over the next 12-18 months? (Percent of respondents, N=289, five responses accepted)

- Backup and recovery solutions: 36%
- Data replication solution for off-site disaster recovery: 24%
- Purchase new SAN storage systems: 23%
- Improved storage management software tools: 21%
- Storage virtualization: 21%
- Purchase more power-efficient storage hardware: 18%
- Data reduction technologies: 18%
- Use cloud storage services: 17%
- Tiered storage: 17%
- Purchase new NAS storage systems: 15%


The benefits of a virtual infrastructure need to be extended beyond the physical walls of the data center. The lofty strategic goal is to create a centrally managed pool of virtual resources spanning all of an organization’s data centers. A practical first step is achieving the ability to move a running application to another data center without declaring a disaster.

---

EMC VPLEX

VPLEX is a combination of hardware and software deployed between servers and SAN attached disk arrays. It turns a heterogeneous mix of arrays into a distributed, federated pool of virtual storage that can be spread over multiple data centers. The VPLEX architecture is designed to overcome the scalability and distance challenges that until recently have made deploying a large pool of centrally-managed virtual resources prohibitively complicated and expensive.

VPLEX hardware is deployed as a rack-mounted solution with VPLEX engines running the EMC GeoSynchrony 5.0 operating environment at its core. Each engine is comprised of a pair of highly available directors, each with a pair of quad core Intel CPUs. The directors have 32 FC ports, each with 8 Gbps of bandwidth, for host and disk array connectivity. The solution is equipped with a management server, Fibre Channel switches, Ethernet switches, and power supplies.

Figure 2. EMC VPLEX Hardware

With GeoSynchrony 5.0, a cache coherent, active-active cluster can be deployed over one to four VPLEX appliances. VPLEX clusters can span synchronous and asynchronous data center distances. All of the engines can be actively used. If any one of them fails, resources in other engines can be used to ride through the failure without interruption. GeoSynchrony 5.0 has been qualified to work with a heterogeneous mix of disk arrays and IT infrastructure components. This list will grow as EMC continues to invest in VPLEX interoperability testing.

As shown in Table 1, the VPLEX family has been qualified to work with a variety of physical and virtual servers, operating systems, and applications. VPLEX Local is intended for use within the confines of the data center while VPLEX Metro can be deployed within, across, and between data centers separated by up to 5ms round-trip (RTT) latency. VPLEX Geo further stretches the benefits of VPLEX between data centers separated by up to 50ms (RTT) latency.
**Table 1. VPLEX Interoperability**

<table>
<thead>
<tr>
<th>Disk Arrays</th>
<th>EMC Symmetrix VMAX, DMX, CLARiiON CX4, VNX; HDS 9970, 9980, VM, USP-V; IBM DS8000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Host Platforms</td>
<td>VMware ESX, Cisco UCS, Microsoft Windows, Solaris, AIX, HP-UX, Linux</td>
</tr>
<tr>
<td>Multipath Drivers</td>
<td>EMC PowerPath, VMware NMP, Host OS NMP</td>
</tr>
<tr>
<td>Local Cluster</td>
<td>VCS, MSCS, Oracle RAC</td>
</tr>
<tr>
<td>Volume Managers</td>
<td>VxVM, AIX LVM, HPQ, HP LVM</td>
</tr>
<tr>
<td>SAN Fabrics</td>
<td>Brocade, McData, Cisco</td>
</tr>
</tbody>
</table>

**How VPLEX is Used**

Some of the more powerful ways that VPLEX Metro and Geo can be used include:

- Enabling online mobility of applications between servers, storage arrays, and data centers.
- Enabling online movement of VMware (VPLEX Metro only) and Microsoft Hyper-V (VPLEX Metro and VPLEX Geo) virtual machines between data centers.
- Enabling online data mobility between EMC and non-EMC disk arrays located within and between data centers.
- Providing centralized online mobility of storage capacity between tiers of storage.
- Standardizing process for the configuration and deployment of storage capacity.
- Engendering active collaboration between disparate sites/locations.

**What is New**

Updates to EMC’s VPLEX include new delivery platforms for stretched clusters (VPLEX Geo) as well as hardware and software updates.

