VxDatacetner
Enterprise Class Storage at a Commodity Price

Introduction

Hexagrid Computing is a pioneer in providing enablement software for cloud computing and infrastructure as a service. It became clear early on that the key to cloud computing would lie in how the storage layers interact with the compute resources in the cloud. The purchase of VMWare by EMC seemed to substantiate this philosophy. The problem that we saw is that the feature sets that we required for enterprise class cloud storage were prohibitively expensive. The goal here is utility computing. It is very difficult to cost justify utility computing when a sizable storage investment is required before one gets started. Understanding this, Hexagrid embarked on a mission to completely understand how the cloud consumes storage resources and what enterprise feature sets are required to ensure integrity, stability and reliability. Hexagrid's flagship product, VxDatacenter embodies this development and answers the tough questions facing infrastructure as a service providers.

"There is always an easy solution to every problem - neat, plausible, and wrong" – H.L. Mencken.

In the case of storing data in the cloud, the easy solution is aligning oneself with one of the many available vendors: EMC, NetApp, Hitachi. Hexagrid would be remiss to suggest that these solutions do not have merit, but they all share one undeniable trait. They are EXPENSIVE. Hexagrid Computing was not satisfied with this approach and ditched the 'easy solution' in favor of the best solution. What Hexagrid understands is that hardware is hardware, and it is essentially a commodity until a vendor logo is slapped on it. The most important features of these proprietary solutions are available in open-source, it is the integration that is missing. These solutions amount to little more than a handful of available technologies packaged with slick management interface and finished off with shiny vendor logos. Hexagrid Computing asked, "Why not Hexagrid's interface?"

Challenges

1. **Performance** – The cloud is for running applications. Storage throughput is the biggest hurdle to high performance computing in the cloud. Local storage is great for performance, but its hardware boundaries are a significant limiting factor.

2. **Flexibility** – A truly dynamic and fluid cloud should schedule the workloads for optimal performance. Moving workloads should not mean moving storage. A logical addressing scheme allow workloads to find their storage regardless of where they are running in the cloud. The bottom line is that the compute nodes should be diskless, so the storage has to be as flexible as the compute layer.

3. **Management** – A true cloud should not have a separate compute provisioning process and storage provision process. Provisioning a 12GB RAM, 4 CPU, 1 TB server is a single action in Hexagrid's opinion. All provisioning should happen through a single unified interface.

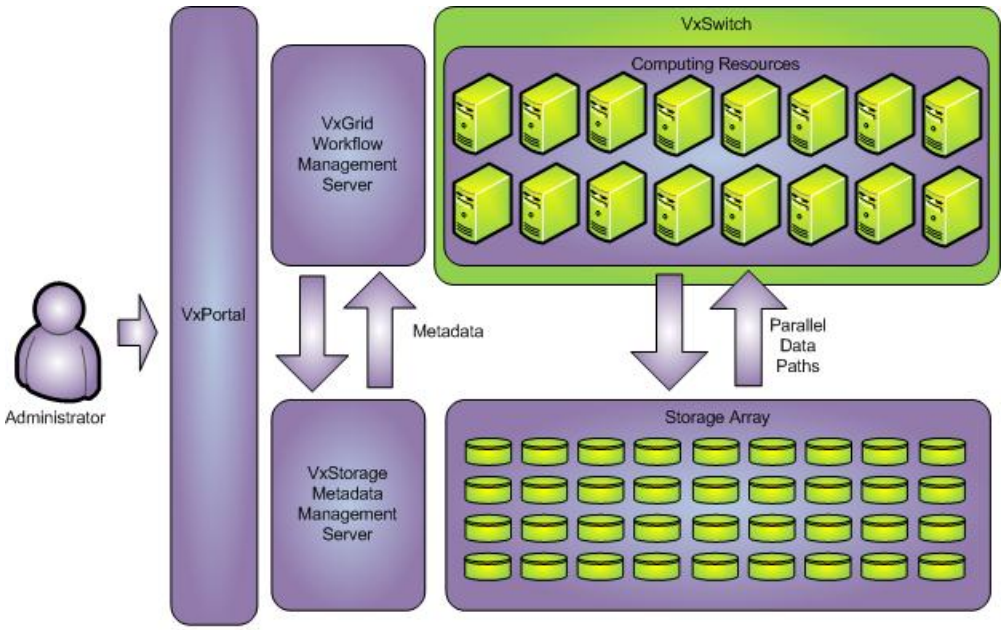
4. **Enterprise Features** – The icing on the cake for most storage vendors is the fancy branding of open features like replication, snapshots and de-duplication. These features provide tremendous value and are expected to be part of any serious cloud storage solution.

