

WHITE PAPER

The Evolution of the Data Center and the Role of Virtualized Infrastructure and Unified 3D Management

Sponsored by: Hitachi Data Systems

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October 2010

EXECUTIVE SUMMARY

Enterprise data centers are going through an evolutionary transformation. Both technology and business factors are influencing this transformation. The advent and proliferation of virtual infrastructure, which separates logical structures from physical structures, is the cornerstone of this transformation. Other technology trends contributing to this transformation include IT service automation, converged infrastructure, scale-out server and storage architectures, and unified management of different technology domains.

However, technology is only part of the equation to this transformation. The economics of both IT and storage infrastructure is driving change. Firms seek to curb the percentage of overall IT budget that is consumed by capex and opex investments in storage. Therefore, they must transform their data center operations from an infrastructure focus to a service-level focus. In addition, firms must address the operational imperative of ensuring that the right service levels are provided to a business unit or application. The arrival of virtual infrastructure and complementary storage technologies makes this goal more feasible. New solutions from Hitachi enable firms to more confidently transform their data centers without compromising performance, scalability, or availability. Hitachi's new Virtual Storage Platform and Command Suite management software have been optimized for the next-generation, dynamic, and service-driven virtual data center. As a result, a firm's storage architecture and management model can be modernized *concurrently* with a firm's strategy to transform its data center.

This IDC White Paper examines these complementary technologies from Hitachi and explains how they speed the benefits of virtualization and dramatically improve the management of the infrastructure while modernizing the storage architecture. Firms enjoy the benefits of this transformation while scaling the infrastructure. From a management perspective, Hitachi's approach is offering unified management of virtualized storage infrastructure in three different dimensions (3D management). Firms can *manage up* within a highly scalable storage environment, *manage out* across different virtualized storage architectures, and *manage deep* by leveraging tight integration across the Command Suite product capabilities — all at once. The unified 3D management approach enables firms to simultaneously reduce both capex and opex associated with storage management.

SITUATION OVERVIEW

Despite the desire for data center transformation, the practical reality is that data center managers face some considerable challenges that can stymie their journey to an evolved and transformed data center. Some of these challenges are discussed in the following sections.

Capex and Opex Constraints with Data Growth and Storage Costs

According to IDC research, there is, on average, a doubling of data storage requirements every year. As firms look to keep up with this growth, storage budgets are taking up an increasingly larger component of overall IT budgets. This reality is driving investment in storage optimization and efficiency technologies. Another core challenge is the management of growing storage infrastructure. However, the number of FTEs managing storage does not scale with the additional storage capacity being added to data centers annually. Another overarching economic storage challenge is low utilization in concert with infrastructure costs. Data center costs related to floor tile, power, and cooling requirements consume large portions of IT budgets. However, the utilization of storage that consumes this infrastructure remains low, varying between 30% and 50% depending on the application, while the unutilized 50% to 70% takes up unnecessary tile, power, and cooling.

The Need for Automation While Management Tools Are Siloed

The ongoing investment in server virtualization has curbed both physical server costs and data center costs but has offered no material gains in reducing operating costs. In fact, virtual server sprawl has added another domain of management. As the ratio of virtual servers to physical servers scales (30:1 in leading organizations) and the growth in shipments of virtual servers exceeds that of physical servers, the management of virtual infrastructure has become the next big hurdle for data center managers. The integration of existing management tools is not mature enough to satisfy the long-term demands of a transformed, highly dynamic, service-led data center. Existing frameworks, built upon the need to manage physical infrastructure, need to be maintained. Virtualization-specific management tools are being deployed but require integration with higher-level management or orchestration frameworks. Lastly, the management across virtual infrastructure, servers, storage, and networks is still not integrated or automated. This integration is essential to achieving the dynamic, pooled resource environment that is the underpinning of IT service management and data center transformation.

