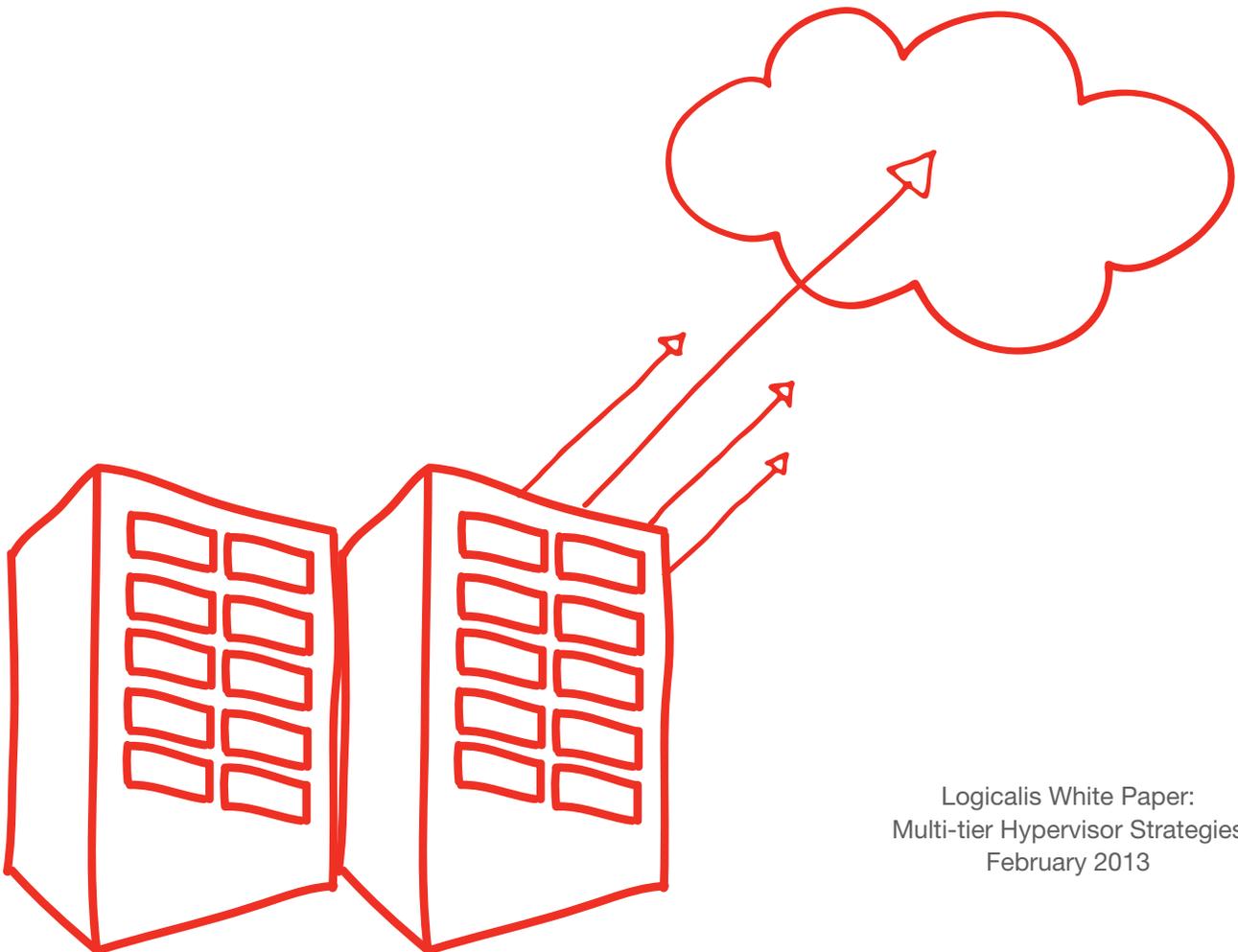# The Gathering Storm in the Virtual World

The pace of innovation in the virtual world continues to accelerate, opening new virtual dimensions and strategies for multi-tier Hypervisors.