5. **Reliability** – Redundancy and fault-tolerance at the hardware and volume layers is essential to hosting production applications in the cloud. The features are absolute requirements of any cloud storage infrastructure.

6. **Cost –** Enterprise features at a commodity price.

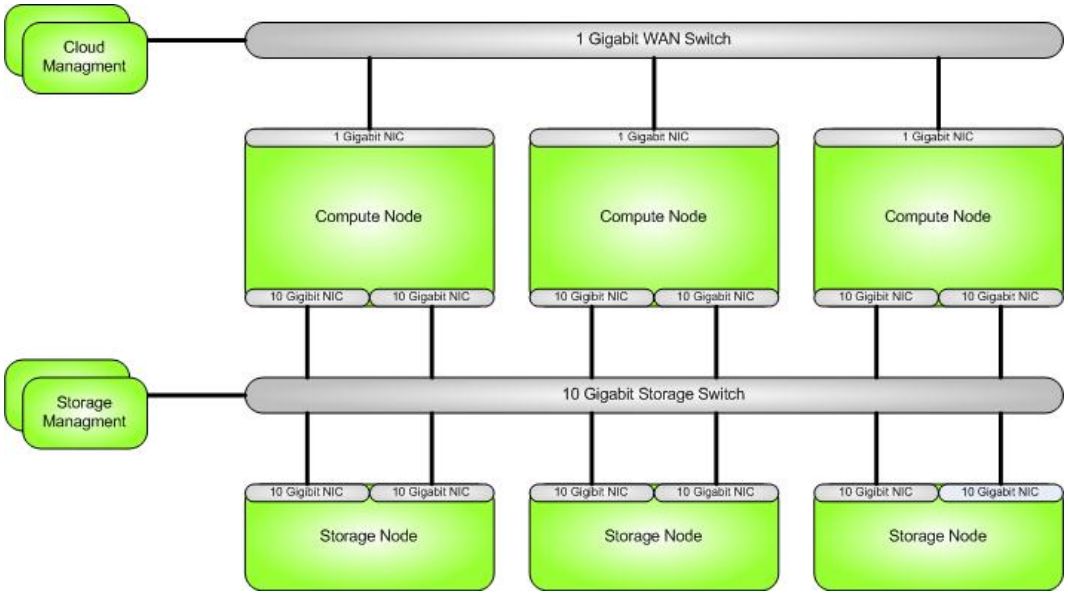
VxDatacenter

VxDatacenter represents Hexagrid's flagship offering for enabling cloud computing. It is a holistic approach to managing and operating an Infrastructure as a Service platform. The challenge that Hexagrid undertook was to design a complete storage sub-system that would empower low-cost commodity hardware so that it could be managed as a fully integrated aspect of the cloud platform. In doing this, it was essential to address all of the aforementioned challenges. The key to VxDatacenter's storage is that it is 100% abstracted from the compute resources of the cloud. In short, the compute layer of VxDatacenter is completely diskless. This dedicated storage layer is packed with the very same enterprise features offered by major storage vendors. This difference is that it comes bundled with cloud enablement platform. No additional software is required. Service providers need only to supply the commodity hardware.

