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An in-depth look at
HOW TO COMBINE COMPUTE, STORAGE AND NETWORKING INFRASTRUCTURES
and why hyperconvergence is a flexible IT framework for small and large enterprises alike.

INSIDE
HYPERCONVERGENCE

COMBINING STORAGE, NETWORKING AND COMPUTE in a single system, hyperconverged infrastructure (HCI) is designed to cut data center complexity while increasing agility and scalability.

HCI has evolved from an architecture supporting discrete workloads such as video and virtual desktop infrastructure (VDI) to a scalable platform for a variety of applications including databases, ERP systems, analytics, private clouds and even edge compuuting.

HCI systems include hypervisors for virtualized computing, software-defined storage and networking, and can run on commodity hardware or special-built, all-in-one appliances.

Choosing the right approach

Enterprises interested in adopting HCI are faced with a basic choice: software or all-in-one hardware. Several vendors offer integrated appliances. These include

INTRO

HPE's Simplivity systems and Dell EMC VxRail appliances. The main advantages of such systems are vendor-specified and guaranteed performance levels along with ease of installation and configuration.

Software-only offerings from vendors such as VMware and Maxta let you buy commodity hardware, potentially reducing costs.

HCI evolves as an enterprise IT architecture

Small and medium-size businesses (SMBs) initially drove adaption of HCI because the architecture allowed them to avoid the cost and complexity of a data center infra-structure. HCI gave them the agility of the public cloud as well as control over on-premises hardware.

Developments in the underlying technology of HCI, however, now make it an IT framework suitable for larger enterprises running a variety of large workloads.

The main improvements to HCI include NVMe (non-volatile memory express), a communications protocol and controller designed to move data to and from SSDs via the PCIe bus standard. NVMe SSDs are expected to offer orders-of-magnitude speed improvement over prior SSDs.

An Ethernet-compatible version of NVMe, NVMe over Fabrics (NVMe-oF) allows you to scale compute and storage separately. This means that enterprises can, for example, allow an application to access more storage without spending more on compute resources.

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WHAT IS HYPERCONVERGENCE?

Hyperconvergence combines compute, storage and networking in a single system. Enterprises can choose an integrated HCI appliance from a single vendor, or hardware-agnostic hyperconvergence software.

BY ANN BEDNARZ

HYPERCONVERGENCE is an IT framwork that combines storage, computing and networking into a single system in an effort to reduce data center complexity and increase scalability.

Hyperconverged platforms include a hypervisor for virtualized computing, software-defined storage, and virtualized networking, and they typically run on standard, off-the-shelf servers. Multiple nodes can be clustered together to create pools of shared compute and storage resources, designed for convenient consumption.

The use of commodity hardware, supported by a single vendor, yields an infrastructure that's designed to be more flexible and simpler to manage than traditional enterprise storage infrastructure. For IT leaders who are embarking on data center modernization projects, hyperconvergence can provide the agility of public cloud infrastructure without relinquishing control of hardware on their own premises.

How does hyperconvergence differ from converged infrastructure?

Hyperconvergence adds deeper levels of abstraction and greater levels of automation.

Converged infrastructure involves a pre-configured package of software and hardware in a single system for simplified management. But with a converged infrastructure, the compute, storage, and networking components are discrete and can be separated. In a hyperconverged environment, the components can't be separated; the software-defined elements are implemented virtually,

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with seamless integration into the hypervisor environment. This allows organizations to easily expand capacity by deploying additional modules.

What are the benefits of hyperconverged infrastructure solutions?

Hyperconverged infrastructure promises to deliver simplicity and flexibility when compared with legacy solutions. The integrated storage systems, servers and networking switches are designed to be managed as a single system, across all instances of a hyperconverged infrastructure. The inherent management capabilities enable ease of use, and software-defined storage is expected to yield greater scalability and resource efficiency. Companies can start small and grow resources as needed. HCI vendors also tout

potential cost savings in areas including data center power and space; IT labor; and avoidance of licensed software such as backup or disaster recovery tools.

