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Navigating Information Technology Horizons^{SM}

IBM's PowerHA Solution — A Win-Win Strategy for Mitigating Risks and Being Prepared

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Management Summary

Stuff happens! Things go wrong, often with undesirable consequences. Some prefer to stick their head in the sand and ignore the possibilities and consequences. For them, life may be more carefree, at least until something goes wrong. At the other end of the spectrum are those who worry about everything, often to the point of paralysis. As with any bell-shaped curve, most of us fall somewhere in between.

However, those involved in IT operations cannot afford to be carefree. We get paid to consider the possibilities, the consequences, and the methods for reducing the risks and to be prepared to respond. Often, this is categorized as "disaster recovery" (a.k.a. "DR"), but there is so much more to winning this game. Yes, it is a game, one that is very much like a board game. Think of *Monopoly*, for example. There is the randomness of the dice, the variability of the consequences, and, of course, the strategies of each player. With a board game, you usually are playing "for fun". However, with enterprise applications and data, you are playing "for real"! *Do you analyze, plan, invest, and prepare (for one or many things to go wrong)?* Or, do you take the more carefree approach of *Alfred E. Neuman* (of *Mad Magazine* fame) and ask **"What? Me worry?"**

For most of us, DR is about planning ahead and investing wisely to provide the needed levels of high availability – for critical applications and data. (We may fret over servers, storage and networks, but our point of measurement usually involves applications and data.) We are being paid to play this game well. The challenges are many. Picking the right components and partners is important. You do not have to play this game in isolation.

Disasters, small and large, are nothing new to the enterprise data center. Power outages occur and systems crash all of the time; sometimes because of faulty hardware, other times because of software. Maintaining business continuity (BC) remains the primary focus of every CIO. If you lose the data center for any measurable length of time, you may lose business. While a business continuity/disaster recovery (BC/DR) plan is an essential requirement for every data center, a high-availability (HA) environment in many cases also may be needed. Yes, there is an increased cost to install and operate an HA solution, but what about the costs that might be incurred if you don't? The economic benefits of deploying high availability are readily measurable; every mission-critical data center needs to deploy HA, to some extent, to ensure business continuity and disaster avoidance. *Can you afford not to?* However, there is more to it than just keeping the lights on. Technical innovation to promote ease-of-use and ease of execution also is crucial for disaster aversion.

One company that has taken the time to consider the whole (and all of the parts) of high availability and disaster recovery and made the necessary investments in technology and integration is IBM. It has enhanced its mission- and business-critical *Power Systems* servers with high-availability and disaster recovery capabilities called *PowerHA* and secure storage solutions to maintain the continuity of your enterprise-critical *AIX* and *IBM i* applications. To learn more about IBM's PowerHA, please read on.

HA Data Center Requirements

Today's data center continues to have an insatiable appetite for more processing power on a constrained budget and with limited resources. The IT staff is under constant pressure to meet burgeoning business requirements, both internal and external, for higher availability than likely was true just a few years ago. With a 24x7 presence on the Internet, there is no tolerance for downtime. Reliability, security, and application responsiveness (a measurement of performance) are paramount. Customers, partners, and users alike are demanding improved service levels even while the IT staff often is faced with operating within the same constraints as before. As they struggle with expanding demands and infrastructure, both physical and virtual, *and* additional users, an increase in complexity often spreads throughout the application infrastructure environment.

The enterprise now must face the reality of a business continuity plan that may include three separate, but overlapping, parts or elements.

- *High availability (HA)* is the ability to provide access to critical applications via a failure-resistant infrastructure that provides continuous application processing.
- *Disaster recovery (DR)* is a set of processes and infrastructure that provides reliable, predictable protection against unplanned outages.
- *Continuous operations and applications availability* are the ability to carry out day-to-day functions like backup and configuration changes without the need to suspend application processing.

