



# ENERGY STAR Servers Version 2.0: Updates

The Green Grid Technical Forum 2010  
San Jose, CA  
February 2, 2010



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# Agenda

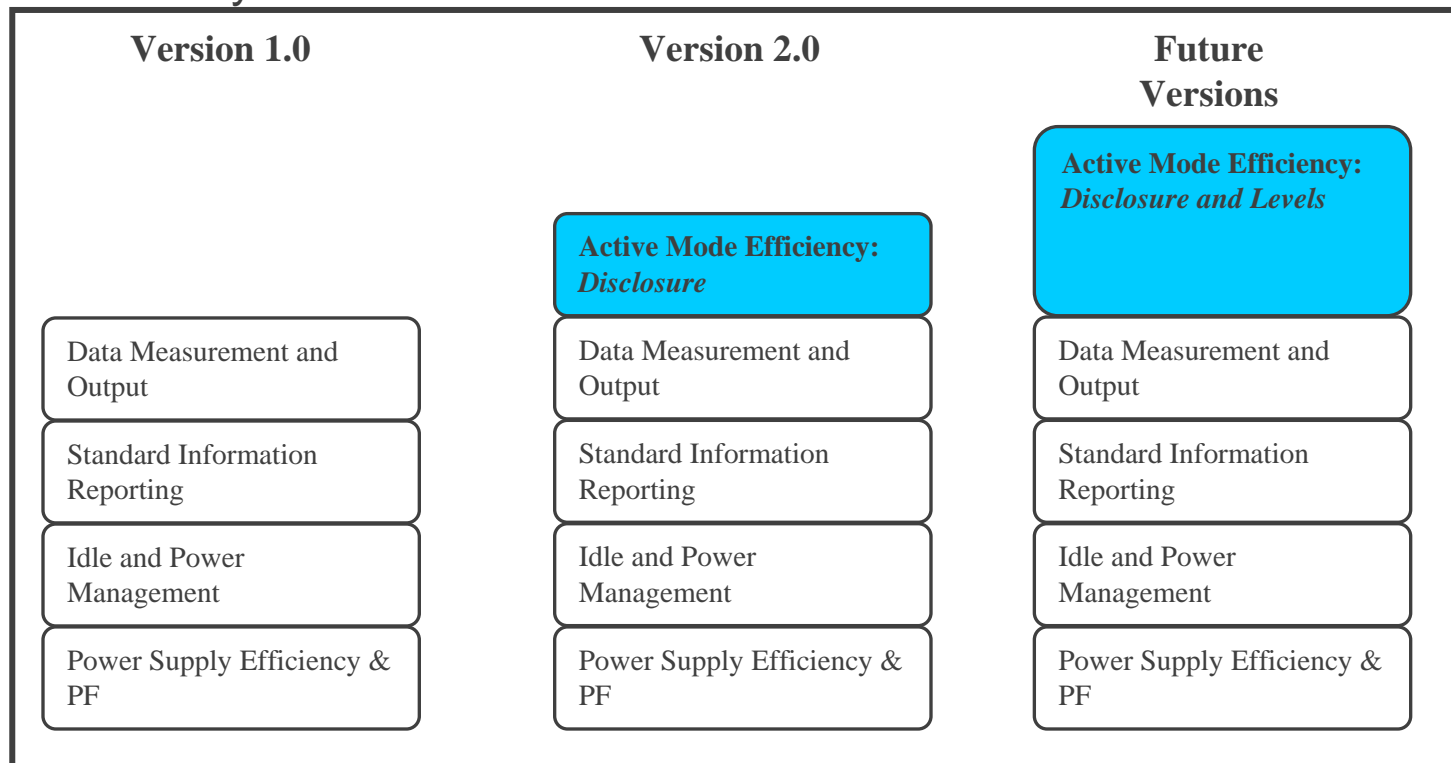


- **Welcome & Agenda Review** 10:00 a.m.
- **Scope** 10:15 a.m.
- **Status Update** 10:30 a.m.
  - “Rollover” Criteria
  - Families
  - Idle: Options for V2.0
- **Blade Servers** 11:00 a.m.
- **Active Mode Efficiency: Rating Tool and Evaluation Method** 11:40 a.m.
- **Adjourn** 12:30 a.m.

