The Private Cloud:
Making the Cloud Work for You

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INTRODUCTION[1]

The news media and trade pubs are filled with stories about innovative cloud solutions being introduced by industry giants: from Amazon's forays into auctioning off computing capacity, to Google's decision to expand the storage capabilities of its Google Docs application, to IBM's comprehensive SmartBusiness cloud portfolio.

But the most interesting cloud story is happening a lot closer to home, in the private data centers run by individual businesses. These businesses have seized the processes and technologies that make cloud computing so intriguing, and shaped them in a way that's more effective for their current needs.

Enter the *private cloud*.

A private cloud is a wholly dedicated server environment that encompasses cloud-like elements of elasticity, scalability, and (usually) usage tracking and metering. Businesses can easily configure their private premises-based data centers into a private cloud by using virtualization technology. A private cloud can also be hosted by a third-party, using dedicated virtualized servers.

Sometimes called a "virtual data center," a private cloud enables a business to retain control over its data center environment, adding efficiencies while minimizing some of the risk associated with public clouds. A well designed private cloud can result in a fully optimized data environment, one that improves application performance, resource utilization, and business continuity efforts. Of even greater value to businesses is that a private cloud can be implemented with just a handful of applications at very low cost, thus allowing the business to try out the new approach without investing significant time and budget.

[1] Stratecast prepared this white paper on behalf of Level 3 Communications. Please note that the insights and opinions expressed in this assessment are those of Stratecast and have been developed through the Stratecast research and analysis process. These expressed insights and opinions do not necessarily reflect the views of the company executives interviewed.

THE VALUE OF VIRTUALIZATION

Virtualization is a foundation of both public and private cloud computing, and it is the driving technology behind the key attributes of scalability and low cost. Virtualization is the "uncoupling" of the application from the underlying server hardware. While many types of purpose-built hardware appliances have been virtualized (including WAN optimization controllers, load balancers, and security devices), server virtualization has had the greatest impact on the data center environment.

A software platform called a hypervisor is loaded onto each server. The hypervisor (for example, VMWare, Citrix XenServer, or Microsoft's Hyper-V) enables multiple virtualized apps—regardless of operating system—to share a single physical server by essentially "tricking" each app into thinking it has full use of all the computer resources (e.g., CPU, memory). Apps are created as virtualized machines, or VMs, which can be easily moved among servers through management software.

By introducing virtualization, a business can realize the following benefits:

- **Server Optimization:** In traditional data centers, it's standard to load a single application per server, configured for peak usage. As a result, most servers run at only 20 to 30 percent capacity. In contrast, multiple VMs can run on a single server, thus ensuring higher utilization of existing hardware and potentially deferring new purchases. Further, when it comes time to replace aging hardware, businesses can invest in higher-capacity servers that are more cost- and energy-efficient.

- **Scalability:** VMs can be built in minutes, using templates. They can be torn down and "stored" when not in use. This significantly reduces the time it takes to launch a new app or expand capacity on an existing app, thus helping the business to meet "time to market" goals. Further, by replicating preferred configurations within VM templates, IT can introduce a measure of quality and consistency into the app-building process.

- **Ease of Management:** A virtualized data center can be managed from a single web console. This reduces the necessity for the resource-strapped IT department to deploy separate management tools to cover different operating systems or server types.

- **Application Mobility:** With VMs, moving apps is as easily as moving a file. Apps can be quickly moved from one physical server to another, even to another data center. This makes it easy to re-allocate server resources as traffic and needs change. It also strengthens the business continuity and disaster recovery plan. With VMs, there's no need to pull business-critical apps off-line to perform routine server maintenance; instead they can be moved to another server for as long as the process takes. For disaster recovery planning, VMs can be transferred to another on-premises or hosted facility.

PRIVATE OR PUBLIC CLOUD?

The cloud is a production and delivery model. As such, it is first and foremost about efficiency. Just as the concept of interchangeable parts revolutionized manufacturing in the eighteenth century, the cloud is reinventing how applications are built and delivered to users. The providers of wildly popular applications like YouTube and Facebook have embraced the cloud model because it gives them an efficient way to scale delivery for millions of users. They can quickly spin virtualized apps as needed onto inexpensive bare metal servers, dynamically grabbing spare capacity from resources located anywhere. And users require nothing more than a web browser to access the software, thus removing a barrier to access.

The IT organization in any business is a software provider as well, responsible for delivering business applications to users, who include employees, partners, and customers. As such, the cloud provides a solid blueprint for efficient delivery. As noted, virtualization technology offers more efficient use of resources and standardized management tools, which bring the benefits of scalability, faster time-to-market, and lower costs.

But as in the manufacturing revolution, efficiency is not always synonymous with quality. In the public cloud, providers like Amazon draw on their massive scale to offer low-priced shared Infrastructure services on a pay-per-use basis. In return for the low cost and utility pricing, businesses are asked to give up some degree of control. Public cloud customers have no visibility into the shared infrastructure or which other customers and applications may be sharing their servers or network facilities. They must trust that the provider's security and privacy measures are sufficient, and that the environment facilitates optimal application delivery (e.g., that traffic is prioritized appropriately over shared network access points).

Specifically, the public cloud introduces risks in the following areas:

Security – Security is the top reason cited by businesses for avoiding public cloud solutions. In a shared environment, there is concern about contamination of data or unauthorized access from other users of the shared server and network infrastructure. With Internet-based access, risk also comes from unknown, outside sources. While cloud providers, and business themselves, can take steps to minimize their risk through security solutions, most businesses will not trust their most sensitive data to a shared server environment like the public cloud.