It doesn't seem that long ago that VMware was an upstart. When they launched the company in 1998, VMware's founders envisioned the abstraction or "virtualization" of x86 hardware from software. IBM had accomplished virtualization in the mainframe world, but the x86 market was still all about cheap physical servers—often running only a single application—strung together on corporate networks.

Virtualization was a game changer, and VMware owned the new game. The cost savings associated with being able to use virtualization technology to consolidate the number of physical servers needed by a factor of 25 to 1 (or more) unleashed a tsunami of virtual machines (VMs), with VMware riding the crest. VMware held 100 percent of the server hypervisor market, as recently as 2005. By then, the company had been acquired by EMC for $635 million.

The virtualization market reached a tipping point in 2010, when more virtual servers were launched than physical servers. Today, VMware generates more than $4 billion in annual sales and has assets valued at more than $40 billion.

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The Writing on the Wall

As the market has continued to grow in scope, extending across infrastructure to include servers, storage, desktops, networks and the cloud, VMware remains dominant. But openings are appearing in its control of the market that it spawned.

Gartner now pegs VMware's market share of server virtualization at 65 percent. Leading the second tier of hypervisor vendors is Microsoft, grabbing 27 percent. The balance of the market is claimed by Citrix's XenServer, Red Hat's KVM, and isolated pockets of Oracle's VM, and others in the open-source Xen community.

Microsoft's rollout of a third-generation Hyper-V—as a component of Windows Server 2012, as well as a standalone implementation—was heralded by pundits claiming that Hyper-V could now stand toe-to-toe with VMware's flagship vSphere.

Considering the Alternatives

Today many companies are considering a multi-tier hypervisor strategy. The most common arguments for a multi-tier hypervisor strategy include:

- License fees by second-tier hypervisor vendors are significantly less than VMware—and, in some cases, appear free.
- VMware alternatives like Hyper-V, KVM, and XenServer are now more mature and have broader scope and more competitive features.
- Management tools are beginning to appear that make it possible to manage multiple hypervisors from behind a single pane of glass.
- The cost-efficient tiered-storage model that distributes data across different types (and costs) of media depending on the criticality and recovery requirements of the data lends credence to the cost advantage of tiered hypervisors for specific workloads.

The pace of innovation in the virtual world continues to accelerate, opening whole new virtual dimensions—such as software-defined data centers and software-defined networks—that ultimately promise to shift more control of the IT infrastructure from hardware to software and extend the disruptive force of virtualization through the IT industry in the process.

VMware almost singlehandedly set in motion one of the most disruptive forces to sweep through the IT industry. A look into the near future suggests that the wave of disruption continues to gain force.

The Top Contenders

Here's a snapshot of the major players:

VMware
Unlike the other hypervisor vendors, VMware's entire focus is on the virtual world. Through internal development and acquisition, it has very aggressively and successfully expanded the virtual world to encompass the entire IT infrastructure, including public, private, and hybrid clouds.

Key products across the infrastructure include:

Server and Storage
VMware's flagship vSphere is now in its fifth generation. vSphere is a combination of bare-metal hypervisor ESXi and vCenter Server, which offers extra services to enhance the reliability and manageability of server deployment, including:

- VMotion—the capability to move a running virtual machine from one ESX host to another.
- Storage VMotion—the capability to move a running virtual machine from one storage device to another.
- DRS (Distributed Resource Scheduler)—automatic load balancing of an ESX cluster using VMotion.
- HA (High Availability)—in case of hardware failure in a cluster, the virtual servers will auto-matically restart on another host in the cluster

Desktop Virtualization
VMware View 5, VMware's offering in virtual desktop infrastructure (VDI), takes advantage of all the features, services, and fault tolerance built into vSphere to manage pools of virtual desktops, assign them to users, and define policies for VDI behavior, all from a single browser-based UI. In response to the bring-your-own-device (BYOD) trend, VMware rolled out Horizon Data (formerly Project Octopus) and Horizon Application Manager 1.5, which deliver virtual desktops and applications to mobile devices.

Application Development
The full potential of virtualized environments—including clouds—will only be realized through advances in lean/agile development of applications that are capable of automatic self-provisioning and can expand and contract as business requirements change.

