



**PERFORMANCE TEST RESULTS
OF THE
KOM NETWORKS KOMPLIANCE**

SUBMITTED TO

**KAMEL SHAATH
CTO
KOM NETWORKS
104 SCHNEIDER ROAD
OTTAWA, ONTARIO, CANADA K2K 1Y2
613.599-7205 x222**

BY

**JON WILLIAM TOIGO
CHIEF EXECUTIVE OFFICER
TOIGO PARTNERS INTERNATIONAL
1538 PATRICIA AVENUE
DUNEDIN, FL 34698
PHONE: 727.736-5367
FAX: 727.504.9311**

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SUMMARY

At the request of KOM Networks, Inc., testing was conducted of the KOM Networks KOMpliance archiving appliance in April 2007. This document summarizes the testing process and results received.

The KOMpliance is a “multilingual compliance archive appliance” comprised of common server hardware and KOMworx software running in a Windows Storage Server 2003 R2 environment. The KOMpliance is designed to bring archive and data management functions into an network-installed appliance format with a range of implementations and price points that make archiving available to companies of virtually any size. KOM Networks has done an outstanding job of realizing this vision.

The company says that the KOMpliance platform “features a cost-effective compliance solution.” This claim is entirely justifiable, even without a comprehensive return on investment analysis, by two key aspects of the KOMpliance approach.

1. Most leading Fibre Channel, SCSI, and iSCSI disk array, optical, and tape library products are compatible with KOM Networks KOMpliance. Using this platform, the buyer has enormous flexibility to design an archive infrastructure that matches both requirements and budget. They can even use legacy gear that has been removed from production use as part of a normal refresh cycle, thereby extending the useful life of past storage investments.
2. The software core of the product, KOMworx, provides a single, unified, set of data management services: simply put, there is nothing extra to buy. The appliance takes files identified by policy and moves them transparently into the archival repository based on user-specified rules. Supporting the operation of KOMworx is Microsoft Windows Storage Server R2, which ships with the KOMpliance platform.

The core business value proposition of the KOMpliance is that it enables the straightforward implementation of a secure data archive capability, whether for regulatory compliance and data management, and/or for improved management of infrastructure growth and expense. The business value case of implementing a secure data archive is compelling and captured well by the KOM Networks approach:

Cost Savings

- Operating an active archiving program using the KOMpliance platform can deliver significant cost savings to a business. As a rule, these savings accrue to segregating data that is rarely referenced from newer data, enabling the purpose-building of storage infrastructure to data based on usage characteristics and business considerations. By archiving seldom-accessed data, companies can preserve expensive, high performance, storage assets to support the acquisition and processing of new information, deferring

expensive capacity increases for as long as possible. KOMpliance's support for the broadest possible range of storage devices, irrespective of brand or interconnect, further optimizes this value. Archives can be written to inexpensive disk arrays or to removable optical or tape media, thereby optimizing the company investment in high performance storage.

- The cost savings accrued to efficient archiving using the KOMpliance platform also extend to the cost and efficiency of data protection technologies and processes. Many businesses use tape backup or disk mirroring as data protection strategies to protect the information assets supporting mission critical business processes. In the absence of cost-effective archiving services like those delivered by the KOMpliance platform, companies are forced to back up or mirror *all* data – including data not required for recovery. Over time, as data volumes grow, businesses must purchase more backup capacity or mirror bandwidth in order to handle increased workload. Through a program of deliberate and selective archiving, such as one enabled by the KOMpliance platform, organizations can make better use of their data protection infrastructure, forestalling new purchases, accomplishing backups of mission critical data within operational windows, and improving recovery timeframes by pre-staging copies of relevant archival data at recovery centers.

Risk Reduction

- By implementing the KOMpliance platform, businesses can establish, operate and administer data retention, deletion, protection and security policies that conform to relevant laws and regulations both today and in the future.
- The KOMpliance platform enables strong encryption and access control security for sensitive data, delivering a robust and transparent AES-256 data encryption algorithm, as well as support for Microsoft Access Controls and a wide range of third party Write Once Read Many (WORM) storage technologies, including KOM's patented e-WORM technology. Software-based data shredding technology is also provided to ensure that deleted data is permanently deleted.
- Non-repudiation of data is also a much sought after feature of archiving solutions, and KOMpliance meets this requirement with a SHA-256 hashing system that can be referenced to ensure that file contents have not changed over time as retention data are migrated from one set of media to another.

Process Improvement

- Productivity, as many analyses have demonstrated, is hampered by information technology when data amasses in a mostly undifferentiated fashion. Simply put, with so many files stored in a common repository, it becomes challenging for workers to find what they need when they need it. A data retention/disposition strategy, such as one enabled by KOM Networks

with its KOMpliance platform, can help cull out older files and data from newer information, reducing clutter and enhancing productivity.

- Archive itself can become an impediment to productivity when the archive strategy manifests itself in proprietary hardware, resulting in “archival stovepipes” – each requiring its own cadre of support personnel. By contrast, KOMpliance provides an elegant alternative to proprietary storage hardware approaches. Interoperability with the broadest range of hardware and software technologies, combined with ease of use and ease of management features, and its agentless architecture, all help to ensure that KOMpliance-centered archive will contribute meaningfully to business process efficiency, rather than detracting from it. In operation, the KOMpliance approach is completely transparent to users. In a Windows environment, authorized users can access KOMpliance-managed data with the ease and alacrity of any public share – though their access is carefully controlled and validated behind the scenes. KOMpliance archive policies operate transparently with minimal impact on the organization's culture and with very minimal training.

Given such a compelling business value case, and such an affordable price, TPI Technologies wanted to validate the performance of the KOMpliance platform. Our findings validated the value proposition advanced by KOM Networks. This family of products is well worth consideration by anyone who wants to deploy an archive strategy in a non disruptive way.

