# StorMagic

White Paper
Modernize your IT with unprecedented flexibility, efficiency and performance

SvSAN is a software-defined storage solution designed to run on two or more servers. It is uniquely architected with the combination of a light footprint, availability out-of-the-box, uncompromising performance and centralized management deployment across a remote and branch office environment.

SvSAN eliminates the need for a physical SAN which are costly, complex and present a single point of failure. With high availability out-of-the-box business critical applications and IT services suffer no downtime and the removal of a SAN along with the low cost of commodity servers and storage lowers IT acquisition and operating cost. Thousands of large organizations and SMEs across 72 countries have already chosen SvSAN to modernize their IT infrastructure.

SvSAN supports the industry leading hypervisors, VMware vSphere and Microsoft Hyper-V. It is installed as a Virtual Storage Appliance (VSA) requiring minimal server resources to provide the shared storage necessary to enable the advanced hypervisor features such as High-Availability/Failover Cluster, vMotion/Live Migration and VMware® Distributed Resource Scheduler (DRS)/Dynamic Optimization.

SvSAN can be deployed as a simple 2-node cluster, with the flexibility to meet changing capacity and performance needs. This is achieved by adding additional capacity to existing servers or by growing the SvSAN cluster, without impacting service availability. A typical 2-node SvSAN configuration is shown below:
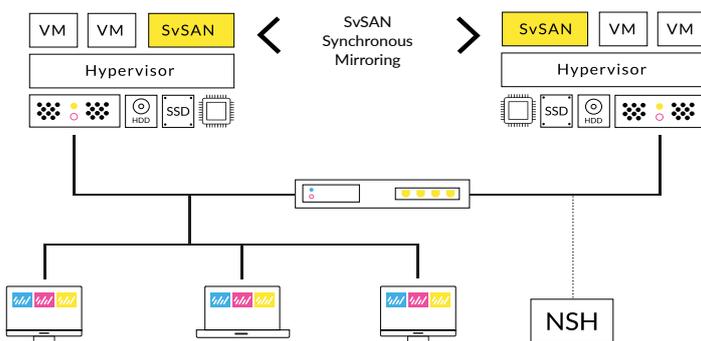
Common IT Challenges

All over the world, organizations, big or small face similar challenges, to deliver IT to support their core business, these are:

Challenge #1 – Reducing cost and complexity
Multi-site enterprises and SME organizations need to keep the IT infrastructure footprint to a minimum with lower storage capacity requirements making the option of external SAN overkill adding unnecessary cost, complexity and a single point of failure.

Challenge #2 – Delivering application performance
Poor performance associated with accessing data over a high latency, low bandwidth network link could lead to unacceptable processing delays, contributing to a poor customer experience. Traditional applications in verticals such as retail, manufacturing and healthcare are now being joined by the new breed of IoT applications at the edge of the network where significant processing of data is required away from the data center.

Challenge #3 – Simplifying and centralizing management
ROBOs lack local skilled IT staff, with organizations preferring to centralize this function at head office or the data center. Maintaining IT infrastructure at remote sites becomes increasingly challenging and impacts the ability to scale and recover from outages.

Challenge #4 – Ensuring application uptime
IT equipment failures lead to IT services outages resulting in loss of revenue, reduced productivity and lower customer service levels. The ability to avoid outages when there is a critical systems failure ensures IT support teams can stay focused on delivering the best possible SLAs to their customers and not reacting to every fire that needs to be extinguished.

SvSAN has been designed and developed to address these challenges to deliver a resilient, cost-effective shared storage solution.

SvSAN Target Use Cases

Large enterprise organizations with multiple (tens to thousands of remote locations) or small to medium size enterprises (SME) that have fewer, but larger remote office, branch office (ROBO) locations have a requirement for IT at the remote sites to run business critical and/or time sensitive applications.

Although the IT requirement to support these applications at the remote sites may be small compared to those at the data center, they still require the same levels of resiliency, availability, and performance. Factors of cost, complexity and physical space, make it impractical to use the same type of infrastructure (storage arrays, switches, etc.) as that deployed in the data center.

