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All “enterprise storage” is not created equal. Learn which platforms truly qualify as enterprise-class and why.
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Ask IDEAS

How does the new Amazon EC2 HPC cloud service compare with other HPC cloud options on the market?

Answer: Managed hosting for high-performance computing (HPC) has been around for a long time, but the old contract-based model for hosting HPC workloads differs from the on-demand/per-core public pricing model now available from cloud services such as Amazon EC2 HPC. The public cloud market for HPC is still young and not yet fully developed, but vendors like Penguin Computing have already established some traction with end users seeking public cloud services to host HPC cycles.

The table below compares Amazon's EC2 HPC with Penguin Computing's Penguin on Demand (PoD). A key advantage that Penguin Computing has right now is its network capability. Penguin offers InfiniBand networking, which is the preferred option for HPC clusters. Otherwise, though, there are few differences in the server platforms for the two offerings. For instance, EC2 HPC holds a slight advantage in clock speed, while PoD holds a 1 GB advantage in memory and a .31 TB advantage in storage, but the only real selling point is PoD's inclusion of three NVIDIA GPUs.

Penguin does have a notable advantage in terms of support. Amazon charges for support while Penguin offers free support for users who exceed 2,000 core hours per month, which equates to utilizing about 2.7 cores non-stop.

Amazon will probably upgrade to InfiniBand in the near future, which will close the performance gap even further. When this switch occurs, price and non-performance-based variables will become the deciding factors for most consumers. ■

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HPC Cloud Offerings Compared: Amazon's EC2 HPC vs. Penguin Computing's Penguin on Demand

	Amazon EC2 HPC	Penguin PoD
Pricing	Per core hour	Per core hour
Processors	2 x Xeon X5570 4-core (2.93 GHz) "Nehalem" architecture (33.5 EC2 compute units)	2 x Xeon X5540 4-core processor (2.53 GHz)
GPU	Unknown	3x NVIDIA Tesla C1060
Memory	23 GB	24 GB
Base Storage	1.69 TB	2 TB
I/O Performance	10Gb	10Gb or InfiniBand
Dedicated Node	No	Yes
Overnight Data	Yes, through AWS Import/Export	Yes, 2 TB hot-swap overnight
Cluster Configuration and Management Tools	Adaptive Computing, Clustercorp, Cycle Computing, Univa-UD	Available (Univa-UD)
Support	Premium support available	Free when usage exceeds 2,000 core hours per month; 6 am - 12 am PST

Traditional Enterprise Storage Holds an Edge in I/O Scalability

Joseph Zhou, Senior Analyst

The term "enterprise storage" is being used extensively by vendors today. While the major storage vendors, such as EMC, HDS, HP, and IBM, offer separate enterprise and midrange product lines, the vendors with a single product line, such as 3PAR, Compellent, NetApp, and Pillar, all position their products as enterprise storage platforms. Even some iSCSI platforms, such as Dell PS (EqualLogic) and HP P4000 (LeftHand), also claim to provide enterprise functionality, despite the fact that most enterprises still prefer FC SAN infrastructures – or are locked into them.

The Diminishing Differentiation of Enterprise Storage

Historically, the definition of enterprise storage included the support for mainframe operating environments. Under that definition, only the storage products from EMC, HDS, HP, and IBM provide mainframe support, and thus qualify as enterprise-class. However, many enterprises today are operating without mainframes, making such a definition less convincing. The fact that IBM markets the XIV system as enterprise storage, even though it does not support mainframes, signals that even IBM is departing from this definition.

Other traditional points of differentiation between enterprise and midrange storage, such as features and single-application performance, are losing their relevance as well. Virtually all storage platforms today offer impressive scalability and comprehensive data protection features (point-in-time copy and remote replication). In addition, as processor technologies advance, storage controllers based on standard server components are delivering exceptional single-application performance that can satisfy a wide range of customers.

Enterprise Storage Maintains Competitive Advantage in I/O Scalability

Nevertheless, the traditional enterprise storage platforms still hold an edge in accommodating large-scale consolidations. As shown in the table below, these platforms have extraordinary front-end (host-side) bandwidth and tremendous cache to provide performance headroom for a large number of server hosts. These platforms also support substantially more logical volumes than midrange platforms. Among the single-product-line vendors, only 3PAR can possibly sell into the same range as the traditional enterprise platforms for large-scale consolidations.

Hence, even without factoring in mainframe support, the traditional enterprise platforms still stand out in their own class. With today's large-capacity disk drives, the customer requirements for capacity scalability can be easily satisfied. However, in terms of performance scalability, only these traditional enterprise storage platforms are truly sufficient to accommodate hundreds of server attachments.

Storage controllers are essentially servers dedicated for serving storage. Massive I/O bandwidth is key to a capable storage server. The traditional enterprise storage platforms all use some proprietary implementation to

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Storage Platforms Compared: Traditional Enterprise, Midrange, and Single Product Line

	FC Ports	Cache	Max. LUN	Max. Disk
Traditional Enterprise Storage Platforms				
EMC VMAX	128	1 TB	2,048 per FC port	2,400
HDS USP V / HP XP24000	224	512 GB	65,536	1,152 + External
IBM DS8700	128	384 GB	65,280	1,024
Top Models of Midrange Storage Lines				
EMC CLARiiON CX4-960	24	32 GB	4,096	960
HDS AMS2500	16	32 GB	4,096	480
HP EVA8400	8	22 GB	2,048	324
IBM DS5300	16	64 GB	2,048	480
Top Models from Single-Product-Line Vendors				
3PAR T800	128	96 GB	Info not available	1,280
Compellent Storage Center 30	18	3.5 GB	Info not available	896
NetApp FAS6080	16	64 GB	4,096	1,176
Pillar Axiom 600	16	192 GB	Info not available	832

achieve scalable and balanced system I/O, such as the EMC VMAX RapidIO fabric, HDS USP crossbar switch, and IBM POWER server. These system designs provide much greater I/O capabilities than the standard X64 server chipsets, which are widely used in other storage products.