- **VPLEX**
  - Ability for VPLEX cluster to support up to ~50ms RTT latency in Geo configuration
  - Updated VPLEX hardware for all configurations (Local, Metro, and Geo)
  - Smaller footprint chassis per engine (2RU versus 4RU)
  - Updated Intel Xeon "Westmere" quad core processors
  - Updated PCI Express interfaces (Gen 2)
  - 10 Gigabit WAN interconnect capabilities
  - Deployment in either VPLEX-specific cabinets or customer racks
  - Lower power and cooling requirements
- **Graphical user interface improvements in GeoSynchrony 5.0**
  - Improved look and feel for login screen and management console
  - Enhancement of federated resource overviews, consistency groups, and cluster resources
- **VPLEX Witness**
  - Third fault domain witness virtual machine to prevent cyclical or cascaded restarts in the event of WAN link outage or other transient errors
Now that we’ve seen what VPLEX is and how it can be used, let’s take a look at how it fits into an existing virtual server infrastructure. As shown in Figure 3, VPLEX is configured between SAN attached hosts and storage. VPLEX was originally introduced in Local and Metro configurations designed to provide a level of protection and coherency in low latency environments. With the introduction of EMC VPLEX Geo, this boundary of access has been extended to asynchronous distances; up to 50ms in RTT latency. With this extension to GeoSynchrony, creation of active/active coherent block file systems for collaboration and protection can be done with minimal interruption.

Figure 3. EMC VPLEX Metro/Geo with VPLEX Witness

Extending VPLEX Metro and Geo even further is the introduction of VPLEX Witness, a virtual machine that runs in a distinct fault domain. VPLEX Witness is designed to monitor both heartbeat and connectivity between two VPLEX clusters and it allows administrators to deterministically fail over sites and offset cluster bias and win/lose states. Utilizing this third fault domain, VPLEX Witness is able to create a safety net that prevents unnecessary outages due to transient WAN outages or scheduled downtimes. By constantly checking connections to primary and secondary clusters and enforcing policies that have been built for the consistency groups, VPLEX Witness can fail over sites automatically (in the case of VPLEX Metro) or with minimal user intervention (in the case of VPLEX Geo).
ESG Lab Validation

ESG Lab performed hands-on evaluation and testing of EMC VPLEX Metro and Geo at EMC’s facilities in Hopkinton, Massachusetts. Testing was designed to demonstrate improvements in GeoSynchrony 5.0, updates to the graphical user interface, and the protection/arbitration provided by VPLEX Witness.

Getting Started

The configuration used for ESG Lab testing is shown in Figure 4. Both Microsoft Hyper-V and VMware ESX 4.1 hypervisors were used to provide testing platforms for virtual machine (VM) migrations and simulated server failures as well as simulated site failures. In both test scenarios (Metro and Geo), VPLEX Witness was configured in a segregated network to arbitrate cluster bias and consistency groups. The servers in data centers A and B were SAN connected to a pair of VPLEX engines, which were in turn connected to EMC Symmetrix VMAX arrays. The virtual infrastructure in data center A was WAN connected to data center B and an Anue WAN Simulator was placed in line to simulate varying levels of latency that would represent geographic spread. ESG Lab used this test bed to examine the resiliency and availability of VMs in both VPLEX Metro and Geo configurations. Additionally, VPLEX Geo was tested with varying levels of RTT latency.

*Figure 4. The ESG Lab Test Bed*
**ESG Lab Testing**

Initial testing of the VPLEX solution sets was conducted in both VMware ESX 4.1 and Microsoft Hyper-V environments as these are the two primary supported hypervisors for the VPLEX solution. Figure 5 shows the view of the test environment used during the VM migration process from vCenter console. As shown, a cluster of two physical hosts had several virtual machines distributed across them with a common datastore provided by VPLEX from the backend Symmetrix VMAX.