Every enterprise needs to have a Business Continuance/Disaster Recovery (BC/DR) plan that is affordable, testable, and workable, and also should be automated as much as possible. For some applications, recovery of data within a day, or even longer, is acceptable. For these applications, the costs inherent in a high-availability solution are not justifiable; using a tape backup solution usually is more than adequate. For others, recovery within hours is acceptable. For them, a system with data replication usually will suffice. However, what about those applications that are mission-critical and demand a recovery time measured in minutes? For them, a multi-tiered recovery system consisting of data mirroring and systems clusters may be the only answer.

Despite the recent disasters that have struck in various geographies, only about half of all enterprises with mission-critical applications have a comprehensive business continuity plan.[1] Those enterprises that don't likely are risking damage to their reputation and their competitiveness, and, just maybe, their very existence.

Let's restate this. All enterprises should have some form of disaster recovery plan; but there is more to recovering from a big failure than an *eventual* return to a normal operating state. In many cases, especially with certain applications, time is of the essence. Time is the differentiating variable between simply being able to achieve business continuity (eventually) and having a high-availability system. Of course, you will want to know how long business activities will be interrupted. "Eventually" rarely is an acceptable answer.

Some applications are so critical (often called "mission critical") that they need to be up and running for the business to function. **While all applications and data need to be part of a disaster recovery plan (with appropriate recovery actions being taken, when needed), mission-critical applications and their related data have high-availability requirements that mandate being up *almost all of the time*.** Regardless of the cause of an outage, these applications require a high-availability solution that will allow short recovery times, whether you are recovering nearby or at a distance. **The enterprise must weigh the cost of having high availability versus the potential costs of even a single prolonged outage. If you must maintain business continuity then you will need a good high-availability solution.**

In addition to keeping the systems up and running, there are other requirements that must be satisfied, including an ever-increasing need for more performance and the unrelenting pressure from senior executives to do more, usually within a stagnant IT budget. You need to deploy systems which *can* fail but which have recovery processes that enable the mission-critical applications to move to another system automatically when they do. This likely means that you cannot approach the future with a business-as-usual attitude. The needed failover processes and the server clustering associated with them *could* add significant complexity to the server (and storage) architecture and place a heavy burden on the IT

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[1] The key word in this sentence is *comprehensive*.

staff, thus adding to the TCO of the IT infrastructure. **Therefore, it is imperative that IT organizations find an integrated HA solution that significantly minimizes that complexity and integrates easily with the existing infrastructure.**

In September, Clipper published a bulletin on high availability requirements.[2] In it, we asked the question: *How prepared are you?* This question reveals a *Pandora's Box of Evils* waiting in the shadows to bring your enterprise to its knees. In this case, however, "Hope"[3] is not an answer that you can accept. What is needed is an honest assessment of the risks that the IT staff faces in its efforts to maintain business continuity and to prepare the data center for the right disaster recovery scenario. (See Exhibit 1, at the top of the next column, for a partial list.)

Enterprises everywhere are demanding a higher level of reliability and performance for their business- and mission-critical applications requiring near-continuous availability. This includes financial institutions on Wall Street, as well as global banks, telecommunications firms, the entertainment industry, and manufacturing enterprises of every kind. For these, downtime equates to lost revenue – ranging up to millions of dollars per hour, in some cases, as customers go elsewhere to execute their transactions. If business comes to a stop because of a failure in the IT infrastructure, someone might lose his or her job. None of these enterprises has exactly the same environment or requirements. **However, most seek a sound business continuity plan that is flexible enough to satisfy their critical application needs, but simple enough to be deployed within the existing architecture by the existing staff.** This includes, but is not limited to, support for virtualized servers and storage. The solution must be able to support the event monitoring of servers, storage, and networking, with customer policy-based actions.

Most industries are becoming more and more dependent on the innovations being made in in-

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[2] See the issue of **Clipper Notes** dated September 30, 2011, entitled *Disasters Remind Us Why We Need a High-Availability Data Center – How Prepared are You?,* available at http://www.clipper.com/research/TCG2011032.pdf. In that bulletin, we discussed which features to seek in a High Availability/Disaster Recovery (HA/DR) solution. Multiple critical success factors were considered, including ease of integration with the existing infrastructure and risk mitigation.

[3] When Pandora opened the box (actually a jar), all of its contents except one was released into the world; the one remaining was "Hope".

