ENERGY STAR® Server Stakeholder Meeting
Discussion Guide
Redmond, WA
July 9, 2008

Background

Since releasing the Draft 1 server specification in February, EPA has engaged in several industry discussions including a stakeholder online meeting held on April 1, 2008. During the online meeting, EPA discussed several key stakeholder comments and next steps toward releasing a subsequent draft. One of the next steps included revising and releasing a Draft definitions and scope document, which was distributed to stakeholders for review and comment on April 25. The goal in distributing a revised definitions document prior to a Draft 2 document was to develop a consensus regarding the types of products to be covered by the specification, which would better inform discussions regarding performance and testing requirements.

Meeting Goals

Over the last two months, the ENERGY STAR team has held additional discussions with industry members, reviewed and clarified comments submitted on the revised definitions and scope document, and collected and analyzed available product performance data. The goals of this meeting are: (1) to share new data and information collected by the ENERGY STAR team; (2) to continue discussions on key specification requirements including power supply efficiency, idle energy, and power management criteria; and (3) to solidify EPA's approach for finalizing the specification by the end of the year.

Document Purpose

Initially EPA had intended to release a Draft 2 specification for review prior to this meeting. However, EPA decided to instead focus its efforts on continued in-depth stakeholder discussions and data collection efforts. The purpose of this Discussion Document is two-fold: (1) to present EPA's latest thinking regarding definitions, testing, and potential performance requirements and (2) to solicit answers to remaining questions for consideration in the next Draft 2 specification. EPA plans to incorporate feedback from the meeting today into a proposed Draft 2 specification for release in early to mid August.

The first section of this document presents revised Definitions and Qualifying Products sections of the draft specification. These revisions are based on comments received by industry stakeholders. The second section presents several elements of the technical specification that warrant more detailed discussions prior to proposing in the next Draft 2 version. Please note that Section D of the pervious Draft 1 specification (Power and Temperature Measurement Requirements), is not included as EPA has received consistent, supportive feedback on this element of the specification.

Resources

All draft proposals, stakeholder comments, EPA presentations, and discussion notes can be found on the ENERGY STAR Web site at www.energystar.gov/productdevelopment by clicking on "New Specifications in Development".

REVISED PROPOSAL: Server Definitions and Scope

The following Definitions and Qualifying Products sections have been revised based on comments submitted to EPA. The deadline to submit comments was May 9, 2008. Text boxes are provided to identify and provide justification for the proposed changes.

1) Definitions: Below are the definitions of the relevant terms in this document.

A. Computer Server: A computer that provides services and manages networked resources for client devices, e.g., desktop computers, notebook computers, thin clients, wireless devices, PDAs, IP telephones, other computer servers and other networked devices. Computer servers primarily respond to requests and are accessed via network connections, and not through direct user input devices such as a keyboard, mouse, etc. For purposes of this specification, computer servers ***must include all*** of the following characteristics:

- Marketed and sold as a server;
- Designed for and listed as supporting Server Operating Systems and/or Hypervisors, and targeted to run user-installed enterprise applications;
- Designed and capable of supporting one or more processor sockets and one or more processor boards in the device;
- Support for error-correcting code (ECC) and/or buffered memory (including both buffered DIMMs and buffered on board (BOB) configurations);
- Dedicated management controller, typically described as a service processor;
- Include Reliability, Availability, Serviceability, and Manageability (RASM) features; and
- Have a hardware configuration available in a rack mountable form factor, for use in enterprise environments[1].

Note: PDAs and IP telephones were added to the list of potential client devices.

EPA received several requests that the computer server definition be broader to cover large, medium, small, and blade servers and individual definitions then be developed to further delineate the individual product types of purposes of including or excluding them in Section 2, Qualifying Products. EPA agrees with this approach and has made changes to the definition above, including the removal of the 4-process socket cap. Providing a general, overarching definition for servers also provides for ease of adding individual product types in subsequent specification revisions.

Several stakeholders questioned whether Wake On LAN (WOL) capability was a distinguishing attribute of a server since many IT devices, primarily desktops, include this capability. Furthermore, stakeholders felt that WOL was not a good replacement for a dedicated management controller, which is more suitable for the enterprise environment. In response to this comment, EPA has removed the WOL reference from the list of server characteristics above.