Context for Testing: TPI’s View of Archiving

Definitions of archive differ depending on the analyst or vendor one consults. TPI Technologies takes the view advanced by Toigo Partners International and the Data Management Institute of archive as a “multi-phase process, consisting of four discrete sets of activities: definition, selection, ingestion and management.” As shown in the figure below, these four activities comprise a continuous loop, since management tasks will inevitably provide a feedback loop for improvement of the overall process:

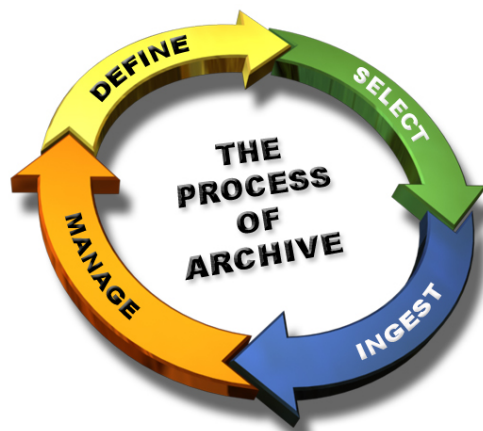


Figure 2: The Archive Process. SOURCE: The Data Management Institute.

- DEFINITION activities include (1) the creation of archive policies that consider relevant legal and regulatory requirements and information stewardship goals, (2) the establishment of program objectives, and (3) the specification of rules that will be applied to govern when data is moved, how access will be facilitated, timeframes for data retention, special security controls to be applied, and when and how data deletion will be handled. KOMworx, the archive software driving the KOMpliance platform, provides excellent templates and tools for policy definition that can be used with minimal training.
- SELECTION activities include the creation of archive repository volumes and the identification of data that will be migrated to them. The KOMworx software provides easy-to-use tools for setting up and configuring archive volumes and an intuitive process for mapping data assets in the production environment to archive volumes on the back end.
- INGESTION activities are the heart and soul of archive engineering. Ingestion is the movement of selected data from designated production volumes into target archive repository volumes according to the policies and rules established in the DEFINITION task. The performance of an archive solution is very much defined by ingestion rates. It is therefore useful when evaluating archive technology options to evaluate the overhead imposed by the archive engine that is being used to move, organize, and write data to the target volume. In testing the KOMpliance platform, we found that ingestion imposed a latency of 12 to 15% on writes to the target volume (relative to the rate of data writes to the same target without the KOMpliance platform performing its ingestion tasks). This is one of the most efficient ingestion rates we have seen.
- MANAGEMENT activities include controlling and logging accesses to archival stores, modifying access controls, managing deletions from the repository, and monitoring operational efficiency of the overall archive process over time. Again, KOMworx shines in terms of the security controls and audit enablers supplied as native functions of the solution.

Overall, we find the KOMpliance platform to be a highly efficient and user friendly archive solution that delivers enormous business value for the price.

Test Overview

The KOMpliance platform installs in a Gigabit Ethernet network and presents its storage (internal or attached) as either a Windows share or a UNIX/NFS share (via Windows Services for UNIX) providing a target for archival data.

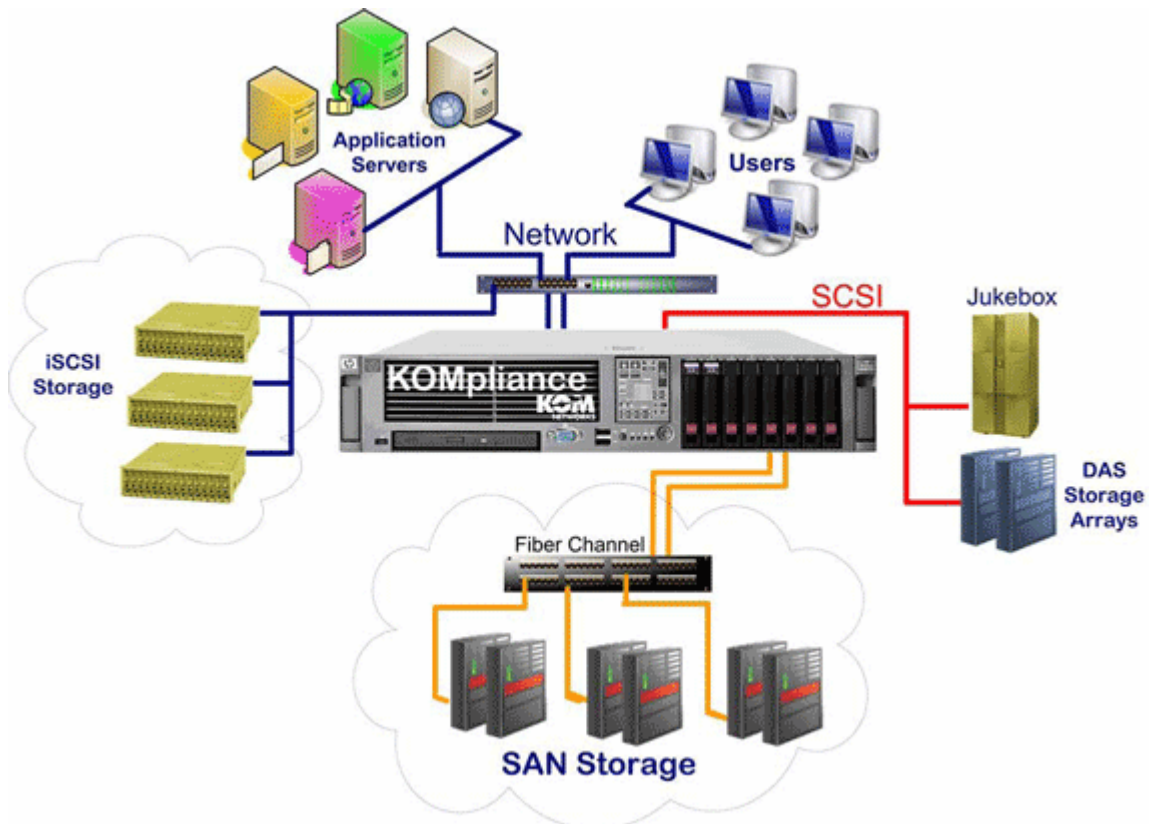


Figure 1: The KOMpliance platform. Source: KOM Networks web site.

