Business continuity has historically been out of reach for small- and medium-sized businesses (SMBs) because it was too costly and complicated. While large companies could afford expensive fibre channel storage area networks (FC SANs), the highly trained staff to manage them, duplicate data centers, channel extenders, and expensive replication software, SMBs were restricted to making backup tapes and carting them to the storage administrator's basement for safe keeping.

Today that has changed, and organizations of every size can affordably build an infrastructure that offers all levels of protection without exorbitant costs or specially trained staff. Advanced functionality that was first developed for mainframe environments has been improved over time, making it available to UNIX, Linux, and Windows environments. As a result, company size and platform selection no longer determine functionality level. This is due to multiple technological advances – in particular intelligent storage, iSCSI connectivity, server virtualization, and wide-area network (WAN) acceleration.

And it's a good thing, because data is just as critical for SMBs as for large companies – and downtime can be much more damaging. This paper looks at how any company can create an affordable infrastructure that delivers the full spectrum of protection – from simple data protection to disaster recovery to business continuity.

THE STAGGERING COST OF DOWNTIME

In today's highly competitive business environment, data center outages can be devastating. Regardless of the cause – hurricane, fire, accident, hacker attack, or even terrorist attack – production downtime is not only costly, but in some cases ruinous. With a mobile workforce, global customers wanting to do business around the clock, and continually greater dependence on technology, companies need to not only protect data, but continue business operations virtually uninterrupted. The cost of downtime, depending on your industry, can be from thousands to millions of dollars per hour – due not only to disaster recovery expenses, but also to lost sales, customer defection, and lack of productivity. Add to that a damaged reputation in the marketplace and diminished shareholder confidence, and the cost of downtime can be staggering.

However, organizations that can continue business operations through any outage, large or small, can gain competitive advantage – and sometimes even take market share from competitors.

TAPE – GOOD FOR ARCHIVING, BAD FOR AVAILABILITY

Tape backup has been the most common protection solution for SMBs. And while tape backup remains a good long-term archiving method for most large and small organizations, numerous problems limit its usefulness. First, backup windows are shrinking – due to the huge growth in data volumes, requirements for longer retention and faster access, and generally greater reliance on data and technology. Second, because backup is not easy or quick, many organizations cannot backup often enough to adequately protect themselves – backing up once a week leaves a lot of data vulnerable. Finally, tape is not the most reliable medium – hardware failures, media failures, and human errors are common. Tape management is a constant IT headache and administrative costs are high.

Instead, organizations need a continuum of protection schemes that include storage array-based data protection, remote replication for recovery after a failure or disaster, and business continuity during outages and common IT maintenance procedures.

DATA PROTECTION

The first line of defense is to protect data where it is stored, and that means keeping storage units running as well as

providing safety features. EqualLogic arrays are fundamentally built to protect data with 99.999% availability. Redundant, hot swappable components – including disk drives, controllers, network interfaces, power supplies, and cooling fans – mean that component failure

does not result in downtime or data loss. A unique system monitors disk drives in the background to detect and correct problems before they occur; in addition, should a drive fail, a spare is automatically placed into service and configured. Disks and arrays "learn" the configuration from those already installed, so no administrator intervention is necessary. Controller caches are mirrored and battery backed, and various RAID levels are supported.

Of course, backup is a basic part of data protection – simply backing up to tape can protect you from complete data loss, although restoring from tape is time consuming, difficult, and unreliable. Disk-based snapshot functionality is a big improvement – snapshots are created quickly and easily without disrupting operations, and can provide multiple restore points to minimize lost work. Many organizations take snapshots and then run tape backups from them; this keeps data more available by virtually eliminating backup windows, and speeding restore, and minimizing errors.

