

## ESG Lab Review

# EMC XtremIO: Lower TCO Through Consolidation

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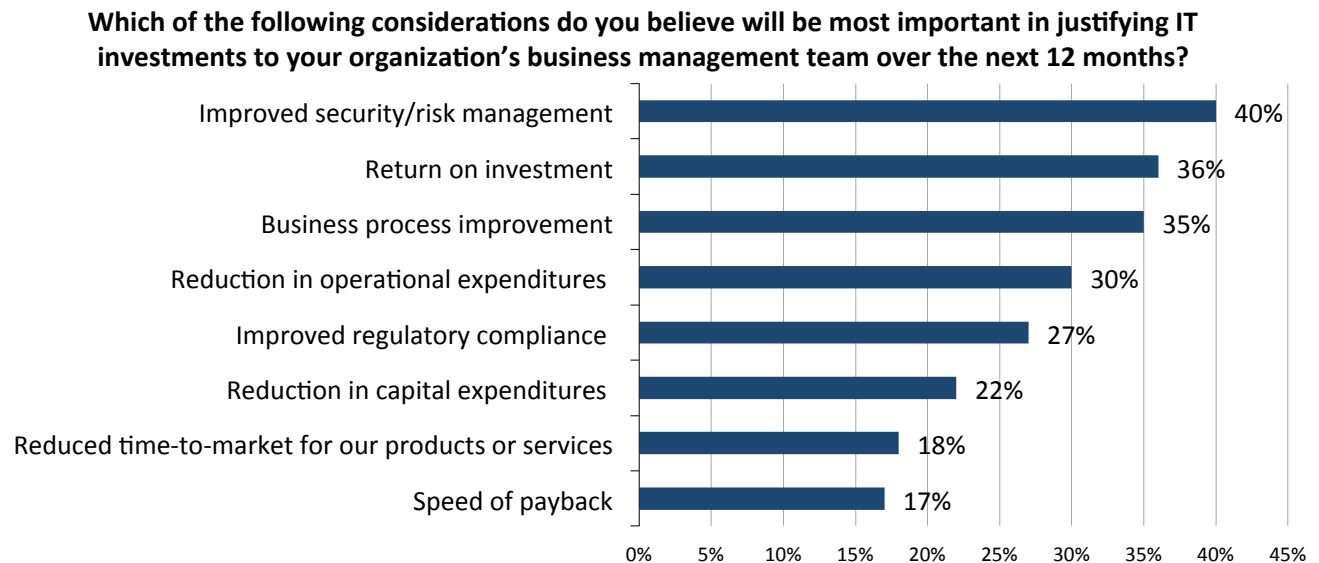
**Abstract:** This ESG Lab review documents hands-on testing of XtremIO all-flash storage and presents the findings of an ESG Lab five-year TCO analysis highlighting the economic benefits of mixed workload storage consolidation.

## The Challenges

Purchasing storage for an IT organization is never an easy task, especially when trying to meet the needs of business units with dissimilar business objectives and technical storage requirements. A single storage system very rarely fits the bill for every department, leading to the need for IT departments to purchase, maintain, and administer multiple storage systems. Rarely do organizations take a step back and address all of their storage needs at once. As systems age, they are often replaced on a one-for-one basis, further perpetuating the management nightmare.

But it is certainly a goal of every business to do more with less and make investments in technologies that help to affect the bottom line of the business. It is no small surprise that recent ESG research reveals that along with security concerns, financial impacts such as return on investment, business process improvement, reduced capital and operational expenses, reduced time-to-market for products, and speed of payback were all identified as important considerations in justifying IT investments (see Figure 1).<sup>1</sup> Consolidating mixed workloads on servers has proven to significantly improve all of these important metrics, and consolidating mixed workloads and functions onto a single storage system would yield similar results if the performance, capacity, and operational requirements could be met.

Figure 1. Most Important Criteria in Justifying IT Investments



Source: Enterprise Strategy Group, 2015.

<sup>1</sup> Source: ESG Research Report, [2015 IT Spending Intentions Survey](#), February 2015.

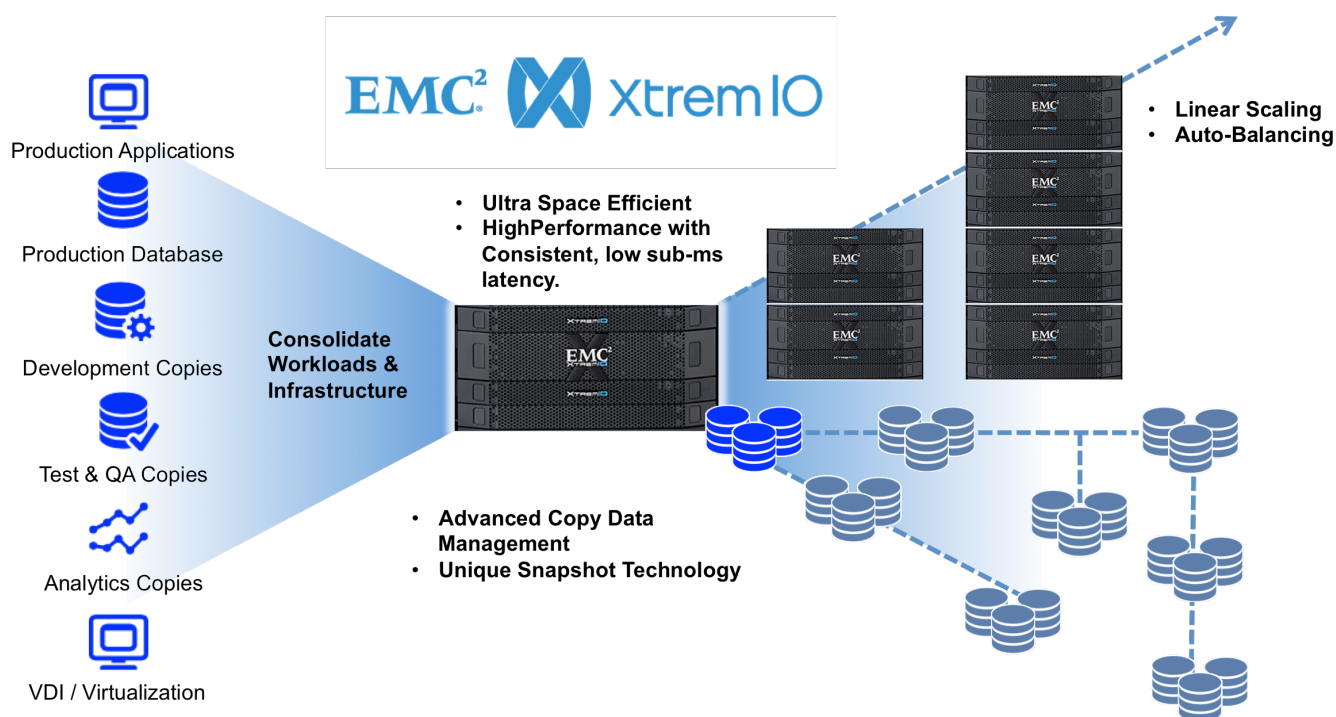
The goal of ESG Lab reports is to educate IT professionals about data center technology products for companies of all types and sizes. ESG Lab reports are not meant to replace the evaluation process that should be conducted before making purchasing decisions, but rather to provide insight into these emerging technologies. Our objective is to go over some of the more valuable feature/functions of products, show how they can be used to solve real customer problems and identify any areas needing improvement. ESG Lab's expert third-party perspective is based on our own hands-on testing as well as on interviews with customers who use these products in production environments. This ESG Lab report was sponsored by EMC.

IT organizations and business decision makers should share the same financial vision. It is in the best interest of every company to make wise investments in storage technologies that can help reduce the total cost of ownership (TCO) while also helping to make a positive impact in other areas of the business that help contribute to financial success.

## The Solution: Mixed Workload Storage Consolidation through XtremIO

EMC XtremIO is a true N-way active-active, scale-out all-flash storage array that was designed from the ground up with a goal of leveraging flash technology to consolidate workloads and infrastructure to positively impact the bottom line of the business. XtremIO delivers high performance with consistently low sub-ms latency, always-on data efficiency, and advanced copy data management with an easy-to-use interface designed to streamline workflows and automate complex management tasks. With XtremIO's scale-out architecture, IT organizations can start small and then linearly grow both performance and capacity, on-demand, without any disruption to host applications.