*Figure 5. VMware vCenter Virtual Machine Migration*

ESG Lab tested the VPLEX Metro configuration with VMware ESX 4.1. By right-clicking on a source VM and choosing “Migrate,” ESG Lab was able to choose the destination host. The same process can also be accomplished by simply dragging and dropping a VM onto another host in the cluster. ESG Lab was able to initiate this process in VPLEX Metro clusters with no impact to standard operation. In this example, vCenter was used to initiate a VM migration to demonstrate the solution’s ability to transparently absorb a server or site failure using a VPLEX Metro connected infrastructure with ~1ms RTT latency.
Lab Validation: EMC VPLEX

Figure 6 shows a view of the VPLEX Geo solution from the Microsoft Windows Cluster Manager console. Cluster Manager can migrate VMs between hosts in Microsoft Hyper-V environments. As shown, the two-node Hyper-V cluster has four running virtual machines.

**Figure 6. Microsoft Windows Cluster Manager Live Migration**

ESG Lab tested VPLEX Geo with Microsoft Hyper-V. In this example, the Microsoft Failover Cluster Manager Snap-In\(^2\) was used to initiate Live Migrations of the VMs to demonstrate the ability to transparently survive a server failure. By selecting the VM to migrate and right-clicking, ESG Lab was able to initiate a Live Migration to another node in the Hyper-V configuration.

**Why This Matters**

IT organizations need to move applications from one data center to another for a variety of reasons including data collaboration, data center consolidations, planned maintenance, disaster avoidance, and load balancing. Traditional methods typically require planned downtime. If the application must remain online during the move, a costly and complex combination of host clustering software and disk array remote mirroring is needed. Additionally, with the emergence of geographically dispersed workforces, the need for cache-consistent data repositories between sites for collaboration purposes becomes important.

ESG Lab has confirmed that VPLEX Metro, coupled with VMware ESX or Microsoft Hyper-V, or Geo, with Microsoft Hyper-V, can be used to quickly and easily move a running virtual machine between data centers with up to ~50ms RTT. The virtual machine migration process looks and feels exactly as if VPLEX were not there. For administrators familiar with the drag and drop vCenter VMotion interface or the Hyper-V Live Migration process, there is nothing new to learn.

\(^2\) Information on this feature is available from http://technet.microsoft.com/en-us/library/cc730692.aspx
Usability Updates in GeoSynchrony 5.0

With GeoSynchrony 5.0, EMC has updated the look and feel of the VPLEX login and management console, enabling administrators to quickly ascertain the status of VPLEX clusters, determine federated storage alignments, and, with the introduction of VPLEX Witness, create a highly-available, non-stop data collaboration engine for their enterprise.

Administering the VPLEX Metro or Geo solution has been simplified with updated login and management screens. These updates have increased VPLEX’s overall usability and have streamlined the creation of resilient clusters for data collaboration and availability.

ESG Lab Testing

ESG Lab logged into the improved management console using the process highlighted in Figure 7. It was observed that GeoSynchrony 5.0 has been refreshed to better align to the GUI design first introduced in EMC’s Unisphere product family.⁴

By simplifying its GUI and creating a unified look, EMC has provided continuity to its management interfaces, improving time-to-deploy and management metrics. The familiar look allows for quicker transitions between primary storage creation activities and propagating VPLEX storage consistency groups.

As shown in Figure 8, once ESG Lab logged in, the VPLEX Management Console presented the cluster health with details regarding faults, connectivity, and availability. Hovering over the visually represented VPLEX Clusters provided additional details designed to speed diagnosis times. Clicking on the linked text in the management screen provided a quick jump off point to affected systems or components. ESG Lab also tested the ability to quickly access system serial number by clicking on the barcode at the bottom of the cluster icon. With GeoSynchrony 5.0, many of these functions previously only available from the command line interface are now available in the GUI for simplified management.

*Figure 8. EMC VPLEX Management Console, System Status Overview*
A single pane of glass management screen allowed ESG Lab to gain insight into shared cluster resources including the allocation, presentation, and management of disk resource between clusters. As shown in Figure 9, ESG Lab utilized this management view to see the same disk resource being utilized between clusters one and two during testing. ESG Lab created a disk resource on cluster one located in data center A. Once this resource was created, the federation capabilities of GeoSynchrony 5.0 propagated it to the second cluster located in data center B. ESG Lab observed that these federation capabilities are a core component of VPLEX’s AccessAnywhere; which is the ability to collaborate across heterogeneous resources.

