PRIVATE CLOUD - DOES IT REALLY A SAVIOR OF YOUR MONEY? FACTS ANALYZED

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ABSTRACT

Organizations with the infrastructure and skills to implement highly virtualized IT operations may consider a private cloud—a multi-tenant, highly scalable and automated infrastructure—part of the enterprise data center's natural evolution. But before you commit to a private cloud, you need to understand associated costs and tradeoffs. This paper tires to analyze and brief up the costs and the needs for organizations who want to implement private cloud. Since so much of costs are involved in establishing private clouds for organizations, this paper attempts to show the real facts behind the private cloud costs.

Keywords: *Cloud Computing, Private Cloud, Public Cloud, Cloud Computing*

1. INTRODUCTION

While no IT implementation and configuration will be the same for all companies, there are several overarching factors—hardware, network and physical data center costs—all companies interested in implementing a private cloud should contemplate. It's also important to compare these costs with those associated with running the same applications and services completely off-premises in a public cloud.

Fig 1. Private Cloud Image Source: www.esri.com

2. HARDWARE

Initial and ongoing capital investment in storage, networking equipment, and power and cooling systems should be included in hardware cost calculations of building a private cloud. So unless you are starting a new company, you likely have servers that can be repurposed to operate in a cloud infrastructure [1].

When purchasing new equipment, keep your private cloud project in mind; acquire hardware in logical units that are most economical, such as a rack of servers rather than single servers. You may find that buying at the rack level allows you to purchase a single unit preconfigured with servers, power distribution and networking equipment. And this can reduce the chance of configuration errors and improve rollout time. Figure 2 give a cost breakdown for applications of the following kind (Medium-scale applications & DB servers, Data Marts, Small CRM, Small Data Warehouses, Messaging (Exchange, etc)) for an organization with greater than $1B in revenue or budget.
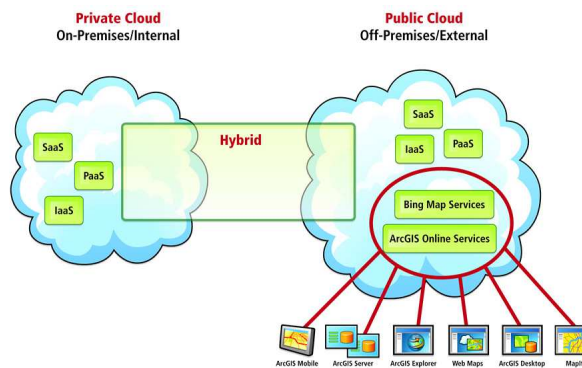
3. NETWORKING

A company that implements a private cloud will encounter two types of networking costs: networking hardware costs such as rack-level Ethernet switches and cluster-level switches, and costs associated with telecommunications services—Internet access and virtual private network (VPN) services. If you have two or more data centers and you replicate data between them, you will want redundant service providers to mitigate the risk of losing one of the services. Another networking-related charge that companies need to consider, especially for public clouds, is the cost of data transfers. Moving a large volume of data into a public cloud often comes down to a

choice between suffering from relatively slow and costly uploads or having to transfer data to a storage device and ship that device to the cloud provider. This doesn't mean private clouds don't suffer from networking problems, though. Data transfer issues can be just as problematic with private clouds; bandwidth and reliability requirements will be a determining factor in the cost of networking for your organization[12].

Fig II.Cost Breakdown Private Vs Public clouds, Image Source : Wikibon , 2010

4. PHYSICAL DATA CENTER.

When planning your project, envision the scale of your private cloud early. Power and cooling systems in your data center can become a limiting growth factor. A data center design that works well for a moderately sized private cloud— one that would contain tens of racks of servers— may not scale to a large-scale private cloud that contains hundreds of racks[10].

Increases in power consumption will drive the need to increase air pressure to circulate cool air. And increased air pressure, in turn, will increase power consumption. At some point, incremental increases in cooling and power systems will become insufficient and require a facility redesign. This need for different designs at different scales is apparent for truly large, scalable data centers, such as Google's, whose data centers feature modular shipping containers that house servers, networking, cooling and power[12].

