INTRODUCTION

EMC Corporation is a global leader in enabling businesses and service providers to transform their operations and deliver IT as a service. Cloud computing is fundamental to this transformation, and EMC accelerates the journey to cloud computing through our innovative products and services. EMC Corporation appreciates the opportunity to respond to the Final Draft of Version 1.0 of the ENERGY STAR® Program Data Center Storage Specification, issued June 20, 2013. We are committed to acting in a socially and environmentally responsible manner and to being an attentive and thoughtful neighbor in our local and global communities. The development of an effective specification for these storage products will be an important component in achieving our shared goal of improving the energy efficiency of cloud infrastructure and data centers.

The improved structure and organization of the Final Draft makes the specification more user-friendly and improves access to the ENERGY STAR Program for Data Center Storage for those who have not been involved previously. This draft responds to several concerns and issues raised in Draft 4, resulting in significant improvements. There are still some items that we would like to see modified, as we consider them to be important to the ultimate success of the program. Even so, they all seem to be manageable in the time remaining prior to publication of Version 1.0

EMC remains committed to the success of these efforts and we would like to follow up with you on the items we identify below.

RECOMMENDATIONS AND DISCUSSION

Several changes in the Final Draft contribute very positively to the needed resolution of areas that have seen lengthy discussions and multiple competing approaches. EMC appreciates these solutions:

- The agreement that Data Center Storage products will not be required to participate in a Verification Testing program recognizes the significant complexity of both the products and the manner in which they are ordered and manufactured.
- The overall revision and simplification of the device substitution rules has made qualification of product families more efficient. It has also allowed the specification to operate in an environment where incremental change to configuration elements such as disk drives can flex as the technology evolves. This allows purchasers to gain the advantage of incremental efficiency improvements without the delay that would result from qualified product families having to be retested.
- The use of flexible as well as fixed bounds for qualified configurations improves everyone's opportunity to expand the available range of storage configurations recognized as being energy and performance efficient, while allowing manufacturers to minimize their testing approaches.
- The simplification resulting from the removal of the rolling average for input power will eliminate a source of confusion that potential customers might have encountered when comparing systems from the QPL.

In addition, EMC recognizes the benefits of the following changes, although in some cases we may offer additional suggestions:

- Use of the terms “scale-up” and “scale-out” to replace centralized and distributed controller (lines 311, 315)
- The introduction of the term “Advanced Data Recovery Capability” (line 368)
- The restructuring of the Testing Requirements (Sections 3.5.3-3.5.5)

During the July Webinar the EPA team offered several clarifying comments. It is important that these clarifications be embodied in the specification::

- Discussions addressed the ENERGY STAR status of bundled ancillary devices. It would be helpful if the documents that define how such devices are handled were included as references in this specification. Many stakeholders in this product space, particularly CBs and Test Labs, are new to the ENERGY STAR program, and may not know where to locate this background material.
- It was evident during the Webinar that there is substantial confusion amongst all parties as to what is intended by the Sequential I/O weighting in Table 6 (line 499). While it is clearly intended to refer to the value listed for the performance/watt data entries, it is not clear how or whether the EPA intended to apply this weighting to the spindle counts that result for the optimal and boundary configuration points. The EPA Program Team committed to address this question very quickly, but a response has not been provided prior to the comment deadline. EMC recommends that the device count for the optimum configuration be set by the Sequential Read configuration, since writing will play such a small part in the actual workload.
- In discussing the Data Elements (line 722), a statement was made about the, “…discretion of the user.” What did this mean? We would appreciate clarification as to what was meant by this.
- The Program team is also still looking for but not requiring a rolling average, as indicated by the text box and mentioned during the webinar. Since text boxes are not included in the published specification, we suggest that this information be included in the text, along with the need to provide the time period and sampling rate used (line 764).

There are several additional areas where we continue to have some questions and concerns. We believe it would be helpful if the specification was amended to minimize the opportunities for misunderstanding between the program, CBs and manufacturers:

- In 1.I.6 the wording on device allocations percentages should acknowledge that when rounding, the ratios can only be maintained a closely as possible, rather than precisely. The wording in 1.I.7.ii serves as an appropriate example.
- In 3.5.3.iii, it would be more appropriate to say that a manufacturer may determine to *submit* rather than test a Fixed Size, Flexible Size, or Mixed Qualification Range.
- In testing a Flexible Qualification Range, the EPA should recognize that a manufacturer may find that the actual bounds of the ±15% qualification band may in fact lie between the 20% fixed device count allowance and the 40% test point (or between the 5% and 15% points). In those cases, the Flexible submission process should accept which ever point less than -20% or greater than +5% can be demonstrated to comply. This would apply to both 3.5.3.iv(b) and 3.5.3.iv(c).
- The recommendations in the point above should also apply to systems where modeled data is part of the submissions.