Which workloads are candidates for hyperconvergence?

HCI systems were initially targeted at virtual desktop infrastructure (VDI) and other general-purpose workloads with fairly predictable

resource requirements. Over time they've grown from being specialty solutions for VDI into generally scalable platforms for enterprise applications, database, and private cloud, according to research firm Forrester.

In a survey of infrastructure pros whose firms are planning, implementing or expanding their use of hyperconverged systems, Forrester found the most common workloads being run on hyperconverged systems are: database, such as Oracle or SQL server (cited by 50%); file and

> **Hyperconverged infrastructure promises to deliver simplicity** and **flexibility** when compared with legacy solutions.

THE MOST COMMON WORKLOADS BEING RUN ON HYPERCONVERGED SYSTEMS ARE:

50% DATABASE, SUCH AS ORACLE OR SQL SERVER

40% FILE AND PRINT SERVICES

38% COLLABORATION, SUCH AS EXCHANGE OR SHAREPOINT

34% VIRTUAL DESKTOP

33% COMMERCIAL PACKAGED SOFTWARE SUCH AS SAP, ORACLE

25% ANALYTICS

17% WEB-FACING WORKLOADS SUCH AS LAMP STACK OR WEB SERVERS

SOURCE: Forrester

print services (40%); collaboration, such as Exchange or SharePoint (38%); virtual desktop (34%); commercial packaged software such as SAP, Oracle (33%); analytics (25%); and Web-facing workloads such as LAMP stack or web servers (17%).

A couple of key developments have made HCI more appealing for more workloads. One is the ability to independently scale compute and storage capacity, via a disaggregated model. The other is the ability to create a hyperconverged solution using NVMe — an open logical device interface specification for accessing non-volatile storage media attached via a PCI Express bus — over fabrics.

In general, there is a greater understanding of the value proposition of

How is hyperconverged infrastructure sold?

HYPERCONVERGED INFRASTRUCTURE is available as an appliance, a reference architecture, or as a software-only model. Bundled capabilities such as data deduplication, compression, data protection, snapshots, WAN optimization, and backup/disaster recovery differentiate vendors' offerings.

HCI HARDWARE typically comes in the form of an integrated appliance, a hardware/software package created and delivered by a single vendor. Appliance vendors include Dell EMC, Nutanix and HPE/SimpliVity.

APPLIANCE-BASED HCI arrives ready to use, offering vendor-guaranteed performance levels and requiring only minimal amounts of installation and configuration work.

A SOFTWARE-ONLY offering allows customers to deploy HCI on a bring-your-own-technology basis. HCI software vendors include Maxta and VMware (vSAN).

Advocates say that a software-based hyperconverged infrastructure approach offers greater flexibility, allowing them to choose their own server vendors and own their own software licenses, which can be transferred among servers.

Software-based HCI products also can be more precisely configured to match a customer's CPU, memory and storage needs. This allows adopters to easily scale up or out, which can make software-based HCI easier to manage and less expensive to operate.

HCI, including for smaller enterprises that may not need a full-scale data center infrastructure, but want to retain some control over their environments in an era when an increasing number of companies are moving to cloud computing, according to Sebastian Lagana, research manager, infrastructure platforms and technologies, at research firm IDC.

Hyperconvergence market heats up

Hyperconvergence is winning over enterprises that are drawn to its potential to ease management, streamline the deployment of new workloads, and optimize infrastructure costs.

As much as 20% of business-critical applications currently deployed on three-tier IT infrastructure will transition to hyperconverged infrastructure by 2020, predicts Gartner, which recently gave the technology <u>its own magic quadrant</u>. ∎

ANN BEDNARZ *is assistant managing editor, features for Networkworld.com.*

MAKING THE RIGHT HYPERCONVERGENCE CHOICE:

HCI HARDWARE
OR **SOFTWARE?**

The choice facing hyperconverged-infrastructure shoppers is simple: an integrated HCI appliance from a single vendor, or hardware-agnostic hyperconvergence software. It's making the final decision that's difficult.