5. PRIVATE OR PUBLIC: WHICH CLOUD IS RIGHT FOR YOU?

Using a public cloud provider eliminates the need to design and manage your own IT infrastructure and instead use resources that live in that cloud. But does that mean public cloud will reduce your bottom line? That depends [2].

Part of the answer involves a basic cost comparison. Given your expected level of IT resource utilization, how much will it cost to provide a unit of service (e.g., one hour of computing on a standard-configuration virtual machine or storing 1 GB of data for one month)? And how does this cost compare with all the marginal costs of implementing a private cloud?

Your utilization rate determines how much you would have to charge back to recover costs, such as hardware, networking and facility charges. If those costs charged back to the business are significantly higher than the cost of subscribing to a public cloud provider, your enterprise is probably a better candidate for a public cloud. However, depending on your market and associated regulations or compliance issues, a public cloud may not be an option, even if it equals the more economical cloud model. Organizations with highly sensitive data or data that is subject to compliance and government regulations may not be suited for a public cloud given the data security risks [2][12].

When comparing private to public cloud models, it's imperative to assess service levels in addition to costs. Private and public clouds can offer different service levels for uptime and availability, and comparisons can sometimes be difficult[12].

Here are some general rules of thumb regarding uptime. A guarantee of 99% uptime equals about 3.65 days of downtime per year; 99.9% uptime equals more than eight hours of downtime per year; 99.99% uptime guarantee brings downtime to under an hour over the course of a year. Understand the time interval used to evaluate uptime. A per-month basis distributes potential downtime over the year; an annual basis is a onetime event but means you may suffer a longer single outage without compensation [4].

The bottom line is: Read the fine print. Uptime, which means servers are up and running, is different from availability, or when servers are up and running and accessible over the network. Uptime without availability means that a network outage will leave you without cloud services and
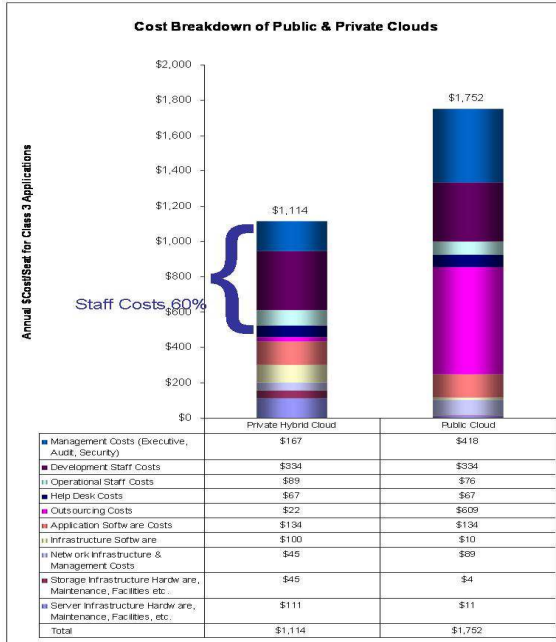
without compensation [10]. Fig III shows a typical public vs private cloud 3Year cumulative cost comparison

	Year 1	Year 2	Year 3	3 Yr Cum
Public Cloud (100%)				
3 Year Reserved Instance	$214,480	$126,910	$147,404	$488,794
1 Year Reserved Instance	$171,605	$199,552	$231,912	$603,069
On-Demand Instance	$260,610	$303,052	$352,196	$915,858
Private Cloud				
Purchase Data Center	$406,396	$86,249	$86,249	$578,894
Leased Data Center	$203,905	$199,205	$199,205	$602,315

Fig III . Public and private cloud Cost Comparisons:
Image source http://www.xuropa.com

6. BUILDING AUTOMATION AND OPERATIONAL EFFICIENCY IN THE CLOUD

One of the major advantages of cloud architecture is that it allows for the relatively rapid deployment and removal of virtual machines (VMs) over a large number of servers. The longer servers sit idle, the less opportunity you have to recover costs. The return on investment (ROI) in a private cloud depends largely on how efficiently a company uses resources, and efficient use often depends on the level of automation IT has built into an infrastructure.