The appliance installs readily and can be configured with virtually any storage within minutes to provide a segregated repository for archival data. Disk-based Write Once Read Many (WORM) technology is supported via the KOMworx software with no additional software purchases, plus a broad range of tape and optical WORM media are natively supported as storage targets.

To perform testing of the KOMpliance ingestion rates and to validate other product features, TPI Technologies configured a test bed that included:

- KOM Networks KOMpliance
- Promise Technologies M200i iSCSI Storage Array, with 1.45TB RAID-0 Storage, configured for management via the KOMpliance unit
- One AMD Opteron Dual CPU server using the Microsoft Windows 2003 Server operating system
- D-Link Gigabit Ethernet switch

The test bed is illustrated below.

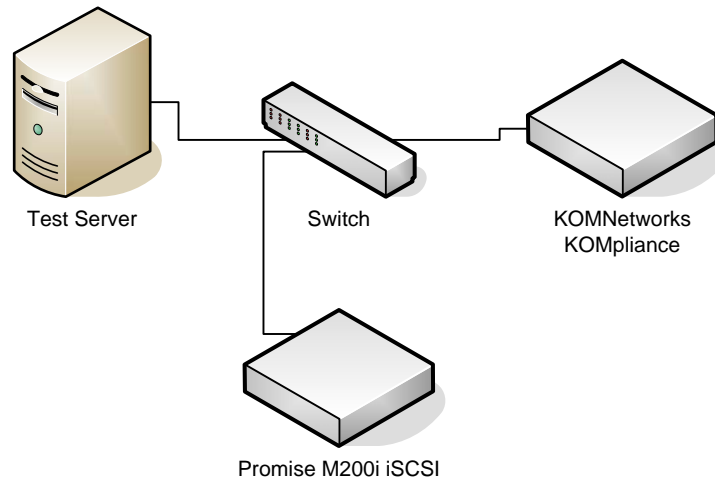


Figure 3: Test bed for KOM Networks KOMpliance validation testing

Testing was performed to evaluate the impact of the KOMpliance unit on storage I/O and to validate a portion of the feature set advertised by the manufacturer. To summarize the testing conducted and the results received:

1. The KOMpliance unit we tested was built on an HP DL380 chassis with two dual processor dual core Intel Xeon chips and 4GB memory. As provided, the unit featured two GigE ports. Installation was facilitated by a good rack mount kit and both the operating system and KOMworx application were pre-installed on the appliance itself.
2. KOMworx is integrated with the Windows Storage Server 2003 R2 OS environment and launches automatically upon power-up of the appliance. The user must create storage pools (archive targets) using KOMworx, then configure physical storage as CIFS or NFS shares in order to provide network targets for archival data streams. Using KOMworx software, it took no more than 15 minutes to configure the storage target to work with the KOMpliance platform in our test bed.
3. Policies were then created using KOMworx software to set file access and modify permissions and to establish archive rules and retention intervals for storage targets containing data that is to be archived. This is perhaps the most time consuming task and can be simplified through the use of templates provided by KOM Networks with the product. Context sensitive help is provided throughout, though some of the help screens were out of step with the pre-release version of the KOMworx software that we were testing.
4. We tested maximum files per second (ingestion throughput) with the KOMpliance product in the IO path and compared this with direct writes to the target iSCSI array. This was done to establish the impact of the KOMpliance on reads and writes. Data writes and reads were not

significantly impacted when traversing the appliance. In fact, reads were actually accelerated with the KOMpliance in the data path, probably due to caching on the KOMpliance itself.

5. Given the range of price points for the KOMpliance product family, and the flexibility of the unit in terms of supported hardware, KOM Networks has created a great tool for implementing basic Hierarchical Storage Management and archive functionality in both large and small business settings.

This document summarizes the results of functional testing performed by TPI Technologies at a facility located at 29296 US Highway 19 North, Suite 204, Clearwater, FL 33761. TPI Technologies CEO Jeremy Evans configured, administered and generated results from the testing that was performed.

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In keeping with our belief that all IT research & analysis firms should disclose potential conflicts of interest, it should be known that Jon William Toigo, Managing Principal of Toigo Partners International, maintains a small number of shares of stock in numerous storage companies – mainly to facilitate the tracking and analysis of industry financial performance. These holdings do not include any companies whose products are tested in this report.

Jeremy Evans, CEO of TPI Technologies, holds no stock in technology companies.

TESTING METHODOLOGY AND RESULTS RECEIVED

Upon receipt of the test unit, the KOM Networks KOMpliance was unpacked and configured for operation. One Gigabit Ethernet connection was made to the KOMpliance through our D-Link Gigabit Ethernet switch. Connections between the appliance and the Promise M200i (the KOMpliance-controlled archive storage target) consisted of a second Gigabit link.

The Promise M200i array was configured as a RAID 0 target with two Logical Unit Numbers (LUNs) of 400GB each.

TPI and KOM Networks personnel configured the unit to demonstrate features and functions. The GUI was very intuitive and easy to operate.