BY JOHN EDWARDS

ONCE A NICHE TECHNOLOGY, primarily attractive to organizations with specific needs, such as streamlining operations at branch offices, hyperconverged infrastructure (HCI) is rapidly finding a wide customer base.

HCI is an IT framework that combines storage, computing and networking into a single system; hyperconverged platforms include a hypervisor for virtualized computing, software-defined storage, and virtualized networking.

Enterprises planning an HCI adoption can select from two main approaches: hardware or software. HCI hardware typically comes in the form of an integrated appliance, a hardware/software package created and delivered by a single vendor. Appliance vendors include Dell EMC, Nutanix and HPE/SimpliVity. A software-only offering allows customers to deploy HCI on a bring-your-own-technology basis. HCI software vendors include Maxta and VMware (vSAN).

"There are advantages going with a hyperconverged appliance versus going with the software approach, and conversely there are cost benefits when you go with the software-only model," says Naveen Chhabra, a senior analyst at market research firm Forrester. "Depending on the size of

the deployment, on your total exposure to a particular server vendor, on the size of the organization, you may want to take one approach or the other."

Plug-and-play HCI appliances

Appliance-based HCI arrives ready to use, offering vendor-guaranteed performance levels and requiring only minimal amounts of installation and configuration work.

"Users don't need to worry about the underlying hardware, as the vendor takes care of everything," explains Darren Wright, president of D2 Technology, a New Castle, Del., IT consulting firm. "Because they are closed systems, the vendors have better control of the hardware, which eases troubleshooting and performance optimization," he adds.

The appliance model's plug-and-play approach is what drew David Aldarondo, manager of network services at Post University in Waterbury, Conn., to the technology—an HPE SimpliVity hyperconverged platform.

"There aren't any firmware issues; everything is designed to work with everything else," he notes. "We have one source for support and we have a much smoother time."

Appliance technology also presented Aldarondo with some important financial benefits, since it allows Post's IT department to get by with fewer workers. "Because it's a Java appliance, we're able to manage it with fewer staff," he says.

Aldarondo is generally satisfied with his choice.

"My only want is for a denser box with more resources in it that takes up less space," he says. "It's already small—two-rack boxes—but the denser the resources are inside of that box, the less space it takes up."

Rich Gagnon, CIO for the City of Amarillo, Texas, says the decision whether to acquire an appliance- or software-based HCI must be rooted in real-world needs. "You have to start with the business case, then apply the technology that best fits that model instead of the other way around," he says.

The lure of integrated operation and management technologies helped sway Gagnon's decision to go with a Dell EMC appliance.

"It lets us be much more efficient as an IT organization and to focus on supporting our departments, our business," he explains. "We're driving efficiencies in their operations because I've got efficiencies in mine."

Localized vendor-based support was another strong factor leading to adoption, Gagnon says.

"We're a mid-size city, situated up in the (Texas) panhandle," he states.

"We're not a Seattle or a Chicago where I can just pick up five or six storage specialists, for example."

Hyperconvergence software: DIY style

Appliance-based solutions make it easy for customers to specify, order and deploy an HCI. "However, there are some downsides to any appliance-based approach, regardless of the industry, as they are essentially 'black boxes,'" observes Larry Chapman, IT infrastructure manager at Trusource Labs, a technical support services company that offers support for Internet of Things (IoT) technologies. "This is why we went to a software-based hyperconverged infrastructure approach," he adds.

Chapman says he appreciates the flexibility the Maxta software provides.

"I can choose whatever server vendor I want, and even change server vendors at any time," he explains. "There's no need to keep the same server vendor or even the same generation of Intel chipset."

Chapman also likes that fact that he owns the software license. "We can transfer this license to a new server," he says.

This is important to Chapman because, like many organizations, Trusource refreshes its servers every three or four years.

