



# System Level Power Modeling in the Si2 Low Power Coalition

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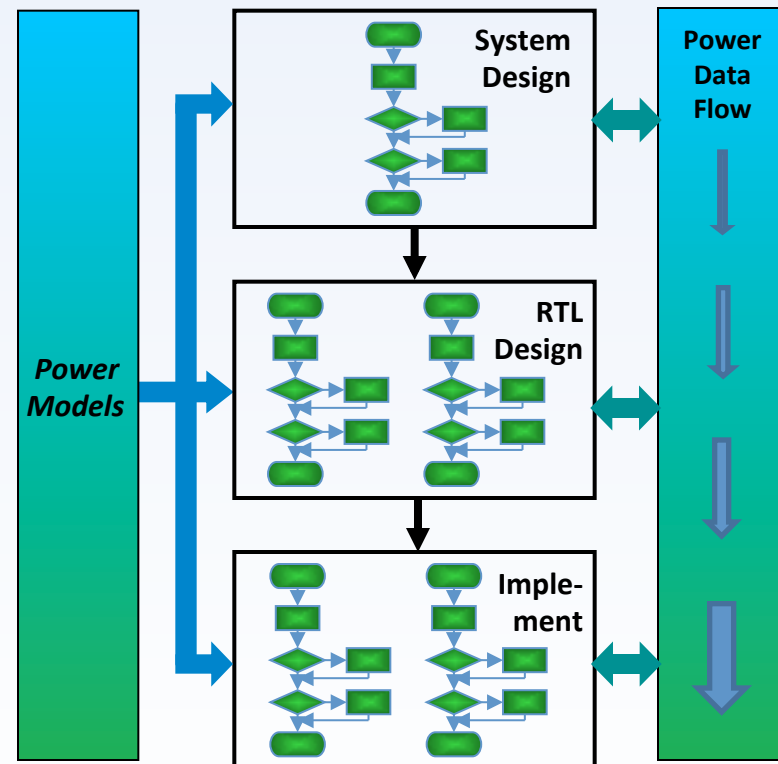
# The Role of Power Model Standards

- 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



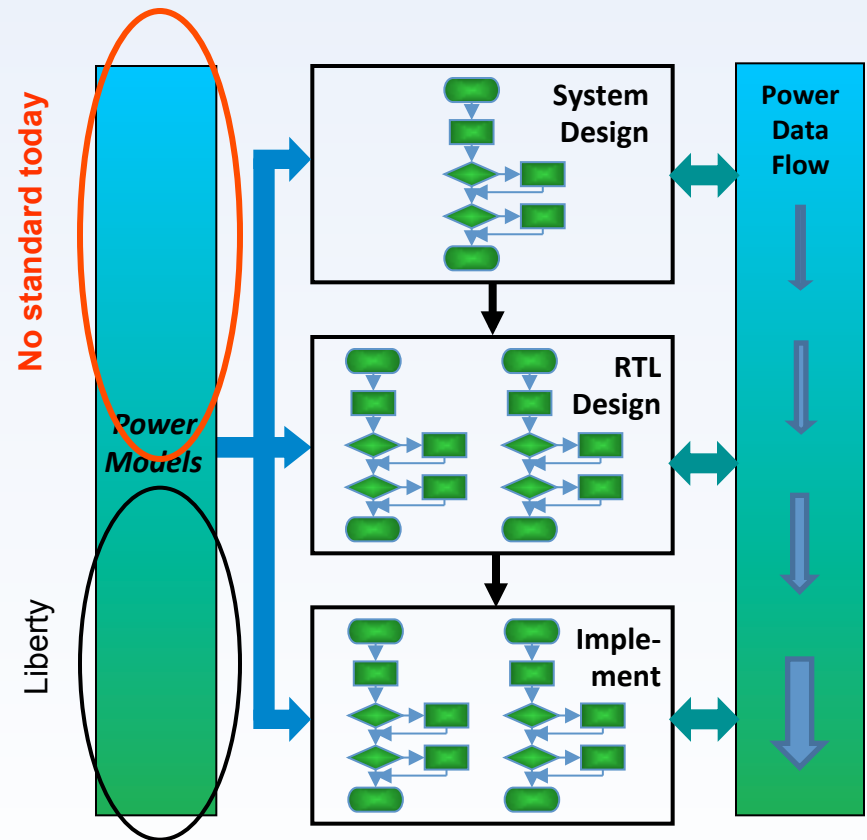
# Si2 and Power Modeling

- 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** *Available today at gate level only*
  - 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** *Partially available today*
  - Cover all modes/states and significant transitions
- **Efficiency** *Needed for system level and multi-die systems*
  - 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

# 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
  - Chapter 9.11, “Power Modeling”, *Liberty User Guides and Reference Manual Version 2013.03*, Synopsys, Inc.

# 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