# Layer Cake



- Building program incrementally
  - Tier 1 foundation: PSUs, Idle, Reporting, Data Output
  - Version 2.0: Add active mode efficiency element
  - Version 3.0 (if not achievable in 2.0): Set levels for active mode efficiency



# Goals and Outcomes

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- Review focus areas for upcoming Server V2.0 Draft 1
- Discuss blades servers and proposed measurement methodology
- Active mode requirements update



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# ENERGY STAR Servers: Version 2.0 Scope

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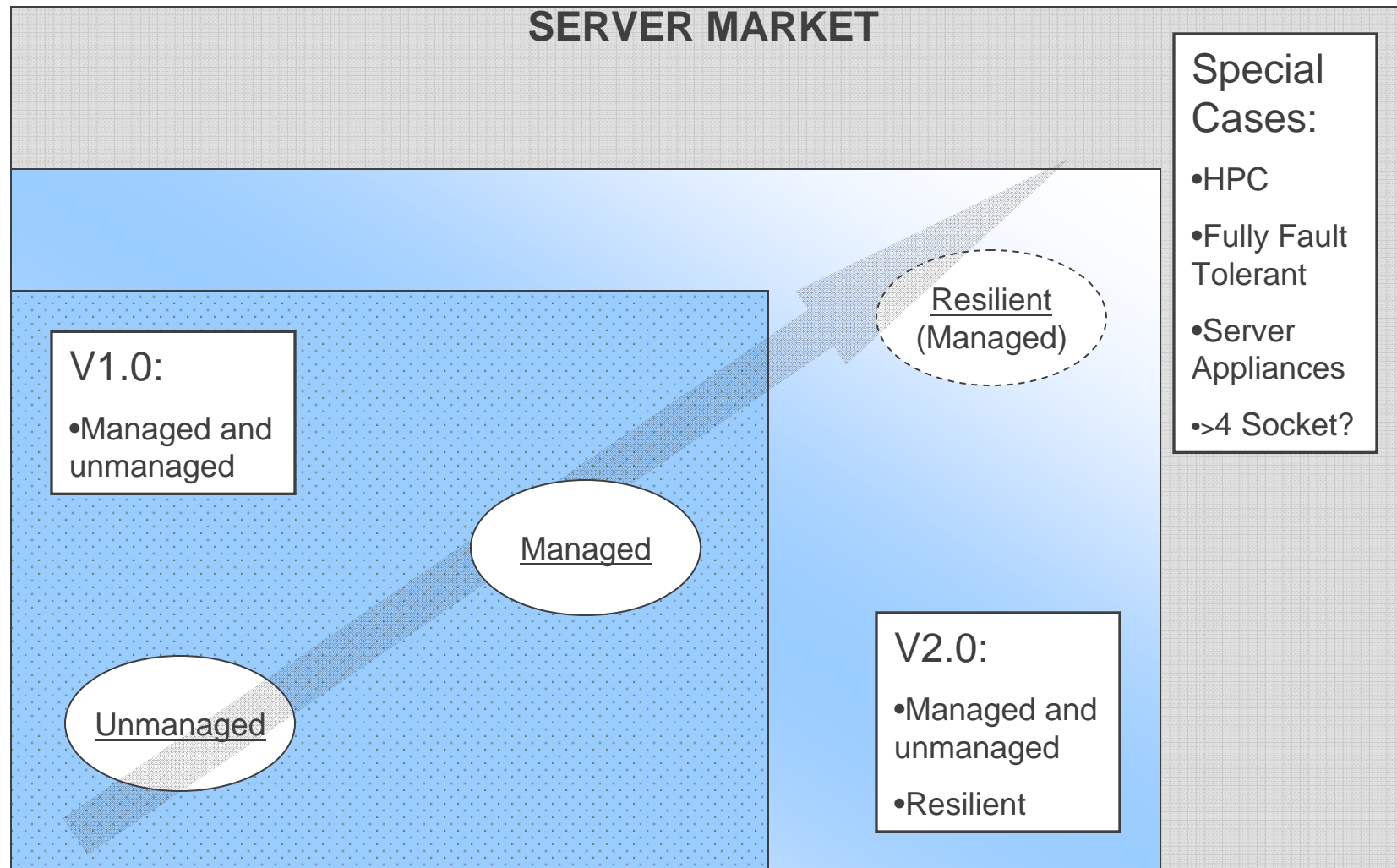


