Joint Breakout Session:
Active Mode Rating Tool for Server Energy Efficiency

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Today's Discussion

- Why: server active mode and the potential for energy savings
- What: key considerations in developing tools and approaches to tap into this potential
- How: Strategies within the ENERGY STAR development process that arrive at a useful solution

Active Power Requirements

- Tier 1 focused on reducing power during down time through PM or Idle limits
  - Set foundation for program
  - Allowed for more time and thought into active mode

- Tremendous potential to highlight other techniques to improve efficiency if *active computing* component evaluated
  - **Power supply management**
  - **Integral storage optimization**
  - **Memory**
  - Processor parallelism
  - Varying utilization
  - Core-level power management techniques
  - Subsystem power management

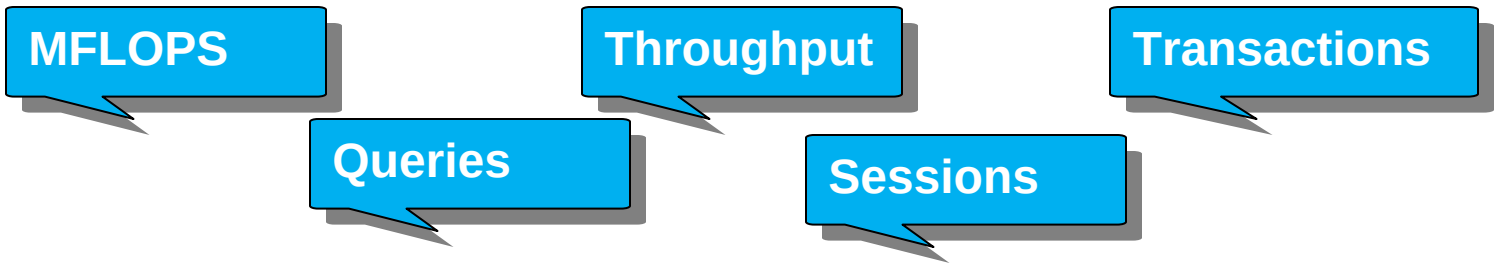
Active Mode Efficiency

- "X feature allows for better functionality … earns power allowance"
  - Core count, I/O, etc.
- In the past, the next step is to take data and figure out if an allowance is justified
- Missing from the process is any direct assessment of functionality
- Next sets of requirements must take the next step by exercising some of these features – showcase benefits to allow customer to weigh the solution

The Challenge

- "Miles per Gallon" often the cited analogy
  - This works because it is generally agreed that miles are the desired output from an automobile

- The data center industry has its gallon – watts (or kWh over time)
- Miles are another matter:



Available Tools to Evaluate Performance

- Industry has long used software benchmarks as a basis for comparing the performance of competing server products

- Industry experience can provide foundation for an active efficiency rating tool
  - Consortium-based development processes
  - Pre-determined and transparent testing methodologies
  - Structured versioning and revision schedules
  - Established presence in the market

Available Tools to Evaluate Performance

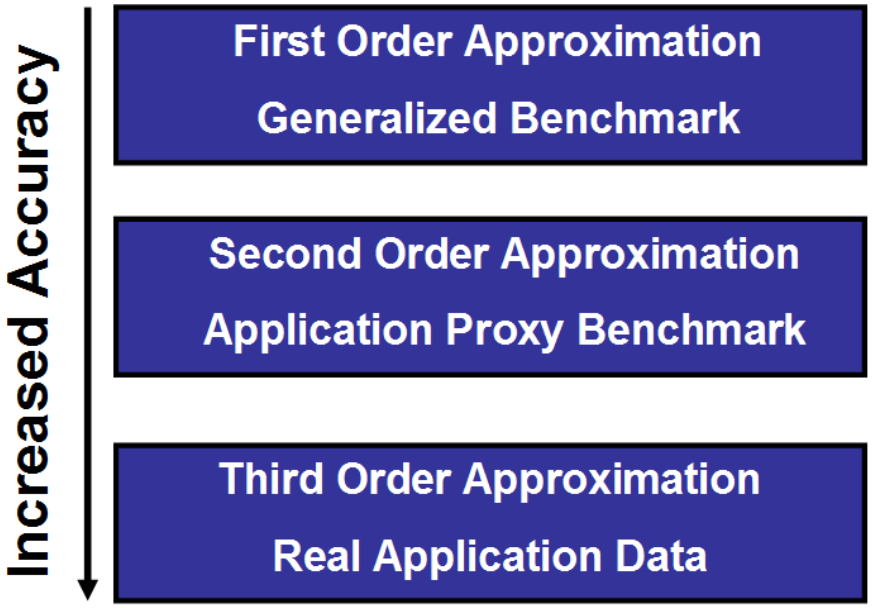
- Not without complications, however
  - Years of development and competition based solely on performance
  - Lack of incentive to publish mid- and low- range results
  - Workloads often serve specific end uses

