Next-Generation Virtual Data centers
By Greg Schulz, Founder StorageIO and Author "The Green and Virtual Data Center" (CRC)

What Defines a Next-Generation and Virtual Data Center?

Virtual data centers enable data mobility, resiliency, and improved IT efficiency. There are many approaches and technologies that can be used to enable a green and virtual data center addressing different issues and requirements. Virtualization is a popular approach to consolidate under-utilized IT resources including servers, storage and I/O networks to free-up floor-space, lower energy consumption and reduce cooling demands, all of which can result in cost savings. However, virtualization and specifically consolidation applies to only a small percentage of all IT resources. The importance is that there are many facets of virtualization that can be used to enable IT infrastructure resource management to improve service delivery in a more cost effective and environmental friendly manner.

Why Virtualize a Data Center?
A virtual data center can, and should, be thought of as an information factory that needs to run 24-7, 365 days a year, to deliver a sustained stream of useful information. For the information factory to operate efficiently, it needs to be taken care of and seen as a key corporate asset. Seen as an asset, the IT factory can be invested in to maintain and enhance productivity and efficiency, rather than being considered a cost center or liability.

The primary focus of enabling virtualization technologies across different IT resources is to boost overall effectiveness while improving application service delivery (performance, availability, responsiveness, security) to sustain business growth in an economic and environmentally friendly manner. That is, most organizations do not have the luxury, time, or budget to deploy virtualization or other green-related technologies and techniques simply for environmental reasons—there has to be a business case or justification.

Virtual data centers regardless of whether new or existing; require physical resources including servers, storage, and networking, and facilities to support a diverse and growing set of application capabilities while sustaining business growth. In addition to sustaining business growth, applications need to be continually enhanced to accommodate changing business rules and enhance service delivery. Application enhancements include ease of use, user interfaces, rich media (graphics and video, audio and intuitive help), along with capturing, storing, and processing more data.

There are a growing number of business cases and justifications for adopting green technologies that reduce costs or maximize use of existing resources while also benefiting the environment. However, it is rare for a business to have surplus budget dollars, personnel, facilities, and management support to deploy new technologies simply for the sake of deploying them.

Energy efficiency today can sometimes mean simply energy avoidance. In the future, however, emphasis will shift to doing and enabling more work and storing increasing amounts of information for longer periods of time. This will have to be accomplished while consuming less energy and using less floor space. Doing more work in a more productive manner with less energy will result in efficiencies from improved technologies, techniques and best practices.

Consequently, a green and virtual data center should be much more than just an environment that leverages some virtualization for consolidation purposes. A green and virtual data center should enable transparent management of different physical resources to support flexible IT service delivery in an environmentally and economically friendly manner on both local and remote bases.

Virtualization beyond Consolidation – Enabling Business Agility and Efficiency
There are many facets of virtualization. Aggregation is a popular approach to consolidate underutilized IT resources including servers, storage, and networks. The benefits of consolidation include improved efficiency by eliminating underutilized servers or storage to reduce electrical power, cooling, and floor space requirements as well as management time, or to reuse and repurpose servers that have become surplus to enable growth or support new application capabilities.

Another form of virtualization is emulation or transparency providing abstraction to support integration and interoperability with new technologies while preserving existing technology investments and not disrupting software procedures and policies. Virtual tape libraries are a commonly deployed example of storage technology that combines emulation of existing tape drives and tape libraries with disk-based technologies. The value proposition of virtual tape and disk libraries is to coexist with existing backup software and procedures while enabling new technology to be introduced.

For a variety of reasons, not all servers or other IT resources lend themselves to consolidation. These reasons may include performance, politics, finances, service-level, or security issues. For example, an application may need to run on a server with low CPU utilization to meet performance and response-time objectives or to support seasonal workload adjustments. Also, certain applications, data, or even users of servers may need to be isolated from each other for security and privacy reasons.

For applications and data that do not lend themselves to consolidation, a different way to use virtualization is to enable transparency of physical resources to support interoperability and coexistence between new and existing software tools, servers, storage, and networking technologies, such as enabling new, more energy-efficient servers or storage with improved performance to coexist with existing resources and applications.

Business continuity (BC) and **disaster recovery (DR)** are other areas in which transparency via virtualization can be applied to in a timely and cost-efficient manner in-house, via a managed service provider, or using some combination. For example, traditionally, a BC or DR plan requires the availability of similar server hardware at a secondary site. Some challenges with this kind of redundancy are that the service and servers must be available to those who need them when they need them. For planned testing, this may not be a problem; however, in the event of a real disaster, a first-come, first-served situation could arise, with too many subscribers to the same finite set of physical servers, storage, and networking facilities.

