White Paper

Addressing IT Infrastructure Complexity for Today and Tomorrow

Red Hat's Flexible Storage Software Architecture Delivers the Simplicity of HCI—While Laying a Foundation for Containers and Automation

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Contents

Introduction

At this point, businesses are drowning in data. But in a data-driven economy, simply storing data is no longer enough; the task is bigger. IT must keep pace with the massive demands of today, while transforming their organizations to enable the digital business opportunities of tomorrow.
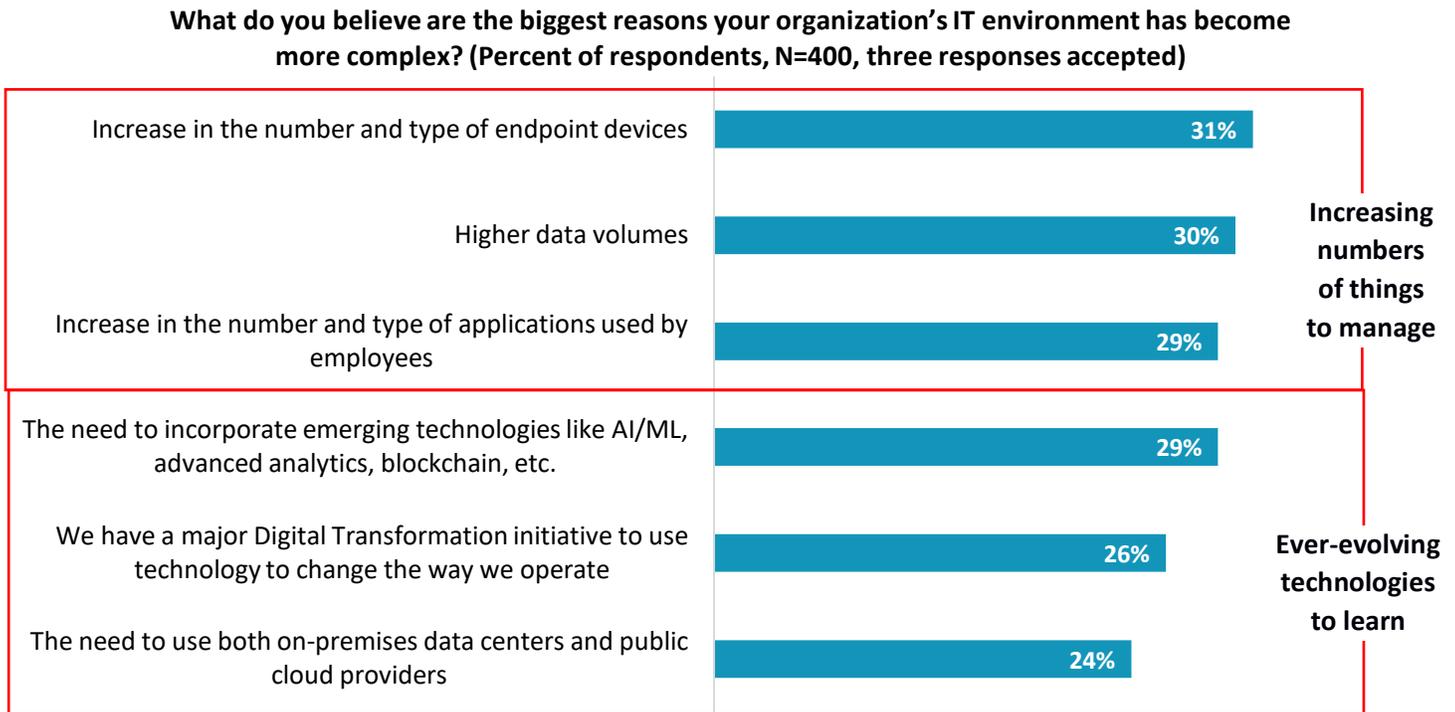
Unfortunately, however, those two goals can contradict each other. As complexity mounts, infrastructure solutions that simplify the management of existing workloads often aren't well suited to supporting emerging workloads as well. IT needs an alternative tool, one that simplifies the IT of today *and* is an optimized platform for emerging workloads and hybrid cloud IT.

