Introduction to Private Cloud Technologies: Virtualization

ATLANTIC.NET

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The Basics of Virtualization

Virtualization is broadly defined as the simulation of physical- or software-based resources on an underlying host server. The software used to manage the resources, called a hypervisor, creates separately contained systems, devices, or applications that utilize resources on that host. Combined, the distribution and management of these resources lay the groundwork for expansive virtualized environments[i].

Virtualization solutions are broad in scope and can be broken down into multiple distinct classifications including application virtualization, desktop virtualization, hardware virtualization, network virtualization, storage virtualization, and nested virtualization[iii].

Physical resources such as CPUs, memory, and storage, can be clustered and made available to the individual virtual environments. A second key feature of virtualization is the scalability of resources in real time. This feature helps to reduce the overall required resources, as each virtual environment does not need constant access to the amount of resources required at peak usage levels. Rather, additional resources can be allocated to or removed from individual virtual environments as demand increases or decreases.

Types of Virtualization

Application virtualization

Application virtualization allows users to locally run server applications without requiring installation of the application on the local machine. These applications run inside small virtual environments on top of the host operating system[ii]. One example of application virtualization is Microsoft's App-V, which has many useful features such as allowing applications to interact with the client computer and allowing these applications to be maintained, updated, and distributed from a single source.

Desktop virtualization

Desktop virtualization, or virtual desk-

top infrastructure (VDI), is similar to application virtualization, however users can access all of their files and software and interact with the virtual machine as if they were using a standard operating system. The user's desktop environment is isolated from the physical device and allows users to access the desktop environment on any computer that an administrator allows. Such a solution is cost-effective, as the cost of software licenses may be decreased, because end users do not need individual licenses for multiple workstations. Additionally, desktop virtualization simplifies patch management and maintenance as the virtual desktops can be centrally managed[iii]. Thus, all management and maintenance can be completed from one location, rather than being required to travel to remote locations. In addition, virtual desktop infrastructure can solve issues with legacy application compatibility by allowing the end user to access applications running in a legacy mode side-by-side with native applications.

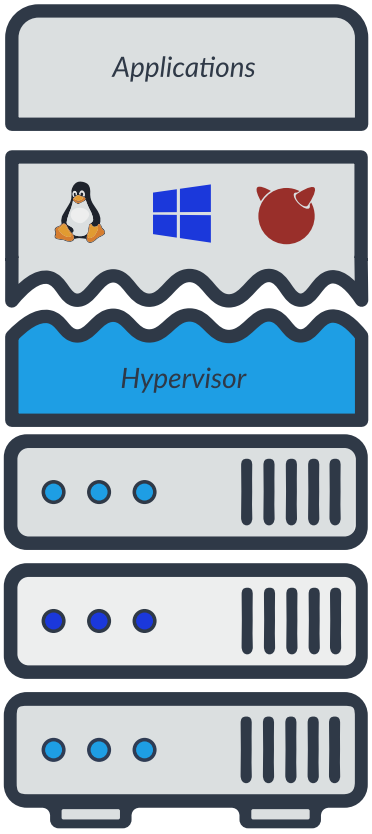
Hardware virtualization

Hardware virtualization runs the hypervisor directly on the hardware and directly allocates hardware resources to guest operating systems. This approach is highly efficient as the abstraction layer is directly between the hardware layer and the operating system. Hardware virtualization is the most common approach for cloud computing. Additionally, end users can run multiple different operating systems on the same physical computer at once[ii]. Microsoft Hyper-V, VMWare, and KVM are examples of hardware virtualization solutions which are used for many practical applications, including establishing or expanding private cloud environments, increasing hardware utilization (by consolidating servers and workloads onto a smaller number of power physical devices), and decreasing scheduled and unscheduled downtime.

Network virtualization

Network virtualization abstracts physical networking equipment into a soft-

ware-based solution with the ability to operate just like a traditional networking environment. This virtual network allows administrators to divide bandwidth into independent channels, and manage switching, routing, firewalling, load balancing, access control, and quality of service (QoS). These channels can then be independently scaled and assigned to servers and devices on demand. Also, custom network protocols and management policies can be introduced to each virtual network. As each virtual network is independent from one another, security is also increased[vii viii].