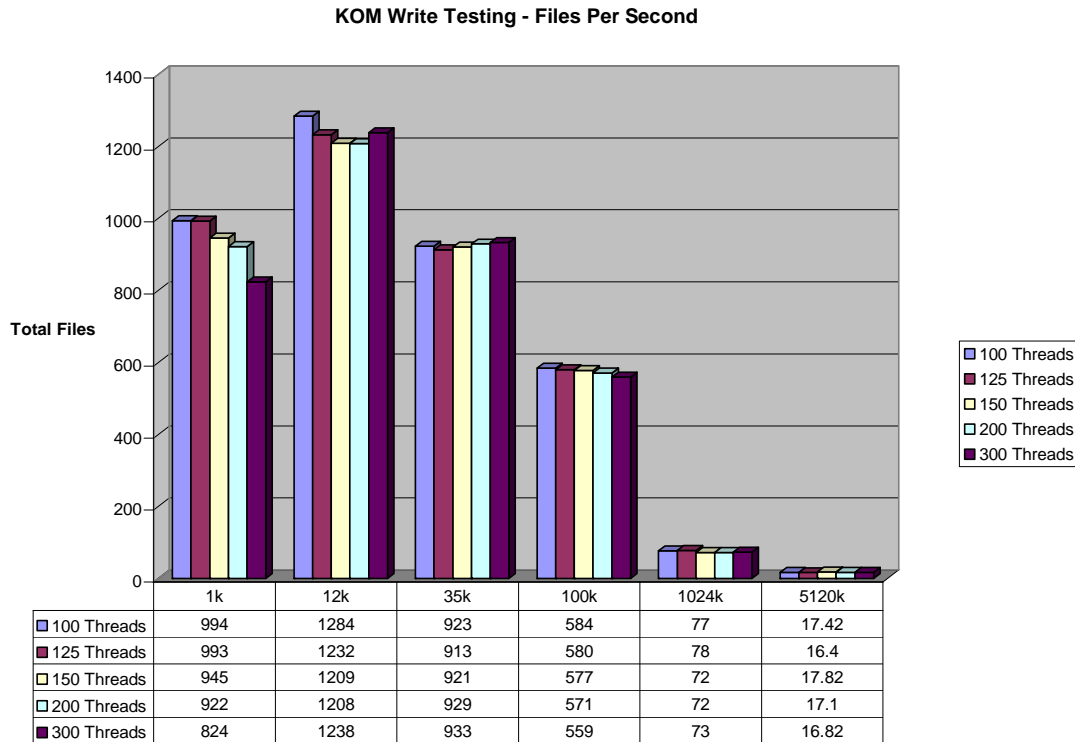
The volumes presented by the disk array were configured via the KOMpliance across a range of archival options (see below for archival options) to demonstrate the flexibility of the KOMworx software. Results were very good for all options tested.

We conducted full testing, first, using CIFS shares presented by the KOMpliance product, which in turn managed reads and writes to the target Promise array using the iSCSI protocol and Microsoft's iSCSI Initiator. After collecting measurement data on this configuration using a specialized workload emulation application that permitted variations of file sizes and numbers of threads (servers accessing the KOMpliance concurrently), we reconfigured the test server to read and write directly to the Promise array via iSCSI (with the KOMpliance unit in passive mode). This combination of tests enabled us to discern the overhead imposed by the KOMpliance gateway functionality.

The initial setup was handled efficiently by the point-and-click GUI.

PERFORMANCE TESTING

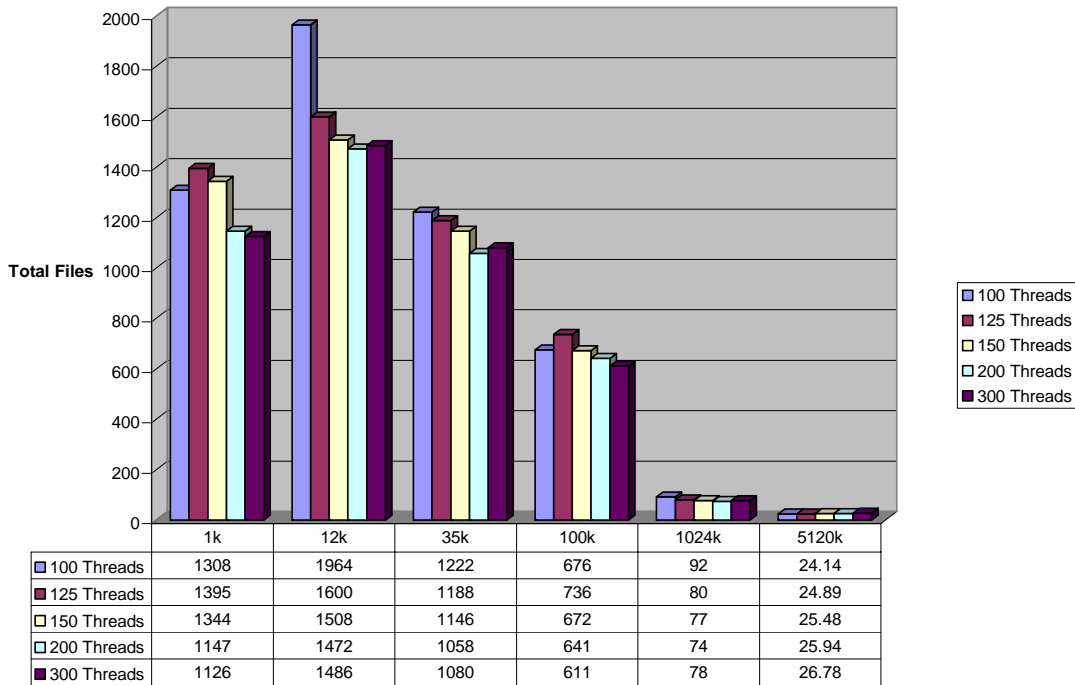
We used our workload emulation application to compare file throughput performance with the KOMpliance gateway brokering access to storage. Then, we re-ran the test app with the KOMpliance gateway in passive mode to the same storage array. Our findings are provided in the charts below.



We tested write performance with six different file sizes and with five different thread counts to determine whether significant performance degradation occurred at any combination of file sizes and threads.

Per the chart above, we found enormous consistency in terms of throughput at specific file sizes, irrespective of threads. As expected, ingestion rates (files per second) declined as file sizes increased.