Regulatory Compliance – Businesses in all industries spend considerable effort to ensure that data—usually customers' or employees' private information—is handled as required by government regulations. In the U.S., this includes PCI and HIPPA. Outside the U.S., local regulations also control how customer data may be stored and managed. For a publicly traded company this is a primary sticking point: people can go to jail for not securing critical financial and customer data. Unfortunately, none of today's public cloud environments meet the standards established by these regulatory bodies. A key sticking point is the sharing of resources among customers—servers, appliances, network

circuits. A second issue is lack of visibility. In a public cloud environment, the business cannot be sure exactly where its data resides. Public cloud providers rarely reveal the exact location of their data centers, and never permit customers to select which location their data will reside in. That's the price of scalability— the provider places all its bare metal servers in a grid that acts as a single computing unit in which processing resources can be shifted as needed.

Reliability – In a shared environment, with multiple applications contending for network and server resources, applications may perform poorly, or not be available at all when users attempt to access them. When the shared resource is in a cloud environment, the business has no control over what other customers' applications are contending for the same resources—thus leading to dual frustrations of unavailable applications and inability to tweak the environment (e.g., through Class of Service prioritizations or shifting Virtual Machines among servers) to correct the issue. Because of the potential impact on availability and performance, most commercial business application providers do not support virtualization of their applications in a cloud "Infrastructure as a Service" environment.

For these reasons, many businesses believe the public cloud brings too many uncertainties for comfort. They prefer to limit their use of shared infrastructure services. They are being selective about which applications to place in a hosted environment. And rightly so: not all applications are appropriate for today's public cloud environment, and some (by their nature) may never be. As a result, businesses are weighing each application or opportunity along a scale that includes variables related to cost, security, privacy, and control. And frequently, the answer is the private cloud, which offers cost and efficiency advantages to the premises-based data center, without many of the risks inherent in the public cloud.

BUILDING A PRIVATE CLOUD: CONSIDERATIONS

For businesses considering virtualizing their data centers, the good news is that the private cloud doesn't require a cold-turkey move or a swap-out of one technology for another. Cloud-building can be done one server at a time, on your terms and timeframe.

1. **Define the problem you're looking to solve.** Is it a lack of buildout space in your current data center(s)? Lack of capital budget to replace aging servers? A corporate directive to reduce IT headcount? An increased need for remote access to critical apps? You can start to address each of these issues by virtualizing your data center environment. If you are using a client-server architecture, with servers located locally with users, you can consolidate data center resources in one or more centralized locations.

2. **Select the applications to be virtualized.** A survey of server usage will reveal which apps consistently utilize a fraction of their server capacity—these are a good place to start. For commercial applications, its best to contact your

vendor regarding impact to SLA and maintenance terms. Because virtualized applications contest for server resources, some software developers discourage virtualization of their apps. Others have partnered with one or more of the top hypervisor providers (e.g., VMWare, Citrix XenServer, Microsoft Hyper-V) to ensure that their apps work appropriately.

3. **Designate which servers will be part of your private cloud**, and where they will be physically located. (Some providers call this your "server farm.") Consider network access options: a metro-based facility may offer more high-speed options than a remote location, which can be an important factor in establishing backup plans. In addition to your premises-based locations, your private cloud may be able to encompass certain hosted environments, such as Co -Lo, dedicated hosting, and some cloud providers who offer private, dedicated arrangements. Talk to your provider about your private cloud options.

4. **Build your Virtual Machines (VM)**, using the hypervisor of your choice. Store the template for re-use with other applications: most businesses find that the majority of VMs use the same handful of configurations, so there's no need to continually build from scratch.

5. **Allocate VMs per server.** Your VM management software allows you to move VMs as easily as moving a Word file on your PC.

6. **Check your network health.** Regardless of where your private cloud is physically located, chances are the majority of users will be accessing it remotely. Be sure your network access facilities provide sufficient bandwidth and appropriate means to prioritize traffic types. Remember, your end-users will only benefit from your data center efficiencies when their productivity-enhancing applications are delivered with consistently high performance.

7. **Assess your business continuity plan.** Virtualization makes it easy to implement business continuity and disaster recovery plans—but the plans have to be in place first. Determine and implement appropriate plans to relocate VMs, either to another premises-based center or a hosted facility. Be sure your network capacity is sufficient for data center to data center transfers—in the even of an emergency, you don't want your carefully laid plans to be thwarted by network access bottlenecks. Talk to your provider about solutions.

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The Last Word

The private cloud is becoming the choice of many businesses that are looking to optimize their existing data centers. These businesses are bypassing the public cloud, with its attendant concerns about security, performance, and control, and instead borrowing its key attributes to introduce efficiencies into their own centers.

Through virtualization of applications, the private cloud eliminates a lot of the labor-intensive, customized aspects of data center management. Businesses benefit from optimization of server capacity, scalability, ease of management and, perhaps most important, mobility.

The private cloud affords maximum flexibility to the business. Applications are no longer tethered to specific servers, meaning they can be moved as capacity allows and demands require. In fact, the virtualized data center is no longer tethered to a specific physical location; instead servers that are part of the private cloud can be located in multiple physical centers, both on-premises and hosted.

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