The answer could be software-defined storage (SDS), or more generally, software-defined infrastructure. SDS brings architectural flexibility to IT in that one technology can support multiple hardware deployment choices. A software-based architecture spanning on- and off-premises infrastructures—with the right storage functionality, automation, and management features—can successfully address the complexity of today's IT, while positioning the organization to easily integrate the innovations of tomorrow.

The Modern IT Challenge

Sixty-six percent of IT decision makers surveyed by ESG say IT is now more complex for them than it was just two years ago. Complexity is rising due to the increasing number of things to manage, the ever-increasing volumes of data, and the fact that IT innovations are constantly emerging (see Figure 1).[1] Innovations in data storage, such as the public cloud, are often meant to address complexity, but integrating these new platforms, as this data reveals, can add complexity. IT requires technologies that address the challenges of scale, while also easing new technology integration.

Figure 1. Top Six Factors Driving IT Complexity

What do you believe are the biggest reasons your organization's IT environment has become more complex? (Percent of respondents, N=400, three responses accepted)

Increase in the number and type of endpoint devices	31%
Higher data volumes	30%
Increase in the number and type of applications used by employees	29%

Increasing numbers of things to manage

The need to incorporate emerging technologies like AI/ML, advanced analytics, blockchain, etc.	29%
We have a major Digital Transformation initiative to use technology to change the way we operate	26%
The need to use both on-premises data centers and public cloud providers	24%

Ever-evolving technologies to learn

Source: Enterprise Strategy Group

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[1] Source: ESG Master Survey Results, *2019 Technology Spending Intentions Survey*, February 2019.

Modernizing IT in a Hybrid Cloud World

Public cloud resources have become a common complement to in-house data center operations, resulting in a rise of hybrid cloud environments. ESG research shows that 58% of surveyed IT organizations now leverage public cloud infrastructure services, with 64% of respondents expecting to increase spending on public cloud services this year.

As IT infrastructure design evolves to integrate public cloud resources, IT complexity increases. As Figure 1 showed, 24% of IT decision makers say the need to manage both on- and off-premises resources adds complexity. Adding to the problem: Experts in IT architecture planning are in short supply. It was the second most-mentioned IT skill shortage area among ESG survey respondents (38%), behind only cybersecurity expertise.[2]

Similar to the changes in IT infrastructure design, the application environment is evolving as well with the rise of container-based applications.
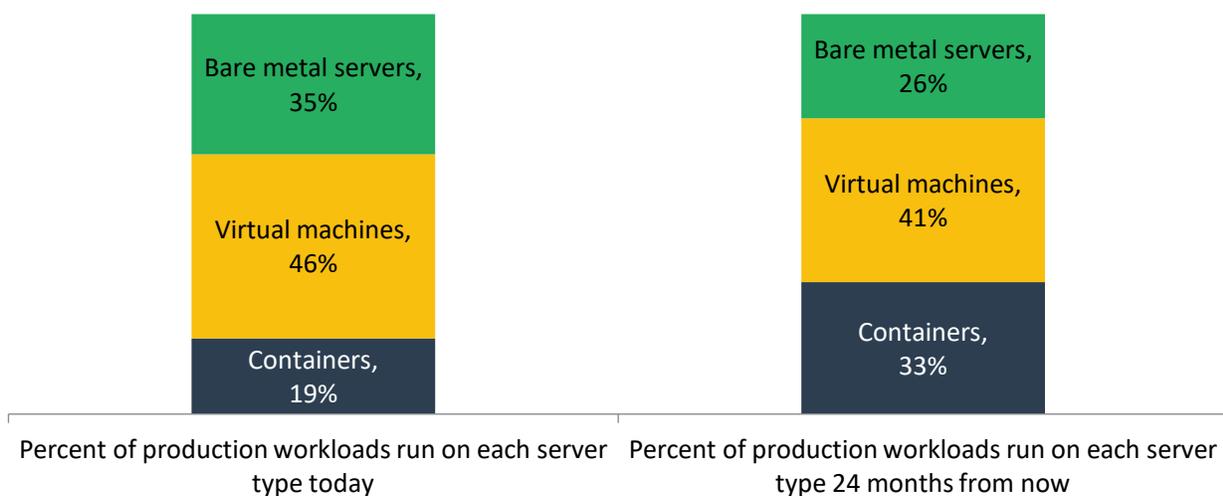
The Rise of Containers

