the green grid™

ENERGY STAR® for Large Networking Equipment Version 1.0
Feedback and Recommendations (July 2013)

The Green Grid Association, a consortium of industry-leading companies, welcomes the opportunity to comment on topics under consideration for the ENERGY STAR for Large Network Equipment specification.

Introduction

As 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 and understands that developing the ENERGY STAR® for Large Network Equipment Version 1.0 represents a significant challenge, one which requires cooperation among a wide range of industry principals. Participants in The Green Grid include such diverse companies as major data center networking equipment manufacturers, server and storage equipment manufacturers, major software providers, and large data center end users/owners.

Summary

The Green Grid appreciates the EPA's investigations and considerations of comments from some industry members during the early stages of the project. The Green Grid is providing comments on the Framework Specification, the Test Method and some of the issues raised in the Discussion Document. Some of these comments may be similar to individual responses provided to the EPA by member companies, but represent the consensus opinion of the Green Grid participants in the process.

The Green Grid is dedicated to improving the energy efficiency of data centers and recognizes the importance of large networking equipment to this efficiency. The Green Grid has a body of work covering all aspects of data center efficiency including components and interactions at the broader system level. The Green Grid is concerned that the Energy Star program for Large Network Equipment should have a beneficial effect on the energy efficiency of data centers; however there is a real possibility that some approaches that minimize the energy consumption of single systems may adversely affect the efficiency of the data center as a whole.

The Green Grid offers its assistance and technical expertise to develop and refine the first version of this specification. We hope these comments and recommendations will aid in the management of an effective and timely program. If you or stakeholders have questions, please feel free to contact Hugh Barrass or Henry M. Wong.

General Comments on the Program

Overall

For a data center, the productivity depends on the performance of the computing equipment that is performing its primary data processing functions. The data center may be considered efficient if it can perform its primary function effectively while using a reasonable minimum of energy to do so. This energy is used by the computing equipment as well as infrastructure and other equipment (such as networking) that supports the operation of the primary function. In some cases, deficiencies of support equipment may detract from the performance of the primary function and this can be detrimental to the efficiency of the data center.

For example, if the data center network suffers from bottlenecks due to insufficient bandwidth, some of the compute servers will be forced to wait for data and will therefore have to spend more time in high power states to perform their primary functions. In this situation, the networking equipment, that comprises a small part of the data center energy footprint, causes an increase in energy usage for the compute equipment that consumes the majority of energy for the facility. Clearly, minimizing the energy usage of the networking equipment at the expense of performance that limits the effectiveness of the overall data center is a false economy. The primary goal for the network design should be for the network to adequately support the primary function, while minimizing the energy consumption of the wider systems ecosystem.

Similarly for enterprise networks, the total energy consumption of client devices will be much higher than that of networking equipment or network infrastructure equipment (such as compute servers or networked storage devices). Therefore, attempted optimizations of energy consumption for such shared resource equipment should not compromise the overall function at the risk of increasing the overall energy consumption of the operation. Furthermore, analysis reviewed by our members has shown that edge networking devices account for (approximately) 80% of the energy consumption of the network, with aggregation and core devices only accounting for 20% of the energy footprint.

The Green Grid takes a holistic view of energy consumption and therefore urges EPA to take a similar view and develop program requirements for Large Networking Equipment that do not risk false optimizations of specific components at the expense of system-wide efficiency. The Green Grid particularly recommends that energy conserving modes which include reduced functionality or sleep should be avoided for devices that serve many endpoints as they may result in widespread performance problems that can also lead to increased overall energy consumption.