# Updates to scope

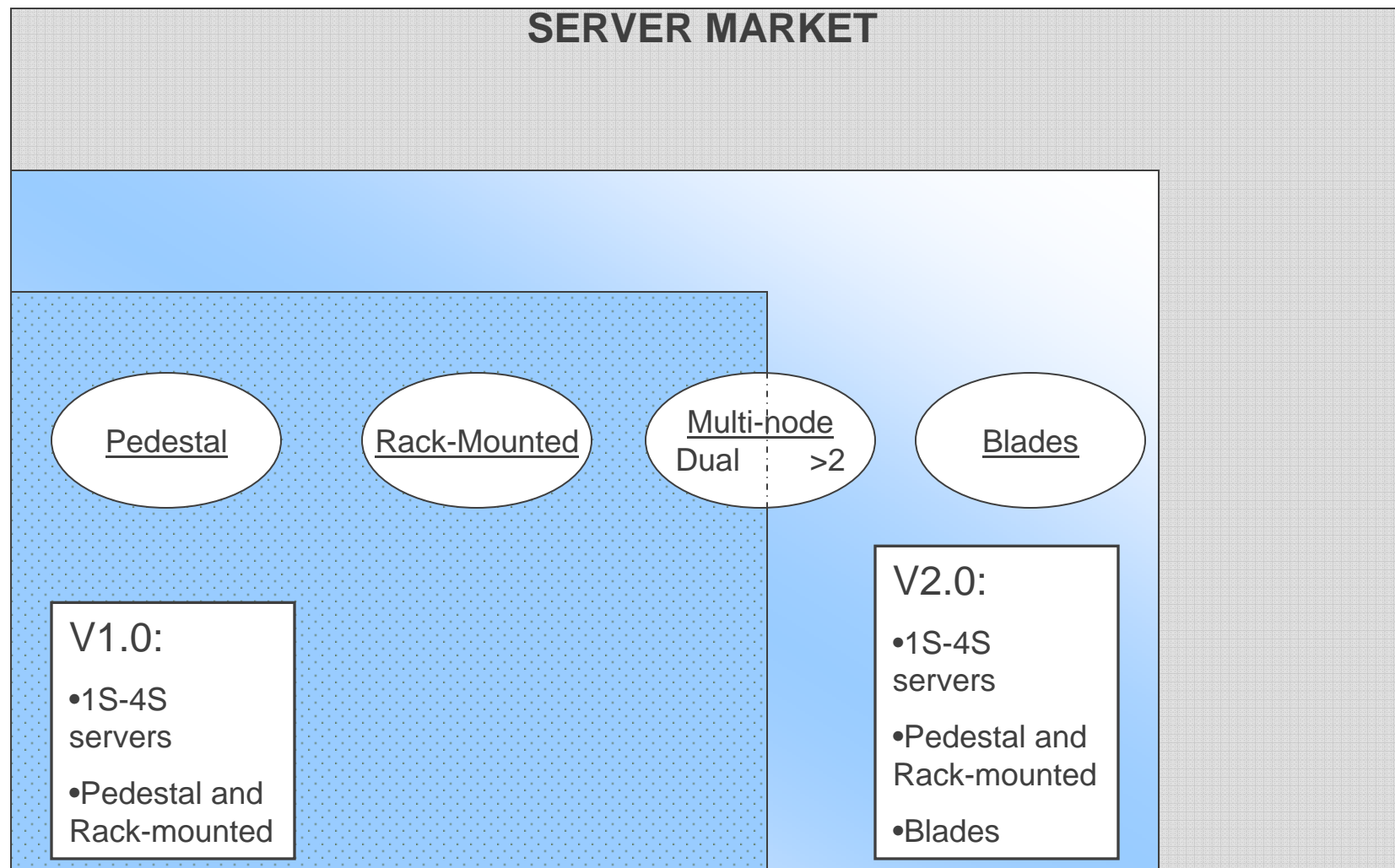
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- Tier 1: 1S-4S servers in rack-mounted and pedestal form factors – “Stand-alone”
  - Managed and unmanaged
  - Blades excluded
- Scoping considerations
  - Modularity/shared resources
  - RASM – *redundancy, availability, serviceability, management*
  - Specialized usage cases
  - Form factor

