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Article

Extending and Enhancing Data Storage System Based on Blade Server in Telecommunication Company

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Article info	Abstract

Mobile telecommunications companies are among the companies that must provide rapid and secure access to information to the end user and link users to each other or to the outside world, such as the Internet and its services or international telephone communications, so access to information must be fast, secure and available at all time. In order to raise the level of performance and capacity in the company's services level, researchers examined and verified the company's data storage center and interviewed 50 employees related to data storage and processing services. After analyzing the interviews, questionnaires, examining the equipment in the data center and processing it, we found that there is a problem in the company, which is the weakness of the data storage capacity and their use of servers with old processors with less capacity than the company needs. So we implemented a four-part integrated plan to expand and harden the data storage system using blade server; Each stage contains many sub-procedures and we found results that achieve the objectives of the study. Finally, the researchers suggest several recommendations to develop and improve the company's services in the future.

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1.Introduction

A large quantity of digital information is being created every moment by individual and corporate consumers of IT [8], [9]. This information needs to be stored, protected, optimized, and managed. Not long ago, information storage was seen as only a bunch of disks or tapes attached to the back of the computer to store data[1],[2],[9]. Even today, only those in the storage industry understand the critical role that information storage technology plays in the availability, performance, integration, and optimization of the entire IT infrastructure [8]. Over the last two decades, information storage has developed into a highly sophisticated technology, providing a variety of solutions for storing, managing, connecting, protecting, securing, sharing, and optimizing digital information [8]. There are a variety of types of secondary storage systems, also called: array, enterprise arrays, storage, mass storage systems, information storage systems, arrays, storage management systems, data storage systems.

According to the first visit to Telecommunication company made by researchers and doing meets with the data storage's official in the (Data Center) of Telecommunication company. They discuss with the problems and difficulties faced during the conduct of the work in the company, they said that are Suffer from the entry into force of the storage capacity used in the company, as well as the system currently used in the storage is old and unable to meet the company's needs in accelerating growth. In addition to slow process in transport and access to data, as well as increasing the costs for the operation and maintenance of the storage system.

The storage system in Telecommunication Company is very high costly, the overall storage capacity is insufficient to store and save all data and transmitting the data on the network is achieved with very latency.

The main objectives of this research:
1. Developing and increasing the data storage capacity.
2. Transfer data and access to the storage system with high performance and effectiveness.
3. Reduce costs used in storage process in Telecommunication company.

2. Data Storage

2.1 Data Protection: RAID
RAID is an enabling technology that leverages multiple disks as part of a set, which provides data protection against HDD failures. In general, RAID implementations also improve the I/O performance of storage systems by storing data across multiple HDDs. (RAID).This section described the use of small-capacity, inexpensive disk drives as an alternative to large-capacity drives common on mainframe computers[10].

2.2 RAID Array Components
A RAID array is an enclosure that contains a number of HDDs and the supporting hardware and software to implement RAID. HDDs inside a RAID array are usually contained in smaller sub enclosures. These sub-enclosures, or physical arrays, hold a fixed number of HDDs, and may also include other supporting hardware, such as power supplies. A subset of disks within a RAID array can be grouped to form logical associations called logical arrays, also known as a RAID set or a RAID group [9]. These techniques determine the data availability and performance characteristics of an array.as shown in table 1.

Table 1: These techniques determine the data availability and performance characteristics of an array.

LEVELS	BRIEF DESCRIPTION
RAID 0	Striped array with no fault tolerance
RAID 1	Disk mirroring
RAID 3	Parallel access array with dedicated parity disk
RAID 4	Striped array with independent disks and a dedicated parity disk
RAID 5	Striped array with independent disks and distributed parity
RAID 6	Striped array with independent disks and dual distributed parity
Nested	Combinations of RAID levels. Example: RAID 1 + RAID 0

2.3 Data Storage Techniques

In larger companies, the storage architecture is often composed of several, linked types of storage hardware. These are typically classified as DAS ,NAS ,or SAN. Larger companies sometimes use DAS as well as NAS and SAN; occasionally placing the legacy DAS on the network using bridge devices or using it to store less critical data. These three types will be discussed as following:

a) Direct Attached Storage (DAS)

Direct-attached storage (DAS) refers to a digital storage system directly attached to a server or workstation, without a storage network in between [3], [4], [5]. It is a mainly used to differentiate no networked storage from the concepts of storage area network (SAN) and network-attached storage (NAS). The computer storage is directly attached to one computer or server, without special support, directly accessible to other ones [11]. The main alternatives to DAS are NAS and SAN. For an individual computer user, the hard drive is the usual form of direct-attached storage. In an enterprise, providing for storage that can be shared by multiple computers and their users tends to be more efficient and easier to manage [12].

b) NAS

NAS is a file-level computer data storage connected to a computer network providing data access to a heterogeneous group of clients. NAS not only operates as a file server, but is specialized for this task either by its hardware, software, or configuration of those elements [6].

