

WHITE PAPER



THE GREENING OF IT: ATRATO'S ENERGY EFFICIENT STORAGE PHILOSOPHY

by Bill Mottram
VP Marketing
Atrato, Inc.

December 2009



ATRATO[™]
ACCESS. THE REVOLUTION.[™]

www.Atrato.com



ATRATO'S ENERGY EFFICIENT STORAGE PHILOSOPHY

Why is Green Data Storage Important?

Data is growing at an unstoppable rate – storage analysts conservatively estimate the compound annual growth rate (CAGR) of data in the average Fortune 1000 enterprise at 60% to 80%. The need for capacity, and more importantly, the need for performance climb in unison with the ever increasing abundance of data. If paying for additional power was the only hurdle IT departments had to overcome, inefficient storage solutions would likely be utilized well into the future. However, power is not an infinite resource. Data centers are maxing out the power they can bring into their data centers. In fact, according to power supply vendor Liebert, 96% of data centers will not have enough power to support their growth by 2011.¹ Energy star found that 61 billion kWh of electricity were consumed in US data centers in 2006. They estimate an annual growth of 12% each year in relation to total power consumed.² If these predictions are accurate, data centers this year (2009) consumed a staggering 85.7 billion kWh. In the US the average cost per kWh is 10.4 cents (\$.104).³ These facts point to a disturbing growth trend. In 2009 the estimated total data center power costs were 8.91 billion dollars; up from an estimated 6.34 billion dollars (adjusted for inflation) in 2006.

Green is undoubtedly a pertinent issue in today's business environment. However, business decisions are always based on priority. Although the impending energy crisis is compelling, next to performance and capacity requirements green status is a nice to have, not a must have. Companies cannot afford to compromise these fundamental competencies in the name of going green. Atrato's Velocity 1000 (V1000) Series delivers undiluted value without compromise; this solution offers a clear remedy to the energy issue while significantly increasing available capacity and performance.

There are two very important aspects to every green solution. First, it is imperative to understand how green will impact the bottom line, and how it will bring value to the data center. Second, it is important to have a working understanding of how to measure green for data storage solutions. These two goals will help IT professionals make intelligent decisions on how to best use green to increase productivity, save money, and reduce management complexity.

How Atrato's Green Solutions Save Money

Power is a central theme to all Green IT. Power is a precious resource with limits to the amount that can be generated, and consumed, and brings certain ramifications for our environment. Power is not only an environmental issue in the data center; it is also an economic one. In fact, it is one of the more significant expenses in the data center and is one that is continuing to grow. This has been a somewhat silent issue in the IT community for the simple fact that these energy costs are often billed to facilities. However, for C-Level executives this is a very important area of concern. From a storage perspective the key to decreasing the enormous costs associated with power consumption is to reduce the watts of power required per terabyte TB of storage while improving the performance of the storage for each watt consumed.

The V1000: Smart Green

IT professionals have a never ending stream of business critical tasks to complete. As green is generally viewed as a marketing tactic, IT professionals often shrug off the green initiative in lieu of more immediate concerns. However, products that truly exemplify green help tackle some of the most prominent concerns that IT professionals address on a daily basis.

The Performance Play: As the wealth of high-speed data increases so does the need for storage that can handle the performance requirements. Atrato's Velocity Series delivers unparalleled performance for its price bracket. The same aspects that make the V1000 green also make it a performance powerhouse. The sheer number of disk actuators in each enclosure (spindle density) provides 16,000 random IOPS. To further enhance performance, Solid State Disk (SSD) technology can be added to boost performance to between 80,000 and 100,000 random IOPS depending on the configuration.

1. Emerson Network Power Presents Industry Survey Results That Project 96 Percent of Today's Data Centers Will Run Out of Capacity by 2011. (2006, November 16). Retrieved December 14, 2009, from Emerson Network Power: http://www.liebert.com/information_pages/NewsRelease.aspx?id=2386

2. Fact Sheet on National Data Center Energy Efficiency Information Program. (2008, March 19). Retrieved December 14, 2009 from Energy Star: http://www.energystar.gov/ia/partners/prod_development/downloads/NDCFactSheet.pdf

3. Average Retail Price of Electricity to Ultimate Customers by End-Use Sector, by State . (2009, November 13). Retrieved December 14, 2009, from Energy Information Administration: http://www.eia.doe.gov/cneaf/electricity/epm/table5_6_a.html



ATRATO'S ENERGY EFFICIENT STORAGE PHILOSOPHY

Capacity Play: Great advances have been made across the data storage industry in available capacity. However, performance enhancements (IOPS) have been slower in coming. This fact does not diminish the need for high capacity storage solutions. Atrato effectively delivers a higher capacity storage solution in 1/5 the rack space. A standard 3U enclosure holds sixteen drives, which can provide up to 32TBs of storage using two terabyte drives. The dense Atrato Velocity1000 enclosure provides 80TBs using 160, 2 ½" 500GB drives in a 3U form factor. As noted earlier Atrato's V1000 series provides this high density solution while delivering industry leading data access performance.