Figure 2. Consolidation and Optimization with XtremIO



Highlights of the XtremIO design include:

**Advanced Flash Technologies:** Enterprise-grade flash storage, an RDMA backplane, and global in-memory metadata technology were combined to create N-way active-active scale-out clusters that are purpose-built for flash, require no tuning, and leverage cost-effective commodity hardware. XtremIO storage systems deliver consistent, sub-ms response times for workloads on every volume, including nested copies of volumes. User data is automatically and inherently evenly distributed across all resources, allowing for even wear and performance that does not degrade at higher utilization.

**Advanced Data Services:** All data stored on XtremIO is thin provisioned, compressed, deduplicated, and encrypted inline. XtremIO's agile copy data services leverage its unique snapshot capabilities. These snapshots provide a writeable copy of a volume that consumes extra capacity only if globally unique data is written to these copies. They can then be rolled forward and back, and they do not suffer from or cause a performance impact. XtremIO leverages flash-specific data protection that allows for 80+% of raw capacity to be utilized. The combination of advanced data services means that an XtremIO X-Brick can deliver effective capacities that are generally more than 6X the usable capacity of the system, with many customers reporting even higher effective capacities.

**Advanced Copy Data Management:** Copies of production data are simple to manage, are stored on the same system, consume extra capacity only for new, globally unique compressed data blocks, and deliver the same level of performance and data services of the original volume. Copy volumes can be nested in a tree structure and any one of them—including the original parent volume—can be deleted at any point in time without affecting other members of the tree. Every volume, including the parent and/or other snapshot copies, deliver the same level of performance and data services. This allows development, testing, analytics, and data warehouse teams to easily update copies as frequently as they like. XtremIO also offers rich copy services like refresh/restore, scheduling, and application-consistent snapshots (with EMC AppSync). These services can have a significant impact on the business, improving workflows and boosting productivity for developers and application owners.

**Automated & Self-Service Workflows:** A simple, intuitive graphical user interface (GUI) makes it easy to manage, monitor, and provision storage from a single pool of storage. Automated workflows can be created to provide self-service for application administrators (through plug-ins for their standard application consoles), easily manage copy data services, and create consolidated reports, helping to lower operational expenses while optimizing and improving business processes.

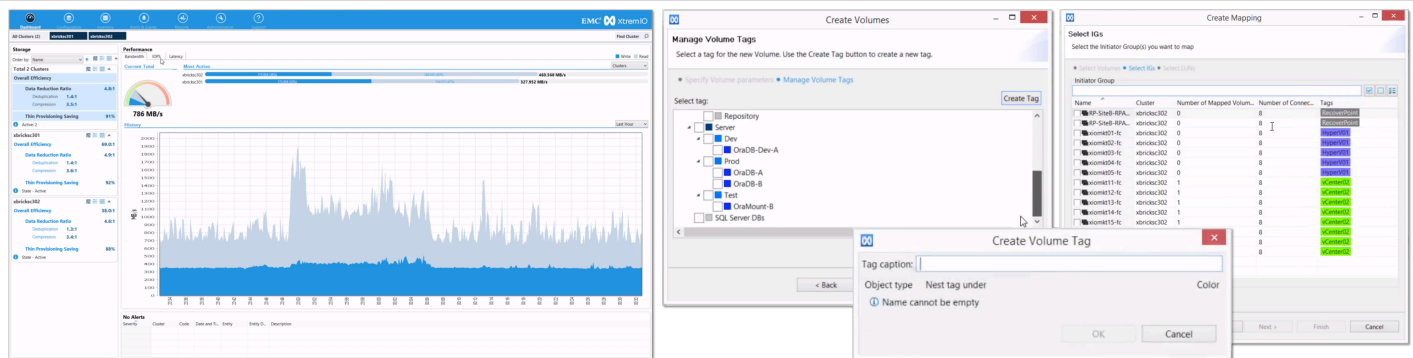
**Workload Consolidation:** XtremIO’s performance, efficiency, and automation capabilities coupled with highly differentiated copy data management techniques allow for the consolidation of diverse tier-1 workloads and non-production copies, reducing infrastructure sprawl and management complexity. XtremIO can consolidate cloud, database, VDI, software development, mail server, and enterprise business applications that once required multiple, dedicated storage systems, lowering costs and providing both operational and business process advantages.

## Simplicity, Efficiency, Performance

ESG Lab performed hands-on testing of XtremIO at EMC’s headquarters in Hopkinton, MA. The testing was designed to show how XtremIO can be used to help consolidate workloads and infrastructure as well as provide benefits that can help optimize the daily operation of the business.

ESG Lab validated that the XtremIO Storage Management Application interface was extremely easy to use to manage and monitor the XtremIO environment. The attractive dashboard was fully customizable and provided a quick summary of the health of the XtremIO solution, including both real-time and historical overviews of performance, capacity, and data efficiency metrics. The configuration tab allowed us to view and configure volumes and initiator groups, as well as manage LUN mappings. Management was very simple. There were no RAID groups or storage pools to manage and it was easy to create and manage multiple volumes and hosts. ESG Lab simply had to create volumes and snapshots and then provide access to those volumes from hosts. Simplified management was augmented with powerful tagging and filtering capabilities, enabling efficient operation when managing very large deployments. The dashboard and configuration screens are shown in Figure 3.

Figure 3. XtremIO Storage Management 4.0 Application Dashboard and Tagging Interface



ESG Lab was able to easily create snapshots of volumes while the array was running a mixed consolidated workload of over 50K IOPS. Testing was performed on an XtremIO starter X-Brick with 5TB of (raw) physical capacity. Three servers running Oracle were used to generate a realistic database mixed workload using the SLOB benchmarking tool. In

addition, ten Linux servers were used to generate write-heavy random workloads using vdbench along with FIO scripts replaying specific VDI traffic patterns used to simulate a VDI workload. These workloads generated 55K IOPS on the Starter X-Brick, and the array easily handled this load with consistent sub-ms latency. It should be noted that the workload tested could not generate more than 55K mixed IOPS workload, and XtremIO is certainly capable of handling much larger mixed IOPS workload with consistently low sub-ms latency.

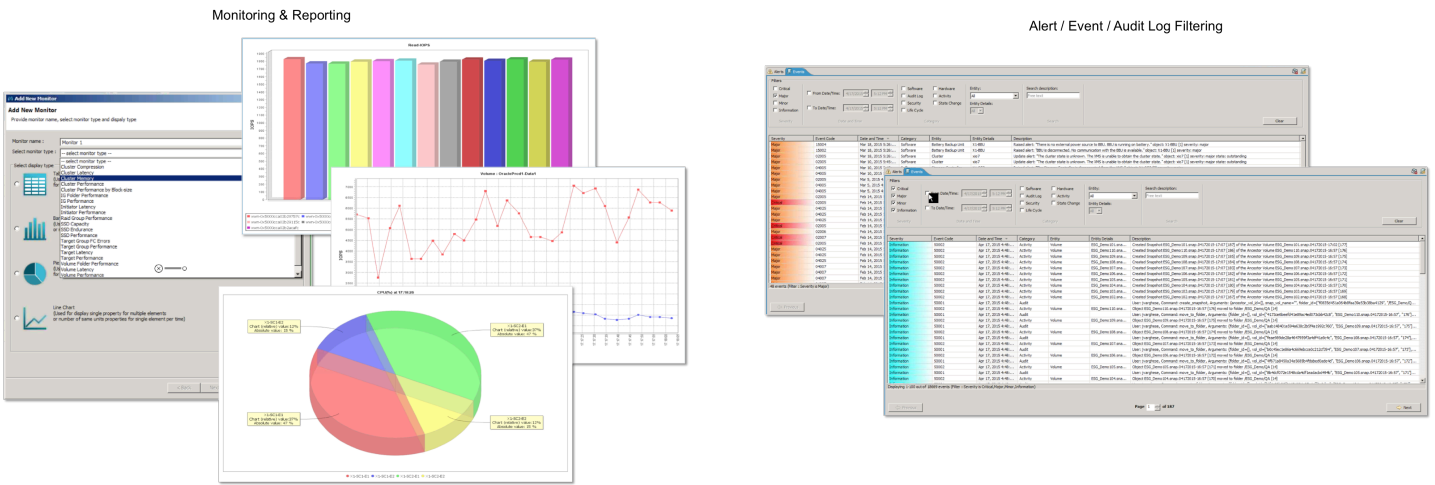
By selecting 100 of the volumes, we were able to simultaneously create 100 writeable snapshot volumes in a matter of seconds with a single command. It was also easy to map these copies to our hosts in seconds with a single click after simply selecting the copies and initiator group. ESG Lab verified that the copies consumed no additional capacity, and that there was no impact to the running workload. The volumes and copies could be easily tagged with custom operational details like application, department, or production role, which made it easy to manage workflows rather than worrying about translating volume and host maps. This simple, logical workflow could save development organizations a significant amount of the time that they currently spend performing copy data management between departments. An administrator could simply provide a daily copy of all of the volumes marked with the “production db” tag to all of the hosts marked with the “developers” initiator group tag, or map all of the copies marked with the “ready for test” tag to the “QA” initiator groups.