# Scope: Server Types



# Scope: Form Factors







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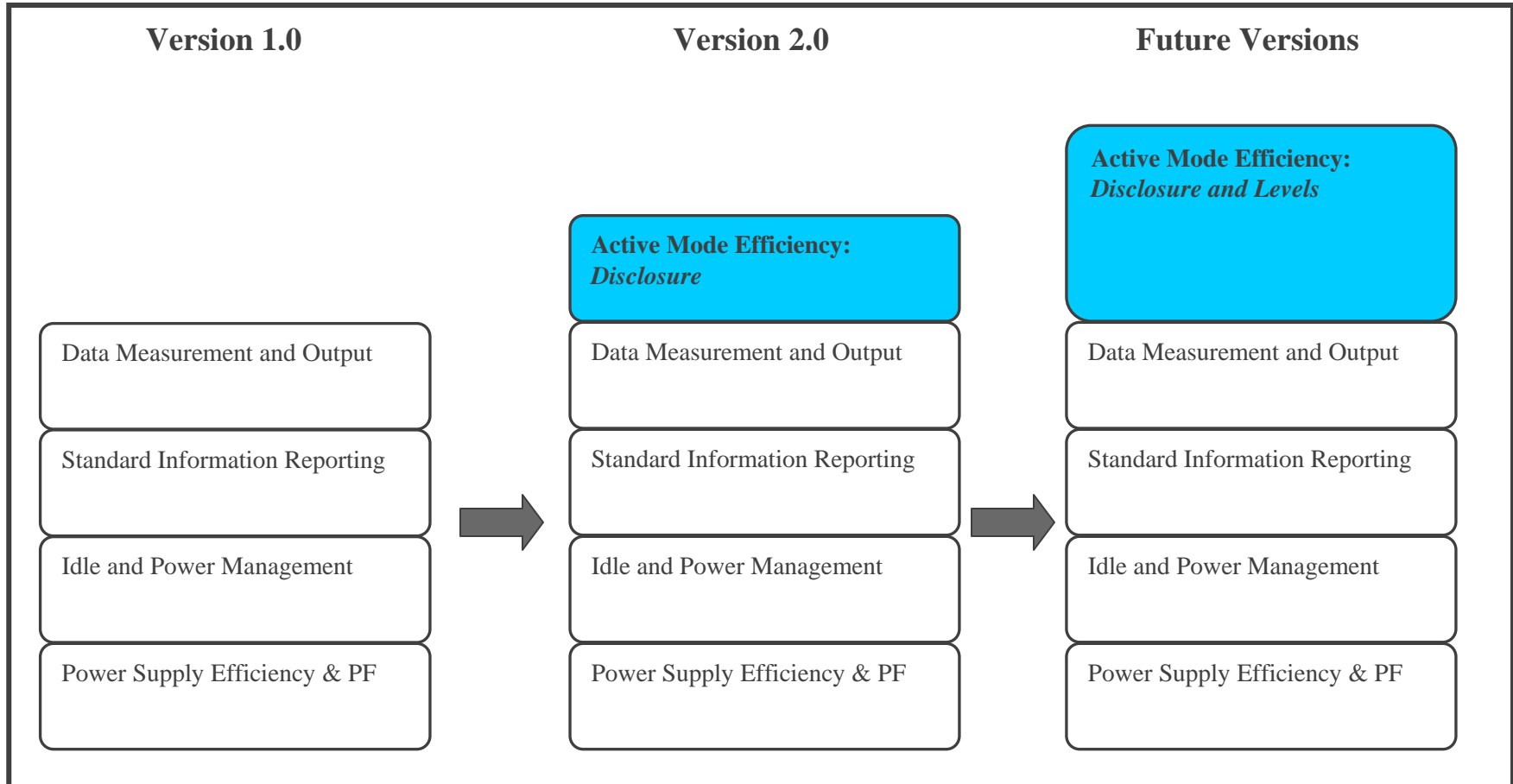
# Rollover Requirements