With application development playing a central role in modern, digital businesses, developers now require a great degree of control over tools, processes, and platforms as they write and test their apps. Answering the call, containers are transforming IT by delivering business-critical application abstraction and portability, while overcoming the challenges with traditional infrastructure such as slow provisioning, coordination across teams, and excessive levels of bureaucracy.

By packaging applications with the libraries and bins those applications depend on to run, containers combine application isolation with a lightweight deployment scheme. As a result, containers are experiencing rampant adoption and are becoming widespread as a production workload deployment method. And as Figure 2 shows, IT managers surveyed by ESG believe the role of containers will expand even further in the near future.[3]

Figure 2. Containers in Production

Of all the production workload server types (e.g., containers, virtual machines, bare metal) used by your organization, what is the approximate percentage breakdown run on each today? What do you expect this to be 24 months from now? (Mean, N=450)

Bare metal servers, 35%	Bare metal servers, 26%
Virtual machines, 46%	Virtual machines, 41%
Containers, 19%	Containers, 33%
Percent of production workloads run on each server type today	Percent of production workloads run on each server type 24 months from now

Source: Enterprise Strategy Group

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[2] ibid.
[3] Source: ESG Brief, *The Growth in the Use of Application Containers*, May 2018.

For containers to achieve their potential in production environments, they need **persistent** storage. Containers are ephemeral by nature. They start up and shut down automatically. Without persistent storage, data "dies" when a container shuts down. Traditional storage arrays, even those fitted with a software wrapper between the array and the container-based environment, however, are often not sufficient to fully support containerized applications.

In container environments, traditional storage offerings often fall short because in addition to data persistence, **scalability** is a major factor. Cloud-native applications and microservices (applications broken into small pieces that are independent yet work together) often require more scalability than traditional applications, as refactoring (restructuring) the code for many of today's applications could result in hundreds or thousands of microservices running simultaneously. And developer require the ability spin up and spin down (provision) storage resources without intervention of the storage administrator slowing down the process.
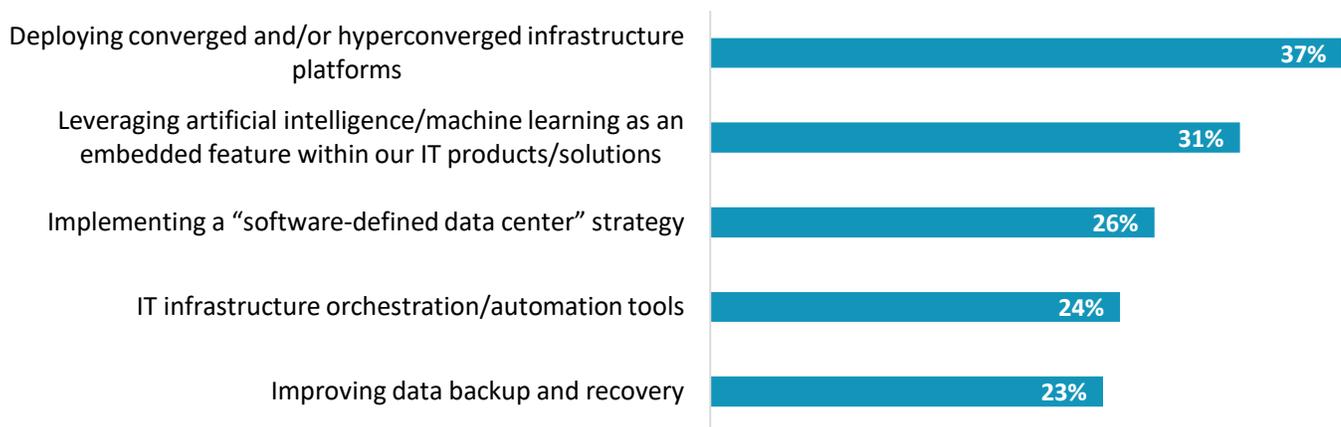
In those large-scale environments, **automated management and maintenance**, including automated installations and upgrades, become incredibly valuable as well. Containers also require **standardization** in order for the containerized applications to be ported across public clouds, private clouds, and traditional data centers. A prerequisite to standardization is infrastructure flexibility. Technologies, such as SDS, that can support multiple hardware infrastructure types and deployment models from the edge through the data center to the cloud offer inherent benefits necessary for container-based environments.