Exhibit 1 — Important High-Availability Questions
- Are you prepared for the loss of your data center?
- What happens when the power goes out?
- Do you understand what a prolonged outage would cost your enterprise?
- How long will it take your data center to recover from a disaster that shuts it down?
- To what point will you recover?
- Does your data center have any (many) SPOFs? Where are they?
- Do you monitor the health of your mission-critical applications and infrastructure?
- Do you have an alternate data center available? Is it local and/or remote?
- Can your enterprise afford not to have an HA system?

Source: The Clipper Group, Inc.

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formation technology, including social networking, digital images and videos, and online shopping. No longer is it sufficient just to maintain last year's capabilities. At the same time, data centers are striving to be more efficient, especially through consolidation and virtualization. Additionally, aging and inefficient infrastructure leads to more server and storage complexity, as it tries to handle evolving business processes. This complexity can delay the deployment of business-critical applications, increasing the time to revenue.

Disaster recovery methods and processes usually add to the level of operational complexity. Also, doing it "95% right" usually results in failure to meet important business objectives. **A successful DR solution also must be flexible enough to restore operations with a minimum of downtime and a minimum of data loss. In addition, it should eliminate – completely – the effects of planned outages, enabling applications availability for continuous operations.** Also, it must enable simple easy to conduct compliance testing. And, finally, it needs to be flexible and capable of evolving, in order to meet future data center needs, as well.

All of this is a tall order. ***Nonetheless, can you afford not to deploy a solution that is both highly available and satisfies the needs for business continuity?*** Continue reading, to see how all of this can be done.

FAQs about HA/DR

What do you need to implement High Availability and Disaster Recovery solutions? Well, you have a choice: (a) you can implement and deploy an integrated solution from a full-service vendor or (b) you can take the do-it-yourself approach and integrate and deploy pieces of a solution from multiple vendors. In the interest of simplification and getting it done right, the integrated solution makes a lot of sense. One hand to hold seems to be preferable, and more reliable, than many. However, before you pick a solution, you need identify your mission-critical applications (those that can't be down for very long) and to classify the characteristics of your data center and identify any existing single-points-of-failure.[4]

Besides the natural disasters that seem to be occurring with alarming regularity, the data center is faced with any number of possible situations that could put its operations in jeopardy, from power failures to hardware crashes and from processor breakdowns to communications outages. ***Are you prepared to continue operations even if your primary data center is off the grid?***[5]

One company that has invested heavily to ensure business continuity in the data center is IBM. Using our HA/DR solution considerations[6] as a guide, IBM's Power Systems' offerings represent a well-conceived solution for those businesses that require a cluster-aware environment. The core element of the solution is the *IBM PowerHA SystemMirror*, which will be called *PowerHA* for brevity. **If you have a Power System server running *IBM AIX* or *IBM i*, PowerHA can help you plan and be prepared for that seemingly inevitable disaster.**

The PowerHA Solution

In terms of business criticality, Power Systems tend to include a high percentage of mission-critical application deployments. If you have put your critical applications on Power System servers, one thing you do not want to see happen is for these applications to become un-

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[4] Single-points-of-failure is discussed in the paper referenced in footnote #2, on Page 3.

[5] Earlier this autumn, many of us in the Mid-Atlantic States up through New England, including me, lost power due to a very early snowstorm. I had to seek refuge in another state. *How well prepared is your data center for several days without power?*

[6] See the bulletin referenced in footnote #2 on Page 3.

available to internal users or to those outside users who come in via a portal on the Internet. **In order to help you eliminate the risks and avoid a disaster that can bring that about, IBM has released a complete HA/DR solution that includes the latest versions of PowerHA.** This creates a unified HA and DR environment for mission-critical application availability, including planned and unplanned outages. PowerHA is the principal component that brings together the needed automation necessary to deliver the capabilities and integration required for a BC/DR plan. PowerHA is coupled with and takes advantage of IBM's server and storage infrastructure and with IBM's planning and implementation services. Thus, IBM's HA/DR solution for Power Systems can span the entire Power Systems ecosystem. Let's see how this works.