ESG Lab also saw how easy it was to roll snapshots forward or backward. Refreshing and rolling back snapshots took only seconds, and required no re-mapping of host connectivity. This means that production DB copies could be restored extremely quickly and development copies could be refreshed daily or even hourly if needed. Because snapshots have zero impact to the performance of existing volumes, and take advantage of all XtremIO space efficiencies, organizations can deliver full copies of production databases to every engineer for development and testing, rather than relying on out-of-date, shared copies of production databases.

ESG Lab then was able to use the interface to drill down on details of the hardware configuration as well as manage and monitor alerts and events. Events and alerts were color-coded according to severity, and an audit log made it easy to retrace the operations that had taken place on the storage system. It was very easy to monitor the performance of the system as well. Using the monitor tab, we were able to create custom, real-time charts and tables of various types fed from real-time data provided by hundreds of built-in counters. These views could be saved, monitored, and exported to generate simple yet powerful consolidated reports.

Using the real-time charting capabilities while performing 55K IOPS of mixed workloads to the system, ESG Lab was able to verify the automatic balancing capabilities of XtremIO. The processor utilization was ideally balanced across controllers; every SSD in the system was performing almost exactly the same number of IOPS; and SSDs were wearing at the same extremely low rate, with nearly 100% endurance remaining even after running the constant workload for months. It was clear to ESG Lab that the built-in, automated data layout and load balancing of all resources could save administrators weeks of identifying, planning, rebalancing resources, and dealing with unexpected performance issues. The monitoring and alerting capabilities of XtremIO are shown in Figure 4.

**Figure 4. Monitoring, Reporting, and Alerting Capabilities of the XtremIO Storage Management Application**



### Why This Matters

It is a well-known and well-proven fact that all-flash arrays can help improve workload performance. But simply improving the performance of a workload is only one concern of IT organizations tasked with a variety of applications and storage requirements. These administrators are challenged with the task of managing complex process workflows designed to meet application service levels while managing, maintaining, tuning, and supporting a variety of dedicated and perhaps dissimilar storage systems.

ESG Lab validated the ability of XtremIO to deliver sub-ms response times simultaneously across a variety of consolidated application workloads while easily creating and mapping hundreds of copies of volumes in a matter of seconds, with no impact to performance and with no additional capacity consumed. XtremIO is not simply an all-flash storage array that merely helps improve performance. XtremIO enables organizations to consolidate and optimize their storage infrastructure and workflows, resulting in clear and quantifiable business advantages.

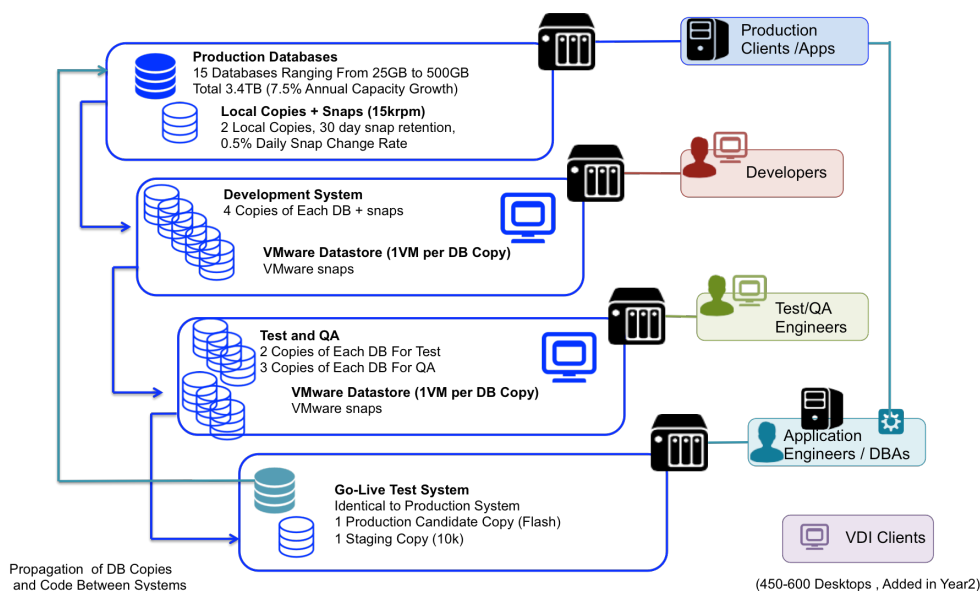


## ESG Lab Five-year TCO Analysis

To get a better understanding of the economic benefits of consolidating a traditional storage environment with an XtremIO all-flash solution, ESG Lab analyzed the expected storage total cost of ownership (TCO) for a modeled mid-sized software development company. The analysis compared the storage-related costs that could be expected when deploying traditional hybrid storage arrays (dedicated flash and disk-based systems) to meet business requirements with those that could be expected to be paid if the company chose to deploy a consolidated solution on a single XtremIO X-Brick. ESG Lab also analyzed some of the additional economic business advantages that would be realized when deploying XtremIO instead of a traditional storage system. All assumptions of XtremIO business benefits used in the model were validated for accuracy through real-world XtremIO customer testimonials.

The modeled company was based on a typical midmarket software development company generating \$54M in annual revenue. The company’s revenue was generated from core production database operations (50%), as well as from maintaining and developing client-server applications (30%) and SaaS offerings (20%). The hypothetical company was looking to replace its traditional storage infrastructure consisting of dedicated systems for production, development, test/QA, and go-live testing. The production and go-live test systems required high-performance, low-latency flash storage systems that would not be impacted by non-production operations. The development, and test/QA storage systems did not require the same low latencies, but did require full copies of the production database that were periodically updated (via manual migration) as well as VMware images to host the development and test environments. The company also planned to deploy a 450 user VDI environment with headroom to grow to 600 users to host personal desktops for each employee one year after the initial storage upgrades. Figure 4 shows the storage requirements and operation for the modeled company.

Figure 5. Storage Requirements of Modeled Software Development Organization.



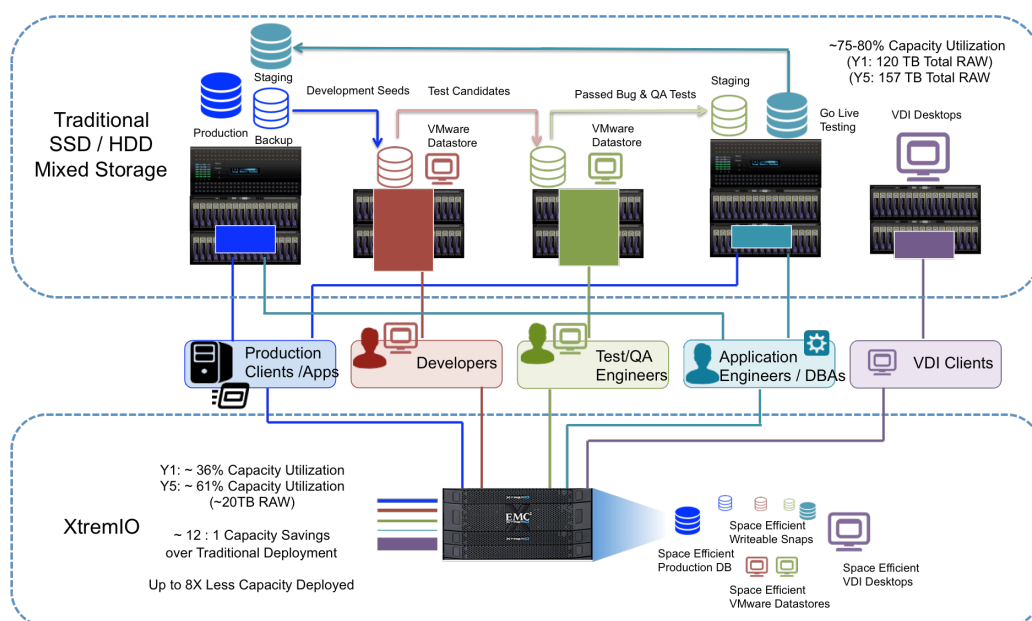
ESG Lab calculated the storage requirements for each system based on production databases that totaled 3.4TB of capacity and required 43,000 IOPS. The necessary capacity and performance requirements were then calculated for every other operation (development, test/QA, etc.) based on the number of full copies of the production DB required, the number of retained snapshots, the daily change rate of snapshots, the growth of the databases (ESG assumed a 7.5% annual capacity growth rate), and the VMware requirements. A 20% capacity overhead was built into the requirements for each system. This overhead was to ensure that the system was never utilized past 80% of its full capacity.<sup>2</sup> Traditionally, once this threshold was reached, IT planners would typically order additional capacity. It should be noted

