

Storage Assessment

Findings & Recommendations

Submitted to:

Valued Customer

Storage Team:

Key Info Subject Matter Experts

Account Manager:

Your Key Info Sales Representative



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Background

A valued client partnered with Key Information Systems (Key Info) to perform a quantitative and qualitative data storage assessment with primary emphasis on evaluating the current storage environment. The overall goal of this assessment was to document the current state and identify the strengths, weaknesses, opportunities and threats. This assessment also included a high level observation of the storage team. The key deliverable was a Findings/Recommendations report to address the identified issues, create a reasonable short-term Plan of Action, and provide a long term enterprise storage strategy.

Executive Summary

Your storage environment that we evaluated consisted of:

- 8 storage arrays
- 2 IBM SVC appliances
- Nightly backup and recovery

There was an identified HP MSA that is project-based storage that we did not evaluate. There are approximately 121 physical servers attached to the SAN environment whose LUN configuration we reviewed through the storage controllers. We further evaluated the SAN architecture which included the SAN director and switch environment.

Key used a combination of data collection tools and employee interviews to obtain the information in this analysis. We took a comprehensive approach to drawing our conclusions. This report documents the design, configurations and performance-related information that we felt was most important. Throughout this report, Key provides concrete steps and recommendations toward addressing critical areas of the infrastructure.

Thank you for the opportunity to provide our experience and expertise in data storage and to partner with our valued client to provide a comprehensive approach to the core of the IT environment which is the data storage architecture.

Key Info Participants

	Key Information Systems	Valued Client
Executive Sponsor	Julie Gutierrez-Farley Director of Storage Solutions	Director of IT/Operations
Project Manager	John Agsalud Director of Professional Services	Lead Client Contact
Account Executive	Your Key Info Account Executive	
Project Team	Solutions Architect Senior Storage Engineer Subject Matter Experts	IT Operations Managers Storage Engineers System Administrators

Valued Client Participants

Thank you to the following individuals who provided their opinions and observations to help create a reasonable Plan of Action for their area of responsibility.

	Name	Function	Date and Time
1	Customer Contact	Storage Administration	Example Date and Time
2	Customer Contact	Sr. Manager, Systems & Databases	Example Date and Time
3	Customer Contact	Database Administration	Example Date and Time
4	Customer Contact	AIX & Linux Administration	Example Date and Time
5	Customer Contact	Application Administrator	Example Date and Time
6	Customer Contact	Windows Administration	Example Date and Time
7	Customer Contact	VMware, Citrix Administration	Example Date and Time
8	Customer Contact	Manager, Windows	Example Date and Time





Assumptions

The recommendations and opinions in this report are based on the following global assumptions about the storage vision:

- The infrastructure and any recommendations are capable of supporting known and projected business requirements for the next 1-2 years
- Overall growth rates have been projected at 5% per month on average which is consistent with the previous 12 months
- Approximately 30% of the X86 server environment has been virtualized with VMware and the goal is to have 80% virtualized within the next 2 years
- All system infrastructure designs should be done with focus on maximum availability during planned and unplanned events

Analysis Rating

In order to ensure the Assessment and Plan of Action are clear to understand, we created a critical rating system and flagged the storage devices as follows:

Storage Device - Assessment Ratings		
	Critical Area of Concern, Address immediately	Failure to resolve this issue runs the risk of impacting performance, availability, and business requirements
	On Track to Continue, Keep moving forward	On target with business requirements and has opportunities to expand as the business grows and changes
	Significant Area of Concern, Address soon	Resolution to these issues should be high on the list of priorities. Infrastructure changes should consider these issues
	Noteworthy Area of Concern, Address as time and resources permits	While not affecting performance or data integrity, these issues pose a financial or other business impact

Current Environment

The following table specifies the current storage arrays and consumption. From a high level, there is unallocated storage space which should be considered for use prior to making any additional purchases. However, it is also important to get a solid understanding of which array groups have the available space and on which storage frames they reside.

Production		RAW	Usable (Tb)	% Util	Avail (Tb)		
Tier 1	Enterprise 1	69	48	75%	12	(144)146Gb; (160) 300Gb	
	Enterprise 2	48	23	38%	14	(128)146Gb; (96) 300Gb	
Total		117	71		26		
Tier 2	Midrange 1	72	57	65%	20	(160) 450Gb	
	Midrange 2	48	34	84%	5	(41)73Gb; (130)300Gb	EOL
Total		237	162		25		
Long-Term Storage	Archive 1	80	56	74%	15	(64) 750Gb SATA; (32) 1Tb SATA	EOL
	Archive 2	80	56	74%	15	(64) 750Gb SATA; (32) 1Tb SATA	EOL
Total		160	112		30		
Backup Pools	Backup Disk 1	40	28	100%	-	(80) 500Gb SATA	EOL
	Backup Disk 2	40	28	100%	-	(80) 500Gb SATA	EOL
Total		80	56		0		

Note:
EOL = Systems are already end of life.