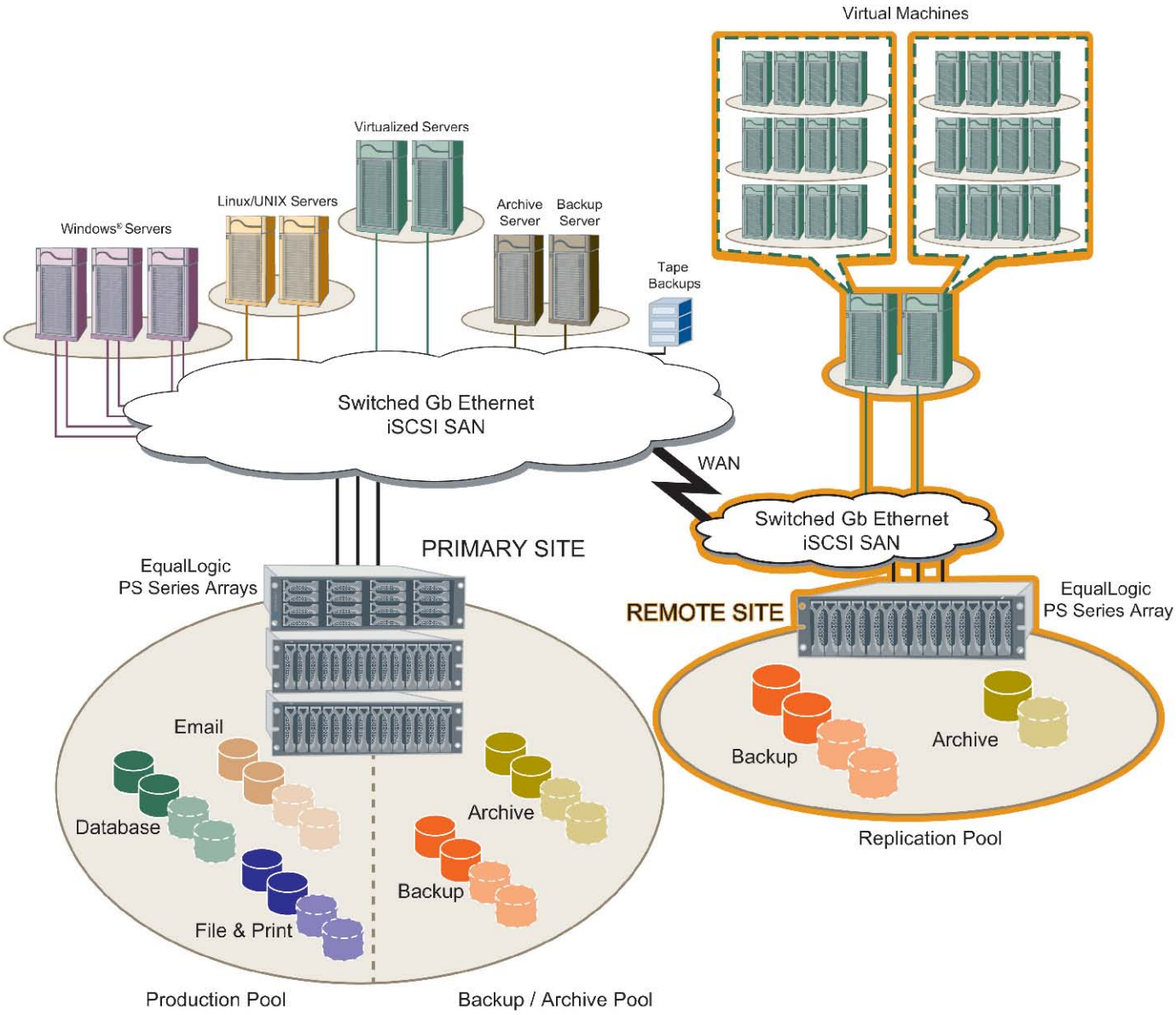
DISASTER RECOVERY

The focus on disaster recovery (DR) has been greatly magnified in recent years, largely in response to the devastating events of September 11, 2001. Beyond the human tragedy, that disaster demonstrated how vulnerable data and operations are, and how difficult it is to run a business when the technology infrastructure is compromised. Increasing virus and hacker attacks, hurricanes, and electrical brown-outs also remind us of how vulnerable our data is.