<sup>2</sup> This modification was added to accommodate the buying behavior of traditional storage arrays, and is not a requirement of XtremIO. Please see the appendix for more details on XtremIO’s ability to operate and deliver consistent performance well past this threshold.

that unlike a traditional storage array, an XtremIO all-flash array can utilize nearly all capacity with no impact to performance. Table 1 in the Appendix summarizes the characteristics of the production database, and Table 2 summarizes the physical capacity required for operation on the traditional system and for XtremIO.

XtremIO was able to solve the business requirements with far less capacity due to inline compression and deduplication as well as the ability to provide space-efficient full writeable copies that required almost no additional capacity, and low-latency performance (for both the master copy and all snapshots copies) with no impact to production DB operations. The raw capacity required for XtremIO in Year 1 was a fraction of what was required for the traditional system (roughly 7TB versus 119TB).<sup>3</sup> Amazingly, the XtremIO solution was initially able to provide substantially better performance for all operations using 16X less physical capacity. Even after the VDI system was added in Year 2, and the data set grew over the years due to growth and copy data changes, the 20TB XtremIO X-Brick never required the purchase of additional storage controllers, drive trays, or media. By Year 5, the traditional array had grown to five systems and 157TB of raw storage capacity, while the XtremIO X-Brick was only at 61% capacity (12.3X less raw capacity). Figure 5 compares the traditional storage deployment with the XtremIO deployment.

*Figure 6. Traditional Hybrid Storage Solutions versus Consolidation with XtremIO*



### Total Cost of Storage Ownership

ESG modeled and compared the storage-related costs associated with purchasing, maintaining, administering, powering, and cooling the storage systems to achieve the current business objectives of the modeled organization. The traditional storage solution consisted of five separate storage systems from a well-known traditional storage vendor, each dedicated to a particular business function. Dedicated arrays were necessary based on the nature of traditional storage arrays, the inability to keep test workloads from impacting production operations, and the need for a separate system to handle the high-performance requirements of VDI. The traditional solutions were sized according to the chosen vendor's best practices and, where possible, based on published reference architectures.

For the traditional storage system, the production, go-live, and VDI storage systems leveraged higher performing controllers with SSDs. While these systems did leverage flash SSDs and benefited from some degree of data efficiency, the performance of the systems would not be expected to offer the same levels of capacity optimization, low-latency performance, or predictability provided by the XtremIO solution. The development and test/QA operations did not require the high performance of SSDs. These systems were designed with cost savings in mind, with less powerful controllers and 10krpm SAS drives for the traditional storage system.

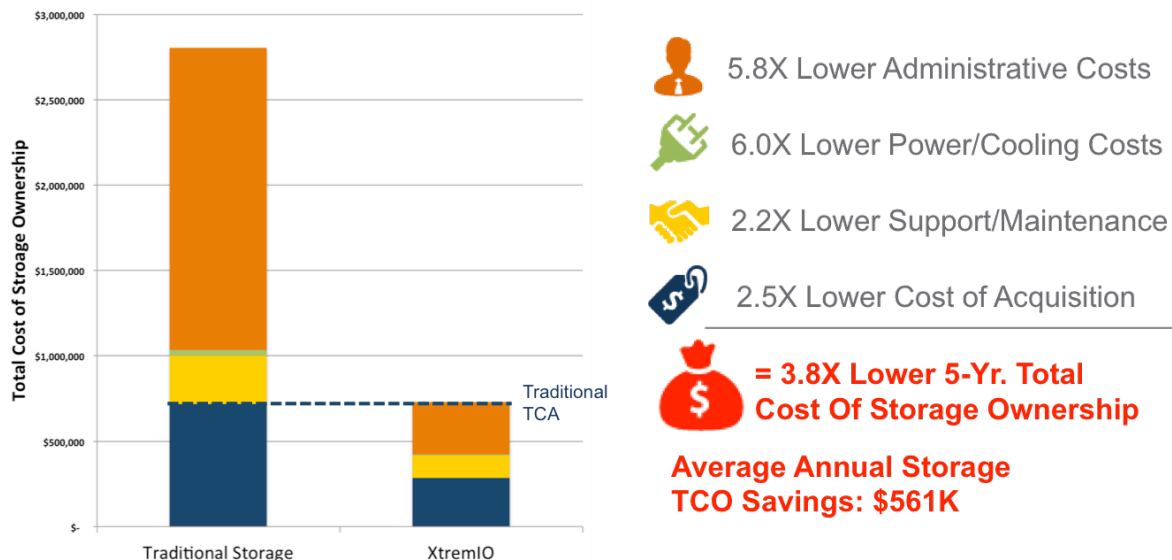
<sup>3</sup> Please see appendix Table 2 for a summary and explanation of the difference in capacity requirements.

While each of the traditional storage solutions individually cost less than the 20TB XtremIO X-Brick, by consolidating the five separate storage systems into a single X-Brick, the five-year cost of acquisition of the XtremIO solution was 2.5X lower than purchasing and growing the traditional solutions. The XtremIO solution was also 2.2X less expensive to maintain and support, with the added benefit of managing a single support contract versus five or more, and the guarantee of support contracts remaining flat over 7 years with EMC’s Xpect More program. Less hardware also resulted in far lower power and cooling costs over the five-year period (6.0X lower). The footprint of the XtremIO solution was much smaller, a large advantage for organizations where lab space is at a premium.

ESG Lab created a detailed model comparing the time needed to complete common storage-related tasks such as provisioning and monitoring, and business-critical tasks such as managing and updating the many copies of the production database for the modeled organization. The traditional system required full copies of the production database to be acquired, migrated, staged, organized, updated, deleted, and cleaned for the use of developers, functionality testing, and performance QA engineers. ESG’s model predicted that the 139 weekly administrative-employee hours<sup>4</sup> required to manage and update hundreds of database copies across several systems and organizations could be reduced to only 15 administrative-employee hours on the XtremIO solution, an 88% improvement. Administrators will be free to allocate more time to performing higher-value-added tasks such as proactive IT resource planning and optimizing synergy between business units. A complete summary of the management model results is shown in the Appendix. When added up, ESG’s models showed that the XtremIO solution can help lower administrative costs and related operational expenses by 5.8X, a savings of over \$1.5M over the five-year period.

When added together, the ESG five-year storage total cost of ownership model concluded that by consolidating operations and deploying a single 20TB XtremIO X-Brick rather than deploying a traditional hybrid storage environment made up of operational silos, the modeled software development organization could lower its storage total cost of ownership by a factor of 3.8X for an estimated annual storage TCO savings of over \$561K. In fact, the entire TCO of XtremIO was roughly equivalent to the TCA (Total Cost of Acquisition) of the traditional storage deployment alone. The results of ESG Lab’s five-year storage total cost of ownership analysis are shown in Figure 6.

Figure 7. Summary of ESG Lab’s Five-year Storage Total Cost of Ownership Analysis



**Additional Economic Business Advantages**

Although consolidation with XtremIO clearly helps lower the traditional costs associated with purchasing, operating, and maintaining a storage solution, ESG Lab analyzed and modeled some of the other ways that an XtremIO deployment could help impact the top and bottom lines of the business. ESG’s economic business advantage models helped to show

<sup>4</sup> Administrative-employee hours include time spent by storage admins, DB admins, application admins, Dev/Test engineers performing storage administration, planning, copy data management, and more. A detailed summary of management savings can be found in the appendix.



that, once deployed, the XtremIO solution would help lower costs in other non-storage related areas, and enable unique improvements to business processes and operations that would ultimately generate additional revenue for the organization.