- Efficiency/power considerations receiving more attention, however:
  - SPECpower_ssj, SPECweb, TPC

EPA

Active Mode Efficiency Rating Tool

- End uses are highly specific
  - ENERGY STAR goal: provide an overview of general active efficiency, with underlying detail on activity for specific usage types
- For users with fewer resources to test = sound high-level idea of most efficient system for general needs
- For users with resources to test their applications before procurement: sound first step before doing more refined testing



For Consideration

- Features to ensure fairness
  - Technology-neutral/architecture-agnostic
  - Limited Barriers to Implementation
  - Covers a Variety of End-use Scenarios (*e.g. HPC, web services, email services, database management, shared file services*)
  - Transparent and Standardized
  - Data across utilization curve
  - Available within an acceptable timeframe for the program; applicable to a widest range of products within the scope

Paths Forward

- Approach A: Refine Tier 1 Criteria plus Individual Benchmark Workload Reporting. *Require manufacturers to publish data for servers under existing benchmark workloads (e.g. SPEC system-level benchmarks, TPC benchmarks, etc.) in the ENERGY STAR Power and Performance Data Sheet (PPDS).*

  - Pros:
    - Streamlined transition from current requirements;
    - Insight into active mode using existing tools.

  - Cons:
    - Assigning \expected end uses for a general purpose server may be unrealistic;
    - Use of benchmark data may focus attention on the performance score and not the *efficiency* result;
    - Hesitance to widely publish benchmark results could be a barrier to participation in the program.

Paths Forward

- Approach B: Refine Tier 1 Criteria plus Unified Benchmark Workload Reporting. *Require manufacturers to publish data in the ENERGY STAR PPDS for servers under a single blended metric that combines power and performance results for several existing benchmark workloads*.

  - Pros:
    - Avoids immediate need to develop specialized rating tools while providing some insight into active mode;
    - Single score fits well with general ENERGY STAR structure.

  - Cons:
    - Benchmark results would likely be in incompatible formats (transactions + MFLOPS = ?);
    - Single result might obscure good performance in one expected end use if the server performs poorly in an unsuitable benchmark;
    - Use of benchmark data may focus attention on the performance score and not the *efficiency* result.

Paths Forward

- Approach C: Refine Tier 1 Criteria Plus Specialized Efficiency Rating Tool. *Require servers to meet refined Tier 1 criteria, with active mode efficiency addressed through development and implementation of a multi-workload rating tool.*
  - Pros:
    - Specialized tool developed *first* with efficiency in mind;
    - ENERGY STAR stakeholders would have opportunity to comment on structure of tools;
    - Tool development could occur in parallel with other development efforts (idle data collection, blade test procedure development).
  - Cons:
    - Requires development time for the rating tool;
    - Underlying components of the workloads would need to be clearly communicated (context);
    - Capturing all servers in the scope of the program would be challenging.
- Approach D: Blend of Approaches B & C. *Implement Approach B, with reporting to a blended metric, for one year. Gather data with the intent of releasing a Tier 3 specification similar to Approach C.*

Joint Breakout Session:
Rating Efficiency During Operation

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