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Green Storage-Redefining Data Centre's Storage

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Abstract—*Today's data centres are dealing with new challenges which are far more exhaustive and demanding than ever before. There is no room for complicated, inefficient storage systems with never ending growth paths in existing IT environment. The rampant demand for data and immediate access to data is much more crucial than ever. Big data, virtualization and much other advancement are rapidly being adapted as a strategic priority in many data centres that in turn demands for online access to huge chunks of data, which is to be retained for longer duration of time. The storage solutions that are traditional in origin suffer from fixed design and cost structure constraints which restrict the enterprise scalability proving to be ill-suited for the new needs. This paper examines the issues and driving factors forcing the organizations to replace older archive and backup-and-restore systems with flexible and always available solutions that can be feasibly expanded to handle extreme data growth while also proving to be energy efficient. This paper also looks at the role of various energy efficient storage technologies that are in accordance with the present needs and its long-term storage services solution that are highly required in the present storage market.*

Keywords*: green storage, advance storage needs, Storage solutions, energy efficient strategies*

1. INTRODUCTION

Many factors are invoking IT companies to throw light at their environmental scorecards. The exponentially increasing demand for power, complications in power generation, creation and usage, the ongoing tension about global warming, and constant demand for more IT services at fewer prices are pushing more focus on green data centres. Other economical and practical business concerns in data centres like running out of space and various other data centre issues further complexes the issue which in turn calls for innovative ways to achieve environmental friendly organizations.

Inefficient storage is a major contributor to various data centre problems. Traditional storage techniques in general are bulky, costly and complex. Most legacy monolithic storage systems used today were based upon the needs of 20 years ago i.e. before the pre-acquisition of the Internet and smartphones, and the explosive rise of unstructured data. These traditional systems were not designed to support such modern developments as virtualization, IT as a Service, big data and the rise of cloud computing. Thus, the use of these existing storage environments has led to the isolated and inefficient storage environment which is filled with underutilized hardware. Therefore, through this paper we survey upon the various reasons for switching to environment friendly storage solutions that match up with the current demand rate of the users and therein enlisting few latest technologies that are hot trends in the market.

The drivers for moving towards latest storage technologies are:

- Reduce the total size of IT budget
- Improve IT staff productivity and reduce IT staff headcount
- Reduce carbon footprint, power, cooling and related costs
- Increase revenues by building new revenue-generating products and services faster
- Improve resource utilization
- Easier management
- Reduction in total cost of ownership
- Simplify and standardize IT infrastructure and applications platforms
- Get access to the newest functionality faster

2. CHALLENGES FACED BY THE DATA CENTRES

In quest for a better storage solution to an ever-expanding volume of data is emerging as a universal challenge. From physical and permanent holes in the ground to the ethereal cloud and beyond, the variety of feasible options for storing stuff are immense. To ensure storage solution ultimately helps the organization and doesn't hinder it clear evaluation of what is needed from it should be made. A comprehensive plan for storing and sharing the various IT assets should be developed so as to ensure the investment in the most beneficial solutions is being made without overspending.

The various factors that influence the selection of correct storage are:

- Storage Capacity

The first thing to think about when choosing a data storage solution is how much capacity is actually needed in the present and in the foreseeable future. The technical proficiency should also be assessed so as make sure that the change in storage can be adapted successfully.

- Access and sharing

The storage solution should provide Quick and Reliable Access. With adequate storage readily available, users can quickly find, use and share up-to-date resources on demand from anywhere in a convenient, centralized location. Thus, this is important factor while selecting the storage solution.

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- Security

Prevent data loss and infringement risks with sophisticated storage and backup technology are the major concerns among the IT professionals. Protecting data from theft and loss is critical for a majority data centres. Downtime and recovery can be extremely expensive and even fatal to a small or medium-sized organization. Therefore, the storage solution that is opted for should be highly secure in nature.

- Affordability

Affordability is another issue is choosing the optimal storage solution. Leverage advanced, enterprise-worthy technology with the cost-conscious budget is best suited storage solution. The technologies that are low in cost and high in performance are much in demand.

- Performance

Performance is the much talked about feature while selecting an appropriate storage solution. The new storage technology should aim in maximizing the organization performance with a complete data storage solution that consolidates and de-duplicates the data, offers reliable data backup and recovery features, and easily scales with the growth of the data in the organization.

3. TRANSITIONING TO GREEN STORAGE

It is no more a secret that the rampant use of, camera phones, smart phones, mobile devices, various latest gadgets, big data, cloud computing and the Internet of Things has led to an uber connected universe. In the present environment social media has emerged out to be an existential strand for fulfilling the increasing dependencies on various latest devices for information access, services, and entertainment to be delivered instantaneously. This urge leads to the use of new form of cheap storage with data accessibility at a higher rate than the conventional devices like tape. Long-term data is becoming more prevalent due to the variation in nature of human interactions, devices, gadgets and applications.