ESG Lab's analysis assumed that the company generated \$54M in annual revenues (roughly \$27M from core online database services, \$16.2M from software applications, and \$10.8M from SaaS offerings). The average annual revenue growth rate was assumed to be 10%. A detailed explanation of ESG Lab's assumptions used to analyze the economic benefits can be found in the Appendix.

ESG Lab estimates that the XtremIO solution could deliver production DB latencies that were up to 3X faster than the SSD storage array priced in the traditional storage solution. In addition, XtremIO auto-balancing and wear leveling means fewer drive and component failures, with quicker rebuild rates, avoiding any spikes in latency. The smallest differences in latency can account for a slightly higher customer satisfaction and customer retention rate versus competitive offerings. Assuming that the lower latencies account for just a 0.2% higher customer retention rate for \$27M in revenue accounted for an additional \$54K in expected annual revenue.

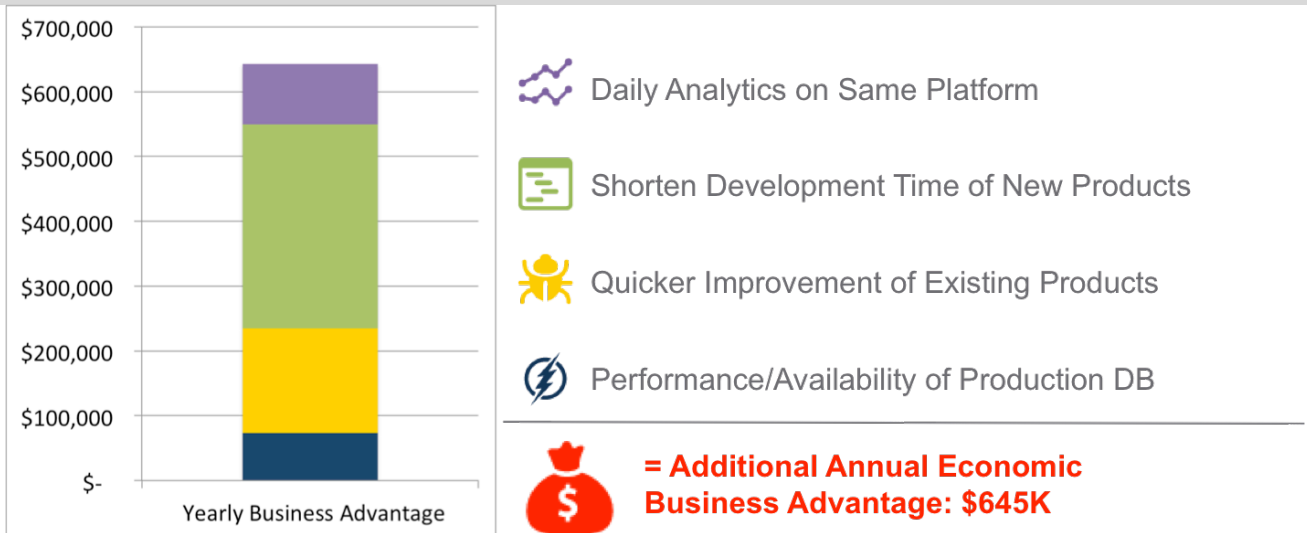
Perhaps the largest economic advantage for a software development organization like the one modeled when deploying XtremIO is the ability to quickly and easily provide copies of data that consume extra capacity only if globally unique data is written to them, that can be rolled forward and back, and that do not suffer from or cause a performance impact. This ability allows organizations to use the same system for production, development, and test copies. Full copies in the traditional storage solution had to be cloned, migrated, and re-mapped to provide a developer or test engineer with a copy of the production database. This process is both labor- and time-intensive. With the XtremIO solution, copies are very easy to manage, can be rolled forward and rolled backward in very little time, and require no re-mapping on the host when refreshing. This allows for easier management, daily updates to the working copies of databases, easier rollback of changes, and ultimately faster development and test cycles. The XtremIO system would provide much higher performing copies of databases for testing, meaning the development and test cycles could complete much faster.

ESG Lab estimates that new products could be developed and tested 33% faster using XtremIO<sup>5</sup>, shortening the time to release a revenue-generating product by a full year (36 months down to 24). Assuming that a new product generates \$400K in its first year with 20% growth, shortening the development cycle over five years can provide an average of \$314K per year in new revenue (although, in reality, additional yearly revenue will not be evenly distributed). In addition, this development and test cycle will help to enhance existing products with new features and bug fixes in a much faster time, giving the business higher customer satisfaction and a competitive advantage. The model assumed that the organization expects to lose 2% of existing application customers annually to competitive offerings with improved features. By speeding the development time for bug fixes and new features by 30%, ESG Lab conservatively estimates that the organization will retain an additional \$162K of annual revenue. Several XtremIO customers have confirmed similar (or even higher) impact to revenue from product development cycle improvements.

Finally, the ESG Lab model predicted an annual benefit of \$94K that could be realized by the organization through the ability to run daily analytics on the data stored on the XtremIO, rather than running and consolidating multiple reports across five storage systems. The detailed model considered the advantage gained by using predictive analytics performed daily rather than weekly to generate additional revenue, reduce operational costs, and avoid unnecessary risk. Some examples of what the model analyzed were the advantages gained through understanding customer needs and purchasing habits, identifying ideal timing for actions, improving operational efficiencies, and the exposure of high-risk customers and/or fraudulent activities. When added together, ESG Lab concluded that by deploying XtremIO instead of a traditional hybrid storage solution, the modeled organization would realize an additional \$645K of annual additional revenue and/or cost savings. Figure 8 summarizes the results of the additional annual economic business advantages.

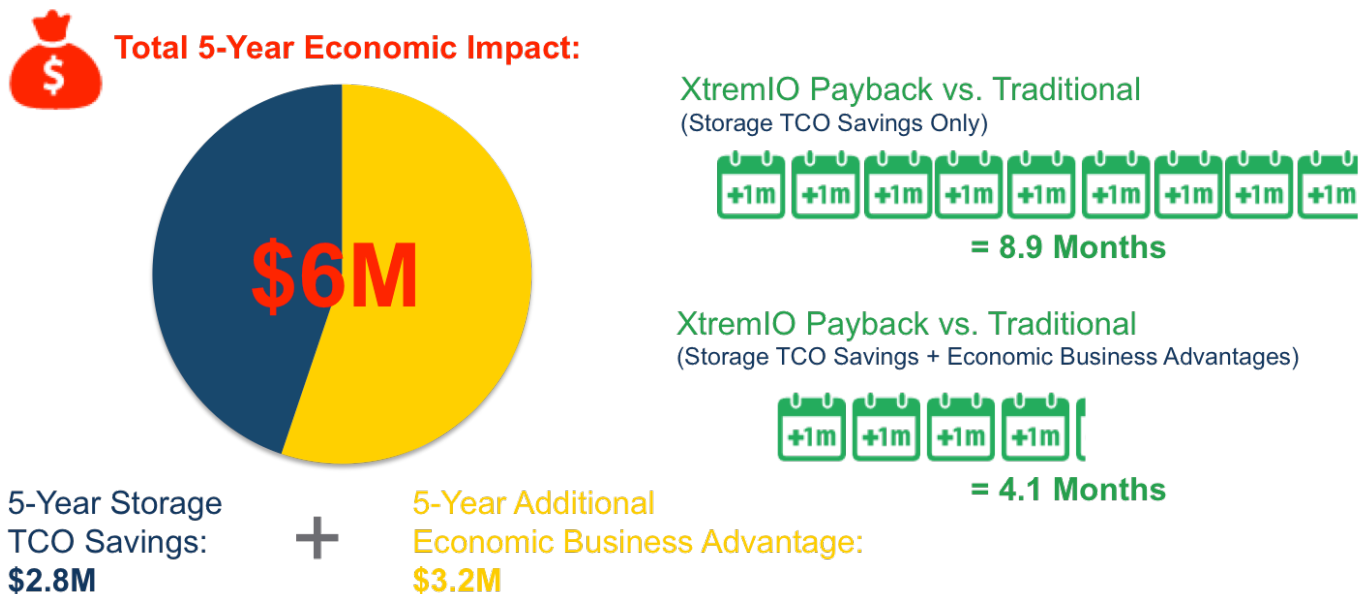
<sup>5</sup> Alternatively, the organization could reallocate 33% of the dev/test engineers for other projects and keep the same development timeline.