Figure 1: NAS Architecture

c) Storage Area Networks (SAN)

SAN is a dedicated network that provides access to consolidated, block level data storage. SANs are primarily used to enhance storage devices, such as disk arrays, tape libraries, and optical jukeboxes, accessible to servers so that the devices appear like locally attached devices to the operating system [3]. Storage virtualization is the pooling of physical storage from multiple network storage devices into what appears to be a single storage device that is managed from a central console [7]. Storage virtualization helps the storage administrator perform the tasks of backup, archiving, and recovery more easily (and in less time) by

disguising the actual complexity of a SAN. Administrators can implement virtualization with software applications or by using hardware and software hybrid appliances.
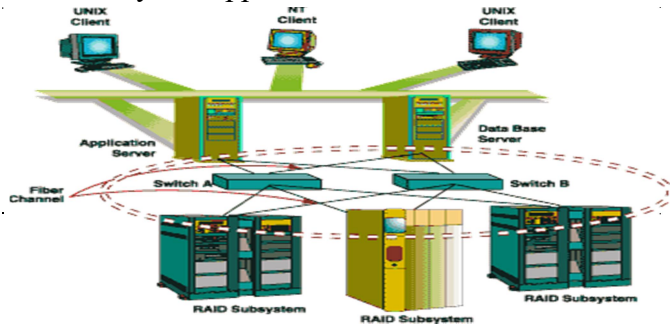

Figure 2: Attached Network Architecture

d) Virtualization

Among the leading business challenges confronting and information technology managers today are: cost-effective utilization of IT infrastructure; responsiveness in supporting new business initiatives, and flexibility in adapting to organizational changes, driving an additional sense of urgency is the continued climate of IT budget constraints and more stringent regulatory requirements [13].
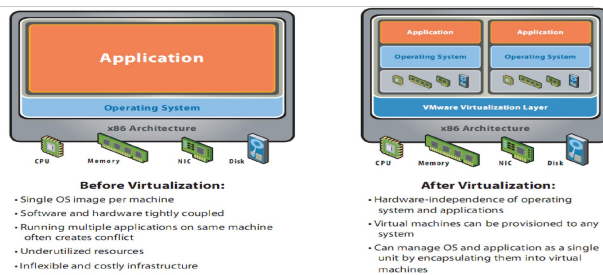

Figure 3: Virtualization

The demand for disk storage capacity in enterprise environments continues to grow at exorbitant levels. As IT organizations procure additional capacity they are faced with many difficult decisions.

- Should they stick with the same vendor that they already have in their environment?
- Should they maintain the same protocols and interface technology?
- What are the performance requirements of the new storage?
- How much capacity must be reserved for growth?
- How will they migrate from an old storage system to the new one?

The Block access is typically delivered over Fiber Channel, iSCSI, SAS, FICON or other protocols. File access is often provided using **NFS** or **CIFS** protocols. Within the context of a storage system, there are two primary types of virtualization that can occur:

Block virtualization used in this context refers to the abstraction (separation) of logical storage (partition) from physical storage so that it may be accessed without regard to physical storage or heterogeneous structure. This separation allows the administrators of the storage system greater flexibility in how they manage storage for end users [14].

File virtualization addresses the NAS challenges by eliminating the dependencies between the data accessed at the file level and the location where the files are physically stored. This provides opportunities to optimize storage use and server consolidation and to perform non-disruptive file migrations. 2.4 Blade server.

3. Blade Server Technology

A blade server is an ultra-compact server designed to be installed within a special chassis, which is responsible for supplying support infrastructure to blades via a backplane connection. Blade servers do not have their

own power supplies or cooling solutions (including fans) as these are supplied by the chassis. To give an idea of the densities possible in a server chassis, in Figure 3, on the right shows 64 physical servers installed in a standard 42RU rack in the HP blade system. This can be increased to 128 servers if use the ProLiant BL2x20 dual-server half-height blades.

