Mid-Range Server Power Architecture: Present & Future

Brian Hruby
Senior Engineering Manager
Agenda

• Overview of IBM Mid-Range Systems
• Scope of Mid-Range and Storage Power Development
• Technical Challenges
• Projected Trends
• Continuous E2E Business Model Improvement
• Evolution of Brand Interaction
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What is an IBM Mid-Range System?

Power 730

Power 750

Power 770
Power Architecture of an IBM Mid-Range System

Some Typical Features:
- IBM Power PC Based

Bulk Power
- Distributed +12V
- 100/200VAC Power Supply
  - Rectified AC Input for Storage Brand
- Maximum Current for IEC C13/14 Plug Set
- Fully Redundant
- Onboard µProcessor
  - IBM Developed FW
- 80 Plus Platinum
- Compact Form Factor Enables Commonality/Durability

DC/DC Conversion
- Processor/Memory Subsystem Requires Multiphase VRMs
  - Non-Redundant for Low-End Systems
  - Phase Redundant for Mid-Range Systems
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IBM Power Development responsibilities include:
- Power Subsystem Architecture.
- Selection of Commercial Off-the-Shelf power conversion components.
- Translating system requirements into Engineering Specifications.
- Unit level testing/functional verification.
- System integration, e.g. verification of redundant operation.
- Review of vendor and IBM unit level qualification.
- Provide support for line and field issues post GA.
Power Assembly Development Business Models

- "White" = IBM designed, IBM manufactured.
- "Light Gray" = Heavy IBM specified content, IBM involvement in Physical Design.
- "Dark Gray" = High level direction provided by IBM, external Physical Design.
- "Black" = Engineering Specification written by IBM. External design and manufacturing.

**Light Gray**
- Examples: VRDs, Mid-range Phase Redundant VRMs
- Multiphase chipset selection performed by IBM
- Heavy IBM involvement in Physical Design

**Dark Gray**
- Example: Non-redundant VRMs for Low-End systems
- Multiphase chipset selection, diagnostics design performed by IBM
- Vendor performs layout and limited mechanical design

**Black Box**
- Example: AC/DC power supplies
- IBM provides Engineering Specification, defines system interface.
- Vendor performs component selection, electrical and mechanical design
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Sample Block Diagram: Power 770.
TPMD: Thermal – Power Management Device

What Does TPMD Enable

- Oversubscription: System power draw above the rating of one power supply.
- Power capping: Necessary for datacenter power management.
- Turbo mode: Enhanced performance through processor overclocking.
- Sleep/idle states for power savings.
- AC and DC power monitoring for datacenter reporting.
- Frequency/Power adjustment for system optimization.
- Fan speed adjustment for power/acoustics

What Is Required of the Power Subsystem

- Accurate AC and DC power monitoring.
- Calibration of DC current readback.
- Sufficient VRM slew rate in response to processor current demand.
- Power supply communication timing to ensure system stays operational while loss of redundancy during Oversubscription.
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Trends: What Requirements Are Important to IBM

- Future systems will have a diverging set of requirements:
  - Mid-Range systems converging with High-End.
  - Low End systems converging with SystemX Intel based products.
Increasing Pressures Every Product Release

Reliability
- Field PPM targets expect to decrease 15% YTY

Cost
- Competition against Intel based platforms.
- Technical choices made due to cost, not performance.

Commonality
- Leveraging solutions across IBM brands.
- Reduces development and qualification expense.

Low Risk
- Time-to-market shrinking, reducing regression testing.
- Development expanding to low cost Geographies.

Durability
- Custom or off-the-shelf assemblies selected for potential use in as many releases as possible.
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Evolution of Supplier Responsibilities

<table>
<thead>
<tr>
<th>Phase</th>
<th>Supplier</th>
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<tbody>
<tr>
<td>Product Definition</td>
<td>* Supplier presents latest technologies for IBM evaluation and possible integration into new projects.</td>
</tr>
<tr>
<td>Concept Design</td>
<td>* IBM communicates system level requirements, supplier provides comprehensive card level solutions.</td>
</tr>
<tr>
<td>RFQ Prep/Review</td>
<td>* Performs electrical and thermal simulations.</td>
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<td></td>
<td>* Engineering specification section-by-section confirmation of ability to meet requirements.</td>
</tr>
<tr>
<td>Detailed Design</td>
<td>* Provide ongoing feedback to design requirements, risk assessments, and suggestions to enhance design robustness.</td>
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<td></td>
<td>* Coordinate design reviews with IBM development, qualification, 1st and 2nd tier suppliers.</td>
</tr>
<tr>
<td>Unit Level Test</td>
<td>* Evaluate critical component waveforms as well as inputs/outputs according to specification.</td>
</tr>
<tr>
<td>System Test</td>
<td>* Provide complete end to end long term risk assessment for both performance and procurement issues: component de-rating guidelines, disaster recovery plans, cost reduction opportunities due to commonality.</td>
</tr>
<tr>
<td>Production/Quality Mgmt</td>
<td>* Provide ongoing feedback of line data and early warning on trends.</td>
</tr>
<tr>
<td></td>
<td>* Coordinate 1st and 2nd tier response to line and field problems.</td>
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Council value proposition is in process of being re-aligned from part number convergence towards technology, supplier design and capability.

**Benefits**
- Improved technology selection improves cost.
- Better alignment with industry standards improves supply assurance posture.
- Ensure cross brand utilization and feedback.
- Gives Suppliers visibility to future needs – increases competitiveness and early assessments of industry & core supplier readiness.
### Specific Council Work Items

<table>
<thead>
<tr>
<th>Work Item</th>
<th>Owner</th>
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<tbody>
<tr>
<td>Multiphase DC/DC chipset cross brand technology review</td>
<td>All</td>
</tr>
<tr>
<td>IBM’s HVDC &amp; datacenter power strategy</td>
<td>Nick Gruendler</td>
</tr>
<tr>
<td>Strategy for achieving efficiency standard certifications: 80+/EPA/Climate Savers/CQC/JEL</td>
<td>Pat Egan/Rick Fishbune</td>
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<tr>
<td>Cross brand common form factors</td>
<td>All</td>
</tr>
<tr>
<td>Review corporate standards against industry standards, e.g. PLD</td>
<td>Paul Wilson</td>
</tr>
<tr>
<td>Concept and HLD (High Level Design) design reviews</td>
<td>Brian Hruby</td>
</tr>
<tr>
<td>Cost avoidance methods</td>
<td>Pat Egan/Paul Severson</td>
</tr>
<tr>
<td>Commonality for power supply communication/diagnostics/telemetry between brands</td>
<td>Mid-Range/SystemX</td>
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<tr>
<td>277VAC input to power supplies</td>
<td>Nick Gruendler/Ray Clemo</td>
</tr>
<tr>
<td>Responding to power IP patent litigation</td>
<td>All</td>
</tr>
<tr>
<td>Establish regular executive readouts of Council activities</td>
<td>Nick Gruendler/Brian Hruby</td>
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Q&A

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