The keywords for disaster recovery are *copies* and *distance*. For DR, you must have more than one data copy, and copies must be stored some distance away from the primary data center on different physical machines – remote replication is the standard for DR. Today remote replication is available for iSCSI SANs, and doesn't use specialized equipment that fibre channel networks require. With iSCSI you can replicate data across standard IP networks and provide multiple replicas from various points in time. Now, should a virus corrupt data, you can almost immediately roll back to a previous replica to prevent data loss. Deciding how and where to replicate depends on your needs and your available locations. Some organizations will replicate from the primary data center to one remote location; others replicate the same data to multiple locations. Organizations with branch offices often replicate from each branch to a central DR site, and then backup data from there.

Configuring your DR implementation depends on two important factors that each organization must identify – recovery time objectives (RTO) and recovery point objectives (RPO). RTO indicates how quickly you can restore data – usually minutes or hours, and in some cases days. Some operations and data types may tolerate very little time to recover, while others can survive longer delays. RPO indicates how much data loss you can tolerate, and that determines how often you replicate data
– every hour, three times per day, etc. Many organizations define different RTOs and RPOs across the enterprise – uniformity is not important as long as you can easily and affordably match data types to protection levels.

EQUALLOGIC ENABLES BUSINESS CONTINUITY



BUSINESS CONTINUITY

Business continuity (BC) differs from data protection and disaster recovery because it describes not only a level of protection that speeds recovery, but also a strategy that makes recovery speed less important. With business continuity, it's not about how long it takes to get back in operation – it's about *staying in operation* regardless of the failure, outage, attack, or corruption. For example, if you have a duplicate data center at another location with data copies, you can quickly bring operations online at the new location.

Another way to continue business is with built-in storage features that minimize disruption during standard IT maintenance tasks. Because of EqualLogic's patented page-based volume management, data can be automatically moved *while it is in use*. This is an advancement of revolutionary proportions because it enables data movement without downtime. That means that capacity can be added or moved among storage tiers, and loads can be automatically balanced across all disks and arrays, without interrupting users – so IT can get its job done and enhance performance while business continues.

Common performance improvement tasks such as load balancing across disks and arrays are done automatically by the storage array – so not only is business not interrupted, but performance is optimized. With automatic disk sparing and multi-path I/O (MPIO), the array will automatically replace a failed disk or manage network throughput without intervention or downtime. These features add tremendous value during regular business operations, and can actually keep problems and accidents from becoming disasters.

BUSINESS CONTINUITY STRATEGIES AND TECHNOLOGIES

SMBs need the same full protection as larger organizations – but in addition, they need it to be easy to use, non-disruptive, and low cost.

Data center equipment costs have dropped sufficiently to make *duplicate data centers* possible for many more organizations today – for instance, EqualLogic's iSCSI arrays make remote replication much more affordable because arrays are not cost-prohibitive and software functionality is included. But what about servers? While physical server costs have dropped, the development of *server virtualization* has most dramatically altered the landscape. Products from companies such as VMware enable multiple virtual machines to reside on fewer physical machines – as a result, you can build a second data center without duplicating hardware. For example, your production data center may have 100 physical servers running business applications, with data shared on a SAN. At your secondary data center you can run those 100 servers as virtual servers, using only 10 physical servers, with each physical machine running 10 virtual machines. This enables your business to remain operational – it may not run at the same performance level, but you're still in business, and you didn't break the bank to get there. Some organizations simply could not have business continuity without virtual servers.

Server virtualization also lets you replicate multiple applications to the same target that normally wouldn't work well on the same machine. For example, you might replicate Lotus Notes, SQL Server, and Oracle servers to different virtual machines on the same replication target –

this costs much less than buying individual physical machines for each application. Different versions of the same application function the same way – Exchange 2003 and 2007 can both be replicated to the same target server, but to different virtual machines.

Virtualization also enables you to share data from a SAN and move virtual machines between physical servers to better manage applications – and you make these modifications without users even knowing it. For primary or remote data centers, this provides business continuity during maintenance and performance optimization.