When servers are left idle because of insufficient demand, you have a capacity problem. However, if servers are unproductive because it takes processing time to find, build or deploy images, then you have an automation problem[10].

This segment outlines some fundamental operational tasks associated with managing a private cloud—end-user self-service portals, operations management and administrative management—and, specifically, looks at how to automate those tasks to control costs [6].

7. END-USER SELF-SERVICE PORTALS

Workloads in a private cloud vary over time, often unpredictably, because it's impractical and inefficient to have cloud admins continually start and stop jobs. Private clouds should have self-service portals that allow end users to choose which images to run, specify when jobs should begin and end, and decide on the size and number of virtual servers needed. The portal interface should also allow users to view jobs that are running, storage benchmarks as well as identity management

information. If users can create their own custom machine images, the portal should provide the ability to create, list and delete those images; users also need the ability to search according to metadata attributes associated with machine images.

8. OPERATIONS MANAGEMENT

The second task category is composed of several behind-the-scenes IT operations that end users may never know about unless a problem arises with those resources.

Tweaking your hardware configuration, for example, allows admins to boost private cloud efficiency. Reducing the number of physical servers that are powered on to accommodate resource demands can improve the overall efficiency of a private cloud. It's possible to have a few VMs running without fully using the capacity of the underlying physical server. In such cases, it can be more efficient to consolidate VMs on a smaller number of physical servers and shut down the additional physical servers [9].

Cloud admins should also have tools in place to manage a machine image catalog, migrate VMs, configure and build images, and manage identities and other associated security procedures [13].

A machine image catalog is a dynamic part of your private cloud that could include several images with varying combinations of operating systems, low-level libraries, developer tools, databases, application servers and specialized enterprise applications. Cloud administrators need tools to manage the image inventory, identify images based on image components, rebuild and patch images, and measure image use. Configuration management tools can alleviate the frustrations of dependency management with a cloud environment. Look for tools that support cross-platform abstractions that allow you to specify high-level tasks, such as installing a package, without having to specify implementation details that may vary from one platform to another. Also look for tools that support identity management and related security services. Your private cloud should work with your enterprise Active Directory or LDAP server to identify users and resources. You won't be able to fully automate security procedures, but integrating security measures within the cloud environment with existing authentication and authorization services within your infrastructure can help keep operations management costs down [9].

9. ADMINISTRATIVE MANAGEMENT

Deploying a private cloud within your organization doesn't eliminate the need for IT administration. In fact, IT managers may need to oversee more high-level management tasks than they had to before the cloud. But the ability to automate certain tasks within a private cloud will reduce the need to manage certain high-volume, low-level and often time-consuming tasks.

Private cloud administration encompasses another set of potentially time consuming, and costly, tasks. End users should have access to detailed reports about the computing and storage resources they use, and the IT department needs to charge users for those resources. Similarly, cloud administrators must have the ability to track image use and inventory, compute and storage use as well as network utilization. Cloud managers should be able to access alert mechanisms that provide real-time updates on hardware failures, significant software errors and other events that may require IT support. These activities are all part of administrative management duties; treat your cloud and it's users as a business entity and manage it accordingly.

The right combination of end-user self-service capabilities, operations management and careful administrative management can help ensure that the entire enterprise uses private cloud resources efficiently [9].

10. USING A CHARGEBACK MODEL TO PROVE PRIVATE CLOUD SAVINGS

Cloud architectures allow for a more efficient allocation of computing and storage resources than other IT architectures. But efficiency doesn't simply happen. Efficient allocation of resources depends on user behavior. Users must select the appropriate size and number of virtual servers for jobs, keeping only as many copies and versions of data as they need, and they must make judicious use of network bandwidth.

Automation is essential to use a private cloud, but it can also come at a cost.

Business units can fire up large numbers of VMs or consume other resources without understanding how their actions affect overall cloud operations. Chargeback, or charging business units for resources consumed, gives cloud consumers information about their usage and enables them to make reasonable choices about resource use in a private cloud [3].