For data center networks and for enterprise networks, the design of the network (and therefore the selection of network equipment) is generally performed by experts who will assess the needs of the application and select appropriate equipment to meet those needs. Experts who are evaluating such candidate networking components are able to compare energy efficiency data for those components as a factor in the design decision as long as standard metrics are available. The Green Grid supports the availability of such metrics and has published recommendations for energy efficiency assessment based on the ATIS TEER metrics in the white paper: [Energy Efficiency Guide For Networking Devices](). The Green Grid does not support setting arbitrary performance level requirements based on those metrics as they will lead to false optimizations as described above. Comparisons should always be made between devices that are fit for function and not between dissimilar devices. It would be impractical to create a sufficient number of categories to ensure that all comparisons are valid. Networking systems are available with varying numbers and speeds of downlink ports; varying numbers and speeds of uplink ports; varying complexity of functionality for switching and routing; and varying complexity of

functionality for other packet processing. All of these dimensions are independently variable and could be used as classifying characteristics. Furthermore there are newer technologies (such as converged networking and software defined networking) that simultaneously create new categories and gray the distinctions between categories. A network designer should be encouraged to select multiple candidate networking devices that are appropriate for a purpose and choose between those candidates for optimal energy efficiency.

Detailed Comments by Section

Framework Document: Eligible Product Categories
c) Market Segments

> < EPA is proposing to exclude security appliances> The Green Grid agrees that security appliances should be excluded as there are no widely accepted methods to assess energy efficiency of these devices. There is some need for clarification regarding the breadth of this exclusion; in particular, it should be stated whether VPN servers are considered to be security devices. Additionally, there are some other classes of large networking equipment that are lacking definitive methods for energy consumption testing and therefore should be excluded from this version. The Green Grid recommends that network caching and load balancing devices should be excluded in a similar manner to security appliances.

Framework Document: Energy Efficiency Criteria and Test Procedures
d) Requirements EPA is considering for the Version 1.0 LNE specification:

> < Minimum power supply efficiency > The Green Grid agrees that power supply efficiency should be considered as an energy efficiency criterion, particularly for networking systems that support Power over Ethernet. Power supply efficiency should be assessed using a widely accepted measurement methodology such as 80-Plus.

> < Active State and possibly Idle State power levels > The Green Grid considers that efficiency criteria based simply on power levels will create problems for many networking devices that perform different levels of function or that operate at different points in a network. This is particularly the case for data center networks, where deficiencies in network performance may lead to increased energy usage for connected equipment. Even where there is an account for the performance level of the device, there are many different types of functionality that can render comparisons between unlike devices meaningless. Furthermore, the changing landscape of networking functions (such as Data Center Bridging or Software Defined Networking) can make categorization extremely difficult. The philosophy behind the development of the ATIS TEER test methodology encourages the comparison of candidate devices for a given networking application using a simple, but standard methodology; it does not expect that broadly applied efficiency levels should be used to compare unlike systems.

> < Collection and display of test results via the product finder tool on the ENERGY STAR website > The Green Grid would like to draw attention to the standard method of reporting product energy use and efficiency that is detailed in the TGG whitepaper:

Energy Efficiency Guide For Networking Devices. This guide defines a standard form for disclosure of energy efficiency based on the ATIS TEER test methodology.

< Standard methods for reporting product energy use and system performance over the network > The Green Grid agrees that a standard method for reporting energy use and performance is crucial for the effective management of energy.

< ability to power down unused ports > Although the ability to power down unused ports is an important energy conservation feature, and should be a basic requirement, The Green Grid would like to point out that for most data center installations, the proportion of unused network ports is generally low, even for edge networking systems. Structured cabling and relatively stable configurations of edge equipment allow data center operators to utilize all of the ports for a large proportion of the networking systems installed. Furthermore, in most data center environments the edge devices remain powered and connected to the network permanently. This is different to the case for home or office networks where edge devices are powered down when out of hours or not in use. Furthermore, networking devices that are not at the edge (i.e. aggregation and core devices) are rarely installed with unused ports and uplink ports are rarely unused.

< remote administration of ports individually > Most networking equipment that is used for large networks supports remote administration of ports using standard network management tools. This requirement as part of the Energy Star framework is not onerous.