The specifics of data publication continue to generate questions that warrant further discussion prior to publication of the specification EMC looks forward to exploring these concerns with the EPA in greater depth:

- EMC appreciates the fact that a major benefit of the ENERGY STAR data publication process is the education of the potential customers. We believe that this would be best served by ensuring that the data being displayed provided consistent, well-vetted results. To that end, we continue to request that the EPA consider a process of reviewing initial submissions with an industry body to ensure that the data about to be published serves this purpose. This review period could cover the first several months of submissions, with the data being anonymized by either the CBs or an industry organization. There has been no body of this data representing a significant number of systems or vendors assembled thus far, which means that neither the EPA nor industry can predict the comparability of the data being published.
- The list of required data in 3.5.7.ii appears to be appropriate for each test configuration. Is it the EPA's intention that the items in 3.5.7.ii-v be reported and published for each tested configuration in a family? Several of the items (e, f, g) may vary with the actual configuration under test, as different device types may require different drawer types. As listed, it will be difficult to match the components of any single data set.
- In the list of information required to fulfill 3.5.7.iii, it is unclear what is being requested. When qualifying a family, maximum and minimum test points, not configurations, are required in addition to the optimal configuration for a single device type. The actual minimum and maximum configurations that are qualified will likely be a blend of device types and counts across the reported data set. The language concerning this reporting and publication is not clear and in the absence of sample data entry information, it is difficult to determine what is being requested.
- A further clarification in 3.5.7.iii is required regarding power consumption and performance data. It has been expected that performance per watt would be published, as indicated in the SNIA Emerald protocol, and not absolute performance and absolute power disclosures. A change of this magnitude requires further discussion with stakeholders.
- In 3.5.7.v, the Program asks for "selected data from the ASHRAE Thermal Report", but no details exist in any of the Program documents concerning this report. Since the Test Method clearly requires operation in controlled temperature and humidity ranges, as does the Emerald test specification, these should be the only data of this nature required or displayed.

Section 3.6.2 contains some very specific details that raise obstacles to implementation of the specification:

- System manufacturers cannot provide the EPA with a copy of the specific, proprietary data sheet they receive from their device vendors. Those documents are created under a mutual non-disclosure agreement, and may not be shared with a third party who cannot be held accountable to the obligations of such a legal agreement. As a result, there are two alternatives that can be used to address the requirements of this section. The first is for the CB to review the custom data sheet and attest during data submission that the drive conforms to the rules in 3.6.2. The alternate approach is for the system manufacturer to provide a link to, or copy of, the device vendor's generic data sheet that is available on that vendor's web site.
- Transfer speed is still listed as a variable that must not change (line 679) even though the Sustained Transfer Rate has been given flexibility (line 692-3). These two items would appear to be in contradiction. Note that a change to transfer speed from the disk to its interface may make no difference to the actual data transfer rate, as that is likely to be capped by device and bus interfaces.

In order to provide consistency with other examples and the rest of the specification, EMC recommends the following changes:

- Add (c) This number may be rounded up to the nearest drawer boundary (line 240).
- Add (c) This number may be rounded down to the nearest drawer boundary (line 249).
- In the discussion of mixed device configurations, the text should refer to Section 7 not 6 (line 298)
- Change "Distributed Controller Storage Product," to "Scale-Out Storage Product" (line 616).
- The sampling rate for input power measurements should be corrected to indicate the number of readings per 10 second interval; the number value is missing (line 743).
- Timestamping should be noted as optional (line 747).
- The remaining reference to the PPDS should be updated (line 762).
- Temperature reporting should be noted as optional (line 763).
- All references to other specifications should be updated to reflect the appropriate revision.
- The ENERGY STAR for Computer Servers specification should be referenced for revision (line 81).

In looking ahead to possible Version 2.0 content, EMC encourages the Program to focus its investigations on two fronts.

- First, with respect to scope, we strongly urge the use of market data, both with respect to the number of options that exist in the market (which would be reduced as a result of setting performance thresholds) and the overall volume of sales in particular new market segments under consideration. While many product areas could fall into an expanded scope, the emphasis should be on those segments that would actually generate notable savings when aggregated and where the incremental costs of improved efficiencies are outweighed by the incremental savings within the useful life of the products.
- Our second recommendation is to avoid selecting specific technology solutions, and instead identify areas of study that might yield effective savings without impairing the functional end-user requirements of products in performance, RAS, useable scalability, or other aspects important to data center operations.

COMMENTS ON FINAL DRAFT TEST METHOD

EMC recommends that Tables 1 and 2 include entries for 200V as Optional Japanese Supply Voltage. Similarly, we recommend that a 200V entry be added to Table 3. Finally, we would like to carry forward our recommendation on citing and/or updating reference specification revisions to this document as well as to the Specification itself.

While the Specification itself no longer directly addresses the question of how converged or unified systems (those containing Block and NAS functions) are to be tested, the Test Method does mention some members of this class of product in 5.1.C (Section 1.I6.vi addresses allocation of Block devices on NAS systems). The approach used here addresses only those products that are marketed primarily as Networked Attached Storage products and also offer a Block I/O option. Many unified or converged products are actually marketed primarily as Block I/O systems to which NAS features can be added. The Specification leaves it very unclear under which circumstances one of these systems can be listed and sold as a qualified product. May it be sold as either Block or Unified if tested with minimal NAS

enabled? Must it be tested this way to be sold as qualified in a Converged configuration? This should be addressed in the Specification itself to eliminate confusion among all parties to the Program.

CONCLUSION

EMC congratulates the EPA on the level of completeness demonstrated in the Final Draft. A great deal of progress has been made since Draft 4. We believe that there are still some significant changes that are required to ensure the success of the ENERGY STAR for Data Center Storage program. Given the impending deadline for final publication, we would appreciate the opportunity to discuss our recommendations with you as quickly as possible.