If dedicated and guaranteed servers and storage resources are available for BC and DR, competition for resources is eliminated. This means, however, that additional servers and storage need to be powered, cooled, and given floor space and management. In addition, these operating systems and applications may require identical or very similar hardware and configurations.

For some organizations, the opportunity to start from scratch with a new green data center may exist. However, for most, enabling a virtualization data center relies on transforming existing facilities, servers,

storage, networking, and software tools along with processes and procedures to adopt virtualization technologies and techniques. Thus, virtualization technologies should enable existing IT resources to be transformed and transition to a next-generation virtualization data center environment. The benefit is support of growth and enhancement of service delivery in a cost-effective and timely manner.

Infrastructure Resource Management Software Tools

Falling under the umbrella of **infrastructure resource management (IRM)** are various activities, tools, and processes for managing IT resources across different technology domains (servers, storage, networks, facilities, and software) with diverse interdependencies to enable IT application service delivery.

Measurements and Management Insight

Various metrics and measurements are needed in order to provide insight into how data centers and applications are running as well as using resources. Metrics and measurements are also important for timely and proactive problem resolution and isolation, as well as event correlation to support planning and reconfiguration for improved service delivery and growth. Metrics and management insight are also needed to ensure compliance and other requirements are being met, including security or activity logs, as well as that data is being protected as it is intended and required to be.

Facilities and Habitats for Technology

One potentially confusing aspect of next-generation data centers is the implication that they must be built from scratch, as new facilities with all new technology, IT equipment, and software. For some environments, that may be the case. For most environments, however, even if a new physical facility is being built or an existing one expanded or remodeled, integration with existing technologies and management tools is required. Consequently, the road to a virtual or next-generation and green data center is an evolution from a current environment to a new and enhanced way of operating and managing IT resources in an efficient and flexible manner.

Tiered Servers and Software

Servers have received a lot of attention as prime consumers of electrical power and producers of heat. Consequently, virtualization in the form of server consolidation to combine multiple lower-utilized servers onto a single or fewer physical servers running virtual machines is a popular topic. Having fewer servers' means that less electrical power is required for both the servers and the necessary cooling.

Tiered Storage and Storage Management

There are many different ways of implementing storage virtualization, including solutions that aggregate heterogeneous or different vendors' storage to enable pooling of resources for consolidated management. Although it is popular to talk about, storage aggregation has trailed in actual customer deployments to other forms of virtualization such as emulation.

Tiered Networks and I/O Virtualization

There are many different types of networks, and convergence may include virtual connect infrastructures inside blade center servers, top-of-rack and end-of-rack solutions, modular switches and routers, as well as core and backbone directors for traditional networks as well as converged virtual I/O and I/O virtualization networks. There are also many kinds of networks and storage interfaces for connecting physical and virtual servers and storage.

Virtual Offices, Desktops, and Workstations

Another component of a virtual data center environment is the remote and virtual or home office. Desktop and workstation virtualization is a natural extension of what is taking place with servers, storage, and networks to boost utilization and effectiveness as well as to address complexities in configuring and deploying large numbers of workstations and desktops while enabling virtual offices to access and use data when and where needed in a secure and flexible manner. Chapter 10 looks at some of the current issues and emerging trends for addressing virtual office, desktop, and workstation challenges that are part of the far-flung and virtual data center environment.

Summary

Green and next-generation virtual data centers should be highly efficient, flexible, resilient, and environmentally friendly while economical to operate. Current focus is on virtualization from a consolidation perspective, but in the future there will be even more opportunities for IT environments to adapt their processes, techniques, and technologies to sustain business growth and enhance application service delivery experience while reducing costs without compromising performance, availability, or ability to store and process more information. There are many aspects of data storage virtualization that address routine IT management and support tasks, including data protection, maintenance, and load-balancing for seasonal and transient project-oriented application workloads.

The idea is to leverage virtualization technologies in the form of abstraction and transparency or emulation combined with tiered servers, tiered storage, and tiered networks to align the right technology to the task at hand at a particular time. Start to fix the problems instead of moving them around or bouncing from distributed to consolidated and moving the distributed problems back to a main site. You can get management of an increasing amount of data and resources under control, and you can do more work with less energy while supporting growth. Learn more in my new book, "The Green and Virtual Data Center" (CRC) at www.thegreenandvirtualdatacenter.com or in my blog www.storageioblog.com and on twitter @storageio.

www.storageio.com   P.O. Box 2026 Stillwater, MN 55082   651-275-1563   info@storageio.com