

# Strategies for Greater Sustainability in the Data Center

## Achieving a Greener Data Center with Hitachi Virtual Storage Platform

*By Hitachi Data Systems*

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## Executive Summary

Balancing the efficiency and costs of data storage has always been a difficult task for most IT leaders. The enterprise organization relies on data to function, driving a relentless need for data storage. But storage budgets are not rising to meet the continuous data growth that must be managed. New pressures to manage costs and improve profitability in today's unpredictable global economy are forcing many IT departments to further strain storage systems or overallocate or underutilize them, resulting in unintended energy expenditure and poor asset management.

Amid the quest to gain cost-efficiency without compromising performance or critical reliability factors lies the promise of sustainable IT and greener data centers. Sustainability of the IT infrastructure covers a wide range of measures, from addressing equipment lifecycles and asset disposal to lowering energy consumption and reducing floor space. Many green technologies offer organizations a way to achieve better performance effectiveness and reduced energy costs.

As a global leader and long-time innovator in storage solutions, Hitachi Data Systems has been integrally involved in researching and maturing sustainability practices and technologies intended to help organizations improve environmental IT practices, and the bottom line. One of the most advanced and resilient storage platforms in the industry is the new Hitachi Virtual Storage Platform, standing ready to increase sustainability in the data center.

Permeated with leading-edge features that wholly contribute to greater sustainability, the Virtual Storage Platform helps organizations transform their data centers for greener results and better cost and power efficiencies. Virtual Storage Platform optimizes a return on assets (ROA) by orchestrating superior performance, utilization and capacity across multivendor systems, while delivering greater floor space efficiency, less power consumption and reduced cooling requirements than any system in its class.

This paper focuses on how to improve on data center efficiencies and deploy greater sustainability across the IT infrastructure with the Hitachi Virtual Storage Platform.

## Introduction

There are many shades of green when it comes to sustainability. From the global perspective, green encompasses environmental responsibility and protecting the welfare of human and natural resources. Concerns for climate changes, greenhouse gases and the ways that societies can develop without adversely affecting future generations are also environmental considerations at the larger level. Around the globe, governments are taking on environmental issues and initiating methods for addressing energy reduction, including the use of energy-efficient computer equipment. What does sustainability mean for business and particularly for IT?

### Energy Consumption and the Storage Budget

If data is the lifeblood of a business entity, then the data center is certainly the central nervous system, filtering through every department, every process that keeps an organization viable. The care and feeding of the IT infrastructure includes significant power and cooling. In fact, powering IT equipment and keeping it at the optimal temperature are among the most energy exhaustive tasks in a data center, requiring 25 to 50 percent of a facility's total energy consumption. Up to 40 percent of that total energy usage is devoured by data storage. Unchecked, energy consumption can consume the budget, not to mention have an impact on the greater good.

With the modern data center having perhaps evolved in an uncontrolled manner over time to accommodate urgent allocation requests or growth spurts, a buildup of siloed or poorly utilized assets is common. Aging equipment running on costly maintenance contracts, a proliferation of disparate systems, and a conglomeration of management tools are some of the typical reasons why IT infrastructure may be less cost-efficient than intended. Moreover, IT departments are charged with meeting availability and compliance mandates for data storage, frequently resulting in the creation and management of numerous redundant copies and labor-intensive processes. These inherent inefficiencies, coupled with nonstop data growth, can quickly add up to dismal performance efficiency and ROA.

In its 2010 list of top storage trends, IDC predicted an acceleration in the adoption of more efficient technologies, including de-duplication, thin provisioning and storage tiering. With energy costs continuing to rise and IT budgets flailing, the need for a lean, green data center has never been greater. Enter: sustainable IT.

### Making the Business Case for Sustainable IT

Organizations are seeking ways to cut power consumption costs, maintain data availability and meet growth demands, usually all at once. An edict for the IT department to implement sustainable practices might seem like just another initiative that further taps withering resources. But, as enterprise organizations experience the squeeze of unyielding data growth on resources, so grows the appeal of a more sustainable data center.

Sustainable IT refers to efforts that increase the useful life and reduce environmental impacts of IT systems, and concurrently offer cost benefits to the business. Perhaps the business case for sustainable IT could be stated as balancing the scales of rampant data storage costs and growth with eco-innovative solutions.