Be Aware of Oversubscribing System Design

In recent years, the I/O interconnect technologies have outgrown the system I/O subsystems. Today, it takes only four 8 Gb/s FC HBAs to max out the typical 4 GB/s internal bandwidth provided by an X64 chipset. Storage products based on standard X64 chipsets often employ an oversubscribing I/O design, which provides an aggregated port bandwidth that is greater than the front-end bandwidth of the system. Oversubscribing may result in considerable performance degradation when heavy workloads are produced by applications, and the aggregated workload exceeds the internal I/O capability of the system. The traditional enterprise systems provide over 100 GB/s of internal I/O bandwidth to accommodate over 100 host ports without oversubscribing.

The 3PAR InServ systems are able to provide a large number of host ports, up to 128 ports. InServ is also based on a proprietary I/O architecture. The 3PAR systems require 3PAR frames, which provide a full-mesh, passive I/O matrix on the backplane. InServ controllers are plugged into the backplane matrix using a high-speed interface. The InServ full-mesh interconnect provides 1.6 GB/s data paths between each controller node, totaling 12.8 GB/s of aggregated matrix bandwidth across a full eight-node configuration (8 x 1.6 GB/s). Using 12.8 GB/s bandwidth to serve 128 FC ports (64 GB/s using 4 Gb/s HBAs) is an example of oversubscribing.

The importance of system I/O bandwidth is especially significant when handling throughput-oriented (MB/s) workloads. While storage vendors tout their I/O rate (IOPS) performance, OLTP applications may not be the dominant storage consumers in a consolidated storage environment. Applications that handle large data objects are often the heaviest consumers of storage resources. Throughput-oriented workloads, such as sequential or steaming data I/O, usually use a very large I/O size to maximize the utilization of available bandwidth. Such workloads persistently consume large portions of the system I/O bandwidth, and are likely to cause I/O congestion in oversubscribed systems.

Hence, while scalable capacity is becoming a less significant differentiator, the traditional enterprise storage platforms still hold a sound competitive advantage in terms of scalable performance against midrange systems and systems from single-product-line vendors. The fact that some enterprises with modest storage performance requirements can deploy a wide variety of storage products does not mean that all of these products are actually enterprise-class. Only the traditional enterprise storage platforms can adequately serve the demanding performance requirements of those enterprises with large-scale consolidated environments.

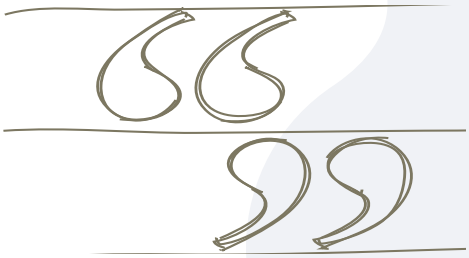
Under this notion, the storage systems from single-product-line vendors would qualify as high-end midrange, instead of enterprise-class. The 3Par InServ may seem like it is reaching into the realm of enterprise storage, but its oversubscribing system I/O design casts doubt around its practical ability to handle heavy consolidated workloads.

The IDEAS Bottom Line

The technological advances in standard server technology have boosted the capabilities of all network storage systems. As a result of the recent hardware upgrades, storage platforms today can serve a wider range of the market than ever before. Enterprise customers are increasingly looking into midrange storage products as viable alternatives to enterprise storage products. Midrange storage vendors are trying to capitalize on this trend by marketing their products as enterprise storage. However, the traditional enterprise storage platforms hold the advantage for accommodating large-scale consolidations, and therefore are the only systems that truly qualify as enterprise storage.

The fact that some enterprises with modest storage performance requirements can deploy a wide variety of storage products does not mean that all of these products are actually enterprise-class.

Nevertheless, the market for such large enterprise storage systems is limited. The increasing maturity of clustered file systems and clustered storage virtualization engines also reduces the demand for exceptionally capable single systems. The industry trend of server virtualization promotes consolidation, but reduces the number of physical servers that require attachment to storage. The average scale of virtual server deployments today can be well served by midrange products. Hence, the market size for enterprise storage does not benefit from current technology trends. Although they hold technological advantages, over time the enterprise storage systems are likely to become the mainframes of storage, with a market that is large enough for survival but provides no room to grow. Nonetheless, these enterprise storage platforms represent the most capable storage systems that can be possibly made; their existence is epic. ■



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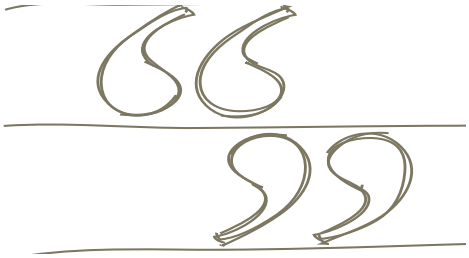

VMware's switch to virtual machine-based licensing is a decisive move, showing that it is rising to the challenge of licensing software in the new virtual world of cloud computing. VMware still licenses all of its other software per physical processor, so this is probably just the beginning of a broader transition to per-VM licensing – not only for VMware, but for the rest of the software industry as well. VMware's initiative will soon put pressure on other commercial software providers to follow its example.

VMware Switches to Virtual Software Licensing in Charge to Cloud
Tony Iams and Gary Burgess | July 16, 2010

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