Several stakeholders also questioned the benefit of referencing EN55022:1994 under the EMC Directive 89/336. They felt that including this requirement in the definition might limit innovation and that a server should be defined by its capabilities and not by a FCC classification. Furthermore, it was suggested that some data center servers may be designed to the more stringent Class B designation. EPA has removed reference to the EMC directive in the list of characteristics, above.

[1] Includes products in a tower form factor which are also available as rack mounted units. Products only available in a tower form factor which is not rack mountable do not fit this definition and are not included in the scope of this specification.

Note: A requirement has been added that the server have a hardware configuration available in a rack mountable form factor, for use in enterprise environments. EPA received several stakeholder suggestions to reference rack mountable form factor to better represent servers designed to be used in the data center environment. A footnote was also added explaining that tower form units that are also available as rack mounted units are included.

Questions for Stakeholders: How common are tower form units utilized in the data center? Will this rack mount requirement eliminate tower form units from the ENERGY STAR program or could these products be addressed by the new computer desktop specification?

B. Blade Chassis: An enclosure containing shared resources for the operation of blade servers and blade storage. These resources include power supply(s) for power conversion, dc power distribution, cooling, network hardware, and system management, and may also contain shared storage. A blade chassis contains multiple slots which can be populated with a number of blades.

C. Blade Server: A computer consisting of, at minimum, a processor and system memory that relies on certain shared resources (e.g., power supply, cooling, etc.). Blade servers are designed to be installed in a blade chassis and are incapable of operating independent of the chassis.

D. Blade Storage: A storage element that relies on certain shared resources, contained in a blade chassis. Blade storage units are incapable of operating independent of the blade chassis.

E. Direct Current (dc) Server: A computer server designed to operate with a dc-dc power supply or a server which runs directly off dc voltage supplied to internal dc-dc converters from an external source.

F. Server Appliance: A self-contained server system bundled with a pre-installed operating system and application software that is used to perform a dedicated function or set of tightly coupled functions. Server appliances deliver services through one or more networks (e.g,. IP or SAN), and are typically locked down systems managed through a web interface. Server appliance hardware and software configurations are customized by the vendor to perform a specific task, and are not intended to execute user-supplied software. Example services that may be made available via a server appliance include: name services, firewall services, authentication services, encryption services, and voice-over-IP (VoIP) services.

G. Storage Equipment: A system composed of integrated storage controllers, storage devices (e.g. disk drives) and software that provides data storage services to one or more computers. While storage equipment may contain one or more embedded processors, these processors are not made available to execute user-supplied software applications, but may execute data specific applications, e.g. data replication, backup utilities, data compression, install agents, and other tasks.

H. Network Equipment: A product whose primary function is to provide data connectivity among the devices connected to its several ports. This is done by routing packets encapsulated according to Internet Protocol, Fibre Channel, InfiniBand or similar protocol. Common network equipment in data centers includes routers and switches.

Note: Several stakeholders advocated removing language in the definition for blade chassis accommodating for blades from different vendors. Blade chassis are normally designed to host servers of a specific type and vendor and using blades from different vendors could compromise warranty.

Based on stakeholder comments, revised definitions for storage and network equipment are proposed above. In addition, a reference to voice-over-IP (VoIP) services was added to the definition for server appliance.

EPA continues to receive comments from stakeholders encouraging the creation of a more detailed taxonomy for defining the many types of servers available in the marketplace. EPA is interested in continuing this discussion and may consider developing additional subcategories to provide clear direction regarding the types of servers covered by the specification. However, mapping these new subcategories to separate performance requirements will be based on observable differences in energy performance. EPA believes that products with similar capabilities and functionality should be assessed under the same performance levels. For example, if a clear trend is identified across many different manufacturers that can be mapped to a specific subcategory then EPA might consider specific performance requirements for this subcategory.

Question for Stakeholders: What are the key subcategories that should be defined under the specification? Do similar subcategories need to be developed for blades and blade chassis?