So, what are the business drivers for considering sustainable IT? For many organizations, it is simply a matter of needing to cut energy and equipment costs. Data centers have traditionally doubled their power consumption every five years to keep pace with increasing requirements. Power, cooling and floor space costs are important factors in how well efficiency targets and budget goals can be attained. By executing energy-efficient measures, such as server and storage consolidation to reduce the amount of equipment needed on the floor, those related energy and flooring costs can be reduced. Optimizing business processes and supply chains, transitioning to virtual travel or meeting software, and using newer technologies to compress the space necessary to store data are among the easiest ways to strip costs while reducing carbon emissions and greening IT.

Another driver is meeting budget without compromising performance, scalability or availability for important data applications. The amount of business-critical data continues to grow, placing additional burden on IT leaders to promote pervasively efficient infrastructure. IDC estimates that this data is growing at a compound annual growth rate (CAGR) of 52 percent.

Some organizations choose to implement greener technologies and practices to meet internal goals for social responsibility. Green IT aims beyond power consumption to also address carbon footprint, equipment lifecycles, inventory management and asset disposal. For these groups, the spotlight is on a win-win to comply with environmental directives while reaping the cost benefits of reduced power, cooling and space needs. Virtualization, intelligent storage tiering, thin provisioning and pervasive automation top the industry list of eco-friendly IT techniques. Services and practices that optimize the use of both new and incumbent systems can amplify the return on sustainability choices.

## Guidance for Greening up the Data Center

Sustainability is not a new word in the IT industry, but there is a renewed interest in how it can mitigate the crunch of encroaching energy usage and related costs affecting today's data center. To successfully capitalize on the benefits of sustainable IT, Hitachi Data Systems recommends a systematic approach to understanding and deploying greener measures.

### Inventory Existing Infrastructure

Rethinking the data center from a sustainability perspective invites the IT leader to evaluate beyond application requirements, performance demands and storage capacity. The sum of the parts may be greater than the whole; by reviewing components and configurations, the organization can better understand where inefficiencies exist and ultimately learn how best to improve overall data center efficiency. An efficiency inventory of the physical IT infrastructure should encompass power and cooling usage, physical security, operational procedures, storage configuration and facility layout.

Consider these categories:

- **Storage Efficiency.** Evaluate the amount of storage per square foot. Estimate the storage utilization percentage per system or cluster. Using unified management software allows IT leaders to have better visibility and control over pooled storage and capacity usage, versus siloed or disparate systems that must be individually monitored for utilization rates. Thin provisioning tools can help improve capacity utilization with fewer steps.
  - **Power Efficiency.** Approximate the power usage per floor tile or area occupied. This may be
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difficult for IT managers that do not have access to electric bills. Older machines and burdened performance thresholds draw more power and cooling than systems running at optimal levels.

- **Space Efficiency.** Look at the density of the systems per floor space used. Higher density architectures and systems with smaller footprints help improve space efficiency.
- **Workload Efficiency.** Measure input/output performance of systems or networks. Higher bandwidth capabilities and automated load balancing aid faster data traffic with fewer bottlenecks. Automated data movement tools that can adjust performance based on activity level and policies will optimize storage costs and free up mission critical or tier 1 space.

## Optimize Eco-storage Technologies

The typical data center has at least some level of eco-storage technologies, such as virtualization, tiered storage or thin provisioning. Independently, these tools help streamline processes and better address storage demands. Collectively, they present an opportunity to achieve greater levels of energy efficiency without sacrificing performance, availability or scalability.

Consider these storage technologies from an efficiency perspective:

- **Storage Virtualization.** Virtualization pools capacity of multiple systems to reduce hardware on the floor and to increase access and sharing of storage. It can be used to address thermal zones or hot spots. The accumulation of storage systems and racks on the data center floor most likely did not consider heat distribution when installed. Virtualization helps reposition or reconfigure storage to mitigate hot spots and better balance cooling topology without disrupting applications.
- **Thin Provisioning.** Storage is provisioned from a virtual shared pool, providing capacity on demand to improve application availability and storage utilization. In this way, data can be placed on the best available class of storage without dedicating or purchasing physical disk storage up front, thereby reducing carbon footprints. Hitachi Dynamic Provisioning software helps shrink space, power and cooling costs. It eliminates management overhead of allocated but unused disk space that is usually replicated many times for backup or other purposes, and it can increase utilization of storage by 40 percent.
- **Tiered Storage.** By creating different levels of storage within the same virtualized network, tiered storage enables centralized and more efficient data movement, accessibility, archiving and consolidation. Whether a disk drive has 75GB or 1000GB, it uses approximately the same amount of power and cooling. But by combining different capacity and performance disks in a shared pool of tiered storage, the power efficiency quotient improves. While tiered storage that integrates slower-spinning secondary disk, such as SATA, can reduce the load placed on electrical and cooling systems, using high-performance media such as SAS or solid state disk or flash drives enhances performance while using less power. By placing data on the correct tiers, IT administrators avoid needless replication and multiple stores, and can best match storage levels to application requirements.

## Reduce, Reuse and Reclaim

To continue rethinking the data center for sustainability, it is important to find ways to reduce data whenever possible, extend or repurpose assets, and reclaim squandered resources. Consider:

- **Data Reduction.** This involves the cutback in redundant copies of volumes, files and bit strings.

Techniques used to reduce data include de-duplication, copy on write, single instance stores, data compression, establishing gold copies and eliminating the working set or intermediate volumes. Also, some software management tools discover orphaned or inactive volumes and files.

- **Consolidation.** This attempts to reduce management complexity and the amount of disparate or poorly used systems on the floor, in order to maximize capacity in the least amount of floor space. Besides helping to lower power and cooling exertion of too many inefficient machines in the data facility, storage consolidation through centralized administration can enhance security, control and policy enforcement, and storage efficiency, power efficiency and productivity.
- **Zero Page Reclaim.** A derivative of Hitachi Dynamic Provisioning software, this transparently reclaims allocated but unused capacity on existing open systems volumes. By extending Dynamic Provisioning to externally virtualized storage, the zero page reclaim feature boosts utilization rate for previously "fat" volumes, page by page.
- **Storage Reclamation.** These processes salvage unused or poorly used storage, such as old or worthless data, duplicate data, usable but unallocated to hosts, and allocated but unused capacity. According to Hitachi research, for every gigabyte or terabyte that can be reclaimed, a portion of capital spending can be deferred or removed. Storage reclamation needs to be a methodical part of an overall sustainability strategy that identifies and rectifies wastage.

## Leverage Proven Practices

To complement the arsenal of sustainable IT technologies and practices, it is important to bring them together under an umbrella of predictable, repeatable procedures and expert services. Hitachi Data Systems recommends engaging professional services teams to help organizations design the most appropriate storage infrastructure for meeting business and sustainability goals. Ensure that vendors offer professional services for eco-friendly technologies, provide for proper recycling or disposal of old or returned equipment, and have a track record for environmentally responsible practices.

### ENTERPRISE STORAGE GREEN CHECKLIST

- ✓ Use virtualization to avoid data center hot spots.
- ✓ Centrally manage storage across the data center.
- ✓ Allocate virtual capacity without dedicating physical storage.
- ✓ Tier storage to reduce the load on electrical and cooling systems.
- ✓ Maximize capacity in the least amount of floor space.
- ✓ Minimize use of toxic materials such as batteries.
- ✓ Utilize services to help design the right infrastructure.
- ✓ Select vendors with an environmentally friendly track record.

## Raising the Bar — Again

Hitachi Data Systems continually strives to align the quality, innovation and performance of its storage architecture solutions with its customers' business requirements. Introduced in 2004, the Hitachi Universal Storage Platform(r) created almost a new class of storage capable of massive consolidation, controller-based virtualization and support for a multivendor range of management tools through an open-standards interface. Hitachi Data Systems is the only high-end enterprise storage vendor currently providing a combination of controller-based virtualization and dynamic thin provisioning in one solution. A few years later, the Hitachi Universal Storage Platform V doubled the maximum cache size over previous models, allowing for more cost-effective performance and power efficiency, especially when united with the advanced control unit logical partitioning feature.

Through these flagship systems comes the promise of one platform for all data, which means support of any workload for block, file and content data types. With the release of the Hitachi Virtual Storage Platform comes the next leap in storage evolution and significant sustainability options for the modern data center.