Figure 8. Predicted Summary of Additional Economic Business Advantages Realized by Deploying XtremIO



When added together, the ESG Lab model predicted that over a five-year period, consolidating storage operations onto a single XtremIO X-Brick rather than deploying traditional storage systems would provide cost savings and additional revenues totaling \$6.0M. Traditional storage-related costs would be reduced by \$2.8M over the five years, while additional economic business advantages totaling \$3.2M would be realized. Investment in an XtremIO solution would make sense to the software development organization with an expected payback period of only 8.9 months (based on storage-related costs only). If the additional economic advantages are considered, this payback period could be as low as 4.1 months. Figure 9 summarizes the results of the five-year ESG Lab analysis.

Figure 9. Total Expected Five-year Economic Impact of XtremIO Solution with Payback Analysis



### **Why This Matters**

It is the goal of every organization to do more with less. Storage is usually purchased against the requirements of a single IT function with a goal of limiting the cost of acquisition. Not surprisingly, only the most critical applications with the highest performance requirements are considered deserving enough to bear the higher acquisition costs and lower raw capacities commonly associated with all-flash arrays.

ESG Lab's analysis demonstrated that consolidating the many storage needs of a modeled organization into a single XtremIO all-flash array proved to be a very wise investment, saving or generating a total of over \$6M for the modeled company over the five-year period. What's even better is that every function benefitted from flash storage, not just those that were deemed mission-critical. Organizations would be wise to consider performing their own analysis to see if consolidating with XtremIO can help realize economic advantages similar to those proposed in this analysis, and proven in customer testimonials.

### **Issues to Consider**

Any TCO study must be based on a set of assumptions. No one model can be created that covers every deployment scenario, and no one single "typical" scenario exists in the real world. ESG's analysis of XtremIO reveals that its architecture presents a distinct TCO advantage for development and test organizations (above and beyond the typical all-flash array advantages of high performance and low latency for production environments). ESG believes these advantages would extend to any organization that would benefit from consistent sub-ms performance, that manages many copies of production data, that has a highly virtualized environment, or that would benefit from consolidation of workloads and/or storage systems.

## The Bigger Truth

The functional lines are blurring between IT and the rest of the business. Decision makers now understand more about the technical tradeoffs and IT workers are beginning to understand the economic impact that their technology choices have on the bottom line. Technology is becoming a key contributor to the success of the business. For many organizations, such as those with software development operations, IT has replaced the physical assembly line for the business and can be optimized to speed production of the end product. Solutions should no longer simply be judged based on technical specs like capacity, performance, and connectivity. Decision makers need to ask the same questions of their technology as they do of their workers: How will this investment make us more productive and improve the bottom line of the business?

Smart organizations analyze the TCO before making a purchase, which is a great first step and a solid basis for comparing one purchase against another. But TCO is no longer the only metric that matters in making an intelligent decision. IT organizations need to understand and convey to decision makers every aspect in which the investment in a particular technology will impact the bottom line of the business.

ESG validated many of the intelligent design choices that went into the design of XtremIO. XtremIO was simple to manage and monitor, and very space efficient while leveraging advanced metadata techniques to its fullest potential. This space efficiency combined with the low-latency, predictable performance seen by ESG Lab makes it a perfect platform for consolidation of workloads. We also validated the abilities to create hundreds of writeable space-efficient copies based on snapshots and to automate the workflows required to manage these copies of data. These tremendously help optimize productivity for a variety of business applications.

ESG Lab performed quantitative analysis based on a modeled mid-sized software development organization looking to make a decision between investing in a traditional storage implementation versus an XtremIO deployment to replace existing infrastructure and add additional functionality. The models predicted that by consolidating with XtremIO over a five-year period, the organization could expect a storage TCO that was 3.8X lower than if the company had chosen to implement the traditional storage solution. This XtremIO solution offered lower costs of acquisition, service, maintenance, power and cooling, and administration.

A 3.8X lower storage TCO is great for any organization, but ESG Lab's model also analyzed other areas in which the advanced capabilities of the XtremIO solution can help impact the bottom line of the business. The XtremIO solution would empower the organization with capabilities that were simply not possible with the traditional storage deployment. XtremIO gave the modeled organization the ability to run daily analytics on production data, streamlined the ability to manage hundreds of copies of data between departments, and provided lower predictable latencies for all workloads. This resulted in increased customer retention and revenue, and most importantly, a 33% reduction in product development time. ESG Lab's model shows that deploying XtremIO would result in additional economic business advantages totaling \$645K annually. When added together, the storage TCO savings and additional economic business advantages produced an expected savings of over \$6M over the five-year period, and an expected payback period of around four months.

Storage is often described as a commodity, but this is not entirely true. Blocks of storage may be approaching commodity, but what is done with those blocks of storage can help transform the business. XtremIO understood this when it designed the all-flash array. XtremIO is designed around a goal of solving business problems rather than storage problems. It is no surprise that ESG Lab's five-year analysis demonstrated that by consolidating traditional single-function storage systems into an XtremIO solution, organizations can lower their storage TCO while realizing additional economic benefits in many other areas of the business. If your organization is looking to get better performance out of its storage system, ESG recommends investing in an all-flash array. If your organization is looking to get more out of its all-flash array, ESG recommends considering XtremIO.

## Appendix

### Storage TCO Model Assumptions:

- Five-year storage TCO study
- Midmarket business-critical database and application development environment
- Replacing existing infrastructure, not a net-new deployment
- Existing database and infrastructure is to be replaced and migrated at Year 1
- Existing infrastructure siloed deployment model resembles traditional multi-system Option 1
  - Option 1: Upgrade current traditional storage solutions
  - Option 2: Consolidate with XtremIO
- A 600 user VDI capability is planned for deployment in Year 2 (450 Employees + Growth)
- A 20% storage capacity overhead was built in (a typical practice, imposed on XtremIO for parity in TCO comparison to traditional arrays)
  - Enforced a maximum 80% capacity utilization on storage array (storage headroom)
  - Running a traditional storage system at 100% capacity is unrealistic
  - Assumed capacity would be expanded when < 20% capacity remains
  - Note: XtremIO arrays can comfortably be run at 95+% capacity utilization

*Table 1. Characteristics of Modeled Production Databases*

15 Production Databases Ranging From 25GB to 500GB				
# of DB	Size Per DB (GB)	IOPS / DB	Total Capacity (GB)	Total IOPS
2	25	1,000	50	2,000
3	50	1,000	150	3,000
2	100	2,000	200	4,000
4	250	3,500	1,000	14,000
4	500	5,000	2,000	20,000
<b>15</b>			<b>3,400</b>	<b>43,000</b>

Requirements shown in Table 1 are Year 1 starting capacities; the ESG Lab model assumed 7.5% annual effective capacity growth rate.