Through this paper various storage technologies that combine to create new standards of efficiency while cutting down the cost now and in the future are being discussed:

- Fluid Data Architecture: The core problem with most of storage systems is that they restrict the amount of data in the system which depletes the flexibility and performance of the system making it hard to manage. Aware of storage capacity and the amount of data to be stored in the system the data is organized within a more granular level that is within the volume itself. Thus, managing data at the granular level using the inbuilt intelligence has enabled the data to flow dynamically within the organization.
- Storage Virtualization: To create a flexible pool of storage assets to be shared by the various servers disk is mainly virtualized. Storage virtualization magnifies the advantages of server virtualization. In fact, virtualization allows users to quickly create hundreds of virtual chunks of data to support the various virtual server platforms and optimize the storage of virtual applications without wasting time, money and disk space.
- Thin Provisioning: With the older storage systems, physical disk capacity is allocated in advance when the data volume is created. Administrators usually estimate about the capacity requirements for a given application and allocate extra needed space to accommodate growth. If the data to be created is 200 GB, all 200 GB is kept aside for that particular application. No other applications are allowed to use any of the pre-allocated memory space. In most cases, only a portion of the pre-allocated capacity is actually utilized resulting in the accumulation or creation of “stranded” storage. Using this technique allocation is completely separated from utilization to permit any size data volume to be created at any instant, yet data is stored only when it is written.
- Automated Tiered Storage: Data dynamically spills from one tier to other according to its actual usage which helps in freeing up high performance drives for mission extensive applications. To ripe benefits from this technique throughout the lifetime of enterprise data, organizations can leverage a unique data movement device or engine that combines intelligent tiering with virtualization technique.
- Space-efficient Snapshots : Continuous snapshots basically captures the changes in data for protection with quick recovery at any point in time safeguarding the organization’s data from server failures, viruses, human error, power outages and other inevitable circumstances which are crucial for continuous business progress. Organizations now-a-days simply can’t remain competitive without being precise, quick and accurate in recovering damaged, lost or negligently deleted data. With the use of obsolete backup technologies consumption of excess storage space occurs. Therefore, creating continuous snapshots protects the data more efficiently and effectively.
- Thin Replication: Due to the high rates and complexity traditionally linked with numerous backup strategies, remote replication proves to be a low priority for most of the organizations. This is due to the reason that duplicating data between locations particularly needs similar site configurations and cost extensive, high-speed

connections for data transfer. And even then replication process can be tedious and unreliable, particularly when the process requires the transmission of full-fledged volume of data. Using this technique data is duplicated between local and remote sites with the usage of space efficient snapshots strategy which requires native IP connectivity which eliminates the urge for identical system configurations or high-speed data links.

- Unified Storage Resource Management: Managing the traditional storage systems is complicated and time-consuming. In fact, IT staff expenses often turn out to be more than the cost of storage platform itself. Administrators need to monitor the ever changing capacity needs, manually cascade data from one tier to other, and configure backup sequences and much more. In majority situations, all such tasks must be done using numerous standalone user interfaces. With the introduction of unified management all storage resources can be controlled via a single point-and-click medium or interface that provides a complete and clear view of the entire storage environment.
- Agile, open and flexible Hardware Platform: This technique for storage is aimed for persistence and not obsolescence. It involves leveraging a single, modular hardware platform supporting technology independence feature. Unlike systems that require ripping, remove and replace the existing hardware to cope up with the varying business needs, this technique supports the adoption of latest technologies on a single, modular and the prevalent platform. Thus, majority storage systems are designed for early obsolescence which urges organizations into costly forklift upgrades instead these systems is designed for persistence.

STORAGE SOLUTIONS

The main aim of this paper is to highlight storage solutions that unlock the green savings. Green storage basically involves the various practices of using a variety of green energy storage methods and products to lessen the data centre's carbon footprint as well as cost. Server virtualization and high speed storage devices are putting unprecedented strains on storage networks. That's why various companies are revolutionizing the storage industry with up to 70% in energy savings without a storage penalty.

The storage solutions that can be brought into practice are:

- Solid state drives and flash storage

A solid-state drive contains no physical disk, drive motor that spins the disk. It is a data storage device that involves the use of integrated circuit assembled in the form of memory that stores data with persistence. SSD comprises no moving mechanical components. This identifies them from traditional electromechanical magnetic disks such as floppy disks or hard disk drives, where spinning disks and movable read write heads constitute as its major components. Most SSDs now-a-days use NAND-based flash memory that is capable of holding data without power.