With vFabric, a set of integrated tools to develop, deploy, run, and manage lean Java-based applications, VMware has laid the foundation for a comprehensive application development environment that runs entirely in a VMware world.

Cloud Management
vCloud Director is VMware's cloud computing management platform for delivering infrastructure as a service (IaaS). vCloud Director abstracts the virtualized resources to enable users to gain self-service access to them through a services catalog. Tasks previously requiring significant IT staff resources and time to accomplish, such as configuring a network, are automatically executed in minutes with vCloud Director.

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Cloud Foundry is VMware's platform as a service (PaaS) solution and provides integrated sets of tools that can be used to set up a PaaS environment in a private cloud and to develop, deploy, and manage applications.

What VMware doesn't develop internally, it acquires, always looking for technologies that open market-launching new dimensions within the virtualized world.

In December, EMC spun out Cloud Foundry, combined with recent acquisitions of Greenplum analytics and Pivotal Labs agile development, into a separate virtual organization with 1,400 employees, led by former VMware CEO Paul Maritz. Referred to as the "Pivotal Initiative," the new organization will be formally launched in Q2 2013 and is positioned to leverage the rapidly expanding application development and big data markets.

Other notable VMware acquisitions in 2012 that open the door to new markets include DynamicOps, a cloud provisioning and management vendor in the emerging software-defined data center space, and NICIRA, a software-defined networking vendor. More on the implications of these acquisitions later.

Microsoft Hyper-V

Microsoft was not an early adopter of virtualization. Chasing the trend, Microsoft acquired the virtual machine solutions of Connectix, a provider of virtualization software for Windows and Macs, in 2003. But it wasn't until 2008 that it launched a beta version of what would become Hyper-V. Leveraging its own dominance in x86 operating systems, since then Microsoft has been building a base of Hyper-V users largely among small and medium businesses (SMBs) and departments within larger organizations.

With the release of Windows Server 2012 in September, Microsoft significantly updated its Hyper-V virtualization platform. Hyper-V 3.0, for example, is capable of scaling up to higher physical and virtual memory limits and supports a host of high-availability and "resiliency" features such as off-site replication of servers, regardless of whether you're virtualizing Windows servers, Windows desktops, or Linux. Hyper-V 3.0 also improves security and isolation in multi-tenant cloud environments, allows the migration of virtual machines from one physical server to another without any downtime, enables network virtualization, and boosts performance.

With Hyper-V 3.0, Microsoft is specifically targeting the cloud and can deploy new server VMs on demand without a local administrator. An updated System Center Virtual Machine Manager enables the creation and management of private clouds running Hyper-V, VMware, or XenServer virtualization hosts.

The licenses for Windows Server itself are tied to a specific set of hardware, but other operating systems can be hosted on the standalone Hyper-V server and managed as part of the same environment—all with the same sort of manageability.

Though smaller, Hyper-V sales have actually been growing faster than VMware's ESX, especially within Microsoft's traditional base of businesses with less than 1,000 employees that use virtual servers. Gartner estimates that Microsoft's Hyper-V has captured as much as 85 percent of this market.

Larger organizations have also turned to Hyper-V for non-critical parts of IT such as development or tests, web services, SharePoint, and applications that have resiliency and can be replicated across multiple servers.

With the release of Windows Server 2012, Microsoft significantly updated its Hyper-V virtualization platform and threw down the gauntlet to VMware.

Techs that started out on Windows server management and have progressed to virtualization roles have a high comfort level with the Windows environment. Ironically, hypervisor tiering requires such a broad range of skills that only larger organizations have the trained resources to administer it successfully.

Citrix's XenServer
Xen, the precursor of XenServer, originated as a research project at the University of Cambridge. The first public release of Xen as an open-source hypervisor was made by XenSource Inc. in 2003. XenSource was acquired by Citrix in 2007.

The latest version of XenServer provides shared-nothing and storage-live migration, a new direct VMware Inc. conversion tool, networking updates, and support for a new storage array through the StorageLink program.

