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Everything You Need to Know About Virtualization

A Practical Approach!

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About Virtualization

Virtualization is a technique that enables the creation of virtual machines by reusing the hardware resources of a system (PC or server/s). In essence, it is a hardware abstraction technique for creating virtual machines.

The process is used by both ordinary users and IT professionals and allows, for example, the execution of complete operating systems or a simulation of system behavior for those working with software development and security testing. Below, you will understand what virtualization is, how the technique works, and what advantages it offers.

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What is virtualization?

Virtualization is the ability to create a virtual machine on your PC, allowing you to install the operating system, run programs, and perform tasks. This way, you can test a Linux operating system without having to install it, have a virtual machine with an older edition of Windows for compatibility issues, and access Windows programs on macOS.

Another possibility is to run Android games and mobile apps directly on a PC using virtualization tools like BlueStacks. Developers can also test their applications directly on the PC without having to connect and compile code on smartphones. Virtualization can also be used in security testing. If a user is unsure about a file, they can run it in a virtual machine to avoid distributing a virus in the system.

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A short story about virtualization

Although virtualization technology dates back to the 1960s, it began to be more widely adopted in the early 2000s. Technologies that made virtualization possible, such as hypervisors, were developed decades ago so that many users could simultaneously access the computers they were using. Batch processing was a well-known type of computing in the business sector, performing routine tasks thousands of times and at high speed (such as payroll). However, in the decades that followed, other solutions addressing the problem of having a large number of users and a single machine gained popularity; unfortunately, virtualization did not follow the same steps. One of these solutions was time-sharing, which would time-share users of operating systems. This solution inadvertently spawned other operating systems like UNIX, which eventually gave way to the emergence of Linux®. Meanwhile, virtualization was not widely adopted and remained a niche technology.

Now, let's move on to the 1990s. Most companies had physical servers and single-vendor IT stacks, preventing legacy applications from running on third-party hardware. As companies upgraded their IT environments with cheaper servers, operating systems, and basic applications from various vendors, physical hardware was underutilized, and each server could only perform a specific task from the provider. At that point, virtualization really took off. Companies could divide servers and run legacy applications on various types and versions of operating systems. Servers were used more efficiently (or out of use), reducing costs related to purchase, installation, cooling, and maintenance. The widespread application of virtualization reduced dependence on a single vendor and turned it into the foundation of cloud computing. It is so common in today's businesses that a specialized virtualization management software system is usually needed to keep track of everything.

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Types of Virtualization

Types of Virtualization

Data scattered everywhere can be consolidated into a single source. Data Virtualization allows businesses to treat data as a dynamic supply chain, providing processing power to gather data from multiple sources, easily integrate new sources, and transform data based on user needs. Data virtualization tools can take various data sources and treat them as one. This way, it's possible to provide any application or user with the necessary data, in the required form, and at the right time.

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Desktop virtualization

Desktop virtualization is often easily confused with operating system virtualization, which allows for the deployment of multiple operating systems on a single machine. However, with desktop virtualization, a central administrator (or automated management tool) can deploy simulated desktop environments on hundreds of physical machines simultaneously. Unlike traditional desktop environments that are installed, configured, and updated physically on each machine, desktop virtualization enables administrators to perform mass security configurations, updates, and checks across all virtual desktops.

Operating System Virtualization

La virtualización del sistema operativo se realiza en el Operating system virtualization is performed at the kernel level, meaning it involves the core task managers of operating systems. It is a useful way to run Linux and Windows environments in parallel. Companies can also incorporate virtual operating systems on computers, which:

- Reduces the cost of massive hardware because machines do not require such immediate capabilities.
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- Increases security because all virtual instances can be monitored and isolated.
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- Limits the time spent on IT services, such as software updates. zaciones de software

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Server virtualization

Servers are devices designed to process a large volume of specific tasks very efficiently, allowing other devices such as laptops or desktops to perform other tasks. Server virtualization allows a server to perform more specific functions by dividing it, enabling its components to be used for various functions.