Modernizing the Data Center with HCI and SDS

Increases in cloud storage adoption are only part of the IT modernization equation: 49% expect to spend more on on-premises storage, too. To modernize their environments and address complexity, IT decision makers are seeking out converged/hyperconverged infrastructure (CI/HCI) and leveraging software-defined data center strategies (see Figure 3).[4]

Figure 3. Top Five Data Center Modernization Investments

In which of the following areas of data center modernization will your organization make the most significant investments over the next 12-18 months? (Percent of respondents, N=497, five responses accepted)

Deploying converged and/or hyperconverged infrastructure platforms	37%
Leveraging artificial intelligence/machine learning as an embedded feature within our IT products/solutions	31%
Implementing a "software-defined data center" strategy	26%
IT infrastructure orchestration/automation tools	24%
Improving data backup and recovery	23%

Source: Enterprise Strategy Group

While investments in CI/HCI and software-defined infrastructures offer value, each can provide an IT organization with a competitive advantage.

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[4] Source: ESG Master Survey Results, *2019 Technology Spending Intentions Survey*, February 2019.

HCI versus SDS: Divergent Pillars of a Modern Data Center

HCI: Simplifying Today's IT

The hallmark of HCI is consolidation, a great benefit to any IT organization trying to combat complexity. Consolidation brings simplicity; it makes the infrastructure easier to deploy, manage, and scale, as each of the top five benefits of HCI involve simplicity in some form (see Figure 4).[5]

Figure 4. Top Five Realized Benefits of HCI

What have been the most significant benefits your organization has realized by deploying a hyperconverged infrastructure technology solution(s)? (Percent of respondents, N=208, five responses accepted)

Benefit	Percent
Improved total cost of ownership (TCO)	28%
Improved scalability	28%
Improved service and support	23%
Faster deployment time	21%
Simplified management	21%

