the green grid™

ENERGY STAR® for Data Center Storage Draft 2 – The Green Grid Response

The Green Grid, a consortium of industry-leading companies, welcomes the opportunity to comment on topics under consideration for the ENERGY STAR® for Data Center Storage specification.

Introduction

A consortium of information technology providers, consumers, and other stakeholders, The Green Grid seeks to improve the energy efficiency of data centers around the globe. The association takes a holistic and comprehensive approach to data center efficiency. The Green Grid membership includes many of the global leaders in the Data Center Storage market, and we appreciate the opportunity to comment on this Draft Specification. We look forward to continuing to work with the ENERGY STAR® Program to bring Version 1 to fruition in a timely manner.

General Comments

The Green Grid recognizes that Draft 2 represents a step forward in the process of developing the ENERGY STAR for Data Center Storage specification. There are positive changes in this draft, and a significant number of open questions yet to be addressed. We look forward to working with the ENERGY STAR Program team to jointly develop solutions to the challenges discussed below.

TGG requests that, in future drafts, external specifications used for reference be identified by version and/or date stamp, so that there is no ambiguity in identifying specific definitions and characteristics as the individual documents in question evolve. In a similar manner, whenever particular formulas or values are required for qualification purposes, they should be presented directly in this specification, rather than by reference. Again, this should serve to eliminate any potential confusion about specific values or calculations, allowing clearer communication amongst all parties, including the ENERGY STAR Program, its partners, the ABs and CBs, test labs, and purchasers of Data Center Storage equipment.

Specific Remarks

1. TGG commends the ENERGY STAR Program on the narrowing of product scope to Online 2, Online 3 and Online 4. We believe this focuses Version 1 of the spec on the high-volume portion of the market. There are a few additional scoping items worthy of discussion. Where there was no consensus among our members, the individual companies will provide detailed feedback on their positions.
   a. Given how far along we are in the spec development process, we recommend that Blade Storage products be defined as out of scope in Version 1
   b. To date, all products included in data collection and other analytic exercises have been examples of "scale up" architectures. TGG believes that there are performance as well as structural and functional differences between scale up and scale out systems, that will require them to be assessed differently and which also require them to be compared by architecture to assure fairness and meet customer needs. As a result, many of our members recommend that Version 1 exclude scale out products from its scope. We will provide specific definitions for scale up and scale out architectures for inclusion in the specification.
   c. There continues to be a lack of consensus in the industry as to an appropriate active power performance metric for file-addressed storage. Since this data

cannot be collected as part of the data submission, many of our members recommend that NAS/Filer products be out of scope for Version 1.

    d. Object-addressed storage is also found in the Online category of storage. Again, there are no accepted performance/power metrics for this type of storage, so inclusion in Version 1 is seen as inappropriate by many TGG members. We will be providing a definition of this type of storage to aid in clarification.

2. Power supplies are a significant area of focus within the spec, and TGG would like to offer the following comments:

    a. We recommend the use of the 80+ standard for assessing power supply efficiency. We believe this best reflects the loading and other characteristics of the supplies in our products. This recommendation may also be offered by other stakeholders as well.

    b. If the specification continues to use the CSCI rating system, TGG recommends that the 10% load point be removed from the PSU requirements. The characteristics of the power load created by storage systems make it highly unlikely that the power loads will drop below 20%. Assuming redundant power supplies, the controller uses 10% of the system power, and that a typical system will have at least 30-40% of the disk drawers populated, the redundant supply will be running at 20% load. Where the disk drives and controllers are powered by separate power supplies, it is still expected that power supplies will operate at 20% of load or higher. Unlike servers, the configuration of storage controllers are relatively fixed making the power use fairly constant over a range of system configurations (dictated by the number of storage media used). Because of the need to be ready to respond to system demands and ongoing maintenance tasks, power management capabilities are typically not present on storage controllers (see the power management discussion). So a power supply will be sized closer to the demand of the controller and load is unlikely to be less than the 20% load point. For disk drives, it is expected that 30-40% of the available slots will be populated (in order to not underutilize the system investment) placing the minimum load near 20%.

    c. TGG urges the ENERGY STAR program to focus its power supply requirements on those supplies used to power controllers and/or drives and enclosures. The ancillary equipment embedded in a system for management, monitoring, service or connectivity/communications represents a small portion of the power draw, and imposing further standards on these items is unlikely to have a meaningful impact on system-level energy efficiency, while it could have unintended side effects on system performance and functionality.

3. The Green Grid has two recommendations in the area of Product Family definitions

    a. First, we continue to have concerns about the concept of Bookending. The logistical challenges of this approach, both in terms of equipment and test cycle implications, as well as the difficulties in extrapolating to heterogeneous disk populations, make this a challenging proposal, particularly if the scope expands beyond Online 4 storage. In its place we recommend the use of an approach that demonstrates and leverages the scalability of modular architectures to develop a power envelope. Multiple alternatives have been proposed, and are outlined in Appendix 1. TGG believes this area is rich with possibilities for solutions that meet customer and ENERGY STAR Program needs for clear

communication about energy choices, while using an approach that is
manageable and time efficient for manufacturers. We look forward to the
opportunity work with you to further develop these options into an approach
that is suitable for the ENERGY STAR Program.

    b. We recommend consideration of the features below to identify family
characteristics and define "adders"

        i. Hardware features

            1. Number and type of front-end connection options

            2. Number and type of back-end connection options

            3. Cache size and type

            4. Hardware RAS features

        ii. Software features

            1. RAS features

            2. Management features

            1. Capacity optimization features

4. We have some concerns about the specification's approach to Capacity Optimization
and Energy Efficiency features, and look forward to helping develop appropriate
approaches to addressing these.