*Figure 9. EMC VPLEX Management Console, Cross-cluster Federated Storage Overview*
VPLEX Consistency Groups are logical groupings of resources that are tied to applications and storage resources. These consistency groups fit within the VPLEX AccessAnywhere topology in that they designate how resources are cached in addition to how they are protected in the event of a site or cluster failure.

**Figure 10. EMC VPLEX Management Console, Consistency Group**

ESG Lab created an asynchronously-cached consistency group for its Windows 2008 hosts, shown in Figure 10. In addition to setting up this consistency group, ESG Lab also created a detach rule which governed how the cluster and consistency group were to be treated in the event of a site or resource failure. These rules govern the behavior of the consistency groups on the surviving infrastructure so that coherency can be maintained. Actions such as “Active Cluster Wins” dictate which cluster will be considered to have the master copy of data in case of a fault.

**Why This Matters**

Forward progress in hardware is meaningless if the methods of managing and using a solution are complex and cumbersome. Utilizing intuitive interfaces, VPLEX enables IT managers to save time and money on the deployment, provisioning, and hardening of non-stop, stretched infrastructures over Metro and Geo distances.

ESG Lab believes the ease of use and intuitive approach of the GeoSynchrony 5.0 GUI for EMC VPLEX can shorten the time spent training and refreshing staff while greatly reducing the length and number of support calls. ESG Lab getting started with VPLEX to be intuitive and straightforward. The user interface provided a high level overview of cluster hardware with drill-down capabilities for fault isolation and remediation. Additional GUI views of storage resources and consistency groups minimize the need for command line administration.
**Federated Resources**

VPLEX is designed to support an “AccessAnywhere” infrastructure. To do this, VPLEX creates a decoupled layer between the application and storage as it maintains a virtual, mirrored, cache-coherent copy of data in both data centers. The latest version incorporates VPLEX Witness to monitor both heartbeat and connectivity between two VPLEX clusters from a separate network domain, allowing administrators to safely fail over resources between sites when true fault conditions occur.

**ESG Lab Testing**

ESG Lab tested the features of VPLEX Metro and Geo by evaluating three simple scenarios that affect stretched clusters. Each scenario was designed to highlight the features and functionality provided by VPLEX and the accompanying VPLEX Witness technologies by injecting faults into the environment.

*Figure 11. EMC VPLEX Metro/Geo Logical Overview*

ESG Lab utilized the logical overview shown in Figure 11 for testing. The inclusion of VPLEX Witness provided the necessary arbitration required to prevent split brain recoveries during site failovers. VPLEX Witness is run as a virtual machine in a designated fault domain, ideally segregated from the two primary domains for the VPLEX clusters. By providing a third fault domain, VPLEX Witness is able to arbitrate data access and cluster bias based on ongoing monitoring of system heartbeats. If VPLEX Witness determines an issue is preventing access to a site, it can promote the other site to the active or "winning" cluster. This process enables enterprises to continue to access and process data with minimal disruption. With the addition of VPLEX Witness to both Metro and Geo configurations, this arbitration can now be stretched to asynchronous distances based on RTT latency, allowing for active/active stretched VPLEX clusters.
As shown in Figure 12, ESG Lab tested the data mobility and high availability capabilities of VPLEX Geo and Metro configurations, starting with simple virtual machine migrations and moving to more complex failure scenarios.

Figure 12. ESG Lab Fault Domain & Testing Overview

Virtual machines were migrated with Microsoft Live Migration and VMware VMotion. In both cases, the virtual machines moved from cluster to cluster with no interruption to applications or end-users. ESG Lab also tested a Geo configuration with Microsoft Hyper-V and Microsoft Cluster services by introducing a server failure and confirmed that virtual machines remained available with no interruption. The Anue appliance was used to inject latency and emulate two VPLEX Geo configurations: latency of 10ms was used for the first configuration and 30ms of latency was used for the second configuration. To demonstrate the effect of latency between data centers connected by VPLEX Geo, both solutions were tested in non-cluster aware configuration.