STORAGE TIERING

Another key to keeping BC affordable is not treating all data the same. Instead of continuously replicating all data to a remote location on the fastest disks so that any piece of data is instantly recoverable, most organizations set up storage tiers – some data are replicated less often, to higher capacity (less expensive) disks with slower performance. Some data should simply be archived to tape – available if needed, but at low cost. Storage tiers should be linked to the business value of the data involved, the ability to re-create it, and the requirement for speedy access. Identify the required RPO and RTO for all data and set up tiers of storage and services that maximize utilization while lowering TCO. Also, today's technologies include single instance storage, enabling you to store only a single copy of identical data, such as email attachments that go to multiple mailboxes. This can streamline data movement and minimize bandwidth requirements for disaster recovery and business continuity.

WAN OPTIMIZATION

Bandwidth is expensive, and accounts for a significant portion of the cost of both DR and BC; in addition, bandwidth latency creates challenges for recovery and restore. These issues can impact the selection of remote sites, the amount of data that can be replicated, RTOs, and RPOs. However, today organizations like Riverbed and Cisco offer WAN acceleration and optimization technologies that enable you to replicate more data while increasing efficiency at very low cost. Using various compression, de-duplication, and optimization techniques, these solutions accelerate WAN traffic in ways that are significantly less costly than purchasing more bandwidth.

CLUSTERING, SAN BOOT, AND THIN PROVISIONING

Clustering servers is a way to create business continuity, as applications can be distributed across multiple nodes for performance optimization as well as failover. This is aided by SAN implementations, since data can be shared among servers. Booting servers from the SAN, another standard feature of PS Series arrays, also enables business continuity; if a server fails, another can be deployed immediately using the boot volume on the SAN. This feature also enables central provisioning and management of virtual machines, as well as implementation of diskless servers such as blades, making a robust infrastructure more affordable.

Thin provisioning is another strategy designed to prevent downtime by enabling applications to grow non-disruptively – IT can add capacity on demand up to pre-set limits. For systems that don't have online expansion, IT can allocate virtual disk capacity up front but not logically provision it – as a result, applications can grow when needed without downtime by allocating increments of actual capacity on demand from a free pool. This strategy does require some

diligence since real and perceived capacity limits are not the same.

BUSINESS CONTINUITY FOR ALL

An enterprise-level storage infrastructure that provides data protection, disaster recovery, and business continuity is affordable today with EqualLogic. iSCSI connectivity means your SAN uses standard Ethernet instead of a complicated and expensive Fibre Channel network. This makes the array itself much less expensive, so you can apply the savings to bullet-proof DR and BC implementations. iSCSI also eliminates the need for IT staff to be specially trained in a new network protocol – you can leverage the skills of the staff you have.

Equally important to business continuity, load balancing and other management tasks are handled *by the array*, not by administrators. Continuously monitoring itself, PS Series arrays allocate disk space – along with connectivity, security, and performance – dynamically for every application as needed. This proactive management helps to prevent downtime and keep business applications running.

Remote replication can be done over the WAN without expensive add-on components like channel extenders. You can replicate between PS Series arrays using Ethernet without buying additional software and licenses for various machines, because PS Series arrays come with all functionality included already. All of the management and protection features described here come standard with all arrays.

Because EqualLogic PS Series arrays include all this advanced functionality, upgrading from DAS can provide you with data protection, disaster recovery, and business continuity capabilities all at the same time. You don't have to think of building a BC infrastructure over time – when you install a PS Series SAN you get all the capabilities in one box, at an affordable price.
There is no software to add on, and as new capabilities are developed they are delivered to EqualLogic customers. This is a fundamental difference from many storage vendors who charge for add-on software to provide snapshots, replication, and other features.

Features such as these make business continuity a reality for organization of all sizes, with pools of storage, server power, and network bandwidth operating almost like an integrated business utility. A few years ago this kind of environment was reserved only for the very largest, wealthiest organizations. Today, this bullet-proof BC infrastructure is available and affordable for organizations of all sizes.

Now that's progress.

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