Autonomic Management: The best green data storage solutions are predicated on making better, faster, smarter technologies that consume less power and space while improving performance and manageability. This is especially applicable in tiered storage environments. Atrato's VxSSD upgrade with ApplicationSmart™ software lends manageability to tiered storage environments. This system can automatically tier data according to access patterns; replicating highly accessed data to solid state, and over writing data that is accessed less often. This approach takes the guesswork out of storage management, and optimizes the tiered storage environment to control costs and stay green. Atrato's ApplicationSmart approach to data tiering extends SSD drive life by minimizing the required number of writes. This approach maximizes investment protection and reduces wasteful and expensive product upgrades.

Measuring Green: A Guide to Important Metrics and Green Data Center Strategy

Green data storage has outgrown its position in the hype cycle to become a viable solution that is implementation ready. As green becomes a perceptible driver in data center design, solid metrics to empirically determine the percent of green improvement are necessary. One organization attempting to tackle the challenge of measuring green is the Storage Networking Industry Association (SNIA). SNIA released its initial GSI (Green Storage Initiative) Green Storage Power Measurement Specification for public review and comment in January 2009. This initiative is designed to help organizations measure the energy consumption and efficiency of storage systems. SNIA is still in process of solidifying the specification.

Without a solid set of metrics, many customers and vendors are left to their own devices in terms of assessing green benefits. Atrato takes the stance that green is directly proportional to energy consumed. Two key factors dictate the energy consumption of storage solutions: performance and capacity. After all, tape is likely the greenest solution of all, but its limitations in terms of accessibility make it all but useless in high performance environments. To help the industry wade through the "greenwash" Atrato has adopted some simple metrics that can be used to determine the green value of storage solutions. These metrics are a useful product comparison tool, and will provide an idea of the green and monetary benefits one can reach with a given solution.

The Atrato Philosophy on Measurement

Measurement of green value is a relative subject that encompasses a great deal of gray area. Atrato takes the straightforward approach. We define a product as green when it provides significantly lower power consumption per work performed, while maintaining a low footprint. These benefits must be provided without impacting cost. That is to say **no overbuying**.

Measurement Based on Work Performed: This approach shows how much energy is used to perform required reads/writes for a given workload at a performance and capacity level that meets or exceeds customer requirements.

Measurement Based on Physical Footprint: This approach measures the space required for the level of performance and storage capacity. Physical footprint is easily overlooked when considering green solutions. Data centers are running out of room and power in light of the accelerating data sprawl. Compact, energy efficient solutions address this impending crisis. Real-estate is costly, especially for those who have to relocate their data center to a larger facility because available space and power have been tapped out. The amount of required floor space for the storage solution should be factored into the overall cost.

Key Performance and Capacity Metrics

A few key metrics can provide customers with an understanding of how their storage solutions are performing today. A quick energy audit will determine how much energy is required to power the data center, and estimate how much energy can be saved with a truly green solution such as Atrato's V1000.

Btu's per Hour (Btu/h): IOPS per Btu gauges the amount of computation that can be delivered for every Btu hour of cooling. Most storage solutions produce less than one IOP per Btu. Atrato's V1000 can improve this number by as much as 60-70%. The common axiom "A watt in is a watt out" aptly describes the cooling situation in data centers. For every watt of power consumed by data storage solutions an equivalent watt is required to mitigate the heat generated by that watt of power consumed in order to keep the data center at an acceptable temperature. This inseparable link between power and cooling costs makes utilizing energy efficient storage twice as important. Because of the mutually bound nature of power and cooling, all wattage numbers represented will include cooling Btu's (conversion note: for every 1 Btu there is .2931 watts).

IOPS per Watt (IOPS/w): This metric displays performance based on actual reads and writes required to complete the operation per watt of power consumed by the storage solution. Understanding the power to performance ratio is important. A higher ratio of IOPS/Watt of power consumed equates to a more efficient and green storage solution. The ratio is a straight forward calculation that provides one key piece of the green answer; the efficiency of a storage solution in regards to performance. However, this metric alone can be misleading. The majority of the storage vendors provide performance or capacity options when it comes to selecting storage.

Performance Solution: For customers requiring high performance levels, one can choose between Fibre Channel or SAS drives that provide the fastest access to data at the expense of capacity. Performance type drives in standard enclosures can supply between 2 and 3 IOPS/Watt. These drives will provide higher IOPS/Watt, but falter in other metrics.

Capacity Solution: On the opposite end of the spectrum is the capacity option where SATA drives provide the lowest IOPS/Watt, but score higher in some of the other metrics. Capacity type drives in a standard enclosure can supply between 1 and 1.5 IOPS/Watt. This difference is directly related to the speed that the disks can spin.

No Compromise: The Atrato V1000 with its dense packaging can provide over 6 IOPS/Watt, a 50 to 80% increase.

Watts per Terabyte: Equally important as the power/performance play is the amount of power required to store the data on spinning media. This will help provide a clearer picture of how efficient the storage is without relying on a snapshot of a single metric. Watts per terabyte provides the amount of power in watts it takes to store the data. The goal is to obtain the lowest wattage possible per terabyte of storage.