Direct iSCSI Write Testing - Files Per Second

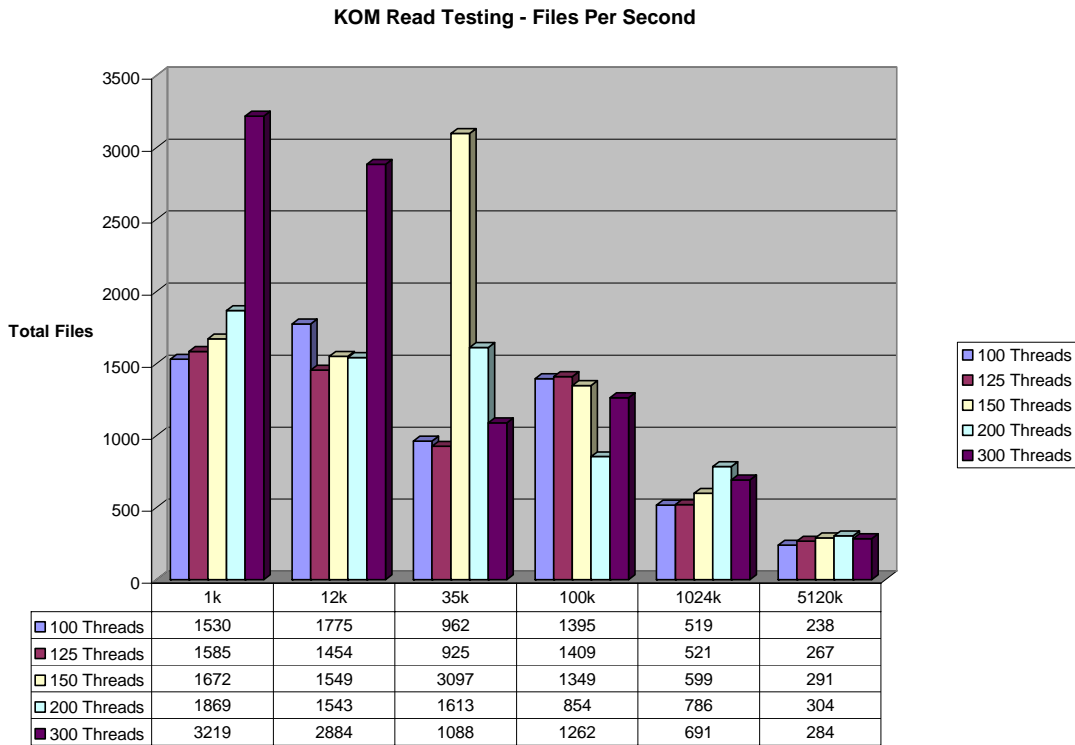


We re-ran the ingestion rate test with the KOMpliance gateway in passive mode. In this mode, data writes are not subjected to the management and migration services of the KOMworx software running on the KOMpliance.

As expected, unmanaged writes to the storage target were about 12 percent faster than KOMworx managed writes. The discrepancy relates to the indexing and hashing functionality of KOMworx, which comprises the data management action applied by the appliance to archival information prior to writes.

At 12 percent latency, this is one of the least intrusive archival ingestion processes that we have measured.

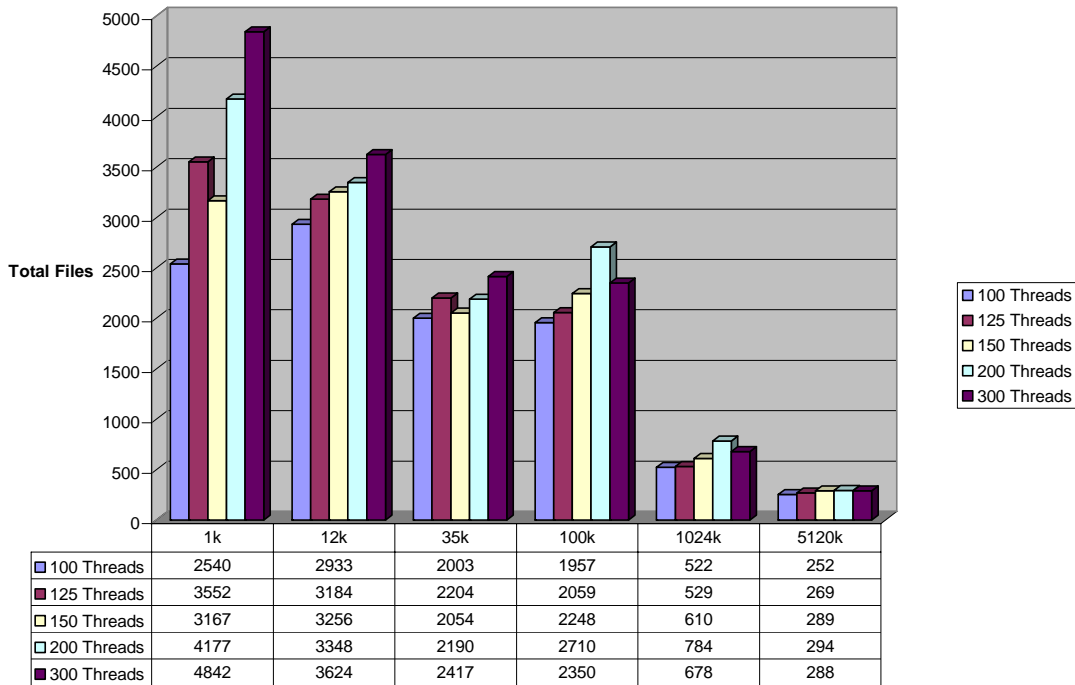
Next, we turned our attention to file read performance. Again, the goal was to measure any differences that accrued to KOMpliance brokerage of read requests given a mix of file sizes and concurrent requests.



Read testing revealed acceptable performance at every combination of file sizes and threads. Some spikes in performance were seen that reflected caching on the KOMpliance gateway. Where files requested for reading were already cached in system memory, the performance of the system improved dramatically.

These results were especially interesting when compared to the results received from testing of read performance with the KOMpliance in passive mode, as shown below.