"If we had bought an appliance, we would have to re-buy the software license every time we refreshed the hardware since the software license is tied to the appliance," he notes. "If I need more capacity, I can literally just pull out a drive—with the system operating—and put in a larger drive."

"Software-based HCIs can be configured to precisely match a customer's exact CPU, memory and storage needs without overprovisioning," Wright observes. The approach allows adopters to easily scale up or out, which helps make them easy to manage and less expensive to operate.

Additionally, since software-based HCIs are hardware agnostic, adopters are free from the higher costs that generally result from vendor lock in. For SMBs, software-based HCIs are often the only choice that will fit within budget restrictions while also comfortably meeting high availability requirements, Wright reports.

"While set up is more labor intensive than with hardware-based

HCIs, once installed the systems are very easy to manage and deliver outstanding performance," he explains.

A software-based HCI can also give adopters leverage to strike a deal with a hardware vendor they may already have a strong relationship with, says Michael Colonno, senior solutions architect at CDI, a firm that architects, deploys and manages hybrid IT solutions, including traditional IT, public, private and hybrid clouds. "Software-based [HCI] creates the best bang for your buck; you are truly a master of your own domain," he says.

Yet the luxury of having multiple hardware options comes with an added risk. Hardware compatibility lists (HCL) must be closely followed, Colonno warns. "Vendors do their best to keep them up to date, as well as provide information on firmware versions, but sometimes this falls short and there are issues," he observes.

Mariusz Nowak, director of infrastructure services at Oakland University, located in the cities of Auburn Hills and Rochester Hills, Mich., decided to go with a software-based HCI running VMware vSAN on a Dell platform because he didn't want to give up the ability to make his own hardware decisions. "It was a matter of flexibility and freedom of choice," he says. "When you're buying a prepackaged solution, you have to stick with whatever the companies offer you."

With VMware vSAN, Nowak was free to use whatever hardware approach provided the most benefits. "If you want to combine it with hardware from different companies, you

> ## "Users don't need to worry about the underlying hardware, as the vendor takes care of everything.
>
> **DARREN WRIGHT,** PRESIDENT, D2 TECHNOLOGY

decouple the hardware layer from the software layer and you have full freedom to choose and apply whatever works for you, whatever platform you are running," he explains.

Nowak also appreciates the fact that moving to a software HCI required only a shallow learning curve. "When you choose something that you've already dealt with, it's much easier to transition rather than having a new animal show up in your zoo," he remarks. "We already knew VMware, and we didn't have to learn third party software or a third-party appliance."

Due diligence for hyperconverged infrastructure

Not surprisingly, given the technology's critical importance, selecting the right type of HCI requires a considerable amount of planning and preparation.

"I would start with doing due diligence and research about particular needs, workloads and applications," Nowak says. "There might be a different environment for a general workload and applications; there might be different requirements for databases."

"Do a proof of concept to make sure that HCI works for you and that the vendor meets your performance requirements," Chapman advises. "Next, ask the vendor to provide a cost estimate for the first five years

of use, assuming storage growth and the need for a hardware refresh or two during that time."

This is where Chapman saw a massive price difference between appliance-based HCI and software-based HCI technologies. "We found that appliance-based HCI solutions were over 50% more expensive than software-based HCI solutions over a five-year period," he reports.

Nowak recommends that buyers should also collect relevant engineering data and set specific requirement benchmarks. "Later on, they should compare the feature list of each solution and determine what would be the best investment based on both need and affordability," he suggests.

Gagnon, however, cautions potential adopters of both hardware- and software-based hyperconverged infrastructure not to get bogged down by slight differences in technical specs and costs and to focus instead on the final result.

"I started as an engineer, and I love getting my propeller spun," he quips. "I could spend all day long looking at the tech, but you also have to step back from that and put it in context in order to make a good decision." ■

JOHN EDWARDS *is a veteran business technology journalist. His work has appeared in* The New York Times, The Washington Post, *and numerous business and technology publications.*

HYPERCONVERGENCE:
Not Just for
SPECIFIC WORKLOADS
Anymore

HCI is appealing for more workloads now that systems can independently scale compute and storage capacity via a disaggregated model. The ability to create a hyperconverged solution using NVMe over fabrics is another draw.