Table 1: Storage Snapshot

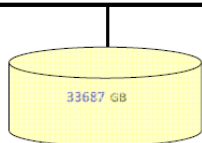
EXPLANATION: In this section we will review each storage controller. Knowing that power, cooling, and space constraints are major concerns for our valued client, we are tagging disparate small drive densities and are recommending, where it makes sense, to replace the less dense data drive types with fewer more dense drives.

Enterprise 1

Purpose

The purpose of this storage array is for business critical applications such as Exchange and VMware.

SAN Summary	Amount
Total Usable Storage (GB)	33687
Total Free Space (GB)	6680
Percent of Storage Allocated	80.2%
# of Storage Arrays/Volumes	19
# of Hosts Attached	20
SAN Efficiency Rating (Usable/Raw)	85.7%
# Storage Enclosures	13
Total # Disk Drives	172



SAN Healthcheck Status	Rating
Configuration & Setup	Ok
Balance	Ok
Hosts & Host Groups	Critical
Errors & Other Conditions	Good
Storage Array Configuration	Good
Replication	N/A

■ = Good - All Key Requirements Met
■ = Ok - Some issues exists, but none are critical
■ = Critical -Requirements NOT Met - Action(s) Required

Category	Reason Codes
Configuration & Setup	Orphaned LUNs
Balance	>60% GB/Ctrl
Hosts & Host Groups	Groups w/(0-1) Host
Errors & Other Conditions	
Storage Array Configuration	
Replication	

Configuration Summary				Storage Usage Efficiency ==> 85.7%				Statistical Information				
Controller		A	B	Reporting Period		228 days, 00:25:21						
Controller Cache		2048 MB	2048 MB	Drive Ch	Ctrl	# Drives	Errors	Ctrl	Drives	TimeOut	I/O Count (Millions)	
Processor Cache		508 MB	508 MB	1	A	36	0	0	0	0	769	
Firmware		06.60.02.00	06.60.02.00		B	29	2	0	0	0	1739	
Machine Type		1815 FAST	1815 FAST	2	A	33	0	0	0	0	1260	
Drive Summary		Fibre	SATA	SAS	Total		B	37	0	0	985	
- Number of Drives		172	0	0	172	3	A	29	0	0	Exceeded	
- Free Space		4102	0	0	4102		B	36	0	0	1771	
- Number of Hot Spares		8	0	0	8	4	A	37	0	0	Exceeded	
- Unassigned Disk		10	0	0	10		B	33	0	0	964	
- Failed Drives		0	0	0	0							
Enclosures	#	LUN Info	#	Space	# Arrays	# of Hosts		20		# Groups		8
EXP710	10	Fibre	59	27007	19	# Single Controller Hosts	9	Hosts with 1 HBA	1			
EXP810	2	SATA	0	0	0	Enclosures Not @ Max Speed	2	Groups w/0-1 Host	3			
		SAS	0	0	0	LUNS with No Host	1	Groups w/0-1 LUN	5			
Percent Storage Array Free Space				19.8%		# Servers with (0-1) LUN	3	Group Name = Host				

Storage Allocation Summary				Storage Array Summary									
Pct of Disk	A	B		Array	Total (GB)	Free (GB)	# Luns	# Hosts	# Drives	Drive Size	Type	Protection	
Fibre	39%	61%		1	68	18	1	4	2	68	Fibre	RAID 1	
SATA	0%	0%		2	68	18	1	4	2	68	Fibre	RAID 1	
SAS	0%	0%		3	68	18	1	4	2	68	Fibre	RAID 1	
# Luns	18	40		4	475	0	1	4	8	68	Fibre	RAID 5	
I/O	A	B		5	475	142	8	4	8	68	Fibre	RAID 5	
Count	2029	2724		6	475	10	7	4	8	68	Fibre	RAID 5	
Total Pct	43%	57%		7	475	225	1	4	8	68	Fibre	RAID 5	
CH 1	31%	69%		8	1952	0	2	10	8	279	Fibre	RAID 5	
CH 2	56%	44%		9	1952	1	1	2	8	279	Fibre	RAID 5	
CH 3	N/A	N/A		10	3347	797	7	13	13	279	Fibre	RAID 5	
CH 4	N/A	N/A		11	2789	141	5	10	11	279	Fibre	RAID 5	
LUN Storage Allocations by Controller (in GB)				12	3068	218	5	5	12	279	Fibre	RAID 5	
A	10518	0	0	13	2510	510	2	3	10	279	Fibre	RAID 5	
B	16488	0	0	14	1952	723	3	10	8	279	Fibre	RAID 5	
Total Alloc	27006	0	0	15	1952	2	1	2	8	279	Fibre	RAID 5	
Free	4102	0	0	16	2510	457	3	9	10	279	Fibre	RAID 5	
UA	2578	0	0	17	3068	0	4	9	12	279	Fibre	RAID 5	
Available	6680	0	0	18	2231	177	4	9	9	279	Fibre	RAID 5	
Totals	33686	0	0	19	1673	644	2	9	7	279	Fibre	RAID 5	
Unassigned LUN Info				Totals	31109	4102	59						
No Fibre				1									
No Total				1									
Allocated				27007									
UA = Unassigned													