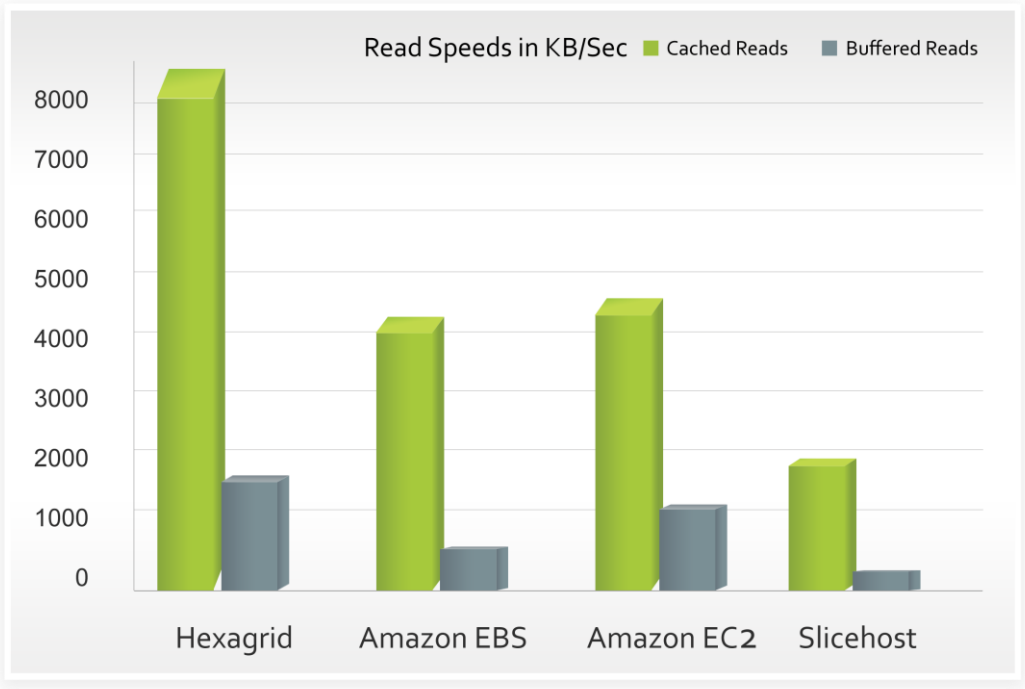


Hexagrid's VxDatacenter High Level Architecture

Compute Nodes – As stated before, there is no requirement for disk or RAID cards. Removing this requirement reduces cost. With respect to storage, the only requirement is that the machine must have at least 2 NICs. The primary NIC is intended as a WAN interface and may be 1 Gigabit or 10 Gigabit depending on requirements. Any additional NICs will be detected by the system upon thin provisioning of the hypervisor. These NICs will be teamed together to provide parallel paths to the storage network. It is recommended that all interfaces for the storage network be 10 Gigabit. The WAN and Storage NICs will be homed on dedicated switches for that purpose.



Performance – The single barrier affecting applications deployed to the cloud is throughput to disk. By automating the teaming of NICs, VxDatacenter allows high performance through cost-effective copper interconnects on commodity 10 Gb Ethernet switches. Compared to other popular cloud computing platforms, VxDatacenter is significantly faster in performing standard read and writes to disk.



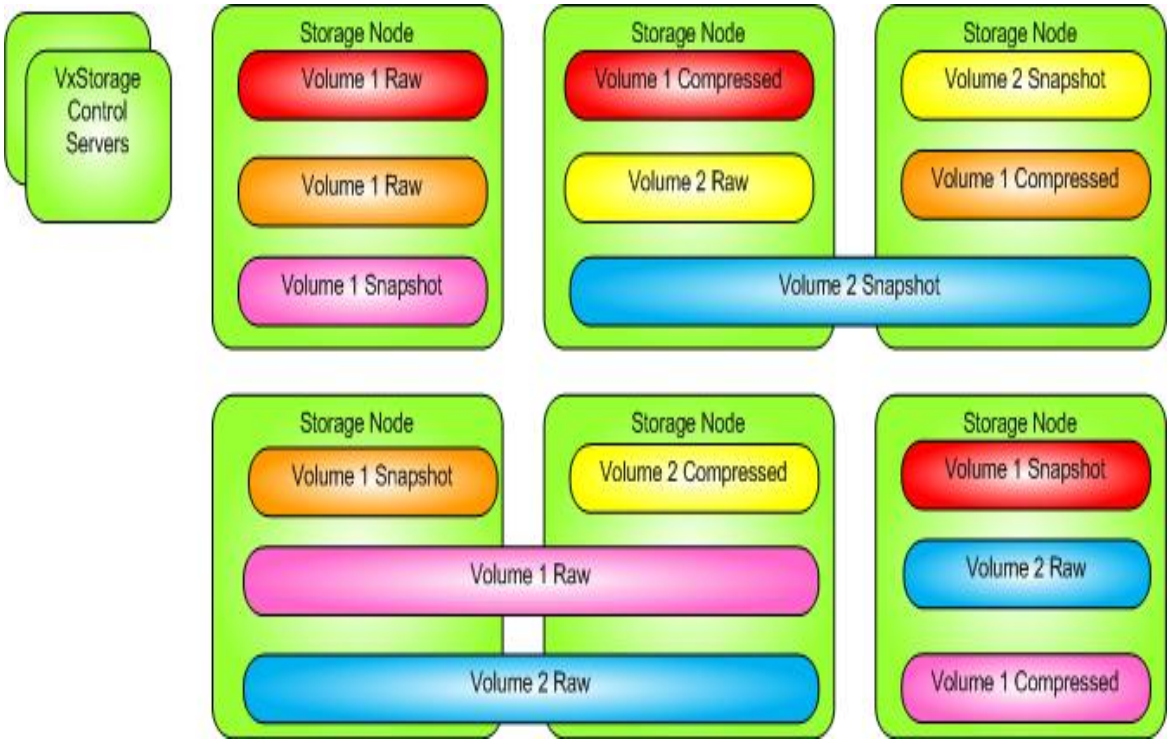
Utilizing pNFS to separate the control meta-data and the actual data-paths, read-write operations can be parallelized across multiple storage nodes. As nodes are added to the cloud, performance continues to increase. The storage throughput becomes as scalable as the cloud itself. Since control meta-data is managed independently of the actual data, filesystems can span actual storage nodes without issue. Because it uses the standard TCP/IP, commodity and switches and JBODs are perfectly acceptable hardware options. Furthermore, managing the mappings of virtual machines to volumes becomes a simple execution of business rules. Moving a virtual appliance across the compute nodes is now as simple as replicating the RAM and re-pointing the new hypervisor to the volume.