ESG Lab tested a server failure and a full site failure. The simulated server failures were conducted by simply enforcing a disorderly shutdown of the underlying platform. This server failure was then followed by a restart of the virtual machine on another host at the surviving cluster. The virtual machine restarted, according to bias rules and VPLEX Witness arbitration. Similarly, a site failure was simulated using the following process:

- Severing storage links from host to storage (presented via VPLEX Geo)
- Killing power to the server platform
- Disconnecting storage and networking resources
- Rebooting the VPLEX Geo cluster
- Confirming resource change from VPLEX Geo cluster at Site A to Site B
- Restarting the virtual machine at Site B

This process essentially negated any available resource and cluster bias rules from being implemented by VPLEX Witness at Site A; propagating resources at Site B as the “winning” cluster.
Figure 13 demonstrates how long it took ESG Lab to restart virtual machines on a surviving cluster after a failure without host-based clustering being enabled.

**Figure 13. EMC VPLEX Remote Restart Times**

<table>
<thead>
<tr>
<th></th>
<th>Metro – Local⁴</th>
<th>Geo – Local⁵</th>
<th>Geo – 10ms RTT</th>
<th>Geo – 30ms RTT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time to restart virtual machines (minutes:seconds)</td>
<td>2:00</td>
<td>3:15</td>
<td>3:18</td>
<td>4:24</td>
</tr>
</tbody>
</table>

**Table 2. Time to Reboot Server, Non-Clustered**

It took two minutes to restart the VMs after a server failure in a Local VPLEX Metro configuration with no latency. This is approximately the time it takes to power up four virtual machines in an environment without VPLEX configured. A server failure with VPLEX Geo with no latency took three minutes and 15 seconds to restart the VMs on the surviving, or winning, cluster. With 10ms of latency, it took three and a half minutes to restart the VMs. With 30ms of latency, it took four minutes and twenty seconds to restart the VMs.

**What the Numbers Mean**

- Moving from ~1ms of RTT latency to 10ms of RTT latency (an estimated operational distance of 300km or ~186 miles) adds less than 3 seconds of measurable time to virtual machine restarts (Geo – Local vs. Geo – 10ms RTT).
- Moving from 10ms of RTT latency to 30ms of RTT latency (an estimated operational distance of 900km or ~560 miles) adds 25% more operational time for restarting virtual machines—well within tolerable limits for near-zero RTO enterprises (Geo – 10ms vs. Geo – 30ms).
- For Metro distances with ~1ms of RTT latency, virtual machine restarts are well within required windows for minimal downtime required by applications.

---

⁴ VPLEX Metro virtual machine restarts were accomplished using VMware ESX.

⁵ Currently, VPLEX Geo is only supported by Microsoft Hyper-V hypervisors for latencies greater than ~5ms RTT.
In addition to testing virtual machine migrations, ESG Lab evaluated the time taken to restart services after both server and site failures. These scenarios involved moving virtual machines from Site A to Site B (server failure) as well as moving an entire consistency group from Site A to Site B (site failure).

**Figure 14. EMC VPLEX Infrastructure Restart Times**

<table>
<thead>
<tr>
<th>Elapsed Time (Minutes)</th>
<th>VPLEX Server &amp; Site Failover</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>VPLEX Geo</td>
</tr>
<tr>
<td>0.5</td>
<td>VPLEX Metro</td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>VPLEX Geo</td>
</tr>
<tr>
<td>2.5</td>
<td>VPLEX Metro</td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>3.5</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

ESG Lab tested server and site failure scenarios as follows:

- Severing storage links from host to storage (presented via VPLEX Metro/Geo)
- Killing power to the server platform
- Disconnecting storage and networking resources
- Rebooting the VPLEX Metro/Geo cluster at Site A
- Confirming resource change from VPLEX Geo cluster at Site A to Site B
- Restarting the virtual resources at Site B

---

6 As noted by the asterisk in Figure 14, site failure required manual intervention for cluster failover.
7 Manual failsafe to prevent cascaded, circular, or split-brain inconsistent states.
This process essentially negated any available resource and cluster bias rules from being implemented by VPLEX Witness at Site A; thus propagating resources at Site B as the winning cluster. Consequently, the times noted in Figure 14 represent the time taken by the hypervisors to reboot the resources on the “surviving” clusters. Table 3 expounds upon this data.