Hardware-layer virtualization

Storage virtualization

Storage virtualization refers to the virtualization of storage volumes. Various approaches to resource virtualization have been adopted, such as the aggregation of individual components into a pool of resources or the partitioning of a single resource. Specifically, storage virtualization aggregates physical storage resources across a network into logical storage, appearing as a single storage device to users[ii]. As storage virtualization utilizes already available resources, this solution is particularly cost-effective to implement. Additionally, storage virtualization can be an effective safeguard against hardware failure as data stored on the virtual storage can readily be transferred to different locations. Storage virtualization may also be used to combine multiple storage devices in a central location, reducing or eliminating the need to

manage multiple storage devices across multiple locations[iii].

Nested virtualization

Nested virtualization allows users to run a hypervisor inside of an already virtualized environment. This is a feature that is available in Windows Server 2016, KVM, and Xen[ix] [x], and provides multiple potential benefits. One potential benefit involves development and testing. As multiple virtual environments can be run on top of one another in a single host system, environments can readily be created and provisioned without purchasing extra hardware or changing tools or processes. Additionally, virtual training environments can be provided to staff or virtual sales demos can be provided to potential customers without requiring extra hardware to be brought on site[xi].

Advantages of Virtualization

Virtualization provides several advantages to organizational adopters including increases in flexibility, availability, scalability, hardware utilization, security, cost savings, adaptability to workload variations, load balancing, and support for legacy applications.

Flexibility

Flexibility is increased with virtualization by allowing more than one virtualized environment to run on a physical machine or the migration of a virtualized environment from one physical machine to another[ii]. Additionally, features such as 'pause', 'resume', 'shutdown', 'boot,' and 'snapshot' are available in a virtualized environment[iii]. Furthermore, specifications of virtual computers, such as CPU, storage size, and RAM, can be modified even while the virtual machine is running, in some instances[ii]. Virtual servers can also run alongside traditional hardware, thus increasing the flexibility of how much and what types of resources to virtualize at any given time.

Availability

Virtualization may be an effective solution to increase availability by allowing users access to the environment even when a physical device must be shut down for upgrades or maintenance. This is accomplished by migrating the virtual environment to a different physical machine during maintenance, such as changing or upgrading hardware[ii]. Additionally, virtualized environments can be utilized as effective failover solutions. Although traditionally multiple physical servers were often used to avoid downtime in the case that one of the servers failed, virtualized environments can accomplish the same result. Multiple virtual machines can even be assigned as member nodes of a failover cluster for each physical host, creating a high-availability cluster of physical and virtual machines[xii].

Scalability

Scalability potential is increased as servers can easily be increased or

decreased based on demand[ii]. Important to note, this process can either be accomplished manually or autonomously based on predetermined indicators of use[xiii]. Another benefit of scalability is that it allows for a more cost-effective computing service model known as utility computing.

Hardware utilization

Hardware utilization is increased when multiple operating systems are run on the same host operating system due to the fact that virtual machines use hardware resources that are not being utilized by the host operating system. For instance, instead of having six physical servers that have 8GB RAM and are only using 4GB, virtualization allows those same machines to run on a 32GB RAM system with room to spare. They also share processor utilization, since most systems do not consume a lot of processing power on a consistent basics. These resources can also be adjusted should needs change.

Security

Virtualization can also improve security in multiple ways. First, virtualized environments are independent of one another. For example, multiple virtual environments can run simultaneously on top of a single host system, all of which are separate from one another. This separation protects the underlying physical environment, along with other virtual environments from attacks in the event that one of the virtual environments is compromised. Second, services may be separated in such an infrastructure by running individual services on different virtual machines. In such a case, if a service were compromised, none of the other services on other virtual machines would be affected.

Cost savings

Cost savings can also be increased with virtualization. As virtualization more efficiently utilizes hardware resources, the overall number of necessary resources for operations is reduced[ii] resulting in decreased energy and ma-

terial consumption. Virtualization can also serve to support an organization's green initiatives by helping to reduce the environmental impact of an organization's IT. This is due to the lower need for physical devices and on site cooling, among other considerations. Additionally, through reducing and centralizing the number of servers required, overall operation costs are also reduced in regards to personnel, floor space, software licenses, and management hours.

Adaptability

Adaptability to workload variations can also be achieved by the potential to shift resources and prioritize allocations across different virtual environments. For example, processors can dynamically be moved across virtual machines.