As a software-defined storage solution, SvSAN is a commonly deployed as a 2 server configuration to deliver highly available shared storage that benefits any application where performance and high-availability are important. The applications broadly fall into one of 3 categories:

Back office applications – the non-customer facing applications that are required to support the running of an organization, including:

- Email & collaboration
- Document management (file & print)
- Desktop/application virtualization
- Network services (DNS)
- Domain controllers for user authentication

Line of business applications – the applications that relate to an organization's specific industry and are critical to the running of the business, these include:
- Point of Sale (POS) for retail
- CCTV/Video surveillance, Workforce management (Timekeeping & manpower scheduling)
- Inventory/stock management,
- Enterprise Resource Planning (ERP) in manufacturing to deliver workflow management and quality control

Internet of Things (IoT) - The Internet of Things, connects hundreds or thousands of devices together using a network. IoT spans multiple industries and uses, including Supervisory Control And Data Acquisition (SCADA) systems, process control, building automation & environmental management (HVAC) and transportation. Each device generates vast amounts of data and the volume, velocity, criticality and time-sensitive nature of the data requires it to be stored and processed at the remote locations.

- Volume & Velocity
IoT solutions generate large amounts of data, this coupled

with poor network connectivity (low bandwidth, high latency) to remote sites, means that central data centers or cloud based repositories cannot be used to store all the data, as there is too much data to be transmitted over the network. Instead, the data should be stored and processed at ingress with only the important, processed data being transmitted to the central location for further analysis.

- Criticality & Time-sensitivity
The criticality of the data produced requires a resilient, highly available solution as downtime could result in gaps in monitoring or worse still lost production. For some IoT applications such as manufacturing or chemical processing, the time-sensitivity of the data requires immediate local processing to ensure the efficient running of machinery, WAN connections could introduce significant processing delays making processing at a central location unviable.

Introducing SvSAN 6

When server virtualization introduced, its intention was to consolidate multiple server workloads onto fewer physical servers, driving up the CPU utilization and making efficient use of space, power and cooling. As hypervisors evolved to include virtual machine mobility and high availability, shared storage became a requirement. Traditionally the storage was provided by large, expensive monolithic SAN arrays that required specialist skillsets, consumed large amounts of data center space and power making server virtualization unsuitable for small or edge of the enterprise environments.

StorMagic SvSAN 6, a software-defined storage (SDS) solution that has been built from the ground up to address the challenges of remote IT previously mentioned, by delivering unprecedented, flexibility, efficiency and performance.

StorMagic SvSAN 6 delivers unprecedented Flexibility, Efficiency and Performance to modernize your IT		
Flexibility	Efficiency	Performance
Any storage combination for any requirement	*Save time, money and reduce your carbon footprint*	*Designed for the most demanding applications*
Automatically tier the ideal balance of disk, flash, and memory	Leverage advanced storage auto-tiering tpo configure the lightest server and storage footprint	Remove costly and complex storage arrays for your most demanding applications
Tune for raw performance, high capacity and the smallest footprint	Reduce CAPEX and OPEX through lower cost and more reliable hardware with improved management	Dramatically increases IOPS and throughput for most intense applications
Configure for today's needs and easily adapt to future demands	Reduce space, power, and cooling requirements	Significantly reduce latency for transaction intensive applications

SvSAN efficiently delivers highly available shared storage using a minimum of two commodity servers with internal disk drives, eliminating the need for SAN/NAS/external storage.

This reduces the overall solution complexity (simpler cabling and configuration), removing single points of failure and the need for specialist skill sets associated

with SANs all for the fraction of the cost of a storage array. Having lower system requirements (CPU and memory) compared to other SDS solutions this enables more system resources to be dedicated to application virtual machines.

Compute and storage can be grown independently. Storage capacity can be scaled up by simply adding more or larger capacity disk drives to the existing servers. Alternatively, the solution can be scaled out by adding more servers to the cluster, increasing compute and/or storage capacity.