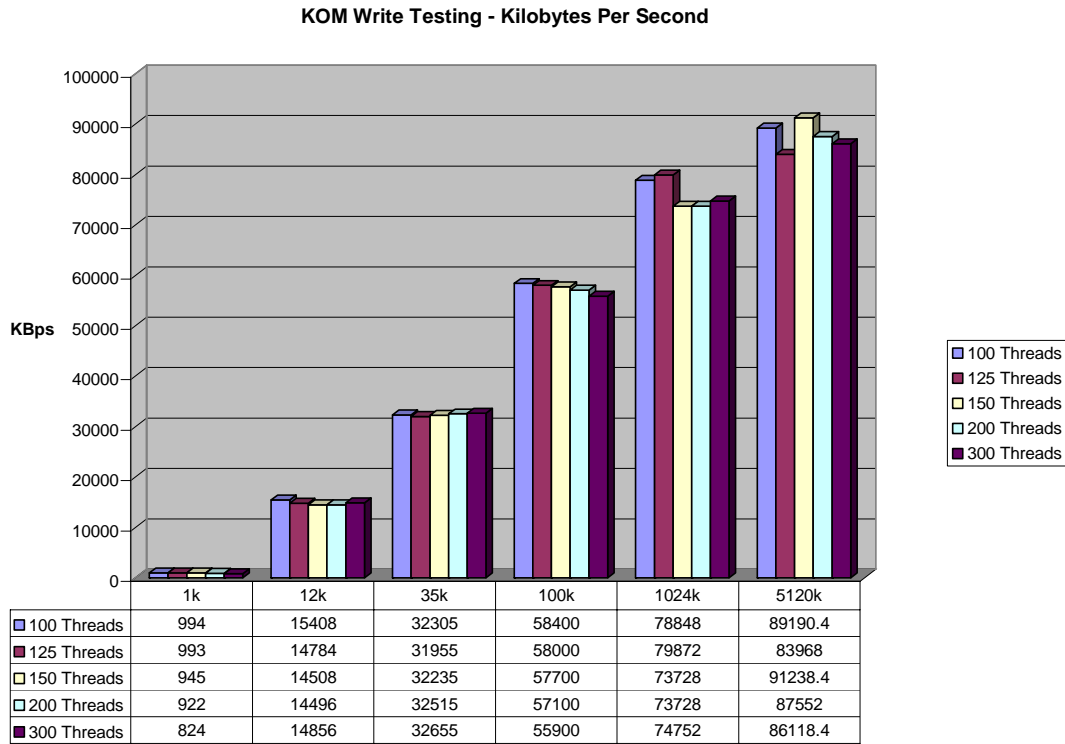
Direct iSCSI Read Testing - Files Per Second



While read tests of small file sizes with the KOMpliance gateway in passive mode were significantly faster than comparable reads with the KOMpliance gateway active, the difference began to decrease dramatically as file sizes increased. Read performance rates were comparable, with the KOMpliance in active or passive mode, with larger files (1024K and above).

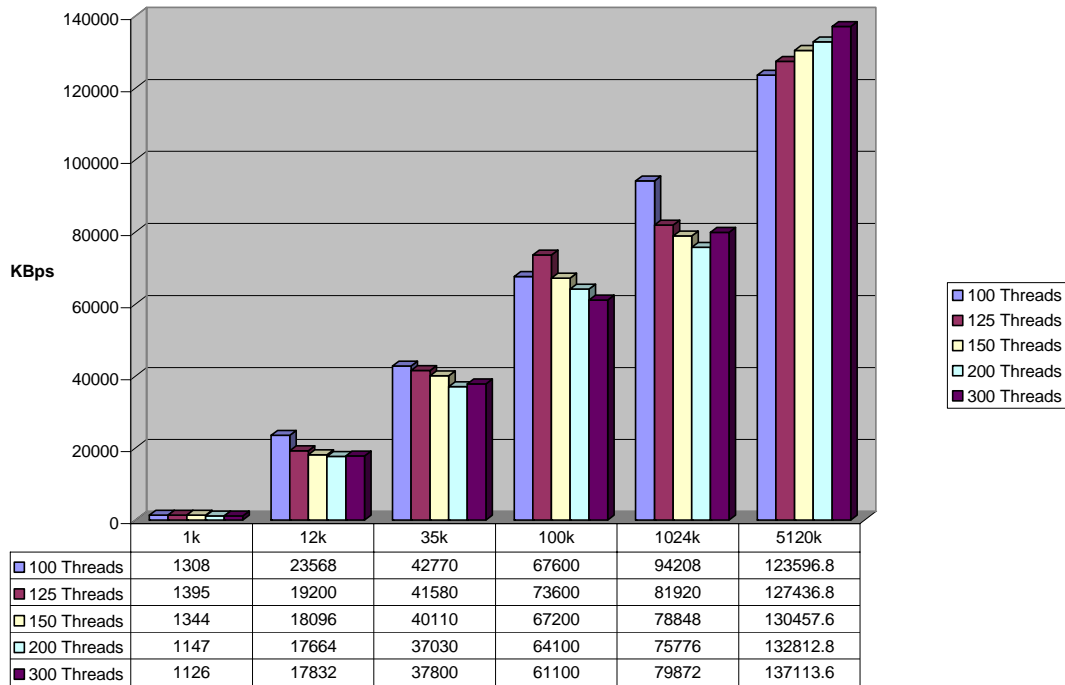
This data suggests that KOMpliance might make an excellent fit for rich media archival environments (healthcare imaging, GIS, CAD, multimedia), where file sizes tend to be larger.

In addition to testing file ingestion and read rates, we also measured throughput on a kilobyte-per-second basis using the same parameters (file sizes and thread counts) as used in the previous tests. These amounted to saturation tests of the overall configuration.



As reflected in the table above, the write performance of the KOMpliance accelerated dramatically as file sizes increased. The write rates held fast even as thread counts increased.