Configuration can simply require installing two The Modular Server Enclosure offers redundant configurations for power supplies, fans, I/O modules, network connections, and management modules:

- Power supply redundancy.
- I/O module redundancy.
- Network connection redundancy.
- Management module redundancy.
- High availability for blade server environments.

4. Data Collection

The research's data is gathered by using interview to obtain the initial data and questionnaires for actual data.

4.1 Interviews

During the initial storage official visit of researchers to Telecommunication company, the initial data was collected by Interview Questions that have been prepared related to the research objectives, and targeted the data center manager and IT employees in the company.

4.2 Questionnaires

The questionnaire has been conducted to gather the data about the users' satisfaction and acceptance of the current data storage and the suggested solutions. These questionnaires have been distributed for 50 users in the company.

4.3 Research Sample

The research aims to study the case of data storage in Telecommunication Company. An interview has been conducted with the director of the data center and the data storage official in the company. In addition, the questionnaire was distributed to 50 users in the company.

4.4 Current situation (Pilot Study)

When the researchers visited the Telecommunication Company and met with the data center manager and data storage manager, they found that the infrastructure consists of a large data center that contains the storage unit and the company's network hardware such as servers, basic keycaps, power supplies, etc. Moreover, they found that the company has 550 employees. The storage unit uses Sun Storagtek technology that was made by SUN in 2007 with version 2510. Telecom has a huge problem with storage, and a lack of enough space to store company data for current and future use.

Where the storage unit is connected to the core-switch using fiber optic cables and using SAN storage technique, and NAS storage technique is used to back up the server data into tapes driver at NAS connection. The SAN-switch has ability to transmit high data with 2, 4, 8Gb speed but the current used speed is 2GB. The SUN storage use an old Hard Disk Drivers internal that are connected through SAS connection and have the speed 7200k rpm of reading and writing. The overall storage capacity is 10TB and is divided into units are called LUNs, every LUN have a specifics space. The storage system uses dynamic partition technique (Raid1,5) to distribute the storage capacity. Each user has a specialty 2 GB from the overall storage capacity, somewhat 300 MB is determined for his E-

mails, so that the user can not send greater than 5 MB size email internally and 4 MB size email externally, in addition to the new employees can't create emails for themselves.

Because the SUN storage system is Old, there is no a good Compatibility between the company's modern resources and the storage system such as (blade server and ESXI Virtual system) where he ESXI don't supported some modern blade server features. The SUN storage has cache memory with 2 GB size and it Is Very slow in the backup process, where this process takes around three and a half days. The cooling system is centralized to the overall data center. The blade server has a virtual machine environment using VMware esx3.0 version at storage technology.

5. Result and Analysis

5.1 Initial Results
The purpose of these interviews was gaining the general ideas and opinions of those individuals related to the data storage that have responsibilities of the data storage in Telecommunication Company. The result of the interviews was following:

1. There is a big problem in storing data, and this problem appears in the lack of sufficient space to store company data in the future.
2. Company employees use Sun storagtek 2510 technology to store most of the company's data.
3. Company employees use outdated (HDD internal) hard drive drivers, and are connected via 7200 kbps SAS connections for reading and writing.
4. The total storage capacity currently in use is 10 TB, distributed on different virtual partition disks.

5. The backup in the current system storage (SUN) is performed in a very slow process in the backup process, as this process takes three and a half days.
6. Storage is divided into a fixed number of LUNs, each LUN having either 500, 300 or 200 GB power.
7. Used to run MS Windows server2003.
8. The maintenance mission of the company is for two employees only.
9. No tire level is used because the SUN volume cannot handle the different levels while accessing the required data. For example, when he tried to enter TIER1, an error message saying "You are not allowed to enter this level and only attempt to re-enter level 2 and 3" is displayed.
10. Compatibility is very weak between the company's resources such as modern (blade server with (ESXI virtual system) and storage system, because the current system used (SUN storage) is Old version that has cache memory 2 GB.
11. Each user has 2GB and 300MB storage space for their emails, so the user cannot send email size internally greater than 5MB and 4MB externally. In addition to the data store administrator does not give private emails to the company's new employees, because they do not have enough space.

5.2 Questionnaire Results
The questions were distributed to a group of 50 employees from the staff of the Y - Company to clarify and find out their opinion and their satisfaction with the environment and the storage of the company. These questions were composed of 10 questions, nine questions are including closed answers

Table 2. Questionnaire Form with Analysis.

