

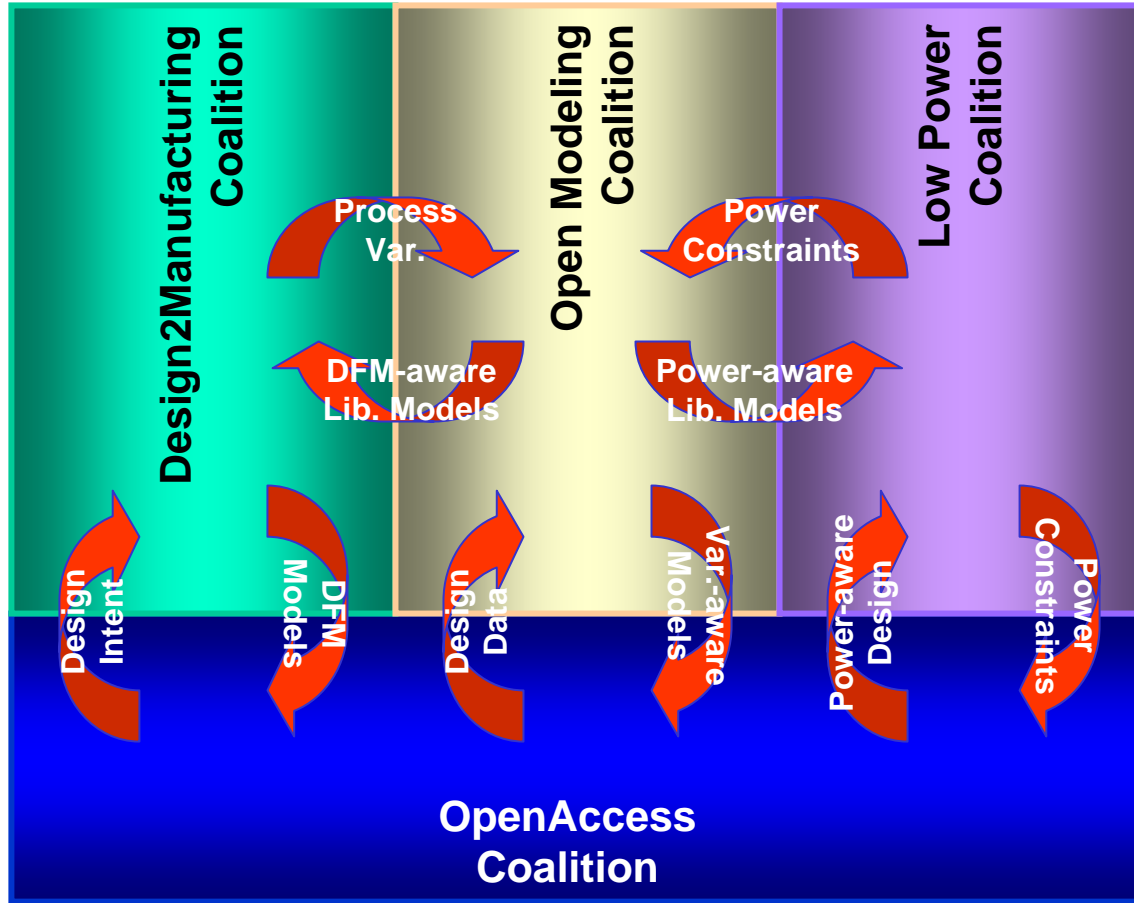


Standards Development at Si2: A Synergistic, End-User Driven Approach

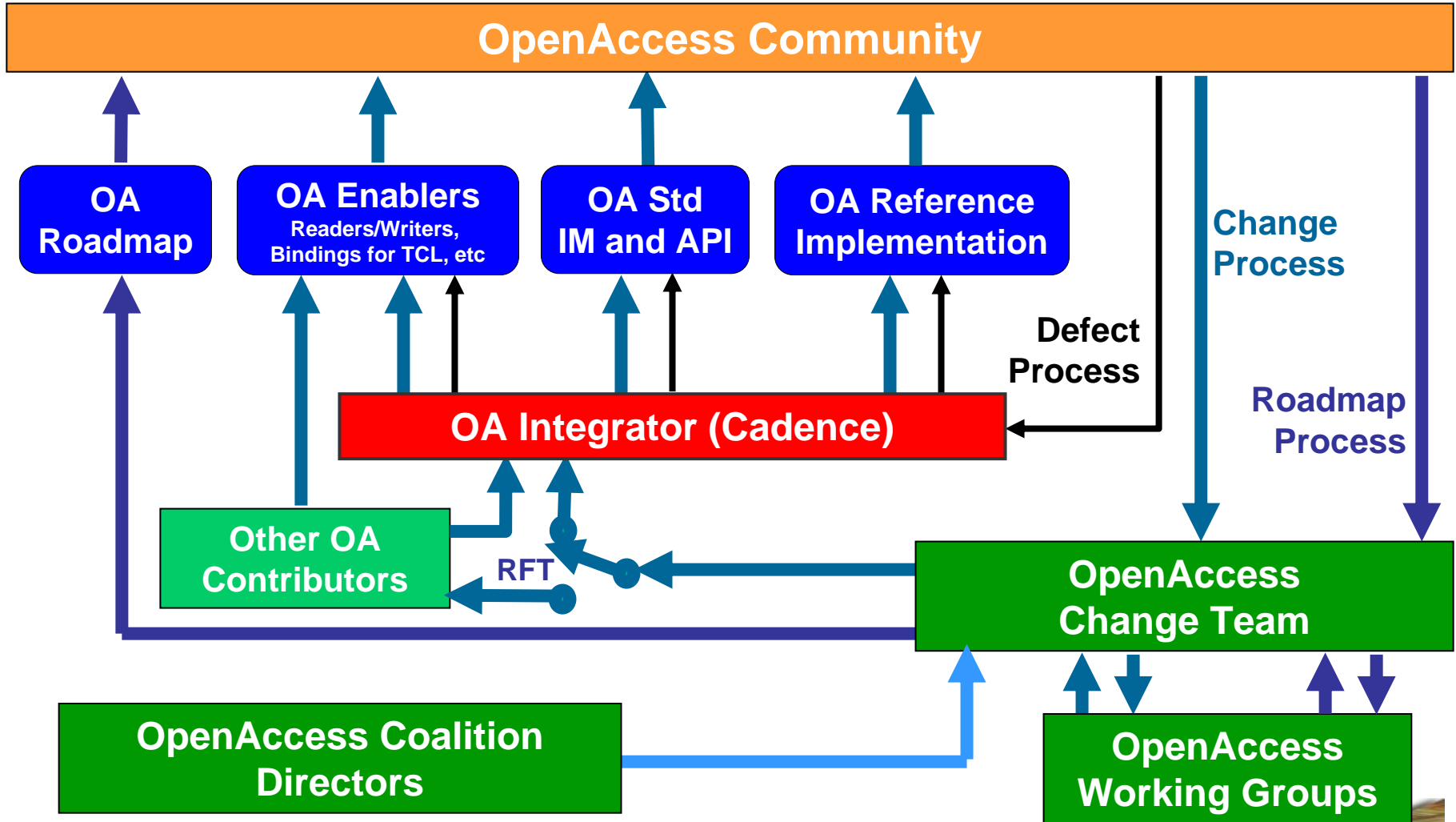
Electronic Design Process Workshop
April 13, 2007

