ENERGY STAR® Servers
February 23, 2011

Server Energy Use Evaluation – Discussion Document

EPA is assembling a dataset for all servers with 1-4 processor sockets in all form factors (rack-mounted, pedestal, and blade), as listed in the scope for the Draft 1 Version 2.0 ENERGY STAR Computer Servers Specification. This discussion document describes EPA's needs and desired outcomes for this effort.

EPA's primary use of the dataset will be to re-evaluate the structure for product families that is currently in effect in the Version 1.0 ENERGY STAR Servers Specification. The testing discussion in this document is designed with the intent to identify appropriate "bookend" scenarios for the family structure. In addition to 1- and 2-socket systems, EPA's scope for this effort includes blade servers and 3-4 socket servers, two categories not currently subject to Idle requirements. This data will be utilized to assess Idle requirements (levels and/or reporting) in light of changes to the product family structure.

EPA is distributing a second document entitled, *Dataset – Test Method*, in parallel with this document which includes revised definitions and testing procedures.

EPA will be hosting a stakeholder meeting on Friday, March 11, 2011, to discuss and answer questions about this dataset assembly. EPA intends to provide an eight-week period for this round of testing after stakeholder feedback on these documents is received and evaluated. Please contact servers@energystar.gov with any questions.

Version 2.0 Product Family Hypothesis

EPA is revising the Computer Server Product Family structure to redefine the hardware components that must be held constant and modify the test requirements for qualification of a product family. These revisions are intended to (1) ensure that test data is sufficiently representative of all configurations within a product family, (2) ensure that all configurations within the family meet ENERGY STAR requirements, and (3) significantly reduce the testing burden for ENERGY STAR Partners. Though not included as part of this dataset, the proposal also seeks to ensure that a wide range of active mode performance data (acquired via the SPEC SERT tool) is generated for each product family to provide end-users a reasonable sense of how a specific configuration will perform in relation to actual test results.

The proposed modifications to Product Family definitions are as follows:

- Common Product Family Attributes: A set of features common to all models/configurations within a product family that constitute a common basic design. All models/configurations within a product family must share the following:
    - be from the same model line;
    - share the same form factor (i.e., rack-mounted, blade, pedestal);
    - share PSUs with both the same rated maximum output and greater than or equal to the rated efficiency of the tested configurations at all required load points specified in Section 3.2 (i.e., 10%, 20%, 50%, and 100% for single-output; 20%, 50%, and 100% for multi-output).

Note: In the provisions for PSUs, EPA has proposed testing of only non-redundant PSUs; this recognizes that the existing Idle Power adder for redundant PSUs is applied after measurement and avoids a double impact of redundancy-related losses both in the measurement and in the Idle metric.

EPA also proposes that PSUs be selected using manufacturer-standard practices, with manufacturers asked to provide EPA with their written rationale for PSU selection associated with a tested family. This will allow data to represent a more realistic scenario and allow EPA to gain further insight into PSU loading during design.