## Lead by Example: Hitachi Virtual Storage Platform

Having the right information at the right time helps business and IT leaders make the best possible decisions. It can mean the difference between success and failure. Because data has become the most valuable assets of the modern organization, the challenge lies in keeping that information safe and accessible while still meeting budget, environmental and performance demands.

Challenge, meet solution. The Hitachi Virtual Storage Platform is unique in the industry, offering the first 3D scaling storage platform designed for all data types to help organizations actually solve today's toughest storage problems. It is the only storage architecture that flexibly adapts data for performance and capacity, and it extends to multivendor storage. Unlike alternatives, the Virtual Storage Platform optimizes ROA by combining unmatched performance, capacity and utilization of multivendor assets. In combination with unique Hitachi Command Suite capabilities, it makes the storage infrastructure more fluid and IT more agile. The platform also serves as an ideal foundation for organizations moving towards the Hitachi Unified Compute Platform, an open architecture that is tested and tightly integrated to reduce data center complexity, risk and costs while increasing efficiencies and asset usage. So what does the Virtual Storage Platform mean to sustainable IT?

### Take a Closer Look at the Sustainability Footprint

At first glance, the Virtual Storage Platform offers a bonanza of sustainability characteristics:

- 2.5" small form factor disk drives
  - Next-generation SAS hard disk drive technology
  - Larger, flash-protected cache
  - Faster processors and high speed memory
  - Interconnected blade-based architecture
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- Fan power control
- Front-to-back airflow
- Simplified and faster storage management
- Dynamic tiering to automate data placement

These characteristics translate to greater data center efficiencies, such as:

- **More storage efficiency** per square foot or square meter with high-density architecture
- **Lower power consumption** per floor space and per capacity utilized
- **More workload efficiency** with 3D scaling, automated dynamic tiering, higher IOPS per square foot and end-to-end virtualization
- **Greater granularity** to ensure that data is in the right place on the right type of storage

Perhaps a good method of illuminating the sustainability of the Virtual Storage Platform is to measure efficiency gains over its popular predecessor, the Universal Storage Platform® V.

Table 1 illustrates gains the Virtual Storage Platform has made.

**TABLE 1. IMPROVEMENTS HITACHI VIRTUAL STORAGE PLATFORM MAKES OVER HITACHI UNIVERSAL STORAGE PLATFORM V**

<b>Performance</b>	<ul style="list-style-type: none"> <li>• 105% more IOPS per square foot</li> <li>• 159% more IOPS per Watt</li> </ul>
<b>Power</b>	<ul style="list-style-type: none"> <li>• 44% lower kVA per terabyte</li> <li>• 11% more terabytes per Watt</li> </ul>
<b>Space</b>	<ul style="list-style-type: none"> <li>• 40% more terabytes per square foot</li> <li>• 78% more drives offer greater density</li> </ul>
<b>Cooling</b>	<ul style="list-style-type: none"> <li>• 15% lower BTU per square foot</li> <li>• Front to back airflow design</li> </ul>

## Platform Features that Contribute to Sustainability

The Virtual Storage Platform exploits a host of industry-leading features that contribute to sustainable IT and the platform as a whole helps IT organizations transform their data centers into greener results. Let's examine some of these key features.

### 3D Scaling

Scale up. Scale out. Scale deep. With 3D scaling, the Virtual Storage Platform allows IT architects to scale up to improve performance, throughput and connectivity for both open and mainframe environments. They can scale out to accommodate and adapt to evolving data capacity and processing needs. And they can scale deep with flexible storage tiering and virtualization of externally attached multivendor assets. 3D scaling allows for the creation and dynamic sharing of

one global cache across all storage and all data types, including block, file and content. Its global architecture transparently distributes uneven and unplanned mixed I/O workload demand across system resources and eliminates poor response time and predictability issues.

Whether the IT department needs to grow virtual server farms or consolidate the storage supporting them, the Virtual Storage Platform supports greater connectivity without sacrificing performance. As a result, additional servers can be virtualized to defer purchases and existing overloaded storage resources plagued by increased server demand can now be virtualized and reclaimed as productive resources.