PowerHA SystemMirror

IBM's *PowerHA SystemMirror* comes in two versions: *PowerHA SystemMirror Standard Edition 7.1* for single-site cluster management within the data center and *PowerHA SystemMirror 6.1 Enterprise Edition*, for cluster management across two sites (or two or three sites for *IBM i*). It is a complete, end-to-end solution for both high availability and disaster recovery, delivering 24x7-application availability.

- **PowerHA Standard Edition** is based upon *Cluster Aware AIX* and uses a kernel-based event management system to enable high-availability, with near-continuous access to applications via clustering of the application across multiple servers. It provides extensive monitoring of cluster resources and event management for impending or actual failures. In the case of a component failure, it moves the application (along with the resources needed to ensure access to the application) to another node in the cluster. PowerHA Standard Edition provides the mission-critical applications with a resilient infrastructure, and features an IBM Systems Director-based management interface, providing integrated and simpler management. Storage volumes are either switchable or, for added resilience, mirrored across nodes in the cluster. PowerHA reduces the time, effort, and cost of ensuring the availability of Power Systems infrastructure by integrating deeply with the services of Power servers and AIX and IBM i operating systems.

- **PowerHA Enterprise Edition** is a superset of the Standard Edition, with capabilities that ex-

tend the solution to a coherent HA/DR solution. It provides cluster management and automated fail over for disaster recovery across two or three sites by integrating with the replication services of supported storage systems (including IBM's *Metro Mirror* and *Global Mirror*). Metro Mirror can be leveraged within a metropolitan region for fail over with no data loss. Global Mirror works over greater distances for disaster recovery beyond metro distances. For IBM i only, the Enterprise Edition supports three-site failover with Metro Mirror-based failover between the primary and a secondary site and Global Mirror failover from the secondary site to a third site (via *IBM DS8000*).

PowerHA Enterprise Edition provides cluster management for the enterprise and extends the deep integration from the Power Systems environment to the following IBM storage environments.

- *The IBM DS8000*, IBM's flagship storage array.[7]
- *The IBM Storwize V7000*, IBM's new standard for unified, mid-range requirements.[8]
- *IBM XIV* (only for AIX) setting a new standard for enterprise class with low cost of ownership.[9]
- *IBM's SAN Volume Controller (SVC)*, IBM's enterprise-class storage virtualization engine.[10]

IBM provides PowerHA support for select non-IBM storage, as well (including many arrays from EMC, HP, and HDS).

A Complete Solution Is Offered

IBM's PowerHA integrates with existing Power Systems and most storage infrastructures, both hardware and software, delivering an inte-

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[7] See **The Clipper Group Navigator** entitled *Maximizing the Business Value of Information and Lowering Energy Consumption with IBM's DS8700*, dated April 13, 2010, at http://www.clipper.com/research/TCG2010018.pdf.

[8] See **The Clipper Group Navigator** entitled *IBM Brings Enterprise Functionality to Mid-Range Storage* dated October 7, 2010, and available at http://www.clipper.com/research/TCG2009046.pdf.