Chargeback allocates costs to users who incur them. Associating an actual dollar amount to IT resources is one way to promote efficient use. It provides incentives to use cloud resources efficiently and allows users to compare the cost of a private cloud with the cost of comparable services from public cloud providers. This can encourage IT admins to offer competitive pricing. For example, if a job will run just as quickly on 10 small VMs as it would on 10 large VMs, and the small virtual servers cost less money, users can see the incentive to use the smaller instances [3].

But while in theory a chargeback model makes sense, in practice, getting it to work can be a challenge and the system is hardly perfect. A chargeback model is a financial transaction that must be executed with the same level of integrity as any other financial transaction within the organization. Reporting on resource use must be accurate and timely. Cloud administrators must be in place to hold and even modify disputed charges [12].

Cloud management software can help track resource use. But to assist with chargeback billing, the tool must also generate chargeback data in a form that is compatible with your organization's financial system. Costs must also be aggregated to an organizational level that corresponds with a budget line item or an account to which the cost will be associated. This level of tracking and billing can add significant overhead to running a private cloud[11].

Another challenge of using chargeback in a private cloud environment is that it can be difficult to derive an accurate cost per hour for a VM or cost per GB of storage. Obvious costs, such as the capital cost of a server, are just the beginning. It's also difficult to accurately report on labor costs associated with cloud admins and IT managers, some of whom may support the cloud infrastructure on only a part-time basis.

A more accurate and all-encompassing cost should include expenses associated with maintaining the physical data center—rent, power and utility bills, cooling infrastructure and expenses, etc. For such shared costs, however, cloud managers must determine whether to use average costs or marginal costs in chargeback calculations [11].

Putting an actual dollar amount on all private cloud costs is not a trivial task, nor is it fixed. The cost of new equipment and services are fluid and can change over time. In addition, the value of existing equipment can depreciate, which requires IT teams to consistently revise the pricing structure to ensure that prices accurately reflect costs.

11. SHOWBACK: WHEN CHARGEBACK JUST WON'T WORK

Chargeback may not work for every organization. An alternative is the show back model, which provides users with information about their resource use without equating this information with billing or actual financial transactions.

No money changes hands (or accounts) in this model. An obvious benefit is a reduction in management overhead; however, showback still requires the creation of some type of pricing structure. The showback pricing model can be more of an estimate, where the goal is to provide users with information that allows them to make decisions about resource usage without the need for precise accounting, which can be difficult to obtain and justify. Which model is right for your organization? If you have a chargeback mechanism in place already, then incorporating chargeback for cloud services may be fairly straightforward. You likely have tackled some of the thorny questions (e.g., average versus marginal costs for physical data center space) if you are charging for other IT services. And even if you do have a chargeback system in place, consider how chargeback and showback models align with the long term goals of implementing a private cloud. Your business or organization does not exist to transfer payments between departments. And a showback model might be the better choice [12].

Pricing is used to allocate scarce resources. If the value derived from the private cloud in general exceeds the overall costs, then the company benefits. Is it truly necessary to know which users or departments are using cloud services most efficiently? Do you want to manage your business at that level, or would you be better off adding more resources to the cloud as needed, even if it means you are not using the resources as efficiently as you could? The culture of an organization will largely determine whether chargeback or showback is a better approach for sharing information and allocating resources [12].

Allocating costs for shared resources within a traditional IT environment is difficult; private cloud only further complicates the task. To determine whether to institute a chargeback or a showback model, decide which one best fits with the culture and overall long-term goals of the organization.

12. HIDDEN EXPENSES (AND SAVINGS) OF PRIVATE CLOUD

There are several obvious costs attached to a shift from a traditional, on premises IT infrastructure to a cloud architecture. But organizations will also incur some less-apparent expenses.

As with any new technology adoption, there is a learning curve associated with deploying and managing a private cloud that will incur additional costs.IT staff and management must be trained to properly administer cloud services and efficiently provide cloud resources. End users must also be trained so they can intelligently consume and use applications. Additionally, organizations must address security issues, which can rack up additional costs. Providing a private cloud will also require changes to your data center or parts of your physical facility.

Unknown economics of the private cloud, however, are not all negative; using private cloud can bring unanticipated savings as users apply cloud resources in novel ways and begin to rethink existing workflows. This segment addresses some cost factors—training, security and changes to the data center facility—an organization may not have initially anticipated before it dove into a cloud project [6].