### ***What It Means for IT Sustainability***

3D scaling leverages unique virtualization scaling capabilities to unify internal and externally attached systems and create a more agile storage infrastructure for greater workload efficiency and increased administrative productivity.

### **Hitachi Dynamic Tiering Software**

Another pillar of the Virtual Storage Platform is Hitachi Dynamic Tiering, technology that evolves thin provisioning and tiered storage to an entirely new level of automation and performance. New, dynamic, page-based tiering capabilities allow the storage infrastructure to be much more fluid for all data types, automating data placement for greater sustainability in the data center.

Dynamic Tiering combines virtual storage controller-based automation and self-managed storage pooling to match the business value of data to the cost of storing it. Dynamic Tiering automates the movement of more active data up to a higher performance tier using low power solid state flash drives, and moves less-active data down to a lower cost SATA drive tier, for example. This new summit of agile, intelligent self-tiering simplifies operations, lowers overall storage costs, improves performance and boosts administrative productivity.

### ***What It Means for IT Sustainability***

By placing active data on the right tier of storage, IT administrators almost gain an "information lifecycle management (ILM) in a box" as unnecessary data movement and other complexities are eliminated, ultimately increasing eco-efficiency and reducing the carbon footprint.

### **3D Storage Management**

Hitachi Command Suite is the newest major release of Hitachi storage management software suite. Intended to orchestrate data center efficiency, Hitachi Command Suite enables up to 50 percent fewer "steps and clicks," unifies visibility and manageability across virtualized environments, and rapidly facilitates dynamic self-optimized storage tiering, Dynamic Provisioning and Hitachi storage virtualization.

### ***What It Means for IT Sustainability***

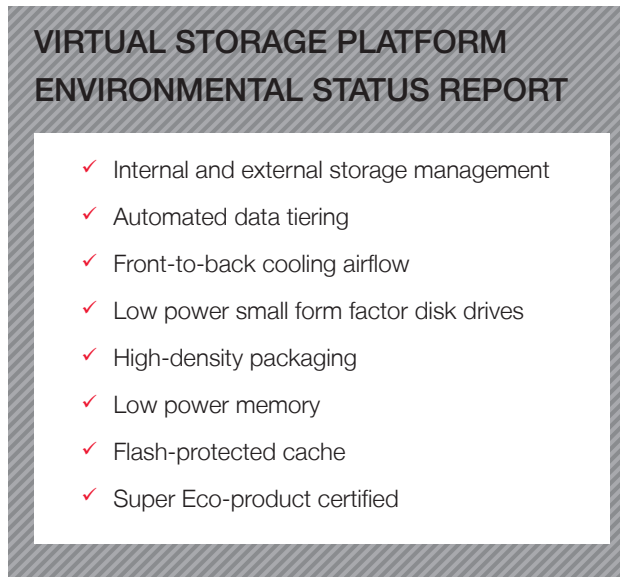
Hitachi Command Suite helps increase utilization of storage assets within complex IT infrastructures, as well as raise levels of usability, sustainability and performance to improve data center efficiency with limited IT resources. Administrators can consolidate management for both virtual storage and virtual server infrastructures comprised of heterogeneous assets.

### **Hitachi Dynamic Provisioning Software**

Hitachi Dynamic Provisioning directly addresses the biggest problem for capacity utilization: the allocated but unused space that is copied many times over. Dynamic Provisioning maximizes storage capacity and performance by provisioning only what is used and using capacity only when required by applications.

### ***What It Means for IT Sustainability***

Dynamic Provisioning improves the responsiveness to new storage demands without downtime, and enables the reclamation of allocated but unused (wasted) capacity. As a result, organizations can often defer or eliminate storage capacity upgrades to better align with actual business usage and reduce power, cooling and floor space associated with spinning unused disk capacity.



## **The Hitachi Commitment to Sustainability**

Since its inception, Hitachi Data Systems has remained staunchly committed to the eco-minded corporate culture of its parent company, Hitachi, Ltd., which includes goals to achieve a sustainable society and to systematically uphold an environmental focus on product development and production. Working with the entire Hitachi supply chain over the years, the company is able to develop and deliver products in a sustainable manner.

For organizations ready to increase green technologies and practices, Hitachi Data Systems becomes a partner of choice for helping implement environmentally efficient IT solutions. From design and manufacturing to support through the entire storage lifecycle, Hitachi Data Systems is focused on helping business and IT leaders create environmentally responsible storage infrastructures.