Computer Server Power Supplies

I. Computer Server Power Supply: A self-contained server component which converts a voltage input to one or more different dc voltage output(s) for the purpose of powering the server. The input voltage can be from either an ac or dc source. A computer server power supply must be separable from the main computer board and must connect to the system via a removable or hard-wired male/female electrical connection, cable, cord or other wiring (i.e. separate from, and not integrated onto the system motherboard).

J. AC-DC Power Supply: A power supply which converts line voltage ac input power into one or more dc output(s) for use by the server.

K. DC-DC Power Supply: Aserver power supply which converts a dc voltage input to one or more different dc voltage output(s) for the purpose of powering the server. Any dc-to-dc converters (also known as voltage regulators) internal to the product and used to convert low dc voltage (e.g. 12 V dc) into other dc voltages for use by the individual server components are not considered dc-dc power supplies under this specification.

L. Single-Voltage Power Supply: A power supply which outputs only one single dc voltage output. Although single-voltage power supplies only provide one primary voltage for powering the server during operation, they may also include one or more low voltage standby rails (typically 5 V dc) used only to initiate start-up when the main system is powered down.

M. Multi-Voltage Power Supply: A power supply which outputs multiple different dc voltage outputs, including, one or more low voltage standby rails (typically 5 V dc) used only to initiate start-up when the main system is powered down

Note: Several stakeholders commented that power supplies should be referenced as either AC-DC/DC-DC or ac-dc/dc-dc as opposed to previously referenced Ac-Dc/Dc-Dc. This has been revised in the definitions provided above.

EPA was asked to clarify the previous statement that the power supply be separable from the system. While it is possible to open the box and remove the power supply from low-end systems, they might not be hot-pluggable power supplies and therefore might not be easy to remove. In response to this comment, additional text has been added clarifying that the power supply must be separated from the motherboard, not the overall system, which was EPA's initial intent.

According to one stakeholder, there are cases (i.e., typically on medium or large servers) where the voltage is boosted during the AC to DC conversions. To recognize this event, EPA replaced the text "lower voltage dc output(s)" with "one or more dc output voltages throughout the power supply definitions.

Question for Stakeholders: Do these definitions accurately represent the types of power supplies available in servers?

2) Qualifying Products: A computer server must meet the definition provided in Section 1.A, 1.B or 1.C above, to be eligible for ENERGY STAR qualification under this specification. In addition, the Tier 1 specification coverage is limited to computer servers and blade servers capable of having at most four processors (i.e. servers with 1 - 4 individual processor sockets). **Higher-end servers (e.g. > 4 processor sockets) are currently ineligible for ENERGY STAR qualification but will be considered under Tier 2.** Storage equipment, blade storage, and network equipment, as defined above, are not eligible for ENERGY STAR qualification under this specification.

Note: A statement was added to clearly state that higher-end servers are not covered by the ENERGY STAR specification. Several stakeholders were concerned about end user perception (i.e., procurement specifications) regarding the availability of ENERGY STAR qualified servers at all levels of performance. EPA will consider covering these product types under the Tier 2 specification.

Question for Stakeholders: Are there other product types that need to be explicitly defined and excluded from the specification? For example, does a definition for higher-end severs need to be developed or are they effectively eliminated based on the number of processor sockets?

TEST PROCEDURE AND PERFORMANCE DISCUSSION

Power Supply Energy Efficiency

During the meeting, EPA will discuss the relative merits of pursuing a traditional power supply efficiency bench test approach versus specifying net power supply losses of the power supply in the system. While measuring power supply efficiency is the simpler, more straight-forward approach, measuring the net losses in the system as a whole offers greater accuracy of power lost due to power conversion during operation. The latter approach would measure the actual losses from the power supply, as configured and installed in the system. However, some challenges to the net power supply loss approach exist, including the need for the development of a test procedure to ensure consistent measurements and access to data within EPA's proposed timeline. Additional details regarding these approaches and supporting data will be shared with meeting attendees. EPA's goal is to walk away from the meeting with a clear direction regarding the most appropriate approach for Tier 1.