[9] See **The Clipper Group Navigator** entitled *XIV Gen 3 - IBM Lowers TCO and Raises Performance and Functionality* dated August 9, 2011, and available at http://www.clipper.com/research/TCG2011028.pdf.
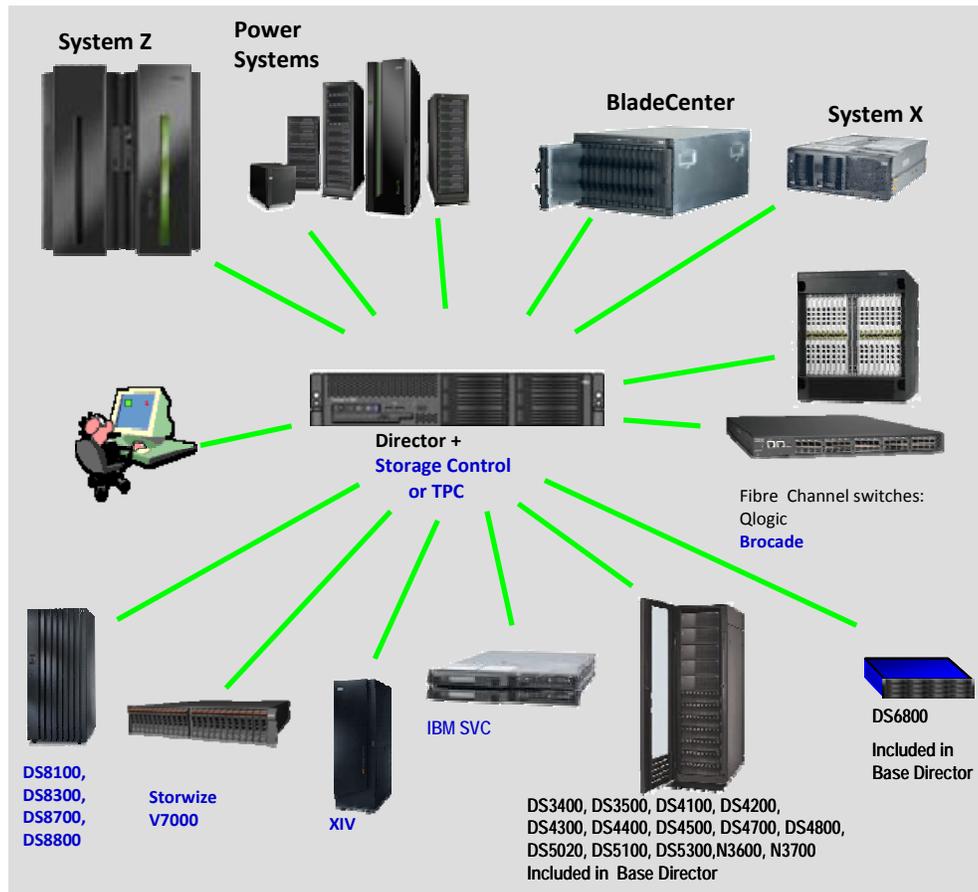
[10] See **The Clipper Group Navigator** entitled *IBM Upgrades SVC with Solid State Drives – Achieves Better Storage Utilization* dated October 14, 2009, and available at http://www.clipper.com/research/TCG2009046.pdf.

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grated HA/DR solution with the fewest resources.[11] It monitors the critical resources of the cluster and will detect changes to the resources that may indicate a failure, or a pending failure. It monitors the overall health of the cluster and any changes to the configuration.

In addition to the basic components described above, IBM provides optional components for the virtualization management, resource management, and monitoring the health and availability of the total IT infrastructure. These include:

- *PowerVM* – for server virtualization.[12]
- *IBM Systems Director integrated with Tivoli Productivity Center (TPC)* – for integrated storage and Power Systems management. This integration provides a single Systems Director interface for discovery, inventory, topology views, alerts, monitoring, configuration, storage and Power system pooling, and integrated virtual machine and storage provisioning. (See Exhibit 2, at the top of the next page.)
- *IBM is moving the management of PowerHA to the Systems Director* environment with a new management "plug-in" for PowerHA Standard Edition. We expect IBM will do the same for Enterprise Edition in the future.

Reduced Complexity and Simplified Deployment and Testing

IBM's complete PowerHA solution (PowerHA with IBM's Storage choices and solution services) simplifies the deployment and reduces the complexity of high availability and disaster recovery by addressing and optimizing the total disaster recovery process. It lowers the TCO by enabling higher server and storage utilization and lower software license fees than competitive products.[13] PowerHA lowers maintenance costs and provides integrated and optimized virtualization, systems management, storage, and availability across the Power Systems infrastructure. It also reduces the time required to comply with disaster recovery guidelines. Most importantly,

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[11] End-to-end testing is available at IBM benchmarking centers – to demonstrate system integration.

[12] *PowerVM Enterprise Edition* supports workload movement without disruption.

[13] According to IBM, it does this by requiring fewer hardware resources, thus (usually) lowering the software license fees that tend to be based on the involved quantities of hardware infrastructure.