Source: Enterprise Strategy Group

Traditional HCI offerings, however, are often limited to serving only virtual machine environments, with little to no optimizations for container-based applications. As a result, traditional HCI offerings often simplify the complexities of today's IT, while introducing new challenges for high performing, higher scale environments. Nearly one in five (19%) users of hyperconverged technology identified performance issues related to data locality, and 16% identified difficulty managing multiple nodes in large scale environments.
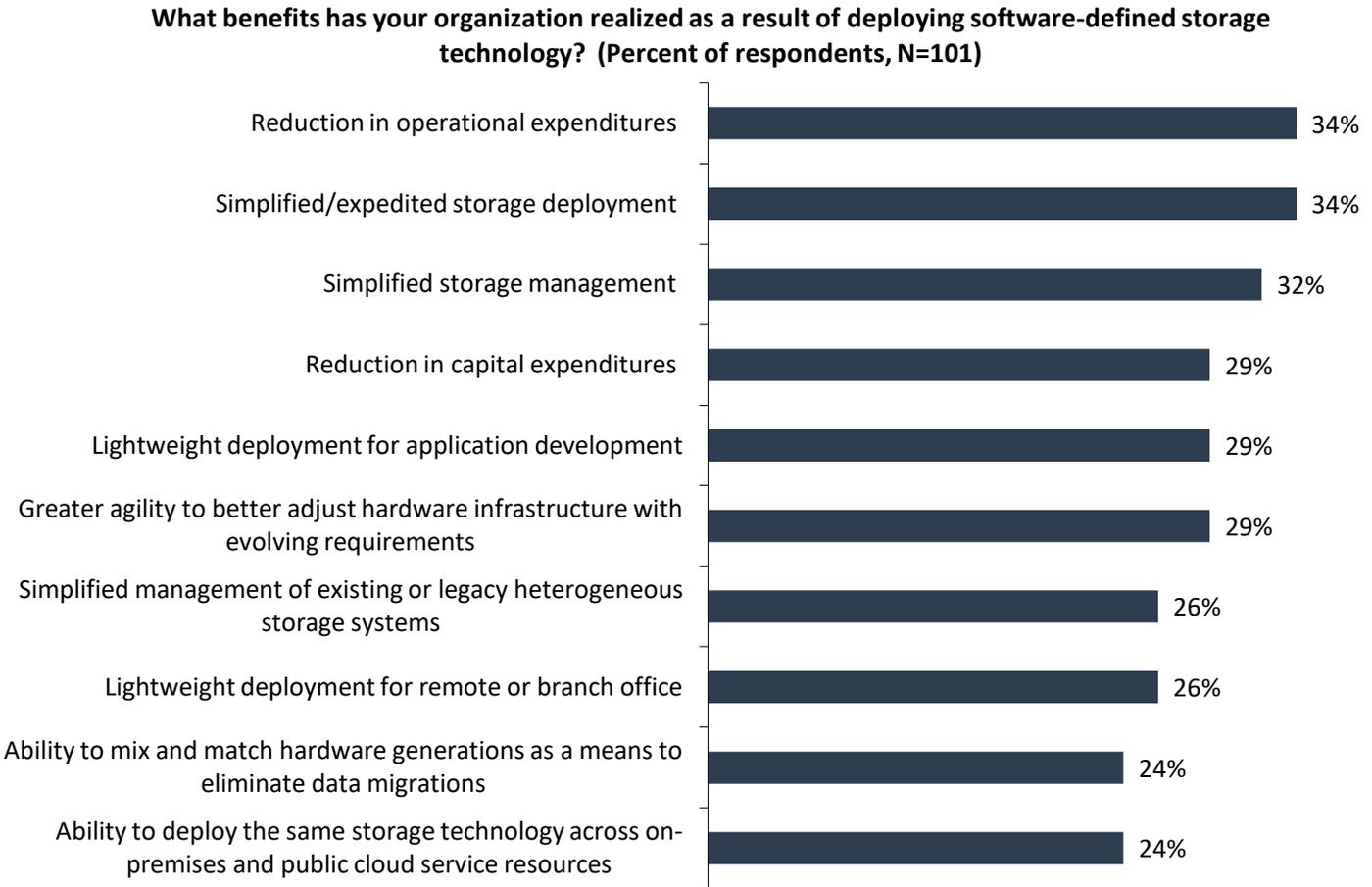
Software-defined Storage: Flexibility for Today and Tomorrow

A modern software-defined storage (SDS) architecture offers the flexibility to support HCI-based deployment models, while being well suited for container-based environments as well. In fact, the benefits SDS offers can be transformational—SDS improves hardware agility, eliminates hardware migrations, and supports hybrid cloud deployments (see Figure 5).[6] These are all important benefits in container-based environments.

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[5] Source: ESG Master Survey Results, *Converged and Hyperconverged Infrastructure Trends*, October 2017.
[6] Source: ESG Research Report, *Software-defined Storage (SDS) Market Trends*, February 2017.