Performance Solution: When looking at the performance drives, i.e. the FC and SAS drives, the wattage per terabyte increases due to the drives lower capacity. FC and SAS drives have a current capacity level of 450GBs. Performance type drives will consume upwards of 150 watts per terabyte.



ATRATO'S ENERGY EFFICIENT STORAGE PHILOSOPHY

Capacity Solutions: Capacity solutions utilizing SATA II drives store up to 2 terabytes of data, an impressive wattage per terabyte. Capacity type drives will provide higher watts per terabyte as their capacities are higher than the performance type drive. Capacity type drives in standard enclosures will consume between 58 and 100 watts per terabyte.

No Compromise: The V1000 is as much as 6-10X as dense as competitive solutions, and occupies just 1/5 the rack space. With just over 31 watts per terabyte Atrato's density is competitive. This results in power savings of 45% to upwards of 80%.

All of these measurements are valuable, but understanding and interpreting them in the context of specific data center needs is more important. Atrato provides a solution for data centers that needs to remain nimble. With the V1000 there is no need to choose between the benefits of performance and capacity as the Atrato V1000 is built to work without compromising either.

Space Efficiency

When looking at green features it is important to take into account the actual space the storage requires. Cutting down on the required floor space is a key component for green storage. Compact solutions allow data centers to maximize their current available floor space and avoid costly relocation or data center renovation due to growth requirements. To best utilize floor space, IOPS per rack unit (IOPS/RU) will demonstrate the efficiency of the storage in regards to the amount of space consumed. Terabytes per rack unit (TBs/RU) will demonstrate the effectiveness of the capacity requirements in regards to the space consumed.

IOPS/RU: The best way to utilize the available square footage for data storage is to meet performance level requirements in as little floor space as possible. IOPS/RU will demonstrate the actual performance available from the storage on a rack unit for rack unit basis. Since rack units are a set standard size, this makes comparing performance at this level fairly simple. This will provide an indication as to the efficiency of the storage in regards to the space used.

Performance Solution: A standard 3U disk enclosure containing fifteen performance type disk drives produces approximately 2,500 random IOPS. Dividing the IOPS by the rack units results in an average of 834 IOPS/RU.

Capacity Solution: The capacity type drives provide lower performance at about 1,200 random IOPS in a 3U enclosure; equating to approximately 400 IOPS/RU.

No Compromise: Atrato's density allows for 10-13X more storage for each individual enclosure and an overall rack space reduction of 5 times compared to other traditional storage solutions. The Atrato V1000 can provide 16,000 IOPS in a standard 3U disk enclosure. Taking into account the controller, this comes out to be 3,200 IOPS/RU. This is a 4X improvement in performance per rack unit.

TBs/RU: Maintaining required capacity is a main concern when data centers are required to consolidate space. Data is growing at an alarming rate, and is causing many data centers to run out of floor space. TBs/RU will provide information on how effectively the floor space is being used. This measurement is purely capacity driven, and does not in any way represent a customer's need for performance. Be that as it may, it is still a useful tool for estimating the amount of storage possible for a given space.

Performance Solution: Using a performance type drive with a maximum capacity of 450GBs would result in a 2.25TB/RU.

Capacity Solution: The majority of the capacity drives in the field today are 1TB or 1.5TB. Two terabyte drives are becoming available as well. Using a standard 3U, 15 drive enclosure, the maximum capacity could possibly reach 30 terabytes. This provides 10TBs/RU.

ATRATO'S ENERGY EFFICIENT STORAGE PHILOSOPHY

No Compromise: The Atrato V1000 provides 16TBs/RU which results in a 35% gain in comparison to capacity solutions and up to an 80% gain in comparison to performance solutions. It also saves companies significant dollars in real-estate costs given the average US data center floor space costs are approximately \$250 per square foot.

Behind the Numbers

As the above numbers illustrate, there are multiple ways for vendors to argue that their products are green. Both performance and capacity solutions exhibit green attributes depending on the measurement. Performance type storage systems do very well in the IOPS/Watt, and IOPS/RU categories, but struggle in the Watts/TB and TBs/RU categories. In contrast, the categories where capacity systems shine are the Watts/TB and TBs/RU categories. However, they struggle in the IOPS/Watt and IOPS/RU categories. With either solution the customer loses an important green attribute.

Bottom Line

The V1000 is the no compromise solution that allows data centers to have both performance and capacity without losing meaningful green benefits. Using the numbers detailed above, the Atrato V1000 provides the best IOPS/Watt (6 vs. 3) and the best Watts/TB (31 vs. 58). When considering floor space efficiency, Atrato's V1000 provides the highest IOPS/RU (3200 vs. 834) and the highest TBs/RU (16 vs. 10).

While other storage vendors force their customers to choose between two data center requirements, the Atrato V1000 provides performance, density and capacity in the same product. The Velocity Series offers green cost savings in power, cooling, and physical footprint while delivering unequalled performance and capacity advantages with innovative software providing ease of management.