Over the last two months EPA has collected efficiency data from server and power supply manufacturers. Based on this data, EPA began assessing possible efficiency levels for the traditional bench test efficiency approach. EPA has also participated in discussions with the Climate Savers Computer Initiative (CSCI) on harmonization of the test procedure for power supply efficiency. Based on data submitted to date, EPA was able to identify observable differences in power supply efficiency and would like to discuss the following proposed power supply efficiency requirements:

Table 1: Efficiency Requirements for Computer Server Power Supplies

Percentage of Rated Power Output	10%	20%	50%	100%
Minimum Efficiency Requirement – Single Voltage	81%	87%	90%	89%
Minimum Efficiency Requirement – Multi-Voltage	-----	82%	85%	82%
Power Factor	0.80	0.85	0.90	0.90

A 10% loading requirement is included to further differentiate single voltage power supplies for ENERGY STAR servers at the low loading conditions where many current servers operate. EPA received very little data for multi-voltage server power supplies. Therefore, EPA is suggesting alignment with the most recent levels proposed in the Draft 1 Version 5.0 ENERGY STAR computer specification. Proposed levels for single voltage power supplies represent the top 24% of EPA's data set across all loading conditions (10-100%). Manufacturers are encouraged to submit additional data on power supplies currently being used in servers positioned to sell in 2008 and 2009 for consideration in the Draft 2 proposal.

In addition, DC powered servers are still under consideration for the Tier 1 specification. The Electric Power Research Institute (EPRI) is working to develop a test procedure for DC-DC power supplies that could be used to test and compare energy performance. Once this test procedure is made available, manufacturers are encouraged to test DC-DC power supplies and submit efficiency performance data for consideration in the next Draft 2 specification.

Comments from Industry:

- Several stakeholders feel that 10% loading should not be included because server manufacturers are implementing programs to eliminate power supply over sizing and addressing 20% will sufficiently cover low load conditions (i.e. improved efficiency at 20% load will result in improved efficiency at 10% load).
- Many stakeholders are interested in including DC-DC power supplies in the Tier 1 specification and are involved in helping to develop the DC-DC power supply test procedure.
- Several stakeholders have suggested ENERGY STAR and CSCI harmonization.
- Some of the manufacturers feel that fan power should not be included in efficiency calculation for single output servers.

Moving Forward:
- EPA will base final efficiency levels on available data and encourages manufacturers to submit additional data points for this effort.
- EPA is interested in the 10% loading as many current systems experience operation at very low loads (i.e. well below 20%), especially in servers with redundant configurations. However, EPA may be open to other proposals to ensure servers operate at more efficient loads.
- EPA is interested in including DC-DC powered servers as long as a test procedure and robust data set can be submitted to EPA within the specification timeline (e.g., finalization of the specification by the end of this year). If levels for DC-DC power supplies cannot be determined prior to finalization of Tier 1, EPA will continue to work with interested stakeholders to determine whether requirements could be added through an amendment at a later date.

Discussion questions:
- The benefits of using a net power loss approach to power supply efficiency is that it addresses real world conditions, including the effects of power supply over sizing and redundancy. Are stakeholders interested in pursuing this approach in the short or long term? What are some of the issues that EPA needs to consider while evaluating this approach?
- Would stakeholders consider a 10% loading condition for power supplies where a model can be exempt if it is proven that it does not operate at low loading (i.e. idle power never operates at lower than 20% rated power supply load)? How could EPA be assured that this will happen in practice? Are there other options where 10% load might be applied only in appropriate situations (e.g., redundant configurations)?
- Given that EPA is dedicated to including power supply cooling fans in the calculation of efficiency, is there any way that power supplies could be effectively categorized between those where this is appropriate (e.g., internal cooling fans) and those for which it is not (e.g., fans also intended for system cooling)?

Idle Power Requirements

EPA continues to be very interested in idle power based on several discussions with data center operators claiming that their servers still spend a significant amount of time in idle and low utilization. While virtualization helps to begin addressing the issue of low utilization, the market penetration of virtualization is still low and not all servers are likely to be virtualized. Idle is the simplest, best indicator of power used during very low utilization times, and data center operators should have access to information on the amount of power consumed by the server in these operating conditions.

Idle power is currently included in the SPECPower ssj_2008 benchmark, which could be used to serve the purpose of measuring idle power for the ENERGY STAR server specification. Initial analysis of the public SPEC data shows some interesting observations regarding idle energy use, which will be shared with meeting attendees. Based on this data and subsequent discussions with industry members, there appears to be notable differentiation in energy performance across similar products signaling a significant opportunity for energy savings.

