Hitachi Virtual Storage Platform G1000:
Pushing the Functionality Envelope

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April 2014

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Business Demands Driving Software-defined Capabilities

Business—and therefore IT—demands are tougher and more stringent than they have ever been. Change is a constant, leading IT organizations to look for ways to be more agile in order to maintain their place in the market. From business to IT to storage, data volumes continue to grow unabated, making the management of data growth a perennial top challenge reported by respondents to ESG’s annual IT spending intentions research.¹ (The importance of this data growth can be divined by “the company it keeps:” other top priorities reported by respondents revolve around server virtualization, information security, and data protection.) And on top of all this, everything is moving faster—to the point that the consumers of IT services have come to expect that anything they ask for can be delivered (effectively) instantly. And why shouldn’t they? Their tablets and smartphones provide access to seemingly any information instantly, in the palms of their hands, wherever they are. They enjoy mobile and stationary computing devices with ridiculously fast processors, along with flash, solid-state disk drives, and the constant advertising chatter about whose network is the fastest. We live in an entitled society, with immediate gratification and service as its watchwords.

You can see some of this general change in popular culture. Some may remember (the authors of this paper do!) how members of the “younger generation” in the 1970s/80s were teased that because they spent so much time watching 30-minute sitcoms they could no longer focus for more than half an hour. Today, that’s been reduced to a focus of 140 characters in a Twitter post. The speed of information access makes users intolerant of any delay, much less actual downtime.

What has happened is that tremendous technology advancements and user expectations are driving each other in a circular manner. The more responsive IT can be, the higher the user expectations. Consequently, the business of today demands continuous uptime, instant communication, and rapid responsiveness, along with access to numerous applications and terabytes of data, all of which must be delivered cost efficiently. This has key implications for IT infrastructure and services:

• Traditional infrastructures are simply not up to the task; they invariably have some mix of information silos, labor-intensive processes, and the inability to share resources...all of which impede productivity.
• Only virtualized resources and cloud-type deployments can deliver on all the objectives: giving business managers the application and data access they need to be productive, enabling IT to deliver services on demand with the agility to avoid business disruption, and assuring the CFO of cost optimization based on actual need rather than best guesstimates.

These realities have created the need for—and are beginning to drive us toward—a more “software-defined” world focused on shared resources and IT-as-a-service. That has inevitably led some commentators and IT users to conclude that hardware is less important, but ESG would argue the opposite. It’s not a zero-sum game; in fact, it becomes even more important to be certain that the hardware foundation can handle all the software-defined functions, IT services, and SLAs that will be built upon it today and tomorrow.

This paper will outline the demands on IT and storage today, and discuss how the latest Hitachi Data Systems (HDS) enterprise storage offering, Hitachi Virtual Storage Platform (VSP) G1000, delivers not just another storage solution, but a holistic storage platform for the future that serves high-end needs.

Storage Needs in the New World

First, don’t confuse “high-end needs” with the idea that this is a product for only large data centers with massive storage capacity needs and deep pockets. Although there were days when only the giants of any industry needed “enterprise-class” features like ultra-high availability, sophisticated flexibility, and fast performance, it’s hard to find any organization that doesn’t need these features to remain competitive today.

To accomplish their competitive goals, organizations require that their mission-critical, smarter storage systems meet the same agility objectives as their virtualized server infrastructures. Enormous scalability is important for

handling (potentially) massively growing data volumes, but it’s about a lot more than just scale. Storage systems must be highly available, extremely “business-malleable” (by which we mean a mix of responsive and automated, with an extensive range of advanced functionality), and highly reliable, particularly when talking about converged and consolidated systems. In a traditional, “one-application/one-server” environment, a host failure only impacts a single application. Today, with applications and data virtualized and consolidated on shared servers and shared storage, any failure can impact multiple parts of the business at the same time. So downtime for backup, storage maintenance, upgrades, etc., is a real hardship. You can have all the redundancy and high availability you want built into your networking and computing systems, but who cares a jot about that if your data isn’t accessible?