Table 3. Time to Restart Server and Sites

<table>
<thead>
<tr>
<th></th>
<th>Server Recovery Time</th>
<th>Site Recovery Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metro</td>
<td>2:00</td>
<td>2:19</td>
</tr>
<tr>
<td>Geo</td>
<td>3:15</td>
<td>3:29</td>
</tr>
</tbody>
</table>

What the Numbers Mean

- Server recovery times are appreciably different between the VPLEX Metro and Geo solutions, with the average time to recover at one minute, fifteen seconds.
- Site recovery times are appreciably different between the VPLEX Metro and Geo solutions, with the average time to recover at one minute, ten seconds. Arguably, this difference can be attributed to the manual intervention required by VPLEX Geo to signify that a site move should be initiated.
- Server recovery and site recovery differences for VPLEX Metro show that moving an entire consistency group from Site A to Site B takes only 14% longer than a simple server failure redirection.
- Server recovery and site recovery differences for VPLEX Geo show that moving an entire consistency group from Site A to Site B takes only 7% longer than a simple server failure redirection.

Why This Matters

ESG Lab tested non-clustered Metro and Geo solutions in local configurations and found that it introduced no performance impact; however, over distance there is a measurable but manageable delay during failover at the server layer. ESG Lab confirmed that with qualified clustering solutions from VMware, Microsoft, and others, you can totally eliminate this impact at up to 30ms of latency. Even in these non-clustered configurations with 30ms of latency, the VPLEX storage remained available.

---

8 Noted RTT latency for these tests is ~1ms.
ESG Lab Validation Highlights

- EMC VPLEX hardware architecture has been updated to reduce footprint, increase WAN performance relative to connection speed, and deliver more desirable customer integration options.
- EMC VPLEX GeoSynchrony 5.0 delivers a much-improved graphical user interface that aids administration of day-to-day tasks including VPLEX health status, consistency groups, and federated resources.
- VPLEX Geo adds negligible overhead to asynchronous data access and streamlines the process of resource utilization for enterprises with distance requirements.
- VPLEX Witness adds additional capabilities to VPLEX Metro and Geo for sustaining WAN transient outages and other situations where split-brain phenomena could negatively impact business agility, performance, and recoverability.

Issues to Consider

- **WAN bandwidth.** Planning is needed to make sure that you can have a properly-sized WAN connection between VPLEX Metro-enabled data centers. Like most organizations that have deployed synchronous remote mirroring for disaster recovery between two data centers, a direct fiber connection (a.k.a., dark fiber) is recommended.
- **GUI vs. CLI.** ESG Lab was impressed by the home screen of the VPLEX management GUI—especially one-click access to wizards for each of the steps in the VPLEX configuration process. That said, the GUI could benefit from a number of enhancements with a focus on helping administrators manage an existing VPLEX deployment (e.g., inventory reporting, audit logging, topology viewers, and wizards for common tasks). As the GUI evolves into a more fully functional graphical user interface, administrators can use the well-documented VPLEX command line interface (CLI).
- **Your mileage may vary.** The results presented in this ESG Lab Validation Report represent a closely-controlled environment. As such, it is reasonable to expect some differences in topology and implementation at customer locations. Additional factors such as underlying storage, fabric interconnects, WAN uplinks, and redundancy as well as host-side inclusions can significantly alter performance and sustainability. ESG Lab recommends consulting the EMC Support Matrix for VPLEX for the most up to date information.
The Bigger Truth

VPLEX extends the benefits of virtual server technology to the storage infrastructure located within and between data centers. Like virtual server technology, VPLEX increases the flexibility and agility of consolidated infrastructure as it creates a single point of control for a consolidated pool of federated resources.