Ensuring the Right Service Levels for Applications and Business Units

A key objective in transforming the data center is moving to an operational model of providing the right IT service to the application or business unit. Firms need to ensure that service-level objectives for availability, performance, and recovery are provided to the application, application owner, and business unit. Often with an investment in

virtualization, these same firms need integration of these tools with the underlying storage infrastructure. This enables use of familiar virtualized management consoles to perform application- and/or virtual machine-specific storage tasks. However, the largest enterprises and service providers seek to go several steps further, not only in automating storage processes and integrating physical and virtual infrastructure but also in coordinating the management of IT from higher-level orchestration frameworks, to ultimately enable IT service automation. IT service automation forms the underlying structure to private and public cloud architectures effectively providing scale-out, dynamic data center transformation.

The Role of Clouds: Private, Public, or Hybrid

As an industry, we have reached the point of understanding the taxonomy and value proposition for cloud services. The question many firms face is around implementing the right approach for a given environment. The largest firms will evolve their data center infrastructure to deliver private cloud services, offering IT as a service. A central tenet of the effective delivery of private cloud services is enabling IT service automation. To achieve this goal of IT service automation, customers must enable service-level integration between management and orchestration frameworks and the underlying physical technology components (storage, server, network, applications). This is necessary to provide end-to-end provisioning of workload, server, hypervisor, network, and storage against a service delivery objective. Once the service is provisioned, ongoing monitoring and management of the infrastructure as well as service quality and levels must be conducted in an automated fashion. When out-of-policy conditions are detected, there should be automated workload and resource balancing or tuning to return the workload or service to expected service levels. The ultimate goal of data center transformation is using IT service automation to dynamically allocate workloads across cloud virtual and physical resources based on service-level objectives.

REQUIREMENTS IN TRANSFORMING THE DATA CENTER

Given the challenges discussed earlier in the document and the legacy infrastructure that exists, data center transformation will be evolutionary rather than revolutionary. There is no single tool or product a firm can buy to gain a new dynamic, scalable data center of the future. This transformation comes through the use of and integration of technologies such as service catalogs to gain IT service automation, data center orchestration tools that can work with and across technology domains, converged infrastructure to streamline management, cost model and advanced scaling for servers and storage infrastructure to keep pace with data and processing requirements, and unified management of different technology domains. Putting in place scalable and dynamic virtualized storage architectures, as well as a management framework that enables service-level orchestration across technology domains, is essential to a successful data center transformation.

However, given that virtual infrastructure is an underlying component of a dynamic, next-generation data center, it is important to understand the adoption of virtual infrastructure and where firms are in terms of deployment. The adoption of virtual infrastructure has tended to follow overall stages of technology adoption, from test/development to technology maturity to technology expansion.

- ☒ **Phase 1 — Early stage testing.** In this stage, firms are conducting proof of concept (POC) projects and using virtual infrastructure in test and development environments to prove and quantify potential benefits without exposing mainstream applications (and their users); user interfaces evaluated by IT-savvy experts; low corporatwide exposure until more experience is gained and quantified; consolidation projects to reduce physical server sprawl, thereby reducing capital expenditures; operational and ease-of-use improvements quantified in a controlled environment; emphasis on operational improvements and cost savings rather than new business opportunities. Firms in this early stage are just at the beginning of data center transformation. They have not yet standardized on virtualization but must do so before they look to address data center transformation and service automation.

- ☒ **Phase 2 — Default builds.** In this stage, virtual infrastructure becomes more a default server build; tier 2 (that is, non-mission-critical applications) are targeted for virtual infrastructure rollout; tier 1 (mission-critical) applications are put on planning calendars but not yet implemented pending experiences and evaluations from Phase 1; mission-critical users are teed up for training classes. In this stage, firms have begun to transform their data centers. They likely have different management schemas in place to manage physical infrastructure, virtual infrastructure, storage, networks, and the like. However, they seek to integrate the management of technology domains with the goal of offering IT service automation.

- ☒ **Phase 3 — Technology proliferation.** In this last stage, firms are expanding the use of virtual infrastructure to distributed environments. Both tier 1 and tier 2 applications are being virtualized; use with higher-priority applications brings about more stringent scalability, security, continuity, and recovery requirements; internal auditors demand accountability for safety of mainstream applications; modern virtualized infrastructure with transformed processes enables business agility and competitive differentiation for firms. In this stage, firms are well on their way to a dynamic, scalable data center and are working to integrate the management capabilities between virtual infrastructure and the underlying physical resources.