< presence of variable speed fans > Variable speed fans are becoming common in large networking equipment and adding a requirement for this in the Energy Star framework should increase the penetration of this technology. However, there should be some consideration to the timing of this requirement. Detailed survey data should reveal the extent of the impact to the industry for this criterion.

< ability to scale power dynamically with the level of utilization > The goal of scalable networking should be the long term focus for the industry, however it should be recognized that the technologies that enable this goal are relatively new and therefore it should be expected that multiple generations of product development will be required before this goal is reached. The use of a standard metric such as ATIS TEER will help to encourage scalability.

< implementation of Energy Efficient Ethernet (IEEE 802.3az) > The Green Grid recognizes the importance of Energy Efficient Ethernet for the purpose of improving networking energy efficiency. The Green Grid recommends that an incentive for

products that implement EEE would be appropriate as it reflects the energy savings that may be achieved by link partner devices.

< ability to perform well at higher operating temperatures > The Green Grid is interested in new environmental specifications for data centers that could result in energy efficiency improvements. However, the topic is still under study in a number of bodies, so it may be premature to be included as a criterion.

Specific Questions from Framework Document

Q.
Are there alternate definitions for the terms above that should be reviewed and considered by EPA?
R.
The definitions for the terms are relatively less important than the approach to categorization of large networking equipment. The ATIS TEER test methodology uses categorization to define the appropriate test structure that should be applied, but does not expect that categorization will be sufficient to guarantee valid comparisons for the test results. In some cases equipment may be tested as part of more than one category so that it can be assessed for different applications within the network.

Q.
Are there any LNE product types not addressed above that should be added to the list of products under consideration for Version 1.0 LNE specification? Are there any products that should be explicitly excluded?
R.
There is some need for clarification regarding the breadth exclusion for security devices; in particular, it should be stated whether VPN servers are considered to be security devices. The Green Grid recommends that network caching, load balancing and analysis devices should also be excluded in a similar manner to security appliances.

Q.
Are there any product characteristics not included above that EPA should be aware of, beyond modular vs. fixed or managed vs. unmanaged? What impact do these categories have on product capabilities and energy consumption?
R.
In order to limit comparisons to "like-with-like" systems, it would be necessary to have hundreds of separate categories for networking devices. Within the networking market, each manufacturer lists hundreds of distinct products that have significant functional differences to each other. Furthermore, the number of examples in each product category is often small, rendering statistical analysis within a category impossible. The Green Grid recommends that ATIS TEER tests are applied and results published without categorization so that a network implementer may make valid comparisons using the data provided.

Q.
Are there features not listed above that provide substantial energy savings? What are the energy and performance impacts of these features as they currently exist? What about in the near future?
R.

Recommendations from The Green Grid to:
ENERGY STAR® for Large Networking Equipment Version-1 July 2013

Specific comments were made for each feature listed. Future energy conservation features are being developed in standards bodies and industry associations. New technologies will need to be reviewed as they emerge.

Q.
Are the savings from the more efficient Power over Ethernet (PoE) large enough to include in this specification? Should PoE mid-span devices be considered to be network equipment or external power supplies?
R.
The power efficiency of PoE is dominated by the efficiency of the PSU in the source system, therefore The Green grid recommends that the PSU efficiency should be evaluated using a well-defined methodology (e.g. 80-Plus). Furthermore, there are improvements in energy efficiency that may be achieved if both the source and load devices use intelligent power negotiation (as enabled by Link-Level Discovery Protocol – LLDP), such implementation should be encouraged.

Conclusion

The Green Grid fully supports the development of the ENERGY STAR for Large Networking Equipment version 1.0 specification. EPA's collaborative development with all industry stakeholders should result in a well-constructed specification and should allow rapid resolution of concerns raised.

The Green Grid will continue to collect industry-wide inputs to work with the EPA in developing the ENERGY STAR programs on ICT equipment. Please feel free to contact us on any concerns or questions in the development of the specifications or the implementation of the program.