Figure 5. Top Ten Realized Benefits of Software-defined Storage

What benefits has your organization realized as a result of deploying software-defined storage technology? (Percent of respondents, N=101)

Benefit	Percent
Reduction in operational expenditures	34%
Simplified/expedited storage deployment	34%
Simplified storage management	32%
Reduction in capital expenditures	29%
Lightweight deployment for application development	29%
Greater agility to better adjust hardware infrastructure with evolving requirements	29%
Simplified management of existing or legacy heterogeneous storage systems	26%
Lightweight deployment for remote or branch office	26%
Ability to mix and match hardware generations as a means to eliminate data migrations	24%
Ability to deploy the same storage technology across on-premises and public cloud service resources	24%

Source: Enterprise Strategy Group

The Red Hat Difference: Creating an Architecture for Today and Tomorrow

Red Hat, a provider of information technology and a leader in open source innovation, offers a software-defined storage infrastructure solution that is flexible enough to support traditional, HCI, and container deployments.

Real benefits come from using Red Hat technology to manage traditional, hyperconverged, and container environments. An organization will get a software-defined infrastructure with minimal hardware footprint. It will also get a solution that leverages Kubernetes—a dominant Linux-based container orchestration technology.

Red Hat's architecture allows an IT group to standardize its infrastructure to achieve multi-site scale-out to support multiple types of modern workloads. This offering, Red Hat OpenShift Container Storage, is portable across different hardware types and cloud services. It runs on-prem, in virtualized environments, and on three major public clouds.

Another product, Red Hat Hyperconverged Infrastructure, also gives IT organizations smart ways to achieve infrastructure consolidation and simplification. Leveraging open source hypervisor technology, and supporting both virtual machines and containers, it will reduce the organization's capital costs and lower risks associated with storage, container, and HCI deployments. Open source addresses the problem of hardware and software lock-in, and Red Hat offers it with an all-inclusive license/subscription, so organizations don't get nickeled and dimed with incremental add-on licensing costs.

This Is a Modern Infrastructure Foundation for the Future of IT

Red Hat optimized its storage technology thoughtfully and intentionally to meet organizations' future demands—for example, for facilitating Agile development for cloud-native applications. Red Hat is also predicting a future in which Kubernetes gradually takes the place of VMs to become the key infrastructure supporting on-prem and cloud environments alike. An HCI-based infrastructure with optimizations for Kubernetes simplifies deployment of infrastructure for both virtual machines and containers, while extending support to public cloud infrastructure providers.

With Red Hat's container technology spanning hybrid cloud IT, a single DevOps environment can persist that acts in the same way, whether it is deployed on-prem or in the cloud. Essentially, it is designed by Red Hat to increase container environment workload portability. IT can:

- Build, modify, and deploy applications residing in application containers and virtual machines in a shared environment.

- Leverage container-native virtualization to help ease migrations of virtualized workloads to containers.

- Build and deploy applications independent of the infrastructure, which simplifies decision making and makes it easier to make adjustments when business demands evolve.

- Use OpenShift to achieve unified Kubernetes orchestration for both the applications and the infrastructure.

- Consistently manage data services using a single storage endpoint, a consistent set of tools, and ultimately, a consistent user experience for both on- and off-premises workloads.

The Bigger Truth

Red Hat has clearly been putting a lot of thought into what organizations may need from their software-defined storage vendor. In fact, Red Hat may be the leading vendor right now that is checking all the boxes: It covers VMs, containers, public and private clouds, and open source. It offers abstraction for storage so developers don't have to care where their apps reside. It provides solid data integrity and security capabilities. And it covers traditional and hyperconverged workloads.

The fact is, however, that at the moment, few organizations are embarking on all those activities simultaneously. For example, companies might not be pursuing container IT right now, but it's almost certainly going to be a matter of *when*, not if, they do. And even SDS itself is still evolving. Ultimately, optimizing storage environments continues to be a moving target for organizations, influenced by changing business demands and evolving technology options.

Therefore, it is advisable for organizations to consider a vendor, such as Red Hat, that already has all the technology-innovation boxes checked off for today and tomorrow—a vendor that has been thinking a lot about how it can offer its customers an "and" experience, instead of an "or" experience. This is the only viable means of "future proofing" the organization.

Enterprise Strategy Group is an IT analyst, research, validation, and strategy firm that provides actionable insight and intelligence to the global IT community.