GIGAOM RESEARCH

Leveraging bare metal clouds

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The emerging bare metal cloud market provides a way to complement or substitute virtualized cloud services with a dedicated server environment. In other words, it's a cloud service that maps to a dedicated physical server, and businesses are the exclusive owner of that service for the duration that it's needed. It's as if the dedicated physical server is an owned server. A business can access and leverage most native features of that platform, including accessing memory and storage subsystems directly without having to go through a cloud API.

Using bare metal cloud eliminates the overhead of virtualization and allows businesses direct access to most of the underlying platform services. Bare metal cloud servers do not run a hypervisor but are delivered using the same on-demand model that most public clouds provide. Providers include Internap, Liquid Web, Digital Ocean, OVH, and now IBM SoftLayer, Mirantis, and Rackspace.

While this may seem like a move away from the cloud by the marketplace, there are some workloads that will run better and at a cheaper cost on bare metal clouds. This report will help IT executives and enterprise architects evaluate bare metal as an option for specific workloads, such as those that are durable over a long period of time, have stable workload characteristics (no need to scale up or down), are sensitive to performance latencies, and are I/O intensive. Workloads such as big data systems, backup and recovery services, and applications that often go to and from storage are the best candidates for bare metal clouds.

Key findings from this report include:

- Bare metal clouds are a requirement for some specific types of workloads and in some cases are actually cheaper to run than traditional public-cloud infrastructures.

- Bare metal clouds can provide better performance than their public-cloud counterparts since there is no hypervisor or multitenant overhead. However, performance varies greatly depending upon a business's workload.

- The single-tenant nature of bare metal clouds make them attractive to companies with security and compliance concerns.

- Bare metal cloud services are starting to be offered by providers that don't reside in the top positions of the public-cloud market, including Rackspace and IBM. These are good niches for these providers, who should grow in the market nicely over time.

- Bare metal cloud should be a consideration for most enterprises moving to cloud. IT executives should review profiles of workloads to understand where they fit and

where they don't. Enterprises that don't consider this technology could be missing an opportunity to optimize application performance and cost efficiency.

- This technology is likely to mature a great deal over the next few years as enterprises figure out its value and providers continue to invest in building it. Count on some of the larger cloud players to provide offerings as well.

Introduction

Enterprises leverage bare metal clouds for a few core reasons:

- More control over the cloud service

- Cost issues

- Fit when performance is imperative

- Security and compliance concerns

More control

Sometimes IT needs to control the platform and platform services by using direct and native access to them. The larger public clouds typically don't allow this, so bare metal cloud offerings usually come from lower tier providers in the IaaS market. These bare metal cloud providers offer features that enterprises are looking for as the service is moving from just a niche to something more strategic.

Bare metal clouds also offer unique benefits around how they process application workloads, and thus give control back to IT. Those previously on the fence around the use of cloud computing now have a path in which to own the system, even though it's not physically in their data center.

Keep in mind that typical hardware procurement cycles can last up to 12 weeks, and that the operational expenditures associated with in-house hardware can make up as much as 70 percent of the initial cost of the hardware per year. So when considering the typical lifetime of the hardware between three to five years, its total cost of ownership (TCO) can be between three and four times its initial acquisition costs.

Cost issues

Bare metal clouds can be more cost-effective than public clouds depending upon the workloads. For instance, enterprises that operate very I/O-intensive workloads benefit the most from bare metal clouds, since their access to the native I/O systems is direct and does not have to go through the cloud provider's APIs. The cost reduction comes because bare metal cloud server instances do not bill by resource usage but by time and resources leveraged. For all practical purposes, it's rented hardware.

In working through cloud TCO identification projects for public cloud systems, bare metal clouds come up most often as the most cost-effective solution — certainly more so than most in the industry originally thought. This is due in part to the fact that companies are moving more workload types that can benefit from the use of bare metal clouds, such as I/O intensive workloads. Other workloads that are a good fit for bare metal clouds include those that don't need to increase or decrease the use of resources, those that have special security requirements, those that have special performance requirements, and those that should always be "up and running."

A business must run the numbers to know if this approach is the right one to take and must also profile the workloads. The table below depicts the features, cost benefits, and percentage of cost savings over a five-year period of time that could be realized when leveraging bare metal clouds. However, this is largely dependent upon workloads. Workload profiling should be the first step in determining TCO, and thus the fit for bare metal clouds.