Different Types of Server Virtualization

With hypervisor-based **virtualization**, or the Virtual Machine Monitor (VMM), sits between the host operating system and the underlying hardware layer, providing the necessary resources for guest operating systems.

Full **virtualization** modifies the guest operating system before installation on the virtual machine. This enhances performance because the modified guest operating system communicates directly with the hypervisor, eliminating the overhead of emulation.

Hardware-assisted **virtualization** also aims to reduce hypervisor overhead, but it does so through hardware extensions rather than software modifications.

With kernel-level **virtualization,** instead of using a hypervisor, you run an independent version of the Linux kernel. This makes it easy to run multiple virtual machines on a single host, with a device driver used for communication between the main Linux kernel and the virtual machines. Lastly, with operating system-level virtualization, you can run various, but logically distinct, environments in a single instance of the system kernel.

In system-level **virtualization,** all virtual machines must share the same copy of the operating system, while server virtualization allows different virtual machines to have different operating systems

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The Key Players in Virtualization within the Private Cloud Market

Among the numerous virtualization companies in the market, we highlight the top 3

vmware®

VMware The leading virtualization platform in the industry enables users to confidently virtualize vertically and horizontally scalable applications, redefines the meaning of availability, and simplifies the virtual data center. The result is a highly available, resilient, and on-demand infrastructure that serves as the ideal foundation for any cloud environment. This can reduce data center costs, increase system and application uptime, and significantly streamline how IT manages the data center. vSphere is specifically designed for the next generation of applications and acts as the fundamental building block for the software-defined data center. vSphere accelerates the shift from existing data centers to cloud computing and provides support for compatible public cloud offerings, laying the groundwork for the industry's only hybrid cloud model. With support from over 3,000 applications from more than 2,000 Independent Software Vendors (ISVs), vSphere is the trusted platform for any application

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Hyper-V

Hyper-V is a hypervisor-based virtualization technology. It utilizes the Windows hypervisor, which requires a physical processor with specific features. In most cases, the hypervisor manages interactions between hardware and virtual machines. This hypervisor-controlled access to hardware provides virtual machines with the isolated environment in which they run. In some configurations, a virtual machine or operating system running within it has direct access to graphics, networking, or storage hardware.

openstack®

OpenStack is an open-source platform that utilizes pooled virtual resources to create and manage public and private clouds. The tools covering the OpenStack platform, referred to as 'projects,' handle essential cloud computing services: computing, networking, storage, identity, and image. You can package over a dozen projects to create a deployable single cloud.

In virtualization, resources such as storage, CPU, and RAM are sourced from various provider-specific programs and partitioned by a hypervisor before being distributed as needed. OpenStack uses a consistent set of Application Programming Interfaces (APIs) to further abstract these virtual resources and transform them into distinct groups used in the operation of standard cloud computing tools that administrators and users interact with directly

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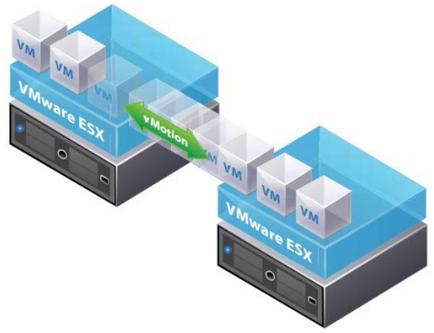
Virtualization Class Features

1.- Provisioning provides dynamic allocation of shared storage capacity, enabling IT organizations to implement a tiered storage strategy and reduce storage costs by up to 50%..

2.- v vMotion® enables real-time migration of virtual machines between servers and virtual switches without disruption to users or loss of service, eliminating the need to schedule application downtime for planned server maintenance



3.- High Availability (HA) allows for automatic restart within a few minutes and provides excellent cost-effectiveness for all applications in the event of hardware or operating system failures.

