Virtualization 101: A Guide to Understanding Virtualization Basics
The Case for Virtualization

The combination of shrinking IT budgets and increased efficiency demands are pressuring IT managers to achieve more with less time and money. Server virtualization is a broad enterprise initiative that addresses this challenge. The business decision to adopt virtualization is driven by four key factors: 1) capital and operational cost savings; 2) consolidation and maximization of server resources; 3) increased employee productivity; and 4) decreased management time and complexity.   In order to realize these benefits, organizations must successfully manage the transition from a physical to a virtual data center. Companies must be able to plan the infrastructure, assess good consolidation candidates, engineer and implement the solution, and measure the results. Properly executed virtualization projects not only deliver technical and efficiency benefits, but they also demonstrate that IT is aligned with the financial needs of the business.

What is Server Virtualization?

Traditionally, IT staff managed individual servers and applications. Each server would run only one operating system (Windows, Linux, etc.) and one dedicated application (Exchange, SQL, etc.) at a time. The advantage of physical isolation is it allows each application to have dedicated processor, memory and storage resources. This decreases the likelihood of performance, availability, and application compatibility problems. Although physical isolation makes sense in theory, the disadvantage is that today, business applications rarely consume all of the resources they have been allocated all of the time. The end result is a data center full of servers that average only 5 – 10% utilization. Advances in server and software technology allow for virtualization to combine these workloads on a single powerful server.

In simple terms, virtualization divides the resources of one physical host server into "containers" called virtual machines (VMs). Virtual machines are software-based representations of a server. Each "guest" operating system is given a slice of the host server's processor, memory, disk, and network resources. This ability to share a single computer's resources across multiple environments dramatically

increases business productivity and efficiency. Another key benefit of virtualization is the ability to run multiple operating systems and applications, regardless of physical or geographical location. Once virtualization software is implemented, it separates the physical hardware from the operating system and applications. The result is that multiple copies of Windows and Linux can simultaneously run side by side on the same host server. Now IT managers can focus on running workloads instead of physical servers and applications.

The Benefits of Virtualization

The greatest benefit of virtualization is the reduction of capital and operational expenses. On average, virtualization allows companies to achieve server consolidation ratios from 10:1 to as high as 20:1. This enables organizations to roll out new workloads while reducing or eliminating the up-front costs of purchasing new servers, drives, power supplies, data center power distribution units, racks, extra network switch ports and software licenses. With fewer servers to set up, initial labor and installation costs are also reduced.

Virtualization reduces operating expenses as well, including data center, maintenance and management costs. Data center costs for power, cooling, and rack space have all been rising due to increased demand, limited capacity, and rising energy costs. Businesses can dramatically lower these monthly bills by consolidating their servers with virtualization. Virtualized servers require a fraction of the power and rack space of physical servers. Maintenance contracts are another large expense – virtualization decreases aggregate spending on server maintenance contracts as well. Perhaps the largest operating savings occur in the IT department. With fewer servers to manage, IT staff members can be more productive by meeting business objectives like deploying new applications, supporting end users and performing other functions that improve day-to-day profitability.

The consolidation and maximization of server resources is another key factor driving virtualization adoption. The typical server averages 5-10% utilization. By pooling common infrastructure resources like servers, storage and networking, virtualization increases server utilization to as much as 60-85%. Virtualization offers an opportunity to centralize resources that were previously distributed, potentially reducing the total number of data centers being used. Server consolidation also results in greater operational agility. Virtualization stores computing resources in a centralized pool, enabling IT management to quickly allocate them to where they are needed.

Increased employee productivity is another driving force for server virtualization. Higher availability of critical applications enables end users to get their jobs done faster. Workloads can be dynamically sized based on worker demand. For the IT staff, productivity increases since virtual machines are less complex and require less time to manage. Provisioning new servers becomes easier with virtual machine templates. IT managers can respond to workload demands and maintenance windows by relocating virtual machines to different servers with live migration technologies like VMware VMotion. Maintenance outages are reduced and become more seamless to end users. New backup and disaster recovery capabilities become available when virtual machines can be backed up and cloned live. Since VM's are separate from the hardware, they can be relocated to an alternate location or disaster recovery site and quickly restarted on different hardware and networks. Simple tasks can be completed in minutes instead of hours. And since virtual machines are easier to deploy, businesses can also roll out and test new applications quickly and more cost-effectively than they would without virtualization.