Storage Resource Pooling – VxDatacenter uses a RAID Z implementation to manage storage pools in the cloud. The advantages of RAID Z are well documented:

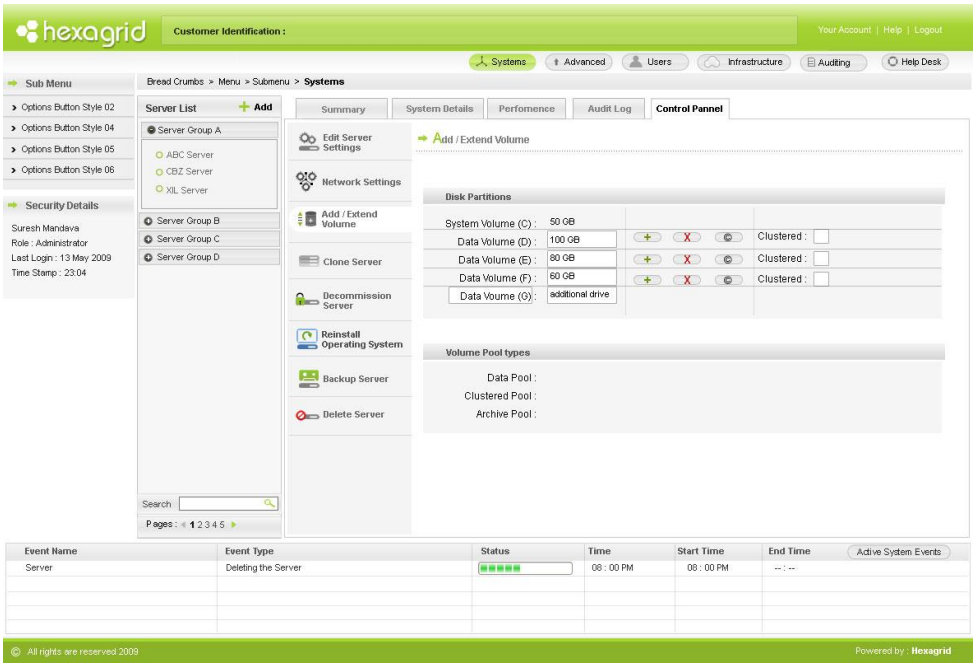
- Copy on Write algorithms avoid the 'RAID 5 Write Hole'
- Triple Parity reduces the chance of catastrophic data loss during rebuild (System can sustain 3 drive failures before losing RAID set.
- Data replication

- Data compression
- Data de-duplication
- Volume snapshots

VxDatacenter automates the installation and configuration of RAID Z. When adding storage capacity to the cloud, the storage system is thin-provisioned. All interaction with the storage pools is automated during the creation of virtual appliances. VxDatacenter automates the distribution of volumes across the storage pools to ensure that the system can sustain the complete loss of any storage device without losing data. The VxStorage control servers are also deployed redundantly.



Management – There are many storage solutions can be used for cloud, but few that are natively part of the virtual appliance deployment process. The deployment of an appliance in the cloud should consist of a single action, not a coordination of 2 events (storage provisioning and VM creation). VxDatacenter provides a single unified interface that manages all aspects of the cloud. Features and replication policies are configured for each volume independently allowing for flexible SLA's depending on the criticality of the data.



VxDatacenter's Server Management Portal

Conclusion – There is little doubt that cloud computing is heavily dependent on the storage implementation. As cloud computing prices continue to drop, service providers are going to have to keep up. Fibre Channel SANs, EMC Symetrix cabinets and expensive SCSI disks have their application, but low-cost computing is not one of them. At the end of the day, it is the features that make a difference. VxDatacenter embodies best-practices and open technologies bundled with Hexagrid's comprehensive middleware to create a true cloud storage solution. At the end of the day, this storage is part of an end-to-end solution that makes cloud computing a simple turnkey solution. Using VxDatacetner, service providers can provide enterprise-class feature sets at the low cost that the market is demanding. Performance, reliability and scalability need not be compromised. Call a Hexagrid representative today to schedule a demo.