ESG research bears this out. When asked to identify up to five features that they would classify as “must have” when purchasing a storage system, high availability topped the list by a wide margin, with 59% of respondents citing it (see Figure 1). The lack of tolerance for mission-critical application downtime and application consolidation with server virtualization make high availability essential.

**Figure 1. “Must-have” Storage Features and Capabilities**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Percent of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>High availability</td>
<td>59%</td>
</tr>
<tr>
<td>10 Gigabit Ethernet support</td>
<td>41%</td>
</tr>
<tr>
<td>Data reduction technologies</td>
<td>37%</td>
</tr>
<tr>
<td>Storage tiering</td>
<td>33%</td>
</tr>
<tr>
<td>Unified storage</td>
<td>23%</td>
</tr>
<tr>
<td>Fibre Channel over Ethernet (FcoE) support</td>
<td>22%</td>
</tr>
<tr>
<td>Flash-based solid-state drives (SSDs)</td>
<td>22%</td>
</tr>
<tr>
<td>Read-write snapshot</td>
<td>21%</td>
</tr>
<tr>
<td>Synchronous replication</td>
<td>19%</td>
</tr>
<tr>
<td>Remote monitoring/management capabilities via tablet</td>
<td>18%</td>
</tr>
<tr>
<td>Thin provisioning</td>
<td>16%</td>
</tr>
<tr>
<td>Asynchronous replication</td>
<td>16%</td>
</tr>
<tr>
<td>Read-only snapshot</td>
<td>15%</td>
</tr>
</tbody>
</table>

*Source: Enterprise Strategy Group, 2014.*

This is a key reason that cloud approaches are proliferating. The only way to keep the business productive all the time, regardless of what IT or other departments are up to, is with fluid, virtualized assets that can be swapped in and out as needed. This type of environment needs to support heterogeneous storage assets, with policy-based management automation, to enable the on-demand IT services for users and high utilization rates that ensure the lowest total cost of ownership.

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3 By “cloud approaches,” we mean the flexible, on-demand consumption of varied IT resources; this can be provided via a public cloud, on-premises as a private cloud, or via a hybrid of both.
Given this, it’s no surprise that data centers are morphing from physical rooms with walls into virtualized pools of resources at multiple locations. But while the resources may look amorphous to the user, the physical assets are critically important as a delivery mechanism for all these virtualized services.

Storage devices that are not up to the tasks at hand—such as continuous availability, non-disruptive operations, ultra-high performance, and high economic efficiency—can actually hold a business back.

In the past, infrastructure capabilities dictated service levels and business functions; 20 years ago, line-of-business managers understood and accepted the limitations that infrastructure placed on them. A new application could be launched in a couple of months (or more!) after the server and storage procurement, testing, and implementation processes. But today, that kind of delay is untenable.

Similarly, those organizations that were taking the time to back up their data knew that eight to 12 hours of nightly downtime was a fact of life, and they had to work around it. That simply will not suffice in the majority of contemporary business environments.

Speaking of protecting the data “crown jewels,” in those bygone days, more organizations than we might like to admit actually considered backup and data protection to be optional—or at least “best efforts”—and they could/did suffer from outages that would result in days, weeks, or months without certain data access. That’s hard to imagine today, when the cost of downtime drives massive availability efforts. Even a few hours of downtime can have disastrous consequences; the competitive landscape will not permit it. In many industries, the inability to rapidly resume operations after an outage can drive a company into bankruptcy. This is why in many industries, such as healthcare and finance, regulatory compliance requirements mandate levels of availability and performance.

The risks of, and from, data loss and downtime are enormous. Minimizing risk is therefore a key part of the IT function, as well as a real motivator for the CIO/CXO. While functional advances are desirable and can deliver value, the need for broad infrastructure confidence is paramount; indeed, when ESG asked about what criteria are important when selecting storage solutions and vendors, IT professionals cited service and support second only to the total cost of ownership. 4 This is logical, given that having a trusted vendor with experience in solution delivery and a history of great support is essential for mitigating risk.