BY BOB VIOLINO

HYPERCONVERGENCE HAS COME A LONG WAY in a relatively short time, and enterprises are taking advantage of the new capabilities.

Hyperconverged infrastructure (HCI) combines storage, computing and networking into a single system; hyperconverged platforms include a hypervisor for virtualized computing, software-defined storage, and virtualized networking.

HCI platforms were initially aimed at virtual desktop infrastructure (VDI), video storage, and other discrete workloads with predictable resource requirements. Over time, they have advanced to become suitable platforms for enterprise applications, databases, private clouds, and edge computing deployments.

A couple of key developments have made HCI more appealing for more workloads. One is the ability to independently scale compute and storage capacity, via a disaggregated model. The other is the ability to create a hyperconverged solution using NVMe — an open logical device interface specification for accessing non-volatile storage media attached via a PCI Express bus — over fabrics.

In general, there is a greater understanding of the value proposition of HCI, "specifically for smaller enterprises that may not need [or] want a full-scale data center infrastructure, but want to retain some control over their environments," says Sebastian Lagana, research manager, infrastructure platforms and technologies, at research firm IDC.

"The increasing use of hybrid cloud environments by enterprises also lines up nicely with the software-defined data center story, which HCI is certainly a large

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part of," Lagana says.

HCI has become a suitable platform for broader use due to a lot of the underlying improvements in the technology, Lagana says. At the same time, many enterprises have gone through an IT "refresh cycle" and HCI seems like a natural transition.

"We've spoken with some HCI adopters and, in some cases, folks we're talking to are upgrading multiple generation-old infrastructure running on old, sometimes now unsupported software," Lagana says.

"At that point, if the old server and/or storage technology they're using is that far behind what's now available, it becomes a matter of the level of complexity they're seeking in their new environment."

HCI has the required horsepower while providing a user-friendly management interface, Lagana says. "Could you run faster with a highly customized solution?" he says. "Sure, but in many cases it's not worth the extra effort when the HCI solution will suffice and provides good long-term scalability."

Among the key benefits organizations can see from deploying HCI more broadly are greater consolidation and simplification of the IT infrastructure, which allows IT teams to better support business objectives, Lagana says.

Other possible benefits include faster helpdesk response times, proactive understanding of potential hardware failures, the ability to quickly spin up new servers or test environments, faster disaster recovery and easier backup features.

"There are also the more mechanical benefits," Lagana says. "Hardware consolidation provides power, cooling and facilities cost savings, which is easy to measure and is an easy sell to less tech-savvy budget holders," he says. "Also, HCI and the underlying software makes it easier to maximize utilization of existing resources, which reduces longer-term storage and server expenses as well."

HCI deployment scales as business expands

Celtic Manor Collection, a resort hotel and conference center operator, started using two clusters of Dell EMC's VxRail HCI appliance, beginning in September 2017. Among the initial business drivers for deploying HCI was that Celtic Manor was embarking on a new joint venture to build an international convention center in Wales, says Chris Stanley, IT manager.

The project required the flexibility to scale systems quickly, the ability to easily manage and maintain data center capacity with a small team, the ability to respond quickly to any outages in service, and resiliency to avoid any downtime for large-scale events at the convention center.

Celtic Manor previously had an environment that included storage-area networks (SAN) and VMware ESXi servers, but it was taking a lot of resources to maintain, upgrade, and troubleshoot, Stanley says. "The business was growing—and still is—rapidly and bursting at the seams with data," he says. "We needed a complete rethink" to prepare the data center for the future and simplify management.

Initially the company was deploying the clusters as separate data centers for different business entities.