Various IT organizations are innovating around flash to bring the storage technology into practice. Various IT organizations are beginning to recognize the need for this high-performance storage systems .Through the use SSD and Flash organizations can deliver dense flash storage–optimized server platforms for IOPS-starved applications. The various benefits of using these solutions are listed below:

- Lower capital expenditures: Fewer SSDs are needed to deliver the same outcome. The performance characteristics of SSDs make them much less subject to the response time issues that can plague HDDs and make massive over provisioning a thing of the past.
- Lower operational expenditures: Reduced data centre space requirements. SSD-based systems not only require fewer drives, they accommodate smaller form factors, enabling two SSDs to fit in the space traditionally required for one HDD.
- SSDs have lower power consumption and generate less heat without all of those spinning disks. This not only saves on powering the drives themselves, there is less heat to dissipate using expensive data centre cooling systems.
- Save time and money by reducing latency and improving quality of service (QoS).
- SSDs are fast. Much faster than HDDs for most read and write operations as much as four to five times faster on reads writes per second.
- SSDs are ideal for weathering events like a "boot storm," when many users are trying to log in simultaneously. HDDs suffer from boot-up latency that makes them especially susceptible during "storm" events.
- Increased reliability and longevity. SSDs are more reliable than HDDs. Unlike HDDs, SSDs have no moving parts. That makes them more resistant to shock, vibration and temperature variations. As a result, they have a higher mean time between failures (MTBF) which is a standard industry measure for reliability.

- Hybrid storage and tiering

Hybrid storage technology is the one that employs both solid-state storage devices and traditional spinning disks. It can improve application performance by as much as a factor of three over pure HDD configurations without the eye-popping price tag of pure SSD. To provide data-tiering capability within the server system combination of hybrid SSD/HDD configurations like combining the traditional hard drives with flash storage exists. This architecture allows the applications to efficiently place the appropriate data on the appropriate tier based on access profile and performance requirements. The most frequently used data can be stored on the SSDs for faster

access, improving the performance of database applications and email deployments.

- Software-defined storage

Software defined storage is a similar concept to server virtualization, where IT managers can use a heterogeneous set of storage hardware and present it as one storage pool to the applications. The characteristics of this storage pool (block, file, object, etc) can be defined at the software layer. This emerging storage architecture is currently getting a lot of interest from IT and storage managers, as they are trying to drive down storage cost to free up IT budget for innovation-related projects, while improving service levels and operational efficiency .Thus, the virtualization trend that swept the computer world a few years ago is now impacting the storage domain. Customers are increasingly looking to adopt virtualization to improve the performance and utilization of storage technologies.

The key characteristics of an SDS solution are that the solution:

- Does not require any proprietary hardware components
- Should be able to run on multiple (virtual and physical) hardware instances
- Is a standalone or autonomous system

4. FUTURE DIRECTIONS

No single effort can solve all of the problems but the fact that the best solution involves the accumulation of various minute actions. Thus, the following advancement in storage technologies can create a greater impact on data centre's performance with regard to environmental aspects.

- Store data more efficiently.
- Virtualization and thin provisioning must be used to maximize the capacity in energy efficient array.
- Put to use technologies like deduplication to reduce the volume of data stored.
- Consolidate the data which is rarely used and employ the use of high levels of energy saving and environment friendly technology for such data.
- Use tiering and snapshot technique to enhance recovery mechanism in case of failure.

5. CONCLUSION

The economic and environmental responsibility of recent times is demanding more and more from the disk storage vendors. One of the reasons that the storage energy waste has been put under scrutiny in the data centre is because much attention has been brought on the largest consumer of energy in the data centre i.e. the server. While the servers may consume majority of power in the data centre, storage can be considered as the second most consumer of power in the data centre. Thus, legacy storage strategies call for a change to fit in to the existing IT environment. Various IT companies no longer have to be restricted by the rigid limitations and perpetual expense of traditional storage systems that use obsolete technologies.

- By actively controlling the data at a more granular level data centres provides dynamic, virtualized and compact storage that easily adapts to constant variations. The usage of storage resources is followed in an optimal manner to lessen the storage presently and in the approaching future.
- Inbuilt intelligence and automation simplifies and streamline the data management which in turn saves on staff time and minimizing human error.
- Advanced, latest, space-efficient snapshot technique protects the organization against downtime for continuous presence of the needed data without squandering various storage assets.
- An open, agile and technology independent hardware platform saves storage investments hugely by remaining flexible and highly scalable.
- By switching on to Fluid Data technology, data centres can considerably lessen the cost involves in managing enterprise data throughout its lifetime.

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