Adding up all these requirements shines a light on the struggles of today’s IT organizations. How can you deliver “business-defined IT” services with an infrastructure built for a different paradigm? 5 It’s bleeding the life out of IT and cash out of the business. Trying to configure and manage multitudes of different infrastructure components and processes to provide for stringent availability, scalability, and performance demands is extremely complex. It takes a lot of IT staff time and effort, and only gets worse as data volumes grow. As a result, while it is trying to deliver on-demand services defined by the business, IT must also focus on how it can be more efficient. As Figure 2 shows, in ESG’s 2014 IT Spending Intentions Survey, return on investment (ROI) was the most-cited consideration for justifying IT investments at 38%, while reducing OpEx and business process improvement were very close seconds with 37%. 6

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4 Ibid.
5 “Business-defined” is a term that HDS has begun to use; it seems appropriate and apposite here, so we have included it.
There’s no question that software can deliver many of the functionalities that make today’s virtualized data center operate effectively. And to continually enable the improvement of both efficiency and effectiveness, this software must constantly be capable of evolving and of being applied to systems non-disruptively. Furthermore, as noted earlier, ESG believes that there must be a partnership of advanced software functionality with a rock-solid hardware foundation. Only in this way can users truly “push the envelope.” And if this sounds unsettling, then the last, crucial piece of the puzzle is to have the comfort level that comes from trusting an experienced vendor with proven support to provide these foundational elements.

HDS: Extending Enterprise-class Software and Storage

HDS has a reputation as an enterprise-class solution vendor of “rock-solid” storage systems; it’s in the company’s DNA. Since Hitachi Lightning 9980V a decade ago, it has gradually added both scale and sophistication as its offerings graduated to Hitachi Universal Storage Platform (USP) and USP V, and then to the initial Hitachi Virtual Storage Platform (VSP) just a couple of years ago.

Although HDS does not always make as much noise as other vendors (or indeed as it justifiably might), it has a loyal—and indeed growing—base of committed users. These users have always benefitted from an expanding range of sophisticated data management tools (ranging from dynamic tiering and thin provisioning to wide striping, WORM, and data encryption) provided on one platform. The USP and VSP are able to manage heterogeneous platforms from other vendors and serve mainframe environments just as well as standard Windows/Linux and now open source platforms. HDS refers to “3-D Scaling” by which it means the ability to independently scale up (performance), out (capacity), and deep (to other tiers and even to integrate other external storage types). The Hitachi Command Suite is the management hub and offers a full suite of alphabet-acronym-administrative functions from QoS, SRM, and BC through to SLO, RPO, and RTO.

The latest version of this successful genus from HDS is the recently announced Hitachi Virtual Storage Platform G1000. But this isn’t like a typical product announcement because it adds more than just new storage features; it introduces what HDS likes to call a “perpetual storage platform” for the future. (That said, in the more traditional speeds and feeds compartment, it does make a splash, too, by delivering 4X the internal bandwidth, 3X the IOPS, and double the cache capacity when compared with the previous VSP!)
Before delving into some more key details, a few high-level comments are important. While many still think of HDS only in terms of large deployments, the VSP G1000 is available for a range of deployments, from small to extremely large—and part of the reason for that is how much functionality is software-based. In addition to being deep in terms of solution sizing, it is also a broad solution across workloads; it can be used for block, file, and object storage; flash-only for performance-focused workloads; or indeed mainframe. And it can support workloads across sites and geographies (hence the “G” in its product name, which stands for global). So no matter what workloads you want to support, there’s probably a VSP G1000 for you. While the broad range of supported workloads is not particularly new, the “deep” message (encompassing entry-level to large enterprise) is a bit of a shift for HDS. The key is that it’s not just the VSP G1000, but its new Hitachi Storage Virtualization Operating System (SVOS) and updated Hitachi Command Suite management tool that work in concert to deliver this holistic tool.

The Basics: Hitachi Virtual Storage Platform G1000

Let’s start with some nuts and bolts. And while that sometimes can be read as “here are the speeds and feeds; it’s your choice whether you bother to pay attention to them or not,” it’s important to remember something that was stated earlier. The software capabilities of any system today are enormously important. But if the hardware cannot support what these capabilities offer, they’re of little use. Do you really expect a fancy computerized engine and navigation system to turn your old clunker with 200,000 miles on it into a transcontinental transportation option? The point is: Without hardware that is purposefully designed to gracefully handle the scalability, performance, and agility that your business demands, all the software you can throw at it won’t make a difference. So we’ll touch on a few of the highlights of this significant announcement.