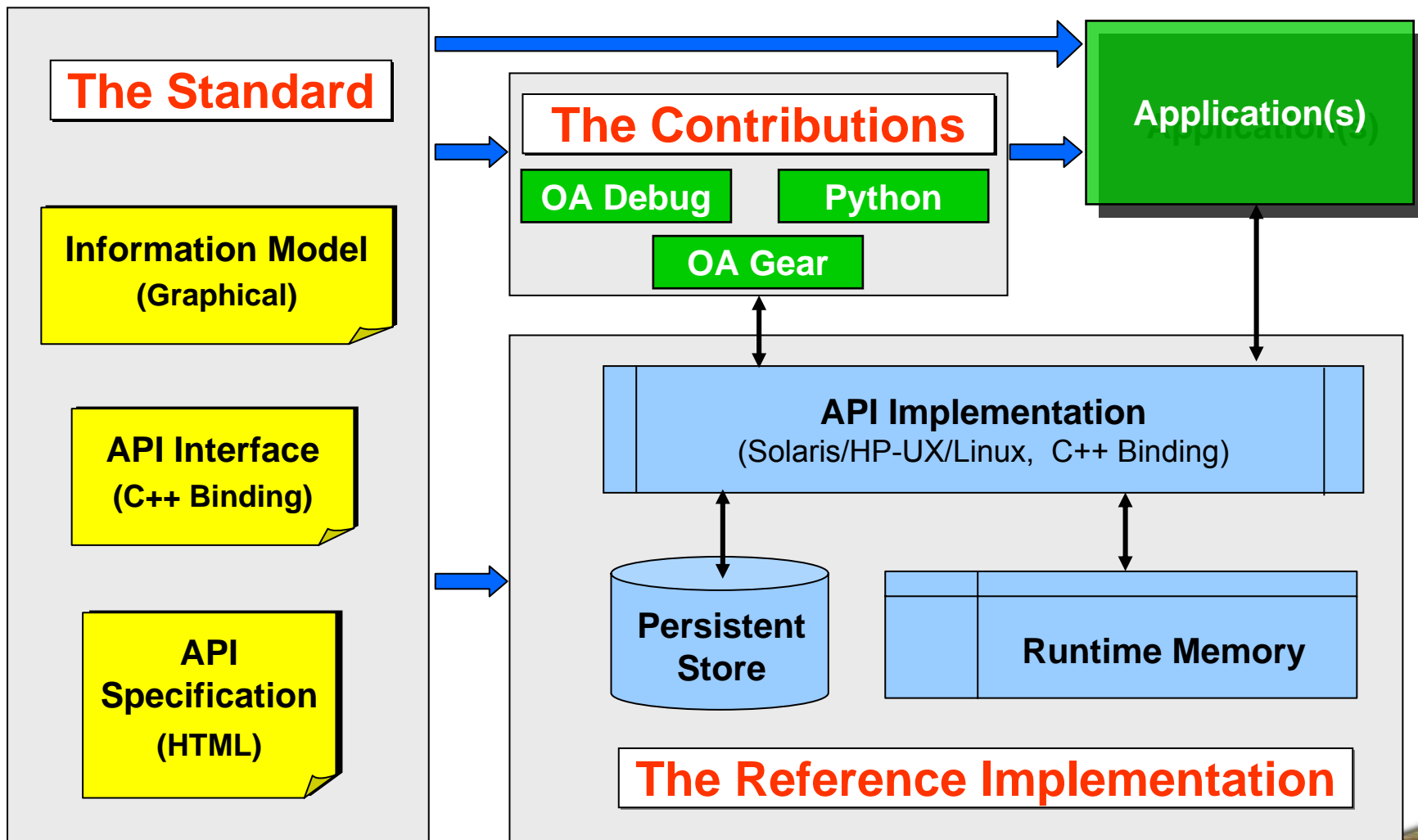
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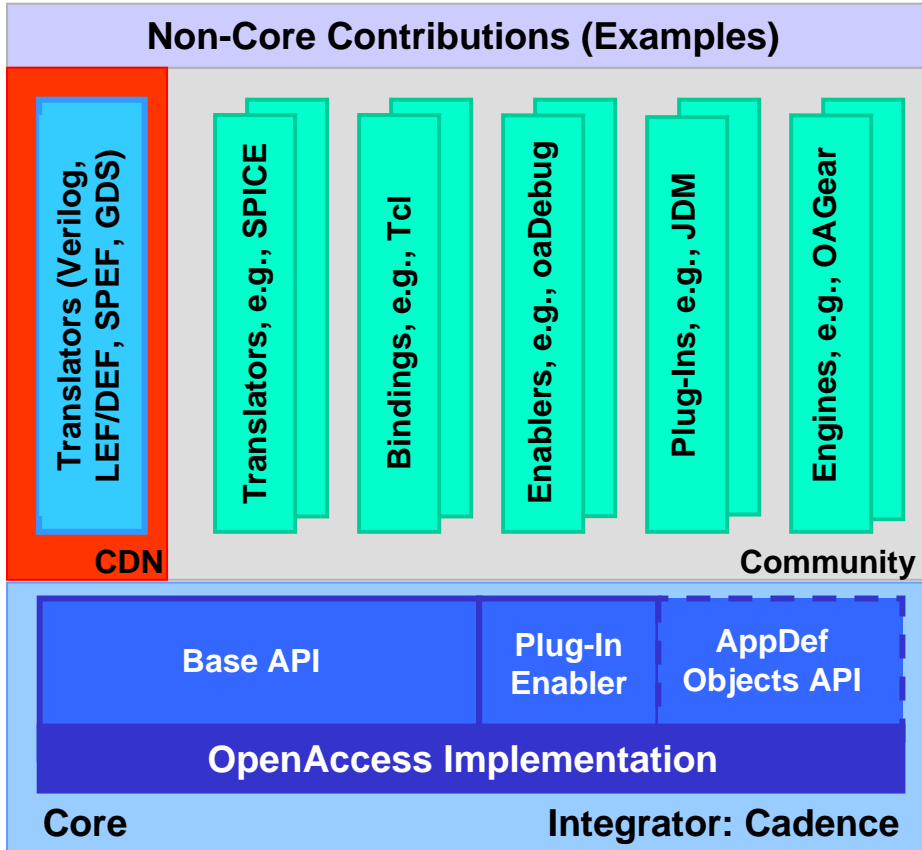
- **What it means to our customers / members:**
 - ◆ Drives openness in EDA industry, tools and flows
 - ◆ Success measured by:
 - **Availability of required collateral**
 - Specifications
 - Reference implementation
 - User documentation, training materials, sample code, etc
 - Forums for enhancements, discussions, etc
 - **Proliferation through EDA industry**
 - **Adoption throughout user flows**