NO.	Question	Completely Agree	Agree	Disagree	Completely disagree
1	The shared application requires frequently saving.	30%	70%	0%	0%
2	You use database, xls, doc and personal files.	15%	80%	5%	0%
3	You save data to shared storage.	62%	35%	3%	0%
4	When saving data you save Quickly without problems.	12%	18%	47%	23%
5	When you edit files you face problems.	15%	64%	21%	0%
6	You loss files from the shared storage.	40%	43%	12%	5%
7	Data you are dealing with is sensitive and important.	90%	10%	0%	0%
8	Business and personal files are shared across the network.	20%	74%	6%	0%
9	You have big limit when sending attachment via outlook internally and externally.	3%	10%	16%	71%
10	Do you have any comments? 1. ……………………………………………………….. 2. ………………………………………………………..				

and one is has opened answer. The results of the questionnaire are shown in the table 2.

Figure 4 shows a sketch graph which clears the percentages and answers the questions and results of the questionnaire, and consists of 10 questions, including closed and open-ended question, which were distributed to 50 employees in the company.
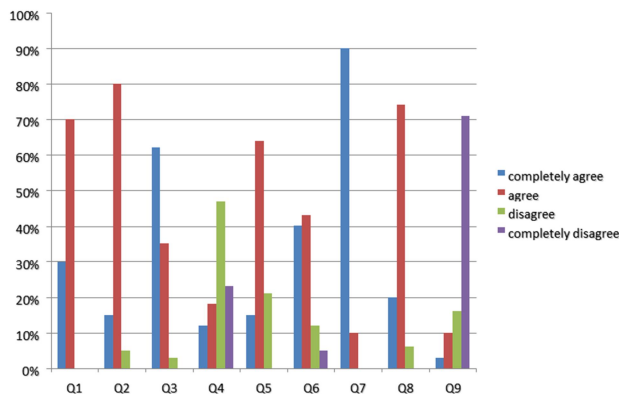

Figure 4. Questionnaire's Analysis

5.3 The Results of the Research and its Reliability and Stability

The answer to the interview questions was consistent with the answers to the questionnaire questions and thus an emphasis on honesty, consistency and reliability in the objectives of the study, which aims to expand and enhance data capacity and activate data transmission while saving the cost of data storage in the telecommunication company. After analyzing all of the above, the researchers found the following:

1. There is a problem with the data storage system that is transferring data slowly at 2 Gbps

2. Insufficient space in the current system storage (SUN Storage) that causes user data loss.

3. Not to use information technology to secure data.

4. Difficulty in managing the current data storage system.

5. The large amount of data that flows on the company's servers, which is not commensurate with the storage capacity in the servers, which leads to slowing down of

the service in the company (the size of the physical memory is 2 gigabits per second and the amount of data flowing frequently is 5 gigabits per second).

6. Suggestion Solutions and Implementation Plan

After analyzing and discussing the data by interview and questionnaire, here will develop solutions proposed to solve the problem statement, then implemented through the implementation plan then doing the feasibility study for the application of these are solutions through the study of implementation as well as to develop a set of recommendations on the problem of the research to be taken and taken in the future, then will be listed a total of facilities and constraints faced the researchers during the preparation of this research.

6.1 Suggestion Solutions

After know and identify the problem faced by the telecommunication company. this problem represented in "The storage system is very high costly, the overall storage capacity is insufficient to store and save all data and transmitting the data on the network is achieved with very latency", then analyzing the data that has been obtained through a questionnaire which was distributed to the company's employees, are here we suggest a final solution to solve this problem which is as follows:

1. Developing the current storage system used in the telecom company (Sun StorageTek 2510).
2. Replacing the current storage system by another:
   a)   EMC VNX 5700.
   b)   HP 3PAR StoreServ 7000 Storage.

6.2 The best solution's choosing

After suggest multi of solution and compare between it, then choose best solution which is EMC VNX 5700 Storage. The solution have be deducted to the multi reasons, this reasons as the following:

1. Efficient Block and File Compression.
2. Supports up to 984TB max raw capacity.
3. Can hold 500 drives. ☐ Has 84GB RAM.
4. Feasible costs.
5. Administration simplicity with EMC Unisphere.
6. Unified storage for multi-protocol.
7. Powerful new multi-core Intel CPUs with 6-Gb/s SAS backend.
8. Flash-optimized with auto-tiering.
9. Extended Flash Cache.
10. The proposed design of storage environment in Telecommunication company.