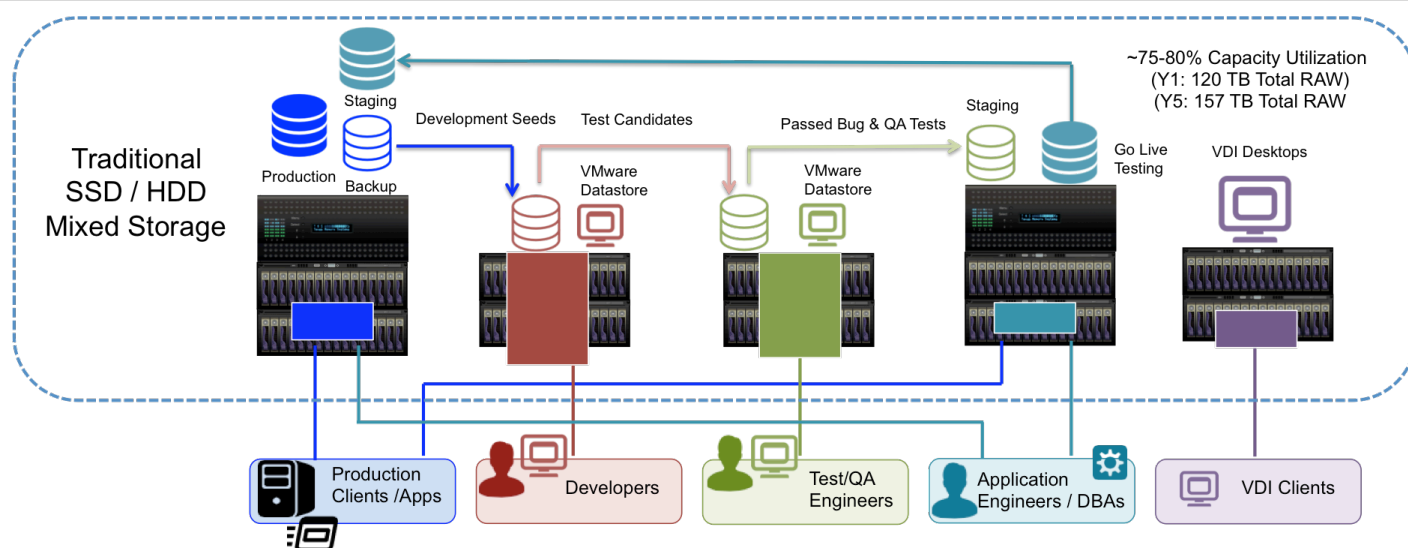
### Storage TCO Model Assumptions – Traditional Storage Solution:

- The traditional storage vendor leveraged separate storage systems for production, development environment, test/QA environment, go-live testing system, and VDI.
- The production system was a high performance all-flash system to provide consistent, low-latency performance.
- This system lacked adequate performance, capacity, and/or advanced copy capabilities necessary to house the development, test/QA, go-live or VDI workloads.
- The flash-powered system for the production database benefitted from up to a 50% space efficiency due to inline compression. This is giving the array the benefit of the doubt that it could provide adequate performance under this condition.
- Two lower performing systems were deployed to house full copies of production database and code for development.
- A second system was deployed for extensive test/QA operations (bug testing).



- These systems would each also house a VMware datastore to provide the development and test environments with one VM per copy of each database (60 and 75 VMs respectively, each 60GB in size).
- Because these systems do not require ultra low latency, 10k drives would prove sufficient for the operations.
- Heavy I/O testing in the test/QA environment would be expected to place a very heavy load on the drives, making a separate development environment necessary to ensure a good user experience.
- A second system provisioned identically to the production system was deployed for go-live testing of developed and tested production candidate applications and database copies.
- Because the extensive stress testing done on this system would negatively affect the production environment, it must be kept physically separated.
- In Year 2, the organization deployed a 600-user capable VDI environment (For employees, offshore development, and future growth). The VDI capacity and performance requirements, and the hardware requirements of the system were based on published reference architecture.
- The flash-powered system for VDI benefited from 4.8X space efficiency. This is giving the array the benefit of the doubt that it could provide adequate performance under this condition.

Figure 10. Traditional Storage Solutions Used in 5 Year TCO Analysis



### Traditional System #1: Production Storage System Requirements (PROD)

- High-performance storage system
- Y1 production databases = 3.4TB
- Yearly capacity growth = 7.5%
- # of full copies of DB = 3 (production database, staging copy, full backup copy)
- Snap retention = 30 days of daily snaps
- Daily snap change rate = 0.5%
- Copy change rate = 0% (unmodified backups/staging)
- Flash storage
- Mirrored SSDs
- MLC/SLC capacity mix = 50/50
- Space efficiency enabled
- Space efficiency = 1.5 to 1
- Performance requirement is ~45,000 IOPS at <2ms latency

**Traditional System #2: Development Storage System Requirements (DEV)**

- Dedicated virtualization cluster for development team
- Database development copies
- Yearly capacity growth = 7.5%
- # of full copies of DB = 4 (development copies)
- Snap retention = 30 days of daily snaps
- Daily snap change rate = 2% (development changes)
- VMware datastore
- 1VM per development copy (development environment)
- 60GB storage per VM
- 15 databases x 4 copies = 60VMs

**Traditional System #3: Test/QA Storage System Requirements (TEST/QA)**

- Dedicated virtualization cluster for test/QA of developed apps
- Database copies for test (dev candidates)
- Yearly capacity growth = 7.5%
- # of full copies of DB = 5 (test/QA of development candidates)
- Snap retention = 30 days of daily snaps
- Daily snap change rate = 2% (heavy stress test change writes)
- VMware dataStore
- 1VM per development copy (development environment)
- 60GB storage per VM
- 15 databases x 5 copies = 75VMs

**Traditional System #4: Go-live Testing Storage System Requirements (Go-live)**

- Production system replica for go-live tests
- Production ready database copies
- Yearly capacity growth = 0%
- # of full copies of DB = 1 (1 production candidate + 1 staging copy)
- Snap retention = 2 snaps
- Daily snap change rate = 0.5% (test change writes)

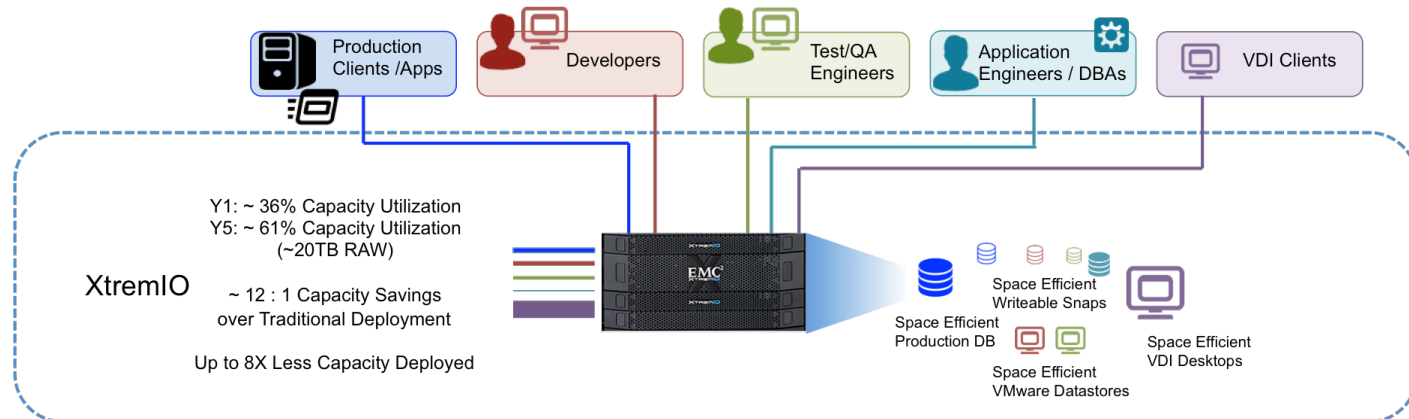
**Traditional System #5: VDI Storage System (Y2) (VDI)**

- Based on published VDI Reference Architecture, 20 IOPS/VM, scaled to 600 users.

**Storage TCO Model Assumptions – XtremIO Solution:**

- The XtremIO model consolidated all of the production, development, testing, go-live, and VDI environments into a single storage system. This was made possible by the nature of the writeable snapshots, and the scalable, consistent, low-latency performance delivered by the system.
- The XtremIO model required far less capacity due to advanced space efficiency and the nature of zero capacity, writeable snapshots.
- A single X-Brick XtremIO cluster was sufficient to handle all workloads simultaneously while also delivering consistently lower latency performance for the production database.
- With XtremIO, there was no need for staging copies because all copies reside on the same system.
- Each copy of the database and VMs required very little capacity (only the changed data for manual and automatic snapshots) and stored space efficiently.

Figure 11. XtremIO Consolidated Solution Used in 5 Year TCO Analysis



### XtremIO Storage System Model

- Y1: 1 x 20TB X-Brick (16.6TB RAW, 100TB effective)
- Consolidate production databases, development copies, test/QA, go-live, VMware dataStores for 135 VMs
- Assumptions:
  - Copies = 0TB at t=0 , then 20% change rate for dev copies
  - DB space efficiency at 2 to 1
  - DB growth and snapshot efficiency at 2 to 1
  - VMware space efficiency at 22 to 1
  - VDI deployment space efficiency = 10 to 1
  - Y2-Y5: database, copies, VMWare growth rate = 7.5% annual (pre-space efficiency)

### Summary of RAW Capacity Required By Year And IT Function

Table 2 compares the physical capacity required for each IT function (including DB, copies, VMware datastores, snapshots etc.). Please refer to sections above and Figure 5 on page 6 for a summary of what is included in each IT function (each blue box represents an IT function, plus VDI). The traditional array required a storage system for each function, while all functions were consolidated onto a single XtremIO X-Brick. The differences in capacity requirements are also explained in further detail following the table.