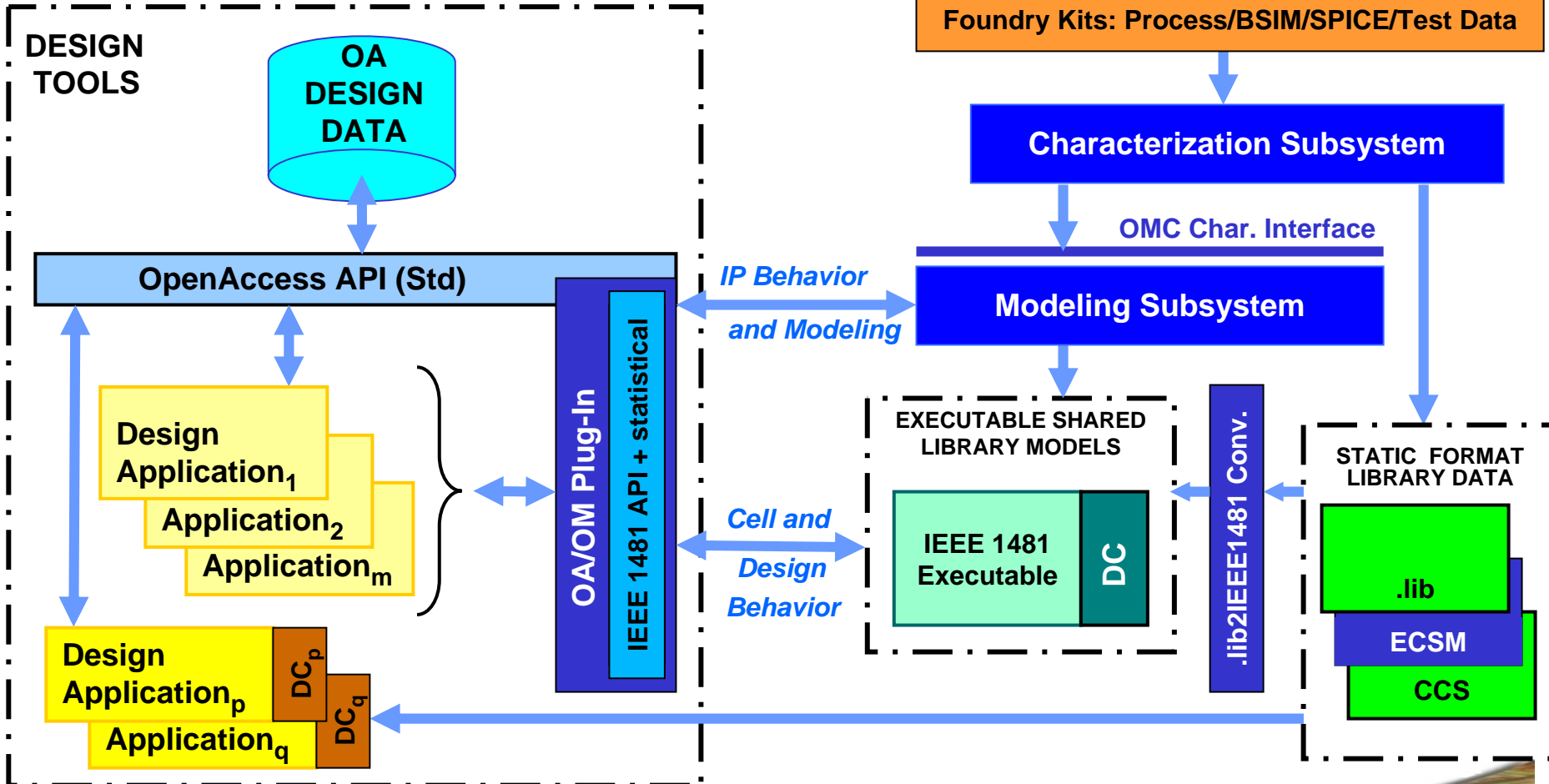


- Promote more community engagement and contributions by re-defining OpenAccess into:
 - ◆ **Core:** Requires Cadence integration / re-implementation
 - ◆ **Non-core:** “Above the API”, does **not** require Cadence integration
- Continue compatible evolution of OpenAccess **Core**, based on Feature-based Compatibility (FBC), as needed and appropriate
 - ◆ Manage enhancements which require significant changes to applications
 - ◆ Planned twice-yearly releases with goal to manage new data features, yet...
 - ◆ Provide monthly source code releases within above constraints
- ◆ Evaluate opportunities to expand into new areas, e.g.,
 - ◆ System level design (ESL SG)
 - ◆ DFM (based on DTMC requirements)