Comments from Industry:
- Idle should not be included because the direction of server design, including virtualization and advanced power management schemes, will lead to higher utilization and less time in idle.
- Idle criteria must recognize different levels of performance and reliability (i.e. redundancy) which can inherently lead to increased idle power.
- Idle power may create an incentive for the wrong behavior, as many high performance (and high idle power) machines are capable of increased energy savings from virtualization.

Moving Forward:
- EPA will address idle energy use in the ENERGY STAR server specification but is open to discussing what that might entail.
- In addition to short term solutions, EPA is also interested in discussing what industry can be doing longer term to discourage operation in idle and low utilization.
- If EPA decides to include performance levels for idle, it is understood that a one-size-fits-all approach is not advisable based on inherent differences in server design and capabilities.

- EPA understands questions have been raised regarding how four processor systems are measured using the SPEC benchmark. Further discussion regarding this concern is needed to determine if an alternative approach for four processor systems is required.

Discussion questions:

- Would end users find it beneficial to know the energy consumption of their servers while idling? Armed with this information, would end users be compelled to take action such as consolidation and/or virtualization?
- How can EPA categorize servers for idle in a way that addresses both performance and reliability? Are there discernable differences in energy performance and are they tied to specific characteristics?
- What are some of the challenges to using SPECPower ssj_2008 to measure and report idle?
- Would it make sense to specify idle as a percentage of maximum power for the system?
- Could EPA make a special category for servers likely to be virtualized? What would characterize such a server?

Performance Reporting

The consistent reporting of power and performance provides an additional layer of transparency such that data center operators can make informed decisions based on several performance characteristics in addition to ENERGY STAR qualification.

Comments from Industry:

- There is general support from industry members for the inclusion of a reporting requirement but mixed feedback in regards to the type of information presented. For example, some stakeholders are concerned about including performance benchmark information on this data sheet.

Moving Forward:

- EPA will continue to work closely with end users and manufacturers to identify key criteria for the performance data sheet.

Discussion questions:

- What key characteristics are critical to the purchase decision making process? How best can the information be presented so that it is helpful and intuitive for end users?
- What opportunities exist to highlight key power management features and benchmarking scores on the power and performance datasheet?

Power Management Criteria/Virtualization

EPA considers advanced power management to be an important solution in the portfolio of data center energy efficiency opportunities. However, while many servers are capable of power management often these products are shipped with this feature disabled. EPA is interested in requiring that a significant number of power management features, such as variable fan speed control, processor power and speed scaling, etc., be included **and enabled** in an ENERGY STAR qualified server. This requirement could potentially also include virtualization capability.

Comments from Industry:

- There is general support from industry members for the inclusion of a power management requirement but mixed feedback regarding whether this should be a reporting requirement or a qualification (pass/fail) requirement.

Moving Forward:

- EPA continues to believe that power management is one solution to reducing energy consumption in servers and is open to discussion on whether this is a reporting or qualification requirement.

Discussion questions:

- What are the pros and cons for including power management as a reporting requirement? As a qualification requirement?

- Given the speed in innovation within this industry, how will the ENERGY STAR specification stay current if prescriptive power management criteria are included? Does this approach limit innovation?
- Do end-users see this as an important and helpful requirement? If so, what power management features would be helpful to include?

Effective Date

EPA is continuing to work towards a January 2009 effective date at which time partnering manufacturers can begin qualifying and labeling their models as ENERGY STAR. An immediate effective date will benefit those manufacturers that have already made an investment in energy efficient improvements and provide end users with a much needed tool to help make informed purchasing decisions. Once the specification is finalized, EPA will continue to work with industry stakeholders to develop longer term Tier 2 requirements that address computing and energy performance. Quick implementation of the Tier 1 specification will ensure an earlier transition to the Tier 2 requirements, which will represent a more flexible and holistic approach.

Tier 2 Requirements

If time allows, EPA will open the floor to discussion regarding: (1) current industry efforts to develop performance based benchmarks that will take into account energy efficiency and how might EPA use these metrics in a Tier 2 specification and (2) EPA and industry efforts regarding storage and networking equipment.

Proposed Timeline