Hitachi's next-generation storage architecture and management model can be inserted at any stage of a firm's transformation to a virtualized environment. Implementing a virtualized, scalable, and dynamic storage infrastructure with either an initial deployment of or an expansion to virtualization can accelerate a data center transformation process and aids in reducing management complexity.

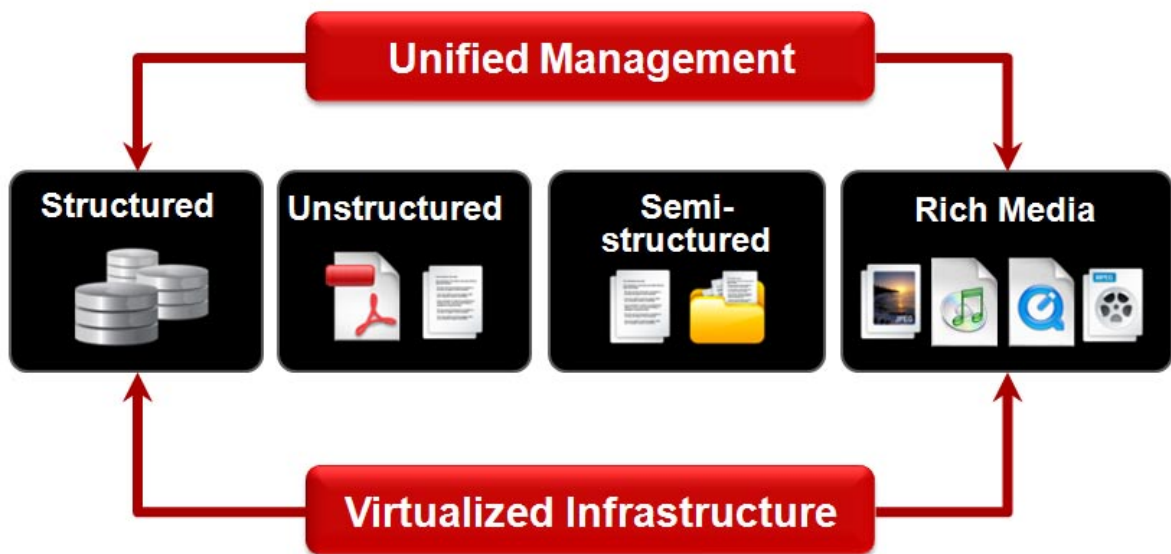
HITACHI SOLUTIONS FOR TRANSFORMING THE DATA CENTER

Hitachi Technology Strategy

Hitachi's technology strategy is to provide a virtualized storage infrastructure, both block and file architectures, that can support a myriad of content from structured to unstructured data. Hitachi's Command Suite offers a unified management approach to easily manage across different Hitachi storage systems and software functionality. Figure 1 outlines the Hitachi technology strategy at both the infrastructure level and the management level.

FIGURE 1

Hitachi Storage Strategy



Source: Hitachi Data Systems, 2010

Unified Management with Hitachi Command Suite

The Hitachi Command Suite is an end-to-end solution that allows IT managers to monitor, automate, and manage their data centers at different layers of abstraction. Central to the unified management of Hitachi Command Suite is its 3D management strategy, which allows administrators to manage up, manage out, and manage deep at the same time. The solution enables managers to configure and manage storage devices and service levels based on an application or any other criteria without having to unnecessarily delve into the details. Hitachi Command Suite includes a series of capabilities coordinated from a central management framework. Hitachi Command Suite includes the following solutions:

- ☒ Hitachi Replication Manager
- ☒ Hitachi Tiered Storage Manager
- ☒ Hitachi Tuning Manager
- ☒ Hitachi Global Link Manager
- ☒ Hitachi Device Manager
- ☒ Hitachi Command Director