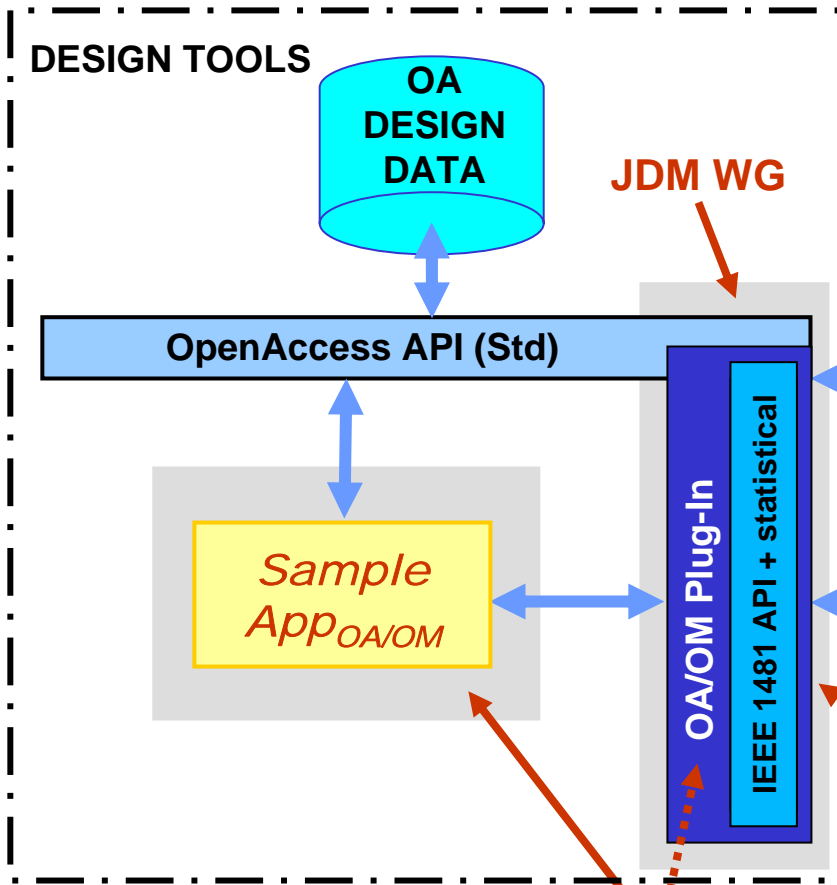
Evolving New OpenAccess Architecture



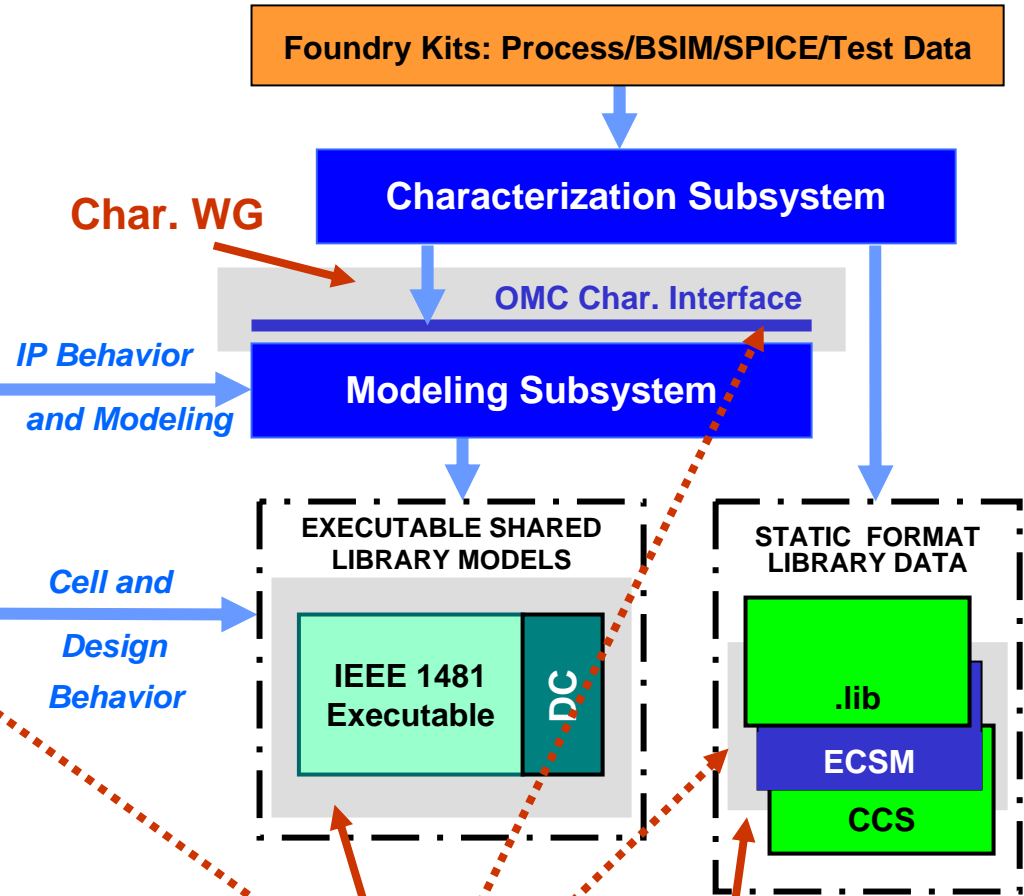
Both static and executable libraries are supported for OA/OM based applications



Library Use Flow



Library Creation Flow

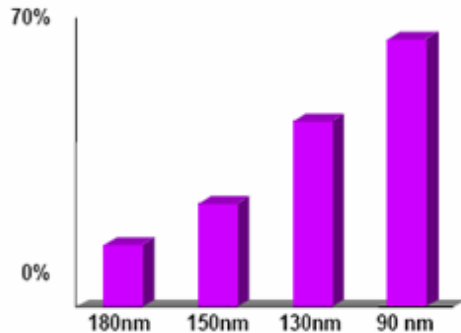


Application WG ← Statistical WG ← ECSM-CMG



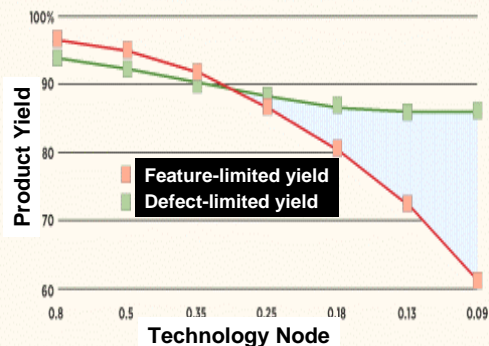
- Variability between die features has increased impact on functionality and yield
- Ownership of wafer yield is becoming shared by the fab manager and product designers
- Design rules are becoming less representative of the real-world
- "To achieve an accurate DFM solution for a particular circuit design requires the development of a comprehensive ecosystem for designers to accurately use DFM data." *(Morris Chang, Chairman TSMC)*

