Digital Sense

Case Study

Public Cloud Provider Overcomes Scale-Out Storage Limitations With Seagate Kinetic™ Platform

Challenge

- Scale-out limitations of legacy storage solutions

Solution

- Seagate Kinetic Open Storage™ Platform

Benefits

- Kinetic's cost-efficient development is complemented by its significant hardware savings.
- Full end-to-end and data-at-rest encryption

Company
Digital Sense

Location
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Industry
Public cloud data center

Digital Sense, established in 2006, is the premier public cloud hosting supplier in Australia. As the country's first fully redundant (2N[1]) co-location facility, the organization has set the bar for redundancy, resiliency and security. In 2008 Digital Sense became one of the first hosting providers to adopt cloud computing and offer it as a public shared service. To remain ahead of the industry, Digital Sense has developed a vast skill set, enabling it to adopt new technologies and innovate existing ones.

1 Standard indicating there is no single point of failure that could impact main production infrastructure.

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SEAGATE

Challenge: Scale-Out Limitations of Legacy Storage Solutions

Digital Sense has experienced significant growth over the past five years, leading to rapid expansion of all systems from physical infrastructure (power and cooling) to networking, servers and storage. Thanks to virtualization technologies such as VMware, the company has been able to minimize physical server footprints while providing true scale-out memory and processor power in a complete high-availability architecture.

However, Digital Sense faced significant challenges with data storage. Unlike servers and networks, storage scale-out with traditional enterprise-class infrastructure is both difficult and expensive. Michael Tran, chief technical officer at Digital Sense, describes a wide variety of public cloud-related storage limitations that confronted the company:

Storage Capacity

To resolve this common issue, additional disk shelves and associated disks are typically deployed, but most servers are limited in the number of disks and SAS lanes they can accommodate. Alternatively, simply adding larger disks reduces IOPS/GB on the disk platform and diminishes overall performance.

IOPS

In public cloud systems, the demand for disk IOPS can vary unpredictably with ever-changing user loads. However, customers always expect the highest levels of service, even from lower tiers of disk. Adding more spindles and/or flash tiers helps with equalizing disk data loads, but as noted previously, traditional storage systems limit the number of spindles that can work together.

Read/Write Speed

Read/write speed is often not limited by the disks themselves but rather by the connectivity and processing power of the storage servers. Increasing speed by adding more storage servers is expensive, and even more costly software licenses are often attached to the servers.

Firmware Upgrades

Frequently required to update storage servers, firmware upgrades pose risks, particularly in multi-tenanted environments where there are many cloud customers using disks all connected to the same server. For example, it can be difficult to roll back an update for one customer who requires an earlier firmware version.

Traditional Volumes on RAID Groups

In a shared public-cloud setup, cloud providers take a one size fits all approach when configuring RAID groups; as such the provider ultimately decides on critical performance and reliability requirements on behalf of all its customers, without having specific knowledge of each customer's individual needs.

Security

Security is a key concern for public cloud tenants, as their providers typically having some form of access to virtual disks and server file systems. File transmissions to/from the provider are often unsecured, entailing additional risks. Technologies to mitigate these risks add significant costs to provider services.

Host-Based Commodity On-Board Storage

Most virtual hosts are designed with 128GB or more of RAM, along with dual multi-core CPUs that can provide the base for 20 to 30 VMs. Even with older, traditionally disk-heavy chassis, there are not enough disk drives to provide meet the IOPS demand required for the host's load.

Tran summarizes the situation: "Hypervisor technologies have enabled scale-out Ethernet-scale compute, network virtualization has provided dynamic scale-out networks, and data centers continue to heavily invest in Ethernet infrastructure. Yet storage, while continuing to grow in size, is still limited to old methodologies in terms of development and innovation. Public cloud facilities like ours need agile scale-out storage with client-enforced security and configurations."

Solution: Seagate Kinetic Open Storage Platform

First announced in 2013, the Seagate Kinetic Open Storage platform is a device-based object storage platform that comprises storage devices, a key/value API and Ethernet connectivity. Core benefits of this innovative platform include:

- **Servers and storage can be built out independently, developed more rapidly**
  Servers are decoupled from storage in two important ways:

  - Cloud data centers can add servers and storage at entirely different rates, matching each precisely to their needs.

  - HDD development creativity can progress more rapidly because servers and operating systems are shielded from device changes through the Kinetic Open Source API.

- **Improves drive and rack-level performance**
  Kinetic eliminates the need for legacy file systems, and shifts HDD storage media space management to the drive itself.

- **Reduces total cost of ownership (TCO)**
  Kinetic redefines and greatly simplifies storage architectures for today's use cases. By combining an open source object storage protocol with Ethernet connectivity, Kinetic HDD eliminates multiple layers of legacy hardware and software infrastructure.

The Seagate Kinetic Open Source API includes a library of predefined commands that help organizations simplify their storage architectures by enabling applications to communicate directly with the storage device. Developers can modify the source code if necessary to meet their needs and even submit the code for approval to the open community if desired.

Digital Sense's Tran thoroughly researched the Seagate Kinetic platform, and concluded it offered the flexibility and scale-out capabilities his company needed. Reflecting on his experiences with the platform after deployment, Tran is clearly satisfied with his choice: "Through Seagate's Kinetic technology, we have been able to rapidly develop storage prototypes that have validated the technology as an extremely viable modern solution for any large-scale disk user, including public cloud providers like ourselves. Its direct attachment of disk to network gives us true Ethernet scale-out storage capabilities that for the first time align with the visions of hypervisors' massive-distributed capabilities."