The VSP G1000 delivers more than 3X the raw performance of the previous VSP, at more than three million IOPS per system. This is key because storage I/O really matters. For virtualization and cloud deployments, storage I/O is a true business enabler. Consolidated workloads create an “I/O blender” effect that is very hard on a traditional storage system and can often result in a storage bottleneck. So having three million IOPS at your disposal is a huge advantage. In terms of file workloads, the system has demonstrated 1.2 million NFS operations with Hitachi NAS Platform (HNAS), another impressive statistic, illustrating how this high-performance platform can deliver for file workloads that require the utmost responsiveness. And speaking of HNAS, VSP G1000 supports up to eight nodes per cluster and up to 16PB of usable capacity, in 256TB file systems pools, all in a single namespace.

Another key performance feature is the integrated flash acceleration and tiering. Hitachi has built an embedded flash memory controller specifically for the most demanding workloads: Hitachi Accelerated Flash. It can deliver equal or greater performance than commodity solid-state drives, yet at a lower price per gigabyte. And it adds punch to the application QoS focus.

In addition, VSP G1000 enables workload consolidation with massive scalability that can enable increased VM density. You can have a system with up to 16 virtual storage directors and 2TB of global cache. This means you have fewer systems to buy and manage, reducing both CapEx and OpEx. Consolidation occurs on the storage side as well as the server/system side: Because the storage controller clusters deliver central storage services, you can manage all data types (block, file, and object) and storage types (HDS and other) together. By matching storage tiers dynamically to application data, you can optimize performance and cost, and do it all on the same platform. It’s IT services, with delivery made easy.

If you don’t have—or want—all your IT consolidated in one physical place, the integrated active mirroring capability ensures that you can provision and manage active-active volumes up to 100 km apart (and enables remote replication). Not only does this reduce the TCO for high-availability environments such as Oracle RAC and VMware Metro Cluster, but it also enables levels of scalability and easier management than point solutions while improving quality of service. Another way the solution reduces operational risk and ensures high availability is with storage-based failover for active-active hypervisor site protection, ensuring integrated data protection for any hypervisor.

In cloud environments based on virtualization, VSP G1000 integration with VMware and Microsoft virtualization product platforms ensures visibility from each VM to the storage LUN. Built-in integration with VMware VAAI, VMware SRM, and Microsoft VSS ensures integrated data protection that is essential to availability and uptime.
The last feature that we will mention here (every detail is available on the HDS website) is the power efficiency, smaller footprint, and reduced power per terabyte of VSP G1000. These support both lower TCO and environmental objectives. In addition, controllers can be separated for optimized use of data center space.

**Key Capabilities**

So what can you do with all of this? What does all this technology mean to the professional IT user? Some of the highlight elements and implications are:

- **The key enabler of much of this functionality, today and in the future as additional features are rolled out, is the Storage Virtualization Operating System.** It enables the complete separation of host and storage, regardless of connectivity, system type, location, or vendor, and creates a continuing storage—or indeed business—infrastructure. So, regardless of where the data is or what hardware it’s on, you get one view of all virtualized storage assets. You can provision and manage it all, regardless of data type, from one place. You can also logically group storage resources with business applications that rely on them, making it easier to configure, report, replicate, and migrate when you need to—you don’t have to go searching for what goes with what.

- **Policy-based automation** makes deployment and ongoing management faster and more efficient. It also makes it easy to dynamically align storage resources according to business needs, while maximizing ROI on your storage. Without data silos and virtualization islands, an organization gets the agility to scale in whatever direction it wants, with whatever assets it has, at whatever time, and in whatever location it wants. Today, Acme Corp.’s IT department may have Hitachi storage in its Chicago headquarters, and EMC and IBM in its Buffalo, Kansas City, and Sacramento branch offices, along with interoperability and sharing challenges. With VSP G1000’s automated global virtualization capability, location, vendor, and type are irrelevant—it’s just Acme. This enables IT to focus on service delivery instead of infrastructure management, and enables continuity of operations with the least complexity and disruption.