Flexibility

SvSAN is capable of using any disk device, including hard disks, solid state drives (SSD), PCIe flash and NVMe, which can be configured in any combination to provide numerous deployment options to suit any businesses storage requirements, from hard disk only configurations using high capacity SATA drives that provide the lowest cost per GB to all flash/SSD configurations that deliver lightning fast, low latency performance.

When there are variable and unpredictable workloads requiring large storage capacity, hybrid storage solutions that blend a mix of memory, SSDs and hard disks with intelligent auto-tiering software can often deliver the required performance and capacity at a lower cost per GB.

This hybrid approach provides a more cost effective option to deliver both capacity and performance the capacity as it benefits from the capacity and low cost per GB of a hard disk solution coupled with the performance characteristics of memory/SSD/flash, reducing the latency from tens of milliseconds to sub-millisecond and increasing the overall performance of the solution.

	Disk Only	All Flash	Hybrid with memory caching
Latency	High	Low	Low
Capacity	High	Low/Medium	High
Performance	Low/Medium	Medium	High
Cost per GB	$	$$$	$
Cost per IOP	$$$	$	$

SvSAN 6 Advanced Edition caching and tiering features enable hybrid storage solutions to be easily built and is achieved by adding a small amount of RAM and/or flash acting as an acceleration tier to hard disks. The intelligent caching and tiering algorithms utilize the different storage tiers efficiently, ensuring that the most frequently accessed or "hot" data remains in cache, while the "cold" data is moved to lower storage tiers (hard disk).

Future proofed solution

As SvSAN is software, additional features can easily be added through firmware upgrades rather than having to "rip and replace" hardware, ensuring that the storage solution is futureproofed and always ready to meet the businesses storage requirements.

SvSAN can be configured for today's needs and easily adapt to meet future demands

Efficiency

The ability to deliver highly available, shared storage solution out-of-the-box with just two servers, coupled with the SvSAN 6 intelligent auto-tiering feature to create hybrid storage solutions, means that smaller, lower-cost servers can be used as the solution require fewer disk devices, this not only reduces both the CAPEX costs associated with server acquisition and OPEX costs related to power, cooling and maintenance, but also improves reliability and reduces the risk of a disk failure as there are fewer to fail.

In addition to the advanced caching features, SvSAN 6 also includes enhancements that simplify the deployment and upgrades of the software, including:

• **Multiple VSA GUI deployment & upgrade**
SvSAN 6 includes the ability to deploy multiple VSAs through a single wizard, reducing the time to deploy SvSAN. In addition to initial deployment, enhancements have been made to the StorMagic dashboard enabling multiple VSAs to be upgraded at the same time. Firmware is selected from a repository and installed onto multiple VSAs. This can be installed immediately or staged where the firmware is uploaded to the VSA in preparation for a later upgrade, for example, out-of-hours. SvSAN handles the dependencies and performs a health check ensuring that there is no impact to environments during upgrades.

• **Automated PowerShell script generation**
When deploying SvSAN via the GUI it is now possible to automatically generate a custom PowerShell script. These scripts can then be used for mass deployments for large environments removing the need for user interaction.

• **VSA OOBE (Out-of-box Experience)**
The OOBE allows SvSAN to be pre-installed on a server at a central staging site. Once the servers are installed onsite the VSAs can be discovered and configured with the site-specific information through the GUI or scripting. This reduces the time to install SvSAN on a server over poor WAN connections.

Performance

SvSAN 6 includes a number of I/O acceleration features such as write-back caching, predictive read-ahead algorithms and data pinning features.

SSD Write-back caching

The write-back caching feature uses a solid-state disk (SSD) to act as a cache for slower, low-performance hard disk drives and is suitable for read-intensive workloads. All data is initially written to SSD, providing low latency and improving application response times for random I/O workloads. Data is efficiently de-staged from the SSD to the final storage location at a later time.

Subsequent reads of data previously written to the SSD are read from cache, further reducing the number of I/Os going to the hard disks. Caching is enabled on a per target basis allowing users to select only the targets that need to benefit from I/O acceleration, ensuring that only important data is accelerated.