Was implementing this new technology a complex undertaking? "Our approach to Kinetic has been simple and effective," notes Tran. "By using RAID techniques, we have developed a storage platform that deals with all of the above-mentioned storage limitations of traditional storage arrays. No longer bound to servers, SAS lanes and limited number of spindles, our solution can dynamically drive tens of thousands of drives simultaneously to provide massive capacity, speed and IOPS… all while providing dynamically-allocated storage configurations that give us higher levels of security, customized redundancy and customer-based firmware control."

To build its next-generation storage platform, Digital Sense developed software using the Kinetic published libraries and storage kits from Seagate:

- Java-Based Drive Emulators
- 4-Bay Kinetic Sample Kit
- 60-Bay Kinetic Developers Kit
- Networking: Dell Force10 s4810 (L2), Z9500 (L2), e600i (L3)
- Hypervisor Platform (for development and testing): VMware
- Servers: Fujitsu CX400 Cloud Infrastructure Servers
- Virtual Drive Creation Platform: NetApp FlexClone
- OS: CentOS, Ubuntu, Windows 8, Windows Server 2012 R2

Benefits

Streamlined development has been another strength of Kinetic, according to Tran, "The well-documented Kinetic libraries provide an excellent platform to access and store data directly to the drives with minimal development. Unlike traditional storage systems, much of the hardware-level complexities have been removed and replaced with simple commands. This enables us to develop features in days rather than months or years."

Kinetic's cost-efficient development is complemented by its significant hardware savings. As Tran explains, "The physical Kinetic platform has removed the most expensive part of disk arrays—the storage server. In addition, it has eliminated the costs of SAS and Fibre Channel networks and replaced them with simple, scalable, cost-effective Ethernet networking."

The results Digital Sense has achieved with the Kinetic platform have impressed Tran: "We have seen faster storage performance than ever before, and while we are early in our development stage, Kinetic looks to deliver hypervisor-like advantages and scale to storage."

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Storage Capacity

Digital Sense tested running all 64 physical drives together in a single platform, and extended the platform with a further 32,704 simulated drives. This yielded a virtual storage pool of 32,768 drives (equivalent to a single 131PB storage array).

IOPS

Under proof-of-concept conditions, the company has been able to measure up to 100.4 object operations (get, put, delete) per second per disk, and expects significantly higher results as they complete their development cycle and system bring-up.

Read/Write Speed

Digital Sense tested the read/write speed of the disks (50% read, 50% write) with the following results.[2] Note, these results are from a single disk, as results scale out as the number of disks increases.

Disk Rate Per Second (MBps)
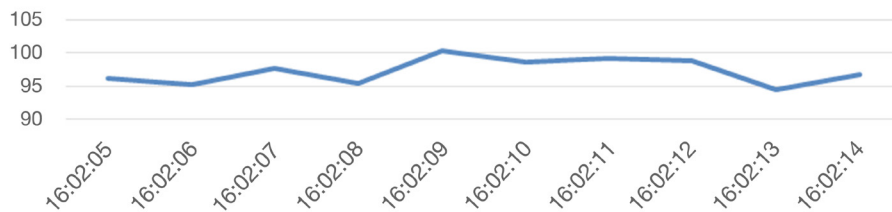
"The Kinetic disk array has consistently outperformed traditional disk systems in our labs when using comparable configurations of similarly sized arrays," states Tran. "One of the unique strengths that Kinetic has to offer is the many-to-many access of devices to disks. Performance on a full set of sixty disks exceeded the capacity of our hosts, maxing out the 10Gb/s adaptors."

Full End-to-End and Data-at-Rest Encryption

Kinetic's built-in support for SSL transport and C++ libraries for encrypted transport enables secure transmission of data packets over public networks into public cloud infrastructure. By encrypting and decrypting the data itself—as well as at the application side—Digital Sense has achieved full end-to-end encryption and data-at-rest encryption. Customers hold the cryptographic keys, enabling public cloud providers to offer true hosted storage without any risk that the provider can read customer data.

Data Center TCO Analysis

"The Seagate Kinetic Open Storage platform is a powerful innovation that scales in cost-effective blocks by utilizing its Ethernet heritage," Tran remarks. "Without costly servers that permit only limited connectivity through SAS laneways, Kinetic enables low-cost scale-out architectures which leverage the inexpensive 10GbE connectivity that's integrated into high-density drive chassis."

"Unlike traditional storage systems, much of the hardware-level complexities have been removed and replaced with simple commands. This enables us to develop features in days rather than months or years."

Michael Tran
Chief technical officer
Digital Sense

2 It is important to note that Digital Sense used a small amount of caching technology; the figures have been post-adjusted to remove this benefit. Also note that the results were obtained through storing/retrieving 1MB chunks of data in a random I/O request.

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Digital Sense expects Seagate Kinetic to deliver storage TCO that could present enterprise disk systems in the cloud at a cost that's closer to consumer pricing. Digital Sense believes that Kinetic presents, on average, a 10-to-1 savings compared to current-generation alternatives.

Conclusion

Leveraging the Seagate Kinetic Open Storage platform, Digital Sense has been able to significantly increase storage capacity, scalability and performance while simultaneously reducing its storage costs (both CAPEX and OPEX). The greater efficiencies delivered by Kinetic translate into compelling business advantages for Digital Sense as it competes in the public cloud hosting provider space.

To Learn More:

To learn more about the Seagate Kinetic HDD, visit http://www.seagate.com/products/enterprise-servers-storage/nearline-storage/kinetic-hdd/

For more information on the Seagate Kinetic Open Storage community, visit http://www.seagate.com/products/enterprise-servers-storage/nearline-storage/kinetic-hdd/partners/

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