Highlights of virtualization include:

- Improved Disaster Recovery and Business Continuity – virtual machines can be easily backed up, migrated, or copied to any industry-standard server with no interruption in service, so businesses can eliminate planned downtime and recover quickly from unplanned outages. Failed VMs can also be restored in minutes or seconds rather than hours or days.
- Improved Scalability - virtualization allows you to easily add on new applications and hardware to your current environment when you need to grow.
- Test and Development – rapidly provision test and development servers by reusing pre-configure systems, enhancing developer collaboration and standardizing development environments.
- Environmental Impact – virtualization provides a foundation for environmentally-friendly "green" initiatives that reduce energy output, achieving the dual purpose of saving money as well as the environment.

Moving Forward with Virtualization

When deciding to implement a virtual strategy, it is most valuable for business decision-makers to evaluate total cost of ownership, including capital and operating expenses, and return on investment. Companies that move forward with server virtualization should create a detailed plan of action based on

project management best practices. This five-step plan provides a foundation that can be customized for your specific organization:

1. **Set goals for server consolidation** - Think about how you plan to incorporate virtualization into your organization. Plan for how many virtual machines you need, what ratio you're aiming for (10:1, 15:1, etc.), how storage and backup will be addressed, and what kind of networking it will require. Then decide what virtualization platform you want to standardize on that will meet those needs. The major platforms include VMware, Citrix XenServer and Microsoft Hyper-V. Capacity planning is also important. Think long term so you can build a virtual infrastructure that can scale accordingly.

2. **Identify good server virtualization candidates** – Not all servers are good candidates for virtualization. Servers that consume substantial amounts of memory or handle CPU-intensive applications such as video editing, graphics or transaction-intensive databases are not ideal for virtualization. Many companies also choose to virtualize non mission-critical servers first, adding more servers later once proof of concept is solid.

3. **Engineer and implement the solution** - This step involves a pilot deployment on servers that have been identified as good virtualization candidates. The servers, storage, network switches and software can all be connected, eventually leading to a full scale rollout and completion of the physical to virtual conversion process. During this step, business assumptions and service quality are validated.

4. **Update best practices** – Physical and virtual server environments are very different and must be treated as such. Policies and best practices must be updated for virtual environments.

5. **Measure results** – Measure the results of the virtualization implementation against the goals you set in the beginning. Evaluate and document your successes and failures, and communicate what was learned to IT staff, management and C-level executives.

Virtualization is a software innovation that aligns IT priorities with the financial needs of the business. Server virtualization projects have proven their strategic value. They enable the IT organization to work faster, smarter and more efficiently, making the business substantially more dynamic, competitive

and operationally sound. Virtualization provides a compelling business case, resulting in reduced capital and operational expenses, maximization of server resources, increased employee productivity, and decreased management time and complexity. As such, the adoption of virtualization should only continue to grow and result in new opportunities and possibilities for business success.

Before and After: Virtualization Benefits at a Glance

(These will be formatted as two side-by-side columns in a sidebar box)

Before Virtualization

- Higher capital/operating expenses (server and hardware purchases, installation)
- Low server utilization rates of 5-10%
- Run individual servers, storage, and applications
- Single operating system per machine
- Highly dispersed computing resources
- Software and hardware tightly integrated
- Inflexible IT infrastructure with greater cost to scale
- Decentralized IT management

After Virtualization

- Reduced capital/operating expenses (lower data center, maintenance & mgmt. costs)
- High server utilization rates of 60-80%
- Manage workloads instead of servers
- Multiple operating systems per machine
- One central pool of computing resources
- Hardware resources independent of OS and applications
- Flexible, scalable IT infrastructure
- Centralized, efficient IT management

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