Bare metal clouds are winning the cost battle in certain instances for certain workloads.

| Feature	Benefits	Typical savings percentage
The ability to hold resources for a long durations of time.	No overhead around resource provisioning and de-provisioning. Companies have it as long as they pay the bill.	50 percent over five years
Direct access to native physical systems and sub-systems without going through a hypervisor or other cloud-management layers.	No need to program around the limitations of leveraging a public cloud's API. Provides better performance for some workloads.	30 percent over five years
The static use of resource instances that eliminate variations in cost.	Resources are leveraged as if they were owned. This typically means stable costs. If the workload needs to scale dynamically, BMCs are usually not a good fit.	40 percent over five years

Generally speaking, unlike the big public cloud providers, bare metal clouds only provide a finite amount of accessible resources, so a business's patterns of use need to consider this characteristic. They must look at which specific features and functions their bare metal cloud provider offers, a topic this report covers in a later section.

Need for performance

Bare metal clouds usually provide better performance because they give businesses direct and unimpeded access to the native platform. There is no hypervisor and no virtualization tax. This single-tenant approach means that companies are not in competition with other applications or users for the same resources — otherwise known as the "noisy neighbor effect." With bare metal clouds application should be able to run faster and smoother.

The benchmarks coming from bare metal cloud providers compare their offerings with IaaS public cloud providers. The reality is that these are apples and oranges. Each is purpose-built for specific types of workloads, as outlined earlier. The figure below, which is a performance chart from Rackspace (a bare metal cloud provider), shows that when dealing with I/O intensive workloads such as Hadoop clusters the bare metal cloud option comes out on top. Rackspace's Cloud Big Data OnMetal platform returned standard Terasort and DFSIO benchmarks in roughly half the time of traditional virtualized Hadoop.

A comparison of big data workloads running on the Rackspace bare metal cloud and a traditional cloud
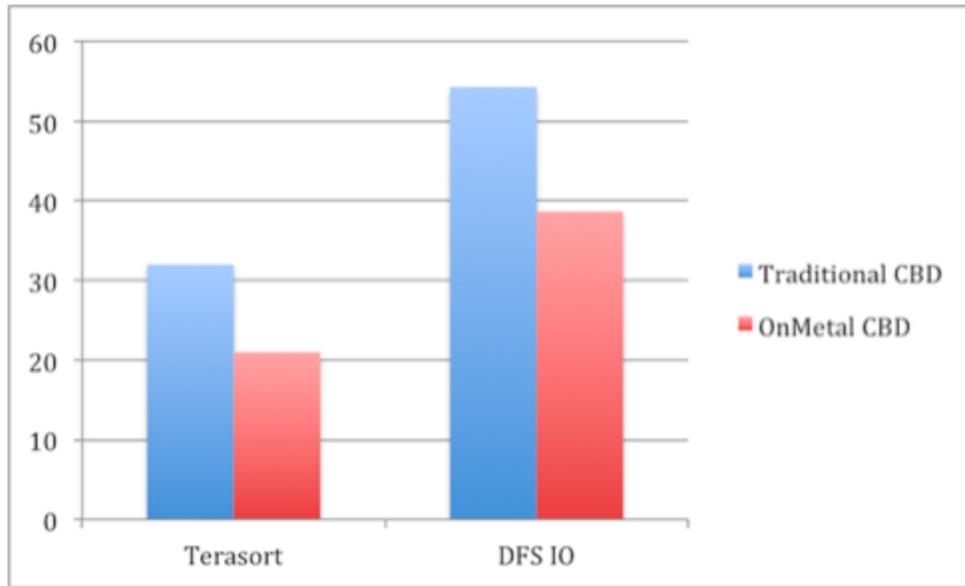
Source: Rackspace

Security and compliance

The control benefit of bare metal clouds may not just be a nice-to-have feature; it may be
mandate by law. In many cases the primary reason for companies leveraging bare metal
clouds is the concern over security and compliance. There is also the fear of breaking
compliance mandates in a multitenant cloud environment. However, all companies
should understand the law before making the proclamation that leveraging a traditional
multitenant cloud platform is out of the question.

Moreover, just having the cloud-based resource under operational control is viewed as
being more secure than traditional multitenant cloud implementations. While this may or
may not be the case depending on the security architecture and technology, enterprises
are slow to let their data onto public clouds that could scatter their bits and bytes all over
the world.

The tradeoffs

There are a few tradeoffs to consider when it comes to bare metal clouds. Most providers do not have the ability to autoscale or autoprovision resources on-demand. Public clouds, on the other hand, usually allow a company to provision as many virtual server instances as it needs and then de-provision them when not needed. They do this because they are able to manage the resource instances as virtual machines and are not bound by physical servers.

The bare metal cloud model is more about dedicated access to physical server resources. This is how a company should think about dealing with bare metal clouds: Not as true clouds, where the resources are well abstracted behind the APIs.