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# Layer Cake



# Rollover Criteria

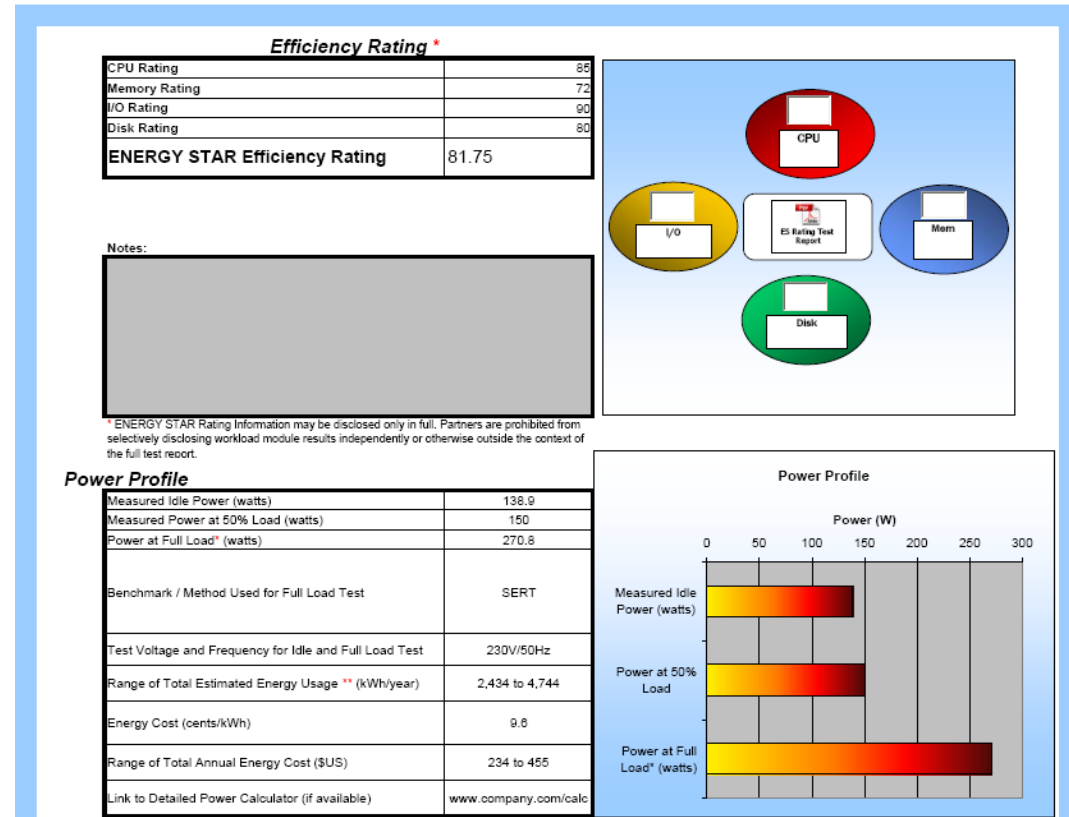


- Power Supplies
  - CSCI Silver (multi-output) and Gold (single-output)
  - Efficiency and PF levels maintained from Preliminary Draft
  - NPL dropped for Version 2.0
- P&P Datasheet
  - Suggestion received to continue performance benchmark disclosure in addition to a specialized rating tool
  - Revised format to present active mode efficiency data
- Data Measurement and Output
  - Power, inlet air temperature, and processor utilization
  - Edits made to accuracy/sampling criteria based on stakeholder feedback

# P&P Datasheet



- Draft 1: sample datasheet format provided for comment
- New efficiency rating section
  - Designed for SPEC tool (*speculative at this stage*)
  - Full results disclosure, standardized format to avoid misrepresentation of results
- Graphical representation of power data
  - Cost calculator



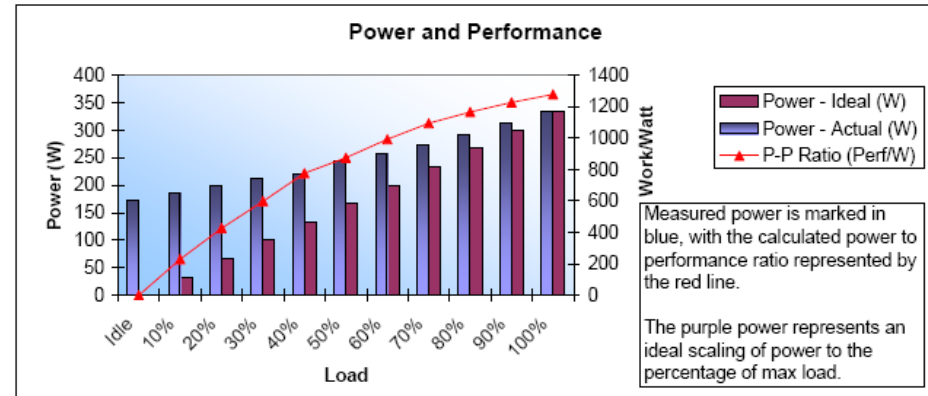
# P&P Datasheet



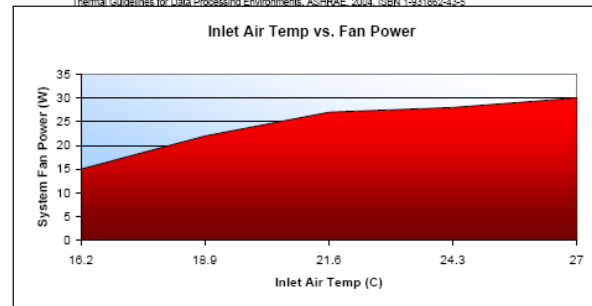
- Graphical representation of power-performance benchmark results
  - Ratio of power consumed to benchmark performance result
  - Actual power consumption
  - Ideal case: power consumption would be if it scaled exactly to the load
- Power of fan when cooling different loads (stakeholder suggestion)