Load balancing

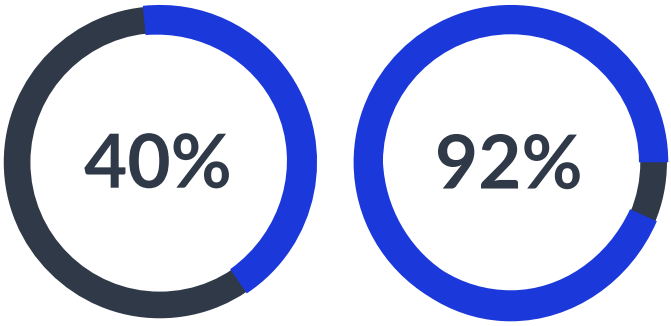
Load balancing, or the distribution of resources and workloads, can also be achieved through the migration of virtual machines across platforms as needed.

Legacy applications

Support for legacy applications can be preserved even when organizations decide to migrate to different operating systems. Specifically, virtualization can allow users to run legacy applications in the required operating system in a virtualized environment[ii].

Adoption of Virtualization

Virtualization represents an easily implementable and attractive solution. Although there are initial costs associated with implementing virtualization solutions, no new physical hardware or floor space need be purchased. Additionally, Atlantic.Net offers a full suite of managed virtualization solutions supported by highly trained professionals. Further, adoption rates of virtualization have been steadily climbing. Even as early as 2011, approximately 40% of servers in an organization were virtualized, and nearly 92% of organizations were utilizing virtualization in one form or another[xiv].

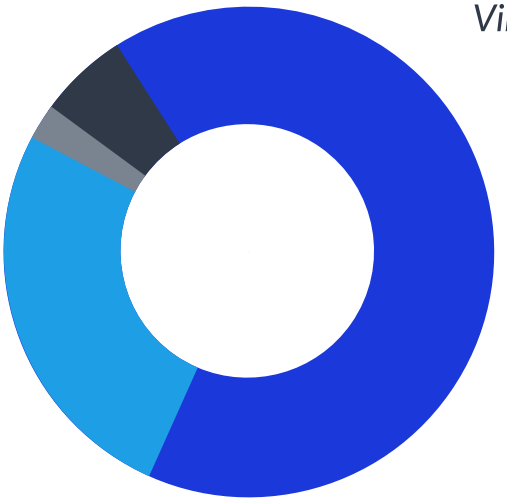


Average percentage of virtualized servers in an organization

Percentage of organizations using virtualization

Source: core0.staticworld.net/assets/media-resource/122905/forecast_1117a.pdf

This trend toward virtualization has continued over the past five years. For example, Computerworld's Tech Forecast 2017 Survey of 196 tech professionals showed that 29% of these professionals report planning to increase spending and 63% report planning to remain at the same levels of spending on virtualization. Among those IT professionals who reported planning to increase spending, they expected that 26% of newly hired employees over the following 12 months would be hired for skills in cloud / SaaS solutions[xv]. In the coming years, the trend toward using virtualization appears evident. By 2020, it is predicted that the demand for hybrid usages of the cloud (referring to use and management across both internal and external cloud services) will increase at a compound rate of nearly 27%[xvii].



Virtualization spending over the next 12 months

2% - New spending category

6% - Decrease

29% - Increase

63% - Remain the same

Conclusion

Virtualization provides many benefits to organizations. Atlantic.Net provides multiple types of virtualization solutions that can be implemented to fit any need. Additionally, Atlantic.Net has extensive experience in regards to both compliance and security for cloud computing. These include a range of virtualization packages delivering flexibility and scalability, along with control and customization. Atlantic.Net's standard virtualization solutions run with Microsoft Hyper-V, VMWare, KVM, and Proxmox VE (custom hypervisors are available upon request). Our virtual servers include many features such as fault-tolerant power supplies, redundant storage, full root/administrative access, and many others. As IT infrastructure demands grow, Atlantic.Net's Managed Private Cloud offerings provide robust and easy-to-use solutions along with access to and server management from Atlantic.Net's experienced support team. Our Private Cloud Solution also includes VM provisioning, cloning, and removal, along with easy system updates, clustering, replication, high availability, advanced monitoring, and advanced management.