Observations

- Enterprise 1 is a recent end of life array. The system has 5 -7 years, respectively, for available support.
- Controller B has greater than 69% of storage ownership.
- Host Groups with no hosts or LUN mappings:
 - Windows has 2 host systems and 0 LUNs
 - AIX Group has 2 host systems and 0 LUNs
- Controller LUN assignments - imbalance of LUNs
 - JGEFSCN01 has all 6 LUNs owned by Controller A
 - JGEFSCN02 has all 6 LUNs owned by Controller A
- Storage enclosures set to 2 Gbps while maximum speed is capable of 4 Gbps.
- In the naming convention, you have a Host Group name that equals the host/system name; we have run into resource function identification issues so we highlight this.

Recommendations

- Re-visit your LUN and application strategy to meet the best practices for controller workloads and availability considerations.
- Follow your standard naming conventions for all arrays in the environment and add a dash (-) and a two letter description of the resource function.
- This system just went End of Life in December 2009, we would not expand this subsystem. Leverage it as long as the maintenance is reasonable, at least for the next 12 months.
- Re-provision space where it makes sense to ensure you are getting optimal performance.
 - You have VMware and Exchange running on one controller. Should that controller go offline, your entire environment will go down. This can be avoided by balancing your physical LUNs among both controllers.



Enterprise 2

Purpose

The purpose of this storage array is for Tier 2 business applications.

SAN Summary	Amount
Total Usable Storage (GB)	58197
Total Free Space (GB)	20524
Percent of Storage Allocated	64.7%
# of Storage Arrays/Volumes	15
# of Hosts Attached	19
SAN Efficiency Rating (Usable/Raw)	86.9%
# Storage Enclosures	11
Total # Disk Drives	160

SAN Healthcheck Status	Rating
Configuration & Setup	Green
Balance	Yellow
Hosts & Host Groups	Red
Errors & Other Conditions	Red
Storage Array Configuration	Green
Replication	N/A

■ = Good - All Key Requirements Met
■ = Ok - Some issues exists, but none are critical
■ = Critical - Requirements NOT Met - Action(s) Required

Category	Reason Codes
Configuration & Setup	
Balance	>60% GB/Ctr
Hosts & Host Groups	Groups w/(0-1) Host
Errors & Other Conditions	Large # Errors in Controller
Storage Array Configuration	
Replication	

Configuration Summary		Storage Usage Efficiency ==>		86.9%	
Controller		A	B		
Controller Cache		8192 MB	8192 MB		
Processor Cache		2044 MB	2044 MB		
Firmware		07.30.21.00	07.30.21.00		
Machine Type		USB 2.0 FD	USB 2.0 FD		
Drive Summary		Fibre	SATA	SAS	Total
- Number of Drives		160	0	0	160
- Free Space		15918	0	0	15918
- Number of Hot Spares		5	0	0	5
- Unassigned Disk		11	0	0	11
- Failed Drives		0	0	0	0
Enclosures		#	LUN Info	#	Space
EXP5000	10	Fibre	85	37673	15
		SATA	0	0	0
		SAS	0	0	0
Percent Storage Array Free Space		35.3%			

Statistical Information						
Reporting Period	Exceeded Day Count					
Drive Ch	Ctr	# Drives	Ctr	Drives	TimeOut	I/O Count (Millions)
1	A	24	0	294	0	78
	B	24	51	528	28	261
2	A	16	0	18	0	56
	B	16	20	266	0	162
3	A	16	0	20	0	55
	B	16	26	224	0	164
4	A	24	2	33	0	82
	B	24	40	329	0	217
# of Hosts	19		# Groups	9		
# Single Controller Hosts	8		Hosts with 1 HBA	0		
Enclosures Not @ Max Speed	10		Groups w/0-1 Host	1		
LUNS with No Host	0		Groups w/0-1 LUN	5		
# Servers with (0-1) LUN	4		Group Name = Host			