For those with experience in the storage industry, this should sound familiar. Storage virtualization solutions from EMC and others have been around for more than a decade. While it starts with the same goals of providing a flexible abstraction layer between servers and storage, VPLEX uses a radically new approach to tackle two fundamental challenges with traditional storage virtualization solutions: scale and distance. It uses advanced clustering and caching to extend the benefits of a virtual infrastructure beyond the walls of the data center. A cache-consistent pool of storage capacity located within—and between—data centers turns a chaotic mix of disk arrays into a distributed federation of centrally-managed storage capacity.

What are the practical implications of this new technology? It offers the ability to non-disruptively move virtual server and storage resources to another data center. Instead of failing over to another site (e.g., with VMware Site Recovery Manager), ESG Lab moved a running virtual machine between two data centers in less than two minutes. The simple drag and drop VMotion interface familiar to VMware administrators was exactly the same with VPLEX. Compared to a VMware Storage VMotion, which could take hours to run in the background, the drag and drop approach was completed in minutes as VPLEX maintained a single cache-consistent image of federated storage at both sites.

ESG Lab confirmed that the performance overhead introduced by VPLEX Geo is manageably low and within a tolerable range for near-zero RPO enterprises in most cases. From ~1ms of RTT latency to 10ms of RTT latency (an estimated operational distance of 300km, or ~186 miles), VPLEX Geo adds less than 3 seconds of measurable time to virtual machine restarts (Geo – Local vs. Geo – 10ms RTT). Moving from 10ms of RTT latency to 30ms (an estimated operational distance of 900km, or ~560 miles) adds 25% more operational time for restarting virtual machines, which is well within tolerable limits for near-zero RTO enterprises (Geo – 10ms vs. Geo – 30ms). For Metro distances with ~1ms of RTT latency, virtual machine restarts are within the windows for minimal downtime required by non-stop infrastructures.

VPLEX leverages the hardware engine at the core of EMC’s enterprise-class disk arrays and field-tested clustering software obtained through acquisition. Both have been deployed in extremely large mission-critical environments. With the introduction of VPLEX Geo, EMC further pushes the limitations of distance from mission-critical applications.

VPLEX is an innovation with the potential to change the way organizations deploy and manage storage infrastructure. Using clustering technology that’s been field-tested at scale in production environments, VPLEX has the potential to create a single view of storage that spans the globe. Existing EMC customers intrigued by the possibility of dynamically moving virtual servers between two locations with up to ~50ms of round trip latency should view taking VPLEX for a test drive as a no-brainer. With global reach capability coming, EMC has established a strong precedent. Customers shopping for a storage infrastructure upgrade that can maximize the value of the storage that they already own should consider adding VPLEX to their shopping lists. Try it for VMotion between data centers or an online migration between disk arrays and you may find it helps enable turning an out-of-control heterogeneous storage infrastructure into a centrally managed storage utility.
## Appendix

### Table 4. Test Bed Overview

| Storage                                      |  
|----------------------------------------------|----------------------------------------------|
| **EMC Symmetrix VMAX**                      | Fibre Channel (FC) connectivity; Enginuity 5875.135.91 |
| **EMC VPLEX Metro & Geo**                   | 2 x VPLEX Metro/Geo storage clusters/4 director midsize configuration |

| Server                                       |  
|----------------------------------------------|----------------------------------------------|
| **Site A/B**                                 | Pair of 4-socket, 6 core, 2.00GHz E7540 Xeons, 128 GB RAM, 2 x Broadcom 5709c Gigabit Ethernet controllers |

| Network                                      |  
|----------------------------------------------|----------------------------------------------|
| **Switches**                                 | Dell PowerConnect 6224F |
| **WAN Emulator**                             | Anue WAN Emulator; 10/30/50ms RTT Latency |
| **SAN Switches**                             | Brocade DCX; 2/4/8Gbps FC; firmware 6.1.0j |
|                                              | Brocade MP-8000; 10Gbe |

| Software Virtualization                      |  
|----------------------------------------------|----------------------------------------------|
| **VMware vSphere**                           | 4.1 Enterprise, build 260247 |
| **VMware vCenter**                           | 4.1, build 259021 |
| **Microsoft Windows**                        | 2008 R2, SP1 |
| **Microsoft System Center Virtual Machine Manager** | 2008 R2, SP1 |