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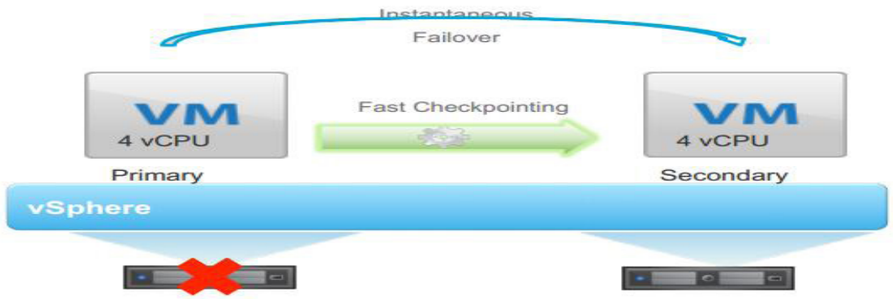

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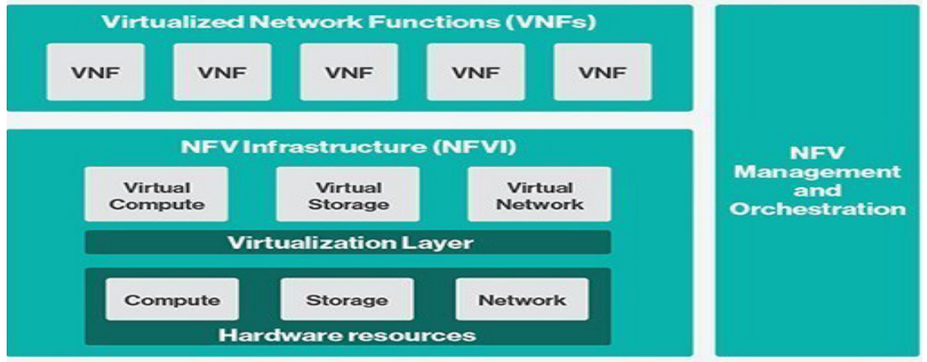
How does network virtualization work?

Network Function Virtualization (NFV) is a term used to address the virtualization of network services to replace dedicated and costly hardware devices, such as routers and firewalls, with software-based devices that run as virtual machines (VMs).

When implemented successfully, it allows you to reduce the amount of proprietary hardware needed to operate network services. The purpose of NFV is to decouple network functions from dedicated hardware devices and transfer them to be hosted on virtual machines (VMs), consolidating various roles onto a single physical server. Since network functions are under the control of a hypervisor, services that traditionally require dedicated hardware can run on standard x86 servers.

This approach enables cost savings and eliminates the need for on-site maintenance because virtual devices replace dedicated network devices. Therefore, there's no need for super network administrators to provision the data center, reducing both Capital Expenditures (CAPEX) and Operational Expenditures (OPEX). Another significant advantage of NFV is flexibility, allowing for more agile responses to meet network service demands. For instance, when an application running on a virtual machine requires more bandwidth, it can simply be moved to another physical server or provided with another virtual machine on the original server to share the load. Hence, when a new network role is required, the service provider can use a new virtual machine to perform the role, and when it's no longer needed, the role can be deleted



Virtualizing network functions, while decreasing dependence on dedicated hardware, also enhances the scalability and customization of the entire network, making upgrades more straightforward. The concept of NFV is part of a transformation in how hardware and software operate and interact, but it should not be confused with the virtualization of the entire network, as it only offloads its functions and not entirely like virtualization. However, NFV is complementary to Software-Defined Networking (SDN). Together, they create an environment with automation capabilities, ready to deploy a customer-centric network infrastructure. Businesses increasingly demand IT infrastructure with high flexibility and speed.

Therefore, virtualization has been the optimal way to meet all business demands. Virtualizing network functions aids in this process, being part of a complete transformation of the entire data center to create an environment with automation, flexibility, and agility capabilities, focused on new corporate needs.

Virtualization as a Foundation for Public Cloud

Virtualization has three characteristics that make it ideal for cloud computing, which are:

Partitioning: The ability for multiple applications and operating systems to coexist on a single system, with available resources divided according to each one's needs.