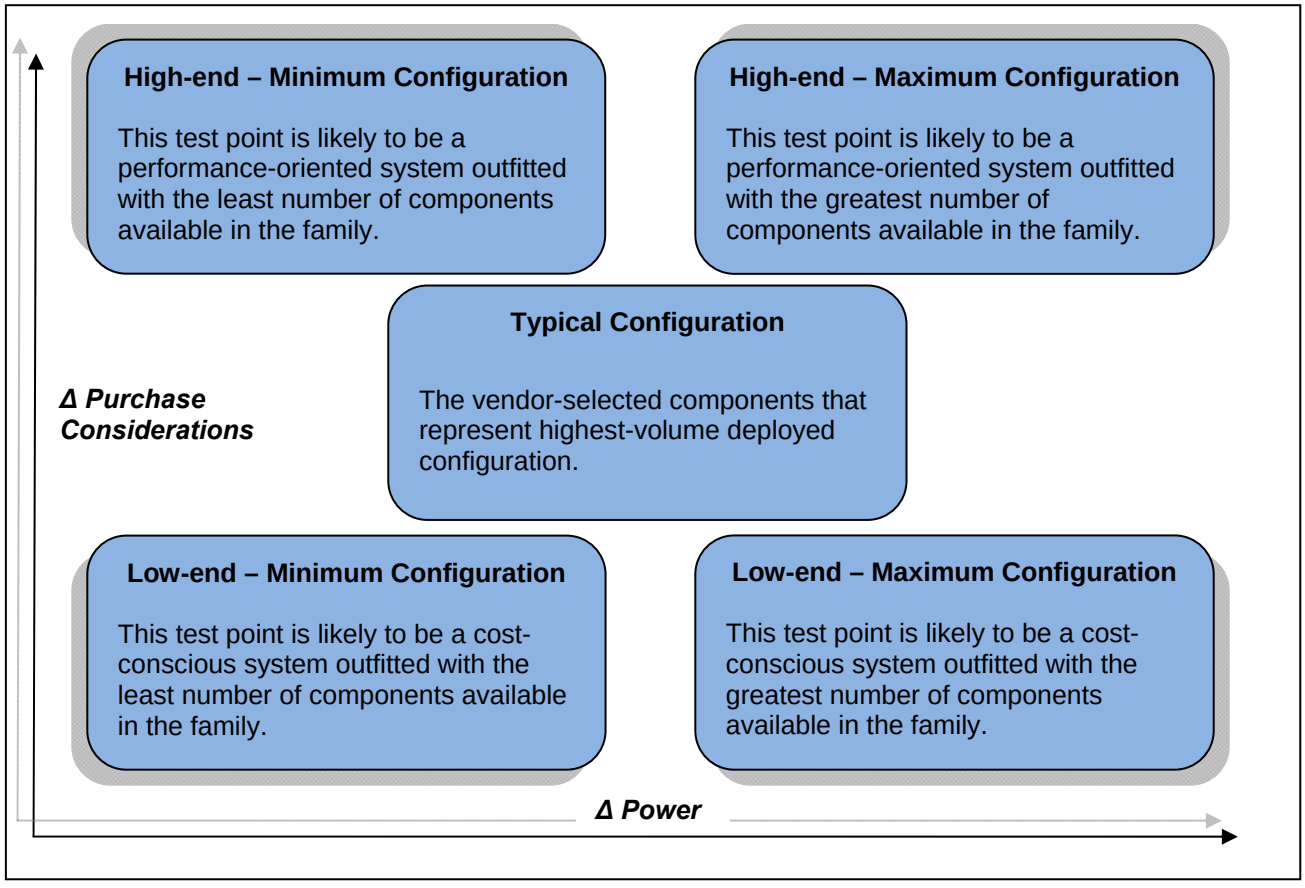
- Product Family Tested Product Configurations: This product family proposal requires five tests to define a product family. The variations listed here are explained within the context of an example product family

shown in Figure 1, below.

- o Low-end Performance Configuration: The combination of PSUs, Memory, Storage (HDD/SDD), and I/O devices that represents the lowest-price computing platform within the Product Family.
- o High-end Performance Configuration: The combination of PSUs, Memory, Storage (HDD/SDD), and I/O devices that represents either the highest-price or highest-performance computing platform within the Product Family.
- o Typical Configuration: A product configuration that lies between the Minimum and Maximum Power configurations and is representative of a product with high volume sales.
- o Minimum Power Configuration: The minimum configuration that is able to boot and execute supported OSs. The Minimum Configuration contains the least number of installed PSUs, Memory, Storage (HDD/SDD), and I/O devices, that is both offered for sale and capable of meeting ENERGY STAR requirements.
- o Maximum Power Configuration: The vendor-selected combination of components that maximize power usage within the Product Family once assembled and operated. The Maximum Configuration contains the greatest number of installed PSUs, Memory, Storage (HDD/SDD), and I/O devices that is both offered for sale and capable of meeting ENERGY STAR requirements.

