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Virtualization and Cloud Computing: Does One Require the Other?

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Introduction

This white paper examines the relationship between cloud computing and virtualization. Many people believe that cloud computing requires server (or desktop) virtualization. But does it? We will look at using virtualization without cloud computing, cloud computing without virtualization, and then look at using both together. In each case, we'll look at where each deployment might be most useful, some use cases for it, and some limitations.

Virtualization without Cloud Computing

Most organizations are virtualized without cloud computing. According to recent surveys, approximately 60 percent of all servers today are virtualized. Virtualization is deployed in businesses of all sizes and affects all industries, organizations, governments, and so forth. Virtualization projects typically start with compute (i.e., server) virtualization, as it is usually the easiest to virtualize and provides the greatest return on investment. This is what is most commonly thought of as "virtualization."

However, more can be virtualized. Both networking and storage can be virtualized. Network Functions Virtualization (NFV) refers to the virtualization of traditional networking functions such as switching, routing, and load balancing. It can include firewalls, Intrusion Detection or Prevention Systems (IDS/IPS), antivirus management and more. Often, NFV is combined with Software Defined Networking (SDN) to automate management of the various physical and virtual network components.

Many vendors also offer Software-Defined Storage (SDS), including traditional vendors, such as EMC, as well as companies that have specialized in SDS for years, such as Data Core. The idea is to use commodity storage devices, often installed in servers, and virtualize access to them so the local storage inside each server gets pooled together and becomes visible as shared network storage.

When virtualized compute, networking, and storage are combined, the result is the Software Defined Data Center (SDDC), which promises a great deal of automation and scalability. Many companies will go to this point and stop.

What is left undone if cloud computing is not also introduced? The self-service provisioning of the VMs necessary for the business workloads to run. It often takes days or even weeks for a VM to go through the approval processes at an organization and for a virtualization administrator to get the necessary VMs created and made available to the users. This decreases a company's agility and often leads users to find a cloud platform on their own, outside the control of IT. This can lead to security issues for the organization, as well as less demand for IT resources, which if taken to the extreme, would drastically reduce or eliminate the need for IT at the company.

So what are some good use cases for using virtualization without cloud computing? Small businesses that don't have an extended VM provisioning process. Medium sized businesses may also be OK with virtualization only, especially if they don't have developers or others that need VMs provisioned quickly.

Cloud Computing without Virtualization

Cloud computing without virtualization falls under the Infrastructure as a Service (IaaS) cloud service model. Some IaaS providers offer provisioning of physical servers located on the cloud providers' premises. They may also offer physical networking devices and/or physical storage devices (or just individual LUNs on a shared storage device). This is related to server-based hosting that many companies offer, except that the servers are not owned by the customer but rather by the provider and are just rented (by the hour, month, or some other contract period) to the customer. There are full-fledged cloud providers that offer this as an option, such as SoftLayer.

The limitations of not using virtualization relate primarily to scale—how many spare servers are around and available in the configuration the customer wants in a timely manner. The provider may limit configuration options to reduce this problem, but that makes customers fit their workloads into server sizes the provider offers. It typically also takes longer for a server to be provisioned versus a VM (usually hours instead of minutes).

So why would a provider offer this service? Because some customers want it. Why would a customer want it? For some, performance and absolute minimal latency is required and any virtualization overhead is just too much. For others, they would prefer to build and manage their own private cloud, but have it hosted by a provider on the Internet. Still others want to avoid the expense of building and maintaining a datacenter—the power, cooling, etc. to run it as well as the administrative staff to set up, manage, and maintain all those assets. Finally, in some cases they just want to have extra capacity in the cloud and link them back to their own on-premises network and managed as a single unit.

Virtualization with Cloud Computing

By far the most common approach for those who have gone to cloud computing from both a consumer and a provider standpoint is the combination of virtual machines and cloud computing. This approach provides all the benefits of virtualization described above (along with many other points not previously discussed) together with the benefits of cloud computing previously discussed. Examples of this model include Amazon Web Services (AWS), Microsoft Azure, and Google Compute Engine (GCE).

Benefits to the Service Provider

Resources are shared, allowing more VMs to be run on less hardware, reducing hardware costs and allowing lower rates to be charged to consumers. If the provider has also implemented SDN, SDS, and/or NFV, the benefits can be multiplied further. In addition, security can be controlled between customers and even within a customer's environment.

Benefits to the Consumer

Resources can be commissioned (and decommissioned when not needed) very quickly, usually within a few minutes. The customer thus does not need to buy a lot of spare capacity for the occasional period of peak demand (during the holidays, at product launches, etc.). Load can be balanced quickly between new instances as they are created and just as quickly removed when they are no longer needed, saving a lot of expense. Most providers only charge for resources you actually used, additionally minimizing costs. Finally, the need to purchase servers (a capital expenditure, or CapEx) is reduced or eliminated and replaced with a rent-on-demand model (an operational expenditure, or OpEx). What's the biggest downside? Consistency of billing for budgeting purposes, but there are ways to level that out as well.

Conclusion

Each of the three scenarios presented here has valid use cases and is the right approach in different situations. However, over the next few years the trend will probably be mostly to cloud computing either exclusively or in a hybrid deployment with on-premises equipment. If you haven't started looking into cloud computing, now is the time. It is becoming a mainstream option and you will be left behind if you cannot articulate use cases for cloud and on-premises deployments. In fact, many companies now have a cloud first policy where new applications and workloads are deployed to the cloud unless there is a specific reason not to so, just as many companies over the last several years have had a virtualization first policy, requiring those who want physical equipment to justify why it is needed.

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About the Author

John Hales, VCP-DCV, VCP-DT, VCAP-DCA, VCI Level 2, is a VMware instructor at Global Knowledge, teaching most of the vSphere classes that Global Knowledge offers, including the Horizon Suite, vCAC, and vCOPS classes. John is also the author of many books, from involved technical books from Sybex to exam preparation books, to many quick reference guides from BarCharts, in addition to custom courseware for individual customers, including Global Knowledge's new SDN Fundamentals and SDN Planning Workshop courses. His latest book on vSphere is titled *Administering vSphere 5: Planning, Implementing and Troubleshooting*. John has various certifications in addition to the VMware certifications previously mentioned, including the Microsoft MCSE, MCDBA, and MOUS, the EMC EMCSA (EMC Storage Administrator), and the CompTIA A+, Network+, and CTT+. John lives with his wife and children in Sunrise, Florida.