Because of its background in delivering applications to the desktop, Citrix's XenApps has been a logical choice for organizations that are migrating to VDI. Many have ended up with multi-hypervisors by default with the application delivery team running XenApps and their server team running VMware.

Channel partners and analysts say Citrix already has ceded ground in the enterprise to Hyper-V as a back end for its own XenApp and XenDesktop applications in the VDI space. Some virtualization industry watchers have wondered if Citrix will continue to develop XenServer to remain competitive or will concede to Hyper-V 3.

Red Hat's KVM (Kernel-based Virtual Machine)
The KVM hypervisor was released as part of Linux 2.6.20 in February 2007. Its functionality has been developed over the years by more than 250 organizations within the open-source community. Red Hat Enterprise Virtualization, which combined KVM and a management system, was initially released as Red Hat KVM in November 2009.

Red Hat has since built a $1 billion company on the premise that open-source Linux is cheaper than Windows or Unix and that open-source Java application servers are cheaper than commercial alternatives such as WebLogic and WebSphere.

Red Hat's KVM has been given a boost from the Open Virtualization Alliance (OVA), which includes IBM, HP, Intel, BMC, and other industry players dedicated to encouraging use of open virtualization technology. IBM in particular is an outspoken champion of KVM.

The choice of a hypervisor within the open-source community can be influenced by non-hypervisor software. OpenStack, for example, is an open-source operating system for building infrastructure as a service (IaaS) public and private clouds. It was originally developed by Rackspace Cloud and NASA in 2010. The OpenStack Foundation now lists more than 150 sponsoring organizations, including AMD, Intel, Red Hat, Cisco, Dell, HP, and IBM. OpenStack is mostly used on the Linux operating system, and most development is done with KVM and Xen hypervisors.

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Caveat Emptor

Each hypervisor toolset excels in specific areas within the virtual world, and each has its outspoken champions. In fact, on their own merits and in their own corners of the market—some of which are obviously much bigger than others—each hypervisor in the top two tiers offers a robust set of competitive features and functionality.

The challenge comes when hypervisors have to interact with each other. In a multi-hypervisor environment, admins end up contending with multiple template libraries, multiple ways to deploy new VMs, and (potentially) multiple private clouds. They have to ask: Do my backup and disaster recovery tools support multiple hypervisors? If a VM fails, what application do I use to restore it? If I have VMware for tier 1 and Hyper-V for tier 2, what happens when I need to move a development workload from one tier to the other? How do I know a workload will behave the same way with a different hypervisor? The answers to these questions is not always readily available.

The lack of robust multi-hypervisor tools means that additional staff are required to manage parallel virtualization islands. Any savings on license fees in the capital expenditures budget by implementing a multi-hypervisor strategy can be quickly erased by the need to provide additional skills in the operational expenditure budget. IT departments need to evaluate their needs very carefully, now and in the future, before they jump at a cheaper price.

The trend, regardless, is for greater competition between hypervisors.

Dealing with Diversity

The key to executing an effective multi-tiered hypervisor strategy is a management tool that makes it possible to manage all the hypervisors from one central point.

Like a lot of this market, the management solution that will enable multi-tiered hypervisors to work together effectively is still taking shape. The "single pane of glass" claim is popular among management vendors, but too often management tools that claim to support multiple hypervisors don't provide the same visibility of performance data for each one. Apples-to-apples comparisons between them, as a result, are problematic, if not impossible.

The situation can be complex enough if you are moving an application you developed and tested in one hypervisor environment in your data center to another hypervisor environment for production. Moving workloads from a data center environment running one hypervisor to a cloud environment running a different one increases the complexity level dramatically. Now you're not just abstracting the hardware from the software to enable consolidation.

This is where virtualization meets IT service management (ITSM)—or should. Once you apply cloud computing concepts such as self-service and consumption-based metering to this type of automated, virtualized environment, you need to build a service catalog and apply ITIL best practices. ITSM requirements include incident, problem, and change management, dynamically updating a configuration management database (CMDM), and aligning your technology with business priorities and policies.