Number of TSMC Mask Layers Using OPC/PSM



Source: TSMC Technology Symposium, April 22 2003

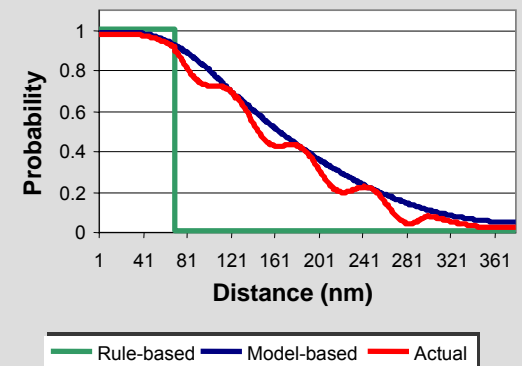
Defect-driven vs. feature-driven yield



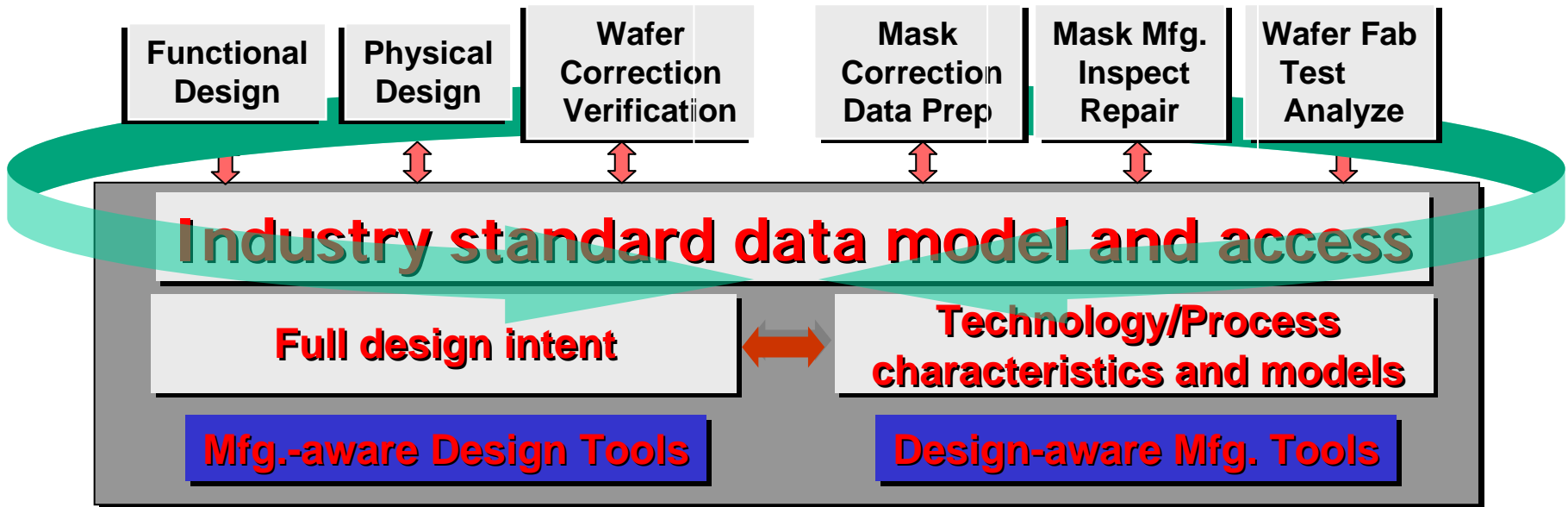
Source: PDF Solutions

Spacing rule failure model vs. actual

Source: Ponté Solutions



Virtual Integration across the supply chain



- Access to needed information
- Integrated flows - allowing tools of choice
- Concurrent processes to shorten cycles
- Additional knowledge to reduce cycles

- **From Design Customers:**

- ◆ DFM adds to the system optimization tradeoff space
- ◆ Need broader support for model-based DFM techniques
- ◆ Must keep our design focus... DFM must be *integrated into our design flows*
- ◆ Require portability and choice -- common solution across foundries and EDA
- ◆ Our suppliers need to take the lead and “get it together” on our behalf

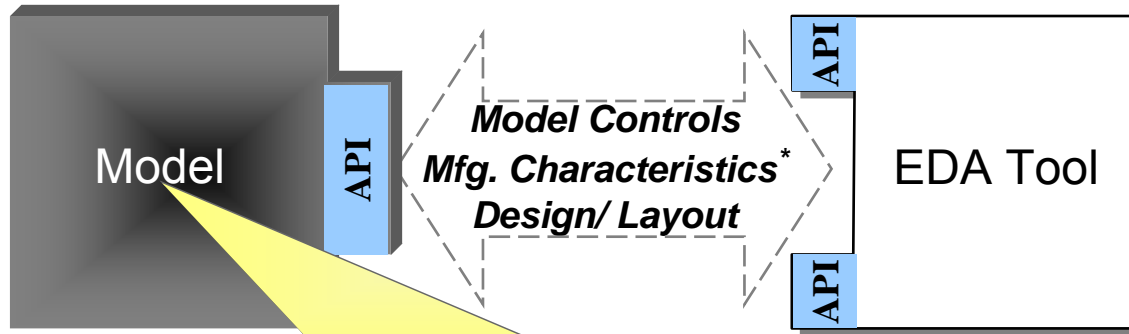
Conflict?

- **From Foundries:**

- ◆ Need better support for model-based DFM techniques
- ◆ Create models *once* to match our specific process... to improve customers’ design flows
- ◆ What specific model data does design require, and how will it get used in tools?
- ◆ Sharing of process / mfg details is problematic... IP must be secure or distribution must be limited
- ◆ Want common solution across all EDA – but not all foundries