Power-Performance Benchmark Disclosure

Benchmark Used and Type of Workload	SPECpower_ssj
Avg. Power Measured During Benchmark Run	246.3
Maximum Load (Operations)	N/A
Benchmark Performance Score	993 ops/W
Power Performance Ratio (perf score/avg. power)	993 ops/W
Link to Full Benchmark Report (Where Available)	N/A



Thermal Guidelines for Data Processing Environments, ASHRAE, 2004, ISBN 1-931862-43-5



# Data Measurement and Reporting



- **Draft 1: revised section to incorporate stakeholder suggestions and feedback**
- Series of requirements to provide users with tools and data necessary to operate the server most efficiently
- Version 1.0: 1S/2S (managed) and 3S/4S (all) must provide data on input power consumption, inlet air temperature, and utilization of all logical CPUs during normal operation
- Version 2.0: Extending to all servers in scope, with modifications to accuracy and sampling
  - Accuracy of power measurement on a per-psu basis
  - V1.0 structure for processor utilization
  - Rolling average of data optional

# Server families and reporting



- Balance of manufacturer testing/reporting burden with data applicability
  - P&P datasheet – *how close to purchased configuration?*
  - Submittal data – *do representative tests validly apply to the grouped configurations?*
- QPI vs. P&P Datasheet
  - QPI is an *internal document* for compliance
  - Datasheet is intended for customer use – provide a uniform format for important configuration, power, and efficiency information



# Family structure

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- Accepting feedback on the V1.0 process, and planning to work with stakeholders to improve the existing process
- For Version 2.0, considering modifications for storage, memory, and I/O
  - part numbers may vary
  - For storage and memory, capacity may vary, with worst case power consumption used for testing in max/min configurations
- Family structuring is a data-driven process



# Idle

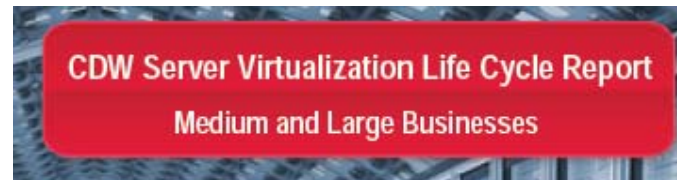


“We believe an idle power requirement is inappropriate for server Energy Star ... increasing cost and limitations of power, the uptake of virtualization technologies ... conspire to reduce the relevance of idle power.”

“It is strongly suggested not to ... delete idle requirements in favor of an overall benchmark. We believe Idle should be addressed [because] for many applications low loads on servers will remain quite common.”

“Idle power requirements should be included as part of the evaluation under [the Version 2.0 efficiency rating], allowing the server to receive a single, overall score ...”

# A case for Idle?



## Glass Half Full? Half Say They Are Fully Deployed...

- ▶ As of June 2009, **90%** of organizations were implementing server virtualization; over half say they have completed their transition

## ...Or Glass Half Empty? What Is "Fully Deployed?"

- ▶ Despite reported progress, the average organization claims that just a third (**34%**) of their total server infrastructure consists of virtualized servers
- ▶ Even in "fully deployed" organizations, this percentage remains at **37%**

Source: CDW's *Server Virtualization Life Cycle Report*, January 2010

# Addressing idle in future versions of the program

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- EPA believes Idle remains a relevant concern ...
  - for many server applications where virtualization and resource scaling remain elusive or “inappropriate”
  - as a datapoint to provide a full range of the server power profile
  - as an incentive for continued industry efforts to optimize resource scaling
- An automated rating tool presents the opportunity to streamline idle power measurement

# Energy Efficient Ethernet

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- EPA continues to strongly support this effort
- Stakeholder feedback received on the timeline to availability of hardware
- Draft 1: propose replacement of the mandatory EEE requirement
- Will reconsider former requirement in future versions of the program



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# ENERGY STAR Servers: Blades

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# Bringing blade servers into the program



- Blade servers and systems were dropped from V1.0 consideration
  - Insufficient data/development time
- Will be part of V2.0
  - Evaluated using rating tool
    - Use of “same language” when discussing efficiency
  - Chassis requirements (allow sale of ENERGY STAR blades independent of chassis, but provide minimum criteria for a chassis sold or marketed for use with qualified blades)



# Stakeholder feedback



- Blades are efficient
  - the form factor has necessitated a clamp down on waste heat
  - many of the savings (and product differences) may be in the chassis design
- Testing can be expensive
  - fully-populated chassis testing is not common and resource-intensive
- Customers do what they want
  - responses differed from manufacturer to manufacturer
  - some customers purchase individual blades, others a fully populated chassis, yet others a chassis with open bays for future expansion