However, most bare metal cloud providers don't custom-build hardware for each customer. They often have four or five typical configurations which are racks of physical servers specifically configured for different levels of offerings. If these configurations are not right for a company's applications, it doesn't have a lot of options.

Of course, companies get the advantage of leveraging their own physical machines. This includes performance, as well as direct control of storage to deal with issues such as security and compliance. This configuration gets around the objection many have about the move to public cloud — typically the loss of control and the subsequent feeling of insecurity. Fundamentally, these are a company's own machines.

Other advantages include the ability to customize bare metal cloud services for specific workloads. Much like servers are tuned for use as database servers or storage servers in traditional data centers, the same can be done with bare metal clouds. Companies will get even more performance advantages than just the single-tenant performance advantages previously discussed.

The value of bare metal cloud services lies in the enterprise's ability to use cloud to, at times, do certain things with dedicated physical instances. It's likely that most that leverage this technology will also employ traditional cloud servers that are offered using multitenant mechanisms.

The players

[Rackspace announced OnMetal](#) at the Gigaom Structure 2014 conference in San Francisco. This was no surprise, given the company's new focus on managed services providers and its search for new niches away from the target markets of AWS, Microsoft, and Google.

Rackspace OnMetal, much like the other bare metal cloud solutions, offers single-tenant bare metal cloud servers that users can spin up or down as quickly as VMs. According to Rackspace, all OnMetal servers use solid-state storage, have no moving parts, and only external cooling. This provides the ability to leverage a single-tenant approach to server utilization, with no sharing of resources with other cloud users.

The idea behind OnMetal is to allow a user to provision single-tenant bare metal cloud services with the same OpenStack API that is already native to Rackspace. The servers borrow ideas from the Open Compute Project, of which Rackspace is a member. This approach follows many of the current trends in cloud computing around bare metal cloud options that are cloud-delivered.

However, Rackspace is not the only game in town. Mirantis and IBM SoftLayer announced their bare metal-as-a-service cloud plan with Mirantis OpenStack Express. Rackspace and IBM have OpenStack in common. So the world of bare metal clouds, especially OpenStack-powered ones, is getting pretty crowded. Each has its own set of features, which should be understood before making the leap to bare metal cloud, as well as the pricing structure and policies.

Other bare metal cloud providers include Internap, Liquid Web, and the aptly named BareMetalCloud. Internap is offering its bare metal cloud servers in what it calls its Bare-Metal Cloud. The company will also offer bare metal cloud servers in its AgileCloud offering. This adds elasticity of service, or the ability to add more servers to the workload if needed. Customers can self-provision the servers through a portal that provides access to an OpenStack provisioning and management system.

Liquid Web offers Storm on Demand | Bare Metal Servers, which function much like the other bare metal clouds in today's market. Liquid Web was actually one of the original innovators in bare metal cloud technology and should be on the list of bare metal cloud considerations beyond the usual suspects listed above.

Key takeaways

Key takeaways when considering the use of bare metal cloud technology include:

- Study the workloads that will run on bare metal clouds. There is a huge difference between workloads that are a fit and those that are not. The cost difference could be hundreds of thousands of dollars over a five-year period.

- There is some lock-in with bare metal clouds. However, in this case a business would be locked in at the platform level, not at the cloud level. Bare metal cloud-dedicated servers should be considered as they define fit and value.

- Bare metal clouds are often leveraged with performance in mind. Direct access to the platform resources means they can be easily optimized for high performance, specifically for I/O-intensive workloads such as big data systems.

- Bare metal clouds should be a consideration for most enterprises moving to cloud. However, they are not always a good fit, so enterprises must beware of IT organizations that insist on using bare metal clouds for everything. That decision could be more about control than value.

- Keep in mind that this technology will mature and change a great deal in the next few years, including who offers bare metal clouds. So this should still be considered an emerging technology.

About David S. Linthicum

David S. Linthicum is a Gigaom Research Analyst, senior vice president at Cloud Technology Partners, and an internationally recognized industry expert and thought leader in the world of cloud computing and the author or co-author of 15 books on computing, including the best-selling *Enterprise Application Integration,* and his latest book, *Cloud Computing and SOA Convergence*. He is a blogger for InfoWorld, Intelligent Enterprise, eBizq.net, and *Forbes*, and he conducts his own podcast, the Cloud Computing Podcast. His industry experience includes tenure as the CTO and CEO of several successful software companies, and upper-level management positions in Fortune 100 companies. In addition, Linthicum was an associate professor of computer science for eight years and continues to lecture at major technical colleges and universities.

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