"When we deployed our second cluster we quickly realized we could do more if the two were able to connect over the network together," Stanley says. "As of today, we now have our core business systems split between the two clusters, with all of these having a recover point copy on the opposite cluster. So we now have full cluster failover if required, [which] gives us a lot of peace of mind as a business."

HCI has become "the core tech in our business, Stanley says. "With our planned business expansion of several new hotels in the next two years, we have a template with predictive costs and scalability."

The company uses HCI for its main enterprise applications, which run on large Oracle and SQL databases. "These are using less resources than when they were in their previous environment, and we regularly monitor these to see if

> **"Hardware consolidation provides power, cooling and facilities cost savings,** which is easy to measure and is an easy sell to less tech-savvy budget holders.
>
> SEBASTIAN LAGANA, RESEARCH MANAGER, IDC

any servers are over provisioned," Stanley says. A VDI rollout became part of Celtic Manor's plan.

"With our business growing, we are looking to potentially use the HCI clusters for cloud and remote deployment for our new hotels," Stanley says. "VxRail has given us a solid, flexible platform to grow our business."

What has enabled an expanded role for HCI are developments in NVMe over fabrics, with CPUs having a smaller workload intensity, and greater amounts of input/output operations per second (IOPS) being achieved on a regular basis, Stanley says.

"With demands on data center performance growing to process and store vast amounts of data every second, it is great timing for the hyperconverged market to make its mark," Stanley says.

Among the key benefits of HCI thus far are less time spent by the IT team on upgrading and maintaining the data center; improved application performance; and a 10% reduction in data center power consumption.

HCI powers county's core apps and services

Also expanding its use of HCI is the County of San Mateo, Calif., which began using Nutanix's HCI platform in 2014.

"We originally looked at the HCI solution to solve performance issues with our VDI deployment on VMware's Horizon platform," says Jon Walton, CIO. "We had unsuccessfully tried to use EMC, Dell, and NetApp storage on blade servers, but kept running into high latency issues, especially as users logged into their sessions."

After initial successes with VDI,

county officials began to consider using the Nutanix HCI platform for all of its virtual workloads. "The timing was perfect, as we were starting to virtualize more and more workloads," Walton says.

In the last two years, the county has moved all its heavier workloads running Microsoft SQL and Oracle to dedicated Nutanix clusters. Most recently, it moved its countywide voice-over-IP implementation to two dedicated Nutanix clusters running Avaya Aura on VMware ESXi.

There have been "constant improvements on every level" with HCI, Walton says. "Shortly after we adopted Nutanix, they came out with one-click software upgrades. Through their HTML5 interface, we can upgrade every element of our virtual stack—disk firmware, BIOS, Nutanix AOS, Nutanix health check and VMware ESXi—with zero downtime and almost zero interaction."

San Mateo has already converted its Oracle and MS SQL applications to the HCI environment. It is also leveraging Nutanix's Protection Domain replication service for remote sites to provide high availability within county data centers, Walton says.

With HCI, "instead of spending all our time reacting to problems and resource constraints, we now have the time to research smart technology choices for the county," Walton says. "Additionally, we no longer must rely on a small group of SMEs [subject matter experts] to provide expertise around storage and servers, as Nutanix takes care of it for us."

County residents who rely on a variety of services have also seen benefits. "They don't know or care what we run on, they just know it is fast and has had almost zero downtime in five-plus years," Walton says.

Hyperconvergence market trends

Demand for HCI and for data center convergence in general is on the rise. Worldwide converged systems market revenue increased 14.8 percent year over year to $4.15 billion during the fourth quarter of 2018, driven primarily by HCI, according to IDC.

HCI differs from converged infrastructure in part by offering greater levels of automation. HCI products are driving take-up of converged systems worldwide thanks largely to their ability to reduce infrastructure complexity, promote consolidation, and allow IT teams to support an organization's business objectives, according to IDC.

IDC provides two ways to rank technology suppliers within the hyperconverged systems market, in terms of market share. One is by the brand of the hyperconverged platform and the other is by the owner of the software providing the core hyperconverged capabilities.