- **From EDA:**

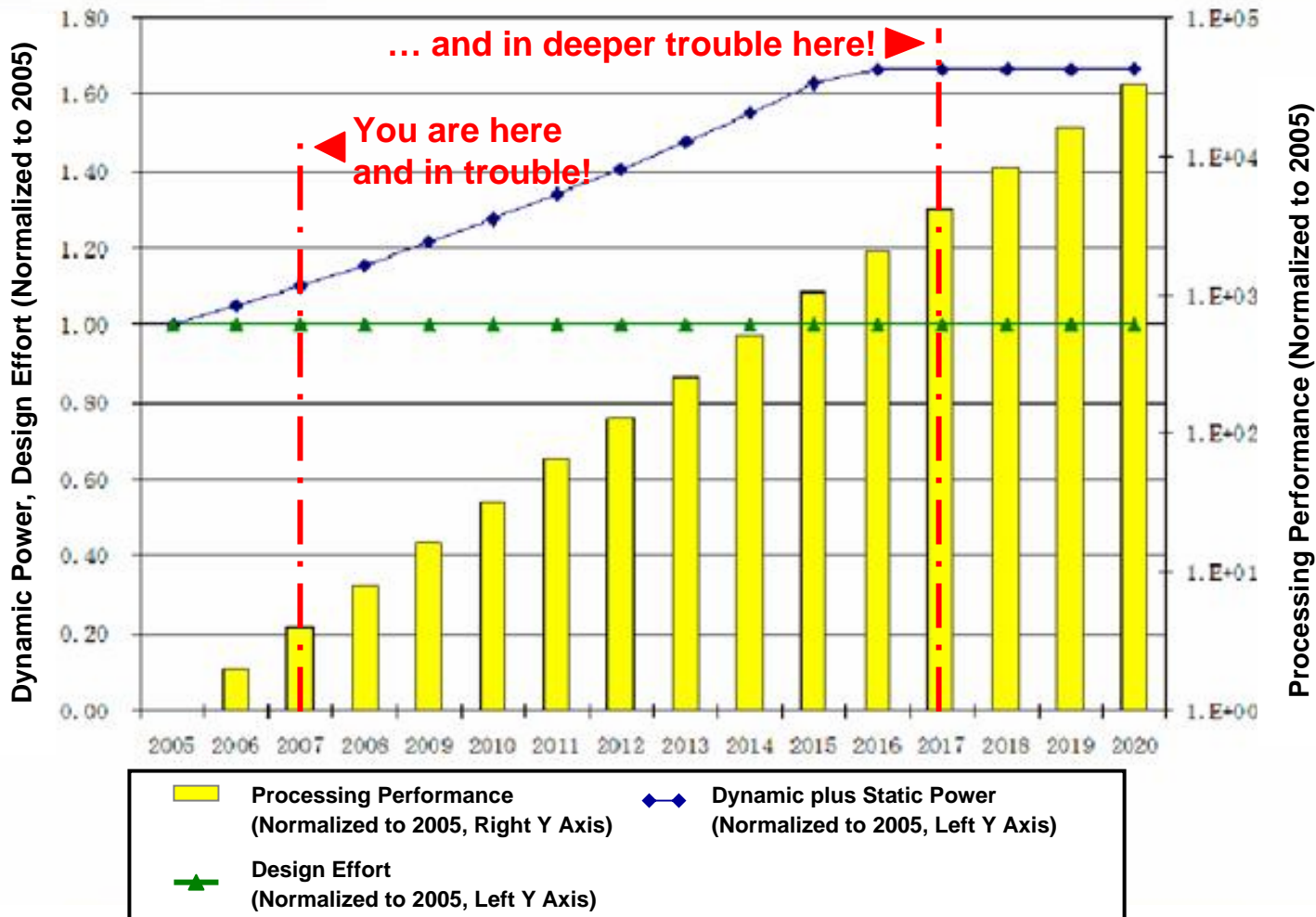
- ◆ Need better support for model-based DFM techniques from foundries
- ◆ Model data should be common, but only if it supports differentiating algorithms
- ◆ Want common solution across all foundries – but not all EDA



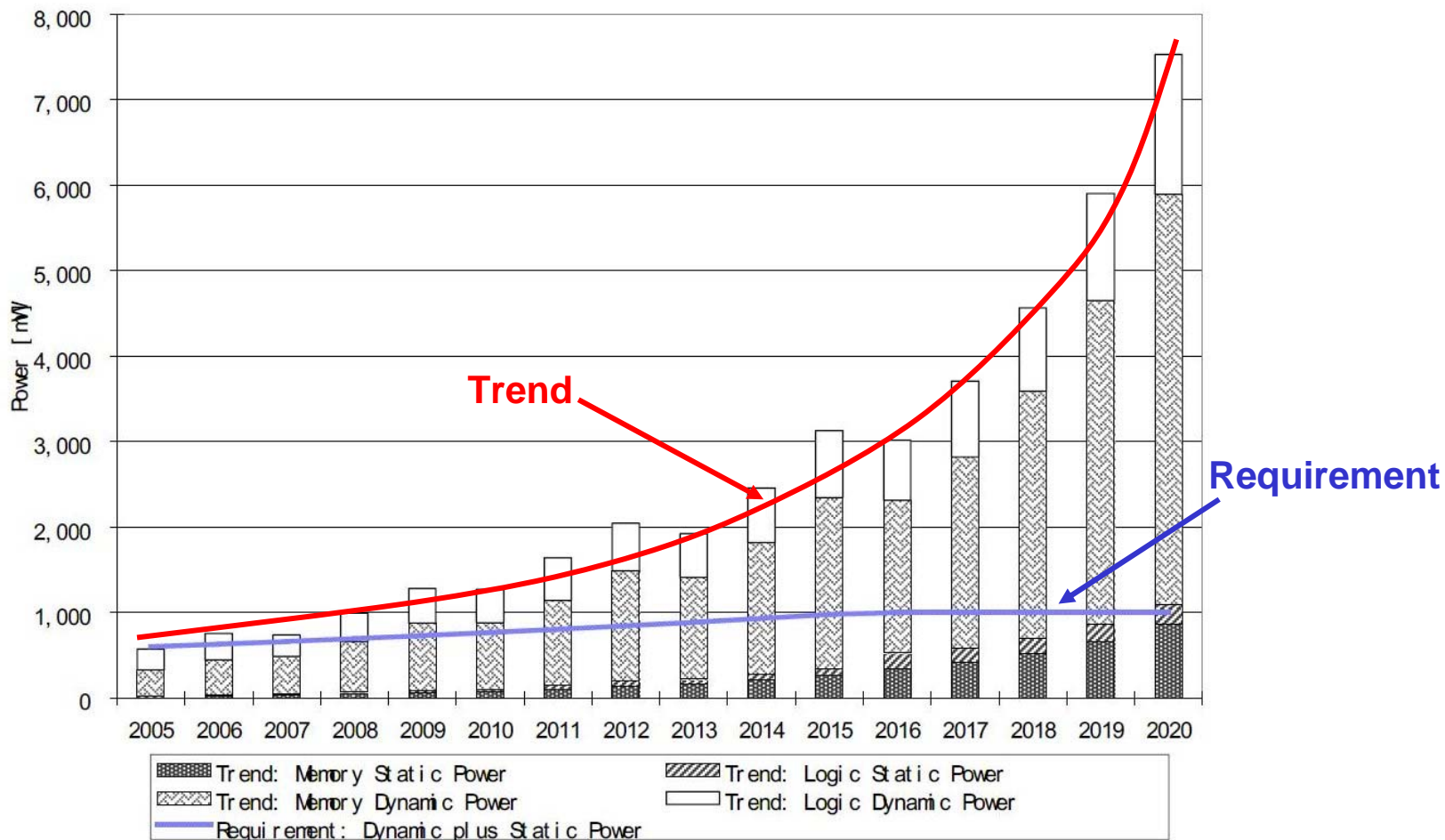
- A model is a “*black-box*” that simulates the model behavior.
- The “black-box” is accessed by the EDA tool at run-time by a user.
- Models access the design environment via the API.
- Models may encapsulate the design environment.
- Models may be developed by the user or the EDA tool.
- Computational elements of the simulated behavior
 - ◆ Formulas
 - ◆ Equations
 - ◆ Table lookups
 - ◆ Decision Logic
 - ◆ Instantiate the model based on mfg parameters
- Software code to access parameter values and the design environment (via the API)