# Blade testing proposal

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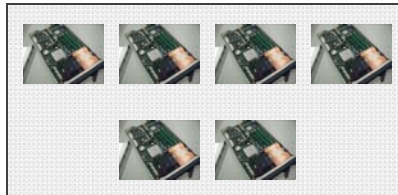
- Chassis requirements
  - If shipped with a chassis, the chassis must be approved (supports PM, does not introduce undue power consumption in idle/full load, adaptive cooling)
- Single blade server
  - tested for idle and full power in a supported chassis (independently metered)
- Partially populated chassis: 1/2 bays populated
  - Tested for idle and full power, and with the rating tool
- Single blade power levels compared with this test to derive chassis idle and full power
  - Rating tool results divided by the number of installed blades to derive efficiency rating



# Route through the program



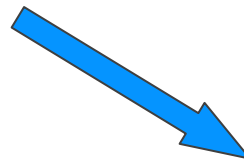
Tested for Idle/  
Full Load



Half populated  
with the same  
model blade  
server



- Idle/Full Power
- Efficiency Rating Result



Meets minimum thermal  
management, data  
management criteria



Tested for Idle/  
Full Load, half  
populated



- Idle/Full Power  
(subtract per-  
blade power  
from total)

# Discussion

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- Blade Server
  - Is ½ populated scenario present in the market?
  - Is individual metering of blade for single blade test a reasonable request?
  - Is individual blade power relevant data to a purchaser?
  
- Blade Chassis
  - What is worst case for chassis efficiency?
  - Are there alternative methods to derive the chassis power?
  - Which scenarios should be targeted to define best/worst case *chassis efficiency*?



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# ENERGY STAR Servers: Active Mode Evaluation

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# Active mode

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- EPA intends to pursue a disclosure-oriented structure for active mode
  - Coexists with required rollover baseline criteria
  - Required: operation of the rating tool, willingness to publish complete results (*in context*) in ENERGY STAR data sources for any ENERGY STAR server
- Why
  - Currently, barriers preventing open customer access to efficiency and operational data
    - Fear of marketing misrepresentation
    - Benchmarking tools specific to limited end uses

# Active mode efficiency

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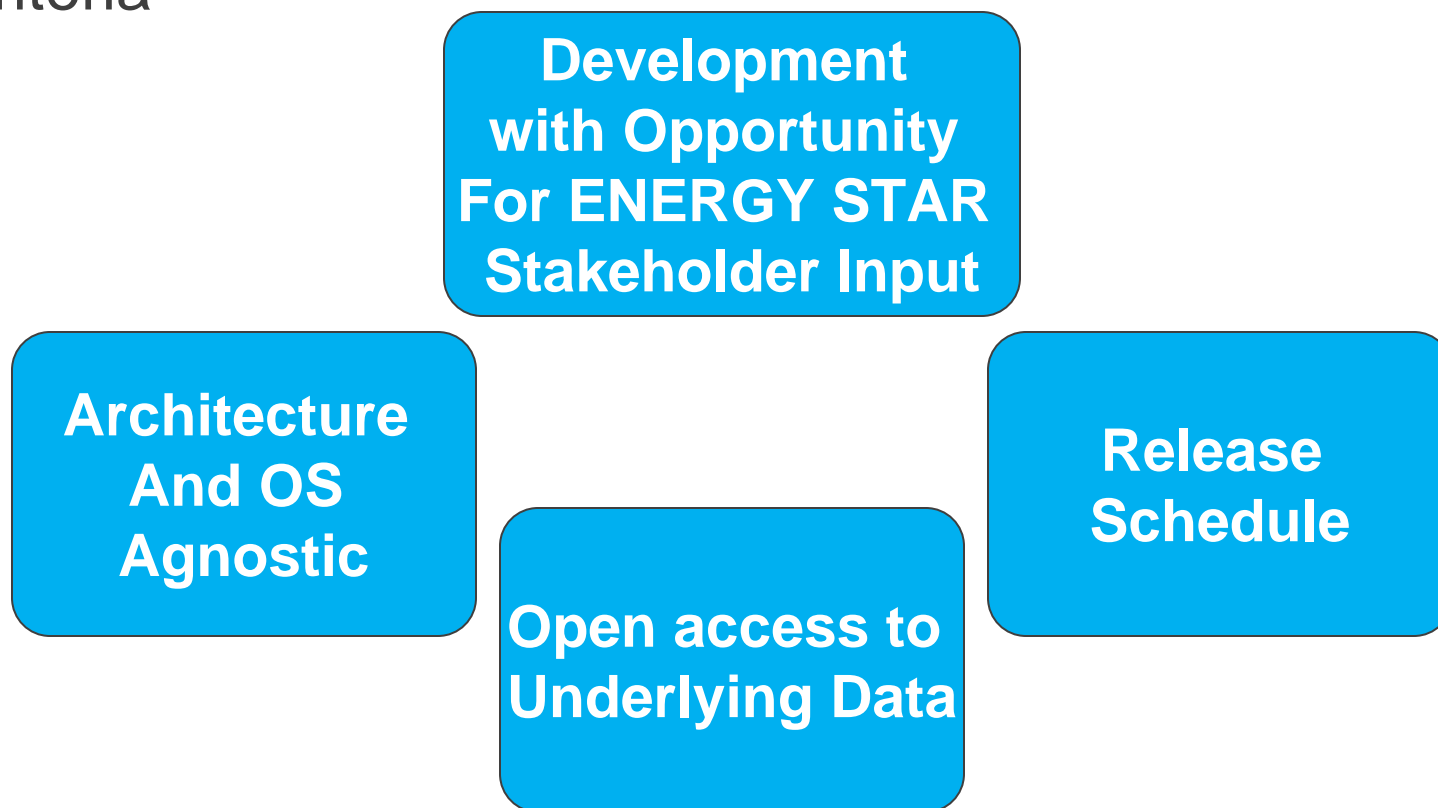