For brand, those with the highest share are Dell, Nutanix, Cisco, and HPE. In terms of HCI software, the leaders are Nutanix, VMware, Dell, Cisco, and HPE.

As for future developments in the hyperconvergence market, one of the growing trends is NVMe-based HCI, Lagana says. "We're seeing flash as a major adoption driver, not just in HCI but in broader converged infrastructure and storage markets, and NVMe is the next step in that evolution," he says. ∎

BOB VIOLINO *is a contributing writer for Computerworld, CIO, CSO, InfoWorld and Network World, based in New York.*

Virtual desktop infrastructure (or VDI) has been an intriguing idea for a long time. We look at the pros and cons of VDI and whether the emergence of hyperconverged infrastructure (HCI) will finally make implementing virtual desktops feasible.

BY NEAL WEINBERG

HYPERCONVERGENCE **BREATHES NEW LIFE** INTO DESKTOP VIRTUALIZATION

Virtual desktop infrastructure (VDI) Is one of those tantalizing technologies that looks great on paper, but hasn't gained much traction over the years for a variety of financial, technical, cultural, even philosophical reasons.

However, hyperconvergence, a relatively new framework combining compute, storage and networking in a single system, could breathe new life into VDI by reducing the cost and complexity associated with a VDI rollout.

The argument in favor of VDI, also known as desktop virtualization or thin-client computing, makes perfect sense.

What if enterprise IT could get off the expensive and time-consuming cycle of replacing desktops and laptops every two or three years, then constantly dealing with patching, updating and maintaining those devices?

And what if it could essentially eliminate the possibility of endpoint data loss?

With VDI, the operating system and all applications are hosted on virtual machines (VMs) running in a secure data center. Companies save on hardware costs by deploying inexpensive thin clients, repurposing old desktops or taking advantage of the BYOD movement and having employees buy their own devices.

Data is not at risk because the virtual desktop doesn't have a hard drive. VDI offers the benefits of centralized management. And VDI enables employees to securely access their virtual desktops at any time from any location on any device.

How VDI works

VDI requires an end user device, network connection and VMs located in the data center. Typically, the virtualized desktop is equipped with nothing more than flash memory and a display protocol client like Microsoft's RDP, VMware's PCoIP or Citrix's HDX.

In the data center, IT administrators create pools of identically configured VMs for specific job functions. When an end user establishes a session, the connection broker assigns the session to an available virtual desktop from the appropriate pool.
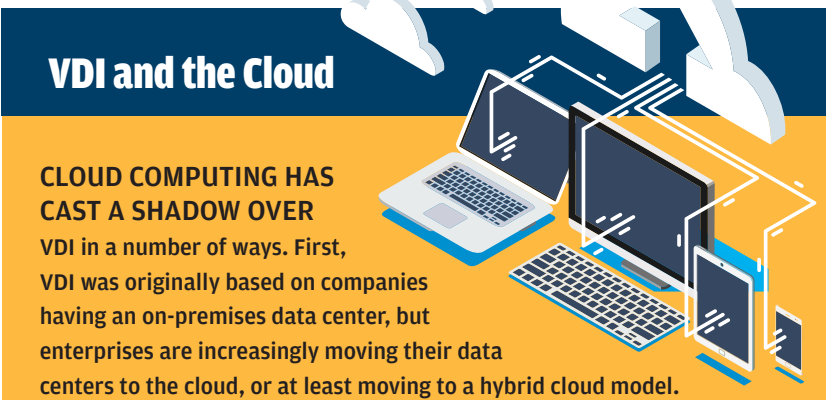
There are two ways to operate VDI. Persistent VDI provides each user with their own desktop image which is saved for future use. Non-persistent desktops revert to their original state each time a user logs out.

VDI Pros and Cons

VDI promised to be a huge money saver, but adopters discovered that VDI didn't reduce costs, it just shifted them. Instead of spending money on new desktops, companies had to upgrade the network to provide the reliability and user experience that employees expected.