Exhibit 2 — IBM Systems Director Storage Control and TPC Integration

System Z
Power Systems
BladeCenter
System X

Director +
**Storage Control
or TPC**

Fibre Channel switches:
Qlogic
Brocade

IBM SVC

DS6800

Included in
Base Director

**DS8100,
DS8300,
DS8700,
DS8800**

**Storwize
V7000**

XIV

DS3400, DS3500, DS4100, DS4200,
DS4300, DS4400, DS4500, DS4700, DS4800,
DS5020, DS5100, DS5300, N3600, N3700
Included in Base Director

Source: IBM

PowerHA usually lowers the acquisition costs for the total DR solution. It automates and coordinates server and storage failover to local or remote systems. PowerHA, with a choice of IBM storage systems, provides a single vendor solution, with simplified deployment and management and with integrated consulting, assessment, planning, and implementation services. These integrated services are offered worldwide, covering the full set of PowerHA features and listed storage solutions.

In addition, PowerHA can do regular and sustained role swaps to test the system. This means that the primary system becomes the backup, and remains so until the next role swap operation. It is not enough to simply test that the role swap can be done. It is essential that the applications can move to the second server and remain there.

Affordable HA/DR

PowerHA is an affordable HA/DR system

that enables both a minimal recovery point objective (RPO)[14] and a minimal recovery time objective (RTO)[15]. This limits risk. It includes both a local, or metro, solution for synchronous replication in a two-site configuration, and an asynchronous two-site configuration to support a remote, or global, solution for DR. A three-site is supported on IBM i.

- **The metro solution** is used to achieve the fastest possible failover and recovery, when no data loss is permitted and the distance is short. It executes an RPO of zero and an RTO of seconds or minutes.
- **The asynchronous solution** is used when a minimal data loss is acceptable and larger distances are required, usually to recover from a localized shutdown situation, of some sort.

IBM can provide the IT staff with a variety of

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[14] The RPO measures the amount of data that must be recovered in units of time.
[15] The RTO is the amount of time in minutes required to bring up (restore) applications and network connectivity.

Exhibit 3 — IBM PowerHA and IBM Storage – Doing More, Together

Integrated Features	DS8000	XIV	SVC	Storwize V7000
PowerHA Enterprise Edition integration with Metro and Global Mirror	✓	✓	✓	✓
Enterprise class storage	✓	✓	✓	
Midrange class storage				✓
Virtualizes existing storage for higher utilization and ease of integration			✓	✓
Self optimizing grid architecture		✓		
3 site support	✓			
Lowest Global Mirror data loss potential (3-5 VS 20-30 sec typical)	✓			
Metro Mirror support for up to 300 km versus 200 typical	✓	✓	✓	✓
Efficient bandwidth utilization for lower bandwidth costs	✓			
Metro and Global Mirror across mixed storage types			✓	✓
IBM i support	✓		✓	✓
IBM z support	✓			
Integrated server and storage management (TPC + Director)	✓	✓	✓	✓
Extreme ease of use		✓	✓	✓

Source: IBM

reference architectures for both two- and three-site business continuity solutions. Obviously, the IT staff needs to complete a thorough risk assessment to determine which features of PowerHA to deploy.

PowerHA can meet any RPO requirement through *Metro Mirror*, with zero data loss over local distances (less then 300km). *Global Mirror* should be used to satisfy the enterprise needs for geographical dispersion over longer distances (many hundreds to thousands of kilometers or miles). Obviously, a major disaster (such as a flood or earthquake) could take down both systems in a Metro Mirror configuration, thus creating the need to consider a remote location.

DS8000

With an *IBM DS8000* deployed, the metro configuration can support a distance of up to 300km with no data loss and for global distances a data loss of three-to-five seconds. (See Exhibit 3, above, for a summary of the configuration benefits of each.) The DS8000 also is easy to implement and manage in a Global Mirror configuration. As a result, the lower data loss means a faster systems recovery in the event of an unplanned outage, with less potential impact on the bottom line because of less need for human intervention, thus lowering the TCO.