    a. The products in scope for this version offer the market a broad span of product
features, and the SNIA definition of these products also reflects a significant
range of capabilities. It is imperative that if Online 2 and Online 3 are to be
included, that the requirements of qualification reflect and respect the
characteristics and market positioning of these products, understanding that
some features may have cost implications that price products out of their
markets.

    b. There are also challenges with respect to Online 3 and Online 4 products in the
required features. Most of the features in the Capacity Optimization category
are offered as value-added, add-on capabilities. As such, requiring that one or
more of them ship as pre-installed and pre-enabled can have implications for
manufacturers' business models. Ideally, EPA should require manufacturers to
list the available Energy Efficiency Features on the PPDS. If EPA wishes to make
the availability of the features a requirement, the requirement should be that at
least one feature must be available for an ENERGY STAR storage system. It
should not be required to be enabled.

    c. There is a tendency with respect to these capabilities and others for the
specification to become very prescriptive. The Green Grid urges the ENERGY
STAR Program to consider ways to specify the types of capability required
without limiting it to a specific set of features, encouraging and recognizing
ongoing innovation in this space.

5. In the area of reporting requirements, it is important for the ENERGY STAR Program to
recognize one of the inherent differences between servers and storage. Unlike
processor chip sets, there is no functional activity change required if voltage or
temperature variations occur. As a result, there is no equivalent to the chip set
reporting functions. This means that some add-in or design-in methods must be
deployed. These are long lead-time design changes for both hardware and software
that have incremental cost impacts. These impacts will be particularly challenging for
Online 2 and Online 3 products, where fundamental infrastructure costs represent a

significant portion of product cost as seen by the purchaser. These capabilities are not currently common in the marketplace, and while external equipment can be applied to solve all or part of the equipment, this equipment may be equivalent to the cost of the storage system itself in the case of Online 2 offerings.

6. Many members of The Green Grid believe that it is premature to publicly disclose attributed data submissions for the active performance/power metrics. Individual companies will address their concerns on this topic in their corporate responses.

Concluding Thoughts

Data Center storage is a complex product space with many highly configurable characteristics. The Green Grid sees Draft 2 as moving the process of Specification development forward in some positive directions. At the same time, there are several critical areas where collaboration between industry and the program will be quite productive in driving the process closer to conclusion. We look forward to working with you closely to resolve some of these issues for the next Draft.

Appendix 1

<u>**PROPOSAL 1**</u>
Storage media qualification
Qualify the individual storage media separately and perform a system level qualification on the storage system populated with qualified drive types:

1. Require qualification of storage media by device type: SSD, and high and low capacity and rpm drives (by rpm/capacity combination). As drives represent 70-90% of a storage system's power use, qualifying the drives makes sense. It also removes the need to test each drive type on a system – each drive can be tested and qualified in a single test which should take a minimal amount of time. These tests can be done once and applied many times.

2. Because storage media have been tested and qualified, the storage system testing can be simplified. This proposal would have a manufacturer test and qualify its optimum configuration of a system (the sweet spot), with their chosen mix of ENERGY STAR® qualified drive types. If the sweet spot system qualifies, then the storage system is qualified for ENERGY STAR with any mix of ENERGY STAR qualified storage media.

This approach offers several benefits to the ENERGY STAR program:

1. It removes the complications presented by the almost limitless permutation of drive combinations that could be qualified under an ENERGY STAR test procedure by qualifying the individual drives. Testing of individual drives, which are used by multiple manufacturers and systems simplifies the qualification process.

2. By allowing a manufacturer to test his optimized system with the appropriate mix of qualified storage media, the ENERGY STAR program qualifies the real world system that customers purchase and which allows a manufacturer to display the benefits of the full capabilities of its controller system.

3. By qualifying all configurations as long as ENERGY STAR qualified drives, you minimize the distortion introduced by the ability to buy a minimum configuration and populate it with your desired drive types. While this approach does not eliminate that eventuality, it minimizes its attractiveness and utility for customers.

The development of an agreed method of testing drives outside of a system setting must still be developed and agreed by the EPA and the industry.

<u>**PROPOSAL 2**</u>
Disk scaling approach
Replace bookends by a methodology that recognizes the near-linear scaling of incremental disk enclosures/drawers in modular scale-out storage architectures. Under this method, manufacturers would provide 2 test data points for each type of target storage media. The first test point would be the product's controller(s) as intended to be configured for the idle test datapoint along with a single full enclosure. The second test point would be the same controller configuration with sufficient full drawers to drive the controller burden to <5% per drawer. A method of supporting mixed drive types in a single drawer, or multiple shelves of different drive types would make this form of testing even more productive for both customers and manufacturers.

Comment [jmd1]: Is there a procedure for drive testing or does it need to be developed.

There remain open questions on how many different drive types must be reported, and on how to most simply use this information to produce an appropriate figure of merit.

In modular architectures that have separate power supplies for controllers versus disk enclosures (also called shelves and/or drawers), the burden of the controller power draw will be amortized over the drive shelves. This is also true of Online 3 products where some drives are enclosed with the controllers, and capacity expansion occurs with additional shelves.

This amortization can be seen to drive to an asymptotically small burden in relatively few drawers for Online 3 and Online 4 systems (in as few as 2-3 disk enclosures for any given drive type).