Storage Allocation Summary		
Pct of Disk	A	B
Fibre	66%	34%
SATA	0%	0%
SAS	0%	0%
# Luns	44	41
I/O	A	B
Count	271	804
Total Pct	25%	75%
CH 1	23%	77%
CH 2	26%	74%
CH 3	25%	75%
CH 4	27%	73%

Storage Array Summary								
Array	Total (GB)	Free (GB)	# Luns	# Hosts	# Drives	Drive Size	Type	Protection
1	837	387	2	1	4	419	Fibre	RAID 10
10	3768	2356	6	3	10	419	Fibre	RAID 5
11	3768	2441	7	3	10	419	Fibre	RAID 5
12	3768	763	6	4	10	419	Fibre	RAID 5
13	3768	764	5	3	10	419	Fibre	RAID 5
14	3769	1773	2	2	10	419	Fibre	RAID 5
15	3769	1773	2	2	10	419	Fibre	RAID 5
2	3768	24	5	4	10	419	Fibre	RAID 5
3	3768	74	5	4	10	419	Fibre	RAID 5
4	3768	774	3	2	10	419	Fibre	RAID 5
5	3768	2120	4	3	10	419	Fibre	RAID 5
6	3768	2167	8	8	10	419	Fibre	RAID 5
7	3768	265	11	7	10	419	Fibre	RAID 5
8	3768	159	11	11	10	419	Fibre	RAID 5
9	3768	78	8	10	10	419	Fibre	RAID 5
Totals	53591	15918	85					

LUN Storage Allocations by Controller (in GB)				
	Fibre	SATA	SAS	Total
A	24681	0	0	24681
B	12992	0	0	12992
Total Alloc	37673	0	0	37673
Free	15918	0	0	15918
UA	4606	0	0	4606
Available	20524	0	0	20524
Totals	58197	0	0	58197

Unassigned LUN Info
UA = Unassigned

Figure 1: Snapshot Configuration

Observations

- 65% of the space is allocated, about 35% is available space.
- In the naming convention, you have the Host Group name that equals the host/system name; we have run into resource function identification issues so we highlight this.
- High number of controller errors.
 - The error count can be reset and often when something is installed errors are reported but after installation those counters can be reset and then those numbers can be useful for spotting issues.
- Storage enclosures set to 2 Gbps while maximum speed is capable of 4 Gbps.
- Host Groups with no LUNs Attached:
 - Linux has 3 hosts but 0 LUNs
 - AIX has 4 hosts but 0 LUNs
 - VMware has 2 hosts but 0 LUNs

Recommendations

- Re-visit your LUN and application strategy to meet the best practices for controller workload and availability considerations.
- Follow your standard naming conventions for all arrays in the environment and add a dash (-) and a two letter description of the resource function.
- Re-assign LUN controller ownership as required.
- For the controller errors, remediation is to read through error logs for system errors and potential direction on corrective action.
 - Reset the counters and monitor over the next 30 days.
- Continue to grow this platform for primary capacity needs. This system is capable of delivering performance that should meet business requirements and provide the best price/performance ratios.
- Consider “front-ending” this platform with an N-series gateway:
 - Add CIFS and NFS capabilities to re-purpose the Windows general purpose file servers and the AIX/Linux NFS file systems
 - Implement snapshot based backup and recovery of these systems
 - Implement application level integration with VMware and Exchange
 - Implement data de-duplication technology on primary storage
 - Implement IP based replication for DR

Threats of Doing Nothing

It is impossible for our valued client to consider or control all threats to the storage infrastructure. Here are some items to consider:

- Implementing service level objectives and agreements will require a greater level of accountability. Business expectations are higher and may or may not provide additional resources to support the established service levels.
- Without a well-documented and communicated *critical server list*, a site disaster would result in systems being brought back online on a best-effort level. The decision of server priority would be left to whoever is available and may not necessarily match the needs of the business units or our valued client as a whole.
- Replication to another site may be beneficial; however, it can be resource intensive and costly. The people, processes and technology necessary to manage offsite replication can be substantial.
- No validation is available to ensure backup process is being completed successfully.
- No formal hot or cold disaster recovery plans exist.
- Backups are all run over the LAN; no SAN-based backups in place.
- Current storage environment could limit ability to leverage server virtualization.

Overall Recommendations

- Install storage reporting tools (Akorri, Brocade, VSI, others)
- Remove 73Gb drives in Enterprise 1
- Migrate VMware, Exchange, Windows Oracle DB workloads
- Implement CIFS for NAS attach
- Decommission General Purpose Windows file servers
- Use vendor retainer services to bridge the gap until there is an opportunity to determine if you really need another resource.