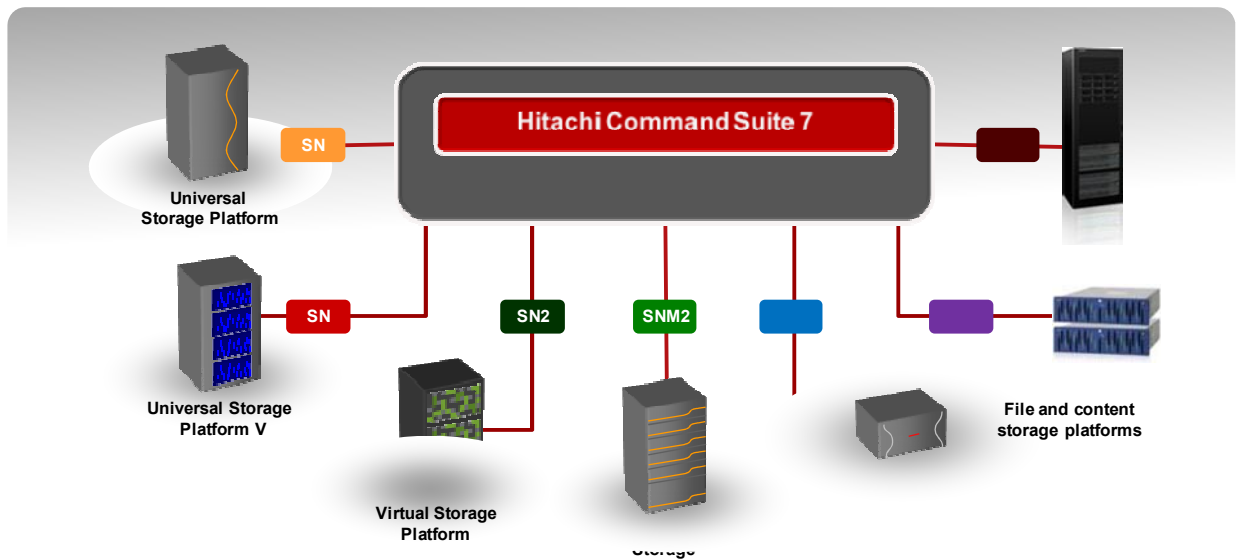
Hitachi Command Suite not only works across different functions — from provisioning to device management to tiering — but also provides this unified management across the range of Hitachi virtualized storage infrastructure. Hitachi's unified management approach enables firms to reduce both capex and opex in the following ways:

- ☒ **Reducing management time** — by providing in-context management functions and by reducing the number of both management screens and products to administer and perform storage functions
- ☒ **Reducing management complexity** — by providing policy-based controls and unifying the administration and management of different storage architectures
- ☒ **Rightsizing storage purchasing** — by ensuring data is placed on the right storage tier, automatically, and with the right service level applied to it (This allows for maximum utilization of the different storage tiers in the infrastructure.)

Figure 2 lays out the unified management of Hitachi Command Suite across different storage architectures.

FIGURE 2

Hitachi Management Approach



- Single management tool for all Hitachi storage systems and virtualized storage environments
- Common GUI and CLI: no need to switch to element managers for everyday storage management tasks

Source: Hitachi Data Systems, 2010

Hitachi's Unified 3D Management Approach

As discussed earlier in the paper, the single overarching goal of any data center transformation initiative is to enable the data center to provide the right service levels at the most optimal cost structure. Data center managers are often faced with the dilemma of having to choose from a multitude of infrastructure and technology options in order to translate their goals to actionable objectives. The Hitachi Command Suite provides data center managers with an easy and powerful way to make these choices at a higher level of abstraction and thus allows more efficient management of the data center.

Hitachi Command Suite offers a three-dimensional approach to supporting IT managers by enabling them to manage up, manage out, and manage deep through a single pane of glass. This addresses not only the aspects of application infrastructure optimization but also the human element that is increasingly playing a bigger part in the data center cost equation. Hitachi Command Suite delivers a 3D management approach to lower capex and opex costs and efficiently manage all data types for agile data centers:

- ☒ **Manage up.** Hitachi's "manage up" approach includes superior levels of scalability within the frame and offers management capabilities to ensure the right service level for a given application.

- ☒ **Manage out.** Within the context of today's evolving data centers, management capabilities must scale out and leverage integration across technology domains. Hitachi's "manage out" approach includes not only storage management but also management into the server domain and beyond.
- ☒ **Manage deep.** The "manage deep" dimension of management includes the tight integration between different management modules as well as efficiency and ease of use in managing Hitachi storage.