- **Unified management**, a key part of VSP G1000, is essential to keeping costs down. If you can consolidate workloads to save on the power and cooling of data center floor space, you optimally also need to consolidate management to reduce administrative overhead. VSP G1000 has integrated Hitachi Storage Navigator setup tasks into the Hitachi Command Suite console, bringing together setup and ongoing operations in one application. Consolidated user resource management and task lists reduce both OpEx and training costs. With the global virtualization capability, Hitachi Command Suite does all the discovery and management across heterogeneous storage resources—HDS and other vendors—aligned by business groupings. Provisioning, monitoring, keeping storage attributes (like performance and cost) in sync with application requirements, and administering data protection is all done by Hitachi Command Suite, as is the tracking of storage usage and costs for chargeback/show-back.

- Another capability that SVOS makes possible is **non-disruptive data migration**, which is built natively into the storage controller in order to avoid an appliance model (and the negative performance, operational, and financial implications that can accompany it). One of the biggest pain points for IT is to move data to grow/replace/upgrade the storage domain or add systems/features. Data migrations require downtime, bring in a risk of data loss, and are a cumbersome and disruptive activity, whether you do them yourself or get professional services. With VSP G1000, data migration can be automatically executed transparently to the application using Hitachi Command Suite (and if it’s an HDS-to-HDS migration, it’s fully non-disruptive, with minimized disruption otherwise). This makes migrations faster and easier, while maintaining RPOs and RTOs for disaster recovery.

- **Automated tiering of both block and file data** means IT organizations can place data on the right storage according to performance policies and still minimize costs. **Hitachi Dynamic Tiering** and **Hitachi Tiered Storage Manager** enable the automatic tiering of internal and external data—including multivendor and mainframe. This capability can deliver on the service levels that you need without operational effort and expense, so your agility and efficiency do not come at an additional cost.
All of this is wrapped in powerful management functionalities that are built into the platform and delivered by Hitachi Command Suite. The end result is a holistic, complete cloud-style storage infrastructure that is always on and automated, and that allows users to even enjoy self-service.

The total VSP G1000 package is a storage and data management solution that fits right at the intersection of software-defined storage, storage virtualization, and the powerful physical fundamentals required to make it all work. It delivers top-notch capabilities, with the various parts working together to deliver the requisite continual availability and uptime of contemporary environments; the flexibility and agility to respond to market and business conditions; and heterogeneous assets so that you are not restricted in your choices. And, of course, this is all wrapped with automation, consolidation, and other features that deliver economic efficiency.

It is easy to hear words such as consolidation, virtualization, and automation as individual functions—something that you might simply check off on a list. But if you really picture what these do together, as VSP G1000 offers, you can envision a holistic storage environment that enables an IT organization to live in the world of providing on-demand services to any location, any user, at any time, and for any reason. This is the kind of fluid, frictionless storage service delivery that organizations have envisioned and talked about for a long time.

**Hitachi Virtual Storage Platform G1000 Market Applicability**

What does this mean for HDS and for the choices available to purchasers in the storage market? HDS seems to have continued its technology leadership role with this announcement. Yes, the company continues to be a leader in the enterprise storage hardware space, as features like the Hitachi Accelerated Flash controller emphasize. But this announcement is about a bigger vision: a “perpetual storage architecture” platform with many enticing high-end features for many types and sizes of users.

First, with Hitachi Storage Virtualization Operating System and other software features, HDS has created a platform that can serve any organization for the long haul with its “always-on infrastructure” that grows and changes along with organizations and their morphing requirements. Organizations think of Windows Server or Linux as providing a set of basic capabilities on which to add applications, and they often make these operating systems the long-term foundations of the entire business. SVOS may be considered in a similar light for enterprise-class storage management. If it’s going to be the foundation for the life of the business, it must include always-on capabilities, high availability, reliability, performance, complete protection, and the lower TCO that comes from efficiency and automation.