Predictive read-ahead

The predictive read-ahead algorithms are used to detect sequential read I/O patterns, with the primary goal to reduce hard disk head movements and reduce I/O latency. On identifying sequential read patterns, additional related data is pre-fetch from disk into memory prior to, ensuring that any subsequent reads are satisfied from memory without accessing disk, resulting in lower access times.

Data pinning

The data pinning feature allows data to permanently reside in memory. Data pinning has a "learning" mode which records all the access data blocks, these are stored in a "pin map". These pin maps are used to load the data from hard disk into memory prior to use ensuring that the data is always available in cache providing the best performance for specific workloads. This can be used for repetitive workloads such as system boots or end of month processing.

Independent Performance testing

The Enterprise Strategy Group (ESG) lab tested the performance of StorMagic SvSAN SSD caching with the industry-standard IOmeter utility that emulated a typical multi-user OLTP database workload . A pair of eight core servers with four 1TB SAS drives and two 20GB volumes, one for the database and the other for database journaling were tested in a VMware environment as shown in the diagram, which illustrates how SSD caching improved performance. Adding a single 480GB SSD improved performance up to 11 times compared with the all-disk configuration with no caching.

A summary of the results shown in the table indicates that adding a single SSD with StorMagic SvSAN SSD caching improved the overall performance capacity of the storage infrastructure up to 11 times with up to 11 times faster response times.

	All-disk (No caching)	Hybrid Cache (Starting)	Hybrid Cache (1.5 hours later)	Delta
IOPS	468	1,200	5,021	2 to 11 times more
DR response	35.48ms	13.24ms	4.07ms	3 to 9 times faster
Journal response	56.20ms	5.05ms	2.25ms	11 to 25 times faster
Blended response	36.26ms	9.15ms	3.16ms	4 to 11 times faster

The results also show how database journal response times were improved even more: up to 25 times faster. Accelerating journaled updates translates directly into faster performance for interactive database users due to the fact that most multi-user applications are blocked until journaled writes have been safely committed to storage media, in this case, high-speed flash SSD.
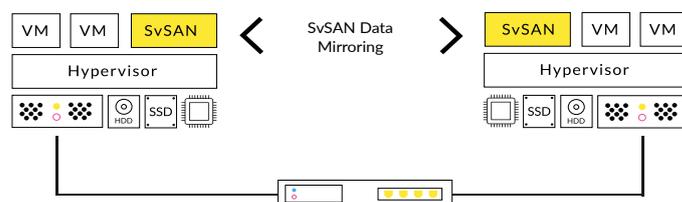
SvSAN server configuration

It is possible to build your own SvSAN storage solution using just a pair of commodity x86 servers from any server vendor with internal storage. The SvSAN software provides the storage features and creates highly available shared storage.

Having low system requirements, SvSAN ensures that the majority of the server resources are dedicated to running business applications rather than delivering the storage functionality:

CPU	1 x Virtual CPU core
	• Ideally 2GHz or higher reserved
Memory	1GB RAM (Additional memory required when caching is enabled)
Disk	2 x virtual storage devices used by VSA
	• 1 x 512MB Boot device
	• 1 x 20GB Journal Disk
Network	1 x 1Gb Ethernet
	• Multiple interfaces required for resiliency
	• 10Gb Ethernet is supported
	• Jumbo frames supported

[1] Workload details: 8 KB, 80% read, 20% sequential, 16 outstanding I/Os for the database volume; 8 KB, 100% sequential write, 1 I/O outstanding for the journal volume; IOmeter version 1.1.0 testing was performed at the physical disk/raw device level on iSCSI direct mapped volumes.

[2] Test bed details: 1U server with eight core Intel Xeon X5-2500 CPU and 64 GB RAM, VMware ESX v5.5 hypervisor, Windows 2012 guest OS, WD Blue 1TB 2.5" SATA HDD, Samsung Enterprise PM863 SATA 480GB SSD, RAID-0 with synchronous mirroring between a pair of servers.