Hitachi Command Suite 7.0: What's New

Hitachi Command Suite 7.0 comes with significant advancements both on the technology front and in its human interface design. These improvements are targeted to support scalability, efficiency, and, above all, greater ease of management of complex physical and virtual IT environments. By bringing in a single management interface, IT administrators today no longer need to switch between multiple tools and screens to manage their IT environments. The new management suite provides a unified interface both as a graphical user interface (GUI) and as a command line interface (CLI). Administrators thus can choose between these interfaces based on whether they prefer to do the task easily or efficiently, respectively, depending on how often they need to perform these tasks and the granularity of configuration that may be required at a given instance.

Hitachi Command Suite 7.0 employs a use case-driven, step-by-step wizard-based approach that allows administrators to perform tasks such as new volume provisioning, configuration of external storage, and creation/expansion of storage pools easily on the fly. The software is also intelligent enough to automate many of the underlying processes such as choosing the right logical device (LDEV) based on particular application requirements and service-level agreements (SLAs). Thus IT administrators no longer need to make these decisions on an individual basis; rather, they make systemwide policy decisions. Superior policy-based management is also achieved by integrating best practices into common administrative tasks involved in managing the data center. Many of the tasks can be scheduled to run at a particular time or can be executed immediately. As a result, administrators can run these processes in parallel in the background while configuring parts of the system. This nondisruptive management capability of Hitachi Command Suite 7.0 executes comparable tasks in fewer cycles than its predecessor, which translates into huge efficiency improvements.

Hitachi Command Suite 7.0 adds another layer of policy-based storage management with its intelligent automated tiering and load balancing engine. A single view of all the storage tiers enables the data traffic to be balanced and directed to different devices by way of reading data heat indexes. Thus, by balancing workloads across systems based on the performance characteristics of storage devices, the Command Suite is able to provide optimal I/O and storage performance across all tiers.

The Command Suite enables administrators to manage the data — regardless of whether it is block, file, or object data — under the same platform. Because the storage virtualization capability resides at the controller level, the movements of data across heterogeneous systems are also easily facilitated. The system's support for virtual partitioning and a high-level business view of provisioning, migration, and reporting makes it ideal for supporting multitenant environments where storage

needs, availability needs, and performance characteristics are subject to the tenant under consideration and its SLAs. The Hitachi Unified Compute platform's data center orchestration, in tandem with policy-based service-level management, makes it ideal for use in multitenant cloud environments that may be public, private, or hybrid.

CHALLENGES

Virtualized infrastructure is a practical reality today, providing real operational benefits, while true IT service automation remains a vision and longer-term objective for the most mature organizations. Scalable, virtualized storage architectures are also a reality today. However, as an industry, we will continue to struggle with automating tasks that have linkages between technology domains. To gain the advantages of true data center transformation and IT service management, organizations must address several items, including:

- ☒ Technology integration at the infrastructure level and across infrastructure domains
- ☒ Integration of multiple management stacks including legacy frameworks and virtualization management tools
- ☒ IT organizational changes as IT roles change and/or converge because of the increased reliance on technology to automate IT tasks
- ☒ Policy setting and standardization, specifically catalog definitions to describe workloads, service objectives, and ongoing monitoring and measurement (This requires extensive planning, policy setting, and detailed ongoing communications between business units and various IT domains.)

SUMMARY

Hitachi's solutions enable firms to more confidently transform their data centers without compromising performance, scalability, or availability. Hitachi's new Virtual Storage Platform system and Hitachi Command Suite 7.0 management software have been optimized for the next-generation, dynamic, and service-driven virtual data center. As a result, a firm's storage architecture and management model can be modernized *simultaneously* with a firm's journey to transform its data center. Hitachi's approach is offering management in three different dimensions (3D management). A firm can *manage up* within a highly scalable environment, *manage out* beyond just storage, and *manage deep* by leveraging tight integration across product capabilities — all at once. The unified 3D management approach enables a firm to simultaneously reduce both capex and opex associated with storage management.

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