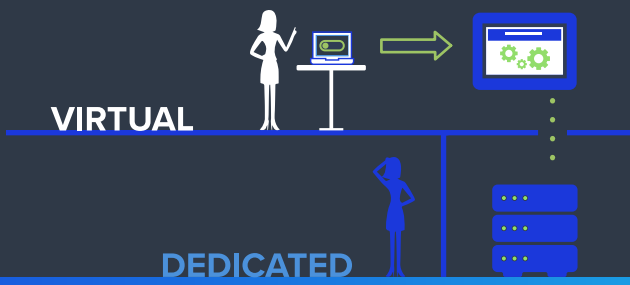
To speak with a sales representative on how Atlantic.Net can provide you with a Private Cloud Solution, please contact sales@atlantic.net.

What Makes Private Cloud So Great

And Why You Should Switch to Private Cloud Now

Flexibility

You have greater control over your environment and can make quick and easy changes. You can pause or shutdown your environment as easily as you can resume or boot it. Several virtualized environments can run on a physical machine, making the use of physical servers more flexible.



Availability

Private Cloud Solutions can be an effective failover solution. Multiple virtual machines can even be assigned as member nodes of a failover cluster for each physical host, creating a high-availability cluster of physical and virtual machines.

Scalability

You can increase or decrease the servers in your Private Cloud based on your needs.

Hardware Utilization

Virtual machines use hardware resources that the server's host operating system otherwise doesn't. Private Clouds run multiple operating systems on the same host system, optimizing hardware utilization.

Security

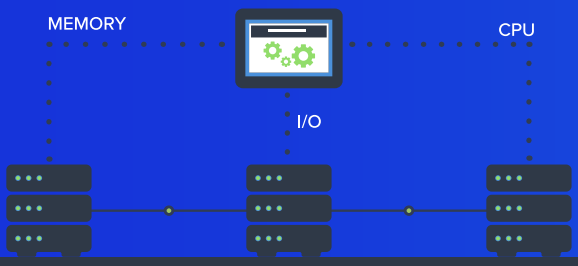
Multiple virtual machines can run simultaneously on top of a single host system while remaining independent from each other. If one of them is compromised, this separation will keep the underlying physical environment and the other virtual machines safe from attacks.

Green Initiative

Virtual machines need fewer physical devices and less on site cooling than dedicated servers. Therefore virtualization can support an organization's green initiatives by helping to reduce its environmental impact.

Cost Savings

Private Cloud's virtualization technology utilizes hardware more efficiently, saving costs by reducing the overall number of necessary resources for operations.

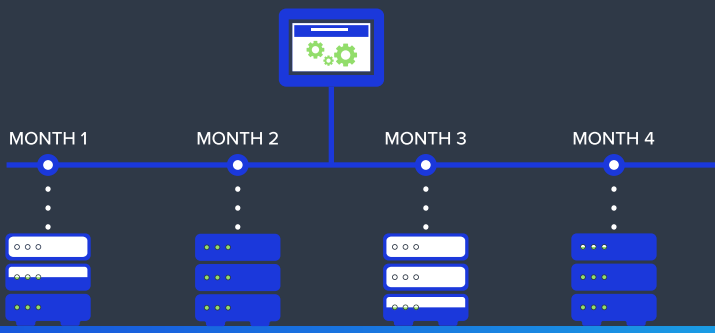


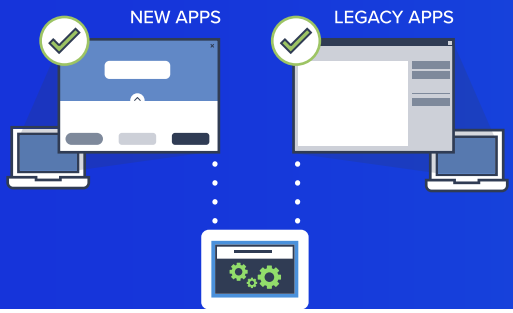
Load Balancing

Adaptability enables better load balancing. You can migrate your virtual machines across platforms as needed, letting you distribute resources and workloads more efficiently.

Adaptability

You can shift resources and priority allocations across different virtual environments, enabling you to adapt to workload variations. For example, you can move processors dynamically across virtual machines.





Support for Legacy Apps

Virtualization allows you to run legacy applications in an old operating system. That means legacy apps in a virtualized server can be preserved even when you decide to migrate to different operating systems.

Ready to move to a Private Cloud solution? Choose a provider you can trust.