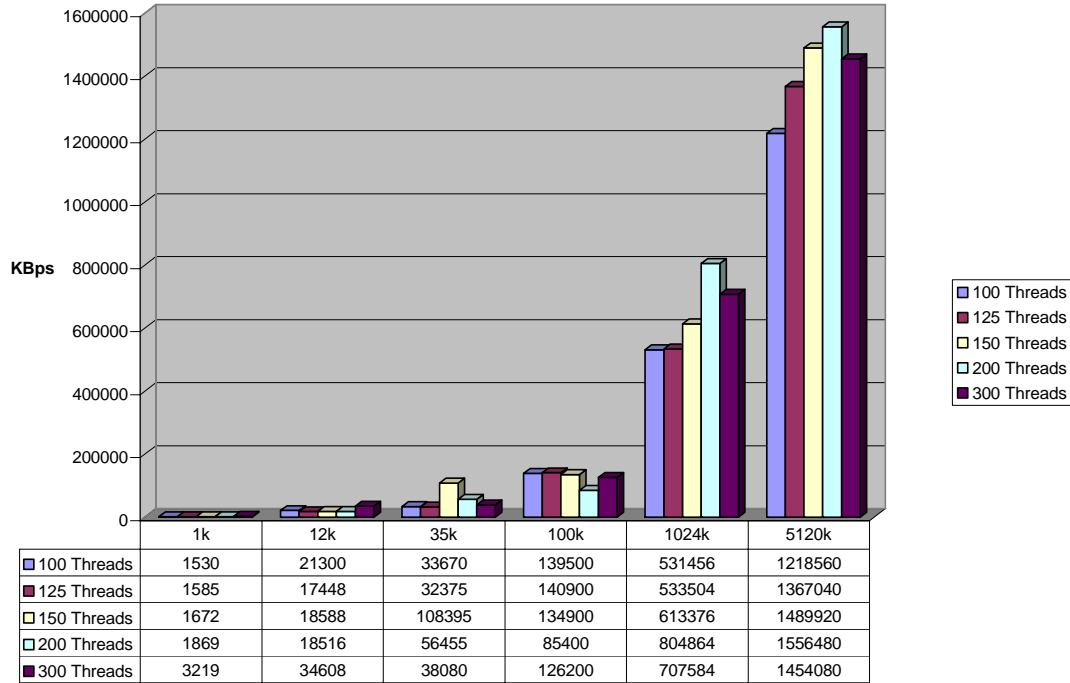
Direct iSCSI Write Testing - Kilobytes Per Second



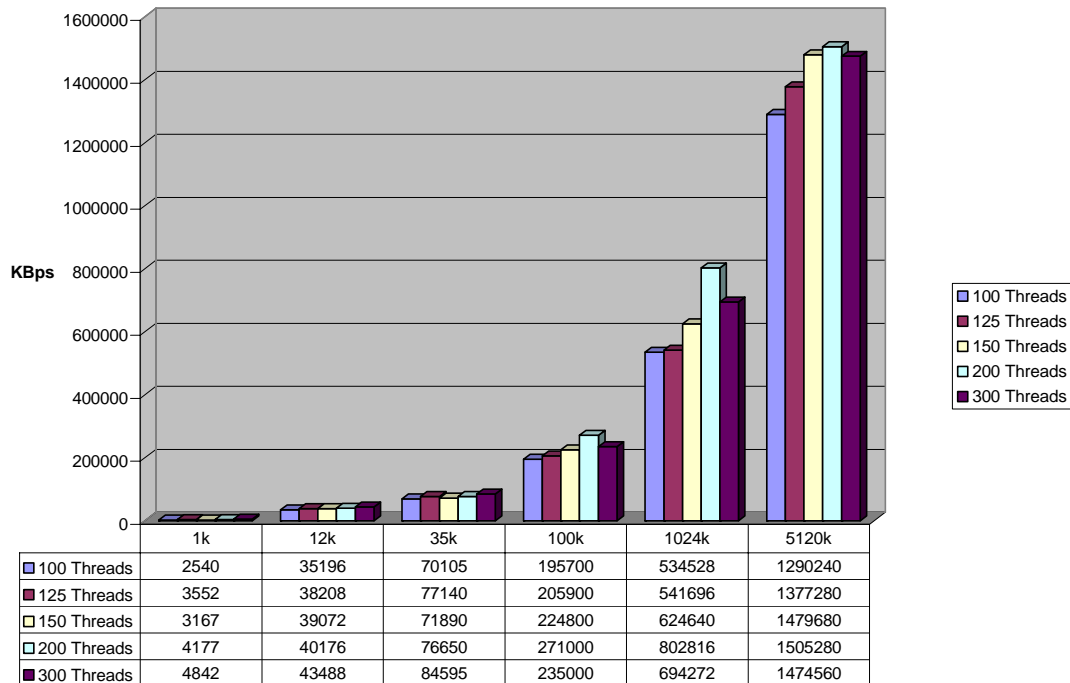
Direct writes to the same system, but with the KOMpliance in passive mode, were between 12 and 15 percent faster than writes with the KOMpliance platform delivering data management services. Since writes to an archival repository tend to be less time constrained than are writes to non-archival storage, we believe that the overhead imposed by the KOMpliance is inconsequential. Again, the performance exceeds that of other solutions we have seen in this space.

Comparisons of read tests – with the KOMpliance active and passive – are provided in the illustrations below.

KOM Read Testing - Kilobytes Per Second



Direct iSCSI Read Testing - Kilobytes Per Second



As discussed in the file read rate tests, differences in block read rates nearly disappeared as file sizes increased. Near nominal read performance was seen in larger block sizes, again suggesting that KOMpliance could be an excellent fit for media rich file archive applications.

USABILITY AND FEATURES TESTING

The KOMpliance is designed to bring archive and data management functions into an appliance format. The approach that KOM Networks used was to define data policies by file type, as designated by the file extension.