Isolation: Each virtual machine is isolated from its physical host system and other virtualized machines. In this way, if an error occurs in one virtual instance, other virtual machines remain unaffected. Additionally, data is not shared between one virtual container and another

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Encapsulation: A virtual machine can be represented (and even stored) as a single file, making it easily identifiable based on the service it provides. Essentially, the encapsulated process could be a business service. This encapsulated virtual machine can be presented to an application as a complete entity. Therefore, encapsulation can protect each application from interfering with others.

Therefore, the more the environment is virtualized, the better the results in the cloud deployment process. The key benefits will include improved IT environment management, information security, and significant cost savings."

The major players in public cloud software

Azure

Microsoft Azure is a platform for running applications and services based on Microsoft's cloud computing concepts. Formerly known as Windows Azure, it is currently one of the company's key focal points. With Azure, you can develop and deploy various applications, including mobile applications. Users can also migrate applications, servers, and databases to the Microsoft cloud. There is also the option to work serverless on Microsoft Azure, where developers can produce faster and optimize infrastructure costs. High-Performance Computing (HPC) also finds a strong ally in Microsoft Azure. With Microsoft's cloud, companies across different industries can easily manage and run their workflows

Versatility and scalability are key here. Another very relevant use for Microsoft Azure is its role in backup and disaster recovery. The corporate world deals with a growing number of data, and having space to securely store them is essential. Azure enables companies to increase their storage capacity on demand, optimizing expenses

Amazon Web Services (AWS) is the world's most widely adopted and comprehensive cloud platform, offering over 200 fully-featured services from data centers around the globe. AWS provides a significantly larger number of services and more resources with these services than any other cloud provider: from infrastructure technologies like computing, storage, and databases to emerging technologies like machine learning and artificial intelligence, data lakes, analytics, and the Internet of Things. With this, it's faster, easier, and more cost-effective to move your applications to the cloud and build almost anything you can imagine.

AWS also has the most detailed functionality for these services. For instance, AWS offers the widest range of purpose-built databases for different types of applications. So, you can choose the right tool for the job, at the best cost, and with the best performance

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Google Cloud consists of a set of physical resources (computers and hard drives) and virtual resources, such as virtual machines (VMs), located in Google data centers worldwide. Each data center location is in a region. Regions include Asia, Australia, Europe, North America, and South America. Each region is a collection of isolated zones within the region. Each zone is identified by a name that combines a letter identifier with the name of the region.

This distribution of resources offers several advantages, including redundancy in case of failure and reduced latency by locating resources closer to customers. This distribution also introduces rules on how resources can be used together. In cloud computing, what you thought of as software and hardware products become services that give you access to the underlying resources. The list of available services from Google Cloud is extensive and continues to grow. When you develop your website or application on Google Cloud, you combine and associate these services in combinations that provide the necessary infrastructure, and then you add your code to enable the scenarios you want to create

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The future of virtualization and its trends

The reality is that server virtualization is a robust technology that drives the vast majority of enterprise applications.

Just like the technology itself, which continues to evolve, server virtualization also has trends and predictions for its future. So, we want to prepare you for what's to come.

1. Artificial Intelligence
2. Big Data
3. Task Automation for Increased Productivity
4. Internet of Things
5. Function as a Service (FaaS)

By the way, FaaS, or Function as a Service, is the latest among them. Processes executed by virtual servers are distributed into microservices running in lightweight containers and currently deployed in the cloud. However, it can expand to hybrid or on-premises servers.

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Infrastructure Management as Support for Virtualization

Virtualization and its different cloud modalities (Private, Public, or Hybrid) rely on critical infrastructures such as Data Centers and the emerging world of distributed computing known today as Edge.

These sectors are increasingly pressured by service delivery, regardless of how it is done. Large hyperscalers like Amazon, Google, etc., have long been aware of this truth and have established management models that span from their critical infrastructures to the delivery of their services, a key factor in the success of their businesses.

Talking about infrastructure management means discussing evolutionary models and the application of these with appropriate technological supports, the processes around them, and the people operating the infrastructures. At bjumper, we can work together to present possible roadmaps toward the automation of critical infrastructures.