This new solution also demonstrates the overall broader “world view” of HDS, if you will. The company is working to deliver an infrastructure that can last and that can adapt easily to growth and change, yet with minimal complexity and without disruption. Hence HDS uses its “continuous cloud” concept that wraps in public, private, and hybrid cloud deployments. It’s a new kind of ecosystem: The business defines financial and operational objectives it needs to meet both generically and for its IT infrastructure, and the VSP platform offers the flexibility, availability, and performance to deliver on-demand storage services to support them. This is different from the old way, when IT was pretty much the body that defined IT service levels and the business had to adjust around those. With VSP G1000’s ability to be enhanced in the future with data in place, could this be the last storage migration a customer ever makes? Could it be the last enterprise storage system a customer ever buys? Of course, these questions are based in hyperbole and would depend on how long “ever” is, but VSP G1000 is certainly not an interim, tactical, or add-on purchase.

Second, with the expanded scalability of VSP G1000 and the SVOS that keeps functionality the same across different environments, HDS enables high-end functionality that is relevant and available for all markets and entry points. Of course, while HDS devotees will love all the high-end features, its genuine high quality and broad capabilities have often served to create the perception that HDS storage products are only available to those willing to pay a premium. The vendor will need to work hard to educate prospects (both in terms of awareness and belief) that VSP G1000 is something that makes economic sense for them—in other words, something that is attainable and not just aspirational. That said, the new and emerging world of software-defined storage and heterogeneous private clouds...
is opening up customers to new possibilities. While the potential long life, and high value, of the VSP G1000 architecture is compelling, we’ll have to wait and see whether it translates beyond the higher echelon customer.

Naturally, other vendors are working in similar veins. All have different approaches, but all are looking to put their “perpetual infrastructure stakes” in the ground. HP has its converged infrastructure (as does Hitachi with the Hitachi Unified Compute Platform) and standard storage management interface; EMC has ViPR, its “uber-hypervisor,” and storage manager; and NetApp has long had a common file platform/structure and a heterogeneous management capability. All are aiming at a similar target: Deliver highly automated solutions to consolidate infrastructure silos and remove the complexity from today’s advanced technologies and user needs. Does anyone have the inside track? That’s hard to say, but the extensible and integrated storage platform that VSP represents certainly simplifies everything for users and helps deliver a requisite, attractive economic model, so it could well ensure not just long-term customer loyalty for HDS, but some new converts, too.

The Bigger Truth

A couple of years ago, an ESG blog detailed the higher level aims of HDS and how it was strategically becoming a key component within the greater Hitachi ecosystem; whereby HDS focuses on helping customers to “innovate with information.”7 HDS solutions are designed to be (come) the glue that brings together many Hitachi vertical solutions, such as enabling Hitachi train systems, proton beam therapy solutions, and power plants. So, while Hitachi builds, for example, earth-moving machinery, HDS supplies the information infrastructure for VMs that run the soil analysis, e-mail, business documents, databases, etc. Hitachi doesn’t have to sell into a vertical stack, they can supply the whole thing.

This idea seems to be congruent with and seminal to VSP G1000. Instead of thinking in terms of the next array to deliver, HDS is focused on combining innovative software and impressive hardware as a fully-fledged storage operating system on which to build a business. This may allow customers to focus on using their information instead of spending time taking care of it.

A comprehensive list of VSP G1000 features and functionality would take pages. But what are the high-level attributes that this solution brings? Advanced software functionality, for sure. Advanced storage virtualization. Built-in performance, availability, and data protection. Automation, simpler operations, and the ability to leverage existing investments with heterogeneous storage. All of which combine into a platform designed to stick with users for the future—to grow and change as needed, without business disruption. “High-end storage” really does still mean something because commoditized hardware cannot get the job done.

The virtualized heterogeneity of VSP G1000 fits perfectly with the emerging world of “software mainframes” (a virtualized, hybrid-cloud environment), and while storage itself doesn’t always get the spotlight, it still underlies all the mega-trends of the moment—cloud, mobility, big data, analytics, and so on. This latest VSP manages to combine the best of the HDS pedigree with the needs of contemporary IT. Indeed, it is reminiscent of the current movie Her, in which a futuristic worker falls in love with an operating system that handles every part of his life for him. Who knows—perhaps HDS customers will soon be playing that role.