Before configuring this product, users should develop a simple data management plan by:

1. Analyze Data Requirements

- Determine what type of data your company generates.
- Determine what the data retention policies are on each data type
- Determine what the data aging parameters, how long should it be kept on primary storage, and when should it be moved to second-tier storage (or archive)
- Usage parameters (read, delete, append)
- Security parameters
- Access patterns on that type of data (should we immediately archive this type)

2. Analyze administrative issues

- How many users/departments will the device serve
- Are access/security requirements the same
- Are the same storage resources shared

3. Design Environment

- Classify storage into groups
- Organize data into categories
- Specify Migration and Lifecycle rules
- Define data protection requirements

4. Analyze Hardware Configuration

- Make a full list of hardware devices in your network you wish to include
- Categorize your hardware by device type (hard disk, removable devices, NAS)
- Define your resource pools in KOMworx from this list

The steps above will greatly simplify the implementation of the KOMpliance and enable users to begin deriving value from their investment immediately upon installation. Rules and policies initially configured in KOMworx can be changed and updated readily and refined to better fit requirements that were not identified in this pre-installation phase.

As part of step 2 above, different user profiles can be created to enable cadres of personnel with different permission levels for accessing and modifying archived content as well as administering the KOMworx software settings and policies.

MANAGEABILITY ASSESSMENT

KOMpliance management and configuration is provided via the KOMworx administration interface. We found the interface very easy to navigate and configure and believe that it should be useable with little training to any system administrator.

No significant problems were found with the interface. On-line help did not accurately describe the options and controls on the GUI in some instances, which we attributed to the pre-release nature of the software version we were using.

INTEROPERABILITY ASSESSMENT

The KOMpliance appliance is architected for interoperability – with business applications, operating systems, file systems and storage interconnects and hardware platforms. That is a key strength.

It fully supports Ethernet and IP network protocols, as well as other open storage transport protocols. Via the Windows Storage Server R2 OS, the product conforms with the CIFS, NFS, and iSCSI protocols as methods for pushing out mounts and targets.

We tested the product in a Windows client/server environment and experienced no problems with network targets presented by KOMworx. No compatibility problems should arise, since the KOMpliance appliance itself runs the Windows operating system.

A real strength of the solution provided by KOMpliance is the ability to remain platform agnostic with respect to the back end arrays used for archival storage. The product could be quickly implemented in iSCSI, Fibre Channel or SCSI attachment modalities, supporting the broadest possible range of low and high cost storage targets. Separating the intelligence of archiving from the controller of the storage array is another example of array deconstruction and a method for driving down the cost of storage generally.

MARKET CONTEXT ASSESSMENT

In our view, KOMpliance offers a practical and economical solution to companies that are confronting a need to manage data better. It enables firms to create archival repositories on the fly, simply by instrumenting production storage repositories with data management policies and designating specific storage targets as archives. This is not a full "Information Lifecycle Management" solution (no ILM solutions exist), but KOMpliance delivers a practical data management methodology that leverages all the strengths of the contemporary file system for data selection, movement, management and access.

KOM Networks has steered clear of the current trends in the storage array industry toward the implementation of data management as a function of a proprietary controller. In general, the array manufacturing industry has sought to "add value" via software on proprietary array controllers as a means to support huge mark-ups on the price of collective commodity disk drives. KOM Networks differentiates its product approach from its many disk array competitors – EMC, HDS, etc. – by choosing to add value in the form of a network based service appliance, enabling their technology to be used with any back end storage the consumer might choose to deploy.

KOM Networks has also managed to preserve the values of simplicity and elegance in the design of their solution. Unlike many competitors, they have chosen to embrace and to build upon the capabilities already extant in the operating system and file system. You will not find a special "content addressing" or "index, search and retrieve engine" in KOMworx. To their credit, KOM Networks have chosen to let the file system do its work. If the customer believes that additional indexing or searching is required to meet a specific operational or legal requirement, third party software is readily available that will work with the KOM Networks solution.

KOM Networks does enhance the security story of archived data with a robust implementation of AES-256 encryption and a SHA-256 hash algorithm that delivers non-repudiation to the files that it manages. Beyond these capabilities, the KOMworx software features its own disk WORM implementation and supports disk, optical and tape WORM capabilities offered by storage manufacturers. The company also leverages nearly 40 years of experience in data management and security to deliver a top notch software-based data shredding capability that will satisfy the most stringent data deletion policy audit.

Judicious application of KOM technology can help companies manage their data better. They can leverage the product to manage capacity on expensive production storage, to migrate stale data off primary arrays, and to maintain controls required in the current regulatory climate. KOM Networks clearly delivers business value with this product family.

KOMpliance clustering would be a logical next step in the product architecture: a fact that is clearly on the minds of the engineers at the company. However, the current line of products, ranging from appliances with integral storage to disk-less gateways , serves a broad range of needs and budgets today.

Bottom line: We believe that KOM Networks KOMpliance is a well-engineered solution to the business problem of data management.

CONCLUSION

These test results of the KOM Networks KOMpliance archive appliance and KOMworx software are certified as accurate by TPI Technologies. While useful as baseline data, they should not be substituted for performance tests conducted under actual application workload.

Our recommendations going forward are to

1. Perform comparative testing between this configuration and configurations based other compliance solutions.
2. Test the appliance with additional archive storage targets (Plasmon UDO, etc.) to demonstrate additional interoperability value.

We hope you will find this data to be useful in your product development effort.

Please forward all responses or inquiries to either of the following:

Jon William Toigo
CEO
Toigo Partners International LLC
1538 Patricia Avenue
Dunedin, FL 34698 USA

jtoigo@toigopartners.com

VOICE: 727.736-5367
FAX: 727.736-8353
MOBILE: 727.504-9311

Jeremy Evans
CEO
TPI Technologies
29296 US Highway 19 North
Suite 204
Clearwater, FL 33761 USA

jevans@tpitechnologies.com

VOICE: 727.489-9945
MOBILE: 727.463-0012