6.3 Implementation Plan

This section contains all measures (Stages) for implement the process development of storage system in Telecommunication company by an effective and ideal plan for this solution, this implementation plan includes the following:

Stage1 planning : This stage will propose a plan to implement the proposals, which include getting the best desired

results of the implementation of this proposed solution includes the design phase of the storage environment proposed needs identification and functional specifications required for this environment.

Stage2 design :

Table 5: Divide Storage

Enclosure	Pool	Hard desk	Size hard disk	Type raid	Total size
1	HD 5	9	900 GB SAS, 10k rpm	5	4.05 TB
1	OS	6	900 GB SAS, 10k rpm	5	2.7 TB
2-3	HD 10	30	900 GB SAS, 10k rpm	1+0	6.75TB
0	HD 10	16	600 GB SAS, 15k rpm	1+0	2.4 TB
0	Fast cash	5	200 flash	0	1 TB
Total size storage					15.9 TB And 1 TB flash
Note: Enclosure0 has 4 flash desks are not used. If happen failure for any hard desk, this flash desks saves the data automatically until replacing this fail's Hard Desk.					

1. Supports RAID protection levels 0, 1, 1/0,0/1 3, 5, and 6.
2. Integration with VMware ESX15.5 and windows server2008, 2012.

Stage3 Determine technique requirements: This stage contains determine the technical requirements (equipments and services) to create the new storage system, where is determine the new storage system and ESXi5.5 and implementation of the connection process between the blade server and storage environment. Figure 5 shows the design storage environment.
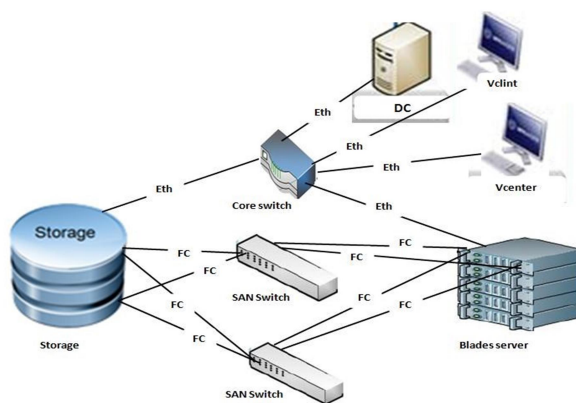

Figure 5 design storage environment

Stage4: The new storage system configuration: At this stage will build a storage system based on the standards and specifications that ensure   the standard design of storage system complies with international standards, and meets the functional requirements. This stage is divided into two sub-phases, where they are in the completion of the first phase of the Sub-technical equipment, while the second phase is the configuration of sub-system storage and blade server.

6.4 Capacity

Use of available resources optimally through:

- High performance of the blade server by the transfer data speed and access that was not previously untapped.
- Expanding the data storage capacity for the Data server to 50 terabytes, and that can be exploited in the store a huge amount of data which will serve the company for coming decades.
- Scalability of the new storage environment, so that was the old SAN storage environment is no scalable.

6.5 Availability

- Increasing the data transfer speed between the storage system and Blade Server from 2Gbps to 8Gbps.
- Increasing the request responding to data so as to increase the Cash memory for storage system from 5GB to 64 GB by using EMC Flash Storage.
- Increasing the availability of data by using Blade Server High Riddance and EMC Storage system.

6.6 Others

- Reduce costs by reducing the number of maintenance staff and technical resources.
- Ease of process management and control of resources.
- Reduce the potential problems and ease of periodic maintenance of the technical resources.

7. Conclusion

After analyzing the interviews, questionnaires, examining the equipment in the data center and processing it, we found that there is a problem in the company, which is the weakness of the data storage capacity and their use of servers with old processors with less capacity than the company needs. So we implemented a four-part integrated plan to expand and harden the data storage system using blade server; Each stage contains many sub-procedures and we found results that achieve the objectives of the study.

8. Recommendations

Finally, the researchers suggest a several recommendations that will develop and improve the company's services in the future, this recommendation can be summarized as follows:

1. Training programs and sensitization of staff and network users about the pros and cons of the use of the storage system.

2. Put strict security policies, if happen misuse of the network and data storage system.

3. Working studies and statistics to know the user's views about quality of the network system and data storage system in the company.

4. Implement ITIL framework to improve the organization of business in company's IT resources management and the exploitation of information technology in a positive and effective way.

5. Using the virtualization technology in the company's network as a whole.

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