System Level Power Modeling in the Si2 Low Power Coalition

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The Role of Power Model Standards

• Model standards increase interoperability
  – Between tools, vendors, teams, and projects

• Model standards increase quality
  – Of analysis results and overall design

• Model standards decrease cost
  – For model generation, support, & maintenance

• Model standards spur innovation
  – More efficient design processes leads to better products
Si2 and Power Modeling

- It all started with the LPC Flows Working Group
  - Low Power Design flows were surveyed and requirements defined from a design flow perspective
  - Models were found to be essential in all design phases
Where are the Models?

• Executing the flow is limited by model availability
  – Implementation tasks rely upon gate level models
  – RTL tasks rely upon gate level models (directly or indirectly)
  – ESL? …. Ad hoc solutions…

• What about IP blocks?
  – Behavioral models are available for ESL & RTL, but without power
  – Simplistic power models may be available, …accuracy? reliability?

• We have a problem
  – Gate level models can be used for IP power simulations, but simulation time and resources are prohibitive
**Power Model Requirements**

- **Accuracy**
  - Both dynamic and leakage power
  - Both average power and power over time
  - Sensitive to key modes and mode transitions
  - *Sensitive to temperature (for leakage modeling)*

- **Completeness**
  - Cover all modes/states and significant transitions

- **Efficiency**
  - Fast execution for lengthy simulations

- **Usable in a variety of flows**
  - Early estimation through post-route signoff
  - Top-down, Bottom-Up, Meet-in-the-middle
  - Successive refinement

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*Available today at gate level only*

*Partially available today*

*Needed for system level and multi-die systems*
Si2 Power Modeling for Complex IP

- Developed by Si2 LPC (Low Power Coalition)
  - Ansys/Apache, ARM, Atrenta, Avago, Cadence, Calypto, Docea, Entasys, IBM, STMicro

- Proposed to Liberty TAB:  Jun 2012

- Accepted by Liberty TAB:  Dec 2012

- Released in Liberty:  May 2013
Si2 Developments & Other Standards

• Si2 developments may stand on their own and/or may be contributed to other standards
  – Complex Macro Modeling contributed to Liberty
  – CPF2.0 and 2.1 contributed to 1801
  – Contributor and Multi-Level Power Modeling contributed to P2416