Companies then had to add expensive storage and compute power to the data center. And VDI required re-architecting data center assets in order to handle VDI-specific situations like the daily login storm at 9 a.m.

Management is another area where VDI's purported benefits proved to be somewhat illusory. The notion that IT could create a "golden image" of the end user desktop and update or patch thousands of desktops with one click sounds great.

VDI and the Cloud

CLOUD COMPUTING HAS CAST A SHADOW OVER VDI in a number of ways. First, VDI was originally based on companies having an on-premises data center, but enterprises are increasingly moving their data centers to the cloud, or at least moving to a hybrid cloud model.

You could certainly run VDI from the cloud, but that creates new security, connectivity and cost issues.

And many applications don't live in an on-premises data center or even in cloud-based servers. For example, for companies that have moved to or are thinking about moving to Office 365, those email and productivity apps live in Microsoft's Azure cloud. So, how does that affect the golden image?

Beyond that, what makes cloud computing attractive to enterprises is that it's all about agility and flexibility. Employees want the freedom to take out a credit card and quickly access a new cloud-based app or switch from one productivity app to another. And what about commonplace, on-the-fly situations where somebody wants you to join a WebEx and download a presentation or grab a document from their Dropbox folder?

So, there's certainly a practical and philosophical side to the question of whether VDI is the right fit for your company or at least which subset of workers would be appropriate for a VDI scenario.

And it works in specific use cases, such as employees who can do their job entirely within the parameters of that standard desktop image, in call centers, warehouses and retail locations, or with contractors.

But in most other circumstances, real life is a lot messier and less controllable. You have employees with their own devices, running a variety of operating systems. Some employees rely on a legacy or customized app to get their job done. And even employees in the same department might have their own specific mix of applications.

There are two other big cons for VDI. If the VDI server goes down or if the connection to the VDI server is interrupted, nobody works. Second, with VDI, employees can't work offline because nothing is stored on the device.

Technologically, VDI is easier to

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VDI was originally based on companies having an on-premises data center, but **enterprises are increasingly moving their data centers to the cloud**, or at least moving to a **hybrid cloud model**.

deploy today that it has ever been thanks to a range of factors including better graphics, faster chips, cheaper storage, reliable broadband and easier VM deployment and management.

But trying to impose centralized control runs counter to the personalization and customization that employees have come to expect. Imagine telling a millennials that if they come to work for your company, they won't be able to use their preferred cloud-based productivity apps or work offline while on a plane, even on their own device.

VDI vs. DaaS

One alternative to an enterprise IT department running its own VDI deployment is Desktop-as-a-Service or DaaS. In the DaaS scenario, companies hand control of their desktops to a cloud services provider.

With hosted desktops, you don't need to own data-center servers or storage at all. And the DaaS provider takes care of patching, maintaining and updated applications. Outsourcing desktop virtualization to the cloud can provide flexibility, mobility and general ease-of-use for users and administrators.

Of course, DaaS has its own potential downsides. You're giving up control over your data and trusting a third-party to protect your information. You're relying on the cloud-services provider not to have an outage that prevents employees from working. And software licensing is an issue with DaaS.

VDI and HCI: Hyperconvergence may be the answer

VDI has been around in one form or another since the `90s, so it's fair to ask: If VDI hasn't taken off by now, when will it?

The answer may lie with hyperconverged infrastructure (HCI), which combines hypervisor, compute, storage and networking in modular building blocks. HCI can also include backup, replication, cloud gateway, caching, WAN optimization and real-time deduplication.

HCI can cut costs in several ways. First, buying an HCI appliance with all of the data center components already bundled is less expensive than buying those pieces individually. HCI delivers simpler management, automated updates, reduced maintenance costs and faster, easier scalability.

HCI vendors are specifically targeting their appliances at the VDI market and some are offering automated VDI deployments.

For companies concerned about the security of their endpoints or looking for an alternative to the traditional desktop lifecycle, VDI on HCI is something to consider. ∎

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