Atlantic.Net's world-class Private Cloud Solutions provide you with the freedom to choose the plans that best fit your budget and business needs.

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References

[i] *Hilley, D. (2009). Cloud computing: A taxonomy of platform and infrastructure-level offerings [CERS Technical Report]. Retrieved from the Center for Experimental Research in Computer Systems: http://www.cercs.gatech.edu/tech-reports/tr2009/git-cercs-09-13.pdf*

[ii] *Sahoo, J., Mohapatra, S., & Lath, R. (2010, April). Virtualization: A survey on concepts, taxonomy, and associated security issues. Paper presented at the Second International Conference on Computer and Network Technology (pp. 222-226). Retrieved December 26, 2016, from IEEE Xplore. doi:10.1109/ICCNT.2010.49*

[iii] *5 different types of virtualization. (2016, January 29). Retrieved January 27, 2017, from http://www.techadvisory.org/2016/01/5-different-types-of-virtualization/*

[iv] *Lich, B. (2016, June 16). Overview of Application Virtualization. Retrieved January 27, 2017, from https://technet.microsoft.com/en-us/itpro/mdop/appv-v4/overview-of-application-virtualization*

[v] *Lich, B. (2016, June 16). Overview of MED-V. Retrieved January 27, 2017, from https://technet.microsoft.com/itpro/mdop/medv-v2/overview-of-med-vmedv2*

[vi] *Hyper-V overview. (2016, May 31). Retrieved January 27, 2017, from https://technet.microsoft.com/en-us/library/hh831531(v=ws.11).aspx*

[vii] *Network virtualization vs. server virtualization. (2015, October 19). Retrieved January 27, 2017, from https://www.vmware.com/radius/network-virtualization-vs-server-virtualization/*

[viii] *Bari, M. F., Boutaba, R., Esteves, R., Granville, L. Z., Podlesny, M., Rabbani, M. G., … Zhani, M. F. (2013). Data center network virtualization: A survey. IEEE Communica*tions Surveys Tutorials, 15, 909–928. Retrieved from http://ieeexplore.ieee.org/abstract/document/6308765/

[ix] Thompson, T., & Cooley, S. (2016, June 20). Run Hyper-V in a virtual machine with nested virtualization. Retrieved January 27, 2017, from https://docs.microsoft.com/en-us/virtualization/hyper-v-on-windows/user-guide/nested-virtualization

References, continued

[x] Jones, T. (2012). Nested virtualization for the next-generation cloud: An introduction to nesting with KVM (pp. 1–8). IBM. Retrieved from https://www.ibm.com/developerworks/cloud/library/-cl-nestedvirtualization/cl-nestedvirtualization-pdf.pdf

[xi] Vmware ESXI nested virtualization. (2015, September 9). Retrieved January 27, 2017, from https://www.cloudshare.com/blog/blogvmware-esxi-nested-virtualization

[xii] Olzak, T. (2011). Virtualization: Hyper-V and high availability. Retrieved January 27, 2017, from https://technet.microsoft.com/en-us/library/hh127064.aspx

[xiii] Chieu, T. C., Mohindra, A., Karve, A. A., & Segal, A. (2009). Dynamic scaling of web applications in a virtualized cloud computing environment. In 2009 IEEE International Conference on e-Business Engineering (pp. 281–286). Retrieved from http://ieeexplore.ieee.org/abstract/document/5342101/

[xiv] Veeam software. (2011). New quarterly index measures virtualization penetration rate, hypervisor use and barriers to adoption with plans to evolve into v-index.com community driven project [Press release]. Retrieved from https://www.veeam.com/news/veeam-launches-v-index-to-measure-virtualization-penetration-rate.html

[xv] Computerworld. (2016). Tech forecast 2017: IT sharpens its focus [Research Report]. Retrieved from http://core0.staticworld.net/assets/media-resource/122905/forecast_1117a.pdf

[xvi] Forni, A. A., & van der Meulen, R. (2016). Gartner says by 2020, a corporate "no-cloud" policy will be as rare as a "no-internet" policy is today [Press release]. Retrieved from http://www.gartner.com/newsroom/id/3354117

[xvii] Rosenbush, S. (2015, October 20). Special report: CIOs say hybrid cloud takes off. The Wall Street Journal. Retrieved from http://blogs.wsj.com/cio/2015/10/20/special-report-cios-say-hybrid-cloud-takes-off/