## Super Eco-products

Hitachi uses a Design for Environment (DfE) assessment system during product development to quantitatively assess and reduce the environmental burden of a product throughout its lifecycle—from material procurement to production, distribution, use and disposal. Super Eco-products meet demanding requirements to be leaders in their industry in energy efficiency. The Virtual Storage Platform has received Super Eco-product status by delivering value and high performance, as well as power-cost savings across the total ownership spectrum, including energy, cooling and space.

## Other Services that Support Treading Lightly on the Environment

As organizations continue to grapple with the issues surrounding data storage growth and its subsequent needs for power, cooling and floor space, Hitachi Data Systems provides an expansive set of services to encourage cost-effective, eco-friendly and socially responsible IT.

### Storage Reclamation Service

Incessant data growth leads to an insatiable need for storage capacity, which in turn usually requires an influx of capital to purchase that capacity in the form of servers or storage systems. But frequently asking for additional capital monies to buy more capacity is neither popular nor always an option. What are the alternatives?

Storage Reclamation Service from Hitachi Data Systems helps organizations implement holistic and sustainable strategies that solve storage growth requirements while lowering long-term storage costs. From helping organizations free up capacity and establishing more cost-efficient operations to leveraging existing systems and exploiting green technology tools, Storage Reclamation Service offers a blend of proven processes to optimize administrative and physical resources.

### Managed Services

To support the evolving needs of enterprise organizations, Hitachi Data Systems Professional Services offers an expanded suite of managed services, including Residency Services and Remote Management Services. These managed services offer critical building blocks to IT leaders focused on bringing greater sustainability to their data centers and optimizing existing assets.

#### Residency Services

Developed to facilitate a higher and quicker return on storage investments, Residency Services help the enterprise to fill critical gaps in staff skills or experience while improving asset utilization and performance, and achieving service level objectives. Experienced and "best fit" Hitachi Data

Systems consultants are assigned to the engagement to implement industry-standard processes, tools, training and best practices.

### **Remote Management Services**

Complementary to Residency Services, the Remote Management Services comprise robust reporting, real-time monitoring, alerting and provisioning services, which are often the essential keys to efficiently managing storage infrastructure. While most organizations have "flatlined" their resource investments and budgets, the demands for capacity and services sharply rise and fall. The resulting environment requires that IT do more, and do it better, faster and cheaper. Remote Management Services help the enterprise manage and align the storage environment with established service level requirements and best practices that enable flexible service delivery to meet changing business requirements.

## **Hitachi Information Technology and Systems Group**

Also within Hitachi Data Systems' arsenal of expert services is the Hitachi Information Technology and Systems Group. Tasked with solving complex IT issues and designing best-fit infrastructure, this team of experts offers a wide range of specialized practices, including virtualization techniques to address power, cooling and space efficiencies associated with storage technology.

## **Gauging Eco-Efficiency**

The Virtual Storage Platform underscores the alliance of cost-effective data management and sustainable IT in one efficient footprint. With an abundance of environmental benefits, the Virtual Storage Platform is tailored to minimize costs and foster eco-friendly, sustainable storage practices. In particular, its high-density design allows for more efficient use of power, cooling and use of facilities. Reducing electric usage and floor space has a direct correlation to lower operating expenses, too.

The Virtual Storage Platform takes advantage of its 3D scaling architecture for improving agility throughout the IT infrastructure, dynamic tiering to automate data placement within virtual tiers of storage, and comprehensive management to improve utilization and mobility of storage assets. Best-in-class performance, scalability and capacity expansion are uniquely packaged in this one platform designed to manage all types of data and workloads. The Virtual Storage Platform helps IT leaders meet the escalating demands of storage infrastructures throughout their lifecycles, satisfy cost and sustainability edicts, and fully address the perpetual challenges of the modern data center.

### **For More Information**

For more information about the Hitachi Virtual Storage Platform or enhancing sustainability in the data center, please visit [www.hds.com/green](http://www.hds.com/green).

For more details about Hitachi Data Systems Corporate Social Responsibility vision, visit [www.hitachi.com/csr](http://www.hitachi.com/csr).

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