SVC

IBM's clustered and virtualized *SAN Volume*

Controller (SVC) system integrates with PowerHA for automated data protection and failover while also providing non-disruptive data mobility for storage system maintenance and ease of moving data between storage tiers without affecting applications.[16] PowerHA with SVC extends PowerHA support to over 100 third-party storage systems, lowering the TCO of PowerHA because customers can use their existing storage platforms. It also allows different storage configurations at the recovery site, removing the painful requirement to buy new storage of "the right kind". SVC also improves storage utilization by up to 30% and management productivity at all sites. TPC can be used to monitor and help optimize performance of the SVC environment.

V7000

IBM developed the *Storwize V7000* as a new, innovative unified storage architecture for midrange systems and endowed it with hardware and software innovations from a number of sources, including the integration of RAID code from the DS8000, solid-state disk drives (SSDs)[17], the

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[16] See *IBM Upgrades SVC with Solid State Drives - Achieves Better Storage Utilization* in the October 19, 2009, issue of **The Clipper Group Navigator**, available at http://www.clipper.com/research/TCG2009046.pdf.

[17] See the issue of Clipper Notes dated January 26, 2009, entitled *A New Tier of Storage Appears – Faster, Solid-State*

software stack from the *SAN Volume Controller* (*SVC*), and the graphical user interface (GUI) from XIV.

XIV

XIV has been designed to reinvent storage to enable higher utilization rates with less administrative effort.[18] XIV's tight integration with PowerHA EE is only supported with AIX (i.e., not on IBM i).

XIV supports thousands of space efficient snapshots, thin provisioning, and other efficiency features to deliver ultra-efficient storage solution. With its unique grid architecture, XIV is designed to provide high performance at greater than 90% capacity utilization. XIV also includes integrated advanced functionality features to support Metro and Global Mirror.

With its autonomic data layout across the grid architecture, massive parallelism, and Infiniband interconnections, XIV rapidly spreads data across all drives for full disk utilization with no manual intervention, no tuning, and no hot spots. With an easy-to-use GUI, XIV delivers rapid provisioning. IBM's latest Generation 3 XIV makes more efficient use of floor space and staff, with a four times increase in performance

ProtecTier

While not part of the core PowerHA solution, in terms of a fast recovery of backed-up data, IBM's *ProtecTier* data deduplication offerings can deliver restores quickly while keeping costs under control.[19]

Automation Makes A Difference

A successful recovery requires a high dependency on automation. With System Director and Tivoli applications, PowerHA provides exactly that. Even when key personnel with critical skills are not available, PowerHA can get the job done. This is good, even if they are available, because disaster recovery procedures executed by humans inherently are error-prone.

Conclusion

If you have a need for a robust high-avail-

ability solution, IBM's PowerHA and DR solutions may be right for you. IBM offers the breadth, depth, expertise, and experience necessary to help the enterprise construct and test a business continuity plan. It enables the data center to simplify the deployment of a high-availability architecture and to reduce the complexity of disaster recovery. It provides superior disaster recovery with a comprehensive, simplified solution that integrates and optimizes virtualization, systems management, storage, and availability. IBM's PowerHA delivers an unmatched ability to govern across the heterogeneous storage environment that is so common in larger data centers.

If you are the CIO of an enterprise with mission-critical applications and are operating in a Power Systems environment, you need to review the capabilities of PowerHA. It can enable your IT staff to reduce the time, effort, and cost of ensuring the availability of those mission-critical applications. If your business' mission-critical applications are not on Power Systems, you should make sure that they are protected adequately, or take a closer look at Power Systems, where a lot of needed integration already has been done by IBM.

Drives State Their Case, and available at http://www.clipper.com/research/TCG2009006.pdf.

[18] See **The Clipper Group Navigator** entitled *XIV Gen 3 – IBM Lowers TCO and Raises Performance and Functionality* dated August 5, 2009, and available at http://www.clipper.com/research/TCG2011028.pdf.

[19] See *Protecting Enterprise Data with ProtecTIER - Improving Recovery Time, and More* in the June 8, 2011, issue of **The Clipper Group Navigator**, available at http://www.clipper.com/research/TCG2011022.pdf.

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