- Product Family Tested Configurations and Examples: The five test points in Figure 1 must be tested for each Product Family.

Figure 1: Product Family Testing



Product Family Hypothesis - Example

The following example illustrates representative testing of a set of configurations within a server product family. The example includes variations of a 4-socket system with multiple CPU, Memory, Disk, and Power Supply options.

Server Common Product Family Attributes:

- Model Line: *A1234 Server*
- Form Factor: *Rack-mounted*
- Motherboard: Model *MB1203 w/ 4 CPU Sockets*
- Other Characteristics:
    - 1 or 2 - (Single, or redundant) Power Supplies
    - 5 - I/O Expansion Slots
    - 4 - 3.5” HDD Slots
    - 12 - Memory (DIMM) Slots

CPU Options:

- 1.5 GHz / 4MBb Cache / 2 Core / 80W
- 1.8 GHz / 2MB Cache / 2 Core / 80W
- 2.2 GHz / 4MB Cache / 4 Core / 60W – Energy Optimized
- 2.6 GHz / 4MB Cache / 4 Core / 95W
- 3.2 GHz / 6MB Cache / 6 Core / 105W

Memory Options (per DIMM):

- 256 MB
- 1 GB
- 2 GB
- 8 GB

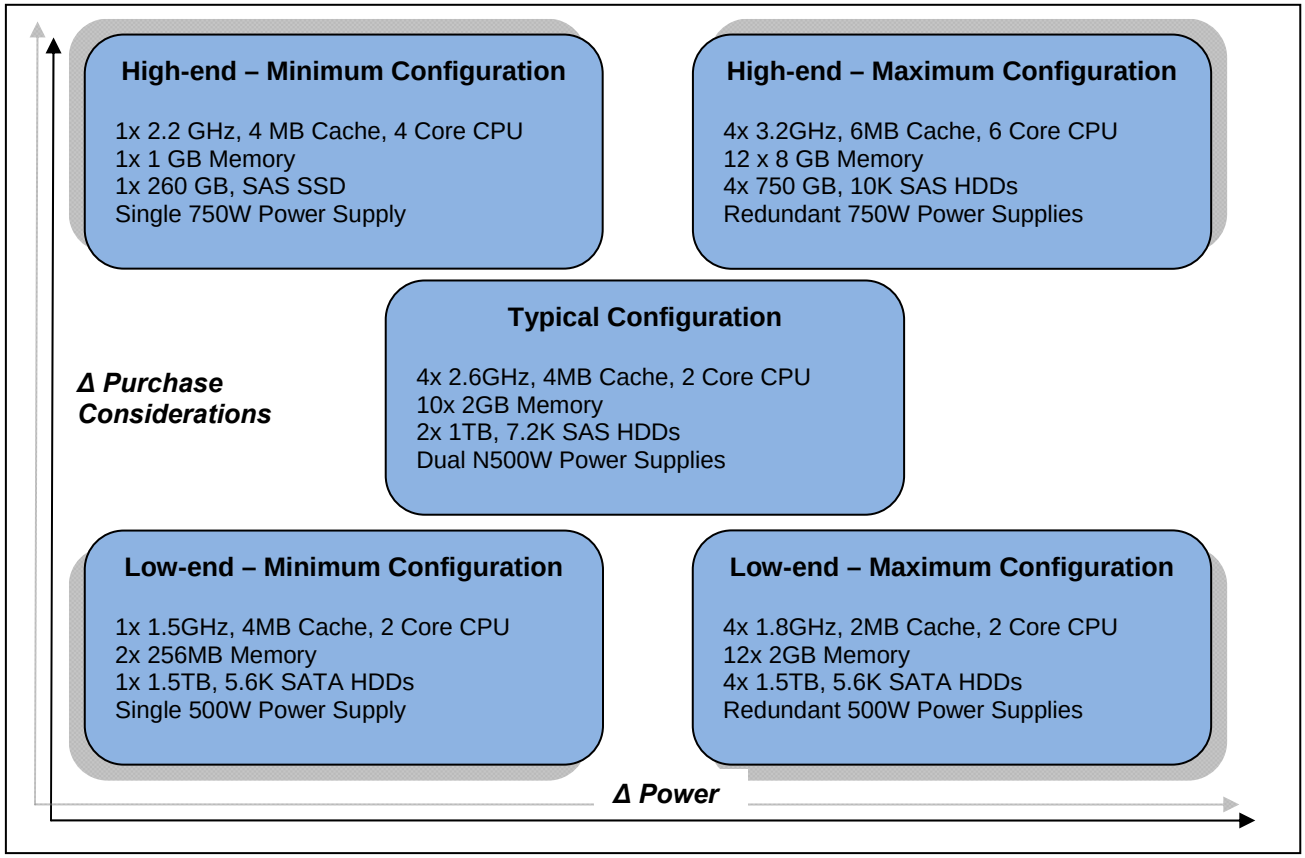
Storage:

- 750 GB / 10,000 RPM / SAS / 3.5”
- 1 TB 7,200 RPM / SAS / 3.5”
- 1.5 TB / 5,600 RPM / SATA / 3.5”
- 260 GB / SSD / SAS / 3.5”

Power Supply:

- 500 W Universal, Single or Redundant
- 750 W Universal, Single or Redundant

Figure 2: Product Family Example



Testing Description

To aid in the development of the product family definition proposed above, EPA recommends testing as follows:

- Type of data: The following test procedure collects Idle State and Full Load power data for each unit under test to accompany configuration details.
- Tested Configurations: Where possible, EPA is interested in data that shows the impact of hardware configuration changes on similar server platforms. The following recommendations should be used to guide selection of products for evaluation:

  A. Processor

     a. Choose base configurations with processors for each available core count per socket and rated power that represent, at a minimum, the highest and lowest available rated system speed (FSB). This processor shall be used across a set of typical, maximum, and minimum testing runs.

     b. For the typical configuration, test the same configuration with a processor socket unpopulated (if offered as an option to customers).

  B. PSU – Choose power supply options that represent typical options for customers (if applicable, select both PSUs optimized for efficiency and standard models). PSUs should be selected using a manufacturer's standard practices, with a brief, written rationale/explanation of why the PSUs were selected for each configuration accompanying power data (e.g., PSU was tuned to Full Load Power of the configuration, PSU is the only option available across the family).

  C. HDD or SSD – Include storage elements that represent a range of customer preferences (i.e., high performance HDDs versus high efficiency HDDs, etc.).

D. Memory (DIMM) – Consider testing several vintages of memory technology such that EPA can evaluate the impact of new memory technologies on overall server efficiency.

E. I/O Device – Provision systems with minimal I/O add-in cards; for testing, ensure the server offers at least one Ethernet port (using a single add-in card only if no onboard Ethernet support is offered). EPA welcomes device-level power information on I/O devices to build on the existing I/O dataset from Version 1, available at http://www.energystar.gov/ia/partners/prod_development/new_specs/downloads/servers/Final_Draft_Server_IO_Data_Set.xls.

- Testing: In the *Server Energy Use Evaluation- Resources* document, the test procedure presented in Draft 1 has been updated per stakeholder comments. Specific testing instructions for each applicable product type:

  Non-blade Servers:

  A. Configure as noted in Section 5.

  B. Complete testing as specified in Section 6.1

  C. Testing for low power modes in Section 7.2 is additionally encouraged.

  Blade Servers:

  A. Conduct a partially-populated test using a commercially-available blade chassis with half of the available bays populated, to the nearest full power domain supported by installed power supplies. Proceed with testing as specified in Section 6.1. EPA welcomes additional data from fully-populated chassis if manufacturers wish to provide it in addition to half-populated data.

  B. Repeat testing as specified in Section 6.1 with a single blade server removed from the chassis as directed in step 7.

  C. Report details for the blade chassis as required as specified in Section 7.1.

  D. Testing for low power modes in Section 7.2 is additionally encouraged.