Degree of visibility (Openness) is a business decision - made by the Model owner





Source: ITRS 2005 Power Consumption Trends for SoC-PE



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- **Flow-based solutions**

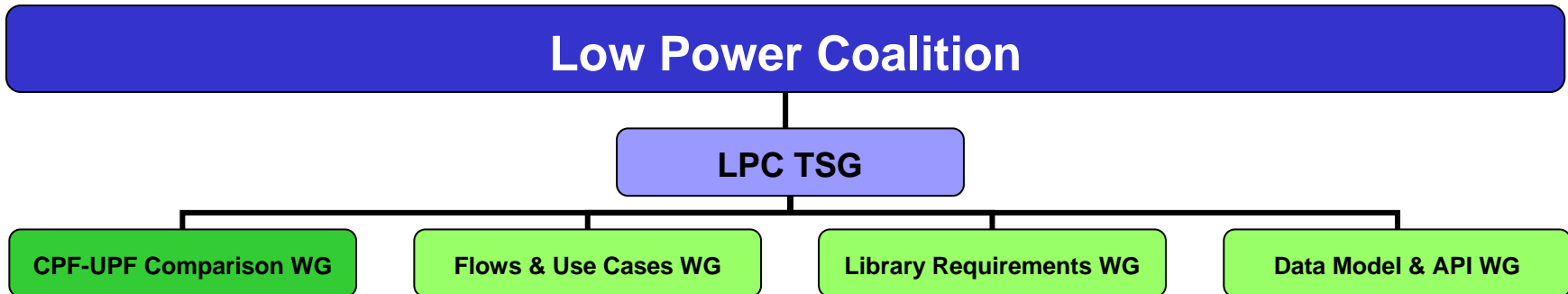
- ◆ Standards to promote integration of open technologies (formats) into cohesive flows
 - CPF specification released, derivative works rights starting 12/06/2006
- ◆ Analyze / develop semantic consistency across data exchanges

- **User-centric and comprehensive**

- ◆ Focused on user needs for successful adoption into production chip design flows
- ◆ Owns roadmap requirements and priorities defined by members (users, EDA partners)
- ◆ Comprehensive coverage via conferences, articles, books, training & training materials, enabling software, press coverage, etc

- **Industry alignment & outreach**

- ◆ Broad industry participation
- ◆ Synergy with other Si2 groups – OAC, OMC, Liberty TAB
- ◆ Collaboration with other standards organizations



Technical Steering Group (TSG)

Responsibilities

- Drive / own roadmap and deliverables
- Define problems to be solved
- Start, manage, and end working groups
- Appoint WG chairs
- Appoint “Champions” to serve as liaisons to working groups

Working Groups

Proposed/potential initial list of WG’s

- CPF-UPF Comparison WG
- Flows & Use Cases WG
- Library Requirements WG
- Data Model & API WG
-

- **Management steps:**

- | | | |
|---|------------|-------------|
| ◆ Member companies appoint representatives: | 11/2006 | DONE |
| ◆ LPC-TSG staffed and begins operation | 12/14/2006 | DONE |
| ◆ Hold first LPC election | 01-02/2007 | DONE |

- **Technical progress:**

- | | | |
|--|---------------|-------------|
| ◆ Members engage CPF (download, train, review) | Start 11/2006 | DONE |
| ◆ Define short-term roadmap | | |
| ➢ Release CPF 1.0 standard to community | 03/04/2007 | DONE |
| ➢ Release RFT | 01/2007 | DONE |
| ➢ Release CPF 1.0 parser | TGT: 2Q2007 | WIP |
| ◆ Complete CPF 1.0 – UPF 1.0 comparison | 2Q2007 | DONE |
| ◆ Define long-term roadmap | 2-3Q2007 | WIP |
| ◆ Start WG's to drive CPF 1.0 evolution | 2Q2007 | WIP |
| ➢ Flows & Use Models, Library Requirements, Data Model & API | | |
| ◆ Release next version | ~3Q2007 | WIP |

- **Described each coalition and their drivers**
 - ◆ Together, coalitions cover design and manufacturing space
- **Each coalition has autonomy in their focus areas but synergize with the rest, e.g.,**
 - ◆ Currently operating: OMC with OAC through JDM WG for dynamic delay calculation
 - ◆ Future: DTMC with OAC for API level extensions
 - ◆ Future: LPC with OMC and LTAB for low power constraints and semantics for library formats and data
 - ◆ Future: LPC with OAC for API extensions for low power constraints and semantics relating to design
- **Net: Primary goals of all coalitions are:**
 - ◆ Solving end-user challenges in specific design and manufacturing domains by...
 - ◆ Partnering with all stakeholders and...
 - ◆ Exploiting synergy among coalitions