13. USER AND ADMINISTRATIVE LEARNING CURVES

Private cloud changes the way in which end users and administrators think about traditional IT resources. Because of self-service portals and automation, end users become responsible for tasks that IT admins handled in the past, such as creating virtual machines and making decisions about administrative access to certain IT resources. End users may also struggle to balance the tradeoffs of using a machine image from the service catalog or creating and maintaining a custom image configured for their particular requirements. Even with solid planning, a cloud administrator may not have all necessary machine images in place when the cloud launches[11].

The catalog will grow over time as requirements become more apparent or change altogether.

Cloud administrators also need to improve their management skills. Usage patterns may become clear over time, which can help admins to optimize the number of servers that are powered on at different times to meet demand. A well-trained

cloud admin must know how to look for these patterns and act accordingly.

Over time, admins will become more adept at filtering alert logs and isolating the most important alerts. Effective cloud administrators should build a set of configuration resources and scripts that can capture best practices and standardize configurations. It will take time to create these scripts, but once they are in place they can improve the operational efficiency of the cloud as well as create some unexpected areas for cost savings[11].

14. SECURITY CONTROLS AND DATA PROTECTION

Security concerns often drive businesses toward keeping resources on-premises in a private cloud versus pushing them into a public cloud. Organizations with confidential and sensitive data can be hesitant to put that data in a public cloud.

One surprising cost of a private cloud deployment centers on implementing security controls, including revising policies and procedures to meet compliance requirements and implementing access controls for cloud resources[13].

Administrators may need to change security policies and procedures to accommodate a multi-tenant system. For example, an organization could have a policy in place that requires locally attached drives to be overwritten and then transferred to another department. In a traditional IT infrastructure, a system administrator may have wiped the drive as part of the procedure for repurposing the machine. In a private cloud model, however, system administrators are not necessarily aware when a virtual machine is shut down, so they cannot perform this operation. Companies must ensure that procedures for deploying and shutting down VMs within a private cloud continue to meet security requirements [8].

15. CHANGES TO THE DATA CENTER FACILITY

When we think about cloud architecture, we tend to think about servers and disk arrays—not necessarily airflow and electrical loads. As you acquire more hardware in the data center, you may find the physical infrastructure no longer meets your needs. For example, adding more hardware will increase the amount of heat generated with the data center, which will, in turn, increase the volume of cool and warm air that mix[13].

Even though this may have occurred in the past, it might never have reached a threshold where it had a

material impact on the overall ability to maintain an appropriate temperature with the server room. With additional hardware, you may have to not only increase the capacity of the cooling system but also find the need to redesign airflow systems in the data center [6].

16. THE SURPRISING SAVINGS OF PRIVATE CLOUD

Private cloud offers developers and end users a new way to do business, which can create some unanticipated cost savings. Developers, for example, may be able to do more test and development in a private cloud. This could eliminate the need to build a single test environment that multiple developers must share for each new project. In a shared test-and-development environment, developers may be constrained in what they test because they do not want to disrupt another developer's project [7].

Another cost savings with private cloud is that it gives users access to tens or hundreds of servers, allowing them to analyze large amounts of data that reside on those servers. In the past, few organizations even considered performing such in-depth data analysis because it would have taken days on a single dedicated server. Within a cloud environment, the same analysis can be done in hours [7].

17. CONCLUSION

Private clouds are and will continue to be more cost effective than public clouds for organizations with revenues or budgets greater than $1 Billion. The main reasons for this are: 1) The applications running in larger organizations demand more resilience, governance and control; 2) While small businesses will find public clouds attractive, large organizations will be able to create a private internal cloud that has many of the same business characteristics as a public cloud, but with much higher levels of control, security and availability and 3) Achieving the same levels of resilience with public cloud infrastructure would be prohibitively expensive for larger organizations. As with any complex system, there are hidden or unanticipated costs. But the potential benefits may outnumber the expenses. It's imperative to approach your private cloud project with realistic expectations about where the cloud will cost the organization and where it can actually help is the bottom line.

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