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IT teams frequently find that traditional change, configuration, and provisioning processes and tools are too disconnected and inconsistent to support the rapid movement of resources required in virtualized and cloud environments. Management tools are emerging that can accommodate an IT infrastructure that includes private, public, and hybrid clouds.

Top-Down Management Tools

The traditional management tool vendors—IBM, HP, BMC, and CA—all have offerings. Two that stand out in the marketplace currently are:

- **CA's Automation Suite for Cloud,** which is arguably considered the lead offering among traditional management tool vendors, and
- **DynamicOps**, which was recently acquired by VMware and rebranded as vCloud Automation Center with the launch of vSphere 5.1.

CA's Automation Suite for Cloud (ASC) allows you to provision physical and virtual workloads regardless of hypervisor and to select different tiers with different hypervisors in your service catalog.

CA's ASC can also sit on top of a VMware or other hypervisor environment and combine midrange and mainframe systems with x86. Logicalis uses CA's ASC for customers who want to access non-virtualized (physical) environments and/or operating environments such as IBM Power or operating systems such as i50S, AIX, HPUX, and other midrange and mainframe operating systems, as well as Windows and Linux environments.

VMware's vCloud Automation Center is the newest member of VMware's vCloud family. Announced with the vCloud Suite 5.1 bundle, vCloud Automation Center allows IT administrators to provision private and public clouds using a policy-based approach in an automated fashion. Resources can be requested by service customers using a self-service portal.

Automation Center integrates closely with VMware vCenter Orchestrator to automate IT workflows related to service provisioning and to integrate with existing corporate IT policies. Workloads can be managed from the vCloud Suite's management console using capabilities derived from VMware's DynamicOps acquisition.

vCloud Automation Center also gives VMware a running start in the emerging market for software-defined data centers. Positioned as a "software-defined data center in a box," the VMware vCloud suite combines vCenter Operations Management Suite 5.6 for virtual systems management, vFabric Application Director 5.0 for deploying applications in a virtual environment, and vCloud Suite 5.1 for managing pooled resources as a cloud operation.

Software-defined networks (SDN) has been touted by some pundits as the biggest networking technology change since Ethernet.

Software-Defined Everything

Pushing the virtualization envelop still further, VMware also bought its way into software-defined networks with the acquisition of Nicera for $1.26 billion.

Software-defined networks (SDN) has been touted by some pundits as the biggest networking technology change since Ethernet. With Nicira's technology, which essentially takes the brains out of networking hardware and puts it into software, VMware is hoping to do for networking what it did for computing.

Ideally, software-defined networks should help IT to more quickly provision network services that underpin business applications. It should also allow more automation of networking, letting companies put more resources into innovation than into day-to-day operations.

This is a long game, however. A core concept of SDN is the OpenFlow protocol, which is used between the network elements and an SDN controller to program the forwarding behavior of the switch. The Open Networking Foundation (ONF), a nonprofit group that oversees the development of the OpenFlow protocol, has more than 70 members, including telecom companies, Internet giants such as Google and Facebook, and some of the world's largest network device manufacturers, including, of course, Cisco. VMware has acknowledged that its acquisition of Nicira did strain its relations with long-term partner Cisco, but the stakes are clearly too high to defer.

Transitioning to Transformation

All hypervisors are evolving towards commodity status. Once management tools allow you to move within a private cloud that could be running VMware, Hyper-V, or some other hypervisor, you will be able to push workloads out to public cloud providers, and you won't need to know or care what the underlying hypervisor is.

We are not there yet. It took a very high level of standardization to turn hardware systems into commodities. And we are a long way from the point where the necessary standards will be in place to make hypervisors interchangeable.

As hypervisor-agnostic management tools evolve and begin to blur the line between virtualized data centers and private and public cloud environments, they will further erode the justification for maintaining standalone, on-premises data centers at all.

In the meantime, all the questions swirling around all the new technologies and trends may have the effect of encouraging more IT shops to consider offloading virtual workloads to a public cloud provider. They could then concentrate their resources on supporting their own businesses and let their service providers worry about which hypervisor strategy will prevail.

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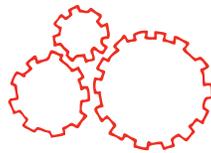
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