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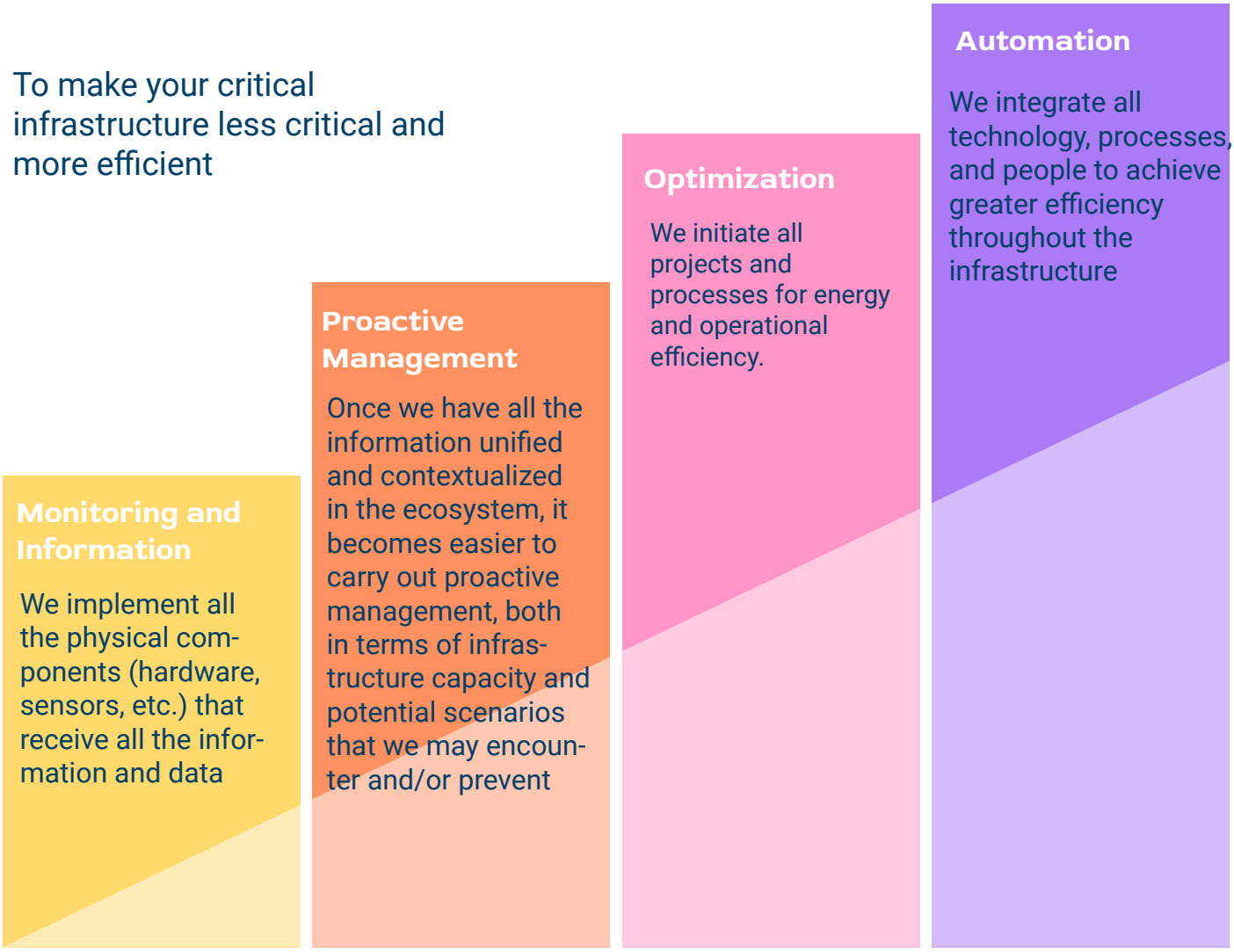
Let it Bjumper work for you

To make your critical infrastructure less critical and more efficient



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