- EPA's objective: institutionalize server energy efficiency reporting
  - Make such information available as the norm rather than from a special request
- EPA seeks to establish an efficiency rating for servers that encompasses a broad range of activities and end uses
- EPA has looked to collaborate with industry to develop an efficiency rating tool for this purpose. The Standard Performance Evaluation Corporation (SPEC) has offered to develop a solution - SERT

# Active mode efficiency



- EPA is committed to adoption of the SPEC efficiency rating tool as an element of the ENERGY STAR specification provided the tool meets EPA's acceptance criteria



# Characteristics



- **SPEC is developing a written description of their tool to share with ENERGY STAR stakeholders**
- First-order efficiency evaluation
  - Rating of hardware efficiency along with fundamental elements of the software stack (OS)
- Composed of a series of loads (“modules”), each oriented toward a specific server subsystem. Tentative list:
  - CPU
  - Memory
  - Network I/O
  - Disk (Storage)
- Each module adjustable to load levels between 0-100% of capability
  - Capacity calibrated as part of the evaluation
- Results presented for each subsystem and as an aggregate a total system result

# Testing process

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- SPEC following elements of their Benchmark Methodology  
([www.spec.org/power\\_ssj2008/docs/SPECpower-Methodology.pdf](http://www.spec.org/power_ssj2008/docs/SPECpower-Methodology.pdf))
  - Controller server to harness and automate setup, measurement, and reporting
- Test process characteristics:
  - repeatability, duration, accuracy



# Key considerations



- System architecture and OS
  - Architecture: EPA received strong feedback from stakeholders that initial development should focus on support for both x86 and RISC systems
  - OS support: EPA believes that the effect an operating system has on overall system efficiency must be included in a general efficiency evaluation, though under a structured system that supports comparable results and avoids unrealistic tuning
- Resources
  - EPA strongly supports a broad-based tool meeting the considerations above
  - Availability of resources will be crucial – if there is not development support, the first version of the tool will move forward accordingly
- Structure
  - Locked down vs. structured guidelines and disclosure

# Schedule Goals



	Specification (rollover criteria/structure)	Rating Tool
February	Draft 1 distributed	Availability of design document
	Comment Period	
March		Development commences
	Draft 2 distributed (refined definitions, rollover criteria, blade requirement structure, active mode reporting format)	
April	Comment period	
May		
June	Draft 3 distributed	TBD: Beta availability (testing and comment period)
July	Version 2.0 finalized	

# Discussion

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- System architecture
- OS support
- Rating tool pros – cons: locked down vs. tune-and-disclose
- Module structure (CPU, Memory, I/O, Storage)



# Closing

# Coming next

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- EPA to distribute Draft 1 (comment period announced)
- Stakeholder comments to EPA. Areas of focus:
  - Stakeholder feedback on disclosure plan and SPEC tool
  - Blade testing scenario – correct balance of burden and accuracy?
  - Families
- Webinar to discuss family structure
- EPA to notify stakeholders on the beginning of the development period

# Contact Information

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More Info:

<http://www.energystar.gov/NewSpecs>