Table 2. Physical Capacity Required Per IT Function (Results in Equivalent Effective Capacity)

		TB of RAW Capacity Required (Inc. 20% Overhead, Data Protection etc.)						TOTAL	RATIO
		PROD	DEV	Test/QA	Go-Live	VDI			
Year 1	Traditional	17.14	40.25	50.31	11.68	0.00	119.4		
	XtremIO	2.82	2.52	1.71	0.37	0.00	7.4	16.1	
Year 2	Traditional	18.42	42.84	53.55	12.56	5.60	133.0		
	XtremIO	3.03	2.70	1.82	0.39	3.20	11.1	11.9	
Year 3	Traditional	19.71	45.43	56.78	13.43	5.60	141.0		
	XtremIO	3.24	2.87	1.93	0.42	3.20	11.7	12.1	
Year 4	Traditional	20.99	48.02	60.02	14.31	5.60	148.9		
	XtremIO	3.45	3.05	2.04	0.45	3.20	12.2	12.2	
Year 5	Traditional	22.28	50.61	63.26	15.19	5.60	156.9		
	XtremIO	3.66	3.22	2.15	0.48	3.20	12.7	12.3	

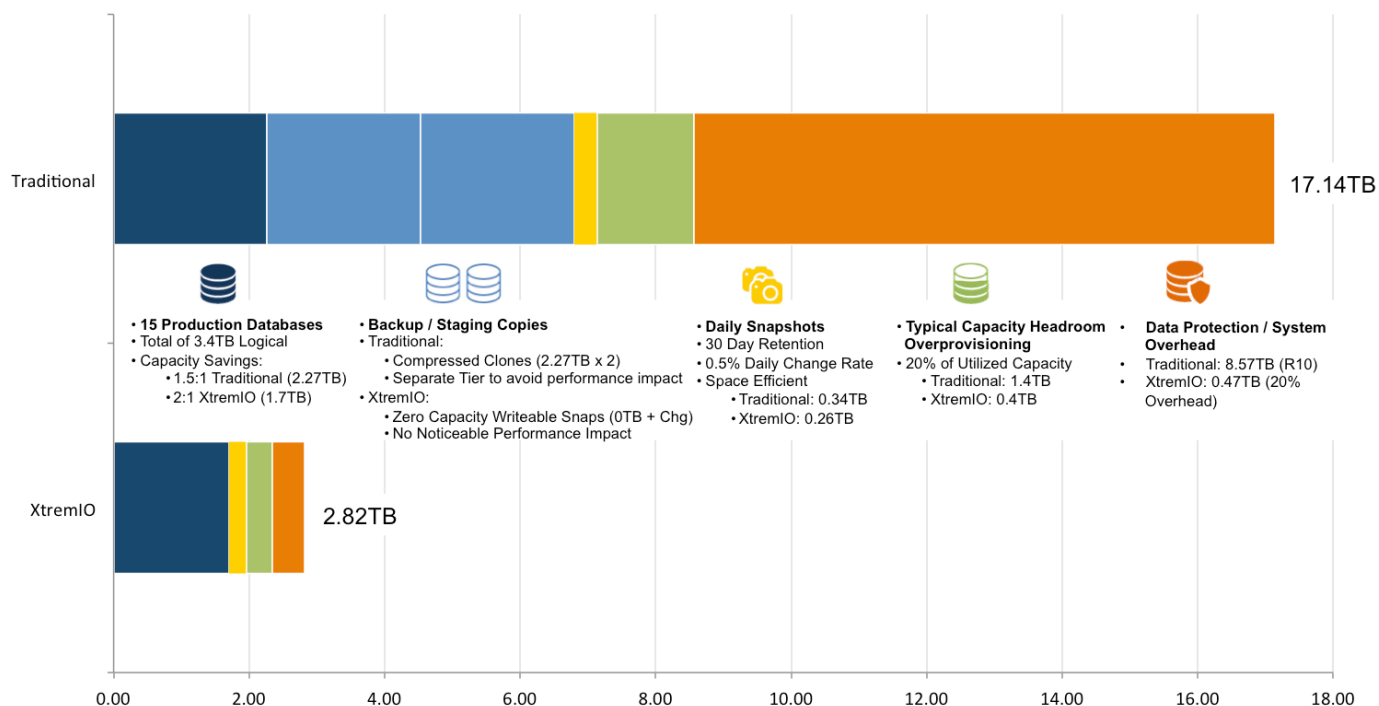
**Factors resulting in higher RAW capacity for Traditional Storage Solution as shown in Table 2**

- **RAID protection / System overhead :**
  - ~20% Overhead for XtremIO (Data protection, rebuild sparing, metadata overhead)
  - 12.5%-50% for traditional (Mix of R5 4+1, 8+1, R10)
- **Full copies, Including staging copies (traditional) vs. zero capacity writeable snapshots (XtremIO):**
  - Traditional system cannot meet the performance, capacity, or functional requirements of copies with snapshot technology, and require full capacity to be allocated for each copy of data. This requires additional time, system resources, and human resources.
  - Development, test/QA, go-live copies are all on the same system for XtremIO, and require only enough capacity to store net-new, globally unique data.
  - This architectural contrast is a major contributor to the difference in capacity required, as each system requires multiple copies of the production databases.
- **Data efficiency:** All data on XtremIO (including production DB) is thin provisioned and globally deduped and compressed with no impact to performance. Flash tiers of traditional system did benefit from lesser space efficiency due to compression, post-process deduplication, and thin provisioning.
- **Snapshots:** Snap changes on XtremIO are globally deduped and compressed, but require the full changed capacity on Traditional storage array.

**Example: Breakdown of Capacities Shown in Appendix Table 2: Year 1 PROD**

A capacity breakdown chart similar to the example shown here could be derived for each IT Function (PROD, DEV, Test/QA, Go-Live, VDI) for each of the 5 years (total of 25 charts). Please note that the PROD IT function consists of the production database and all related functions (from a traditional deployment perspective), such as the production database, staging and backup copies, snapshots, system overhead, raid protection, etc. In this example, the Traditional system requires full copies of data stored on another tier of storage to avoid further impact to production DB latency.

*Figure 12. Capacity Breakdown of the PROD IT Functions (Traditional Production Database System) In Year 1*



### **Results of Management Model**

- 98% less time planning for growth and resource optimization
- 68% less time monitoring and consolidating reports
- 68% less daily task system management time
- 67% less time planning application deployment and optimization
- 71% less time managing backups
- 79% less time servicing and installing components
- 88% less time managing copies of data

### **Business Model Assumptions**

- Total Company Revenue of \$54M in Y1
  - \$27M From core database-driven online operations (50%)
    - 0.2% of potential revenue lost annually to latency related customer issues
    - 3 production DB restores/rollback required per year (out of 15+ DB)
      - 20 minutes of downtime per restore (traditional)
      - 1 minute of downtime per restore (XtremIO)
      - \$333/minute of downtime
  - \$16.2M From application / software development and service (20%)
    - 2% customer churn rate (due to lack of feature or bug)
    - 30% faster development rate with XtremIO solution (based on real world cases)
  - \$10.8M From new SaaS offerings (30%)
    - 2% customer churn rate (due to lack of feature or bug)
    - 30% faster development rate with XtremIO solution (based on real world cases)
- 10% annual revenue growth rate
- New product development
  - New product currently takes 3 years to develop (36 months) on traditional
  - XtremIO speeds development, test/QA, and go-live testing by 33%
  - New product on XtremIO solution takes 24 months to develop
  - New product generates \$400K in first year, then 20% revenue growth rate each following year
- Running daily analytics on same platform as data versus weekly involving manual copy operations
  - Daily analysis provides 15% more revenue than weekly
    - Increased customer identification, retention, business optimization
  - Daily analysis reduced risk by 75% vs weekly
    - Faster identification of fraud, poor transactions, adaptive pricing policies
  - Daily analysis provides 50% improvement in cost reduction initiatives
    - Customer optimization, business optimizations, operational efficiencies